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Final Report Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

VSL-05R5830-1, Rev. 0, 10/31/05

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Office of River Protection

P.O. Box 450
Richland, Washington 99352

**Approved for Public Release,
Further Dissemination Unlimited**

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VSL-05R5830-1

Final Report

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

prepared by

Keith S. Matlack, Weiliang Gong, Tevfik Bardakci, Nicholas D'Angelo,
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for

Duratek, Inc.

and

Bechtel National, Inc.

for W. Tamosaitis 11/14/05

ACCEPTED FOR
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Document Number and Revision: VSL-05R5830-1, Rev. 0
Issue Date: 10/31/05
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Test Exceptions: 24590-WTP-TEF-RT-04-00035, 24590-WTP-TEF-RT-04-00034, 24590-WTP-TEF-RT-04-00039, 24590-WTP-TEF-RT-04-00038, 24590-WTP-TEF-RT-05-00001
Test Plan: VSL-04T4830-1, Rev. 0
R&T Focus Area(s): HLW Vitrification, HLW Off-Gas
Test Scoping Statement(s): VH-4, VHO-3, VHO-2, VH-5

Completeness of Testing:

This report describes the results of work and testing specified by the above-listed Test Specification(s), Test Plan(s), and Text Exception(s). The work and any associated testing followed established quality assurance requirements and was conducted as authorized. The descriptions provided in this test report are an accurate account of both the conduct of the work and the data collected. Results required by the Test Plan are reported. Also reported are any unusual or anomalous occurrences that are different from the starting hypotheses. The test results and this report have been reviewed and verified.

I.L. Pegg:
VSL Program Director/Principal Investigator

Date: 10/31/05

I. Joseph:
Duratek Sub-Contract Manager

Date: 10/31/05

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List of Abbreviations

AA	Atomic Absorption Spectroscopy
ACM	Aspen Custom Modeler
AC-S	Sulfur Impregnated Activated Carbon
ADS	Air Displacement Slurry
AOD	Air Operated Diaphragm
BBI	Best Basis Inventory
CFR	Code of Federal Regulation
CPVC	Chlorinated Polyvinyl Chloride
DCP	Direct Current Plasma Emission Spectroscopy
DF	Decontamination Factor
DM	DuraMelter®
DOE	Department Of Energy
EDL	Estimated Detection Limit
EOG	Emergency Off-Gas system
FTIR	Fourier Transform Infrared Spectroscopy
HCU	Hybrid Catalyst Unit (TCO+SCR)
HEME	High-Efficiency Mist Eliminator
HEPA	High-Efficiency Particulate Air Filter
HLW	High Level Waste
i.d.	Inside Diameter
ISE	Ion Selective Electrode
LAW	Low Activity Waste
MDL	Method Detection Limit
ML	Minimum Level
MS	Microsoft
MT	Metric Ton
ORP	Office of River Protection
PBS	Packed Bed Scrubber
PLC	Programmable Logic Controller
PTFE	Polytetrafluoroethylene
QAPjP	Quality Assurance Project Plan for Testing Programs Generating Environmental Regulatory Data
QCGR	Qualified Glass Composition Region
RL	Reporting Limit
RPP	River Protection Project
RPP-WTP	River Protection Project-Waste Treatment Plant
SBS	Submerged Bed Scrubber
SCR	Selective Catalytic Reduction
TCO	Thermal Catalytic Oxidizer
TDS	Total Dissolved Solids
TFCOUP	Tank Farm Contractor Operation and Utilization Plan
TRU	Transuranic
TSS	Total Suspended Solids

VOC	Volatile Organic Compound
VSL	Vitreous State Laboratory
W.C.	Water Column
WESP	Wet Electrostatic Precipitator
WTP	Waste Treatment Plant
XRF	X-Ray Fluorescence

SUMMARY OF TESTING

A) Objectives

The principal objectives of these tests are identified below. DM1200 testing reported here addresses all of the Test Specification objectives. The DM1200 was operated under WTP normal and worst-case conditions, as outlined in the Test Specification [4]. The table below lists the test objectives and, for each specific test objective, lists the success criteria that were fulfilled (lettered a-c). For traceability to the Test Specification, test objectives are sequential and correspond to the objectives of the Test Specification:

Test Objective	Objective Met?	Discussion Section
1. Design, fabricate, install, and operate a prototypic carbon bed, including instrumentation to monitor temperature (inlet stream, middle of bed, and exit stream), pressure drop, and gas flow.	Yes	Section 1.5.6 describes the installation of the carbon bed and monitoring points. Section 4.1.7 provides data and operational details for the carbon bed.
2. Replace the existing thermal catalytic oxidizer catalyst bed material with an equivalent volume of platinum based catalyst Engelhart model VOCAT 360 PFC for HLW and LAW testing.	Yes	VOCAT 360 PFC was installed as directed; however, prior to the present tests, WTP directed that the catalyst media be changed again, to VOCAT 300S [6], which was used for all of the tests reported herein.
3. Utilizing the DM1200 melter and associated feed handling and prototypic off-gas treatment equipment, design and conduct testing using representative simulants for both HLW and LAW feed compositions. The feed compositions shall be nominally based on the projected WTP pre-treated commissioning tanks; C-106/AY-102 for the HLW waste composition and AP-101 for the LAW waste composition. Feed will include specified adjustments for the contributions of waste recycle, feed spikes, and other feed additives. b. Generate regulatory and engineering data while operating the melter system using WTP normal operating scenarios. c. Generate regulatory and engineering data while operating the melter system using WTP worst-case operating scenarios.	Yes	Section 2.1 provides the composition of the HLW feed. Section 2.2 provides the composition of the LAW feed. The results from collection of regulatory and engineering data using these feeds under normal and worst-case operating scenarios are detailed in Sections 3 – 6.
4. Demonstrate the sampling and analytical methods for allyl alcohol in high NO _x off-gas streams. The test methods should be based on existing regulatory protocols. a. Successful development and demonstration of sampling and analytical methods for alcohols in high NO _x off-gas streams.	Yes	Appendix I describes successful method development. Section 6.8 provides quality control data for allyl alcohol analysis.

Test Objective	Objective Met?	Discussion Section
<p>5. Perform feed analyses using both the SW-846 prescribed methods as well as standard VSL procedures to support both regulatory/environmental and engineering data. The Test Plan and test report will clearly distinguish between the two.</p> <p>b. Generate regulatory and engineering data while operating the melter system using WTP normal operating scenarios.</p> <p>c. Generate regulatory and engineering data while operating the melter system using WTP worst-case operating scenarios.</p>	Yes	Sections 2.4.1-2.4.3 provide detailed feed analysis performed by VSL. Section 2.4.4 provides detailed feed analysis performed by STL of RCRA metals. Regulatory and engineering data are clearly distinguished.
<p>6. Characterize the melter emissions (organic, particulate, aerosol, and gaseous) under WTP normal steady state operating conditions.</p> <p>b. Generate regulatory and engineering data while operating the melter system using WTP normal operating scenarios.</p>	Yes	Section 6 provides the data that were collected, and detailed description and discussion of melter emissions.
<p>7. Characterize the melter emissions (organic, particulate, aerosol, and gaseous) under WTP worst-case operating conditions that promote reduced DRE factors, maximum concentrations of products of incomplete combustion (PIC) and other organics, maximum emissions of inorganic materials, maximum emissions of halides/acid gases and maximum emissions of dioxins and furans.</p> <p>c. Generate regulatory and engineering data while operating the melter system using WTP worst-case operating scenarios.</p>	Yes	Section 6 provides the data that were collected, and detailed description and discussion of melter emissions.
<p>8. Characterize the stack emissions (particulate, aerosol, and gaseous) under WTP normal and worst-case operating conditions.</p> <p>b. Generate regulatory and engineering data while operating the melter system using WTP normal operating scenarios.</p> <p>c. Generate regulatory and engineering data while operating the melter system using WTP worst-case operating scenarios.</p>	Yes	Section 6 provides the data that were collected and detailed description and discussion of catalyst emissions.
<p>9. Quantify and document the occurrence and associated operating conditions of any melter off-gas volume surging events.</p>	Yes	Section 4.0 provides melter pressure data and control air flow rates during testing. Occasional pressure spikes were observed during processing. These transient spikes were typically associated with breakup and rapid incorporation of cold cap sections into the melt.
<p>10. Inspection of the major off-gas components and jumpers for deposits and accumulations.</p>	Yes	Inspection information for off-gas equipment is provided in Section 4.0.

B) Test Exceptions

Test Exception	Description
24590-WTP-TEF-RT-04-00034	Added Total Organic Emissions (TOE) at catalyst outlet. Reduced the number of analyses of other constituents.
24590-WTP-TEF-RT-04-00035	Changed the catalyst media from VOCat 360PFC to VOCat 300S.
24590-WTP-TEF-RT-04-00038	Specified temperature changes for the carbon column.
24590-WTP-TEF-RT-04-00039	Specified change of the low-plenum-temperature target to "lowest achievable".
24590-WTP-TEF-RT-05-00001	For LAW tests, specified temperature changes to carbon column, plenum, and SBS. Reduced allyl alcohol spike rate. Added analysis at the carbon column outlet for allyl alcohol, naphthalene, and total hydrocarbons.

C) R&T Testing Conditions

A series of tests were conducted with the HLW C-106/AY-102 and LAW Sub-Envelope A2 simulants at conditions intended to mimic WTP nominal and bounding operating conditions. The tests were designed to determine melter and off-gas system efficiency under these conditions for the removal of hazardous organics, acid halides, toxic metals, particles, and combustion byproducts. Between 11/15/04 and 12/12/04, a total of 23,969 kg of HLW feed was processed to produce 7525 kg of glass; between 3/07/05 and 3/23/05, 28,750 kg of LAW feed was processed to produce 15,201 kg of glass. The tests are summarized below in the order in which they were conducted:

- HLW Test 1: 52-hour test with separate spiking periods using allyl alcohol and solution of naphthalene in methanol for DRE determinations. Melter and off-gas system temperatures were maintained at WTP nominal conditions: 400°C plenum, 50°C SBS outlet, 70-75°C carbon bed outlet (target not maintained hence target changed to bed inlet in subsequent tests), and 400°C TCO outlet. The catalyst exhaust was monitored for particle size distribution. Various gaseous species, including total hydrocarbons, were monitored at several locations. This test was interrupted as a result of Project concerns with respect to the observed temperature increases in the carbon bed when the feed was spiked with organic compounds.
- HLW Test 2A: 75-hour test with separate spiking periods using allyl alcohol, a solution of naphthalene in methanol, and a solution of naphthalene in allyl alcohol for DRE determinations and total organic emissions (TOE) at the catalyst unit outlet. Melter and off-gas system temperatures were targeted at WTP challenge conditions for organic destruction: 345°C plenum (lowest achievable), 55°C SBS outlet (highest achievable), 85-90°C carbon bed inlet [9] and 370°C TCO outlet. Additional samples were taken at the melter and catalyst outlet to determine emission rates of dioxins/furans, PCBs, and volatile organic compounds. The catalyst exhaust was monitored for TOE while a solution of naphthalene in allyl alcohol was spiked into the feed to the melter [7]. Carbon monoxide concentrations at the carbon column outlet were monitored continuously throughout the test. Various gaseous species including total hydrocarbons were monitored at several locations.

- HLW Test 1-continued: 19-hour test with a spiking period using a solution of naphthalene in methanol for DRE determinations. Melter and off-gas system temperatures were maintained at WTP nominal conditions: 400°C plenum, 50°C SBS inlet, 70-75°C carbon bed inlet [9] and 400°C TCO outlet. Additional samples were taken at the melter and catalyst outlets to determine emission rates of particles, toxic metals, and halides. Carbon monoxide concentrations at the carbon column outlet were monitored continuously throughout the test. Various gaseous species including total hydrocarbons were monitored at several locations.
- HLW Test 2B: 54-hour test. Melter and off-gas system temperatures were targeted at WTP challenge conditions for inorganic emissions: 500°C plenum, 55°C SBS outlet (highest achievable), 85-90°C carbon bed inlet [9] and 370°C TCO outlet. Additional samples were taken at the melter and catalyst outlets to determine emission rates of particles, toxic metals, halides, dioxins/furans, PCBs, and volatile organic compounds. The catalyst exhaust was monitored for particle size distribution. Carbon monoxide concentrations at the carbon column outlet were monitored continuously throughout the test. Various gaseous species were monitored at several locations.
- LAW Test 1: 75-hour test with separate spiking periods using allyl alcohol and a solution of naphthalene in methanol for DRE determinations. Melter and off-gas system temperatures were maintained at WTP nominal conditions: 400°C plenum, 50°C SBS outlet, 70-80°C carbon bed inlet [10], and 400°C TCO outlet. The catalyst exhaust was monitored for particle size distribution. Various gaseous species, including total hydrocarbons, were monitored at several locations.
- LAW Test 2B: 68.5-hour test with chloride and fluoride spiked into the feed. Melter and off-gas system temperatures were targeted at WTP challenge conditions for inorganic emissions: 500°C plenum, 50°C SBS outlet [10], 70-80°C carbon bed inlet [10] and 370°C TCO outlet. Additional samples were taken at the melter and catalyst outlets to determine emission rates of particles, toxic metals, halides, dioxins/furans, PCBs, and volatile organic compounds. The catalyst exhaust was monitored for particle size distribution. Various gaseous species were monitored at several locations.
- LAW Test 2A: 69-hour test with separate spiking periods using solutions of naphthalene in allyl alcohol and naphthalene in methanol for DRE determinations and total organic emissions (TOE) at the catalyst unit outlet. Melter and off-gas system temperatures were targeted at WTP challenge conditions for organic destruction: 327°C plenum (lowest achievable), 50°C SBS outlet [10], 70-80°C carbon bed inlet [10] and 370°C TCO outlet. Additional samples were taken at the melter and catalyst outlet to determine emission rates of dioxins/furans, PCBs, and volatile organic compounds. One of these sample pairs was taken while the melter feed was spiked with a solution of naphthalene in allyl alcohol to determine the effect of these compounds on dioxin/furan generation. The catalyst exhaust was monitored for TOE while a solution of naphthalene in allyl alcohol was spiked into the feed to the melter [7]. Various gaseous species including total hydrocarbons were monitored at several locations.

All of the tests were performed on the DM1200 melter system. The DM1200 HLW Pilot Melter is a Joule-heated melter with Inconel 690 electrodes. The melter shell is water-cooled and incorporates a jack-bolt thermal expansion system. The footprint of the melter is approximately 8 ft by 6.5 ft with a 4 ft by 2.3 ft air-lift discharge chamber appended to one end; the melter shell is almost 8 ft tall. The melt surface area and the melt pool height are approximately 32 percent and 57 percent, respectively, of the corresponding values for the full-scale HLW melter. The discharge riser and trough are full-scale to verify pouring performance. The surface of the glass pool is about 1.2 m², and the volume is about 849 liters, corresponding to about 2 metric tonnes. The feed system consists of a mix tank and a feed tank, both of which are 750-gallon polyethylene tanks with conical bottoms that are fitted with mechanical agitators. The feed tank is also fitted with baffles to improve mixing and calibrated load cells that are electronically monitored to determine the feed rate to the melter. The feed is introduced into the melter using an air-displacement-slurry (ADS) pump, which is the present RPP-WTP baseline. Feed from the ADS pump flows into the melter through a prototypic un-cooled feed nozzle that is located above the center of the glass pool. The melter and entire off-gas treatment system are maintained under negative pressure by two Paxton external induced draft blowers. This negative pressure is necessary to direct the gases from the melter to the prototypical off-gas system. The off-gas treatment system consists of a submerged bed scrubber (SBS); a wet electrostatic precipitator (WESP); a high-efficiency mist eliminator (HEME for HLW only), a high-efficiency particulate air (HEPA) filter; a thermal catalytic oxidation unit (TCO); a NO_x removal system (SCR); a packed-bed caustic scrubber (PBS); and a second HEME. A sulfur impregnated activated carbon column was installed between the HEPA and the TCO for these tests. The second HEME is used to limit entrained particle carryover into the balance of the VSL ventilation system; the PBS and the second HEME are not part of the WTP HLW off-gas train, which effectively ends at the SCR.

The following table outlines the specific testing conditions established in the Test Plan and the extent to which these were met during testing:

R&T Test Condition	Status
Melter	--
Bulk glass temperature target - 1150°C (typically allowed to vary $\pm 25^\circ\text{C}$ before power input changes are initiated). The bulk glass temperature is taken as the average of the readings from thermocouples located 13, 15.5, and 18 in. from the bottom.	Satisfied. See Tables 3.5 and 3.6
Plenum temperature – 300, 400, or 500°C, according to Test Specification. Temperature control will be maintained within a 50°C window while sampling melter system exhaust.	Satisfied. See Tables 3.5 and 3.6 Test Exception 24590-HLW-TEF-RT-04-00039 raised the 300°C plenum temperature to “lowest achievable”
Bubbling rate – to be adjusted as needed in order to obtain the desired plenum temperature at the selected feed rate.	Satisfied.

R&T Test Condition	Status
Feed rate – as-required to achieve plenum temperature range. Glass production rate is not a critical parameter for these tests; however, attempts will be made to achieve the highest feed rates possible at the target plenum temperatures.	Feed rates are reported in Tables 3.1 and 3.2.
Melter plenum pressure is controlled by the air injection method described in Section 2.3 of Test Plan. The air flow rate will be as required to maintain stable plenum pressure control without exceeding maximum SBS non-condensable gas flow rate. The typical control air flow rate on the DM1200 system is about 40 scfm.	Air injection method was used for plenum pressure control. Occasional pressure fluctuations occurred due to frequent opening of ducts for exhaust sampling. See discussion provided in Section 4.0.
Film cooler: No special constraints; typically 70 scfm of air at about 100°C. Prior to spiking and sampling, the film cooler will be inspected and, if necessary, cleaned. The film cooler will also be cleaned whenever differential pressure measurements indicate significant clogging is occurring.	Typical flow rates for the film cooler were about 70 scfm. The film cooler was periodically rinsed. See discussion provided in Section 4.0.
SBS	--
Sump temperature will be maintained such that the off-gas outlet temperature is maintained at 50°C for nominal operation and as high as achievable for the challenge condition. An outlet temperature of 60°C is called for in the Task Specification [4] but past experience suggests that this may result in excessive downstream condensation. Consequently, if this proves to be an issue, the outlet temperature will be maintained at the maximum achievable level without condensation downstream in the HEPA filter.	Target SBS outlet temperatures of 50°C and 55°C, as reported in Tables 4.1 and 4.2. Some of the targets were changed by Test Exception 24590-HLW-TEF-RT-04-00001, and changed verbally by WTP R&T during a portion of HLW Test 1.
Liquid level – utilize lower overflow point. (both overflow lines open)	Satisfied.
Condensate purge rate – Dependent on the extent of condensation, which in turn is dependent on the water vapor emission rate from the melter and the SBS sump temperature. Purges will be accomplished in blow-downs of about 40 gallons, as needed. The variation in the purge rate should be within about +/- 20 gallons per day.	<p>Average SBS blow-down rates for the tests were as follows:</p> <p>HLW Test 1: 281 gal/day HLW Test 2A: 140 gal/day HLW Test 1-continued: 390 gal/day HLW Test 2B: 442 gal/day LAW Test 1: 125 gal/day LAW Test 2B: 266 gal/day LAW Test 2A: 153 gal/day</p> <p>Note that the specified purge rate variation is not relevant across tests involving feeds of vastly disparate water contents and feed rates, as was the case for the present tests.</p>
All SBS blow-downs will be via the solids removal "square" pick-up wand to help minimize solids accumulation.	Satisfied.
Solids sparger lances will be operated on a timer cycle (10 seconds on, 20 seconds off, with lances operated in opposing pairs) throughout the tests.	Satisfied.

R&T Test Condition	Status
Inspect off-gas inlet pipe for accumulated solids prior to and following each run. Do not remove solids between tests unless accumulations are determined to be increasing from previous observation and, if allowed to continue, could lead to unacceptable SBS performance.	No significant increase in differential pressure was observed over course of tests, indicating a lack of blockages. SBS performed within specifications throughout the tests.
Prior to DRE testing, the SBS sump will be spiked with allyl alcohol and naphthalene to bring their concentrations in the sump fluid to the estimated long-term steady state levels in order to expedite the sump equilibration process.	Satisfied, as described in Section 4.2.1.3.
WESP	--
Operate at maximum current to achieve maximum voltage without sparking. Based on previous experience this would be about 17 milliamps and 31 - 33 kilovolts.	WESP performance is discussed in Section 4.1.3. Average operating values were: HLW Test 1: 30.3 kV, 16.8 mA HLW Test 2A: 26.7 kV, 14.8 mA HLW Test 1-continued: 30.8 kV, 16.8 mA HLW Test 2B: 29.5 kV, 16.2 mA LAW Test 1: 31.0 kV, 15.8 mA LAW Test 2B: 27.8 kV, 11.8 mA LAW Test 2A: 23.9 kV, 11 mA WESP power was turned off during sampling periods, as specified in 24590-HLW-TEF-RT-04-00035, giving a low bias to test average values. Difficulties in maintaining power to the WESP were experienced during LAW Tests 2A and 2B.
Inlet water spray – 2 gph $\pm$ 0.2 gph.	Water spray rate was occasionally about 1.7 gph due to limitations of the spray nozzle and low building water pressure.
As a part of normal operation, the WESP electrodes will be deluged with water from the internal overhead nozzle once a day at the nominal rate of 20 gpm for 2 minutes.	WESP deluges are discussed in Section 4.1.3. The WESP was deluged daily at a nominal rate of 12 gpm for 3.3 minutes during most tests. The spray was turned off immediately before and after deluges. The time delays for reinstatement of stable operation are documented in Tables 4.5-4.7. The deluge schedule was modified during LAW Tests 2A and 2B in attempts to restore power to the WESP.
At end of each melter feeding test, inspect WESP internals prior to and after typical wash-down operation.	Discussion and photos are provided; see Section 4.1.3.
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HEME: HEME upstream of the HEPA filter will only be used during HLW tests. Operate with 0.2 gph continuous water spray or per manufacturer's recommendations (< 50 mg/acfm of entrained liquid water). Pressure drop will be a dependant variable	Satisfied.
HEPA Pre-heater: Operate to achieve a 20°C temperature rise during Run #1. Do not exceed a 20°C temperature rise. Temperature rise during Run #2 will be at least 10°C, but adjusted according to the required carbon bed outlet temperature.	HEME 1 outlet, HEPA outlet, WESP outlet and carbon column inlet temperatures are reported in Tables 4.1 and 4.2. Test average temperature rise values ranged from 10-20°C.

R&T Test Condition	Status
Carbon Bed: Inlet Temperatures HLW: 70-75°C + 85-90°C, LAW: 70-80°C (Test Exception 24590-HLW-TEF-RT-04-00001)	Carbon column inlet temperatures are reported in Tables 4.1 and 4.2. All temperatures were achieved except for the HLW high temperature range.
TCO: Bed temperature 400°C for nominal operation and 370°C for challenge conditions. Based on previous tests, the gas residence time is about 0.16 sec.	Satisfied. TCO temperatures are reported in Tables 4.1 and 4.2.
SCR: Bed temperature – per the catalyst manufacturer’s recommendation (350-400°C).	Satisfied. SCR inlet and outlet temperatures are reported in Tables 4.1 and 4.2.
SCR: Ammonia slip (exit concentration) $\leq$ 25 ppm, if possible.	Ammonia concentrations measured at the catalyst outlet are reported in Tables 6.12 and 6.25.
All other melter and off-gas treatment system unit operation process and control parameters will be within standard limits and reported in the test summary report.	See Tables 3.1, 3.2, 4.1, 4.2. Difficulties in achieving some carbon column temperature targets and problems with WESP power are described herein and were also discussed in summary reports.

D) Results and Performance Against Objectives

Two sets of DuraMelter 1200 melter tests consisting of two runs each were conducted, one using HLW and the other with LAW feed. The HLW feed composition was based on the C-106/AY-102 tank waste, while the LAW feed composition was based on data for the AP-101 tank waste and represents LAW Sub-Envelope A2. The melter and off-gas operating conditions were adjusted to simulate WTP normal and challenge conditions. Tests were conducted between November 2004 and March 2005, with the HLW testing being performed first because the existing glass pool composition was similar to the composition of the HLW feed used for this test. The first week of HLW testing was used to collect samples while the melter and off-gas system were operating under WTP normal conditions (WTP normal plenum temperature; 400°C). The waste simulant was spiked with the selected hazardous organic compounds (allyl alcohol and naphthalene) during this period to collect organic DRE data across the melter and primary and secondary off-gas systems. Since there is no existing EPA method for allyl alcohol, the method that was previously developed for this purpose was used in these tests. Exhaust samples were taken at other locations in the off-gas system to collect data for calculating DF values for a variety of inorganic constituents. This test was stopped prior to completion due to Project concerns over temperature increases in the AC-S bed. Tests resumed in December of 2004 after a review of literature information, operating conditions, and potential safety issues with WTP and the carbon manufacturer. The second portion of HLW testing was performed under WTP challenge conditions and was divided into three parts: the first employed a low-plenum-temperature condition (WTP cold plenum; 300°C or lowest attainable temperature), the second was a completion of the nominal conditions that had not been finished due to the interruption of the first week of testing, and the third employed a high-plenum-temperature condition (WTP hot plenum; 500°C). Feed was spiked with allyl alcohol and naphthalene during a portion of the first segment of the second test to collect organic DRE data across the melter and primary and secondary off-gas systems. Exhaust samples were also taken at other locations in the off-gas system during the tests to determine the extent of PIC generation and subsequent removal

by off-gas system components. Sampling to obtain data for calculating DF values of various inorganic compounds was also done during the latter segment of Test 2. The LAW testing was performed in a similar fashion to the HLW testing with the following exceptions: (i) the HEME upstream of the HEPA filter was bypassed; (ii) the feed was spiked with chloride and fluoride during the higher plenum temperature segment of Test 2; (iii) all of Test 1 was completed during the first week of testing, (iv) based on experience gained during the HLW tests the high temperature test (2B) was conducted prior to the low temperature test (2A), and the spiking rate of allyl alcohol was reduced to limit the temperature increase across the carbon column. A turnover to the LAW composition was conducted prior to the LAW tests to test safety modifications to the carbon bed, evaluate temperature increases across the carbon bed in response to LAW melter exhaust while spiking with allyl alcohol, and to change out the glass pool from an HLW to LAW composition. Sampling and analyses were performed according to established EPA or California Air Resource Board (CARB) methods by independent contractors; Air Tech Environmental for emissions sampling and STL Knoxville for chemical analysis. Data that are to be used for regulatory purposes were subjected to a data validation review by Keika Ventures.

The general performance of the DM1200 melter and off-gas treatment system was good with the exception of the WESP during LAW tests. Film cooler blockages requiring mechanical clean-out occurred less frequently as compared to previous tests due to lower feed and bubbling rates. Upon post test inspection, however, it was discovered that the film cooler was damaged and corroded to the extent that it cannot be re-used (Section 4.1.1). Design modifications to the internals of the SBS, directed by the Project to address the build-up of solids in the down-comer appeared to limit the build-up of deposits in the down-comer that had been seen in tests prior to these modifications (Section 4.1.2), although this observation should not be considered definitive given the short duration of the tests. During the turnover test with LAW simulants, the wand used to remove material from the bottom of the SBS was clogged and became operational only after three days of testing with intermittent attempts to restore flow. The WESP functioned well during HLW tests; however, during LAW tests it was difficult or impossible to restore normal power after deluges (Section 4.1.3). Post-test inspections failed to identify any mechanical or electrical defects and the unit functioned normally in the immediately following HLW Turnover Test. Similar electrical problems have been encountered with the WESP in past tests with LAW simulants. The sulfur-impregnated carbon bed installed in between the HEPA filter and the catalyst unit performed without incident throughout testing although there were indications that elements, most notably sulfur, were being stripped from the media (Section 6.5). The safeguards and modifications put in place successfully prevented excessive heating of the carbon bed (Sections 1.5.6, 4.1.7). Extensive sets of process engineering data were collected during the tests, including post-test inspections of all major off-gas system components.

The glass product was close to the intended composition for all elements except zinc once the melt inventory was turned over; the absolute deficiency of zinc was very small and did not impact the test objectives (Section 5.1). During the relevant performance tests, one feed sample per test was analyzed for Resource Conservation and Recovery Act (RCRA) metals for regulatory purposes. Also, one feed sample per each unique feed tank charging was obtained and analyzed per VSL standard methods for composition verification (Section 2.4.4).

During nominal and challenge WTP melter system conditions, the DM1200 melter and catalyst exhaust streams were sampled for allyl alcohol using a modified version of 40 CFR 63 Appendix A, Method 308; Volatile Organic Compounds (VOCs) using EPA SW-846 Method 0031; Semi Volatiles using EPA SW-846 Method 0010; dioxins, furans, and coplanar PCBs using SW-846 Method 0023A; metals using SW-846 Method 0060; halides using 40 CFR-60 Method 26; and total hydrocarbons using 40 CFR 60, Method 25A. The modifications to Method 308 are: (i) Use of 0.2 M NaOH in the impinger solutions instead of deionized water in order to prevent acidification in the high NO_x off-gas streams; (ii) Addition of a vertical condenser to reduce the temperature of the gas entering the impingers; and (iii) Use of up to four impingers in series to eliminate breakthrough. The sampling periods for allyl alcohol and naphthalene coincided with the introduction of these compounds into the melter feed stream at a rate sufficient to calculate the required level of destruction across the melter system. Where sampling was being performed for the calculation of DREs, samples were drawn from the melter, HEPA filter, carbon column and catalyst outlets simultaneously such that any variation in the melter and off-gas conditions would not impact the DRE calculation. Samples were also taken at the catalyst outlet for total organic emissions (TOE) using SW-846-0040 as the melter feed was spiked with a mixture of allyl alcohol and naphthalene. The off-gas was also sampled for 24 hour periods at the catalyst outlet using a University of Washington Mark III cascade impactor to collect particulate material by size fractions of > 10 microns, 1 - 10 microns, and < 1 micron (CARB Method 501); each fraction was subjected to gravimetric analysis. Additional data was collected by VSL using CEM monitoring for a variety of gaseous species including acid gases, CO_x, and NO_x, by FTIR and hydrogen by gas chromatography.

Emissions data collected show a high rate of removal or destruction for most constituents. The objective of at least 99.99% destruction of allyl alcohol and naphthalene across the melter system was achieved for all sampling periods, challenge conditions, and simulant types except for two naphthalene sampling periods, which had DREs of 99.987 and 99.978% (Section 6.8). Based on a careful review of the data and system operating conditions, trace contamination, and not a lack of system performance, is the most plausible explanation for not achieving the performance objective for these two naphthalene samples. The continuous total hydrocarbon monitor was found to be an excellent operational tool for monitoring relative organic destruction throughout the off-gas system but was not sensitive enough to measure DREs to 99.99%. Emissions of dioxins, furans, and PCBs were at or below measurable or qualified levels except at the melter outlet during tests with HLW simulants where low but measurable amounts of these compounds were observed. Emissions of toxic metals were very low at the catalyst outlet; however, the magnitude of the off-gas system DF is obscured by the presence of trace contaminants in commercially available filters and reagents (Section 6.4). Particulate removal by the off-gas system was extremely high although difficult to quantify because of the miniscule mass of particulate collected at the catalyst outlet (Section 6.1). All gaseous fluorine species were removed by the off-gas system; however, gaseous chlorine was measured at the catalyst outlet at concentrations that were even higher than those measured in the melter exhaust (Section 6.3).

The volumes of processing solutions generated in the SBS, WESP, HEME, and PBS were documented during testing (Section 4.2). All solutions except for those from the PBS were

mildly to very acidic due to the high concentration of acid gases such as nitrogen oxides in the exhaust stream. Fluid samples were taken from the SBS sump and analyzed for either allyl alcohol or naphthalene at the end of the respective spiking periods. Additional samples were taken for dioxins, furans, and coplanar PCB analysis.

Attached to this report are five appendices which consist of previously submitted VSL letter reports on the carbon media and Sub-contractor reports which provide supporting data for the MACT tests. The appendices are arranged as follows: APPENDIX I - Method Development for Measurement of Allyl Alcohol in High NO_x Off-Gas Streams (VSL Letter Report), APPENDIX II - Thermogravimetric Testing of Donau Carbon Combisorbon BAT37 Material (VSL Letter Report), APPENDIX III - Off-Line DM1200 Slipstream Carbon Column Scoping Tests (VSL Letter Report), APPENDIX IV – Emissions Sampling (Air Tech Environmental Reports), APPENDIX V - Data Validation Reports (Keika Ventures).

E) Quality Requirements

This work was conducted under a quality assurance program that is in place at the VSL that is based on NQA-1 (1989) and NQA-2a (1990) Part 2.7. This program is supplemented by a Quality Assurance Project Plan for RPP-WTP work [12] that is conducted at VSL. Test and procedure requirements by which the testing activities are planned and controlled are also defined in this plan. The program is supported by VSL standard operating procedures that were used for this work [13].

This work was also subject to the WTP Quality Assurance Project Plan (QAPjP) [14] for environmental and regulatory data. This work did not generate data to support waste form qualification activities and therefore was not subject to DOE/RW-0333P.

F) Simulant Use

This testing used HLW C-106/AY-102 and LAW Sub-Envelope A2 simulants with compositions described in Sections 2.1 and 2.2; these compositions were defined in the BNI Test Specifications [24, 31]. Compositions were modified based on direction provided in a BNI Test Specification [4] to include toxic metal spikes and envelope maximum concentrations of volatile compounds such as nitrates and organic carbon.

G) Issues

The modified SBS design appeared to show less tendency for accumulation of solids in the down-comer than did the previous design, but longer test durations are needed to confirm this. Net accumulation of solids in the SBS bowl over the course of several tests contributed to the clogging of the wand that is used to remove solids from the bottom of the SBS bowl (Section 4.1.2).

Film cooler clogging was less of an operational problem during these tests. However, post-test inspection showed corrosion, cracking, and filling of the air holes with glass over the course of this and previous tests. Although the damage had likely prevented air flow through the air holes in the leading edge of the film cooler, air flow through the film cooler as a whole, presumably through the louvers, was maintained throughout its service life (Section 4.1.1).

Electrical malfunctions of the WESP, which have been reported in previous DM1200 tests with LAW simulants, continued to be a problem during the present tests with LAW simulants. No such problems were encountered during the HLW tests (Section 4.1.3).

Maintaining a cold-cap-limited feed rate during DM1200 tests is dependent on frequent visual monitoring of conditions in the melter plenum (Section 3.0). This is particularly true when establishing and maintaining low temperature challenge plenum conditions. The planned operation of the WTP melters, based on only non-visual data such as plenum temperature, could lead to either under feeding of the melter resulting in lower than attainable production rates or over feeding of the melter resulting in excessive cold-cap buildup as well as other operational difficulties. Testing under prototypic conditions is therefore recommended to determine whether the required glass production rates can be achieved without the visual data.

Analysis and recovery of off-gas samples at detection level concentrations of naphthalene in the presence of samples with very high concentrations of naphthalene can easily lead to cross contamination. A miniscule amount of cross contamination drastically affects calculated DRE values (Section 6.8). Sampling and analysis of the two sample types should be carefully isolated. Another possibility would be to sample only stack exhaust for naphthalene and to use a total hydrocarbon monitor to evaluate relative organic destruction in other off-gas system locations.

Commercially available filters and reagents contain trace levels of metals making DF determination across the off-gas system difficult (Section 6.4). The problem can be addressed by taking multiple samples of long duration (24 hour samples were used successfully at the WESP outlet in previous tests) as well as provide a series of blanks for analysis to improve blank correction when permissible. Increasing the feed concentration would also improve DF calculations.

The low particulate concentrations at the catalyst outlet cause difficulties in determining particle emission rates and size distribution (Sections 6.1, 6.2). The problem can be addressed by taking multiple samples of long duration as well as by using microscopic analysis of filters to estimate size distributions.

Measurable gaseous chlorine emissions at the catalyst outlet are higher than at the melter outlet indicating that gaseous chlorine is generated within the off gas system (Section 6.3). Potential sources of the HCl monitored at the catalyst outlet include HCl desorption from the carbon media or generation of HCl in the SBS or WESP sumps as a result of collection of particulate NaCl in the acidic sump solutions. Gaseous HCl may have deleterious effects on the catalyst. Quantification of total chloride emissions (gaseous and particulate) at various locations in the off-gas system would identify the mechanism for the gaseous chlorine generation and

therefore facilitate strategies for limiting the emissions.

Sulfur dioxide emissions from the carbon column indicate that sulfur is being stripped off the column (Section 6.5). The loss of sulfur from the carbon media would compromise its effectiveness for mercury removal, which is one of its principal functions in the off-gas train. Gaseous sulfur also has the potential to poison the catalyst and/or to react with ammonia to form ammonium sulfate particulate, which can clog the catalyst. Consequently, the integrity of the carbon media in the presence of high nitrogen oxide exhaust needs to be understood.

SECTION 1.0 INTRODUCTION

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP-WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems, together with the feed constituents, impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents (including those arising from products of incomplete combustion of sugar and organics in the feed) to concentration levels below those imposed by regulatory requirements. The baseline design for the RPP-WTP LAW primary off-gas system includes a submerged bed scrubber (SBS), a wet electrostatic precipitator (WESP), and a high efficiency particulate air (HEPA) filter. The secondary off-gas system includes a sulfur-impregnated activated carbon bed (AC-S), a thermal catalytic oxidizer (TCO), a single-stage selective catalytic reduction NO_x treatment system (SCR), and a packed-bed caustic scrubber (PBS). The baseline design for the RPP-WTP HLW primary off-gas system includes an SBS, a WESP, a high efficiency mist eliminator (HEME), and a HEPA filter. The HLW secondary off-gas system includes a sulfur-impregnated activated carbon bed, a silver mordenite bed, a TCO, and a single-stage SCR. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design [1]. Various modifications have been made to the DM1200 system as the details of the WTP design have evolved, including the installation of a silver mordenite column and an AC-S column for testing on a slipstream of the off-gas flow; the installation of a full-flow AC-S bed for the present tests was completed prior to initiation of testing. The DM1200 system was reconfigured to enable testing of the baseline HLW or LAW off-gas trains to perform off-gas emissions testing with both LAW and HLW simulants in the present work.

During 2002 and 2003, many of these off-gas components were tested individually and in an integrated manner with the DM1200 Pilot Melter [2, 3]. Data from these tests are being used to support engineering design confirmation and to provide data to support air permitting activities. In fiscal year 2004, the WTP Project was directed by the Office of River Protection (ORP) to comply with Environmental Protection Agency (EPA) Maximum Achievable Control Technology (MACT) requirements for organics. This requires that the combined melter and off-gas system have destruction and removal efficiency (DRE) of $\geq 99.99\%$ for principal organic dangerous constituents (PODCs). In order to provide confidence that the melter and off-gas system are able to achieve the required DRE, testing has been directed with both LAW and HLW feeds [4]. The tests included both "normal" and "challenge" WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. The WTP Project, Washington State Department of Ecology, and ORP have agreed that naphthalene will be used for testing to represent semi-volatile organics and allyl alcohol will be used to represent volatile organics. Testing was also performed to determine emissions of halides, metals, products of incomplete combustion (PICs), dioxins, furans, coplanar PCBs, total hydrocarbons, and CO_x and NO_x, as well as the particle size distribution (PSD) of particulate

matter discharged at the end of the off-gas train. A description of the melter test requirements and analytical methods used is provided in the Test Plan for this work [5]. Test Exceptions were subsequently issued which changed the TCO catalyst [6], added total organic emissions (TOE) to exhaust sampling schedule [7], and allowing modification of the test conditions in response to attainable plenum temperatures [8] as well as temperature increases in the sulfur impregnated activated carbon (AC-S) column [9, 10]. Data are provided in this final report for all the required emission samples as well as melter and off-gas conditions during all the sampling periods. Appended to this report are previously issued VSL Letter Reports on method development for monitoring allyl alcohol in melter exhaust streams, on the results of characterization of the selected AC-S carbon media (Donnau BAT37), and on DM1200 off-line tests on the AC-S bed; also appended are reports from Air Tech on emissions sampling, and reports from Keika Ventures on validation of analytical data provided by Severn Trent Laboratories of Knoxville, Tennessee.

1.1 Test Objectives

As listed in the BNI Test Specification for this work [4], the principal objectives of these tests are identified below. DM1200 testing addressed all of the Test Specification objectives. The DM1200 was operated under WTP normal and worst case conditions, as outlined in the Test Specification and Test Plan [5]. For traceability to the Test Specification, test objectives are listed sequentially and correspond to the objectives of the Test Specification [4]:

1. Design, fabricate, install, and operate a prototypic carbon bed, including instrumentation to monitor temperature (inlet stream, middle of bed, and exit stream), pressure drop, and gas flow.
2. Replace the existing thermal catalytic oxidizer catalyst bed material with an equivalent volume of platinum based catalyst Engelhart model VOCAT 360 PFC for HLW and LAW testing¹.
3. Utilizing the DM1200 melter and associated feed handling and prototypic off-gas treatment equipment, design and conduct testing using representative simulants for both HLW and LAW feed compositions. The feed compositions shall be nominally based on the projected WTP pre-treated commissioning tanks; C-106/AY-102 for the HLW waste composition and AP-101 for the LAW waste composition. Feed will include specified adjustments for the contributions of waste recycle, feed spikes, and other feed additives.
4. Demonstrate the sampling and analytical methods for allyl alcohol in high NO_x off-gas streams. The test methods should be based on existing regulatory protocols.
5. Perform feed analyses using both the SW-846 prescribed methods as well as standard VSL procedures to support both regulatory/environmental and engineering data. The Test Plan and test report will clearly distinguish between the two.
6. Characterize the melter emissions (organic, particulate, aerosol, and gaseous) under WTP normal steady state operating conditions.

¹ Note that VOCAT 360 PFC was installed as directed; however, prior to the present tests, WTP directed that the catalyst media be changed again, to VOCAT 300S [6], which was used for all of the tests reported herein.

7. Characterize the melter emissions (organic, particulate, aerosol, and gaseous) under WTP worst-case operating conditions that promote reduced DRE factors, maximum concentrations of products of incomplete combustion (PIC) and other organics, maximum emissions of inorganic materials, maximum emissions of halides/acid gases and maximum emissions of dioxins and furans.
8. Characterize the stack emissions (particulate, aerosol, and gaseous) under WTP normal and worst-case operating conditions.
9. Quantify and document the occurrence and associated operating conditions of any melter off-gas volume surging events.
10. Inspection of the major off-gas components and jumpers for deposits and accumulations.

1.2 Test Overview

Two sets of DuraMelter 1200 melter tests consisting of two runs each were conducted, one using HLW and the other with LAW feed. The HLW feed composition was based on the C-106/AY-102 tank waste, while the LAW feed composition was based on data for the AP-101 tank waste and represents LAW Sub-Envelope A2. The melter and off-gas operating conditions were adjusted to simulate WTP normal and challenge conditions. Tests were conducted between November 2004 and March 2005, with the HLW testing being performed first because the existing glass pool composition was similar to the composition of the HLW feed used for this test. The first week of HLW testing was used to collect samples while the melter and off-gas system were operating under WTP normal conditions (WTP normal plenum temperature; 400°C). The waste simulant was spiked with the selected hazardous organic compounds (allyl alcohol and naphthalene) during this period to collect organic DRE data across the melter and primary and secondary off-gas systems. Since there is no existing EPA method for allyl alcohol, the method that was previously developed for this purpose [11] was used in these tests. Exhaust samples were taken at other locations in the off-gas system to collect data for calculating DF values for a variety of inorganic constituents. This test was stopped prior to completion due to Project concerns over temperature increases in the AC-S bed. Tests resumed in December of 2004 after a review of literature information, operating conditions, and potential safety issues. The second portion of HLW testing was performed under WTP challenge conditions and was divided into three parts: the first employed a low-plenum-temperature condition (WTP cold plenum; 300°C or lowest attainable temperature [8]), the second was a completion of the nominal conditions that had not been finished due to the interruption during the first week of testing, and the third employed a high-plenum-temperature condition (WTP hot plenum; 500°C). Feed was spiked with allyl alcohol and naphthalene during a portion of the first segment of the second test to collect organic DRE data across the melter and primary and secondary off-gas systems. Exhaust samples were also taken at other locations in the off-gas system during the tests to determine the extent of PIC generation and subsequent removal by off-gas system components. Sampling to obtain data for calculating DF values of various inorganic compounds was also done during the latter segment of Test 2. The LAW testing was performed in a similar fashion to the HLW testing with the following exceptions: (i) the HEME upstream of the HEPA filter was bypassed; (ii) the feed was spiked with chloride and fluoride during the higher plenum temperature segment of Test 2; (iii) all of Test 1 was completed during the first week of testing, (iv) based on experience gained during the HLW tests the high temperature test (2B) was

conducted prior to the low temperature test (2A), and the spiking rate of allyl alcohol was reduced to limit the temperature increase across the carbon column. A turnover to the LAW composition was conducted prior to the LAW tests to test safety modifications to the carbon bed, evaluate temperature increases across the carbon bed in response to LAW melter exhaust while spiking with allyl alcohol, and to change out the glass pool from an HLW to LAW composition. A detailed description of the sampling to be performed, the sampling locations, the number of samples to be collected, and the sampling and analytical methods to be used are described in the Test Plan [5]. Modifications of the sampling schedule are given in the Test Exceptions [7, 10].

During the relevant performance tests, one feed sample per test was analyzed for Resource Conservation and Recovery Act (RCRA) metals for regulatory purposes. Also, one feed sample per each unique feed tank charging was obtained and analyzed per VSL standard methods for composition verification. Glass samples were taken from each discharged drum during the course of operations to provide process data. Fluid samples were taken from the SBS sump and analyzed for either allyl alcohol or naphthalene at the end of the respective spiking periods. Additional samples were taken for dioxins, furans, and coplanar PCB analysis. These samples were shipped to STL Knoxville by Air Tech for analysis. Sampling and analyses were performed according to established EPA or California Air Resource Board (CARB) methods. Data that are to be used for regulatory purposes were subjected to a data validation review by Keika Ventures.

1.3 Types of Data Collected

The tests are designed to collect data for two principal purposes with somewhat different requirements:

- *Regulatory Data:* Data needed to support RPP-WTP regulatory activities. Regulatory data were collected using EPA methods by an independent analytical laboratory. These data include RCRA metals analysis of the feed, particle size distributions at the end of the off-gas train, and organic and metals analysis of off-gas samples collected at various points in the off-gas treatment system.
- *Process Engineering Data:* Data in addition to those described above that are valuable for process engineering and design. EPA methods are either not available, not appropriate, or unnecessary for these purposes. Examples include the extensive system operating data that are collected during all such tests; gaseous continuous emissions monitoring (CEM) data at various locations throughout the off-gas system; and analysis of the feed and glass using VSL standard operating procedures.

The melter tests themselves and collection of all of the "Process Engineering Data" was performed by VSL. Off-gas sampling according to EPA methods was performed at VSL by an independent contractor, Air Tech Environmental, Research Triangle Park, NC. Sample analysis according to EPA methods was performed by a second independent contractor, Severn Trent

Laboratories, Knoxville, TN. This report presents all of the "Process Engineering Data" together with summaries of the "Regulatory Data". Test Reports prepared by Air Tech on the emissions sampling and associated analytical work are appended. Data checking and validation of the supporting data packages for the Regulatory Data was performed by Kieka ventures an independent contractor; reports from that review are also appended.

1.4 Quality Assurance

This work was conducted under a quality assurance program that is in place at the VSL that is based on NQA-1 (1989) and NQA-2a (1990) Part 2.7. This program is supplemented by a Quality Assurance Project Plan for RPP-WTP work [12] that is conducted at VSL. Test and procedure requirements by which the testing activities are planned and controlled are also defined in this plan. The program is supported by VSL standard operating procedures that were used for this work [13].

This work was also subject to the WTP Quality Assurance Project Plan (QAPjP) [14] for environmental and regulatory data. This work did not generate data to support waste form qualification activities and therefore was not subject to DOE/RW-0333P.

1.5 Melter System Description

1.5.1 Feed System

The feed materials for these tests were prepared and controlled according to VSL specifications by chemical suppliers, as detailed in Section 2. Each batch of feed slurry was shipped to VSL in lined 55-gallon drums (approximately 16 per shipment), which were staged for unloading into the mix tank. Both the mix tank and the feed tank are 750-gallon polyethylene tanks with conical bottoms that are fitted with mechanical agitators; the feed tank is also fitted with baffles to improve mixing. Five calibrated load cells directly mounted on the legs of the feed tank are used to measure additions to and removal from the feed tank and are electronically monitored to determine the feed rate to the melter. The requisite amount of feed is pumped into the feed tank from the mix tank; measured amounts of water are combined by weight with the feed at this point to adjust the concentration of the melter feed. The material in the feed tank is constantly recirculated from the feed tank discharge outlet, at the tank bottom, to the tank inlet at the top, which provides additional mixing.

The feed is introduced into the melter using an air displacement slurry (ADS) pump, which is the present WTP baseline. The feed transfer line extends from the outlet of the ADS pump in the feed tank to the top of the melter. Feed is introduced into the melter through a prototypic un-cooled feed nozzle that is located above the center of the glass pool. Only one feed tube is used to represent the planned number of feed tubes per unit melt surface area in the full-scale WTP HLW melter. The operation of the ADS pump [15] is controlled from the melter computer control system. The ADS pump works by opening the pump reservoir to the feed tank using a double-acting air cylinder and mechanical link to actuate the poppet. The reservoir is

filled with slurry by gravity. After sufficient time is allowed to fill the reservoir (a few seconds), the poppet is toggled to close the reservoir to the tank and open the transfer line. After a two second delay time, the reservoir is pressurized with air to transfer the slurry (about 1.6 liter/shot) to the melter. This cycle is repeated at the rate required to provide the desired feed rate.

When necessary, a backup system is used to introduce feed into the melter with an air operated diaphragm (AOD) pump system that simulates the pulsed feeding action of an ADS pump. The recirculation loop extends to the top of the melter where feed is diverted from the recirculation loop into the melter through a Teflon-lined feed line and water-cooled feed tube. Two computer-operated pinch valves, one on the feed line and one on the recirculation loop, are activated in a timed sequence to introduce feed into the melter at the desired rate. The feed rate is regulated by adjusting the length of each pulse, the time between each pulse, and the pressure applied to the recirculation loop. A compressed air line is attached to each of the feed lines and can be used to automatically clear the feed line into the melter after each pulse; air at 40 psi is flowed for 3 seconds through the 0.275" i.d. line for this purpose.

The organic spike (either allyl alcohol or naphthalene dissolved in allyl alcohol or methanol) is introduced into the feed stream immediately upstream of the melter feed tube. The injection system consists of a liquid reservoir, an HPLC-type metering pump, an injection nozzle, and an inline mixing vessel. The spike mixture was injected into the feed stream midway between the feed tank and melter feed tube using the metering-pump injection system that was used previously for noble metals testing [16] and alcohol spiking [17]. The bottle containing the spike mixture is set on a balance to monitor the injection rate by the measured weight loss during the test. The concentration of the spike in the feed stream is controlled by adjusting the spike mixture feed rate and the slurry feed rate.

1.5.2 Melter System

The DuraMelter™ 1200 (DM1200), which is the HLW Pilot Melter, was used for these tests. Cross-sectional diagrams of the melter illustrating the discharge chamber and electrode configuration are provided in Figures 1.1 and 1.2. The DM1200 is a Joule-heated melter with Inconel 690 electrodes and thus has an upper operating temperature of about 1200°C. The melter shell is water-cooled and incorporates a jack-bolt thermal expansion system. The footprint of the melter is approximately 8 ft. by 6.5 ft. with a 4 ft. by 2.3 ft. air-lift discharge chamber appended to one end; the melter shell is almost 8 ft. tall. The melt surface area and the melt pool height are approximately 32 percent and 57 percent, respectively, of the corresponding values for the full-scale HLW melter. The discharge riser and trough are full-scale to verify pouring performance. Other aspects of the discharge system are also prototypical such as the chamber ventilation scheme. The glass contact refractory is Monofrax® K-3, while the plenum area walls are constructed of Monofrax® H refractory. The surface of the glass pool is 34" by 54" with a glass depth of nominally 25". The resultant melt volume is approximately 45,000 cubic inches (735 liters), which represents a glass tank capacity of more than 1.7 metric tons of glass. However, since the typical operating glass level is closer to 29 inches, the effective glass volume during testing is actually about 849 liters, giving an inventory of about 2.0 metric tons, which is

larger than had been previously assumed [2]. The DM1200 is fitted with one pair of electrodes placed high on opposite walls of the melter as well as one bottom electrode. The side electrodes are 11" by 34" giving an electrode area for the pair of about 750 sq. in. Depending on the glass level, the plenum space extends about 33" to 36" above the melt surface, resulting in a plenum volume ranging from about 43 to 46 ft³.

The single-phase power supply to the melter electrodes (250 kW design power) is derived from the DuraMelter™ 1000 transformers by wiring them in parallel and using a single large silicon controlled rectifier. Current can be passed either from the side electrodes to the bottom electrode or between the two side electrodes only, by rearranging jumpers; only side-to-side operation was used for the present tests. Programmable process controllers are installed and can be used to control temperature or power. The melt temperature is controlled by configuring the process controller to maintain constant power and adjusting the power set-point as needed to maintain the desired operating temperature. Alarms can be set to detect out-of-range temperatures or power in the melter. Backup process controllers are installed to be used in case of failure of the main controllers. The entire system is supported by a back-up generator that is tripped on in the event of a power outage.

The DM1200 has several other features. The lid refractory is prototypic and also includes a two-piece construction, which simulates the seam needed for the LAW lid that was planned to be fabricated in three pieces. Nozzles are provided for the off-gas film cooler, a standby off-gas port, discharge airlift, along with 11 ports available for top-entering bubblers, start-up heaters and other components as needed. In addition, a bubbler arrangement is installed in the bottom electrode with the objective of developing permanent bubblers for possible use on future melters. A small portion of the total air used to agitate the melt pool was supplied through the bottom electrode during the LAW tests.

1.5.3 Lance Bubblers

Two types of lance bubblers, placed in two different locations and orientations, were used in these tests. The two types of bubblers used, single-outlet "L" used in previous DM1200 LAW tests [2, 3, 18, 19] and double-outlet "J" used in previous tests with HLW simulants [20, 21], are shown in Figures 1.3 and 1.4, respectively. Bubbling to agitate the melt pool during the LAW MACT tests was supplied in the same way as previous LAW tests: four top-entering "L" bubblers located in diagonally opposite corners, six inches from the melter floor augmented by bubblers installed in the bottom electrode. The bubbling configuration used in the HLW MACT tests was based on the combination of the results from previous DM1200 tests [20] and room-temperature tests that were performed in a transparent fluid simulating the properties of the glass melt [22]. Figure 1.5 shows a schematic of the prototypical HLW double-outlet bubbler design. These bubblers have outlets 8 inches apart and were placed on the melter floor. The orientation of the bubblers in the melter, as shown in Figure 1.6, results in one of the bubbling outlets being 11.3 inches from the feed tube.

1.5.4 Off-Gas System

The melter and entire off-gas treatment system are maintained under negative pressure by two Paxton external induced draft blowers. The two blowers operate in series: the first located upstream of the thermal catalytic oxidizer, and the second located downstream of the packed-bed scrubber. Most of the components of the off-gas system are functionally prototypical. The system, shown schematically in Figure 1.7, consists of a submerged bed scrubber (SBS), a wet electrostatic precipitator (WESP), a high-efficiency mist eliminator (HEME), a high-efficiency particulate air (HEPA) filter, a thermal catalytic oxidation unit (TCO), a NO_x removal system (SCR), a packed-bed caustic scrubber (PBS), and a second HEME. The second HEME is used to limit entrained particle carryover into the balance of the VSL ventilation system. The PBS and the second HEME are not parts of the HLW WTP off-gas train. The first HEME is not part of the LAW WTP off-gas train and is bypassed for LAW testing on the DM1200. The DM1200 off-gas system can be functionally divided into four subsystems:

<u>Particulate Removal:</u>	Components from the submerged bed scrubber (SBS) through the HEPA remove the particulate matter entrained within the gas stream with an estimated removal efficiency greater than 99.9999% for particles larger than 0.3 μm. In the RPP-WTP facility, this provision serves to segregate the radioactive from the non-radioactive components in the system for maintenance and handling purposes.
<u>VOC Control/Acid Gas:</u>	The thermal catalytic oxidation (TCO) unit is designed to oxidize any hazardous organics that are present in the off-gas stream. The catalyst media that was originally installed was VOCAT 300H but this was changed to VOCAT 360 PFC [4] and then to VOCAT 300S [6], which was used for all of the MACT tests. The TCO is followed by a SCR to remove NO _x gases and a packed-bed scrubber to remove remaining acidic gases.
<u>Stack System:</u>	Both the primary and the emergency/bypass exhaust system with its separate HEPA filter vent into the atmosphere through the building stack.
<u>Liquid Processing:</u>	Components such as water spray lines, liquid sampling and water storage tanks, as well as the effluent evaporator, function to sample and process the system liquids for recycle or discharge.

As noted above, with minor exceptions, the DM1200 off-gas system processing sequence used for the present tests follows the proposed designs for the full-scale WTP HLW and LAW installations.

Initial quenching of the melter exhaust gas stream takes place in the film cooler, which is designed to eliminate deposition of solids in the melter off-gas exit. Immediately downstream of

the film cooler is the injection point for control air, which is used to regulate slow fluctuations (i.e., occurring in the time scale of several seconds or more) in melter pressure. At the film cooler exit the off-gas stream is in the temperature range of 250 to 350°C and its flow rate is between 100-250 scfm, of which about 10-80 scfm is water vapor. The off-gas is then rapidly quenched by percolation through a submerged packed column in the SBS, which also removes large particulate and many water-soluble species from the gas stream. The piping between the film cooler and SBS has a high superficial gas velocity (~80 ft/s) to minimize particulate deposition. The gas stream leaving the SBS is at a temperature that is typically set at a temperature between 40 and 50°C. Heat is removed from the SBS by means of two banks of internal cooling coils and an external cooling jacket connected in series to a chilled water system. Further mist and particulate removal takes place in the WESP, the HEME (HLW only), and the HEPA. The TCO and SCR follow the particle removal components and serve to destroy organic compounds and nitrogen oxides. Finally, the PBS provides acid gas removal (prototypical only in LAW design). Water sprays located in the WESP, the HEMEs, and the PBS drain into their respective collection sumps from which they can be sampled. The system components are fabricated from corrosion resistant materials including AL6XN (SBS and TCO), 316/316L stainless steel, and various plastics (mostly CPVC) at low-temperature locations. There are extensive provisions for sampling of both the gas and the liquid streams throughout the system.

The off-gas system maintains the melter plenum under slightly negative pressure, typically -3 to -5 in. W.C. The plenum pressure is controlled by means of an air injection system that introduces a controlled air flow into the off-gas jumper just downstream of the film cooler. The air is supplied by a blower through a diverter valve. The position of the diverter valve, and therefore the air flow rate, is proportionally controlled by a feedback signal from a melter pressure transducer. Loss of vacuum on the plenum causes the air injection flow rate to decrease, which restores the pressure to the set-point level. Conversely, the control air flow rate increases when the plenum pressure becomes too low.

1.5.5 Modifications to the SBS

Prior to these tests, a modified SBS was placed into service. Details of these SBS modifications are given in a previous report [20]. A depiction of the new SBS internals with temperature and pressure monitoring points is provided in Figure 1.8. A summary of the significant modifications to the SBS are as follows:

- The diameter of the bed was increased by 40% to make the superficial flow velocity closer to its prototypical value.
- The water level above the packing was lowered by several inches such that the nominal level is now equal to the prototypical level of 3 inches above the top of the bed packing. This change reduces the pressure drop across the SBS. It also results in a prototypical SBS plenum height (21 inches) from the top of the liquid to the off-gas entry and exit points. The DM1200 SBS plenum volume is, however, smaller than prototypical due to the difference in SBS diameters.
- The overflow nozzle design was changed to the prototypical funnel-like shape.

- The down-comer annular pipe was changed to the prototypical open-ended type.
- An additional ring of the inner cooling coil was added, making a total of two coils in the DM1200 system as compared to three in the WTP SBS. This change improves the heat transfer efficiency enabling the support of higher (water) feed rates to the melter.

1.5.6 Installation and Modification of Sulfur Impregnated Activated Carbon (AC-S) Bed

Prior to the last test of the previous series of melter tests [21], a Sulfur Impregnated Activated Carbon (AC-S) Bed was installed immediately upstream of the TCO unit. A schematic diagram of the AC-S unit is provided in Figure 1.9 and photographs are provided in Figures 1.10 and 1.11. The unit contains 606 lb of granulated, sulfur impregnated activated carbon mixed with an inert mineral material in the ratio of 7:3 by volume; the material is manufactured by Donau Carbon, EU, under the trade name Kombisorbon BAT37. Installation piping allows process gases to flow through the reactor or to by-pass it altogether. Both the inlet and the outlet ports are located on the top cover of the reactor. The process flow enters the vessel downwards through the central pipe and then reverses direction at the bottom, flowing upwards through the diffuser plate and the cylindrical carbon bed. The dimensions of the bed conform to its design specifications of 4.0 seconds residence time at the superficial velocity of 35 ft/min and a volumetric flow rate of 250 ft³/min. Instrumentation includes pressure sensors and thermocouples located at the inlet and the outlet of the reactor and along the carbon bed.

The AC-S was modified prior to the LAW tests with a series of safety interlocks to be activated in the event of bed temperature excursions. The interlocks and the conditions at which they are activated are as follows:

- An audible alarm sounds at a bed temperature of 135°C to supplement the thermocouple temperature readings displayed on the control panel.
- The AC-S bed is by-passed and ventilated with ambient air through separate inlet/outlet piping if the bed temperature exceeds 150°C. Pictures of the AC-S bed auxiliary exhaust and ambient air inlet lines are shown in Figures 1.12 and 1.13.
- The AC-S bed is flushed for 9 - 10 minutes with nitrogen gas at the flow rate of ~150 scfm if the bed temperature exceeds 200°C. The nitrogen is supplied from three interconnected UHP cylinders, each containing ~455 scf of gas, as shown in Figure 1.14.
- The AC-s bed is doused with 100 gallons of water at the rate of ~14 gpm if the bed temperature exceeds 250°C. Unlike the lower temperature provisions, which are automatic, the water is manually activated based on the response to an alarm.

SECTION 2.0

WASTE SIMULANT AND GLASS FORMULATIONS

Tests were performed with HLW simulants based on the projected composition of C-106/AY-102 feeds and with LAW simulants based on the projected composition of AP-101 feeds. However, in both cases, the WTP Project prescribed specific compositional adjustments to meet the needs of the present tests. The waste simulant and melter feed compositions and the corresponding glass formulations used for these tests are described in this section.

2.1 HLW Composition

2.1.1 HLW C-106/AY-102 Simulant

The HLW simulant that was used is based on the C-106/AY-102 composition, which has been extensively tested previously [16, 21, 23], with minor adjustments to accommodate the spikes. This section describes the derivation of the C-106/AY-102 HLW simulant and the modifications made to arrive at the HLW simulant for the present tests.

Formulation of the C-106/AY-102 waste simulant is based on the Test Specification [24], which made use of inventory data from the TFCOUP [25], calculated data from Steady-State ACM Flowsheet modeling, and analytical data on Cs- and Tc-removal eluates from LAW pretreatment. In addition, products from Sr/TRU removal for pretreatment of LAW were also included in the waste blend. Table 2.1 summarizes the compositions of the different waste streams and the blended waste.

The composition of the C-106/AY-102 Envelope D solids (Stream FRP02) is based on the inventory data found in Revision 3A of the TFCOUP [25]. As seen in Table 2.1, in addition to updated information, Revision 3A of the TFCOUP also provides information on minor components that were not included in earlier revisions [26] and the Best Basis Inventory (BBI) database (e.g., cadmium). The use of other data sources (e.g., HLW Feed Staging Plan [27]) to supplement the TFCOUP, as was done in previous tests, is therefore no longer necessary. The ACM model calculates the composition of the recycle stream (PWD01), which is then blended with the Envelope D solids based on the expected daily processing rates (i.e., $3.79\text{E}+04$ lb/day for Envelope D solids and $1.31\text{E}+03$ lb/day for the recycle stream on a dry solid basis). The resulting material is concentrated and pretreated through caustic leaching/water washing and ultra-filtration to produce the pretreated HLW solids. The separation factors due to caustic leaching and ultra-filtration are given in Table 2.1. Note that some of the separation factors are larger than unity (many of which were ignored in derivation of the waste composition, which is used as-provided [24] in the present work) and that the ACM model predicts mass increases for Fe and Zr after ultra-filtration (75 lb/day and 68 lb/day, respectively) [24].

To complete the C-106/AY-102 simulant formulation, the pretreated HLW solids are blended with wastes from LAW pretreatment. Similar to the blending scenario used in Part B1 tests [28], Sr/TRU removal products from pretreatment of Envelope C wastes have been added, although the amounts of Sr and Mn (449 lb/day and 499 lb/day, respectively) blended are considerably less than those used in earlier tests, which results in lower concentrations of SrO and MnO in the current test glass (e.g., 0.92 wt% vs. 7.35 wt% for SrO) [28]. Analytical data on eluates from Cs- and Tc-removal on an Envelope B sample (AN-102) [29] provide the compositional bases for the respective ACM-model feed streams CNP12 and TEP12, although that was not the case for the Sr/TRU stream. The blending proportions are determined by the projected daily processing rate of sodium in the eluates (i.e., 2.02E+01 lb/day for Cs-removal and 9.14E-01 lb/day for Tc-removal). It can be seen in Table 2.1 that waste blending primarily leads to increase of manganese, strontium, sodium, chloride, and nitrate in the HLW simulant.

The calculated composition of the blended HLW solids (HLP09b), which is shown in Table 2.1, lists a total of 55 components. A few of the components, however, were left out of the blended solid composition, as provided by the WTP Project, because of missing separation factors, low concentrations and other unspecified reasons (e.g., Be, Co and Mo) [24]. In addition, similar to the approach taken in previous melter tests, radionuclides, noble metals (including silver), and minor components (< 0.02 wt% in glass on an oxide basis) are omitted from the C-106/AY-102 simulant formulations. Cesium and iodine were spiked in the C-106/AY-102 simulant for analytical purposes for previous tests but they are eliminated from the current tests. The resulting HLW simulant formulation for the C-106/AY-102 waste, which is given in Table 2.2, consists of 30 components, 26 of which are non-volatile.

Modifications to the base formulation of the C-106/AY-102 simulant primarily involve addition of the components to be spiked, at their respective levels, and then renormalizing the remaining components. A total of eleven constituents were spiked and they are listed in Table 2.2, together with their respective spike levels [4]. Eight of the spikes are non-volatile and expected to be retained in glass; they total 1.241 wt% (with respect to glass). Since the spike levels are defined with respect to the target glass composition, derivation of the HLW simulant for the present tests starts with the reference glass developed for the C-106/AY-102 base simulant, which is discussed in the next section. The eight non-volatile spike components are fixed in the reference glass (and simulant) composition while the other components are re-scaled to make up 98.759 wt% of the glass composition; sulfate is included in the feed at a level corresponding to 0.15 wt% of SO₃ in glass if volatilization is ignored. The new glass composition can then be used to arrive at the HLW simulant composition by removal of the glass forming additives. The resultant HLW simulant composition is given in Table 2.2. Recall that cesium and iodine are not included in these tests and they are therefore eliminated from the simulant. Finally, the volatile carbonate, which is not a spike component, is retained in the MACT HLW simulant at the same concentration as in the base simulant.

2.1.2 C-106/AY-102 Glass and Melter Feed Formulation

After definition of the composition for the C-106/AY-102 HLW base simulant, new glass formulations were developed and tested at VSL to support previous melter tests. The glass

composition selected as the basis for those tests, HLW98-86, is presented in Table 2.3. The same glass formulation, with modifications to incorporate spikes (see above), was used for the present tests. On an oxide basis, HLW98-86 has a total waste loading of 27.75 wt%, of which 25.13 wt% is Envelope D waste. These can be compared with the respective values of 51.00 wt% and 39.42 wt% for HLW98-34, the C-106/AY-102 reference glass used in Part B1 [28]. The difference is primarily due to the presence of much more Na₂O in the Part B1 simulant (20.61 wt% vs. 2.11 wt% for the current simulant). The current target glass (HLW98-86) is also different from HLW98-34 in that it meets the contract minimum component limit by incorporating 12.56 wt% of Fe₂O₃, instead of > 21 wt% of (Al₂O₃+Fe₂O₃+ZrO₂) [28].

Crucible melts of HLW98-86 and related formulations have been prepared and tested to determine that the target glass meets the necessary processing requirements. Heat treatment of HLW98-86 at 950°C for over 70 hours results in a homogeneous dark brown glass that is free of secondary phases. The viscosity and electrical conductivity measured for HLW98-86AG, which has the same composition as HLW98-86 except with Ag₂O excluded, are 44 P and 0.36 S/cm, respectively, at 1150°C. Finally, the normalized PCT leach rates of HLW98-86 are (in g/(m²-day)) 0.058, 0.047, 0.046 and 0.028, respectively for B, Li, Na and Si; these values can be compared with those for the reference glass (SRL-EA): 1.17, 0.71, 0.80 and 0.27. The target glass formulation for previous DM1200 tests with C-106/AY-102 simulant [23] differs slightly from HLW98-86, with the removal of silver and the addition of small amounts of cesium and iodine.

The glass formulation used for the MACT HLW tests is very similar to the target formulation, as shown in Table 2.3. The increase in chromium may increase the crystal content at the reference heat treatment temperature (950°C) and the TCLP leachate concentrations of some of the components are likely to be higher as a result of adding the MACT spikes. However, other properties, such as viscosity, electrical conductivity, and PCT response are likely to be unaffected.

The additional constituents required to form the target test glass from the MACT HLW simulant are aluminum, boron, lithium, sodium, silicon, and zinc. They were added in the same proportions as those used in HLW98-86 (with the exception of lithium, which was added at 2.993 wt%, with respect to glass (oxide basis), compared to 3.01 wt% in HLW98-86). The raw materials that are the sources for the glass-forming additives were selected based on previous testing and per direction of the WTP Project. Table 2.4 lists the starting materials and amounts required to produce the target C-106/AY-102 simulant and melter feed. Note that all of the TOC is assumed to be oxalate. Additionally, the recipe in Table 2.4 corresponds to only 2.18 (g/100 g waste oxide) of carbonate present in the simulant, instead of the required 4.65 (g/100 g waste oxide). This discrepancy in carbonate did not impact the tests since much greater amounts are present in the glass forming additives. The undissolved solids content in the *simulant* is assumed to be 20 wt%, which is equivalent to 21.49 wt% total solids, based on the data from AZ-102 testing [30]. Compared with the previously tested C-106/AY-102 HLW simulants [16, 23], notably more water is required to produce a slurry with 21.49 wt% total solids for the MACT HLW simulant because of the increased amounts of volatile components (i.e., oxalate and nitrate). This in turn has the effect of reducing the glass yields for the current testing (see

Section 2.4). The theoretical glass yield of the resulting MACT feed is 312 g of glass/kg of feed (about 400-460 g/l of feed, depending on feed density).

Melter feeds for all HLW tests were produced by NOAH Technologies Corporation, the supplier of simulant and feed samples used in previous testing on the DM1200 melter system.

2.2 LAW Composition

2.2.1 LAW Waste Simulant

The LAW Sub-Envelope A2 waste simulant used for these tests was based on composition data for tank AP-101 given in a WTP Test Specification [31]. The sodium concentration in the LAW Sub-Envelope A2 simulant was increased by 2.56 % to account for sodium additions in pretreatment [32, 33]. The concentrations of nitrate, nitrite, organics, chromium, cadmium, copper, chlorine, fluorine, and sulfur in the target glass were provided in the Test Specification for these tests [4]. Consequently, the recycle stream that was added to the Sub-Envelope A2 simulant in a previous study, which increased the concentrations of sulfur, chlorine, and fluorine, was not added. The nominal concentration, expressed in terms of the sodium molarity, was determined on the basis of melter feed rheology tests on similar formulations [34]. The results of those tests led to the selection of 8.0 molar sodium as the nominal simulant concentration. The simulant formulation for LAW Sub-Envelope A2 is shown in Table 2.5. The resulting Sub-Envelope A2 simulant is a solution of predominantly sodium, potassium, aluminum, nitrate, and nitrite. Samples of the simulant were prepared according to Table 2.5 and tested at VSL.

2.2.2 LAW Glass Formulation

The feed additives were selected on the basis of glass formulation studies, which included optimization with respect to sulfate incorporation and prevention of formation of a separate sulfate phase [32, 35-49], and rheological testing [34]. Project-directed glass forming chemicals [50] were used in the tests. LAW126 has been identified as a suitable glass composition for the Sub-Envelope A2, AP-101 waste and was used for the present tests. The composition of LAW126 glass, including the Project-directed spikes [4], is compared to the previously tested Sub-Envelope A2 glass [49] in Table 2.6. The additive sources are shown in Table 2.7.

Optima Chemicals, which has supplied all of the LAW simulants for the previous DM100, DM1200, and LAW Pilot Melter tests, prepared the simulant and added the glass forming chemicals before shipment to VSL in 55-gallon drums. Sugar was added at VSL.

2.2.3 Sugar Additions to LAW Feed

The addition of reductants to high nitrate feeds is necessary in order to control melt foaming. Sugar, which was used for this purpose at West Valley, has also been selected as the

baseline reductant for the WTP. The amount of sugar required increases with the amount of nitrates present in the feed and decreases with the amount of waste organics present in the feed, which themselves act as reductants. Excessive additions of reductants can be deleterious, leading to over-reduction of the melt and formation of sulfides and molten metals. Consequently, the oxidants and reductants in the feed must be suitably balanced. The basis for achieving this balance was developed by VSL and Duratek for the vitrification of high-sodium-nitrate feeds at Savannah River's M-Area and has been successfully applied to the processing of a wide variety of simulated RPP-WTP feeds over the past six years. In developing this approach, we elected to conservatively adopt the most reducing potential reaction as the basis for the *definition* of a "sugar ratio" of 1.0 as a result of concerns for over-reducing the melt. Such a reaction, using sodium salts as an example, is:

Fundamentally, the basis that is selected is simply a convention, since the precise stoichiometry of the reactions involved is neither known nor constant under the conditions prevailing in the melter. However, with this convention, a sugar ratio of 1.0 corresponds to one mole of sucrose per eight moles of nitrate or, more generally, 1.5 moles of organic carbon per mole of nitrate. It is then expected that significantly less sugar than this will be required in practice. The empirically determined amount required to successfully control melt foaming without significantly reducing the glass melt was found to correspond to a ratio of 0.5 when any nitrites present were counted as nitrates (i.e., 0.75 moles of organic carbon per mole of nitrate + nitrite). This approach has been employed for all WTP melter testing. It is, however, expected that slight variations around the nominal value of 0.5 may be necessary to account for differences in the reducing power of waste organics in comparison to sugar, particularly for LAW streams that are high in organics.

As an example, the calculation of the amount of sugar needed for the present Sub-Envelope A2 feed to achieve a sugar ratio of 0.5 proceeds as follows:

- One liter of simulant contains 1.016 moles of nitrite and 2.594 moles of nitrate, giving a total of 3.61 moles of NO_x (see Table 2.5)
- Required total amount of organic carbon for a sugar ratio of 0.5 is $3.61 \times 0.75 = 2.708$ moles
- One liter of simulant contains 1.52 moles of organic carbon (see Table 2.5)
- Therefore, $2.708 - 1.52 = 1.188$ moles of organic carbon must be added.

Since the molecular weight of sucrose is 342 g per mole, $1.188 \times 342/12 = 33.858$ g sugar must be added per liter of simulant, as shown in Table 2.7.

2.2.4 Halide Additions to LAW Feed

The melter feed was spiked with additional halides during LAW Test 2B, as directed in the Test Specification [4]. The weight percent of halide targeted in the glass product assuming

total retention was increased from 0.376 to 1.2 wt% for chloride and from 0.042 to 0.42 wt% for fluorine. Alkali halide salts were added to drummed feed for Test 2B as feed was pumped into the feed and mix tanks. The amount of feed remaining in the feed tank at the end of Test 2B was intentionally minimized in order to facilitate maximum dilution with feed not containing the additional halides prior to the subsequent test.

2.3 Organic Spikes

Organic analytes were selected by agreement between the RPP-WTP Project, Washington State Department of Ecology, and ORP. Naphthalene represented semi-volatile organics, and allyl alcohol represented volatile organics in MACT demonstration tests. However, EPA sampling and analytical methods are not defined for allyl alcohol. As a result, a potentially suitable method, 40 CFR Appendix A of Part 63 – Method 308, was evaluated in scoping tests performed on the DM1200 in November 2003. The method was determined to have deficiencies when applied to high NO_x off-gas streams. The WTP Project directed [51, 52] VSL to investigate potential modifications to Method 308 in order to mitigate the observed deficiencies. That work was successful in that the modified method achieves recoveries for allyl alcohol that are within the acceptance limits for other EPA VOC methods (50 - 150%) [11]. However, it is important to note that, like the original Method 308, the detection limit for the modified method is orders of magnitude higher than that for the method typically used for volatile organic compounds (SW-846-0031). As a result, correspondingly higher allyl alcohol feed rates were required to measure a DRE of >99.99%.

2.4 Analysis of Feed Samples

2.4.1 General Properties

Feed samples were taken from each distinct feed tank charging to confirm the chemical composition and physical properties. Sample names, sampling dates, and measured properties are provided for HLW and LAW feed samples in Table 2.8. Data from previous samples based on the HLW C-106/AY-102 [16, 21, 23] and LAW Sub-Envelope A2 simulants [49] are provided for comparison. All samples were taken from the feed line immediately upstream of the entrance point to the melter. Among the HLW melter feeds, the glass yields for the MACT feed are significantly lower than those found for earlier C-106/AY-102 feeds [16, 23], despite similar target water contents and glass formulations. This is due to the presence of increased volatile components in the MACT feed, which contribute to the total solids content but not to the glass yield. The high waste-loading C-106/AY-102 melter feed has comparably lower glass yields (≈ 420 g/l) [21], which is expected because, other things being equal, the water content increases as the waste loading is increased. The test average measured glass yields for both feeds very closely approximate the respective targets: the HLW analysis matches the target whereas the LAW analysis is within 5% on a mass per mass basis and within 2% on a glass per liter of feed basis. The measured glass yields were all close to target values, therefore target glass yields were used for calculating glass production rates. For each feed type and target solids content, all measured parameters including glass conversion ratio, water content, density, and pH fall within

narrow ranges, confirming the relative consistency of the melter feed. Most of measured parameters were also similar to those for previous tests conducted with the same feeds at the same solids contents. Differences in pH and, in the case of LAW, glass yields can be attributed to compositional changes intended to reflect maximum expected component values for the MACT test feeds [4].

2.4.2 Rheology

Samples of the melter feeds that were used for these tests were also subjected to rheological characterization. The results from rheological characterization of a variety of other melter feeds and waste simulants, as well as the effects of a range of test variables, are described in detail in a separate reports [34, 53]. Melter feeds were characterized using a Haake RS75 rheometer, which was equipped with either a Z40DIN or a FL22-SZ40 sensor. A typical set of measurements consists of identifying the flow characteristics of the slurry by measuring the shear stress on the slurry at controlled shear rates and temperatures. In these measurements, the shear rate values are preset and are increased stepwise from 0.01 s^{-1} to 200 s^{-1} (70 s^{-1} for FL22-SZ40) with a sufficient delay (typically 15 to 30 seconds) between steps to ensure that shear stress is allowed to fully relax and therefore measured at equilibrium. The viscosity of the sample as a function of the shear rate is then calculated as the ratio of the shear stress to the shear rate. All of the measurements in this work were made at 25°C ; previous work [53], which examined a range of temperatures, showed a relatively weak effect of temperature.

Rheograms for feed with HLW C-106/AY-102 and LAW Sub-Envelope A2 simulants showing feed viscosity versus shear rate are given in Figures 2.1 and 2.2. Included in the figures for comparison are data from previously reported [16, 21, 23, 49] feed samples. Measured values for viscosity at selected shear rates and the yield stress values are shown in Table 2.9. The measured rheological properties for feed samples were within expectations and therefore no difficulties in processing these feeds was anticipated or occurred (see Section 3.0). Feeds containing HLW C-106/AY-102 simulants become increasingly more viscous as the water content is decreased and as nitrate and sugar concentrations increased. The measured yield stress mirrors this trend with the exception of the measured value for the HLW MACT test sample, which is lower than the measured value for the high waste loading sample even though the feed concentration is lower. The viscosity of the LAW feed sample was very similar to the samples from a previous test with the same simulant except at very low shear rates where the feed from the MACT test is a little less viscous. Yield stress measurements follow the same trends as measured viscosity for the LAW samples.

2.4.3 Chemical Composition

Feed samples collected during these tests were subjected to chemical analysis using x-ray fluorescence (XRF). The chemical compositions of the feed samples from the tests were determined by first making a glass from the feed samples via crucible melt. The glass was subsequently crushed and analyzed directly by XRF. Target values for boron and lithium oxide

were used for normalizing the XRF data since they were not determined by XRF. The data are compared to the target compositions in Table 2.10. The compositional analysis results can be discussed by dividing the elements into four categories: major elements with measured oxide concentrations greater than 3%, intermediate elements with measured oxide concentrations between 1 and 3%, minor elements with target concentrations less than 1%, and contaminants that are not in the target composition. The major elements constitute the bulk of the glass and, therefore, largely determine its properties. All oxides with target concentrations greater than 1 percent were within six percent of the HLW C-106/AY-102 target composition. The average measured concentration for all the major elements in the LAW samples (Al, Fe, K, Na, Si, and Zr) were within 10 percent of the target composition except for potassium, which was about thirteen percent below the target value of 3.01 wt% K₂O. This deficiency can be attributed to the crucible melt process, which results in greater volatilization of some elements than processing feed in a melter while maintaining a cold cap. The measured potassium concentration in product glasses from the LAW tests average less than four percent below the target value, which supports this notion. Four elements are in the intermediate concentration range for the LAW formulation: calcium, magnesium, titanium, and zinc. Calcium and zinc deviations from target were less than three and one percent, respectively. A near thirty percent deficit of magnesium and about twelve percent surplus of titanium were observed in the LAW feed samples, whereas concentrations measured in the glass discharge samples were within three percent of the target values (see Table 5.2). This trend for magnesium has been encountered in past LAW studies without explanation [2, 3]. The large number of minor elements (HLW: As, Ca, Cd, Cl, Cr, Cu, F, La, Nd, Ni, P, Pb, S, Sb, Se, Sr, Ti and Zr; LAW: Cd, Cl, Cr, Cu, F, P, S, and Se) are all contributed by the simulated waste or spiked into the feed at low levels. Deviations were not calculated for these oxides due to the high volatility of many of the constituents and the uncertainty associated with deviation calculations on very low concentrations. As expected, highly volatile elements such as halogens, sulfur and selenium are under-represented in the glasses. Conversely, common elements such as calcium and titanium in the HLW feed, chromium in the LAW feed, and phosphorus in both feeds which are typical impurities in bulk chemicals, are over-represented when the constituent is a minor component. Elements not included in some of the glass formulations but detected at low levels in the feed as impurities were barium in both feeds, potassium in the HLW feed and manganese and nickel in the LAW feed; small amounts of these common elements are present in additive sources.

2.4.4 STL Analysis of RCRA metals

Feed samples from tests where data were collected to monitor melter and off-gas system DF for RCRA metals were sent to STL for metals analysis by SW-846 methods. The procedures used are SW-846-3005A for digestion of the feed slurry and SW-846-6010B to analyze the digested solutions using Inductively Coupled Plasma (ICP). The results are compared to the target compositions and the VSL analysis of feed samples in Table 2.11. The VSL values given in Table 2.11 were calculated from data presented in Section 2.4.3. Both of the sets of analyses approximate the target concentrations for Ag, Cu, Mn, Ni, Pb and Zn. The VSL analysis approximated target concentrations for Cd, Cr and Sb while the STL results were significantly below target concentrations. Both methods reported values below target

concentrations for selenium and arsenic as well as a small barium contamination in the feed. The deficiency in selenium and arsenic for the VSL analysis was expected due to volatilization during the crucible melting procedure. The low concentrations measured by STL of the soluble species As, Cr, Sb, and Se might suggest that sub-sampling of parent sample provided to STL was biased towards the insoluble components in the feed and deficient in the liquid portion. However, another more likely explanation is that the volatile and semi-volatile metals were partially volatilized during sample digestion. The SW-846-3005A procedure entails acidification of the feed sample with nitric and hydrochloric acids followed by heating the sample to between 90 and 95°C until the total volume of the sample is reduced by a factor of about five. In future tests, consideration should be given to the use of alternative digestion methods when semi-volatile metals such as selenium and arsenic feed concentrations are to be determined. An appropriate method would avoid the use of a thermal step to volatilize water hence the SW-846-3005A method maybe adequate for the volatile species if the volume reduction step is eliminated. It is recommended that method development for the feed analysis of volatile and semi-volatile metals be completed prior to WTP Performance Tests. The contaminant levels of barium and nickel (LAW feed only) measured in feed samples will be used to calculate system DF values in Section 6.4 (see Tables 6.8-6.11).

SECTION 3.0 DM1200 OPERATIONS

A series of tests were conducted with the HLW C-106/AY-102 and LAW Sub-Envelope A2 simulants at conditions intended to mimic WTP nominal and bounding operating conditions. The tests were designed to determine melter and off-gas system efficiency under these conditions for the removal of hazardous organics, acid halides, toxic metals, particles, and combustion byproducts. Between 11/15/04 and 12/12/04, a total of 23,969 kg of HLW feed was processed to produce 7525 kg of glass; between 3/07/05 and 3/23/05, 28,750 kg of LAW feed was processed to produce 15,201 kg of glass. Summaries of the test conditions, time intervals and rates for organic spiking, periods of water feeding and cold-cap burn-off, feed processed, and glass produced are provided in Tables 3.1 and 3.2. Detailed chronologies of operational events, including pretest system modifications and post test inspections, are given in Tables 3.3 and 3.4. The tests are summarized below in the order in which they were conducted:

- HLW Test 1: 52-hour test with separate spiking periods using allyl alcohol and solution of naphthalene in methanol for DRE determinations. Melter and off-gas system temperatures were maintained at WTP nominal conditions: 400°C plenum, 50°C SBS outlet, 70-75°C carbon bed outlet (target not obtained hence target changed to bed inlet in subsequent tests), and 400°C TCO outlet. The catalyst exhaust was monitored for particle size distribution. Various gaseous species, including total hydrocarbons, were monitored at several locations. This test was interrupted as a result of Project concerns with respect to the observed temperature increases in the carbon bed when the feed was spiked with organic compounds.
- HLW Test 2A: 75-hour test with separate spiking periods using allyl alcohol, a solution of naphthalene in methanol, and a solution of naphthalene in allyl alcohol for DRE determinations and total organic emissions (TOE) at the catalyst unit outlet. Melter and off-gas system temperatures were targeted at WTP challenge conditions for organic destruction: 345°C plenum (lowest achievable), 55°C SBS outlet (highest achievable), 85-90°C carbon bed inlet [9] and 370°C TCO outlet. Additional samples were taken at the melter and catalyst outlet to determine emission rates of dioxins/furans, PCBs, and volatile organic compounds. The catalyst exhaust was monitored for TOE while a solution of naphthalene in allyl alcohol was spiked into the feed to the melter [7]. Carbon monoxide concentrations at the carbon column outlet were monitored continuously throughout the test. Various gaseous species including total hydrocarbons were monitored at several locations.
- HLW Test 1-continued: 19-hour test with a spiking period using a solution of naphthalene in methanol for DRE determinations. Melter and off-gas system temperatures were maintained at WTP nominal conditions: 400°C plenum, 50°C SBS inlet, 70-75°C carbon bed inlet [9] and 400°C TCO outlet. Additional samples were taken at the melter and catalyst outlets to determine emission rates of particles, toxic metals,

and halides. Carbon monoxide concentrations at the carbon column outlet were monitored continuously throughout the test. Various gaseous species including total hydrocarbons were monitored at several locations.

- HLW Test 2B: 54-hour test. Melter and off-gas system temperatures were targeted at WTP challenge conditions for inorganic emissions: 500°C plenum, 55°C SBS outlet (highest achievable), 85-90°C carbon bed inlet [9] and 370°C TCO outlet. Additional samples were taken at the melter and catalyst outlets to determine emission rates of particles, toxic metals, halides, dioxins/furans, PCBs, and volatile organic compounds. The catalyst exhaust was monitored for particle size distribution. Carbon monoxide concentrations at the carbon column outlet were monitored continuously throughout the test. Various gaseous species were monitored at several locations.
- LAW Test 1: 75-hour test with separate spiking periods using allyl alcohol and a solution of naphthalene in methanol for DRE determinations. Melter and off-gas system temperatures were maintained at WTP nominal conditions: 400°C plenum, 50°C SBS outlet, 70-80°C carbon bed inlet [10], and 400°C TCO outlet. The catalyst exhaust was monitored for particle size distribution. Various gaseous species, including total hydrocarbons, were monitored at several locations.
- LAW Test 2B: 68.5-hour test with chloride and fluoride spiked into the feed. Melter and off-gas system temperatures were targeted at WTP challenge conditions for inorganic emissions: 500°C plenum, 50°C SBS outlet [10], 70-80°C carbon bed inlet [10] and 370°C TCO outlet. Additional samples were taken at the melter and catalyst outlets to determine emission rates of particles, toxic metals, halides, dioxins/furans, PCBs, and volatile organic compounds. The catalyst exhaust was monitored for particle size distribution. Various gaseous species were monitored at several locations.
- LAW Test 2A: 69-hour test with separate spiking periods using solutions of naphthalene in allyl alcohol and naphthalene in methanol for DRE determinations and total organic emissions (TOE) at the catalyst unit outlet. Melter and off-gas system temperatures were targeted at WTP challenge conditions for organic destruction: 327°C plenum (lowest achievable), 50°C SBS outlet [10], 70-80°C carbon bed inlet [10] and 370°C TCO outlet. Additional samples were taken at the melter and catalyst outlet to determine emission rates of dioxins/furans, PCBs, and volatile organic compounds. One of these sample pairs was taken while the melter feed was spiked with a solution of naphthalene in allyl alcohol to determine the effect of these compounds on dioxin/furan generation. The catalyst exhaust was monitored for TOE while a solution of naphthalene in allyl alcohol was spiked into the feed to the melter [7]. Various gaseous species including total hydrocarbons were monitored at several locations.

Immediately prior to these tests, a test using the HLW C-106/AY-101 simulant was conducted to evaluate the effects of bubbler configuration on glass production rate [21]. The test was also used to evaluate carbon column response to the HLW exhaust stream. In between the

HLW and LAW MACT tests, almost six metric tons of glass was produced over 85 hours of LAW slurry feeding. This LAW feeding period was used to change the melt pool composition from the HLW to LAW composition and to evaluate the carbon column response to high nitrogen oxide exhaust containing spiked levels of allyl alcohol and naphthalene.

The tests employed a prototypical ADS feed system, a single feed tube in the center of the melter, a nominal glass temperature of 1150°C for all tests, and a side-to-side electrode firing pattern. In each test, the cold-cap-limited production rate was determined by visual observations of the cold cap and confirmed by the plenum temperature. The ADS feed system performed well throughout all the tests. A fourteen minute pause in feeding was required to replace an ADS purge valve and feed tube gasket during the first day of the second HLW testing sequence. The feed tube required a minimal number of rod outs indicating that routine water flushes were sufficient to keep feed lines free of blockages. The organics spiking system which delivered organic into feed line also operated without incident. The backup AOD feed system was not used during the MACT tests.

The objective of the tests was to obtain and maintain target plenum temperatures and not to maximize production rates; however, attempts were made to achieve the highest glass production rates at the targeted plenum temperatures. During these tests, glass production rates varied inversely with plenum temperature, as illustrated in Figures 3.1.a – 3.1.d. The plenum is heated by openings in the cold cap that are created by bubbling. In these tests, the openings in the cold cap were reduced to achieve the desired plenum temperature by reducing bubbling, which in turn resulted in the reduction of production rate. The lowest production rate occurred during HLW Test 2A, in an attempt to achieve a plenum temperature of 300°C, which was aborted due to excessive accumulations of feed mounds in the melter; stable conditions returned as bubbling rate was increased resulting in a plenum temperature increase to about 350°C and a glass production rate increase from about 500 to 600 kg/m²/day. The steady-state production rate achieved for the HLW feed at a 500°C plenum temperature exceeded the WTP design minimum of 1050 kg/m²/day. Predictably, production rates were significantly higher during LAW tests than those during HLW tests due to the much lower water content of the LAW feed and the more favorable glass composition. In these LAW DM1200 tests, relatively higher glass production rate was achieved at lower bubbling rates than in previous tests with LAW simulants [2, 3, 19]. For example, a total bubbler flow of 71 lpm was required to produce glass at about 1800 kg/m²/day in a previous test [2], whereas only 43 lpm was used in the current tests. Given that the same bubbler configuration and glass temperature were used in all DM1200 tests with LAW simulants, differences in rate are due to the differences in feed composition. Even though feed from the current test processed faster than feed in previous tests, the glass production rate while collecting DRE data was lower than in previous tests (1400 vs. 1850-2000 kg/m²/day).

A variety of operational measurements recorded during these tests, including temperatures throughout the melter system, are given in Tables 3.5 and 3.6. The target glass temperature of 1150°C was successfully maintained for most of the glass pool during each test, as illustrated in Figures 3.2.a -3.2.d. One exception was near the surface (27" from the floor) in some of the tests where temperatures were lower due to the thermocouples being in or near the

cold cap. Two brief temperature spikes (approximately 1200°C and 1180°C) occurred during the first day of HLW Test 2A; the smaller of these was associated with a minor foaming event. Glass temperatures dipped below the target in portions of HLW Tests 2A and Test 1-continued during attempts to achieve the lowest attainable plenum temperature and during the transition from the low plenum temperature. However, test average bulk glass temperatures were within seven degrees of the target. The target plenum temperatures of 400°C, 300°C and 500°C were achieved and maintained for most of the appropriate tests, as shown in Figure 3.3.a - 3.3.d. A notable exception was the inability to maintain a 300°C plenum temperature at steady-state melter conditions during HLW Test 2A. A stable cold cap was established at 350°C and the plenum temperature target for future tests planned at 300°C was changed to the lowest temperature achievable [8]. The lowest plenum temperature achievable for LAW Test 2A was about 325°C. Another exception was the exposed thermocouple readings during HLW Test 2B. The plenum temperature of 500°C was targeted as the average of the three thermocouples, two at different elevations in the thermowell and one bare thermocouple in the plenum. As shown in Figure 4.3.b, the exposed thermocouple gave temperatures that were about one hundred degrees hotter than the other two thermocouples, presumably because of its close proximity to a bubbler induced opening in the cold cap. The test was therefore conducted using only the average of the two shielded thermocouples to target 500°C, which more accurately reflected temperatures in the vast majority of the plenum. A larger number of thermocouples would be recommended for operation of WTP melter in order to facilitate the identification of thermocouples that are providing reading that are skewed high or low as a result of either: (i) being directly over a hole in the cold cap created by bubbling, thereby giving anomalously high plenum temperature readings or (ii) being covered in feed, thereby giving anomalously low plenum temperature readings. Also, it is important to note that the target plenum temperatures used in these tests are based on expected WTP nominal and challenge conditions, not conditions which are nominal or explicitly targeted on the DM1200 in past tests. Routine operation of the DM1200 entails feeding the melter to achieve a cold cap limited feed rate, as defined by visual observations through the view port. This process typically results in plenum temperatures ranging between 400 to 600°C, depending on bubbling rate and the number of bubblers, for HLW feeds and from 500 to 550°C for LAW feeds in tests used to determine melter DRE for organic components [2, 3]. Visual observations of the DM1200 melt pool were essential in these tests to allow operators to obtain sufficient cold cap coverage in order to achieve the target plenum temperatures without creating unsustainable or unsafe melter conditions. Observations in the plenum can also aid in identifying thermocouples which are adjacent to holes in the cold cap created by bubbling or that are coated with feed. Consequently, it is recommended that the ability to maintain challenge condition plenum temperatures without use of visual information be evaluated, prior to WTP performance tests.

The east and west side electrode temperatures varied over the narrow range of 1060 – 1140°C after the cold cap was established, and typically varied by no more than 30°C from each other during each test, as shown in Figures 3.4.a - 3.4.d. An exception was LAW Test 1 where the west side electrode was about a 50°C colder than the east side electrode throughout the test. Temperature of the bottom electrode, which was not powered in these tests, was about 100°C lower than the average temperature of the side electrodes. The difference between electrode

temperatures decreased with increasing bubbling as the melt pool was better mixed. The discharge chamber and riser temperatures (the riser thermocouple is located about 4 inches above the bottom of the riser pipe, which is about 7.5 inches above the melter floor) were maintained above 1000°C and averaged mostly above 1050°C throughout the HLW tests to prevent crystallization in the discharge chamber. The likelihood of crystallization was less while feeding LAW simulants and therefore the discharge components were maintained about 100°C colder. Gas temperatures after the film-cooler were 100 - 180°C lower than the plenum temperature as a result of film-cooler and control-air dilution. The film cooler was cleaned by a water spray every 12 hours during most of the testing, resulting in a short-duration reduction to about 70°C in the film cooler outlet gas temperature.

Conditions in the glass pool are illustrated for electrical properties in Figures 3.5.a – 3.5.d, level and density in Figures 3.6.a – 3.6.d, and bubbling in Figures 3.7.a – 3.7.d. As expected, power supplied to the electrodes increased with increased production rate. Power was more frequently manipulated in these tests than in many of the previous DM1200 tests in order to attain and maintain the WTP challenge conditions. Bubbling was also frequently manipulated to maintain target plenum temperatures, which required further changes in power settings. Despite these operational demands, most changes in power settings were made gradually. Glass resistance varied as a function of electrode power and glass pool bubbling as well as glass composition; the resistance in the LAW glass pool was significantly less than in the HLW glass pool due to the differences in glass composition, particularly the higher alkali content. Glass pool density varied within narrow ranges for both the HLW composition (2.38 to 2.54 g/cc) and the LAW composition (2.29 to 2.44 g/cc). Glass pool level averaged about 33 inches from the melter floor and varied by about half an inch from this nominal height as the melter was fed and glass was discharged. Deviation from this behavior occurred near the start of HLW Test 2A as a result of a mild foaming event which caused a rise in the glass level and a drop in glass density, followed by a minor glass auto-discharge. This event was short in duration and did not occur while collecting emissions data used to calculate DRE or DF values. Bubbling was adjusted throughout the MACT tests to achieve the target plenum temperatures, achieve the maximum production rate at the target temperatures, and aid in maintaining an even cold cap. Predictably, bubbling rates were increased with increasing plenum temperatures and production rates. The second HLW testing sequence in Figure 3.7.b illustrates the increase in bubbling rate as the plenum temperature was increased from 350°C to 400°C to 500°C. The bubblers in the bottom electrode were used in the LAW tests although flow through these bubblers constituted less than ten percent of the total bubbler air flow.

SECTION 4.0

OFF-GAS SYSTEM PERFORMANCE

The off-gas treatment system, shown schematically in Figure 1.7 consists of a submerged bed scrubber (SBS); a wet electrostatic precipitator (WESP); a high-efficiency mist eliminator (HEME #1) (for HLW runs only); a heater; a high-efficiency particulate arrestor (HEPA); a sulfur impregnated activated carbon bed (AC-S) unit; a TCO/SCR catalytic unit, which includes a heater, a thermal catalytic oxidation unit (TCO), and a selective catalytic reduction unit (SCR) equipped with an ammonia injection system; a packed-bed caustic scrubber (PBS); a second high-efficiency mist eliminator (HEME #2); and a second HEPA on the bypass off-gas system. The new full size sulfur-impregnated activated carbon bed was installed in November 2004, prior to these tests. The AC-S unit was inserted between the HEPA filter and the heater for the TCO/SCR catalytic unit in the off-gas train. Data on the operational parameters of the off-gas system units collected during the MACT tests are presented and discussed in this section.

As described previously, the HLW tests used C-106/AY-102 feed and the LAW tests used Sub-Envelope A2 feed. Each test series (HLW and LAW) included test periods where the melter and off-gas system operating conditions were intentionally varied to simulate WTP normal and challenge conditions for emissions. Additionally, each test series included segments of spiking selected hazardous organic compounds (allyl alcohol and naphthalene) in order to collect DRE data across the melter and primary and secondary off-gas systems.

This section describes the overall off-gas system performance during the entire testing period. Detailed information on the off-gas emissions are presented in Section 6. Tables 3.3 and 3.4 provide an overview of the complete test series for HLW and LAW tests, respectively, in the chronological sequence in which the tests were performed. These tables also include major post-test inspections and equipment modifications as well as key operational events that affected off-gas system performance during the tests.

4.1 Off-Gas System Test Results

Data for each of the off-gas system components, logged by the LabVIEW data acquisition and control software, were imported into MS Excel files for data manipulation and plotting. Time “0” on the x-axis of each data plot corresponds to the start of water feed into the melter at the beginning of each test. Where indicated, data were smoothed by time averaging instantaneous measurements logged at two-minute intervals to reduce data scatter and the number of data points for the plots. The average, minimum, and maximum values of the measured off-gas system parameters are given in Tables 4.1 and 4.2 for HLW and LAW tests, respectively. Plots of the typical sequence of gas temperatures through the DM1200 off-gas system at various locations are given in Figures 4.1 through 4.4 for the HLW tests, and Figures 4.5 through 4.7 for the LAW tests. The increase of SCR outlet #1 temperature seen in the LAW

test data is likely due to the exothermic reaction between the added ammonia and higher concentration of NO_x in the LAW off-gas as compared to the HLW off-gas. The difference in temperatures measured by the two SCR outlet thermocouples suggests there may be some non-uniformity in the flow through, or at the exit of, the SCR.

During these tests the melter plenum and off-gas temperatures were controlled according to the parameters specified in the Test Plan [5]. These include the SBS off-gas exit temperature (controlled by adjustments to the SBS cooling flow conditions) and the TCO temperature (controlled by the TCO heater set point). Additionally, the HEPA inlet temperature was controlled to prevent condensation in the HEPA. Figures 4.8 through 4.11 show representative off-gas system temperatures for the HLW test series. Figures 4.8 and 4.10 provide temperatures for the SBS outlet, WESP outlet, AC-S inlet and outlet, the HEPA outlet, and the downstream blower outlet. Figures 4.9 and 4.11 provide temperatures in the TCO. In general, the figures show that conditions were maintained at the target values during testing and particularly during the spiking periods. The AC-S temperature was monitored but was not actively controlled because the temperature is dependent on chemical reactions in the bed that resulted in the fluctuations seen in Figures 4.8 and 4.10. Note also that the TCO inlet temperature shows some decrease during allyl alcohol spiking; however, the bed and outlet temperatures are reasonably stable and near the target value of 400°C for the spiking periods of Test 1 (Figure 4.9) and Test 1-continued (Figure 4.11), and were stable and near the target value of 370°C for Test 2A and 2B segments.

Figures 4.12 through 4.15 provide representative off-gas system temperatures for the LAW test series. As with HLW testing, the data indicate that, in general, target values were maintained, especially during the spiking periods. As previously mentioned, the rise in AC-S outlet temperature resulted from reactions in the bed. The target TCO temperature was 400°C for Test 1 and 370°C for the Test 2B and 2A segments. Figures 4.13 and 4.15 show reasonably steady TCO outlet values that were close to the target.

During the course of the above tests, equipment malfunction, deterioration of cold cap conditions, etc., resulted in a few test interruptions or deviations from normal equipment operating parameters. As noted above, the key operational events that affected off-gas system performance are listed in Tables 3.3 and 3.4.

4.1.1 Melter Pressure

HLW Test 1

The computer-logged melter pressures measured at the instrument port and calculated control air flow rates for Test 1 are plotted in Figure 4.16. The test ended at 52.3 hours. The average melter pressure was -2.5 in. W.C. for Test 1 and the melter pressure ranged from -4.3 in. W.C. to -0.5 in. W.C. The control air system, to control melter pressure, was operational and

effective during this test and its flow rate averaged 31.0 scfm. The small non-positive pressure spikes at 8.9 and 36.4 hours were due to off-gas sampling and inadvertent melter LabVIEW shut-down, respectively. Not all small non-positive pressure spikes are captured in the LabVIEW data since the events can be of very short duration and the electronic data are captured every two minutes; a complete listing of these events for all the tests is given in Tables 3.3 and 3.4. At 17.7 hours, Blower-701 and Blower-801 speeds were adjusted and the control air setting was changed from -2.75 to -2.5 in. W.C. to maintain -2.0 in. W.C. pressure at the Blower-701 outlet and to maintain better overall system airflow of 230 to 240 scfm at the WESP outlet.

The differential pressure across the film cooler is given in Figure 4.17. Between 31.5 - 31.8 hours the clogged film cooler sensor was cleaned. This sensor frequently clogs due to high particulate concentrations at the melter outlet even though it, like all pressure sensors in the DM1200, is constantly purged with air at 0.5 scfh. During this test, the film cooler was rinsed at 9.6, 33.7, and 45.6 hours with 5 liters of water. A view of the partially clogged film cooler at about 1.5 hours is provided in Figure 4.18. Transition line differential pressure data for HLW Test 1 are shown in Figure 4.19. The transition line differential pressure rose to 4.4 in. W.C. at 33.8 hours when the film cooler was being rinsed. The pressure dip at 36.4 hours corresponds to the inadvertent melter LabVIEW shutdown. At this time, the blowers, heaters, and EOG were reset.

HLW Tests 2A, 1-continued and 2B

The computer-logged melter pressures measured at the instrument port and calculated control air flow rates for HLW Tests 2A, 1-continued, and 2B are plotted in Figure 4.20. The test ended at 149.4 hours. The average melter pressure was -2.7 in. W.C., -2.8 in. W.C., and -2.8 in. W.C. for HLW Tests 2A, 1-continued and 2B, respectively, and the melter pressure ranged from -5.3 in. W.C. to 0.0 in. W.C. The control air system, to control melter pressure, was operational and effective during this test, and its flow rate averaged 19.8 scfm, 20.3 scfm, and 24.3 scfm for HLW Tests 2A, 1-continued, and 2B, respectively. The single positive melter pressure value of 0.0 in. W.C. observed in LabVIEW data and shown in Figure 4.20, occurred at about 121.7 hours when the cold cap coverage was about 95-98%. This spike was probably due to rapid cold cap incorporation into the melt.

The differential pressure across the film cooler is given in Figure 4.21. During this test, the film cooler was rinsed with 5 liters of water at 9.2, 21.7, 33.4, 45.6, 69.4, 72.0, 120.0, and 142.4 hours. A view of the partially clogged film cooler taken at 47.9 hours is shown in Figure 4.22. At 131.2 hours, visual observation showed about 5% film cooler blockage. The transition line differential pressure during HLW Tests 2A, 1-continued, and 2B is given in Figure 4.23. The average transition line differential pressure was 1.2 in. W.C., 1.5 in. W.C., and 2.1 in. W.C. for HLW Tests 2A, 1-continued, and 2B respectively. There were no transition line blockages.

LAW Test 1

The computer-logged melter pressures measured at the instrument port and calculated control air flow rates for LAW Test 1 are plotted in Figure 4.24. The test ended at 75.0 hours. The average melter pressure was -2.8 in. W.C. through the spiking and non-spiking segments. During the LAW Test 1 segments, the melter pressure ranged from -3.6 in. W.C. to -1.7 in. W.C. The control air system, to control melter pressure, was operational and effective during this test and its flow rate averaged 25.3 scfm, 33.8 scfm, and 31.6 scfm for LAW Test 1 segments with allyl alcohol, naphthalene/MeOH, and no spiking, respectively. Periodic non-positive pressure spikes occurred during off-gas sampling as well as during the initial part of the test when the cold cap was being established. The control air was maintained at a lower flow rate during the initial hours to minimize pressure spikes while the cold cap was being formed.

The differential pressure across the film cooler is given in Figures 4.25. The film cooler was not rodded during this test. However, at 36 hours the film cooler and the transition line differential pressure tubing was cleaned due to apparent clogging. Differential pressure data between about 22 and 36 hours appear to be affected by the clogging. During this test, the film cooler was rinsed about every 12 hours with 5 liters of water. The transition line differential pressure during LAW Test 1 is provided in Figure 4.26; the average value is 1.9 in. W.C. The pressure spike at about 36 hours was due to the removal and cleaning of the differential pressure tubing.

LAW Tests 2B and 2A

The computer-logged melter pressures measured at the instrument port and calculated control air flow rates for LAW Tests 2B and 2A are plotted in Figure 4.27. The test ended at 138.7 hours. The average melter pressure was -2.9 in. W.C., and -2.8 in. W.C. for LAW Tests 2B and 2A respectively. During LAW Tests 2B and 2A, the melter pressure ranged from -4.9 in. W.C. to 0.1 in. W.C. The control air system, to control melter pressure, was operational and effective during this test and its flow rate averaged 24.5 scfm and 36.1 scfm (including feeding time before the allyl alcohol/naphthalene spiking period) for LAW Tests 2B and 2A, respectively. The single positive melter pressure value of 0.1 in. W.C. seen in LabVIEW data and Figure 4.27, occurred at about 127 hours when the melter cold cap coverage was almost complete. The melter pressure spike at 52.4 hours was due to film cooler rodding. At 18.6 hours and 32.6 hours the melter and melter/off-gas LabVIEW systems had to be reset. The control air setting was adjusted about 6 times during the initial 9 hours of operation when the cold cap was being established.

The differential pressure across the film cooler is given in Figure 4.28. Between 23.7 and 25.6 hours the film cooler differential pressure sensor tubing was replaced due to clogging. During LAW Test 2B, at 6.5 hours, the film cooler was inspected and found to be clean. At 52.4 hours the film cooler was about 80% blocked and was rodded out. At 69.6 hours, the film cooler

was clogged at approximately 30% of its area. The film cooler was rinsed approximately every 12 hours with 5 liters of water. The transition line differential pressures for LAW Tests 2B and 2A are given in Figure 4.29. The average transition line differential pressures were 3.2 in. W.C., and 3.1 in. W.C for LAW Tests 2B and 2A, respectively. There were no transition line blockages.

After LAW Tests 2B and 2A, an HLW Turnover Test was performed for about 62 hours, after which the transition line sections and the film cooler were taken out and inspected. The film cooler was installed during the bubbler configuration test series in July of 2003 [20]. Since that installation, the film cooler and transition line were removed and cleaned on several occasions, the most recent of which occurred in April 2004 [20]. The amount of material collected and documented at the inspection at the end of the MACT tests therefore reflects feed processing during the simulant verification tests [21], turn-over and scoping tests associated with the MACT tests, the MACT tests, and idling time in between these tests. One exception occurred after the MACT tests during the HLW turnover when a clog that began to severely limit the vacuum on the melter required cleaning and removal of the bellows along with the adjacent transition line segments being cleaned in place. Corrosion observed on the film cooler can be attributed to about 440 days of idling and 87 days of feed processing whereas the measured amounts of solids collected are the result of about 41 days of feeding but do not include the material removed during the HLW turnover test. The masses of the collected solids and a list of figures illustrating them are tabulated in Table 4.3. More than 1.56 kg of solids was removed. The layout of the film cooler and transition line sections with the SBS Y-piece, or transition line section #4, are shown in Figures 4.30 and 4.31. During the HLW Turnover Test, the transition line clogged and the transition line bellows were taken out. The views of transition line section #3 outlet, transition line bellows, and transition line section #4 inlet at 26.9 hours of the HLW Turnover Test are given in Figures 4.32, 4.33, and 4.34, respectively. A view of the film cooler inlet after the HLW Turnover Test is given in Figure 4.35. Glassy solids had deposited at the end of the film cooler. In Figure 4.36, damage to the tip of the film cooler is shown. Even though the film cooler was severely corroded, it functioned without incident throughout the tests. Close-up views of the film cooler louvers and the film cooler outlet are shown in Figures 4.37 and 4.38, respectively. The inlet of the film cooler after cleaning is shown in Figures 4.39 and 4.40. Included in Figure 4.39 for comparison is a picture of the film cooler after about half the exposure time. The transition line section #1 inlet and outlet are shown in Figures 4.41 and 4.42, respectively. The transition line section #2 inlet and outlet are shown in Figures 4.43 and 4.44, respectively. The transition line section #3 inlet and the solids that fell out of this section during the inspection after the HLW Turnover Test are shown in Figures 4.45 and Figure 4.46. The transition line bellows outlet is shown in Figure 4.47. Inlet and outlet views of transition line section #4 are shown in Figures 4.48 and 4.49, respectively.

4.1.2 SBS Performance

SBS inlet and outlet gas temperatures, pressures, and flow rates, pressure drop across the SBS, SBS water temperature, heat exchanger inlet and outlet water temperatures, and flow rates

were recorded during the tests. The amounts of heat removed by the SBS jacket, and the SBS inner cooling coil were calculated from the measured data, using the hourly averaged cooling water temperature increases (outlet temperature minus supply temperature) across the SBS inner cooling coil and cooling jacket multiplied by the same time-averaged water flow rate through each.

Data on the performance of the SBS regarding solids removal from the off-gas stream are presented and discussed in Section 6.0. Results from the analysis of fluids accumulated in the SBS are presented and discussed in Section 4.2.

HLW Test 1

The SBS inlet and outlet gas temperatures are plotted in Figure 4.50. The three downward spikes in the SBS inlet gas temperature are due to film cooler rinses with water. The decrease in SBS gas outlet temperature at 30.9 hours is due to lowering of the SBS cold water control set point from 52°C to 46°C. The Project directed that the lower set point be used until the start of the naphthalene/MeOH injection. The increase in SBS outlet gas temperature at 45.4 hours is due to increase in the SBS cold water set point from 46°C to 51°C. The SBS inlet gas temperature averaged 203°C, 205°C, and 220°C during the allyl alcohol spiked, naphthalene/MeOH spiked, and unspiked periods, respectively; the corresponding outlet gas temperature values were 50.7°C, 49.8°C, and 48.1°C. The average outlet temperature values during the spiking periods were close to the target of 50°C; the lower value during the unspiked period is due to the lower set point used for a portion of the unspiked test period. The inlet, outlet, and differential pressures are shown in Figure 4.51. During HLW Test 1, the inlet gas pressure averaged -4.7 in. W.C., the outlet pressure averaged -35.4 in. W.C., and the pressure drop across the SBS averaged about 30.3 in. W.C. The pressure drop across the SBS remained steady over 54.8 hours of testing with C-106/AY-102 feed. The SBS down-comer annulus pressure is given in Figure 4.52. The SBS off-gas temperatures in the down-comer measured at 12 depths (from 3 to 58 inches at 5 inch intervals) and the SBS sump water temperature are given in Figure 4.53. The measured off-gas temperatures decrease as the depth from the SBS lid increases due to cooling of the gas in the down-comer pipe by the surrounding SBS liquid.

Water temperatures at the SBS inner cooling coil inlet, inner cooling coil outlet/jacket inlet, and jacket outlet are given in Figure 4.54. The effects of SBS cold water set point changes mentioned above at 30.9 and 45.4 hours can be observed in the inner cooling coil water outlet/jacket inlet, and jacket outlet temperatures. The average water temperature difference was 27.3°C across the SBS inner cooling coil and 0.7°C across the jacket during HLW Test 1. The SBS cooling coil/SBS jacket water flow rate is plotted in Figure 4.55 and averaged 9.2 gpm. The amounts of heat removed by the SBS inner coil and jacket are shown in Figure 4.56. For HLW Test 1, heat removal averaged 53.1 kW by the SBS inner cooling coil and 1.2 kW by the cooling jacket. This corresponds to about 98% of the heat load to the SBS being removed by the inner cooling coil and about 2% by the cooling jacket. For HLW Test 1, the SBS sump temperature was 43.1°C, which was 4.5°C less than the SBS outlet gas temperature.

At the end of HLW Test 1, the SBS was not blown down.

HLW Tests 2A, 1-continued, and 2B

The SBS inlet and outlet gas temperatures are plotted in Figure 4.57. The downward spikes in the SBS gas inlet and outlet temperatures between 20.1 and 21.8 hours are due to feed stoppage to allow cold cap conditions to improve in the melter. Most of the other downward spikes in the SBS inlet gas temperature are due to periodic cleaning of the film cooler with water. The inlet gas temperature during feeding averaged 173°C and the outlet gas temperature averaged 54.9°C (target was 55°C) during HLW Test 2A. The SBS outlet gas temperature averages for the individual spiking periods were: 54.8°C (allyl alcohol spike); 54.9°C (naphthalene/MeOH spike); and 54.6°C (allyl alcohol/naphthalene spike). The inlet gas temperature averaged 210°C and the outlet gas temperature averaged 49.7°C (target was 50°C) during HLW Test 1-continued. The average SBS outlet gas temperatures for the individual naphthalene/MeOH spiking period was 49.6°C. The inlet gas temperature averaged 271°C and the outlet gas temperature averaged 55.1°C (target was 55°C) during HLW Test 2B. The inlet, outlet, and differential pressures are shown in Figure 4.58. During HLW Test 2A, the inlet gas pressure averaged -4.3 in. W.C., the outlet pressure averaged -34.8 in. W.C., and the pressure drop across the SBS averaged about 30.1 in. W.C. During HLW Test 1-continued, the inlet gas pressure averaged -4.8 in. W.C., the outlet pressure averaged -35.9 in. W.C., and the pressure drop across the SBS averaged about 30.6 in. W.C. During HLW Test 2B the inlet gas pressure averaged -6.0 in. W.C., the outlet pressure averaged -38.2 in. W.C., and the pressure drop across the SBS averaged 31.7 in. W.C. The pressure drop across the SBS increased by about 2.2 in. W.C. over 151.3 hours of testing with HLW C-106/AY-102 feed. The SBS down-comer annulus pressure is given in Figure 4.59. The SBS off-gas temperatures in the down-comer measured at 12 depths (from 3 to 58 inches at 5 inch intervals) and the SBS sump water temperature are given in Figure 4.60. The measured off-gas temperatures decrease as the depth from the SBS lid increases due to cooling of the gas in the down-comer pipe by the surrounding SBS liquid. The average SBS sump temperatures were 50.5°C, 44.5°C, and 49.3°C, which were 4.4°C, 5.0°C, and 5.8°C less than the SBS outlet gas temperatures for HLW Tests 2A, 1-continued, and 2B, respectively.

Water temperatures at the SBS inner cooling coil inlet, inner cooling coil outlet/jacket inlet, and jacket outlet are given in Figure 4.61. The average water temperature difference was 37.2°C across the SBS inner cooling coil and 0.7°C across the jacket during HLW Test 2A. The average water temperature difference was 29.1°C across the SBS inner cooling coil and 1.1°C across the jacket during HLW Test 1-continued. The average water temperature difference was 31.9°C and 1.8°C across the SBS inner cooling coil and jacket, respectively, during HLW Test 2B. Between 22.9 and 23.5 hours the SBS cold water flow was reduced to raise the SBS outlet gas temperature. The effect can be observed in the measured water temperatures.

The SBS cooling coil/SBS jacket water flow rate is plotted in Figure 4.62. The average

SBS cooling coil/SBS jacket water flow rate was 3.4 gpm, 8.1 gpm, and 11.5 gpm during HLW Tests 2A, 1-continued, and 2B, respectively. The amounts of heat removed by the SBS inner coil and jacket are shown in Figure 4.63. For HLW Test 2A, heat removal averaged 31.0 kW by the SBS inner cooling coil and 0.5 kW by the cooling jacket. This corresponds to about 98% of the heat load to the SBS being removed by the inner cooling coil and about 2% by the cooling jacket. For HLW Test 1-continued, heat removal averaged 50.5 kW by the SBS inner cooling coil and 2.0 kW by the cooling jacket. About 96% of the heat load to the SBS was removed by the inner cooling coil and about 4% by the cooling jacket. For HLW Test 2B, heat removal averaged 78.5 kW by the SBS inner cooling coil and 4.6 kW by the cooling jacket. About 95% of the heat load to the SBS was removed by the inner cooling coil and about 5% by the cooling jacket. The SBS was not blown down at the end of this test. The remaining water in the overflow tank, 109.1 gallons, was blown down and the tank was refilled with 80.0 gallons of fresh water.

LAW Test 1

Before starting LAW Test 1, an LAW Scoping test was performed to evaluate the activated carbon column temperature variations in response to LAW feed, including the high nitrogen exhaust with allyl alcohol spiking. Several weeks had passed since completion of the previous HLW MACT tests, and problems were encountered in trying to use the SBS blow-down wand in the LAW Scoping test. Periodic attempts were made to remove the clogging by applying water pressure and, in the meantime, the SBS was blown down by opening valves in the SBS vessel or overflow tank. After about 75 hours of runtime in the LAW Scoping test, attempts to remove the clogging were successful, and normal use of the wand for blow-downs continued. The clogging was likely a result of the wand having sat in the accumulated solids in the bottom of the SBS bowl during the idle time; however, idling times of this duration have occurred frequently between past tests without causing the wand to clog. A key difference between this and prior idling periods was the lack of mechanical removal (by completely draining the SBS, dropping the bowl, and scooping out the solids) of solids between tests. As discussed below, post-test inspections showed that the amount of solids accumulated was greater than had been the case prior to all previous mechanical cleanings, as a direct result of the deliberately longer duration between the cleaning events. The amount of solids accumulated indicates that the rate of solids accumulation shows no evidence of decreasing with time between cleanings (see discussion at the end of this section).

For LAW Test 1, the SBS inlet and outlet gas temperatures are plotted in Figure 4.64. The downward spikes in the SBS inlet gas temperature are due to periodic cleaning of the film cooler with water which occurred at about 12 hour intervals. The inlet gas temperature during allyl alcohol, naphthalene/MeOH and unspiked periods averaged 210°C, 205°C and 204°C, respectively. The outlet gas temperature during these same periods averaged 50.0°C, 50.0°C, and 50.2°C, respectively. The inlet, outlet, and differential pressures are shown in Figure 4.65. During LAW Test 1 allyl alcohol spiking segment, the inlet gas pressure averaged -5.2 in. W.C., the outlet pressure averaged -37.5 in. W.C., and the pressure drop across the SBS averaged about 32.4 in. W.C. During the naphthalene/MeOH spiking segment, the inlet gas pressure averaged

-5.4 in. W.C., the outlet pressure averaged -37.6 in. W.C., and the pressure drop across the SBS averaged about 32.5 in. W.C. During LAW Test 1 unspiked segment, the inlet gas pressure averaged -5.4 in. W.C., the outlet pressure averaged -37.5 in. W.C., and the pressure drop across the SBS averaged 32.5 in. W.C. The pressure drop across the SBS increased by about 1.0 in. W.C. over 76.3 hours of testing with LAW Sub Envelope A2 feed. The down-comer annulus air pressure is given in Figure 4.66. The SBS off-gas temperatures in the down-comer measured at 12 depths (from 3 to 58 inches at 5 inch intervals) and the SBS sump water temperature are given in Figure 4.67. The measured off-gas temperatures decrease as the depth from the SBS lid increases due to cooling of the gas in the down-comer pipe by the surrounding SBS liquid. The average SBS sump temperatures were 44.6°C, 44.5°C, and 44.9°C, which were 5.4°C, 5.5°C, and 5.3°C less than the SBS outlet gas temperatures for LAW Test 1 allyl alcohol, naphthalene/MeOH, and unspiked periods, respectively.

Water temperatures at the SBS inner cooling coil inlet, inner cooling coil outlet/jacket inlet, and jacket outlet are given in Figure 4.68. The average water temperature difference was 29.3°C across the SBS inner cooling coil, and 1.5°C across the jacket during the LAW Test 1 allyl alcohol spiking segment. The average water temperature difference was 29.3°C across the SBS inner cooling coil and 1.5°C across the jacket during the LAW Test 1 naphthalene/MeOH spiking segment. The average water temperature difference was 29.6°C and 1.5°C across the SBS inner cooling coil and jacket, respectively, during the LAW Test 1 unspiked segment. The SBS cooling coil/SBS jacket water flow rate is plotted in Figure 4.69. The average SBS cooling coil/SBS jacket water flow rate was 5.4 gpm, 5.2 gpm, and 5.2 gpm during LAW Test 1 allyl alcohol, naphthalene/MeOH, and unspiked segments, respectively. The amounts of heat removed by the SBS inner coil and jacket are shown in Figure 4.70. For the allyl alcohol spiking segment, heat removal averaged 33.6 kW by the SBS inner cooling coil and 1.8 kW by the cooling jacket. This corresponds to about 95% of the heat load to the SBS being removed by the inner cooling coil and about 5% by the cooling jacket. For the naphthalene/MeOH spiking segment, heat removal averaged 32.7 kW by the SBS inner cooling coil and 1.8 kW by the cooling jacket. About 95% of the heat load to the SBS was removed by the inner cooling coil and about 5% by the cooling jacket. For the unspiked segment, heat removal averaged 33.1 kW by the SBS inner cooling coil and 1.7 kW by the cooling jacket. About 95% of the heat load to the SBS was removed by the inner cooling coil and about 5% by the cooling jacket.

At the end of LAW Test 1, the SBS was not blown down.

LAW Tests 2B and 2A.

Before these tests, the SBS recirculation pump was replaced due to leakage. The SBS process water level detector was not working properly and was therefore removed from service.

The SBS inlet and outlet gas temperatures during LAW Tests 2B and 2A are plotted in Figure 4.71. The downward spikes in SBS gas temperature are due to periodic cleaning of the film cooler with water which occurred at about 12 hour intervals. The inlet gas temperature

during feeding averaged 274°C and the outlet gas temperature averaged 50.0°C (target was 50°C) during LAW Test 2B. The inlet gas temperature averaged 172°C, 163°C, and 164°C, respectively, during the allyl alcohol, naphthalene/MeOH, and unspiked periods of LAW Test 2A, and the corresponding average outlet gas temperatures were 49.8°C, 50.2°C, and 49.8°C (target was 50°C). The inlet, outlet, and differential pressures are shown in Figure 4.72. During LAW Test 2B, the inlet gas pressure averaged -7.2 in. W.C., the outlet pressure averaged -39.8 in. W.C., and the pressure drop across the SBS averaged about 32.1 in. W.C. During LAW Test 2A, the inlet gas temperature averaged 172°C, 163°C, and 164°C during the allyl alcohol/naphthalene spike, naphthalene/MeOH spike, and unspiked periods, respectively. The corresponding average gas outlet temperatures were 49.8°C, 50.2°C, and 49.8°C (target was 50.0°C). During LAW Test 2A, the inlet gas pressure averaged -6.4 in. W.C., the outlet pressure averaged -38.4 in. W.C., and the pressure drop across the SBS averaged about 31.7 in. W.C. The pressure drop across the SBS decreased by about 0.4 in. W.C. over 138.7 hours of testing with LAW Sub-Envelope A2 feed. The SBS down-comer annulus pressure is given in Figure 4.73. The SBS off-gas temperatures in the down-comer measured at 12 depths (from 3 to 58 inches at 5 inch intervals) and the SBS sump water temperature are plotted in Figure 4.74. The measured off-gas temperatures decrease as the depth from the SBS lid increases due to cooling of the gas in the down-comer pipe by the surrounding SBS liquid. The average SBS sump temperatures were 44.2°C for LAW Test 2B, and 44.4°C, 44.6°C, and 44.6°C, respectively, for the allyl alcohol/naphthalene spike, naphthalene/MeOH spike, and unspiked periods of LAW Test 2A.

Water temperatures at the SBS inner cooling coil inlet, inner cooling coil outlet/jacket inlet, and jacket outlet are given in Figure 4.75. The average water temperature difference was 28.2°C across the SBS inner cooling coil, and 1.7°C across the jacket during LAW Test 2B. The average water temperature difference was 29.1°C across the SBS inner cooling coil and 1.6°C across the jacket during LAW Test 2A.

The SBS cooling coil/SBS jacket water flow rates are plotted in Figure 4.76. The average SBS cooling coil/SBS jacket water flow rates were 8.4 gpm and 4.6 gpm during LAW Tests 2B and 2A, respectively. The amounts of heat removed by the SBS inner coil and jacket are shown in Figure 4.77. For LAW Test 2B, heat removal averaged 50.6 kW by the SBS inner cooling coil, and 3.2 kW by the cooling jacket. This corresponds to about 94% of the heat load to the SBS being removed by the inner cooling coil and about 6% by the cooling jacket. For LAW Test 2A, heat removal averaged 28.7 kW by the SBS inner cooling coil and 1.6 kW by the cooling jacket. About 95% of the heat load to the SBS was removed by the inner cooling coil and about 5% by the cooling jacket.

The SBS was blown down after the HLW Turnover Test, which followed these MACT tests. As shown in Figure 4.78, the SBS overflow tank did not contain any residual solids. Visual images of the SBS bowl contents are shown in Figures 4.79 and 4.80. SBS solids, after the standing water was removed, are shown in Figure 4.81. Notice that the solids pile has a tip (lower part of the photo) which is pointed towards the draining point into the SBS overflow tank. The total mass of the wet SBS bowl solids was 36.0 kg (Sample O-12G-116A). The DCP analyzed composition of Sample O-12G-116A is given in Table 4.4. The average water content

of this material was 35%. The corresponding dry SBS solids mass was 23.5 kg. The amount of solids accumulated was greater than had been the case prior to all previous mechanical cleanings, as a direct result of the deliberately longer duration between the cleaning events. Since this material accumulated over 51 run days (following the previous time solids were removed from the SBS), this corresponds to a solids accumulation rate of about 0.5 kg/day. This accumulation rate is about the same as the values (~ 0.1 to 0.5 kg/day) obtained from test periods with shorter durations between measurements (and cleanings). There is therefore no evidence of this rate approaching zero, which would be the desirable steady state value in order to avoid the possibility of unbounded accumulation.

A view of the bottom of the SBS diffuser plate after the HLW Turnover Test is given in Figure 4.82. Bottom views of the SBS down-comer are given in Figures 4.83 and 4.84. There was a ring of solids at the bottom of the down-comer. The percent occlusion of the SBS down-comer pipe at the tip was approximately 30%. A view from the top of the SBS showing a clean SBS down-comer is given in Figure 4.85.

The material in the SBS bowl represents sediments accumulated during multiple tests since the last bowl cleaning in September, 2003. These tests include the last HLW configuration test (Test 9) [20], the HLW Simulant Verification Tests [21], and the present MACT Tests, including the LAW A2 Scoping Test preceding the LAW MACT Tests. The bowl was dropped for inspection following the HLW configuration test in April 2004; however, the sediment was not removed.

4.1.3 WESP Performance

The inlet and outlet gas temperatures, differential pressure across the WESP, and the WESP current and voltage were measured and recorded by the computer data acquisition system.

Data on the performance of the WESP regarding solids removal from the off-gas stream are presented and discussed in Section 6.0. Results of the analysis of fluids that accumulated in the WESP are presented and discussed in Section 4.2.

HLW Test 1

The WESP inlet and outlet gas temperatures are plotted in Figure 4.86. Average WESP gas temperatures during HLW Test 1 are given in Table 4.1. Based on inlet and outlet average gas temperature values, there was a 0.9°C temperature increase across the WESP during HLW Test 1. The periodic downward spikes in the WESP outlet temperature are a result of the daily deluge of the WESP. The effect of changing the SBS gas outlet temperature between 30.9 and 45.4 hours can be also observed in the WESP inlet and outlet temperatures. The WESP differential pressure and outlet gas flow rate are plotted in Figure 4.87. The pressure drop across the WESP averaged 1.9 in. W.C. The average WESP wet gas flow rate was 235 scfm.

The amount of liquid accumulated in the WESP is plotted as a function of run time in Figure 4.88 where it is compared with the amount of fresh water sprayed into the WESP. The inlet spray water was targeted at 2.0 ± 0.2 gph, as specified by the Test Plan. However, the actual spray water flow rate was ≈ 1.7 gph because of limitations of the spray nozzle. As evident from Figure 4.88, spray water accounts for the majority of the liquid accumulation in the WESP. The difference between accumulated liquid and fresh water sprayed is equal to the amount of liquid removed from the off-gas, which is also plotted in Figure 4.88. The WESP electrodes were deluged daily, as planned, with water at a nominal rate of 12 gpm for 3.33 minutes.

The WESP voltage and current are plotted as a function of run time in Figure 4.89. The current remained steady at about 17mA; however, the voltage fluctuated between approximately 27 and 32 kV. The power stabilized immediately after deluges, as indicated in Table 4.5, which also provides the durations of spray water flow interruptions.

At the end of the test, 21.6 gallons of liquid was initially blown down. After a deluge, an additional 46.6 gallons of liquid was removed.

HLW Test 2A, 1-continued and 2B

The WESP inlet and outlet gas temperatures are plotted in Figure 4.90. The lower temperature values between about 75 through 96 hours correspond to the Test 1-continued segment, and result from the lower SBS outlet temperature set point for that test. During HLW Test 2A the WESP inlet gas temperature averaged 53.6°C and the outlet gas temperature averaged 53.7°C. During Test 1-continued, the WESP inlet gas temperature averaged 48.8°C and the outlet temperature averaged 49.9°C, indicating a 1.1°C temperature increase across the WESP. During Test 2B, the WESP inlet gas temperature averaged 54.3°C and the outlet temperature averaged 54.6°C, indicating a 0.3°C temperature increase across the WESP. The periodic downward spikes in the WESP outlet temperature are a result of the daily deluge of the WESP. Another downward spike at about 20.1 hours is due to stoppage of feed. The WESP differential pressure and outlet gas flow rate are plotted in Figure 4.91. The pressure drop across the WESP averaged 1.9 in., 1.7 in., and 2.1 in. W.C. during HLW Tests 2A, 1-continued, and 2B, respectively. The average WESP wet gas flow rate was 239 scfm, 224 scfm, and 220 scfm for HLW Tests 2A, 1-continued, and 2B, respectively. Some problems with the pitot tube to measure WESP flow rate were encountered between 98 to 105 hours. The instrument was purged and repositioned in the flow stream at about 98 hours and purged again at about 105 hours. After the second purge, the gas flow rate values decreased and stabilized.

The amount of liquid accumulated in the WESP is plotted as a function of run time in Figure 4.92 where it is compared to the amount of fresh water sprayed into the WESP. The inlet spray water was targeted at 2.0 ± 0.2 gph, as specified by the Test Plan. However, the actual spray water flow rate was ≈ 1.7 gph because of limitations of the spray nozzle coupled with low building water supply pressure. As evident from Figure 4.92, spray water accounts for the majority of the liquid accumulation in the WESP. The difference between accumulated liquid

and fresh water sprayed is equal to the amount of liquid removed from the off-gas, which is also plotted in Figure 4.92. WESP power and spray were turned off about 30 minutes each at 27.8, 29.8, 49.2, 52.8, 120.8, and 124.1 hours for off-gas sampling. The WESP electrodes were deluged daily, as planned, with water at a nominal rate of 12 gpm for 3.33 minutes.

The WESP voltage and current are plotted as a function of run time in Figure 4.93. The current remained reasonably steady around 16-17 mA throughout the test; however, the voltage varied between about 28 to 31kV. The time required to stabilize power to operating values after deluges and durations of WESP water spray flow interruptions are shown in Table 4.5. The power stabilized immediately after deluges.

At the end of the test, 79.3 gallons of liquid was initially blown down. After a deluge, an additional 41.8 gallons of liquid was removed. Two thirds of the WESP bottom area was covered with sludge after the deluge, as shown in Figure 4.94. Figure 4.95 shows the WESP collector plates and grid post-deluge. There were some solids accumulation on both the collector plates and rods. In Figure 4.96, a view of minor solid deposits at the inlet spray nozzle and inlet piping is shown.

LAW Test 1

Before LAW Test 1, and after the preceding LAW Scoping test, the WESP was inspected. Some fluctuations in WESP current were noticed during the latter stages of the LAW Scoping Test; however, no unusual observations were noted during the inspection. The majority of rods were clean. The south manway was opened to allow inspection and the grid posts and power connections all appeared to be in good condition, as seen in Figures 4.97 and 4.98. No signs of shorting were apparent. Some solids accumulation was observed on the rods at the upper manway access level.

The WESP inlet and outlet gas temperatures are plotted in Figure 4.99. The WESP inlet gas temperature averaged 49.3°C, 49.2°C, and 49.4°C, and the outlet temperature averaged 50.8°C, 50.9°C and 51.2°C, indicating 1.5°C, 1.7°C, and 1.8°C temperature increases across the WESP during allyl alcohol, naphthalene/MeOH, and unspiked segments of LAW Test 1, respectively. The downward spikes in the WESP outlet temperature are a result of the daily deluge of the WESP. The WESP differential pressure and outlet gas flow rate are plotted in Figure 4.100. The pressure drop across the WESP averaged 2.3 in. W.C. and the average WESP wet gas flow rate was 224 scfm during LAW Test 1.

The amount of liquid accumulated in the WESP is plotted as a function of run time in Figure 4.101 where it is compared with the amount of fresh water sprayed into the WESP. The inlet spray water was set to 2.0 ± 0.2 gph, as specified by the Test Plan. The actual spray water flow rate was ≈ 1.63 gph. As evident from Figure 4.101, spray water accounts for the majority of the liquid accumulation in the WESP. The difference between accumulated liquid and fresh water sprayed is equal to the amount of liquid removed from the off-gas, which is also plotted in

Figure 4.101. At the beginning of the test, there was a net water evaporation into the gas. At 24.9 hours, the net liquid accumulation was negative, corresponding to 2.5 gallons of water evaporated into the gas stream. The WESP electrodes were deluged daily, as planned, with water at a nominal rate of 12 gpm for 3.33 minutes.

The WESP voltage and current are plotted as a function of run time in Figure 4.102. The average operating voltage and current were about 30.8 kV and 15.9 mA, respectively. Except for the initial current fluctuations, the voltage and current remained steady throughout the test. The time required to stabilize power to operating values after deluge of the WESP was 13 minutes for the first deluge and 15 minutes for the second deluge, as shown in Table 4.6, which also provides the duration of the interruptions of spray water flow.

At the end of the test, 60.4 gallons of liquid was initially blown down. After a deluge, an additional 42.1 gallons of liquid was removed.

LAW Tests 2B and 2A

The WESP inlet and outlet gas temperatures are plotted in Figure 4.103. The WESP inlet gas temperature averaged 49.4 °C and the outlet temperature averaged 50.9°C, indicating a 1.5°C temperature increase across the WESP during LAW Test 2B. The WESP inlet gas temperature averaged 49.1°C and the outlet temperature averaged 50.3°C, indicating a 1.2°C temperature increase across the WESP during LAW Test 2A. The downward spikes in the WESP outlet temperature are a result of the daily deluge of the WESP. The WESP differential pressure and outlet gas flow rate are plotted in Figure 4.104. The pressure drop across the WESP averaged 2.1 in. W.C. for both tests and the average WESP wet gas flow rates were 218 scfm and 222 scfm for LAW Tests 2B and 2A, respectively.

The estimated amount of liquid accumulated in the WESP is plotted as a function of run time in Figure 4.105 where it is compared with the amount of fresh water sprayed into the WESP. There is some uncertainty in the estimate of the amount of liquid accumulated because of the use of multiple deluges of variable volumes in attempts to recover from the electrical instability in the WESP operation, as discussed below. The inlet spray water flow rate was set to 2.0 ± 0.2 gph, as specified by the Test Plan. The actual spray water flow rate was ≈ 1.77 gph and 1.72 gph during LAW Tests 2B and 2A, respectively.

The WESP voltage and current are plotted as a function of run time in Figure 4.106. After 24 hours, electrical problems were observed in the WESP. First there was a short within the WESP, which was captured with an IR camera as shown in Figure 4.107. As a result of the continued electrical instability various measures were tried, including ceasing the daily deluges in an attempt to keep the WESP as dry as possible as well as repeated deluges in attempts to dislodge any potential shorting paths. All of these efforts were unsuccessful. Operational events associated with the WESP deluges are summarized in Table 4.7. After 131.3 hours, repeated attempts to restore WESP power were unsuccessful. At the end of the test, 7.5 gallons of liquid

was blown down. After the test, no deluge was performed. A view of rod and collector plate after LAW Tests 2B and 2A is provided in Figure 5.108. There were minor solids accumulations on the plates and rods.

An HLW Turnover Test followed the LAW MACT tests. The WESP started up and continued to function normally during this test. After about 62 hours of testing during the HLW Turnover Test, the WESP was inspected. During this HLW Turnover Test, the WESP voltage was normal; however, the current was ~10.5 mA during the second half of the test. Post-deluge views of the collector grid from the bottom end of the WESP (after removing the diffuser plate) are given in Figures 4.109 and 4.110. There were still minor solid deposits on both collector plates and rods. The condition of the south upper grid support rod (shown in Figure 4.111) appears the same as before the test (Figure 4.97). The top parts of the rods seen from the south upper manway opening show some solids accumulation (Figure 4.112). A view of the WESP upper grid support from the north manway opening is given in Figure 4.113 where arc marks can be seen. However, these marks were in existence prior to these tests. There was also a slight yellowish build-up. Near the WESP north grid support rod, there were yellow solid deposits that are shown in Figure 4.114. From the north and south WESP manway openings, a sample of the yellowish solid was collected. The total mass of the sample was 1.2 grams (Sample# O-12G-116B). Three separate portions of the sample were submitted for analysis. DCP analysis results from the first portion of WESP solid sample #O-12G-116B are shown in Table 4.8. Major components in the solid are aluminum, boron, calcium, chromium, iron, potassium, magnesium, nitrate, sodium, phosphorus, selenium, silicon, and zinc. SEM/EDS spectra of three regions from this first portion are presented in Figure 4.115. EDS analysis revealed that the sample consists of calcium, sodium, potassium, zinc, chromium, silicon, selenium, carbon, oxygen, chlorine, iodine, fluorine, and sulfur. SEM/EDS spectra of five regions from second portion of the sample are presented in Figures 4.116 and 4.117. EDS analysis revealed that the second portion of the sample consists of the same elements as the first with the exception of chromium and fluorine (not found in the second portion), and silver and magnesium (found in the second, but not in the first). SEM/EDS spectra of three regions from the third portion of the sample are presented in Figure 4.118. EDS analysis revealed that the third sample portion consists of calcium, sodium, potassium, zinc, carbon, oxygen, chlorine, and iodine. Compared to the first sample portion, the third does not show chromium, silicon, selenium, fluorine and sulfur; however, it does reveal the existence of nitrogen.

The operational history of the DM1200 WESP has been previously documented (see Table 5.4 of Reference [19]); the majority of operational problems occurred during processing of LAW feeds and may be partially the result of the off-gas composition, which is more acidic, as evidenced by the pH of the LAW SBS and WESP sump solutions. As noted above, there had been some fluctuation of WESP current during the latter stages of the LAW Scoping Test preceding the LAW MACT Tests; however, inspection uncovered no indication of shorting. Nevertheless, WESP electrical issues occurred during these MACT tests when processing LAW feed. The electrical problems included observations of arcing, along with persistent difficulty during LAW Tests 2B and 2A in reestablishing stable operating conditions after turning off the WESP power to perform a deluge. Once normal operating conditions could be established, in

general, operation of the WESP continued without problems. Near the end of LAW Tests 2B and 2A, it was not possible to reestablish WESP operation despite repeated attempts over about 8 hours. Although the loss of power to the WESP would increase the particulate load to the HEPA filter, no significant increase in pressure drop across the filter was observed during LAW Tests 2B and 2A, in contrast to previous tests that experienced WESP failures [19]. The WESP internals were viewed remotely during these failed attempts to restore power. On at least one occasion, brief arcing was seen in the upper portions of the WESP in the general vicinity of the insulators. In the HLW Turnover Test performed several weeks after the LAW MACT Tests 2B and 2A, the WESP was restarted easily and functioned normally with no special efforts required.

Based on several observations made during recent DM1200 testing, one qualitative difference in WESP operation with LAW and HLW feeds is in the behavior of a fog formed during and after deluges. With HLW feeds it has been observed that once the high voltage is turned off for a deluge, a fog typically forms in the WESP which persists during and after the deluge. Once the voltage is turned back on, the fog appears to dissipate quickly and stable operations ensue. With LAW feeds, the fog typically forms as it does for HLW operation when the voltage is turned off for deluges. However the fog does not dissipate easily or quickly, and arcing in the fog can be occasionally observed when trying to reestablish stable operations. It seems likely that chemical or physical differences in emissions between the two feeds, HLW and LAW, may be influential factors in the WESP behavior. The higher sodium and halide concentrations in the LAW feed may also be contributing factors. It is possible that a WESP design which minimizes the exposure of the electrical connectors to exhaust gases by locating them further away from the body of the WESP and increases the purge air flow rate may reduce or eliminate the problems if the failure is a result of the electrical connectors being exposed to moisture or conductive components in the exhaust stream. However, since the specific cause of the problem is still not conclusively known, this is speculation.

4.1.4 HEME #1

A HEME (HEME #1) that follows the WESP in the off-gas system removes any water droplets that may be present in water-saturated gas exiting the WESP.

For HLW Test 1, the outlet gas temperature and differential pressure are plotted in Figure 4.119. The HEME #1 gas outlet temperature shows the same pattern seen in the SBS gas outlet temperature (Figure 4.50) and the WESP inlet and outlet temperatures (Figure 4.86). The average pressure drops across HEME #1 was 1.0 in. W.C. The differential pressure value of zero recorded at 36.4 hours was due to an inadvertent shutdown of the LabVIEW system. At the end of the test, 18.9 gallons of liquid was blown down from HEME #1.

For HLW Test 2A, 1-continued, and 2B, the outlet gas temperature and differential pressure are plotted in Figure 4.120. The average HEME #1 gas outlet temperatures were 51.5°C, 47.1°C, and 51.9°C for HLW Tests 2A, 1-continued, and 2B, respectively. The corresponding average pressure drops across HEME #1 were 0.9 in. W.C., 0.9 in. W.C., and 1.0 in. W.C. The

drop in the outlet gas temperature at about 20.1 hours is a result of feed stoppage. The minimum differential pressure at about 98 hours occurred when the WESP pitot tube was purged. At the end of the test, 51.8 gallons of liquid was blown down from HEME #1.

For the LAW tests, HEME #1 was taken offline.

4.1.5 HEPA Filter

HEME #1 is followed in the off-gas system by a heater, a HEPA filter (HEPA #1), and a Paxton blower (Blower #1). The purpose of the heater is to ensure that water-saturated gas exiting HEME #1 is heated above its dew point before passing through the HEPA filter in order to prevent moisture condensation in the HEPA filter. The outlet gas temperature and the pressure differential across HEPA #1 are the two parameters monitored by the off-gas data acquisition system; for HLW Test 1, these are shown in Figure 4.121. At 17.0 hours, the Heater-701 setpoint was increased to 71°C. At 30.9 hours, the Heater-701 setpoint was lowered from 71°C to 65°C. At 41.2 and 41.9 hours the Heater 701 setpoint was raised to 68°C and 69°C, respectively. The effect of these setpoint changes can be observed in HEPA #1 outlet temperatures. The average differential pressure across HEPA #1 was 0.1 in. W.C.

The outlet gas temperature and the pressure differential across HEPA #1 for HLW Test 2A, 1-continued, and 2B are shown in Figures 4.122. For the three tests, the HEPA #1 outlet temperature generally ranged between about 65.5°C and 70.7°C. The average differential pressure across HEPA #1 was 0.1 in. W.C. for all three test segments. These data indicate that no significant particulate loading or moisture blinding of HEPA #1 took place during HLW Test 2A, 1-continued, and 2B.

The outlet gas temperature and the pressure differential across HEPA #1 for LAW Test 1 are shown in Figure 4.123. For the three test segments of LAW Test 1 (i.e., the allyl alcohol spike, the naphthalene/MeOH spike, and the unspiked segments), the average HEPA #1 outlet temperatures were 61.8°C, 63.5°C, and 62.7°C, respectively. For the corresponding three test segments of LAW Test 1, the average differential pressures across HEPA #1 were 0.1, 0.2, and 0.2 in. W.C. Negative differential pressure data between 66.2 and 68.0 hours were eliminated from the plot; however, no specific reasons for these readings could be identified. These differential pressure data indicate that no significant particulate loading or moisture blinding of HEPA #1 took place during LAW Test 1.

The outlet gas temperature and the pressure differential across HEPA #1 for LAW Tests 2B and 2A are shown in Figure 4.124. For LAW Test 2B and 2A, the average HEPA #1 outlet temperatures were 62.7°C and 61.2°C, respectively. For both LAW Tests 2B and 2A, the average differential pressure across HEPA #1 was 0.2 in. W.C. These data indicate that no significant particulate loading or moisture blinding of HEPA #1 took place during LAW Tests 2B and 2A.

4.1.6 Paxton Blowers (Blower-701 and Blower-702)

After LAW Test 1, Blower 702 was inspected. There was approximately 1 gallon of standing liquid in the bottom of the housing bowl. The Blower-702 impeller blades showed minor corrosion, as can be seen in Figure 4.125. The impeller had seized up but was freed up by holding it under hot water. The Blower-702 discharge port also showed minor corrosion, as shown in Figure 4.126.

During LAW Tests 2B and 2A at 44.5 hours, Blower-701 displayed signs of bearing failure indicated by a metallic grinding noise. Inspection showed that the tensioner spring inside Blower-701 had broken causing the fan blades to grind against the housing. The Blower-701 head was, therefore, replaced with a used head removed from Blower-801.

4.1.7 Activated Carbon Bed Unit

A bulk flow sulfur impregnated activated carbon bed (AC-S) with Donau carbon BAT-37 media was installed and used for these tests. The operational parameters for that unit are presented in this section.

Mass balances of NO_x, CO, and CO₂ around the activated carbon-bed are provided in Tables 4.9 – 4.12. Monitoring at various off-gas locations with FTIR is done sequentially not simultaneously. Given that nitrogen oxide concentrations can vary by an order of magnitude at a single sampling location due to changes in the cold cap, the calculated removal efficiencies serve only as a guide to removal efficiency. This is particularly true during spiking periods which feature shorter sampling periods and increasing carbon emissions at the beginning of each spiking period. The mass balance for carbon and nitrogen oxides around the AC-S are within twenty percent for 85% of the test segment values, indicating that the carbon column was not a source or sink for these oxides during the HLW Test 1. Exceptions include five testing periods where up to about twice as much carbon monoxide was measured in carbon column exhaust than in the carbon column inlet (negative values in Tables 4.9 – 4.12), giving the impression that carbon monoxide was generated in the column during the specified testing interval. Close examination of the sampling intervals indicates that the inlet was sampled at the beginning of spiking periods whereas the outlet was sampled in the middle or end of the spiking periods (see Figures 6.3.e and 6.3.f for examples). Carbon monoxide concentrations in the entire exhaust stream often increased over the course of the spiking periods and decreased in the entire exhaust stream over time after the spiking had stopped. The higher carbon monoxide values at the carbon outlet therefore are not an indication of carbon monoxide generation in the column rather an artifact of sampling location sequencing as the melter reaches steady state with respect to carbon monoxide generation. Another exception is an apparent nitrogen oxide removal of up to 42.7% during two HLW test portions when hazardous organic compounds were not spiked into the melter feed. In both of these instances, measurements were made at the carbon column outlet at the onset of feeding followed by measurements at the carbon column inlet as feeding was

increased (see Figures 6.1.a and 6.1.b). The decrease in nitrogen oxide concentrations at the carbon column outlet therefore is the result of decreased amounts of feed nitrates being introduced into the melter and associated nitrogen oxide generation rather than the removal of nitrogen oxides by the carbon column.

HLW Test 1

Temperatures at different locations in the AC-S unit are plotted in Figure 4.127.a. The initial spike in the carbon bed temperatures are most likely due to adsorption of moisture and small amounts of NO_x. The average inlet temperatures were 75.1°C, 73.8°C, and 72.0°C; average outlet temperatures were 79.2°C, 78.6°C, and 74.1°C during allyl alcohol, naphthalene/MeOH, and unspiked periods, respectively. The target carbon bed outlet temperature during HLW Test 1 was between 70°C and 75°C. The actual carbon bed average outlet temperature during HLW Test 1 was 78.5°C which slightly exceeded the target value. The maximum carbon bed top temperatures were 95.0°C, and 88.4°C, during allyl alcohol, and naphthalene/MeOH spiking periods, respectively. The increase in bed temperature during allyl alcohol spiking as a result of adsorption and chemical reactions in the bed is illustrated in Figure 4.127.b. Notice that the bed temperature during allyl alcohol spiking appears to have stabilized after about five hours of exposure and, after allyl alcohol spiking was stopped, the carbon bed temperature remained high for about five hours and then decreased over the next couple of hours. Therefore, the average and maximum temperatures measured for the bed during *unspiked* periods are *also* influenced by the preceding periods of organics spiking.

Activated carbon bed and outlet screen differential pressures are given in Figure 4.128. The average activated carbon bed and outlet screen differential pressures were 1.4 in. W.C. and 4.2 in. W.C., respectively, during HLW Test 1.

HLW Tests 2A, 1-continued and 2B

The previous test (Test 1) was terminated prematurely due to Project concerns over carbon-bed temperature increase during organics spiking. Extensive data review with VSL staff, the WTP Project, and the carbon manufacturer indicated that a temperature rise in the bed should be expected due to the adsorption of water, nitrogen oxides, and organic compounds. Furthermore, temperature guidelines were provided by the manufacturer for safe operation of the carbon bed. The Project subsequently issued a Test Exception which accepted these operational constraints and changed the Test Plan direction targeting carbon bed temperatures during testing (control inlet as opposed to outlet). Heating tapes on the AC-S inlet pipe were used to heat the gas to the desired inlet temperature.

Temperatures at different locations in the AC-S unit are plotted in Figure 4.129.a. The initial spikes in the carbon bed temperatures are most likely due to adsorption of moisture and small amounts of NO_x. Average inlet temperatures were 83.3°C, 81.9°C, 81.6°C, and 81.9°C;

average outlet temperatures were 86.4°C, 81.0°C, and 80.0°C during the HLW Test 2A allyl alcohol, naphthalene/MeOH, and allyl alcohol/naphthalene spike periods, respectively. The target carbon column inlet temperature for HLW Test 2A was 85°C to 90°C. Since the heating tape failed during the test, the actual carbon bed average inlet temperature during HLW Test 2A was slightly lower, at 82.2°C. The average inlet temperatures were 74.8°C, 74.8°C, and 78.9°C; average outlet temperatures were 81.3°C and 79.3°C during the HLW Test 1-continued naphthalene/MeOH spiked period, and Test 2B, respectively. The target carbon bed inlet temperature during HLW Test 1-continued was between 70°C and 75°C. The actual average carbon bed inlet temperature during Test 1-continued was 74.7°C. The planned carbon bed inlet temperature during HLW Test 2B was between 85°C and 90°C but the corresponding actual average inlet temperature was 78.9°C, again due to the failed heat tape on the AC-S inlet pipe. The maximum carbon bed top temperatures were 109°C, 90.8°C, and 94.4°C during the HLW Test 2A allyl alcohol spiked, naphthalene/MeOH spiked, and allyl alcohol/naphthalene spiked periods, respectively. The carbon column bed temperatures during the allyl alcohol spiking period dropped about 5°C shortly after the start of spiking, rose about 25°C, then dropped about 15°C, as shown in Figure 4.129.b. The periodic abrupt drop in bed temperatures was observed throughout the tests as a result of the WESP deluges, which cause short term decreases in the exhaust stream water content down stream of the WESP. Data illustrated in Figure 4.129.c illustrated the relationship between the WESP deluge, bed temperatures and the water content of the exhaust stream around the carbon column. Notice immediately after the deluge, the concomitant drop in exhaust water content from the steady state concentration of about 11.5% to about 6% along with a 5°C drop in carbon bed temperatures. The temperature of the inlet air stream to the carbon column remains constant throughout this period, indicating that the temperature change in the bed is the result of a change in the exhaust stream composition (primarily water content). The increase in the bed temperatures over the hour or so period after the deluge mirrors the increase in exhaust stream water content for that time period. The drop in the WESP exhaust water content in response to the deluge is due to the cooling of the internal WESP elements by the deluge, which then causes the unit to act as a condenser until the unit heats up again. The maximum carbon bed top temperatures were 95.4°C and 90.8°C during HLW Test 1-continued naphthalene/MeOH spiked period and Test 2B, respectively. In Figure 4.130 the carbon bed temperatures during the HLW Test 1-continued naphthalene/MeOH spiking period is shown in an expanded time scale between about 75 and 82 hours. Temperatures within the bed decreased slightly during the first naphthalene sampling period and stayed steady during the second period.

Activated carbon bed and outlet screen differential pressures are given in Figure 4.131. The average activated carbon bed and outlet screen differential pressures were 1.3 in. W.C., 1.2 in. W.C., and 1.4 in. W.C. during HLW Tests 2A, 1-continued and 2B, respectively. The corresponding outlet screen differential pressures were 4.2 in. W.C., 3.8 in. W.C., and 4.4 in. W.C.

As noted above, the heating tape used at the AC-S unit inlet failed during these tests. This resulted in average inlet temperatures being slightly lower than desired during Tests 2A and 2B. (The Test 1-continued target inlet temperature was a lower value, which was achieved.) After the

tests, the heating tape was removed and inspected. Figure 4.132 is a photograph of the damaged sections of the heating tapes.

The carbon media was installed during the Simulant Verification Tests [21] and removed after the HLW MACT tests, giving a total media exposure time to HLW exhaust of about 13 days. Nitrogen oxide exhaust concentrations were extremely low during the last Simulant Verification Test, which accounts for about the first 4 days of bed media usage.

LAW Test 1

After a detailed safety review regarding the potential for excessive carbon bed temperatures during organics spiking with LAW feeds, the AC-S bed was modified prior to the LAW MACT tests. To protect against carbon bed temperature increases beyond defined limits, interlock systems were installed by modifying the AC-S valve structure to incorporate automatic valves with interlocks for ambient air purge and nitrogen purge. The ability to flood the bed with water was also added. The LabVIEW data acquisition system was upgraded to display temperature graphs for AC-S temperatures. Slip stream tests with bottled nitrogen oxides gases (Appendix III) and DM1200 tests with LAW MACT feed were conducted to determine the concentrations of nitrogen oxides and hazardous organic that could be processed without causing higher than desired carbon bed temperatures. The carbon media was replaced after the HLW tests and prior to the LAW scoping test. The total media exposure time during LAW scoping and MACT tests was about 12 days. The strategy used for operating the carbon column included the normal startup procedure, which employs an hour of water feeding followed by an increase of feed rate over 12 to 24 hours to steady state feeding conditions and adherence to the temperature limits given in Section 1.5.6. In the Scoping tests, the allyl alcohol spiking rate of 10 g/min was tested with the projected melter feed and associated nitrogen oxide emission rate to ensure bed temperatures would not rise above the set thresholds. Data from these tests suggest that the 40 g/min allyl alcohol spiking rate used during HLW tests combined with the LAW nitrogen oxide emission would create higher than acceptable temperatures in the carbon bed. Given the sensitivity of the carbon media to the combination of nitrogen oxides with allyl alcohol and the uncertainties associated with scaling up the process, preliminary tests should be conducted on the WTP carbon bed to determine limits for allyl alcohol spike rates with actual LAW melter emissions. Also, the duration over which allyl alcohol was spiked into the melter feed was minimized in order to limit carbon media exposure to bed temperatures that may accelerate the degradation of the media and perhaps decrease media performance. Given that high concentrations of allyl alcohol are atypical during processing of actual LAW waste, it is recommended to minimize the exposure time of the media to these extreme conditions that are only required for volatile organic DRE measurements.

Temperatures at different locations in the AC-S unit are plotted in Figure 4.133.a. The initial spikes in the carbon bed temperatures are most likely due to adsorption of moisture and NO_x. Average inlet temperatures were 75.8°C, 74.3°C, and 74.6°C during allyl alcohol spiked, naphthalene/MeOH spiked, and unspiked segments of LAW Test 1, respectively; average outlet temperatures were 86.7°C and 77.0°C during allyl alcohol spiked and naphthalene/MeOH spiked

segments of LAW Test 1, respectively. The planned carbon bed inlet temperature of 70-80°C was met. The maximum carbon bed top temperature was 110.0°C and 85.9°C, during allyl alcohol spiked, and naphthalene/MeOH spiked segments of LAW Test 1, respectively. The carbon bed temperatures increased throughout the allyl alcohol spiking period and did not reach steady state by the end of the spiking period, as shown in Figure 4.133.b. It should be noted that the bed temperature increase lags the beginning of spiking and the elevated temperatures extend beyond the end of spiking. Therefore the average and maximum temperatures recorded for the unspiked period are significantly influenced by the spike itself. Activated carbon bed temperatures during LAW Test 1 naphthalene/methanol spiking period are given in Figure 4.134 with an expanded time scale. These data indicate that steady AC-S bed temperatures existed during each of the naphthalene sampling segments. Activated carbon bed and outlet screen differential pressures are given in Figure 4.135. The average activated carbon bed differential pressures were 1.2 in. W.C., 1.3 in. W.C., and 1.3 in. W.C. during the allyl alcohol spiked, naphthalene/MeOH spiked, and unspiked segments of LAW Test 1, respectively. The corresponding outlet screen differential pressures were 4.5 in. W.C., 4.8 in. W.C., and 4.7 in. W.C.

LAW Tests 2B and 2A

Temperatures at different locations in the AC-S unit are plotted in Figure 4.136.a. The initial spikes in the carbon bed temperatures were most likely due to adsorption of moisture and NO_x. Average inlet temperatures were 74.4°C, 73.9°C, 74.5°C, and 73.8°C during Test 2B, and the allyl alcohol/naphthalene spiked, naphthalene/MeOH spiked and unspiked periods of LAW Test 2A, respectively; average outlet temperatures were 76.9°C, 84.2°C, and 75.7°C during Test 2B and the allyl alcohol/naphthalene spiked, and naphthalene/MeOH spiked periods of LAW Test 2A, respectively. The planned carbon bed inlet temperature of 70-80°C was met. The maximum carbon bed top temperatures were 96.6°C, 102°C, and 87.3°C during Test 2B, and the allyl alcohol/naphthalene spiked, and naphthalene/MeOH spiked periods of LAW Test 2A, respectively. The carbon bed temperatures increased during the allyl alcohol/naphthalene spiking period and attained steady state after about eight hours, as shown in Figure 4.136.b. Bed temperatures were not as high during LAW Test 2A as in Test 1 due to lower nitrogen oxide concentrations in the carbon inlet off-gas stream. Activated carbon bed and outlet screen differential pressures are given in Figure 4.137. The average activated carbon bed differential pressure was 1.2 in. W.C. during each segment of LAW Test 2B. Between 76.2 and 76.7 hours, the AC-S column differential pressure sensor tubing was broken. The average outlet screen differential pressure during LAW Test 2B was 4.6 in. W.C. Most of the outlet screen differential pressure data readings exceeded the sensor limit of 5 in. W.C. for Test 2A.

4.1.8 TCO/SCR Unit

The TCO/SCR (hybrid catalyst) unit consists of a heater, a Thermal Catalytic Oxidizer (TCO), and a Selective Catalytic Reduction (SCR) unit with an ammonia injection system. After

the off-gas is heated in the pre-catalyst heater, organics are catalytically oxidized in the TCO. The off-gas is then mixed with ammonia before entering the SCR unit where NO_x is reduced to nitrogen. The target temperature at the TCO outlet (SCR inlet) was obtained by manually adjusting the temperature set point at the face of the pre-catalyst heater. These set point temperatures are listed in Table 4.13. Set point temperatures were typically 60°C to 70°C higher than TCO inlet, mid-bed, and outlet temperatures. Gas residence times in the TCO during testing are given in Table 4.14. The gas residence times ranged over the narrow interval of 0.17 to 0.19 seconds for all test segments and spiking periods.

HLW Test 1

The TCO/SCR heater inlet gas temperature is plotted in Figure 4.138 and averaged 77.2°C for HLW Test 1. The average TCO inlet and mid-bed temperatures, SCR inlet and outlet temperatures, and post SCR temperatures during the test are plotted in Figure 4.139. The average TCO inlet temperatures were 395°C, 408°C, and 411°C during the allyl alcohol, naphthalene/MeOH, and unspiked periods. The corresponding average TCO mid-bed temperatures were 403°C, 409°C, and 404°C; the average SCR inlet temperatures were 404°C, 407°C, and 403°C. The targeted TCO outlet temperature (SCR inlet) was 400°C for HLW Test 1.

The average SCR outlet gas temperatures were measured at two locations, one foot apart at the outlet of the SCR. The average SCR outlet temperature pairs were 394°C and 353°C, 397°C and 357°C, and 389°C and 347°C during the allyl alcohol, naphthalene/MeOH, and unspiked periods, respectively. The differential pressures across the TCO, SCR, and TCO/SCR are plotted in Figure 4.140 and averaged 4.1 in. W.C., 2.7 in. W.C., and 7.0 in. W.C., respectively, during HLW Test 1.

Information on NO_x and CO removal in the TCO/SCR is provided in Table 4.15. During the HLW Test 1 unspiked, allyl alcohol spiked, and naphthalene spiked periods, nitrogen oxide removals were 72.4%, 83.0%, and 72.4%, respectively. Corresponding carbon monoxide removals were 98.6%, >99.9%, and >99.7. Average ammonia injection rates into the SCR during the unspiked, allyl alcohol spiked, and naphthalene spiked periods were 0.342, 0.460, and 0.417 lbs/hr, respectively. Corresponding ammonia slippages were <2.2%, <0.1% and <0.1%. Corresponding average ammonia concentrations after the SCR unit were 11.6 ppm, <1 ppm, and <1 ppm.

HLW Tests 2A, 1-continued and 2B

The TCO/SCR heater inlet gas temperature is plotted in Figure 4.141 and averaged 80.4, 79.7, and 80.5°C for HLW Tests 2A, 1-continued, and 2B, respectively (faulty temperature readings at 29.0 and 53.0 hours were deleted from the data set). The TCO inlet and mid-bed, TCO outlet (SCR inlet) and SCR outlet, and post SCR temperatures are plotted in Figure 4.142.

The average TCO inlet gas temperatures were 346°C, 386°C, and 362°C, for HLW Tests 2A, 1-continued, and 2B, respectively. The average SCR inlet gas temperatures were 370°C, 400°C, and 369°C, respectively. These values closely match the targeted TCO outlet (SCR inlet) temperature values of 400°C for Test 1-continued and 370°C for Test 2 segments. The average SCR outlet gas temperatures measured at two locations, one foot apart at the outlet of the SCR, were 360°C, and 320°C for HLW Test 2A, 388°C and 347°C for HLW Test 1-continued, and 367°C and 326°C for HLW Test 2B. The average temperatures after the SCR were 309°C, 334°C, and 312°C for HLW Tests 2A, 1-continued, and 2B, respectively. The TCO temperatures during the HLW Test 1-continued naphthalene/methanol spiking period are given in Figure 4.143 with an expanded time scale. Temperatures remained steady near the target of 400°C during the sampling periods. The differential pressures across the TCO, SCR, and TCO/SCR are plotted in Figure 4.144 and averaged 3.7 in. W.C., 2.5 in. W.C. and 6.5 in. W.C., respectively, during HLW Tests 2A, 1-continued, and 2B.

Information on NO_x, CO, and CO₂ removal in the TCO/SCR is provided in Table 4.16. During the HLW Test 2A unspiked, allyl alcohol spiked, naphthalene/MeOH spiked, and allyl alcohol/naphthalene spiked segments, nitrogen oxide removals were 82.4%, 57.5%, 82.0%, and 53.1%, respectively. During the HLW Test 1-continued naphthalene/MeOH spiking period, and HLW Test 2B, nitrogen oxide removals were 79.0% and 85.8%, respectively. During the HLW Test 2A unspiked, allyl alcohol spiked, naphthalene/MeOH spiked, and allyl alcohol/naphthalene spiked segments, carbon monoxide removals were >98.7%, >99.8%, >99.4%, and >99.8%, respectively. During the HLW Test 1-continued naphthalene/MeOH spiking segment and HLW Test 2B, carbon monoxide removals were >99.6% and >99.2%, respectively. During the HLW Test 1-continued naphthalene/MeOH spiking segment and HLW Test 2B. Average ammonia injection rates into the SCR during the HLW Test 2A unspiked, allyl alcohol spiked, naphthalene/MeOH spiked, and allyl alcohol/naphthalene spiked segments, the HLW Test 1-continued naphthalene/MeOH spiked segment, and HLW Test 2B were 0.37, 0.44, 0.40, 0.40, 0.40, and 0.60 lbs/hr, respectively. The corresponding ammonia slippages were 2.9%, ~0.2%, <0.2%, ~0.2%, ~0.2% and ~0.8%, respectively. The average ammonia concentration after the SCR unit, during all the segments, was <1.0 ppm except the HLW Test 2A unspiked segment (ammonia: 16.4 ppm), and HLW Test 2B (ammonia: 8.3 ppm).

LAW Test 1

The TCO/SCR heater inlet gas temperature is plotted in Figure 4.145 and averaged 80.3°C for LAW Test 1. Faulty temperature readings at 34.7 and 58.7 hours were deleted from the data set for the plot. The TCO inlet and mid-bed, SCR inlet and outlet, and post SCR temperatures during the test are plotted in Figure 4.146. The average TCO inlet gas temperatures were 408°C, 404°C, and 411°C during the individual test segments (allyl alcohol spiked, naphthalene/ MeOH spiked, and unspiked, respectively). The average TCO outlet (SCR inlet) gas temperatures were 402°C, 400°C, and 399°C during allyl alcohol, naphthalene/MeOH, and unspiked periods, respectively, which are close to the target of 400°C. The average SCR outlet gas temperatures measured at two locations, one foot apart at the outlet of the SCR, were 440

and 404°C, 438°C, and 400°C, and 440°C and 403°C during the allyl alcohol, naphthalene/MeOH, and unspiked periods of LAW Test 1, respectively. The increase in the gas temperature through the SCR is probably due to the exothermic reaction between ammonia and NO_x. The TCO temperatures during the LAW Test 1 naphthalene/MeOH spiking period is presented in Figure 4.147 with an expanded time scale. The TCO inlet temperature dropped about 17 degrees during the initial part of the first sampling period; however, the mid-bed and outlet temperatures are somewhat damped during the same interval, showing an approximate 10 degree drop. Generally, the temperatures are reasonably steady near the target of 400°C. The differential pressures across the TCO, SCR, and TCO/SCR are plotted in Figure 4.148 and averaged 4.4 in. W.C., 3.3 in. W.C., and 7.9 in. W.C., respectively, during LAW Test 1.

Information on NO_x, CO, and CO₂ removal in the TCO/SCR is provided in Table 4.16. During the LAW Test 1 allyl alcohol, naphthalene/MeOH, and unspiked segments, nitrogen oxide removals were 76.6%, 70.3%, and 82.1%, respectively. The corresponding carbon monoxide removals were >99.7%, >99.4%, and >99.2%. The average ammonia injection rates into the SCR during the LAW Test 1 allyl alcohol, naphthalene/MeOH, and unspiked periods were 2.4, 2.4, and 2.5 lbs/hr, respectively. Corresponding ammonia slippages were ~0.2%, ~0.0%, and ~1.3%; average ammonia concentrations after the SCR unit were 9.3 ppm, <1.0 ppm, and 50.7 ppm.

LAW Tests 2B and 2A

The TCO/SCR heater inlet gas temperatures are plotted in Figure 4.149 and averaged 80.3°C and 79.7°C during LAW Tests 2B and 2A, respectively. The TCO inlet and mid-bed, SCR inlet and outlet and post SCR temperatures during LAW Tests 2B and 2A are plotted in Figure 4.150. During LAW Test 2B, the average TCO inlet gas temperature was 376°C, while the average SCR inlet gas temperature was 370°C. The average SCR outlet gas temperatures were 423°C and 381°C at two locations, one foot apart, at the outlet of the SCR. The increase in the gas temperature through the SCR is probably due to the exothermic reaction between ammonia and NO_x. The average temperature after the SCR was 361°C during LAW Test 2B. During LAW Test 2A, the average TCO inlet gas temperatures were 371°C, 363°C, and 369°C during allyl alcohol/naphthalene, naphthalene/MeOH, and unspiked periods respectively. The corresponding average SCR inlet gas temperatures were 371°C, 371°C, and 370°C. The SCR inlet temperature is indicative of the TCO outlet (SCR inlet) temperature. The target TCO outlet temperature was 370°C. The average SCR outlet gas temperatures were 403°C and 366°C, 401°C and 364°C, and 403°C and 365°C at two locations, one foot apart, at the outlet of the SCR during allyl alcohol/naphthalene, naphthalene/MeOH and unspiked periods, respectively. The average temperatures after the SCR were 346°C, 345°C, and 346°C during these same periods. Again, the increase in the gas temperature through the SCR is probably due to the exothermic reaction between ammonia and NO_x. The differential pressures across the TCO, SCR, and TCO/SCR are plotted in Figure 4.151. Average differential pressures during LAW Test 2A were 3.9 in. W.C., 3.1 in. W.C., and 7.3 in. W.C., respectively, during LAW Test 2B. Average differential pressures were 4.0 in. W.C., 3.0 in. W.C., and 7.2 in. W.C., respectively.

Information on NO_x, CO, and CO₂ removal in the TCO/SCR is provided in Table 4.18. During LAW Test 2B, nitrogen oxide, carbon monoxide and carbon dioxide removals were 78.7%, 92.1%, and 8.5%, respectively. During the LAW Test 2A allyl alcohol/naphthalene, naphthalene/MeOH, and unspiked periods, nitrogen oxide removals were 68.9%, 64.1%, and 65.7%, respectively; carbon monoxide removals were 98.7%, 87.0%. Average ammonia injection rates into the SCR during LAW Test 2B and the LAW Test 2A allyl alcohol/naphthalene spiked, naphthalene/MeOH spiked, and unspiked segments were 1.77, 1.81, 1.82 and 1.41 lbs/hr, respectively. Corresponding ammonia slippages were >0.4%, ~0.0%, ~0.0%, and 1.5%. The average ammonia concentration after the SCR unit, during all the segments was <1.0 ppm, except for LAW Test 2B (ammonia: 19.6 ppm) and the unspiked period of LAW Test 2A (ammonia: 51.1 ppm).

The LAW MACT tests were followed by an HLW Turnover Test after which, Heater 801 and the TCO catalyst were inspected. Figure 4.152 provides a view of the upper half and inlet face of Heater 801 coils. Views of lower half and inlet face with heater coils end loops are given in Figures 4.153 and 4.154. No major deterioration was observed. Minor flake-off of material from the coils is visible. In Figures 4.155 through 4.159 various views of the inlet of the TCO catalyst are presented. Inspection of TCO catalyst inlet side shows minor debris accumulation that covers or clogs some flow paths. The largest piece of material is shown in Figure 4.159 and appears to be fiber glass. Note that the apparent gap between the TCO blocks in Figure 4.157 was created during the inspection process by removal of some of the packing material (the gap does not extend all the way through the catalyst block section).

4.1.9 Packed Bed Scrubber (PBS)

The TCO/SCR is followed in the off-gas train by a packed bed caustic scrubber (PBS) to remove iodine and acid gases from the off-gas stream. The effluent solution can be pumped out of the PBS sump and process water and caustic solution (25% NaOH) added to control the solid content and pH of the scrubber liquid.

The inlet gas temperature and the pressure drop across the PBS for HLW Test 1 are shown in Figure 4.160. The average PBS differential pressure during HLW Test 1 was 2.6 in. W.C. The average PBS inlet gas temperature was 315°C during HLW Test 1. At 29.9 and 51.5 hours the temperature readings were faulty and therefore they were deleted from the data set. In the systems used for the DM1200, failed thermocouples give readings between 3332 and 3334°C as an indication that they are no longer functioning properly; consequently, the decision to replace the thermocouples and remove the spurious data was unequivocal. The PBS sump temperatures and pH values are plotted in Figure 4.161. The sump temperature averaged 30.0°C, and the pH averaged 9.2. The pH probe was replaced at 2.6 hours. At the end of the test, 41 gallons of liquid was blown down from the PBS.

The inlet gas temperature and the pressure drop across the PBS for HLW Tests 2A,

1-continued, and 2B are shown in Figure 4.162. The average PBS differential pressures during HLW Tests 2A, 1-continued, and 2B were 2.2 in. W.C., 2.1 in. W.C., and 2.5 in. W.C., respectively. The corresponding average PBS inlet gas temperatures were 290°C, 310°C, and 294°C. Several faulty temperature readings between 55 and 131 hours have been removed from the data set for the above plot. The PBS sump temperatures and pH are plotted in Figure 4.163. The sump temperature averaged 28.9°C, 29.4°C, and 32.4°C during HLW Test 2A, 1-continued, and 2B, respectively. The corresponding pH values averaged 9.2 for each test segment. The minor downward spike in the PBS sump temperature at about 20.1 hours corresponds to stoppage of feed between 20.1 and 21.8 hours. At the end of the test, no liquids were blown-down from the PBS.

The inlet gas temperature and the pressure drop across the PBS for LAW Test 1 are shown in Figure 4.164. The average PBS differential pressure was 4.2 in. W.C. and the average PBS inlet gas temperature was 348°C. At about 7.9 hours, the inlet gas temperature readings were faulty and therefore deleted from the data set. The SBS sump temperature and pH are plotted in Figure 4.165 and averaged 30.3°C and 9.2, respectively. At the end of the test, 34.4 gallons of liquids was blown down from the PBS.

The inlet gas temperature and the pressure drop across the PBS for LAW Tests 2B and 2A are shown in Figure 4.166. The average PBS differential pressures during LAW Tests 2B and 2A were 2.9 in. W.C., and 4.0 in. W.C., respectively. The average PBS inlet gas temperatures were 337°C and 327°C during LAW Tests 2B and 2A, respectively. The PBS outlet pressure port was clogged at 117 hours and therefore was cleaned. Although not certain, the downward spike at about 88 hours is likely the result of a transient clog of the port. The PBS sump temperatures and pH are plotted in Figure 4.167. The sump temperature averaged 30.8°C, and 29.1°C during LAW Tests 2B and 2A, respectively. The corresponding pH values averaged 9.2 for both tests. At the end of the test, 34 gallons of liquid was blown-down from the PBS.

4.1.10 Final Paxton Blower (Blower-801)

After LAW Test 1, Blower-801 was inspected. During the inspection, it was noticed that the impeller blades were worn and some metal was missing, as can be seen in Figures 4.168 and 4.169. The head was replaced with a previously used head that appeared to be in good operating condition. There was also some wet material in the exhaust boot and impeller housing, as shown in Figure 4.170.

4.1.11 Emergency Off-Gas System

After LAW Test 2B and 2A, the emergency off-gas system (EOG) was inspected and cleaned. A view of the EOG piping showing significant solids deposits is given in Figure 4.171. Approximately 15 kg of solid material was removed from the emergency off gas piping. A post-cleaning view of EOG piping is given in Figure 4.172. The previous cleaning of the EOG piping

occurred during the Simulant Verification Tests [21] and therefore the deposits in about half the piping collected during these tests accumulated over about 30 days of feed processing and about 3 months of idling. The section of the piping, which is about 6 feet long and immediately downstream of the right angle bend on top of the melter outlet, was cut from the EOG system (see Figure 4.171) following the LAW 2B and 2A tests. Previously, this pipe section could only be cleaned in place because of the lack of flanges that would permit removal and reinstallation. Some of the deposits removed from the pipe therefore could have originated over the life time of the DM1200. After the pipe section was cleaned, it was reinstalled with flanges to facilitate future cleaning.

4.1.12 Effluent Liquid Treatment System

Effluent liquids from the SBS, WESP, PBS, HEM#1, and HEME # 2 are all piped to a series of sampling tanks that discharge to three 500-gallon storage tanks for neutralization, mixing, and storage. The largest effluent volume is overflow (blow-down) from the SBS, which is pumped to one of two SBS sampling tanks. Caustic solution (25% NaOH) from the same caustic tank that supplies the PBS can also be added to the 500-gallon storage tank that receives acidic effluents from SBS sampling tanks; this storage tank is therefore referred to as the neutralization tank.

4.2 SBS, WESP, HEME, and PBS Process Fluids

One-liter samples were collected from the SBS, WESP, PBS, and HEME sumps each time liquids were blown down and at the end of each test. All of the sump samples that were taken throughout the DM1200 tests are listed in Tables 4.19-4.22; the initial or middle letter in the sample name is "S", "W", "P", and "H" for the SBS, WESP, PBS, and HEME samples, respectively. The tables provide pH values for each sample, as well as the blow-down volume from which each sample was taken and the cumulative blow-down volumes. The SBS and WESP liquids samples are correlated with the spiking of organic compounds and halides into the melter feed.

4.2.1 SBS Fluids

4.2.1.1 pH of SBS Fluids

The pH values for the SBS liquids for each test are plotted in Figure 4.173 as a function of the amount of glass produced. The sump solution pH varied between 4 and 8.5 depending on the feed being processed and when the feed was spiked with allyl alcohol or halides. In past tests, measured SBS solution pH typically ranged between 5.5 and 7 while processing volatile-rich LAW feeds [2, 3, 18, 19] and between 7 and 9 for HLW feeds that have low concentrations of nitrogen oxides [20, 21, 30]. Lower pH values were measured in tests with HLW C-106/AY-102

simulants with added nitrates and carbon in the form of sugar [16]. The lowest pH values in the current test series was during HLW tests due to the incorporation of envelope maximum concentrations of nitrates. The high alkali content of LAW feed results in high alkali emissions, which buffer the SBS pH; alkali concentrations are lower in HLW simulants and therefore lower pH values were measured due to a lower buffering capacity. The higher levels of ammonia emissions from LAW feeds, as a result of the presence of sugar and waste organics, also tends to drive the SBS sump solutions more alkaline. The HLW feed also contained more of the volatile species selenium, arsenic and antimony, which may have caused the SBS solutions to be more acidic. The allyl alcohol feed and SBS spike reduced sump pH by 0.5 to 1 unit, whereas methanol solutions had no effect on pH, as is readily discerned by comparing solution pH before and after spiking periods in Table 4.19. The halide spike used in LAW Test 2B also resulted in a reduction of one pH unit, as shown in Figure 4.173 at about 13,000 kg glass produced, as the pH dropped from 6 to 5 and returned to about 6 during Test 2A.

4.2.1.2 Accumulated Volume of SBS Fluids

Figures 4.174 – 4.177 compare the amount of water fed to the total volumetric accumulations in the SBS over the course of each separate testing period. Included is the water fed to cool the melter plenum at the start of each test to create a cold cap and thereby minimize subsequent off-gas surges due to pulsed feeding onto bare glass (this is the same feed start-up protocol as that used at West Valley). The feed rate of water into the melter is determined by the amount of water in the feed and the slurry feed rate; hence, water emission rates were highest in tests with HLW feed as a result of the water content being almost twice that of LAW feeds. HLW Test 1 and LAW Test 1 featured near constant feed rates and therefore had constant water feed rates to the melter. In contrast, Tests 2 which featured two segments conducted at two different feed rates, resulted in two different water feed rates, as can be observed in changes in the slope of the water accumulation curves in Figures 4.175 and 4.177. The difference between the amounts of SBS water coming from the feed and the amounts blown down represents the amount of water carried out in the off-gas stream as a result of it being saturated at the SBS sump temperature, as well as a small amount of entrained droplets. This amount is largely determined by the SBS sump water temperature, which was targeted (and maintained) at 50°C for all tests except HLW Tests 2A and 2B, which targeted and attained 55°C. Changes in the water feed rate to the melter were therefore reflected in the amount of water accumulation in the SBS.

4.2.1.3 Organic Spiking of SBS Sump

When allyl alcohol is first introduced into the melter feed, the allyl-alcohol-free SBS fluids would provide a sink for allyl alcohol in the melter exhaust stream because of the solubility of allyl alcohol in water. Over time, the concentration of allyl alcohol in the SBS sump fluid would increase until equilibrium with the gas phase is reached, at which point the SBS is neither a sink nor a source of allyl alcohol. Clearly, the latter, steady-state situation is more representative of plant operations than is the early transient situation. From a practical

perspective with respect to the present tests, this effect would tend to bias the overall system DREs high if off-gas sampling was performed before steady state was reached. Reaching the equilibrium concentrations, however, especially in cases involving low concentrations of a high solubility compound such as allyl alcohol, may be a long process. In view of the costs associated with added run time in large-scale melter tests of this type, in the present work it was decided to accelerate the approach to equilibrium by pre-spiking the SBS sump fluids with allyl alcohol; the same approach was also used for naphthalene. This section describes how the spike levels were estimated and compares the spike levels with post-test analytical results on the concentrations of allyl alcohol in the SBS sump fluids.

Assuming the validity of Henry's law, the partitioning of a substance between the liquid and the gaseous phases can be expressed as:

$$R_C = \frac{C_{liquid}}{C_{gas}} = k_H^o \cdot M_w \cdot P \cdot 10^{-3} \cdot \exp \left[-\alpha_T \left(\frac{1}{T} - \frac{1}{T^o} \right) \right]$$

Where: C_{liquid} is expressed in units of mass/volume of liquid (such as g/m³ or mg/l)

C_{gas} is expressed in terms of gas volume fraction (such as ml/m³ or ppmv)

k_H^o is Henry's constant (in mol/l·atm) at temperature T^o (K)

M_w is molecular weight of substrate

P is average system pressure (in atm)

$\alpha_T = \Delta H_{sol}/R$ where ΔH_{sol} is enthalpy of solution and R is universal gas constant
(α_T is a negative number)

T is average system absolute temperature

The value of R_C depends strongly on temperature. Figure 4.178 shows calculated values of R_C for allyl alcohol and naphthalene at a pressure of 0.931 atm (the average operational pressure of the DM1200 SBS). Data for k_H^o and α_T were taken from the compilation at <http://www.mpch-mainz.mpg.de/~sander/res/henry.html>; use of these data involves the assumption that the liquid in question is pure water, which is obviously an approximation in the case of the SBS sump fluids.

The calculated values of R_C can then be used to determine the equilibrium concentration of each substance in the liquid phase (which gives the desired pre-spike concentration) if the concentrations of the substances in the gas phase are known. Since the concentrations in the gas phase (i.e., the exhaust from the DM1200 melter) were not known *a priori*, these too had to be estimated. The basis for their estimation was knowledge of (i) the rate of introduction of allyl alcohol (and naphthalene) into the melter as part of the spiked melter feed; (ii) the off-gas flow rate out of the DM1200 melter; and (iii) *assumed* values of the DRE of each compound *in the melter*, since these DRE values were not known before the results of the tests were available. Thus, the key assumption required in the estimation of the SBS pre-spike levels was the value of the *melter* DRE for each substance. Consequently, these DRE values had to be estimated prior to

each test. As the results for one test became available, the melter DRE values assumed for subsequent tests were refined.

The DM1200 SBS contains 1.5 m^3 of liquid with an average flow-through of 217 scfm (which accounts for an average flow variance of -11.4% due to condensation). Other parameters used and the calculated pre-spike levels are shown in Table 4.23. In the only previous test measuring allyl alcohol destruction across the melter, DREs greater than 99% were achieved but at plenum temperatures much higher than employed in the current tests [17]. In view of the lower plenum temperature and since it was thought that slight over-spiking would relax more quickly than under-spiking, a slightly lower DRE was assumed, which led to the value of 90% that was used initially; this value was then modified based on data collected over the course of the MACT tests as new DRE values became available. Table 4.24 compares the pre-spike concentrations to the post-test measured concentrations and also shows the pre-spike levels that would have been calculated if the DRE values measured during the test had been used. For example, for allyl alcohol in HLW Test 1, the SBS pre-spike, which was based on an assumed melter DRE of 90% (Table 4.23), corresponds to an allyl alcohol concentration in the sump fluid of 970 mg/l. The post-test measured (presumed) equilibrium level based on sampling and analysis was 2300 mg/l. The measured melter DRE was 70%, as compared to the pre-test assumption of 90%. If now the measured melter DRE is used to calculate the pre-spike level using the methodology described above, the value of 2760 mg/l is obtained, which is in good agreement with the measured value. There is similarly good agreement for Test HLW 2A but much worse agreement for allyl alcohol in the two LAW tests. This may indicate that factors such as dissolved species (i.e., departure from the pure-water approximation), pH effects, or NO_x effects may lead to departures from the Henry's law estimates. In general, the post-test measured (presumed) equilibrium levels of allyl alcohol based on sampling and analysis were higher than the pre-test spiked levels (i.e., the SBS sump was somewhat "under-spiked"), which would tend to bias the early DRE values high due to the effect of removal of allyl alcohol in the SBS sump until the steady state concentration was reached.

The corresponding data for naphthalene are also presented in Tables 4.23 and 4.24. Based on the pre-test presumed DRE for naphthalene of 30%, the spike amount of 3.0 g was obtained (see Table 4.23). Table 4.24 compares the pre-spike concentrations to the post-test measured concentrations and also shows the pre-spike levels that would have been calculated if the DRE values measured during the test had been used. Again, taking the results for HLW Test 1 as an example, the SBS pre-spike, which was based on an assumed melter DRE of 30% (Table 4.23), corresponds to a naphthalene concentration in the sump fluid of 2.0 mg/l. The post-test measured (presumed) equilibrium level based on sampling and analysis was 1.3 mg/l. The measured melter DRE was 37%, as compared to the pre-test assumption of 30%. If now the measured melter DRE is used to calculate the pre-spike level using the methodology described above, the value of 1.8 mg/l is obtained, which is in good agreement with the measured value. The agreement was comparable, but slightly worse, for the other tests. The consistency of the measured naphthalene concentrations in the SBS sump solutions across the four tests suggests that the steady state concentration was achieved and that that concentration is relatively insensitive to the variation in test conditions. In contrast, as discussed above, the results for allyl alcohol showed a marked

dependence on the change from HLW to LAW test conditions. In general, the post-test measured (presumed) equilibrium levels of naphthalene based on sampling and analysis were lower than the pre-test spiked levels (i.e., the SBS sump was somewhat “over-spiked”), which would tend to bias the early DRE values low due to the effect of removal of the excess naphthalene from the SBS sump solution until the steady state concentration was reached.

4.2.1.4 Dioxin and Furan Analysis of SBS Fluids

Samples of SBS solutions from HLW and LAW Tests 2B were sent to STL Knoxville for organic analysis using EPA SW-846 method 8290 for dioxins and furans as well as EPA Office of Waste water method 1668A for PCBs. The results from these procedures are intended to guide process engineering with respect to treatment of secondary process solutions and were not requested for environmental applications. The results from dioxin, furan, and PCB analysis are provided in Tables 4.25. All measured dioxin and furan concentrations were below the Minimum Level (ML, the concentration or mass of analyte in the sample that corresponds to the lowest calibration level in the initial calibration) and most were below the Estimated Detection Limit (EDL, the concentration of a given analyte required to produce a signal with a peak height of at least 2.5 times the background signal level). Also, many of the values above the EDL were additionally qualified as not meeting the qualitative criteria for a positive identification or being present in the associated method or reagent blank at reportable levels. No organic spikes were used during the tests from which the samples were collected and therefore the effect of these compounds on the generation dioxins, furans, and PCBs in the melter or SBS sump cannot be assessed from these samples. The halide feed spike used throughout LAW Test 2B did not result in the generation of more halogenated organic compounds than in HLW Test 2B, which did not feature a halide feed spike. The higher concentrations of trace dioxin, furan, and PCBs measured in sample from the HLW test is consistent with the higher measured melter emissions during the HLW tests (see Section 6.10).

4.2.2 WESP, PBS, and HEME Fluids

Between 60 and 120 gallons of liquid was blown down from the WESP daily: the first 40 to 80 gallons from the previous day’s accumulation of water from spraying and condensation (typically, the sample with suffix “A” in the name) and the second from the 40-gallon deluge (typically, the sample with suffix “B” in the name). An exception was during the second LAW testing sequence when normal spraying and deluging of the WESP were suspended due to an inability to routinely restore power to the WESP after a deluge. On two occasions during Test 2B, the WESP was deluged multiple times in an attempt to restore WESP power thus creating additional blow down solutions. The PBS was blown down as required to maintain constant volume. The pH of the PBS sump is maintained between 9 and 10 during testing by the addition of 25% sodium hydroxide solution.

The WESP solution pH values from solutions taken during the HLW MACT tests were lower than in most previous HLW tests. The higher concentration of nitrates and volatiles such

as selenium in the MACT HLW feed resulted in lower pre-deluge pH values (2.5 to 4.2 vs. 7 to 8.5) than previous HLW tests [16, 20, 21, 23, 30]. The WESP solution pH values during LAW tests are lower than HLW tests due to higher nitrates/nitrites concentrations in the feed. Most of the values were between 1 and 2, which is comparable to solutions generated from previous LAW tests conducted at the same processing rate [19] and lower than generated from previous LAW Sub-Envelope B1 tests [18] (1 to 2 vs. 2 to 4) as a result of higher nitrogen oxide feed concentrations. Post-deluge samples had higher pH values due to the dilution of sump solutions with 40 gallons of tap water used in the deluge.

The first HEME (immediately downstream of the WESP) was only used during the HLW tests and liquids were only removed from the HEME sump at the end of each of the two HLW test sequences. The HEME was continuously sprayed at a rate of 0.2 gal/hr, resulting in the addition of about 11 and 30 gallons of water for the first and second testing sequence, respectively. As a result of condensation, the liquid accumulated during each of the test sequences was about 70% greater than the amount sprayed. The pH values of HEME solutions were similar to the contemporaneous WESP samples not associated with the deluge, suggesting that the HEME liquid pH is influenced by both misting from the WESP during routine operation and by species captured by the HEME that are relatively poorly captured by the SBS and WESP (e.g., NO_x).

SECTION 5.0 GLASS PRODUCT

Over twenty two and half metric tons of glass product was discharged from the melter through an airlift system into 55-gallon drums. The discharged product glass was sampled from each drum by removing sufficient glass from the top for total inorganic analysis. Product glass masses, discharge date, and the analyses performed are listed in Table 5.1.

5.1 Compositional Analysis

Glass samples were crushed and analyzed directly by XRF. The target values for the boron and lithium oxide concentrations were used for normalizing the XRF data, since boron and lithium were not determined by XRF. Analyzed compositions for discharged glass samples are provided in Table 5.2. There was good agreement with the target composition for the majority of oxides and, in particular, for the major oxides, as described for feed samples in Section 2.4.3. All major and intermediate oxides were within 10% of the target composition with the exception of zinc in both HLW and LAW glasses. Zinc oxide was between ten and twelve percent below the target value, which corresponded to an absolute deviation of only 0.24 and 0.32% ZnO. This small deficiency would not affect glass quality or compromise any of the test objectives. Barium, cerium, potassium, and tin are not included in the HLW MACT target composition but were measured at trace levels in the product glasses as residuals from the prior test or as a result of chemical impurities. The same phenomenon was observed for arsenic, lanthanum, manganese, neodymium, nickel, antimony, strontium, cesium, and barium in the glasses produced during the LAW tests. Common elements targeted at low concentrations, such as calcium and potassium, in the HLW glasses and chromium in the LAW glasses are over-represented in the glass product in the same manner as observed in the feed samples (see Section 2.4).

Corroborative analysis using DCP on solutions of acid-dissolved glass was performed on select glasses produced from each test; the results are compared to the XRF analysis in Table 5.3. Values for all of the major oxides compare favorably with the XRF analysis and target composition except for sodium, which often exhibits a low bias using this procedure [2, 21]. The closeness of the DCP boron and lithium analyses to the target validates the use of the target boron and lithium concentrations for normalizing the XRF data.

Compositional trends from the XRF data are plotted for selected elements in Figures 5.1-5.6. Not included in the plots are the compositions from the nearly six metric tons of glass produced in between the HLW and LAW MACT tests. The figures illustrate many of the points apparent in the tabular summaries of the data: good agreement with target for all major oxides after the melt pool has experienced or approached three turnovers (~6000 kg of glass produced) in the HLW tests and throughout the LAW tests. No major compositional changes at the beginning of testing were observed, due to the similarity between the MACT and previous high-waste-loading HLW C-106/AY-102 compositions. Increases in concentrations of the

intermediate range elements strontium, manganese, and zinc, as well as the toxic metal spikes added for the MACT tests, were observed at the expense of zirconium and a small percentage of the silicon and iron. The change from the HLW to LAW glass composition is shown as the break in the plotted data at about 8000 kg of glass produced. A gradual transition between the two compositions is not depicted in the figures as a result of the omission of the turnover glass production, which was not part of the MACT tests. Major differences expected and observed in the HLW and LAW glasses are the higher iron, manganese, and strontium concentrations in the HLW glasses as well as the higher sodium, calcium, titanium, and zirconium in the LAW glasses. Also, the concentration of MACT toxic metal spikes, with the exception of chromium, is much lower in the LAW glasses. Similar to previous DM1200 tests [16, 20, 21, 23], elements with glass concentrations significantly below target concentrations due to elemental volatility were chlorine, selenium, and arsenic during HLW tests. The halide spike during LAW Test 2B can be observed as the increase in chlorine concentrations at about 12,300 kg glass production, the plateau in concentration at about one weight percent chlorine, and the systematic decrease in chlorine concentration at about 18,000 kg glass production when halide spike incorporation into the feed was discontinued. Feed was spiked at a chlorine concentration of 1.2 wt% (glass basis) during LAW Test 2B and therefore at steady-state conditions, about eighty percent of the feed chlorine was retained in the glass.

5.2 Iron Redox State

The iron oxidation states for glass samples from all four tests were measured using colorimetric methods. The method detection limit of 0.3 and 0.8 % divalent iron for HLW and LAW glasses, respectively, is dependent on several factors including the level (12.6 to 5.6 wt%) of Fe_2O_3 in the target glasses. Sample information including name, test, and simulant type for all samples analyzed for divalent iron are given in Table 5.4. All measured divalent iron concentrations were below measurable amounts due to the oxidizing environment in the cold cap and glass melt. Glasses produced from HLW simulants often have low, but measurable concentrations of divalent iron; however, the addition of nitrates to the feed results in an even more oxidized glass product [16]. Glasses produced from LAW simulants at a sugar ratio of 0.5 (see Section 2.2.3) are usually fully oxidized [37-40, 49, 54]. The organic spikes used in the MACT tests did not result in reduction of iron in the glass due to the volatility of the organic compounds as compared to sugar, as well as the short duration (spike periods were typically less than 12 hours) and episodic use of the organic spikes.

SECTION 6.0 MONITORED OFF-GAS EMISSIONS

A primary objective of these tests was to characterize melter emissions and determine off-gas performance for a variety of regulated compounds. This objective was met by sampling the exhaust stream at various locations and performing analysis on these samples. Both of these activities were conducted using EPA or other approved regulatory methods. A listing of all the off-gas samples including sampling interval and methods used is provided in Tables 6.1 and 6.2. Particle size distribution samples are listed in a separate table for convenience. Methods for characterizing the exhaust stream which do not involve taking a sample for subsequent laboratory analysis were also used, including FTIR for a variety of gaseous species, 40-CFR-60 Method 25a for total hydrocarbons, gas chromatography for hydrogen, and 40-CFR-60 Method 10 for carbon monoxide. The majority of off-gas characterization activities were performed by independent Subcontractors: Air Tech Environmental of Research Triangle Park, NC for exhaust sampling, Severn Trent Laboratories of Knoxville, TN for sample analysis, and Kieka Ventures of Research Triangle Park, NC for data validation. The complete exhaust sampling report compiled by Air Tech and the Data Validation report compiled by Kieka Ventures are appended to this report. Operation of the FTIR and gas chromatograph for hydrogen determination was performed by VSL.

6.1 Particulate Emissions

Twelve exhaust samples, half from the melter outlet and half from the catalyst outlet were taken using 40-CFR-60 Methods 4, 5, and 26 to examine total particulate as well as gaseous halide emissions. The methods entail sampling air from the exhaust stream at the same velocity it is flowing through the duct to obtain a representative particulate sample. The sampled air stream is passed through a heated filter and then bubbled through a series of iced solutions which remove gaseous constituents. Total particulate load is then determined by gravimetric analysis of a particle filter and an acetone probe-rinse solution. The particle concentration is then calculated using the measured dry gas volume sampled. The particle emission rate is subsequently determined by multiplying the particulate concentration by the volumetric air flow rate that was determined by 40-CFR-60 Method 2A. The scrubbing solutions downstream of the particle filter are analyzed for gaseous species, which in these tests were halides (see Section 6.3). Samples for determining particle emission rates were taken during nominal and WTP hot plenum conditions (Tests 1 and 2B) for both feed compositions. During the high temperature challenge condition, power to the WESP was turned off for at least 30 minutes during each of the three samples. The results of these measurements are provided by test, date, time interval, and sampling location in Table 6.3. All particulate emission samples were taken while hazardous organic compounds were not spiked into the feed.

The majority of the particulate data follow the expected trends: particulate emissions from the melter are orders of magnitude higher than from the catalyst outlet for each test; there is higher solids carry-over from the melter at the higher plenum temperature; and near detection limit particulate concentrations were observed at the catalyst outlet for most samples. The melter emission rates for LAW Test 2B were higher than previous DM1200 tests with LAW simulants [2, 3, 18, 19] due to the high sodium concentration and the halide spike added to the MACT feed. Conversely, melter emission rates for HLW tests were lower than most previous DM1200 tests with HLW simulants [16, 20, 21] due to the maintenance of more extensive cold cap coverage in order to reduce plenum temperatures. The emission rates were low at the catalyst outlet for all samples; however, most of the concentrations were above detectable levels. These measured amounts maybe attributed to the difficulty in determining the differential mass of the filter and beaker used to dry down the acetone rinse to a tenth of a milligram. Note in Table 6.3 that the total recovered mass of particulate was less than 3 milligrams for all samples and less than 2 milligrams for all but one sample. The method includes the subtraction of an acetone blank from the sample data, which is the differential mass of a tared beaker before and after the evaporation of a like volume of acetone to the sample, but does not permit the subtraction of a filter blank. Data presented for particle size distribution in Section 6.2 suggest that the particle concentration at the catalyst could be lower than indicated in Table 6.3. Despite provisions for desiccation of filters and repeating weighing of filters and beakers, the practical detection limit for particle loading is probably higher than reported here. The best method for lowering the detectable particle concentration is the increase in air sampling duration. A sampling time of about 24 hours was used successfully at the WESP outlet in numerous previous tests [3, 16, 18, 20, 23, 30] and therefore a sampling interval of at least 24 hours is recommended at the catalyst outlet due to additional particle removal by the HEPA filter.

6.2 Particle Size Distribution

Four samples of the catalyst exhaust were taken using a University of Washington Mark III cascade impactor to collect particulate material by size fractions of > 10 microns, $1 - 10$ microns, and < 1 micron using California Air Resources Board Method 501. Each fraction was subjected to gravimetric analysis by Air Tech to determine the mass fraction in each size range. Sampling intervals were about 24 hours to ensure enough material was present for gravimetric determinations. Results for the particle size distribution analysis along with sampling intervals are provided in Table 6.4. Similar to the total particle loading determination described in Section 6.1, very little mass accumulated on the sampling filters. Greater than 1 milligram was collected only on one of twelve filters used. Consequently, the results are highly variable, indicating that a different size fraction contains a greater proportion of particulate for three of the four samples. This high degree of variability suggests that despite the one-day sampling interval, insufficient mass accumulated on the filter media to reliably report the particulate size distribution using this procedure.

6.3 Gaseous Halogen Emissions Determined by EPA Method 26

Solutions from the twelve samples used in particulate determination described in Section 6.1 were evaluated using EPA 40-CFR-60 Method 26 to determine halogen emissions for regulatory purposes. The method employs the same isokinetic train used in metals sampling and also contains acidic (dilute sulfuric acid) and basic (sodium hydroxide) impinger solutions to scrub acid gases and molecular halides, respectively. The results of the analysis are provided in Table 6.5. All gaseous halide emission samples were taken while hazardous organic compounds were not spiked into the feed. The data show the expected trends of increased emissions with increased feed rates for the two compositions and increased emissions when the feed included the halide spike during LAW Test 2B. No diatomic homonuclear halogens were detected in any of the LAW tests and only Cl_2 was detected in HLW melter exhaust. No HF was detected in any of the samples taken at the catalyst outlet but was present in all samples taken at the melter outlet, indicating that the off-gas system is efficient at removing HF from the exhaust stream. Conversely, more HCl was measured in the catalyst exhaust than in the melter exhaust during LAW tests. Potential sources of the HCl monitored at the catalyst outlet are HCl desorption from the SA-C media or generation of HCl in the SBS or WESP sumps as a result of collection of particulate NaCl in the acidic sump solutions. This phenomenon was observed in a previous test prior to the installation of the SA-C bed [3] giving added credence to the latter mechanism. More HCl was emitted from the melter during HLW tests than LAW tests, even though LAW feed chlorine concentrations are much higher. Chlorine emissions during vitrification of LAW simulants are mostly particulate [3, 19, 37-40, 54] due to the higher sodium content of the feed whereas chlorine emissions during vitrification of HLW simulants are more equally distributed between particulate and gaseous phases due to the lower sodium and higher water contents of the feed [20, 21]. Particulate halide emissions are not measured using this method and therefore performing halide mass balances with respect to the melter and off-gas system is not possible. Total chlorine emissions from the melter during LAW tests can reasonably be expected to be an order of magnitude higher than the gaseous emissions presented here. The LAW off-gas train includes a PBS downstream of the catalyst unit and therefore halide emissions measured in this study upstream of the PBS should be higher than those that would be expected to be seen downstream of a WTP prototypical PBS and mist eliminator. It is also possible that the inclusion in the WTP off-gas system of the guard bed in the AC-S and the silver mordenite bed might further reduce gaseous halide emissions beyond those measured in the present work. A small silver mordenite column tested on a slip stream of the DM1200 primary off-gas system exhaust had DF values of greater than two thousand for gaseous iodine; however, insufficient concentrations of chlorine and fluorine entered the column to be able to calculate DF values for these halides [16, 23, 55].

6.4 Metal Emissions

Twelve exhaust samples per waste type, half from the melter outlet and half from the catalyst outlet were taken using EPA Method SW-846-0060 to examine toxic metal emissions. The method is the same as the particulate determination described in Section 6.1, except that a

low-metal quartz filter is used and the impinger solutions are analyzed along with the filter and rinses for metals. Also, an additional nitric acid rinse is conducted on the probe and the impinger solutions are 5% concentrated nitric acid plus 10% hydrogen peroxide. Metals analysis of the filter, rinses, and impinger solutions was performed by STL using EPA Method SW-846-6010B. All metal emission samples were taken while hazardous organic compounds were not spiked into the feed.

The total toxic metal recoveries for reagent and field blanks are compared to samples taken at the catalyst outlet in Tables 6.6 and 6.7. Values for the reagent blanks given are the sum of the toxic metal recovered in nitric rinse solutions, impinger solutions, and the particle filter in proportions identical to those in the samples. Details on blank analysis of the individual components are provided in the appended Data Validation report. The data indicate that variable amounts of most toxic metals are present in reagent blanks, resulting in recoveries being 2X for many and 4X for most toxic metals recovered in samples taken at the catalyst outlet. One exception is selenium, which forms a very fine particulate that is not easily removed by the primary off-gas system. Another is zinc, which is the only toxic metal that constitutes more than one percent of the target glasses other than manganese in the HLW glass. The other type of blank sample provided for comparison is the field blank. These samples are derived from sampling trains assembled in the field during the melter test, and recovered and analyzed along side the exhaust samples. The intent of these blanks is to indicate if samples were contaminated during recovery or exposure to field and laboratory conditions. The majority of the field blanks have similar recoveries to the reagent banks. Exceptions are one selenium, one manganese, and all zinc and cadmium field blank values. Both types of blank samples taken together suggest that the vast majority of the very low concentrations of metals measured in the exhaust samples did not originate from the exhaust air stream. The same conclusion was drawn in a previous study evaluating catalyst exhaust and blank data obtained using the same EPA methods [3].

Toxic metals emission rates at the melter and catalyst outlets along with calculated DF values are given in Tables 6.8 – 6.11. Target metal concentrations and actual production rates were used to calculate metal feed rates to the melter except in the case of barium and nickel, where the measured values were used (see Section 2.4.4). Emission rates were corrected with reagent blank data using methods prescribed in SW-846-0060. Melter emissions rates were higher during HLW tests due to the higher metal concentrations in the feed. Rates were also higher in Test 2B for each composition as a result of the increased melter feed and glass pool bubbling rate. Several metals were detected in the LAW exhaust streams that were not in the feed recipe as a result of residual metals in the system from the HLW tests, trace feed contamination, or a high analytical background for those metals. Total DF (melter and off-gas system) values ranged from about thirty thousand to over three million for metals constituting greater than 0.02 wt% oxide in the target composition. An exception was selenium, which forms a fine particulate which is difficult to remove from the exhaust stream. Total DF values calculated for metals with low feed concentrations were typically lower than those calculated for the more abundant feed metals due to the uncertainty in the analysis at such low concentrations. The DF values calculated across the off-gas system are low for the same reasons. Most of the metals in the feed except for selenium are retained in the glass at levels of at least 99%, which

reduces the already low concentrations in the feed to extremely low emission rates into the off-gas system. Given the analytical background for most elements, the metals data presented here dramatically under represent the actual DF of the off-gas system. Measurement of the off-gas system DF can be improved by increasing the number of reagent and field blanks to better evaluate the analytical background, increasing the feed concentration of the metals, increasing the melter feed rate, and increasing the sampling durations.

6.5 FTIR Analysis

Off-gas analysis by Fourier Transform Infra-Red (FTIR) spectroscopy was performed using an On-Line Technologies Inc. Model 2010 Multi-Gas™ Analyzer. Data were recorded at 71 s intervals, corresponding to an average of 128 scans at 0.5 cm^{-1} spectral resolution. The melter off-gas supplied to the FTIR spectrometer was extracted using a heated sampling and transfer loop, which removed a gas sample stream from the off-gas system at 5 liters per minute. The sampling and transfer loop was maintained at 150°C throughout in order to prevent analyte loss due to condensation. Summaries of gaseous emissions monitored by Fourier Transform Infra-Red spectroscopy (FTIR) are provided in Tables 6.12- 6.25 and Figures 6.1.a – 6.3.f. The data are grouped by test and organic spiking periods. It should be noted, however, that the sampling locations (melter, SBS, WESP, carbon column, and catalyst) were not sampled simultaneously for these measurements.

The data from tests that do not include organic feed spikes (Tests 2B) exhibit the same trends as previous tests: nitrogen oxides emissions vary in proportion to feed concentrations of nitrogen oxides and feed rate; concentrations of byproducts of incomplete combustion such as carbon monoxide vary in proportion to the organic feed concentration; nitrogen oxide and carbon monoxide concentrations vary by as much as a factor of 10 during test segments due to changes in the cold cap; nitrogen oxides and carbon monoxide concentrations are constant across the off-gas system until reduction across the hybrid catalyst unit; ammonia slip from the SCR; removal of soluble species such as ammonia by the SBS; water and carbon dioxide emissions from the melter are proportional to the feed rate; and water emissions downstream of the SBS are constant due to the constant SBS sump temperature. Tests with LAW simulants result in higher nitrogen oxide, carbon monoxide, and ammonia emissions than do tests with HLW simulants, although nitrates were added to the HLW simulant used in these tests, which resulted in higher nitrogen oxide emissions than in previous tests with HLW simulants. Spiking the feed with allyl alcohol resulted in large increases in carbon monoxide concentration to 200-2000 ppmv at all monitored locations except the catalyst outlet. Carbon monoxide emissions were lower in LAW tests because the allyl alcohol spiking rate was decreased from 40 to 10 g/min. Carbon monoxide concentrations also increased as methanol solutions were fed to the melter, although to a lesser extent. Changes in carbon monoxide concentrations in response to organic spiking were also monitored by EPA 40-CFR-60 Method 10, as shown in Figure 6.4. Carbon monoxide concentrations were monitored continuously at the carbon column outlet during HLW Tests 2A and 1-continued. Notice the large increase in carbon monoxide concentrations during allyl alcohol spiking, the modest increase during methanol spiking, and the high degree of variability

in concentration, particularly during allyl alcohol spiking. No carbon monoxide was measured at the catalyst outlet during all HLW tests and the first LAW test. The decrease in performance during LAW Tests 2A and 2B (also suggested by the THC data, see Section 6.6) could be due to poisoning of the catalyst but further testing of the catalyst media would be needed to confirm this. Total nitrogen oxide emissions were unaffected by allyl alcohol and methanol, although the ratio of NO: NO₂ changed from about 10 to 1 in HLW tests when allyl alcohol was spiked into the melter feed. Acetonitrile and ammonia were detected as byproducts of nitrate and organic decomposition throughout most of the LAW testing and during HLW testing when allyl alcohol was fed. Sulfur dioxide was measured almost exclusively in melter and carbon bed emissions, indicating that sulfur is emitted from the melter, scrubbed by the primary off-gas system, reintroduced into the exhaust stream by stripping of sulfur from the carbon column, and subsequently removed by the catalyst unit. It is possible that removal of sulfur in the catalyst unit occurs by reaction with ammonia to form ammonium sulfate particulate, which is well known in industrial SCR applications. No obvious correlation was observed with organic feed spiking or waste type and carbon column sulfur dioxide emissions. For example, the test segment average sulfur dioxide concentration while spiking naphthalene in methanol was the highest of the three segments (no spiking, allyl alcohol spiking, and naphthalene in methanol spiking) during HLW Test 1 and the lowest of the three segments during LAW Test 1. Also, sulfur dioxide was measured during most but not all the non-organic spiking periods. Additional tests monitoring total sulfur emissions (SO₂, oxidized gaseous sulfur such as sulfuric acid, and particulate) at the carbon column inlet and outlet over a variety of off-gas compositions would be required to characterize the mechanism and magnitude of sulfur release from the carbon media.

6.6 Total Hydrocarbons by Method 25A

Total hydrocarbon (THC) testing was performed at a variety of locations throughout the off-gas system during tests with hazardous organic compounds spiked into the feed. Sample gas was extracted from the source via a heated head pump and directed to the analyzer through a heated Teflon line. The analyzer utilized a flame ionization detector (FID) to detect the presence of any volatile organic material in the gas stream. The FID operates on the principle of flame ionization where organic compounds entering the flame are combusted, forming positive and negatively charged ions that give rise to a small current between two electrodes. This analog signal is then converted to a digital readout and displayed on a computer screen. The data are then stored electronically for subsequent data reduction. For organic compounds, the generated signal is roughly proportional to the number of carbon atoms present in the sampled gas. The response represents the total hydrocarbon concentration present and not that of individual compounds. The sampling was performed following the protocol of EPA 40-CFR-60 Method 25A. Prior to actual sampling, the analyzer was calibrated directly with a series of Protocol gaseous standards (propane in this case) followed by a system bias check where a calibration gas is introduced between the probe and the heated sample line. The calibration drift and bias check QC parameters were all within method specifications. Average total hydrocarbon concentrations measured during HLW Tests 1 and 2A are tabulated in Table 6.26; concentrations measured during LAW Test 1 and 2A are included with the FTIR data in Tables 6.19-21 and

6.23-6.25, respectively. Depictions of hydrocarbon concentrations during the melter tests are given in Figures 6.5.a-6.5.d.

The primary factor affecting THC concentrations in these tests was the use of organic spikes. Prior to the addition of the hazardous organics to the feed, measured THC concentrations were at or near the detection limit. The organic compounds present in the exhaust in the absence of organic spikes, such as carbon monoxide and acetonitrile, are too low in concentration to provide a significant signal. Once the feed was spiked with organics, THC concentrations increased rapidly to a steady-state concentration, although variation around the mean concentration covers an order of magnitude, in a manner similar to nitrogen oxides. THC concentrations at the SBS, WESP, and HEPA outlets during spiking periods are similar to those in the melter exhaust due in part to the direct injection of organic compounds into the SBS sump at the beginning of the spiking period (see Section 4.2.1.3). During allyl alcohol spiking periods, THC concentrations drop by a factor of about 10 during HLW tests and 5 during LAW tests across the carbon column. The lower DRE during LAW tests may be attributed to the change in the exhaust composition or the lowering of the allyl alcohol spike rate by a factor of 4. During spiking with methanol solutions, little or no reduction of THC concentrations across the carbon column was observed, presumably because the temperature of carbon column was greater than the boiling point of methanol (64.5°C). THC concentrations drop to near detection limit at the outlet of the catalyst unit during most of the organic spiking periods (values increased to about 3 ppmv during last LAW test). In previous tests, THC destruction measured across the catalyst unit for a mixture of chlorobenzene and trichloroethylene was 96.5 to 97.7% [18, 20], which is within the range (90 to 99.9%) measured in this study with alcohols; however, these measurements are dependent on the concentration entering the catalyst and the detection limit of the instrument. Once the spike is no longer introduced into the melter feed, the THC concentration drops off rapidly in the melter exhaust, in contrast to the exhaust downstream of the SBS, as shown in Figures 6.6 – 6.9. Alcohols in the cold cap are volatilized or destroyed quickly, whereas alcohols are gradually released from the SBS sump as it comes into equilibrium with the lack of alcohols in the inlet air and dilution by condensation of moisture from the melter exhaust. These observations should be considered when evaluating data for the “no spiking periods” provided in Tables 6.19 – 6.26, which often include data from periods immediately after organic spiking was discontinued. Manipulations of alcohol spike rate into the melter have little immediate effect on alcohol concentrations throughout the secondary off-gas system and therefore these manipulations would be a very ineffective method for controlling temperatures in the carbon bed.

Method 25A provided real time data, which was very useful for conducting the MACT tests. These data provided verification of the melter feed and SBS sump spiking systems as well as illustrating the amount of time the system was affected by the organic spike after spiking to the feed was ceased. It also enabled the calculation of preliminary DRE values across the primary off gas system, carbon column, and catalyst unit. The limitation of the method is that the values do not reflect a single compound but rather an aggregate of combustible organics and, therefore, DRE values for individual compounds cannot be calculated. The other limitation is that the detection limit is high compared to other methods, particularly when measuring high and low concentration exhaust streams sequentially.

6.7 Hydrogen by Gas Chromatography

Monitoring for hydrogen was performed using Gas Chromatography (GC). The GC was equipped with a 3' $\times$ 1/8" stainless-steel column packed with molecular sieve 5A and a thermal conductivity detector operated with an argon carrier gas at 4 psi and a column temperature of 40°C. The unit was calibrated against a certified standard gas (1090 ppmv hydrogen in air) that was progressively diluted using mass-flow controllers to obtain six different hydrogen concentrations ranging between 1090 ppmv and 10 ppmv. The limit of detection of this system was below the 10-ppmv lower calibration point, but was not further quantified. Measurements were made only at the WESP outlet and are indicative of melter emissions, since no hydrogen is removed by the SBS or WESP. Measured hydrogen concentrations are presented in Table 6.27 by test and organic spiking period. The results adhere to expected trends for the HLW tests and appear to follow no pattern for the LAW tests. Hydrogen concentrations are typically very low while processing HLW simulants due to the low concentration of organic compounds in the feed although concentrations of several hundred ppmv can be produced with the addition of sugar to the feed [16, 20, 21, 23]. Even without the hazardous organic compounds in feed, hydrogen concentrations were higher than previous tests with HLW simulants due to the higher waste organic concentration and the lower plenum temperatures. Hydrogen concentrations further increased with the addition of the organic spikes and the reduction of the plenum temperature. Neither of these trends were observed during the LAW test; the plenum temperature and inclusion of the organic spike appeared to have no effect on hydrogen concentrations. The spiked hazardous organic carbon contribution was apparently masked by the sugar and nitrates present in the feed. Hydrogen concentrations were on average about two to three times higher than during previous tests on the DM1200 with LAW simulants [3, 19] due perhaps to the differences in waste organic compounds and the lower plenum temperature used in these tests.

6.8 Allyl Alcohol and Naphthalene Emissions

Samples were taken at various locations in the off-gas system to measure concentrations of allyl alcohol and naphthalene. The sampling periods coincided with the introduction of these compounds into the melter feed stream at a rate sufficient to calculate the required level of destruction across the melter system. A method for sampling and analyzing allyl alcohol was developed by modifications to 40 CFR 63 Appendix A, Method 308 [11]. The modifications to Method 308 are: (i) Use of 0.2 M NaOH in the impinger solutions instead of deionized water in order to prevent acidification in the high NO_x off-gas streams; (ii) Addition of a vertical condenser to reduce the temperature of the gas entering the impingers; and (iii) Use of up to four impingers in series to eliminate breakthrough. Naphthalene concentrations in the exhaust streams were determined using EPA Methods SW-846-0010 and 8270 for semi-volatile sampling and analysis. The feed rate of the two organic compounds into the melter feed was determined using the known composition of the spike mixture and flow rate of the mixture into the melter feed (from the spike pump settings) and verified by differential readings from a balance on which the spike solution reservoir rested. Measured emission rates from these analyses along with feed rates and calculated DRE percentages are given in Tables 6.28 – 6.31.

The objective of at least 99.99 % destruction of allyl alcohol across the melter system was achieved for all sampling periods, challenge conditions, and simulant types. Destruction across the melter was only between 20 and 90% and, therefore, most of the destruction/removal of allyl alcohol was done by the off-gas system. As anticipated, more allyl alcohol was consumed in the melter at higher plenum temperatures and while feeding LAW simulants. The primary off-gas system DRE for allyl alcohol was 14 to 72 percent, presumably as removal by the SBS, WESP, or the HEME (HLW only). As described in Section 4.2.1.3, the SBS sump was spiked to bring the SBS sump more quickly into equilibrium with allyl alcohol and naphthalene melter emissions whereas the small WESP or HEME sumps were not spiked. Both of these units feature water sprays and sumps which could remove the water soluble alcohols; however, per the Test Specification, no testing of the sump solutions for allyl alcohol or naphthalene to determine the extent of removal by these components was performed. The amount of removal performed by these units is considered to be inherent to routine processing. Also inherent to the process is conversion to other organic compounds or destruction of allyl alcohol and naphthalene originating from the sump spike or melter emissions. The DRE across the carbon column was between 80 and 99 percent, with the remainder of the allyl alcohol being removed by the catalyst. No allyl alcohol was measured in any of the primary or backup impinger solutions from samples taken at the catalyst outlet. Reducing the catalyst outlet temperature from 400°C to 370°C during Tests 2A had no observable effect on allyl alcohol destruction. System performance for volatile organic removal was improved over previous tests which measured organic destruction using a system without the AC-S bed and a different catalyst media [2, 3].

The objective of at least 99.99 % destruction of naphthalene across the melter system was achieved for all challenge conditions and simulant types except for two sampling periods, which had 99.987 and 99.978 % destruction. Only between 0 and 37 percent of the naphthalene in the feed was consumed in the melter and the DRE of the primary off-gas system for naphthalene was less than 32 percent, resulting in the bulk of the naphthalene destruction/removal being done by the carbon column and catalyst unit. As anticipated, more naphthalene was consumed in the melter at higher plenum temperatures. The DRE across the carbon column was greater than 99.99% during HLW tests but only between 94 and 99 percent during LAW tests. The reduced performance during LAW tests may be due to competition with nitrogen oxides for carbon media binding sites or the stripping of sulfur from the media by the high nitrogen oxide exhaust stream. Measured naphthalene emission rates at the catalyst outlet ranged from less than detectable to 0.2 mg/min. Reducing the catalyst outlet temperature from 400°C to 370°C during Tests 2A had no observable effect on naphthalene destruction. In fact, the sampling periods in which the 99.99% destruction level was not met were both at the higher catalyst temperature. No change in off-gas system conditions, such as a drop in catalyst temperatures, can be identified as a reason the level of destruction sought was not obtained for the two sampling periods. One sampling period occurred while processing HLW simulants, the other, LAW simulants; one occurred as the last sample taken prior to replacing AC-S media, the other immediately after changing the media; one occurred at the end of a test, the other at the beginning. Given the lack of difference between off-gas system conditions during the sampling periods and the randomness of the samples which did not show the required off-gas system performance, the most likely explanation is trace contamination, in the field or the lab. Melter samples contain hundreds of

milligrams of naphthalene whereas samples from the catalyst outlet contained tens of micrograms. Samples taken at the melter and HEPA outlets have visible crystals of naphthalene growing on the condenser coils during sampling and have a strong naphthalene odor during sampling recovery. Given the vast difference in amounts of naphthalene in the samples from the two locations, the close proximity of the samples to each other throughout the recovery and analysis process, the minuscule amount of naphthalene required to alter the result in the catalyst outlet samples, and the random occurrence of not achieving the destruction target, trace contamination is the most plausible explanation for the slight elevation in the two catalyst outlet samples. This explanation for the results cannot be proven by available data given the random nature of the occurrence. Review of blank data given in the Data Validation Report (Appendix V) gave no clear indication that trace contamination occurred, although in discussions with the author of that report there was agreement on the probability of a contamination given the differing sample concentrations and the proximity of the samples throughout the process. This problem can be easily overcome in WTP tests by sampling only at locations downstream of the catalyst unit. System performance for naphthalene removal is improved but similar (>99.999-99.978% vs. 99.98%) to previous tests [3]. The addition of the AC-S bed clearly reduced the amount of naphthalene flux into the catalyst, particularly while processing HLW simulants.

Detailed assessment of data quality for naphthalene and allyl alcohol, including blank analysis and semi-volatile surrogate recovery, is provided in the appended Data Validation Report. Additional quality checks were developed for evaluating allyl alcohol data, which are summarized in Table 6.32. Spike recoveries are calculated from a known amount of allyl alcohol that is spiked into impinger solutions prior to pulling the exhaust sample taken before allyl alcohol was spiked into the feed. The percentage of alcohol recovered indicates the amount of allyl alcohol not lost due to exposure to a representative exhaust stream. In all samples taken during these tests, recoveries were within 90 to 104 percent of the original spike, which is well within the 50 – 150% window used for volatiles in other methods. This includes a sample from the carbon bed outlet which had gone acidic during sampling. Percent breakthrough was calculated by separately analyzing the fourth impinger in the sampling train for allyl alcohol and comparing the amount measured to that found in the first two impingers. One backup impinger per sampling location per test was sent to STL for analysis while the rest of the backup impinger samples were retained at VSL in cold storage. Analysis of backup impingers from HLW tests showed less than one percent breakthrough, whereas samples taken during LAW tests had breakthroughs ranging from seven to twenty five percent. No backup impinger from catalyst outlet samples during either HLW or LAW tests contained any measurable allyl alcohol. In view of the observed breakthrough of the LAW samples, all backup impingers from the LAW tests were sent to STL for analysis. The measured amount of alcohol in these samples was added to the amount measured in the primary impingers and the emissions rates calculated from these totals.

6.9 Total Organic Emissions

Total Organic Emissions (TOE) by EPA Methods SW-846-0040 and 0010 were measured at the catalyst outlet [7] while the feed was spiked with allyl alcohol and naphthalene during HLW and LAW Tests 2A. The method is intended to measure the total organic content of the exhaust stream as volatile, total chromatographable, and total gravimetric organic compounds. The results for this method are given in Tables 6.33 and 6.34.

6.10 Dioxin, Furan, and PCB Emissions

The melter and catalyst exhaust streams were sampled for the presence of dioxins, furans, and PCBs. Methods used for quantifying these compounds were as follows: EPA SW-846-0023A for sampling, EPA SW-846-8290 for dioxin analysis, and Waste Water Method 1668A for PCBs. Total toxicity equivalents were calculated using weighting factors from SW-846-8290, 1998 Revision. Analytical results for samples taken during HLW and LAW Tests 2A and 2B are provided in Tables 6.35-6.40. Note that allyl alcohol and naphthalene were not spiked into the feed during sampling except for one sample pair taken near the end of LAW Test 2A. All reported values for samples taken during LAW tests at both the melter and catalyst outlets were below the Minimum Level (ML, the concentration or mass of analyte in the sample that corresponds to the lowest calibration level in the initial calibration), below the Estimated Detection Limit (EDL, the concentration of a given analyte required to produce a signal with a peak height of at least 2.5 times the background signal level), qualified as not meeting the qualitative criteria for a positive identification, or had concentrations comparable to associated blanks. Conversely, samples taken at the melter outlet during HLW tests contain low but quantifiable levels of most dioxins, some furans, and three PCB isomers. The vast majorities of these compounds are removed from the exhaust stream by the off-gas system and therefore are not observed in the catalyst exhaust. In previous DM1200 tests with LAW Sub-Envelope A simulants, only trace amounts of dioxins, furans, and PCBs were present in both melter and catalyst exhaust streams [3]. The higher concentrations of these compounds measured in the HLW melter exhaust may be due to the presence of metals such as copper and manganese in the HLW feed, which may in turn catalyze dioxin, furan, and PCB generation. Dioxin, furan, and PCB data have not been previously collected while processing HLW simulants on the DM1200 and therefore no comparison is available for data from the current HLW tests.

6.11 Volatile and Semi-Volatile Organic Emissions

Samples were taken at the outlets of the melter and catalyst for analysis of volatile and semi-volatile organic compounds. EPA SW-846 methods used were as follows: 0031 for volatile sampling, 0010 for semi-volatile sampling, 8260 for volatile analysis, and 8270 for semi-volatile analysis. All volatile organic emission samples were taken while hazardous organic compounds were not spiked into the feed. Conversely, all semi-volatile organic emission samples were taken while naphthalene dissolved in methanol was spiked into the feed in order to monitor

naphthalene concentrations for the purpose of calculating semi-volatile destruction across the melter system and select off-gas system components. The method for volatile analysis entails desorbing Tenax tubes that are used for sampling directly into the gas chromatograph. Employing this method resulted in concentrations that were orders of magnitude above the instrument calibration range and caused significant damage to the chromatographic columns during the analysis of melter exhaust samples from LAW tests. Usable data was generated by desorbing the tubes into methanol and then injecting the methanol solution into the gas chromatograph. The procedure results in a 200-fold dilution and therefore detection limits are much higher for LAW melter exhaust samples than for catalyst exhaust samples. High detection limits are also given for semi-volatiles as result of the high naphthalene concentrations used in DRE evaluation (see Section 6.8). Other analytical problems were encountered during volatile and semi-volatile analysis as a result of the high nitrogen oxide concentration in the exhaust streams. In evaluating the semi-volatile data, the potential for false positive results due to high nitrogen oxide concentrations needs to be considered. The extraction of compounds from the XAD sampling column results in an acidic solution that is rich in nitrates. Phenols, which are added to each column prior to sampling as an internal standard, can be readily converted to nitrobenzene or nitrophenols. Also, many of the surrogates placed on the sampling media by the laboratory could not be recovered, rendering the analysis of some types of compounds suspect. A detailed evaluation of the volatile and semi-volatile data is provided in the appended validation report. Semi-volatile data for the sample taken during HLW Test 1 was inadvertently only analyzed for naphthalene and therefore results for this sample are shown only in Table 6.30. Samples taken during HLW Test 1-continued were taken under the same conditions and thus provide a reasonable estimate of semi-volatile emissions other than naphthalene during HLW Test 1. Data for the volatile and semi-volatile samples are presented in Tables 6.41 – 6.48.

The objective addressed by the volatile and semi-volatile analyses was to quantify byproduct generation from sugar, waste organics present in melter feed or the naphthalene spike solution. The most abundant volatile byproducts are the nitriles (acetonitrile and acrylonitrile) particularly during tests with LAW simulants. Acetonitrile and acrylonitrile have been observed in high concentrations as byproducts of vitrifying high nitrate LAW simulants with sugar in previous studies [2, 3]. Few other volatiles other than lab contaminants (acetone, methylene chloride, toluene) were detected in melter emission samples. Low concentrations of benzene were observed in a couple of the samples presumably from breakdown of the sampling media. Also observed in low concentrations in some of the samples was halogenated methane. Given the low boiling point of these compounds and the absence of iodine and bromine in the feed, these compounds are probably present as laboratory contaminants. Semi-volatile byproducts were limited to a small number of low concentration nitrated and phenolic compounds as well as phthalates. The latter are common laboratory contaminants associated with plastics. Nitrated compounds were probably generated during sample preparation and the surrogate recoveries for phenol were poor which qualifies the data for all like compounds.

SECTION 7.0

SUMMARY AND CONCLUSIONS

Two sets of DuraMelter 1200 melter tests consisting of two runs each were conducted, one using HLW and the other with LAW feed. The HLW feed composition was based on the C-106/AY-102 tank waste, while the LAW feed composition was based on data for the AP-101 tank waste and represents LAW Sub-Envelope A2. The melter and off-gas operating conditions were adjusted to simulate WTP normal and challenge conditions. Tests were conducted between November 2004 and March 2005, with the HLW testing being performed first because the existing glass pool composition was similar to the composition of the HLW feed used for this test. The first week of HLW testing was used to collect samples while the melter and off-gas system were operating under WTP normal conditions (WTP normal plenum temperature; 400°C). The waste simulant was spiked with the selected hazardous organic compounds (allyl alcohol and naphthalene) during this period to collect organic DRE data across the melter and primary and secondary off-gas systems. Since there is no existing EPA method for allyl alcohol, the method that was previously developed for this purpose was used in these tests. Exhaust samples were taken at other locations in the off-gas system to collect data for calculating DF values for a variety of inorganic constituents. This test was stopped prior to completion due to Project concerns over temperature increases in the AC-S bed. Tests resumed in December of 2004 after a review of literature information, operating conditions, and potential safety issues with WTP and the carbon manufacturer. The second portion of HLW testing was performed under WTP challenge conditions and was divided into three parts: the first employed a low-plenum-temperature condition (WTP cold plenum; 300°C or lowest attainable temperature), the second was a completion of the nominal conditions that had not been finished due to the interruption of the first week of testing, and the third employed a high-plenum-temperature condition (WTP hot plenum; 500°C). Feed was spiked with allyl alcohol and naphthalene during a portion of the first segment of the second test to collect organic DRE data across the melter and primary and secondary off-gas systems. Exhaust samples were also taken at other locations in the off-gas system during the tests to determine the extent of PIC generation and subsequent removal by off-gas system components. Sampling to obtain data for calculating DF values of various inorganic compounds was also done during the latter segment of Test 2. The LAW testing was performed in a similar fashion to the HLW testing with the following exceptions: (i) the HEME upstream of the HEPA filter was bypassed; (ii) the feed was spiked with chloride and fluoride during the higher plenum temperature segment of Test 2; (iii) all of Test 1 was completed during the first week of testing, (iv) based on experience gained during the HLW tests the high temperature test (2B) was conducted prior to the low temperature test (2A), and the spiking rate of allyl alcohol was reduced to limit the temperature increase across the carbon column. A turnover to the LAW composition was conducted prior to the LAW tests to test safety modifications to the carbon bed, evaluate temperature increases across the carbon bed in response to LAW melter exhaust while spiking with allyl alcohol, and to change out the glass pool from an HLW to LAW composition. Sampling and analyses were performed according to established EPA or California Air Resource Board (CARB) methods by independent contractors;

Air Tech Environmental for emissions sampling and STL Knoxville for chemical analysis. Data that are to be used for regulatory purposes were subjected to a data validation review by Keika Ventures.

The general performance of the DM1200 melter and off-gas treatment system was good with the exception of the WESP during LAW tests. Film cooler blockages requiring mechanical clean-out occurred less frequently as compared to previous tests due to lower feed and bubbling rates. Upon post test inspection, however, it was discovered that the film cooler was damaged and corroded to the extent that it cannot be re-used. Design modifications to the internals of the SBS, directed by the Project to address the build-up of solids in the down-comer appeared to limit the build-up of deposits in the down-comer that had been seen in tests prior to these modifications, although this observation should not be considered definitive given the short duration of the tests. During the turnover test with LAW simulants, the wand used to remove material from the bottom of the SBS was clogged and became operational only after three days of testing with intermittent attempts to restore flow. The WESP functioned well during HLW tests; however, during LAW tests it was difficult or impossible to restore normal power after deluges. Post-test inspections failed to identify any mechanical or electrical defects in the WESP and the unit functioned normally in the immediately following HLW Turnover Test. Similar electrical problems have been encountered with the WESP in past tests with LAW simulants. The sulfur-impregnated carbon bed installed in between the HEPA filter and the catalyst unit performed without incident throughout testing although there were indications that elements, most notably sulfur, were being stripped from the media. The safeguards and modifications put in place successfully prevented excessive heating of the carbon bed. Extensive sets of process engineering data were collected during the tests, including post-test inspections of all major off-gas system components.

The glass product was close to the intended composition for all elements except zinc once the melt inventory was turned over; the absolute deficiency of zinc was very small and did not impact the test objectives. During the relevant performance tests, one feed sample per test was analyzed for Resource Conservation and Recovery Act (RCRA) metals for regulatory purposes. Also, one feed sample per each unique feed tank charging was obtained and analyzed per VSL standard methods for composition verification.

During nominal and challenge WTP melter system conditions, the DM1200 melter and catalyst exhaust streams were sampled for allyl alcohol using a modified version of 40 CFR 63 Appendix A, Method 308; Volatile Organic Compounds (VOCs) using EPA SW-846 Method 0031; Semi Volatiles using EPA SW-846 Method 0010; dioxins, furans, and coplanar PCBs using SW-846 Method 0023A; metals using SW-846 Method 0060; halides using 40 CFR-60 Method 26; and total hydrocarbons using 40 CFR 60, Method 25A. The modifications to Method 308 are: (i) Use of 0.2 M NaOH in the impinger solutions instead of deionized water in order to prevent acidification in the high NO_x off-gas streams; (ii) Addition of a vertical condenser to reduce the temperature of the gas entering the impingers; and (iii) Use of up to four impingers in series to eliminate breakthrough. The sampling periods for allyl alcohol and naphthalene coincided with the introduction of these compounds into the melter feed stream at a rate

sufficient to calculate the required level of destruction across the melter system. Where sampling was being performed for the calculation of DREs, samples were drawn from the melter, HEPA filter, carbon column and catalyst outlets simultaneously such that any variation in the melter and off-gas conditions would not impact the DRE calculation. Samples were also taken at the catalyst outlet for total organic emissions (TOE) using SW-846-0040 as the melter feed was spiked with a mixture of allyl alcohol and naphthalene. The off-gas was also sampled for 24 hour periods at the catalyst outlet using a University of Washington Mark III cascade impactor to collect particulate material by size fractions of > 10 microns, 1 - 10 microns, and < 1 micron (CARB Method 501); each fraction was subjected to gravimetric analysis. Additional data was collected by VSL using CEM monitoring for a variety of gaseous species including acid gases, CO_x, and NO_x, by FTIR and hydrogen by gas chromatography.

Emissions data collected show a high rate of removal or destruction for most constituents. The objective of at least 99.99% destruction of allyl alcohol and naphthalene across the melter system was achieved for all sampling periods, challenge conditions, and simulant types except for two naphthalene sampling periods, which had DREs of 99.987 and 99.978%. Based on a careful review of the data and system operating conditions, trace contamination, and not a lack of system performance, is the most plausible explanation for not achieving the performance objective for these two naphthalene samples. The continuous total hydrocarbon monitor was found to be an excellent operational tool for monitoring relative organic destruction throughout the off-gas system but was not sensitive enough to measure DREs to 99.99%. Emissions of dioxins, furans, and PCBs were at or below measurable or qualified levels except at the melter outlet during tests with HLW simulants where low but measurable amounts of these compounds were observed. Emissions of toxic metals were very low at the catalyst outlet; however, the magnitude of the off-gas system DF is obscured by the presence of trace contaminants in commercially available filters and reagents. Particulate removal by the off-gas system was extremely high although difficult to quantify because of the miniscule mass of particulate collected at the catalyst outlet. All gaseous fluorine species were removed by the off-gas system; however, gaseous chlorine was measured at the catalyst outlet at concentrations that were even higher than those measured in the melter exhaust.

The volumes of processing solutions generated in the SBS, WESP, HEME, and PBS were documented during testing. All solutions except for those from the PBS were mildly to very acidic due to the high concentration of acid gases such as nitrogen oxides in the exhaust stream. Fluid samples were taken from the SBS sump and analyzed for either allyl alcohol or naphthalene at the end of the respective spiking periods. Additional samples were taken for dioxins, furans, and coplanar PCB analysis.

During the course of the MACT tests a number of operational, sampling and analytical issues were identified and are summarized below.

Film cooler clogging was not a significant operational problem during these tests. However, post-test inspection showed corrosion, cracking, and filling of the air holes with glass over the course of this and previous tests. Although the damage had likely prevented air flow

through the air holes in the leading edge of the film cooler, air flow through the film cooler as a whole, presumably through the louvers, was maintained throughout its service life.

Electrical malfunctions of the WESP, which have been reported in previous DM1200 tests with LAW simulants, continued to be a problem during the present tests with LAW simulants. No such problems were encountered during the HLW tests.

Maintaining a cold-cap-limited feed rate during DM1200 tests is dependent on frequent visual monitoring of conditions in the melter plenum. This is particularly true when establishing and maintaining low temperature challenge plenum conditions. The planned operation of the WTP melters, based on only non-visual data such as plenum temperature, could lead to either under feeding of the melter resulting in lower than attainable production rates or over feeding of the melter resulting in excessive cold-cap buildup as well as other operational difficulties. Testing under prototypic conditions is therefore recommended to determine whether the required glass production rates can be achieved without the visual data.

Analysis and recovery of off-gas samples at detection level concentrations of naphthalene in the presence of samples with very high concentrations of naphthalene can easily lead to cross contamination. A miniscule amount of cross contamination drastically affects calculated DRE values. Sampling and analysis of the two sample types should be carefully isolated. Another possibility would be to sample only stack exhaust for naphthalene and to use a total hydrocarbon monitor to evaluate relative organic destruction in other off-gas system locations.

Commercially available filters and reagents contain trace levels of metals making DF determination across the off-gas system difficult. The problem can be addressed by taking multiple samples of long duration as well as provide a series of blanks for analysis to improve blank correction when permissible. Increasing the feed concentration would also improve DF calculations.

The low particulate concentrations at the catalyst outlet cause difficulties in determining particle emission rates and size distribution. The problem can be addressed by taking multiple samples of long duration as well as by using microscopic analysis of filters to estimate size distributions.

Measurable gaseous chlorine emissions at the catalyst outlet are higher than at the melter outlet indicating that gaseous chlorine is generated within the off gas system. Gaseous HCl may have deleterious effects on the catalyst. Quantification of total chloride emissions (gaseous and particulate) at various locations in the off-gas system would identify the mechanism for the gaseous chlorine generation and therefore facilitate strategies for limiting the emissions.

Sulfur dioxide emissions from the carbon column indicate that sulfur is being stripped off the column. The loss of sulfur from the carbon media would compromise its effectiveness for mercury removal, which is one of its principal functions in the off-gas train. Gaseous sulfur also has the potential to poison the catalyst and/or to react with ammonia to form ammonium sulfate

particulate, which can clog the catalyst. Consequently, the integrity of the carbon media in the presence of high nitrogen oxide exhaust needs to be understood.

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Table 2.1. Compositional Summary of Different Waste Streams and Blended Solids for the C-106/AY-102 HLW Simulant.

Waste Component	C-106/AY-102 Solids	Recycle Stream	Separation Factor	Sr/TRU Product	Cs-Eluate	Tc-Eluate	Blended Solids
	FRP02	PWD01	—	—	CNP12	TEP12	HLP09b
	(lb/day)	(lb/day)	(fraction remained)	(lb/day)	(lb/day)	(lb/day)	(lb/day)
Ag	9.20E+01	5.49E-21	4.885*	—	—	—	9.20E+01
Al	3.19E+03	2.17E+00	0.395	—	5.13E+00	7.54E-02	1.27E+03
As	9.77E+01	1.32E-01	1.825*	—	—	—	9.78E+01
B	1.83E+01	2.88E+00	2.759*	—	7.27E+00	—	2.84E+01
Ba	6.59E+01	2.69E-04	0.054	—	6.24E-03	2.10E-03	3.55E+00
Be	4.89E+00	0.00E+00	1.000	—	—	—	4.89E+00
Bi	1.71E+00	2.58E-04	5.303*	—	—	—	1.71E+00
Ca	4.01E+02	9.03E-02	0.360	—	9.31E-01	2.22E-02	1.45E+02
Cd	1.07E+01	1.57E-04	0.028	—	1.19E-02	2.05E-03	3.10E-01
Ce	5.08E+01	5.90E+00	0.041	—	—	—	2.33E+00
Cl	3.83E+01	2.13E+00	0.064	—	5.94E+01	1.14E+01	7.34E+01
Co	2.05E+01	0.00E+00	1.000	—	—	5.59E-03	2.05E+01
Carbonate	4.73E+03	2.41E+00	0.185	—	—	—	8.74E+02
Cr	1.27E+02	2.01E-01	0.281	—	1.38E-01	5.45E-03	3.58E+01
Cs	7.84E-01	0.00E+00	0.186	—	6.33E-02	3.35E-07	2.09E-01
Cu	2.34E+01	6.86E-33	200.513*	—	3.75E-01	3.89E-03	2.38E+01
F	1.30E+01	7.49E-01	0.037	—	—	—	5.07E-01
Fe	5.87E+03	1.49E+00	1.897*	—	9.57E-02	5.63E-03	5.95E+03
Hg	2.56E+01	2.09E-05	4.438*	—	—	—	2.56E+01
K	2.09E+01	9.11E-01	0.134	—	9.77E-01	2.03E-02	3.91E+00
La	1.39E+02	1.98E-02	2.753*	—	—	2.00E-02	1.39E+02
Li	0.00E+00	7.57E-01	2.848	—	—	5.65E-03	2.16E+00
Mg	2.21E+02	4.89E-06	2.154	—	1.50E-01	4.17E-03	4.76E+02
Mn	1.26E+03	9.01E-02	1.000	4.49E+02	8.20E-03	7.73E-04	1.71E+03
Mo	3.94E+00	0.00E+00	1.000	—	—	2.07E-03	3.94E+00
Na	4.28E+03	3.65E+02	0.059	—	2.02E+01	9.14E-01	2.93E+02
Nd	8.71E+01	0.00E+00	1.000	—	—	—	8.71E+01
Ni	2.20E+02	1.10E-01	0.411	—	5.85E-01	6.68E-03	9.13E+01
Nitrite	4.47E+01	5.06E-01	0.050	—	—	—	2.28E+00
Nitrate	2.93E+01	8.67E+02	0.037	—	1.14E+02	—	1.47E+02
Hydroxide	8.33E+03	3.16E+01	0.114	—	—	—	9.56E+02
Hydroxide(Bound)	5.34E+03	0.00E+00	0.076	—	—	—	4.06E+02
Pb	2.56E+02	2.27E-02	0.353	—	0.00E+00	2.11E-02	9.04E+01
Pd	0.00E+00	2.15E-09	5.392	—	—	—	1.16E-08
Phosphate	1.15E+03	1.66E-02	0.074	—	—	—	8.53E+01
Pr	0.00E+00	0.00E+00	1.000	—	—	—	0.00E+00
Rb	0.00E+00	0.00E+00	1.000	—	—	—	0.00E+00
Rh	0.00E+00	0.00E+00	1.000	—	—	—	0.00E+00
Ru	0.00E+00	0.00E+00	1.000	—	—	—	0.00E+00
Sb	5.91E+01	0.00E+00	2.434	—	—	—	1.44E+02
Se	9.77E+01	0.00E+00	1.825*	—	—	—	1.78E+02
Si	6.36E+02	6.02E+00	4.398*	—	2.13E+00	5.69E-02	6.44E+02
Sulfate	3.48E+01	5.45E-01	0.034	—	—	—	1.20E+00
Sr	2.52E+01	0.00E+00	0.985	4.99E+02	—	1.05E-03	5.24E+02
Ta	0.00E+00	0.00E+00	—	—	—	—	0.00E+00
Te	5.83E+00	0.00E+00	—	—	—	—	0.00E+00
Th	0.00E+00	0.00E+00	—	—	—	—	0.00E+00
Ti	1.07E+01	1.53E-03	5.306	—	—	5.02E-03	5.69E+01
Tl	1.97E+02	0.00E+00	—	—	—	—	0.00E+00
TOC	2.96E+02	0.00E+00	0.017	—	—	—	4.92E+00
U	2.18E+02	0.00E+00	—	—	2.01E-01	—	2.01E-01
V	4.89E+01	0.00E+00	—	—	—	9.14E-03	9.14E-03
Y	0.00E+00	0.00E+00	—	—	—	—	0.00E+00
Zn	1.30E+01	4.36E-01	2.843	—	4.66E-02	2.87E-03	3.81E+01
Zr	6.14E+01	3.44E-01	4.576*	—	—	6.94E-03	1.30E+02
TOTAL	3.79E+04	1.31E+03**	—	9.48E+02	2.12E+02	1.26E+01	1.49E+04

* Separation Factors not Used in Calculation (see text). — = Empty Data Field. ** Includes negligible components that are omitted.

Table 2.2. Compositional Summary (Oxide Basis) of the C-106/AY-102 Base Simulant, Spikes, and the MACT HLW Simulant.

Wt%	C-106/AY-102 HLW Simulant	Spikes (as wt% of glass)	MACT HLW Simulants
Al ₂ O ₃	12.77%	—	12.729%
As ₂ O ₅	0.69%	—	0.688%
B ₂ O ₃	0.49%	—	0.338%
CaO	1.09%	—	1.084%
CdO	—	0.250%	0.901%
Cl	0.39%	0.125%	0.450%
Cr ₂ O ₃	0.28%	0.175%	0.630%
Cs ₂ O	0.18%	—	—
CuO	0.16%	0.052%	0.187%
F	—	0.042%	0.151%
Fe ₂ O ₃	45.35%	—	45.301%
I	0.36%	—	—
La ₂ O ₃	0.87%	—	0.871%
Li ₂ O	0.02%	—	0.000%
MgO	4.21%	—	4.204%
MnO*	14.41%	—	14.389%
Na ₂ O	2.11%	—	1.924%
Nd ₂ O ₃	0.54%	—	0.541%
NiO	0.62%	—	0.619%
P ₂ O ₅	0.34%	—	0.340%
PbO	0.52%	0.300%	1.081%
SO ₃	—	0.150%	0.540%
Sb ₂ O ₃	0.92%	—	0.917%
SeO ₂	1.34%	0.147%	0.530%
SiO ₂	7.35%	—	6.621%
SrO	3.31%	—	3.303%
TiO ₂	0.51%	—	0.505%
ZnO	0.25%	—	0.221%
ZrO ₂	0.93%	—	0.933%
TOTAL	100.0%	1.241%	100.00%
Volatiles	(g/100 g waste oxide)	(g/ 100 g glass)	(g/ 100 g glass)
Carbonate	4.650	—	4.650 [#]
Nitrite	0.012	0.582	0.582
Nitrate	0.784	3.000	3.000
TOC	0.026	2.491	2.491

— = Empty Data Field. *MnO₂ in Reference [13]. [#]Unit = g/ 100 g waste oxide.

Table 2.3. Compositional Summary (Oxide Basis) of the MACT HLW Simulant, Glass Additives, Target MACT Test Glass, and the Reference Glass (HLW98-86).

Wt%	MACT HLW Simulant	Glass Former (as wt% of glass)	MACT Melter Test Target Glass	HLW98-86
Ag ₂ O	—	—	—	0.15%
Al ₂ O ₃	12.729%	1.750%	5.283%	5.29%
As ₂ O ₅	0.688%	—	0.191%	0.19%
B ₂ O ₃	0.338%	9.250%	9.344%	9.39%
CaO	1.084%	—	0.301%	0.30%
CdO	0.901%	—	0.250%	—
Cl	0.450%	—	0.125%	0.11%
Cr ₂ O ₃	0.630%	—	0.175%	0.08%
CuO	0.187%	—	0.052%	0.04%
F	0.151%	—	0.042%	—
Fe ₂ O ₃	45.301%	—	12.574%	12.56%
La ₂ O ₃	0.871%	—	0.242%	0.24%
Li ₂ O	0.000%	2.993%	2.993%	3.01%
MgO	4.204%	—	1.167%	1.17%
MnO*	14.389%	—	3.994%	3.99%
Na ₂ O	1.924%	11.250%	11.784%	11.84%
Nd ₂ O ₃	0.541%	—	0.150%	0.15%
NiO	0.619%	—	0.172%	0.17%
P ₂ O ₅	0.340%	—	0.092%	0.09%
PbO	1.081%	—	0.300%	0.14%
SO ₃	0.540%	—	0.150%	—
Sb ₂ O ₃	0.917%	—	0.255%	0.26%
SeO ₂	0.530%	—	0.147%	0.37%
SiO ₂	6.621%	45.000%	46.838%	47.07%
SrO	3.303%	—	0.917%	0.92%
TiO ₂	0.505%	—	0.140%	0.14%
ZnO	0.221%	2.000%	2.061%	2.07%
ZrO ₂	0.933%	—	0.259%	0.26%
TOTAL	100.00%	72.243%	100.00%	100.0%
Volatiles (g/100 g glass)	—	—	—	—
Carbonate	4.650 [#]	—	—	—
Nitrite	0.582	—	—	—
Nitrate	3.000	—	—	—
TOC	2.491	—	—	—

— = Empty Data Field. *MnO₂ in Reference [13]. [#]Unit = g /100 g waste oxide.

Table 2.4. Composition of Melter Feed To Produce 1 Metric Ton of Target Glass from MACT HLW Simulant (20 wt% undissolved solids).

MACT HLW Simulant		Glass-Forming Additives	
Starting Materials	Target Weight (kg) *	Starting Materials	Target Weight (kg)
Al(OH) ₃	56.90	Kyanite	30.65
As ₂ O ₃	1.66	--	--
H ₃ BO ₃	1.69	Na ₂ B ₄ O ₇ ·10H ₂ O	255.91
CaCO ₃	2.44	--	--
CdO	2.53	--	--
NaCl	2.08		
Cr ₂ O ₃	1.77	--	--
CuO	0.53	--	--
CaF ₂	0.89	--	--
Fe(OH) ₃ (13% slurry)	1283.43	--	--
La(OH) ₃ ·3H ₂ O	3.66	--	--
Mg(NO ₃) ₂ ·6H ₂ O	62.65	Li ₂ CO ₃	75.93
Mg(OH) ₂	2.83	--	--
MnO ₂	49.44	--	--
Na ₂ CO ₃	0.56	Na ₂ CO ₃	123.20
Nd ₂ O ₃	1.52	--	--
Ni(OH) ₂	2.21	--	--
FePO ₄ ·xH ₂ O (80%)	2.51	--	--
PbO	3.03	--	--
CaSO ₄ ·2H ₂ O	3.26		
Sb ₂ O ₃	2.57	--	--
SeO ₂	1.48	--	--
SiO ₂	18.56	SiO ₂	441.54
SrCO ₃	13.39	--	--
TiO ₂	1.42	--	--
ZnO	0.62	ZnO	20.20
Zr(OH) ₄ ·xH ₂ O (50%)	6.70	--	--
NaNO ₂	8.95	--	--
H ₂ C ₂ O ₄ ·2H ₂ O	131.51	--	--
Water	587.00	--	--
TOTAL	2257.79	TOTAL	947.43
--	--	FEED TOTAL	3205.22

*Target weights adjusted for assay information of starting materials; -- = Empty Data Field

Table 2.5. LAW MACT AP-101/AY-102 Simulant Recipe at 8 Molar Sodium.

Envelope Constituents	Simulant AP-101/AY-102 Including Pretreatment		Glass Oxides	LAW MACT Simulant as Oxides (wt%)	Waste Contribution to Glass	Source in Simulant	Order for Addition	Formula Weight	Assay\$	Target Weight (g)
-	mg/L	Molarity	Loading	-	24.66 %	In 420 ml water add following compounds in the order listed below				
Al	11500	0.426	Al ₂ O ₃	6.525	1.609	Al(NO ₃) ₃ ·9H ₂ O, 60% sol.	1	375.14	0.607	263.47
B	274	0.025	B ₂ O ₃	0.265	0.065	H ₃ BO ₃	2	61.83	0.990	1.58
Cd spike	1650	0.015	CdO	0.566	0.140	Cd(NO ₃) ₂ ·4H ₂ O	3	400.14	0.985	1.89
Cr spike	3700	0.071	Cr ₂ O ₃	1.624	0.400	Na ₂ CrO ₄ ·4H ₂ O	8	234.04	0.985	16.91
Cu spike	50	0.001	CuO	0.019	0.005	Cu(NO ₃) ₂ ·2.5H ₂ O	4	295.64	1.000	0.233
K	33800	0.864	K ₂ O	12.225	3.014	KOH	10	56.10	0.908	53.410
Li	13	0.002	Li ₂ O	0.008	0.002	LiOH·H ₂ O	11	41.94	0.970	0.081
Na	185000	8.047	Na ₂ O	74.877	18.462	NaOH, 50% sol. D=1.53	9	40.00	0.501	323.433
Pb	12	0.000	PbO	0.004	0.001	Pb(NO ₃) ₂	5	331.20	0.990	0.019
Se spike	190	0.002	SeO ₂	0.080	0.020	SeO ₂	6	110.96	0.999	0.267
Si	157	0.006	SiO ₂	0.101	0.025	SiO ₂	7	60.09	0.990	0.339
Cl	5,075	0.143	Cl	1.524	0.376	NaCl	12	58.45	0.990	8.452
F	570	0.030	F	0.171	0.042	NaF	13	42.00	0.990	1.273
PO ₄	2,597	0.027	P ₂ O ₅	0.583	0.144	Na ₃ PO ₄ ·12H ₂ O	14	380.12	0.990	10.500
SO ₄	5,710	0.059	SO ₃	1.429	0.352	Na ₂ SO ₄	15	142.06	0.990	8.529
NO ₂	46740	1.016	NO ₂	-	-	NaNO ₂	19	69.00	0.995	70.462
NO ₃	160800	2.594	NO ₃	-	-	NaNO ₃	20	84.99	0.990	110.210
Org. Carbon	18240	1.52	-	-	-	-	-	-	-	-
Acetate	20254	0.343	-	-	-	Sodium Acetate (C2)	16	136.08	0.990	47.123
Formate	14820	0.329	-	-	-	Sodium Formate (C1)	17	68.01	0.990	22.619
Oxalate	22230	0.253	-	-	-	Sodium Oxalate (C2)	18	134.00	0.990	34.192
-	-	-	-	-	-	Target Glass Weight				1350.75
-	-	-	SUM	100.000	24.66	Total simulant Weight				1399.07

"-" Empty data field

\$ - refers to purity of raw materials as specified by vendor.

Table 2.6. Oxide Composition of LAW MACT AP-101/AY-102 Pretreated Simulant and Corresponding Glass Composition (wt%).

Glass Oxides	Simulant AP-101/AY-102 in glass @ 18.46 % Na ₂ O	Additives Mix	MACT LAW A126 Target Glass Composition	Previous [7] LAW A126 Target Glass Composition
Loading	24.656 %	75.344 %	100.00%	-
Al ₂ O ₃	1.609	4.068	5.676	5.617
B ₂ O ₃	0.065	9.823	9.888	9.821
CaO	0.000	2.004	2.004	1.987
CdO	0.140	-	0.140	-
Cr ₂ O ₃	0.400	-	0.400	0.021
Cs ₂ O	-	-	-	0.149
CuO	0.005	-	0.005	-
Fe ₂ O ₃	0.000	5.580	5.580	5.531
K ₂ O	3.014	-	3.014	3.811
Li ₂ O	0.002	-	0.002	0.000
MgO	0.000	1.488	1.488	1.476
Na ₂ O	18.462	-	18.462	18.462
PbO	0.001	-	0.001	-
Se ₂ O	0.020	-	0.020	-
SiO ₂	0.025	44.384	44.409	43.987
TiO ₂	0.000	2.008	2.008	1.986
ZnO	0.000	2.976	2.976	2.938
ZrO ₂	0.000	3.013	3.013	2.961
Cl	0.376	-	0.376	0.424
F	0.042	-	0.042	0.350
P ₂ O ₅	0.144	-	0.144	0.077
SO ₃	0.352	-	0.352	0.401
Total	24.656	75.344	100.000	100.000

"-" Empty data field

Table 2.7. Glass Forming Additives for 1 Liter of LAW MACT Simulant and Corresponding Melter Feed Properties.

Additives Source	LAW A126
Additives in Glass (wt%)	75.344 %
Kyanite (Al_2SiO_5) 325 Mesh (Kyanite Mining) (g)	98.88
H_3BO_3 (US Borax – Technical Granular) (g)	239.02
Wollastonite NYAD 325 Mesh (NYCO Minerals) (g)	57.39
Fe_2O_3 (Prince Mfg.) (g)	70.69
Olivine (Mg_2SiO_4) 325 Mesh (#180 Unimin) (g)	42.29
SiO_2 (Sil-co-Sil 75 US Silica) (g)	490.35
TiO_2 (Rutile Airfloated Chemaloy) (g)	28.43
ZnO (KADOX – 920 Zinc Corp. of America) (g)	40.32
Zircon ZrSiO_4 (Flour) Mesh 325 (AM. Mineral) (g)	61.12
Addition of Sucrose as Reductant (g)	33.86
Simulant Weight for 1 liter (g)	1399
Sum of Additives (g)	1128
Sum of Complete Batch (g)	2561
Target Density (g/ml)	1.70
Final Volume (l) (based on target density)	1.51
Target Water Content in Slurry Feed (Weight %)	34%
Additives in Slurry (Weight %)	44%
Target Glass Yield (g/kg of Feed)	527
Target Glass Yield (g/L of Feed)	896
Target Total Solids (g/L of Feed)	1140
Target Additives (g/L of Feed)	749

Table 2.8. Characteristics of DM1200 Melter Feed Samples.

Waste Type	Date	Name	%Water	g/ml	Glass Yield		pH
					(kg/kg)	(g/l)	
HLW	11/15/04	1Z2-F-39A	NA	1.35	NA	NA	9.37
	11/16/04	1Z2-F-58A	NA	1.36	NA	NA	9.38
	11/17/04	1Z2-F-94A	62.74	1.35	0.314	423	9.47
	12/06/04	F-12A-14A	NA	1.36	NA	NA	9.76
	12/07/04	F-12A-54A	NA	1.36	NA	NA	9.73
	12/09/04	F-12A-104A	61.96	1.36	0.316	429	9.62
	12/10/05	F-12B-40A	NA	1.36	NA	NA	9.40
	12/11/04	F-12B-80A	NA	1.36	NA	NA	9.37
	12/12/04	F-12B-114A	NA	1.36	NA	NA	9.42
	Average		62.35	1.36	0.315	426	9.50
	Target		-	-	0.315	400 -460	-
	C-106/AY-102 at 20% UDS [23]		54.2	1.42	0.389	553	10.23
	C-106/AY-102 at 20% UDS [16]		53.8	1.45	0.380	553	10.14
	High Waste loading C-106/AY-102 at 20% UDS [21]		62.56	1.33	0.317	420	10.99
LAW	3/7/2005	F-12D-87A	NA	1.74	NA	NA	12.27
	3/8/2005	F-12D-129A	34.43	1.75	0.508	888	12.25
	3/10/2005	F-12E-30A	NA	1.74	NA	NA	12.25
	3/18/2005	F-12E-87A	NA	1.74	NA	NA	12.30
	3/21/2005	F-12E-131A	NA	1.71	NA	NA	12.24
	3/21/2005	F-12F-21A	35.63	1.74	0.494	859	12.26
	3/21/2005	F-12F-60A	NA	1.75	NA	NA	12.23
	3/23/2005	F-12F-104A	36.13	1.76	0.515	906	12.24
	3/23/2005	F-12F-141A	NA	1.73	NA	NA	12.23
	Average		35.40	1.74	0.505	885	12.25
	Target		34	1.70	0.527	896	-
	Sub-Envelope A2 feed, DM100 [49]		36.01	1.73	0.474	820	12.50

NA – Not analyzed

"-" Empty data field

Table 2.9. Rheological Characteristics of Melter Feed Samples.

Waste Type	Sample	% Water	Density	Glass Yield		pH	Yield Stress (Pa)	Viscosity (Poise)		
			(g/ml)	(kg/kg)	(g/l)			@1/s	@10/s	@100/s
HLW	F-12A-104A	61.96	1.36	0.316	429	9.62	1.7	8.81	0.98	0.20
	High Waste loading C-106/AY-102 at 15% UDS [21]	69.48	1.28	0.272	348	10.90	3.2	4.54	0.67	0.13
	C-106/AY-102 at 20% UDS [23]	54.20	1.42	0.389	553	10.23	5.5	23.3	2.62	0.42
	C-106/AY-102 at 20% UDS with added sugar [16]	53.83	1.45	0.380	553	10.14	11.2	63.0	14.5	1.80
	C-106/AY-102 at 20% UDS with added nitrates and sugar [16]	55.2	1.44	0.370	535	9.91	12.3	115	15.2	2.65
LAW	F-12F-104A	29.93	1.76	0.515	906	12.24	0.3	1.11	0.37	0.30
	Previous DM100 Tests [49]	36.01	1.73	0.474	820	12.50	0.4	2.45	0.55	0.34

Table 2.10. XRF Analyzed Compositions for Select Melter Feed Samples During DM1200 Test (wt%).

Waste	HLW					LAW					
Element	Target	1Z2-F-94A	F-12A-104A	Average	%Dev.	Target	F-12D-129A	F-12F-21A	F-12F-104A	Average	%Dev.
Al ₂ O ₃	5.28	5.67	5.32	5.50	4.01	5.68	5.43	5.76	5.71	5.63	-0.76
As ₂ O ₃	0.19	0.13	0.17	0.15	NC	§	<0.01	<0.01	<0.01	<0.01	NC
B ₂ O ₃ *	9.34	9.34	9.34	9.34	NC	9.89	9.89	9.89	9.89	9.89	NC
BaO	§	0.09	0.08	0.08	NC	§	<0.01	<0.01	<0.01	<0.01	NC
CaO	0.30	0.38	0.36	0.37	NC	2.00	1.95	2.01	1.91	1.95	-2.48
CdO	0.25	0.23	0.25	0.24	NC	0.14	0.19	0.16	0.16	0.17	NC
Cl	0.13	0.03	0.03	0.03	NC	0.38	0.06	0.06	0.15	0.09	NC
Cr ₂ O ₃	0.18	0.20	0.19	0.19	NC	0.40	0.70	0.51	0.65	0.62	NC
CuO	0.05	0.06	0.06	0.06	NC	0.01	<0.01	<0.01	0.01	<0.01	NC
F	0.04	NA	NA	<0.01	NC	0.04	<0.01	<0.01	<0.01	<0.01	NC
Fe ₂ O ₃	12.57	12.82	12.56	12.69	0.90	5.58	5.29	5.30	5.37	5.32	-4.65
K ₂ O	§	0.12	0.12	0.12	NC	3.01	2.72	2.26	2.87	2.62	-13.19
La ₂ O ₃	0.24	0.28	0.27	0.27	NC	§	<0.01	<0.01	<0.01	<0.01	NC
Li ₂ O*	2.99	2.99	2.99	2.99	NC	§	<0.01	<0.01	<0.01	<0.01	NC
MgO	1.17	1.11	1.22	1.17	0.04	1.49	0.96	1.03	1.05	1.01	-31.93
MnO	3.99	4.26	4.17	4.22	5.55	§	0.02	0.02	0.02	0.02	NC
Na ₂ O	11.78	10.92	11.96	11.44	-2.94	18.46	20.03	19.64	19.62	19.76	7.04
Nd ₂ O ₃	0.15	0.17	0.16	0.17	NC	§	<0.01	<0.01	<0.01	<0.01	NC
NiO	0.17	0.16	0.19	0.17	NC	§	0.01	0.01	0.01	0.01	NC
P ₂ O ₅	0.09	0.13	0.13	0.13	NC	0.14	0.23	0.22	0.20	0.22	NC
PbO	0.30	0.28	0.27	0.27	NC	§	<0.01	<0.01	<0.01	<0.01	NC
Sb ₂ O ₃	0.26	0.28	0.29	0.28	NC	§	<0.01	<0.01	<0.01	<0.01	NC
SeO ₂	0.15	0.03	0.03	0.03	NC	0.02	<0.01	<0.01	0.01	0.01	NC
SiO ₂	46.84	46.62	46.17	46.39	-0.95	44.41	43.85	44.25	43.79	43.96	-1.00
SO ₃	0.15	0.13	0.14	0.13	NC	0.35	0.24	0.11	0.23	0.19	NC
SrO	0.92	0.94	0.92	0.93	1.32	§	<0.01	<0.01	<0.01	<0.01	NC
TiO ₂	0.14	0.26	0.25	0.26	NC	2.01	2.23	2.33	2.22	2.26	12.62
ZnO	2.06	2.02	1.98	2.00	-3.04	2.98	2.96	3.11	2.92	3.00	0.71
ZrO ₂	0.26	0.37	0.37	0.37	NC	3.01	3.24	3.33	3.22	3.27	8.41
Sum	100.00	100.00	100.00	100.00	NC	100.00	100.00	100.00	100.00	NC	NC

* Target values

§ - Not a target constituent

NA – Not analyzed by XRF

NC – Not calculated

Table 2.11. STL and VSL Analyzed Concentrations of Toxic Metals in Melter Feed Samples (mg/kg).

-	HLW					LAW				
Sample I.D.	Target	F-12A-104A		F-12B-8A	F-12B-40A	Target	F-12F-21A		F-12F-104A	
Element		STL Analysis	VSL Analysis*	STL Analysis			STL Analysis	VSL Analysis	STL Analysis	VSL Analysis
Ag	0	NA	<29.05	NA	NA	0	0.85	<49.06	0.72	<49.06
As	388.58	128.89	270.10	148.77	134.78	0	<0.46	<34.36	<0.46	<34.36
Ba	0	26.07	167.37	33.88	21.73	0	20.50	<38.42	23.00	38.42
Cd	682.80	438.95	539.83	478.72	458.10	645.86	556.00	704.18	559.00	657.16
Cr	373.58	2.50	377.18	2.64	2.25	1442.3	2750.00	1783.27	2140.00	2201.31
Cu	129.59	130.36	131.85	136.99	121.52	20.05	24.20	<42.09	20.60	<42.09
Mn	9649.78	8543.37	9092.50	9132.57	8322.42	<58.13	58.60	66.45	49.10	58.13
Ni	421.70	421.28	318.16	444.84	385.92	0	26.20	21.07	16.60	33.71
Pb	868.90	751.23	659.20	795.42	718.09	4.89	6.20	<24.89	5.50	24.89
Sb	598.67	36.82	536.68	66.43	43.90	0	<0.21	<39.66	<0.21	<39.66
Se	326.37	251.88	55.41	229.05	253.36	75.00	87.10	37.50	70.40	30.53
Zn	5166.06	4905.07	4181.10	5096.56	4625.20	12600.01	14200.00	12093.72	12600.00	11278.15

* - VSL analysis performed on glass produced from crucible melt of feed.

"-" Empty data field

Table 3.1. Summary of HLW MACT Test Conditions and Results.

C-106/AY-102 Simulant + MACT spikes, Target Glass Yield = 0.312 kg/kg					
Test		1	2A	1-continued	2B
Target Plenum Temp. (C°)		400	300	400	500
Average [#] Measured Plenum Temp. (C°)	8" below ceiling	400	353	410	488
	17" below ceiling	392	338	387	484
	Exposed TC	405	345	407	593
	Overall	399	345	401	522
Time	Feed Start	11/15/04 13:45	12/6/04 10:12	12/9/04 13:24	12/10/04 09:40
	Feed End	11/17/04 18:00	12/9/04 13:24	12/10/04 09:40	12/12/04 15:35
	Duration	52.3 hr	75.2 hr	19.1 hr	54.0 hr
Water Feeding for Start-up		1.0 hr	1.0 hr	NA	NA
Slurry Feeding		51.3 hr	74.2 hr	19.1 hr	54.0 hr
Cold Cap Burn-Off		2.0 hr	NA	NA	2.0 hr
Average Bubbling Rate (lpm)		23.9	9.2	28.1	42.7
Organic Spikes	Type	Allyl Alcohol	Allyl Alcohol	Naphthalene/ MeOH	NA
	Rate	40 g/min	40 g/min	13 g/min	
	Start	11/16/04 11:36	12/07/04 11:29	12/09/04 13:38	
	End	11/16/04 17:42	12/07/04 17:58	12/09/04 21:00	
	Duration	6.1 hr	6.5 hr	7.4 hr	
	Type	Naphthalene/ MeOH	Naphthalene/ MeOH	NA	
	Rate	13 g/min	13 g/min	NA	
	Start	11/17/04 12:15	12/08/04 10:44	NA	
	End	11/17/04 17:36	12/08/04 21:38	NA	
	Duration	5.4 hr	10.9 hr	NA	
	Type	NA	Allyl Alcohol/ Naphthalene	NA	
	Rate	NA	40 g/min	NA	
	Start	NA	12/09/04 10:28	NA	
	End	NA	12/09/04 13:22	NA	
	Duration	NA	2.9 hr	NA	
Feed	Used	5751 kg	6656 kg	2268 kg	9294 kg
	Average Rate	112 kg/h	88 kg/hr	119 kg/hr	172 kg/hr
Glass Produced	Poured	1833 kg	1933 kg	724 kg	3035 kg
	Average Rate ^{\$}	715 kg/m ² /day	521 kg/m ² /day	758 kg/m ² /day	1122 kg/m ² /day
	Average Rate [*]	699 kg/m ² /day	550 kg/m ² /day	742 kg/m ² /day	1072 kg/m ² /day

\$ - Rates calculated from glass poured.

*- Rates calculated from feed data.

NA – Not applicable.

Note: Rates do not take into account the time for water feeding and cold cap burn-off.

Table 3.2. Summary of LAW MACT Test Conditions and Results.

Test		1	2B ^{&}	2A
Target Plenum Temp. (C°)		400	500	300
Average [#] Measured Plenum Temp. (C°)	8" below ceiling	397	490	321
	17" below ceiling	414	504	333
	Exposed TC	416	503	326
	Overall	409	499	327
Time	Feed Start	3/7/05 09:03	3/17/05 9:30	3/20/05 06:01
	Feed End	3/10/05 12:01	3/20/05 06:00	3/23/05 03:01
	Duration	75 hr	68.5 hr	69 hr
Water Feeding for Start-up		1.0 hr	1.0 hr	NA
Slurry Feeding		74 hr	67.5 hr	69 hr
Cold Cap Burn-Off		1.3 hr	NA	1.2 hr
Average Bubbling Rate (lpm)		26	43	9.3
Organic Spikes	Type	Allyl Alcohol	-	Allyl Alcohol/ Naphthalene
	Rate	10 g/min		11 g/min
	Start	3/8/05 10:06		3/21/05 09:00
	End	3/8/05 16:50		3/21/05 20:16
	Duration	6.7 hr		11.3 hr
	Type	Naphthalene/ MeOH		Naphthalene/ MeOH
	Rate	13 g/min		13 g/min
	Start	3/9/05 10:02		3/22/05 09:05
	End	3/9/05 21:12		3/22/05 19:58
	Duration	11.2 hr		10.9 hr
Feed	Used	9036 kg	11000 kg	8714 kg
	Average Rate	122 kg/h	163 kg/hr	126 kg/hr
Glass Produced	Poured	4774 kg	5779 kg	4648 kg
	Average Rate ^{\$}	1290 kg/m ² /day	1712 kg/m ² /day	1347 kg/m ² /day
	Average Rate [*]	1287 kg/m ² /day	1718 kg/m ² /day	1331 kg/m ² /day
	Steady State Rate	1400 kg/m ² /day	1850 kg/m ² /day	1300 kg/m ² /day

\$ - Rates calculated from glass poured.

*- Rates calculated from feed data.

NA – Not applicable.

Note: Rates do not take into account the time for water feeding and cold cap burn-off.

"-" Empty data field

& Cl and F levels were increased to 1.2 wt% and 0.42 wt%, respectively in Test 2B.

Table 3.3. DM1200 HLW MACT Table of Events.

Pre-test modifications			1. Setup to inject allyl alcohol and naphthalene into feed system and SBS. SBS injection will be done via stainless tubing inserted from top plate to the bottom of SBS bowl. 2. Installed a thermocouple for measuring the TCO inlet temperature. (HCU-OG-TR-812). 3. HF/HCl slip stream piping disconnected from O/G stream.		
Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
1	11/15/2004 13:45	0.0	-	Start of water feeding	-
	11/15/2004 16:20	2.6	-	-	Replaced PBS pH probe which was faulty up to this point.
	11/15/2004 23:22	9.6	-	Film cooler rinse with 5 liters.	-
	11/16/2004 11:36	21.8	Allyl Alcohol	Begin allyl alcohol spiking into melter feed at 40 g/min.	-
	11/16/2004 11:55	22.2			SBS spike. Injected 1.7 liters of allyl alcohol into the SBS sump.
	11/16/2004 12:57	23.2		Glass discharge for 4 minutes. 1Z2-G-62A	-
	11/16/2004 14:26	24.7		Glass discharge for 3 minutes. 1Z2-G-63A	-
	11/16/2004 15:27	25.7		Glass discharge for 3 minutes. 1Z2-G-72A	-
	11/16/2004 16:27	26.7		Transient increase of plenum pressure during off-gas sampling.	SBS blowdown sample taken. 1Z2-S-73A
	11/16/2004 17:20	27.6		Glass discharge for 3 minutes. 1Z2-G-73A	-
	11/16/2004 17:32	27.8		-	SBS blowdown sample taken. 1Z2-S-73B
	11/16/2004 17:42	28.0		End allyl alcohol spiking into melter feed.	-
	11/16/2004 17:51	28.1	None	Noted that glass temperatures rose about 5°C (from 1135 to 1140°C) after spiking injection stopped. Power subsequently reduced to return to desired glass temperature.	-
	11/16/2004 20:34	30.8		-	SBS outlet temperature targeted to 45°C (instead of 50°C) until naphthalene injection starts.

"-" Empty data field

Table 3.3. DM1200 HLW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
1	11/16/2004 21:16	31.5	None	Film cooler dP noted as negative, troubleshooting begins.	-
	11/16/2004 21:31	31.8		Film cooler dP instrument port cleaned.	-
	11/16/2004 23:25	33.7		Film cooler rinse with 5 liters of water.	-
	11/17/2004 2:10	36.4		-	Labview shutdown inadvertently. EOG activated and manually reset. Reset blowers.
	11/17/2004 11:20	45.6		Film cooler rinse with 5 liters.	-
	11/17/2004 12:15	46.5	Naphthalene in MeOH	Start spiking 600 g naphthalene dissolved in 10 liters of MeOH at 13 g/min	-
	11/17/2004 12:27	46.7		-	Naphthalene spike injected into SBS. Spike is 10 ml of a solution of 600 g naphthalene dissolved in 10 liters of MeOH.
	11/17/2004 13:16	47.5		Glass discharge for 4 minutes. 1Z2-G-102A	-
	11/17/2004 13:36	47.9		Noted that small shelf (partially melted feed adhering to the melter walls not touching the glass surface) has formed on cold cap from T/W #2 to mound in front of Lance #2.	-
	11/17/2004 14:15	48.5		Glass discharge for 4 minutes. 1Z2-G-102B	-
	11/17/2004 14:21	48.6		Ridge (elongate mound of feed on cold cap) noticed in cold cap.	-
	11/17/2004 14:48	49.1		Glass discharge for 3 minutes. 1Z2-G-111A	-
	11/17/2004 15:50	50.1		Transient increase of plenum pressure during off-gas sampling.	-
	11/17/2004 16:15	50.5		-	SBS blowdown & sample. 1Z2-S-112A
	11/17/2004 16:16	50.5		Opening in cold cap noticed to be increasing.	-
	11/17/2004 17:02	51.3		Glass discharge for 3 minutes. 1Z2-G-112A	-
	11/17/2004 17:30	51.8		-	SBS blowdown & sample. 1Z2-S-114A
	11/17/2004 17:36	51.8		End Naphthalene in MeOH spiking into melter feed.	-
	11/17/2004 18:00	52.3	None	End of feeding	-

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Table 3.3. DM1200 HLW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
1	11/17/2004 19:30	53.8	None	Cold cap fully dissolved.	-
Post-test modifications			1. Added heat tracing to the AC-S inlet.		
2A	12/6/2004 10:12	0.0	None	Start of water feeding	-
	12/6/2004 11:20	1.1		-	Reduce SBS booster pump cold water flow from 22 to 16 gpm. Flow rate subsequently reduced further in order to adjust SBS outlet gas temperature to target value.
	12/6/2004 13:37	3.4		Paused feeding for 14 minutes to replace (suspected) faulty ADS purge valve and feed tube gasket	-
	12/6/2004 13:56	3.7		Foamy cold cap observed and melter power reduced.	-
	12/6/2004 16:36	6.4		Foam noted to have subsided.	-
	12/6/2004 19:22	9.2		Film cooler rinse with 5 liters.	-
	12/6/2004 21:07	10.9		Transient increase of plenum pressure observed due to a cold cap collapse on west side of melt. Event causes short-term lowering of plenum temperatures.	-
	12/7/2004 3:42	17.5		Short-term rise in glass level observed along with auto-discharge. Power reduced in response.	-
	12/7/2004 4:00	17.8		Feed rate reduced due to ongoing foaming.	-
	12/7/2004 4:21	18.1		Foaming subsided.	-
	12/7/2004 5:25	19.2		Transient increase of plenum pressure due to collapse of part of the cold cap.	-
	12/7/2004 6:16	20.1		Feeding paused to allow cold cap conditions to improve (trying to dissolve excessive cold cap).	Plenum temperatures affected by the ongoing shelving which is burying some TC's.
	12/7/2004 7:54	21.7		Film cooler rinse with 5 liters.	-
	12/7/2004 8:00	21.8		Feed resumed because shelving has diminished.	-
	12/7/2004 7:30	21.3		-	Assumed approximate time of loss of heat tracing for AC-S inlet. Notebook mention at 8:53.
	12/7/2004 10:40	24.5		-	AC-S heat trace restored.
	12/7/2004 11:29	25.3	Allyl alcohol	Begin allyl alcohol spiking into melter feed at 40 g/min	-
	12/7/2004 11:44	25.5		-	SBS spike. This is 4.7 liters of allyl alcohol.

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Table 3.3. DM1200 HLW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
2A	12/7/2004 12:05	25.9	Allyl alcohol	-	WESP power & spray secured for purposes of sampling.
	12/7/2004 12:08	25.9		-	WESP blowdown and sample. W-12A-45A & W-12A-45B
	12/7/2004 12:20	26.1		Some sporadic opening and closing of cold cap holes is observed between about 12:15 to 12:35	-
	12/7/2004 12:35	26.4		-	WESP power restored
	12/7/2004 13:58	27.8		-	WESP power and spray secured for off-gas sampling.
	12/7/2004 14:05	27.9		Glass discharged for 2 minutes. G-12A-47A	-
	12/7/2004 14:30	28.3		-	Reenergized WESP and restarted spray.
	12/7/2004 15:36	29.4		Transient increase of plenum pressure during off-gas sampling.	-
	12/7/2004 16:03	29.8		-	WESP power and spray secured for off-gas sampling.
	12/7/2004 16:36	30.4		Discharged glass for 3 minutes. G-12A-48A	-
	12/7/2004 16:57	30.8		-	Reenergized WESP and restarted spray.
	12/7/2004 17:21	31.1		Transient increase of plenum pressure during off-gas sampling.	-
	12/7/2004 17:32	31.3		Discharged glass for 3 minutes. G-12A-49A	-
	12/7/2004 17:48	31.6		-	SBS blowdown and sample. S-12A-49A
	12/7/2004 17:58	31.8		End allyl alcohol spiking into melter feed.	-
	12/7/2004 18:51	32.6	None	Plenum temperatures rising above target. Feed increased over the next ½ hour to stabilize and lower plenum temperatures. (Initial feed increase resulted in increased plenum temperatures, but then things stabilized as desired.)	-
	12/7/2004 19:37	33.4		Film cooler rinse with 5 liters.	-
	12/8/2004 7:00	44.8		Cold cap collapse and EOG trip.	-
	12/8/2004 7:48	45.6		Film cooler rinse with 5 liters.	Additional heat trace tape placed on AC-S inlet.
	12/8/2004 10:44	48.5	Naphthalene in MeOH	Start spiking 600 g naphthalene dissolved in 10 liters of MeOH at 13 g/min.	-

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Table 3.3. DM1200 HLW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
2A	12/8/2004 11:06	48.9	Naphthalene in MeOH	-	SBS spike injection. Spike solution is 3 grams of naphthalene dissolved in 1 liter of MeOH.
	12/8/2004 11:17	49.1		Transient increase of plenum pressure during off-gas sampling.	-
	12/8/2004 11:24	49.2		-	WESP power and spray secured for off-gas sampling. WESP blowdown and sampling followed by deluge and additional blowdown and sample. W-12A-91A & W-12A-91B
	12/8/2004 11:54	49.7		-	WESP power and spray restored.
	12/8/2004 12:08	49.9		Glass discharged for 4 minutes. Noticeable dip in glass temperature after discharge. Power increased. G-12A-92A	-
	12/8/2004 12:50	50.6		Glass discharged for 4 minutes. G-12A-92B	-
	12/8/2004 14:17	52.1		Glass discharged for 5 minutes. G-12A-93A	-
	12/8/2004 15:03	52.8		-	WESP power and spray secured for off-gas sampling.
	12/8/2004 15:33	53.3		-	WESP power and spray back on.
	12/8/2004 16:02	53.8		Transient increase of plenum pressure during off-gas sampling.	-
	12/8/2004 17:04	54.9		Glass discharged for 4 minutes. G-12A-97A	-
	12/8/2004 17:21	55.1		Plenum temperatures rising above target. Feed increased to stabilize and lower plenum temperatures.	-
	12/8/2004 18:29	56.3		Glass discharged for 4 minutes. G-12A-98A	-
	12/8/2004 18:35	56.4		-	SBS blowdown and sample. S-12A-98A
	12/8/2004 18:45	56.5		Transient increase of plenum pressure and EOG trip due to off-gas sampling.	-
	12/8/2004 18:50	56.6		-	WESP power and spray secured.
	12/8/2004 19:20	57.1		-	WESP power and spray back on.
	12/8/2004 19:47	57.6		Transient increase of plenum pressure during off-gas sampling.	-

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Table 3.3. DM1200 HLW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
2A	12/8/2004 20:37	58.4	Naphthalene in MeOH	Discharged glass for 3 minutes. G-12A-99A	-
	12/8/2004 21:32	59.3		-	SBS blowdown and sample. S-12A-100A
	12/8/2004 21:36	59.4		-	Labview error. Corrected at 21:55.
	12/8/2004 21:38	59.4		End naphthalene in MeOH spiking into melter feed.	-
	12/9/2004 7:37	69.4	None	Film cooler rinse with 5 liters.	-
	12/9/2004 10:14	72.0		Film cooler rinse with 5 liters.	-
	12/9/2004 10:28	72.3	Naphthalene in allyl alcohol	Start spiking 160 g naphthalene dissolved in 8 liters of allyl alcohol at 40 g/min.	-
	12/9/2004 10:41	72.5		-	SBS spike injection. Spike solution is 3 grams of naphthalene dissolved in 4.7 liters of allyl alcohol.
	12/9/2004 11:29	73.3		-	WESP blowdown and sampling followed by deluge and additional blowdown and sample. W-12A-134A & W-12A-134B
	12/9/2004 13:03	74.8		Discharged glass for 4 minutes. G-12A-135A	-
	12/9/2004 13:22	75.2		End naphthalene in allyl alcohol spiking into melter feed and Test 2A	-
1-continued	12/9/2004 13:24	75.2	None	Start transition to Test 1 parameters.	Start transition to Test 1 parameters.
	12/9/2004 13:38	75.4	Naphthalene in MeOH	Start spiking 600 g naphthalene dissolved in 10 liters of MeOH at 13 g/min.	-
	12/9/2004 14:13	76.0		Glass discharge for 4 minutes. G-12A-138A	-
	12/9/2004 15:31	77.3		Transient increase of plenum pressure during off-gas sampling.	-
	12/9/2004 15:50	77.6		Glass discharge for 4 minutes. G-12A-139A	-

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Table 3.3. DM1200 HLW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
1-continued	12/9/2004 16:44	78.5	Naphthalene in MeOH	-	SBS blowdown and sample. S-12A-139A
	12/9/2004 17:25	79.2		Glass discharge for 4 minutes. G-12A-140A	-
	12/9/2004 17:52	79.7		Transient increase of plenum pressure during off-gas sampling.	-
	12/9/2004 18:45	80.5		Glass discharge for 3 minutes. G-12A-141A	-
	12/9/2004 18:53	80.7		Transient increase of plenum pressure during off-gas sampling.	-
	12/9/2004 19:39	81.4		Glass discharge for 4 minutes. G-12A-141B	-
	12/9/2004 19:54	81.7		-	SBS blowdown and sample. S-12A-142A
	12/9/2004 20:50	82.6		-	SBS blowdown and sample. S-12A-142B
	12/9/2004 21:00	82.8		End naphthalene in MeOH spiking into melter feed	-
	12/10/2004 6:51	92.6	None	Specific glass temperature (TC-17) observed to decrease rapidly presumably due to cold cap shifting.	-
	12/10/2004 7:47	93.6		Specific glass temperature (TC-17) observed to decrease rapidly presumably due to cold cap shifting.	-
	12/10/2004 8:47	94.6		L2 lance repositioned per test instruction as it appeared to have shifted.	-
	12/10/2004 9:40	95.5		End of Test 1-continued	-
2B	12/10/2004 9:43	95.5		Cold cap shift and transient increase of plenum pressure.	-
	12/10/2004 12:10	98.0		-	Purge of WESP outlet flow pitot tube and slight adjustment to point straight into flow. Measured flow rate dropped as a result of readjustment.
	12/10/2004 16:53	102.7		-	High measured WESP outlet flow rate noted.

"-" Empty data field

Table 3.3. DM1200 HLW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
2B	12/10/2004 18:52	104.7	None	-	Purge of WESP outlet flow pitot tube due to high measured readings. Measured flow rate values decreased.
	12/11/2004 6:50	116.6		-	WESP flow reading noted to be lower than expected. Sensor isolated but no problem identified.
	12/11/2004 8:03	117.8		-	Purge WESP flow transmitter. Slight decrease in reading after purge.
	12/11/2004 10:10	120.0		Film cooler rinse with 5 liters.	-
	12/11/2004 15:51	125.6		Melter stalactite removed because it was redirecting feed shots.	-
	12/11/2004 18:50	128.6		-	Problems noted with LabView for about 15 minutes.
	12/11/2004 21:26	131.2		Visual inspection of the film cooler estimated 5% blockage,	-
	12/12/2004 3:41	137.5		Transient increase of plenum pressure due to cold cap shifting.	-
	12/12/2004 8:35	142.4		Film cooler rinse with 5 liters of water.	-
	12/12/2004 15:35	149.4		End of slurry feeding to melter	-
	12/12/2004 17:30	151.3		Cold cap fully dissolved.	-
Post-test inspections and cleanings			1. WESP was inspected.		
LAW Turnover and Scoping Test 2/28/05 – 3/3/05			Produced almost six metric tons of glass over 85 hours of feeding LAW slurry. The wand inside the SBS used to remove material was clogged for the first 74 hours of the test during which it was inoperable. Fluctuation of WESP current during the latter stages of the scoping test. Post test inspection uncovered no visible indication of shorting.		

"-" Empty data field

Note: Sampling listings of glass, SBS and WESP are shown in detail only during the spiking periods. Sampling outside these periods is shown in Section 4.0.

Table 3.4. DM1200 LAW MACT Table of Events.

Pre-test modifications & checks			1. WESP inspection. 2. Installed and tested AC-S interlock system. 3. Added two thermocouples to the AC-S bed; one below the diffuser plate, and one at 1" below the top of the carbon bed. 4. Filled bed with new BAT-37 carbon. 5. Covered the base of the AC-S bed with 2" insulation. 6. Installed 4 sets of strip heaters between Blower 701/702 and the AC-S inlet. 7. Upgraded LabVIEW to display temperature graphs for AC-S temperatures.		
Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
1	3/7/2005 9:03	0.0	None	Start of water feeding	-
	3/7/2005 13:17	4.2		Paused feed to rod out feed tube due to clogging.	-
	3/7/2005 13:43	4.7		EOG activated. Noted that recent feed shots are causing pressure spikes. Control air setpoint increased at 13:44	-
	3/7/05 19:06	10.0		Film cooler rinsed with 5 liters of water.	-
	3/7/2005 19:29	10.4		-	WESP current at 19.3 mA. Voltage reduced from 31.5 to 30.0 kV.
	3/8/2005 7:18	22.3		-	WESP current at 17.7 mA. Voltage reduced from 30.3 to 29.8 kV.
	3/8/05 8:03	23.0		Film cooler rinsed with 5 liters of water.	-
	3/8/2005 9:59	24.9		Cold cap observed to be about 98% coverage.	-
	3/8/2005 10:06	25.0	allyl alcohol	Begin allyl alcohol spiking into melter feed at 10 g/min.	-
	3/8/2005 10:16	25.2		-	Allyl alcohol spiking of the SBS sump. Amount spiked is 1.5 liters.
	3/8/2005 10:45	25.7		Discharged glass for 7 minutes. G-12D-121A	-
	3/8/2005 11:43	26.7		Discharged glass for 8 minutes. G-12D-122A	-
	3/8/2005 13:02	28.0		Discharged glass for 5 minutes. G-12D-123A	-
	3/8/2005 13:32	28.5		Transient increase of plenum pressure during off-gas sampling.	-
	3/8/2005 13:56	28.9		Discharged glass for 6 minutes. G-12D-124A	-
	3/8/2005 15:23	30.3		Transient increase of plenum pressure during off-gas sampling.	-
	3/8/2005 15:28	30.4		Discharged glass for 3 minutes. G-12D-125A	-
	3/8/2005 16:19	31.3		Discharged glass for 4 minutes. G-12D-125B	-
	3/8/2005 16:43	31.7		-	SBS blowdown and sample. S-12D-126A
	3/8/2005 16:50	31.8		End allyl alcohol spiking into melter feed.	-

"-" Empty data field

Table 3.4. DM1200 LAW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
1	3/8/2005 18:15	33.2	None	Transient increase of plenum pressure during off-gas sampling.	-
	3/8/05 19:45	34.7		Film cooler rinsed with 5 liters of water.	-
	3/8/2005 20:35	35.5		-	Low reading on film cooler dP noticed.
	3/8/2005 21:26	36.4		-	Film cooler dP instrument cleaned and film cooler outlet TC replaced.
	3/8/2005 23:36	38.5		Noticed buildup of solids on thermowell #2 lance.	-
	3/9/2005 7:29	46.4		Film cooler rinse with 5 liters of water	-
	3/9/2005 9:26	48.4		-	WESP blowdown and deluge.
	3/9/2005 10:02	49.0	Naphthalene in MeOH	Spiked a solution of 660 grams of naphthalene dissolved in 11 liters of MeOH into the melter feed at 13 g/min.	-
	3/9/2005 10:19	49.3		-	3 grams of naphthalene dissolved in 1 liter of MeOH spiked directly into SBS sump.
	3/9/2005 10:48	49.7		Discharged glass for 6 minutes. G-12D-153A	-
	3/9/2005 12:10	51.1		Discharged glass for 8 minutes. G-12D-154A	-
	3/9/2005 12:34	51.5		Transient increase of plenum pressure during off-gas sampling.	-
	3/9/2005 13:42	52.6		Discharged glass for 3 minutes. G-12E-16A	-
	3/9/2005 14:37	53.6		Discharged glass for 4 minutes. G-12E-17A	-
	3/9/2005 15:20	54.3		Transient increase of plenum pressure during off-gas sampling.	-
	3/9/2005 15:39	54.6		Discharged glass for 4 minutes. G-12E-18A	-
	3/9/2005 16:28	55.4		Transient increase of plenum pressure during off-gas sampling.	-
	3/9/2005 16:54	55.9		Discharged glass for 5 minutes. G-12E-18B	-
	3/9/2005 18:20	57.3		Discharged glass for 4 minutes. G-12E-19A	-
	3/9/2005 19:33	58.5		Discharged glass for 4 minutes. G-12E-19B	-
	3/9/2005 20:18	59.3		Discharged glass for 4 minutes. G-12E-20A	-
	3/9/2005 21:10	60.1		-	SBS blowdown. S-12E-20A
	3/9/2005 21:12	60.1		End naphthalene in MeOH spiking into melter feed.	-

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Table 3.4. DM1200 LAW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
1	3/9/2005 21:28	60.4	None	Film cooler rinse with 5 liters.	-
	3/10/2005 7:30	70.5		Film cooler rinse with 5 liters.	-
	3/10/2005 12:01	75.0		Stop slurry feeding to melter	-
	3/10/2005 13:21	76.3		Cold cap dissolved.	-
Post-test inspections & cleanings			1. Blower 702 inspection. 2. Blower 801 inspection. Blower 801 head was replaced with a used head.		
Post-test equipment modifications			1. Replaced HEPA pre-filter and HEPA filter. 2. Replaced Blower 801 belt and tensioner. 3. SBS recirculation pump replaced due to leakage.		
Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
2B	3/17/2005 9:30	0.0	None	Start water feeding to melter. NaCl and NaF added to the feed to target 1.2 and 0.42 wt.% Cl and F in the glass product, respectively.	-
	3/17/2005 10:30	1.0		Start slurry feeding to melter	-
	3/17/2005 13:13	3.7		Feed tube rodded to clear minor blockage.	-
	3/17/2005 16:01	6.5		Transient increase of plenum pressure during visual inspection of the film cooler. Film cooler is clean.	-
	3/17/05 19:13	9.7		Film cooler rinse with 5 liters.	-
	3/17/2005 21:50	12.3		-	Possible off-gas surge. AC-S bed went momentarily into bypass mode. AC-S bed reset.
	3/18/2005 4:07	18.6		-	LabView closed. Equipment tripped and reset.
	3/18/2005 5:28	20.0		-	High HCU inlet pressure alarm. Blower speed increased slightly for 3 minutes.
	3/18/2005 8:01	22.5		Film cooler rinse with 5 liters.	-
	3/18/2005 9:10	23.7		Film cooler dP instrument cleaned due to observed low reading.	-
	3/18/2005 9:28	24.0		-	AC-S temperature alarmed during off-gas sampling. Probable cause was a pressure fluctuation. ACS valves reset.
	3/18/2005 9:45	24.2		Film cooler dP instrument removed for inspection due to continued low and negative values being observed.	-
	3/18/2005 9:55	24.4		-	WESP blowdown and deluge.
	3/18/2005 10:12	24.7		-	WESP electrical problems encountered. WESP power turned off for troubleshooting.
	3/18/2005 10:46	25.3		-	WESP power supply confirmed OK. WESP problem therefore appears to be shorting.
	3/18/2005 11:04	25.6		Film cooler dP instrument restored.	-

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Table 3.4. DM1200 LAW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
2B	3/18/2005 11:25	25.9	None	Plenum TC's experience a 10-15°C drop in temperature, probably as a result of melter steam surge (from cold cap shift and consequent rapid boiling of feed liquid).	-
	3/18/2005 11:47	26.3		-	WESP deluge with blowdown.
	3/18/2005 12:17	26.8		-	WESP deluge with blowdown.
	3/18/2005 12:42	27.2		-	WESP power supply back online but appears to function about 50% of the time.
	3/18/2005 18:04	32.6		-	LabView shutdown. Reset.
	3/18/05 19:14	33.7		Film cooler rinse with 5 liters.	-
	3/18/2005 21:21	35.8		Transient increase of plenum pressure. Suspected cause is a cold cap shift.	-
	3/18/2005 22:23	36.9		-	Switch from Blower-701 to Blower-702 due to grinding noises and anticipated failure.
	3/19/2005 6:40	45.2		Transient increase of plenum pressure due to cold cap shift.	-
	3/19/2005 7:35	46.1		Film cooler rinse with 5 liters.	-
	3/19/2005 8:02	46.5		-	Blower-701 head replaced with used head. Blower-701 available as a backup.
	3/19/2005 13:52	52.4		Rodded film cooler due to estimated 80% blockage.	-
	3/19/2005 15:07	53.6		-	Power restored to WESP but appears to be having a shorting problem. Performed another deluge.
	3/19/2005 15:18	53.8		-	Attempt to restore WESP power, appears to be shorted. Redeluged at 15:20. Powered back on at 15:30 but still shorted. Powered off.
	3/19/2005 21:02	59.5		Film cooler rinse with 5 liters.	-
	3/20/2005 6:00	68.5		End of Test 2B	-
2A	3/20/2005 6:00	68.5		Start of Test 2A	-
	3/20/2005 6:18	68.8		Begin transition to plenum temperature of 300°C.	-
	3/20/2005 7:31	70.0		Film cooler rinse with 5 liters.	-
	3/20/2005 8:03	70.5		Feed tube rodded. No apparent clog.	-
	3/20/2005 11:28	74.0		Observed cold cap shift with (non-positive) pressure surge.	-
	3/20/2005 14:16	76.8		-	Replaced broken AC-S dP tubing because of suspect readings.
	3/21/2005 1:06	87.6		Thick cold cap observed with unwanted mounding. Bubbling increased and improved conditions noted at 2:03.	-

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Table 3.4. DM1200 LAW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
2A	3/21/2005 8:17	94.8	None	Film cooler rinse with 5 liters.	-
	3/21/2005 9:00	95.5	Naphthalene in allyl alcohol	Begin spiking a solution of 840 grams of naphthalene dissolved in 10.5 liters of allyl alcohol into melter feed at 11 g/min.	-
	3/21/2005 9:12	95.7		-	Spike a solution of 3 grams naphthalene in 1.5 liters of allyl directly into the SBS sump.
	3/21/2005 9:50	96.3		Glass discharge for 3 minutes. G-12F-83A	-
	3/21/2005 10:30	97.0		Shift in the cold cap resulted in a pressure spike.	-
	3/21/2005 10:53	97.4		Glass discharge for 4 minutes. G-12F-87A	-
	3/21/2005 11:18	97.8		-	Secured WESP power and inlet spray.
	3/21/2005 11:48	98.3		-	Restored power to WESP.
	3/21/2005 11:53	98.4		-	Restored WESP inlet spray.
	3/21/2005 12:23	98.9		Discharged glass for 4 minutes. G-12F-88A	-
	3/21/2005 13:10	99.7		Feed mounded under feed tube and approached ceiling height.	-
	3/21/2005 13:50	100.3		Discharged glass for 3 minutes. G-12F-89A	-
	3/21/2005 14:43	101.2		Transient increase of plenum pressure during off-gas sampling.	-
	3/21/2005 15:03	101.5		Discharged glass for 3 minutes. G-12F-99A	-
	3/21/2005 15:06	101.6		Cold cap mound appeared to have dissolved.	-
	3/21/2005 15:32	102.0		Transient increase of plenum pressure during off-gas sampling.	-
	3/21/2005 15:43	102.2		Discharged glass for 3 minutes. G-12F-99B	-
	3/21/2005 16:34	103.1		Transient increase of plenum pressure during off-gas sampling.	-
	3/21/2005 16:42	103.2		Discharged glass for 3 minutes. G-12F-100A	-
	3/21/2005 17:42	104.2		Discharged glass for 3 minutes. G-12F-100B	-
	3/21/2005 18:47	105.3		Discharged glass for 3 minutes. G-12F-102A	-
	3/21/2005 19:22	105.9		Transient increase of plenum pressure during off-gas sampling.	-
	3/21/2005 19:49	106.3		Discharged glass for 4 minutes. G-12F-102B	-
	3/21/2005 20:09	106.6		-	SBS blowdown. S-12F-102A

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Table 3.4. DM1200 LAW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
2A	3/21/2005 20:16	106.8	None	Stop organic spiking into melter feed.	-
	3/21/05 21:28	108.0		Film cooler rinse with 5 liters.	-
	3/22/2005 7:22	117.9		-	PBS dP instrument noted to be clogged. Instrument cleaned at this time.
	3/22/2005 9:01	119.5		Film cooler rinse with 5 liters.	-
	3/22/2005 9:05	119.6	Naphthalene in MeOH	Begin spiking a solution of 660 grams of naphthalene in 11 liters MeOH into melter feed at 13 g/min.	-
	3/22/2005 9:21	119.8		-	3 grams of naphthalene dissolved in 1 liter of MeOH spiked directly into SBS sump.
	3/22/2005 9:52	120.4		Discharged glass for 5 minutes. G-12F-126A	-
	3/22/2005 10:45	121.2		Transient increase of plenum pressure during off-gas sampling.	Secured WESP power and inlet spray in order to conduct off-gas testing.
	3/22/2005 11:05	121.6		Discharged glass for 4 minutes. G-12F-135A	-
	3/22/2005 11:15	121.7		-	Restored WESP power.
	3/22/2005 11:21	121.8		-	Restored WESP inlet spray.
	3/22/2005 12:16	122.8		Discharged glass for 5 minutes. G-12F-135B	-
	3/22/2005 13:22	123.9		Discharged glass for 4 minutes. G-12F-136A	-
	3/22/2005 14:10	124.7		Transient increase of plenum pressure during off-gas sampling.	-
	3/22/2005 14:49	125.3		Discharged glass for 4 minutes. G-12F-137A	-
	3/22/2005 15:15	125.7		Transient increase of plenum pressure during off-gas sampling.	-
	3/22/2005 15:50	126.3		Discharged glass for 4 minutes. G-12F-137B	-
	3/22/2005 16:20	126.8		Transient increase of plenum pressure and EOG trip.	-
	3/22/2005 17:16	127.8		Discharged glass for 4 minutes. G-12F-138A	-
	3/22/2005 18:00	128.5		Transient increase of plenum pressure during off-gas sampling.	-
	3/22/2005 18:31	129.0		Discharged glass for 4 minutes. G-12F-140A	-
	3/22/2005 19:47	130.3		Discharged glass for 4 minutes. G-12F-141A	-
	3/22/2005 19:53	130.4		-	SBS blowdown. S-12F-141A
	3/22/2005 19:58	130.5		Stop organic spiking into melter feed.	-
	3/22/2005 20:30	131.0	None	-	WESP blowdown with deluge. Video taken during and after deluge.

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Table 3.4. DM1200 LAW MACT Table of Events (continued).

Test	Date & time	Run time (hr)	Organic Spike	Melter event	Off-gas system event
2A	3/22/2005 20:50	131.3	None	-	Unsuccessful attempt to restore power to the WESP.
	3/22/05 21:23	131.9		Film cooler rinse with 5 liters.	-
	3/22/2005 22:18	132.8		-	Unsuccessful attempt to restore power to the WESP.
	3/22/2005 23:06	133.6		-	Unsuccessful attempt to restore power to the WESP.
	3/23/2005 0:13	134.7		-	Unsuccessful attempt to restore power to the WESP. Additional unsuccessful attempts at 1:16 and 2:20.
	3/23/2005 3:01	137.5		Stop melter feeding.	-
	3/23/2005 4:11	138.7		Cold cap dissolved.	-
Post-test inspections			1. WESP was inspected. 2. The EOG piping was cleaned.		
HLW Turnover Tests 4/13/05 – 4/16/05			Produced nearly 2 metric tons of glass over about 60 hours of slurry feeding. Transition line blockage after 27 hours feeding resulting in switching to EOG while blockage was removed. The WESP was used during this test without any internal electrical problems.		
Post-test inspections after the HLW Turnover Test			1. Film cooler inspected and cleaned. 2. Transition line inspected and cleaned. 3. SBS blown down and inspected. 4. SBS overflow tank blown down and inspected. 5. WESP inspected. 6. Heater 801 (TCO inlet heater) inspected. 7. TCO catalyst inspected.		

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Note: Sampling listings of glass, SBS and WESP are shown in detail only during the spiking periods. Sampling outside these periods is shown in Section 4.0.

Table 3.5. Melter System Measured Parameters During HLW Tests.

-			1			2A			1-continued			2B		
			avg	min	max	avg	min	max	avg	min	max	avg	min	max
TEMPERATURE (°C)	Glass	13" from floor E	1150	1127	1168	1143	1118	1169	1143	1121	1158	1146	1120	1164
		15.5" from floor E	1149	1125	1166	1145	1121	1170	1146	1124	1161	1150	1123	1168
		18" from floor E	1150	1121	1164	1144	1120	1172	1147	1125	1159	1153	1124	1170
		27" from floor E	1146	1110	1170	1141	1098	1181	1143	1101	1167	1152	1101	1171
		13" from floor W	1149	1127	1169	1146	1110	1164	1143	1131	1154	1145	1127	1160
		15.5" from floor W	1147	1122	1165	1145	1110	1165	1144	1129	1156	1144	1127	1158
		18" from floor W	1147	1121	1164	1143	1107	1167	1143	1128	1155	1142	1124	1157
		27" from floor W	1143	1103	1169	1137	1093	1175	1140	1116	1164	1141	1117	1165
	Plenum	8" below ceiling	400	367	449	353	304	432	410	352	458	488	442	524
		17" below ceiling	392	353	428	338	206	414	387	336	428	484	430	554
		Exposed	405	100	473	345	165	468	407	324	548	593	497	669
	Discharge	TC 1	1032	1003	1064	1028	980	1065	1041	1030	1071	1052	1029	1083
		TC 2	1053	1039	1080	1050	1002	1080	1062	1052	1084	1073	1051	1096
		Air Flow	50	49	53	50	45	53	52	51	54	55	53	64
		Riser	1093	1074	1152	1072	1036	1138	1085	1056	1147	1112	1075	1159
	Electrode	East	1121	1107	1137	1102	1077	1136	1115	1099	1131	1139	1116	1148
		West	1091	1074	1109	1079	1039	1103	1081	1065	1104	1111	1086	1124
		Bottom	1029	1017	1044	1001	979	1026	1026	1008	1044	1057	1035	1072
	Film Cooler	Added Air	82	74	83	82	81	83	82	81	83	82	80	83
		Outlet	248	69	291	222	70	280	268	240	308	342	75	395
Glass	Density (g/cc)		2.44	2.38	2.48	2.49	2.42	2.54	2.47	2.42	2.52	2.46	2.41	2.52
	Level (" from floor)		33.18	32.19	33.85	32.99	31.94	33.96	33.08	32.36	33.79	33.06	31.94	33.79
	Resistance (ohms)		0.084	0.081	0.088	0.084	0.079	0.091	0.084	0.081	0.088	0.081	0.078	0.088
Electrodes	Current (A)		1239	1157	1326	1125	941	1182	1254	1142	1300	1501	1298	1574
	Voltage (V)		104	97	111	94	85	99	105	97	110	122	111	128
	Power (kW)		129	115	142	106	80	114	132	110	140	183	145	198
Lance Bubblers	1	Rate (lpm)	11.0	1.6	16.9	4.6	1.5	11.9	10.4	4.0	14.9	21.8	3.8	29.6
	2	Rate (lpm)	11.9	1.5	19.2	4.5	1.3	12.8	16.2	11.9	24.4	26.6	1.9	51.0
Total Bubbling (lpm)			23.0	3.2	36.2	9.2	3.0	24.8	26.6	18.0	36.4	48.5	5.8	74.0

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Table 3.6. Melter System Measured Parameters During LAW Tests.

			1			2B			2A		
			avg	min	max	avg	min	max	avg	min	max
TEMPERATURE (°C)	Glass	13" from floor E	1151	1137	1165	1148	1115	1170	1153	1137	1166
		15.5" from floor E	1146	1129	1163	1152	1115	1174	1149	1134	1166
		18" from floor E	1145	1124	1163	1156	1111	1177	1149	1134	1164
		27" from floor E	1133	1074	1163	1151	1097	1173	1147	1100	1166
		13" from floor W	1149	1132	1160	1143	1115	1165	1150	1138	1159
		15.5" from floor W	1150	1132	1164	1144	1112	1168	1150	1139	1160
		18" from floor W	1148	1131	1163	1143	1113	1167	1148	1136	1157
		27" from floor W	1124	1091	1144	1125	1077	1165	1129	1101	1144
	Plenum	8" below ceiling	397	358	438	490	431	536	321	300	363
		17" below ceiling	414	371	518	504	451	557	333	312	379
		Exposed	416	348	562	503	392	587	326	273	375
	Discharge	TC 1	960	837	1016	970	868	1059	1024	961	1066
		TC 2	984	927	1029	999	944	1073	1048	1013	1083
		Air Flow	53	50	55	52	49	57	48	46	50
		Riser	1052	1028	1117	1056	983	1153	943	823	1022
	Electrode	East	1124	1103	1133	1110	1079	1133	1121	1107	1128
		West	1082	1069	1088	1121	1104	1140	1116	1111	1121
		Bottom	1018	990	1038	1063	1031	1085	1065	1061	1071
	Film Cooler	Added Air	81	80	82	83	81	86	83	80	85
		Outlet	245	71	285	320	71	367	211	66	266
Glass	Density (g/cc)		2.36	2.31	2.42	2.36	2.29	2.44	2.40	2.36	2.44
	Level (" from floor)		33.0	31.7	33.8	33.1	32.0	34.3	33.0	31.7	33.9
	Resistance (ohms)		0.074	0.071	0.080	0.066	0.061	0.074	0.066	0.064	0.070
Electrodes	Current (A)		1272	1142	1320	1502	1292	1573	1279	1234	1318
	Voltage (V)		94	86	98	99	90	105	85	81	88
	Power (kW)		120	100	126	149	117	160	109	103	113
Bubbling Rate (lpm)	Lances		24.7	11.4	45.3	40.8	6.7	63.4	8.1	5.6	14.4
	Electrodes		0.9	0.5	1.3	2.4	1.9	3.2	1.2	0.9	2.5
	Total		25.6	13.0	41.4	43.2	8.8	62.4	9.3	6.6	13.3

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Table 4.1. DuraMelter 1200 HLW MACT Tests Off-Gas System Measured Parameters.

Test		1								
		Allyl alcohol			Naphthalene/MeOH			No spiking		
		Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
Melter	Pressure at Level Detector Port ("H ₂ O)	-2.5	-3.3	-1.8	-2.5	-3.2	-1.7	-2.6	-4.3	-0.5
	Pressure at Instrument Port ("H ₂ O)	-2.5	-3.3	-1.8	-2.5	-3.2	-1.6	-2.6	-4.3	-0.5
	Control Air Flow Rate (scfm)	32.2	20.4	46.9	24.2	13.5	38.4	26.1	1.2	51.5
Film Cooler Differential Pressure ("H ₂ O)		Clogged sensor			0.74	0.43	1.54	Clogged sensor		
Transition Line Differential Pressure ("H ₂ O)		1.5	0.6	2.7	1.4	0.3	3.1	1.4	0.0	4.4
SBS	Differential Pressure ("H ₂ O)	30.4	25.3	31.7	30.3	29.0	31.8	30.3	25.7	32.3
	Inlet gas pressure ("H ₂ O)	-4.8	-6.6	-3.6	-4.5	-6.7	-3.0	-4.8	-9.4	-0.4
	Outlet gas pressure ("H ₂ O)	-35.6	-38.1	-31.5	-35.2	-39.2	-34.0	-35.5	-39.9	-26.3
	Downcomer Annulus Pressure (psia)	14.5	14.5	14.6	14.5	14.5	14.6	14.6	14.4	14.7
	Inlet gas Temp. (°C)	203	187	221	205	182	224	220	106	409
	Outlet gas Temp. (°C)	50.7	49.1	52.1	49.8	47.6	52.0	48.1	43.5	53.1
	C. Coil W. Inlet Temp (°C)	15.8	13.4	19.5	15.8	13.6	17.6	15.8	14.0	19.2
	C. Coil W. Outlet Temp (°C)	46.4	44.6	47.9	45.0	43.0	47.7	43.7	38.7	49.1
	Jacket W. Outlet Temp (°C)	47.0	45.6	48.3	45.8	44.0	48.0	44.3	39.8	49.2
	Sump Temp. (°C)	46.2	44.7	47.8	45.0	43.0	47.5	43.7	38.9	48.7
	Off-gas Downcomer Temp @3" (°C)	160	148	165	160	147	168	171	109	331
	Off-gas Downcomer Temp @8" (°C)	171	159	177	171	157	180	184	121	355
	Off-gas Downcomer Temp @13" (°C)	177	164	183	177	162	185	190	127	366
	Off-gas Downcomer Temp @18" (°C)	174	162	181	175	160	183	188	126	363
	Off-gas Downcomer Temp @23" (°C)	175	163	181	175	161	183	189	127	361
	Off-gas Downcomer Temp @28" (°C)	174	162	180	175	160	183	187	128	355
	Off-gas Downcomer Temp @33" (°C)	172	160	178	173	159	180	185	127	346
	Off-gas Downcomer Temp @38" (°C)	164	153	170	165	151	172	176	123	329
	Off-gas Downcomer Temp @43" (°C)	159	148	165	160	147	166	170	118	313
	Off-gas Downcomer Temp @48" (°C)	155	142	160	155	141	162	165	107	299
	Off-gas Downcomer Temp @53" (°C)	141	116	149	144	132	150	150	61	259
	Off-gas Downcomer Temp @58" (°C)	70	66	77	69	65	76	70	49	79
	C. Coil/Jacket W. Flow Rate (gal/min)	7.6	3.6	14.0	8.5	3.1	14.2	9.0	2.9	28.8
	Recirc. pump discharge Temp (°C)	50.6	50.0	51.6	49.6	48.5	50.7	48.0	43.1	51.5
	Recirc. pump discharge Pressure (psi)	38.0	34.3	39.1	38.0	33.9	39.1	38.0	33.7	39.2
WESP	Differential Pressure ("H ₂ O)	2.0	1.7	2.6	1.8	1.5	2.0	1.9	1.5	2.3
	Inlet gas Temp. (°C)	49.8	48.5	51.2	48.9	47.0	50.8	47.2	42.7	51.8
	Outlet gas Temp. (°C)	50.6	49.7	51.4	49.6	48.4	50.8	48.0	23.7	51.9
	Wet Gas Flow Rate (scfm)	241	234	255	229	220	232	235	8	246
	Voltage (kV)	30.8	28.9	32.0	30.7	29.4	31.7	29.3	0.0	31.7
	Current (mA)	16.8	16.8	16.8	16.8	16.8	16.8	16.7	0.0	16.9
HEME	Differential Pressure ("H ₂ O)	1.0	0.9	1.2	1.0	0.8	1.0	1.0	0.0	1.1
	Outlet Gas Temp. (°C)	48.1	47.3	48.9	47.2	46.3	48.4	45.7	33.4	49.2
HEPA 1	Differential Pressure ("H ₂ O)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
	Outlet Gas Temp. (°C)	68.0	67.5	68.8	67.7	66.0	68.6	65.4	61.0	68.5
Activated Carbon Bed	Inlet gas Temp. (°C)	75.1	74.5	75.6	73.8	72.2	74.4	72.0	67.5	74.9
	Bottom Temp. (°C)	77.5	74.4	79.3	74.0	73.1	76.0	72.2*	66.2*	77.4*
	Middle Temp. (°C)	84.0	77.2	88.6	79.9	77.7	83.8	77.1*	60.5*	85.6*
	Top Temp. (°C)	87.6	80.2	95.0	84.8	81.6	88.4	81.4*	61.6*	94.1*
	Outlet gas Temp. (°C)	79.2	73.2	86.5	78.6	75.8	80.9	74.1*	53.1*	86.8*
	Differential Pressure ("H ₂ O)	1.4	1.3	1.6	1.3	1.1	1.4	1.3	0.0	1.5
	Outlet Screen Differential Pressure ("H ₂ O)	4.4	3.8	5.1	3.9	3.3	4.2	4.0	0.1	4.8
	TCO/SCR Heater Inlet Gas Temp. (°C)	79.5	78.8	80.3	78.6	76.5	79.5	76.3	69.6	79.9
TCO	Inlet Gas Temp. (°C)	395	384	421	408	402	412	411	390	422
	Mid-bed Temp. (°C)	403	391	416	409	405	412	404	373	413
	Differential Pressure ("H ₂ O)	4.2	3.9	4.5	4.0	3.6	4.1	4.0	0.4	4.3
SCR	Inlet Gas Temp. (°C)	404	393	416	407	402	411	403	360	414
	Outlet Gas Temp. Right (°C)	394	386	404	397	392	399	389	353	399
	Outlet Gas Temp. Left (°C)	353	343	362	357	350	361	347	306	358
	Differential Pressure ("H ₂ O)	2.8	2.6	3.0	2.7	2.5	2.8	2.7	0.3	2.9
	Post Outlet Gas Temp. (°C)	339	331	345	342	336	346	333	293	343
PBS	Inlet Gas Temp. (°C)	317	312	322	319	310	321	311	271	321
	PBS Sump Temp. (°C)	31.3	29.4	32.5	30.0	28.9	31.2	29.5	27.5	31.7
	Differential Pressure ("H ₂ O)	2.8	2.2	3.2	2.3	1.7	2.6	2.5	0.3	3.7

* Value influenced by residual effects from spiking periods.

Table 4.1. DuraMelter 1200 HLW MACT Tests Off-Gas System Measured Parameters (continued).

Test		2A								
		Allyl alcohol			Naphthalene/MeOH			Allyl alcohol/Naphthalene		
		Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
Melter	Pressure at Level Detector Port ("H ₂ O)	-2.6	-3.3	-1.8	-2.7	-3.4	-2.0	-2.8	-3.3	-2.1
	Pressure at Instrument Port ("H ₂ O)	-2.7	-3.3	-1.7	-2.8	-3.5	-2.1	-2.8	-3.3	-2.2
	Control Air Flow Rate (scfm)	20.8	14.0	33.8	15.7	10.7	26.8	22.6	15.6	32.1
Film Cooler Differential Pressure ("H ₂ O)		0.53	0.25	1.23	0.55	0.28	0.91	0.51	0.35	0.97
Transition Line Differential Pressure ("H ₂ O)		1.0	0.2	1.5	1.2	0.4	1.8	1.2	0.8	1.6
SBS	Differential Pressure ("H ₂ O)	30.1	28.1	31.2	30.1	28.1	31.4	30.3	29.4	31.4
	Inlet gas pressure ("H ₂ O)	-4.2	-5.2	-3.0	-4.5	-5.5	-3.5	-4.5	-5.3	-3.6
	Outlet gas pressure ("H ₂ O)	-34.7	-35.7	-32.4	-34.9	-36.2	-33.1	-35.2	-36.2	-34.6
	Downcomer Annulus Pressure (psia)	14.3	14.2	14.4	14.4	14.4	14.5	14.4	14.4	14.5
	Inlet gas Temp. (°C)	178	165	198	174	158	185	169	154	183
	Outlet gas Temp. (°C)	54.8	52.9	56.9	54.9	53.8	56.5	54.6	53.3	56.1
	C. Coil W. Inlet Temp (°C)	14.7	10.7	17.4	14.7	13.0	17.5	14.6	14.0	15.1
	C. Coil W. Outlet Temp (°C)	51.2	49.1	53.0	50.3	48.9	51.9	49.9	48.2	51.6
	Jacket W. Outlet Temp (°C)	51.4	49.6	53.1	51.1	49.9	52.5	50.7	49.1	52.3
	Sump Temp. (°C)	50.9	48.8	52.8	50.3	49.0	51.9	49.9	48.2	51.6
	Off-gas Downcomer Temp @3" (°C)	140	133	150	137	129	143	133	118	140
	Off-gas Downcomer Temp @8" (°C)	151	143	161	147	138	152	142	124	149
	Off-gas Downcomer Temp @13" (°C)	155	147	167	151	143	156	146	127	154
	Off-gas Downcomer Temp @18" (°C)	153	146	164	149	140	154	144	125	152
	Off-gas Downcomer Temp @23" (°C)	154	147	165	150	141	155	145	126	153
	Off-gas Downcomer Temp @28" (°C)	154	146	164	149	141	154	144	126	152
	Off-gas Downcomer Temp @33" (°C)	152	145	163	148	141	153	143	126	151
	Off-gas Downcomer Temp @38" (°C)	146	139	155	142	135	146	137	121	144
	Off-gas Downcomer Temp @43" (°C)	142	136	151	138	131	143	134	118	140
	Off-gas Downcomer Temp @48" (°C)	138	132	147	135	128	139	130	115	137
	Off-gas Downcomer Temp @53" (°C)	128	119	137	127	119	132	123	109	129
	Off-gas Downcomer Temp @58" (°C)	66	62	73	67	63	75	67	64	73
	C. Coil/Jacket W. Flow Rate (gal/min)	3.1	2.4	5.1	3.8	2.5	4.5	3.7	3.0	4.3
	Recirc. pump discharge Temp (°C)	54.7	52.9	56.1	54.8	53.6	56.4	54.5	53.2	55.8
	Recirc. pump discharge Pressure (psi)	38.0	34.5	39.2	38.0	33.0	39.3	37.9	34.1	39.1
WESP	Differential Pressure ("H ₂ O)	1.9	1.6	2.2	1.9	1.7	2.2	1.9	1.7	2.1
	Inlet gas Temp. (°C)	54.0	51.7	55.4	54.0	52.3	55.3	53.7	51.8	55.4
	Outlet gas Temp. (°C)	52.9	25.1	55.4	53.8	26.2	55.5	53.0	27.4	55.5
	Wet Gas Flow Rate (scfm)	249	232	255	242	235	250	231	224	236
	Voltage (kV)	21.0	0.0	31.3	26.7	0.0	31.9	29.5	0.0	31.4
	Current (mA)	11.7	0.0	16.8	14.5	0.0	17.0	16.2	0.0	16.8
HEME	Differential Pressure ("H ₂ O)	1.0	0.8	1.1	0.9	0.8	1.1	0.9	0.9	1.0
	Outlet Gas Temp. (°C)	51.1	37.2	52.9	51.4	39.4	52.7	50.6	38.8	52.9
HEPA 1	Differential Pressure ("H ₂ O)	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.1
	Outlet Gas Temp. (°C)	69.9	67.4	70.7	69.3	65.4	69.9	69.4	65.9	70.3
Activated Carbon Bed	Inlet gas Temp. (°C)	83.8	82.6	84.3	81.9	81.3	83.9	81.6	81.3	81.9
	Bottom Temp. (°C)	83.0	71.2	88.9	81.7	75.8	84.5	81.8	73.7	85.0
	Middle Temp. (°C)	88.6	75.0	99.1	84.5	80.0	87.2	85.0	77.7	90.9
	Top Temp. (°C)	94.6	80.7	109	88.0	82.5	90.8	87.5	80.0	94.4
	Outlet gas Temp. (°C)	86.4	75.0	95.7	81.0	76.0	83.4	80.0	74.6	85.1
	Differential Pressure ("H ₂ O)	1.4	1.3	1.5	1.3	1.3	1.4	1.3	1.3	1.4
	Outlet Screen Differential Pressure ("H ₂ O)	4.3	4.0	4.7	4.1	3.9	4.5	4.1	3.8	4.3
TCO/SCR Heater Inlet Gas Temp. (°C)		80.8	80.2	81.3	80.8	79.5	81.5	80.9	79.9	81.0
TCO	Inlet Gas Temp. (°C)	347	324	371	348	341	358	351	345	360
	Mid-bed Temp. (°C)	372	365	382	372	364	377	374	366	382
	Differential Pressure ("H ₂ O)	3.8	3.6	4.1	3.7	3.6	3.9	3.6	3.5	3.8
SCR	Inlet Gas Temp. (°C)	374	367	383	371	363	375	371	363	379
	Outlet Gas Temp. Right (°C)	366	357	371	361	354	365	360	354	366
	Outlet Gas Temp. Left (°C)	328	316	339	322	314	328	318	311	325
	Differential Pressure ("H ₂ O)	2.6	2.4	2.7	2.5	2.4	2.6	2.5	2.4	2.5
	Post Outlet Gas Temp. (°C)	315	304	326	310	304	315	307	302	313
PBS	Inlet Gas Temp. (°C)	295	287	302	291	287	294	288	285	292
	PBS Sump Temp. (°C)	29.6	27.6	30.8	28.9	27.8	30.3	29.5	28.2	30.4
	Differential Pressure ("H ₂ O)	2.4	2.0	2.7	2.2	1.9	2.6	2.1	1.9	2.3

Table 4.1. DuraMelter 1200 HLW MACT Tests Off-Gas System Measured Parameters (continued).

Test		2A			1-continued					
		No spiking			Naphthalene/MeOH			No spiking		
		Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
Melter	Pressure at Level Detector Port ("H ₂ O)	-2.6	-5.1	-0.2	-2.7	-3.4	-1.8	-2.7	-4.1	-1.6
	Pressure at Instrument Port ("H ₂ O)	-2.6	-5.3	-0.1	-2.8	-3.5	-1.9	-2.8	-4.1	-1.6
	Control Air Flow Rate (scfm)	20.4	0.6	39.2	21.4	13.6	35.3	19.6	11.0	36.3
Film Cooler Differential Pressure ("H ₂ O)		0.60	0.12	3.44	0.68	0.36	1.24	0.75	0.22	1.54
Transition Line Differential Pressure ("H ₂ O)		1.2	0.1	4.5	1.5	0.8	2.3	1.3	0.5	2.5
SBS	Differential Pressure ("H ₂ O)	30.1	26.3	31.9	30.5	27.6	31.7	30.7	26.2	32.5
	Inlet gas pressure ("H ₂ O)	-4.4	-10.1	-1.7	-4.9	-6.8	-3.9	-4.8	-6.5	-2.6
	Outlet gas pressure ("H ₂ O)	-34.9	-42.5	-32.0	-35.8	-37.3	-32.6	-35.9	-38.3	-31.5
	Downcomer Annulus Pressure (psia)	14.4	14.2	14.5	14.3	14.2	14.4	14.2	14.1	14.4
	Inlet gas Temp. (°C)	195	96	419	206	188	224	211	172	240
	Outlet gas Temp. (°C)	54.4	43.0	59.0	49.6	47.5	50.9	49.8	47.5	55.8
	C. Coil W. Inlet Temp (°C)	15.5	10.8	54.7	15.4	12.9	17.8	15.4	14.2	17.8
	C. Coil W. Outlet Temp (°C)	50.1	38.2	55.7	44.5	41.7	45.9	44.5	41.8	51.3
	Jacket W. Outlet Temp (°C)	50.2	20.8	55.5	45.5	42.9	46.9	45.8	43.4	52.1
	Sump Temp. (°C)	50.2	38.5	55.7	44.5	41.8	45.9	44.6	42.3	51.3
	Off-gas Downcomer Temp @3" (°C)	154	104	341	160	144	170	164	137	176
	Off-gas Downcomer Temp @8" (°C)	165	112	365	172	153	182	175	146	189
	Off-gas Downcomer Temp @13" (°C)	170	115	376	177	158	188	181	151	195
	Off-gas Downcomer Temp @18" (°C)	168	114	372	175	155	185	178	148	192
	Off-gas Downcomer Temp @23" (°C)	168	116	370	175	156	185	179	149	193
	Off-gas Downcomer Temp @28" (°C)	167	116	365	174	155	184	178	149	191
	Off-gas Downcomer Temp @33" (°C)	166	116	355	173	154	182	176	148	189
	Off-gas Downcomer Temp @38" (°C)	158	112	334	163	146	172	161	142	171
	Off-gas Downcomer Temp @43" (°C)	153	109	310	157	143	165	149	123	161
	Off-gas Downcomer Temp @48" (°C)	149	106	281	150	139	157	130	92	150
	Off-gas Downcomer Temp @53" (°C)	137	88	241	131	117	141	91	71	131
	Off-gas Downcomer Temp @58" (°C)	68	60	80	68	64	73	65	61	70
	C. Coil/Jacket W. Flow Rate (gal/min)	4.2	0.8	28.7	8.0	5.8	16.6	8.4	3.1	16.9
	Recirc. pump discharge Temp (°C)	54.2	44.0	57.5	49.7	49.0	52.7	49.7	48.5	55.6
	Recirc. pump discharge Pressure (psi)	38.1	31.6	39.4	38.2	34.3	39.3	38.1	33.2	39.5
WESP	Differential Pressure ("H ₂ O)	1.9	1.4	2.5	1.7	1.5	2.0	1.7	1.4	2.1
	Inlet gas Temp. (°C)	53.5	42.5	57.9	48.7	46.1	50.3	49.0	46.9	55.3
	Outlet gas Temp. (°C)	53.8	44.6	56.9	49.8	48.4	51.9	50.1	47.8	54.2
	Wet Gas Flow Rate (scfm)	239	8	252	226	221	237	223	216	234
	Voltage (kV)	29.6	23.2	31.5	31.1	30.4	31.7	30.4	29.2	31.5
HEME	Current (mA)	16.7	16.5	18.2	16.8	16.8	17.0	16.8	16.6	16.9
	Differential Pressure ("H ₂ O)	0.9	0.7	1.1	0.9	0.9	1.0	0.9	0.8	1.1
HEPA 1	Outlet Gas Temp. (°C)	51.2	42.5	54.4	47.3	46.4	49.5	47.2	46.5	51.9
	Differential Pressure ("H ₂ O)	0.1	0.1	0.4	0.1	0.0	0.1	0.1	0.1	0.2
Activated Carbon Bed	Outlet Gas Temp. (°C)	68.7	65.6	70.2	67.8	66.0	68.9	68.0	66.2	69.5
	Inlet gas Temp. (°C)	81.9	73.8	84.3	74.8	73.2	75.8	74.8	74.4	81.7
	Bottom Temp. (°C)	80.7*	71.8*	88.1*	75.4	74.0	82.9	74.6*	73.7*	85.1*
	Middle Temp. (°C)	83.5*	73.1*	93.8*	81.2	78.3	91.0	78.6*	77.4*	91.8*
	Top Temp. (°C)	86.7*	75.7*	97.8*	87.8	83.6	95.4	83.1*	81.6*	95.7*
	Outlet gas Temp. (°C)	80.0*	69.8*	91.0*	81.3	77.8	86.2	76.9*	75.6*	85.8*
	Differential Pressure ("H ₂ O)	1.3	1.1	1.6	1.2	1.2	1.4	1.2	1.1	1.4
	Outlet Screen Differential Pressure ("H ₂ O)	4.1	3.4	6.4	3.9	3.6	4.3	3.8	3.4	4.3
	TCO/SCR Heater Inlet Gas Temp. (°C)	79.8	77.1	81.5	79.7	77.6	80.4	79.7	79.3	80.9
TCO	Inlet Gas Temp. (°C)	352	325	393	381	354	387	387	343	401
	Mid-bed Temp. (°C)	370	360	393	405	385	411	403	371	410
	Differential Pressure ("H ₂ O)	3.7	3.2	4.3	3.8	3.7	4.2	3.8	3.6	4.1
SCR	Inlet Gas Temp. (°C)	370	361	399	401	384	408	398	371	406
	Outlet Gas Temp. Right (°C)	359	349	376	388	368	395	387	362	392
	Outlet Gas Temp. Left (°C)	318	306	339	347	329	356	346	321	353
	Differential Pressure ("H ₂ O)	2.5	2.2	2.8	2.6	2.5	2.8	2.6	2.4	2.8
	Post Outlet Gas Temp. (°C)	306	297	324	334	316	340	333	310	339
PBS	Inlet Gas Temp. (°C)	287	268	302	310	293	313	309	291	314
	PBS Sump Temp. (°C)	28.9	25.7	31.4	29.5	27.6	31.7	29.3	28.6	31.0
	Differential Pressure ("H ₂ O)	2.2	1.6	3.7	2.1	1.8	2.7	2.1	1.7	2.6

* Value influenced by residual effects from spiking periods.

Table 4.1. DuraMelter 1200 HLW MACT Tests Off-Gas System Measured Parameters (continued).

Test		2B		
		Avg.	Min.	Max.
Melter	Pressure at Level Detector Port ("H ₂ O)	-2.7	-4.5	-0.1
	Pressure at Instrument Port ("H ₂ O)	-2.8	-4.6	0.0
	Control Air Flow Rate (scfm)	24.3	10.1	49.8
Film Cooler Differential Pressure ("H ₂ O)		1.04	0.22	2.91
Transition Line Differential Pressure ("H ₂ O)		2.1	0.9	3.9
SBS	Differential Pressure ("H ₂ O)	31.7	28.1	33.9
	Inlet gas pressure ("H ₂ O)	-6.0	-8.8	-1.8
	Outlet gas pressure ("H ₂ O)	-38.2	-43.1	-33.7
	Downcomer Annulus Pressure (psia)	14.1	13.9	14.3
	Inlet gas Temp. (°C)	271	174	314
	Outlet gas Temp. (°C)	55.1	53.2	59.2
	C. Coil W. Inlet Temp (°C)	16.8	14.6	18.8
	C. Coil W. Outlet Temp (°C)	48.7	46.8	54.0
	Jacket W. Outlet Temp (°C)	50.5	48.8	54.9
	Sump Temp. (°C)	49.3	47.5	53.8
	Off-gas Downcomer Temp @3" (°C)	211	165	235
	Off-gas Downcomer Temp @8" (°C)	227	180	253
	Off-gas Downcomer Temp @13" (°C)	234	188	261
	Off-gas Downcomer Temp @18" (°C)	229	185	256
	Off-gas Downcomer Temp @23" (°C)	229	185	255
	Off-gas Downcomer Temp @28" (°C)	227	184	254
	Off-gas Downcomer Temp @33" (°C)	222	180	246
	Off-gas Downcomer Temp @38" (°C)	159	110	204
	Off-gas Downcomer Temp @43" (°C)	119	88	188
	Off-gas Downcomer Temp @48" (°C)	91	76	164
	Off-gas Downcomer Temp @53" (°C)	77	71	112
	Off-gas Downcomer Temp @58" (°C)	63	59	74
	C. Coil/Jacket W. Flow Rate (gal/min)	11.5	5.7	13.2
	Recirc. pump discharge Temp (°C)	54.8	53.0	57.9
	Recirc. pump discharge Pressure (psi)	38.0	32.4	39.3
WESP	Differential Pressure ("H ₂ O)	2.1	1.4	2.7
	Inlet gas Temp. (°C)	54.3	52.5	58.5
	Outlet gas Temp. (°C)	54.6	25.6	57.6
	Wet Gas Flow Rate (scfm)	220	49	310
	Voltage (kV)	29.5	0.0	32.1
HEME	Current (mA)	16.2	0.0	18.0
	Differential Pressure ("H ₂ O)	1.0	0.7	1.3
HEPA 1	Outlet Gas Temp. (°C)	51.9	38.8	55.2
	Differential Pressure ("H ₂ O)	0.1	0.0	0.5
Activated Carbon Bed	Outlet Gas Temp. (°C)	65.8	54.4	68.2
	Inlet gas Temp. (°C)	78.9	75.1	82.4
	Bottom Temp. (°C)	79.5	73.1	84.1
	Middle Temp. (°C)	81.9	76.3	86.6
	Top Temp. (°C)	85.2	79.5	90.8
	Outlet gas Temp. (°C)	79.3	75.0	83.8
	Differential Pressure ("H ₂ O)	1.4	1.1	1.7
TCO/SCR Heater	Outlet Screen Differential Pressure ("H ₂ O)	4.4	3.1	5.5
	TCO/SCR Heater Inlet Gas Temp. (°C)	80.5	75.5	82.1
TCO	Inlet Gas Temp. (°C)	362	277	370
	Mid-bed Temp. (°C)	364	261	372
	Differential Pressure ("H ₂ O)	3.8	2.8	4.1
SCR	Inlet Gas Temp. (°C)	369	252	382
	Outlet Gas Temp. Right (°C)	367	260	374
	Outlet Gas Temp. Left (°C)	326	225	334
	Differential Pressure ("H ₂ O)	2.6	2.0	2.8
	Post Outlet Gas Temp. (°C)	312	233	318
PBS	Inlet Gas Temp. (°C)	294	248	298
	PBS Sump Temp. (°C)	32.4	30.6	33.5
	Differential Pressure ("H ₂ O)	2.5	1.1	3.2

Table 4.2. DuraMelter 1200 LAW MACT Tests Off-Gas System Measured Parameters.

Test		Test 1								
		Allyl alcohol			Naphthalene/MeOH			No spiking		
		Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
Melter	Pressure at Level Detector Port ("H ₂ O)	-2.7	-3.3	-2.0	-2.7	-3.5	-2.1	-2.7	-3.6	-1.8
	Pressure at Instrument Port ("H ₂ O)	-2.8	-3.3	-2.0	-2.8	-3.5	-2.1	-2.8	-3.6	-1.7
	Control Air Flow Rate (scfm)	25.3	12.3	42.8	33.8	19.1	56.5	31.6	13.7	80.4
Film Cooler Differential Pressure ("H ₂ O)		Clogged sensor								
Transition Line Differential Pressure ("H ₂ O)		1.7	1.2	3.2	1.9	0.9	3.0	1.9	1.2	6.1
SBS	Differential Pressure ("H ₂ O)	32.4	30.8	33.6	32.5	30.6	33.8	32.5	28.6	33.9
	Inlet gas pressure ("H ₂ O)	-5.2	-7.2	-4.2	-5.4	-6.8	-4.0	-5.4	-7.2	-4.1
	Outlet gas pressure ("H ₂ O)	-37.5	-40.0	-36.2	-37.5	-39.7	-35.0	-37.6	-40.1	-34.4
	Downcomer Annulus Pressure (psia)	14.0	13.9	14.2	14.3	14.2	14.4	14.3	14.1	14.4
	Inlet gas Temp. (°C)	210	196	233	205	180	230	204	114	236
	Outlet gas Temp. (°C)	50.0	46.8	51.8	50.0	48.9	51.2	50.2	47.7	53.4
	C. Coil W. Inlet Temp (°C)	15.0	13.9	17.8	14.9	14.3	15.6	15.0	13.9	16.6
	C. Coil W. Outlet Temp (°C)	44.3	40.7	46.0	44.2	43.0	45.1	44.6	41.9	47.4
	Jacket W. Outlet Temp (°C)	45.8	42.6	47.4	45.7	44.6	46.7	46.1	43.6	48.8
	Sump Temp. (°C)	44.6	41.1	46.3	44.5	43.3	45.4	44.9	42.3	47.7
	Off-gas Downcomer Temp @3" (°C)	166	159	178	163	151	176	163	122	180
	Off-gas Downcomer Temp @8" (°C)	173	166	184	169	156	182	169	126	187
	Off-gas Downcomer Temp @13" (°C)	179	171	190	175	161	188	174	132	193
	Off-gas Downcomer Temp @18" (°C)	173	166	184	169	156	182	169	130	187
	Off-gas Downcomer Temp @23" (°C)	173	166	184	168	155	180	168	130	187
	Off-gas Downcomer Temp @28" (°C)	172	165	182	165	153	176	165	127	184
	Off-gas Downcomer Temp @33" (°C)	168	161	178	158	148	169	159	121	179
	Off-gas Downcomer Temp @38" (°C)	149	137	156	131	118	141	133	97	155
	Off-gas Downcomer Temp @43" (°C)	139	124	147	109	99	118	114	80	142
	Off-gas Downcomer Temp @48" (°C)	115	97	125	79	75	86	87	70	113
	Off-gas Downcomer Temp @53" (°C)	73	71	80	70	67	74	71	66	79
	Off-gas Downcomer Temp @58" (°C)	58	55	62	55	53	59	56	52	63
	C. Coil/Jacket W. Flow Rate (gal/min)	5.4	3.4	16.0	5.2	4.7	6.1	5.2	3.4	8.7
	Recirc. pump discharge Temp (°C)	49.9	48.2	51.8	49.8	48.8	51.0	50.1	48.3	52.4
	Recirc. pump discharge Pressure (psi)	39.7	36.3	40.7	39.7	35.7	40.9	39.7	33.1	41.1
WESP	Differential Pressure ("H ₂ O)	2.2	2.0	2.5	2.4	1.9	2.7	2.4	1.9	3.1
	Inlet gas Temp. (°C)	49.3	46.0	51.1	49.2	48.3	50.6	49.4	47.1	52.8
	Outlet gas Temp. (°C)	50.8	38.2	52.6	50.9	47.0	52.2	51.2	21.7	54.2
	Wet Gas Flow Rate (scfm)	219	210	234	227	216	236	226	215	250
	Voltage (kV)	30.2	0.0	31.5	31.2	1.1	32.3	31.1	0.1	31.6
	Current (mA)	15.8	0.0	17.1	15.8	11.6	16.9	15.6	0.0	17.0
HEPA 1	Differential Pressure ("H ₂ O)	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.0	0.2
	Outlet Gas Temp. (°C)	61.8	55.2	64.5	63.5	60.6	64.8	62.7	54.0	64.9
Activated Carbon Bed	Inlet gas Temp. (°C)	75.8	74.7	76.8	74.3	72.6	75.8	74.6	71.8	75.6
	Bottom Temp. (°C)	83.6	66.9	87.9	76.5	75.5	77.6	77.8*	56.5*	88.2*
	Middle Temp. (°C)	92.1	70.2	101	79.8	78.8	80.9	83.5*	62.0*	103*
	Top Temp. (°C)	95.6	74.1	110	82.8	81.1	85.9	88.6*	68.7*	114*
	Bed surface -1" (°C)	92.2	71.4	106	80.1	78.8	81.2	85.6*	65.9*	109*
	Outlet gas Temp. (°C)	86.7	71.5	99.7	77.0	75.6	78.3	82.4*	68.2*	103*
	Differential Pressure ("H ₂ O)	1.2	1.1	1.4	1.3	1.0	1.4	1.3	1.1	1.4
	Outlet Screen Differential Pressure ("H ₂ O)	4.5	4.0	5.0	4.8	4.0	5.0	4.7	0.1	5.0
	TCO/SCR Heater Inlet Gas Temp. (°C)	81.5	80.1	82.9	80.3	77.8	84.3	80.3	77.4	81.7
TCO	Inlet Gas Temp. (°C)	408	404	417	404	395	423	411	395	422
	Mid-bed Temp. (°C)	400	392	406	401	396	406	399	392	406
	Differential Pressure ("H ₂ O)	4.3	4.0	4.6	4.4	4.1	5.0	4.4	3.9	5.0
SCR	Inlet Gas Temp. (°C)	402	395	407	400	394	407	399	393	412
	Outlet Gas Temp. Right (°C)	440	426	455	438	424	444	440	422	453
	Outlet Gas Temp. Left (°C)	404	388	421	400	383	408	403	380	422
	Differential Pressure ("H ₂ O)	3.3	3.0	3.6	3.4	3.2	3.8	3.4	3.0	3.7
	Post Outlet Gas Temp. (°C)	377	364	394	374	360	382	377	357	393
PBS	Inlet Gas Temp. (°C)	351	341	366	351	340	356	353	341	366
	PBS Sump Temp. (°C)	30.5	28.8	31.8	30.2	28.6	30.7	30.3	28.1	32.0
	Differential Pressure ("H ₂ O)	3.7	3.2	5.0	4.4	3.1	6.1	4.8	3.3	8.3

* Value influenced by residual effects from spiking periods.

Table 4.2. DuraMelter 1200 LAW MACT Tests Off-Gas System Measured Parameters (continued).

Test		2B		
		Avg.	Min.	Max.
Melter	Pressure at Level Detector Port ("H ₂ O)	-2.8	-4.9	-0.8
	Pressure at Instrument Port ("H ₂ O)	-2.9	-4.9	-0.8
	Control Air Flow Rate (scfm)	24.5	7.5	58.3
Film Cooler Differential Pressure ("H ₂ O)		1.22	0.13	4.79
Transition Line Differential Pressure ("H ₂ O)		3.2	1.4	6.0
SBS	Differential Pressure ("H ₂ O)	32.1	26.4	34.7
	Inlet gas pressure ("H ₂ O)	-7.2	-12.2	-4.9
	Outlet gas pressure ("H ₂ O)	-39.8	-45.9	-34.3
	Downcomer Annulus Pressure (psia)	14.3	14.0	14.5
	Inlet gas Temp. (°C)	274	134	454
	Outlet gas Temp. (°C)	50.0	47.4	54.5
	C. Coil W. Inlet Temp (°C)	15.7	14.0	19.8
	C. Coil W. Outlet Temp (°C)	43.9	41.0	50.0
	Jacket W. Outlet Temp (°C)	45.6	42.3	50.1
	Sump Temp. (°C)	44.2	41.8	49.8
	Off-gas Downcomer Temp @3" (°C)	222	146	373
	Off-gas Downcomer Temp @8" (°C)	225	153	384
	Off-gas Downcomer Temp @13" (°C)	233	159	399
	Off-gas Downcomer Temp @18" (°C)	228	157	390
	Off-gas Downcomer Temp @23" (°C)	224	155	380
	Off-gas Downcomer Temp @28" (°C)	218	152	366
	Off-gas Downcomer Temp @33" (°C)	207	145	350
	Off-gas Downcomer Temp @38" (°C)	160	106	227
	Off-gas Downcomer Temp @43" (°C)	133	89	201
	Off-gas Downcomer Temp @48" (°C)	95	73	155
	Off-gas Downcomer Temp @53" (°C)	75	66	93
	Off-gas Downcomer Temp @58" (°C)	57	51	64
	C. Coil/Jacket W. Flow Rate (gal/min)	8.4	4.0	28.4
	Recirc. pump discharge Temp (°C)	49.7	43.2	52.5
	Recirc. pump discharge Pressure (psi)	37.8	32.7	39.5
WESP	Differential Pressure ("H ₂ O)	2.1	1.0	3.1
	Inlet gas Temp. (°C)	49.4	46.8	53.0
	Outlet gas Temp. (°C)	50.9	21.8	54.0
	Wet Gas Flow Rate (scfm)	218	128	255
	Voltage (kV)	27.6	0.0	39.7
	Current (mA)	11.8	0.0	29.7
HEPA 1	Differential Pressure ("H ₂ O)	0.2	0.1	0.2
	Outlet Gas Temp. (°C)	62.7	47.9	66.0
Activated Carbon Bed	Inlet gas Temp. (°C)	74.4	64.8	77.6
	Bottom Temp. (°C)	76.6	49.5	87.8
	Middle Temp. (°C)	79.9	54.2	93.2
	Top Temp. (°C)	82.8	62.3	96.6
	Bed surface -1" (°C)	79.9	58.9	90.9
	Outlet gas Temp. (°C)	76.9	60.1	85.7
	Differential Pressure ("H ₂ O)	1.2	0.0	1.4
	Outlet Screen Differential Pressure ("H ₂ O)	4.6	0.0	5.0
	TCO/SCR Heater Inlet Gas Temp. (°C)	80.3	57.0	83.7
TCO	Inlet Gas Temp. (°C)	376	361	401
	Mid-bed Temp. (°C)	376	357	388
	Differential Pressure ("H ₂ O)	3.9	2.7	4.9
SCR	Inlet Gas Temp. (°C)	370	352	395
	Outlet Gas Temp. Right (°C)	423	349	438
	Outlet Gas Temp. Left (°C)	381	308	400
	Differential Pressure ("H ₂ O)	3.1	2.2	3.7
	Post Outlet Gas Temp. (°C)	361	291	378
PBS	Inlet Gas Temp. (°C)	337	273	352
	PBS Sump Temp. (°C)	30.8	26.4	32.3
	Differential Pressure ("H ₂ O)	2.9	1.0	11.3

**Table 4.2. DuraMelter 1200 LAW MACT Tests Off-Gas System Measured Parameters
 (continued).**

Test		2A								
		Allyl alch./Naph.			Naph./MeOH			No spiking		
		Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
Melter	Pressure at Level Detector Port ("H ₂ O)	-2.8	-3.3	-2.2	-2.7	-3.4	0.0	-2.7	-3.4	-1.7
	Pressure at Instrument Port ("H ₂ O)	-2.8	-3.3	-2.2	-2.8	-3.4	0.1	-2.8	-3.5	-1.7
	Control Air Flow Rate (scfm)	38.5	25.3	53.1	41.0	24.9	58.3	39.7	17.0	56.8
Film Cooler Differential Pressure ("H ₂ O)		0.42	0.27	1.12	0.39	0.17	1.00	0.60	0.14	3.07
Transition Line Differential Pressure ("H ₂ O)		3.3	2.4	4.3	3.3	2.3	5.1	3.1	1.9	5.8
SBS	Differential Pressure ("H ₂ O)	32.0	27.8	33.1	31.7	26.8	32.9	31.9	27.2	33.9
	Inlet gas pressure ("H ₂ O)	-6.4	-7.6	-5.3	-6.3	-9.3	-4.9	-6.3	-9.3	-4.7
	Outlet gas pressure ("H ₂ O)	-38.7	-40.2	-33.7	-38.2	-41.8	-32.5	-38.4	-42.3	-33.4
	Downcomer Annulus Pressure (psia)	14.3	14.3	14.4	14.4	14.3	14.5	14.4	14.3	14.5
	Inlet gas Temp. (°C)	172	155	194	163	87	194	164	92	199
	Outlet gas Temp. (°C)	49.8	47.8	51.4	50.2	48.7	51.0	49.8	46.7	51.7
	C. Coil W. Inlet Temp (°C)	14.6	14.0	15.7	14.5	13.8	15.1	14.5	12.9	15.9
	C. Coil W. Outlet Temp (°C)	44.1	41.8	45.2	44.4	42.7	45.6	44.3	40.9	46.2
	Jacket W. Outlet Temp (°C)	45.7	43.8	46.8	46.0	44.5	46.8	45.8	42.8	47.5
	Sump Temp. (°C)	44.4	42.1	45.5	44.6	43.1	45.7	44.6	41.2	46.6
	Off-gas Downcomer Temp @3" (°C)	143	132	153	136	101	143	137	103	153
	Off-gas Downcomer Temp @8" (°C)	144	133	154	137	102	144	138	105	154
	Off-gas Downcomer Temp @13" (°C)	148	137	159	141	106	149	142	109	159
	Off-gas Downcomer Temp @18" (°C)	144	133	155	138	104	145	138	107	155
	Off-gas Downcomer Temp @23" (°C)	144	133	153	137	104	144	138	107	154
	Off-gas Downcomer Temp @28" (°C)	142	132	152	136	103	142	136	106	152
	Off-gas Downcomer Temp @33" (°C)	139	130	148	132	102	138	133	103	148
	Off-gas Downcomer Temp @38" (°C)	121	114	129	114	92	121	114	89	128
	Off-gas Downcomer Temp @43" (°C)	102	94	111	93	79	103	95	76	109
	Off-gas Downcomer Temp @48" (°C)	81	74	90	73	65	82	75	65	87
	Off-gas Downcomer Temp @53" (°C)	66	64	73	65	62	69	66	61	71
	Off-gas Downcomer Temp @58" (°C)	56	53	59	56	53	59	56	51	61
	C. Coil/Jacket W. Flow Rate (gal/min)	4.0	3.4	6.3	3.9	3.6	5.0	3.9	2.1	6.2
	Recirc. pump discharge Temp (°C)	49.9	49.4	50.8	50.1	48.6	50.9	49.8	47.6	50.8
	Recirc. pump discharge Pressure (psi)	38.0	34.5	39.1	38.0	32.3	39.2	38.1	33.8	39.4
WESP	Differential Pressure ("H ₂ O)	2.2	1.8	2.4	2.2	1.8	2.6	2.2	1.7	2.7
	Inlet gas Temp. (°C)	49.1	47.5	50.2	49.4	48.1	50.3	49.1	46.5	51.1
	Outlet gas Temp. (°C)	49.9	47.8	51.7	50.3	48.1	51.6	49.6	23.8	51.5
	Wet Gas Flow Rate (scfm)	223	207	228	224	212	234	223	207	242
	Voltage (kV)	25.1	0.0	30.8	25.9	0.0	32.7	20.8	0.0	31.0
	Current (mA)	11.2	0.0	17.1	12.4	0.0	18.8	9.4	0.0	17.0
HEPA 1	Differential Pressure ("H ₂ O)	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.2
	Outlet Gas Temp. (°C)	60.0	56.6	63.5	61.0	58.2	62.7	60.0	52.4	63.3
Activated Carbon Bed	Inlet gas Temp. (°C)	73.9	71.9	75.3	74.5	73.2	75.7	73.8	71.5	76.4
	Bottom Temp. (°C)	79.8	76.0	82.6	76.3	75.2	77.6	77.1*	67.3*	82.2*
	Middle Temp. (°C)	87.4	78.6	92.9	79.0	77.4	81.2	82.4*	70.3*	90.7*
	Top Temp. (°C)	92.2	80.3	102	81.8	79.4	87.3	87.6*	73.5*	101*
	Bed surface -1" (°C)	88.8	77.5	96.6	79.0	76.9	82.0	84.5*	70.8*	96.6*
	Outlet gas Temp. (°C)	84.2	74.1	92.4	75.7	73.6	79.0	81.0*	69.6*	92.3*
	Differential Pressure ("H ₂ O)	1.2	1.1	1.3	1.2	1.1	1.3	1.2	1.0	1.4
	Outlet Screen Differential Pressure ("H ₂ O)	Most of the data was above the sensor detection limit of 5.0 in. W.C.								
	TCO/SCR Heater Inlet Gas Temp. (°C)	79.4	77.0	80.9	80.0	78.4	81.4	79.2	75.9	83.1
TCO	Inlet Gas Temp. (°C)	371	358	384	363	351	375	369	353	380
	Mid-bed Temp. (°C)	370	365	375	370	364	377	369	357	377
	Differential Pressure ("H ₂ O)	4.0	3.6	4.2	4.0	3.5	4.2	4.0	3.5	4.4
SCR	Inlet Gas Temp. (°C)	371	365	377	371	362	377	370	359	379
	Outlet Gas Temp. Right (°C)	403	395	409	401	394	408	403	392	411
	Outlet Gas Temp. Left (°C)	366	358	373	364	354	373	365	353	377
	Differential Pressure ("H ₂ O)	3.0	2.7	3.2	3.0	2.6	3.2	3.0	2.6	3.3
	Post Outlet Gas Temp. (°C)	346	339	352	345	337	352	346	338	355
	Inlet Gas Temp. (°C)	325	315	330	324	307	329	325	316	333
PBS	PBS Sump Temp. (°C)	28.9	28.4	29.8	28.9	28.1	29.5	28.6	27.3	29.7
	Differential Pressure ("H ₂ O)	4.1	3.2	5.7	4.5	3.0	7.3	3.8	0.0	7.7

* Value influenced by residual effects from spiking periods.

Table 4.3. Mass of Solid Deposits Removed from the Film Cooler and Transition Line Sections after MACT Tests and Subsequent Turnover to HLW Composition.

Section Name	Mass (kg)	Figures
Film Cooler	First, could not be cleaned due to damage at the bottom. After cleaning the solid mass was not recorded.	4.35-4.38 (4.39 and 4.40 are post-cleaning figures)
Transition line section #1	0	4.41 and 4.42
Transition line section #2	0.83 ¹	4.43 and 4.44
Transition line section #3	0.36	4.32 ¹ , 4.45 and 4.46
Transition line bellows	Included in value ¹ of section #3	4.33 ¹ and 4.47
Transition line Section #4	0.37	4.34 ¹ , 4.48 and 4.49
Total	>1.56	-

¹During the HLW Turnover test, the transition line bellows was taken out at 26.9 hours and cleaned. Transition line section #3 was cleaned with an all-thread rod. The above masses do not include the solid material removed at that time.

"-" Empty data field.

Table 4.4. DCP Analyzed Compositions of SBS Bowl Dried Solids (wt%) after HLW Turnover Test (Sample O-12G-116A).

Ag ₂ O	0.01
Al ₂ O ₃	4.68
As ₂ O ₃	0.10
B ₂ O ₃	3.05
BaO	0.03
CaO	0.69
CdO	0.15
Cr ₂ O ₃	0.25
CuO	0.04
Fe ₂ O ₃	16.83
K ₂ O	0.68
Li ₂ O	0.42
MgO	0.41
MnO	1.67
MoO ₃	<0.01
Na ₂ O	2.66
NiO	0.66
P ₂ O ₅	0.36
PbO	0.25
Sb ₂ O ₃	0.08
SeO ₂	1.60
SiO ₂	41.71
SnO ₂	0.03
SrO	0.22
TiO ₂	0.33
ZnO	2.38
ZrO ₂	4.56
Total	83.86

Table 4.5. Time Needed to Restore Power after Deluge of WESP and Duration of Spray Water Flow Interruptions during HLW Tests.

Test	DATE	TIME	Time Required to Restore Power (Minutes)	Duration of Spray Water Flow Interruption (Minutes)
1	11/16/2004	10:11	0	11
	11/17/2004	10:28	0	10
	Avg.		0	10.5
2A , 1-continued and 2B	12/7/2004	12:05	0	35
	12/8/2004	11:24	0	35
	12/9/2004	11:44	0	9
	12/10/2004	12:25	0	9
	12/11/2004	11:02	0	36
	Avg.		0	25

Table 4.6. Time Needed to Restore Power after Deluge of WESP and Duration of Spray Water Flow Interruptions during LAW Test 1.

DATE	TIME	Time Required to Restore Power (Minutes)	Duration of Spray Water Flow Interruption (Minutes)
3/8/2005	10:06	13	29
3/9/2005	9:49	15	14 (spraying started early)
Avg.		14.0	21.5

Note: Values based on start of interruption and 5 minutes of assumed deluge time.

Table 4.7. Time Needed to Restore Power after Deluge of WESP and Duration of Spray Water Flow Interruptions during LAW Tests 2B and 2A.

DATE	TIME	Run Time (hr)	Duration of Spray Water Flow Interruption (Minutes)	Comments
3/18/2005	9:55	24.4	~22	WESP power secured due to possible problems after a deluge.
3/18/2005	11:47	26.3	~60	Deluge performed. WESP found to have apparent shorting. WESP powered back on at 12:42, however it is functioning only ~50% of time.
3/19/2005	14:36	53.1	219	Deluge performed. WESP failed at 15:06, 15:18 and 15:29, 16:07, 16:10, 16:51. Stable conditions established at 18:10, at 9.6 kV and 14.2 mA. In this period there were two deluges.
3/19/2005	19:25	57.9	40	Secured power and spraying without a deluge. Off gas sampling performed and stable conditions reestablished at 20:00.
3/20/2005	01:16	63.8	NA	WESP totalizer failed and taken out of service.
3/21/2005	11:18	97.8	35	Secured power and spraying without a deluge. Off gas sampling performed and stable conditions reestablished at 11:48 at 31.0 kV and 10-12 mA.
3/21/2005	14:45	101.3	35	Secured power and spraying without a deluge. Stable conditions reestablished at 15:15 at 30.6 kV and 12.6 mA.
3/21/2005	16:40	103.2	35	Secured power and spraying without a deluge. Stable conditions reestablished at 17:10 at 30.7 kV and 13.0 mA.
3/21/2005	18:35	105.1	35	Secured power and spraying without a deluge. Stable conditions reestablished at 19:05 at 30.8 kV and 14.2 mA.
3/22/2005	10:45	121.2	35	Secured power and spraying without a deluge. Off gas sampling performed. Stable conditions reestablished at 11:15 at 31.0 kV and 10-12 mA.
3/22/2005	14:10	124.7	45	Secured power and spraying without a deluge. Off gas sampling performed. Stable conditions reestablished at 14:50 at 31.0 kV and 14-17 mA.
3/22/2005	18:03	128.5	35	Secured power and spraying without a deluge. Off gas sampling performed. Stable conditions reestablished at 18:33 at 31.0 kV and 13-17 mA.
3/22/2005	20:30	131.0	Spraying turned off.	Deluge performed. Attempts to restart WESP failed at 20:50 and 22:18, 00:13, 1:16, 2:20 (3/23/2005).

Table 4.8. DCP and IC Analyzed Compositions of WESP Dry Solids (wt%) after HLW Turnover Test (Sample O-12G-116B).

Ag ₂ O	<0.01
Al ₂ O ₃	0.42
As ₂ O ₃	<0.01
B ₂ O ₃	0.93
BaO	0.00
CaO	6.19
CdO	0.01
Cr ₂ O ₃	0.16
CuO	0.01
Fe ₂ O ₃	0.15
K ₂ O	0.99
Li ₂ O	0.08
MgO	0.27
MnO	<0.01
MoO ₃	<0.01
Na ₂ O	2.68
NiO	0.03
P ₂ O ₅	0.22
PbO	0.02
Sb ₂ O ₃	<0.01
SeO ₂	1.06
SiO ₂	3.16
SnO ₂	<0.01
SrO	0.01
TiO ₂	0.04
ZnO	0.30
ZrO ₂	<0.01
F	0.21
Cl	2.31
I	<0.01
Nitrite	<0.01
Nitrate	19.02
Sulfate	1.66
Total	40.01

Table 4.9. Nitrogen and Carbon Oxides Mass Balance Around Activated Carbon-Bed During HLW Test 1.

-	Gaseous Species	Conc. at HEPA Outlet (ppmv)	Conc. at Carbon Column Outlet (ppmv)	Flux at HEPA Outlet (mol/hr)	Flux at Carbon Column Outlet (mol/hr)	NO _x , CO and CO ₂ removal (%)	DF
No spiking periods	N ₂ O	30	32.6	0.496	0.539	NC	NC
	NO	759.5	485	12.561	8.021	NC	NC
	NO ₂	135.2	12.5	2.236	0.207	NC	NC
	Total NO _x	924.7	530.1	15.293	8.767	42.7	1.7
	CO	77.8	70.8	1.287	1.171	9.0	1.1
	CO ₂	7100	6700	117.4	110.8	5.6	1.1
Allyl Alcohol spiking period	N ₂ O	31	31.6	0.526	0.536	NC	NC
	NO	442.3	818	7.503	13.876	NC	NC
	NO ₂	395.7	76	6.713	1.289	NC	NC
	Total NO _x	869	925.6	14.742	15.702	-6.5	0.9
	CO	907.9	831.8	15.402	14.111	8.4	1.1
	CO ₂	10100	10600	171.3	179.8	-5.0	1.0
Naphthalene/Methanol spiking period	N ₂ O	26.6	36	0.429	0.580	NC	NC
	NO	758.6	884.7	12.229	14.261	NC	NC
	NO ₂	212.7	98.5	3.429	1.588	NC	NC
	Total NO _x	997.9	1019.2	16.086	16.429	-2.1	1.0
	CO	230	359.6	3.708	5.797	-56.3	0.6
	CO ₂	9300	10700	149.9	172.5	-15.1	0.9

Table 4.10. Nitrogen and Carbon Oxides Mass Balance Around Activated Carbon-Bed During HLW Test 2A, 1-continued and 2B.

-	Gaseous Species	Conc. at HEPA Outlet (ppmv)	Conc. at Carbon Column Outlet (ppmv)	Flux at HEPA Outlet (mol/hr)	Flux at Carbon Column Outlet (mol/hr)	NO _x , CO and CO ₂ removal (%)	DF
Test 2A No spiking periods	N ₂ O	32.6	25.9	0.548	0.435	NC	NC
	NO	816	651	13.717	10.943	NC	NC
	NO ₂	158	45.8	2.656	0.770	NC	NC
	Total NO _x	1006.6	722.7	16.921	12.148	28.2	1.4
	CO	84.9	81.6	1.427	1.372	3.9	1.0
	CO ₂	7900	7000	132.8	117.7	11.4	1.1
Test 2A Allyl Alcohol spiking period	N ₂ O	22.8	23.7	0.399	0.415	NC	NC
	NO	561	810	9.813	14.168	NC	NC
	NO ₂	524	97	9.166	1.697	NC	NC
	Total NO _x	1107.8	930.7	19.378	16.280	16.0	1.2
	CO	582	580	10.180	10.145	0.3	1.0
	CO ₂	9100	8400	159.2	146.9	7.7	1.1
Test 2A Naphthalene/ MeOH spiking period	N ₂ O	25.7	27.9	0.438	0.475	NC	NC
	NO	682	754	11.614	12.840	NC	NC
	NO ₂	123	81.5	2.095	1.388	NC	NC
	Total NO _x	830.7	863.4	14.146	14.703	-3.9	1.0
	CO	121	170	2.061	2.895	-40.5	0.7
	CO ₂	8200	9500	139.6	161.8	-15.9	0.9

Table 4.10. Nitrogen and Carbon Oxides Mass Balance Around Activated Carbon-Bed During HLW Test 2A, 1-continued and 2B (cont.)

-	Gaseous Species	Conc. at HEPA Outlet (ppmv)	Conc. at Carbon Column Outlet (ppmv)	Flux at HEPA Outlet (mol/hr)	Flux at Carbon Column Outlet (mol/hr)	NO _x , CO and CO ₂ removal (%)	DF
Test 2A Allyl Alcohol/ Naphthalene spiking period	N ₂ O	22.3	28	0.363	0.456	NC	NC
	NO	536	772	8.729	12.573	NC	NC
	NO ₂	405	53.9	6.596	0.878	NC	NC
	Total NO _x	963.3	853.9	15.688	13.907	11.4	1.1
	CO	524	515	8.534	8.387	1.7	1.0
	CO ₂	8000	8700	130.3	141.7	-8.8	0.9
Test 1-continued, Naphthalene/ MeOH spiking period	N ₂ O	34	39.5	0.540	0.628	NC	NC
	NO	708	949	11.253	15.083	NC	NC
	NO ₂	403	117	6.405	1.860	NC	NC
	Total NO _x	1145	1105.5	18.199	17.571	3.4	1.0
	CO	288	276	4.577	4.387	4.2	1.0
	CO ₂	9600	10500	152.6	166.9	-9.4	0.9
Test 2B	N ₂ O	52.2	53.5	0.808	0.828	NC	NC
	NO	1228	1184	19.001	18.320	NC	NC
	NO ₂	309	284	4.781	4.394	NC	NC
	Total NO _x	1589.2	1521.5	24.590	23.543	4.3	1.0
	CO	128	130	1.981	2.012	-1.6	1.0
	CO ₂	12600	12500	195.0	193.4	0.8	1.0

Table 4.11. Nitrogen and Carbon Oxides Mass Balance Around Activated Carbon-Bed During LAW Test 1.

-	Gaseous Species	Conc. at HEPA Outlet (ppmv)	Conc. at Carbon Column Outlet (ppmv)	Flux at HEPA Outlet (mol/hr)	Flux at Carbon Column Outlet (mol/hr)	NO _x , CO and CO ₂ removal (%)	DF
Allyl Alcohol spiking period	N ₂ O	468	540	7.213	8.323	NC	NC
	NO	3293	3434	50.754	52.927	NC	NC
	NO ₂	2157	2349	33.245	36.204	NC	NC
	Total NO _x	5918	6323	91.213	97.455	-6.8	0.9
	CO	177	350	2.728	5.394	-97.7	0.5
	CO ₂	11200	12100	172.6	186.5	-8.0	0.9
Naphthalene/ MeOH spiking period	N ₂ O	438	423	6.994	6.754	NC	NC
	NO	2904	2588	46.370	41.324	NC	NC
	NO ₂	1735	1942	27.704	31.009	NC	NC
	Total NO _x	5077	4953	81.067	79.087	2.4	1.0
	CO	160	184	2.555	2.938	-15.0	0.9
	CO ₂	9300	9200	148.5	146.9	1.1	1.0
No spiking periods	N ₂ O	457	511	7.275	8.134	NC	NC
	NO	3063	3261	48.757	51.908	NC	NC
	NO ₂	1908	2043	30.371	32.520	NC	NC
	Total NO _x	5428	5815	86.403	92.563	-7.1	0.9
	CO	86.3	139	1.374	2.213	-61.1	0.6
	CO ₂	9900	11600	157.6	184.6	-17.2	0.9

Table 4.12. Nitrogen and Carbon Oxides Mass Balance Around Activated Carbon-Bed During LAW Tests 2B and 2A.

-	Gaseous Species	Conc. at HEPA Outlet (ppmv)	Conc. at Carbon Column Outlet (ppmv)	Flux at HEPA Outlet (mol/hr)	Flux at Carbon Column Outlet (mol/hr)	NO _x , CO and CO ₂ removal (%)	DF
Test 2B	N ₂ O	608	619	9.339	9.508	NC	NC
	NO	3962	3482	60.857	53.484	NC	NC
	NO ₂	3205	3627	49.229	55.711	NC	NC
	Total NO _x	7775	7728	119.425	118.703	0.6	1.0
	CO	162	174	2.488	2.673	-7.4	0.9
	CO ₂	14200	13900	218.1	213.5	2.1	1.0
Test 2A Allyl Alcohol /Naphthalene spiking period	N ₂ O	464	525	7.266	8.221	NC	NC
	NO	2969	3527	46.493	55.231	NC	NC
	NO ₂	1742	1203	27.279	18.838	NC	NC
	Total NO _x	5175	5255	81.038	82.291	-1.5	1.0
	CO	109	219	1.707	3.429	-100.9	0.5
	CO ₂	9900	10200	155.0	159.7	-3.0	1.0
2A Naphthalene/ MeOH spiking period	N ₂ O	439	463	6.924	7.302	NC	NC
	NO	3042	2946	47.977	46.463	NC	NC
	NO ₂	1647	1727	25.975	27.237	NC	NC
	Total NO _x	5128	5136	80.876	81.002	-0.2	1.0
	CO	120	128	1.893	2.019	-6.7	0.9
	CO ₂	9400	9400	148.3	148.3	0.0	1.0

Table 4.12. Nitrogen and Carbon Oxides Mass Balance Around Activated Carbon-Bed During LAW Tests 2B and 2A (continued)

-	Gaseous Species	Conc. at HEPA Outlet (ppmv)	Conc. at Carbon Column Outlet (ppmv)	Flux at HEPA Outlet (mol/hr)	Flux at Carbon Column Outlet (mol/hr)	NO _x , CO and CO ₂ removal (%)	DF
2A No Spiking periods	N ₂ O	439	435	6.885	6.822	NC	NC
	NO	3048	2817	47.803	44.180	NC	NC
	NO ₂	1783	1620	27.963	25.407	NC	NC
	Total NO _x	5270	4872	82.651	76.409	7.6	1.1
	CO	75.4	81	1.183	1.270	-7.4	0.9
	CO ₂	9800	9100	153.7	142.7	7.1	1.1

Table 4.13. DM1200 MACT HCU Heater Settings.

Waste	Test	Date & time	Run time (hr)	Organic Spike	HCU Heater Setting Changes
HLW	1	11/15/2004 13:45	0.0	None	475°C
		11/15/2004 16:20	2.6		475°C to 470°C
		11/16/2004 7:59	18.2		470°C to 465°C
		11/16/2004 12:10	22.4	Alyl Alcohol	465°C to 460°C
		11/16/2004 12:15	22.5		460°C to 450°C
		11/16/2004 12:54	23.2		450°C to 440°C
		11/16/2004 13:52	24.1		440°C to 430°C
		11/16/2004 20:22	30.6	None	430°C to 437°C
HLW	1	11/16/2004 21:12	31.5	None	437°C to 440°C
		11/16/2004 22:22	32.6		440°C to 447°C
		11/16/2004 22:57	33.2		447°C to 450°C
		11/17/2004 2:10	36.4		Heater controls reset.
		11/17/2004 10:43	45.0		455°C to 457°C.
		11/17/2004 17:15	51.5	Naphthalene in MeOH	457°C to 450°C
	2A	12/6/2004 6:59	-3.2	None	HCU heater set to 465°C start up. 465°C to 450°C.
		12/6/2004 10:43	0.5		450°C to 445°C
		12/6/2004 11:29	1.3		445°C to 430°C
		12/6/2004 12:00	1.8		430°C to 420°C
		12/6/2004 13:18	3.1		420°C to 415°C
		12/6/2004 15:49	5.6		415°C to 420°C
		12/7/2004 0:04	13.9		420°C to 430°C
		12/7/2004 0:53	14.7		430°C to 425°C
		12/7/2004 5:37	19.4		425°C to 430°C
		12/7/2004 6:10	20.0		430°C to 427°C
		12/7/2004 8:31	22.3		427°C to 429°C
		12/7/2004 11:12	25.0		429°C to 426°C
		12/7/2004 11:39	25.4	Alyl alcohol	426°C to 421°C
		12/7/2004 11:42	25.5		421°C to 411°C

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Table 4.13. DM1200 MACT HCU Heater Settings (continued).

Waste	Test	Date & time	Run time (hr)	Organic Spike	HCU Heater Settings
HLW	2A	12/7/2004 13:08	26.9	Allyl alcohol	411°C to 408°C
		12/7/2004 13:34	27.4		408°C to 400°C
		12/7/2004 13:54	27.7		400°C to 396°C
		12/7/2004 13:58	27.8		396°C to 390°C
		12/7/2004 15:41	29.5		390°C to 385°C
		12/7/2004 16:55	30.7		385°C to 380°C
		12/7/2004 17:13	31.0		380°C to 375°C
		12/7/2004 18:12	32.0	None	375°C to 385°C
		12/7/2004 23:56	37.8		381°C to 384°C
		12/8/2004 1:22	39.2		384°C to 387°C
		12/8/2004 2:07	39.9		387°C to 390°C
		12/8/2004 2:18	40.1		390°C to 395°C
		12/8/2004 2:41	40.5		395°C to 400°C
		12/8/2004 2:56	40.8		400°C to 397°C
		12/8/2004 5:27	43.3		397°C to 400°C
		12/8/2004 5:48	43.6		400°C to 402°C
		12/8/2004 6:20	44.2		402°C to 405°C
		12/8/2004 9:09	47.0		405°C to 408°C
		12/8/2004 9:40	47.5		408°C to 412°C
HLW	2A	12/8/2004 10:47	48.6	Naphthalene in MeOH	412°C to 409°C
		12/8/2004 11:36	49.4		409°C to 406°C
		12/8/2004 11:57	49.8		406°C to 409°C
		12/8/2004 13:08	51.0		409°C to 406°C
		12/8/2004 13:52	51.7		406°C to 405°C
		12/8/2004 15:44	53.6		405°C to 402°C
		12/8/2004 18:12	56.0		402°C to 405°C

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Table 4.13. DM1200 MACT HCU Heater Settings (continued).

Waste	Test	Date & time	Run time (hr)	Organic Spike	HCU Heater Settings
HLW	2A	12/8/2004 23:16	61.1	None	405°C to 408°C
		12/9/2004 0:42	62.5		408°C to 413°C
		12/9/2004 2:48	64.6		413°C to 416°C
		12/9/2004 4:08	66.0		416°C to 420°C
		12/9/2004 6:50	68.7		420°C to 423°C
		12/9/2004 10:16	72.1		423°C to 421°C
		12/9/2004 10:28	72.3	Naphthalene in allyl alcohol	421°C to 422°C
		12/9/2004 11:17	73.1		422°C to 410°C
		12/9/2004 11:47	73.6		410°C to 405°C
		12/9/2004 12:05	73.9		405°C to 408°C
		12/9/2004 13:14	75.1		408°C to 405°C
		12/9/2004 13:20	75.2		405°C to 400°C
	1-continued	12/9/2004 13:24	75.2	None	400°C to 425°C
		12/9/2004 13:41	75.5	Naphthalene in MeOH	425°C to 435°C
		12/9/2004 13:45	75.6		435°C to 450°C
	1-continued	12/9/2004 16:59	78.8		450°C to 447°C
		12/10/2004 23:26	85.3		447°C to 449°C
		12/10/2004 0:37	86.4		449°C to 452°C
		12/10/2004 2:16	88.1		452°C to 455°C
		12/10/2004 2:57	88.8		455°C to 457°C
		12/10/05 6:07	91.9		457°C to 460°C
		12/10/2004 9:40	95.5		460°C to 410°C
	2B	12/10/2004 10:08	96.0	None	410°C to 405°C
		12/10/2004 10:18	96.1		405°C to 400°C
		12/10/2004 10:40	96.5		400°C to 397°C
		12/10/2004 11:25	97.2		397°C to 399°C
		12/10/2004 11:47	97.6		399°C to 403°C
		12/10/2004 11:50	97.7		403°C to 408°C
		12/10/2004 12:20	98.2		408°C to 425°C
		12/10/2004 12:21	98.2		Heater 801 lost power.
		12/10/2004 12:23	98.2		Found low air flow alarm output had not been reset. Leaving heater 801 @ 408°C.

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Table 4.13. DM1200 MACT HCU Heater Settings (continued).

Waste	Test	Date & time	Run time (hr)	Organic Spike	HCU Heater Settings
HLW	2B	12/10/2004 17:10	102.9	None	408°C to 410°C
		12/10/2004 17:40	103.5		410°C to 413°C
		12/10/2004 18:40	104.5		Heater 801 and 701 tripped.
		12/10/2004 18:52	104.7		Heater 801 and 701 reset and heating up.
		12/10/2004 23:50	109.7		405°C to 410°C
		12/11/2004 4:42	114.5		410°C to 412°C
		12/11/2004 7:36	117.4		412°C to 410°C
		12/11/2004 18:50	128.6		Heaters were tripped off and reset.
		12/12/2004 0:48	134.6		410°C to 412°C
LAW	1	Start up			445°C
		3/7/2005 9:10	0.1	None	450°C to 445°C
		3/7/2005 10:05	1.0		445°C to 440°C
		3/7/2005 10:15	1.2		440°C to 430°C
		3/7/2005 10:50	1.8		430°C to 433°C
		3/7/2005 11:08	2.1		433°C to 435°C
		3/7/2005 20:30	11.5		435°C to 432°C
		3/8/2005 11:15	26.2	Allyl alcohol	432°C to 429°C
		3/8/2005 16:50	31.8	None	429°C to 425°C
		3/9/2005 0:38	39.6		425°C to 430°C
		3/9/2005 4:16	43.2		430°C to 435°C
		3/9/2005 5:42	44.7		435°C to 433°C
		3/9/2005 8:40	47.6		433°C to 435°C
		3/9/2005 10:17	49.3	Naphthalene in MeOH	436°C to 434°C
		3/9/2005 10:30	49.5		434°C to 432°C
		3/9/2005 10:33	49.5		432°C to 427°C
		3/9/2005 11:28	50.4		432°C to 435°C

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Table 4.13. DM1200 MACT HCU Heater Settings (continued).

Waste	Test	Date & time	Run time (hr)	Organic Spike	HCU Heater Settings
LAW	1	3/9/2005 23:04	62.0	None	427°C to 430°C
		3/10/2005 0:05	63.0		430°C to 433°C
		3/10/2005 2:40	65.6		433°C to 430°C
		3/10/2005 7:56	70.9		430°C to 433°C
		3/10/2005 11:37	74.6		433°C to 436°C
	2B	Start up		None	400°C
		3/17/2005 8:10	-1.3		400°C to 440°C
		3/17/2005 8:39	-0.9		440°C to 430
		3/17/2005 9:25	-0.1		430°C to 425°C
		3/17/2005 9:50	0.3		425°C to 430°C
		3/17/2005 10:54	1.4		430°C to 410°C
		3/17/2005 11:18	1.8		410°C to 400°C
		3/17/2005 12:24	2.9		400°C to 403°C
		3/17/2005 12:41	3.2		403°C to 406°C
		3/17/2005 13:11	3.7		406°C to 410°C
		3/17/2005 20:57	11.5		410°C to 405°C
		3/17/05 23:19	13.8		405°C to 408°C
		3/18/2005 4:47	19.3		408°C to 413°C
		3/18/2005 5:52	20.4		413°C to 416°C
		3/18/2005 7:11	21.7		416°C to 419°C

"-" Empty data field

Table 4.13. DM1200 MACT HCU Heater Settings (continued).

Waste	Test	Date & time	Run time (hr)	Organic Spike	HCU Heater Settings
LAW	2B	3/18/2005 11:43	26.2		419°C to 417°C
		3/18/2005 12:43	27.2		417°C to 420°C
		3/18/2005 22:55	37.4		420°C to 415°C
		3/19/2005 3:58	42.5		415°C to 418°C
		3/19/2005 8:21	46.9		418°C to 415°C
		3/19/2005 11:08	49.7		415°C to 416°C
	2A	3/20/2005 7:37	70.1	None	416°C to 418°C
		3/20/2005 11:14	73.8		418°C to 415°C
		3/20/2005 11:43	74.2		415°C to 410°C
		3/20/2005 13:27	75.9		410°C to 412°C
		3/20/2005 14:07	76.6		412°C to 415°C
		3/20/2005 14:24	76.9		415°C to 418°C
		3/20/2005 22:34	85.1		417°C to 420°C
		3/20/2005 23:05	85.8		420°C to 418°C
		3/21/2005 1:53	88.4		418°C to 413°C
		3/21/2005 2:57	89.5	None	408°C to 411°C
		3/21/2005 5:20	91.8		411°C to 408°C
		3/21/2005 6:47	93.3		408°C to 405°C
		3/21/2005 10:00	96.5		405°C to 402°C
		3/21/2005 10:42	97.2	Naphthalene in allyl alcohol	402°C to 399°C
		3/21/2005 12:35	99.1		399°C to 395°C
		3/21/2005 13:41	100.2		395°C to 397°C
		3/21/2005 15:13	101.7		334°C to 391°C
		3/21/2005 18:52	105.4		391°C to 388°C
		3/21/2005 19:54	106.4		388°C to 392°C
		3/21/2005 20:47	107.3	None	392°C to 395°C
		3/21/2005 22:53	109.4		398 to 395°C
		3/22/2005 3:37	114.1		395°C to 397°C
		3/22/2005 9:38	120.1	Naphthalene in MeOH	397°C to 395°C
		3/22/2005 10:08	120.6		395°C to 392°C
		3/22/2005 12:10	122.7		392°C to 389°C
		3/22/2005 16:42	127.2		389°C to 394°C
		3/22/2005 17:45	128.3		394°C to 396°C
		3/22/2005 18:08	128.6		396°C to 401°C
		3/22/2005 19:20	129.9		396°C to 394°C
		3/22/2005 23:53	134.4	None	394°C to 397°C
		3/23/2005 0:09	134.6		397°C to 400°C

"-" Empty data field

Table 4.14. Gas Residence Times in TCO.

Waste	Test	Period	Residence Time (seconds)
HLW	1	No Spiking	0.17
	1	Allyl Alcohol Spiking	0.17
	1	Naphthalene Spiking	0.17
	2A	No Spiking	0.18
	2A	Allyl Alcohol Spiking	0.17
	2A	Naphthalene/MeOH Spiking	0.18
	2A	Allyl Alcohol / Naphthalene Spiking	0.18
LAW	1-continued	Naphthalene/MeOH Spiking	0.18
	2B	No Spiking	0.19
	1	Allyl Alcohol Spiking	0.18
	1	Naphthalene/MeOH Spiking	0.17
	1	No spiking	0.17
	2B	No Spiking	0.19
	2A	Allyl Alcohol/Naphthalene Spiking	0.19
	2A	Naphthalene/MeOH Spiking	0.19
	2A	No Spiking	0.19

Table 4.15. Nitrogen Oxides and Carbon Monoxide Destruction Across TCO-SCR Catalytic Unit During HLW Test 1.

-	Gaseous Species	Conc. at Carbon Column Outlet (ppmv)	Conc. at TCO-SCR Outlet (ppmv)	Flux at Carbon Column outlet (mol/hr)	Flux at TCO-SCR outlet (mol/hr)	NO _x , CO, CO ₂ and NH ₃ removal (%)	DF	
No spiking periods	N ₂ O		32.6	27.4	0.539	0.465	NC	NC
	NO		485	57.2	8.021	0.971	NC	NC
	NO ₂		12.5	57.9	0.207	0.982	NC	NC
	Total NO _x		530.1	142.5	8.767	2.418	72.4	3.6
	CO		70.8	1	1.171	0.017	98.6	69.0
	NH ₃	exhaust	<1	11.6	<0.017	0.197	N/A	N/A
		injected	N/A	N/A	9.108*	N/A	N/A	N/A
		Total	<1	11.6	<9.125*	0.197	>97.8	>46.4
Allyl Alcohol spiking period	N ₂ O		31.6	34.7	0.536	0.604	NC	NC
	NO		818	79.6	13.876	1.386	NC	NC
	NO ₂		76	38.6	1.289	0.672	NC	NC
	Total NO _x		925.6	152.9	15.702	2.662	83.0	5.9
	CO		831.8	<1	14.111	<0.017	>99.9	>810.5
	NH ₃	exhaust	<1	<1	<0.017	<0.017	N/A	N/A
		injected	N/A	N/A	12.254*	N/A	N/A	N/A
		Total	<1	<1	<12.271*	<0.017	~99.9	~704.9
Naphthalene spiking period	N ₂ O		36	34	0.580	0.562	NC	NC
	NO		884.7	128.8	14.261	2.131	NC	NC
	NO ₂		98.5	111.2	1.588	1.839	NC	NC
	Total NO _x		1019.2	274.0	16.429	4.533	72.4	3.6
	CO		359.6	<1	5.797	<0.017	>99.7	>350.4
	NH ₃	exhaust	1.4	<1	0.023	<0.017	N/A	N/A
		injected	N/A	N/A	11.126*	N/A	N/A	N/A
		Total	1.4	<1	11.148*	<0.017	>99.9	>673.9

“NA” Not applicable.

“NC” Not calculated.

“*” The ammonia injected before SCR is added to the ammonia coming from the carbon bed to calculate the total ammonia input to the TCO-SCR unit.

Table 4.16. Nitrogen Oxides and Carbon Monoxide Destruction Across TCO-SCR Catalytic Unit During HLW Test 2A, 1-continued and 2B.

-	Gaseous Species		Conc. at Carbon Column Outlet (ppmv)	Conc. at TCO-SCR Outlet (ppmv)	Flux at Carbon Column outlet (mol/hr)	Flux at TCO-SCR outlet (mol/hr)	NO _x , CO, CO ₂ and NH ₃ removal (%)	DF
Test 2A No spiking periods	N ₂ O		25.9	29.2	0.435	0.507	NC	NC
	NO		651	63	10.943	1.094	NC	NC
	NO ₂		45.8	30.7	0.770	0.533	NC	NC
	Total NO _x		722.7	122.9	12.148	2.135	82.4	5.7
	CO		81.6	<1	1.372	<0.017	>98.7	>79.0
	NH ₃	exhaust	2.3	16.4	0.039	0.285	N/A	N/A
		injected	N/A	N/A	9.954*	N/A	N/A	N/A
		Total	2.3	16.4	9.992*	0.285	97.1	35.1
Test 2A Allyl Alcohol spiking period	N ₂ O		23.7	34.4	0.415	0.623	NC	NC
	NO		810	237	14.168	4.290	NC	NC
	NO ₂		97	111	1.697	2.009	NC	NC
	Total NO _x		930.7	382.4	16.280	6.922	57.5	2.4
	CO		580	<1	10.145	<0.018	>99.8	>560.5
	NH ₃	exhaust	<1	<1	<0.017	<0.018	N/A	N/A
		injected	N/A	N/A	11.730*	N/A	N/A	N/A
		Total	<1	<1	<11.747*	<0.018	~99.8	~649.0
Test 2A Naphthalene/ MeOH spiking periods	N ₂ O		27.9	32.2	0.475	0.568	NC	NC
	NO		754	72.2	12.840	1.274	NC	NC
	NO ₂		81.5	45.7	1.388	0.806	NC	NC
	Total NO _x		863.4	150.1	14.703	2.648	82.0	5.6
	CO		170	<1	2.895	<0.018	>99.4	>164.1
	NH ₃	exhaust	7.8	<1	0.133	N/A	N/A	N/A
		injected	N/A	N/A	10.628*	N/A	N/A	N/A
		Total	7.8	<1	10.761*	<0.018	>99.8	>610.0

NA - Not applicable.

NC - Not calculated.

* - The ammonia injected before SCR is added to the ammonia coming from the carbon bed to calculate the total ammonia input to the TCO-SCR unit.

Table 4.16. Nitrogen Oxides and Carbon Monoxide Destruction Across TCO-SCR Catalytic Unit During HLW Test 2A, 1-continued and 2B (continued).

-	Gaseous Species	Conc. at Carbon Column Outlet (ppmv)	Conc. at TCO-SCR Outlet (ppmv)	Flux at Carbon Column outlet (mol/hr)	Flux at TCO-SCR outlet (mol/hr)	NO _x , CO, CO ₂ and NH ₃ removal (%)	DF
Test 2A Allyl Alcohol/ Naphthalene spiking period	N ₂ O	28	45.1	0.456	0.760	NC	NC
	NO	772	205	12.573	3.454	NC	NC
	NO ₂	53.9	137	0.878	2.308	NC	NC
	Total NO _x	853.9	387.1	13.907	6.522	53.1	2.1
	CO	515	<1	8.387	<0.017	>99.8	>497.8
	NH ₃	exhaust	<1	<0.016	<0.017	N/A	N/A
		injected	N/A	10.664	N/A	N/A	N/A
		Total	<1	<10.680	<0.017	~99.8	~633.9
Test 1-continued Naphthalene/ MeOH spiking period	N ₂ O	39.5	35.3	0.628	0.581	NC	NC
	NO	949	79.9	15.083	1.315	NC	NC
	NO ₂	117	109	1.860	1.794	NC	NC
	Total NO _x	1105.5	224.2	17.571	3.690	79.0	4.8
	CO	276	<1	4.387	<0.016	>99.6	>266.6
	NH ₃	exhaust	<1	<0.016	<0.016	N/A	N/A
		injected	N/A	<10.610*	N/A	N/A	N/A
		Total	<1	10.626*	0.016	~99.8	~645.7
Test 2B	N ₂ O	53.5	48.5	0.828	0.776	NC	NC
	NO	1184	105	18.320	1.680	NC	NC
	NO ₂	284	55.2	4.394	0.883	NC	NC
	Total NO _x	1521.5	208.7	23.543	3.340	85.8	7.0
	CO	130	<1	2.012	<0.016	>99.2	>125.7
	NH ₃	exhaust	<1	<0.015	0.133	N/A	N/A
		injected	N/A	16.092	N/A	N/A	N/A
		Total	<1	<16.108	0.133	<99.2	<121.3

NA - Not applicable.

NC - Not calculated.

* - The ammonia injected before SCR is added to the ammonia coming from the carbon bed to calculate the total ammonia input to the TCO-SCR unit.

Table 4.17. Nitrogen Oxides and Carbon Monoxide Destruction Across TCO-SCR Catalytic Unit During LAW Test 1.

-	Gaseous Species	Conc. at Carbon Column Outlet (ppmv)	Conc. at TCO-SCR Outlet (ppmv)	Flux at Carbon Column outlet (mol/hr)	Flux at TCO-SCR outlet (mol/hr)	NO _x , CO, CO ₂ and NH ₃ removal** (%)	DF
Allyl Alcohol spiking period	N ₂ O	540	431	8.323	6.977	NC	NC
	NO	3434	721	52.927	11.671	NC	NC
	NO ₂	2349	259	36.204	4.192	NC	NC
	Total NO _x	6323	1411	97.455	22.840	76.6	4.3
	CO	350	<1	5.394	<0.016	>99.7	>333.3
	NH ₃	exhaust	<1	<0.015	0.151	N/A	N/A
		injected	N/A	64.337*	N/A	N/A	N/A
		Total	<1	<64.352*	0.151	<99.8	<426.1
Naphthalene/ MeOH spiking period	N ₂ O	423	379	6.754	6.382	NC	NC
	NO	2588	769	41.324	12.950	NC	NC
	NO ₂	1942	247	31.009	4.160	NC	NC
	Total NO _x	4953	1395	79.087	23.492	70.3	3.4
	CO	184	<1	2.938	<0.017	>99.4	>174.5
	NH ₃	exhaust	2	0.032	<0.017	N/A	N/A
		injected	N/A	63.981*	N/A	N/A	N/A
		Total	2	64.013*	<0.017	100.0	>3801.2
No spiking periods	N ₂ O	511	344	8.134	5.772	NC	NC
	NO	3261	462	51.908	7.752	NC	NC
	NO ₂	2043	179	32.520	3.003	NC	NC
	Total NO _x	5815	985.0	92.563	16.527	82.1	5.6
	CO	139	<1	2.213	<0.017	>99.2	>131.9
	NH ₃	exhaust	<1	<0.016	0.851	N/A	N/A
		injected	N/A	66.616*	N/A	N/A	N/A
		Total	<1	<66.632*	0.851	<98.7	<78.3

NA - Not applicable.

NC - Not calculated.

* - The ammonia injected before SCR is added to the ammonia coming from the carbon bed to calculate the total ammonia input to the TCO-SCR unit.

** - Negative values represent generation of the respective gaseous species in the TCO-SCR.

Table 4.18. Nitrogen Oxides and Carbon Monoxide Destruction Across TCO-SCR Catalytic Unit During LAW Tests 2B and 2A.

-	Gaseous Species	Conc. at Carbon Column Outlet (ppmv)	Conc. at TCO-SCR Outlet (ppmv)	Flux at Carbon Column outlet (mol/hr)	Flux at TCO-SCR outlet (mol/hr)	NO _x , CO, CO ₂ and NH ₃ removal** (%)	DF
Test 2B	N ₂ O	619	476	9.508	7.746	NC	NC
	NO	3482	767	53.484	12.481	NC	NC
	NO ₂	3627	310	55.711	5.045	NC	NC
	Total NO _x	7728	1553	118.703	25.272	78.7	4.7
	CO	174	13	2.673	0.212	92.1	12.6
	NH ₃	exhaust	<1	<0.015	0.319	N/A	N/A
		injected	N/A	79.537*	N/A	N/A	N/A
		Total	<1	<79.553*	0.319	<99.6	<249.4
Test 2A Allyl Alcohol /Naphthalene spiking period	N ₂ O	525	515	8.221	8.457	NC	NC
	NO	3527	768	55.231	12.612	NC	NC
	NO ₂	1203	277	18.838	4.549	NC	NC
	Total NO _x	5255	1560	82.291	25.618	68.9	3.2
	CO	219	2.7	3.429	0.044	98.7	77.3
	NH ₃	exhaust	<1	<0.016	<0.016	N/A	N/A
		injected	N/A	<52.962*	N/A	N/A	N/A
		Total	<1	52.978*	<0.016	~100.0	~3226.1
Test 2A Naphthalene/ MeOH spiking period	N ₂ O	463	491	7.302	8.118	NC	NC
	NO	2946	964	46.463	15.939	NC	NC
	NO ₂	1727	305	27.237	5.043	NC	NC
	Total NO _x	5136	1760.0	81.002	29.099	64.1	2.8
	CO	128	15.9	2.019	0.263	87.0	7.7
	NH ₃	exhaust	3.3	0.052	<0.017	N/A	N/A
		injected	N/A	52.562*	N/A	N/A	N/A
		Total	3.3	52.614*	<0.017	100.0	>3182.2
Test 2A No spiking periods	N ₂ O	435	475	6.822	7.828	NC	NC
	NO	2817	757	44.180	12.476	NC	NC
	NO ₂	1620	356	25.407	5.867	NC	NC
	Total NO _x	4872	1588	76.409	26.172	65.7	2.9
	CO	81	7.7	1.270	0.127	90.0	10.0
	NH ₃	exhaust	3.4	0.053	0.842	N/A	N/A
		injected	N/A	55.835*	N/A	N/A	N/A
		Total	3.4	55.889*	0.842	98.5	66.4

NA - Not applicable.

NC - Not calculated.

* - The ammonia injected before SCR is added to the ammonia coming from the carbon bed to calculate the total ammonia input to the TCO-SCR unit.

** - Negative values represent generation of the respective gaseous species in the TCO-SCR.

Table 4.19. Listing of Samples from SBS Blow-Downs.

Waste Type	Test	Date	Feed Spike	Sample Name	pH	Blow-Down Vol. (gal)	Cumulative Vol. (gal)	
HLW	1	11/15/04	None	1Z2-S-35A	8.26	40.0	40.0	
		1Z2-S-39A		8.19	40.0	80.0		
		1Z2-S-49A		8.30	48.8	128.8		
		1Z2-S-53A		8.11	40.7	169.5		
		1Z2-S-55A		8.09	40.1	209.6		
		1Z2-S-59A		8.06	60.0	269.6		
		11/16/04	Allyl Alcohol	1Z2-S-73A	6.88	40.0	309.6	
				1Z2-S-73B	6.53	20.1	329.7	
			None	1Z2-S-77A	6.35	40.0	369.7	
				1Z2-S-82A	6.30	40.4	410.1	
				1Z2-S-92A	5.81	39.9	450.0	
				1Z2-S-95A	5.56	40.1	490.1	
		1Z2-S-96A		5.76	39.9	530.0		
		1Z2-S-99A		5.98	21.3	551.3		
		11/17/04	Naphthalene in MeOH	1Z2-S-112A	5.93	40.0	591.3	
				1Z2-S-114A	5.78	20.0	611.3	
	2A		12/06/04	None	1Z2-S-152A	6.60	40.0	651.3
					S-12A-14A	6.61	40.0	691.3
		S-12A-16A			6.70	40.1	731.4	
		S-12A-28A			6.86	40.1	771.5	
		12/07/04	Allyl Alcohol	S-12A-44A	6.39	49.9	821.4	
				S-12A-49A	5.68	30.0	851.4	
		12/08/04	None	S-12A-72A	6.26	40.0	891.4	
				S-12A-89A	5.63	20.0	911.4	
			Naphthalene in MeOH	S-12A-98A	5.50	40.0	951.4	
				S-12A-100A	5.80	20.0	971.4	
	12/09/04	None (Naphthalene in allyl alcohol after S-12A-139A)	S-12A-116A	5.31	40.0	1011.4		
			S-12A-121A	5.02	40.0	1051.4		
		Naphthalene in MeOH	S-12A-139A	4.56	40.0	1091.4		
			S-12A-142A	4.63	40.0	1131.4		
		2B	12/10/04	None	S-12A-142B	4.65	30.0	1161.4
					S-12B-8A	4.71	40.1	1201.5
	S-12B-12A				4.69	40.0	1241.5	
	S-12B-15A				4.72	40.0	1281.5	
	S-12B-18A				4.50	40.0	1321.5	
	S-12B-31A				5.61	29.9	1351.4	
	S-12B-33A				4.36	40.0	1391.4	
	S-12B-35A				4.40	40.0	1431.4	
	S-12B-40A				4.25	40.0	1471.4	
	S-12B-42A				4.29	40.0	1511.4	
	12/11/04	S-12B-43A	4.22	39.9	1551.3			
		S-12B-54A	4.32	40.0	1591.3			
		S-12B-56A	4.08	45.2	1636.5			

Table 4.19. Listing of Samples from SBS Blow-Downs (continued).

Waste Type	Test	Date	Feed Spike	Sample Name	pH	Blow-Down Vol. (gal)	Cumulative Vol. (gal)	
HLW	2B	12/11/04	None	S-12B-58A	4.09	40.0	1676.5	
				S-12B-60A	4.10	40.0	1716.5	
				S-12B-71A	4.21	40.0	1756.5	
				S-12B-73A	4.61	40.0	1796.5	
				S-12B-76A	4.21	40.0	1836.5	
				S-12B-77A	4.24	40.0	1876.5	
				S-12B-80A	4.41	40.0	1916.5	
				S-12B-81A	4.43	40.0	1956.5	
		S-12B-84A		4.45	40.1	1996.6		
		12/12/04		S-12B-85A	4.88	40.0	2036.6	
				S-12B-86A	4.64	41.6	2078.2	
				S-12B-90A	4.55	40.1	2118.3	
				S-12B-92A	4.51	40.1	2158.4	
				S-12B-93A	4.46	40.0	2198.4	
				S-12B-112A	4.57	40.0	2238.4	
S-12B-113A	4.59			40.0	2278.4			
LAW	1	03/07/05		S-12D-90A	5.62	30.7	2309.1	
		03/08/05		S-12D-95A	5.60	39.9	2349.0	
				S-12D-120A	5.85	40.3	2389.3	
		Allyl Alcohol	S-12D-126A	5.26	40.0	2429.3		
		03/09/05	None	S-12D-132A	5.56	39.8	2469.1	
				S-12D-146A	5.80	40.0	2509.1	
				S-12D-152A	6.05	40.0	2549.1	
		Naphthalene in MeOH	S-12E-20A	5.99	40.0	2589.1		
			03/10/05	None	S-12E-33A	5.88	40.1	2629.2
		S-12E-36A	6.00		39.4	2668.6		
		2B	03/17/05	Halides	S-12E-71E	5.98	40.0	2708.6
					S-12E-88A	5.59	40.0	2748.6
					S-12E-100A	5.83	40.1	2788.7
			03/18/05		S-12E-103A	5.16	40.0	2828.7
					S-12E-107A	4.97	39.8	2868.5
S-12E-119A	4.90				40.0	2908.5		
S-12E-123A	4.92				40.0	2948.5		
S-12E-127A	5.09				40.1	2988.6		
S-12E-132A	4.93				40.0	3028.6		
S-12E-133A	4.96				39.9	3068.5		
03/19/05	S-12E-136A		4.90		40.1	3108.6		
	S-12E-138A		4.87		40.1	3148.7		
	S-12E-143A		4.86		39.9	3188.6		
	S-12E-147A		4.89		40.0	3228.6		
	S-12F-19A		4.84		40.0	3268.6		
	S-12F-21A	4.83	40.0		3308.6			
S-12F-22A	4.79	40.2	3348.8					

Table 4.19. Listing of Samples from SBS Blow-Downs (continued).

Waste Type	Test	Date	Feed Spike	Sample Name	pH	Blow-Down Vol. (gal)	Cumulative Vol. (gal)
LAW	2B	03/20/05	Halides	S-12F-25A	4.76	41.5	3390.3
				S-12F-39A	4.81	38.3	3428.6
	2A	03/20/05	None	S-12F-51A	5.05	40.1	3468.7
				S-12F-54A	5.15	39.9	3508.6
				S-12F-59A	5.10	40.0	3548.6
				S-12F-62A	5.16	40.0	3588.6
				S-12F-68A	5.21	40.1	3628.7
				S-12F-82A	5.80	39.9	3668.6
		03/21/05	Naphthalene in allyl alcohol	S-12F-102A	5.35	40.0	3708.6
		03/22/05	None	S-12F-108A	5.33	40.1	3748.7
				S-12F-114A	5.34	40.9	3789.6
			Naphthalene in MeOH	S-12F-141A	5.91	40.1	3829.7
		03/23/05	None	S-12F-145A	5.78	39.1	3868.8

Table 4.20. Listing of Samples from WESP Blow-Downs.

Waste Type	Test	Date	Feed Spike	Sample Name	pH	Blow-Down Vol. (gal)	Cumulative Vol. (gal)
HLW	1	11/16/04	None	1Z2-W-58A	6.66	40.7	40.7
				1Z2-W-58B	6.92	43.1	83.8
		11/17/04		1Z2-W-98A	3.54	51.7	135.5
				1Z2-W-98B	5.90	40.0	175.5
				1Z2-W-116A	2.73	21.6	197.1
				1Z2-W-116B	3.37	46.6	243.7
	2A	12/07/04	Allyl Alcohol	W-12A-45A	4.13	56.8	300.5
				W-12A-45B	6.80	38.9	339.4
		12/08/04	Naphthalene in MeOH	W-12A-91A	3.48	59.0	398.4
				W-12A-91B	6.63	38.6	437.0
		12/09/04	Naphthalene in allyl alcohol	W-12A-134A	3.28	40.0	477.0
				W-12A-134B	6.10	35.9	512.9
	2B	12/10/04	None	W-12B-30A	2.97	56.6	569.5
		W-12B-30B		3.87	40.0	609.5	
		12/11/04		W-12B-71A	2.77	55.2	664.7
				W-12B-71B	3.21	44.4	709.1
		12/12/04		W-12B-115A	2.57	79.3	788.4
				W-12B-115B	2.88	41.8	830.2
LAW	1	03/08/05	None	W-12D-120A	1.98	36.8	867.0
				W-12D-120B	2.21	40.0	907.0
		03/09/05		W-12D-151A	1.62	55.3	962.3
				W-12D-151B	2.35	40.2	1002.5
		03/10/05		W-12E-53A	1.66	60.4	1062.9
				W-12E-53B	2.36	42.1	1105.0
	2B	03/18/05	Halides	W-12E-118A	1.45	51.6	1156.6
		W-12E-118B		1.95	38.3	1194.9	
		W-12E-120A		2.09	75.1	1270.0	
		W-12F-15A		1.01	58.8	1328.8	
		W-12F-15B		1.42	37.5	1366.3	
		No Sample		NM	79.0	1445.3	
	03/20/05	W-12F-68A	1.00	35.3	1480.6		
	2A	03/21/05	None	W-12F-82A	1.17	44.8	1525.4
		W-12F-113A		1.52	47.4	1572.8	
		03/22/03	Naphthalene in MeOH	W-12F-141A	1.49	23.9	1596.7
				W-12F-141B	2.07	38.0	1634.7
		03/23/05	None	W-12F-146A	1.35	7.5	1642.2

NM – Not measured,

Note: Spiking occurred during HLW Test 1 and LAW Test 1 although no WESP blow downs occurred during spiking periods.

Table 4.21. Listing of Samples from PBS Blow-Downs.

Waste Type	Test	Date	Sample Name	pH	Blow-Down Vol. (gal)	Cumulative Vol. (gal)	
HLW	1	11/15/04	1Z2-P-35A	12.72	33.7	33.7	
			1Z2-P-37A	12.41	24.8	58.5	
			1Z2-P-38A	10.53	33.4	91.9	
		11/16/04	1Z2-P-54A	9.45	30.5	122.4	
			1Z2-P-59A	9.04	30.5	152.9	
			1Z2-P-77A	9.01	27.7	180.6	
		11/17/04	1Z2-P-96A	8.99	33.6	214.2	
			1Z2-P-116A	9.63	41.0	255.2	
	2A	12/06/04	P-12A-14A	9.24	33.6	288.8	
		12/07/04	P-12A-27A	9.54	34.2	323.0	
			P-12A-34A	9.18	38.1	361.1	
			P-12A-49A	9.52	35.9	397.0	
			P-12A-56A	9.28	35.5	432.5	
		12/08/04	P-12A-73A	9.18	33.4	465.9	
			P-12A-91A	9.55	41.4	507.3	
			P-12A-100A	9.12	41.9	549.2	
		12/09/04	P-12A-116A	9.36	40.0	589.2	
			P-12A-121A	9.36	37.8	627.0	
			P-12A-142A	9.26	35.9	662.9	
		1-continued	12/10/04	P-12B-13A	9.11	36.8	699.7
		P-12B-31A		9.2	38.7	738.4	
		P-12B-40A		9.13	31.1	769.5	
	2B	12/11/04	P-12B-54A	9.14	40.2	809.7	
			P-12B-61A	9.27	41.5	851.2	
			P-12B-76A	9.23	26.6	877.8	
			P-12B-81A	9.13	30.6	908.4	
		12/12/04	P-12B-86A	8.92	33.7	942.1	
			P-12B-93A	9.18	38.6	980.7	
			P-12B-115A	9.52	31.4	1012.1	
LAW		1	03/07/05	P-12D-81A	9.02	30.7	1042.8
	P-12D-86A			9.59	27.3	1070.1	
	03/08/05		P-12D-92A	9.28	34.9	1105.0	
			P-12D-97A	9.27	28.8	1133.8	
			P-12D-120A	9.47	14.7	1148.5	
			P-12D-125A	9.68	28.3	1176.8	
			P-12D-130A	9.31	27.4	1204.2	
	03/09/05		P-12D-144A	9.34	36.8	1241.0	
			P-12D-152A	9.44	30.5	1271.5	
			P-12E-18A	9.18	26.9	1298.4	
	03/10/05		P-12E-33A	9.22	39.5	1337.9	
			P-12E-37A	9.12	27.1	1365.0	
			P-12E-53A	9.27	34.4	1399.4	

Table 4.21. Listing of Samples from PBS Blow-Downs (continued).

Waste Type	Test	Date	Sample Name	pH	Blow-Down Vol. (gal)	Cumulative Vol. (gal)
LAW	2B	03/17/05	P-12E-83A	9.01	32.0	1431.4
			P-12E-87A	9.11	27.0	1458.4
		03/18/05	P-12E-101A	9.52	30.8	1489.2
			P-12E-108A	9.15	29.4	1518.6
			P-12E-125A	9.04	29.2	1547.8
			P-12E-132A	9.18	29.5	1577.3
		03/19/05	P-12E-137A	9.25	40.9	1618.2
			P-12E-144A	9.34	26.1	1644.3
			P-12F-20A	9.47	37.3	1681.6
	2A	03/20/05	P-12F-25A	9.09	34.8	1716.4
			P-12F-42A	9.53	26.6	1743.0
			P-12F-54A	9.39	30.0	1773.0
			P-12F-64A	9.16	44.8	1817.8
		03/21/05	P-12F-71A	9.27	33.9	1851.7
			P-12F-89A	9.32	39.9	1891.6
			P-12F-104A	9.36	36.4	1928.0
		03/22/05	P-12F-110A	9.19	36.7	1964.7
			P-12F-140A	9.06	33.3	1998.0
		03/23/05	P-12F-145A	9.16	41.4	2039.4
			P-12F-146A	9.26	33.8	2073.2

Table 4.22. Listing of Samples from HEME 1 Blow-Downs.

Waste Type	Test	Date	Name	pH	Blow-Down Vol. (gal)	Cumulative Blow-Down Vol. (gal)
HLW	1	11/17/04	1Z2-H1-116A	2.66	18.88	18.88
	2B	12/12/04	H1-12B-122A	2.33	51.8	70.68

Table 4.23. SBS Pre-Spike Levels.

Test	Substrate	Intended Spike Rate [g/min]	SBS Sump Temperature [°C]	Presumed Melter DRE [%]	Calculated pre-Spike Amount ¹	Actual pre-Spike Amount
HLW 1	Allyl Alcohol	40	50	90	1.64 l	1.7 l
	Naphthalene	1		30	2.9 g	3.0 g
HLW 2A	Allyl Alcohol	40	55	60	4.67 l	4.7 l
	Naphthalene	1		30	2.9 g	3.0 g
LAW 1	Allyl Alcohol	10	50	65	1.44 l	1.5 l
	Naphthalene	1		30	2.9 g	3.0 g
LAW 2A	Allyl Alcohol	10	50	65	1.44 l	1.5 l
	Naphthalene	1		30	2.9 g	3.0 g

1- Using average SBS pressure of 0.931 atm and flow of 217 scfm.

Table 4.24. SBS Spike and Equilibrium Data.

Test		Test HLW 1 Nov. 15-17 & Dec. 9-10, 2004	Test HLW 2A Dec. 6-9, 2004	Test LAW 1 Mar. 7-10, 2005	Test LAW 2A Mar. 20-23, 2005
Target Plenum Temperature ($\pm 5\%$), °C		400	300	400	300
SBS Outlet Temperature ($\pm 2\%$), °C		50	55	50	50
SBS Flow Rate ($\pm 7\%$), scfm		217	217	217	217
Allyl Alcohol (AAL)	pre-Spike	1.7 l AAL	4.7 l AAL	1.5 l AAL	3.0 g NPH in 1.5 l AAL
	[AAL] in SBS after pre-spike, mg/l	970	2680	850	850
	Spiking Solution	pure AAL	pure AAL	pure AAL	80 g NPH per 1.0 l AAL
	Spiking Rate as pure AAL, g/min	40.0	40.0	10.0	10.1
	[AAL] in SBS liq., mg/l (meas.)	2300	3200	1200	1200
	Average Melter AAL DRE, % (meas.)	70	40	85	81
	Expected [AAL] in SBS, mg/l (calc.)	2760	3930	350	440
Naphthalene (NPH)	pre-Spike	3.0 g NPH in 1 l MeOH	3.0 g NPH in 1 l MeOH	3.0 g NPH in 1 l MeOH	3.0 g NPH in 1 l MeOH
	[NPH] in SBS after pre-spike, mg/l	2.0	2.0	2.0	2.0
	Spiking Solution	60 g NPH per 1 l MeOH	60 g NPH per 1 l MeOH	60 g NPH per 1 l MeOH	60 g NPH per 1 l MeOH
	Spiking Rate as pure NPH, g/min	1.0	1.0	1.0	1.0
	[NPH] in SBS liq., mg/l (meas.)	1.3	1.5	1.4	1.2
	Average Melter NPH DRE, % (meas.)	37	4	29	14
	Expected [NPH] in SBS, mg/l (calc.) ¹	1.8	2.3	2.0	2.4

Table 4.25. Measured Concentrations of Dioxins, Furans and PCBs in SBS Sump Solutions.

	Test	HLW 2B	LAW 2B
	Sample Name	S-12B-76A	S-12E-123A
	Sample Date	12/11/04	03/18/05
Dioxin (pg/L)	2,3,7,8-TCDD	< 46	< 32
	1,2,3,7,8-PeCDD	160 Q, J	< 20
	1,2,3,4,7,8-HxCDD	220 J	< 28
	1,2,3,6,7,8-HxCDD	120 Q, J	< 24
	1,2,3,7,8,9-HxCDD	160 J	< 25
	1,2,3,4,6,7,8-HpCDD	470 J	48 Q, J
	OCDD	540 B, J	140 Q, B, J
Furan (pg/L)	2,3,7,8-TCDF	160 Q, J	< 27
	1,2,3,7,8-PeCDF	220 J	< 12
	2,3,4,7,8-PeCDF	33 B, J	< 11
	1,2,3,4,7,8-HxCDF	180 Q, B, J	< 12
	1,2,3,6,7,8-HxCDF	26 Q, J	< 12
	2,3,4,6,7,8-HxCDF	< 13	< 14
	1,2,3,7,8,9-HxCDF	< 18	< 17
	1,2,3,4,6,7,8-HpCDF	< 15	< 14
	1,2,3,4,7,8,9-HpCDF	< 21	< 19
	OCDF	59 Q, B, J	72 B, J
PCB (ng/L)	PCB 77 (BZ)	< 0.32	< 0.24
	PCB 81 (BZ)	< 0.34	< 0.25
	PCB 126 (BZ)	< 0.27	< 0.17
	PCB 105 (BZ)	< 0.24	< 0.16
	PCB 118 (BZ)	< 0.21	0.66 Q, B, J
	PCB 123 (BZ)	< 0.20	< 0.14
	PCB 114 (BZ)	< 0.19	< 0.14
	PCB 169 (BZ)	< 0.28	< 0.21
	PCB 156 (BZ)	< 0.25	< 0.23
	PCB 157 (BZ)	< 0.25	< 0.23
	PCB 167 (BZ)	< 0.21	< 0.19
	PCB 189 (BZ)	< 0.22	< 0.17

B – The analyte is present in the associated method or reagent blank at a reportable level

Q – Estimated maximum possible concentration, result is from data that does not meet qualitative criteria for a positive identification

J – The reported result is an estimate. The amount reported is below the Minimum Level (ML)

Table 5.1. List of Glass Discharged, Masses, and Analysis Performed.

Waste	Test	Date	Name	Analysis	Mass (kg)	Cumulative Mass (kg)
HLW	1	11/15/04	1Z2-G-37A	-	515.5	515.5
			1Z2-G-37B	-		
			1Z2-G-38A	-		
			1Z2-G-39A	-		
			1Z2-G-40A	-		
		11/16/04	1Z2-G-49A	-	521.0	1036.5
			1Z2-G-50A	-		
			1Z2-G-53A	-		
			1Z2-G-53B	-		
			1Z2-G-54A	XRF		
			1Z2-G-57A	-		
			1Z2-G-57B	-		
			1Z2-G-59A	-		
			1Z2-G-62A	-		
			1Z2-G-63A	-		
			1Z2-G-72A	-		
			1Z2-G-73A	-		
			1Z2-G-75A	-		
			1Z2-G-76A	-		
			1Z2-G-77A	XRF		
			1Z2-G-80A	-	522.5	1559.0
		11/17/04	1Z2-G-83A	-		
			1Z2-G-92A	-		
			1Z2-G-93A	-		
			1Z2-G-94A	-		
			1Z2-G-95A	-		
			1Z2-G-98A	-		
			1Z2-G-99A	-		
			1Z2-G-102A	XRF	273.5	1832.5
			1Z2-G-102B	-		
			1Z2-G-111A	-		
			1Z2-G-112A	-		
			1Z2-G-116A	XRF		
	2A	12/06/04	G-12A-10A	-	513.0	2345.5
			G-12A-10B	-		
			G-12A-14A	-		
			G-12A-15A	-		
		12/07/04	G-12A-17A	-		
			G-12A-26A	-		
			G-12A-27A	-		
			G-12A-28A	XRF, DCP		
			G-12A-47A	-		
			G-12A-48A	-		
			G-12A-49A	-		

"-" Empty data field

Table 5.1. List of Glass Discharged, Masses, and Analysis Performed (continued).

Waste	Test	Date	Name	Analysis	Mass (kg)	Cumulative Mass (kg)		
HLW	2A	12/07/04	G-12A-53A	-	529.0	2874.5		
			G-12A-54A	-				
			G-12A-56A	-				
		12/08/04	G-12A-67A	-			527.0	3401.5
			G-12A-69A	-				
			G-12A-72A	XRF, DCP				
			G-12A-76A	-				
			G-12A-92A	-				
			G-12A-93A	-				
			G-12A-97A	-				
			G-12A-98A	-				
			G-12A-99A	-				
			G-12A-100A	-				
			G-12A-92B	-				
		12/09/04	G-12A-104A	XRF	520.0	3921.5		
			G-12A-105A	-				
			G-12A-116A	-				
			G-12A-117A	-				
			G-12A-119A	-				
			G-12A-121A	-				
			G-12A-132A	-				
			G-12A-135A	-				
			G-12A-138A	-				
			G-12A-139A	-				
			G-12A-140A	XRF, DCP				
			G-12A-141A	-			516.5	4438.0
	G-12A-141B		-					
	G-12A-144A		-					
	G-12A-145A		-					
	12/10/04	G-12B-9A	-	519.0	4957.0			
		G-12B-11A	-					
		G-12B-12A	-					
		G-12B-14A	-					
		G-12B-15A	-					
		G-12B-16A	XRF					
		G-12B-16B	-					
G-12B-19A		-						
G-12B-20A		-						
G-12B-31A		-						
2B	G-12B-32A	-						
	G-12B-32B	-						
	G-12B-33A	-						
	G-12B-34A	-						
	G-12B-35A	-						
	G-12B-36A	XRF						

"-" Empty data field

Table 5.1. List of Glass Discharged, Masses, and Analysis Performed (continued).

Waste	Test	Date	Name	Analysis	Mass (kg)	Cumulative Mass (kg)
HLW	2B	12/10/04	G-12B-40A	-	527.0	5484.0
			G-12B-40B	-		
			G-12B-41A	-		
			G-12B-42A	-		
			G-12B-43A	-		
		12/11/04	G-12B-43B	-	510.0	5994.0
			G-12B-44A	-		
			G-12B-54A	-		
			G-12B-55A	-		
			G-12B-56A	XRF		
			G-12B-57A	-	528.0	6522.0
			G-12B-57B	-		
			G-12B-60A	-		
			G-12B-61A	-		
			G-12B-71A	-		
			G-12B-72A	-		
			G-12B-73A	XRF, DCP, Fe ²⁺	522.5	7044.5
			G-12B-75A	-		
			G-12B-76A	-		
			G-12B-76B	-		
			G-12B-77A	-		
			G-12B-78A	-	480.5	7525.0
			G-12B-78B	-		
			G-12B-80A	-		
			G-12B-81A	-		
			G-12B-82A	-		
			G-12B-82B	XRF	480.5	7525.0
		12/12/04	G-12B-85A	-		
			G-12B-85B	-		
			G-12B-86A	-		
			G-12B-87A	-		
			G-12B-87B	-		
			G-12B-90A	-		
			G-12B-91A	-		
			G-12B-93A	XRF		
			G-12B-93B	-		
			G-12B-111A	-		
			G-12B-112A	-		
			G-12B-114A	-		
			G-12B-115A	XRF, DCP, Fe ²⁺		

"-" Empty data field

Table 5.1. List of Glass Discharged, Masses, and Analysis Performed (continued).

Waste	Test	Date	Name	Analysis	Mass (kg)	Cumulative Mass (kg)
LAW	1	03/07/05	G-12D-84A	-	502.0	8027.0
			G-12D-85A	-		
			G-12D-86A	-		
			G-12D-87A	-		
			G-12D-87B	-		
			G-12D-88A	-		
			G-12D-88B	-		
			G-12D-90A	-		
			G-12D-90B	XRF		
		03/08/05	G-12D-91A	-	497.0	8524.0
			G-12D-92A	-		
			G-12D-92B	-		
			G-12D-92C	-		
			G-12D-93A	-		
			G-12D-94A	-		
			G-12D-95A	-		
			G-12D-97A	XRF		
			G-12D-110A	-	511.0	9035.0
			G-12D-120A	-		
			G-12D-121A	-		
			G-12D-122A	-		
			G-12D-123A	-		
			G-12D-124A	XRF		
			G-12D-125A	-	519.0	9554.0
			G-12D-125B	-		
			G-12D-126A	-		
			G-12D-126B	-		
			G-12D-127A	-		
			G-12D-129A	-		
			G-12D-129B	-		
			G-12D-130A	XRF		
			G-12D-131A	-	524.0	10078.0
		03/09/05	G-12D-132A	-		
			G-12D-142A	-		
			G-12D-143A	-		
			G-12D-144A	-		
			G-12D-146A	-	516.0	10594.0
			G-12D-148A	-		
			G-12D-152A	-		
			G-12D-153A	-		
			G-12D-154A	XRF, DCP, Fe ²⁺		
			G-12C-16A	-		
			G-12D-17A	-		

"-" Empty data field

Table 5.1. List of Glass Discharged, Masses, and Analysis Performed (continued).

Waste	Test	Date	Name	Analysis	Mass (kg)	Cumulative Mass (kg)
LAW	1	03/09/05	G-12E-18A	-	513.5	11107.5
			G-12E-18B	-		
			G-12E-19A	-		
			G-12E-18B	-		
			G-12E-20A	XRF		
			G-12E-30A	-		
		03/10/05	G-12E-30B	-	501.0	11608.5
			G-12E-31A	-		
			G-12E-33A	-		
			G-12E-34A	-		
			G-12E-34B	XRF		
			G-12E-35A	-	492.5	12101.0
			G-12E-36A	-		
			G-12E-37A	-		
			G-12E-44A	-		
			G-12E-46A	XRF, DCP, Fe ²⁺		
			G-12E-48A	-	197.5	12298.5
			G-12E-48B	XRF		
	2B	03/17/05	G-12E-83A	-	489.0	12787.5
			G-12E-84A	-		
			G-12E-85A	-		
			G-12E-85B	-		
			G-12E-86A	-		
			G-12E-87A	-		
			G-12E-87B	XRF		
			G-12E-88A	-	515.5	13303.0
			G-12E-90A	-		
			G-12E-99A	-		
		03/18/05	G-12E-100A	-	501.0	13804.0
			G-12E-101A	-		
			G-12E-102A	XRF		
			G-12E-102B	-		
			G-12E-103A	-		
			G-12E-104A	-		
			G-12E-104B	-	494.0	14298.0
			G-12E-106A	-		
			G-12E-106B	-		
			G-12E-107A	XRF		
			G-12E-108A	-		
			G-12E-118A	-		
			G-12E-119A	-		
			G-12E-120A	-		
			G-12E-122A	XRF		

"-" Empty data field

Table 5.1. List of Glass Discharged, Masses, and Analysis Performed (continued).

Waste	Test	Date	Name	Analysis	Mass (kg)	Cumulative Mass (kg)
LAW	2B	03/18/05	G-12E-123A	-	502.0	14800.0
			G-12E-123B	-		
			G-12E-125A	-		
			G-12E-126A	-		
			G-12E-126B	-		
			G-12E-127A	-		
			G-12E-127B	XRF		
			G-12E-129A	-	512.0	15312.0
			G-12E-129B	-		
			G-12E-131A	-		
			G-12E-132A	-		
			G-12E-133A	-		
		03/19/05	G-12E-133B	XRF	495.0	15807.0
			G-12E-134A	-		
			G-12E-135A	-		
			G-12E-135B	-		
			G-12E-136A	-		
			G-12E-136B	-		
			G-12E-137A	XRF	486.0	16293.0
			G-12E-138A	-		
			G-12E-141A	-		
			G-12E-142A	-		
			G-12E-143A	-		
			G-12E-144A	XRF	485.5	16778.5
			G-12E-145A	-		
			G-12E-147A	-		
			G-12F-15A	-		
			G-12F-15B	-		
			G-12F-16A	XRF	500.5	17279.0
			G-12F-19A	-		
			G-12F-19B	-		
			G-12F-20A	-		
			G-12F-21A	-		
			G-12F-22A	XRF	496.5	17775.5
			G-12F-22B	-		
			G-12F-23A	-		
		03/20/05	G-12F-23B	-		
			G-12F-25A	-		
			G-12F-27A	XRF	502.0	18277.5
			G-12F-37A	-		
			G-12F-39A	-		
			G-12F-39B	-		
			G-12F-40A	-		
	2A		G-12F-51A	XRF		

"-" Empty data field

Table 5.1. List of Glass Discharged, Masses, and Analysis Performed (continued).

Waste	Test	Date	Name	Analysis	Mass (kg)	Cumulative Mass (kg)
LAW	2A	03/20/05	G-12F-52A	-	526.0	18803.5
			G-12F-52B	-		
			G-12F-54A	-		
			G-12F-56A	-		
			G-12F-57A	-		
			G-12F-58A	-		
			G-12F-58B	XRF		
			G-12F-59A	-	506.5	19310.0
		03/21/05	G-12F-59B	-		
			G-12F-60A	-		
			G-12F-62A	-		
			G-12F-62B	-		
			G-12F-64A	XRF		
			G-12F-66A	-	521.0	19831.0
			G-12F-67A	-		
			G-12F-68A	-		
			G-12F-68B	-		
			G-12F-69A	-		
			G-12F-70A	-		
			G-12F-71A	-		
			G-12F-73A	XRF		
			G-12F-82A	-	496.5	20327.5
			G-12F-83A	-		
			G-12F-87A	-		
			G-12F-88A	-		
			G-12F-89A	-		
			G-12F-99A	-		
			G-12F-99B	XRF		
			G-12F-100A	-	518.0	20845.5
			G-12F-100B	-		
			G-12F-102A	-		
			G-12F-104A	-		
			G-12F-105A	-		
			G-12F-105B	XRF, DCP, Fe ²⁺		
		03/22/05	G-12F-107A	-	520.0	21365.5
			G-12F-108A	-		
			G-12F-108B	-		
			G-12F-109A	-		
			G-12F-109B	-		
			G-12F-109C	-		
			G-12F-110A	-		
			G-12F-113A	XRF		

"-" Empty data field

Table 5.1. List of Glass Discharged, Masses, and Analysis Performed (continued).

Waste	Test	Date	Name	Analysis	Mass (kg)	Cumulative Mass (kg)
LAW	2A	03/22/05	G-12F-114A	-	517.0	21882.5
			G-12F-126A	-		
			G-12F-135A	-		
			G-12F-135B	-		
			G-12F-136A	-		
			G-12F-137A	-		
			G-12F-137B	XRF		
			G-12F-138A	-	517.0	22399.5
			G-12F-140A	-		
			G-12F-141A	-		
			G-12F-141B	-		
			G-12F-143A	-		
			G-12F-144A	-		
		03/23/05	G-12F-144B	XRF, DCP, Fe ²⁺	324.0	22723.5
			G-12F-145A	-		
			G-12F-145B	-		
			G-12F-146A	XRF		

"-" Empty data field

Table 5.2. XRF Analyzed Compositions for Discharged Glass (wt%).

Waste	HLW										
Test#	-	1				2A			1-continued		2B
Glass (kg)	-	515.5	1036.5	1559.0	1832.5	2345.5	2874.5	3401.5	3921.5	4438.0	4957.0
Element	Target	1Z2-G-54A	1Z2-G-77A	1Z2-G-102A	1Z2-G-116A	G-12A-28A	G-12A-72A	G-12A-104A	G-12A-140A	G-12B-16A	G-12B-36A
Al ₂ O ₃	5.28	5.52	5.35	5.51	5.52	5.80	5.62	5.65	5.18	5.65	5.74
As ₂ O ₃	0.19	0.04	0.07	0.08	0.09	0.10	0.11	0.14	0.15	0.14	0.13
B ₂ O ₃ *	9.34	10.02	9.86	9.74	9.68	9.61	9.54	9.50	9.46	9.43	9.41
BaO	§	0.08	0.06	0.07	0.07	0.10	0.09	0.08	0.11	0.08	0.08
CaO	0.30	0.49	0.47	0.43	0.43	0.43	0.41	0.41	0.39	0.37	0.37
CdO	0.25	<0.01	0.10	0.13	0.15	0.19	0.22	0.23	0.25	0.24	0.25
Ce ₂ O ₃	&	0.07	0.05	0.04	0.04	0.03	0.02	0.01	<0.01	<0.01	<0.01
Cl	0.13	0.03	0.04	0.05	0.06	0.02	0.04	0.06	0.07	0.06	0.07
Cr ₂ O ₃	0.18	0.22	0.22	0.20	0.21	0.20	0.20	0.20	0.20	0.19	0.19
Cs ₂ O	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CuO	0.05	0.01	0.02	0.03	0.03	0.04	0.04	0.05	0.05	0.05	0.05
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	12.57	12.94	13.02	12.24	12.42	12.63	12.48	12.64	12.51	12.19	12.05
K ₂ O	§	0.17	0.14	0.14	0.15	0.12	0.12	<0.01	0.13	0.13	0.13
La ₂ O ₃	0.24	0.12	0.16	0.17	0.18	0.20	0.22	0.22	0.23	0.24	0.24
Li ₂ O*	2.99	2.74	2.80	2.85	2.87	2.90	2.92	2.94	2.95	2.96	2.97
MgO	1.17	0.34	0.55	0.69	0.70	0.76	0.93	0.93	1.03	1.02	1.08
MnO	3.99	3.07	3.37	3.38	3.48	3.66	3.71	3.86	3.89	3.83	3.82
Na ₂ O	11.78	12.20	12.29	12.53	11.72	12.40	12.62	12.31	12.34	12.12	12.12
Nd ₂ O ₃	0.15	0.03	0.07	0.08	0.09	0.10	0.12	0.13	0.13	0.14	0.14
NiO	0.17	0.32	0.29	0.24	0.24	0.22	0.20	0.20	0.19	0.18	0.17
P ₂ O ₅	0.09	0.50	0.42	0.36	0.35	0.30	0.26	0.23	0.21	0.20	0.18
PbO	0.30	0.39	0.38	0.33	0.33	0.33	0.31	0.30	0.29	0.27	0.26
Sb ₂ O ₃	0.26	0.06	0.10	0.13	0.15	0.19	0.22	0.24	0.26	0.25	0.28
SeO ₂	0.15	0.02	0.03	0.04	0.04	0.02	0.04	0.05	0.05	0.05	0.05
SiO ₂	46.84	47.81	47.06	47.55	47.92	46.49	46.25	46.21	46.47	46.84	46.88
SnO ₂	&	0.06	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	<0.01
SO ₃	0.15	0.18	0.19	0.19	0.20	0.12	0.16	0.18	0.18	0.19	0.19
SrO	0.92	0.31	0.45	0.50	0.55	0.62	0.68	0.73	0.77	0.74	0.76
TiO ₂	0.14	0.11	0.14	0.16	0.17	0.19	0.21	0.22	0.23	0.22	0.23
ZnO	2.06	1.11	1.33	1.36	1.43	1.54	1.63	1.74	1.76	1.72	1.72
ZrO ₂	0.26	1.04	0.91	0.74	0.72	0.69	0.60	0.56	0.52	0.45	0.44
Sum	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values based on simple well-stirred tank model

§ - Not a target constituent

& - Impurity from preceding test

NA – Not analyzed by XRF

"-" Empty data field

Table 5.2. XRF Analyzed Compositions for Discharged Glass (wt%) (continued).

Waste	HLW							
Test#	-	2B					-	
Glass (kg)	-	5484.0	5994.0	6522.0	7044.5	7525.0	5994-7525	
Element	Target	G-12B-56A	G-12B-73A	G-12B-82B	G-12B-93A	G-12B-115A	Avg.	%Dev
Al ₂ O ₃	5.28	5.24	5.87	5.36	5.44	5.82	5.62	6.42
As ₂ O ₃	0.19	0.16	0.14	0.15	0.16	0.15	0.15	NC
B ₂ O ₃ *	9.34	9.40	9.38	9.37	9.37	9.36	9.37	NC
BaO	§	0.09	0.08	0.08	0.06	<0.01	0.06	NC
CaO	0.30	0.38	0.37	0.37	0.37	0.36	0.37	NC
CdO	0.25	0.28	0.08	0.30	0.28	0.28	0.23	NC
Ce ₂ O ₃	&	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NC
Cl	0.13	0.07	0.06	0.06	0.06	0.08	0.07	NC
Cr ₂ O ₃	0.18	0.20	0.19	0.19	0.20	0.20	0.20	NC
Cs ₂ O	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NC
CuO	0.05	0.06	0.05	0.06	0.06	0.06	0.06	NC
F	0.04	NA	NA	NA	NA	NA	NA	NC
Fe ₂ O ₃	12.57	12.36	11.90	12.14	12.31	12.05	12.10	-3.78
K ₂ O	§	0.00	0.13	0.12	0.13	0.13	0.13	NC
La ₂ O ₃	0.24	0.25	0.24	0.25	0.26	0.25	0.25	NC
Li ₂ O*	2.99	2.97	2.98	2.98	2.98	2.99	2.98	NC
MgO	1.17	1.05	1.10	1.13	1.15	1.13	1.13	-3.14
MnO	3.99	3.99	3.84	3.99	4.04	3.96	3.96	-0.92
Na ₂ O	11.78	12.77	12.18	12.35	11.73	12.08	12.09	2.57
Nd ₂ O ₃	0.15	0.14	0.14	0.15	0.15	0.15	0.15	NC
NiO	0.17	0.17	0.16	0.16	0.16	0.16	0.16	NC
P ₂ O ₅	0.09	0.17	0.16	0.15	0.16	0.15	0.15	NC
PbO	0.30	0.27	0.26	0.26	0.27	0.26	0.26	NC
Sb ₂ O ₃	0.26	0.30	0.29	0.30	0.30	0.30	0.30	NC
SeO ₂	0.15	0.04	0.04	0.04	0.04	0.04	0.04	NC
SiO ₂	46.84	46.18	46.95	46.61	46.79	46.59	46.74	-0.22
SnO ₂	&	0.01	0.01	<0.01	0.01	<0.01	<0.01	NC
SO ₃	0.15	0.18	0.20	0.19	0.19	0.19	0.19	NC
SrO	0.92	0.81	0.78	0.81	0.84	0.82	0.81	NC
TiO ₂	0.14	0.24	0.23	0.23	0.24	0.24	0.24	NC
ZnO	2.06	1.82	1.75	1.82	1.87	1.85	1.82	-11.75
ZrO ₂	0.26	0.43	0.39	0.39	0.38	0.37	0.38	NC
Sum	100.00	100.00	100.00	100.00	100.00	100.00	100.00	NC

* Target values based on simple well-stirred tank model

§ - Not a target constituent

& - Impurity from preceding test

NA – Not analyzed by XRF

NC – Not calculated

"-" Empty data field

Table 5.2. XRF Analyzed Compositions for Discharged Glass (wt%) (continued).

Waste	LAW										
Test#	-	1									
Glass (kg)	-	8027.0	8524.0	9035.0	9554.0	10078.0	10594.0	11107.5	11608.5	12101.0	12298.5
Element	Target	G-12D-91A	G-12D-97A	G-12D-124A	G-12D-130A	G-12D-144A	G-12D-154A	G-12E-20A	G-12E-34B	G-12E-46A	G-12E-48B
Al ₂ O ₃	5.68	5.57	5.50	5.51	5.40	5.35	5.38	5.60	5.29	5.25	5.30
As ₂ O ₃	§	0.01	0.01	<0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01
B ₂ O ₃ *	9.89	10.38	10.26	10.18	10.11	10.06	10.02	9.99	9.96	9.95	9.94
BaO	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	0.00
CaO	2.00	1.75	1.84	1.85	1.85	1.86	1.90	1.83	1.90	1.87	1.87
CdO	0.14	0.23	0.22	0.23	0.19	0.22	0.23	0.20	0.21	0.23	0.22
Ce ₂ O ₃	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cl	0.38	0.23	0.25	0.29	0.32	0.36	0.41	0.42	0.45	0.45	0.46
Cr ₂ O ₃	0.40	0.66	0.71	0.71	0.71	0.73	0.76	0.73	0.76	0.74	0.75
Cs ₂ O	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CuO	0.01	0.01	0.01	<0.01	<0.01	0.01	0.01	<0.01	0.01	0.01	<0.01
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	5.58	5.75	6.04	5.95	5.90	5.90	5.98	5.64	5.84	5.68	5.71
K ₂ O	3.01	2.70	2.81	2.87	2.88	2.93	3.00	2.96	3.03	2.97	2.98
La ₂ O ₃	§	0.03	0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.02	<0.01
Li ₂ O*	<0.01	0.20	0.16	0.12	0.09	0.07	0.05	0.04	0.03	0.03	0.02
MgO	1.49	1.50	1.48	1.45	1.52	1.46	1.44	1.52	1.53	1.55	1.43
MnO	§	0.26	0.24	0.20	0.16	0.13	0.12	0.10	0.09	0.07	0.07
Na ₂ O	18.46	18.16	18.12	18.04	18.59	18.44	17.82	18.88	18.17	18.92	18.91
Nd ₂ O ₃	§	<0.01	0.01	0.01	0.01	<0.01	<0.01	0.01	0.01	<0.01	<0.01
NiO	§	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
P ₂ O ₅	0.14	0.21	0.20	0.21	0.21	0.20	0.21	0.20	0.22	0.21	0.21
PbO	<0.01	0.02	0.02	0.01	0.01	<0.01	<0.01	0.01	<0.01	0.01	0.01
Sb ₂ O ₃	§	0.02	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SeO ₂	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.02	0.02
SiO ₂	44.41	44.52	43.75	43.91	43.68	43.68	43.97	43.63	43.98	43.47	43.59
SnO ₂	§	<0.01	0.01	0.00	0.01	<0.01	<0.01	0.01	<0.01	0.01	<0.01
SO ₃	0.35	0.30	0.31	0.32	0.33	0.33	0.34	0.32	0.33	0.32	0.31
SrO	§	0.05	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01
TiO ₂	2.01	1.98	2.10	2.11	2.11	2.16	2.17	2.13	2.17	2.16	2.16
ZnO	2.98	2.61	2.84	2.84	2.82	2.87	2.91	2.79	2.87	2.82	2.83
ZrO ₂	3.01	2.85	3.03	3.14	3.00	3.19	3.24	2.98	3.12	3.21	3.17
Sum	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values based on simple well-stirred tank model

§ - Not a target constituent

NA – Not analyzed by XRF

"-" Empty data field

Table 5.2. XRF Analyzed Compositions for Discharged Glass (wt%) (continued).

Waste	LAW											
Test#	-	2B										
Glass (kg)	-	12787.5	13303.0	13804.0	14298.0	14800.0	15312.0	15807.0	16293.0	16778.5	17279.0	17775.5
Element	Target	G-12E-87B	G-12E-102A	G-12E-107A	G-12E-122A	G-12E-127B	G-12E-133B	G-12E-137A	G-12E-144A	G-12F-16A	G-12F-22A	G-12F-27A
Al ₂ O ₃	5.68	5.65	5.54	5.45	5.39	5.38	5.50	5.34	5.36	5.40	5.43	5.35
As ₂ O ₃	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
B ₂ O ₃ *	9.89	9.93	9.92	9.91	9.91	9.90	9.90	9.90	9.89	9.89	9.89	9.89
BaO	§	0.08	0.08	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08
CaO	2.00	1.78	1.74	1.74	1.79	1.81	1.80	1.80	1.79	1.83	1.74	1.79
CdO	0.14	0.19	0.18	0.20	0.18	0.17	0.16	0.16	0.18	0.16	0.20	0.20
Ce ₂ O ₃	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cl	0.38§	0.42	0.60	0.73	0.81	0.93	0.98	0.96	0.99	1.00	0.99	1.03
Cr ₂ O ₃	0.40	0.65	0.66	0.68	0.71	0.71	0.68	0.67	0.65	0.68	0.62	0.69
Cs ₂ O	§	0.01	0.01	0.01	0.01	<0.01	0.01	0.01	0.01	0.01	0.01	0.01
CuO	0.01	0.01	<0.01	0.01	0.01	0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01
F	0.04§	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fe ₂ O ₃	5.58	5.14	5.01	5.07	5.29	5.20	5.15	5.12	5.18	5.45	4.92	5.11
K ₂ O	3.01	2.81	2.78	2.81	2.87	2.89	2.90	2.86	2.85	2.93	2.82	2.90
La ₂ O ₃	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Li ₂ O*	<0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01
MgO	1.49	1.46	1.56	1.44	1.39	1.52	1.56	1.48	1.52	1.37	1.52	1.46
MnO	§	0.08	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03
Na ₂ O	18.46	19.00	20.01	19.90	19.74	19.62	18.84	19.76	19.74	19.27	20.45	19.76
Nd ₂ O ₃	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
NiO	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
P ₂ O ₅	0.14	0.21	0.21	0.22	0.21	0.22	0.22	0.21	0.21	0.20	0.21	0.21
PbO	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sb ₂ O ₃	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SeO ₂	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	<0.01	0.01	0.01	0.01
SiO ₂	44.41	45.03	44.21	44.22	43.68	43.80	44.53	43.88	43.74	43.60	43.74	43.70
SnO ₂	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SO ₃	0.35	0.30	0.31	0.32	0.32	0.34	0.36	0.32	0.31	0.31	0.30	0.35
SrO	§	0.01	0.01	0.01	<0.01	0.01	0.01	<0.01	0.01	0.01	0.01	0.01
TiO ₂	2.01	2.00	1.96	1.98	2.06	2.06	2.02	2.05	2.03	2.10	1.97	2.04
ZnO	2.98	2.50	2.44	2.50	2.63	2.54	2.54	2.54	2.56	2.68	2.45	2.58
ZrO ₂	3.01	2.71	2.67	2.65	2.86	2.77	2.69	2.81	2.84	2.97	2.62	2.76
Sum	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Target values based on simple well-stirred tank model

§ - Not a target constituent

NA – Not analyzed by XRF

"-" Empty data field

§ Cl and F were spiked to 1.2 wt% and 0.42 wt%, respectively, in LAW Test 2B.

Table 5.2. XRF Analyzed Compositions for Discharged Glass (wt%) (continued).

Waste	LAW												
Test#	-	2A										Whole Test	
Glass (kg)	-	18277.5	18803.5	19310.0	19831.0	20327.5	20845.5	21365.5	21882.5	22399.5	22723.5	8027-22724	
Element	Target	G-12F-51A	G-12F-58B	G-12F-64A	G-12F-73A	G-12F-99B	G-12F-105B	G-12F-113A	G-12F-137B	G-12F-144B	G-12F-146A	Average	%Dev
Al ₂ O ₃	5.68	5.39	5.34	5.44	5.59	5.73	5.84	5.54	5.67	5.51	5.50	5.47	-3.69
As ₂ O ₃	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NC
B ₂ O ₃ *	9.89	9.89	9.89	9.89	9.89	9.89	9.89	9.89	9.89	9.89	9.89	9.96	0.70
BaO	§	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.08	0.09	0.06	NC
CaO	2.00	1.82	1.86	1.80	1.79	1.80	1.84	1.61	1.82	1.82	1.83	1.81	-9.79
CdO	0.14	0.19	0.18	0.17	0.16	0.17	0.18	0.17	0.17	0.18	0.19	0.19	NC
Ce ₂ O ₃	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NC
Cl	0.38	0.96	0.90	0.84	0.76	0.70	0.67	0.57	0.56	0.53	0.53	0.65	NC
Cr ₂ O ₃	0.40	0.64	0.65	0.63	0.65	0.64	0.67	0.59	0.68	0.67	0.68	0.68	NC
Cs ₂ O	§	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.01	0.01	0.01	NC
CuO	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NC
F	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	NC
Fe ₂ O ₃	5.58	5.17	5.69	5.27	5.27	5.33	5.50	4.66	5.46	5.49	5.42	5.43	-2.71
K ₂ O	3.01	2.91	2.97	2.92	2.90	2.92	3.01	2.69	3.00	3.01	3.02	2.90	-3.78
La ₂ O ₃	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NC
Li ₂ O*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	NC
MgO	1.49	1.52	1.39	1.46	1.56	1.51	1.47	1.67	1.51	1.58	1.57	1.50	0.65
MnO	§	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.07	NC
Na ₂ O	18.46	19.87	18.64	19.17	19.56	19.14	18.26	22.61	18.99	18.62	18.85	19.16	3.76
Nd ₂ O ₃	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NC
NiO	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NC
P ₂ O ₅	0.14	0.21	0.21	0.20	0.20	0.21	0.20	0.20	0.20	0.21	0.21	0.21	NC
PbO	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NC
Sb ₂ O ₃	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NC
SeO ₂	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.01	NC
SiO ₂	44.41	43.62	43.97	44.15	43.51	43.72	43.90	42.71	43.65	44.33	44.04	43.87	-1.22
SnO ₂	§	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NC
SO ₃	0.35	0.31	0.29	0.29	0.30	0.30	0.31	0.29	0.31	0.33	0.33	0.32	NC
SrO	§	<0.01	<0.01	0.01	<0.01	<0.01	0.01	0.01	0.01	0.01	0.01	0.01	NC
TiO ₂	2.01	2.07	2.13	2.07	2.03	2.06	2.12	1.83	2.07	2.06	2.06	2.07	2.88
ZnO	2.98	2.58	2.75	2.63	2.66	2.65	2.77	2.28	2.72	2.66	2.70	2.66	-10.48
ZrO ₂	3.01	2.71	3.02	2.92	3.02	3.04	3.19	2.56	3.14	2.96	3.05	2.93	-2.69
Sum	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	NC

* Target values based on simple well-stirred tank model

§ - Not a target constituent

NA – Not analyzed by XRF

NC – Not calculated

"-" Empty data field

Table 5.3. DCP and XRF Analyzed Compositions for Select Discharged Glass Samples (wt%).

Waste	HLW										
Glass (kg)	-	2345.5		2874		3921.5		5994		75252	
Element	Target	G-12A-28A		G-12A-72A		G-12A-140A		G-12B-73A		G-12B-115A	
		XRF	DCP	XRF	DCP	XRF	DCP	XRF	DCP	XRF	DCP
Al ₂ O ₃	5.28	5.80	5.18	5.62	4.91	5.18	4.82	5.87	5.17	5.82	5.12
As ₂ O ₃	0.19	0.10	0.08	0.11	0.10	0.15	0.14	0.14	0.08	0.15	0.12
B ₂ O ₃ *	9.34	9.61	10.01	9.54	9.97	9.46	10.06	9.38	9.71	9.36	9.38
CaO	0.30	0.43	0.47	0.41	0.44	0.39	0.41	0.37	0.41	0.36	0.35
CdO	0.25	0.19	0.15	0.22	0.16	0.25	0.18	0.08	0.21	0.28	0.20
Cr ₂ O ₃	0.18	0.20	0.19	0.20	0.18	0.20	0.18	0.19	0.19	0.20	0.18
CuO	0.05	0.04	0.03	0.04	0.04	0.05	0.04	0.05	0.05	0.06	0.05
Fe ₂ O ₃	12.57	12.63	11.85	12.48	11.66	12.51	11.44	11.90	11.20	12.05	11.88
Li ₂ O*	2.99	2.90	3.02	2.92	2.93	2.95	2.95	2.98	3.04	2.99	2.67
MgO	1.17	0.76	0.95	0.93	1.03	1.03	1.10	1.10	1.26	1.13	1.25
MnO	3.99	3.66	3.21	3.71	3.20	3.89	3.33	3.84	3.54	3.96	3.47
Na ₂ O	11.78	12.40	9.80	12.62	9.92	12.34	9.67	12.18	9.65	12.08	10.26
NiO	0.17	0.22	0.25	0.20	0.23	0.19	0.20	0.16	0.19	0.16	0.19
PbO	0.30	0.33	0.46	0.31	0.42	0.29	0.39	0.26	0.37	0.26	0.29
Sb ₂ O ₃	0.26	0.19	0.18	0.22	0.21	0.26	0.20	0.29	0.26	0.30	0.22
SeO ₂	0.15	0.02	0.03	0.04	0.05	0.05	0.09	0.04	0.07	0.04	0.09
SiO ₂	46.84	46.49	46.98	46.25	46.25	46.47	45.32	46.95	44.98	46.59	45.12
SrO	0.92	0.62	0.74	0.68	0.80	0.77	0.87	0.78	0.98	0.82	0.92
TiO ₂	0.14	0.19	0.21	0.21	0.23	0.23	0.23	0.23	0.26	0.24	0.25
ZnO	2.06	1.54	1.51	1.63	1.57	1.76	1.65	1.75	1.79	1.85	1.82
ZrO ₂	0.26	0.69	0.71	0.60	0.61	0.52	0.50	0.39	0.43	0.37	0.37
Sum	99.19	99.01	96.01	98.94	94.91	98.94	93.77	98.93	93.84	99.07	94.20

*Target values calculated using simple well-stirred tank model were used for XRF analyses

"-" Empty data field

**Table 5.3. DCP and XRF Analyzed Compositions for Select Discharged Glass Samples (wt%)
(continued).**

Waste	LAW									
Glass (kg)	-	10594			12101		20845.5		22399.5	
Element	Target	G-12D-154A			G-12E-46A		G-12F-105B		G-12F-144B	
		XRF	DCP	DCP	XRF	DCP	XRF	DCP	XRF	DCP
Al ₂ O ₃	5.68	5.39	5.44	5.42	5.26	5.33	5.84	5.54	5.51	5.43
As ₂ O ₃	§	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
B ₂ O ₃ *	9.89	9.88	9.93	9.84	9.89	9.98	9.89	10.06	9.89	10.08
BaO	§	<0.01	0.01	0.01	0.04	0.01	0.09	0.01	0.08	0.08
CaO	2.00	1.90	1.74	1.73	1.87	1.75	1.84	1.73	1.82	<0.01
CdO	0.14	0.23	0.17	0.17	0.23	0.17	0.18	0.15	0.19	0.15
Cr ₂ O ₃	0.40	0.76	0.64	0.65	0.74	0.67	0.67	0.59	0.67	0.60
CuO	0.01	0.01	0.01	0.01	0.01	0.01	<0.01	0.01	<0.01	<0.01
Fe ₂ O ₃	5.58	5.99	5.35	5.30	5.68	5.31	5.50	5.21	5.49	5.23
K ₂ O	3.01	3.00	2.79	2.76	2.98	2.87	3.01	2.89	3.01	2.87
Li ₂ O*	<0.01	0.03	0.09	0.09	0.01	0.06	<0.01	0.02	<0.01	0.02
MgO	1.49	1.44	1.64	1.66	1.56	1.66	1.47	1.69	1.58	1.67
MnO	§	0.12	0.11	0.11	0.07	0.08	0.03	0.03	0.03	0.03
Na ₂ O	18.46	17.85	16.59	16.75	18.93	17.00	18.26	17.03	18.62	16.82
NiO	§	<0.01	0.04	0.03	<0.01	0.03	<0.01	0.03	<0.01	0.04
PbO	<0.01	<0.01	0.02	0.02	0.01	0.02	<0.01	0.02	<0.01	0.02
Sb ₂ O ₃	§	<0.01	0.04	0.03	<0.01	0.03	<0.01	0.02	<0.01	0.02
SeO ₂	0.02	0.02	0.08	0.07	0.02	0.04	0.02	0.08	0.02	0.06
SiO ₂	44.41	44.05	43.76	43.64	43.50	43.38	43.90	43.65	44.33	43.28
SrO	§	0.02	0.02	0.02	0.01	0.01	0.01	<0.01	0.01	<0.01
TiO ₂	2.01	2.17	1.96	1.95	2.16	1.98	2.12	1.97	2.06	1.97
ZnO	2.98	2.92	2.73	2.72	2.82	2.70	2.77	2.71	2.66	2.70
ZrO ₂	3.01	3.24	2.78	2.75	3.21	2.78	3.19	2.78	2.96	2.79
Sum	99.09	99.03	95.94	95.73	99.00	95.87	98.78	96.22	98.91	93.86

*Target values calculated using simple well-stirred tank model were used for XRF analyses

"-" Empty data field

Table 5.4. Measured Iron Oxidation State of Discharged Glasses.

Waste Type	Test	Date	Time	Sample I.D.	%Fe ²⁺ /Total Fe
HLW	2	12/11/04	13:10	G-12B-73A	<0.3
		12/12/04	17:10	G-12B-115A	<0.3
LAW	1	03/09/05	12:10	G-12D-154A	<0.8
		03/10/05	10:21	G-12-E-46A	<0.8
	2A	03/21/05	23:15	G-12F-105B	<0.8
		03/23/05	00:31	G-12F-144B	<0.8

Table 6.1. HLW Testing Summary.

Test	Location	Sample Type	Date	Time
1	Melter	Ally Alcohol M308 (Modified 40 CFR 63 Appendix A – Method 308)	11/15/04	2100 - 2240
			11/16/04	1212 - 1242
				1359 - 1429
				1543 - 1613
	HEPA		11/16/04	1207 - 1307
				1356 - 1546
				1541 - 1641
	TCO		11/16/04	1210 - 1350
				1354 - 1534
				1539 - 1719
Melter	Semi Volatile Organic Carbon (SW-846 Methods 0010, 8270)	11/17/04	1243 - 1543	
HEPA		11/17/04	1243-1543	
TCO		11/17/04	1240 - 1540	
2A	Melter	Ally Alcohol (Modified 40 CFR 63 Appendix A – Method 308)	12/06/04	1730 - 1912
			12/07/04	1158 – 1248
				1358 – 1448
				1558 – 1648
	HEPA		12/07/04	1158 – 1248
				1402 – 1452
				1600 – 1650
	Carbon Bed		12/08/04	1156 – 1336
				1358 – 1538
				1558 - 1738
TCO	12/07/04	1200 – 1340		
		1400 – 1540		
		1559 - 1739		

Table 6.1. HLW Testing Summary (continued).

Test	Location	Sample Type	Date	Time
2A	Melter	Dioxin/ Furan/PCB (SW-846 Method 0023A, 8290 + EPA Office of Water Method 1668A) Dioxin/ Furan/ PCB	12/07/04 – 12/08/04	2235 – 0035
2B			12/08/04	0200-0400
			12/10/04	1343-1543
			12/10/04	1723-1923
2A	TCO		12/07/04	1943-2143
2B			12/07/04 – 12/08/04	2230 - 0030
			12/08/04	0204-0404
			12/10/04	1100-1300
			12/10/04	1349-1549
			12/10/04	1715-1915
2A	Melter	Volatile Organic Carbon (SW-846 Methods 0031, 8260)	12/09/04	0350-0513
2B				0539-0709
				0737-0857
			12/10/04 - 12/11/04	2153-2307
				2337-0050
				0128-0247
2A	TCO	Total Organic Emissions (SW-846 Methods 0010, 0040)	12/9/04	1100-1322
2B	TCO	Volatile Organic Carbon (SW-846 Methods 0031, 8260)	12/09/04	0345-1515
				0543-0710
				0737-0910
			12/10 - 12/11/04	2130-2252
				2311-0030
0045-0205				

Table 6.1. HLW Testing Summary (continued)

Test	Location	Sample Type	Date	Time
2A	Melter	Halides and Particulate Matter (40 CFR 60 Method 5, 26)	12/10/04	0521-0621
1 Continued				0700-0800
				0836-0926
			12/11/04	0330-0445
0526-0626				
0714-0814				
2A	TCO		12/10/04	0526-0626
1 Continued				0703-0803
				0839-0939
			12/11/04	0333-0433
0525-0625				
0713-0813				
2A	Melter	Metals (SW-846 Method 0060, 6010B)	12/09/04	2227 – 2327
1 Continued			12/10/04	0020-0120
			12/10/04	0210-0310
			12/11/04	0901-1001
			12/11/04	1051-1151
			12/11/04	1234-1334
	2A		TCO	12/09/04
1 Continued	12/10/04			0021-0121
	12/11/04			0212-0312
				0857-0957
				1053-1153
				1235-1335
			1359-1459	

Table 6.1. HLW Testing Summary (continued)

Test	Location	Sample Type	Date	Time
2A	Melter	Semi Volatile Organic Carbon (SW-846 Methods 0010, 8270)	12/08/04	1118-1218
				1501-1601
				1844-1944
1 Continued			12/09/04	1430-1530
				1751-1851
2A	TCO		12/08/04	1111-1411
				1455-1755
				1843-2130
1 Continued			12/09/04	1428-1728
				1747-2047
2A	HEPA		12/08/04	1113-1313
				1457-1657
				1846-2046
1 Continued			12/09/04	1430-1630
				1750-1950
2A	Carbon Bed		12/08/04	1115-1415
				1455-1755
				1844-2130

Table 6.2. LAW Testing Summary.

Test	Location	Sample Type	Date	Time
1	Melter	Ally Alcohol (Modified 40 CFR 63 Appendix A – Method 308)	3/8/05	1053-1141
				1243-1332
				1451-1523
	HEPA			1056-1146
				1245-1335
				1454-1525
	TCO		3/9/05	0803-0853
			3/7/05	1852-2032
			3/8/05	1030-1210
				1222-1302
				1419-1559
			Carbon Bed	3/8/05
	1220-1400			
	1440-1532			
	3/9/05			0802-0852
	Melter	Metals (SW-846 Method 0060, 6010B)	3/08/05	1821-1921
				2112-2212
	3/08/05 – 3/09/05		2333-0033	
	TCO		3/08/05	1819-1919
				2130-2230
			3/08/05 – 3/09/05	2336-0136
	Melter	Halides and Particulate Matter (40 CFR 60 Method 5, 26)	3/09/05	0144-0244
				0351-0451
				0547-0647
	TCO			0147-0247
				0353-0453
				0549-0649
	Melter	Semi Volatile Organic Carbon (SW-846 Methods 0010, 8270)	3/09/05	1130-1230
				1524-1624
				1902-2002
	HEPA			1133-1233
				1523-1623
				1903-2003

Table 6.2. LAW Testing Summary (continued).

Test	Location	Sample Type	Date	Time
1	TCO	Semi Volatile Organic Carbon (SW-846 Methods 0010, 8270)	3/09/05	1030-1330
				1417-1717
				1803-2103
	Carbon Bed			1031-1331
				1420-1720
				1805-2105
2B	Melter	Ally Alcohol (Modified 40 CFR 63 Appendix A – Method 308)	3/17/05	1740 - 1850
2A			3/21/05	1442 - 1532
				1633 - 1723
				1834 - 1924
				1409 - 1549
				1601 - 1742
				1807 - 1947
				1446 - 1636
				1638 - 1728
				1837 - 1927
				1445 - 1635
				1636 - 1716
				1836 - 1916
2B	Melter	Metals (SW-846 Method 0060, 6010B)	3/18/05	1328 - 1428
				1526 - 1626
				1811 - 1911
	TCO			1327 - 1427
				1523 - 1723
				1803 - 2003

Table 6.2. LAW Testing Summary (continued).

Test	Location	Sample Type	Date	Time
2B	Melter	Dioxin/ Furan/ PCB (SW-846 Method 0023A, 8290 + EPA Office of Water Method 1668A)	3/18/05	0930 - 1050
			3/19/05	0856 - 1016
2A			3/21-22/05	2310 - 0120
2B	TCO		3/18/05	0930 - 1130
			3/19/05	0900 - 1100
			3/19/05	1135 - 1335
2A			3/21/05 – 3/22/05	2322 - 0122
			3/22/05	0220 - 0420
	Melter	Halides and Particulate Matter (40 CFR 60 Method 5, 26)	3/19/05	1430 - 1530
				1647 - 1747
	TCO			1908 - 2008
				1402 - 1602
				1621 - 1821
				1846 - 2046
	Melter	Volatile Organic Carbon (SW-846 Methods 0031, 8260)	3/19/05 -3/20/05	2355 - 0104
			3/20/05	0206 - 0308
				0408 - 0509
				2051 - 2152
				1041 - 1138
2A			3/21/05	0046 - 0153
2B	TCO		3/20/05	0011 - 0200
				0220 - 0337
				0352 - 0537
				2046 - 2234
2A		3/20/05 – 3/21/05	2248 - 0006	
		3/21/05	0018 - 0204	

Table 6.2. LAW Testing Summary (continued).

Test	Location	Sample Type	Date	Time
2A	Melter	Semi Volatile Organic Carbon /Dioxin/ Furan (SW-846 Methods 0010, 8270, 8290)	3/22/05	1801 - 1901
	TCO			1648 - 1948
	Melter	Semi Volatile Organic Carbon (SW-846 Methods 0010, 8270)	3/22/05	1054 - 1154
	TCO			1410 - 1510
				0941 - 1241
				1309 - 1609
	TCO	Total Organic Emissions (SW-846 Methods 0010, 0040)	3/21/05	1101 - 1301
	HEPA	Semi Volatile Organic Carbon (SW-846 Methods 0010, 8270)	3/22/05	1056 - 1156
				1413 - 1513
	Carbon Bed			1753 - 1853
				1012 - 1212
				1337 - 1537
				1720 - 1920

**Table 6.3. Summary of Measured Particulate Matter Emissions Results.
(Regulatory Data)**

Test	Location	Sampling Interval	Weight Gain (mg)	Concentration mg/dscf	Emission Rate mg/min	Moisture %
HLW 1	Melter Outlet	12/10/04 0521 - 0621	245.5	12.21	1854	32.6
		12/10/04 0700 – 0800	235.7	10.73	1651	27.6
		12/10/04 0836 – 0926	226.9	14.82	1952	39.1
	Catalyst Outlet	12/10/04 0526 – 0626	1.1	0.03	4.6	10.5
		12/10/04 0703 – 0803	0.7	0.02	2.87	10.1
		12/10/04 0839 – 0939	< 0.1	< 0.01	NC	9.9
HLW 2B	Melter Outlet	12/11/04 0330 – 0445	773.4	30.92	4778	36.4
		12/11/04 0526 – 0626	608.8	23.47	3681	37.0
		12/11/04 0714 – 0814	581.8	23.62	3646	36.7
	Catalyst Outlet	12/11/04 0333 – 0433	< 0.1	< 0.01	NC	13.1
		12/11/04 0525 – 0625	1.2	0.03	4.98	13.2
		12/11/04 0713 – 0813	0.1	< 0.01	0.41	13.1
LAW 1	Melter Outlet	03/09/05 0144 - 0244	476.2	11.35	2197	19.0
		03/09/05 0351 – 0451	533.1	13.62	2483	19.6
		03/09/05 0547 - 0647	565.4	12.61	2581	17.9
	Catalyst Outlet	03/09/05 0147 – 0247	1.7	0.04	9.3	10.2
		03/09/05 0353 – 0453	2.9	0.07	15.8	10.9
		03/09/05 0549 - 0649	1.6	0.03	8.7	11.0
LAW 2B	Melter Outlet	03/19/05 1430 – 1530	1762.5	57.3	9526	25.2
		03/19/05 1647 – 1747	1703.3	54.2	9077	25.4
		03/19/05 1908 – 2008	1593.3	51.5	8496	24.6
	Catalyst Outlet	03/19/05 1402 – 1602	1.2	0.01	3.35	9.7
		03/19/05 1621 – 1821	0.6	0.01	1.66	10.7
		03/19/05 1846 - 2046	0.6	0.01	1.65	10.7

**Table 6.4. Measured Particulate Sizes in Catalyst Exhaust Determined by CARB Method 501.
(Regulatory Data)**

Test	Sampling Interval	Particle Size (μ)	Net Gain (mg)	Concentration (μg/dscf)	Emissions Rate (μg/min)	Mass Fraction %
HLW 1	11/15/04 2249 – 11/16/04 1025 , 11/16/04 2204 – 11/17/04 1004	> 10	< 0.01	< 0.1	< 0.1	< 3.5
		1 – 10	< 0.01	< 0.1	< 0.1	< 3.5
		< 1	0.31	0.29	58.7	100
HLW 2B	12/11/04 1533 – 12/12/04 1440	> 10	1.23	1.47	286	64.7
		1 – 10	0.03	0.04	6.98	1.58
		< 1	0.64	0.76	149	33.7
LAW 1	03/08/05 2056 – 03/10/05 1050	> 10	0.14	0.267	62.9	27
		1 – 10	0.20	0.381	89.8	38
		< 1	0.18	0.343	80.8	35
LAW 2B	03/17/05 2027 – 03/19/05 0819	> 10	0.07	0.122	28	9
		1 – 10	0.31	0.539	124	41
		< 1	0.37	0.644	148	49

"-" Empty data field

**Table 6.5. Gaseous Halide Emission Rates Determined by Method 26.
(Regulatory Data)**

Test	Location	HCl		HF		Cl ₂		F ₂	
		Conc. µg/dscf	Emission mg/min	Conc. µg/dscf	Emission mg/min	Conc. µg/dscf	Emission mg/min	Conc. µg/dscf	Emission mg/min
HLW 1-continued	Melter Outlet	834	126.5	522	79.20	8.31	1.261	< 32.5	< 4.939
		557	85.67	395	60.84	11.7	1.807	< 27.1	< 4.174
		832	109.7	468	61.60	< 7.6	< 0.998	< 50.3	< 6.624
	Catalyst Outlet	48.0	8.778	< 20.0	< 3.658	4.49	0.820	< 13.3	< 2.428
		56.1	10.44	< 17.8	< 3.321	< 4.03	< 0.750	< 13.4	< 2.498
		43.9	8.180	< 15.0	< 2.793	19.7	3.67	< 13.8	< 2.568
HLW 2B	Melter Outlet	1632	252.1	935	144.4	44.4	6.858	< 101	< 15.57
		1874	294.0	1011	158.5	< 6.71	< 1.052	< 112	< 17.53
		1477	228.1	1094	168.9	< 7.51	< 1.159	< 125	< 19.30
	Catalyst Outlet	66.2	12.73	< 49.1	< 9.431	< 3.49	< 0.672	< 58.2	< 11.12
		65.1	12.47	< 45.6	< 8.746	< 3.77	< 0.723	< 62.8	< 12.04
		66.4	12.60	< 47.0	< 8.919	< 3.73	< 0.709	< 62.2	< 11.81
LAW 1	Melter Outlet	< 3.7	< 0.7	46	8.9	< 22	< 4.2	< 72	< 14
		< 4.0	< 0.7	56	10.2	< 25	< 4.6	< 84	< 15
		< 3.5	< 0.7	44	9.0	< 23	< 4.7	< 77	< 16
	Catalyst Outlet	46.1	11.7	< 29	< 7.2	< 43	< 11	< 72	< 18
		55.2	12.9	< 32	< 7.5	< 41	< 9.6	< 69	< 16
		45.8	11.5	< 32	< 8.0	< 42	< 11	< 70	< 18
LAW 2B	Melter Outlet	279	46.3	462	77	< 62	< 10	< 103	< 17
		< 98.9	< 16.6	522	88	< 65	< 11	< 108	< 18
		342	56.5	419	69	< 56	< 9.3	< 94	< 15
	Catalyst Outlet	402	97.2	< 38	< 9.1	< 24	< 5.9	< 40	< 9.8
		796	186	< 67	< 16	< 24	< 5.6	< 40	< 9.3
		593	137	< 64	< 15	< 20	< 4.5	< 33	< 7.6

"-" Empty data field

- CFR 40 Method 26 assumes anions measured in acidic impinger solutions are acids (HCl and HF) and those measured in the following basic impinger solutions are molecular gases (Cl₂ and F₂).

**Table 6.6. Blank and Catalyst Exhaust Total Metal Recoveries (µg) Determined
by SW-846-0060 Metals Analysis, HLW Tests.
(Regulatory Data)**

-	Reagent Blank	Field Blank	HLW Test 1-continued Catalyst Exhaust			HLW Test 2B Catalyst Exhaust		
Antimony	9.9	8.9	10.0	15.3	10.3	9.1	3.8	3
Arsenic	0.8	3.4	2.3	2.6	0.7	0.9	0.5	< 0.1
Barium	5.2	4.7	8.1	7	6.5	5.9	1.3	< 0.1
Cadmium	< 0.1	0.4	1.8	2.0	1.3	0.5	0.6	0.4
Chromium	0.8	1.7	3.5	2.2	1.8	3.3	3.6	1.9
Copper	< 0.1	4.2	10.0	6.6	5	6.5	5.1	2.0
Lead	2.2	4.3	10.6	6.8	4.1	4.6	1.9	0.8
Manganese	1.0	2.5	4.7	4.7	2.3	4.0	2.0	1.0
Nickel	5.2	5.9	9.7	8.5	8	7.8	2.9	0.8
Selenium	0.6	58.7	27.2	98.9	15	31.6	27.3	8.3
Silver	0.6	< 0.1	0.4	0.5	0.5	< 0.1	0.7	0.3
Zinc	2.2	65.0	61.9	58.5	77.2	53.7	19.6	14.5

"-" Empty data field

**Table 6.7. Blank and Catalyst Exhaust Total Metal Recoveries (µg) Determined
by SW-846-0060 Metals Analysis, LAW Tests.
(Regulatory Data)**

-	Reagent Blanks		Field Blanks		LAW Test 1 Catalyst Exhaust		LAW Test 2B Catalyst Exhaust		
Antimony	2.6	1.2	2.0	1.2	5.6	5.2	2.3	2.1	1.9
Arsenic	1.2	0.6	1.1	0.7	1.9	1.5	1.4	1.3	1.1
Barium	5.4	0.7	5.6	0.8	7.4	5.9	5.8	6.4	6.2
Cadmium	0.2	0.2	1.3	0.4	4.1	3.4	2	2.6	1.9
Chromium	1.2	0.5	6.5	1.4	3.2	3.3	7.4	14.2	10.2
Copper	0.8	0.5	2.0	1.1	6.9	6.7	2.9	4.8	3.6
Lead	1.0	0.5	0.7	0.4	29.4	26.8	1.0	1.1	1.1
Manganese	1.6	0.3	3.0	80.2	14.0	5.3	3.4	3.5	3.5
Nickel	9.8	0.8	12.8	1.8	20.4	22.5	11.7	11.0	9.7
Selenium	5.5	0.6	11.7	3.1	90.8	86.4	47.6	71.5	60.2
Silver	1.7	1.0	1.6	1.4	1.0	1.0	1.0	1.0	1.0
Zinc	5.7	1.2	32.7	16.3	68.3	68.1	52.3	78.6	60.6

"-" Empty data field

**Table 6.8. Average Metal Emission Rates and System DF's From HLW Test 1-continued.
(Regulatory Data)**

Element	Feed Rate* (mg/min)	Avg. Melter Emissions [#]		Avg. Catalyst Emission [#]		Total DF	Off-Gas System DF
		Concentration (ug/dscf)	Rate (µg/min)	Concentration (ug/dscf)	Rate (µg/min)		
Antimony	1332	35.0	5137	0.06	10.4	128077	494
Arsenic	778	82.3	11964	0.03	6.4	121563	1869
Barium	54.6 ^{\$}	2.0	291	0.05	8.6	6349	34
Cadmium	1399	30.6	4473	0.04	6.9	202754	648
Chromium	748	49.6	7227	0.04	7.0	106857	1032
Copper	260	3.0	439	0.16	29.5	8814	15
Lead	1741	33.1	4846	0.11	20.4	85343	238
Manganese	19332	29.0	4312	0.06	12.0	1611000	359
Nickel	845	9.8	1448	0.08	14.5	58276	100
Selenium	654	2437.7	356874	1.02	189	3460	1888
Silver	0	0.04	5.4	0.02	2.9	NC	2
Zinc	10349	90.7	13456	1.38	255	40584	53

* - Calculated from target composition and average feed rate.

- Values corrected with reagent blank data using methods prescribed in SW-846-0060.

\$ - Barium feed value calculated from STL analysis given in Table 2.11.

NC – Not calculated

**Table 6.9. Average Metal Emission Rates and System DF's From HLW Test 2B.
(Regulatory Data)**

Element	Feed Rate* (mg/min)	Avg. Melter Emissions [#]		Avg. Catalyst Emissions [#]		Total DF	Off-Gas System DF
		Concentration (ug/dscf)	Rate (µg/min)	Concentration (ug/dscf)	Rate (µg/min)		
Antimony	1953	85.6	15304	< 0.01	0.5	3906000	30608
Arsenic	1141	167.3	29926	0.01	1.3	877692	23020
Barium	80.0 ^{\$}	3.2	571	0.02	3.3	24242	173
Cadmium	2052	58.3	10424	0.01	2.6	789231	4009
Chromium	1098	74.8	13369	0.04	8.5	129176	1573
Copper	381	7.0	1252	0.10	19.4	19639	65
Lead	2553	62.7	11215	0.04	7.2	354583	1558
Manganese	28354	111.3	19895	0.04	7.0	4050571	2842
Nickel	1239	20.5	3670	0.03	6.3	196667	583
Selenium	959	4787.0	855785	0.49	94.8	10116	9027
Silver	0	0.08	15	0.01	2.9	NC	5
Zinc	15178	270.0	48257	0.50	97.4	155832	495

* - Calculated from target composition and average feed rate.

- Values correct with reagent blank data using methods prescribed in SW-846-0060.

\$ - Barium feed value calculated from STL analysis given in Table 2.11.

NC – Not calculated

**Table 6.10. Average Metal Emission Rates and System DFs From LAW Test 1.
(Regulatory Data)**

Element	Feed Rate* (mg/min)	Avg Melter Emissions [#]		Avg TCO Emissions [#]		Total DF	Off-Gas System DF
		Concentration (ug/dscf)	Rate (µg/min)	Concentration (ug/dscf)	Rate (µg/min)		
Antimony	0	0.7	112.8	0.07	18.0	NC	NC
Arsenic	0	0.5	82.2	0.02	4.6	NC	NC
Barium	33.4 ^{\$}	0.2	25.6	0.03	7.6	4400	3.4
Cadmium	1016	19.4	3312.6	0.08	19.4	52409	171
Chromium	2217	186.8	31839.2	0.05	11.2	197999	2844
Copper	32	0.8	139.6	0.13	32.5	985	4.3
Lead	8	1.9	321.0	0.59	146	> 55	> 2.2
Manganese	0	0.7	119.6	0.18	43.4	NC	2.8
Nickel	33.3 ^{\$}	0.4	61.0	0.26	63.5	524	1.0
Selenium	115	302.2	51561.8	1.81	447.2	257	115.3
Silver	0	<0.04	< 7.0	< 0.01	< 5.2	NC	NC
Zinc	19371	49.7	8463.9	1.40	347	55905	24.4

* - Calculated from target composition and average feed rate

NC – Not calculated

[#] - Values corrected with reagent blank data using methods prescribed in SW-846-0060.

^{\$} - Barium and nickel feed values calculated from STL analysis given in Table 2.11.

**Table 6.11. Average Metal Emission Rates and System DFs From LAW Test 2B.
(Regulatory Data)**

Element	Feed Rate* (mg/min)	Avg Melter Emissions [#]		Avg TCO Emissions [#]		Total DF	Off-Gas System DF
		Concentration (ug/dscf)	Rate (µg/min)	Concentration (ug/dscf)	Rate (µg/min)		
Antimony	0	< 0.1	< 7.78	< 0.02	< 4.64	NC	NC
Arsenic	0	0.5	84.4	< 0.01	< 3.42	NC	NC
Barium	44.2 ^{\$}	0.3	57.9	< 0.08	< 19.7	2244	NC
Cadmium	1342	67.7	11757	0.03	7.21	186156	1631
Chromium	2930	424.5	74173	0.14	32.7	89512	2266
Copper	43	3.0	524	0.05	11.3	3800	< 46.3
Lead	10	1.4	250	< 0.01	< 2.06	4861	> 122
Manganese	0	0.3	59.1	0.05	11.8	NC	5.01
Nickel	43.6 ^{\$}	0.3	58.4	< 0.16	< 37.8	> 1153	NC
Selenium	152	413.5	72159	0.89	209	727	345
Silver	0	< 0.03	< 5.98	0.01	< 3.57	NC	NC
Zinc	25597	137.7	24117	0.95	222	115159	108

* - Calculated from target composition and average feed rate

NC – Not calculated

- Values corrected with reagent blank data using methods prescribed in SW-846-0060.

\$ - Barium and nickel feed values calculated from STL analysis given in Table 2.11.

**Table 6.12. FTIR Monitored Emissions During HLW MACT Test 1 While No Organics Were Spiked into the Feed.
(ppmv)**

-	Melter outlet			SBS outlet			HEPA outlet			Carbon outlet			Catalyst outlet		
	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.
N ₂ O	25.3	19.1	38.8	32.7	3.0	47.5	30.0	22.7	36.2	32.6	22.7	43.1	27.4	10.5	49.9
NO	842.6	601.3	1170	922.1	64.4	1187	759.5	482.2	846.1	485	380.4	580.1	57.2	5.3	155
NO ₂	59.7	34.1	130.3	199.4	29.1	414.7	135.2	112.3	159.6	12.5	4.5	17.8	57.9	< 1.0	220.2
NH ₃	5.1	< 1.0	12.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	11.6	< 1.0	54.9
H ₂ O%	21.8	17.4	29.6	8.9	1.2	12.1	9.2	5.8	10.0	9.5	6.6	10.3	6.1	3.5	7.7
CO ₂ %	0.28	0.01	0.78	0.83	0.11	1.1	0.71	0.54	0.81	0.67	0.44	0.83	0.55	0.26	0.86
Nitrous Acid	1.2	< 1.0	2.1	< 1.0	< 1.0	< 1.0	4.2	2.8	4.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Nitric Acid	1.6	< 1.0	4.0	< 1.0	< 1.0	< 1.0	2.2	1.5	2.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HCN	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
SO ₂	4.9	< 1.0	14.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7	< 1.0	< 1.0	2.2	< 1.0	< 1.0	1.9
Acetonitrile	< 1.0	< 1.0	< 1.0	8.5	< 1.0	32.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	90.3	51.9	182.3	93.5	10.8	199.2	77.8	59.0	89.2	70.8	37.4	102.7	< 1.0	< 1.0	< 1.0
HCl	2.9	< 1.0	13.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Note: Measurements at different locations are not made simultaneously.

"-" Empty data cell

**Table 6.13. FTIR Monitored Emissions During HLW MACT Test 1 (Nov. 2004) While Allyl Alcohol Was Spiked into the Feed.
(ppmv)**

-	Melter outlet			SBS outlet			WESP outlet			HEPA outlet			Carbon outlet			Catalyst outlet		
	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.
N ₂ O	21.4	16.5	28.3	27.3	21.1	33.4	30.9	25.3	38.0	31.0	22.7	40.5	31.6	27.8	35.1	34.7	25.6	51.2
NO	551.9	377.4	692.6	410.5	221.4	565.7	446.1	317.8	533.4	442.3	264.6	754.2	818	778.3	850.2	79.6	43.4	133.4
NO ₂	488.1	45.5	693.6	499.8	406.1	575.6	444.5	425.1	464.1	395.7	357.5	439.4	76.0	71.8	82.3	38.6	19.9	63.5
NH ₃	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1
H ₂ O%	20.6	18.6	24.8	11.3	10.6	11.8	10.4	9.8	10.8	9.7	9.2	10.3	10.1	9.7	10.9	7.7	6.6	8.3
CO ₂ %	0.57	0.01	0.94	1.2	1.0	1.3	1.13	1.03	1.25	1.01	0.9	1.19	1.06	1.02	1.14	0.87	0.66	1.12
Nitrous Acid	3.7	< 1.0	8.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.0	2.5	2.4	2.6	< 1.0	< 1.0	< 1.0
Nitric Acid	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.1	1.8	2.9	< 1.0	< 1.0	< 1.0
HCN	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
SO ₂	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.2	< 1.0	< 1.0	1.7
Acetonitrile	141.2	4.3	933.3	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	535.6	51.7	1556	1519	975.3	2217	1320	778.3	2208	907.9	365.8	1478	831.8	579.6	1118	< 1.0	< 1.0	< 1.0
HCl	11.2	< 1.0	23.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.5	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Note: Measurements at different locations are not made simultaneously.

"-" Empty data cell

Table 6.14. FTIR Monitored Emissions During HLW MACT Test 1 While Naphthalene in Methanol Was Spiked into the Feed. (ppmv)

-	Melter outlet			SBS outlet			HEPA outlet			Carbon outlet			Catalyst outlet		
	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.
N ₂ O	30.4	21.0	43.2	35.2	21.2	60.7	26.6	14.1	57.2	36.0	28.4	46.9	34.0	22.2	54.9
NO	1012.1	747.6	1272.8	1038.6	694.7	1761.3	758.6	527.7	1288.9	884.7	811.1	947.6	128.8	47.8	245.3
NO ₂	132.5	60.3	191.0	205.7	131.4	332.4	212.7	120.1	380.7	98.5	88.9	107.6	111.2	42.3	203.2
NH ₃	6.1	< 1.0	10.8	8.0	7.3	8.7	< 1.0	< 1.0	< 1.0	1.4	< 1.0	2.2	< 1.0	< 1.0	< 1.0
H ₂ O%	24.0	20.2	28.9	11.1	10.1	11.7	9.3	8.9	9.8	8.1	7.8	8.5	7.2	5.8	8.1
CO ₂ %	0.47	0.03	1.32	1.17	0.89	1.61	0.93	0.69	1.39	1.07	0.95	1.24	0.74	0.45	1.14
Nitrous Acid	1.7	< 1.0	2.9	2.0	1.5	2.8	3.3	1.9	5.8	1.5	1.3	1.6	< 1.0	< 1.0	< 1.0
Nitric Acid	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HCN	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.0	< 1.0	< 1.0	< 1.0
SO ₂	12.0	3.4	17.1	5.8	4.0	6.9	< 1.0	< 1.0	< 1.0	21.8	18.1	24.7	1.1	< 1.0	2.1
Acetonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	210.0	110.6	356.0	201.4	141.3	268.5	230.0	122.0	387.9	359.6	214.9	499.7	< 1.0	< 1.0	< 1.0
HCl	13.4	1.2	19.9	4.9	< 1.0	7.3	< 1.0	< 1.0	< 1.0	4.4	4.0	4.9	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Note: Measurements at different locations are not made simultaneously.

"-" Empty data cell

Table 6.15. Average FTIR Monitored Emissions During HLW MACT Test 2A (ppmv).

Spike	None				Allyl Alcohol				Naphthalene/ Methanol				Allyl Alcohol/ Naphthalene		
	Melter	HEPA	Carbon	HCU	Melter	HEPA	Carbon	HCU	Melter	HEPA	Carbon	HCU	HEPA	Carbon	HCU
N ₂ O	24.0	32.6	25.9	29.2	18.8	22.8	23.7	34.4	20.7	25.7	27.9	32.2	22.3	28.0	45.1
NO	725	816	651	63.0	443	561	810	237	637	682	754	72.2	536	772	205
NO ₂	54.6	158	45.8	30.7	589	524	97.0	111	93.4	123	81.5	45.7	405	53.9	137
NH ₃	< 1.0	< 1.0	2.3	16.4	< 1.0	< 1.0	< 1.0	< 1.0	6.8	3.7	7.8	< 1.0	< 1.0	< 1.0	< 1.0
H ₂ O%	18.2	11.7	10.4	9.2	15.5	10.7	10.9	9.9	17.6	12.2	11.8	10.2	9.5	11.5	8.9
CO ₂ %	0.70	0.79	0.70	0.54	1.10	0.91	0.84	0.67	1.11	0.82	0.95	0.70	0.80	0.87	0.75
Nitrous Acid	< 1.0	3.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Nitric Acid	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HCN	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
SO ₂	< 1.0	< 1.0	5.7	< 1.0	< 1.0	< 1.0	5.4	< 1.0	9.6	2.3	8.0	< 1.0	< 1.0	6.4	< 1.0
Acetonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	83.8	84.9	81.6	< 1.0	925	582	580	< 1.0	116	121	170	< 1.0	524	515	< 1.0
HCl	< 1.0	< 1.0	2.2	< 1.0	12.2	< 1.0	2.0	< 1.0	12.3	6.0	8.7	< 1.0	< 1.0	4.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Table 6.16. Range of FTIR Monitored Emissions During HLW MACT Test 2A (ppmv).

Spike	None				Allyl Alcohol				Naphthalene/ Methanol				Allyl Alcohol/ Naphthalene		
Outlet	Melter	HEPA	Carbon	HCU	Melter	HEPA	Carbon	HCU	Melter	HEPA	Carbon	HCU	HEPA	Carbon	HCU
N ₂ O	16 – 36	28 – 39	2.3 – 85	7.6 – 90	2.0 – 28	18 – 52	16 – 29	28 – 41	16 – 32	19 – 46	16 – 44	25 – 40	20 – 30	20 – 51	35 – 54
NO	360 – 1000	710 – 920	260 – 1100	< 1.0 – 220	30 – 690	400 – 770	610 – 1000	140 – 320	490 – 920	540 – 870	610 – 990	41 – 140	480 – 650	520 – 990	130 – 270
NO ₂	26 – 190	120 – 200	12 – 120	< 1.0 – 120	30 – 740	180 – 650	85 – 110	45 – 200	46 – 130	96 – 190	73 – 100	14 – 88	370 – 450	41 – 80	93 – 180
NH ₃	< 1.0	< 1.0	< 1.0 – 3.8	< 1.0 – 160	< 1.0	< 1.0	< 1.0	< 1.0	4.2 – 12	< 1.0 – 5.9	5.8 – 10	< 1.0	< 1.0	< 1.0	< 1.0
H ₂ O%	13 – 23	10 – 13	5.9 – 15	3.3 – 11	2.2 – 21	6.0 – 12	10 – 14	8.9 – 11	15 – 23	6.8 – 13	11 – 13	8.5 – 12	7.4 – 10	7.4 – 13	7.8 – 9.6
CO ₂ %	0.01 – 1.1	0.65 – 0.94	0.15 – 1.90	0.15 – 1.9	0.12 – 1.4	0.60 – 1.6	0.56 – 0.97	0.56 – 0.79	0.03 – 1.5	0.65 – 1.2	0.71 – 1.5	0.57 – 0.86	0.73 – 0.92	0.63 – 1.2	0.61 – 0.91
Nitrous Acid	< 1.0	3.0 – 4.8	< 1.0 – 3.6	< 1.0 – 1.7	< 1.0	< 1.0	< 1.0	< 1.0 – 1.1	< 1.0 – 1.3	< 1.0 – 4.4	< 1.0 – 1.2	< 1.0	< 1.0	< 1.0 – 1.3	< 1.0
Nitric Acid	< 1.0	< 1.0 – 1.7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HCN	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 – 1.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 – 1.4	< 1.0
SO ₂	< 1.0	< 1.0 – 1.4	< 1.0 – 16	< 1.0	< 1.0	< 1.0	< 1.0 – 18	< 1.0	1.3 – 15	< 1.0 – 5.3	4.9 – 12	< 1.0	< 1.0	2.3 – 9.2	< 1.0
Acetonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	44 – 210	65 – 110	16 – 220	< 1.0	38 – 1400	120 – 1100	72 – 960	< 1.0	70 – 170	87 – 180	120 – 270	< 1.0	420 – 730	190 – 840	< 1.0
HCl	< 1.0	< 1.0 – 1.1	< 1.0 – 4.1	< 1.0	5.5 – 15	< 1.0	< 1.0 – 4.3	< 1.0	1.3 – 17	1.6 – 7.1	7.1 – 10	< 1.0	< 1.0	2.2 – 6.2	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Table 6.17. Average FTIR Monitored Emissions During HLW MACT Test 1-continued and Test 2B (ppmv).

Test	1-continued 400°C Target Plenum Temperature				2B 500°C Target Plenum Temperature			
Spike	Naphthalene/ Methanol				None			
Outlet	Melter	HEPA	Carbon	HCU	Melter	HEPA	Carbon	HCU
N ₂ O	15.4	34.0	39.5	35.3	30.2	52.2	53.5	48.5
NO	442	708	949	79.9	953	1228	1184	105
NO ₂	56.3	403	117	109	51	309	284	55.2
NH ₃	8.5	< 1.0	< 1.0	< 1.0	1.5	< 1.0	< 1.0	8.3
H ₂ O%	12.2	8.8	8.0	6.5	21.6	12.6	11.7	9.2
CO ₂ %	0.60	0.96	1.05	0.67	0.41	1.26	1.25	0.86
Nitrous Acid	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	8.8	7.3	< 1.0
Nitric Acid	< 1.0	< 1.0	< 1.0	< 1.0	1.7	3.3	3.6	< 1.0
HCN	< 1.0	< 1.0	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
SO ₂	7.4	< 1.0	10.0	< 1.0	3.5	1.2	7.3	< 1.0
Acetonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.1
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	96.9	288	276	< 1.0	67.7	128	130	< 1.0
HCl	6.3	< 1.0	4.6	< 1.0	1.2	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Table 6.18. Range of FTIR Monitored Emissions During HLW MACT Test 1-continued and Test 2B (ppmv).

Test	1-continued 400°C Target Plenum Temperature				2B 500°C Target Plenum Temperature			
Spike	Naphthalene in Methanol				None			
Outlet	Melter	HEPA	Carbon	HCU	Melter	HEPA	Carbon	HCU
N ₂ O	12 – 20	26 – 48	28 – 78	30 – 41	21 – 41	33 – 100	13 – 96	5.7 – 100
NO	360 – 530	580 – 880	850 – 1200	55 – 120	620 – 1200	940 – 1800	290 – 1500	8.6 – 590
NO ₂	43 – 72	350 – 470	99 – 150	81 – 150	34 – 71	180 – 540	32 – 360	1.9 – 620
NH ₃	5.2 – 10	< 1.0	< 1.0	< 1.0	< 1.0 – 2.9	< 1.0	< 1.0	< 1.0 – 76
H ₂ O%	8.6 – 18	8.2 – 11	7.6 – 8.9	5.6 – 7.6	16 – 25	11 – 14	4.7 – 16	1.9 – 11
CO ₂ %	0.44 – 0.92	0.82 – 1.2	0.87 – 1.8	0.61 – 0.82	0.01 – 1.1	0.89 – 2.2	0.3 – 2.4	0.1 – 2.3
Nitrous Acid	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 – 1.1	3.9 – 15	< 1.0 – 9.2	< 1.0 – 4.0
Nitric Acid	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 – 2.5	< 1.0 – 6.4	2.5 – 4.6	< 1.0
HCN	< 1.0	< 1.0	< 1.0 – 1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
SO ₂	1.6 – 10	< 1.0	< 1.0 – 15	< 1.0	1.5 – 5.5	< 1.0 – 3.1	2.8 – 38	< 1.0
Acetonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0 – 6.5
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	63 – 130	210 – 540	240 – 360	< 1.0	52 – 87	81 – 290	35 – 290	< 1.0
HCl	3.1 – 12	< 1.0	4.1 – 5.9	< 1.0	< 1.0 – 2.1	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Table 6.19. FTIR and Method 25a Monitored Emissions During LAW MACT Test 1 While Allyl Alcohol Was Spiked into the Feed (ppmv).

-	Melter outlet			HEPA outlet			Carbon outlet			Catalyst outlet		
	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.
N ₂ O	394	232	562	468	196	748	540	286	927	431	156.1	731
NO	4332	3083	5324	3293	2142	4160	3434	2723	4323	721	77.2	1604
NO ₂	972	677	1224	2157	936	3715	2349	1755	3206	259	11.5	671
NH ₃	155	1.1	261	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	9.33	< 1.0	133
H ₂ O%	18.8	16.0	21.7	11.8	7.9	12.8	11.0	9.3	12.2	11.8	10.4	13.0
CO ₂ %	1.00	0.69	1.25	1.12	0.58	1.62	1.21	0.72	1.98	1.18	0.71	1.9
Nitrous Acid	6.3	2.6	11.1	35.2	13.5	49.9	28.0	20.2	36.9	1.1	< 1.0	4.8
Nitric Acid	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	14.5	2.9	20.0	< 1.0	< 1.0	< 1.0
HCN	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	1.8	< 1.0	< 1.0	< 1.0
SO ₂	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	16.0	9.2	23.3	< 1.0	< 1.0	< 1.0
Acetonitrile	230	101	490	100	15.2	125	< 1.0	< 1.0	< 1.0	3.3	< 1.0	11.0
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	236	153	343	177	30.6	300	350	251	476	< 1.0	< 1.0	< 1.0
HCl	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
THC	326	195	433	221	28.5	275	43.0	35.9	108	3.6	2.3	37

"-" Empty data field

Table 6.20. FTIR and Method 25a Monitored Emissions During LAW MACT Test 1 While Naphthalene in Methanol Was Spiked into the Feed (ppmv).

-	Melter outlet			HEPA outlet			Carbon outlet			Catalyst outlet		
	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.
N ₂ O	399	170	671	438	202	812	423	187	735	379	166	578
NO	3836	2511	5332	2904	1943	4177	2588	1750	3352	769	118	1314
NO ₂	847	318	1331	1735	815	3495	1942	1434	2436	247	20.2	479
NH ₃	215	45.1	386	1.50	< 1.0	15.4	2.0	< 1.0	2.8	< 1.0	< 1.0	< 1.0
H ₂ O%	17.7	13.0	25.3	10.6	7.8	12.2	10.5	8.7	11.7	11.3	10.6	11.7
CO ₂ %	0.69	0.44	1.17	0.93	0.42	1.70	0.92	0.48	1.40	1.06	0.73	1.41
Nitrous Acid	6.7	3.6	11.8	24.5	10.5	39.2	25.3	21.3	29.4	1.4	< 1.0	2.9
Nitric Acid	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	3.2
HCN	< 1.0	< 1.0	< 1.0	1.1	< 1.0	2.6	2.3	1.4	2.9	< 1.0	< 1.0	< 1.0
SO ₂	10.1	5.6	17.6	< 1.0	< 1.0	< 1.0	2.9	< 1.0	5.6	< 1.0	< 1.0	< 1.0
Acetonitrile	< 1.0	< 1.0	< 1.0	57.8	4.2	469	51.7	21.0	109	3.7	< 1.0	6.8
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	133	69.6	207	160	51.2	301	184	107	296	< 1.0	< 1.0	< 1.0
HCl	8.1	5.8	10.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
THC	269	196	349	199	38.0	289	154	113	198	3.7	2.3	11.2

"-" Empty data field

**Table 6.21. FTIR and Method 25a Monitored Emissions During LAW MACT Test 1
While No Organics Were Spiked into the Feed (ppmv).**

-	Melter outlet			HEPA outlet			Carbon outlet			Catalyst outlet		
	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.
N ₂ O	387	237	500	457	134	907	511	209	1030	344	90.3	817
NO	4376	3250	5036	3063	1930	4787	3261	1988	5080	462	< 1.0	2460
NO ₂	850	367	1165	1908	717	4355	2043	1433	3770	179	< 1.0	1111
NH ₃	225	158	301	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	50.7	< 1.0	1098
H ₂ O%	18.6	15.5	24.5	11.4	8.0	13.3	11.5	10.2	12.9	10.4	7.9	12.1
CO ₂ %	0.95	0.69	1.14	0.99	0.48	1.89	1.16	0.58	2.47	0.94	0.41	1.79
Nitrous Acid	8.9	6.1	15.4	26.5	8.8	50.2	22.5	15.2	34.3	0.9	0.0	8.2
Nitric Acid	3.5	< 1.0	20.6	< 1.0	< 1.0	< 1.0	9.4	< 1.0	18.9	< 1.0	< 1.0	< 1.0
HCN	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.0	< 1.0	1.8	< 1.0	< 1.0	< 1.0
SO ₂	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	8.8	< 1.0	18.5	< 1.0	< 1.0	< 1.0
Acetonitrile	< 1.0	< 1.0	< 1.0	53.7	31.3	80.5	4.9	< 1.0	89.3	4.7	< 1.0	56.0
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	87.8	41.3	159	86.3	16.6	267	139	39.9	344	< 1.0	< 1.0	< 1.0
HCl	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
THC	91.5	8.1	503	152	39.4	281	40.1	31.0	57.3	2.5	0.0	18.6

"-" Empty data field

Note: Melter and HEPA outlet values maybe influenced by data taken immediately after organic spiking was stopped.

Table 6.22. FTIR Monitored Emissions During LAW MACT Test 2B (ppmv).

-	Melter outlet			HEPA outlet			Carbon Bed outlet			Catalyst outlet		
	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.
N ₂ O	453	287	780	608	286	1025	619	314	1021	476	1.5	1030
NO	5095	3905	6708	3962	2321	5450	3482	2527	5376	767	16.9	3680
NO ₂	954	649	1457	3205	1825	6225	3627	2908	4810	310	5.1	2053
NH ₃	180	11.3	296.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	19.6	< 1.0	2290
H ₂ O%	21.2	17.4	27.8	11.8	5.0	14.0	11.9	7.3	13.7	11.7	4.1	13.4
CO ₂ %	1.07	0.80	1.65	1.42	0.87	2.53	1.39	0.81	2.82	1.20	0.05	3.28
Nitrous Acid	9.4	3.9	16.1	37.7	16.1	56.2	32.1	19.7	45.5	1.6	0.0	13.4
Nitric Acid	4.2	1.2	7.5	23.8	9.3	42.4	22.8	14.7	32.3	1.2	< 1.0	12.2
HCN	< 1.0	< 1.0	1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	< 1.0	< 1.0
SO ₂	1.8	< 1.0	4.6	1.0	< 1.0	3.4	1.3	< 1.0	4.4	< 1.0	< 1.0	< 1.0
Acetonitrile	< 1.0	< 1.0	< 1.0	27.9	5.4	40.3	25.2	< 1.0	37.5	2.8	< 1.0	86.6
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	123	82.6	214	162	63.0	340	174	88.8	380	13.0	< 1.0	27.2
HCl	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.7	< 1.0	< 1.0	3.2

"-" Empty data field

Table 6.23. FTIR and Method 25a Monitored Emissions During LAW MACT Test 2A While Naphthalene and Allyl Alcohol Were Spiked into the Feed (ppmv).

-	Melter outlet			HEPA outlet			Carbon Bed outlet			Catalyst outlet		
	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.
N ₂ O	371	209	514	464	163	783	525	194	899	515	238	929
NO	3701	2677	4670	2969	2129	4013	3527	2277	4757	768	166	2980
NO ₂	765	524	1007	1742	950	3389	1203	626	2162	277	32.0	1357
NH ₃	203	3.2	359	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
H ₂ O%	14.3	11.4	20.2	11.5	10.0	12.7	8.7	6.5	10.9	11.6	10.1	12.9
CO ₂ %	0.86	0.62	1.07	0.99	0.59	1.58	1.02	0.56	1.86	1.04	0.63	2.35
Nitrous Acid	3.2	< 1.0	8.0	24.5	11.1	43.5	15.0	6.9	25.8	1.9	< 1.0	11.0
Nitric Acid	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	7.3	< 1.0	12.0	1.3	< 1.0	6.5
HCN	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.4	< 1.0	2.2	< 1.0	< 1.0	< 1.0
SO ₂	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	31.4	4.7	52.8	< 1.0	< 1.0	< 1.0
Acetonitrile	230	112	302	124	32.4	152	20.1	11.1	59.4	9.7	6.4	15.1
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	126	67.2	237	109	54.6	270	219	73.9	430	2.7	< 1.0	5.7
HCl	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
THC	400	177	688	311	5.9	426	64.6	47.1	129	3.0	0.0	58.5

"-" Empty data field

Table 6.24. FTIR and Method 25a Monitored Emissions During LAW MACT Test 2A While Naphthalene and Methanol Were Spiked into the Feed (ppmv).

-	Melter outlet			HEPA outlet			Carbon Bed outlet			Catalyst outlet		
	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.
N ₂ O	364	222	524	439	181	812	463	244	704	491	288	792
NO	3704	2495	5113	3042	2026	4268	2946	2069	3616	964	263	1800
NO ₂	602	348	999	1647	784	3112	1727	1340	2060	305	43.0	631
NH ₃	255	163	366	2.0	< 1.0	3.3	3.3	2.9	3.8	< 1.0	< 1.0	< 1.0
H ₂ O%	15.8	11.0	20.2	12.3	11.6	12.9	11.6	10.9	12.0	12.1	9.5	13.2
CO ₂ %	0.58	0.32	0.97	0.94	0.55	1.55	0.94	0.54	1.29	1.02	0.68	1.40
Nitrous Acid	5.5	2.3	12.4	25.4	13.2	42.4	28.2	23.1	31.5	2.3	< 1.0	5.1
Nitric Acid	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HCN	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.8	2.8	2.4	3.2	< 1.0	< 1.0	< 1.0
SO ₂	12.1	7.6	17.6	< 1.0	< 1.0	< 1.0	8.4	5.3	11.6	< 1.0	< 1.0	< 1.0
Acetonitrile	< 1.0	< 1.0	< 1.0	35.8	1.8	88.6	66.9	35.8	94.7	1.9	< 1.0	4.8
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	89.2	47.5	147	120	27.7	223	128	55.4	199	15.9	9.4	24.2
HCl	8.6	5.6	11.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
THC	337	165	497	241	61.8	292	181	145	210	7.7	0.7	95.3

"-" Empty data field

Table 6.25. FTIR and Method 25a Monitored Emissions During LAW MACT Test 2A While No Organics Were Spiked into the Feed (ppmv)*.

-	Melter outlet			HEPA outlet			Carbon outlet			Catalyst outlet		
	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.
N ₂ O	360	118	726	439	144	858	435	208	831	475	133	1030
NO	3622	1740	5095	3048	1766	5128	2817	1994	3706	757	< 1.0	3693
NO ₂	583	182	1211	1783	800	4401	1620	1180	2132	356	< 1.0	1901
NH ₃	168	21.9	790	< 1.0	< 1.0	< 1.0	3.4	2.3	5.9	51.1	< 1.0	1712
H ₂ O%	14.3	9.0	24.8	11.8	10.1	13.4	11.6	10.1	12.7	11.4	8.6	13.2
CO ₂ %	0.79	0.24	1.31	0.98	0.50	2.20	0.91	0.49	1.46	1.06	0.38	3.61
Nitrous Acid	8.7	3.1	18.3	26.4	9.0	53.0	26.1	21.2	31.3	2.1	0.0	14.1
Nitric Acid	2.9	< 1.0	9.4	6.5	< 1.0	25.9	< 1.0	< 1.0	< 1.0	1.9	< 1.0	29.6
HCN	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.4	1.3	3.7	< 1.0	< 1.0	< 1.0
SO ₂	2.9	< 1.0	24.5	< 1.0	< 1.0	< 1.0	4.1	< 1.0	8.2	< 1.0	< 1.0	< 1.0
Acetonitrile	< 1.0	< 1.0	< 1.0	28.1	13.9	42.3	64.4	24.2	156.7	8.4	< 1.0	120
Acrylonitrile	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
CO	64.0	14.2	134	75.4	9.5	271	81.0	34.8	168	7.7	< 1.0	22.1
HCl	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
HF	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	2.1	< 1.0	< 1.0	1.3
THC	55.1	13.2	603	110	3.8	152	156	103	240	2.7	0.0	118

"-" Empty data field

* - Although sampling occurred while the feed was not being spiked with allyl alcohol, naphthalene or methanol, measured values (particularly THC) reflect organics exhausting from any melter and SBS inventories remaining from the spiking periods.

Table 6.26. Average Total Hydrocarbon Concentrations (ppmv as Propane) Measured by CFR 40 Method 25A During HLW MACT Tests.

-	Outlet	Melter	SBS	WESP	HEPA	Carbon	HCU
Test 1	No spike	3.1	NM	NM	NM	NM	1.0
	Allyl alcohol spike	3652	3470	2808	2960	151	1.3
	Naphthalene/MeOH spike	968	931	NM	677	257	1.1
Test 2A	No spike	0.4	NM	NM	NM	3.1	< 0.1
	Allyl alcohol spike	1739	NM	1691	1508	201	3.5
	Naphthalene/MeOH spike	402	NM	359	270	266	< 0.1
	Naphthalene/ Allyl alcohol spike	NM	NM	NM	1328	141	3.8
Test 1-continued	Naphthalene/MeOH spike	353	NM	699	1017	281	< 0.1

NM – Not Measured

"-" Empty data field

Table 6.27. Average Hydrogen Concentrations (ppmv) Measured at the WESP Outlet.

-	Date	Spike	Concentration (ppmv)
HLW Test 2A	12/07/04	Allyl alcohol	270
	12/8/04	Naphthalene in methanol	95
HLW Test 1-continued	12/9/04	Allyl alcohol	116
HLW Test 2B	12/10/04	None	85
LAW Test 1	3/8/05	Allyl alcohol	147
	3/8/05	None	213
	3/9/05	Naphthalene in methanol	318
LAW Test 2B	3/18/05	None	330
LAW Test 2A	3/21/05	Naphthalene in allyl alcohol	202
	3/21/05	None	201
	3/22/05	Naphthalene in methanol	223

"-" Empty data field

**Table 6.28. Emission Fluxes (mg/min) and DRE Values for Allyl Alcohol for HLW Tests.
(Regulatory Data)**

-		Nov. 2004			Dec. 2004		
Target Plenum Temperature		400°C			300°C		
Rate (mg/ min)	Feed (Target)	40000					
	Melter Emissions	15728	8857	15641	30871	19741	24983
	HEPA Emissions	4433	7509	8918	11699	16888	19545
	Carbon Column Emissions	NM	NM	NM	65.5	1058	3678
	HCU Emissions ^{&}	< 0.34	< 0.37	< 0.36	< 0.37	< 0.39	< 0.39
% * DRE	Melter	60.7	77.9	60.9	22.8	50.6	37.5
	Primary Off Gas System	71.8	15.2	43.0	62.1	14.5	21.8
	Carbon Column	NM	NM	NM	99.4	93.7	81.3
	Catalyst	NM	NM	NM	> 99.44	> 99.96	> 99.99
	Secondary Off Gas System	> 99.992	> 99.995	> 99.996	> 99.997	> 99.998	> 99.998
	Melter + Off Gas System	> 99.9992	> 99.9991	> 99.9991	> 99.9991	> 99.9990	> 99.9990

NM – Not Measured.

* - DRE = 100% X (INFLUX – OUTFLUX) / INFLUX.

& - Based on STL detection limit (MDL) on solutions of 0.08 ppm. The reporting limit (RL) is 0.5 ppm.

"-" Empty data field

Note: Emissions rates may differ from Air Tech's values due to a 4th significant figure used in the VSL calculations.

**Table 6.29. Emission Fluxes (mg/min) and DRE Values for Allyl Alcohol During LAW Tests.
(Regulatory Data)**

Target Plenum Temperature		400°C			300°C		
Rate (mg/ min)	Feed (Target)*	10000					
	Melter Emissions	1223	1602	1911	2353	1785	1869
	HEPA Emissions	353	447	763	799	703	757
	Carbon Column Emissions	12.5	10.6	10.1	59.9	54.9	93.3
	HCU Emissions ^{&}	< 0.5	< 0.5	< 0.5	< 0.6	< 0.6	< 0.6
% # DRE	Melter	87.8	84.0	80.9	76.5	82.2	81.3
	Primary Off Gas System	71.1	72.1	60.1	66.0	60.6	59.5
	Carbon Column	96.5	97.6	98.7	92.5	92.2	87.6
	Catalyst	> 96.00	>95.28	> 95.05	> 99.00	> 98.91	> 99.36
	Secondary Off Gas System	> 99.86	> 99.89	> 99.93	> 99.92	> 99.91	> 99.92
	Melter + Off Gas System	> 99.995	> 99.995	> 99.995	> 99.994	> 99.994	> 99.994

* - Based on Target Feed Rate.

& - Based on STL detection limit (MDL) on solutions of 0.08 ppm. The reporting limit (RL) is 0.5 ppm.

- DRE = 100% X (INFLUX – OUTFLUX) / INFLUX.

Note: Mass of allyl alcohol measured in backup impinger added to primary impingers for all samples.

Note: Emissions rates may differ from Air Tech's values due to a 4th significant figure used in the VSL calculations.

**Table 6.30. Emission Fluxes (mg/min) and DRE Values for Naphthalene for HLW Tests.
(Regulatory Data)**

-		Nov. 2004	Dec. 8, 2004			Dec. 9, 2004	
Target Plenum Temperature		400°C	300°C			400°C	
Rate (mg/ min)	Feed	916	915	915	915	915	915
	Melter Emissions	580	844	900	931	869	878
	HEPA Emissions	398	700	755	908	643	682
	Carbon Column Emissions	NM	0.0081	< 0.0065	0.0091	NM	NM
	HCU Emissions	0.0063	< 0.00247	< 0.00235	< 0.0027	0.0212	0.115
% * DRE	Melter	36.7	7.8	1.6	0.0	5.1	4.0
	Primary Off Gas System	31.3	17.1	16.1	2.5	26.0	22.3
	Carbon Column	NM	99.9988	> 99.9991	99.9990	NM	NM
	Catalyst	NM	> 69.51	NM	> 70.34	NM	NM
	Secondary Off Gas System	99.998	> 99.9996	> 99.9996	> 99.9997	99.9963	99.9809
	Melter + Off Gas System	99.9993	> 99.9997	> 99.9997	> 99.9997	99.9977	99.9874

NM – Not Measured.

* - DRE = 100% X (INFLUX – OUTFLUX) / INFLUX.

"-" Empty data field

**Table 6.31. Emission Fluxes (mg/min) and DRE Values for Naphthalene During LAW Tests.
(Regulatory Data)**

Target Plenum Temperature		400°C			300°C		
Rate (mg/ min)	Feed*	916					
	Melter Emissions	625	745	667	911	965	785
	HEPA Emissions	650	708	539	15	289	314
	Carbon Column Emissions	17.8	6.62	1.00	31.0	< 17	14.6
	HCU Emissions	0.20	0.023	0.036	< 0.017	< 0.017	< 0.017
% # DRE	Melter	31.8	18.7	27.2	0.5	NC	14.3
	Primary Off Gas System	NC	5.0	19.2	98.4	70.1	14.3
	Carbon Column	97.3	99.1	99.8	NC	> 94.1	95.4
	Catalyst	98.88	99.65	96.40	> 99.95	NC	> 99.88
	Secondary Off Gas System	99.97	99.997	99.993	> 99.89	99.994	99.995
	Melter + Off Gas System	99.978	99.997	99.996	> 99.998	> 99.998	> 99.998

* - Based on Target Feed Rate.

NC – Not Calculated.

- DRE = 100% X (INFLUX – OUTFLUX) / INFLUX.

**Table 6.32. Allyl Spike Recovery and Breakthrough.
(Regulatory Data)**

Test	Spike Recovery		Breakthrough	
	Sampled Location	%	Sampled Location	% of Total Sample in backup impinger
HLW Test 1	Melter	92.6	Melter	< 1
			HEPA	< 1
			TCO	ND
HLW Test 2A	TCO	92.1	Melter	< 1
			HEPA	< 1
			Carbon	< 1
			TCO	ND
LAW Test 1	TCO	90.2	Melter	7.4
	HEPA	104	HEPA	25.3
	Carbon	103	Carbon	14.4
			TCO	ND
Law Test 2A	Melter	97.7	Melter	10.3
			HEPA	24.1
			Carbon	14.5
			TCO	ND

ND – No allyl alcohol was measured in any of the backup impingers

Table 6.33. Total Organic Emissions (mg/m³) Measured by Method 0040 at the Catalyst Outlet While the Melter Feed Was Spiked with Allyl Alcohol and Naphthalene During HLW Test 2A. (Regulatory Data)

-	C1	C2	C3	C4	C5	C6	C7	Total
Field Gas Chromatography	1.69	ND	2.26	ND	ND	ND	ND	3.95
Purge and Trap Condensate	ND	ND	ND	0.009	0.007	ND	ND	0.016
Total Chromatographable Organics								0.437
Total Gravimetric Organics								1.34
Total Organic Emissions								5.74

Cx – denotes carbon chain length for field gas chromatography and condensate analysis.

ND – Not Detected.

"-" Empty data field

Table 6.34. Total Organic Emissions (mg/m³) Measured by Method 0040 at the Catalyst Outlet While the Melter Feed Was Spiked with Allyl Alcohol and Naphthalene During LAW Test 2A. (Regulatory Data)

-	C1	C2	C3	C4	C5	C6	C7	Total
Field Gas Chromatography	2.80	ND	ND	ND	ND	ND	ND	2.80
Purge and Trap Condensate	ND	ND	ND	0.05	0.017	0.0017	ND	0.069
Total Chromatographable Organics								ND
Total Gravimetric Organics								3.096
Total Organic Emissions								5.97

"-" Empty data field

Cx – denotes carbon chain length for field gas chromatography and condensate analysis.

ND – Not Detected.

Table 6.35. Dioxin, Furan and PCB Emissions from Melter and Catalyst Outlets During HLW Test 2A.
(No organic spiking into melter feed during sampling)
(Regulatory Data)

-	Sampling Interval	Melter Outlet		Catalyst Outlet		
		12/07/04 2235 – 12/08/04 0035	12/08/04 0200 - 0400	12/07/04 1943 – 2143	12/07/04 2230 – 12/08/04 0030	12/08/04 0204 - 0404
Dioxin (pg/ min)	2,3,7,8-TCDD	Q, J 48.1	< 62.5	< 9.51	< 36.0	< 47.5
	1,2,3,7,8-PeCDD	J 373	Q, J 383	J 8.09	Q, J 22.2	< 9.29
	1,2,3,4,7,8-HxCDD	J 377	469	< 2.23	Q, J 20.5	< 5.18
	1,2,3,6,7,8-HxCDD	J 289	Q, J 293	Q, J 5.87	Q, J 31.5	< 5.18
	1,2,3,7,8,9-HxCDD	J 341	430	Q, J 6.88	Q, J 31.5	< 4.75
	1,2,3,4,6,7,8-HpCDD	882	1133	J 48.5	J 144	Q, J 21.2
	OCDD	B, J 722	B 898	B, J 364	B, J 202	B, J 147
Furan (pg/ min)	2,3,7,8-TCDF	Q 722	820	< 9.30	78.7	< 43.2
	1,2,3,7,8-PeCDF	Q, J 112	Q, J 156	J 14.4	247	< 11.0
	2,3,4,7,8-PeCDF	Q, J 68.2	Q, J 125	Q, J 11.5	Q, J 216	< 10.4
	1,2,3,4,7,8-HxCDF	J 377	664	Q, J 42.5	Q 809	Q, J 25.9
	1,2,3,6,7,8-HxCDF	Q, J 34.9	Q, J 133	Q, J 16.6	Q 382	Q, J 8.85
	2,3,4,6,7,8-HxCDF	Q, J 18.8	Q, J 70.3	Q, J 8.29	Q, J 133	< 4.32
	1,2,3,7,8,9-HxCDF	Q, J 9.22	Q, J 32.4	< 2.43	J 65.2	< 4.54
	1,2,3,4,6,7,8-HpCDF	J 88.2	547	J 93.0	1101	J 41.0
	1,2,3,4,7,8,9-HpCDF	J 18.4	J 234	J 34.4	562	Q, J 19.9
PCB (ng/ min)	OCDF	J 56.1	Q, J 508	Q, J 146	1393	Q, J 54.0
	PCB 77 (BZ)	2.20	2.62	Q, J 0.223	J 0.382	J 0.160
	PCB 81 (BZ)	Q, J 0.237	Q, J 0.469	< 0.036	Q, J 0.171	< 0.045
	PCB 126 (BZ)	< 0.176	< 0.223	< 0.053	Q, J 0.315	< 0.060
	PCB 105 (BZ)	3.37	2.62	2.23	J 0.899	J 0.518
	PCB 118 (BZ)	8.82	5.47	4.85	1.98	J 0.972
	PCB 123 (BZ)	< 0.136	< 0.187	< 0.040	Q, J 0.074	< 0.048
	PCB 114 (BZ)	Q, J 0.341	J 0.430	Q, J 0.148	Q, J 0.112	< 0.043
	PCB 169 (BZ)	< 0.148	< 0.199	< 0.057	< 0.072	< 0.054
	PCB 156 (BZ)	C, J 0.641	Q, J, C 0.664	Q, J, C 0.465	Q, J, C 0.292	J, C 0.149
	PCB 157 (BZ)	C, J 0.641	Q, J, C 0.664	C 0.465	Q, J, C 0.292	J, C 0.149
	PCB 167 (BZ)	Q, J 0.313	< 0.187	Q, J 0.158	0.200	< 0.045
	PCB 189 (BZ)	< 0.124	< 0.152	< 0.047	J 0.169	< 0.054

B – The analyte is present in the associated method or reagent blank at a reportable level

Q – Estimated maximum possible concentration, result is from data that does not meet qualitative criteria for a positive identification

C – The isomers 156 & 157 are known to coelute with one another.

J – The reported result is an estimate. The amount reported is below the Minimum Level (ML); "-" Empty data field

Table 6.36. Dioxin, Furan and PCB Emissions from Melter and Catalyst Outlets During HLW Test 2B. (No organic spiking into melter feed during sampling)
(Regulatory Data)

-	Sampling Interval	Melter Outlet		Catalyst Outlet		
		12/10/04 1343 - 1543	12/10/04 1723 - 1923	12/10/04 1100 - 1300	12/10/04 1349 - 1549	12/10/04 1715 - 1915
Dioxin (pg/ min)	2,3,7,8-TCDD	Q 72.3	Q, J 52.6	< 23.3	< 19.6	< 11.1
	1,2,3,7,8-PeCDD	526	559	< 5.08	< 5.11	< 4.03
	1,2,3,4,7,8-HxCDD	592	657	< 2.75	< 3.68	< 2.62
	1,2,3,6,7,8-HxCDD	428	427	< 2.75	< 3.68	< 2.62
	1,2,3,7,8,9-HxCDD	526	526	< 2.54	< 3.48	< 2.42
	1,2,3,4,6,7,8-HpCDD	1579	1512	Q, J 15.5	Q, J 15.5	Q, J 13.1
	OCDD	B 1743	B 1282	B, J 148	B, J 71.6	B, J 90.7
Furan (pg/ min)	2,3,7,8-TCDF	1217	1118	< 25.4	< 19.4	< 9.47
	1,2,3,7,8-PeCDF	J 217	J 299	< 6.35	< 5.32	< 3.43
	2,3,4,7,8-PeCDF	J 102	J 118	< 5.93	< 4.91	< 3.23
	1,2,3,4,7,8-HxCDF	625	690	Q, J 5.29	Q, J 4.30	Q, J 5.85
	1,2,3,6,7,8-HxCDF	J 82.2	Q, J 78.9	Q, J 3.60	Q, J 4.30	< 1.94
	2,3,4,6,7,8-HxCDF	J 28.3	Q, J 39.4	< 2.54	J 4.50	< 2.22
	1,2,3,7,8,9-HxCDF	Q, J 10.5	J 15.4	< 2.54	< 3.07	< 2.42
	1,2,3,4,6,7,8-HpCDF	Q, J 187	J 187	Q, J 19.3	Q, J 22.5	Q, J 14.1
	1,2,3,4,7,8,9-HpCDF	Q, J 39.5	J 49.3	Q, J 5.08	J 9.61	< 2.62
	OCDF	J 270	J 125	Q, J 44.5	Q, J 34.8	Q, J 34.3
PCB (ng/ min)	PCB 77 (BZ)	3.19	2.96	J 0.125	Q, J 0.100	J 0.177
	PCB 81 (BZ)	J 0.362	Q, J 0.460	< 0.034	< 0.041	< 0.048
	PCB 126 (BZ)	J 0.250	< 0.154	< 0.051	< 0.057	< 0.052
	PCB 105 (BZ)	1.97	3.09	Q, J 0.318	J 0.777	J 0.564
	PCB 118 (BZ)	3.95	6.90	J 0.720	2.046	1.49
	PCB 123 (BZ)	Q, J 0.243	< 0.131	< 0.040	< 0.049	< 0.042
	PCB 114 (BZ)	J 0.428	J 0.362	< 0.038	< 0.045	< 0.042
	PCB 169 (BZ)	< 0.115	< 0.131	< 0.047	< 0.051	< 0.058
	PCB 156 (BZ)	J, C 0.526	Q, J, C 0.789	J, C 0.140	J, C 0.170	J, C 0.153
	PCB 157 (BZ)	J, C 0.526	Q, J, C 0.789	J, C 0.140	J, C 0.170	J, C 0.153
	PCB 167 (BZ)	< 0.105	Q, J 0.289	< 0.038	< 0.047	< 0.050
	PCB 189 (BZ)	< 0.102	< 0.125	< 0.044	< 0.053	< 0.050

B – The analyte is present in the associated method or reagent blank at a reportable level

Q – Estimated maximum possible concentration, result is from data that does not meet qualitative criteria for a positive identification

C – The isomers 156 & 157 are known to coelute with one another.

J – The reported result is an estimate. The amount reported is below the Minimum Level (ML)

"-" Empty data field

Table 6.37. Dioxin and Furan Toxic Equivalents (pg/dscf) for HLW Test Average Analysis.
(No organic spiking into melter feed during sampling.)
(Regulatory Data)

Compound	Toxic Factor	HLW Test 2A				HLW Test 2B			
		Melter		Catalyst		Melter		Catalyst	
		Avg. Conc.	Avg. Toxic Equiv.	Avg. Conc.	Avg. Toxic Equiv.	Avg. Conc.	Avg. Toxic Equiv.	Avg. Conc.	Avg. Toxic Equiv.
2,3,7,8-TCDD	1	< 0.314	< 0.314	< 0.148	< 0.148	0.352	0.352	< 0.093	< 0.093
1,2,3,7,8-PeCDD	0.5	2.15	1.073	< 0.063	< 0.032	3.095	1.547	< 0.025	< 0.012
1,2,3,4,7,8-HxCDD	0.1	2.40	0.240	< 0.044	< 0.004	3.569	0.357	< 0.016	< 0.002
1,2,3,6,7,8-HxCDD	0.1	1.65	0.165	< 0.067	< 0.007	2.433	0.243	< 0.016	< 0.002
1,2,3,7,8,9-HxCDD	0.1	2.19	0.219	< 0.068	< 0.007	2.995	0.299	< 0.015	< 0.001
1,2,3,4,6,7,8-HpCDD	0.01	5.72	0.057	0.340	0.003	8.783	0.088	0.076	0.001
OCDD	0.001	4.60	0.005	1.172	0.001	8.517	0.009	0.539	0.001
2,3,7,8-TCDF	0.1	4.38	0.438	< 0.207	< 0.021	6.624	0.662	< 0.094	< 0.009
1,2,3,7,8-PeCDF	0.05	0.76	0.038	< 0.427	< 0.021	1.486	0.074	< 0.026	< 0.001
2,3,4,7,8-PeCDF	0.5	0.549	0.274	< 0.372	< 0.186	0.630	0.315	< 0.024	< 0.012
1,2,3,4,7,8-HxCDF	0.1	2.96	0.296	1.372	0.137	3.756	0.376	0.027	0.003
1,2,3,6,7,8-HxCDF	0.1	0.477	0.048	0.637	0.064	0.458	0.046	< 0.017	< 0.002
2,3,4,6,7,8-HxCDF	0.1	0.253	0.025	< 0.227	< 0.023	0.195	0.020	< 0.016	< 0.002
1,2,3,7,8,9-HxCDF	0.1	0.118	0.012	< 0.113	< 0.011	0.075	0.007	< 0.014	< 0.001
1,2,3,4,6,7,8-HpCDF	0.01	1.81	0.018	1.937	0.019	1.067	0.011	0.097	0.001
1,2,3,4,7,8,9-HpCDF	0.01	0.719	0.007	0.964	0.010	0.255	0.003	< 0.030	< 0.000
OCDF	0.001	1.60	0.002	2.502	0.003	1.094	0.001	0.197	0.000
Total Toxic Equivalent		-	< 3.23	-	< 0.696	-	4.41	-	< 0.143

"-" Empty data field

Table 6.38. Dioxin, Furan, and PCB Emissions from Melter and Catalyst Outlets During LAW Test 2B. (No organic spiking into melter feed during sampling). (Regulatory Data)

-	Sampling Interval	Melter Outlet		Catalyst Outlet		
		03/18/05 09:30 – 10:50	03/19/05 08:56 – 10:16	03/18/05 09:30 – 11:30	03/19/05 09:00 – 11:00	03/19/05 11:35 – 13:35
Dioxin (pg/min)	2,3,7,8-TCDD	Q, J 26.7	< 17.4	Q, J 5.25	< 4.96	< 13.0
	1,2,3,7,8-PeCDD	Q, J 24	Q, J 22.3	< 3.32	< 2.76	< 5.5
	1,2,3,4,7,8-HxCDD	J 18	Q, J 9.3	< 3.04	< 2.43	< 5.2
	1,2,3,6,7,8-HxCDD	Q, J 21	Q, J 27.1	< 3.04	J 4.69	< 5.2
	1,2,3,7,8,9-HxCDD	J 28	< 5.3	Q, J 6.36	< 2.26	< 5.0
	1,2,3,4,6,7,8-HpCDD	B, J 90	B, J 129.5	B, J 27.36	Q, B, J 26.18	< 9.9
	OCDD	B, J 244	B, J 400.6	Q, B, J 99.48	B, J 143.32	B, J 99.4
Furan (pg/min)	2,3,7,8-TCDF	119	Q 121.4	Q, J 33.16	Q, J 8.54	Q, J 38.7
	1,2,3,7,8-PeCDF	Q, J 32	J 35.6	Q, J 18.51	Q, J 8.00	Q, J 14.4
	2,3,4,7,8-PeCDF	B, J 54.6	Q, B, J 68.8	Q, B, J 13.26	< 1.90	Q, B, J 16.8
	1,2,3,4,7,8-HxCDF	J 35	Q, J 34.4	J 49.74	Q, J 11.03	J 41.4
	1,2,3,6,7,8-HxCDF	Q, J 17.0	J 23.9	Q, J 26.80	Q, J 4.96	Q, J 17.7
	2,3,4,6,7,8-HxCDF	B, J 12.5	Q, B, J 12.9	Q, B, J 8.01	< 2.21	B, J 15.5
	1,2,3,7,8,9-HxCDF	< 2.15	< 5.3	J 12.44	Q, J 10.47	< 6.1
	1,2,3,4,6,7,8-HpCDF	Q, B, J 51.4	Q, B, J 40.5	Q, B, J 71.85	Q, B, J 22.60	Q, B, J 80.1
	1,2,3,4,7,8,9-HpCDF	J 29.9	< 8.9	J 41.45	Q, J 9.10	J 35.9
PCB (ng/min)	OCDF	B, J 89.9	B, J 48.6	Q, B, J 138.17	Q, B, J 49.61	Q, B, J 55.2
	PCB 77 (BZ)	1.83	Q, J 1.82	Q, J 0.19	J 0.28	Q, J 0.28
	PCB 81 (BZ)	J 0.39	< 0.77	< 0.04	< 0.06	< 0.04
	PCB 126 (BZ)	< 0.55	< 0.57	< 0.41	< 0.41	< 0.28
	PCB 105 (BZ)	Q, J 1.99	Q, S, J 3.12	J 1.13	< 0.50	Q, J 1.38
	PCB 118 (BZ)	J 7.06	J 6.88	J 2.38	Q, J 2.18	Q, J 3.24
	PCB 123 (BZ)	< 0.58	< 0.77	< 0.41	< 0.41	< 0.26
	PCB 114 (BZ)	< 0.04	< 0.57	< 0.33	< 0.36	< 0.22
	PCB 169 (BZ)	< 0.64	< 0.89	< 0.72	< 0.61	< 0.43
	PCB 156 (BZ)	< 0.77	< 1.09	< 0.86	< 0.66	< 0.48
	PCB 157 (BZ)	< 0.77	< 1.09	< 0.86	< 0.66	< 0.48
	PCB 167 (BZ)	< 0.64	< 0.85	< 0.75	< 0.55	< 0.41
	PCB 189 (BZ)	< 0.05	< 0.73	< 0.05	< 0.05	< 0.04

B – The analyte is present in the associated method or reagent blank at a reportable level

Q – Estimated maximum possible concentration, result is from data that does not meet qualitative criteria for a positive identification

J – The reported result is an estimate. The amount reported is below the Minimum Level (ML)

S – Ion suppression is evident, caused by matrix interference.

"-" Empty data field

**Table 6.39. Dioxin, Furan, and PCB Emissions from Melter and Catalyst Outlets During
LAW Test 2A.
(Regulatory Data)**

-	Sampling Interval	Melter Outlet		Catalyst Outlet		
		03/21/05 23:10 – 01:20	03/22/05 18:01 – 19:01	03/21/05 23:22 – 03/22/05 01:22	03/22/05 02:20 – 04:20	03/22/05 16:48 – 19:48
Organic Spiking During Sampling		None	Methanol + Naphthalene	None	None	Methanol + Naphthalene
Dioxin (pg/min)	2,3,7,8-TCDD	Q, J 15.1	Q, J 30.3	Q, J 7.1	< 5.4	Q, J 3.0
	1,2,3,7,8-PeCDD	J 17.7	J 43.7	< 1.9	Q, J 8.3	< 2.8
	1,2,3,4,7,8-HxCDD	Q, J 4.9	Q, J 17.4	< 2.5	Q, J 14.5	Q, J 4.5
	1,2,3,6,7,8-HxCDD	Q, J 9.0	Q, J 30.8	< 2.5	Q, J 12.5	< 2.6
	1,2,3,7,8,9-HxCDD	J 11.9	Q, J 25.8	< 2.4	J 21.1	Q, J 5.2
	1,2,3,4,6,7,8-HpCDD	Q, B, J 36.4	B, J 95.3	Q, B, J 9.4	B, J 91.1	Q, B, J 14.6
	OCDD	Q, B, J 97.1	B, J 252.2	Q, B, J 45.4	B, J 142.4	Q, B, J 91.5
Furan (pg/min)	2,3,7,8-TCDF	J 29.1	Q, J 84.1	Q, J 20.7	J 88.3	Q, J 9.7
	1,2,3,7,8-PeCDF	Q, J 12.9	Q, J 36.4	Q, J 6.8	Q, J 139.5	Q, J 8.2
	2,3,4,7,8-PeCDF	B, Q, J 18.5	Q, J 32.5	Q, B, J 6.2	Q, B, J 102.5	Q, J 5.4
	1,2,3,4,7,8-HxCDF	Q, J 24.3	Q, J 35.3	Q, J 19.3	598.0	Q, J 7.3
	1,2,3,6,7,8-HxCDF	J 14.3	J 26.9	J 8.8	J 250.6	Q, J 6.7
	2,3,4,6,7,8-HxCDF	Q, B, J 8.0	Q, S, J 14.0	< 1.8	Q, B, J 102.5	Q, J 5.4
	1,2,3,7,8,9-HxCDF	< 1.7	Q, J 19.1	Q, J 6.8	Q, J 31.3	Q, J 14.2
	1,2,3,4,6,7,8-HpCDF	Q, B, J 43.7	Q, B, J 72.8	Q, B, J 25.0	Q, B 854.3	Q, B, J 26.1
	1,2,3,4,7,8,9-HpCDF	J 9.5	Q, J 19.6	Q, J 6.5	341.7	Q, J 9.3
	OCDF	B, J 53.4	Q, B, J 72.8	Q, B, J 28.4	Q, B 655.0	Q, B, J 39.2
PCB (ng/min)	PCB 77 (BZ)	J 0.5	NA	Q, J 1.0	3.1	NA
	PCB 81 (BZ)	< 0.05		J 0.4	J 0.3	
	PCB 126 (BZ)	< 0.3		Q, J 2.0	< 0.5	
	PCB 105 (BZ)	< 0.4		J 1.3	J 3.1	
	PCB 118 (BZ)	J 1.6		Q, J 2.2	J 8.0	
	PCB 123 (BZ)	< 0.3		< 0.3	< 0.5	
	PCB 114 (BZ)	< 0.3		< 0.3	< 0.4	
	PCB 169 (BZ)	< 0.5		J 1.2	< 0.7	
	PCB 156 (BZ)	< 0.5		< 0.6	< 0.8	
	PCB 157 (BZ)	< 0.5		< 0.6	< 0.8	
	PCB 167 (BZ)	< 0.4		< 0.5	< 0.6	
	PCB 189 (BZ)	< 0.04		J 0.4	J 0.1	

NA – Not Analyzed

B – The analyte is present in the associated method or reagent blank at a reportable level

Q – Estimated maximum possible concentration, result is from data that does not meet qualitative criteria for a positive identification

J – The reported result is an estimate. The amount reported is below the Minimum Level (ML)

S – Ion suppression is evident, caused by matrix interference.

"-" Empty data field

**Table 6.40. Dioxin and Furan Toxic Equivalents (pg/dscf) for LAW Test Average Analysis.
(Regulatory Data)**

Compound	Toxic Factor	Test 2B				Test 2A			
		Melter		Catalyst		Melter		Catalyst	
		Avg. Conc.	Avg. Toxic Equiv.	Avg. Conc.	Avg. Toxic Equiv.	Avg. Conc.	Avg. Toxic Equiv.	Avg. Conc.	Avg. Toxic Equiv.
2,3,7,8-TCDD	1	< 0.13	< 0.13	< 0.03	< 0.03	0.11	0.11	0.02	0.02
1,2,3,7,8-PeCDD	0.5	0.13	0.07	< 0.02	< 0.01	0.15	0.07	0.02	0.01
1,2,3,4,7,8-HxCDD	0.1	0.08	< 0.01	< 0.02	< 0.01	0.05	0.01	0.03	< 0.01
1,2,3,6,7,8-HxCDD	0.1	0.14	0.01	< 0.02	< 0.01	0.09	0.01	0.02	< 0.01
1,2,3,7,8,9-HxCDD	0.1	< 0.09	< 0.01	< 0.02	< 0.01	0.09	0.01	0.04	< 0.01
1,2,3,4,6,7,8-HpCDD	0.01	0.64	< 0.01	< 0.09	< 0.01	0.31	< 0.01	0.16	< 0.01
OCDD	0.001	1.88	< 0.01	0.49	< 0.01	0.83	< 0.01	0.39	< 0.01
2,3,7,8-TCDF	0.1	0.70	0.07	0.12	0.01	0.27	0.03	0.17	0.02
1,2,3,7,8-PeCDF	0.05	0.20	0.01	0.06	< 0.01	0.12	0.01	0.22	0.01
2,3,4,7,8-PeCDF	0.5	0.36	0.18	0.05	0.02	0.12	0.06	0.16	0.08
1,2,3,4,7,8-HxCDF	0.1	0.20	0.02	0.15	0.02	0.14	0.01	0.87	0.09
1,2,3,6,7,8-HxCDF	0.1	0.12	0.01	0.07	< 0.01	0.10	0.01	0.37	0.04
2,3,4,6,7,8-HxCDF	0.1	0.07	0.01	0.04	< 0.01	0.05	0.01	0.15	0.02
1,2,3,7,8,9-HxCDF	0.1	< 0.02	< 0.01	< 0.04	< 0.01	< 0.05	< 0.01	0.07	0.01
1,2,3,4,6,7,8-HpCDF	0.01	0.27	< 0.01	0.25	< 0.01	0.28	< 0.01	1.27	0.01
1,2,3,4,7,8,9-HpCDF	0.01	< 0.11	< 0.01	0.13	< 0.01	0.07	< 0.01	0.50	0.01
OCDF	0.001	0.40	< 0.01	0.35	< 0.01	0.30	< 0.01	1.01	< 0.01
Total Toxic Equivalent		-	< 0.59	-	< 0.21	-	< 0.40	-	< 0.38

"-" Empty data field

**Table 6.41. Emission Rates ($\mu\text{g}/\text{min}$) of Volatile Products of Incomplete Combustion Measured by Method SW-846-0031) During HLW Test 2A. (No organic spiking into melter feed during sampling).
(Regulatory Data)**

Compound	Melter	Catalyst	Melter	Catalyst	Melter	Catalyst
Acetone [#]	508	47501	623	728	1018	314
Acetonitrile	3990	< 300	3185	< 300	2262	< 444
Acrylonitrile	< 300	< 300	< 300	< 300	< 300	< 300
Benzene*	< 300	< 300	428	< 300	361	< 300
Bromomethane	< 300	< 300	< 300	< 300	< 300	< 300
2-Butanone	< 300	< 300	< 300	< 300	< 300	< 300
Carbon disulfide	< 300	< 300	< 300	< 300	< 300	< 300
Carbon tetrachloride	< 300	< 300	< 300	< 300	< 300	< 300
Chlorobenzene	< 300	< 300	< 300	< 300	< 300	< 300
Chloroform	< 300	< 300	< 300	< 300	< 300	< 300
Chloromethane [#]	308	401	< 300	< 300	< 300	< 300
Ethylbenzene	< 300	< 300	< 300	< 300	< 300	< 300
2-Hexanone	< 300	< 300	< 300	< 300	< 300	< 300
Iodomethane	< 300	< 300	< 300	< 300	< 300	< 300
Methylene Chloride [#]	< 300	< 300	< 300	< 300	< 300	< 300
4-Methyl-2-pentanone	< 300	< 300	< 300	< 300	< 300	< 300
Tetrachloroethene	< 300	< 300	< 300	< 300	< 300	< 300
Toluene	< 300	< 300	< 300	< 300	< 300	< 300
Trichloroethene	< 300	< 300	< 300	< 300	< 300	< 300
Vinyl chloride	< 300	< 300	< 300	< 300	< 300	< 300
Xylenes (total)	< 300	< 300	< 300	< 300	< 300	< 300

[#] - Common laboratory contaminant.

* - Can result from the decomposition of sampling media in the presence of melter exhaust.

Note: Reported emission rates may be slightly different than given in Appendix IV as a result of differing methods of treating less than values.

**Table 6.42. Emission Rates ($\mu\text{g}/\text{min}$) of Volatile Products of Incomplete Combustion Measured by Method SW-846-0031) During HLW Test 2B. (No organic spiking into melter feed during sampling).
(Regulatory Data)**

Compound	Melter	Catalyst	Melter	Catalyst	Melter	Catalyst
Acetone [#]	1358	3023	1276	325	1018	< 300
Acetonitrile	4332	< 2966	7416	< 669	6630	< 300
Acrylonitrile	463	< 300	566	< 300	583	< 300
Benzene*	635	< 300	714	< 300	716	< 300
Bromomethane	< 300	< 300	< 300	< 300	< 300	< 300
2-Butanone	< 300	< 300	< 300	< 300	< 300	< 300
Carbon disulfide	< 300	< 300	< 300	< 300	< 300	< 300
Carbon tetrachloride	< 300	< 300	< 300	< 300	< 300	< 300
Chlorobenzene	< 300	< 300	< 300	< 300	< 300	< 300
Chloroform	< 300	< 300	< 300	< 300	< 300	< 300
Chloromethane [#]	< 300	< 300	< 300	< 300	< 300	< 300
Ethylbenzene	< 300	< 300	< 300	< 300	< 300	< 300
2-Hexanone	< 300	< 300	< 300	< 300	< 300	< 300
Iodomethane	< 300	< 300	< 300	< 300	< 300	< 300
Methylene Chloride [#]	< 300	329	< 300	< 300	< 300	< 300
4-Methyl-2-pentanone	< 300	< 300	< 300	< 300	< 300	< 300
Tetrachloroethene	< 300	< 300	< 300	< 300	< 300	< 300
Toluene	< 300	< 300	< 300	< 300	< 300	< 300
Trichloroethene	< 300	< 481	< 300	< 300	< 300	< 595
Vinyl chloride	< 300	< 300	< 300	< 300	< 300	< 300
Xylenes (total)	< 300	< 300	< 300	< 300	< 300	< 300

- Common laboratory contaminant.

* - Can result from the decomposition of sampling media in the presence of melter exhaust.

Note: Reported emission rates may be slightly different than given in Appendix IV as a result of differing methods of treating less than values.

**Table 6.43. Emission Rates (µg/min) of Volatile Products of Incomplete Combustion Measured by Method SW-846-0031) During LAW Test 2B. (No organic spiking into melter feed during sampling).
(Regulatory Data)**

Compound	Melter	TCO	Melter	TCO	Melter	TCO
Acetone	49300	259	52390	270	50860	330
Acetonitrile	529440	110	432680	430	531380	460
Acrylonitrile	28540	< 100	29050	< 100	33430	< 100
Benzene	< 20000	< 100	< 20000	< 100	< 20000	< 100
Bromodichloromethane	< 20000	< 100	< 20000	< 100	< 20000	< 100
Bromoform	< 20000	< 100	< 20000	< 100	< 20000	< 100
Bromomethane	< 20000	240	< 20000	2371	< 20000	2630
2-Butanone	< 20000	< 100	< 20000	< 100	< 20000	< 100
Carbon disulfide	< 20000	< 100	< 20000	< 100	< 20000	< 100
Carbon tetrachloride	< 20000	< 100	< 20000	< 100	< 20000	< 100
Chlorobenzene	< 20000	< 100	< 20000	< 100	< 20000	< 100
Dibromochloromethane	< 20000	< 100	< 20000	< 100	< 20000	< 100
Chloroethane	< 20000	< 100	< 20000	< 100	< 20000	< 100
Chloroform	< 20000	< 100	< 20000	< 100	< 20000	< 100
Chloromethane	< 20000	4960	< 20000	4500	< 20000	5487
1,1-Dichloroethane	< 20000	< 100	< 20000	< 100	< 20000	< 100
1,2-Dichloroethane	< 20000	< 100	< 20000	< 100	< 20000	< 100
1,1-Dichloroethene	< 20000	< 100	< 20000	< 100	< 20000	< 100
1,2-Dichloroethene (total)	< 20000	< 100	< 20000	< 100	< 20000	< 100
1,2-Dichloropropane	< 20000	< 100	< 20000	< 100	< 20000	< 100
cis-1,3-Dichloropropene	< 20000	< 100	< 20000	< 100	< 20000	< 100
trans-1,3-Dichloropropene	< 20000	< 100	< 20000	< 100	< 20000	< 100
Ethylbenzene	< 20000	< 100	< 20000	< 100	< 20000	< 100
2-Hexanone	< 20000	< 100	< 20000	< 100	< 20000	< 100
Iodomethane	< 20000	< 100	< 20000	2404	< 20000	2690
Methylene chloride	123510	1337	185440	260916	450930	240986
4-Methyl-2-pentanone	< 20000	< 100	< 20000	< 100	< 20000	< 100
Styrene	< 20000	< 100	< 20000	< 100	< 20000	< 100
1,1,2,2-Tetrachloroethane	< 20000	< 100	< 20000	< 100	< 20000	< 100
Tetrachloroethene	< 20000	< 100	< 20000	< 100	< 20000	< 100
Toluene	< 20000	< 100	< 20000	< 100	< 20000	< 100
1,1,1-Trichloroethane	< 20000	< 100	< 20000	< 100	< 20000	< 100
1,1,2-Trichloroethane	< 20000	< 100	< 20000	< 100	< 20000	< 100
Trichloroethene	< 20000	< 100	< 20000	< 100	< 20000	< 100
Vinyl chloride	< 20000	< 100	< 20000	< 100	< 20000	< 100
Xylenes (total)	< 20000	< 100	< 20000	< 100	< 20000	< 100

Note: All Melter Tanax/Anasorb samples were methanol desorbed. All TCO detection limits are calculated without including condensate when no analyte was measured.

Note: Reported emission rates may be slightly different than given in Appendix IV as a result of differing methods of treating less than values.

**Table 6.44. Emission Rates (µg/min) of Volatile Products of Incomplete Combustion Measured by Method SW-846-0031) During LAW Test 2A. (No organic spiking into melter feed during sampling).
(Regulatory Data)**

Compound	Melter	TCO	Melter	TCO	Melter	TCO
Acetone	51120	348	35840	360	47200	317
Acetonitrile	500080	820	343410	5567	472590	< 665
Acrylonitrile	28890	< 100	< 27000	< 100	29500	< 100
Benzene	< 27000	< 100	< 27000	< 100	< 27000	< 100
Bromodichloromethane	< 27000	< 100	< 27000	< 100	< 27000	< 100
Bromoform	< 27000	< 100	< 27000	< 100	< 27000	< 100
Bromomethane	< 27000	12486	< 27000	17195	< 27000	13940
2-Butanone	< 27000	< 100	< 27000	144	< 27000	< 100
Carbon disulfide	< 27000	< 100	< 27000	< 100	< 27000	< 100
Carbon tetrachloride	< 27000	< 100	< 27000	< 100	< 27000	< 100
Chlorobenzene	< 27000	< 100	< 27000	< 100	< 27000	< 100
Dibromochloromethane	< 27000	< 100	< 27000	< 100	< 27000	< 100
Chloroethane	< 27000	< 100	< 27000	< 100	< 27000	< 100
Chloroform	< 27000	< 100	< 27000	< 100	< 27000	< 100
Chloromethane	< 27000	3277	< 27000	4170	< 27000	2447
1,1-Dichloroethane	< 27000	< 100	< 27000	< 100	< 27000	< 100
1,2-Dichloroethane	< 27000	< 100	< 27000	< 100	< 27000	< 100
1,1-Dichloroethene	< 27000	< 100	< 27000	< 100	< 27000	< 100
1,2-Dichloroethene (total)	< 27000	< 100	< 27000	< 100	< 27000	< 100
1,2-Dichloropropane	< 27000	< 100	< 27000	< 100	< 27000	< 100
cis-1,3-Dichloropropene	< 27000	< 100	< 27000	< 100	< 27000	< 100
trans-1,3-Dichloropropene	< 27000	< 100	< 27000	< 100	< 27000	< 100
Ethylbenzene	< 27000	< 100	< 27000	< 100	< 27000	< 100
2-Hexanone	< 27000	< 100	< 27000	< 100	< 27000	< 100
Iodomethane	< 27000	10202	< 27000	13732	20640	12461
Methylene chloride	926100	530606	869990	446687	1034600	590245
4-Methyl-2-pentanone	< 27000	< 100	< 27000	< 100	< 27000	< 100
Styrene	< 27000	< 100	< 27000	< 100	< 27000	< 100
1,1,2,2-Tetrachloroethane	< 27000	< 100	< 27000	< 100	< 27000	< 100
Tetrachloroethene	< 27000	< 100	< 27000	< 100	< 27000	< 100
Toluene	< 27000	< 100	< 27000	< 100	< 27000	< 100
1,1,1-Trichloroethane	< 27000	< 100	< 27000	< 100	< 27000	< 100
1,1,2-Trichloroethane	< 27000	< 100	< 27000	< 100	< 27000	< 100
Trichloroethene	< 27000	< 100	< 27000	< 100	< 27000	< 100
Vinyl chloride	< 27000	< 100	< 27000	< 100	< 27000	< 100
Xylenes (total)	< 27000	< 100	< 27000	< 100	< 27000	< 100

Note: Reported emission rates may be slightly different than given in Appendix IV as a result of differing methods of treating less than values.

Table 6.45 Semi-Volatile Emissions Rates, HLW Test 2A (µg/min).
(Regulatory Data)

Compound	Melter	HEPA	Carbon	TCO	Melter	HEPA	Carbon	TCO
Acenaphthene	< 13038	< 7003	< 3.11	< 2.34	< 12750	< 6758	< 6.18	< 2.22
Acenaphthylene	< 12271	< 6591	< 2.93	< 2.20	< 12000	< 6361	< 5.82	< 2.09
Anthracene	< 12271	< 6591	< 2.93	< 2.20	< 12000	< 6361	< 5.82	< 2.09
Benzo(a)anthracene	< 16106	< 8650	< 3.85	< 2.89	< 15750	< 8348	< 7.64	< 2.74
Benzo(b)fluoranthene	< 31446	< 16889	< 7.51	< 5.63	< 30749	< 16299	< 14.9	< 5.35
Benzo(k)fluoranthene	< 36814	< 19772	< 8.79	< 6.60	< 35999	< 19082	< 17.5	< 6.27
Benzo(ghi)perylene	< 32213	< 17301	< 7.69	< 5.77	< 31499	< 16697	< 15.3	< 5.49
Benzo(a)pyrene	< 16873	< 9062	< 4.03	< 3.02	< 16500	< 8746	< 8.00	< 2.87
bis(2-Chloroethoxy)methane	< 13805	< 7415	< 3.30	< 2.47	< 13500	< 7156	< 6.55	< 2.35
bis(2-Chloroethyl) ether	< 15339	< 8238	< 3.66	< 2.75	< 15000	< 7951	< 7.27	< 2.61
bis(2-Chloroisopropyl) ether	< 18407	< 9886	< 4.39	< 3.30	< 17999	< 9541	< 8.73	< 3.13
bis(2-Ethylhexyl) phthalate	< 107376	< 57669	< 25.6	< 19.2	< 104997	< 55656	< 50.9	< 18.3
4-Bromophenyl phenyl ether	< 12271	< 6591	< 2.93	< 2.20	< 12000	< 6361	< 5.82	< 2.09
Butyl benzyl phthalate	< 19941	< 10710	4.76	< 3.57	< 19499	< 10336	< 9.46	< 3.40
4-Chloroaniline	< 76697	< 41192	< 18.3	< 13.7	< 74998	< 39754	< 36.4	< 13.1
4-Chloro-3-methylphenol	< 31446	< 16889	< 7.51	< 5.63	< 30749	< 16299	< 14.9	< 5.35
2-Chloronaphthalene	< 11505	< 6179	< 2.75	< 2.06	< 11250	< 5963	< 5.45	< 1.96
2-Chlorophenol	< 16106	< 8650	< 3.85	< 2.89	< 15750	< 8348	< 7.64	< 2.74
4-Chlorophenyl phenyl ether	< 16873	< 9062	< 4.03	< 3.02	< 16500	< 8746	< 8.00	< 2.87
Chrysene	< 15339	< 8238	< 3.66	< 2.75	< 15000	< 7951	< 7.27	< 2.61
Dibenz(a,h)anthracene	< 28378	< 15241	< 6.78	< 5.08	< 27749	< 14709	< 13.5	< 4.83
Dibenzofuran	< 16106	< 8650	< 3.85	< 2.89	< 15750	< 8348	< 7.64	< 2.74
Di-n-butyl phthalate	< 92036	< 49431	< 22.0	< 16.5	< 89997	< 47705	< 43.6	< 15.7
1,2-Dichlorobenzene	< 15339	< 8238	< 3.66	< 2.75	< 15000	< 7951	< 7.27	< 2.61
1,3-Dichlorobenzene	< 17640	< 9474	< 4.21	< 3.16	< 17249	< 9143	< 8.36	< 3.00
1,4-Dichlorobenzene	< 18407	< 9886	< 4.39	< 3.30	< 17999	< 9541	< 8.73	< 3.13
3,3'-Dichlorobenzidine	< 99706	< 53550	< 23.8	< 17.9	< 97497	< 51680	< 47.3	< 17.0
2,4-Dichlorophenol	< 22242	< 11946	< 5.31	< 3.98	< 21749	< 11529	< 10.55	< 3.79
Diethyl phthalate	< 21475	< 11534	< 5.13	< 3.85	< 20999	< 11131	< 10.18	< 3.66
2,4-Dimethylphenol	< 75163	< 40368	< 17.9	< 13.5	< 73498	< 38959	< 36.4	< 12.8
Dimethyl phthalate	< 12271	< 6591	< 2.93	< 2.20	< 12000	< 6361	< 5.82	< 2.09
4,6-Dinitro-2-methylphenol	< 107376	< 57669	< 25.6	< 19.2	< 104997	< 55656	< 50.9	< 18.3
2,4-Dinitrophenol	< 222421	< 119458	< 53.1	< 39.8	< 217494	< 115286	< 105.5	< 37.9
2,4-Dinitrotoluene	< 23776	< 12770	< 5.68	< 4.26	< 23249	< 12324	< 11.27	< 4.05
2,6-Dinitrotoluene	< 19941	< 10710	< 4.76	< 3.57	< 19499	< 10336	< 9.46	< 3.40
Di-n-octyl phthalate	< 27611	< 14829	< 6.59	< 4.95	< 26999	< 14311	< 13.1	< 4.70
Fluoranthene	< 13038	< 7003	< 3.11	< 2.34	< 12750	< 6758	< 6.18	< 2.22
Fluorene	< 15339	< 8238	< 3.66	< 2.75	< 15000	< 7951	< 7.27	< 2.61
Hexachlorobenzene	< 16106	< 8650	< 3.85	< 2.89	< 15750	< 8348	< 7.64	< 2.74
Hexachlorobutadiene	< 22242	< 11946	< 5.31	< 3.98	< 21749	< 11529	< 10.55	< 3.79
Hexachlorocyclopentadiene	< 176403	< 94742	< 42.1	< 31.6	< 172495	< 91434	< 83.6	< 30.0
Hexachloroethane	< 29145	< 15653	< 6.96	< 5.22	< 28499	< 15106	< 13.8	< 4.96
Indeno(1,2,3-cd)pyrene	< 26844	< 14417	< 6.41	< 4.81	< 26249	< 13914	< 12.7	< 4.57
Isophorone	< 13805	< 7415	< 3.30	< 2.47	< 13500	< 7156	< 6.55	< 2.35
2-Methylnaphthalene	< 14572	< 7827	< 3.48	< 2.61	< 14250	< 7553	< 6.91	< 2.48
2-Methylphenol	< 46785	< 25127	< 11.17	< 8.38	< 45749	< 24250	< 21.8	< 7.97
Naphthalene	843665	700269	8.06	< 2.47	899974	755325	< 6.55	< 2.35
2-Nitroaniline	< 16873	< 9062	< 4.03	< 3.02	< 16500	< 8746	< 8.00	< 2.87
3-Nitroaniline	< 58290	< 31306	< 13.9	< 10.4	< 56998	< 30213	< 27.3	< 9.93
4-Nitroaniline	< 44484	< 23892	< 10.62	< 7.97	< 43499	< 23057	< 21.8	< 7.57
Nitrobenzene	< 14572	< 7827	< 3.48	< 2.61	< 14250	< 7553	< 6.91	< 2.48
2-Nitrophenol	< 36048	< 19360	< 8.61	< 6.46	< 35249	< 18684	< 17.1	< 6.14
4-Nitrophenol	< 62124	< 33366	< 14.8	< 11.1	< 60748	< 32201	< 29.1	< 10.6
N-Nitrosodiphenylamine	< 15339	< 8238	< 3.66	< 2.75	< 15000	< 7951	< 7.27	< 2.61
N-Nitrosodi-n-propylamine	< 16106	< 8650	< 3.85	< 2.89	< 15750	< 8348	< 7.64	< 2.74
Pentachlorophenol	< 391154	< 210081	< 93.4	< 70.1	< 382489	< 202745	< 182	< 66.6
Phenanthrene	< 13038	< 7003	< 3.11	< 2.34	< 12750	< 6758	< 6.18	< 2.22
Phenol	< 21475	< 11534	5.13	7.01	< 20999	< 11131	< 10.18	15.7
Pyrene	< 13805	< 7415	< 3.30	< 2.47	< 13500	< 7156	< 6.55	< 2.35
1,2,4-Trichlorobenzene	< 16106	< 8650	< 3.85	< 2.89	< 15750	< 8348	< 7.64	< 2.74
2,4,5-Trichlorophenol	< 33747	< 18125	< 8.06	< 6.05	< 32999	< 17492	< 16.0	< 5.75
2,4,6-Trichlorophenol	< 23776	< 12770	< 5.68	< 4.26	< 23249	< 12324	< 11.27	< 4.05

Table 6.45. Semi-Volatile Emissions Rates, HLW Test 2A (µg/min) (continued).
(Regulatory Data)

Compound	Melter	HEPA	Carbon	TCO
Acenaphthene	< 13182	< 6715	< 3.42	< 2.55
Acenaphthylene	< 12407	< 6320	< 3.22	< 2.40
Anthracene	< 12407	< 6320	< 3.22	< 2.40
Benzo(a)anthracene	< 16284	< 8295	< 4.23	< 3.15
Benzo(b)fluoranthene	< 31793	< 16194	< 8.26	< 6.14
Benzo(k)fluoranthene	< 37221	< 18959	< 9.66	< 7.19
Benzo(ghi)perylene	< 32568	< 16589	< 8.46	< 6.29
Benzo(a)pyrene	< 17060	< 8689	< 4.43	< 3.30
bis(2-Chloroethoxy)methane	< 13958	< 7110	< 3.62	< 2.70
bis(2-Chloroethyl) ether	< 15509	< 7900	< 4.03	< 3.00
bis(2-Chloroisopropyl) ether	< 18610	< 9479	< 4.83	< 3.60
bis(2-Ethylhexyl) phthalate	< 108561	< 55297	36.2	25.5
4-Bromophenyl phenyl ether	< 12407	< 6320	< 3.22	< 2.40
Butyl benzyl phthalate	< 20161	< 10269	6.44	4.50
4-Chloroaniline	< 77543	< 39498	< 20.1	< 15.0
4-Chloro-3-methylphenol	< 31793	< 16194	< 8.26	< 6.14
2-Chloronaphthalene	< 11631	< 5925	< 3.02	< 2.25
2-Chlorophenol	< 16284	< 8295	< 4.23	< 3.15
4-Chlorophenyl phenyl ether	< 17060	< 8689	< 4.43	< 3.30
Chrysene	< 15509	< 7900	< 4.03	< 3.00
Dibenz(a,h)anthracene	< 28691	< 14614	< 7.45	< 5.54
Dibenzofuran	< 16284	< 8295	< 4.23	< 3.15
Di-n-butyl phthalate	< 93052	< 47397	< 24.2	< 18.0
1,2-Dichlorobenzene	< 15509	< 7900	< 4.03	< 3.00
1,3-Dichlorobenzene	< 17835	< 9084	< 4.63	< 3.45
1,4-Dichlorobenzene	< 18610	< 9479	< 4.83	< 3.60
3,3'-Dichlorobenzidine	< 100806	< 51347	< 26.2	< 19.5
2,4-Dichlorophenol	< 22488	< 11454	< 5.84	< 4.35
Diethyl phthalate	< 21712	< 11059	< 5.64	< 4.20
2,4-Dimethylphenol	< 75992	< 38708	< 19.7	< 14.7
Dimethyl phthalate	< 12407	< 6320	< 3.22	< 2.40
4,6-Dinitro-2-methylphenol	< 108561	< 55297	< 28.2	< 21.0
2,4-Dinitrophenol	< 224875	< 114543	< 58.4	< 43.5
2,4-Dinitrotoluene	< 24038	< 12244	< 6.24	< 4.65
2,6-Dinitrotoluene	< 20161	< 10269	< 5.23	< 3.90
Di-n-octyl phthalate	< 27916	< 14219	< 7.25	< 5.39
Fluoranthene	< 13182	< 6715	< 3.42	< 2.55
Fluorene	< 15509	< 7900	< 4.03	< 3.00
Hexachlorobenzene	< 16284	< 8295	< 4.23	< 3.15
Hexachlorobutadiene	< 22488	< 11454	< 5.84	< 4.35
Hexachlorocyclopentadiene	< 178350	< 90845	< 46.3	< 34.5
Hexachloroethane	< 29466	< 15009	< 7.65	< 5.69
Indeno(1,2,3-cd)pyrene	< 27140	< 13824	< 7.05	< 5.24
Isophorone	< 13958	< 7110	< 3.62	< 2.70
2-Methylnaphthalene	< 14733	< 7505	< 3.83	< 2.85
2-Methylphenol	< 47301	< 24094	< 12.3	< 9.14
Naphthalene	930519	908448	9.06	< 2.70
2-Nitroaniline	< 17060	< 8689	< 4.43	< 3.30
3-Nitroaniline	< 58933	< 30018	< 15.3	< 11.4
4-Nitroaniline	< 44975	< 22909	< 11.7	< 8.69
Nitrobenzene	< 14733	< 7505	< 3.83	< 2.85
2-Nitrophenol	< 36445	< 18564	< 9.46	< 7.04
4-Nitrophenol	< 62810	< 31993	< 16.3	< 12.1
N-Nitrosodiphenylamine	< 15509	< 7900	< 4.03	< 3.00
N-Nitrosodi-n-propylamine	< 16284	< 8295	4.23	< 3.15
Pentachlorophenol	< 395471	< 201438	< 102.7	< 76.4
Phenanthrene	< 13182	< 6715	< 3.42	< 2.55
Phenol	< 21712	< 11059	6.24	7.49
Pyrene	< 13958	< 7110	< 3.62	< 2.70
1,2,4-Trichlorobenzene	< 16284	< 8295	< 4.23	< 3.15
2,4,5-Trichlorophenol	< 34119	< 17379	< 8.86	< 6.59
2,4,6-Trichlorophenol	< 24038	< 12244	< 6.24	< 4.65

**Table 6.46. Semi-Volatile Emissions Rates, HLW Test 1-continued (µg/min).
(Regulatory Data)**

Compound	Melter	HEPA	TCO	Melter	HEPA	TCO
Acenaphthene	< 12305	< 6833	< 2.41	< 12441	< 6823	< 2.38
Acenaphthylene	< 11581	< 6431	< 2.27	< 11709	< 6422	< 2.24
Anthracene	< 11581	< 6431	< 2.27	< 11709	< 6422	< 2.24
Benzo(a)anthracene	< 15200	< 8441	< 2.97	< 15369	< 8429	< 2.94
Benzo(b)fluoranthene	< 29677	< 16480	< 5.80	< 30005	< 16456	< 5.74
Benzo(k)fluoranthene	< 34743	< 19293	< 6.80	< 35128	< 19266	< 6.72
Benzo(ghi)perylene	< 30401	< 16882	< 5.95	< 30737	< 16857	< 5.88
Benzo(a)pyrene	< 15924	< 8843	< 3.11	< 16100	< 8830	< 3.08
bis(2-Chloroethoxy)methane	< 13029	< 7235	< 2.55	< 13173	< 7225	< 2.52
bis(2-Chloroethyl) ether	< 14476	< 8039	< 2.83	< 14637	< 8027	< 2.80
bis(2-Chloroisopropyl) ether	< 17372	< 9647	< 3.40	< 17564	< 9633	< 3.36
bis(2-Ethylhexyl) phthalate	< 101335	< 56272	< 19.8	< 102457	< 56192	23.8
4-Bromophenyl phenyl ether	< 11581	< 6431	< 2.27	< 11709	< 6422	< 2.24
Butyl benzyl phthalate	< 18819	< 10451	< 3.68	< 19028	< 10436	< 3.64
4-Chloroaniline	< 72382	< 40194	< 14.2	< 73184	< 40137	< 14.0
4-Chloro-3-methylphenol	< 29677	< 16480	< 5.80	< 30005	< 16456	< 5.74
2-Chloronaphthalene	< 10857	< 6029	< 2.12	< 10978	< 6021	< 2.10
2-Chlorophenol	< 15200	< 8441	< 2.97	< 15369	< 8429	< 2.94
4-Chlorophenyl phenyl ether	< 15924	< 8843	< 3.11	< 16100	< 8830	< 3.08
Chrysene	< 14476	< 8039	< 2.83	< 14637	< 8027	< 2.80
Dibenz(a,h)anthracene	< 26781	< 14872	< 5.24	< 27078	< 14851	< 5.18
Dibenzofuran	< 15200	< 8441	< 2.97	< 15369	< 8429	< 2.94
Di-n-butyl phthalate	< 86859	< 48233	< 17.0	< 87821	< 48164	< 16.8
1,2-Dichlorobenzene	< 14476	< 8039	< 2.83	< 14637	< 8027	< 2.80
1,3-Dichlorobenzene	< 16648	< 9245	< 3.26	< 16832	< 9231	< 3.22
1,4-Dichlorobenzene	< 17372	< 9647	< 3.40	< 17564	< 9633	< 3.36
3,3'-Dichlorobenzidine	< 94097	< 52253	< 18.4	< 95139	< 52178	< 18.2
2,4-Dichlorophenol	< 20991	< 11656	4.11	< 21223	< 11640	< 4.06
Diethyl phthalate	< 20267	< 11254	< 3.96	< 20491	< 11238	4.76
2,4-Dimethylphenol	< 70935	< 39391	< 13.9	< 71720	< 39334	13.7
Dimethyl phthalate	< 11581	< 6431	< 2.27	< 11709	< 6422	< 2.24
4,6-Dinitro-2-methylphenol	< 101335	< 56272	< 19.8	< 102457	< 56192	< 19.6
2,4-Dinitrophenol	< 209909	< 116564	< 94.9	< 212233	< 116397	< 252
2,4-Dinitrotoluene	< 22438	< 12460	< 4.39	< 22687	< 12442	< 4.34
2,6-Dinitrotoluene	< 18819	< 10451	< 3.68	< 19028	< 10436	< 3.64
Di-n-octyl phthalate	< 26058	< 14470	< 5.10	< 26346	< 14449	< 5.04
Fluoranthene	< 12305	< 6833	< 2.41	< 12441	< 6823	< 2.38
Fluorene	< 14476	< 8039	< 2.83	< 14637	< 8027	< 2.80
Hexachlorobenzene	< 15200	< 8441	< 2.97	< 15369	< 8429	< 2.94
Hexachlorobutadiene	< 20991	< 11656	< 4.11	< 21223	< 11640	< 4.06
Hexachlorocyclopentadiene	< 166479	< 92447	< 32.6	< 168323	< 92315	< 32.2
Hexachloroethane	< 27505	< 15274	< 5.38	< 27810	< 15252	< 5.32
Indeno(1,2,3-cd)pyrene	< 25334	< 14068	< 4.96	< 25614	< 14048	< 4.90
Isophorone	< 13029	< 7235	< 2.55	< 13173	< 7225	< 2.52
2-Methylnaphthalene	< 13753	< 7637	< 2.69	< 13905	< 7626	< 2.66
2-Methylphenol	< 44153	< 24519	< 8.64	< 44642	< 24484	< 8.54
Naphthalene	868587	643110	21.2	878207	682327	115
2-Nitroaniline	< 15924	< 8843	< 3.11	< 16100	< 8830	< 3.08
3-Nitroaniline	< 55011	< 30548	< 10.8	< 55620	< 30504	< 10.6
4-Nitroaniline	< 41982	< 23313	< 8.21	< 42447	< 23279	< 8.12
Nitrobenzene	< 13753	< 7637	< 2.69	< 13905	< 7626	< 2.66
2-Nitrophenol	< 34020	< 18891	184	< 34396	< 18864	140
4-Nitrophenol	< 58630	< 32557	32.6	< 59279	< 32511	33.6
N-Nitrosodiphenylamine	< 14476	< 8039	< 2.83	< 14637	< 8027	< 2.80
N-Nitrosodi-n-propylamine	< 15200	< 8441	< 2.97	< 15369	< 8429	< 2.94
Pentachlorophenol	< 369149	< 204991	< 72.20	< 373238	< 204698	< 71.4
Phenanthrene	< 12305	< 6833	< 2.41	< 12441	< 6823	< 2.38
Phenol	< 20267	< 11254	< 3.96	< 20491	< 11238	8.12
Pyrene	< 13029	< 7235	< 2.55	< 13173	< 7225	< 2.52
1,2,4-Trichlorobenzene	< 15200	< 8441	< 2.97	< 15369	< 8429	< 2.94
2,4,5-Trichlorophenol	< 31848	< 17686	< 6.23	< 32201	< 17660	< 6.16
2,4,6-Trichlorophenol	< 22438	< 12460	< 4.39	< 22687	< 12442	< 4.34

Table 6.47. Semi-Volatile Emissions Rates, LAW Test 1 (µg/min).
(Regulatory Data)

Compound	Melter	HEPA	Carbon	TCO	Melter	HEPA	Carbon	TCO
Acenaphthene	< 7588	< 9207	< 681	< 2.99	< 7445	< 9261	< 281	< 3.06
Acenaphthylene	< 7142	< 8665	< 649	< 2.81	< 7007	< 8716	< 265	< 2.88
Anthracene	< 7142	< 8665	< 649	< 2.81	< 7007	< 8716	< 265	< 2.88
Benzo(a)anthracene	< 9374	< 11373	< 844	< 3.69	< 9197	< 11440	< 347	< 3.78
Benzo(b)fluoranthene	< 18301	< 22204	< 1622	< 7.21	< 17957	< 22335	< 678	< 7.38
Benzo(k)fluoranthene	< 21425	< 25995	< 1947	< 8.44	< 21022	< 26148	< 794	< 8.65
Benzo(ghi)perylene	< 18747	< 22746	< 1622	< 7.38	< 18395	< 22880	< 695	< 7.56
Benzo(a)pyrene	< 9820	< 11915	< 892	< 3.87	< 9635	< 11985	< 364	< 3.96
bis(2-Chloroethoxy)methane	< 8034	< 9748	< 730	< 3.16	< 7883	< 9806	< 298	< 3.24
bis(2-Chloroethyl) ether	< 8927	< 10831	< 811	< 3.52	< 8759	< 10895	< 331	< 3.60
bis(2-Chloroisopropyl) ether	< 10713	< 12998	< 973	< 4.22	< 10511	< 13074	< 397	< 4.32
bis(2-Ethylhexyl) phthalate	< 62490	< 75820	< 5677	< 24.6	< 61315	< 76265	< 2316	< 25.22
4-Bromophenyl phenyl ether	< 7142	< 8665	< 649	< 2.81	< 7007	< 8716	< 265	< 2.88
Butyl benzyl phthalate	< 11605	< 14081	< 1054	< 4.57	< 11387	< 14164	< 430	< 4.68
4-Chloroaniline	< 44636	< 54157	< 4055	< 17.6	< 43796	< 54475	< 1654	< 18.01
4-Chloro-3-methylphenol	< 18301	< 22204	< 1622	< 7.21	< 17957	< 22335	< 678	< 7.38
2-Chloronaphthalene	< 7142	< 8665	< 616	< 2.64	< 6569	< 8171	< 248	< 2.70
2-Chlorophenol	< 9374	< 11373	< 844	< 3.69	< 9197	< 11440	< 347	< 3.78
4-Chlorophenyl phenyl ether	< 9820	< 11915	< 892	< 3.87	< 9635	< 11985	< 364	< 3.96
Chrysene	< 8927	< 10831	< 811	< 3.52	< 8759	< 10895	< 331	< 3.60
Dibenz(a,h)anthracene	< 16515	< 20038	< 1492	< 6.50	< 16205	< 20156	< 612	< 6.66
Dibenzofuran	< 9374	< 11373	< 844	< 3.69	< 9197	< 11440	< 347	< 3.78
Di-n-butyl phthalate	< 53563	< 64989	< 4866	< 21.1	< 52556	< 65370	< 1985	< 21.61
1,2-Dichlorobenzene	< 8927	< 10831	< 811	< 3.52	< 8759	< 10895	< 331	< 3.60
1,3-Dichlorobenzene	< 10266	< 12456	< 941	< 4.04	< 10073	< 12529	< 380	< 4.14
1,4-Dichlorobenzene	< 10713	< 12998	< 973	< 4.22	< 10511	< 13074	< 397	< 4.32
3,3'-Dichlorobenzidine	< 58027	< 70404	< 5191	< 22.9	< 56935	< 70818	< 2150	< 23.42
2,4-Dichlorophenol	< 12944	< 15706	< 1168	< 5.10	< 12701	< 15798	< 480	< 5.22
Diethyl phthalate	< 12498	< 15164	< 1135	6.33	< 12263	< 15253	< 463	< 5.04
2,4-Dimethylphenol	< 43743	< 53074	< 3893	< 17.2	< 42921	< 53386	< 1621	< 17.65
Dimethyl phthalate	< 7142	< 8665	< 649	< 2.81	< 7007	< 8716	< 265	< 2.88
4,6-Dinitro-2-methylphenol	< 62490	< 75820	< 5677	24.6	< 61315	< 76265	< 2316	< 25.22
2,4-Dinitrophenol	< 129444	< 157056	< 11679	< 52.7	< 127010	< 157978	< 4797	< 52.23
2,4-Dinitrotoluene	< 13837	< 16789	< 1265	< 5.45	< 13577	< 16887	< 513	< 5.58
2,6-Dinitrotoluene	< 11605	< 14081	< 1054	< 4.57	< 11387	< 14164	< 430	< 4.68
Di-n-octyl phthalate	< 16069	< 19497	< 1460	< 6.33	< 15767	< 19611	< 595	< 6.48
Fluoranthene	< 7588	< 9207	< 681	< 2.99	< 7445	< 9261	< 281	< 3.06
Fluorene	< 8927	< 10831	< 811	< 3.52	< 8759	< 10895	< 331	< 3.60
Hexachlorobenzene	< 9374	< 11373	< 844	< 3.69	< 9197	< 11440	< 347	< 3.78
Hexachlorobutadiene	< 12944	< 15706	< 1168	< 5.10	< 12701	< 15798	< 480	< 5.22
Hexachlorocyclopentadiene	< 102663	< 124561	< 9408	< 40.4	< 100732	< 125293	< 3804	< 41.43
Hexachloroethane	< 16962	< 20580	< 1541	< 6.68	< 16643	< 20701	< 629	< 6.84
Indeno(1,2,3-cd)pyrene	< 15623	< 18955	< 1427	< 6.15	< 15329	< 19066	< 579	< 6.30
Isophorone	< 8034	< 9748	< 730	< 3.16	< 7883	< 9806	< 298	< 3.24
2-Methylnaphthalene	< 8481	< 10290	< 779	< 3.34	< 8321	< 10350	< 314	< 3.42
2-Methylphenol	< 27228	< 33036	< 2433	< 10.72	< 26716	< 33230	< 1009	10.99
Naphthalene	624902	649886	17843	193	744540	708176	6616	23.42
2-Nitroaniline	< 9820	< 11915	< 892	< 3.87	< 9635	< 11985	< 364	< 3.96
3-Nitroaniline	< 33923	< 41159	< 3082	< 13.36	< 33285	< 41401	< 1257	< 13.69
4-Nitroaniline	< 25889	< 31411	< 2271	< 10.19	< 25402	< 31596	< 959	< 10.45
Nitrobenzene	< 8481	< 10290	< 779	5.10	< 8321	< 10350	< 314	< 3.42
2-Nitrophenol	< 20979	< 25454	< 1947	33.4	< 20584	< 25603	< 777	< 8.47
4-Nitrophenol	< 36155	< 43867	< 3244	36.9	< 35475	< 44125	< 1340	< 14.59
N-Nitrosodiphenylamine	< 8927	< 10831	< 811	< 3.52	< 8759	< 10895	< 331	< 3.60
N-Nitrosodi-n-propylamine	< 9374	< 11373	< 844	< 3.69	< 9197	< 11440	< 347	< 3.78
Pentachlorophenol	< 227643	< 276202	< 21088	< 89.6	< 223362	< 277823	< 8436	< 91.86
Phenanthrene	< 7588	< 9207	< 681	< 2.99	< 7445	< 9261	< 281	< 3.06
Phenol	< 12498	< 15164	< 1135	28.12	< 12263	< 15253	< 463	19.81
Pyrene	< 8034	< 9748	< 730	< 3.16	< 7883	< 9806	< 298	< 3.24
1,2,4-Trichlorobenzene	< 9374	< 11373	< 844	< 3.69	< 9197	< 11440	< 347	< 3.78
2,4,5-Trichlorophenol	< 19640	< 23829	< 1784	< 7.73	< 19270	< 23969	< 728	< 7.93
2,4,6-Trichlorophenol	< 13837	< 16789	< 1265	< 5.45	< 13577	< 16887	< 513	< 5.58

Table 6.47. Semi-Volatile Emissions Rates, LAW Test 1 (µg/min) (continued).
(Regulatory Data)

Compound	Melter	HEPA	Carbon	TCO
Acenaphthene	< 7561	< 9164	< 61	< 3.08
Acenaphthylene	< 7116	< 8625	< 57	< 2.90
Anthracene	< 7116	< 8625	< 57	< 2.90
Benzo(a)anthracene	< 9340	< 11321	< 75	< 3.80
Benzo(b)fluoranthene	< 18236	< 22102	< 147	< 7.42
Benzo(k)fluoranthene	< 21349	< 25876	< 172	< 8.69
Benzo(ghi)perylene	< 18680	< 22642	< 150	< 7.60
Benzo(a)pyrene	< 9785	< 11860	< 79	< 3.98
bis(2-Chloroethoxy)methane	< 8006	< 9704	< 64	< 3.26
bis(2-Chloroethyl) ether	< 8895	< 10782	< 72	< 3.62
bis(2-Chloroisopropyl) ether	< 10675	< 12938	< 86	< 4.35
bis(2-Ethylhexyl) phthalate	< 62268	< 75472	< 501	< 25.35
4-Bromophenyl phenyl ether	< 7116	< 8625	< 57	< 2.90
Butyl benzyl phthalate	< 11564	< 14016	< 93	< 4.71
4-Chloroaniline	< 44477	< 53908	< 358	< 18.11
4-Chloro-3-methylphenol	< 18236	< 22102	< 147	< 7.42
2-Chloronaphthalene	< 6672	< 8086	< 54	< 2.72
2-Chlorophenol	< 9340	< 11321	< 75	< 3.80
4-Chlorophenyl phenyl ether	< 9785	< 11860	< 79	< 3.98
Chrysene	< 8895	< 10782	< 72	< 3.62
Dibenz(a,h)anthracene	< 16457	< 19946	< 132	< 6.70
Dibenzofuran	< 9340	< 11321	< 75	< 3.80
Di-n-butyl phthalate	< 53373	< 64690	< 429	< 21.73
1,2-Dichlorobenzene	< 8895	< 10782	< 72	< 3.62
1,3-Dichlorobenzene	< 10230	< 12399	< 82	< 4.16
1,4-Dichlorobenzene	< 10675	< 12938	< 86	< 4.35
3,3'-Dichlorobenzidine	< 57820	< 70081	< 465	< 23.54
2,4-Dichlorophenol	< 12898	< 15633	< 104	< 5.25
Diethyl phthalate	< 12454	< 15094	< 100	< 5.07
2,4-Dimethylphenol	< 43588	< 52830	< 358	< 17.74
Dimethyl phthalate	< 7116	< 8625	< 57	< 2.90
4,6-Dinitro-2-methylphenol	< 62268	< 75472	< 501	< 25.35
2,4-Dinitrophenol	< 128984	< 156334	< 1038	< 52.51
2,4-Dinitrotoluene	< 13788	< 16712	< 111	< 5.61
2,6-Dinitrotoluene	< 11564	< 14016	< 93	< 4.71
Di-n-octyl phthalate	< 16012	< 19407	< 129	< 6.52
Fluoranthene	< 7561	< 9164	< 61	< 3.08
Fluorene	< 8895	< 10782	< 72	< 3.62
Hexachlorobenzene	< 9340	< 11321	< 75	< 3.80
Hexachlorobutadiene	< 12898	< 15633	< 104	< 5.25
Hexachlorocyclopentadiene	< 102297	< 123989	< 823	< 41.65
Hexachloroethane	< 16901	< 20485	< 136	< 6.88
Indeno(1,2,3-cd)pyrene	< 15567	< 18868	< 125	< 6.34
Isophorone	< 8006	< 9704	< 64	< 3.26
2-Methylnaphthalene	< 8451	< 10243	< 68	< 3.44
2-Methylphenol	< 27131	< 32884	< 215	< 11.05
Naphthalene	667156	539083	1002	36.21
2-Nitroaniline	< 9785	< 11860	< 79	< 3.98
3-Nitroaniline	< 33803	< 40970	< 268	< 13.76
4-Nitroaniline	< 25797	< 31267	< 215	< 10.50
Nitrobenzene	< 8451	< 10243	75	< 3.44
2-Nitrophenol	< 20904	< 25337	< 168	< 8.51
4-Nitrophenol	< 36026	< 43666	< 286	< 14.67
N-Nitrosodiphenylamine	< 8895	< 10782	< 72	< 3.62
N-Nitrosodi-n-propylamine	< 9340	< 11321	< 75	< 3.80
Pentachlorophenol	< 226833	< 274933	< 1789	< 92.35
Phenanthrene	< 7561	< 9164	< 61	< 3.08
Phenol	< 12454	< 15094	< 100	10.86
Pyrene	< 8006	< 9704	< 64	< 3.26
1,2,4-Trichlorobenzene	< 9340	< 11321	< 75	< 3.80
2,4,5-Trichlorophenol	< 19570	< 23720	< 157	< 7.97
2,4,6-Trichlorophenol	< 13788	< 16712	< 111	< 5.61

Table 6.48. Semi-Volatile Emissions Rates, LAW Test 2A (µg/min).
(Regulatory Data)

Compound	Melter	HEPA	Carbon	TCO	Melter	HEPA	Carbon	TCO
Acenaphthene	< 9684	< 9019	< 20001	< 318	< 965	< 18194	< 16022	< 16
Acenaphthylene	< 9114	< 8488	< 18825	< 299	< 908	< 17123	< 15080	< 15
Anthracene	< 9114	< 8488	< 18825	< 3	< 908	< 17123	< 15080	< 15
Benzo(a)anthracene	< 11962	< 11141	< 23531	< 4	< 1192	< 22475	< 19792	< 19
Benzo(b)fluoranthene	< 23355	< 21751	< 47062	< 766	< 2327	< 43879	< 37699	< 38
Benzo(k)fluoranthene	< 27343	< 25465	< 56474	< 897	< 2725	< 51370	< 44768	< 45
Benzo(ghi)perylene	< 23925	< 22282	< 49415	< 785	< 2384	< 44949	< 40056	< 39
Benzo(a)pyrene	< 12532	< 11672	< 25884	< 411	< 1249	< 23545	< 20735	< 21
bis(2-Chloroethoxy)methane	< 10253	< 9549	< 21178	< 3	< 1022	< 19264	< 16965	< 17
bis(2-Chloroethyl) ether	< 11393	< 10610	< 23531	< 4	< 1135	< 21404	< 18850	< 19
bis(2-Chloroisopropyl) ether	< 13671	< 12733	< 28237	< 4	< 1362	< 25685	< 22620	< 23
bis(2-Ethylhexyl) phthalate	< 79749	< 74273	< 16472	< 280	< 7947	< 149830	< 131948	< 131
4-Bromophenyl phenyl ether	< 9114	< 8488	< 18825	< 3	< 908	< 17123	< 15080	< 15
Butyl benzyl phthalate	< 14811	< 13794	< 30590	30	< 1476	< 27826	< 23562	< 24
4-Chloroaniline	< 56964	< 53052	< 117655	< 19	< 5676	< 107022	< 94248	< 94
4-Chloro-3-methylphenol	< 23355	< 21751	< 47062	< 8	< 2327	< 43879	< 37699	< 38
2-Chloronaphthalene	< 8545	< 7958	< 17648	< 280	< 851	< 16053	< 14137	< 14
2-Chlorophenol	< 11962	< 11141	< 23531	< 4	< 1192	< 22475	< 19792	< 19
4-Chlorophenyl phenyl ether	< 12532	< 11672	< 25884	< 411	< 1249	< 23545	< 20735	< 21
Chrysene	< 11393	< 10610	< 23531	< 4	< 1135	< 21404	< 18850	< 19
Dibenz(a,h)anthracene	< 21077	< 19629	< 42356	< 691	< 2100	< 395980	< 35343	< 34
Dibenzofuran	< 11962	< 11141	< 23531	< 392	< 1192	< 224745	< 19792	< 19
Di-n-butyl phthalate	< 68356	< 63663	< 141186	< 22	< 6812	< 128426	< 11310	< 113
1,2-Dichlorobenzene	< 11393	< 10610	< 23531	< 4	< 1135	< 21404	< 18850	< 19
1,3-Dichlorobenzene	< 13102	< 12202	< 28237	< 4	< 1306	< 24615	< 21677	< 23
1,4-Dichlorobenzene	< 13671	< 12733	< 28237	< 4	< 1362	< 25685	< 22620	< 23
3,3'-Dichlorobenzidine	< 74053	< 68968	< 152952	< 24	< 7379	< 139128	< 122523	< 122
2,4-Dichlorophenol	< 16519	< 15385	< 32943	< 5	< 1646	< 31036	< 28275	< 26
Diethyl phthalate	< 15950	< 14855	< 32943	< 523	< 1589	< 29966	< 25918	< 26
2,4-Dimethylphenol	< 55824	< 51991	< 115302	< 18	< 5563	< 107022	< 91892	< 92
Dimethyl phthalate	< 9114	< 8488	< 18825	< 299	< 908	< 17123	< 15080	< 15
4,6-Dinitro-2-methylphenol	< 79749	< 74273	< 164717	32	< 7947	< 149830	< 131948	143
2,4-Dinitrophenol	< 165195	< 153852	< 329434	< 5420	< 16462	< 310362	< 282745	< 263
2,4-Dinitrotoluene	< 17659	< 16446	< 37650	579	< 1760	< 33177	< 28275	< 30
2,6-Dinitrotoluene	< 14811	< 13794	< 30590	< 486	< 1476	< 27826	< 23562	< 24
Di-n-octyl phthalate	< 20507	< 19099	< 42356	< 673	< 2044	< 38528	< 32987	< 34
Fluoranthene	< 9684	< 9019	< 20001	< 3	< 965	< 18194	< 16022	< 16
Fluorene	< 11393	< 10610	< 23531	< 374	< 1135	< 21404	< 18850	< 19
Hexachlorobenzene	< 11962	< 11141	< 23531	< 4	< 1192	< 224745	< 19792	< 19
Hexachlorobutadiene	< 16519	< 15385	< 32943	< 5	< 1646	< 310362	< 28275	< 26
Hexachlorocyclopentadiene	< 131017	< 122020	< 282372	< 4299	< 13056	< 246150	< 216771	< 225
Hexachloroethane	< 21646	< 20160	< 44709	< 7	< 2157	< 40668	< 35343	< 36
Indeno(1,2,3-cd)pyrene	< 19937	< 18568	< 42356	< 654	< 1987	< 37458	< 32987	< 34
Isophorone	< 10253	< 9549	< 21178	< 3	< 1022	< 19264	< 16965	< 17
2-Methylnaphthalene	< 10823	< 10080	< 22354	< 4	< 1079	< 20334	< 17907	< 18
2-Methylphenol	< 34748	< 32362	< 70593	< 11	< 3463	< 64213	< 56549	< 56
Naphthalene	911420	15385	30590	< 4	965003	288958	< 16965	< 17
2-Nitroaniline	< 12532	< 11672	< 25884	< 411	< 1249	< 23545	< 20735	< 21
3-Nitroaniline	< 43292	< 40320	< 89418	< 1420	< 4314	< 80266	< 70686	< 71
4-Nitroaniline	< 33039	< 30770	< 68240	< 1084	< 3292	< 64213	< 54193	< 54
Nitrobenzene	< 10823	< 10080	< 22354	21	< 1079	< 20334	< 17907	< 18
2-Nitrophenol	< 26773	< 24935	< 56474	9	< 2668	< 50300	< 44768	75
4-Nitrophenol	< 46141	< 42972	< 94124	< 1514	< 4598	< 85617	< 75399	< 75
N-Nitrosodiphenylamine	< 11393	< 10610	< 23531	< 4	< 1135	< 21404	< 18850	< 19
N-Nitrosodi-n-propylamine	< 11962	< 11141	< 23531	< 4	< 1192	< 22475	< 197922	< 19
Pentachlorophenol	< 290515	< 270567	< 611807	< 95	< 28950	< 535108	< 471242	< 488
Phenanthrene	< 9684	< 9019	< 20001	< 3	< 965	< 18194	< 16022	< 16
Phenol	< 15950	< 14855	< 32943	< 5	< 1589	< 29966	< 25918	60
Pyrene	< 10253	< 9549	< 21178	< 3	< 1022	< 19264	< 16965	< 17
1,2,4-Trichlorobenzene	< 11962	< 11141	< 23531	< 4	< 1192	< 22475	< 19792	< 19
2,4,5-Trichlorophenol	< 25064	< 23343	< 51768	< 822	< 2498	< 47089	< 42412	< 41
2,4,6-Trichlorophenol	< 17659	< 16446	< 37650	< 579	< 1760	< 33177	< 28275	< 30

Table 6.48. Semi-Volatile Emissions Rates, LAW Test 2A (µg/min) (continued).
(Regulatory Data)

Compound	Melter	HEPA	Carbon	TCO
Acenaphthene	< 95	< 18088	< 163	< 16
Acenaphthylene	< 90	< 17024	< 153	< 15
Anthracene	< 90	< 17024	< 153	< 15
Benzo(a)anthracene	< 118	< 22344	< 201	< 19
Benzo(b)fluoranthene	< 230	< 43624	< 47958	< 37
Benzo(k)fluoranthene	< 269	< 51072	< 57549	< 45
Benzo(ghi)perylene	< 235	< 44688	< 50356	< 39
Benzo(a)pyrene	< 123	< 23408	< 26377	< 21
bis(2-Chloroethoxy)methane	< 101	< 19152	< 173	< 17
bis(2-Chloroethyl) ether	< 112	< 21280	< 192	< 19
bis(2-Chloroisopropyl) ether	< 134	< 25536	< 230	< 22
bis(2-Ethylhexyl) phthalate	< 785	< 148960	< 1343	< 131
4-Bromophenyl phenyl ether	< 90	< 17024	< 153	< 15
Butyl benzyl phthalate	< 146	< 27664	< 240	< 24
4-Chloroaniline	< 560	< 106400	< 959	< 93
4-Chloro-3-methylphenol	< 230	< 43624	< 384	< 37
2-Chloronaphthalene	< 84	< 15960	< 144	< 14
2-Chlorophenol	< 118	< 22344	< 201	< 19
4-Chlorophenyl phenyl ether	< 123	< 23408	< 211	< 21
Chrysene	< 112	< 21280	< 192	< 19
Dibenz(a,h)anthracene	< 207	< 39368	< 43162	< 34
Dibenzofuran	< 118	< 22344	< 201	< 19
Di-n-butyl phthalate	< 672	< 127680	< 1151	< 112
1,2-Dichlorobenzene	< 112	< 21280	< 192	< 19
1,3-Dichlorobenzene	< 129	< 24472	< 221	< 22
1,4-Dichlorobenzene	< 134	< 25536	< 230	< 22
3,3'-Dichlorobenzidine	< 728	< 138320	< 1247	< 121
2,4-Dichlorophenol	< 163	< 30856	< 288	< 26
Diethyl phthalate	< 157	< 29792	< 264	< 26
2,4-Dimethylphenol	< 549	< 106400	< 935	< 91
Dimethyl phthalate	< 90	< 17024	< 153	< 15
4,6-Dinitro-2-methylphenol	897	< 148960	< 1343	280
2,4-Dinitrophenol	< 1625	< 308561	< 2877	< 261
2,4-Dinitrotoluene	< 174	< 32984	< 288	< 30
2,6-Dinitrotoluene	< 146	< 27664	< 240	< 24
Di-n-octyl phthalate	269	< 38304	< 43162	< 34
Fluoranthene	< 95	< 18088	< 163	< 16
Fluorene	< 112	< 21280	< 192	< 19
Hexachlorobenzene	< 118	< 22344	< 201	< 19
Hexachlorobutadiene	< 163	< 30856	< 288	< 26
Hexachlorocyclopentadiene	< 1288	< 244721	< 2206	< 224
Hexachloroethane	< 213	< 40432	< 360	< 35
Indeno(1,2,3-cd)pyrene	< 196	< 37240	< 43162	< 34
Isophorone	< 101	< 19152	< 173	< 17
2-Methylnaphthalene	< 106	< 20216	< 182	< 18
2-Methylphenol	< 342	< 63840	< 575	224
Naphthalene	784509	313881	14627	< 17
2-Nitroaniline	< 123	< 23408	< 211	< 21
3-Nitroaniline	< 426	< 79800	< 719	< 71
4-Nitroaniline	< 325	< 63840	< 552	< 54
Nitrobenzene	1345	< 20216	213	< 18
2-Nitrophenol	1961	< 50008	< 456	< 45
4-Nitrophenol	1008	< 85120	< 767	< 75
N-Nitrosodiphenylamine	< 112	< 21280	< 192	< 19
N-Nitrosodi-n-propylamine	< 118	< 22344	< 201	< 19
Pentachlorophenol	< 2858	< 532001	< 4796	< 485
Phenanthrene	< 95	< 18088	< 163	< 16
Phenol	347	< 29792	< 264	54
Pyrene	< 101	< 19152	< 173	< 17
1,2,4-Trichlorobenzene	< 118	< 22344	< 201	< 19
2,4,5-Trichlorophenol	< 247	< 46816	< 432	< 41
2,4,6-Trichlorophenol	< 174	< 32984	< 288	< 30

Figure 1.1. Cross-section of the DM1200 melter through the discharge chamber.

Figure 1.2. Cross-section through the DM1200 melter showing electrodes.

Figure 1.3. Single Outlet “L” Bubbler.

Figure 1.4. Double Outlet “J” Bubbler.

Figure 1.6. Placement of double outlet bubblers. Note: solid circles represent location of bubbler outlet.

Figure 1.7. Schematic diagram of DM1200 off-gas system. “Sx” indicates sampling point.

Figure 1.8. Schematic of SBS internals and monitoring points.

Figure. 1.9. Schematic of the AC-S bed. Exterior of the vessel is insulated to prevent heat loss (not shown). Unless otherwise indicated, dimensions are in inches.

Figure 1.10. View of the sulfur impregnated activated carbon bed.

Figure 1.11. View of carbon in the bed and top, middle, and bottom thermocouples.

Figure 1.12. AC-S interlock system stack exhaust pipe.

Figure 1.13. View of the AC-S bed with ambient air inlet pipe.

Figure 1.14. S-AC Nitrogen Purge system.

Figure 2.1. Viscosity vs. shear rate of High Waste Loading HLW C-106/AY-102 DM1200 feed samples.

Figure 2.2. Viscosity vs. shear rate of LAW Sub-Envelope A2 DM1200 feed samples.

Figure 3.1.a. Production rate for HLW MACT Test 1 (1 hour moving average).

Figure 3.1.b. Production rates for HLW MACT Tests 2A, 1-continued and 2B (1-hour moving average).

Figure 3.1.c. Production rate for LAW MACT Test 1 (1-hour moving average).

Figure 3.1.d. Production rates for LAW MACT Tests 2B and 2A (1-hour moving average).

Figure 3.2.a. Glass temperatures (hourly averages) for HLW MACT Test 1.

Figure 3.2.b. Glass temperatures (hourly averages) for HLW MACT Tests 2A, 1-continued, and 2B.

Figure 3.2.c. Glass temperatures (hourly averages) for LAW MACT Test 1.

Figure 3.2.d. Glass temperatures (hourly averages) for LAW MACT Tests 2B and 2A.

Figure 3.3.a. Plenum temperatures (hourly averages) for HLW MACT Test 1.

Figure 3.3.b. Plenum temperatures (hourly averages) for HLW MACT Tests 2A, 1-continued and 2B.

Figure 3.3.c. Plenum temperatures (hourly averages) for LAW MACT Test 1.

Figure 3.3.d. Plenum temperatures (hourly averages) for LAW MACT Tests 2B and 2A.

Figure 3.4.a. Electrode temperatures and power (hourly averages) for HLW MACT Test 1.

Figure 3.4.b. Electrode temperatures and power (hourly averages) for HLW MACT Tests 2A, 1-continued and 2B.

Figure 3.4.c. Electrode temperatures and power (hourly averages) for LAW MACT Test 1.

Figure 3.4.d. Electrode temperatures and power (hourly averages) for LAW MACT Tests 2B and 2A.

Figure 3.5.a. Electrode power and glass resistance for HLW MACT Test 1.

Figure 3.5.b. Electrode power and glass resistance for HLW MACT Tests 2A, 1-continued and 2B.

Figure 3.5.c. Electrode power and glass resistance for LAW MACT Test 1.

Figure 3.5.d. Electrode power and glass resistance for LAW MACT Tests 2B and 2A.

Figure 3.6.a. Glass density and level for HLW MACT Test 1.

Figure 3.6.b. Glass density and level for HLW MACT Tests 2A, 1-continued and 2B.

Figure 3.6.c. Glass density and level for LAW MACT Test 1.

Figure 3.6.d. Glass density and level for LAW MACT Tests 2B and 2A.

Figure 3.7.a. Glass pool bubbling for HLW MACT Test 1.

Figure 3.7.b. Glass pool bubbling for HLW MACT Tests 2A, 1-continued and 2B.

Figure 3.7.c. Glass pool bubbling for LAW MACT Test 1.

Figure 3.7.d. Glass pool bubbling for LAW MACT Tests 2B and 2A.

Figure 4.1. Average gas temperatures along the DM1200 off-gas train during HLW Test 1.

Figure 4.2. Average gas temperatures along the DM1200 off-gas train during HLW Test 2A.

Figure 4.3. Average gas temperatures along the DM1200 off-gas train during HLW Test 1-continued.

Figure 4.4. Average gas temperatures along the DM1200 off-gas train during HLW Test 2B.

Figure 4.5. Average gas temperatures along the DM1200 off-gas train during LAW Test 1.

Figure 4.6. Average gas temperatures along the DM1200 off-gas train during LAW Test 2B.

Figure 4.7. Average gas temperatures along the DM1200 off-gas train during LAW Test 2A.

Figure 4.8. Representative off-gas system component temperatures during HLW Test 1.

Figure 4.9. TCO temperatures during HLW Test 1 (hourly averages).

Figure 4.10. Representative off-gas system component temperatures during HLW Tests 2A, 1-continued, and 2B (hourly averages).

Figure 4.11. TCO temperatures during HLW Tests 2A, 1-continued and 2B (hourly averages).

Figure 4.12. Representative off-gas system component temperatures during LAW Test 1 (hourly averages).

Figure 4.13. TCO temperatures during LAW Test 1 (hourly averages).

Figure 4.14. Representative off-gas system component temperatures during LAW Tests 2B and 2A (hourly averages).

Figure 4.15. TCO temperatures during LAW Tests 2B and 2A (hourly averages).

Figure 4.16. Melter pressure at instrument port and control air flow rate during HLW Test 1.

Figure 4.17. Film cooler differential pressure during HLW Test 1.

Figure 4.18. View of the film cooler from top at 1.5 hours during HLW Test 1.

Figure 4.19. Transition line differential pressure during HLW Test 1.

Figure 4.20. Melter pressure at instrument port and control air flow rate during HLW Tests 2A, 1-continued, and 2B.

Figure 4.21. Film cooler differential pressure during HLW Tests 2A, 1-continued, and 2B.

Figure 4.22. View of the film cooler from top at 47.9 hours during HLW Tests 2A, 1-continued, and 2B.

Figure 4.23. Transition line differential pressure during HLW Tests 2A, 1-continued, and 2B.

Figure 4.24. Melter pressure at instrument port and control air flow rate during LAW Test 1.

Figure 4.25. Film cooler differential pressure during LAW Test 1.

Figure 4.26. Transition line differential pressure during LAW Test 1.

Figure 4.27. Melter pressure at instrument port and control air flow rate during LAW Tests 2B and 2A.

Figure 4.28. Film cooler differential pressure during LAW Tests 2B and 2A.

Figure 4.29. Transition line differential pressure during LAW Tests 2B and 2A.

Figure 4.30. Layout of film cooler and transition line sections.

Figure 4.31. SBS Y-piece (Transition Line #4) connecting transition line bellows to the SBS inlet.

Figure 4.32. Transition line section #3 outlet at 26.9 hours of HLW Turnover Test.

Figure 4.33. Transition line bellows at 26.9 hours of HLW Turnover Test.

**Figure 4.34. Transition line section #4 inlet at 26.9 hours of HLW
Turnover Test.**

Figure 4.35. Film cooler inlet after HLW Turnover Test.

Figure 4.36. Tip of the film cooler inlet showing damage after HLW Turnover Test.

Figure 4.37. A close-up view of inlet and louvers of the film cooler after HLW Turnover Test.

Figure 4.38. Film cooler outlet after HLW Turnover Test.

Figure 4.39. View of bottom end of film cooler (post-cleaning) after Configuration Tests (left) and HLW Turnover Test at the conclusion of the MACT tests (right).

Figure 4.40. Another close-up view of bottom end of film cooler (post-cleaning) after HLW Turnover Test.

Figure 4.41. Transition line section #1 inlet after HLW Turnover Test.

Figure 4.42. Transition line section #1 outlet after HLW Turnover Test.

Figure 4.43. Transition line section #2 inlet after HLW Turnover Test.

Figure 4.44. Transition line section #2 outlet after HLW Turnover Test.

Figure 4.45. Transition line section #3 inlet after HLW Turnover Test.

Figure 4.46. Solids that fell out of Transition line section #3 after HLW Turnover Test.

Figure 4.47. Transition line bellows outlet after HLW Turnover Test.

Figure 4.48. Transition line section #4 inlet after HLW Turnover Test.

Figure 4.49. Transition line section #4 outlet after HLW Turnover Test.

Figure 4.50. SBS inlet and outlet gas temperatures during HLW Test 1.

Figure 4.51. SBS inlet, outlet and differential pressures (hourly average values) during HLW Test 1.

Figure 4.52. SBS downcomer annulus pressure (hourly average values) during HLW Test 1.

Figure 4.53. Off-gas temperatures in the SBS downcomer and sump water temperatures (hourly average values) during HLW Test 1.

Figure 4.54. SBS cooling coil inlet, cooling coil outlet/jacket inlet and jacket outlet water temperatures (hourly average values) during HLW Test 1.

Figure 4.55. SBS cooling coil/jacket water flow rate (hourly average values) during HLW Test 1.

Figure 4.56. Calculated heat loads on the inner coil and jacket (hourly average values) during HLW Test 1.

Figure 4.57. SBS inlet and outlet gas temperatures during HLW Tests 2A, 1-continued, and 2B.

Figure 4.58. SBS inlet, outlet, and differential pressures (hourly average values) during HLW Tests 2A, 1-continued, and 2B.

Figure 4.59. SBS downcomer annulus pressure (hourly average values) during HLW Tests 2A, 1-continued, and 2B.

Figure 4.60. Off-gas temperatures in the SBS downcomer and sump water temperatures (hourly average values) during HLW Tests 2A, 1-continued, and 2B.

Figure 4.61. SBS cooling coil inlet, cooling coil outlet/jacket inlet and jacket outlet water temperatures (hourly average values) during HLW Tests 2A, 1-continued, and 2B.

Figure 4.62. SBS cooling coil/jacket water flow rate (hourly average values) during HLW Tests 2A, 1-continued, and 2B.

Figure 4.63. Calculated heat loads on the inner coil and jacket (hourly average values) during HLW Tests 2A, 1-continued, and 2B.

Figure 4.64. SBS inlet and outlet gas temperatures during LAW Test 1.

Figure 4.65. SBS inlet, outlet, and differential pressures (hourly average values) during LAW Test 1.

Figure 4.66. SBS downcomer annulus pressure (hourly average values) during LAW Test 1.

Figure 4.67. Off-gas temperatures in the SBS downcomer and sump water temperatures (hourly average values) during LAW Test 1.

Figure 4.68. SBS cooling coil inlet, cooling coil outlet/jacket inlet and jacket outlet water temperatures (hourly average values) during LAW Test 1.

Figure 4.69. SBS cooling coil/jacket water flow rate (hourly average values) during LAW Test 1.

Figure 4.70. Calculated heat loads on the inner coil and jacket (hourly average values) during LAW Test 1.

Figure 4.71. SBS inlet and outlet gas temperatures during LAW Tests 2B and 2A.

Figure 4.72. SBS inlet, outlet, and differential pressures (hourly average values) during LAW Tests 2B and 2A.

Figure 4.73. SBS downcomer annulus pressure (hourly average values) during LAW Tests 2B and 2A.

Figure 4.74. Off-gas temperatures in the SBS downcomer and sump water temperatures (hourly average values) during LAW Tests 2B and 2A.

Figure 4.75. SBS cooling coil inlet, cooling coil outlet/jacket inlet and jacket outlet water temperatures (hourly average values) during LAW Tests 2B and 2A.

Figure 4.76. SBS cooling coil/jacket water flow rate (hourly average values) during LAW Tests 2B and 2A.

Figure 4.77. Calculated heat loads on the inner coil and jacket (hourly average values) during LAW Tests 2B and 2A.

Figure 4.78. Bottom view of SBS overflow tank from top after HLW Turnover Test.

Figure 4.79. Visual image of SBS bowl contents after HLW Turnover Test.

Figure 4.80. Close-up view of the SBS bowl contents after HLW Turnover Test.

Figure 4.81. SBS solids after standing water was removed after HLW Turnover Test. Note: The tip of the accumulated solids (lower part of photo) was tilted toward the SBS overflow tank side.

Figure 4.82. View from the bottom of SBS diffuser plate after HLW Turnover Test.

Figure 4.83. Bottom view of SBS downcomer after HLW Turnover Test.

Figure 4.84. Close-up view of the SBS downcomer after HLW Turnover Test.

**Figure 4.85. View of SBS downcomer from the top of SBS after HLW
Turnover Test.**

Figure 4.86. WESP inlet and gas outlet temperatures during HLW Test 1. (Note: Downward outlet temperature spikes are the result of WESP deluges.)

Figure 4.87. WESP differential pressure and outlet gas flow rate (hourly average values) during HLW Test 1.

Figure 4.88. Accumulated WESP blowdown volume, accumulated fresh spray water, and water removed from off-gas during HLW Test 1.

Figure 4.89. Voltage and current across the WESP during HLW Test 1.

Figure 4.90. WESP inlet and outlet gas temperatures during HLW Tests 2A, 1-continued, and 2B. (Note: Downward outlet temperature spikes are the result of WESP deluges.)

Figure 4.91. WESP differential pressure and outlet gas flow rate (hourly average values) during HLW Tests 2A, 1-continued, and 2B.

Figure 4.92. Accumulated WESP blowdown volume, accumulated fresh spray water and water removed from off-gas during HLW Tests 2A, 1-continued, and 2B.

Figure 4.93. Voltage and current across the WESP during HLW Tests 2A, 1-continued, and 2B.

**Figure 4.94. Post-deluge view of WESP floor after HLW Tests 2A,
1-continued, and 2B.**

Figure 4.95. Post-deluge view of WESP collector plates and grid after HLW Tests 2A, 1-continued, and 2B.

Figure 4.96. View of WESP inlet spray nozzle and inlet piping after HLW Tests 2A, 1-continued, and 2B.

Figure 4.97. View of WESP south grid support post after LAW Scoping Test.

Figure 4.98. View of WESP power supply connection to grid structure after LAW Scoping Test.

Figure 4.99. WESP inlet and outlet gas temperatures during LAW Test 1. (Note: Downward outlet temperature spikes are the result of WESP deluges.)

Figure 4.100. WESP differential pressure and outlet gas flow rate (hourly average values) during LAW Test 1.

Figure 4.101. Accumulated WESP blowdown volume, accumulated fresh spray water, and water removed from off-gas during LAW Test 1.

Figure 4.102. Voltage and current across the WESP during LAW Test 1.

Figure 4.103. WESP inlet and outlet gas temperatures during LAW Tests 2B and 2A. (Note: Downward outlet temperatures spikes are the result of WESP deluges.)

Figure 4.104. WESP differential pressure and outlet gas flow rate (hourly average values) during LAW Tests 2B and 2A.

Figure 4.105. Accumulated WESP blowdown volume (estimated) and accumulated fresh spray water during LAW Tests 2B and 2A.

Figure 4.106. Voltage and current across the WESP during LAW Tests 2B and 2A.

Figure 4.107. View of an arc in a WESP plate at 132.2 hours of LAW Tests 2B and 2A.

Figure 4.108. View of WESP rod and collector plate after LAW Tests 2B and 2A.

Figure 4.109. View of WESP collector grid from bottom end with diffuser plate removed (post-deluge) after HLW Turnover Test.

Figure 4.110. Close-up view of WESP collector grid from bottom end with diffuser plate removed (post-deluge) after HLW Turnover Test.

Figure 4.111. View of WESP south upper grid support rod (post-deluge) after HLW Turnover Test.

Figure 4.112. View of WESP upper grid support from south manway opening (post-deluge) after HLW Turnover Test.

Figure 4.113. View of WESP upper grid support from north manway opening (post-deluge) after HLW Turnover Test.

Figure 4.114. View of WESP north upper grid support rod showing yellow deposits (post-deluge) after HLW Turnover Test.

Figure 4.115. Low magnification SEM micrograph of BSE image of first part of WESP solids sample and EDS spectra of the corresponding regions #1 through #3 (Sample # O-12G-116B.)

Figure 4.116. Intermediate magnification SEM micrograph of second part of WESP solids sample and EDS spectra of corresponding regions #1 through #3 (Sample # O-12G-116B).

Figure 4.117. EDS spectra of regions #4 and #5 indicated in Figure 4.116. (Sample # O-12G-116B).

Figure 4.118. High magnification SEM micrograph of third part of WESP solids sample and EDS spectra of corresponding regions #1 through #3 (Sample # O-12G-116B).

Figure 4.119. Outlet gas temperature and differential pressure for HEME #1 during HLW Test 1.

Figure 4.120. Outlet gas temperature and differential pressure for HEME #1 during HLW Tests 2A, 1-continued, and 2B.

Figure 4.121. Outlet gas temperature and differential pressure for HEPA #1 (hourly average values) during HLW Test 1.

Figure 4.122. Outlet gas temperature and differential pressure for HEPA #1 (hourly average values) during HLW Tests 2A, 1-continued, and 2B.

Figure 4.123. Outlet gas temperature and differential pressure for HEPA #1 (hourly average values) during LAW Test 1.

Figure 4.124. Outlet gas temperature and differential pressure for HEPA #1 (hourly average values) during LAW Tests 2B and 2A.

Figure 4.125. View of Blower 702 impeller blades after LAW Test 1.

Figure 4.126. View of Blower 702 discharge port showing minor corrosion after LAW Test 1.

Figure 4.127a. Activated carbon bed temperatures during HLW Test 1.

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*Regulatory Off-Gas Emissions Testing on the DM1200
Melter System Using HLW and LAW Simulants
Final Report, VSL-05R5830-1, Rev. 0*

APPENDIX I

LETTER REPORT

Method Development for Measurement of Allyl Alcohol in High NO_x Off-Gas Streams

VSL-04L4300-1

Letter Report

Method Development for Measurement of Allyl Alcohol in High NO_x Off-Gas Streams

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Rev. 0

Method Development for Measurement of Allyl Alcohol in High NO_x Off-Gas Streams

1.0 Introduction

Washington State DOE, EPA, ORP, and the WTP Project agreed to use one of three alcohols (methanol, ethanol, and allyl alcohol) as a principal organic dangerous constituent (PODC) for organic destruction testing required by the MACT standard. These water soluble compounds were selected due to their likely presence in aqueous waste streams. However, because of their water solubility, the use of these alcohols presents problems for the analytical methods that are typically used for monitoring the destruction of volatile (SW-846-0030 and SW-846-8260) and semi-volatile (SW-846-0010 and SW-846-8270) organic compounds. As a result, in previous tests, an existing EPA method for methanol, 40 CFR Appendix A of Part 63 – Method 308, was evaluated for its suitability for determining methanol, ethanol, and allyl alcohol in WTP melter off-gas streams as a means for calculating organic destruction across the DM1200 melter system [1]. Based on the results of these tests, allyl alcohol was selected as the PODC for future testing. However, these tests also revealed serious shortcomings with Method 308 for monitoring alcohol emissions in LAW exhaust streams that contain high levels of nitrogen oxides. The WTP Project therefore provided direction to VSL/Duratek to investigate this issue and use the results to develop modifications to Method 308 that would improve its performance with high nitrogen oxide exhaust streams [2, 3]. The present report provides the results of that work. Data are presented here for bench-scale, DM100, and DM1200 tests, as well as from additional analyses performed on samples taken during previous DM1200 tests [1]; these data include pH and anion analysis of solutions generated by sampling, percent recovery of allyl alcohol in test samples, estimations of detection limits, as well as concentration of various gaseous species monitored by FTIR. This Letter Report fulfills the reporting requirements of the CCNs for this work [2, 3].

2.0 Test Method Development Overview

A summary of the development activities is given below in the order in which they were conducted:

- Analysis of solutions generated from Method 308 sampling during previous DM1200 tests [1]. Analysis included determination of pH and anion concentrations and searching for potential organic reaction products of alcohol degradation. This information was used to provide insight into possible causes of the low recoveries in high-NO_x environments.
- Bench-scale tests examining the retention of allyl alcohol in pre-spiked impinger

solutions in the sampling train after flowing gasses containing nitrogen oxides through them. These tests used:

- NO and NO₂ bottled gases
- A variety of impinger solutions: deionized water, 0.2 NaOH, 0.2 M carbonate buffer, 0.07 M borate buffer, and 0.2 M phosphate buffer.
- Sampling melter exhaust during previously planned HLW DM1200 tests using Method 308 employing a variety of pre-spiked impinger solutions (deionized water, 0.2 M NaOH, 0.2 M carbonate buffer, 0.07 M borate buffer, and 0.2 M phosphate buffer).
- DM100 tests examining the retention of allyl alcohol in pre-spiked impinger solutions in the sampling train using:
 - LAW feeds and melter conditions to generate bounding melter exhaust conditions.
 - Impinger solutions containing either deionized water or 0.2 M NaOH.
- DM100 tests examining the collection of allyl alcohol from spiked melter exhaust by impingers containing 0.2 M NaOH solutions. These tests used:
 - Solutions of nitric acid and sugar in water fed to the melter to generate bounding nitrogen and carbon oxide exhaust concentrations.
 - Dynamic spiking based on 40 CFR Appendix A of Part 63 Method 301 in which four sampling trains (2 spiked and two unspiked) are run in parallel.
 - Additional tests were conducted to determine method detection limits.

Method 308 melter emissions sampling was performed by Air Tech Environmental, NC and VSL staff; the sampling system for bottled gases was constructed and operated by VSL staff. Analysis of impinger solutions for pH and anions as well as monitoring of the exhaust streams for various gaseous constituents (most notably NO_x and CO_x) by FTIR was performed at VSL. Analysis of the impinger solutions for allyl alcohol was conducted by Severn Trent Laboratories, Knoxville, TN. Data have been provided to VSL for all submitted samples, laboratory blanks, and post-sampling laboratory surrogates. Laboratory blanks were below detectable levels for allyl alcohol and therefore no subtractions from the sample results were performed.

3.0 Method 308 Alcohol Data

A description of the sampling and analytical aspects of Method 308 has been provided previously [1]. A diagram of the Method 308 sampling train taken directly from 40 CFR Appendix A of Part 63 is provided in Figure 1. In brief, the method entails pulling a known volume of exhaust through chilled water in an impinger, which is intended to quantitatively remove the highly water-soluble methanol, for which the method is intended. In the present work, two to four such impingers in series were used, whereas only one is used in Method 308. In addition, during method development, a vertical condenser was added to the sampling train in front of the first impinger to cool the hot inlet gas stream and drain any condensed liquid directly into the first impinger. At the end of the Method 308 train, the air stream passes through a silica gel column to remove any residual moisture. The water solutions are analyzed for alcohols using a gas chromatograph (GC) equipped with a flame ionization detector (FID). Per method, the silica gel columns are washed and the resulting solutions are analyzed in the same way; in this study, the silica gels were not analyzed but were archived. In the previous study [1], and consistent with the intent of the method, the water from the impingers contained the vast majority of the recovered alcohols. The additional impingers used in this study make the accumulation of significant amounts of allyl alcohol in the silica gel even more unlikely. Calculated method detection limits are provided in Table 1; these values are dependent on the STL analytical detection limits (estimated to be 0.1 ppm in solution), impinger volumes, air sample volumes, and stack flow rates. Surrogate and field spike recoveries are not required or specified in Method 308. However, other EPA methods for volatile organic compounds used for DRE calculations require surrogate recoveries between 50 and 150%. Consequently, this range was employed as a *de facto* success criterion for the present work.

4.0 Analysis of Samples from Previous Tests with Alcohols

Selected samples from a previous study [1] were subjected to pH, anion, and organic analysis in an effort to diagnose the difference in allyl alcohol spike recovery during tests with HLW and LAW feeds. Analytical results are given in Tables 2 and 3. A summary of the results is as follows:

- pH values for LAW samples were between 1.3 and 1.9 for all samples taken on exhaust not exposed to the TCO/SCR.
- pH values for HLW samples were between 2.5 and 3.2 for all samples taken on exhaust not exposed to the TCO/SCR.
- pH values increase in samples taken downstream of the TCO/SCR due to the removal of nitrogen species and the addition of ammonia in that unit.
- Nitrate concentrations are over an order of magnitude higher in the sample from the LAW melter exhaust than for either of the samples taken during HLW processing.

- The sample taken after the PBS during LAW processing contains five times more nitrate than the sample taken from the *melter* exhaust during HLW processing.
- Other anions, such as chloride, fluoride, iodide, and sulfate, are present in small quantities and particularly in samples taken from the melter exhaust.
- Except for the three alcohols spiked into the feed, no other peaks were observed in the gas chromatograms from the Method 308 procedure.

In summary, the principal differences between the two tests were that samples from LAW tests had lower pH values and higher nitrite/nitrate concentrations (by about 30 to 40 times) than samples from HLW tests. This suggests that either one of these factors or both in combination results in poor allyl alcohol retention in impinger solutions. Although conversion of the alcohols to other organic compounds in the low-pH high-NO_x environment was suspected, no other compounds were observed in the gas chromatograms. Other anions such as halides were actually higher in samples from HLW tests indicating that the presence of these constituents does not negatively impact allyl alcohol retention in sampling impinger solutions.

5.0 Bench Scale Tests

Bench scale tests were conducted with a variety of impinger solutions (deionized water, 0.2 M NaOH, 0.2 M carbonate buffer, 0.07 M borate buffer, and 0.2 M phosphate buffer) and bottled NO (1000 ppmv in nitrogen) and NO₂ (1000 ppmv in air). These gases were bubbled through allyl alcohol-spiked impinger solutions at 1 liter per minute for two hours. Two impingers each with an initial solution volume of 20 ml were used and combined during sample recovery for analysis. Solutions were then analyzed for allyl alcohol retention and pH. Results of the tests are given in Table 4 and are summarized as follows:

- De-ionized water impinger solutions became acidic when bubbled with nitrogen oxide gases, consistent with previous LAW melter exhaust samples [1].
- Sodium hydroxide and the selected buffering agents were all successful at preventing impinger solutions from becoming acidic when bubbled with either of the nitrogen oxide gases.
- NO₂ reduced solution pH significantly more than NO.
- Sodium hydroxide solutions experienced less change in pH than the other solutions when bubbled with NO₂.
- Allyl alcohol recovery for all impinger solutions was greater than 80% when bubbled with NO.
- Allyl alcohol recovery for all impinger solutions was lower when bubbled with NO₂ than NO; however, recoveries were greater than 70% for all impinger solutions other than de-ionized water.

Sodium hydroxide at 0.2 M was selected as the impinger solution for future melter testing since it was the least susceptible to changes in pH and all modified solutions tested had comparable allyl alcohol retention when bubbled with nitrogen oxides.

6.0 DM1200 HLW Tests

Melter exhaust samples were taken during the DM1200 HLW “Best Configuration” test [4] using a modified Method 308 and a variety of impinger solutions (deionized water, 0.2 M NaOH, 0.2 M carbonate buffer, 0.07 M borate buffer, and 0.2 M phosphate buffer) spiked with allyl alcohol. Exhaust was sampled at about 0.75 lpm for one hour. Two impingers, each with an initial solution volume of 20 ml, were used and combined during sample recovery for analysis. Although the exhaust stream from this test was low in nitrogen oxides (only 3 and 9 ppmv of NO and NO₂, respectively) the test was used as an opportunity to determine if minor constituents in the exhaust stream react unfavorably with the buffer solutions; it was not intended to provide a definitive validation of the method for all exhaust streams. Samples collected from these tests were analyzed along side those from the bench-scale tests to augment the data with respect to pH changes and allyl alcohol recovery of the various impinger solutions. Results of the tests are given in Table 5 and are summarized as follows:

- pH values for de-ionized water impinger solutions became acidic, consistent with previous HLW melter exhaust samples [1].
- The sodium hydroxide and buffering agents were successful at preventing impinger solutions from becoming acidic.
- Sodium hydroxide solutions had a higher pH value after sampling than the other solutions.
- Allyl alcohol recovery for all samples was greater than 80%.

The results indicate that in the absence of significant nitrogen oxides in the exhaust stream, the impinger solution content does not affect the retention of allyl alcohol in solution. This validates the data and reported DRE values from the previous HLW DM1200 test, which used de-ionized water as the impinger solution [1]. Also of note is that low solution pH alone in samples generated from HLW melter exhaust or bottled NO gas did not reduce allyl alcohol recovery. The combination of low pH and NO₂ appears to be required to reduce allyl alcohol retention in impinger solutions.

7.0 DM100 LAW Tests

Allyl alcohol retention in impinger solutions while sampling high nitrogen oxide exhaust was evaluated by processing various residual LAW Sub-Envelope A feeds on the DM100-WV melter. Sugar additions to the feed were scaled back and melter conditions

were manipulated to produce melter exhaust similar (NO₂ concentrations between 1000 and 2000 ppmv) to previous DM1200 tests with LAW Sub-Envelope A1 feed [5]. An additional sample was taken while processing residual LAW Sub-Envelope C feeds to evaluate the effect of higher concentrations of organic decomposition products, such as ammonia, on allyl alcohol retention. A vertical condenser was added to the modified Method 308 sampling train to cool the gas prior to it entering the first impinger. The solutions used were deionized water and 0.2 M NaOH spiked with allyl alcohol. Two impingers, each with an initial solution volume of 20 ml, were used and combined during sample recovery for analysis. Exhaust was sampled at between 0.4 – 0.8 lpm for one to two hours. Results of the tests along with concentrations of gaseous species during sampling are given in Table 6 and are summarized as follows:

- Allyl alcohol recovery for all samples using sodium hydroxide as the impinger solution was greater than 69%.
- Allyl alcohol recovery for the sample using de-ionized water as the impinger solution was less than the required 50%.
- High concentrations of constituents from the decomposition of organic compounds (sugar and EDTA), such as ammonia and carbon monoxide, do not have any adverse effects on retention of allyl alcohol in impinger solutions.

The results indicate that the modifications to Method 308, most notably using 0.2 M NaOH as the impinger solution, significantly improve method performance for high nitrogen oxide exhaust streams. The failure of the method while using de-ionized water corroborates the assumed reason for previous poor performance during LAW DM1200 tests, i.e., that the standard Method 308 using de-ionized water is not sufficiently robust for use with exhaust streams that are high in nitrogen oxides.

8.0 Dynamic Spiking Tests Using the DM100

Dynamic spiking was used as final confirmation of the modifications that were made to Method 308 for use with high nitrogen oxide exhaust streams. Based on 40 CFR Part 63 Method 301, the dynamic spiking procedure entails injecting the inlet air of the sampling train with the constituent of interest, in this case allyl alcohol. Four sampling trains are run in parallel, two of which are spiked at approximately 10X the assumed method detection limit. A vertical condenser was added to the Method 308 sampling train to cool the gas prior to it entering the first impinger. Two impingers each containing 0.2 M NaOH at an initial solution volume of 20 ml were used and combined during sample recovery for analysis. These were followed by an empty impinger, which served to condense any moisture carried over from the first two impingers, and an additional impinger with 0.2 M NaOH. Any liquid condensing in the empty impinger was combined with the contents of the first two impingers for analysis, whereas the contents of the last impinger was analyzed separately from the others to determine the amount of allyl alcohol carried over from the impingers up the train (break-through analysis). Exhaust

was sampled at between 0.6 – 0.9 lpm for 70 minutes. Additional samples were taken at reduced rates of injection of allyl alcohol into the sampling train inlet air to estimate actual method detection limits. Solutions of nitric acid and sugar in water were fed into the DM100 melter to generate 5000-10000 ppmv NO, 1000-3000 ppmv NO₂, and CO. Results from the dynamic spike tests were as follows:

- Allyl alcohol recoveries: 67%, 71%, 111%, 73%, 72%, 69% — Average = 77%
- Break-through of 3-5% in two-thirds of the samples
- Low allyl alcohol concentrations in one-third of the method blanks
- Method detection limit recoveries
 - Average of 77% at 0.077 mg allyl alcohol /ft³
 - 107 and 89 % at 0.013 mg allyl alcohol /ft³
 - 220 and 92 % at 0.005 mg allyl alcohol /ft³

Data from the dynamic spiking tests further demonstrate the effectiveness of the modified Method 308 for monitoring allyl alcohol in high nitrogen oxide exhaust streams. Despite the success in developing a method for this application, it is important to note that methods that are typically used for determining DREs for volatile organic constituents (SW-846 Methods 0030 and 8260) have much lower detection limits than Method 308 or the modified version developed in the present work, as shown in Table 7. As a result, relatively high feed rates of allyl alcohol into the melter (about 40 g per minute) will be needed to be able to measure a DRE of 99.99% across the system using this method.

9.0 Conclusions and Recommendations

Method 308 has been successfully adapted for monitoring allyl alcohol in high-NO_x exhaust streams. A series of tests have been conducted that demonstrate that changing the solution chemistry of the impinger solutions to prevent the solutions from becoming acidic effectively mitigates the low recoveries that are obtained with the standard method for exhaust streams that are rich in nitrogen dioxide. The sensitivity of the modified method is such that allyl alcohol feed rates of about 40 grams per minute will be required to enable the determination of DREs of 99.99% across the DM1200 system. Although this is a relatively high organics feed rate, it is manageable in the DM1200 system.

10.0 References

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- [2] "CCN: 086150 "Test Instructions to Support MACT Method Development for Sampling Alcohols in High NO_x Off Gas Streams," E-Mail from S. Kelly to K.S. Matlack, 4/02/04.
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- [5] "Integrated Off-Gas System Tests on the DM1200 Melter with RPP-WTP LAW Sub-Envelope A1 Simulants," K.S. Matlack, W. Gong, T. Bardakci, D'Angelo, and I.L. Pegg, VSL-02R8800-2, Rev. 0, 9/03/02.

Table 1. Allyl Alcohol Emission Rate Detection Limits for Method 308.

Outlet Location	Detection Limit, mg/min
Melter	0.51
SBS	0.37
WESP	0.40
TCO	0.40

Table 2. Measured pH in Method 308 Impinger Solutions After Sampling.

-	Outlet	pH
LAW	Melter	1.9
	SBS	1.5
	WESP	1.3
	TCO/SCR	3.7
	Carbon Column	1.4
	PBS	2.6
HLW	Melter	2.9
	SBS	3.0
	WESP	2.5
	TCO/SCR	6.6
	Carbon Column	3.2

**Table 3. Measured Concentration of Anions in Method 308 Impinger Solutions.
(ppm)**

		Cl	F	I	Nitrate	Nitrite	Sulfate
LAW	Melter	0.6	2.7	4.5	2781	47	0.4
	PBS	0.7	<0.1	<0.1	441	0.6	0.1
HLW	Melter	18	47	5.9	88	0.6	4.3
	TCO	0.4	<0.1	1.2	9.7	0.8	0.7

Table 4. Measured pH of Impinger Solutions from Bench-Scale Tests.

Gas Source	Impinger Solution	Measured pH	% Allyl Alcohol Recovery
Bottled NO (1000 ppmv)	De-ionized Water	4.07	89
	0.2 M NaOH	12.82	87
	0.2 M Carbonate	11.67	83
	0.2 M Phosphate	9.11	81
	0.07 M Borate	9.44	84
Bottled NO ₂ (1000 ppmv)	De-ionized Water	2.02	62
	0.2 M NaOH	12.77	76
	0.2 M Carbonate	10.75	81
	0.2 M Phosphate	7.40	73
	0.07 M Borate	9.08	82
None	De-ionized Water	7.05	NA
	0.2 M NaOH	12.99	
	0.2 M Carbonate	11.62	
	0.2 M Phosphate	9.14	
	0.07 M Borate	9.46	

Table 5. Measured pH of Various Impinger Solutions and Allyl Alcohol Recoveries After Sampling DM1200 HLW Melter Exhaust.

Impinger Solution	Measured pH	% Allyl Alcohol Recovery
De-ionized Water	3.88	96
0.2 M NaOH	10.14	95
0.2 M Carbonate	10.00	92
0.2 M Phosphate	7.91	88
0.07 M Borate	8.95	83

Table 6. Allyl Alcohol Recoveries After Sampling DM100 LAW Melter Exhaust.

Impinger Solution	Average Concentrations in Off-Gas (ppmv)					% Allyl Alcohol Recovery
	NO ₂	NO	NH ₃	CO	CO ₂	
0.2 M NaOH	1890	8220	10.8	< 3.0	3000	69
De-ionized Water	1740	9000	< 3.0	3.0	3000	43
0.2 M NaOH	1980	8400	< 3.0	< 3.0	2700	83
0.2 M NaOH	120	1920	2535	960	16200	90

Table 7. Measurable Allyl Alcohol DREs for Projected Melter Feed Rate.

-	Detection Limit (mg/ft ³)	Maximum % DRE that can be measured using the projected feed rate of 40 g/min
SW-846 Methods 0030 and 8260 (VOCs)	0.0000003 – 0.003	> 99.9999 – 99.9985
Modified Method 308 (Allyl alcohol)	0.077	99.95
	0.013	99.992
	0.005	99.997

Figure 1. 40 CFR Appendix A of Part 63 – Method 308 sampling train.

APPENDIX II

LETTER REPORT

Thermogravimetric Testing of Donau Carbon Combisorbon BAT37 Material

VSL-05L5290-1

Letter Report

Thermogravimetric Testing of Donau Carbon Combisorbon BAT37 Material

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Thermogravimetric Testing of Donau Carbon Combisorbon BAT37 Material

1.0 Introduction

The WTP vitrification off-gas treatment systems include sulfur impregnated activated carbon beds for the removal of mercury and organics. The carbon media that has been selected for that application is Combisorbon BAT37, produced by Donau Carbon. The BAT37 material consists of 70% (by weight) of a sulfur impregnated activated carbon extrudate mixed with 30% of irregularly shaped pieces of an inorganic inert filler (Figure 1). According to the manufacturer, the filler is intended to improve heat dissipation from the material during use. Although this material is employed in various industrial applications, the vendor's experience with the relatively high levels of NO_x (for WTP LAW) and organics (for WTP DRE testing) is very limited. Tests on a different sulfur impregnated carbon media (Calgon HGR) on a slipstream from the DM1200 off-gas system during LAW tests [1] showed significant temperature rises in the media. Subsequently, a full-scale (for the DM1200 system) carbon bed with the BAT37 media was installed on the DM1200 system to support HLW and LAW MACT testing [2]. Bed temperature excursions observed during the first of the HLW MACT tests led the WTP to interrupt that test to further evaluate the behavior before completing those tests [3]. In addition, in view of the very much higher NO_x concentrations expected for the LAW MACT tests, a series of activities was initiated at VSL, including off-line tests on the slipstream carbon column with BAT37; safety modifications to the DM1200 carbon bed system; and DM1200 screening tests on the modified system with LAW feed prior to the LAW MACT tests. Based on the results of these activities and the associated evaluations that were performed, the DM1200 LAW MACT tests were successfully completed while maintaining carbon bed temperature rises within the predetermined limits. In parallel with these activities, WTP R&T authorized VSL to perform lab-scale tests on the BAT37 carbon material to address basic aspects of its interaction with key species in the LAW off-gas stream during DRE testing. The results of that work are the subject of the present report. The principal objectives were to characterize the absorption and desorption behavior of the carbon fraction of the BAT37 material and the associated heat evolution effects on exposure to NO, NO₂, water and allyl alcohol (one of the two organics selected for WTP DRE testing), separately and in combination. The test matrix for this work, which was approved by the WTP, is shown in Table 1.

2.0 Experimental Setup

Only the carbonaceous fraction of the BAT37 media was investigated. In a typical experiment, a weighed 400 – 600 mg sample (2 – 3 pellets of carbon media) was placed onto the thermogravimetric transducer of a SETARAM MHTC96 Calorimeter. This is a multi-mode machine equipped with TG-DCS, TD-DTA, TG-only, and Drop Calorimetry

modules. The TG-DCS module used in the present tests is a twin-type, heat flux calorimeter, used for thermogravimetric analysis, i.e., simultaneous measurement of the mass of the sample and of the heat flux between the sample and the reference under a specified atmosphere and programmed temperature profile. The essential part of this module is the DCS transducer, which is designed and calibrated for heat flux measurements. The transducer has two thermocouples, the first monitoring the temperature of the sample and the second, a differential thermocouple, providing the DSC signal. The transducer, together with the two crucibles containing the sample and the reference, is hung from a beam microbalance and reaches into the center of the tubular, vertical experimental chamber. The balance is a null-deflection instrument, where the position of the balance is monitored and a servo-system is used to maintain it in a quasi-equilibrium position. The power supplied to the servo-system is a measure of the weight change, thus providing the thermogravimetric signal. Relevant characteristics of the balance are:

- Maximum load including suspension and crucibles: 100 g (the mass of the 20 ml platinum crucible used in TG-only version is 36.65 g).
- Measuring range: ± 2000 mg or ± 200 mg.
- Resolution: $\sim 1 - 3$ μ g at 400 °C (limited by the absolute short-time noise).
- Stability of the baseline (long-time noise of the TG signal at 400 °C): ~ 25 μ g.
- Balance precision: about 0.9 % when standard 10-200 mg weights are used.

The DSC instrument is not an absolute measuring device; the generated data must be related to absolute thermodynamic values by calibration. Calibration of the DSC is a two part process: thermometric and caloric (i.e., temperature and heat flow rate calibration). For the present work, both calibrations of the transducer were performed using indium metal at its freezing point (156.61°C) as the reference. In a typical measurement, the indium sample (~ 50 mg), placed in a small alumina crucible, is sandwiched between several pieces of carbonaceous BAT37 material to simulate as much as possible the thermal conditions during subsequent adsorption measurements. The melting and crystallization of indium was monitored repeatedly at very slow (0.1-0.5 K/min) heating and cooling rates. Simultaneously, the calorimetric peaks due to the phase transformation were registered. The transducer calibration constant was calculated as the ratio of the average peak areas during both the heating and the cooling modes and the associated heat effect was calculated based on the fusion enthalpy of indium (26.5 J/g).

The experimental chamber (28 mm in diameter) surrounding the transducer allowed for immersion of the sample under investigation in a constant, continuous flow of a reactive gas (Figure 2). The chamber was kept at constant temperature by means of an external heater. The system for introduction of the gas mixtures is shown schematically in Figure 3. The setup enables adjustment of NO and NO₂ concentrations by dilution of commercial compressed binary mixtures while water and allyl alcohol vapors are generated by passing air through spargers immersed in thermostated water baths kept at temperatures that result in the desired vapor pressures (50.0 to 52.8°C [4])

and 23.3°C [5], respectively, at 1 atm, depending on the experiment). All lines carrying vapors are heat traced and kept at about 60°C to avoid the possibility of condensation.

The following reactants, separately or as mixtures per the test matrix, were introduced at constant concentrations with air or nitrogen as the carrier gas:

Water vapor	11.0±0.5 % v/v (7.11±0.33 % w/w)
NO	2700±35 ppmv (2900±40 ppmw)
NO ₂	2700±35 ppmv (4500±60 ppmw)
Allyl Alcohol vapor	2300±30 ppmv (4800±60 ppmw)

Both the thermogravimetric and the differential calorimetric signals were acquired for the various test compounds and test temperatures, as shown in Table 1. In each case, adsorption as well as desorption cycles were recorded vs. time. Desorption was carried out with only the respective carrier gas flowing but under otherwise identical conditions.

3.0 Results and Discussion

Any given adsorption/desorption measurement session was performed essentially under isothermal conditions. Temperature fluctuations around the TG96 thermogravimetric transducer were within ±2°C of target over a ~24 hour period. The total reactive gas flow was maintained constant at 56.0±0.5 scm³/min (at 70°F and 1 atm) throughout all the experiments with small adjustments required to the water sparger temperature. Thus, the thermal signals obtained under such conditions can be attributed only to processes occurring between the sample and the reactive gases since there can be no net heat flow due to differences in heat capacity between the substrate and the inert reference (sapphire in this case). Both the gravimetric and the thermal differential (i.e., heat flux) data were recorded versus time. In each test, the intent was, to the extent practical, to achieve saturation of the sample (adsorbant) with the compound of interest (adsorbate) and to measure the total associated heat effect.

The results for each test are plotted in the Appendix. For illustration, Figure 4 shows qualitatively typical, if somewhat idealized representations of the two basic types of responses that were observed. Water and allyl alcohol showed normal absorption-type responses with the mass increasing with approximately first-order kinetics up to saturation. The associated heat flux signal shows a peak as a result of the onset of the absorption process followed by the decreasing rate of absorption and, ultimately, saturation. In contrast, NO and NO₂ both exhibited mass increases of essentially constant rate, that showed little, if any, sign of saturation. The associated heat flux signals showed a step-like behavior, with the expected rise at the onset of exposure but no subsequent decline and, instead, a constant rate of heat evolution. This behavior is suggestive of an ongoing reaction rather than a simple absorption process.

Table 2 provides a summary of the results shown for each test in the Appendix. The mass gain/loss values are based on extrapolations of the data to saturation according

to first-order kinetics. The integrated heat fluxes are shown on a per-mass-of-adsorbate basis as well as on a per-mass-of-adsorbant (carbon) basis. Also shown are the average heat fluxes. For comparison, Table 2 also shows the enthalpies of condensation, which for water and allyl alcohol, are comparable to the respective measured heat effects per mass of adsorbate. Table 3 shows the fitted exponential time constants, assuming first-order kinetics, for allyl alcohol and water; the constant rates for NO and NO₂ are provided in Table 2. From the results, the following observations are apparent:

- Water and allyl alcohol show absorption-type behavior, whereas NO and NO₂ show behavior that is more characteristic of an ongoing reaction.
- Adsorption of water appears to be reversible but there is some indication that desorption may occur in steps and the desorption process is somewhat slower. The measured heat effect is about half of the condensation enthalpy of water.
- Adsorption of allyl alcohol is only partially reversible. The rates of adsorption and desorption are of the same order of magnitude, but a significant fraction of the absorbed alcohol is not removed by the carrier gas suggesting partial chemisorption. The heat effect is about equal to the enthalpy of condensation. The adsorption rate time constant for allyl alcohol is about 30 times smaller than that for water; this factor is comparable to the ratio of their concentrations in the gas stream, suggesting similar rate constants.
- Gravimetric data for NO_x shows no plateau and the associated thermal flux is step-like. In addition, only a small fraction appears to be desorbable and the rate of desorption is much slower. This behavior suggests a chemical reaction, perhaps occurring in parallel with adsorption.
- When the media is first exposed to NO_x + water and then exposed to allyl alcohol, the heat effect due to the allyl alcohol is comparable to that observed with allyl alcohol alone.
- The heat effects due to water and allyl alcohol separately show little change with temperature, whereas those for NO_x + water show a strong increase with temperature. The effect of temperature on NO or NO₂ alone was not part of the test matrix; consequently, it is possible that this may be a feature of NO_x alone, rather than NO_x in combination with water. If so, this would be indicative of a higher activation energy for the presumed reaction that occurs with NO_x as compared to that for simple absorption.

As is apparent from the Figures in the Appendix, in tests in which the heat effect is small and the evolution rate is low, the thermal signals can be difficult to resolve from the background noise. There are a number of ways in which these signals could be improved. First, the present temperature control set-up is optimized for high-temperature (up to 1600°C) applications. The thermal stability, and therefore the heat effect

resolution, could be improved by modifying this aspect of the system. Secondly, in the present work it was desirable to collect the mass change and the heat effect signals simultaneously and, therefore, the thermogravimetric mode was employed. However, this mode limits the sample mass and, therefore, the resolution of the thermal effect measurement. The thermal data could be improved by instead employing the drop calorimetry mode of the SETARAM TG96 Calorimeter. The advantage of using drop calorimetry is its considerably lower specific noise due to the more than ten times larger sample volume. In addition, this mode employs a thermopile arrangement, rather than a single thermocouple, that completely surrounds the sample vessel, which is therefore better able to collect the thermal signal. Any subsequent tests should consider these factors if improved thermal data are needed.

4.0 Comparison with MACT Results

Although the primary objective of the present report is to provide the results of the lab-scale testing on the carbon media, a cursory comparison of the thermal data obtained with results from the DM1200 LAW MACT tests [2] is provided in this section.

In the DM1200 installation, the AC-S bed contains 275 kg (16.7 ft³) of the BAT37 material. The carbonaceous fraction constitutes 70% of that amount, i.e., 192.5 kg. The void fraction is 45.6%. The average flow rate through the reactor at 90°C is 270 ft³/min (220 scfm), resulting in standard and actual residence times of 3.7 s and 2.0 s, respectively. Results of the temperature measurements at the inlet and the outlet of the AC-S bed recorded during the recent LAW MACT Test 1 [2] are shown in Figure 5.

From hour 25 on, allyl alcohol was spiked into the melter feed; as a result, allyl alcohol was introduced into the gas stream into the AC-S bed (from hour 25 on) at an average rate of 485 mg/min (~32.4 ppm). The temperature across the reactor rose almost linearly by 22°C over 5.6 hours (340 min.). The heat capacity of the process gas is 34.9 J/sft³·K ($d=32.7$ g/sft³). Consequently, the heat removed from the carbon bed by the process gas over the 5.6-hour period is about 28.7 MJ. In addition, the temperature of the BAT37 media (and the bed housing, which is ignored here) also rose. Assuming the heat capacity of the BAT37 material to be 0.95 J/g·K [6], the additional heat that must have been generated is about 2.9 MJ, for a total (neglecting any losses to the environment) of about 31.6 MJ (8.8 kW.hr) over the 5.6 hour period. Since 98% of the allyl alcohol was removed by the carbon bed, a total of 165 g of allyl alcohol was absorbed over the 5.6-hour period; therefore, the heat evolved per unit mass of allyl alcohol adsorbed was 195 kJ/g_{AA}. Similarly, the heat evolved per unit mass of the carbonaceous adsorbent was 164 J/g_C. The fact that the value of 195 kJ/g_{AA} is even greater than the standard enthalpy of combustion of allyl alcohol (~31 kJ/g_{AA} [7]) suggests that that is not the only reactant and, consequently, the heat effects per unit mass of allyl alcohol may be misleading. Regardless, the heat effects estimated from the DM1200 data are considerably (~100x) larger than those measured in the present work. There are a number of differences between the tests that may contribute to this disparity, including the inert filler, the bed geometry, the flow-through conditions, and the precise off-gas composition. Whatever,

the cause, the large disparity suggests that the heat effects due to allyl alcohol absorption characterized in the present work cannot alone account for the temperature rises observed on the DM1200 AC-S system on introduction of allyl alcohol. Although the calorimetric results for the reaction of NO_x with the carbon media are much closer in magnitude to the heat effects estimated from the DM1200 data (but also smaller), as is evident in Figure 5, the most significant temperature rise on the DM1200 system was observed when allyl alcohol was introduced, rather than with NO_x and water alone.

5.0 References

- [1] "Bubbling Rate and Foaming Tests on the DuraMelter 1200 with LAWC22 and LAWA30 Glasses, K.S. Matlack, W. Gong, T. Bardakci, N. D'Angelo, P.M. Bizot, R.A. Callow, M. Brandys, and I.L. Pegg, VSL-04R4851-1, Rev. 0, 7/1/04.
- [2] "Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants," K. S. Matlack, M. Brandys, I. S. Muller, W. Kot, and I. L. Pegg, Test Plan VSL-04T4830-1, Rev. 0, 9/10/04.
- [3] "Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW Simulants," K.S. Matlack and I.L. Pegg, Data Summary Report, VSL-05S5830-1, Rev. 0, 2/28/05.
- [4] *Perry's Chemical Engineering Handbook*, 6th ed., McGraw-Hill, 1984, p.12-8.
- [5] Calculated using Antoine equation coefficients for allyl alcohol from *Lange's Handbook of Chemistry*, 14th ed., McGraw-Hill, 1992, p. 5.52.
- [6] 70/30 composite value based on numbers for charcoal and vermiculite taken from *CRC Handbook of Tables for Applied Engineering Science*, 2nd ed., CRC Press, 2000, Table 1-110.
- [7] Calculated using standard enthalpies of formation found in ref. [5], Table 6.3.

Table 1. Test Matrix.

Test Compound	Carrier	Temperature, [°C]			Cycle
		80	110	140	
H ₂ O vapor	Air	×	×	×	adsorption/desorption
NO	N ₂		×		adsorption/desorption
NO ₂	Air		×		adsorption/desorption
Allyl Alcohol vapor	Air	×	×	×	adsorption/desorption
H ₂ O+NO+NO ₂ to saturation then add allyl alcohol into stream to saturation	Air	×	×	×	adsorption/desorption

Table 2. Summary of Test Results.

Exp.	Adsorbate	Carrier Gas	Temperature [°C]	Initial Sample Mass [mg]	Mass Gain (adsorption) ^[1] [%]	Mass Loss (desorption) ^[1] [%]	Heat Effect ^{[2], [6]} [kJ/g _{adsorbate}]		Enthalpy of Condensation ^[3] [kJ/g _{adsorbate}]	Heat Effect ^{[4], [6]} [J/g _{adsorbant}]		Average Heat Flux ^{[5], [6]} [mW/g _{adsorbant}]	
							adsorption	desorption		adsorption	desorption	adsorption	desorption
1	H ₂ O	Air	80	467.1	0.55	~0.65	-1.3	0.8	-2.26	-6.8	5.3	-5.5	2.2
2	H ₂ O	Air	110	497.1	0.35	~0.40	-1.1	1.8		-3.8	6.2	-4.6	2.2
3	H ₂ O	Air	140	488.6	0.16	~0.15	-1.8	4.5		-3.3	3.7	-1.5	4.0
4	NO	Nitrogen	110	573.8	No saturation (rate=0.10 %/hr)	~0.05	-53	-	-0.46	-12	-	-12.0	-
5	NO ₂	Air	110	583.9	No saturation (rate=0.32 %/hr)	~0.4	-10.8	2.3	-0.41	-55	3.1	-9.7	0.7
6	AA	Air	80	562.7	6.10	4.0±01	-0.78	1.7	-1.45	-3.5	19.5	-3.0	2.7
7	AA	Air	110	549.0	3.80	1.9±0.1	-0.70	1.8		-2.2	2.9	-1.8	2.7
8	AA	Air	140	500.6	2.30	1.2±0.1	-1.3	1.6		-5.3	1.6	-2.4	3.9
9	All	Air	80	551.4	8.5	3.3±0.1	-1.0 -0.51	0.9	-2.0	-8.3 -3.3	9.0	-5.3 -2.7	2.3
10	All	Air	110	518.1	4.0	1.0±0.1	-2.0 -0.61	2.6		-11.2 -3.7	3.3	-7.2 -2.3	4.7
11	All	Air	140	557.6	2.5	1.3±0.1	-4.2 -0.55	3.3 1.7		-9.8 -1.6	7.5 3.6	-7.0 -1.5	6.0 1.7

[1] – Based on extrapolation to saturation assuming first-order kinetics.

[2] – (peak area)/[(calibration factor)·(mass variation)]; for two-step experiments (9, 10 and 11), thermal effects of both steps are shown separately, wherever measurable (water+NO_x | Allyl Alcohol).

[3] – Data taken from ref. 5; the value of 2.0 given for experiments 9-11 assumes contribution of each adsorbate according to its relative concentration in reactive gas mixture.

[4] – (peak area)/[(calibration factor)·(mass of sample)]; For two-step experiments (9, 10 and 11), thermal effects of both steps are shown separately, wherever measurable (water+NO_x | Allyl Alcohol).

[5] – (peak area)/[(calibration factor)·(mass of sample)·(peak duration)]; For two-step experiments (9, 10 and 11), thermal effects of both steps are shown separately, wherever measurable (water+NO_x | Allyl Alcohol).

Table 3. Fitted Exponential Time Constants for Adsorption Rates.

Adsorbate	Temperature [°C]	Exponential Time Constant [hr ⁻¹]
H ₂ O	80	6.13
	110	7.88
	140	4.92
Allyl Alcohol	80	0.204
	110	0.194
	140	0.267
All	80	0.172
	110	0.210
	140	0.284

Figure 1. Photograph of Donau BAT37 media.

Figure 2. Diagram of sample chamber used for thermogravimetric measurements.

Figure 3. Diagram of set-up for delivering gas mixtures to the test chamber.

Figure 4. Schematic diagram to illustrate the two qualitatively different thermogravimetric responses that were observed.

Figure 5. Inlet and outlet gas temperatures around the carbon bed on the DM1200 system during LAW MACT Test 1 showing the temperature rise upon introduction of allyl alcohol.

APPENDIX

Plots of Measured Thermogravimetric Responses for Each Test

The Adsorption of NO_x and water (1) and of Allyl Alcohol (2) at 110 °C.

APPENDIX III

LETTER REPORT

Off-Line DM1200 Slipstream Carbon Column Scoping Tests

VSL-05L5290-2

Letter Report

**Off-Line DM1200 Slipstream Carbon Column
Scoping Tests**

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1.0 Introduction

The requirements of the R&T Test Instructions concerning Off-Line Scoping Tests on Sulfur Impregnated Carbon [1] were detailed in the subsequent VSL test matrix description [2] and approved by the Project on January 6, 2005 [3]. Scoping work was necessary to evaluate safety and performance of the activated carbon bed prior to pilot-scale DM1200 tests, which was prompted by unexpected temperature excursions recorded during the HLW portion of the MACT demonstration [4]. Two tests were ultimately performed in succession between January 11 and January 28. In both cases, the original test matrices (Table 1 and 2) were modified as tests progressed, in accordance with the *a-priori* provision in the test matrix [2] to reflect the unpredictability of the test results and to ensure the safety of the tests [5]. A fresh batch of Combisorbon BAT37 Sulfur Impregnated Active Carbon (AC-S) was used in each test. While both tests involved humid air and nitrogen oxides, Test #2 included also allyl alcohol.

2.0 Test Setup

Testing was performed in the slipstream system of the DM1200 off-gas train using the 6-in. by 30-in. glass column loaded with 0.46 ft³ of BAT37 material. The glass column and all connecting piping were insulated to minimize heat losses from the system. Water was fed into the DM1200 melter while air was drawn through the SBS in order to effect humidification, which was controlled by manipulating the temperature of the liquid in the SBS sump. A slipstream was drawn immediately upstream of the TCO from the main off-gas system flow into the arrangement shown in Figure 1. NO and NO₂ were introduced from gas bottles and metered into the humidified air stream through mass-flow controllers or needle valves. Their initial concentrations could be adjusted and then monitored using sampling points provided at the inlet and outlet of the column. Samples from these points were directed to a Fourier transform infra-red spectrometer (FTIR) through a switch-box for analysis. Exhaust from the FTIR was directed through a total hydrocarbon monitor (THC) during the second test. Allyl alcohol was metered by an HPLC pump into a flash evaporator and then injected into the humidified air stream as a vapor. In order to ensure a known concentration, the liquid allyl alcohol flow rate was confirmed gravimetrically. The resulting gas mixture then flowed through the carbon column. The flow rate of the gas mixture was measured at the outlet of the column by means of an orifice meter. Thermocouples were located at the inlet and outlet and in the carbon media at the centerline, 10" and 22" from the inlet of the column; the total bed height was 28", which is the same as for the pilot-scale bed. There were also thermocouples located on the glass vessel surface in two places, in line with the centerline thermocouple locations. The pressure differential across the column was also measured. All temperature, pressure, flow, and FTIR data were logged electronically. A nitrogen purge was also installed in the system for safety. Gas leaving the column was heated to prevent condensation and to ensure constant orifice temperature. Finally, the slip stream flow re-joins the main off-gas train upstream of the PBS.

3.0 Flow Calibration

The orifice flow meter was calibrated against a commercial rotameter under measurement temperature and gauge pressure conditions comparable to those maintained during Test #1 and Test #2 (55°C and -9 “W.C.). Calibration yielded linear plots, as shown in Figure 2. Based on this, the flow was adjusted using the blower speed controller until the orifice differential pressure reached 1.1 or 2.4 “W.G., indicating 4.0 or 6.0 scfm, respectively, as required by the test matrix.

4.0 Gas Analysis

Gas analyses (at the inlet and outlet of column) were performed by FTIR. Analytes included H₂O, CO, CO₂, NO_x, and SO₂. Other compounds (NH₃, acetonitrile, acrylonitrile, N₂O, HNO₂, HNO₃, HCN, HCl, and HF) were also monitored during the second test as their presence became significant. Total sulfur was determined using an impinger train once towards the end of each test at the column outlet. In addition, for Test #2, the total concentration of hydrocarbons as propane (Method 25A) was monitored at the column outlet during the test and one sample for allyl alcohol was taken towards the end of the test using modified Method 308.

5.0 Results

All recorded run parameters and analytical data are presented graphically in two blocks of figures: Figures 3 to 11 for Test #1 and Figures 12 to 46 for Test #2. Detailed timeline for each test are given in Tables 3 and 4 to describe observed phenomena and to highlight eventual deviations from the original test matrices, as well as to indicate the current sampling locations for the analytical equipment. A series of vertical lines shown in the figures mark time segments in which system parameters were altered according to the respective test matrices (Tables 1 and 2); further details are provided in the timeline tables. Italicized numerals in Figures 3 and 12 further identify consecutive test segments. Results of the impinger train measurements are reported in Table 5.

5.1 Test #1

As is evident from Figures 3 and 4, each change in system parameters was accompanied by a corresponding thermal effect. In general, the effects were significant but not dramatic, resulting in maximum measured temperature changes of 15°C in segments 8, 11, and 19 (Figure 3). These peak events appear to be associated mostly with lowering the flow rate through the column rather than with introduction of reactive

species¹. Increases in NO_x inlet concentration resulted in a steady temperature rise over time. Two peak events that could be clearly related to the introduction of reactive species occurred in segments 2 and 15, when water vapor and NO₂ concentrations, respectively, were increased by 6% and 750 ppm. The effect of water vapor was fairly large but subsided quickly as the column became saturated. The NO₂-related spike was also short-lived. Interestingly, further increase in water vapor and NO₂ concentration of similar magnitude (segments 3 and 16) did not produce similar peak.

The inlet column temperature throughout the test was maintained around 90°C. Responding to the introduction of reactive species, both in-bed and column wall temperatures rose progressively along the column. This is consistent with the fact, that the flowing gas is the only significant heat removal means in this thermally insulated system. This was corroborated by the lack of a measurable response after installation of heating tape around the column (~61 hrs) to reduce any radial heat transfer patterns. The cooling effectiveness diminishes as the temperature of the gas increases along the bed, leading to the observed temperature distribution. Under such conditions, the outlet column temperature was expected to be close to the average between the inlet and the top of the bed but Figure 3 indicates that that was not the case. Initially, insufficient thermal insulation of the outlet pipe was suspected, but adding additional insulation (at ~41 hrs) failed to produce a change. The problem was eventually traced to turbulence at the vicinity of the thermocouple tap. This could not be corrected during the test. However, the tap was relocated prior to Test #2 which successfully corrected this problem.

FTIR results (Figures 6 and 7) indicate that 30 to 60% of incoming NO_x was adsorbed at all times. The reason for the “saw-tooth” variation in NO_x concentration (74 to 94 hrs) could not be attributed to system flow fluctuations or an analytical artifact² and the remains unknown (it was never encountered during the second test). Both CO₂ and CO levels were higher at the outlet than in the inlet of the column (Figure 9 and 10), strongly suggesting some kind of ongoing carbon oxidation process. Sulfur release from the column was observed throughout the tests, with the amount released generally following the bed temperature.

5.2 Test #2

Prior to Test #2 an additional 2” layer of fiberglass insulation was added to the column (to a total of 4”) in response to WTP R&T request. The outside heating tape installed during the previous test was retained and operated to maintain the insulation at a surface temperature of 35 – 40 °C, virtually eliminating radial heat losses. Flow through the system was maintained at 6 scfm within ±15%. Thermal effects observed in Test #2 as compared to Test #1 were large and clearly a consequence of introducing large

¹ Periods of flow rate change through the system can be easily traced by referring to Figure 5, which shows the pressure differential across the column, which is proportional to the flow.

² The FTIR interferograms and diagnostic data were provided to the FTIR manufacturer who reported that there was no evidence of an instrument malfunction that might have explained this effect.

amounts of reactive species into the system at a high rate. The inlet gas temperature was set lower (80°C) in Test #2. The response to water vapor was similar in Test #2 to that observed in Test #1, including the more pronounced stronger reaction to the increase from 0 to 6% absolute humidity than to the 6 to 12% step (segments 1 and 2, respectively, in Figure 12). Instantaneous introduction of ~2500 ppmv each NO and NO₂ at 7.3 hours into the run produced a large effect (segment 3 in Figure 12). The temperature in the upper bed increased by 75 °C in less than a hour, prompting the NO_x concentration to be reduced by 25%, as required by the safety protocol. Eventually, the column cooled and continued to do so even after the NO_x concentration was increased to the fourth segment target (total ~9500 ppmv). Allyl alcohol was introduced into the system at 26.8 hrs into the run at the rate of 0.60 ml/min (nominally 1250 ppmv). A large temperature spike (segment 5 at 28.0 hrs) resulted in the upper bed and the column outlet, reaching 240 and 153 °C, respectively. At the same time, the outlet concentrations of both NO and NO₂, following a brief spike, dropped almost to zero (Figures 18 and 20) while those of THC, acrylonitrile, N₂O, CO₂, CO, HCN, HCl, SO₂ and HF peaked strongly (Figures 16, 28, 30, 32, 38, 40, 42, 44 and 46). Interestingly, shortly preceding this event, a high concentration of acetonitrile was recorded at the column inlet. This is consistent with thermal desorption caused by an oxidation process, as evidenced by the CO, CO₂ and HCN data. All the temperatures dropped immediately after the allyl alcohol and NO_x supplies were cut off. Subsequent attempts to reestablish target NO_x concentrations (with no allyl alcohol) resulted in yet another temperature spike (30 hrs) and a 25% reduction in NO_x delivery. Throughout the remainder of the test (segments 6, 7, 8 and 9) the amounts of allyl alcohol (AA) and nitrogen oxides were varied (see Table 4 for details) in order to establish a sustainable operational envelope for the AC-S bed. From the results, the sustainable boundaries include:

1. 5000 ppmv NO, 4700 ppmv NO₂ and 625 ppmv AA (segment 7), and
2. 3000 ppmv NO, 3000 ppmv NO₂ and 2500 ppmv AA (segment 8).

It seems, however, that establishment of these operational conditions may not be possible unless reactive species are introduced into the system gradually, over a significant period of time, as opposed to step changes. At 71.7 hours into the run (segment 9), the flow of NO_x was suspended while the AA delivery continued at 2500 ppmv until hour 82. As a consequence, system temperatures declined sharply, reaching baseline level within about 4 hours, indicating little thermal effect from allyl alcohol adsorption. However, it is not possible to draw the conclusion that the absence of nitrogen oxides is a determining factor leading to thermal stability in the system because the loading of the column was also changing with time.

5.3 Impinger Train Analysis

In addition to the loss of mercury removal activity, uncontrolled sulfur release from the AC-S material could be potentially harmful to the platinum based TCO catalyst downstream in the WTP flow sheet. The impinger train analysis for sulfur conducted

toward the ends of both tests (Table 5) yielded 0.6 and 0.8 ppmv in the first and second test, respectively. This result compares favorably with FTIR data for Test #1 (Figure 11) of ~1 ppmv SO₂ (which is about the detection limit of this technique) but not with the ~15 ppmv recorded during Test #2 (Figure 44). The reason for this difference is unclear. The results for allyl alcohol shown in Table 5 obtained from using the modified Method 308 at 55.3 through 56.3 hours of the second test conform within experimental error to the results of the THC measurement (Figure 16) and suggest at least three “nines” DRE before the column efficiency began to decline at 60 hrs.

5.4 Desorption

When delivery of reactive contaminants ceases but the air flow through the system continues, previously adsorbed species begin to desorb. As evident from the FTIR data for NO_x in both tests (Figures 6 and 7, hour 94.5 on, and Figures 18 and 20, hour 71.7 on) and from THC data in Test #2 (Figure 16 hour 82 on), this process lasted several hours. Although a normal consequence of an equilibrium process, in case of NO₂, this may have implications on the preferred geometry of the reactor: as indicated in Figure 7 and Figure 19, high-density nitrogen dioxide desorbs downwards, despite the upward flow through the column, hence the positive reading at the inlet.

6.0 Conclusions

BAT37 activated carbon in a packed bed reactor can undergo significant temperature excursions when suddenly subjected to high concentrations of nitrogen oxides or allyl alcohol in presence of nitrogen oxides. In view of these temperature excursions, the possibility of bed fire is real and therefore appropriate design features and safety measures must be implemented to address this possibility. Sustained operation at total NO_x concentrations of up to 1% or up to 0.6% NO_x with 0.25% allyl alcohol appears to be possible if reactive species are introduced gradually and the system is allowed to equilibrate after each concentration increment. One must exercise care to provide continuous flow through the system sufficient for the removal of the generated heat. Under the conditions investigated, the BAT37 material showed evidence of deterioration by releasing sulfur species as the temperature is increased.

7.0 References

- [1] “R&T Test Instructions to (1) Support Activated Carbon Bed Bench Scale and Off-line DM1200 Testing with Allyl Alcohol in High NO_x Off Gas Streams and (2) Assess Method 308 Analytical Steps to reduce Detection Limits”, WTP R&T Memorandum, S. Kelly, Jr. (WTP) to K. S. Matlack (VSL), CCN: 109328, Bechtel National, Inc., December 30, 2004.
- [2] “Scoping Tests on Sulfur Impregnated Carbon Media,” I. L. Pegg et al., The Catholic University of America, Vitreous State Laboratory, Washington, D.C., January 6, 2005.
- [3] “Teleconference Call Discussion of VSL’s Scoping Test on Sulfur Impregnated Carbon”, moderated by J. M. Perez, Meeting Minutes prepared by S. Kelly, Jr., CCN: 110399, Bechtel National, Inc., January 6, 2005.
- [4] “Regulatory Off Gas Emissions Testing on the DM1200 Melter System Using HLW Simulants”, K.S. Matlack and I.L. Pegg, Data Summary Report, VSL-05S5830-1, Rev 0, February 28, 2005.
- [5] There were daily teleconferences with the WTP R&T personnel to discuss the newly available data as it was collected. The matrix for the second test was approved on January 19, 2005.

Table 1. Test Matrix for Off-Line DM1200 Slipstream Carbon Column Scoping Test #1.

Slip Stream Testing of BAT37 AC-S bed

Test Conditions for TEST #1 (without Allyl Alcohol)

Flow: Normal: 6 scfm (37.7 aft/min) Low: 4 scfm (25.1 aft/min)

Humidity: Normal: ~12% (abs.) Low: ~6%(abs.)

Inlet Temp.: Constant, 90°C (at time “0” bed will be thermally equilibrated at 90°C with ambient air)

Segment	1	2	3	4	5	6	7	8	9	10	11
Run Hours	0-2	2-6	6-10	10-14	14-18	18-22	22-26	26-30	30-34	34-38	38-42
H ₂ O, %	Low	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
NO, ppmv	0	0	1000	1000	1000	1000	1000	1000	1750	2500	2500
NO ₂ , ppmv	0	0	0	0	1000	1500	2000	2000	2000	2000	2000
Flow	Normal	Normal	Low	Normal	Normal	Normal	Normal	Low	Normal	Normal	Low
NO Use, lb per segment/lb cumulative	0	0	0.075	0.11/0.19	0.11/0.30	0.11/0.41	0.11/0.52	0.075/0.60	0.20/0.79	0.28/1.07	0.19/1.26
NO ₂ Use, lb per segment/lb cumulative	0	0	0	0	0.17	0.26/0.43	0.34/0.77	0.23/1.00	0.34/1.34	0.34/1.68	0.23/1.91

Segment	12	13	14	15	16	17	18	19	20	21
Run Hours	42-46	46-50	50-54	54-58	58- 62	62-66	66-70	70-74	74-94	94-100
H ₂ O, %	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
NO, ppmv	3250	4000	4000	4000	4000	4000	4500	5000	5000	0
NO ₂ , ppmv	2000	2000	2750	3500	4250	4700	4700	4700	4700	0
Flow	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Low	Normal	Normal
NO Use, lb per segment/lb cumulative	0.36/0.62	0.45/2.07	0.45/2.51	0.45/2.96	0.45/3.41	0.45/3.85	0.50/4.36	0.37/4.73	2.79/7.52	0
NO ₂ Use, lb per segment/lb cumulative	0.34/2.26	0.34/2.60	0.47/3.07	0.60/3.67	0.73/4.40	0.80/5.20	0.80/6.01	0.54/6.55	4.03/10.6*	0

* There is one bottle with 10 lbs of NO₂ gas available so the experiment may be terminated earlier.

- NOTES:
- 1) Incremental change for each step may be adjusted if necessary based on test results.
 - 2) If SAC bed temperature reaches or exceeds 140°C, stop NO_x concentration increases.

Table 2. Test Matrix for Off-Line DM1200 Slipstream Carbon Column Scoping Test #2.

Slip Stream Testing of BAT37 AC-S bed

Test Conditions for TEST #2 (with Allyl Alcohol)

Flow: Normal: 6 scfm (37.7 aft/min)

Humidity: Normal: ~12% (abs.) Low: ~6% (abs.)

Inlet Temp.: Constant, 80°C (at time “0” bed will be thermally equilibrated at 80°C with ambient air)

Segment	1	2	3	4	5	6	7	8	9
Run Hours	0-2	2-6	6-10	10-25	25-30	30-50	50-57*	*57-67	67-77
H ₂ O, %	Low	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
NO, ppmv	0	0	2500	5000	5000	5000	3000	0	0
NO ₂ , ppmv	0	0	2500	4700	4700	4700	3000	0	0
Flow	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
Allyl Alcohol, ppm	0	0	0	0	1250	2500	2500	2500	0
NO Use, lb per segment/lb cumulative	0	0	.28	2.13/ 2.41	0.71/ 3.12	2.84/ 5.96	0.99/ 6.95		
NO ₂ Use lb per segment/lb cumulative	0	0	.43	3.07/ 3.50	1.02/ 4.52	4.10/ 8.62	1.38 / 10		

* There is one bottle with 10 lbs of NO₂ gas available, usage projects to approximately 57 hours. The test will go until we run out of gas.

NOTES: 1) Incremental change for each step may be adjusted if necessary based on test results.
2) If SAC bed temperature reaches or exceeds 140°C, stop NO_x concentration increases.

Table 3. Timeline of the Small Scale AC-S Bed Test #1.

Date	Time [#]	Run Time (hr)	FTIR ^{##} sampling position	Comments
1/11/2005	20:30	0.0	Inlet	Test starting time. Inlet temperature 92 °C, NO<1 ppm, NO ₂ <1 ppm, abs. humidity at ~6%.
1/11/2005	20:38	0.1	Outlet	-
1/11/2005	21:32	1.0	-	Abs. humidity at ~6%.
1/11/2005	23:15	2.7	Inlet	Temp.=90 °C, NO<1 ppm, NO ₂ <1 ppm, abs. humidity 11.8%.
1/11/2005	23:23	2.9	Outlet	-
1/12/2005	3:00	6.5	Inlet	Temp. =90 °C, NO=925 ppm, NO ₂ =79 ppm, abs. humidity 11.1%.
1/12/2005	3:17	6.8	Outlet	-
1/12/2005	3:50	7.3	Inlet	NO + NO ₂ adjusted to 1000 ppm.
1/12/2005	7:04	10.6	-	Temp.=92 °C, NO=934 ppm, NO ₂ =64 ppm, abs. humidity 11.7%.
1/12/2005	7:18	10.8	Outlet	-
1/12/2005	11:00	14.5	Inlet	NO and NO ₂ adjusted to 1000 ppm each.
1/12/2005	11:04	14.6	-	T =91 °C, NO=1025 ppm, NO ₂ =976 ppm, humidity@ 11.5%..
1/12/2005	11:22	14.9	Outlet	-
1/12/2005	13:30	17.0	-	Abs. humidity 12.1%, the system is stable at this time.
1/12/2005	15:00	18.5	Inlet	Temp.= 91 °C, NO=1014 ppm, NO ₂ =1473 ppm, abs. humidity 13.1%.
1/12/2005	15:23	18.9	Outlet	-
1/12/2005	19:00	22.5	Inlet	Temp.= 91 °C, NO=1021 ppm, NO ₂ =1988 ppm, abs. humidity 13.4%.
1/12/2005	19:21	22.8	Outlet	-
1/12/2005	23:00	26.5	Inlet	Temp.= 91 °C, NO=1013 ppm, NO ₂ =1990 ppm, abs. humidity 12.4 %.
1/12/2005	23:26	26.9	Outlet	-
1/13/2005	3:00	30.5	Inlet	Temp.= 90 °C, NO=1741 ppm, NO ₂ =1955 ppm, abs. humidity 14.9%.
1/13/2005	3:11	30.7	Outlet	-
1/13/2005	7:00	34.5	Inlet	Temp.= 91 °C, NO=2492 ppm, NO ₂ =2016 ppm, abs. humidity 14.4%.
1/13/2005	7:22	34.9	Outlet	-
1/13/2005	11:00	38.5	Inlet	Temp.= 91 °C, NO=2500 ppm, NO ₂ =2019 ppm, abs. humidity 13.6%.
1/13/2005	11:16	38.8	Outlet	-
1/13/2005	13:35	41.1	-	Added insulation to AC-S column outlet pipe.
1/13/2005	14:15	41.7	-	Since insulation was installed, the AC-S outlet temperature increased from 84 to 87 °C.
1/13/2005	15:14	42.7	Inlet	Replaced faulty NO ₂ mass flow controller with a needle valve. Temp.= 91 °C, NO=3258 ppm, NO ₂ =2111 ppm, abs. humidity 16.3%. Humidity at PBS inlet 12.2%.
1/13/2005	15:28	43.0	Outlet	NO ₂ is being regulated by needle valve instead of a mass flow meter using pressure gauge for NO ₂ setpoint.
1/13/2005	19:00	46.5	Inlet	Temp.= 91 °C, NO=3961 ppm, NO ₂ =2099 ppm, abs. humidity 13.2%. Humidity at PBS inlet 12.2%.
1/13/2005	19:20	46.8	Outlet	-
1/13/2005	23:00	50.5	Inlet	Temp.= 91 °C, NO=4122 ppm, NO ₂ =2823 ppm, abs. humidity 12.1%.

Date	Time [#]	Run Time (hr)	FTIR ^{##} sampling position	Comments
1/13/2005	21:43	49.2	-	Humidity at PBS inlet 12.3%.
1/13/2005	23:49	51.3	Outlet	-
1/14/2005	3:01	54.5	Inlet	Temp.= 91 °C, NO=4034 ppm, NO ₂ =3528 ppm, abs. humidity 11.3%.
1/14/2005	3:23	54.9	Outlet	-
1/14/2005	7:00	58.5	Inlet	Temp.= 91 °C, NO=4079 ppm, NO ₂ =4296 ppm, abs. humidity 12.8% (at PBS inlet 12.0%).
1/14/2005	7:18	58.8	Outlet	-
1/14/2005	9:50	61.3	-	Installed heat tape around outside of column. Heat tape are set at 20 % power. Column skin temperature at 10" increased from 80 to 83 °C. Column skin temperature at 20" increased from 82 to 87 °C.
1/14/2005	11:12	62.7	Inlet	Temp.=91 °C, NO=4130 ppm, NO ₂ =4671 ppm, humidity 13.5% (hand held @ 12.2%).
1/14/2005	11:20	62.8	Outlet	-
1/14/2005	14:51	66.3	-	Isolated NO and NO ₂ supply to replace empty NO cylinder. Back online in 16 minutes.
1/14/2005	15:05	66.6	Inlet	Temp.= 91 °C, NO=4467 ppm, NO ₂ =4733 ppm, abs. humidity 13.4% (at PBS inlet 12.1%).
1/14/2005	15:19	66.8	Outlet	-
1/14/2005	19:01	70.5	Inlet	Temp.=91 °C, NO=4959 ppm, NO ₂ =4796 ppm, humidity 13.1% (hand held @ 12.0%).
1/14/2005	19:25	70.9	Outlet	-
1/14/2005	23:00	74.5	Inlet	Temp.= 89 °C, NO=4846 ppm, NO ₂ =4839 ppm, abs. humidity 14.2%.
1/14/2005	23:23	74.9	Outlet	-
1/15/2005	19:00	94.5	Inlet	Secured NO and NO ₂ and begun delivery line nitrogen purge. Temp.= 91 °C, NO=10 ppm, NO ₂ ~45 ppm, humidity 11.9% (handheld @ 12.2%)
1/15/2005	20:18	95.8	-	NO ₂ would not drop below 45 ppm. Removed NO ₂ delivery line. NO ₂ concentration dropped ~5 ppm and held steady.
1/15/2005	20:24	95.9	Outlet	-
1/16/2005	1:00	100.5	-	Stopped H ₂ O feeding and begun off gas shutdown.
1/16/2005	1:49	101.3	Outlet	Test is terminated.

(-) – Indicates Empty data field.

(#) – Times are accurate within 1 minute, however FTIR response time is usually 3-6 minutes.

(##) – Should be read with a preceding “switched to... and remains there until next switch”.

Table 4. Timeline of the Small Scale AC-S Bed Test #2.

Date	Time [#]	Run Time (hr)	FTIR ^{##} sampling position	Comments
1/24/2005	11:00	0.0	-	Test starting time (temp. equilibration with dry air at 80°C).
1/24/2005	12:00	1.0	Inlet	Introduced moist air (6% abs. humidity).
1/24/2005	14:20	3.3	-	Introduced moist air (12% abs. humidity).
1/24/2005	18:54	7.9	-	Temperature >135°C, NO _x concentrations lowered to 75% of target.
1/24/2005	19:08	8.1	Outlet	Temperature is dropping.
1/24/2005	21:00	10.0	Inlet	Increased NO _x concentrations to target.
1/24/2005	21:25	10.4	Outlet	Temperature is rising. NO _x at target.
1/24/2005	23:03	12.1	Inlet	Temperature >135°C, drop NO, NO ₂ to 75%.
1/24/2005	23:32	12.5	Outlet	Temperature is dropping, NO _x at 75 %.
1/25/2005	00:22	13.4	Inlet	Increased NO _x to target.
1/25/2005	00:42	13.7	Outlet	NO _x at target, NO=4773 ppm, NO ₂ =4644 ppm. Temp. are stable.
1/25/2005	13:40	26.7	Inlet	NO _x at target.
1/25/2005	13:50	26.8	-	Started allyl alcohol (AA) at 0.6 ml/min, NH ₃ and acetonitrile were produced, NO/NO ₂ dropped.
1/25/2005	14:26	27.4	Outlet	-
1/25/2005	15:07	28.1	-	AA off due to high temperature.
1/25/2005	15:16	28.3	-	NO/NO ₂ off due to high temperature.
1/25/2005	16:32	29.5	-	Replaced NO mass flow meter.
1/25/2005	16:50	29.8	Inlet	Set NO/NO ₂ on target.
1/25/2005	16:53	29.9	-	Reduced NO/NO ₂ to 75% of target due to high temp.
1/25/2005	17:50	30.8	Outlet	NO _x @ 75% of target.
1/25/2005	18:01	31.0	Inlet	-
1/25/2005	18:06	31.1	-	Started AA @ 0.30 ml/min.
1/25/2005	18:24	31.4	Outlet	-
1/25/2005	21:05	34.1	Inlet	Increased NO/NO ₂ to target.
1/25/2005	21:24	34.4	Outlet	-
1/25/2005	22:47	35.8	Inlet	Verify NO/NO ₂ . They were lower than the target. NO=4300 ppm, NO ₂ =4200 ppm.
1/25/2005	23:22	36.4	Outlet	NO/NO ₂ on target, NO=5000 ppm, NO ₂ =4700 ppm. AA @ 0.30ml/min.
1/26/2005	01:25	38.4	-	Increased AA to 0.45 ml/min.
1/26/2005	01:58	39.0	-	Verify AA @ 0.45 ml/min.
1/26/2005	02:06	39.1	Inlet	Reduced AA to 0.3 ml/min, reduced NO/NO ₂ to 75% of target, temp. >140 °C.
1/26/2005	02:44	39.7	Outlet	NO _x @ 75 %, AA=0.30 ml/min.
1/26/2005	06:20	43.3	-	Increased AA to 0.45 ml/min.
1/26/2005	07:00	44.0	-	Verify AA @ 0.45 ml/min.
1/26/2005	08:23	45.4	Inlet	Verify NO/NO ₂ . NO=3300 ppm, NO ₂ =3000 ppm.
1/26/2005	08:28	45.5	Outlet	-
1/26/2005	09:15	46.3	-	AC-S temperatures are stable.

Date	Time [#]	Run Time (hr)	FTIR ^{##} sampling position	Comments
1/26/2005	11:02	48.0	Inlet	-
1/26/2005	11:22	48.4	-	AA flow off. NO/NO ₂ gas compositions are erratic.
1/26/2005	12:00	49.0	-	Adjusted NO _x to target. NO=5000 ppm, NO ₂ =4700ppm.
1/26/2005	12:55	49.9	-	Started AA @0.15 ml/min.
1/26/2005	13:35	50.6	-	Increased AA to 0.30 ml/min.
1/26/2005	14:05	51.1	-	Increased AA to 0.45 ml/min.
1/26/2005	14:45	51.8	Outlet	-
1/26/2005	15:20	52.3	-	Reduced AA to 0.30 ml/min, temperature>140 °C.
1/26/2005	15:50	52.8	Inlet	-
1/26/2005	17:40	54.7	Outlet	-
1/26/2005	18:00	55.0	-	Replaced NO bottle in 6 minutes.
1/26/2005	18:30	55.5	Inlet	-
1/26/2005	19:00	56.0	Outlet	-
1/26/2005	19:36	56.6	-	Increased AA to 0.40 ml/min.
1/26/2005	20:13	57.2	Inlet	AA off, NO&NO ₂ at 2500 ppm.
1/26/2005	20:28	57.5	-	Swap NO bottle.
1/26/2005	20:49	57.8	-	Started AA @ 0.60 ml/min.
1/26/2005	21:07	58.1	Outlet	-
1/26/2005	21:43	58.7	Inlet	-
1/26/2005	22:00	59.0	Outlet	-
1/26/2005	22:04	59.1	-	Increased AA to 0.70 ml/min.
1/26/2005	22:28	59.5	Inlet	Monitor NO/NO ₂ . NO=2793 ppm, NO ₂ =2612 ppm.
1/26/2005	22:55	59.9	Outlet	-
1/26/2005	23:45	60.8	Inlet	-
1/26/2005	23:54	60.9	Outlet	-
1/27/2005	00:30	61.5	Inlet	-
1/27/2005	00:48	61.8	Outlet	Increased AA to 0.80 ml/min.
1/27/2005	02:27	63.5	Inlet	Verify NO _x . NO=2779 ppm, NO ₂ =2822 ppm.
1/27/2005	02:43	63.7	Outlet	Increased AA to 0.90 ml/min.
1/27/2005	03:25	64.4	Inlet	NO=2321 ppm, NO ₂ =2554 ppm.
1/27/2005	03:45	64.8	Outlet	Increased AA to 1.00 ml/min.
1/27/2005	04:13	65.2	-	Verified AA @1.00 ml/min.
1/27/2005	04:15	65.3	Inlet	NO=2321 ppm, NO ₂ =2554 ppm.
1/27/2005	04:36	65.6	Outlet	-
1/27/2005	05:11	66.2	Inlet	AA @ 1.00 ml/min., NO=2267 ppm, NO ₂ =2528 ppm.
1/27/2005	05:37	66.6	Outlet	-
1/27/2005	05:40	66.7	-	Increased AA to 1.20 ml/min.
1/27/2005	06:10	67.2	Inlet	AA @ 1.20 ml/min., NO=2719 ppm, NO ₂ =2898 ppm.
1/27/2005	06:31	67.5	Outlet	-
1/27/2005	07:00	68.0	Inlet	-

Date	Time [#]	Run Time (hr)	FTIR ^{##} sampling position	Comments
1/27/2005	07:10	68.2	Outlet	-
1/27/2005	07:44	68.7	Inlet	NO=2700 ppm, NO ₂ =3000 ppm.
1/27/2005	07:53	68.9	Outlet	-
1/27/2005	08:12	69.2	Inlet	NO=3000 ppm, NO ₂ =3100ppm.
1/27/2005	08:20	69.3	Outlet	-
1/27/2005	08:43	69.7	Inlet	-
1/27/2005	09:01	70.0	Outlet	-
1/27/2005	09:30	70.5	Inlet	NO=2500-2700 ppm, NO ₂ =2500-2600 ppm.
1/27/2005	09:39	70.7	Outlet	-
1/27/2005	10:00	71.0	Inlet	NO=2500-2600 ppm, NO ₂ =2300-2400ppm.
1/27/2005	10:17	71.3	Outlet	-
1/27/2005	10:40	71.7	Inlet	NO=2700 ppm, NO ₂ =2500 ppm.
1/27/2005	10:43	71.7	-	NO/NO ₂ off.
1/27/2005	10:48	71.8	Outlet	-
1/27/2005	11:17	72.3	Inlet	NO reads 0 ppm. NO ₂ reads ~0.
1/27/2005	11:20	72.3	Outlet	-
1/27/2005	11:50	72.8	Inlet	NO ~0, NO ₂ is between 700 to 800 ppm.
1/27/2005	11:52	72.9	Outlet	-
1/27/2005	12:23	73.4	Inlet	NO<1 ppm, NO ₂ ~850 ppm.
1/27/2005	12:27	73.5	Outlet	-
1/27/2005	13:32	74.5	Inlet	NO ₂ > 800ppm.
1/27/2005	13:52	74.9	-	Still observing ~850 ppm NO ₂ @inlet. Disconnected NO ₂ tubing @ needle valve inlet and capping/plugging lines.
1/27/2005	14:22	75.4	Outlet	At inlet NO =< 1ppm, NO ₂ =817 ppm.
1/27/2005	15:20	76.3	Inlet	-
1/27/2005	15:25	76.4	-	NO=0 ppm, NO ₂ =850 ppm.
1/27/2005	15:52	76.9	Outlet	-
1/27/2005	16:22	77.4	Inlet	-
1/27/2005	16:28	77.5	-	NO ₂ =848 ppm. NO=0 ppm
1/27/2005	17:17	78.3	Outlet	
1/27/2005	17:49	78.8	Inlet	
1/27/2005	17:59	79.0	-	NO= 0 ppm, NO ₂ =802 ppm.
1/27/2005	18:05	79.1	-	AA @ 1.20 ml/min, NO=0 ppm, NO ₂ =913 ppm.
1/27/2005	18:32	79.5	Outlet	-
1/27/2005	19:00	80.0	Inlet	NO=0 ppm, NO ₂ =788 ppm.
1/27/2005	19:10	80.2	-	NO ₂ =824 ppm.
1/27/2005	19:30	80.5	Outlet	-
1/27/2005	20:30	81.5	Inlet	NO=0 ppm, NO ₂ =846 ppm.
1/27/2005	21:00	82.0	Outlet	Secured AA.
1/27/2005	22:05	83.1	Inlet	-
1/27/2005	22:20	83.3	-	NO ₂ =135 ppm, NO=0 ppm.

Date	Time [#]	Run Time (hr)	FTIR ^{##} sampling position	Comments
1/27/2005	23:05	84.1	Outlet	-
1/28/2005	00:05	85.1	Inlet	-
1/28/2005	00:24	85.4	-	NO=0 ppm, NO ₂ =35 ppm.
1/28/2005	01:05	86.1	Outlet	-
1/28/2005	01:25	86.4	-	NO=2.2 ppm, NO ₂ =110.2 ppm.
1/28/2005	02:05	87.1	Inlet	-
1/28/2005	02:26	87.4	-	NO=0 ppm, NO ₂ =28 ppm.
1/28/2005	03:05	88.1	Outlet	-
1/28/2005	04:05	89.1	Inlet	-
1/28/2005	04:25	89.4	-	NO=0 ppm, NO ₂ =15.5 ppm.
1/28/2005	05:05	90.1	Outlet	-
1/28/2005	06:05	91.1	Inlet	-
1/28/2005	07:01	92.0	Outlet	Switched AC-S column flow to ambient air.
1/28/2005	07:15	92.3	-	Observed an initial surge on NO ₂ emission from AC-S column (345 ppm), After 3-4 minutes on ambient air, it dissipated quickly and now NO<1 ppm, NO ₂ =10 ppm.
1/28/2005	07:25	92.4	-	Secured heat trace power on exterior of AC-S column. NO ₂ =5 ppm.
1/28/2005	07:37	92.6	-	NO ₂ , 1ppm and HC ~15 ppm at the column outlet. Roof blower will maintain air flow through the column.
1/28/2005	08:33		-	NO=< 1ppm, NO ₂ =<1ppm, HC=10.2 ppm,
1/28/2005	08:38	93.6	Inlet	NO=< 1ppm, NO ₂ =1-2 ppm.
1/28/2005	08:40	93.7	Outlet	-
1/28/2005	10:30	95.5	-	Test is terminated.

(-) – Indicates Empty data field.

(#) – Times are accurate within 1 minute, however FTIR response time is usually 3-6 minutes.

(##) – Should be read with a preceding “switched to... and remains there until next switch”.

Table 5. Concentrations Measured Using Impinger Train (S, F, Cl) and Modified Method 308 (Allyl Alcohol) at Column Outlet.

Analyte	Sampling Time	Concentration [mg/dscf] / [ppmv]
Sulfur	01/15/05 13:04 – 14:04 (Test #1, 88.6 – 89.6 hrs)	0.0254 / 0.60
Fluorine		0.0070 / 0.28
Chlorine		0.3794 / 8.0
Sulfur	01/26/05 16:43 – 17:43 (Test #2, 53.7 – 54.7 hrs)	0.0342 / 0.80
Fluorine		0.0063 / 0.25
Chlorine		0.3057 / 6.5
Allyl Alcohol (nominal supply rate 48.5 mg/dscf or 627 ppmv)	01/26/05 18:20 – 19:20 (Test #2, 55.3 – 56.3 hrs)	0.0171/ 0.22

Figure 1. Experimental setup for slipstream BAT37 tests.

Figure 2. Slipstream flow calibration curve at 28 and 55 °C.

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Figure 44. Small Scale AC-S Bed Test #2: sulfur dioxide concentration by FTIR at column outlet.

Figure 45. Small Scale AC-S Bed Test #2: hydrogen fluoride concentration by FTIR at column inlet.

Figure 46. Small Scale AC-S Bed Test #2: hydrogen fluoride concentration by FTIR at column outlet.

*The Catholic University of America
Vitreous State Laboratory*

*Regulatory Off-Gas Emissions Testing on the DM1200
Melter System Using HLW and LAW Simulants
Final Report, VSL-05R5830-1, Rev. 0*

APPENDIX IV

Air Tech Environmental Reports

TEST REPORT

for

**Emissions Sampling of the 1200 Melter
The Vitrification Unit
at The Catholic University of America
(Low Level Waste)
Updated 10-14-05**

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August 1, 2005

Air-Tech Environmental, LLC

Report Certification

This report has been reviewed by the following *Air-Tech Environmental, LLC* personnel and is a true representation of the results obtained for the sampling program at the 1200 Melter The Vitrification Unit at The Catholic University of America. The sampling and analytical methods were performed in accordance applicable EPA reference methods except where noted in this report.

Approvals:

Team Leader:	Michael W. Hartman, Principal Scientist	<u>8/8/05</u> Date
Reviewer:	Darrell H. Doerle, Senior Staff Scientist	<u>8/8/5</u> Date
Facility Representative:	Keith Matlack, Ph.D.	<u>8/8/05</u> Date

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1.0 INTRODUCTION

Air-Tech Environmental provided off-gas sampling and particulate analytical services for The Catholic University of America (CUA) Vitrification State Laboratory (VSL) in Washington, D.C. This report covers the test program conducted in March 2005, encompassing testing performed March 8 - 10, 2005 and March 16 - 23, 2005.

The testing objective was to characterize the off-gas exiting the melter for selected compounds of interest and to assess the performance of various control devices. The sampling locations were: (1) outlet of the melter; (2) outlet of the hybrid catalyst unit (HCU); (3) outlet of the HEPA filter; and (4) the outlet of the carbon bed. A schematic of the VSL melter and off-gas handling system, showing the sampling locations, is depicted in Figure 1.

Testing for the determination of Destruction and Removal Efficiency (DRE) was conducted while the melter was spiked with allyl alcohol and naphthalene. The determination of DRE (to be calculated by CUA) will be made by comparing the mass of each compound detected at each location to the mass spiked. Additional testing, for parameters such as particulate matter, was performed during non-spiking conditions.

All samples were collected from the midpoint of 4-inch ducts at the melter, and 4.26-inch ducts at all other locations. Velocity measurements were made following the procedures of EPA Method 1A, *Sample and Velocity Measurements for Stationary Sources with Small Stacks or Ducts* and EPA Method 2, *Determination of Stack Gas Velocity and Volumetric Flow Rate*. Four (4) types of samples of the flue gas were collected for analysis. The complete target analyte list includes metals, anions, particulate matter (both total and by size distribution), semi-volatile organics and volatile organics. A Method 26 sampling train was employed for collection of particulate, halides and acid gas samples. Samples for the determination of particle size distributions were collected using a Pilat (University of Washington) Mark 3 cascade impactor per CARB Method 501. Samples of semi-volatiles and volatiles were collected by employing EPA SW 846 Methods 0010, 0023 and 0031 respectively.

Several of the sampling methods were modified to accommodate the unique sampling locations and the gas stream matrix. Of particular interest was the sampling procedure used for the collection of allyl alcohol. The oxides of nitrogen in the gas stream matrix were sufficiently dissolved in the water-absorbing solution of the train, causing the acidification of the water. This acidified water reacted with some amount of the collected alcohol, thus reducing the detectable amounts of the target compound. This phenomenon was demonstrated by sampling the gas stream matrix using water in the impingers followed by directly spiking the impingers with a known amount of the target alcohol. This experiment was repeated with 0.2 M sodium hydroxide solution as a replacement for the water. Recoveries of the spiked alcohol were found to be acceptable when using the 0.2 M sodium hydroxide solution.

Due to the toxic nature of allyl alcohol, spiking/testing was performed only during the first shift of the designated test day.

Testing for total hydrocarbons (THC) using a continuous emission monitor was performed on a flexible schedule, making measurements when the sampling ports were available.

Testing for particle size determination (PSD) also was flexible due to availability of the sampling port and the time necessary to collect a valid sample, which had been estimated to range from 12 to 24 hours.

In addition, a single sample was collected at the TCO for total organic emissions (TOE) employing EPA methods 0040 and 0010.

Table 1-1 provides a summary of the analytes and methods performed during each test condition. Tables 1-2 and 1-3 show the number of runs of each type performed at the various locations.

Air-Tech Environmental provided only the particulate analysis for the samples that were collected. Severn Trent Laboratories (STL) performed analyses for halogens, metals, volatile organics, allyl alcohol and semi-volatile organics.

Table 1-1. Summary of Analytes and Methods Per Test Event

<i>Parameter</i>	<i>Analyte</i>	<i>Sampling Method</i>	<i>Analysis Method</i>
Total Particulate	Particulate matter	M-26A (Filter, Probe Rinse)	Gravimetric
Allyl Alcohol	Allyl alcohol	Modified Method 308	FID
Particle Size	Particulate matter	Impactor (3 stages) CARB 501	Gravimetric
Halogens/Halides	HCl, HF Cl ₂ , F ₂	M-26A (Acidic Impingers) M-26A (Caustic Impingers)	EPA 9057/340 (IC/ISE)
Total Metals	See footnote 1	M-0060	ICPES/ICPMS
Semi-volatile organics	See Footnote 2	SW 846 Method M-0010	EPA 8270C
THC	Total hydrocarbons	M-25A	NA
PCB / Dioxins	WHO ⁴ List; D/F	SW 846 Method 0023A	EPA 1668A / 8290A
Volatile organics	See Footnote 3	SW 846 Method 0031	EPA 8260B
Total Organic Emissions (TOE) ⁵	Volatiles Semi-Volatiles Non-volatiles	M-0040 M-0010 M-0010	GC/FID GC/FID GC/FID

¹ Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn.

² Semi-volatile organic compound target list from Method 8270 C.

³ Volatile organic compound target list from Method 0031. Each run consisted of 3 sets of tubes, designated as pair A, pair B, and pair C.

⁴ World Health Organization List of PCBs

⁵ Refer to "Guidance for Total Organics", EPA/600/R-96/033, March, 1996.

The testing locations are as described in Section 1 and Section 3.

This report consists of the following sections: Section 2- results; Section 3 - sampling location descriptions; Section 4 - sampling methodologies; and Section 5 - Quality Control. All results tables, field and gravimetric analytical data, calibrations and example calculations are appended.

Table 1-2. Sampling Time Table for March 8-10, 2005 Mobilization (Revised 10-1-05)

Location	Sample Type	Date	Run #	Start/Stop Time
Melter	Halides/ PM	3/09/05	1	0144-0244
			2	0351-0451
			3	0547-0647
TCO			1	0147-0247
			2	0353-0453
			3	0549-0649
Melter	Metals	3/08/05	1	1821-1921
			2	2112-2212
		3/08/05 - 3/09/05	3	2333-0033
TCO		3/08/05	1	1819-1919
			2	2130-2230
		3/08/05 - 3/09/05	3	2336-0136
Melter	SVOC	3/09/05	1	1130-1230
			2	1524-1624
			3	1902-2002
HEPA			1	1133-1233
			2	1523-1623
			3	1903-2003
TCO			1	1030-1330
			2	1417-1717
			3	1803-2103
Carbon Bed			1	1031-1331
			2	1420-1720
			3	1805-2105
TCO	PSD	3/8-3/10/05	1	2056-1050

Table 1-2. Sampling Time Table for March 8-10, 2005 Mobilization (cont'd)

Melter	M308 (Ally Alcohol)	3/8/05	1	1053-1141
			2	1243-1332
			3	1451-1523
1			1056-1146	
2			1245-1335	
3			1454-1525	
HEPA		3/9/05	pH assess.	0803-0853
		3/7/05	1-spike	1852-2032
		3/8/05	1	1030-1210
2			1222-1302	
3			1419-1559	
TCO		3/8/05	1	1031-1211
			2	1220-1400
			3	1440-1532
Carbon Bed		3/9/05	1-spike	0802-0852

Table 1-3. Sampling Time Table for March 16-22, 2005 Mobilization (Revised 10-01-05)

Location	Sample Type	Date	Run #	Start/Stop Time
Melter	Metals	3/18/05	1	1328 - 1428
			2	1526 - 1626
			3	1811 - 1911
TCO			1	1327 - 1427
			2	1523 - 1723
			3	1803 - 2003
Melter	SVOC	3/22/05	4	1054 - 1154
			5	1410 - 1510
	SVOC + Dioxon/Furan		6	1801 - 1901
TCO	SVOC		4	0941 - 1241
			5	1309 - 1609
	SVOC + Dioxon/Furan		6	1648 - 1948
TCO	TOE/ SVOC	3/21/05	1	1101 - 1301
HEPA	SVOC	3/22/05	4	1056 - 1156
			5	1413 - 1513
			6	1753 - 1853
Carbon Bed			4	1012 - 1212
			5	1337 - 1537
			6	1720 - 1920
Melter	CDD/ CDF/ PCB	3/18/05	1	0930 - 1050
		3/19/05	2	0856 - 1016
		3/21-22/05	3	2310 - 0120
TCO		3/18/05	1	0930 - 1130
		3/19/05	2	0900 - 1100
		3/19/05	3	1135 - 1335
		3/21/05 - 3/22/05	4	2322 - 0122
		3/22/05	5	0220 - 0420
Melter	Halide/ PM	3/19/05	1	1430 - 1530
			2	1647 - 1747
			3	1908 - 2008
TCO			1	1402 - 1602
			2	1621 - 1821
			3	1846 - 2046
TCO	PSD	3/17-19/05	1	2027 - 0819

Table 1-3. Sampling Time Table for March 16-22, 2005 Mobilization (cont'd)
 (Revised 10-01-05)

Location	Sample Type	Date	Run #	Time	
Melter	Allyl M-308	3/17/05	1-Spiked	1740 - 1850	
		3/21/05	1	1442 - 1532	
			2	1633 - 1723	
			3	1834 - 1924	
TCO			1	1409 - 1549	
			2	1601 - 1742	
			3	1807 - 1947	
HEPA			1	1446 - 1636	
			2	1638 - 1728	
			3	1837 - 1927	
Carbon Bed			1	1445 - 1635	
			2	1636 - 1716	
			3	1836 - 1916	
Melter		VOST	3/19-3/20/05	1A	2355 - 0005
			3/20/05	1B	0017 - 0027
				1C	0035 - 0045
	1D			0054 - 0104	
	2A			0206 - 0216	
	2B			0223 - 0233	
	2C			0240 - 0250	
	2D			0258 - 0308	
	3A			0408 - 0418	
	3B			0425 - 0435	
	3C			0442 - 0452	
	3D			0459 - 0509	
	4A			2051 - 2101	
	4B			2110 - 2120	
	4C			2126 - 2136	
	4D			2142 - 2152	
	5A			1041 - 1051	
	5B			1057 - 1107	
	5C			1113 - 1123	
	5D			1128 - 1138	
	3/21/05			6A	0046 - 0056
			6B	0102 - 0112	
			6C	0118 - 0128	
			6D	0143 - 0153	

Table 1-3. Sampling Time Table for March 16-22, 2005 Mobilization (cont'd)
 (Revised 10-01-05)

<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Time</i>
TCO	VOST	3/20/05	1A	0011 - 0031
			1B	0040 - 0100
			1C	0111 - 0131
			1D	0140 - 0200
			2A	0220 - 0240
			2B	0248 - 0308
			2C	0317 - 0337
			3A	0352 - 0412
			3B	0420 - 0440
			3C	0449 - 0509
			3D	0517 - 0537
			4A	2046 - 2106
			4B	2116 - 2136
			4C	2145 - 2205
			4D	2214 - 2234
			5A	2248 - 2308
			5B	2317 - 2337
			5C	2346 - 0006
		3/21/05	6A	0018 - 0038
			6B	0047 - 0107
			6C	0115 - 0135
			6D	0144 - 0204

Figure 1. DM 1200 Melter and Flue Gas Cleanup System

2.0 RESULTS

A sampling and analytical summary of the characterizations conducted during this test program is contained in Tables 1-2 and 1-3. These tables present the complete list of samples collected and dates and time of collection. A presentation of results has been organized by analyte with discussions presented in the following sections.

2.1 Volatile Compounds (SW 846 Method 0031)

Twelve (12) sampling runs for the determination of volatile organic compound emission rates were performed: six at the melter and six at the TCO outlet.

Each run consisted of the collection of three sets of sorbent tubes designated as Set A, Set B, and Set C. A set of sorbent tubes consisted of two Tenax tubes and one Anasorb-747 tube.

Tables 2-1 and 2-2 provide the date and time of collection of each set of the tubes along with the sample volume and stack flow rate. For analysis, the two Tenax tubes were thermally desorbed as a pair and the Anasorb desorbed separately. Due to the high concentrations expected at the Melter, the Tenax tubes were desorbed with methanol. A portion of the diluted methanol then was injected into the mass spectrometer for analysis. The analytical results were reported from the laboratory as total micrograms (ug) for the combined Tenax tubes and total ug for the Anasorb tube. In addition, an aqueous condensate sample was collected during each run (composite over the three sets of tubes). The condensate was analyzed using the purge and trap procedure and the results reported from the laboratory in units of ug/liter of aqueous condensate. The calculation of concentration (ug/dscf) and emission rate (ug/min) was performed as follows. The mass detected for each target compound in Set A Tenax and Set A Anasorb was summed to get a subtotal. The mass subtotal by compound for each set was divided by the sample volume (nominally 20 liters) collected for that set to get a concentration and then the concentration value was multiplied by the stack flow rate (dscfm) to get the emission rate. This was repeated for Set B and Set C. An average value by compound for the concentration and emission rate was then calculated. The mass detected for each compound in the condensate sample was calculated by multiplying the reported concentration (ug/L) by the liquid volume of the condensate collected plus rinse (i.e., 40 mL collected and recovered into a 40 mL VOA vial). Since the condensate was an integrated sample collected over the three sets of tubes, the gaseous sample volumes for the corresponding three sets of tubes were summed and this sum was used for the calculation of concentration and subsequently the emission rate. The total concentration and emission rate by compound for each run was calculated by summing the averaged value for the tube sets and the value for the condensate. If a target was not detected (ND), the analytical method detection limit (MDL) was used rather than a zero value for the purpose of calculations and the final results are reported as a "less than values". If a ND was reported for a target in one or more of the sample components (i.e., Tenax, Anasorb and/or condensate) the total for that compound for the run was reported as "less than" value. The results, as reported here, have not been blank corrected.

The results of the VOST sampling (samples and blank) can be found in Appendix A.1 and the corresponding field data sheets in Appendix B.1.

Table 2-1. Summary of Melter Volatile Sample Volumes and Stack Flow Rates
 (Revised 10/01/05)

<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Time</i>	<i>Standard Meter Volume</i>	<i>Flow Rate (dscfm)</i>
Melter	VOST	3/19/05 - 3/20/05	1A	2355 - 0005	4.63	171.27
		3/20/05	1B	0017 - 0027	4.66	171.27
			1C	0035 - 0045	4.78	171.27
			1D	0054 - 0104	4.78	171.27
			2A	0206 - 0216	4.93	171.27
			2B	0223 - 0233	4.88	171.27
			2C	0240 - 0250	4.63	171.27
			2D	0258 - 0308	4.87	171.27
			3A	0408 - 0418	4.96	171.27
			3B	0425 - 0435	5.38	171.27
			3C	0442 - 0452	4.75	171.27
			3D	0459 - 0509	4.77	171.27
			4A	2051 - 2101	4.99	208.21
			4B	2110 - 2120	4.93	208.21
			4C	2126 - 2136	4.70	208.21
			4D	2142 - 2152	4.82	208.21
			5A	1041 - 1051	4.93	208.21
			5B	1057 - 1107	5.02	208.21
			5C	1113 - 1123	4.89	208.21
			5D	1128 - 1138	4.96	208.21
		3/21/05	6A	0046 - 0056	4.91	208.21
			6B	0102 - 0112	4.97	208.21
			6C	0118 - 0128	4.72	208.21
			6D	0143 - 0153	4.97	208.21

Table 2-2. Summary of TCO Outlet Volatile Sample Volumes and Stack Flow Rates
 (Revised 10/01/05)

<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Time</i>	<i>Standard Meter Volume</i>	<i>Flow Rate (dscfm)</i>
TCO	VOST	3/20/05	1A	0011 - 0031	17.14	233.46
			1B	0040 - 0100	18.49	233.46
			1C	0111 - 0131	16.72	233.46
			1D	0140 - 0200	18.76	233.46
			2A	0220 - 0240	17.26	233.46
			2B	0248 - 0308	17.85	233.46
			2C	0317 - 0337	17.85	233.46
			3A	0352 - 0412	17.86	233.46
			3B	0420 - 0440	18.09	233.46
			3C	0449 - 0509	17.57	233.46
			3D	0517 - 0537	17.37	233.46
			4A	2046 - 2106	17.83	238.22
			4B	2116 - 2136	18.61	238.22
			4C	2145 - 2205	17.58	238.22
			4D	2214 - 2234	17.40	238.22
			5A	2248 - 2308	19.49	238.22
			5B	2317 - 2337	18.26	238.22
			5C	2346 - 0006	17.31	238.22
		3/21/05	6A	0018 - 0038	17.90	238.22
			6B	0047 - 0107	18.17	238.22
			6C	0115 - 0135	18.74	238.22
			6D	0144 - 0204	18.82	238.22

2.2 Semi-Volatiles (SW 846 Method M 0010)

Twenty-one (21) samples were collected for the determination of semi-volatile organic compounds - six each at the melter, HEPA and TCO, and three at the carbon bed. Table 2-3 shows the summary of semi-volatile sampling, including date, sample volume and flow rate for each sample collected. The sampling method (EPA Method 0010) and the analysis method (EPA SW-846 Method 8270C) procedures were followed for the determination of semi-volatile organic compounds.

A summary of the results for the semi-volatile sampling is presented in Appendix A.2, showing the stack gas concentrations in ug/dscf and the emission rates in µg/min. The concentration values were calculated by dividing the laboratory reported results, in ug, by the sampled volume, in cubic feet, on a dry basis and corrected to standard conditions of 1 atmosphere and 68 degrees F. All runs were performed while spiking naphthalene into the melter.

Due to high concentrations of naphthalene found at the melter and HEPA outlets, extracts required dilution before analysis. As a consequence, some compounds present may have been diluted to a level so as not to be detectable and are reported as ND in the laboratory results.

All field data sheets associated with these analyses can be found as Appendix B.2.

The recovered sampling train fractions for each sample were prepared in the laboratory and the extracts combined for analysis. If a compound was not detected, a "ND" is listed in the laboratory results indicating that it may be present but at a level less than the MDL. The MDL varies from compound to compound based on instrument sensitivity and increases proportionally with any required sample dilution. If a target was not detected (ND), the analytical method detection limit (MDL) was used rather than a zero value for the purpose of calculations and the final results are reported as "less than values". The results, as reported here, have not been blank corrected.

Table 2-3. Summary of Semi-Volatile Sampling (Revised 10/01/05)

Location	Run Number	Date	Sample Volume dscf	Flow Rate dscfm
Melter	1	3/9/05	43.707	195.09
	2		44.942	196.83
	3		43.229	192.27
	4	3/22/05	35.972	204.91
	5		36.512	207.26
	6		37.274	208.87
HEPA	1	3/9/05	34.651	187.66
	2		34.111	185.82
	3		33.275	179.38
	4	3/22/05	38.053	201.88
	5		37.385	200.05
	6		36.389	193.59
TCO	1	3/9/05	139.919	254.94
	2		136.962	246.69
	3		135.837	245.96
	4	3/22/05	127.946	239.12
	5		128.134	240.58
	6		124.850	233.07
Carbon Bed	1	3/9/05	109.733	178.00
	2		107.705	178.15
	3		100.409	179.68
	4	3/22/05	84.055	197.79
	5		84.220	198.44
	6		79.787	191.32

2.3 Dioxins/Furans/PCB (SW 846 Method 0023)

Chlorinated dioxins and furans (D/F) were determined in combination with the polychlorinated biphenyls (PCB) using a modified Method 0023 sampling train. Table 2-4 shows the sample volume and stack flow rate for each sample.

During sample preparation, each sample extract was split: one-half for D/F analysis and one-half for PCB analysis (following analytical procedures of EPA Method 1668). One sample was a semi-volatile/dioxin split. A total of four (4) samples were collected at the melter and six (6) at the TCO. Each sample was analyzed by high resolution gas chromatography (HRGC) / high resolution mass spectrometry (HRMS). The results of the analysis for D/F are given in Appendix A.3. For the melter samples, all congeners were detected in all samples except for run 2, where 2,3,7,8-TCDD was not detected. In the TCO samples, generally speaking, most of the congeners were not detected or detected at low levels, except for run 2 where all were detected except for 2,3,7,8-TCDD. OCDD was the predominant congener detected in all TCO samples. If a target was not detected (ND), the analytical method detection limit (MDL) was used rather than a zero value for the purpose of calculations and the final results are reported as "less than values". OCDD was the only congener detected in the field blank and present at trace levels. The results, as reported here, have not been blank corrected.

Also found in Appendix A.3 are the D/F results presented in terms of 2,3,7,8 TCDD equivalents (TEQ).

The results of the PCB sampling and analysis are given in Appendix A.4. For the melter samples, PCB 77, PCB 105 and PCB 188 were detected at the highest amounts. For the TCO samples, PCB 105 and PCB 188 were detected at the highest amounts. All others were either not detected or detected at levels less than 5 times the MDL. PCB 118 was the only target detected in the field blank at a level of 0.019 ng which is just above the MDL of 0.012 ng.

All field data sheets associated with these analyses can be found in Appendix B.3 and B.4 for D/F and PCB respectively.

2.4 Metals (SW 846 Method 0060)

Samples for the determination of metals emissions were collected at the outlet of the melter (6 runs) and the outlet of the TCO (7 runs). One sample of the TCO was discarded due to contamination. Thirteen (13) Method 0060 samples were collected.

Table 2-5 gives the sample volumes and stack flow rates.

The results for the Method 0060 test runs performed are summarized in Appendix A.5 in units of concentration and emission rates respectively and have been blank corrected. The field data sheets are given in Appendix B.4.

The front and back half components of the sampling train were digested with acid and using inductively coupled argon plasma emission spectrometry (ICPES). The laboratory results, reported in total ug, the volume of sample collected and the stack gas flow rates were used to calculate the stack gas concentration and emission rates respectively.

Table 2-4. Summary of D/F/PCB Sample Volumes and Stack Flow Rates (Revised 10/01/05)

<i>Location</i>	<i>Run Number</i>	<i>Date</i>	<i>Sample Volume dscf</i>	<i>Flow Rate dscfm</i>
Melter	1	3/18/05	55.318	177.62
	2	3/19/05	41.646	168.51
	3	3/21-3/22/05	87.223	211.83
TCO	1	3/18/05	82.476	227.91
	2	3/19/05	84.916	234.04
	3	3/19/05	84.706	233.85
	4	3/21-3/22/05	84.740	240.42
	5	3/22/05	83.656	238.23

Table 2-5. Summary of Metals Sample Volumes and Stack Flow Rates (Revised 10/01/05)

Location	Run Number	Date	Sample Volume dscf	Flow Rate dscfm
Melter	1	3/8/05	37.483	166.35
	2		40.979	175.59
	3	3/8 - 3/9/05	37.412	168.47
	1	3/18/05	26.129	165.55
	2		31.824	175.81
	3		32.228	184.10
TCO	1	3/8/05	45.017	243.15
	2		46.732	250.73
	3	3/8 - 3/9/05	44.135	245.63
	1	3/18/05	41.191	228.65
	2		84.451	235.09
	3		84.855	240.06

A review of the melter result show the data to be generally consistent for Runs 1-3 (process condition 1) and for Runs 4-6 (process condition 2). This was also the case for the corresponding TCO samples. TCO Run 7 results were noticeably lower than any of the other TCO runs. Selenium was present at the highest levels and all samples required dilution to bring several metals within the calibration range. If a target was not detected (ND), the analytical method detection limit (MDL) was used rather than a zero value for the purpose of calculations and the final results are reported as "less than values".

2.5 Hydrogen Chloride, Hydrogen Fluoride, and Halogens (EPA Method 26A)

Samples for the determination of hydrochloric acid (HCl), hydrofluoric acid (HF) and the halogen gases chlorine (Cl₂), fluorine (F₂) were collected in a Method 26A train which employed two impingers containing dilute sulfuric acid solution to facilitate collection of the acid gases and two impingers containing dilute sodium hydroxide to facilitate collection of the halogen gases. Table 2-6 provides the sample volumes and stack flow rates. Summary tables of the results of the sampling are presented in Appendix A.6.

The melter and TCO data show that HF and HCl were detected in all runs with HCl being predominant. Fluorine was not detected in any of the samples.

Melter run1 and TCO run1 were sampled simultaneously, as were the other runs. When comparing the results for Melter runs 1-3 and TCO runs 1-3, it was apparent that the results for the acidic impingers for Run 3 melter were not consistent with runs 1 and 2. This was also the case for the TCO run 3 acidic impinger results. The results for the other train components (i.e., particulate catch on the filter and caustic impinger) were consistent across the three runs for both the melter and TCO. The laboratory re-analyzed the acidic impinger samples for run 3 melter and TCO and confirmed the results as previously reported. If the results as reported from the laboratory for the acidic impinger samples of run 3 Melter and TCO are reversed, the results show consistency across the three runs. Therefore it was concluded that these two samples were mislabeled at the time of sample recovery.

The field data sheets can be found in Appendix B.5.

2.6 Particle Size Determination Results (CARB Method 501)

Particle size determination (PSD) was conducted with a two-stage cascade impactor with a final filter. These devices separate particles by inertia and particle size classifications are performed solely on a mass per unit volume basis. PM is collected on a separate substrate in each of the stages with the diameter of the particles collected becoming smaller and smaller as the gas stream passes sequentially through the device. For this study, two sampling runs were performed at the TCO outlet.

The results of the PSD gravimetric analysis are presented in Appendix A.7 and the raw laboratory and field data are found in Appendix B.6. All runs were performed in a similar fashion, resulting in the collection of sufficient material to be gravimetrically meaningful for all runs. Each sample was collected for nominally 24 hours with the results being reported at three cut points: greater than 10 microns, 1-10 microns and less than 1 micron.

Table 2-6. Summary of Halogens Sample Volumes and Stack Flow Rates

<i>Location</i>	<i>Run Number</i>	<i>Date</i>	<i>Sample Volume dscf</i>	<i>Flow Rate dscfm</i>	
Melter	1	3/9/05	41.948	193.51	
	2		39.145	182.31	
	3		44.852	204.73	
	1	3/19/05	30.740	166.15	
	2		31.443	167.56	
	3		30.920	164.88	
	TCO	1	3/9/05	46.170	252.79
2		42.842		233.08	
3		46.057		251.50	
1		3/19/05	86.607	241.62	
2			84.097	233.16	
3			83.767	230.62	

2.7 Particulate Matter Results (EPA Method 5)

A summary of the particulate sampling results is presented in Appendix A.8. Twelve (12) tests for total particulate matter (PM) were performed - six at the melter and six at the TCO. These tests were performed in conjunction with the Method 26 tests. Sample dates, sample volumes and flow rates are given in Table 2-6.

2.8 Total Organic Emissions (TOE) (SW 846 Method 0040 for Volatiles, and SW 846 Method 0010 for Semi-Volatiles and Non-Volatiles)

The determination of Total Organic Emissions (TOE) involves the measurement of organic compounds over three fractions distinguished by boiling point ranges: 1) volatile compounds; 2) semi-volatile compounds also known as total chromatographable organics (TCO) and 3) nonvolatile compounds also known as gravimetric (Grav). These measurements are performed using a combination of two sampling methods, Method 0040 and Method 0010. One TOE test run was performed at the outlet of the TCO on 12/9/04. The results are given in Appendix A.9 and the field data sheets given Appendix B.7.

2.9 Total Hydrocarbon (THC) Testing (EPA Method 25A)

Investigative total hydrocarbon (THC) testing was performed at various sampling points during the organic spiking. Sample gas was extracted from the source via heated head pump and directed to the analyzer through a heated Teflon line. The analyzer utilized a flame ionization detector (FID) to detect the presence of any volatile organic material in the gas stream. The

FID operates on the principle of flame ionization. Organic compounds entering the flame are combusted, forming positive and negatively charged ions that give rise to a small current between two electrodes. The instrument electronically outputs an analog voltage signal proportional to this small current. This analog signal then is converted to a digital readout and displayed on a computer screen. The data is stored electronically for subsequent data reduction. The generated signal is roughly proportional to the number of carbon atoms present in the sampled gas and, therefore, the response represents the total hydrocarbon concentration present and not that of individual compounds.

The total hydrocarbon sampling followed the procedures of EPA Method 25A in a general fashion. Due to the wide range of hydrocarbon concentrations that were to be characterized at the various sampling points through the emissions control system calibration procedures were expanded upon to assess instrument linearity between multiple instrument ranges. Prior to sampling, the instrument and data system were calibrated at a selected instrument range according to the method procedures. The instrument response was then checked at ranges above and below the range selected for full calibration, allowing a QC assessment of the data collected as the instrument was operated at different ranges as the probe was moved from sampling location to sampling location. Drift assessments were conducted sporadically throughout the test days to allow assessments of instrument drift to be made on an ongoing basis rather than to bookend a specific test. Results of this non specie specific hydrocarbon testing have been archived..

2.10 Allyl Alcohol (Modified EPA Method 308)

Sampling for the determination of allyl alcohol was performed during each of two mobilizations. During the November 2004 test three samples were collected at the melter, the HEPA and the TCO. Sampling at the three locations was performed simultaneously. In addition, one run at the melter was performed after the train had been pre-spiked with a known amount of allyl alcohol. This testing was repeated during the December 2004 mobilization when one additional spiked train run was performed at the TCO location. Analyte breakthrough from the first two impingers was determined for one run at each of the sampling locations. Breakthrough was determined by analyzing the contents of the fourth impinger. Breakthrough was found to be less than 1% in all cases. The results of the Method 308 tests are given in Appendix A.10 and the corresponding field data sheets are given in Appendix B.8. Table 2-7 provides the sample volumes and flow rates.

2.11 Carbon Monoxide (EPA Method 10)

As a safety measure carbon monoxide content of the gas stream was monitored at the outlet of the carbon bed during periods of organic spiking of the waste feed. This sampling was conducted using a non-dispersive infrared analyzer according to the procedures of EPA Method 10.

Gas samples were withdrawn from the carbon bed exhaust through a filter and chilled condenser. The dried flue gas was then directed to a CO analyzer in excess of instrument demand. A slipstream of the dried sample was drawn into the analyzer sample cell. CO concentrations were determined by the amount of infrared absorption occurring as the sample passed through the cell.

Analyzer output was an analog voltage signal. This signal was fed through an A/D converter and logged on computer. Calibrations and sampling system bias checks were performed as per the method. Data collection was continuous during periods of organic spiking, interrupted only for infrequent assessments of instrument drift. The data collected during this testing has been archived.

Table 2-7 Summary of Method 308 Sample Volumes and Stack Flow Rates (Revised 10/01/05)

Please Note: The flow rates for the Melter, HEPA, and Carbon Bed Outlet are calculated from the average of all the isokinetic samples at those locations during each test segment. The TCO flow rates are calculate from the average of all the isokinetic samples at the TCO during each test segment.

Location	Run Number	Date	Sample Volume dscf	Flow Rate dscfm
Melter	1	3/8/05	1.169	186.988
	2		1.175	186.988
	3		0.746	186.988
	1 - Spiked	3/21/05	31.65	208.21
	1		23.44	208.21
	2		23.08	208.21
	3		22.41	208.21
HEPA	1	3/8/05	1.252	186.988
	2		1.254	186.988
	3		0.786	186.988
	pH assessment	3/9/05	1.292	186.988
	1	3/21/05	25.27	208.21
	2		24.95	208.21
	3		28.58	208.21
TCO	1 - Spiked	3/7/05	2.559	241.58
	1	3/8/05	2.655	241.58
	2		2.654	241.58
	3		2.586	241.58
	1	3/21/05	68.10	238.22
	2		70.71	238.22
	3		69.56	238.22
Carbon Bed	1- Spiked	3/9/05	1.471	186.988
	1	3/8/05	2.501	186.988
	2		2.482	186.988
	3		1.248	186.988
	1	3/21/05	25.19	208.21
	2		25.50	208.21
	3		24.37	208.21

3.0 SAMPLING LOCATIONS

Samples were collected from four locations: melter outlet, HEPA outlet, carbon bed outlet and the TCO outlet. See Figure 1 for a diagram of these locations.

4.0 DISCUSSION OF SAMPLING METHODS BY ANALYTE

This section describes the methods that were employed by *Air-Tech Environmental* personnel to accomplish the prescribed testing program. The gas sample collection procedures employed during this test program are briefly discussed in the following sections. Except as noted, sampling methodologies adhered to procedures described in appropriate reference methodologies.

4.1 Volatile Organics Testing

SW 846 Method 0031 was employed for the characterization of gas stream volatile organic content. Each run consisted of three samples (*i.e.*, three sets of tubes: two tubes of each set containing Tenax and the other containing Anasorb-747). Each set of tube samples was collecting sample at a nominal rate of 1.0 liter per minute using the volatile organic sampling train (VOST) as described in the sampling method. One field blank (one set of tubes) was collected during one of the test runs. Figure 2 is a drawing of a VOST train; and Figure 3 shows the VOST Tube Components.

4.2 Semi-Volatile Sampling (including Dioxin/Furan/PCBs)

A single sampling train (depicted in Figure 4) was used for the collection of semi-volatile organic compounds (SVOCs), dioxin/furan and PCBs. Glassware preparation and sampling procedures followed those presented in the respective methods. Sample recovery procedures resulted in the following five sample fractions being presented for analysis when employing Method 23:

- Fraction 1- XAD-2: resin trap, sealed and stored on ice;
- Fraction 2- Filter: removed from housing and sealed in a glass petri dish;
- Fraction 3- Acetone followed by methylene chloride rinses of the front half of the train (nozzle, probe, by-pass and front half of filter holder);
- Fraction 4- Acetone followed by methylene chloride rinse of the back half of the train components (back half of filter, condenser and knock-out);
- Fraction 5- Toluene rinse of the front half of the train when required;
- Fraction 6- Toluene rinse of the back half of the train;
- Fraction 7- Aqueous condensate.

These samples were analyzed for dioxin/furans by Method 8290. The PCBs were analyzed by water method 1668A for the World Health Organization (WHO) list of PCBs.

When only Method 0010 was required, the train was recovered in the following fractions:

- Fraction 1 - XAD-2;
- Fraction 2 - Filter;
- Fraction 3 - 50:50 acetone/methanol rinse of front-half of the train;
- Fraction 4 - 50:50 acetone/methanol rinse of the back half of the train;
- Fraction 5 - Aqueous condensate.

The aqueous impingers of the Method 0010 train are for the purpose of determining the moisture content of the sample gas, and the contents of which are typically discarded after each run.

4.3 Metals

The metals samples were collected using a modified EPA Method 0060 sampling train. Figure 5 contains a schematic of this modified sampling train. Modifications to the sampling methodology included the removal of acidic potassium permanganate impingers from the condenser train to eliminate mercury samples (which was not a target compound).

Sample recovery resulted in the following sample fractions:

Front half nitric: 0.1N nitric acid rinses of the probe, nozzle, inlet of the filter holder, and connecting glassware;

Filter: the tared filter placed in a properly labeled petri dish;

Back half nitric: nitric acid/hydrogen peroxide impinger contents plus 0.1N nitric acid rinses of the filter support, outlet of the filter housing, the first three impingers, and all connecting glassware;

The filter, along with the acidic rinses and acidic impinger contents, were submitted for metals analysis.

Figure 2. Schematic of Volatile Organic Sampling Train (VOST)

Figure 3. VOST Tube Components

3504408R

Figure 4. Semi-Volatile Sampling Train Configuration

4.4 Particulate Matter (PM)

Total particulate matter (PM) and fractionated PM was determined during this testing. The procedures for both are briefly discussed below.

Total PM

Total PM was determined in conjunction with the Method 26A sampling. The filters used in this train were weighed to a constant value prior to sampling. The filters were recovered from each train following sample collection and returned to the laboratory for the gravimetric determination of weight gain. Each filter was desiccated for 24 hours and then weighed to a constant weight to the nearest 0.5 milligrams. A constant weight is defined as two consecutive weights 24 hours apart that do not differ by more than 0.5 milligrams. The initial filter tare weight was subtracted from the sample filter weight to calculate the mass of PM collected. In addition, the mass of PM recovered from the aqueous rinse of the front half of the train also was determined as above and added to the mass collected on the filter. Filters were returned to VSL after gravimetric analysis was completed.

Fractionated PM

Particle size distribution was determined using a Method 5-type train equipped with a cascade impactor. The impactor contained three (3) stages each containing a separate pre-weighed substrate. As the sample gas passed through the impactor, the PM was separated by particle size. After sampling, each substrate was removed and weighed as discussed above to determine the mass at each cut size.

4.5 Halogens

EPA Method 26A was used for the determination of the halogens chlorine (Cl_2) and fluorine (F_2) and hydrogen halides hydrochloric acid (HCl) and hydrofluoric acid (HF). Samples taken for the determination of the halogens were sampled isokinetically according to the protocol of EPA Method 26A. Figure 6 shows a schematic of this sampling train. Sample fractions submitted for analyses consisted of sulfuric acid impinger solutions (for analyses of HCl and HF) and NaOH impinger solutions (for analyses of Cl_2 and F_2) with their respective impinger rinses.

4.6 Stack Gas Flow Rates

The flow rate of the sample stream at each location was determined during all tests using the procedures outlined in EPA Methods 2-4. These methods are incorporated into EPA Methods 0060, 26A, 0010 and 23.

4.7 Total Hydrocarbons by Method 25A

A total hydrocarbon (THC) analyzer was used to measure the concentration of any volatile organics that was present in the gas stream. This analyzer does not speciate the compounds present, but rather presents a total concentration in ppm relative to a calibration standard that is typically methane or propane. The detector is a flame ionization detector (FID). Sample was extracted from the source and directed to the THC analyzer through a heated Teflon® sample line. The instrument was calibrated with protocol methane compressed gas standards following the procedures of EPA Method 25A.

3504411R

Figure 5. Schematic of Metals Sampling Train

4715624R

Figure 6. Method 26A Sampling Train Configuration

4.8 Allyl Alcohol by Modified EPA Method 308

Samples for the determination of allyl alcohol were collected by using a Method 308 sampling train, modified as discussed below. Method 308 utilizes a single midget impinger containing 15 mL of organic free water followed by a single two stage silica gel adsorbent tube. Alcohols are collected mainly in the water fraction, with the silica gel tube collecting any small amount of alcohol that may "break through" the impinger. The silica gel tube fraction is desorbed in the laboratory using the prescribed desorbing solution and then this solution along with the water fraction are analyzed separately by using a gas chromatograph equipped with a flame ionization detector (FID).

Due to the unique sample matrix encountered at the vitrification unit (high moisture and high levels of oxides of nitrogen), the Method 308 train used was modified by: (1) placing a chilled glass condenser prior to the first impinger; (2) adding three additional midget impingers; (3) replacing the organic free water adsorbing solution with an aqueous 0.2 M sodium hydroxide solution in the first, second and fourth impingers; and (4) removing the silica gel tube. This modified train is depicted in Figure 7.

The chilled condenser facilitated the condensation of the water vapor in the gas stream and this condensate was collected in the first impinger. The second and fourth impingers each contained nominally 15 mL of 0.2 M sodium hydroxide solution. The third impinger remained empty. Samples were collected for nominally 100 minutes at a nominal sampling rate of 0.75 liter per minute. Upon completion of sampling, the volume of the contents of the four impingers was determined for the calculation of gas stream moisture content. The contents of the first three impingers, along with water rinses of the sampling line, chilled condenser, impingers and connecting glassware, were combined and placed in an amber glass bottle. The contents of the fourth impinger was collected separately and analyzed to determine if breakthrough occurred.

4.9 Total Organic Emissions (TOE)

A discussion of TOE is provided in the EPA document entitled "Risk Burn Guidance for Hazardous Waste Combustors" (EPA 530-R-01-001, July 2001) which references sampling and analysis procedures given in the EPA document entitled "Guidance for Total Organics" (EPA/600/R-96/033, March 1996).

The determination of TOE involves the measurement of organic compounds over three fractions distinguished by boiling point ranges: 1) volatile compounds with boiling points less than 100 °C; 2) semi-volatile compounds (also known as total chromatographable organics or TCO) with boiling points ranging between 100 and 300 °C; and 3) non-volatile compounds (also known as GRAV) with boiling points greater than 300 °C. The sum of the three fractions represents the total organic mass and is typically expressed in units of mass per unit of volume of sample collected. The collection of the samples for the determination of TOE involves two sampling methods; Method 0040 and Method 0010. Samples, using these two methods, were collected simultaneously.

4.9.1 Volatile Fraction

The procedures outlined in Method 0040 were used for the collection of the *volatile organic fraction*. This fraction was comprised of two recovered samples, an aqueous condensate and a

gaseous sample collected in a Tedlar bag. Components of the sampling train are shown in Figure 8. Sample gas is withdrawn from the stack at a constant rate through a heated probe and filter, a chilled condenser and a water knockout trap and collected in a Tedlar bag. Sample was collected at a nominal rate of 0.5 liters per minute for one hour. Upon completion of sampling, the train components were recovered as follows:

- Condensate: Collected aqueous condensate plus organic free water rinses of the condenser and knockout trap were combined in a glass bottle and thoroughly mixed. The contents of the bottle was transferred to a 40 mL VOA vial and sealed with a Teflon lined cap in a fashion such that no void space (bubble) was present. This sample was stored on ice for transport to the laboratory.
- Tedlar Bag: The inlet to the Tedlar bag was sealed and the bag placed in a rigid container that protects the sample from light.

The gaseous Tedlar bag sample was analyzed on-site using a gas chromatograph equipped with a FID (GC/FID). The analysis procedure, given in "EPA/600/R-96/033", is summarized below.

The GC/FID was calibrated at three concentration levels using a gaseous standard composed of a mixture of C1 to C7 alkanes (methane, ethane, propane....). The retention time of each alkane is graphed against its corresponding boiling point using a x-y plot. Using method-specified boiling point ranges on either side of each alkane, a retention time window is determined for each of the alkanes. For the analysis, the area count of each peak falling within each retention time window is summed and a value (mass) is calculated based on the three-point calibration curve.

The condensate was shipped to the laboratory for analysis by GC/FID using a purge and trap method as specified in EPA/600/R-96/033.

4.9.2 Total Chromatographable Organics Fraction (TCO)

The procedures outlined in Method 0010 was used for the collection of the *TCO fraction*. This fraction was comprised of the combined extracts from the various train components that were recovered upon completion of the sampling. Components of the sampling train are shown in Figure 4 and the recovery procedure is discussed in Section 4.2. The combined extract was available for two analyses, the *TCO fraction* analysis and the *gravimetric (GRAV) fraction* analysis. The TCO fraction was prepared and analyzed by the GC/FID procedures given in EPA /600/R-96/033.

4.9.3 Gravimetric Fraction (GRAV)

A measured aliquot (typically 1 mL) of the Method 0010 combined methylene chloride extract described above is placed in a clean, pre-weighed aluminum weighing pan and allowed to evaporate following the procedures given in EPA /600/R-96/033. The pan, plus sample residue, is weighed to a constant weight and the weight gained is designated as the GRAV fraction.

Since the sample collected for the TOE was for "engineering formation", the level of quality control activities was reduced from those prescribed in the method, but included the following:

- leak check of new, unused Tedlar bags;
- collection of a field blank consisting of a Tedlar bag filled with high purity nitrogen and a water rinse of the condensate knockout trap collected in a VOA vial;
- leak check of the sampling train; and
- use of organic free reagents.

The collection of only one sample at the TCO outlet while spiking allyl alcohol and naphthalene into the melter was performed.

Figure 7. Modified Method 308 Train

Figure 8. Method 0040 Sampling Train

5.0 QUALITY CONTROL

The sampling and analytical quality control measures employed during this test program included those specified in Method 5 for meter calibrations, sampling rates, and sample train integrity. These parameters are summarized for each method in Tables 5-1 and 5-2 below.

Table 5-1. Sampling Summary - March 8-10, 2005 Mobilization

Location	Sample Type	Date	Run #	Initial Leak Check	Final Leak Check	% Iso.	% Moisture
Melter	Halides/ PM	3/09/05	1	.02@13"	.02@11"	91.75	19.05
			2	.001@10"	.001@12"	90.89	19.62
			3	.01@12"	.001@22"	92.73	17.88
TCO			1	.02@13"	.02@12"	104.43	10.24
			2	.01@13"	.001@13"	105.09	10.86
			3	.01@12"	.001@12"	104.71	10.99
Melter	Metals	3/08.05	1	.004@13"	.004@7"	95.4	20.28
			2	.008@12"	.005@12"	98.8	19.85
			3	.001@13"	.001@13"	94.0	19.72
TCO			1	.004@11"	.00@9"	106	11.14
			2	.001@12"	.001@13"	107	10.53
			3	.001@13"	.001@13"	103	10.66
Melter	SVOC	3/09/05	1	.00@16"	.003@16"	94.8	19.43
			2	.00@15"	.00@18"	96.7	20.08
			3	.00@19"	.017@14"	95.2	19.29
HEPA			1	.005@14"	.000@12"	106	14.52
			2	.004@12"	.004@13"	105	13.49
			3	.004@13"	.004@10"	106	13.36
TCO			1	.012@15"	.004@14"	105	10.65
			2	.010@14"	.00@10"	106	10.60
			3	.11@12"	.00@17"	105	10.61
Carbon Bed			1	.004@13"	.004@10"	99.5	16.16
			2	.000@11"	.004@10"	97.6	12.15
			3	.000@10"	.000@12"	90.2	12.34
TCO	PSD	3/8-3/10/05	1	0.011@24"	NA	110	10.0

Table 5-1. Sampling Summary - March 8-10, 2005 Mobilization (cont'd)

<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Leak Rate - Pre</i>	<i>Leak Rate - Post</i>
Melter	Allyl Alcohol M-308	3/8/05	1	0.00@7"	0.00@5"
			2	0.00@5"	0.00@6"
			3	0.00@6"	0.00@5"
TCO			1	0.00@6"	0.00@5"
			2	0.00@6"	0.00@6"
			3	0.00@6"	0.00@6"
HEPA			1	0.00@5"	0.00@6"
			2	0.00@5"	0.00@6"
			3	0.00@6"	0.00@6"
Carbon Bed			1	0.00@5"	0.00@4"
			2	0.01@5"	0.00@5"
			3	0.00@5"	0.00@7"

Table 5-2. Sampling Summary - March 16-22, 2005 Mobilization

Location	Sample Type	Date	Run #	Initial Leak Check	Final Leak Check	% Iso.	% Moisture
Melter	Metals	3/18/05	1	0.000@10"	0.004@15"	86.96	29.39
			2	0.012@15"	0.018@14"	99.73	24.03
			3	0.00@14"	0.004@15"	96.75	22.97
TCO			1	0.004@13"	0.006@6"	112.58	10.71
			2	0.00@10"	0.004@9"	112.25	10.32
			3	0.010@12"	0.004@7"	110.45	9.94
Melter	SVOC	3/22/05	4	0.004@15"	0.004@17"	96.72	19.27
			5	0.008@16"	0.006@13"	97.06	19.21
			6	0.00@15"	0.006@20"	98.32	18.69
TCO			4	0.008@16"	0.006@11"	111.46	11.15
			5	0.010@11"	0.010@15"	110.94	10.76
			6	0.010@15"	0.010@11"	111.58	10.48
TCO	TOE/ SVOC	3/21/05	1	0.010@13"	0.006@11"	110.40	10.13
HEPA	SVOC	3/22/05	4	0.010@15"	0.008@9"	107.77	12.93
			5	0.004@9"	0.004@6"	106.85	12.33
			6	0.004@10"	0.004@6"	107.47	12.70
Carbon Bed			4	0.004@22"	0.004@21"	102.83	12.35
			5	0.006@2"	0.004@9"	102.69	12.35
			6	0.004@11"	0.004@11"	100.91	11.89
Melter	CDD/ CDF/ PCB	3/18/05	1	0.008@19"	0.006@25"	99.66	25.18
		3/19/05	2	0.001@20"	0.004@22"	102.13	25.78
		3/21-22/05	3	.00@10"	.00@16"	87.84	18.57
TCO		3/18/05	1	0.004@12"	0.004@12"	113.07	10.32
		3/19/05	2	0.008@14"	0.010@10"	113.37	10.65
		3/19/05	3	0.009@13"	0.010@12"	113.18	10.35
		3/21/05	4	0.00@15"	0.00@15"	110.13	10.89
		3/22/05	5	.01@15"	.00@15"	109.72	10.37

Table 5-2. Sampling Summary - March 16-22, 2005 Mobilization (con'td)

<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Initial Leak Check</i>	<i>Final Leak Check</i>	<i>% Iso.</i>	<i>% Moisture</i>
Melter	Halide/ PM	3/19/05	1	0.008@21"	0.004@15"	101.94	25.16
			2	0.010@15"	0.008@15"	103.39	25.35
			3	0.008@15"	0.004@15"	103.32	24.64
1			0.006@13"	0.004@7"	112.00	9.73	
2			0.010@13"	0.006@11"	112.70	10.74	
3			0.016@10"	0.012@9"	113.49	10.70	
TCO	PSD	3/17-19/05	1	0.00@11"	NA	123.00	10.5
<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Leak Rate - Pre</i>		<i>Leak Rate - Post</i>	
Melter	Allyl M-308	3/17/05	1-Spiked	0 lpm @ 5"		0 lpm @ 3"	
		3/21/05	1	0 lpm @ 11"		0.00 lpm @ 11"	
			2	0 lpm @ 12"		0.00 lpm @ 9"	
			3	0.00 lpm @ 11"		0.00 lpm @ 7"	
1			0.01 lpm @ 8"		0.00 lpm @ 6"		
2			0.00 lpm @ 6"		0.010 lpm @ 6"		
3			0.00 lpm @ 8"		0.00 lpm @ 7"		
1			0 lpm @ 11"		0.01 lpm @ 5"		
2			0.00 lpm @ 8"		0.00 lpm @ 8"		
3			0.00 lpm @ 11"		0.00 lpm @ 10"		
1		0.01 lpm @ 8"		0.01 lpm @ 10"			
2		0 lpm @ 10"		0.01 lpm @ 9"			
3		0.00 lpm @ 11"		0.00 lpm @ 8"			

Table 5-2. Sampling Summary - March 16-22, 2005 Mobilization (con'td) (Revised 10/01/05)

<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Leak Rate - Pre</i>	<i>Leak Rate - Post</i>
Melter	VOST	3/19/05	1A	.00 lpm @ 12"	.00 lpm @ 14"
		3/20/05	1B	.00 lpm @ 14"	.00 lpm @ 9"
			1C	.00 lpm @ 9"	.00 lpm @ 16"
			1D	.00 lpm @ 16"	.00 lpm @ 14"
			2A	0.00 lpm @	0.00 lpm @ 16"
			2B	.00 lpm @ 14"	.00 lpm @ 9"
			2C	0.00 lpm @ 16"	0.00 lpm @ 15"
			2D	0.00 lpm @ 15"	0.00 lpm @ 16"
			3A	0.00 lpm @ 16"	0.00 lpm @ 16"
			3B	0.00 lpm @ 16"	0.00 lpm @ 16"
			3C	0.00 lpm @ 16"	0.00 lpm @ 14"
			3D	0.00 lpm @ 13"	0.00 lpm @ 15"
			4A	0.00 lpm @ 12"	.00 lpm @ 11"
			4B	0.00 lpm @ 10"	0.00 lpm @ 13"
			4C	0.00 lpm @ 13"	0.00 lpm @ 12"
			4D	.00 lpm @ 12"	0.00 lpm @ 12"
			5A	0.00 lpm @ 13"	0.00 lpm @ 12"
			5B	0.00 lpm @ 12"	0.00 lpm @ 13"
			5C	0.00 lpm @ 13"	0.00 lpm @ 14"
			5D	0.00 lpm @ 14"	0.00 lpm @ 13"
		3/21/05	6A	0.00 lpm @	0.00 lpm @ 12"
			6B	0.00 lpm @ 12"	0.00 lpm @ 16"
			6C	0.00 lpm @ 16"	0.00 lpm @ 15"
			6D	0.00 lpm @ 15"	0.00 lpm @ 12"

Table 5-2. Sampling Summary - March 16-22, 2005 Mobilization (con'td)(Revised 10/01/05)

<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Leak Rate - Pre</i>	<i>Leak Rate - Post</i>
TCO	VOST	3/20/05	1A	0 lpm @ 14"	0 lpm @ 17"
			1B	0 lpm @ 17"	0.01 lpm @ 18"
			1C	0 lpm @ 18"	0 lpm @ 21"
			1D	0 lpm @ 21"	0 lpm @ 17"
			2A	0 lpm @ 17"	0 lpm @ 21"
			2B	0.005 lpm @ 18"	0 lpm @ 12"
			2C	0 lpm @ 18"	0.005 lpm @ 19"
			3A	0 lpm @ 19"	0 lpm @ 19"
			3B	0 lpm @ 20"	0.005 lpm @ 19"
			3C	0 lpm @ 20"	0 lpm @ 21"
			3D	0.005 lpm @ 21"	0.005 lpm @ 20"
			4A	0 lpm @ 21"	0 lpm @ 21"
			4B	0 lpm @ 21"	0 lpm @ 21"
			4C	0 lpm @ 21"	0 lpm @ 17"
			4D	0 lpm @ 17"	0 lpm @ 17"
			5A	0 lpm @ 17"	0 lpm @ 21"
			5B	0 lpm @ 21"	0 lpm @ 22"
			5C	0 lpm @ 23"	0 lpm @ 25"
		3/21/05	6A	0 lpm @ 25"	0 lpm @ 21"
			6B	0 lpm @ 21"	0 lpm @ 22"
			6C	0 lpm @ 23"	0 lpm @ 24"
			6D	0 lpm @ 23"	0 lpm @ 21"

The acceptable range for % isokinetic sampling is 90-110%.

Appendix A

Data Tables

Appendix A.1

VOST

V-1. Melter VOST Summary - Run 1

Test Date 3/20/05 (Test #2) 3/19 - 3/20/05

Compounds	Run 1 A				Run 1B				Run 1C				Run 1D				Condensate				Melter Run 1A - 1D				Avg of Tubes A-D				Emission Rate				Total Run 1			
	Conc.		Emission Rate		Conc.		Emission Rate		Conc.		Emission Rate		Conc.		Emission Rate		Conc.		Emission Rate		Conc.		Emission Rate		Conc.		Emission Rate		Conc.		Emission Rate					
	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min						
Acetone	< 379	< 64951	< 346	< 59329	< 332	< 56824	< 308	< 52765									18.6	3191					< 341	< 58467	< 360	< 61658										
Acetonitrile	< 4037	< 691413	< 3950	< 676553	< 3614	< 618980	< 3673	< 629127									355	60726					< 3819	< 654018	< 4173	< 714744										
Acrylonitrile	< 287	< 49237	< 273	< 46838	< 284	< 48707	< 302	< 51751									< 25.8	< 4426					< 287	< 49133	< 313	< 53559										
Benzene	< 15.7	< 2682	< 14.3	< 2456	< 17.5	< 3004	< 17.5	< 3004									< 1.02	< 175					< 16.3	< 2786	< 17.3	< 2961										
Bromodichloromethane	< 10.8	< 1844	< 10.7	< 1832	< 10.4	< 1786	< 10.4	< 1786									< 1.02	< 175					< 10.6	< 1812	< 11.6	< 1987										
Bromoform	< 15.9	< 2724	< 15.8	< 2706	< 15.4	< 2638	< 15.4	< 2638									< 1.38	< 237					< 15.6	< 2677	< 17.0	< 2913										
Bromomethane	< 20.2	< 3457	< 19.4	< 3331	< 19.0	< 3247	< 21.9	< 3754									3.85	659					< 20.1	< 3447	< 24.0	< 4106										
2-Butanone	< 78.3	< 13409	< 77.8	< 13323	< 75.8	< 12988	< 75.8	< 12988									< 7.81	< 1338					< 76.9	< 13177	< 84.8	< 14515										
Carbon disulfide	< 10.3	< 1760	< 10.2	< 1749	< 10.0	< 1705	< 10.0	< 1705									< 1.02	< 175					< 10.1	< 1730	< 11.1	< 1904										
Carbon tetrachloride	< 8.32	< 1425	< 8.27	< 1416	< 8.06	< 1380	< 8.06	< 1380									< 1.26	< 216					< 8.17	< 1400	< 9.44	< 1616										
Chlorobenzene	< 10.5	< 1802	< 10.5	< 1790	< 10.2	< 1745	< 10.2	< 1745									< 1.02	< 175					< 10.3	< 1771	< 11.4	< 1946										
Dibromochloromethane	< 9.30	< 1592	< 9.24	< 1582	< 9.01	< 1542	< 9.01	< 1542									< 1.98	< 340					< 9.14	< 1565	< 11.1	< 1904										
Chloroethane	< 9.54	< 1634	< 9.48	< 1624	< 9.24	< 1583	< 9.24	< 1583									< 2.40	< 412					< 9.38	< 1606	< 11.8	< 2018										
Chloroform	< 11.3	< 1928	< 11.2	< 1915	< 10.9	< 1867	< 10.9	< 1867									< 1.02	< 175					< 11.1	< 1894	< 12.1	< 2069										
Chloromethane	< 22.6	< 3876	< 15.2	< 2602	< 14.2	< 2435	< 29.0	< 4972									< 1.20	< 206					< 20.3	< 3471	< 21.5	< 3677										
1,1-Dichloroethane	< 8.32	< 1425	< 8.27	< 1416	< 8.06	< 1380	< 8.06	< 1380									< 1.02	< 175					< 8.17	< 1400	< 9.20	< 1575										
1,2-Dichloroethane	< 11.7	< 2011	< 11.7	< 1998	< 11.4	< 1948	< 11.4	< 1948									< 1.02	< 175					< 11.5	< 1977	< 12.6	< 2152										
1,1-Dichloroethene	< 13.5	< 2305	< 13.4	< 2290	< 13.0	< 2232	< 13.0	< 2232									< 1.02	< 175					< 13.2	< 2265	< 14.2	< 2440										
1,2-Dichloroethene (total)	< 20.8	< 3562	< 20.7	< 3539	< 20.1	< 3450	< 20.1	< 3450									< 1.98	< 340					< 20.4	< 3500	< 22.4	< 3840										
1,2-Dichloropropane	< 11.0	< 1886	< 10.9	< 1874	< 10.7	< 1826	< 10.7	< 1826									< 1.02	< 175					< 10.8	< 1853	< 11.8	< 2028										
cis-1,3-Dichloropropene	< 9.54	< 1634	< 9.48	< 1624	< 9.24	< 1583	< 9.24	< 1583									< 1.02	< 175					< 9.38	< 1606	< 10.4	< 1781										
trans-1,3-Dichloropropene	< 9.54	< 1634	< 9.48	< 1624	< 9.24	< 1583	< 9.24	< 1583									< 1.08	< 185					< 9.38	< 1606	< 10.5	< 1791										
Ethylbenzene	< 7.83	< 1341	< 7.78	< 1332	< 7.58	< 1299	< 7.58	< 1299									< 1.02	< 175					< 7.69	< 1318	< 8.72	< 1493										
2-Hexanone	< 44.0	< 7543	< 43.8	< 7494	< 42.7	< 7306	< 42.7	< 7306									< 7.81	< 1338					< 43.3	< 7412	< 51.1	< 8750										
Iodomethane	< 80.7	< 13828	< 80.8	< 13843	< 73.5	< 12583	< 105	< 17961									2.16	371					< 85.0	< 14554	< 87.1	< 14924										
Methylene chloride	< 29.4	< 5028	< 29.2	< 4996	< 28.4	< 4871	< 28.4	< 4871									721	123511					< 28.9	< 4941	< 750	< 128452										
4-Methyl-2-pentanone	< 71.0	< 12152	< 70.5	< 12074	< 68.7	< 11771	< 68.7	< 11771									< 4.03	< 690					< 69.7	< 11942	< 73.8	< 12631										
Styrene	< 12.0	< 2053	< 11.9	< 2040	< 11.6	< 1989	< 11.6	< 1989									< 1.02	< 175					< 11.8	< 2018	< 12.8	< 2193										
1,1,2,2-Tetrachloroethane	< 15.9	< 2724	< 15.8	< 2706	< 15.4	< 2638	< 15.4	< 2638									< 1.50	< 257					< 15.6	< 2677	< 17.1	< 2934										
Tetrachloroethene	< 10.8	< 1844	< 10.7	< 1832	< 10.4	< 1786	< 10.4	< 1786									< 1.02	< 175					< 10.6	< 1812	< 11.6	< 1987										
Toluene	< 6.61	< 1131	< 6.56	< 1124	< 6.69	< 1147	< 6.93	< 1187									< 1.02	< 175					< 6.70	< 1147	< 7.72	< 1322										
1,1,1-Trichloroethane	< 12.2	< 2095	< 12.2	< 2082	< 11.8	< 2029	< 11.8	< 2029									< 1.02	< 175					< 12.0	< 2059	< 13.0	< 2234										
1,1,2-Trichloroethane	< 13.5	< 2305	< 13.4	< 2290	< 13.0	< 2232	< 13.0	< 2232									< 2.40	< 412					< 13.2	< 2265	< 15.6	< 2677										
Trichloroethene	< 24.5	< 4190	< 24.3	< 4163	< 23.7	< 4059	< 23.7	< 4059									< 1.02	< 175					< 24.0	< 4118	< 25.1	< 4293										
Vinyl chloride	< 7.83	< 1341	< 7.78	< 1332	< 7.58	< 1299	< 7.58	< 1299									< 2.40	< 412					< 7.69	< 1318	< 10.1	< 1729										
Xylenes (total)	< 29.4	< 5028	< 29.2	< 4996	< 28.4	< 4871	< 28.4	< 4871									< 3.00	< 515					< 28.9	< 4941	< 31.9	< 5456										

V-2. Melter VOST Summary - Run 2

Test Date 3/20/05 (Test #2) - Corrected 10/01/05

Compounds	Run 2A			Run 2B			Run 2C			Run 2D			Melter Run 2A - 2D			Avg of Tubes A-D			Total Run 2		
	Conc.		Emission Rate ug/min	Conc.		Emission Rate ug/min	Conc.		Emission Rate ug/min	Conc.		Emission Rate ug/min	Conc.		Emission Rate ug/min	Conc.		Emission Rate ug/min	Conc.		Emission Rate ug/min
	ug/dscf	ug/dscf		ug/dscf	ug/dscf		ug/dscf	ug/dscf		ug/dscf	ug/dscf		ug/dscf	ug/dscf		ug/dscf	ug/dscf		ug/dscf	ug/dscf	
Acetone	< 338.92	< 58047	< 51684	< 302	< 51684	< 77522	< 453	< 77522	< 302	< 51790	< 61.0	10441	< 349	< 59761	< 410	< 70202					
Acetonitrile	< 3791.32	< 649339	< 596357	< 3482	< 596357	< 838076	< 4893	< 838076	< 3431	< 587621	< 387	66313	< 3899	< 667848	< 4287	< 734161					
Acrylonitrile	< 321.69	< 55095	< 46715	< 273	< 46715	< 59713	< 349	< 59713	< 262	< 44819	< 76.3	13062	< 301	< 51585	< 377	< 64647					
Benzene	< 21.02	< 3601	< 12.5	< 12.5	< 2147	< 2996	< 17.5	< 2996	< 13.7	< 2350	< 2.93	502	< 16.2	< 2774	< 19.1	< 3276					
Bromodichloromethane	< 10.11	< 1732	< 10.2	< 10.2	< 1749	< 1844	< 10.8	< 1844	< 10.2	< 1753	< 2.93	502	< 10.3	< 1769	< 13.3	< 2272					
Bromoform	< 14.94	< 2558	< 15.1	< 15.1	< 2584	< 2724	< 15.9	< 2724	< 15.1	< 2590	< 4.05	693	< 15.3	< 2614	< 19.3	< 3307					
Bromomethane	< 18.38	< 3148	< 18.6	< 18.6	< 3181	< 3352	< 19.6	< 3352	< 18.6	< 3187	11.7	2009	< 18.8	< 3217	< 30.5	< 5227					
2-Butanone	< 73.53	< 12593	< 74.3	< 74.3	< 12722	< 13409	< 78.3	< 13409	< 74.4	< 12748	< 22.3	3818	< 75.1	< 12868	< 97.4	< 16686					
Carbon disulfide	< 9.65	< 1653	< 9.7	< 9.7	< 1670	< 1760	< 10.3	< 1760	< 9.8	< 1673	< 2.99	512	< 9.86	< 1689	< 12.9	< 2201					
Carbon tetrachloride	< 7.81	< 1338	< 7.89	< 7.89	< 1352	< 1425	< 8.32	< 1425	< 7.91	< 1355	< 3.64	623	< 7.98	< 1367	< 11.6	< 1990					
Chlorobenzene	< 9.88	< 1692	< 10.0	< 10.0	< 1710	< 1802	< 10.5	< 1802	< 10.0	< 1713	< 2.93	502	< 10.1	< 1729	< 13.0	< 2232					
Dibromochloromethane	< 8.73	< 1495	< 8.82	< 8.82	< 1511	< 1592	< 9.30	< 1592	< 8.84	< 1514	< 5.75	985	< 8.92	< 1528	< 14.7	< 2513					
Chloroethane	< 8.96	< 1535	< 9.05	< 9.05	< 1551	< 1634	< 9.5	< 1634	< 9.07	< 1554	< 7.04	1206	< 9.16	< 1568	< 16.2	< 2774					
Chloroform	< 10.57	< 1810	< 10.7	< 10.7	< 1829	< 1833	< 11.3	< 1833	< 10.7	< 1833	< 2.93	502	< 10.8	< 1850	< 13.7	< 2352					
Chloromethane	< 13.79	< 2361	< 15.1	< 15.1	< 2584	< 2789	< 14.7	< 2789	< 16.3	< 2789	< 3.52	603	< 15.0	< 2562	< 18.5	< 3165					
1,1-Dichloroethane	< 7.81	< 1338	< 7.89	< 7.89	< 1352	< 1425	< 8.32	< 1425	< 7.91	< 1355	< 2.93	502	< 7.98	< 1367	< 10.9	< 1870					
1,2-Dichloroethane	< 11.03	< 1889	< 11.1	< 11.1	< 1908	< 2011	< 11.7	< 2011	< 11.2	< 1912	< 2.93	502	< 11.3	< 1930	< 14.2	< 2433					
1,1-Dichloroethene	< 12.64	< 2164	< 12.8	< 12.8	< 2187	< 2305	< 13.5	< 2305	< 12.8	< 2191	< 2.93	502	< 12.9	< 2212	< 15.8	< 2714					
1,2-Dichloroethene (total)	< 19.53	< 3345	< 19.7	< 19.7	< 3379	< 3562	< 20.8	< 3562	< 19.8	< 3386	< 5.87	1005	< 20.0	< 3418	< 25.8	< 4423					
1,2-Dichloropropane	< 10.34	< 1771	< 10.4	< 10.4	< 1789	< 1886	< 11.0	< 1886	< 10.5	< 1793	< 2.93	502	< 10.6	< 1810	< 13.5	< 2312					
cis-1,3-Dichloropropene	< 8.96	< 1535	< 9.05	< 9.05	< 1551	< 1634	< 9.54	< 1634	< 9.07	< 1554	< 2.93	502	< 9.16	< 1568	< 12.1	< 2071					
trans-1,3-Dichloropropene	< 8.96	< 1535	< 9.05	< 9.05	< 1551	< 1634	< 9.54	< 1634	< 9.07	< 1554	< 3.23	553	< 9.16	< 1568	< 12.4	< 2121					
Ethylbenzene	< 7.35	< 1259	< 7.43	< 7.43	< 1272	< 1341	< 7.83	< 1341	< 7.44	< 1275	< 2.99	512	< 7.51	< 1287	< 10.5	< 1799					
2-Hexanone	< 41.36	< 7084	< 41.8	< 41.8	< 7156	< 7543	< 44.0	< 7543	< 41.9	< 7171	< 22.3	3818	< 42.3	< 7238	< 64.6	< 11056					
Iodomethane	68.36	11708	67.3	67.3	11530	11628	67.9	11628	80.2	13744	6.45	1105	71.0	12153	77.4	13258					
Methylene chloride	< 94.21	< 16135	< 27.9	< 27.9	< 4771	< 5028	< 29.4	< 5028	< 27.9	< 4781	1056	180853	< 44.8	< 7679	< 1101	< 188531					
4-Methyl-2-pentanone	< 66.64	< 11413	< 67.3	< 67.3	< 11530	< 12152	< 71.0	< 12152	< 67.5	< 11553	< 11.7	2009	< 68.1	< 11662	< 79.8	< 13671					
Styrene	< 11.26	< 1928	< 11.4	< 11.4	< 1948	< 2053	< 12.0	< 2053	< 11.4	< 1952	< 2.93	502	< 11.5	< 1970	< 14.4	< 2473					
1,1,2,2-Tetrachloroethane	< 14.94	< 2558	< 15.1	< 15.1	< 2584	< 2724	< 15.9	< 2724	< 15.1	< 2590	< 4.46	764	< 15.3	< 2614	< 19.7	< 3377					
Tetrachloroethene	< 10.11	< 1732	< 10.2	< 10.2	< 1749	< 1844	< 10.8	< 1844	< 10.2	< 1753	< 3.05	522	< 10.3	< 1769	< 13.4	< 2292					
Toluene	< 6.89	< 1181	< 6.27	< 6.27	< 1073	< 1131	< 6.61	< 1131	< 6.28	< 1076	< 2.93	502	< 6.51	< 1115	< 9.45	< 1618					
1,1,1-Trichloroethane	< 11.49	< 1968	< 11.6	< 11.6	< 1988	< 2095	< 12.2	< 2095	< 11.6	< 1992	< 2.93	502	< 11.7	< 2011	< 14.7	< 2513					
1,1,2-Trichloroethane	< 12.64	< 2164	< 12.8	< 12.8	< 2187	< 2305	< 13.5	< 2305	< 12.8	< 2191	< 7.04	1206	< 12.9	< 2212	< 20.0	< 3417					
Trichloroethene	< 22.98	< 3935	< 23.2	< 23.2	< 3976	< 4190	< 24.5	< 4190	< 23.3	< 3984	< 2.93	502	< 23.5	< 4021	< 26.4	< 4524					
Vinyl chloride	< 7.35	< 1259	< 7.43	< 7.43	< 1272	< 1341	< 7.83	< 1341	< 7.44	< 1275	< 7.04	1206	< 7.51	< 1287	< 14.6	< 2493					
Xylenes (total)	< 27.57	< 4722	< 27.9	< 27.9	< 4771	< 5028	< 29.4	< 5028	< 27.9	< 4781	< 8.80	1507	< 28.2	< 4826	< 37.0	< 6333					

V-3. Melter VOST Summary - Run 3

Test Date 3/20/05 (Test #2)

Compounds	Run 3A			Run 3B			Run 3C			Run 3D			Melter Run 3A - 3D			Avg of Tubes A-D			Total Run 3		
	Conc.		Emission Rate ug/min	Conc.		Emission Rate ug/min	Conc.		Emission Rate ug/min	Conc.		Emission Rate ug/min	Conc.		Emission Rate ug/min	Conc.		Emission Rate ug/min	Conc.		Emission Rate ug/min
	ug/dscf			ug/dscf			ug/dscf			ug/dscf			ug/dscf			ug/dscf			ug/dscf		
Acetone	< 331	< 56718	< 77534	< 453	< 77534	< 66373	< 388	< 66373	< 291	< 49826	< 105	< 17976	< 366	< 62613	< 471	< 80589					
Acetonitrile	< 3597	< 616075	< 838446	< 4895	< 838446	< 806693	< 4710	< 806693	< 3325	< 569435	< 742	< 128489	< 4132	< 707662	< 4873	< 836151					
Acrylonitrile	< 291	< 49873	< 61306	< 358	< 61306	< 56162	< 328	< 56162	< 261	< 44741	< 148	< 25698	< 310	< 53020	< 458	< 78718					
Benzene	< 16.3	< 2797	< 3210	< 18.7	< 3210	< 2818	< 16.5	< 2818	< 17.0	< 2908	< 5.70	< 988	< 17.1	< 2933	< 22.8	< 3922					
Bromodichloromethane	< 10.0	< 1721	< 1587	< 9.26	< 1587	< 1797	< 10.5	< 1797	< 10.4	< 1790	< 5.70	< 988	< 10.1	< 1724	< 15.8	< 2712					
Bromoform	< 14.8	< 2543	< 2344	< 13.7	< 2344	< 2655	< 15.5	< 2655	< 15.4	< 2644	< 7.99	< 1384	< 14.9	< 2546	< 22.9	< 3930					
Bromomethane	< 18.3	< 3129	< 2885	< 16.8	< 2885	< 3268	< 19.1	< 3268	< 19.0	< 3254	< 21.7	< 3756	< 18.3	< 3134	< 40.0	< 6890					
2-Butanone	< 73.1	< 12517	< 11540	< 67.4	< 11540	< 13070	< 76.3	< 13070	< 76.0	< 13016	< 43.3	< 7512	< 73.2	< 12536	< 117	< 20047					
Carbon disulfide	< 9.6	< 1643	< 1515	< 8.84	< 1515	< 1715	< 10.0	< 1715	< 10.0	< 1708	< 5.70	< 988	< 9.61	< 1645	< 15.3	< 2634					
Carbon tetrachloride	< 7.77	< 1330	< 1226	< 7.16	< 1226	< 1389	< 8.11	< 1389	< 8.07	< 1383	< 6.84	< 1186	< 7.78	< 1332	< 14.6	< 2518					
Chlorobenzene	< 9.82	< 1682	< 1551	< 9.05	< 1551	< 1756	< 10.3	< 1756	< 10.2	< 1749	< 5.70	< 988	< 9.84	< 1684	< 15.5	< 2673					
Dibromochloromethane	< 8.68	< 1486	< 1370	< 8.00	< 1370	< 1552	< 9.06	< 1552	< 9.02	< 1546	< 11.4	< 1977	< 8.89	< 1489	< 20.1	< 3465					
Chloroethane	< 8.91	< 1526	< 1406	< 8.21	< 1406	< 1593	< 9.30	< 1593	< 9.26	< 1586	< 13.7	< 2372	< 8.92	< 1528	< 22.6	< 3900					
Chloroform	< 10.5	< 1799	< 1659	< 9.7	< 1659	< 1879	< 11.0	< 1879	< 10.9	< 1871	< 5.70	< 988	< 10.5	< 1802	< 16.2	< 2790					
Chloromethane	< 14.8	< 2543	< 2795	< 16.3	< 2795	< 2451	< 14.3	< 2451	< 14.2	< 2440	< 6.84	< 1186	< 14.9	< 2557	< 21.8	< 3743					
1,1-Dichloroethane	< 7.77	< 1330	< 1226	< 7.16	< 1226	< 1389	< 8.11	< 1389	< 8.07	< 1383	< 5.70	< 988	< 7.78	< 1332	< 13.5	< 2320					
1,2-Dichloroethane	< 11.0	< 1878	< 1731	< 10.1	< 1731	< 1961	< 11.4	< 1961	< 11.4	< 1952	< 5.70	< 988	< 11.0	< 1880	< 16.7	< 2869					
1,1,1-Trichloroethane	< 12.6	< 2151	< 1983	< 11.6	< 1983	< 2246	< 13.1	< 2246	< 13.1	< 2237	< 5.70	< 988	< 12.6	< 2155	< 18.3	< 3143					
1,2-Dichloroethene (total)	< 19.4	< 3325	< 3065	< 17.9	< 3065	< 3472	< 20.3	< 3472	< 20.2	< 3457	< 11.4	< 1977	< 19.4	< 3330	< 30.8	< 5307					
1,2-Dichloropropane	< 10.3	< 1760	< 1623	< 9.48	< 1623	< 1838	< 10.7	< 1838	< 10.7	< 1830	< 5.70	< 988	< 10.3	< 1763	< 16.0	< 2751					
cis-1,3-Dichloropropene	< 8.91	< 1526	< 1406	< 8.21	< 1406	< 1593	< 9.30	< 1593	< 9.26	< 1586	< 5.70	< 988	< 8.92	< 1528	< 14.6	< 2516					
trans-1,3-Dichloropropene	< 8.91	< 1526	< 1406	< 8.21	< 1406	< 1593	< 9.30	< 1593	< 9.26	< 1586	< 6.27	< 1087	< 8.92	< 1528	< 15.2	< 2615					
Ethylbenzene	< 7.31	< 1252	< 1154	< 6.74	< 1154	< 1307	< 7.63	< 1307	< 7.60	< 1302	< 5.70	< 988	< 7.32	< 1254	< 13.0	< 2242					
2-Hexanone	< 41.1	< 7041	< 6491	< 37.9	< 6491	< 7352	< 42.9	< 7352	< 42.7	< 7321	< 43.3	< 7512	< 41.2	< 7051	< 84.5	< 14563					
Iodomethane	64.5	11050	10278	60.0	10278	11641	68.0	11641	76.6	13117	15.4	2669	67.3	11522	82.7	14190					
Methylene chloride	144	24643	4327	25.3	4327	4901	28.6	4901	28.5	4881	2567	444769	56.6	9688	2623	454458					
4-Methyl-2-pentanone	< 66.2	< 11344	< 10458	< 61.1	< 10458	< 11845	< 69.2	< 11845	< 68.9	< 11795	< 22.8	< 3954	< 66.3	< 11361	< 89.1	< 15314					
Styrene	< 11.2	< 1917	< 1767	< 10.3	< 1767	< 2001	< 11.7	< 2001	< 11.6	< 1993	< 5.70	< 988	< 11.2	< 1920	< 16.9	< 2908					
1,1,2,2-Tetrachloroethane	< 14.8	< 2543	< 2344	< 13.7	< 2344	< 2655	< 15.5	< 2655	< 15.4	< 2644	< 8.56	< 1483	< 14.9	< 2546	< 23.4	< 4029					
Tetrachloroethene	< 10.0	< 1721	< 1587	< 9.26	< 1587	< 1797	< 10.5	< 1797	< 10.4	< 1790	< 5.70	< 988	< 10.1	< 1724	< 15.8	< 2712					
Toluene	< 6.17	< 1056	< 1064	< 6.21	< 1064	< 1103	< 6.44	< 1103	< 6.41	< 1098	< 5.70	< 988	< 6.31	< 1080	< 12.0	< 2069					
1,1,1-Trichloroethane	< 11.4	< 1956	< 1803	< 10.5	< 1803	< 2042	< 11.9	< 2042	< 11.9	< 2034	< 5.70	< 988	< 11.4	< 1959	< 17.1	< 2947					
1,1,2-Trichloroethane	< 12.6	< 2151	< 1983	< 11.6	< 1983	< 2246	< 13.1	< 2246	< 13.1	< 2237	< 13.7	< 2372	< 12.6	< 2155	< 26.3	< 4527					
Trichloroethene	< 22.8	< 3912	< 3606	< 21.1	< 3606	< 4085	< 23.8	< 4085	< 23.7	< 4067	< 5.70	< 988	< 22.9	< 3917	< 28.6	< 4906					
Vinyl chloride	< 7.31	< 1252	< 1154	< 6.74	< 1154	< 1307	< 7.63	< 1307	< 7.60	< 1302	< 13.7	< 2372	< 7.32	< 1254	< 21.0	< 3626					
Xylenes (total)	< 27.4	< 4694	< 4327	< 25.3	< 4327	< 4901	< 28.6	< 4901	< 28.5	< 4881	< 17.1	< 2965	< 27.4	< 4701	< 44.6	< 7666					

V-4. Melter VOST Summary - Run 4

Test Date 3/20/05 (Test #2)

Compounds	Run 4A			Run 4B			Run 4C			Run 4D			Melter Run 4A - 4D Condensate			Avg of Tubes A-D			Total Run 4		
	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate
	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min
Acetone	< 272	< 56720	< 65783	< 316	< 65783	< 80293	< 386	< 80293	< 59944	< 288	< 59944	< 22402	< 108	< 22402	< 65685	< 315	< 65685	< 423	< 88087	< 423	< 88087
Acetonitrile	< 2781	< 579016	< 717628	< 3447	< 717628	< 966024	< 4640	< 966024	< 611671	< 2938	< 611671	< 157726	< 758	< 157726	< 718584	< 3451	< 718584	< 4209	< 876310	< 4209	< 876310
Acrylonitrile	< 267	< 55538	< 57410	< 276	< 57410	< 75275	< 362	< 75275	< 48934	< 235	< 48934	< 31545	< 152	< 31545	< 59289	< 285	< 59289	< 436	< 90834	< 436	< 90834
Benzene	< 9.8	< 2032	< 2093	< 10.1	< 2093	< 3086	< 14.8	< 3086	< 2104	< 10.3	< 2104	< 1213	< 5.83	< 1213	< 2329	< 11.2	< 2329	< 17.0	< 3542	< 17.0	< 3542
Bromodichloromethane	< 10.0	< 2080	< 2105	< 10.1	< 2105	< 2208	< 10.6	< 2208	< 2153	< 10.3	< 2153	< 1213	< 5.83	< 1213	< 2136	< 10.3	< 2136	< 16.1	< 3350	< 16.1	< 3350
Bromoform	< 14.8	< 3072	< 3110	< 14.9	< 3110	< 3262	< 15.7	< 3262	< 3181	< 15.3	< 3181	< 1699	< 8.16	< 1699	< 3156	< 15.2	< 3156	< 23.3	< 4855	< 23.3	< 4855
Bromomethane	< 18.2	< 3781	< 3827	< 18.4	< 3827	< 4015	< 19.3	< 4015	< 3915	< 18.8	< 3915	< 7158	< 34.4	< 7158	< 3885	< 18.7	< 3885	< 53.0	< 11043	< 53.0	< 11043
2-Butanone	< 72.6	< 15125	< 15309	< 73.5	< 15309	< 16059	< 77.1	< 16059	< 15659	< 75.2	< 15659	< 9221	< 44.3	< 9221	< 15538	< 74.6	< 15538	< 119	< 24759	< 119	< 24759
Carbon disulfide	< 9.53	< 1985	< 2009	< 9.7	< 2009	< 2108	< 10.1	< 2108	< 2055	< 9.87	< 2055	< 1213	< 5.83	< 1213	< 2039	< 9.79	< 2039	< 15.6	< 3253	< 15.6	< 3253
Carbon tetrachloride	< 7.72	< 1607	< 1627	< 7.81	< 1627	< 1706	< 8.19	< 1706	< 1664	< 7.99	< 1664	< 1456	< 6.99	< 1456	< 1651	< 7.93	< 1651	< 14.9	< 3107	< 14.9	< 3107
Chlorobenzene	< 9.76	< 2032	< 2057	< 9.88	< 2057	< 2158	< 10.4	< 2158	< 2104	< 10.1	< 2104	< 1213	< 5.83	< 1213	< 2088	< 10.0	< 2088	< 15.9	< 3301	< 15.9	< 3301
Dibromochloromethane	< 8.63	< 1796	< 1818	< 8.73	< 1818	< 1907	< 9.16	< 1907	< 1859	< 8.93	< 1859	< 2427	< 11.7	< 2427	< 1845	< 8.86	< 1845	< 20.5	< 4272	< 20.5	< 4272
Chloroethane	< 8.85	< 1843	< 1866	< 8.96	< 1866	< 1957	< 9.40	< 1957	< 1908	< 9.17	< 1908	< 2912	< 14.0	< 2912	< 1894	< 9.10	< 1894	< 23.1	< 4806	< 23.1	< 4806
Chloroform	< 10.4	< 2174	< 2201	< 10.6	< 2201	< 2308	< 11.1	< 2308	< 2251	< 10.8	< 2251	< 1213	< 5.83	< 1213	< 2234	< 10.7	< 2234	< 16.6	< 3447	< 16.6	< 3447
Chloromethane	< 13.6	< 2836	< 2871	< 13.8	< 2871	< 3262	< 15.7	< 3262	< 4404	< 12.2	< 4404	< 1456	< 6.99	< 1456	< 3343	< 16.1	< 3343	< 23.0	< 4799	< 23.0	< 4799
1,1-Dichloroethane	< 7.72	< 1607	< 1627	< 7.81	< 1627	< 1706	< 8.2	< 1706	< 1664	< 7.99	< 1664	< 1213	< 5.83	< 1213	< 1651	< 7.93	< 1651	< 13.8	< 2864	< 13.8	< 2864
1,2-Dichloroethane	< 10.9	< 2269	< 2296	< 11.0	< 2296	< 2409	< 11.6	< 2409	< 2349	< 11.3	< 2349	< 1213	< 5.83	< 1213	< 2331	< 11.2	< 2331	< 17.0	< 3544	< 17.0	< 3544
1,1-Dichloroethene (total)	< 12.5	< 2600	< 2631	< 12.6	< 2631	< 2760	< 13.3	< 2760	< 2891	< 12.9	< 2891	< 1213	< 5.83	< 1213	< 2671	< 12.8	< 2671	< 18.7	< 3884	< 18.7	< 3884
1,2-Dichloroethene	< 19.3	< 4018	< 4067	< 19.5	< 4067	< 4266	< 20.5	< 4266	< 4159	< 20.0	< 4159	< 2427	< 11.7	< 2427	< 4127	< 19.8	< 4127	< 31.5	< 6554	< 31.5	< 6554
cis-1,3-Dichloropropene	< 10.2	< 2127	< 2153	< 10.3	< 2153	< 2258	< 10.8	< 2258	< 2202	< 10.6	< 2202	< 1213	< 5.83	< 1213	< 2185	< 10.5	< 2185	< 16.3	< 3398	< 16.3	< 3398
trans-1,3-Dichloropropene	< 8.85	< 1843	< 1866	< 8.96	< 1866	< 1957	< 9.40	< 1957	< 1908	< 9.17	< 1908	< 1213	< 5.83	< 1213	< 1894	< 9.10	< 1894	< 14.9	< 3107	< 14.9	< 3107
Ethylbenzene	< 7.26	< 1513	< 1531	< 7.35	< 1531	< 1606	< 7.71	< 1606	< 1566	< 7.52	< 1566	< 1213	< 5.83	< 1213	< 1554	< 7.46	< 1554	< 13.3	< 2767	< 13.3	< 2767
2-Hexanone	< 40.9	< 8508	< 8612	< 41.4	< 8612	< 9033	< 43.4	< 9033	< 8808	< 42.3	< 8808	< 9221	< 44.3	< 9221	< 8740	< 42.0	< 8740	< 86.3	< 17961	< 86.3	< 17961
Iodomethane	64.7	13471	12917	62.0	12917	13299	63.9	13299	15169	72.9	15169	4489	21.6	4489	13714	65.9	13714	87.4	18203	87.4	18203
Methylene chloride	776	161652	5741	27.6	5741	6022	28.9	6022	5872	28.2	5872	885689	4254	885689	44822	215	44822	4469	930511	4469	930511
4-Methyl-2-pentanone	< 65.8	< 13707	< 13874	< 66.6	< 13874	< 14553	< 69.9	< 14553	< 14191	< 68.2	< 14191	< 4853	< 23.3	< 4853	< 14081	< 67.6	< 14081	< 90.9	< 18934	< 90.9	< 18934
Styrene	< 11.1	< 2316	< 2344	< 11.3	< 2344	< 2459	< 11.8	< 2459	< 2398	< 11.5	< 2398	< 1213	< 5.83	< 1213	< 2379	< 11.4	< 2379	< 17.3	< 3593	< 17.3	< 3593
1,1,2,2-Tetrachloroethane	< 14.8	< 3072	< 3110	< 14.9	< 3110	< 3262	< 15.7	< 3262	< 3181	< 15.3	< 3181	< 1820	< 8.74	< 1820	< 3156	< 15.2	< 3156	< 23.9	< 4976	< 23.9	< 4976
Tetrachloroethene	< 10.0	< 2080	< 2105	< 10.1	< 2105	< 2208	< 10.6	< 2208	< 2153	< 10.3	< 2153	< 1213	< 5.83	< 1213	< 2136	< 10.3	< 2136	< 16.1	< 3350	< 16.1	< 3350
Toluene	< 6.13	< 1276	< 1292	< 6.20	< 1292	< 1355	< 6.51	< 1355	< 1321	< 6.35	< 1321	< 1213	< 5.83	< 1213	< 1311	< 6.30	< 1311	< 12.1	< 2524	< 12.1	< 2524
1,1,1-Trichloroethane	< 11.4	< 2363	< 2392	< 11.5	< 2392	< 2509	< 12.1	< 2509	< 2447	< 11.8	< 2447	< 1213	< 5.83	< 1213	< 2428	< 11.7	< 2428	< 17.5	< 3641	< 17.5	< 3641
1,1,2-Trichloroethane	< 12.5	< 2600	< 2631	< 12.6	< 2631	< 2760	< 13.3	< 2760	< 2691	< 12.9	< 2691	< 2912	< 14.0	< 2912	< 2671	< 12.8	< 2671	< 26.8	< 5582	< 26.8	< 5582
Trichloroethene	< 22.7	< 4727	< 4784	< 23.0	< 4784	< 5018	< 24.1	< 5018	< 4893	< 23.5	< 4893	< 1213	< 5.83	< 1213	< 4856	< 23.3	< 4856	< 29.1	< 6069	< 29.1	< 6069
Vinyl chloride	< 7.26	< 1513	< 1531	< 7.35	< 1531	< 1606	< 7.71	< 1606	< 1566	< 7.52	< 1566	< 2912	< 14.0	< 2912	< 1554	< 7.46	< 1554	< 21.4	< 4466	< 21.4	< 4466
Xylenes (total)	< 27.2	< 5672	< 5741	< 27.6	< 5741	< 6022	< 28.9	< 6022	< 5872	< 28.2	< 5872	< 3640	< 17.5	< 3640	< 5827	< 28.0	< 5827	< 45.5	< 9467	< 45.5	< 9467

V-5. Melter VOST Summary - Run 5

Test Date 3/20/05 (Test #2)

Compounds	Run 5A			Run 5B			Run 5C			Run 5D			Melter Run 5A - 5D Condensate			Avg of Tubes A-D			Total Run 5		
	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate
	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min
Acetone	< 138	< 28705	< 39937	< 192	< 39937	< 85614	< 411	< 85614	< 291	< 60629	< 129	< 26892	< 258	< 53721	< 387	< 80613					
Acetonitrile	< 2068	< 430577	< 446349	< 2144	< 446349	< 4228	< 4228	< 880256	< 3312	< 689511	< 915	< 190594	< 2938	< 611673	< 3853	< 802267					
Acrylonitrile	< 230	< 47842	< 226	< 226	< 46984	< 336	< 336	< 69938	< 246	< 51119	< 183	< 38119	< 259	< 53971	< 442	< 92090					
Benzene	< 9.88	< 2057	< 9.70	< 9.70	< 2020	< 10.4	< 10.4	< 2158	< 9.82	< 2045	< 6.87	< 1429	< 9.94	< 2070	< 16.8	< 3500					
Bromodichloromethane	< 10.1	< 2105	< 9.93	< 9.93	< 2067	< 10.2	< 10.2	< 2122	< 10.0	< 2092	< 6.87	< 1429	< 10.1	< 2097	< 16.9	< 3526					
Bromoform	< 14.9	< 3110	< 14.7	< 14.7	< 3054	< 15.1	< 15.1	< 3135	< 14.8	< 3091	< 9.73	< 2025	< 14.9	< 3097	< 24.6	< 5123					
Bromomethane	< 18.4	< 3827	< 18.1	< 18.1	< 3759	< 20.8	< 20.8	< 4341	< 18.3	< 3804	< 29.2	< 6075	< 18.9	< 3933	< 48.1	< 10008					
2-Butanone	< 73.5	< 15309	< 72.2	< 72.2	< 15035	< 74.1	< 74.1	< 15435	< 73.1	< 15217	< 54.4	< 11317	< 73.2	< 15249	< 128	< 26565					
Carbon disulfide	< 9.65	< 2009	< 9.48	< 9.48	< 1973	< 7.73	< 7.73	< 2026	< 9.59	< 1997	< 7.44	< 1549	< 9.61	< 2001	< 17.1	< 3550					
Carbon tetrachloride	< 7.81	< 1627	< 7.67	< 7.67	< 1597	< 7.88	< 7.88	< 1640	< 7.77	< 1617	< 9.15	< 1906	< 7.78	< 1620	< 16.9	< 3526					
Chlorobenzene	< 9.88	< 2057	< 9.70	< 9.70	< 2020	< 9.96	< 9.96	< 2074	< 9.82	< 2045	< 6.87	< 1429	< 9.84	< 2049	< 16.7	< 3479					
Dibromochloromethane	< 8.73	< 1818	< 8.57	< 8.57	< 1785	< 8.80	< 8.80	< 1833	< 8.68	< 1807	< 13.7	< 2859	< 8.70	< 1811	< 22.4	< 4670					
Chloroethane	< 8.96	< 1866	< 8.80	< 8.80	< 1832	< 9.03	< 9.03	< 1881	< 8.91	< 1855	< 17.2	< 3574	< 8.93	< 1858	< 26.1	< 5432					
Chloroform	< 10.6	< 2201	< 10.4	< 10.4	< 2161	< 10.7	< 10.7	< 2219	< 10.5	< 2187	< 6.87	< 1429	< 10.5	< 2192	< 17.4	< 3621					
Chloromethane	< 13.8	< 2871	< 13.5	< 13.5	< 2819	< 17.4	< 17.4	< 3617	< 13.7	< 2853	< 8.58	< 1787	< 14.6	< 3040	< 23.2	< 4827					
1,1-Dichloroethane	< 7.81	< 1627	< 7.67	< 7.67	< 1597	< 7.88	< 7.88	< 1640	< 7.77	< 1617	< 6.87	< 1429	< 7.78	< 1620	< 14.6	< 3050					
1,2-Dichloroethane	< 11.0	< 2296	< 10.8	< 10.8	< 2255	< 11.1	< 11.1	< 2315	< 11.0	< 2283	< 6.87	< 1429	< 6.87	< 1429	< 17.9	< 3717					
1,1-Dichloroethene	< 12.6	< 2631	< 12.4	< 12.4	< 2584	< 12.7	< 12.7	< 2653	< 12.6	< 2615	< 6.87	< 1429	< 6.87	< 1429	< 19.5	< 4050					
1,2-Dichloroethene (total)	< 19.5	< 4067	< 19.2	< 19.2	< 3994	< 19.7	< 19.7	< 4100	< 19.4	< 4042	< 14.3	< 2978	< 19.5	< 4050	< 33.8	< 7029					
1,2-Dichloropropane	< 10.3	< 2153	< 10.2	< 10.2	< 2114	< 10.4	< 10.4	< 2170	< 10.3	< 2140	< 6.87	< 1429	< 6.87	< 1429	< 17.2	< 3574					
cis-1,3-Dichloropropene	< 8.96	< 1866	< 8.80	< 8.80	< 1832	< 9.03	< 9.03	< 1881	< 8.91	< 1855	< 6.87	< 1429	< 6.87	< 1429	< 15.8	< 3288					
trans-1,3-Dichloropropene	< 8.96	< 1866	< 8.80	< 8.80	< 1832	< 9.03	< 9.03	< 1881	< 8.91	< 1855	< 8.01	< 1668	< 8.93	< 1858	< 16.9	< 3526					
Ethylbenzene	< 7.35	< 1531	< 7.22	< 7.22	< 1503	< 7.41	< 7.41	< 1543	< 7.31	< 1522	< 7.44	< 1549	< 7.32	< 1525	< 14.8	< 3073					
2-Hexanone	< 41.4	< 8612	< 40.6	< 40.6	< 8457	< 41.7	< 41.7	< 8682	< 41.1	< 8559	< 54.4	< 11317	< 41.2	< 8578	< 95.5	< 19894					
Iodomethane	< 61.5	< 12798	< 59.8	< 59.8	< 12451	< 77.0	< 77.0	< 16038	< 64.5	< 13434	< 25.7	< 5360	< 65.7	< 13680	< 91.4	< 19040					
Methylene chloride	< 442	< 92096	< 36.7	< 36.7	< 7635	< 27.8	< 27.8	< 5788	< 27.4	< 5706	< 4062	< 845762	< 134	< 27806	< 4196	< 873568					
4-Methyl-2-pentanone	< 66.6	< 13874	< 65.4	< 65.4	< 13625	< 67.2	< 67.2	< 13988	< 66.2	< 13790	< 28.6	< 5956	< 66.4	< 13819	< 95.0	< 19775					
Styrene	< 11.3	< 2344	< 11.1	< 11.1	< 2302	< 11.4	< 11.4	< 2363	< 11.2	< 2330	< 6.87	< 1429	< 11.2	< 2335	< 18.1	< 3764					
1,1,2,2-Tetrachloroethane	< 14.9	< 3110	< 14.7	< 14.7	< 3054	< 15.1	< 15.1	< 3135	< 14.8	< 3091	< 10.9	< 2263	< 14.9	< 3097	< 25.7	< 5361					
Tetrachloroethene	< 10.1	< 2105	< 9.93	< 9.93	< 2067	< 10.2	< 10.2	< 2122	< 10.0	< 2092	< 7.44	< 1549	< 10.1	< 2097	< 17.5	< 3645					
Toluene	< 6.20	< 1292	< 6.09	< 6.09	< 1269	< 6.25	< 6.25	< 1302	< 6.17	< 1284	< 6.87	< 1429	< 6.87	< 1429	< 13.0	< 2716					
1,1,1-Trichloroethane	< 11.5	< 2392	< 11.3	< 11.3	< 2349	< 11.6	< 11.6	< 2412	< 11.4	< 2378	< 6.87	< 1429	< 11.4	< 2383	< 18.3	< 3812					
1,1,2-Trichloroethane	< 12.6	< 2631	< 12.4	< 12.4	< 2584	< 12.7	< 12.7	< 2653	< 12.6	< 2615	< 17.2	< 3574	< 12.6	< 2621	< 29.8	< 6195					
Trichloroethene	< 23.0	< 4784	< 22.6	< 22.6	< 4698	< 23.2	< 23.2	< 4823	< 22.8	< 4755	< 6.87	< 1429	< 22.9	< 4765	< 29.8	< 6195					
Vinyl chloride	< 7.35	< 1531	< 7.22	< 7.22	< 1503	< 7.41	< 7.41	< 1543	< 7.31	< 1522	< 7.44	< 1549	< 7.32	< 1525	< 24.5	< 5099					
Xylenes (total)	< 27.6	< 5741	< 27.1	< 27.1	< 5638	< 27.8	< 27.8	< 5788	< 27.4	< 5706	< 21.7	< 4527	< 27.5	< 5718	< 49.2	< 10245					

V-6. Melter VOST Summary - Run 6

Test Date 3/20/05 (Test #2)

Compounds	Run 6A			Run 6B			Run 6C			Run 6D			Melter Run 6A - 6D			Avg of Tubes A-D			Total Run 6		
	Conc.		Emission	Conc.		Emission	Conc.		Emission	Conc.		Emission	Conc.		Emission	Conc.		Emission	Conc.		Emission
	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min
Acetone	< 277	< 57644	< 353	< 73558	< 284	< 54967	< 291	< 60507	< 130	< 27001	< 296	< 61869	< 426	< 88670							
Acetonitrile	< 3057	< 636487	< 3818	< 794901	< 3240	< 674600	< 3134	< 652531	< 926	< 192834	< 3312	< 689630	< 4238	< 882464							
Acrylonitrile	< 254	< 52840	< 274	< 56948	< 252	< 52469	< 251	< 52202	< 185	< 38567	< 258	< 53615	< 443	< 92182							
Benzene	< 11.3	< 2354	< 11.2	< 2325	< 10.7	< 2236	< 11.2	< 2325	< 6.95	< 1446	< 11.1	< 2310	< 18.0	< 3756							
Bromodichloromethane	< 10.2	< 2114	< 10.0	< 2088	< 10.6	< 2199	< 10.0	< 2088	< 6.95	< 1446	< 10.2	< 2122	< 17.1	< 3568							
Bromoform	< 15.0	< 3122	< 14.8	< 3085	< 15.6	< 3248	< 14.8	< 3085	< 9.84	< 2049	< 15.1	< 3135	< 24.9	< 5184							
Bromomethane	< 18.5	< 3843	< 18.2	< 3797	< 19.2	< 3998	< 18.2	< 3797	< 37.6	< 7834	< 18.5	< 3858	< 56.2	< 11892							
2-Butanone	< 73.8	< 15372	< 72.9	< 15186	< 76.8	< 15991	< 72.9	< 15186	< 55.0	< 11450	< 74.1	< 15434	< 129	< 26883							
Carbon disulfide	< 9.69	< 2018	< 9.57	< 1993	< 10.1	< 2099	< 9.57	< 1993	< 7.52	< 1567	< 9.73	< 2026	< 17.3	< 3592							
Carbon tetrachloride	< 7.84	< 1633	< 7.75	< 1614	< 8.16	< 1699	< 7.75	< 1614	< 9.26	< 1928	< 7.88	< 1640	< 17.1	< 3568							
Chlorobenzene	< 9.92	< 2066	< 9.80	< 2041	< 10.3	< 2149	< 9.80	< 2041	< 6.95	< 1446	< 10.0	< 2074	< 16.9	< 3520							
Dibromochloromethane	< 8.77	< 1825	< 8.66	< 1803	< 9.12	< 1899	< 8.66	< 1803	< 13.9	< 2893	< 8.80	< 1833	< 22.7	< 4725							
Chloroethane	< 9.00	< 1873	< 8.89	< 1851	< 9.36	< 1949	< 8.89	< 1851	< 17.4	< 3616	< 9.03	< 1881	< 26.4	< 5497							
Chloroform	< 10.6	< 2210	< 10.5	< 2183	< 11.0	< 2299	< 10.5	< 2183	< 6.95	< 1446	< 10.7	< 2219	< 17.6	< 3665							
Chloromethane	< 15.0	< 3122	< 13.7	< 2847	< 16.2	< 3373	< 13.7	< 2847	< 8.68	< 1808	< 14.6	< 3048	< 23.3	< 4855							
1,1-Dichloroethane	< 7.84	< 1633	< 7.75	< 1614	< 8.16	< 1699	< 7.75	< 1614	< 6.95	< 1446	< 7.88	< 1640	< 14.8	< 3086							
1,2-Dichloroethane	< 11.1	< 2306	< 10.9	< 2278	< 11.5	< 2399	< 10.9	< 2278	< 6.95	< 1446	< 11.1	< 2315	< 18.1	< 3761							
1,1,1-Trichloroethane	< 12.7	< 2642	< 12.5	< 2610	< 13.2	< 2748	< 12.5	< 2610	< 6.95	< 1446	< 12.7	< 2653	< 19.7	< 4099							
1,2-Dichloroethene (total)	< 19.6	< 4083	< 19.4	< 4034	< 20.4	< 4247	< 19.4	< 4034	< 14.5	< 3013	< 19.7	< 4100	< 34.2	< 7113							
1,2-Dichloropropane	< 10.4	< 2162	< 10.3	< 2136	< 10.8	< 2249	< 10.3	< 2136	< 6.95	< 1446	< 10.4	< 2170	< 17.4	< 3617							
cis-1,3-Dichloropropene	< 9.0	< 1873	< 8.89	< 1851	< 9.36	< 1949	< 8.89	< 1851	< 6.95	< 1446	< 9.03	< 1881	< 16.0	< 3327							
trans-1,3-Dichloropropene	< 9.0	< 1873	< 8.89	< 1851	< 9.36	< 1949	< 8.89	< 1851	< 8.10	< 1687	< 9.03	< 1881	< 17.1	< 3568							
Ethylbenzene	< 7.4	< 1537	< 7.29	< 1519	< 7.88	< 1599	< 7.29	< 1519	< 7.52	< 1567	< 7.41	< 1543	< 14.9	< 3110							
2-Hexanone	< 41.5	< 8647	< 41.0	< 8542	< 43.2	< 8995	< 41.0	< 8542	< 55.0	< 11450	< 41.7	< 8681	< 96.7	< 20131							
Iodomethane	< 83.6	< 17413	< 60.4	< 12576	< 61.8	< 12867	< 63.2	< 13169	< 31.8	< 6629	< 67.3	< 14007	< 99.1	< 20635							
Methylene chloride	< 427	< 88688	< 27.4	< 5695	< 28.8	< 5996	< 27.4	< 5695	< 4862	< 1012379	< 128	< 26564	< 4990	< 1038943							
4-Methyl-2-pentanone	< 66.9	< 13931	< 66.1	< 13762	< 69.6	< 14491	< 66.1	< 13762	< 28.9	< 6026	< 67.2	< 13987	< 96.1	< 20013							
Styrene	< 11.3	< 2354	< 11.2	< 2325	< 11.8	< 2449	< 11.2	< 2325	< 6.95	< 1446	< 11.4	< 2363	< 18.3	< 3810							
1,1,2,2-Tetrachloroethane	< 15.0	< 3122	< 14.8	< 3085	< 15.6	< 3248	< 14.8	< 3085	< 11.0	< 2290	< 15.1	< 3135	< 26.1	< 5425							
Tetrachloroethene	< 10.2	< 2114	< 10.0	< 2088	< 10.6	< 2199	< 10.0	< 2088	< 7.52	< 1567	< 10.2	< 2122	< 17.7	< 3689							
Toluene	< 6.23	< 1297	< 6.15	< 1281	< 6.48	< 1349	< 6.15	< 1281	< 6.95	< 1446	< 6.25	< 1302	< 13.2	< 2748							
1,1,1-Trichloroethane	< 11.5	< 2402	< 11.4	< 2373	< 12.0	< 2499	< 11.4	< 2373	< 6.95	< 1446	< 11.6	< 2412	< 18.5	< 3858							
1,1,2-Trichloroethane	< 12.7	< 2642	< 12.5	< 2610	< 13.2	< 2748	< 12.5	< 2610	< 6.95	< 1446	< 12.7	< 2653	< 30.1	< 6268							
Trichloroethene	< 23.1	< 4804	< 22.8	< 4746	< 24.0	< 4997	< 22.8	< 4746	< 6.95	< 1446	< 23.2	< 4823	< 30.1	< 6269							
Vinyl chloride	< 7.38	< 1537	< 7.29	< 1519	< 7.68	< 1599	< 7.29	< 1519	< 17.4	< 3616	< 7.41	< 1543	< 24.8	< 5159							
Xylenes (total)	< 27.7	< 5764	< 27.4	< 5695	< 28.8	< 5996	< 27.4	< 5695	< 22.0	< 4580	< 27.8	< 5788	< 49.8	< 10367							

V-7. TCO VOST Summary - Run 1

Test Date 3/20/05 (Test #2)

Compounds	Run 1A				Run 1B				Run 1C				Run 1D				Melter Run 1A - 1D				Avg of Tubes A-D				Total Run 1			
	Conc.		Emission Rate		Conc.		Emission Rate		Conc.		Emission Rate		Conc.		Emission Rate		Conc.		Emission Rate		Conc.		Emission Rate		Conc.		Emission Rate	
	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min
Acetone	0.306	71.4	0.306	71.4	1.91	447	1.91	447	Tenax tubes broken				Methanol Desorbed - Not Included in Average				29.2	6807	29.2	6807	1.11	259	1.11	259	30.3	7066.5	30.3	7066.5
Acetonitrile	2.974	694	2.974	694	2.83	662	2.83	662													2.90	678	2.90	678	274	63889	274	63889
Acrylonitrile	0.324	75.6	0.324	75.6	0.300	70.1	0.300	70.1													0.312	72.8	0.312	72.8	54.5	12715	54.5	12715
Benzene	0.157	36.8	0.157	36.8	0.140	32.6	0.140	32.6													0.149	34.7	0.149	34.7	2.23	521	2.23	521
Bromodichloromethane	0.015	3.39	0.015	3.39	0.013	3.15	0.013	3.15													0.014	3.27	0.014	3.27	2.10	490	2.10	490
Bromoform	0.021	5.01	0.021	5.01	0.020	4.65	0.020	4.65													0.021	4.83	0.021	4.83	2.94	686	2.94	686
Bromomethane	0.484	113	0.484	113	0.199	46.5	0.199	46.5													0.342	79.8	0.342	79.8	8.26	1927	8.26	1927
2-Butanone	0.131	30.5	0.131	30.5	0.172	40.0	0.172	40.0													0.151	35.3	0.151	35.3	16.0	3731	16.0	3731
Carbon disulfide	0.014	3.2	0.014	3.2	0.013	3.00	0.013	3.00													0.013	3.12	0.013	3.12	2.10	489	2.10	489
Carbon tetrachloride	0.011	2.6	0.011	2.6	0.010	2.43	0.010	2.43													0.011	2.53	0.011	2.53	2.51	586	2.51	586
Chlorobenzene	0.023	5.4	0.023	5.4	0.020	4.68	0.020	4.68													0.022	5.06	0.022	5.06	2.10	491	2.10	491
Dibromochloromethane	0.013	2.9	0.013	2.9	0.012	2.72	0.012	2.72													0.012	2.82	0.012	2.82	4.18	975	4.18	975
Chloroethane	0.013	3.0	0.013	3.0	0.012	2.79	0.012	2.79													0.012	2.90	0.012	2.90	5.01	1170	5.01	1170
Chloroform	0.016	3.7	0.016	3.7	0.014	3.29	0.014	3.29													0.015	3.52	0.015	3.52	2.10	490	2.10	490
Chloromethane	24.0	5593.23	24.0	5593.23	18.53	4327	18.53	4327													21.2	4960	21.2	4960	23.7	5543	23.7	5543
1,1-Dichloroethane	0.011	2.62	0.011	2.62	0.010	2.43	0.010	2.43													0.011	2.53	0.011	2.53	2.09	489	2.09	489
1,2-Dichloroethane	0.016	3.70	0.016	3.70	0.015	3.43	0.015	3.43													0.015	3.57	0.015	3.57	2.10	490	2.10	490
1,1,1-Dichloroethene	0.019	4.40	0.019	4.40	0.017	4.08	0.017	4.08													0.018	4.24	0.018	4.24	2.10	490	2.10	490
1,2-Dichloroethene (total)	0.138	32.2	0.138	32.2	0.153	35.8	0.153	35.8													0.146	34.0	0.146	34.0	4.31	1006	4.31	1006
1,2-Dichloropropane	0.015	3.47	0.015	3.47	0.014	3.22	0.014	3.22													0.014	3.34	0.014	3.34	2.10	490	2.10	490
cis-1,3-Dichloropropene	0.013	3.01	0.013	3.01	0.012	2.79	0.012	2.79													0.012	2.90	0.012	2.90	2.10	489	2.10	489
trans-1,3-Dichloropropene	0.013	3.01	0.013	3.01	0.012	2.79	0.012	2.79													0.012	2.90	0.012	2.90	2.30	538	2.30	538
Ethylbenzene	0.043	10.0	0.043	10.0	0.010	2.29	0.010	2.29													0.026	6.16	0.026	6.16	2.11	492	2.11	492
2-Hexanone	0.059	13.9	0.059	13.9	0.055	12.9	0.055	12.9													0.057	13.4	0.057	13.4	15.9	3709	15.9	3709
Iodomethane	0.111	25.8	0.111	25.8	0.048	11.2	0.048	11.2													0.079	18.5	0.079	18.5	2.58	602	2.58	602
Methylene chloride	0.330	77.1	0.330	77.1	0.297	69.4	0.297	69.4													0.314	73.3	0.314	73.3	5.73	1337	5.73	1337
4-Methyl-2-pentanone	0.096	22.4	0.096	22.4	0.089	20.7	0.089	20.7													0.092	21.6	0.092	21.6	8.42	1966	8.42	1966
Styrene	0.016	3.78	0.016	3.78	0.015	3.50	0.015	3.50													0.016	3.64	0.016	3.64	2.10	490	2.10	490
1,1,2,2-Tetrachloroethane	0.022	5.17	0.022	5.17	0.021	4.79	0.021	4.79													0.021	4.98	0.021	4.98	3.15	734	3.15	734
Tetrachloroethene	0.015	3.39	0.015	3.39	0.013	3.15	0.013	3.15													0.014	3.27	0.014	3.27	2.10	490	2.10	490
Toluene	0.027	6.21	0.027	6.21	0.009	2.22	0.009	2.22													0.018	4.21	0.018	4.21	2.10	490	2.10	490
1,1,1-Trichloroethane	0.017	3.93	0.017	3.93	0.016	3.65	0.016	3.65													0.016	3.79	0.016	3.79	2.10	490	2.10	490
1,1,2-Trichloroethane	0.019	4.32	0.019	4.32	0.017	4.00	0.017	4.00													0.018	4.16	0.018	4.16	5.02	1171	5.02	1171
Trichloroethene	0.033	7.64	0.033	7.64	0.030	7.08	0.030	7.08													0.032	7.36	0.032	7.36	2.11	494	2.11	494
Vinyl chloride	0.104	24.3	0.104	24.3	0.048	11.1	0.048	11.1													0.076	17.7	0.076	17.7	5.07	1185	5.07	1185
Xylenes (total)	0.243	56.7	0.243	56.7	0.037	8.58	0.037	8.58													0.140	32.6	0.140	32.6	6.39	1491	6.39	1491

V-8. TCO VOST Summary - Run 2

Test Date 3/20/05 (Test #2)

Compounds	Run 2A			Run 2B			Run 2C			Melter Run 2A - 2C			Avg of Tubes A-C			Total Run 2				
	Conc.	ug/dscf	Emission Rate ug/min	Conc.	ug/dscf	Emission Rate ug/min	Conc.	ug/dscf	Emission Rate ug/min	Conc.	ug/dscf	Emission Rate ug/min	Conc.	ug/dscf	Emission Rate ug/min	Tube avg + Condensate				
																Conc	Emission Rate			
Acetone	1.13	3.07	716	1.30	333	304	1.08	252	29.9	278	6991	1.17	330	273	31.1	7264.41				
Acetonitrile	<	0.161	<	0.311	<	72.6	<	0.311	<	815	<	3.49	<	815	<	3.30	<	281	<	65687
Acrylonitrile	<	0.130	<	30.4	<	34.2	<	0.146	<	72.6	<	0.311	<	72.6	<	0.261	<	60.9	<	13044
Benzene	<	0.007	<	169	<	3.26	<	0.014	<	32.6	<	0.014	<	32.6	<	0.132	<	30.8	<	530
Bromodichloromethane	<	0.011	<	2.49	<	4.82	<	0.021	<	4.82	<	0.021	<	4.82	<	0.012	<	2.73	<	502
Bromoform	<	0.133	<	31.0	<	27.1	<	0.090	<	21.1	<	0.084	<	19.6	<	0.017	<	4.04	<	703
Bromomethane	<	0.164	<	38.3	<	0.116	<	0.116	<	21.0	<	0.176	<	41.1	<	0.102	<	23.9	<	2371
2-Butanone	<	0.007	<	1.61	<	3.11	<	0.013	<	3.11	<	0.013	<	3.11	<	0.152	<	35.5	<	3831
Carbon disulfide	<	0.006	<	1.30	<	0.011	<	0.011	<	2.52	<	0.011	<	2.52	<	0.011	<	2.61	<	502
Carbon tetrachloride	<	0.020	<	4.60	<	0.021	<	0.021	<	4.89	<	0.018	<	4.15	<	0.009	<	2.11	<	601
Chlorobenzene	<	0.006	<	1.46	<	0.012	<	0.012	<	2.82	<	0.018	<	4.15	<	0.019	<	4.54	<	504
Dibromochloromethane	<	0.006	<	1.49	<	0.012	<	0.012	<	2.89	<	0.012	<	2.82	<	0.010	<	2.36	<	1001
Chloroethane	<	0.008	<	1.76	<	0.015	<	0.015	<	3.41	<	0.015	<	3.41	<	0.010	<	2.42	<	1201
Chloroform	<	17.4	<	4063	<	23.2	<	5408	<	4037	<	17.29	<	4037	<	0.012	<	2.86	<	502
Chloromethane	<	0.006	<	1.30	<	0.011	<	2.52	<	2.14	<	0.011	<	2.52	<	0.012	<	4.29	<	5102
1,1-Dichloroethane	<	0.008	<	1.84	<	0.015	<	3.56	<	3.56	<	0.015	<	3.56	<	0.009	<	2.11	<	501
1,2-Dichloroethane	<	0.009	<	2.18	<	0.018	<	4.22	<	4.22	<	0.018	<	4.22	<	0.013	<	2.98	<	502
1,1-Dichloroethene	<	0.175	<	40.9	<	0.159	<	37.0	<	37.0	<	0.120	<	28.0	<	0.015	<	3.54	<	503
1,2-Dichloroethene (total)	<	0.007	<	1.72	<	0.014	<	3.33	<	3.33	<	0.014	<	3.33	<	0.151	<	35.3	<	1034
1,2-Dichloropropane	<	0.006	<	1.49	<	0.012	<	2.89	<	2.89	<	0.012	<	2.89	<	0.012	<	2.80	<	502
cis-1,3-Dichloropropene	<	0.006	<	1.49	<	0.012	<	2.89	<	2.89	<	0.012	<	2.89	<	0.010	<	2.42	<	502
trans-1,3-Dichloropropene	<	0.005	<	1.23	<	0.010	<	2.37	<	2.37	<	0.010	<	2.37	<	0.010	<	2.42	<	552
Ethylbenzene	<	0.030	<	6.90	<	0.057	<	13.3	<	13.3	<	0.057	<	13.3	<	0.009	<	1.99	<	501
2-Hexanone	<	0.032	<	7.51	<	0.036	<	8.52	<	8.52	<	0.036	<	8.52	<	0.048	<	1.99	<	3806
Iodomethane	<	13.9	<	3257	<	1.82	<	426	<	426	<	0.019	<	4.41	<	16.3	<	11.2	<	2404
Methylene chloride	<	0.048	<	11.1	<	0.092	<	21.5	<	21.5	<	0.092	<	21.5	<	0.029	<	6.81	<	260916
4-Methyl-2-pentanone	<	0.008	<	1.88	<	0.016	<	3.63	<	3.63	<	0.016	<	3.63	<	5.34	<	1247	<	1118
Styrene	<	0.011	<	2.57	<	0.021	<	4.96	<	4.96	<	0.021	<	4.96	<	0.077	<	18.0	<	863
1,1,2,2-Tetrachloroethane	<	0.007	<	1.69	<	0.014	<	3.26	<	3.26	<	0.014	<	3.26	<	0.013	<	3.05	<	2015
Tetrachloroethene	<	0.016	<	3.68	<	0.009	<	2.00	<	2.00	<	0.014	<	3.26	<	0.018	<	4.16	<	502
Toluene	<	0.008	<	1.95	<	0.016	<	3.78	<	3.78	<	0.016	<	3.78	<	0.012	<	4.73	<	753
1,1,1-Trichloroethane	<	0.009	<	2.15	<	0.018	<	4.15	<	4.15	<	0.016	<	3.78	<	0.011	<	2.65	<	502
1,1,2-Trichloroethane	<	0.016	<	3.79	<	0.031	<	7.33	<	7.33	<	0.018	<	4.15	<	0.014	<	3.17	<	503
Trichloroethene	<	0.039	<	9.00	<	0.070	<	16.3	<	16.3	<	0.031	<	7.33	<	0.015	<	3.48	<	1202
Vinyl chloride	<	0.020	<	4.60	<	0.038	<	8.89	<	8.89	<	0.030	<	7.04	<	0.026	<	6.15	<	506
Xylenes (total)	<	0.006	<	1.46	<	0.012	<	2.82	<	2.82	<	0.012	<	2.82	<	0.046	<	10.8	<	1209
	<	0.020	<	4.60	<	0.038	<	8.89	<	8.89	<	0.038	<	8.89	<	0.032	<	7.46	<	1506

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V-9. TCO VOST Summary - Run 3

Test Date 3/20/05 (Test #2)

Compounds	Run 3A			Run 3B			Run 3C			Run 3D			Condensate			Avg of Tubes A-D			Total Run 3		
	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate	Conc.		Emission Rate
	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min	ug/dscf	ug/min	ug/min
Acetone	1.74	407	431	1.85	841	151	0.645	4.19	978				29.7	6944	330	1.41	330	330	31.2	7274	
Acetonitrile	3.01	703	71.6	3.60	841	73.8	0.316	4.19	978				208	48498	841	3.60	841	841	211	49339	
Acrylonitrile	0.311	23.4	31.2	0.307	71.6	22.3	0.096	3.22	3.31				41.5	9700	72.6	0.311	72.6	72.6	41.9	9772	
Benzene	0.100	23.4	31.2	0.134	71.6	22.3	0.096	3.22	3.31				1.60	373	25.6	0.110	25.6	25.6	1.71	399	
Bromodichloromethane	0.014	3.26	4.75	0.014	3.22	4.89	0.014	3.31					1.60	373	3	0.014	3	3	1.61	376	
Bromoform	0.021	4.81	4.75	0.020	4.75	4.89	0.021	4.89					2.24	522	5	0.021	5	5	2.26	527	
Bromomethane	0.082	19.2	16.8	0.072	16.8	18.8	0.081	18.8					11.2	2611	18.3	0.078	18.3	18.3	11.3	2630	
2-Butanone	0.216	50.3	85.5	0.366	85.5	42.5	0.182	42.5					12.1	2835	59.5	0.255	59.5	59.5	12.4	2895	
Carbon disulfide	0.013	3.11	3.07	0.013	3.07	3.16	0.014	3.16					1.60	373	3.11	0.013	3.11	3.11	1.61	376	
Carbon tetrachloride	0.011	2.52	2.49	0.011	2.49	2.56	0.011	2.56					1.92	448	2.52	0.011	2.52	2.52	1.93	450	
Chlorobenzene	0.016	3.70	3.25	0.014	3.25	3.50	0.015	3.50					1.60	373	3.48	0.015	3.48	3.48	1.61	377	
Dibromochloromethane	0.012	2.81	2.78	0.012	2.78	2.86	0.012	2.86					3.20	746	2.82	0.012	2.82	2.82	3.21	749	
Chloroethane	0.012	2.89	2.85	0.012	2.85	2.94	0.013	2.94					3.84	895	2.89	0.012	2.89	2.89	3.85	898	
Chloroform	0.015	3.41	3.36	0.014	3.36	3.46	0.015	3.46					1.60	373	3.41	0.015	3.41	3.41	1.61	376	
Chloromethane	19.5	4553	5409	23.2	5409	5155	22.1	5155					1.92	448	5039	21.6	5039	5039	23.5	5487	
1,1-Dichloroethane	0.011	2.52	2.49	0.011	2.49	2.56	0.011	2.56					1.60	373	2.52	0.011	2.52	2.52	1.61	376	
1,2-Dichloroethane	0.015	3.55	3.51	0.015	3.51	3.61	0.015	3.61					1.60	373	3.56	0.015	3.56	3.56	1.61	377	
1,1-Dichloroethene	0.018	4.22	4.17	0.018	4.17	4.29	0.018	4.29					1.60	373	4.23	0.018	4.23	4.23	1.62	377	
1,2-Dichloroethene (total)	0.109	25.4	15.2	0.065	15.2	26.2	0.112	26.2					3.20	746	22.2	0.095	22.2	22.2	3.29	768	
1,2-Dichloropropane	0.014	3.33	3.29	0.014	3.29	3.39	0.015	3.39					1.60	373	3.34	0.014	3.34	3.34	1.61	376	
cis-1,3-Dichloropropene	0.012	2.89	2.85	0.012	2.85	2.94	0.013	2.94					1.60	373	2.89	0.012	2.89	2.89	1.61	376	
trans-1,3-Dichloropropene	0.012	2.89	2.85	0.012	2.85	2.94	0.013	2.94					1.76	410	2.89	0.012	2.89	2.89	1.77	413	
Ethylbenzene	0.010	2.37	2.34	0.010	2.34	6.10	0.026	6.10					1.60	373	3.60	0.015	3.60	3.60	1.61	377	
2-Hexanone	0.057	13.3	13.2	0.056	13.2	13.5	0.058	13.5					12.1	2835	13.3	0.057	13.3	13.3	12.2	2849	
Iodomethane	0.018	4.22	4.02	0.017	4.02	3.91	0.017	3.91					11.5	2686	4.05	0.017	4.05	4.05	11.5	2690	
Methylene chloride	25.6	5967	651	2.79	651	61.3	0.263	61.3					1023	238760	2226	9.54	2226	2226	1032	240986	
4-Methyl-2-pentanone	0.092	21.5	21.2	0.091	21.2	21.8	0.093	21.8					6.39	1492	21.5	0.092	21.5	21.5	6.48	1514	
Styrene	0.016	3.63	3.58	0.015	3.58	3.69	0.016	3.69					1.60	373	3.63	0.016	3.63	3.63	1.61	377	
1,1,2,2-Tetrachloroethane	0.021	4.96	4.90	0.021	4.90	5.04	0.022	5.04					2.40	560	4.97	0.021	4.97	4.97	2.42	565	
Tetrachloroethene	0.014	3.26	3.22	0.014	3.22	3.31	0.014	3.31					1.60	373	3.26	0.014	3.26	3.26	1.61	376	
Toluene	0.013	2.92	4.46	0.019	4.46	2.33	0.010	2.33					1.60	373	3.24	0.014	3.24	3.24	1.61	376	
1,1,1-Trichloroethane	0.016	3.78	3.73	0.016	3.73	3.84	0.016	3.84					1.60	373	3.78	0.016	3.78	3.78	1.61	377	
1,1,2-Trichloroethane	0.018	4.15	4.09	0.018	4.09	4.21	0.018	4.21					3.84	895	4.15	0.018	4.15	4.15	3.85	899	
Trichloroethene	0.031	7.33	7.24	0.031	7.24	7.45	0.032	7.45					1.60	373	7.34	0.031	7.34	7.34	1.63	380	
Vinyl chloride	0.039	9.22	19.0	0.081	19.0	16.5	0.071	16.5					3.84	895	14.9	0.064	14.9	14.9	3.90	910	
Xylenes (total)	0.038	8.88	8.8	0.038	8.8	29.4	0.126	29.4					4.79	1119	15.7	0.067	15.7	15.7	4.86	1135	

V-10. TCO VOST Summary - Run 4

Test Date 3/20/05 (Test #2)

Compounds	Run 4A			Run 4B			Run 4C			Run 4D			Melter Run 4A - 4D			Avg of Tubes A-D			Total Run 4		
	Emission Rate			Emission Rate			Emission Rate			Emission Rate			Condensate			Emission Rate			Emission Rate		
	Conc.	ug/dscf	ug/min	Conc.	ug/dscf	ug/min	Conc.	ug/dscf	ug/min	Conc.	ug/dscf	ug/min	Conc.	ug/dscf	ug/min	Conc.	ug/dscf	ug/min	Conc.	ug/dscf	ug/min
Acetone	1.68	< 3.18	401	1.22	9.74	2320	1.48	3.71	883				< 145	< 34584	348	1.46	< 147	< 34932			
Acetonitrile		< 0.311	74.2	0.298	< 0.298	71.1	0.316	< 0.316	75.2	Methanol Desorbed - Not included in Average											
Acrylonitrile		< 0.101	24.0	0.046	< 0.046	11.0	0.150	< 0.150	35.8												
Benzene		< 0.014	3.33	0.013	< 0.013	3.19	0.014	< 0.014	3.38												
Bromodichloromethane		< 0.021	4.92	0.020	< 0.020	4.71	0.021	< 0.021	4.99												
Bromoform		0.054	12.9	0.111	26.5	59.5	0.056	13.4	84.8				< 10.9	< 2607	4.87	0.020	< 11.0	< 2612			
Bromomethane		< 0.181	43.1	0.250	59.5	138	0.356	84.8					52.3	12469	17.6	0.074	52.4	12486			
2-Butanone		< 0.013	3.18	0.013	< 0.013	3.05	0.014	< 0.014	3.22				< 60.3	< 14358	62.5	0.262	< 60.5	< 14421			
Carbon disulfide		< 0.011	2.57	0.010	< 0.010	2.47	0.011	< 0.011	2.61				< 8.09	< 1927	3.15	0.013	< 8.10	< 1930			
Carbon tetrachloride		< 0.014	3.37	0.013	< 0.013	3.12	0.031	< 0.031	7.41				< 9.83	< 2343	2.55	0.011	< 9.84	< 2345			
Chlorobenzene		< 0.012	2.88	0.012	< 0.012	2.76	0.012	< 0.012	2.92				< 7.93	< 1889	4.63	0.019	< 7.95	< 1894			
Dibromochloromethane		< 0.012	2.95	0.012	< 0.012	2.83	0.013	< 0.013	2.99				< 15.5	< 3703	2.85	0.012	< 15.6	< 3706			
Chloroethane		< 0.019	4.58	0.014	< 0.014	3.34	0.020	< 0.020	4.84				< 19.0	< 4534	2.92	0.012	< 19.0	< 4537			
Chloroform		12.4	2951	18.4	4386	10.5	2494						< 7.93	< 1889	4.25	0.018	< 7.95	< 1893			
Chloromethane		< 0.011	2.57	0.010	< 0.010	2.47	0.011	< 0.011	2.61				< 9.52	< 2267	3.27	0.013	< 9.54	< 2270			
1,1-Dichloroethane		< 0.015	3.63	0.015	< 0.015	3.48	0.015	< 0.015	3.68				< 7.93	< 1889	3.60	0.015	< 7.94	< 1892			
1,2-Dichloroethane		< 0.018	4.31	0.017	< 0.017	4.13	0.018	< 0.018	4.37				< 7.93	< 1889	4.27	0.018	< 7.95	< 1893			
1,1,2-Dichloroethene (total)		< 0.042	10.0	0.033	< 0.033	7.79	0.036	< 0.036	8.63				< 15.9	< 3778	8.82	0.037	< 15.9	< 3787			
1,2-Dichloropropane		< 0.014	3.41	0.014	< 0.014	3.26	0.014	< 0.014	3.45				< 7.93	< 1889	3.37	0.014	< 7.94	< 1893			
cis-1,3-Dichloropropene		< 0.012	2.95	0.012	< 0.012	2.83	0.013	< 0.013	2.99				< 7.93	< 1889	2.92	0.012	< 7.94	< 1892			
trans-1,3-Dichloropropene		< 0.012	2.95	0.012	< 0.012	2.83	0.013	< 0.013	2.99				< 8.72	< 2078	2.92	0.012	< 8.74	< 2081			
Ethylbenzene		< 0.010	2.42	0.010	< 0.010	2.32	0.010	< 0.010	2.46				< 8.09	< 1927	2.40	0.010	< 8.10	< 1929			
2-Hexanone		< 0.057	13.6	0.055	< 0.055	13.05	0.058	< 0.058	13.8				< 60.3	< 14358	13.5	0.057	< 60.3	< 14372			
Iodomethane		< 0.016	3.78	0.020	< 0.020	4.75	0.023	< 0.023	5.56				42.8	10202	4.70	0.020	< 42.8	< 10206			
Methylethyl chloride		19.2	4578	0.670	160	138	0.580	138					2221	528980	1625	6.8	2227	530606			
4-Methyl-2-pentanone		< 0.092	21.9	0.088	< 0.088	21.0	0.093	< 0.093	22.3				< 31.7	< 7557	21.7	0.091	< 31.8	< 7579			
Styrene		< 0.016	3.71	0.015	< 0.015	3.55	0.016	< 0.016	3.76				< 7.93	< 1889	3.67	0.015	< 7.95	< 1893			
1,1,2,2-Tetrachloroethane		< 0.021	5.07	0.020	< 0.020	4.86	0.022	< 0.022	5.14				< 12.1	< 2872	5.02	0.021	< 12.1	< 2877			
Tetrachloroethene		< 0.014	3.33	0.013	< 0.013	3.19	0.014	< 0.014	3.38				< 8.25	< 1965	3.30	0.014	< 8.26	< 1968			
Toluene		< 0.014	3.22	0.011	< 0.011	2.72	0.009	< 0.009	2.97				< 7.93	< 1889	2.67	0.011	< 7.94	< 1892			
1,1,1-Trichloroethane		< 0.016	3.86	0.016	< 0.016	3.70	0.016	< 0.016	3.91				< 7.93	< 1889	3.82	0.016	< 7.95	< 1893			
1,1,2-Trichloroethane		< 0.018	4.24	0.017	< 0.017	4.06	0.018	< 0.018	4.30				< 19.0	< 4534	4.20	0.018	< 19.1	< 4538			
Trichloroethane		< 0.031	7.49	0.030	< 0.030	7.18	0.032	< 0.032	7.60				< 7.93	< 1889	7.42	0.031	< 7.96	< 1897			
Vinyl chloride		< 0.026	6.13	0.033	7.98	6.29	0.026	6.29					< 19.0	< 4534	6.80	0.029	< 19.1	< 4541			
Xylenes (total)		< 0.038	9.08	< 0.037	8.70	9.21	0.039	9.21					< 23.8	< 5668	9.00	0.038	< 23.8	< 5677			

V-11. TCO VOST Summary - Run 5

Test Date 3/20/05 (Test #2)

Compounds	Run 52A			Run 5B			Run 5C			Melter Run 5A - 5C			Avg of Tubes A-C			Total Run 5		
	Conc.	Emission Rate		Conc.	Emission Rate		Conc.	Emission Rate		Conc.	Emission Rate		Conc.	Emission Rate		Conc.	Emission Rate	
		ug/dscf	ug/min		ug/dscf	ug/min		ug/dscf	ug/min		ug/dscf	ug/min		ug/dscf	ug/min		ug/dscf	ug/min
Acetone	1.95	464		1.16	277		1.42	339		142	33818		1.51	360		143	34178	
Acetonitrile	64.4	15334		2.79	665		2.94	702		1358	323474		23.4	5567		1381	329041	
Acrylonitrile	0.285	67.8		0.304	72.4		0.321	76.4		267	63715		0.303	72.2		268	63787	
Benzene	0.028	6.68		0.050	11.9		0.087	20.8		10.3	2451		0.055	13.1		10.3	2464	
Bromodichloromethane	0.013	3.05		0.014	3.25		0.014	3.43		10.3	2451		0.014	3.24		10.3	2454	
Bromoform	0.019	4.50		0.020	4.80		0.021	5.07		14.2	3382		0.020	4.79		14.2	3387	
Bromomethane	0.413	98.3		0.057	13.7		0.049	11.7		72.0	17154		0.173	41.2		72.2	17195	
2-Butanone	0.671	160		0.713	170		0.425	101		78.2	18624		0.603	144		78.8	18768	
Carbon disulfide	0.017	3.95		0.013	3.10		0.014	3.27		10.5	2500		0.014	3.44		10.5	2503	
Carbon tetrachloride	0.010	2.35		0.011	2.51		0.011	2.65		12.8	3039		0.011	2.51		12.8	3041	
Chlorobenzene	0.012	2.98		0.013	3.18		0.014	3.35		10.3	2451		0.013	3.17		10.3	2454	
Dibromochloromethane	0.011	2.63		0.012	2.81		0.012	2.96		20.2	4803		0.012	2.80		20.2	4806	
Chloroethane	0.011	2.70		0.012	2.88		0.013	3.04		24.7	5881		0.012	2.87		24.7	5884	
Chloroform	0.013	3.18		0.014	3.40		0.015	3.59		10.3	2451		0.014	3.39		10.3	2454	
Chloromethane	33.3	7927		9.77	2328		9.42	2245		12.3	2941		17.5	4166		29.8	7107	
1,1-Dichloroethane	0.010	2.35		0.011	2.51		0.011	2.65		10.3	2451		0.011	2.51		10.3	2453	
1,2-Dichloroethane	0.014	3.32		0.015	3.55		0.016	3.74		10.3	2451		0.015	3.54		10.3	2454	
1,1-Dichloroethene	0.017	3.95		0.018	4.21		0.019	4.44		10.3	2451		0.018	4.20		10.3	2455	
1,2-Dichloroethene (total)	0.025	5.88		0.026	6.28		0.028	6.63		20.6	4901		0.026	6.26		20.6	4907	
1,2-Dichloropropane	0.013	3.12		0.014	3.33		0.015	3.51		10.3	2451		0.014	3.32		10.3	2454	
cis-1,3-Dichloropropene	0.011	2.70		0.012	2.88		0.013	3.04		10.3	2451		0.012	2.87		10.3	2453	
trans-1,3-Dichloropropene	0.011	2.70		0.012	2.88		0.013	3.04		11.3	2696		0.012	2.87		11.3	2698	
Ethylbenzene	0.009	2.22		0.010	2.36		0.010	2.49		10.5	2500		0.010	2.36		10.5	2502	
2-Hexanone	0.052	12.5		0.056	13.3		0.059	14.0		78.2	18624		0.056	13.3		78.2	18638	
Iodomethane	0.086	20.4		0.016	3.69		0.016	3.90		57.6	13723		0.039	9.34		57.6	13732	
Methylene chloride	7.85	1869		0.450	107		0.327	77.9		1872	446002		2.87	685		1875	446687	
4-Methyl-2-pentanone	0.084	20.1		0.090	21.4		0.095	22.6		41.1	9802		0.090	21.4		41.2	9824	
Styrene	0.014	3.39		0.015	3.62		0.016	3.82		10.3	2451		0.015	3.61		10.3	2454	
1,1,2,2-Tetrachloroethane	0.019	4.64		0.021	4.95		0.022	5.22		15.6	3725		0.021	4.94		15.7	3730	
Tetrachloroethene	0.013	3.05		0.014	3.25		0.014	3.43		10.7	2549		0.014	3.24		10.7	2552	
Toluene	0.020	4.85		0.013	3.14		0.009	2.18		10.3	2451		0.014	3.39		10.3	2454	
1,1,1-Trichloroethane	0.015	3.53		0.016	3.77		0.017	3.98		10.3	2451		0.016	3.76		10.3	2454	
1,1,2-Trichloroethane	0.016	3.88		0.017	4.14		0.018	4.37		24.7	5881		0.017	4.13		24.7	5885	
Trichloroethene	0.029	6.85		0.031	7.32		0.032	7.72		10.3	2451		0.031	7.30		10.3	2458	
Vinyl chloride	0.043	10.3		0.018	4.21		0.015	3.59		24.7	5881		0.025	6.05		24.7	5887	
Xylenes (total)	0.035	8.31		0.037	8.87		0.039	9.35		30.9	7352		0.037	8.84		30.9	7361	

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Appendix A.2

Semi-VOST

Table N-1. Summary of Naphthalene Results (Method 0010)				
3/9/2005 Test Date				
(Corrected 10/13/05)				
Run #	Compound	Concentration ug/dscf	Emission Rate ug/min	
Melter				
1	Naphthalene	3203	624902	
2	Naphthalene	3783	744540	
3	Naphthalene	3470	667156	
HEPA				
1	Naphthalene	3463	649886	
2	Naphthalene	3811	708176	
3	Naphthalene	3005	539083	
TCO				
1	Naphthalene	0.7862	200	
2	Naphthalene	0.0949	23.4	
3	Naphthalene	0.1472	36.2	
Carbon Bed				
1	Naphthalene	100	17844	
2	Naphthalene	37.1	6616	
3	Naphthalene	5.58	1002	

Table N-2. Naphthalene Results (Method 0010)									
3/9/2005 Test Date									
Run #	Compound	Amount ug	MDL ug	Sample Volume dscf	Flow dscfm	Concentration ug/dscf	Emission Rate ug/min		
Melter									
1	Naphthalene	140000	1800	43.707	195.09	3203	624902		
2	Naphthalene	170000	1800	44.942	196.83	3783	744540		
3	Naphthalene	150000	1800	43.229	192.27	3470	667156		
HEPA									
1	Naphthalene	120000	1800	34.651	187.66	3463	649886		
2	Naphthalene	130000	1800	34.111	185.82	3811	708176		
3	Naphthalene	100000	1800	33.275	179.38	3005	539083		
TCO									
1	Naphthalene	110	1.8	139.919	254.94	0.786	200		
2	Naphthalene	13	1.8	136.962	246.69	0.095	23.4		
3	Naphthalene	20	1.8	135.837	245.96	0.147	36.2		
Carbon Bed									
1	Naphthalene	11000	450	109.733	178.002	100	17844		
2	Naphthalene	4000	180	107.705	178.149	37.1	6616		
3	Naphthalene	560	36	100.409	179.677	5.58	1002		
Fid Blank									
	Naphthalene	12	1.8						

Table N-3. Summary of Naphthalene Results (3/22/05) (Corrected 10/13/05)										
Run #	Melter		HEPA		TCO		Carbon Bed			
	Conc. ug/dscf	Emission Rate ug/min	Conc. ug/dscf	Emission Rate ug/min	Conc. ug/dscf	Emission Rate ug/min	Conc. ug/dscf	Emission Rate ug/min	Conc. ug/dscf	Emission Rate ug/min
4	4448	911420	76.2	15385	0.016	3.74	155	30590		
5	4656	965003	1444	288958	< 0.070	< 16.9	< 85.5	< 16965		
6	3756	784509	1621	313881	< 0.072	< 16.8	76.5	14627		

Table N-4. Napthalene Results (3/22/05)

Run #	Compound	Sample Date	3/22/2005	Amount ug	Detection Limit ug	Sample Volume dscf	Flow dscfm	Concentration ug/dscf	Emission Rate ug/min
Melter									
4	Naphthalene			160000	10000	35.972	204.91	4448	911420
5	Naphthalene			170000	1000	36.512	207.26	4656	965003
6	Naphthalene			140000	1800	37.274	208.87	3756	784509
HEPA									
4	Naphthalene			2900	10000	38.053	201.88	76	15385
5	Naphthalene			54000	20000	37.385	200.05	1444	288958
6	Naphthalene			59000	20000	36.389	193.59	1621	313881
TCO									
4	Naphthalene			2	1.8	127.946	239.12	0.016	3.74
5	Naphthalene			ND	9	128.134	240.58	0.07	16.90
6	Naphthalene			ND	9	124.85	233.07	0.07	16.80
Carbon Bed									
4	Naphthalene			13000	50000	84.055	197.79	154.661	30590.33
5	Naphthalene			ND	7200	84.22	198.44	85	16965
6	Naphthalene			6100	400	79.787	191.32	76	14627
Blank									
	Naphthalene			3.5	10				

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Table SV-1. Summary Meter Semi-Vost Results
3/9/2005

Compound										
	Run 1					Run 2				
	Dilution Factor 1000					Dilution Factor 1000				
	Conc ug/dscf		Emission Rate ug/min			Conc ug/dscf		Emission Rate ug/min		
Acenaphthene	<	38.9	<	7588	<	37.83	<	7445	<	39.3
Acenaphthylene	<	36.6	<	7142	<	35.60	<	7007	<	37.0
Anthracene	<	36.6	<	7142	<	35.60	<	7007	<	37.0
Benzo(a)anthracene	<	48.0	<	9374	<	46.73	<	9197	<	48.6
Benzo(b)fluoranthene	<	93.8	<	18301	<	91.2	<	17957	<	94.8
Benzo(k)fluoranthene	<	110	<	21425	<	106.8	<	21022	<	111
Benzo(ghi)perylene	<	96.1	<	18747	<	93.5	<	18395	<	97.2
Benzo(a)pyrene	<	50.3	<	9820	<	48.95	<	9635	<	50.9
bis(2-Chloroethoxy)methane	<	41.2	<	8034	<	40.05	<	7883	<	41.6
bis(2-Chloroethyl) ether	<	45.8	<	8927	<	44.50	<	8759	<	46.3
bis(2-Chloroisopropyl) ether	<	54.9	<	10713	<	53.40	<	10511	<	55.5
bis(2-Ethylhexyl) phthalate	<	320	<	62490	<	311.5	<	61315	<	324
4-Bromophenyl phenyl ether	<	36.6	<	7142	<	35.60	<	7007	<	37.0
Butyl benzyl phthalate	<	59.5	<	11605	<	57.85	<	11387	<	60.1
4-Chloroaniline	<	229	<	44636	<	222.5	<	43796	<	231
4-Chloro-3-methylphenol	<	93.8	<	18301	<	91.2	<	17957	<	94.8
2-Chloronaphthalene	<	36.6	<	7142	<	33.38	<	6569	<	34.7
2-Chlorophenol	<	48.0	<	9374	<	46.73	<	9197	<	48.6
4-Chlorophenyl phenyl ether	<	50.3	<	9820	<	48.95	<	9635	<	50.9
Chrysene	<	45.8	<	8927	<	44.5	<	8759	<	46.3
Dibenz(a,h)anthracene	<	84.7	<	16515	<	82.3	<	16205	<	85.6
Dibenzofuran	<	48.0	<	9374	<	46.7	<	9197	<	48.6
Di-n-butyl phthalate	<	275	<	53563	<	267	<	52556	<	278
1,2-Dichlorobenzene	<	45.8	<	8927	<	44.5	<	8759	<	46.3
1,3-Dichlorobenzene	<	52.6	<	10266	<	51.2	<	10073	<	53.2
1,4-Dichlorobenzene	<	54.9	<	10713	<	53.4	<	10511	<	55.5
3,3'-Dichlorobenzidine	<	297	<	58027	<	289	<	56935	<	301
2,4-Dichlorophenol	<	66.4	<	12944	<	64.5	<	12701	<	67.1
Diethyl phthalate	<	64.1	<	12498	<	62.3	<	12263	<	64.8
2,4-Dimethylphenol	<	224	<	43743	<	218	<	42921	<	227
Dimethyl phthalate	<	36.6	<	7142	<	35.6	<	7007	<	37.0
4,6-Dinitro-2-methylphenol	<	320	<	62490	<	312	<	61315	<	324
2,4-Dinitrophenol	<	664	<	129444	<	645	<	127010	<	671
2,4-Dinitrotoluene	<	70.9	<	13837	<	69.0	<	13577	<	71.7
2,6-Dinitrotoluene	<	59.5	<	11605	<	57.9	<	11387	<	60.1
Di-n-octyl phthalate	<	82.4	<	16069	<	80.1	<	15767	<	83.3
Fluoranthene	<	38.9	<	7588	<	37.8	<	7445	<	39.3
Fluorene	<	45.8	<	8927	<	44.5	<	8759	<	46.3
Hexachlorobenzene	<	48.0	<	9374	<	46.7	<	9197	<	48.6
Hexachlorobutadiene	<	66.4	<	12944	<	64.5	<	12701	<	67.1
Hexachlorocyclopentadiene	<	526	<	102663	<	512	<	100732	<	532
Hexachloroethane	<	86.9	<	16962	<	84.6	<	16643	<	87.9
Indeno(1,2,3-cd)pyrene	<	80.1	<	15623	<	77.9	<	15329	<	81.0
Isophorone	<	41.2	<	8034	<	40.1	<	7883	<	41.6
2-Methylnaphthalene	<	43.5	<	8481	<	42.3	<	8321	<	44.0
2-Methylphenol	<	140	<	27228	<	136	<	26716	<	141
Naphthalene		3203		624902		3783		744540		3470
2-Nitroaniline	<	50.3	<	9820	<	49.0	<	9635	<	50.9
3-Nitroaniline	<	174	<	33923	<	169	<	33285	<	176
4-Nitroaniline	<	133	<	25889	<	129	<	25402	<	134
Nitrobenzene	<	43.5	<	8481	<	42.3	<	8321	<	44.0
2-Nitrophenol	<	108	<	20979	<	105	<	20584	<	109
4-Nitrophenol	<	185	<	36155	<	180	<	35475	<	187
N-Nitrosodiphenylamine	<	45.8	<	8927	<	44.5	<	8759	<	46.3
N-Nitrosodi-n-propylamine	<	48.0	<	9374	<	46.7	<	9197	<	48.6
Pentachlorophenol	<	1167	<	227643	<	1135	<	223362	<	1180
Phenanthrene	<	38.9	<	7588	<	37.8	<	7445	<	39.3
Phenol	<	64.1	<	12498	<	62.3	<	12263	<	64.8
Pyrene	<	41.2	<	8034	<	40.1	<	7883	<	41.6
1,2,4-Trichlorobenzene	<	48.0	<	9374	<	46.7	<	9197	<	48.6
2,4,5-Trichlorophenol	<	101	<	19640	<	97.9	<	19270	<	102
2,4,6-Trichlorophenol	<	70.9	<	13837	<	69.0	<	13577	<	71.7

Note: "<" numbers are MDL values

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Table SV-2 Summary HEPA Semi-Vost Results
3/9/2005

Compound	Run 2				Run 2				Run 3			
	Dilution Factor 1000				Dilution Factor 1000				Dilution Factor 1000			
	Conc		Emission Rate		Conc		Emission Rate		Conc		Emission Rate	
	ug/dscf		ug/min		ug/dscf		ug/min		ug/dscf		ug/min	
Acenaphthene	<	49.1	<	9207	<	49.8	<	9261	<	51.1	<	9164
Acenaphthylene	<	46.2	<	8665	<	46.9	<	8716	<	48.1	<	8625
Anthracene	<	46.2	<	8665	<	46.9	<	8716	<	48.1	<	8625
Benzo(a)anthracene	<	60.6	<	11373	<	61.6	<	11440	<	63.1	<	11321
Benzo(b)fluoranthene	<	118	<	22204	<	120	<	22335	<	123	<	22102
Benzo(k)fluoranthene	<	139	<	25995	<	141	<	26148	<	144	<	25876
Benzo(ghi)perylene	<	121	<	22746	<	123	<	22880	<	126	<	22642
Benzo(a)pyrene	<	63.5	<	11915	<	64.5	<	11985	<	66.1	<	11860
bis(2-Chloroethoxy)methane	<	51.9	<	9748	<	52.8	<	9806	<	54.1	<	9704
bis(2-Chloroethyl) ether	<	57.7	<	10831	<	58.6	<	10895	<	60.1	<	10782
bis(2-Chloroisopropyl) ether	<	69.3	<	12998	<	70.4	<	13074	<	72.1	<	12938
bis(2-Ethylhexyl) phthalate	<	404	<	75820	<	410	<	76265	<	421	<	75472
4-Bromophenyl phenyl ether	<	46.2	<	8665	<	46.9	<	8716	<	48.1	<	8625
Butyl benzyl phthalate	<	75.0	<	14081	<	76.2	<	14164	<	78.1	<	14016
4-Chloroaniline	<	289	<	54157	<	293	<	54475	<	301	<	53908
4-Chloro-3-methylphenol	<	118	<	22204	<	120	<	22335	<	123	<	22102
2-Chloronaphthalene	<	46.2	<	8665	<	44.0	<	8171	<	45.1	<	8086
2-Chlorophenol	<	60.6	<	11373	<	61.6	<	11440	<	63.1	<	11321
4-Chlorophenyl phenyl ether	<	63.5	<	11915	<	64.5	<	11985	<	66.1	<	11860
Chrysene	<	57.7	<	10831	<	58.6	<	10895	<	60.1	<	10782
Dibenz(a,h)anthracene	<	107	<	20038	<	108	<	20156	<	111	<	19946
Dibenzofuran	<	60.6	<	11373	<	61.6	<	11440	<	63.1	<	11321
Di-n-butyl phthalate	<	346	<	64989	<	352	<	65370	<	361	<	64690
1,2-Dichlorobenzene	<	57.7	<	10831	<	58.6	<	10895	<	60.1	<	10782
1,3-Dichlorobenzene	<	66.4	<	12456	<	67.4	<	12529	<	69.1	<	12399
1,4-Dichlorobenzene	<	69.3	<	12998	<	70.4	<	13074	<	72.1	<	12938
3,3'-Dichlorobenzidine	<	375	<	70404	<	381	<	70818	<	391	<	70081
2,4-Dichlorophenol	<	83.7	<	15706	<	85.0	<	15798	<	87.2	<	15633
Diethyl phthalate	<	80.8	<	15164	<	82.1	<	15253	<	84.1	<	15094
2,4-Dimethylphenol	<	283	<	53074	<	287	<	53386	<	295	<	52830
Dimethyl phthalate	<	46.2	<	8665	<	46.9	<	8716	<	48.1	<	8625
4,6-Dinitro-2-methylphenol	<	404	<	75820	<	410	<	76265	<	421	<	75472
2,4-Dinitrophenol	<	837	<	157056	<	850	<	157978	<	872	<	156334
2,4-Dinitrotoluene	<	89.5	<	16789	<	90.9	<	16887	<	93.2	<	16712
2,6-Dinitrotoluene	<	75.0	<	14081	<	76.2	<	14164	<	78.1	<	14016
Di-n-octyl phthalate	<	104	<	19497	<	106	<	19611	<	108	<	19407
Fluoranthene	<	49.1	<	9207	<	49.8	<	9261	<	51.1	<	9164
Fluorene	<	57.7	<	10831	<	58.6	<	10895	<	60.1	<	10782
Hexachlorobenzene	<	60.6	<	11373	<	61.6	<	11440	<	63.1	<	11321
Hexachlorobutadiene	<	83.7	<	15706	<	85.0	<	15798	<	87.2	<	15633
Hexachlorocyclopentadiene	<	664	<	124561	<	674	<	125293	<	691	<	123989
Hexachloroethane	<	110	<	20580	<	111	<	20701	<	114	<	20485
Indeno(1,2,3-cd)pyrene	<	101	<	18955	<	103	<	19066	<	105	<	18868
Isophorone	<	51.9	<	9748	<	52.8	<	9806	<	54.1	<	9704
2-Methylnaphthalene	<	54.8	<	10290	<	55.7	<	10350	<	57.1	<	10243
2-Methylphenol	<	176	<	33036	<	179	<	33230	<	183	<	32884
Naphthalene		3463		649886		3811		708176		3005		539081
2-Nitroaniline	<	63.5	<	11915	<	64.5	<	11985	<	66.1	<	11860
3-Nitroaniline	<	219	<	41159	<	223	<	41401	<	228	<	40970
4-Nitroaniline	<	167	<	31411	<	170	<	31596	<	174	<	31267
Nitrobenzene	<	54.8	<	10290	<	55.7	<	10350	<	57.1	<	10243
2-Nitrophenol	<	136	<	25454	<	138	<	25603	<	141	<	25337
4-Nitrophenol	<	234	<	43867	<	237	<	44125	<	243	<	43666
N-Nitrosodiphenylamine	<	57.7	<	10831	<	58.6	<	10895	<	60.1	<	10782
N-Nitrosodi-n-propylamine	<	60.6	<	11373	<	61.6	<	11440	<	63.1	<	11321
Pentachlorophenol	<	1472	<	276202	<	1495	<	277823	<	1533	<	274933
Phenanthrene	<	49.1	<	9207	<	49.8	<	9261	<	51.1	<	9164
Phenol	<	80.8	<	15164	<	82.1	<	15253	<	84.1	<	15094
Pyrene	<	51.9	<	9748	<	52.8	<	9806	<	54.1	<	9704
1,2,4-Trichlorobenzene	<	60.6	<	11373	<	61.6	<	11440	<	63.1	<	11321
2,4,5-Trichlorophenol	<	127	<	23829	<	129	<	23969	<	132	<	23720
2,4,6-Trichlorophenol	<	89.5	<	16789	<	90.9	<	16887	<	93.2	<	16712

Note: "<" numbers are MDL values

ORP-51444, Rev. 0
Table SV-3. Summary TCO Semi-Vost Results

3/9/2005

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Note: "<" numbers are MDL values

ORP-51444, Rev. 0
Table SV-4. Summary Carbon Bed Semi-Vost Results

3/9/2005

Compound		Run 1		Run 2		Run 3	
		Dilution Factor 20		Dilution Factor 100		Dilution Factor 250	
		Conc	Emission Rate	Conc	Emission Rate	Conc	Emission Rate
		ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min
Acenaphthene	<	3.83	<	1.58	<	0.339	<
Acenaphthylene	<	3.65	<	1.49	<	0.319	<
Anthracene	<	3.65	<	1.49	<	0.319	<
Benzo(a)anthracene	<	4.74	<	1.95	<	0.418	<
Benzo(b)fluoranthene	<	9.11	<	3.81	<	0.817	<
Benzo(k)fluoranthene	<	10.9	<	4.46	<	0.956	<
Benzo(ghi)perylene	<	9.11	<	3.90	<	0.837	<
Benzo(a)pyrene	<	5.01	<	2.04	<	0.438	<
bis(2-Chloroethoxy)methane	<	4.10	<	1.67	<	0.359	<
bis(2-Chloroethyl) ether	<	4.56	<	1.86	<	0.398	<
bis(2-Chloroisopropyl) ether	<	5.47	<	2.23	<	0.478	<
bis(2-Ethylhexyl) phthalate	<	31.9	<	13.0	<	2.789	<
4-Bromophenyl phenyl ether	<	3.65	<	1.49	<	0.319	<
Butyl benzyl phthalate	<	5.92	<	2.41	<	0.518	<
4-Chloroaniline	<	22.8	<	9.28	<	1.99	<
4-Chloro-3-methylphenol	<	9.11	<	3.81	<	0.817	<
2-Chloronaphthalene	<	3.46	<	1.39	<	0.299	<
2-Chlorophenol	<	4.74	<	1.95	<	0.418	<
4-Chlorophenyl phenyl ether	<	5.01	<	2.04	<	0.438	<
Chrysene	<	4.56	<	1.86	<	0.398	<
Dibenz(a,h)anthracene	<	8.38	<	3.44	<	0.737	<
Dibenzofuran	<	4.74	<	1.95	<	0.418	<
Di-n-butyl phthalate	<	27.3	<	11.1	<	2.39	<
1,2-Dichlorobenzene	<	4.56	<	1.86	<	0.398	<
1,3-Dichlorobenzene	<	5.29	<	2.14	<	0.458	<
1,4-Dichlorobenzene	<	5.47	<	2.23	<	0.478	<
3,3'-Dichlorobenzidine	<	29.2	<	12.1	<	2.59	<
2,4-Dichlorophenol	<	6.56	<	2.69	<	0.578	<
Diethyl phthalate	<	6.38	<	2.60	<	0.558	<
2,4-Dimethylphenol	<	21.9	<	9.10	<	1.99	<
Dimethyl phthalate	<	3.65	<	1.49	<	0.319	<
4,6-Dinitro-2-methylphenol	<	31.9	<	13.0	<	2.79	<
2,4-Dinitrophenol	<	65.6	<	26.9	<	5.78	<
2,4-Dinitrotoluene	<	7.11	<	2.88	<	0.617	<
2,6-Dinitrotoluene	<	5.92	<	2.41	<	0.518	<
Di-n-octyl phthalate	<	8.20	<	3.34	<	0.717	<
Fluoranthene	<	3.83	<	1.58	<	0.339	<
Fluorene	<	4.56	<	1.86	<	0.398	<
Hexachlorobenzene	<	4.74	<	1.95	<	0.418	<
Hexachlorobutadiene	<	6.56	<	2.69	<	0.578	<
Hexachlorocyclopentadiene	<	52.9	<	21.4	<	4.58	<
Hexachloroethane	<	8.66	<	3.53	<	0.757	<
Indeno(1,2,3-cd)pyrene	<	8.02	<	3.25	<	0.697	<
Isophorone	<	4.10	<	1.67	<	0.359	<
2-Methylnaphthalene	<	4.37	<	1.76	<	0.378	<
2-Methylphenol	<	13.7	<	5.66	<	1.20	<
Naphthalene		100	17843	37.1	6616	5.58	1002
2-Nitroaniline	<	5.01	<	2.04	<	0.438	<
3-Nitroaniline	<	17.3	<	7.06	<	1.49	<
4-Nitroaniline	<	12.8	<	5.39	<	1.20	<
Nitrobenzene	<	4.37	<	1.76	<	0.418	75.2
2-Nitrophenol	<	10.9	<	4.36	<	0.936	<
4-Nitrophenol	<	18.2	<	7.52	<	1.59	<
N-Nitrosodiphenylamine	<	4.56	<	1.86	<	0.398	<
N-Nitrosodi-n-propylamine	<	4.74	<	1.95	<	0.418	<
Pentachlorophenol	<	118	<	47.4	<	9.96	<
Phenanthrene	<	3.83	<	1.58	<	0.339	<
Phenol	<	6.38	<	2.60	<	0.558	<
Pyrene	<	4.10	<	1.67	<	0.359	<
1,2,4-Trichlorobenzene	<	4.74	<	1.95	<	0.418	<
2,4,5-Trichlorophenol	<	10.0	<	4.09	<	0.876	<
2,4,6-Trichlorophenol	<	7.11	<	2.88	<	0.617	<

Note: "<" numbers are MDL values

ORP-51444, Rev. 0
Table SV-5. Summary Melter Semi-Vost Results

3/22/2005 (Corrected 10/13/05)										
Compound	Run 4				Run 5				Run 6 (1/2 Dioxin - 1/2 SV)	
	Dilution Factor 1000				Dilution Factor 100				Dilution Factor 1	
	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min
Acenaphthene	< 47.3	< 9684	< 4.66	< 965	< 0.456	< 95				
Acenaphthylene	< 44.5	< 9114	< 4.38	< 908	< 0.429	< 90				
Anthracene	< 44.5	< 9114	< 4.38	< 908	< 0.429	< 90				
Benzo(a)anthracene	< 58.4	< 11962	< 5.75	< 1192	< 0.563	< 118				
Benzo(b)fluoranthene	< 114	< 23355	< 11.2	< 2327	< 1.10	< 230				
Benzo(k)fluoranthene	< 133	< 27343	< 13.1	< 2725	< 1.29	< 269				
Benzo(ghi)perylene	< 117	< 23925	< 11.5	< 2384	< 1.13	< 235				
Benzo(a)pyrene	< 61.2	< 12532	< 6.03	< 1249	< 0.590	< 123				
bis(2-Chloroethoxy)methane	< 50.0	< 10253	< 4.93	< 1022	< 0.483	< 101				
bis(2-Chloroethyl) ether	< 55.6	< 11393	< 5.48	< 1135	< 0.537	< 112				
bis(2-Chloroisopropyl) ether	< 66.7	< 13671	< 6.57	< 1362	< 0.644	< 134				
bis(2-Ethylhexyl) phthalate	< 389	< 79749	< 38.3	< 7947	< 3.76	< 785				
4-Bromophenyl phenyl ether	< 44.5	< 9114	< 4.38	< 908	< 0.429	< 90				
Butyl benzyl phthalate	< 72.3	< 14811	< 7.12	< 1476	< 0.698	< 146				
4-Chloroaniline	< 278	< 56964	< 27.4	< 5676	< 2.68	< 560				
4-Chloro-3-methylphenol	< 114	< 23355	< 11.2	< 2327	< 1.10	< 230				
2-Chloronaphthalene	< 41.7	< 8545	< 4.11	< 851	< 0.402	< 84				
2-Chlorophenol	< 58.4	< 11962	< 5.75	< 1192	< 0.563	< 118				
4-Chlorophenyl phenyl ether	< 61.2	< 12532	< 6.03	< 1249	< 0.590	< 123				
Chrysene	< 55.6	< 11393	< 5.48	< 1135	< 0.537	< 112				
Dibenz(a,h)anthracene	< 103	< 21077	< 10.1	< 2100	< 0.993	< 207				
Dibenzofuran	< 58.4	< 11962	< 5.75	< 1192	< 0.563	< 118				
Di-n-butyl phthalate	< 333.6	< 68356	< 32.9	< 6812	< 3.22	< 672				
1,2-Dichlorobenzene	< 55.6	< 11393	< 5.48	< 1135	< 0.537	< 112				
1,3-Dichlorobenzene	< 63.9	< 13102	< 6.30	< 1306	< 0.617	< 129				
1,4-Dichlorobenzene	< 66.7	< 13671	< 6.57	< 1362	< 0.644	< 134				
3,3'-Dichlorobenzidine	< 361	< 74053	< 35.6	< 7379	< 3.49	< 728				
2,4-Dichlorophenol	< 80.6	< 16519	< 7.94	< 1646	< 0.778	< 163				
Diethyl phthalate	< 77.8	< 15950	< 7.67	< 1589	< 0.751	< 157				
2,4-Dimethylphenol	< 272.4	< 55824	< 26.8	< 5563	< 2.63	< 549				
Dimethyl phthalate	< 44.5	< 9114	< 4.38	< 908	< 0.429	< 90				
4,6-Dinitro-2-methylphenol	< 389	< 79749	< 38.3	< 7947	< 4.29	< 897				
2,4-Dinitrophenol	< 806	< 165195	< 79.4	< 16462	< 7.78	< 1625				
2,4-Dinitrotoluene	< 86.2	< 17659	< 8.49	< 1760	< 0.832	< 174				
2,6-Dinitrotoluene	< 72.3	< 14811	< 7.12	< 1476	< 0.698	< 146				
Di-n-octyl phthalate	< 100	< 20507	< 9.86	< 2044	< 1.29	< 269				
Fluoranthene	< 47.3	< 9684	< 4.66	< 965	< 0.456	< 95				
Fluorene	< 55.6	< 11393	< 5.48	< 1135	< 0.537	< 112				
Hexachlorobenzene	< 58.4	< 11962	< 5.75	< 1192	< 0.563	< 118				
Hexachlorobutadiene	< 80.6	< 16519	< 7.94	< 1646	< 0.778	< 163				
Hexachlorocyclopentadiene	< 639	< 131017	< 63.0	< 13056	< 6.17	< 1289				
Hexachloroethane	< 106	< 21646	< 10.4	< 2157	< 1.02	< 213				
Indeno(1,2,3-cd)pyrene	< 97.3	< 19937	< 9.59	< 1987	< 0.939	< 196				
Isophorone	< 50.0	< 10253	< 4.93	< 1022	< 0.483	< 101				
2-Methylnaphthalene	< 52.8	< 10823	< 5.20	< 1079	< 0.510	< 106				
2-Methylphenol	< 170	< 34748	< 16.7	< 3463	< 1.64	< 342				
Naphthalene	4448	911420	4656	965003	3756	784509				
2-Nitroaniline	< 61.2	< 12532	< 6.03	< 1249	< 0.590	< 123				
3-Nitroaniline	< 211	< 43292	< 20.8	< 4314	< 2.04	< 426				
4-Nitroaniline	< 161	< 33039	< 15.9	< 3292	< 1.56	< 325				
Nitrobenzene	< 52.8	< 10823	< 5.20	< 1079	< 6.44	< 1345				
2-Nitrophenol	< 131	< 26773	< 12.9	< 2668	< 9.39	< 1961				
4-Nitrophenol	< 225	< 46141	< 22.2	< 4598	< 4.83	< 1009				
N-Nitrosodiphenylamine	< 55.6	< 11393	< 5.48	< 1135	< 0.537	< 112				
N-Nitrosodi-n-propylamine	< 58.4	< 11962	< 5.75	< 1192	< 0.563	< 118				
Pentachlorophenol	< 1418	< 290515	< 140	< 28950	< 13.7	< 2858				
Phenanthrene	< 47.3	< 9684	< 4.66	< 965	< 0.456	< 95				
Phenol	< 77.8	< 15950	< 7.67	< 1589	< 1.66	< 347				
Pyrene	< 50.0	< 10253	< 4.93	< 1022	< 0.483	< 101				
1,2,4-Trichlorobenzene	< 58.4	< 11962	< 5.75	< 1192	< 0.563	< 118				
2,4,5-Trichlorophenol	< 122	< 25064	< 12.1	< 2498	< 1.18	< 247				
2,4,6-Trichlorophenol	< 86.2	< 17659	< 8.49	< 1760	< 0.832	< 174				

Note: "<" numbers are MDL values

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Table SV-6. Summary HEPA Semi-Vost Results

3/22/2005

	Run 4				Run 5				Run 6		
	Dilution Factor 1000				Dilution Factor 2000				Dilution Factor 2000		
	Conc		Emission Rate	Conc		Emission Rate	Conc		Emission Rate		
Compound	ug/dscf		ug/min	ug/dscf		ug/min	ug/dscf		ug/min		
Acenaphthene	< 44.7	<	9019	< 90.9	<	18194	< 93.4	<	18088		
Acenaphthylene	< 42.0	<	8488	< 85.6	<	17123	< 87.9	<	17024		
Anthracene	< 42.0	<	8488	< 85.6	<	17123	< 87.9	<	17024		
Benzo(a)anthracene	< 55.2	<	11141	< 112	<	22475	< 115	<	22344		
Benzo(b)fluoranthene	< 108	<	21751	< 219	<	43879	< 225	<	43624		
Benzo(k)fluoranthene	< 126	<	25465	< 257	<	51370	< 264	<	51072		
Benzo(ghi)perylene	< 110	<	22282	< 225	<	44949	< 231	<	44688		
Benzo(a)pyrene	< 57.8	<	11672	< 118	<	23545	< 121	<	23408		
bis(2-Chloroethoxy)methane	< 47.3	<	9549	< 96.3	<	19264	< 98.9	<	19152		
bis(2-Chloroethyl) ether	< 52.6	<	10610	< 107	<	21404	< 110	<	21280		
bis(2-Chloroisopropyl) ether	< 63.1	<	12733	< 128	<	25685	< 132	<	25536		
bis(2-Ethylhexyl) phthalate	< 368	<	74273	< 749	<	149830	< 769	<	148960		
4-Bromophenyl phenyl ether	< 42.0	<	8488	< 85.6	<	17123	< 87.9	<	17024		
Butyl benzyl phthalate	< 68.3	<	13794	< 139	<	27826	< 143	<	27664		
4-Chloroaniline	< 263	<	53052	< 535	<	107022	< 550	<	106400		
4-Chloro-3-methylphenol	< 108	<	21751	< 219	<	43879	< 225	<	43624		
2-Chloronaphthalene	< 39.4	<	7958	< 80.2	<	16053	< 82.4	<	15960		
2-Chlorophenol	< 55.2	<	11141	< 112	<	22475	< 115	<	22344		
4-Chlorophenyl phenyl ether	< 57.8	<	11672	< 118	<	23545	< 121	<	23408		
Chrysene	< 52.6	<	10610	< 107	<	21404	< 110	<	21280		
Dibenz(a,h)anthracene	< 97.2	<	19629	< 1979	<	395980	< 203	<	39368		
Dibenzofuran	< 55.2	<	11141	< 1123	<	224745	< 115	<	22344		
Di-n-butyl phthalate	< 315	<	63663	< 642	<	128426	< 660	<	127680		
1,2-Dichlorobenzene	< 52.6	<	10610	< 107	<	21404	< 110	<	21280		
1,3-Dichlorobenzene	< 60.4	<	12202	< 123	<	24615	< 126	<	24472		
1,4-Dichlorobenzene	< 63.1	<	12733	< 128	<	25685	< 132	<	25536		
3,3'-Dichlorobenzidine	< 342	<	68968	< 695	<	139128	< 715	<	138320		
2,4-Dichlorophenol	< 76.2	<	15385	< 155	<	31036	< 159	<	30856		
Diethyl phthalate	< 73.6	<	14855	< 150	<	29966	< 154	<	29792		
2,4-Dimethylphenol	< 258	<	51991	< 535	<	107022	< 550	<	106400		
Dimethyl phthalate	< 42.0	<	8488	< 85.6	<	17123	< 87.9	<	17024		
4,6-Dinitro-2-methylphenol	< 368	<	74273	< 749	<	149830	< 769	<	148960		
2,4-Dinitrophenol	< 762	<	153852	< 1551	<	310362	< 1594	<	308561		
2,4-Dinitrotoluene	< 81.5	<	16446	< 166	<	33177	< 170	<	32984		
2,6-Dinitrotoluene	< 68.3	<	13794	< 139	<	27826	< 143	<	27664		
Di-n-octyl phthalate	< 94.6	<	19099	< 193	<	38528	< 198	<	38304		
Fluoranthene	< 44.7	<	9019	< 90.9	<	18194	< 93.4	<	18088		
Fluorene	< 52.6	<	10610	< 107	<	21404	< 110	<	21280		
Hexachlorobenzene	< 55.2	<	11141	< 1123	<	224745	< 115	<	22344		
Hexachlorobutadiene	< 76.2	<	15385	< 1551	<	310362	< 159	<	30856		
Hexachlorocyclopentadiene	< 604	<	122020	< 1230	<	246150	< 1264	<	244721		
Hexachloroethane	< 99.9	<	20160	< 203	<	40668	< 209	<	40432		
Indeno(1,2,3-cd)pyrene	< 92.0	<	18568	< 187	<	37458	< 192	<	37240		
Isophorone	< 47.3	<	9549	< 96.3	<	19264	< 98.9	<	19152		
2-Methylnaphthalene	< 49.9	<	10080	< 102	<	20334	< 104	<	20216		
2-Methylphenol	< 160	<	32362	< 321	<	64213	< 330	<	63840		
Naphthalene	76.2		15385	1444		288958	1621		313881		
2-Nitroaniline	< 57.8	<	11672	< 118	<	23545	< 121	<	23408		
3-Nitroaniline	< 199.7	<	40320	< 401	<	80266	< 412	<	79800		
4-Nitroaniline	< 152	<	30770	< 321	<	64213	< 330	<	63840		
Nitrobenzene	< 49.9	<	10080	< 102	<	20334	< 104	<	20216		
2-Nitrophenol	< 124	<	24935	< 251	<	50300	< 258	<	50008		
4-Nitrophenol	< 213	<	42972	< 428	<	85617	< 440	<	85120		
N-Nitrosodiphenylamine	< 52.6	<	10610	< 107	<	21404	< 110	<	21280		
N-Nitrosodi-n-propylamine	< 55.2	<	11141	< 112	<	22475	< 115	<	22344		
Pentachlorophenol	< 1340	<	270567	< 2675	<	535108	< 2748	<	532001		
Phenanthrene	< 44.7	<	9019	< 90.9	<	18194	< 93.4	<	18088		
Phenol	< 73.6	<	14855	< 150	<	29966	< 154	<	29792		
Pyrene	< 47.3	<	9549	< 96.3	<	19264	< 98.9	<	19152		
1,2,4-Trichlorobenzene	< 55.2	<	11141	< 112	<	22475	< 115	<	22344		
2,4,5-Trichlorophenol	< 116	<	23343	< 235	<	47089	< 242	<	46816		
2,4,6-Trichlorophenol	< 81.5	<	16446	< 166	<	33177	< 170	<	32984		

Note: "<" numbers are MDL values

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Table SV-7. Summary TCO Semi-Vost Results

3/22/2005

(Corrected 10/13/05)

Compound	Run 4				Run 5				Run 6 (1/2 Dioxin - 1/2 SV)			
	DF 1*		DF 100**		Dilution Factor 5		Dilution Factor 5		Dilution Factor 5		Dilution Factor 5	
	Conc		Emission Rate		Conc		Emission Rate		Conc		Emission Rate	
	ug/dscf		ug/min		ug/dscf		ug/min		ug/dscf		ug/min	
Acenaphthene	< **	1.329	< **	318	<	0.066	<	15.96	<	0.068	<	15.87
Acenaphthylene	< **	1.251	< **	299	<	0.062	<	15.02	<	0.064	<	14.93
Anthracene	< *	0.013	< *	2.99	<	0.062	<	15.02	<	0.064	<	14.93
Benzo(a)anthracene	< *	0.016	< *	3.92	<	0.078	<	18.78	<	0.080	<	18.67
Benzo(b)fluoranthene	< **	3.204	< **	766	<	0.156	<	37.55	<	0.160	<	37.34
Benzo(k)fluoranthene	< **	3.752	< **	897	<	0.187	<	45.06	<	0.192	<	44.80
Benzo(ghi)perylene	< **	3.283	< **	785	<	0.164	<	39.43	<	0.168	<	39.20
Benzo(a)pyrene	< **	1.719	< **	411	<	0.086	<	20.65	<	0.088	<	20.53
bis(2-Chloroethoxy)methane	< *	0.014	< *	3.36	<	0.070	<	16.90	<	0.072	<	16.80
bis(2-Chloroethyl) ether	< *	0.016	< *	3.74	<	0.078	<	18.78	<	0.080	<	18.67
bis(2-Chloroisopropyl) ether	< *	0.019	< *	4.49	<	0.094	<	22.53	<	0.096	<	22.40
bis(2-Ethylhexyl) phthalate	*	1.17	*	280	<	0.546	<	131	<	0.561	<	131
4-Bromophenyl phenyl ether	< *	0.013	< *	2.99	<	0.062	<	15.02	<	0.064	<	14.93
Butyl benzyl phthalate	*	0.125	*	29.9	<	0.101	<	24.41	<	0.104	<	24.27
4-Chloroaniline	< *	0.078	< *	18.7	<	0.390	<	93.88	<	0.400	<	93.34
4-Chloro-3-methylphenol	< *	0.032	< *	7.66	<	0.156	<	37.55	<	0.160	<	37.34
2-Chloronaphthalene	< **	1.17	< **	280	<	0.059	<	14.08	<	0.060	<	14.00
2-Chlorophenol	< *	0.016	< *	3.92	<	0.078	<	18.78	<	0.080	<	18.67
4-Chlorophenyl phenyl ether	< **	1.72	< **	411	<	0.086	<	20.65	<	0.088	<	20.53
Chrysene	< *	0.016	< *	3.74	<	0.078	<	18.78	<	0.080	<	18.67
Dibenz(a,h)anthracene	< **	2.89	< **	691	<	0.140	<	33.80	<	0.144	<	33.60
Dibenzofuran	< **	1.64	< **	392	<	0.078	<	18.78	<	0.080	<	18.67
Di-n-butyl phthalate	< *	0.094	< *	22.4	<	0.468	<	113	<	0.481	<	112
1,2-Dichlorobenzene	< *	0.016	< *	3.74	<	0.078	<	18.78	<	0.080	<	18.67
1,3-Dichlorobenzene	< *	0.018	< *	4.30	<	0.094	<	22.53	<	0.096	<	22.40
1,4-Dichlorobenzene	< *	0.019	< *	4.49	<	0.094	<	22.53	<	0.096	<	22.40
3,3'-Dichlorobenzidine	< *	0.102	< *	24.3	<	0.507	<	122	<	0.521	<	121
2,4-Dichlorophenol	< *	0.023	< *	5.42	<	0.109	<	26.29	<	0.112	<	26.14
Diethyl phthalate	< **	2.19	< **	523	<	0.109	<	26.29	<	0.112	<	26.14
2,4-Dimethylphenol	< *	0.077	< *	18.3	<	0.382	<	92.00	<	0.392	<	91.47
Dimethyl phthalate	< **	1.25	< **	299	<	0.062	<	15.02	<	0.064	<	14.93
4,6-Dinitro-2-methylphenol	*	0.133	*	31.8		0.593		143		1.20		280
2,4-Dinitrophenol	< **	22.7	< **	5420	<	1.09	<	263	<	1.12	<	261
2,4-Dinitrotoluene	< **	2.42	< **	579	<	0.125	<	30.04	<	0.128	<	29.87
2,6-Dinitrotoluene	< **	2.03	< **	486	<	0.101	<	24.41	<	0.104	<	24.27
Di-n-octyl phthalate	< **	2.81	< **	673	<	0.140	<	33.80	<	0.144	<	33.60
Fluoranthene	< *	0.013	< *	3.18	<	0.066	<	15.96	<	0.068	<	15.87
Fluorene	< **	1.56	< **	374	<	0.078	<	18.78	<	0.080	<	18.67
Hexachlorobenzene	< *	0.016	< *	3.92	<	0.078	<	18.78	<	0.080	<	18.67
Hexachlorobutadiene	< *	0.023	< *	5.42	<	0.109	<	26.29	<	0.112	<	26.14
Hexachlorocyclopentadiene	< **	18.0	< **	4299	<	0.937	<	225	<	0.961	<	224
Hexachloroethane	< *	0.030	< *	7.10	<	0.148	<	35.67	<	0.152	<	35.47
Indeno(1,2,3-cd)pyrene	< **	2.74	< **	654	<	0.140	<	33.80	<	0.144	<	33.60
Isophorone	< *	0.014	< *	3.36	<	0.070	<	16.90	<	0.072	<	16.80
2-Methylnaphthalene	< *	0.015	< *	3.55	<	0.074	<	17.84	<	0.076	<	17.73
2-Methylphenol	< *	0.048	< *	11.4	<	0.234	<	56.33		0.961		224
Naphthalene	*	0.016	*	3.74	<	0.070	<	16.90	<	0.072	<	16.80
2-Nitroaniline	< **	1.72	< **	411	<	0.086	<	20.65	<	0.088	<	20.53
3-Nitroaniline	< **	5.94	< **	1420	<	0.297	<	71.35	<	0.304	<	70.94
4-Nitroaniline	< **	4.53	< **	1084	<	0.226	<	54.45	<	0.232	<	54.14
Nitrobenzene	*	0.086	*	20.6	<	0.074	<	17.84	<	0.076	<	17.73
2-Nitrophenol	*	0.037	*	8.78		0.312		75.10	<	0.192	<	44.80
4-Nitrophenol	< **	6.33	< **	1514	<	0.312	<	75.10	<	0.320	<	74.67
N-Nitrosodiphenylamine	< *	0.016	< *	3.74	<	0.078	<	18.78	<	0.080	<	18.67
N-Nitrosodi-n-propylamine	< *	0.016	< *	3.92	<	0.078	<	18.78	<	0.080	<	18.67
Pentachlorophenol	< *	0.399	< *	95.3	<	2.029	<	488	<	2.082	<	485
Phenanthrene	< *	0.013	< *	3.18	<	0.066	<	15.96	<	0.068	<	15.87
Phenol	< *	0.022	< *	5.23		0.250		60.08		0.232		54.14
Pyrene	< *	0.014	< *	3.36	<	0.070	<	16.90	<	0.072	<	16.80
1,2,4-Trichlorobenzene	< *	0.016	< *	3.92	<	0.078	<	18.78	<	0.080	<	18.67
2,4,5-Trichlorophenol	< **	3.44	< **	822	<	0.172	<	41.31	<	0.176	<	41.07
2,4,6-Trichlorophenol	< **	2.42	< **	579	<	0.125	<	30.04	<	0.128	<	29.87

Note: "<" numbers are MDL values

< ** = Dilution Factor 100

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Table SV-8. Summary Carbon Bed Semi-Vost Results

3/22/2005										
(Corrected 10/13/05)										
Compound	Run 4				Run 5				Run 6	
	Dilution Factor 5000				Dilution Factor 4000				DF 40	DF 5000 *
	Conc	Emission Rate	Conc	Emission Rate	Conc	Emission Rate	Conc	Emission Rate	Conc	Emission Rate
	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min
Acenaphthene	<	101	<	20001	<	80.7	<	16022	<	0.852
Acenaphthylene	<	95.2	<	18825	<	76.0	<	15080	<	0.802
Anthracene	<	95.2	<	18825	<	76.0	<	15080	<	0.802
Benzo(a)anthracene	<	119	<	23531	<	100	<	19792	<	1.05
Benzo(b)fluoranthene	<	238	<	47062	<	190	<	37699	< *	251
Benzo(k)fluoranthene	<	286	<	56474	<	226	<	44768	< *	301
Benzo(ghi)perylene	<	250	<	49415	<	202	<	40056	< *	263
Benzo(a)pyrene	<	131	<	25884	<	104	<	20735	< *	138
bis(2-Chloroethoxy)methane	<	107	<	21178	<	85.5	<	16965	<	0.902
bis(2-Chloroethyl) ether	<	119	<	23531	<	95.0	<	18850	<	1.00
bis(2-Chloroisopropyl) ether	<	143	<	28237	<	114	<	22620	<	1.20
bis(2-Ethylhexyl) phthalate	<	83.3	<	16472	<	665	<	131948	<	7.02
4-Bromophenyl phenyl ether	<	95.2	<	18825	<	76.0	<	15080	<	0.802
Butyl benzyl phthalate	<	155	<	30590	<	119	<	23562	<	1.25
4-Chloroaniline	<	595	<	117655	<	475	<	94248	<	5.01
4-Chloro-3-methylphenol	<	238	<	47062	<	190	<	37699	<	2.01
2-Chloronaphthalene	<	89	<	17648	<	71.2	<	14137	<	0.752
2-Chlorophenol	<	119	<	23531	<	100	<	19792	<	1.05
4-Chlorophenyl phenyl ether	<	131	<	25884	<	104	<	20735	<	1.10
Chrysene	<	119	<	23531	<	95.0	<	18850	<	1.00
Dibenz(a,h)anthracene	<	214	<	42356	<	178	<	35343	< *	226
Dibenzofuran	<	119	<	23531	<	100	<	19792	<	1.05
Di-n-butyl phthalate	<	714	<	141186	<	57.0	<	11310	<	6.02
1,2-Dichlorobenzene	<	119	<	23531	<	95.0	<	18850	<	1.00
1,3-Dichlorobenzene	<	143	<	28237	<	109	<	21677	<	1.15
1,4-Dichlorobenzene	<	143	<	28237	<	114	<	22620	<	1.20
3,3'-Dichlorobenzidine	<	773	<	152952	<	617	<	122523	<	6.52
2,4-Dichlorophenol	<	167	<	32943	<	142	<	28275	<	1.50
Diethyl phthalate	<	167	<	32943	<	131	<	25918	<	1.38
2,4-Dimethylphenol	<	583	<	115302	<	463	<	91892	<	4.89
Dimethyl phthalate	<	95.2	<	18825	<	76.0	<	15080	<	0.802
4,6-Dinitro-2-methylphenol	<	833	<	164717	<	665	<	131948	<	7.02
2,4-Dinitrophenol	<	1666	<	329434	<	1425	<	282745	<	15.0
2,4-Dinitrotoluene	<	190	<	37650	<	142	<	28275	<	1.50
2,6-Dinitrotoluene	<	155	<	30590	<	119	<	23562	<	1.25
Di-n-octyl phthalate	<	214	<	42356	<	166	<	32987	< *	226
Fluoranthene	<	101	<	20001	<	80.7	<	16022	<	0.852
Fluorene	<	119	<	23531	<	95.0	<	18850	<	1.00
Hexachlorobenzene	<	119	<	23531	<	100	<	19792	<	1.05
Hexachlorobutadiene	<	167	<	32943	<	142	<	28275	<	1.50
Hexachlorocyclopentadiene	<	1428	<	282372	<	1092	<	216771	<	11.5
Hexachloroethane	<	226	<	44709	<	178	<	35343	<	1.88
Indeno(1,2,3-cd)pyrene	<	214	<	42356	<	166	<	32987	< *	226
Isophorone	<	107	<	21178	<	85.5	<	16965	<	0.902
2-Methylnaphthalene	<	113	<	22354	<	90.2	<	17907	<	0.953
2-Methylphenol	<	357	<	70593	<	285	<	56549	<	3.01
Naphthalene		155		30590	<	85.5	<	16965		76.5
2-Nitroaniline	<	131	<	25884	<	104	<	20735	<	1.10
3-Nitroaniline	<	452	<	89418	<	356	<	70686	<	3.76
4-Nitroaniline	<	345	<	68240	<	273	<	54193	<	2.88
Nitrobenzene	<	113	<	22354	<	90.2	<	17907		1.12
2-Nitrophenol	<	286	<	56474	<	226	<	44768	<	2.38
4-Nitrophenol	<	476	<	94124	<	380	<	75399	<	4.01
N-Nitrosodiphenylamine	<	119	<	23531	<	95.0	<	18850	<	1.00
N-Nitrosodi-n-propylamine	<	119	<	23531	<	997	<	197922	<	1.05
Pentachlorophenol	<	3093	<	611807	<	2375	<	471242	<	25.1
Phenanthrene	<	101	<	20001	<	80.7	<	16022	<	0.852
Phenol	<	167	<	32943	<	131	<	25918	<	1.38
Pyrene	<	107	<	21178	<	85.5	<	16965	<	0.902
1,2,4-Trichlorobenzene	<	119	<	23531	<	100	<	19792	<	1.05
2,4,5-Trichlorophenol	<	262	<	51768	<	214	<	42412	<	2.26
2,4,6-Trichlorophenol	<	190	<	37650	<	142	<	28275	<	1.50

Note: "<" numbers are MDL values

< ** = Dilution Factor 5000

Appendix A.3

Dioxin/Furan

Table DF-1. Dioxin/Furan Results Summary for Melter

Compound	Run 1			Run 2			Run 3			Run 4		
	Concentration pg/dscf	Emission Rate pg/min	Concentration pg/dscf	Emission Rate pg/min	Concentration pg/dscf	Emission Rate pg/min	Concentration pg/dscf	Emission Rate pg/min	Concentration pg/dscf	Emission Rate pg/min	Concentration pg/dscf	Emission Rate pg/min
2,3,7,8-TCDD	0.1500	26.7	<	0.1033	<	17.4	0.0711	15.1	0.1449	30.3		
1,2,3,7,8-PeCDD	0.1338	23.8		0.1321		22.3	0.0837	17.7	0.2093	43.7		
1,2,3,4,7,8-HxCDD	0.0994	17.7		0.0552		9.31	0.0229	4.86	0.0832	17.4		
1,2,3,6,7,8-HxCDD	0.1193	21.2		0.1609		27.1	0.0424	8.99	0.1476	30.8		
1,2,3,7,8,9-HxCDD	0.1573	27.9	<	0.0312	<	5.26	0.0562	11.9	0.1234	25.8		
1,2,3,4,6,7,8-HpCDD	0.5062	89.9		0.7684		129	0.1720	36.4	0.4561	95.3		
OCDD	1.37	244		2.38		401	0.4586	97.1	1.21	252		
2,3,7,8-TCDF	0.6689	119		0.7204		121	0.1376	29.1	0.4024	84.1		
1,2,3,7,8-PeCDF	0.1790	31.8		0.2113		35.6	0.0608	12.9	0.1744	36.4		
2,3,4,7,8-PeCDF	0.3073	54.6		0.4082		68.8	0.0871	18.5	0.1556	32.5		
1,2,3,4,7,8-HxCDF	0.1989	35.3		0.2041		34.4	0.1146	24.3	0.1690	35.3		
1,2,3,6,7,8-HxCDF	0.0958	17.0		0.1417		23.9	0.0676	14.3	0.1288	26.9		
2,3,4,6,7,8-HxCDF	0.0705	12.5		0.0768		12.9	0.0378	8.01	0.0671	14.0		
1,2,3,7,8,9-HxCDF	0.0121	<	<	0.0312	<	5.26	<	<	0.0912	19.1		
1,2,3,4,6,7,8-HpCDF	0.2892	51.4		0.2401		40.5	0.2064	43.7	0.3488	72.8		
1,2,3,4,7,8,9-HpCDF	0.1681	29.9	<	0.0528	<	8.90	0.0447	9.47	0.0939	19.6		
OCDF	0.5062	89.9		0.2881		48.6	0.2522	53.4	0.3488	72.8		

Table DF-2. Dioxin/Furan Results Summary for TCO

Compound	Run 1			Run 2			Run 3			Run 4			Run 5			Run 6		
	Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min	
2,3,7,8-TCDD	0.0230	5.25	<	0.0212	4.96	<	0.0555	13.0	<	0.0295	7.09	<	0.0227	5.41	<	0.0128	2.99	<
1,2,3,7,8-PeCDD	<	3.32	<	0.0118	2.76	<	0.0236	5.52	<	0.0079	1.90	<	0.0347	8.26	<	0.0120	2.80	<
1,2,3,4,7,8-HxCDD	<	3.04	<	0.0104	2.43	<	0.0224	5.25	<	0.0105	2.53	<	0.0610	14.5	<	0.0192	4.48	<
1,2,3,6,7,8-HxCDD	<	3.04	<	0.0200	4.69	<	0.0224	5.25	<	0.0104	2.50	<	0.0526	12.5	<	0.0112	2.61	<
1,2,3,7,8,9-HxCDD	0.0279	6.36	<	0.0097	2.26	<	0.0212	4.97	<	0.0099	2.38	<	0.0885	21.1	<	0.0224	5.23	<
1,2,3,4,6,7,8-HpCDD	0.1200	27.4		0.1119	26.2	<	0.0425	9.94	<	0.0389	9.36		0.3825	91.1		0.0625	14.6	
OCDD	0.4365	99.5		0.6124	143		0.4250	99.4		0.1888	45.4		0.5977	142		0.3925	91.5	
2,3,7,8-TCDF	0.1455	33.2		0.0365	8.54		0.1653	38.7		0.0861	20.7		0.3706	88.3		0.0416	9.71	
1,2,3,7,8-PeCDF	0.0812	18.5		0.0342	7.99		0.0614	14.4		0.0283	6.81		0.5857	140		0.0352	8.21	
2,3,4,7,8-PeCDF	0.0582	13.3	<	0.0081	1.90	<	0.0720	16.8		0.0260	6.24		0.4303	103		0.0232	5.47	
1,2,3,4,7,8-HxCDF	0.2182	49.7		0.0471	11.0		0.1771	41.4		0.0802	19.3		2.51	598		0.0312	7.28	
1,2,3,6,7,8-HxCDF	0.1176	26.8		0.0212	4.96		0.0756	17.7		0.0366	8.80		1.05	251		0.0288	6.72	
2,3,4,6,7,8-HxCDF	0.0352	8.01	<	0.0094	2.20	<	0.0661	15.5	<	0.0077	1.84	<	0.4303	103		0.0232	5.44	
1,2,3,7,8,9-HxCDF	0.0546	12.4		0.0448	10.5	<	0.0260	6.07	<	0.0283	6.81		0.1315	31.3		0.0609	14.2	
1,2,3,4,6,7,8-HpCDF	0.3152	71.8		0.0966	22.6		0.3424	80.1		0.1038	25.0		3.59	854		0.1121	26.8	
1,2,3,4,7,8,9-HpCDF	0.1819	41.5		0.0389	9.10		0.1535	35.9		0.0271	6.53		1.43	342		0.0400	9.33	
OCDF	0.6062	138		0.2120	49.6		0.2361	55.2		0.1180	28.4		2.75	655		0.1682	39.2	

Table T-1. TEQ Results for Melter Run 1

<i>Compound</i>	<i>Sample Concentration Average (pg/dscf)</i>	<i>TE Factor</i>	<i>Toxic Equivalent (pg/dscf)</i>
2,3,7,8-TCDD	0.150	1	0.150
1,2,3,7,8-PeCDD	0.134	0.5	0.067
1,2,3,4,7,8-HxCDD	0.099	0.1	0.010
1,2,3,6,7,8-HxCDD	0.119	0.1	0.012
1,2,3,7,8,9-HxCDD	0.157	0.1	0.016
1,2,3,4,6,7,8-HpCDD	0.506	0.01	0.005
OCDD	1.374	0.001	0.001
2,3,7,8-TCDF	0.669	0.1	0.067
1,2,3,7,8-PeCDF	0.179	0.05	0.009
2,3,4,7,8-PeCDF	0.307	0.5	0.154
1,2,3,4,7,8-HxCDF	0.199	0.1	0.020
1,2,3,6,7,8-HxCDF	0.096	0.1	0.010
2,3,4,6,7,8-HxCDF	0.071	0.1	0.007
1,2,3,7,8,9-HxCDF	< 0.012	0.1	< 0.001
1,2,3,4,6,7,8-HpCDF	0.289	0.01	0.003
1,2,3,4,7,8,9-HpCDF	0.168	0.01	0.002
OCDF	0.506	0.001	0.001
Total Toxic Equivalent			0.533

Table T-2. TEQ Results for Melter Run 2

Compound		Sample Concentration Average (pg/dscf)	TE Factor		Toxic Equivalent (pg/dscf)
2,3,7,8-TCDD	<	0.103	1	<	0.103
1,2,3,7,8-PeCDD		0.132	0.5		0.066
1,2,3,4,7,8-HxCDD		0.055	0.1		0.006
1,2,3,6,7,8-HxCDD		0.161	0.1		0.016
1,2,3,7,8,9-HxCDD	<	0.031	0.1	<	0.003
1,2,3,4,6,7,8-HpCDD		0.768	0.01		0.008
OCDD		2.38	0.001		0.002
2,3,7,8-TCDF		0.720	0.1		0.072
1,2,3,7,8-PeCDF		0.211	0.05		0.011
2,3,4,7,8-PeCDF		0.408	0.5		0.204
1,2,3,4,7,8-HxCDF		0.204	0.1		0.020
1,2,3,6,7,8-HxCDF		0.142	0.1		0.014
2,3,4,6,7,8-HxCDF		0.077	0.1		0.008
1,2,3,7,8,9-HxCDF	<	0.031	0.1	<	0.003
1,2,3,4,6,7,8-HpCDF		0.240	0.01		0.002
1,2,3,4,7,8,9-HpCDF	<	0.053	0.01	<	0.001
OCDF		0.288	0.001		0.000
Total Toxic Equivalent					0.539

Table T-3. TEQ Results for Melter Run 3

Compound	Sample Concentration Average (pg/dscf)	TE Factor	Toxic Equivalent (pg/dscf)
2,3,7,8-TCDD	0.071	1	0.071
1,2,3,7,8-PeCDD	0.084	0.5	0.042
1,2,3,4,7,8-HxCDD	0.023	0.1	0.002
1,2,3,6,7,8-HxCDD	0.042	0.1	0.004
1,2,3,7,8,9-HxCDD	0.056	0.1	0.006
1,2,3,4,6,7,8-HpCDD	0.172	0.01	0.002
OCDD	0.46	0.001	0.000
2,3,7,8-TCDF	0.138	0.1	0.014
1,2,3,7,8-PeCDF	0.06	0.05	0.003
2,3,4,7,8-PeCDF	0.09	0.5	0.044
1,2,3,4,7,8-HxCDF	0.11	0.1	0.011
1,2,3,6,7,8-HxCDF	0.07	0.1	0.007
2,3,4,6,7,8-HxCDF	0.038	0.1	0.004
1,2,3,7,8,9-HxCDF	< 0.008	0.1	< 0.001
1,2,3,4,6,7,8-HpCDF	0.21	0.01	0.002
1,2,3,4,7,8,9-HpCDF	0.04	0.01	0.000
OCDF	0.25	0.001	0.000
Total Toxic Equivalent			0.213

Table T-4. TEQ Results for Melter Run 4

Compound	Sample Concentration Average (pg/dscf)	TE Factor	Toxic Equivalent (pg/dscf)
2,3,7,8-TCDD	0.145	1	0.145
1,2,3,7,8-PeCDD	0.209	0.5	0.105
1,2,3,4,7,8-HxCDD	0.083	0.1	0.008
1,2,3,6,7,8-HxCDD	0.148	0.1	0.015
1,2,3,7,8,9-HxCDD	0.123	0.1	0.012
1,2,3,4,6,7,8-HpCDD	0.456	0.01	0.005
OCDD	1.21	0.001	0.001
2,3,7,8-TCDF	0.402	0.1	0.040
1,2,3,7,8-PeCDF	0.174	0.05	0.009
2,3,4,7,8-PeCDF	0.156	0.5	0.078
1,2,3,4,7,8-HxCDF	0.169	0.1	0.017
1,2,3,6,7,8-HxCDF	0.129	0.1	0.013
2,3,4,6,7,8-HxCDF	0.067	0.1	0.007
1,2,3,7,8,9-HxCDF	0.091	0.1	0.009
1,2,3,4,6,7,8-HpCDF	0.349	0.01	0.003
1,2,3,4,7,8,9-HpCDF	0.094	0.01	0.0009
OCDF	0.349	0.001	0.0003
Total Toxic Equivalent			0.468

Melter Blank			
Compound	Amount	Report Limit	
	<i>pg</i>		
2,3,7,8-TCDD	ND	2	pg/sampl
1,2,3,7,8-PeCDD	ND	0.92	pg/sampl
1,2,3,4,7,8-HxCDD	ND	1.1	pg/sampl
1,2,3,6,7,8-HxCDD	ND	1.1	pg/sampl
1,2,3,7,8,9-HxCDD	ND	1.1	pg/sampl
1,2,3,4,6,7,8-HpCDD	0.85	1.1	pg/sampl
OCDD	7.1	1.6	pg/sampl
2,3,7,8-TCDF	ND	1.8	pg/sampl
1,2,3,7,8-PeCDF	ND	0.81	pg/sampl
2,3,4,7,8-PeCDF	1.4	0.77	pg/sampl
1,2,3,4,7,8-HxCDF	ND	0.74	pg/sampl
1,2,3,6,7,8-HxCDF	ND	0.66	pg/sampl
2,3,4,6,7,8-HxCDF	1.2	0.81	pg/sampl
1,2,3,7,8,9-HxCDF	ND	0.87	pg/sampl
1,2,3,4,6,7,8-HpCDF	1.4	0.72	pg/sampl
1,2,3,4,7,8,9-HpCDF	ND	0.95	pg/sampl
OCDF	3.4	1.7	pg/sampl

Table T-5. TEQ Results for TCO Run 1

<i>Compound</i>	<i>Sample Concentration Average (pg/dscf)</i>	<i>TE Factor</i>	<i>Toxic Equivalent (pg/dscf)</i>
2,3,7,8-TCDD	0.023	1	0.023
1,2,3,7,8-PeCDD	< 0.015	0.5	< 0.007
1,2,3,4,7,8-HxCDD	< 0.013	0.1	< 0.001
1,2,3,6,7,8-HxCDD	< 0.013	0.1	< 0.001
1,2,3,7,8,9-HxCDD	0.028	0.1	0.003
1,2,3,4,6,7,8-HpCDD	0.120	0.01	0.001
OCDD	0.436	0.001	0.000
2,3,7,8-TCDF	0.145	0.1	0.015
1,2,3,7,8-PeCDF	0.081	0.05	0.004
2,3,4,7,8-PeCDF	0.058	0.5	0.029
1,2,3,4,7,8-HxCDF	0.218	0.1	0.022
1,2,3,6,7,8-HxCDF	0.118	0.1	0.012
2,3,4,6,7,8-HxCDF	0.035	0.1	0.004
1,2,3,7,8,9-HxCDF	0.055	0.1	< 0.005
1,2,3,4,6,7,8-HpCDF	0.315	0.01	0.003
1,2,3,4,7,8,9-HpCDF	0.182	0.01	0.002
OCDF	0.606	0.001	0.001
Total Toxic Equivalent			0.133

Table T-6. TEQ Results for TCO Run 2

<i>Compound</i>		<i>Sample Concentration Average (pg/dscf)</i>	<i>TE Factor</i>		<i>Toxic Equivalent (pg/dscf)</i>
2,3,7,8-TCDD	<	0.021	1	<	0.021
1,2,3,7,8-PeCDD	<	0.012	0.5	<	0.006
1,2,3,4,7,8-HxCDD	<	0.010	0.1	<	0.001
1,2,3,6,7,8-HxCDD		0.020	0.1		0.002
1,2,3,7,8,9-HxCDD	<	0.010	0.1	<	0.001
1,2,3,4,6,7,8-HpCDD		0.112	0.01		0.001
OCDD		0.612	0.001		0.001
2,3,7,8-TCDF		0.037	0.1		0.004
1,2,3,7,8-PeCDF		0.034	0.05		0.002
2,3,4,7,8-PeCDF	<	0.008	0.5	<	0.004
1,2,3,4,7,8-HxCDF		0.047	0.1		0.005
1,2,3,6,7,8-HxCDF		0.021	0.1		0.002
2,3,4,6,7,8-HxCDF	<	0.009	0.1	<	0.001
1,2,3,7,8,9-HxCDF		0.045	0.1		0.004
1,2,3,4,6,7,8-HpCDF		0.097	0.01		0.001
1,2,3,4,7,8,9-HpCDF		0.039	0.01		0.000
OCDF		0.212	0.001		0.000
Total Toxic Equivalent					0.056

Table T-7. TEQ Results for TCO Run 3

Compound		Sample Concentration Average (pg/dscf)	TE Factor	Toxic Equivalent (pg/dscf)
2,3,7,8-TCDD	<	0.055	1	< 0.055
1,2,3,7,8-PeCDD	<	0.024	0.5	< 0.012
1,2,3,4,7,8-HxCDD	<	0.022	0.1	< 0.002
1,2,3,6,7,8-HxCDD	<	0.022	0.1	< 0.002
1,2,3,7,8,9-HxCDD	<	0.021	0.1	< 0.002
1,2,3,4,6,7,8-HpCDD	<	0.042	0.01	< 0.000
OCDD		0.425	0.001	0.000
2,3,7,8-TCDF		0.165	0.1	0.017
1,2,3,7,8-PeCDF		0.061	0.05	0.003
2,3,4,7,8-PeCDF		0.072	0.5	0.036
1,2,3,4,7,8-HxCDF		0.177	0.1	0.018
1,2,3,6,7,8-HxCDF		0.076	0.1	0.008
2,3,4,6,7,8-HxCDF		0.066	0.1	0.007
1,2,3,7,8,9-HxCDF	<	0.026	0.1	< 0.003
1,2,3,4,6,7,8-HpCDF		0.342	0.01	0.003
1,2,3,4,7,8,9-HpCDF		0.153	0.01	0.002
OCDF		0.236	0.001	0.000
Total Toxic Equivilent				0.170

Table T-8. TEQ Results for TCO Run 4

<i>Compound</i>		<i>Sample Concentration Average (pg/dscf)</i>	<i>TE Factor</i>		<i>Toxic Equivalent (pg/dscf)</i>
2,3,7,8-TCDD		0.030	1		0.030
1,2,3,7,8-PeCDD	<	0.008	0.5	<	0.004
1,2,3,4,7,8-HxCDD	<	0.011	0.1	<	0.001
1,2,3,6,7,8-HxCDD	<	0.010	0.1	<	0.001
1,2,3,7,8,9-HxCDD	<	0.010	0.1	<	0.001
1,2,3,4,6,7,8-HpCDD		0.039	0.01		0.000
OCDD		0.189	0.001		0.000
2,3,7,8-TCDF		0.086	0.1		0.009
1,2,3,7,8-PeCDF		0.028	0.05		0.001
2,3,4,7,8-PeCDF		0.026	0.5		0.013
1,2,3,4,7,8-HxCDF		0.080	0.1		0.008
1,2,3,6,7,8-HxCDF		0.037	0.1		0.004
2,3,4,6,7,8-HxCDF	<	0.008	0.1	<	0.001
1,2,3,7,8,9-HxCDF		0.028	0.1		0.003
1,2,3,4,6,7,8-HpCDF		0.104	0.01		0.001
1,2,3,4,7,8,9-HpCDF		0.027	0.01		0.0003
OCDF		0.118	0.001		0.0001
Total Toxic Equivalent					0.077

Table T-9. TEQ Results for TCO Run 5

Compound		Sample Concentration Average (pg/dscf)	TE Factor		Toxic Equivalent (pg/dscf)
2,3,7,8-TCDD	<	0.023	1	<	0.023
1,2,3,7,8-PeCDD		0.035	0.5		0.017
1,2,3,4,7,8-HxCDD		0.061	0.1		0.006
1,2,3,6,7,8-HxCDD		0.053	0.1		0.005
1,2,3,7,8,9-HxCDD		0.088	0.1		0.009
1,2,3,4,6,7,8-HpCDD		0.383	0.01		0.004
OCDD		0.598	0.001		0.001
2,3,7,8-TCDF		0.371	0.1		0.037
1,2,3,7,8-PeCDF		0.586	0.05		0.029
2,3,4,7,8-PeCDF		0.430	0.5		0.215
1,2,3,4,7,8-HxCDF		2.51	0.1		0.251
1,2,3,6,7,8-HxCDF		1.05	0.1		0.105
2,3,4,6,7,8-HxCDF		0.430	0.1		0.043
1,2,3,7,8,9-HxCDF		0.131	0.1		0.013
1,2,3,4,6,7,8-HpCDF		3.59	0.01		0.036
1,2,3,4,7,8,9-HpCDF		1.43	0.01		0.014
OCDF		2.75	0.001		0.003
Total Toxic Equivalent					0.812

Table T-10. TEQ Results for TCO Run 6

Compound		Sample Concentration Average (pg/dscf)	TE Factor		Toxic Equivalent (pg/dscf)
2,3,7,8-TCDD		0.013	1		0.013
1,2,3,7,8-PeCDD	<	0.012	0.5	<	0.006
1,2,3,4,7,8-HxCDD		0.019	0.1		0.002
1,2,3,6,7,8-HxCDD	<	0.011	0.1	<	0.001
1,2,3,7,8,9-HxCDD		0.022	0.1		0.002
1,2,3,4,6,7,8-HpCDD		0.062	0.01		0.001
OCDD		0.392	0.001		0.000
2,3,7,8-TCDF		0.042	0.1		0.004
1,2,3,7,8-PeCDF		0.035	0.05		0.002
2,3,4,7,8-PeCDF		0.023	0.5		0.012
1,2,3,4,7,8-HxCDF		0.031	0.1		0.003
1,2,3,6,7,8-HxCDF		0.029	0.1		0.003
2,3,4,6,7,8-HxCDF		0.023	0.1		0.002
1,2,3,7,8,9-HxCDF		0.061	0.1		0.006
1,2,3,4,6,7,8-HpCDF		0.112	0.01		0.001
1,2,3,4,7,8,9-HpCDF		0.040	0.01		0.000
OCDF		0.168	0.001		0.000
Total Toxic Equivalent					0.059

TCO Blank			
Compound	Amount	Report Limit	
	pg		
2,3,7,8-TCDD	2.5	1.3	pg/sampl
1,2,3,7,8-PeCDD	ND	0.87	pg/sampl
1,2,3,4,7,8-HxCDD	ND	0.75	pg/sampl
1,2,3,6,7,8-HxCDD	ND	0.74	pg/sampl
1,2,3,7,8,9-HxCDD	ND	0.71	pg/sampl
1,2,3,4,6,7,8-HpCDD	4	0.92	pg/sampl
OCDD	19	0.97	pg/sampl
2,3,7,8-TCDF	1.3	1.4	pg/sampl
1,2,3,7,8-PeCDF	1.1	0.65	pg/sampl
2,3,4,7,8-PeCDF	0.98	0.62	pg/sampl
1,2,3,4,7,8-HxCDF	2.4	0.47	pg/sampl
1,2,3,6,7,8-HxCDF	0.85	0.42	pg/sampl
2,3,4,6,7,8-HxCDF	ND	0.51	pg/sampl
1,2,3,7,8,9-HxCDF	ND	0.55	pg/sampl
1,2,3,4,6,7,8-HpCDF	3.3	0.75	pg/sampl
1,2,3,4,7,8,9-HpCDF	ND	0.99	pg/sampl
OCDF	3.1	1	pg/sampl

Appendix A.4

PCB

Table PBC-1. Melter PCB Results

[illegible]

Table PBC-2. TCO PCB Results

Compound	Run 1			Run 2			Run 3			Run 4			Run 5			Blank	
	Concentration			Concentration			Concentration			Concentration			Concentration			Amount	
	ng/dscf	Emission Rate ng/min		ng/dscf	Emission Rate ng/min		ng/dscf	Emission Rate ng/min		ng/dscf	Emission Rate ng/min		ng/dscf	Emission Rate ng/min		pg	Report Limit
PCB 77 (BZ)	0.0008	0.193		0.0012	0.276		0.0012	0.276		0.0040	0.965		0.0131	3.133		0.055	0.017
PCB 81 (BZ)	<	0.0002	0.044	<	0.0002	0.058	<	0.0002	0.035	0.0015	0.369		0.0012	0.285		ND	0.017
PCB 126 (BZ)	<	0.0018	0.415	<	0.0018	0.413	<	0.0013	0.281	0.0083	1.986		<	0.0020	0.484	ND	0.017
PCB 105 (BZ)	0.0050	1.13		0.0021	0.496		0.0066	1.382		0.0055	1.333		0.0131	3.133		0.33	0.018
PCB 118 (BZ)	0.0104	2.38		0.0093	2.18		0.0155	3.239		0.0091	2.185		0.0335	7.974		0.79	0.015
PCB 123 (BZ)	<	0.0018	0.415	<	0.0018	0.413	<	0.0012	0.259	<	0.0014	0.340	<	0.0020	0.484	ND	0.014
PCB 114 (BZ)	<	0.0015	0.332	<	0.0015	0.358	<	0.0010	0.216	<	0.0013	0.312	<	0.0016	0.370	ND	0.015
PCB 169 (BZ)	<	0.0032	0.718	<	0.0026	0.606	<	0.0021	0.432	0.0048	1.163		<	0.0029	0.683	ND	0.019
PCB 156 (BZ)	<	0.0038	0.857	<	0.0028	0.661	<	0.0023	0.475	<	0.0025	0.596	<	0.0032	0.769	0.057	0.02
PCB 157 (BZ)	<	0.0038	0.857	<	0.0028	0.661	<	0.0023	0.475	<	0.0025	0.596	<	0.0032	0.769	0.057	0.02
PCB 167 (BZ)	<	0.0033	0.746	<	0.0024	0.551	<	0.0020	0.410	<	0.0021	0.511	<	0.0025	0.598	ND	0.018
PCB 189 (BZ)	<	0.0002	0.053	<	0.0002	0.047	<	0.0002	0.037	0.0017	0.397		0.0004	0.103		ND	0.016

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Appendix A.5

Metals

Table M-1. Metals Results Summary - Melter

3/18/2005										
Metal	Run 1		Run 2		Run 3		Run 4		Run 5	
	Conc. ug/dscf	Emission ug/min	Conc. ug/dscf	Emission ug/min	Conc. ug/dscf	Emission ug/min	Conc. ug/dscf	Emission ug/min	Conc. ug/dscf	Emission ug/min
Antimony	<	0.000	<	0.000	<	0.000	<	0.000	<	0.000
Arsenic		0.687		114		0.341		59.9		79.4
Barium		0.427		70.6		0.218		38.4		64.6
Cadmium		90.3		14955		56.3		9892		10424
Chromium		501		83003		321		56362		83154
Copper		3.68		609		2.43		426		537
Lead		1.84		305		1.20		210		235
Manganese		0.415		68.7		0.228		40.1		68.5
Nickel		0.427		70.7		0.262		46.1		58.4
Selenium		502		83115		314		55236		78125
Silver		0.007		1.08		<		0.000		0.000
Zinc		153		25348		106		18586		28417

Note: All numbers are blank corrected in this table.

TCO Method Blk		FH		BH		Total, ug		MDL			FH	BH	Total, ug
		0.6	0.35	0.6	0.35	1.2	0.7				0.6	0.6	1.2
	Antimony												
	Arsenic	0.35	0.35	0.35	0.35	0.7	0.7				0.35	0.35	0.7
	Barium	0.45	0.35	0.35	0.35	0.8	0.8				0.35	0.35	0.7
	Cadmium	0.3	0.079	0.079	0.079	0.4	0.4				0.05	0.05	0.1
	Chromium	1.1	0.25	0.25	0.25	1.4	1.4				0.25	0.25	0.5
	Copper	0.82	0.25	0.25	0.25	1.1	1.1				0.25	0.25	0.5
	Lead	0.2	0.2	0.2	0.2	0.4	0.4				0.2	0.2	0.4
	Manganese	1.4	78.8	78.8	78.8	80.2	80.2				0.15	0.15	0.3
	Nickel	1.4	0.44	0.44	0.44	1.8	1.8				0.44	0.44	0.88
	Selenium	2.5	0.64	0.64	0.64	3.1	3.1				0.35	0.35	0.7
	Silver	0.71	0.71	0.71	0.71	1.4	1.4				0.71	0.71	1.42
	Zinc	4.4	11.9	11.9	11.9	16.3	16.3				0.23	0.23	0.46

CUA Metals		Quartz Filters															
Melter		Sample date				Blk corr		3/18/2005									
Run 1	Metal	FH	BH	FH	BH	FH	BH	Total, ug	Volume dscf	Flow dscfm	Conc. ug/dscf	Emission ug/min					
	Antimony	0.6	0.6	0.0	0	0.0	0	0.0	26.129	165.55	0.00	0					
	Arsenic	18.3	0.23	18.0	0	18.0	0	18.0	26.129	165.55	0.69	114					
	Barium	11.5	0.3	11.2	0	11.2	0	11.2	26.129	165.55	0.43	71					
	Cadmium	2360	0.56	2360	0.51	2360	0.51	2360	26.129	165.55	90.3	14955					
	Chromium	13100	0.93	13100	0.7	13100	0.7	13100	26.129	165.55	501	83003					
	Copper	96.3	0.25	96.1	0	96	0	96	26.129	165.55	3.68	609					
	Lead	48	0.59	47.8	0.33	48	0.33	48	26.129	165.55	1.8	305					
	Manganese	10.8	0.34	10.7	0.19	11	0.19	11	26.129	165.55	0.4	69					
	Nickel	11.6	0.4	11.2	0	11	0	11	26.129	165.55	0.4	71					
	Selenium	13100	18.7	13100	18.48	13118	18.48	13118	26.129	165.55	502	83115					
	Silver	0.88	0.25	0.2	0	0.2	0	0.2	26.129	165.55	0.007	1.1					
	Zinc	3980	21.9	3980	20.9	4001	20.9	4001	26.129	165.55	153	25348					

CUA Metals				Quartz Filters						
Melter		Sample date		3/18/2005				bold = ND use MDL		
				Blk corr						
Run 2	Metal	FH	BH	FH	BH	Total, ug	Volume dscf	Flow dscfm	Conc. ug/dscf	Emission ug/min
	Antimony	0.6	0.6	0.0	0	0.0	31.824	175.81	0.00	0
	Arsenic	11.2	0.23	10.9	0	10.9	31.824	175.81	0.34	60
	Barium	7.3	0.3	7.0	0	7.0	31.824	175.81	0.218	38.4
	Cadmium	1790	0.71	1790	0.7	1790.5	31.824	175.81	56.3	9892
	Chromium	10200	2.8	10200	2.57	10202	31.824	175.81	321	56362
	Copper	76.6	1.1	76.4	0.85	77.2	31.824	175.81	2.43	426
	Lead	37.2	1.3	37.0	1.04	38.0	31.824	175.81	1.2	210
	Manganese	7.1	0.45	7.0	0.3	7.3	31.824	175.81	0.23	40
	Nickel	8.7	0.49	8.3	0.09	8.4	31.824	175.81	0.26	46
	Selenium	9980	19.1	9980	18.88	9999	31.824	175.81	314	55236
	Silver	0.71	0.25	0.00	0	0.0	31.824	175.81	0.000	0.0
	Zinc	3330	35.6	3330	34.6	3364	31.824	175.81	105.7	18586

CUA Metals		Sample date		Quartz Filters		Note: FH of melter run 3 and FH of TCO run 3 may have been switched				
Melter		3/18/2005		Blk corr						
Run 3	Metal	FH	BH	FH	BH	Total, ug	Volume dscf	Flow dscfm	Conc. ug/dscf	Emission ug/min
	Antimony	0.6	1	0.0	0	0.0	32.328	184.1	0.00	0.0
	Arsenic	14.3	0.23	14.0	0	14.0	32.328	184.1	0.43	79.4
	Barium	11.7	0.32	11.4	0	11.4	32.328	184.1	0.35	65
	Cadmium	1830	0.56	1829.9	0.51	1830.4	32.328	184.1	56.6	10424
	Chromium	14600	2.3	14599.8	2.07	14601.8	32.328	184.1	451.7	83154
	Copper	94.1	0.71	93.9	0.46	94.3	32.328	184.1	2.92	537
	Lead	41	0.69	40.8	0.43	41.2	32.328	184.1	1.3	235
	Manganese	11.5	0.82	11.4	0.67	12.0	32.328	184.1	0.4	68
	Nickel	10.7	0.4	10.3	0	10.3	32.328	184.1	0.32	58
	Selenium	13700	19.4	13699.7	19.18	13718.8	32.328	184.1	424	78125
	Silver	0.71	0.25	0.0	0	0.0	32.328	184.1	0.000	0.00
	Zinc	4970	21.2	4969.8	20.2	4990.0	32.328	184.1	154.4	28417

Table M-2. Metals Results Summary - TCO
3/18/2005

Metal	Run 1		Run 2		Run 3	
	Conc. ug/dscf	Emission ug/min	Conc. ug/dscf	Emission ug/min	Conc. ug/dscf	Emission ug/min
Antimony	0.041	9.44	0.011	2.51	0.008	1.98
Arsenic	0.029	6.66	0.009	2.09	0.006	1.50
Barium	0.125	28.6	0.068	16.0	0.061	14.6
Cadmium	0.044	10.2	0.028	6.63	0.020	4.84
Chromium	0.147	33.6	0.162	38.2	0.110	26.5
Copper	0.058	13.3	0.051	12.0	0.036	8.69
Lead	0.012	2.78	0.007	1.67	0.007	1.73
Manganese	0.076	17.4	0.038	8.94	0.038	9.02
Nickel	0.264	60.3	0.120	28.3	0.103	24.8
Selenium	1.14	261	0.840	197	0.703	169
Silver	< 0.000	0.00	< 0.000	0.000	< 0.000	0.000
Zinc	1.24	283	0.916	215	0.700	168

Note: All numbers are blank corrected in this table.

CUA Metals		Sample Date				Quartz Filters							
TCO		3/18/2005											
Run 1	Metal	FH	BH	FH	Blk corr	BH	Total, ug	Volume dscf	Flow dscfm	Conc. ug/dscf	Emission ug/min		
	Antimony	1.7	0.6		1.1	0	1.7	41.191	228.65	0.041	9.4		
	Arsenic	1.2	0.23		0.9	0	1.2	41.191	228.65	0.029	6.66		
	Barium	5.5	0.3		5.2	0	5.2	41.191	228.65	0.125	28.6		
	Cadmium	1.6	0.4		1.5	0.35	1.8	41.191	228.65	0.044	10.2		
	Chromium	6.3	1.1		6.1	0	6.1	41.191	228.65	0.147	33.6		
	Copper	2.1	0.79		1.9	0.54	2.4	41.191	228.65	0.058	13.3		
	Lead	0.2	0.76		0.0	0.5	0.5	41.191	228.65	0.012	3		
	Manganese	2.5	0.94		2.4	0.79	3.1	41.191	228.65	0.076	17.4		
	Nickel	11.3	0.4		10.9	0	10.9	41.191	228.65	0.264	60.3		
	Selenium	37	10.6		36.7	10.38	47.0	41.191	228.65	1.142	261		
	Silver	0.71	0.25		0.0	0	0.00	41.191	228.65	0.000	0.00		
	Zinc	24.7	27.6		24.5	26.6	51.1	41.191	228.65	1.24	283		

CUA Metals		Sample date		Quartz Filters							
TCO		3/18/2005		Blk corr							
Run 3	Metal	FH	BH	FH	BH	Total, ug	Volume dscf	Flow dscfm	Conc. ug/dscf	Emission ug/min	
	Antimony	1.3	0.6	0.7	0	0.7	84.855	240.06	0.008	2.0	
	Arsenic	0.88	0.23	0.5	0	0.5	84.855	240.06	0.006	1.5	
	Barium	5.5	0.7	5.2	0	5.2	84.855	240.06	0.061	14.6	
	Cadmium	1.8	0.082	1.7	0.032	1.7	84.855	240.06	0.0	5	
	Chromium	9.6	0.55	9.4	0	9.4	84.855	240.06	0	26	
	Copper	2.9	0.67	2.7	0.42	3.1	84.855	240.06	0.036	9	
	Lead	0.2	0.87	0.0	0.61	0.6	84.855	240.06	0.007	2	
	Manganese	2.8	0.69	2.7	0.54	3.2	84.855	240.06	0.038	9.0	
	Nickel	9.2	0.5	8.8	0	8.8	84.855	240.06	0.103	24.8	
	Selenium	22.2	38	21.9	37.78	59.6	84.855	240.06	1	169	
	Silver	0.71	0.25	0.0	0	0.00	84.855	240.06	0.0	0.0	
	Zinc	29.3	31.3	29.1	30.3	59.4	84.855	240.06	0.7	168	

Table M-3. Metals Results Summary - Melter
3/8/2005

Metal	Run 1		Run 2		Run 3	
	Concentration ug/dscf	Emission Rate ug/min	Concentration ug/dscf	Emission Rate ug/min	Concentration ug/dscf	Emission Rate ug/min
Antimony	<	142	<	83.1	<	43.7
Arsenic	<	98.3	<	66.2	<	18.6
Barium	0.1974	32.8	0.1049	18.4	0.0802	13.5
Cadmium	21.7	3609	17.2	3016	3.44	579
Chromium	209	34842	164	28836	41.2	6939
Copper	0.9431	157	0.6967	122	0.2553	43.0
Lead	2.17	361	1.60	281	0.2432	41.0
Manganese	1.23	205	0.1977	34.7	0.2219	37.4
Nickel	0.4034	67.1	0.3124	54.8	0.2887	48.6
Selenium	323	53789	281	49335	41.9	7059
Silver	<	7.94	<	5.96	<	2.66
Zinc	58.8	9778	40.7	7149	25.4	4275

CUA Metals		Quartz Filters										
Melter	Run 1	Sample date		3/8/2005		Blk corr		Total, ug	Volume dscf	Flow dscfm	Conc. ug/dscf	Emission ug/min
		FH	BH	FH	BH	FH	BH					
		Metal	FH	BH	FH	BH	FH	BH				
		Antimony	33.7	0.6	32.1	0	32.1	0	37.483	166.35	0.86	142
		Arsenic	22.9	0.23	22.1	0	22.1	0	37.483	166.35	0.59	98
		Barium	12.2	0.4	7.4	0	7.4	0	37.483	166.35	0.20	33
		Cadmium	810	3.4	810	3.3	813	3.3	37.483	166.35	21.7	3609
		Chromium	7850	2	7849	1.54	7851	1.54	37.483	166.35	209	34842
		Copper	34.2	1.9	34.0	1.4	35	1.4	37.483	166.35	0.94	157
		Lead	38.2	44.2	38.0	43.4	81	43.4	37.483	166.35	2.2	361
		Manganese	23.8	23.9	22.5	23.6	46	23.6	37.483	166.35	1.2	205
		Nickel	24.1	0.82	15.1	0.02	15	0.02	37.483	166.35	0.4	67
		Selenium	12100	25.5	12095	25.06	12120	25.06	37.483	166.35	323	53789
		Silver	2.5	0.25	1.8	0	1.8	0	37.483	166.35	0.048	7.9
		Zinc	2130	79	2128	75.05	2203	75.05	37.483	166.35	59	9778

TCO Method Blk	FH	BH	Total, ug
3/10/2005			
Antimony	1.4	0.6	2.0
Arsenic	0.89	0.23	1.1
Barium	5.3	0.3	5.6
Cadmium	1.2	0.067	1.3
Chromium	6.2	0.3	6.5
Copper	1.7	0.27	2.0
Lead	0.2	0.52	0.7
Manganese	2.4	0.58	3.0
Nickel	12.4	0.4	12.8
Selenium	10.9	0.78	11.7
Silver	0.71	0.92	1.6
Zinc	13.4	19.3	32.7

MDL	FH	BH	Total, ug
Antimony	0.6	0.6	1.2
Arsenic	0.35	0.23	0.58
Barium	0.35	0.3	0.65
Cadmium	0.05	0.05	0.1
Chromium	1.2	0.23	1.43
Copper	0.25	0.25	0.5
Lead	0.2	0.24	0.44
Manganese	0.15	0.15	0.3
Nickel	0.44	0.4	0.84
Selenium	1.8	0.22	2.02
Silver	0.71	0.25	0.96
Zinc	1.2	0.45	1.65

Reagent Blank Results

		FH Rinse= 0				BH Rinse= 0				
		Front Half				Back Half				
Reagent	ug	Filter	FH Rinse	ug	FH Rinse	ug	value for FH	ug	ug for 200 mL	ug total
							Blk corr., ug	Impinger	BH imp sol'n	BH
Blk	Antimony	1.6		0	0.00	0.00	1.6	0.6	1.20	1.20
	Arsenic	0.76		0	0.00	0.00	0.76	0.23	0.46	0.46
	Barium	4.8		0	0.00	0.00	4.8	0.3	0.60	0.60
	Cadmium	0.05		0	0.00	0.00	0.05	0.05	0.10	0.10
	Chromium	0.74		0	0.00	0.00	0.7	0.23	0.46	0.46
	Copper	0.25		0	0.00	0.00	0.25	0.25	0.50	0.50
	Lead	0.2		0	0.00	0.00	0.20	0.4	0.80	0.80
	Manganese	1.3		0	0.00	0.00	1.3	0.15	0.30	0.30
	Nickel	9		0	0.00	0.00	9.0	0.4	0.80	0.80
	Selenium	5.1		0	0.00	0.00	5.1	0.22	0.44	0.44
Silver	0.71		0	0.00	0.00	0.71	1.6	3.20	3.20	
Zinc	1.7		0	0.00	0.00	1.7	5.1	10.2	10.2	

Front half blank = filter ug plus FH nitric rinse corrected to actual mL rinse volume
since all values were ND for nitric acid rinse...zero is used

Back half blank = total ug of nitric/peroxide corrected to 200 mL plus total ug of nitric rinse corrected to actual rinse volume mL
since all values were ND for nitric acid rinse...zero is used

If results were neg after blank correction the value was set to zero

CUA Metals		Quartz Filters										bold = ND use MDL	
Melter	Sample date	3/8/2005		Blk corr		BH		Total, ug		Volume	Flow	Conc.	Emission
Run 2	Metal	FH	BH	FH	corr	BH				dscf	dscfm	ug/dscf	ug/min
	Antimony	21	0.6	19.4		0	19.4	40.979	175.59	0.47	83		
	Arsenic	16.2	0.23	15.4		0	15.4	40.979	175.59	0.38	66		
	Barium	9.1	0.45	4.3		0	4.3	40.979	175.59	0.105	18.4		
	Cadmium	701	3	701		2.9	703.9	40.979	175.59	17.2	3016		
	Chromium	6730	1	6729		0.54	6730	40.979	175.59	164	28836		
	Copper	27.5	1.8	27.3		1.3	28.6	40.979	175.59	0.70	122		
	Lead	27.4	39.1	27.2		38.3	65.5	40.979	175.59	1.6	281		
	Manganese	7.8	1.9	6.5		1.6	8.1	40.979	175.59	0.20	35		
	Nickel	21.2	1.4	12.2		0.6	12.8	40.979	175.59	0.31	55		
	Selenium	11500	19.3	11495		18.86	11514	40.979	175.59	281	49335		
	Silver	2.1	0.25	1.39		0	1.4	40.979	175.59	0.034	6.0		
	Zinc	1630	42.3	1628		40.18	1668	40.979	175.59	40.7	7149		

CUA Metals			Quartz Filters		Note: FH of melter run 3 and FH of TCO run 3 may have been switched					
Melter	Sample date		3/8/2005		Total, ug	Volume dscf	Flow dscfm	Conc. ug/dscf	Emission ug/min	
	Metal	FH	BH	Blk corr						FH
Run 3										
	Antimony	11.3	0.6		9.7	0	37.412	168.47	0.26	43.7
	Arsenic	4.9	0.23		4.1	0	37.412	168.47	0.11	18.6
	Barium	7.8	0.32		3.0	0	37.412	168.47	0.08	14
	Cadmium	128	0.8		128.0	0.7	37.412	168.47	3.4	579
	Chromium	1540	2.2		1539.3	1.74	37.412	168.47	41.2	6939
	Copper	7.9	2.4		7.7	1.9	37.412	168.47	0.26	43
	Lead	3.2	6.9		3.0	6.1	37.412	168.47	0.2	41
	Manganese	6.4	3.5		5.1	3.2	37.412	168.47	0.2	37
	Nickel	19.8	0.6		10.8	0	37.412	168.47	0.29	49
	Selenium	1530	43.1		1524.9	42.66	37.412	168.47	42	7059
	Silver	1.3	0.25		0.6	0	37.412	168.47	0.016	2.66
	Zinc	904	49.6		902.3	47.12	37.412	168.47	25.4	4275

Table M-4. Metals Results Summary - TCO
3/8/2005

Metal	Run 1		Run 2		Run 3	
	Concentration ug/dscf	Emission Rate ug/min	Concentration ug/dscf	Emission Rate ug/min	Concentration ug/dscf	Emission Rate ug/min
Antimony	<	0.0889	<	21.6	<	0.3127
Arsenic	<	0.0260	<	6.32	<	14.5
Barium		0.0489		11.9		2.90
Cadmium		0.0877		21.3		3.22
Chromium		0.0458		11.1		17.4
Copper		0.1359		33.1		11.3
Lead	<	0.6309	<	153	<	31.9
Manganese		0.2755		67.0		138
Nickel		0.2421		58.9		19.9
Selenium		1.89		461		68.1
Silver	<	0.0000	<	0.0000	<	434
Zinc		1.44		350		185
				0.0000		0.0000
				1.37		13.6
				343		3329

Quartz Filters

CUA Metals

TCO		Sample Date		3/8/2005		Blk corr		Total, ug		Volume		Flow		Conc.		Emission	
Run 1	Metal	FH	BH	FH	BH	FH	BH	FH	BH	dscf	dscf	dscfm	dscfm	ug/dscf	ug/dscf	ug/min	ug/min
	Antimony	5				3.4	0	4.0		45.017		243.15		0.089		21.6	
	Arsenic	1.7	0.6			0.9	0	1.2		45.017		243.15		0.026		6.32	
	Barium	7	0.35			2.2	0	2.2		45.017		243.15		0.049		11.9	
	Cadmium	1.9	2.2			1.9	2.1	4.0		45.017		243.15		0.088		21.3	
	Chromium	2.8	0.42			2.1	0	2.1		45.017		243.15		0.046		11.1	
	Copper	6.2	0.67			6.0	0.17	6.1		45.017		243.15		0.136		33.1	
	Lead	0.2	29.2			0.0	28.4	28.4		45.017		243.15		0.631		153	
	Manganese	3.3	10.7			2.0	10.4	12.4		45.017		243.15		0.275		67.0	
	Nickel	19.9	0.48			10.9	0	10.9		45.017		243.15		0.242		58.9	
	Selenium	48.8	42			43.7	41.56	85.3		45.017		243.15		1.894		461	
	Silver	0.71	0.25			0.0	0	0.00		45.017		243.15		0.000		0.00	
	Zinc	30.4	37.9			28.7	36.01	64.7		45.017		243.15		1.44		350	

bold = less than value <

MDL	FH	BH	Total, ug
Antimony	0.6	0.6	1.2
Arsenic	0.35	0.23	0.58
Barium	0.35	0.3	0.65
Cadmium	0.05	0.05	0.1
Chromium	0.25	0.23	0.48
Copper	0.25	0.25	0.5
Lead	0.2	0.24	0.44
Manganese	0.15	0.15	0.3
Nickel	0.44	0.4	0.84
Selenium	0.35	0.22	0.57
Silver	0.71	0.25	0.96
Zinc	0.23	0.45	0.68

TCO Method Blk	FH	BH	Total, ug
Antimony	1.4	0.6	2.0
Arsenic	0.89	0.23	1.1
Barium	5.3	0.3	5.6
Cadmium	1.2	0.067	1.3
Chromium	6.2	0.3	6.5
Copper	1.7	0.27	2.0
Lead	0.2	0.52	0.7
Manganese	2.4	0.58	3.0
Nickel	12.4	0.4	12.8
Selenium	10.9	0.78	11.7
Silver	0.71	0.92	1.6
Zinc	13.4	19.3	32.7

Reagent Blank Results

Reagent	FH Rinse= 0				BH Rinse= 0			
	Front Half				Back Half			
	ug Filter	ug FH Rinse	ug FH Rinse	value for FH Blk corr., ug	ug Impinger	ug for 200 mL BH imp sol'n	ug total BH	Value for BH Blk Corr., ug
Antimony	1.6	0	0.00	1.6	0.6	1.20	1.20	1.0
Arsenic	0.76	0	0.00	0.76	0.23	0.46	0.46	0.46
Barium	4.8	0	0.00	4.8	0.3	0.60	0.60	0.6
Cadmium	0.05	0	0.00	0.05	0.05	0.10	0.10	0.1
Chromium	0.74	0	0.00	0.7	0.23	0.46	0.46	0.46
Copper	0.25	0	0.00	0.25	0.25	0.50	0.50	0.5
Lead	0.2	0	0.00	0.20	0.4	0.80	0.80	0.8
Manganese	1.3	0	0.00	1.3	0.15	0.30	0.30	0.3
Nickel	9	0	0.00	9.0	0.4	0.80	0.80	0.8
Selenium	5.1	0	0.00	5.1	0.22	0.44	0.44	0.44
Silver	0.71	0	0.00	0.71	1.6	3.20	3.20	1.0
Zinc	1.7	0	0.00	1.7	5.1	10.2	10.2	1.89

Front half blank = filter ug plus FH nitric rinse corrected to actual mL rinse volume
since all values were ND for nitric acid rinse...zero is used

Back half blank = total ug of nitric/peroxide corrected to 200 mL plus total ug of nitric rinse corrected to actual rinse volume mL
since all values were ND for nitric acid rinse...zero is used

If results were neg after blank correction the value was set to zero

CUA Metals Quartz Filters Note: FH of melter run 3 and FH of TCO run3 may have been switched

TCO	Run 3	Metal	Sample date		3/8/2005		Total, ug	Volume	Flow	Conc.	Emission
			FH	BH	FH	BH		dscf			
		Antimony	15.4	0.6	13.8	0	13.8	44.135	245.63	0.313	76.8
		Arsenic	11.3	0.23	10.5	0	10.5	44.135	245.63	0.239	58.7
		Barium	7.5	0.32	2.7	0	2.7	44.135	245.63	0.061	15.0
		Cadmium	558	0.54	558.0	0.44	558.4	44.135	245.63	12.7	3108
		Chromium	4600	0.31	4599.3	0	4599.3	44.135	245.63	104	25597
		Copper	18.4	1.8	18.2	1.3	19.5	44.135	245.63	0.441	108
		Lead	16.6	5.3	16.4	4.5	20.9	44.135	245.63	0.474	116
		Manganese	5.8	0.62	4.5	0.32	4.8	44.135	245.63	0.109	26.8
		Nickel	19.3	0.55	10.3	0	10.3	44.135	245.63	0.233	57.3
		Selenium	8180	2.9	8174.9	2.46	8177.4	44.135	245.63	185	45510
		Silver	0.71	0.25	0.0	0	0.00	44.135	245.63	0.0	0.0
		Zinc	572	29.4	570.3	27.93	598.2	44.135	245.63	13.6	3329

Appendix A.6

Halogens/Acid Gases

Table H.1 Halogens Results Summary - Melter				
3/9/2005				
Run 1	Compound		Conc. ug/dscf	Emission ug/min
	HCl	<	3.7	< 710
	HF		46	8938
	Cl ₂	<	21.5	< 4152
	F ₂	<	71.5	< 13839
Run 2	Compound		Conc. ug/dscf	Emission ug/min
	HCl	<	4.0	< 731
	HF		56.0	10201
	Cl ₂	<	25.1	< 4569
	F ₂	<	83.5	< 15229
Run 3	Compound		Conc. ug/dscf	Emission ug/min
	HCl	<	3.5	< 712
	HF		43.9	8988
	Cl ₂	<	23.2	< 4747
	F ₂	<	76.9	< 15748
Note: "<" = MDL value used				

Table H.2 Halogens Results Summary - TCO				
3/9/2005				
			Conc.	Emission
Run 1	Compound		ug/dscf	ug/min
	HCl		46.1	11651
	HF	<	28.6	7227
	Cl ₂	<	43.3	10950
	F ₂	<	72.1	18232
Run 2	Compound		Conc.	Emission
	HCl		55.2	12863
	HF	<	32.2	7508
	Cl ₂	<	41.3	9630
	F ₂	<	68.9	16049
Run 3	Compound		Conc.	Emission
	HCl		45.8	11508
	HF	<	31.7	7973
	Cl ₂	<	42.1	10594
	F ₂	<	70.1	17638
Note: "<" = MDL value used				

Run H.3 Halogens Results Summary - Melter

3/19/2005

(Corrected 10/13/05)

			Conc.		Emission
Run 1	Compound		ug/dscf		ug/min
	HCl		279		46340
	HF		462		76835
	Cl ₂	<	61.5	<	10215
	F ₂	<	102	<	17026
Run 2	Compound		Conc.		Emission
			ug/dscf		ug/min
	HCl	<	98.9	<	16573
	HF		522		87539
	Cl ₂	<	64.9	<	10871
	F ₂	<	108	<	18119
Run 3	Compound		Conc.		Emission
			ug/dscf		ug/min
	HCl		342		56462
	HF		419		69066
	Cl ₂	<	56.3	<	9278
	F ₂	<	93.8	<	15464

Note: "<" = MDL value used

Run H.4 Halogens Results Summary - TCO

3/19/2005

(Updated 10/13/05)

			Conc.		Emission
Run 1	Compound		ug/dscf		ug/min
	HCl		402		97224
	HF	<	37.5	<	9067
	Cl ₂	<	24.2	<	5859
	F ₂	<	40.4	<	9764
Run 2	Compound		Conc.		Emission
	HCl		796		185544
	HF	<	66.6	<	15526
	Cl ₂	<	23.9	<	5573
	F ₂	<	39.8	<	9288
Run 3	Compound		Conc.		Emission
	HCl		593		136699
	HF	<	64.2	<	14812
	Cl ₂	<	19.7	<	4543
	F ₂	<	32.8	<	7571

Note: "<" = MDL value used

Appendix A.7

Particle Size Distribution

TCO PSD
Test # 1

One run only 3/08/05-3/10/05

Filter #	grams		Net Gain	Beaker #	Tare Wt	Final Wt	Net Gain	total Wt gain
	Tare Wt	Final Wt						
Stage 1	42903-10	0.25145	0.25159	NA	0	0	0	0.00014
Stage 5	82403-3	0.13270	0.13290					0.00020
Final Filter	091504-9	0.11090	0.11108					0.00018

Stage	Cut Point, um	Net Weight, ug	Conc, ug/dscf	Emission Rate, ug/min	Mass Fraction, %
1	> 10	140	0.267	62.9	27.00
5	1-10	200	0.381	89.8	38.00
8	<1	180	0.343	80.8	35.00
					100.00
			part 1	part 2	
	sample vol		265.529	259.451	524.98 dscf
	flow		231.51	240.09	235.8 dscfm

PARTICLE SIZE DISTRIBUTION:

by Glenn Rives (Radian), Modified by Charlie Parrish (12/90)

 Facility: CUA 1200 Melter 323.75
 Run: TCO-01

Date: 03/08/05

Filter Set :

 W/ preimpactor, density = 1.00
 TIME 1440 Qm 0.388347222
 VOLUME 559.22 Pm 29.57647059
 Ts 760.00 Tm 555.5
 T 421.88889 Qa 288.0260065
 %M 0.1 u 0.000231756
 MW 24.552 Lambda 1.086E-05
 Ps 28.61 Pvac 15
 Meter Y 0.999 Vm(std) 524.9075278

 TIME=MINUTES
 VOLUME=dcf MEASURED AT METER
 Ts=IMPACTOR TEMPERATURE (R) (F+460)
 T=IMPACTOR TEMPERATURE (K)
 %M=STACK MOISTURE FRACTION (%/100)
 MW=STACK GAS MOLECULAR WEIGHT WET BASIS
 Ps=ABSOLUTE STACK GAS PRESSURE
 Y=Gas meter correction factor

STAGE	Wb	Vo	N	Dp 50	Pi	Wm	Vom
1	0.1651	254.65533	1	15.123359	1.12	0.5	1.27
2	0.12446	205.02477	6	11.407341	1.125	0.228	0.57912
3	0.094	585.42972	12	4.4094083	1.139	0.096	0.24384
4	0.07493	761.05741	90	2.219016	1.158	0.031	0.07874
5	0.05334	1545.0881	110	1.2761789	1.196	0.02	0.0508
6	0.03708	3572.6056	110	0.7167816	1.26	0.0135	0.03429
7	0.02718	8589.5647	90	0.4281189	1.36	0.01	0.0254
8	0.02438	NA	0		1.56	0	0

Vo=jet velocity (cm/sec)

Wb=diameter of jet (cm) Incorporating Pi

N=number of jets on a stage

Pi=pressure drop across the st

THESE RESULTS KEEP PRESEP CATCH SEPARATE FROM STAGE 1

(See below for combined results)

STAGE	Dp50 micron	Net Weight (grams)	Mass Fraction	Mass Fract. Less Than	PM Conc. (gr/dscf)	Interval Geometric Midpoint	dM/dlog dP (gr/dscf)	Log Dp50
1	15.123359	0.00014	0.269230769	0.7307692	4.12E-06	27.498508	7.926E-06	1.17964827
2	11.407341	0	0	0.7307692	0.00E+00	13.134585	0.000E+00	1.057184437
3	4.4094083	0	0	0.7307692	0.00E+00	7.0922229	0.000E+00	0.644380314
4	2.219016	0	0	0.7307692	0.00E+00	3.1280261	0.000E+00	0.346160431
5	1.2761789	0.00020	0.384615385	0.3461538	5.88E-06	1.6828135	2.447E-05	0.105911554
6	0.7167816	0	0	0.3461538	0.00E+00	0.9564212	0.000E+00	-0.144613136
7	0.4281189	0	0	0.3461538	0.00E+00	0.5539564	0.000E+00	-0.36843563
8		0.00018	0.346153846	0	5.29E-06	0.0462666	2.738E-06	-2.301029996
TOTAL		0.00052	1		1.53E-05			

* these values assume top end and bottom end dp50s of 50 and .005

EXPLANATION: This spreadsheet calculates cut size (Dp50) based on a set of equations from D. Balfours PSD manual (Radian, April 1986)
 Preseparator Dp50 calcs are taken from Andersons Mk III presep manual. NOTE: If the presep Dp50 is GREATER than or SIMILAR TO stage 1 dp50, then ypu can combine presep catch with stage 1 catch as done below

A particle density of

1.00 grams/cm3 was used in calculating cut sizes (Dp50)

TCO PSD

One run only

3/17/05-3/19/05

	Filter #	grams Tare Wt	Final Wt	Net Gain	Beaker #	Tare Wt	Final Wt	Net Gain	total Wt gain
Stage 1	082404-30	0.09910	0.09917	0.00007	NA	0	0	0	0.00007
Stage 5	082404-21	0.13230	0.13261	0.00031					0.00031
Final Filter	082404-23	0.09900	0.09937	0.00037					0.00037

Stage	Cut Point, um	Net Weight, ug	Conc, ug/dscf	Emission Rate, ug/min	Mass Fraction, %
1	> 10	70	0.122	28	9.33
5	1-10	310	0.539	124	41.33
8	<1	370	0.644	148	49.33
					99.99
			part 1	part 2	
	sample vol	281.338	293.583	574.921 dscf	
	flow	227.08	232.22	229.65 dscfm	

PARTICLE SIZE DISTRIBUTION:

by Glenn Rives (Radian), Modified by Charlie Parrish (12/90)

Facility: CUA 1200 Melter 323.75

Date: 03/17/05

Run: TCO-01

Filter Set :

W/ preimpactor, density = 1.00

TIME 1440 Qm 0.414847222
VOLUME 597.38 Pm 30.70941176
Ts 765.00 Tm 562
T 424.66667 Qa 305.1560752
%M 0.1 u 0.000232867
MW 24.552 Lambda 1.095E-05
Ps 29.8 Pvac 15
Meter Y 0.999 Vm(std) 575.4713171

TIME=MINUTES
VOLUME=dcf MEASURED AT METER
Ts=IMPACTOR TEMPERATURE (R) (F+460)
T=IMPACTOR TEMPERATURE (K)
%M=STACK MOISTURE FRACTION (%/100)
MW=STACK GAS MOLECULAR WEIGHT WET BASIS
Ps=ABSOLUTE STACK GAS PRESSURE
Y=Gas meter correction factor

STAGE	Wb	Vo	N	Dp 50	Pi	Wm	Vom
1	0.1651	269.80071	1	14.727972	1.12	0.5	240.89
2	0.12446	217.21842	6	11.109131	1.125	0.228	193.08
3	0.094	620.24759	12	4.2942625	1.139	0.096	544.55
4	0.07493	806.32056	90	2.1612876	1.158	0.031	696.30
5	0.05334	1636.9808	110	1.2433189	1.196	0.02	1368.71
6	0.03708	3785.0829	110	0.6989448	1.26	0.0135	3004.03
7	0.02718	9100.4207	90	0.4184384	1.36	0.01	6691.49
8	0.02438	NA	0		1.56	0	#DIV/0!

Vo=jet velocity (cm/sec)

Wb=diameter of jet (cm)/ Incorporating Pi

N=number of jets on a stage

Pi=pressure drop across the st

THESE RESULTS KEEP PRESEP CATCH SEPARATE FROM STAGE 1

(See below for combined results)

STAGE	Dp50 micron	Net Weight (grams)	Mass Fraction	Mass Fract. Less Than	PM Conc. (gr/dscf)	Interval Geometric Midpoint	dM/dlog dP (gr/dscf)	Log Dp50
1	14.727972	0.00007	0.093333333	0.9066667	1.88E-06	27.136665	3.536E-06	1.16814295
2	11.109131	0	0	0.9066667	0.00E+00	12.791207	0.000E+00	1.045680072
3	4.2942625	0	0	0.9066667	0.00E+00	6.9069185	0.000E+00	0.632888588
4	2.1612876	0	0	0.9066667	0.00E+00	3.0464958	0.000E+00	0.334712566
5	1.2433189	0.00031	0.413333333	0.4933333	8.31E-06	1.6392589	3.462E-05	0.094582551
6	0.6989448	0	0	0.4933333	0.00E+00	0.9322078	0.000E+00	-0.155557105
7	0.4184384	0	0	0.4933333	0.00E+00	0.5408006	0.000E+00	-0.378368509
8		0.00037	0.493333333	0	9.92E-06	0.0457405	5.161E-06	-2.301029996
TOTAL		0.00075	1		2.01E-05			

* these values assume top end and bottom end dp50s of 50 and .005

EXPLANATION: This spreadsheet calculates cut size (Dp50) based on a set of equations from D. Balfours PSD manual (Radian, April 1986)
Preseparator Dp50 calcs are taken from Andersons Mk III presep manual. NOTE: If the presep Dp50 is GREATER than or SIMILAR TO stage 1 dp50, then ypu can combine presep catch with stage 1 catch as done below

A particle density of 1.00 grams/cm3 was used in calculating cut sizes (Dp50)

Appendix A.8

Total Particulate Matter

Table PM-2. Total PM by Method 26					
3/19/2005					
		<i>Conc</i>	<i>Emission</i>	<i>Moisture</i>	
<i>Location</i>	<i>Run #</i>	<i>mg/dscf</i>	<i>mg/min</i>	<i>% vol</i>	
Melter Out	1	57.3	9526	25.2	
Melter Out	2	54.2	9077	25.4	
Melter Out	3	51.5	8496	24.6	
TCO	1	0.014	3.35	9.73	
TCO	2	0.007	1.66	10.7	
TCO	3	0.007	1.65	10.7	

Table A-1. Method 308 Allyl Alcohol Results (Test #1)
revised 10-13-05

Melter

<i>Run #</i>	<i>Sample volume ds liter</i>	<i>dscf</i>	<i>Meas. Day of test Flow dscfm</i>	<i>from 0010 3/9/2005 Flow dscfm</i>	<i>Date</i>	<i>Time</i>
1	33.116	1.169	---	186.988	3/8/2005	10:53-11:41
2	33.29	1.175	---	186.988	3/8/2005	12:43-13:32
3	21.113	0.746	---	186.988	3/8/2005	14:51-15:23

HEPA

<i>Run #</i>	<i>Sample volume ds liter</i>	<i>dscf</i>	<i>Meas. Day of test Flow dscfm</i>	<i>from 0010 3/9/2005 Flow dscfm</i>	<i>Date</i>	<i>Time</i>
1	35.458	1.252	---	186.988	3/8/2005	10:56-11:46
2	35.514	1.254	---	186.988	3/8/2005	12:45-13:35
3	22.255	0.786	---	186.988	3/8/2005	14:54-15:25
pH asses.	36.588	1.292	---	186.988	3/9/2005	08:03-08:53

TCO

<i>Run #</i>	<i>Sample volume ds liter</i>	<i>dscf</i>	<i>Meas. Day of test Flow dscfm</i>	<i>from 0010 3/9/2005 Flow dscfm</i>	<i>Date</i>	<i>Time</i>
1 Spike	72.46	2.559	228.84	241.58	3/7/2005	18:52-20:32
1	75.186	2.655	236.29	241.58	3/8/2005	10:30-12:10
2	75.175	2.654	234.22	241.58	3/8/2005	12:22-14:02
3	73.234	2.586	231.47	241.58	3/8/2005	14:19-15:59

Carbon Bed

<i>Run #</i>	<i>Sample volume ds liter</i>	<i>dscf</i>	<i>Meas. Day of test Flow dscfm</i>	<i>from 0010 3/9/2005 Flow dscfm</i>	<i>Date</i>	<i>Time</i>
1 Spike	41.659	1.471	---	186.988	3/9/2005	08:02-08:52
1	70.817	2.501	---	186.988	3/8/2005	10:31-12:11
2	70.294	2.482	---	186.988	3/8/2005	12:20-14:00
3	35.292	1.246	---	186.988	3/8/2005	14:40-15:31

Appendix A.9

Total Organic Emissions (TOE)

Table T-1. TOE Summary									
TOE = Field GC + Purge and Trap + TCO + Grav									
(in units of mg/m3)									
Field GC	C1	C2	C3	C4	C5	C6	C7	Total	
	2.8	0	0	0	0	0	0	2.8	mg/m3
P and T								0.1	mg/m3
TCO								0.000	mg/m3
Grav								3.10	mg/m3
TOE								6.0	mg/m3

[illegible]

Appendix A.10

Allyl Alcohol

Table AA-1. Method 308 Allyl Alcohol Summary Results (3-8-05)
(revised 7/25/05)

Run #	Melter			HEPA			TCO			Carbon Bed		
	Conc mg/dscf	Emission Rate mg/min	Conc mg/dscf	Conc mg/dscf	Emission Rate mg/min	Conc mg/dscf	Conc mg/dscf	Emission Rate mg/min	Conc mg/dscf	Conc mg/dscf	Emission Rate mg/min	Emission Rate mg/min
1	6.54	1223	1.90	353	<	0.002	<	0.455	0.067		12.5	
2	8.60	1603	2.39	447	<	0.002	<	0.420	0.056		10.60	
3	10.20	1911	4.08	763	<	0.002	<	0.467	0.054		10.1	
Avg.	8.45	1579	2.79	521	<	0.002	<	0.447	0.059		11.05	

Table AA-2. Method 308 Allyl Alcohol Melter Results (3-8-05)
(revised 7/25/05)

Run #	Front Half mg/L	Recovered Sample Vol mL	Back Half mg/L	Recovered Sample Vol mL	Total mg	Sample Volume dscf	Flow dscfm	Conc mg/dscf	Emission Rate mg/min
1	110	64.4	29	19.5	7.6	1.169	186.988	6.5	1223
2	150	64.9	17	20	10.1	1.175	186.988	8.6	1603
3	110	63.7	36	17	7.6	0.746	186.988	10.2	1911
Fld Blank	0.12	58.2	0.081	19.4	0.009		avg	8.4	1579

bold = ND
0.081 =MDL
 Break through as % of total
 7.39

run #	Sample vol liters	sample vol dscf
1	33.116	1.169
2	33.290	1.175
3	21.113	0.746

Table AA-3. Method 308 Allyl Alcohol HEPA Results (3-8-05)
(revised 7/25/05)

Run #	Front Half mg/L	Recovered Sample Vol mL	Back Half mg/L	Recovered Sample Vol mL	Total mg	Sample Volume dscf	Flow dscfm	Conc mg/dscf	Emission Rate mg/min
1	29	60.9	33	18.2	2.4	1.252	186.988	1.9	353
2	37	81.0			3.0	1.254	186.988	2.4	447
3	27	103.9	24	16.8	3.2	0.786	186.988	4.1	763
3 (dup)	28	103.9			2.9	0.786	186.988	3.7	692
4 (pH asses)	13	68.3			0.9	1.292	186.988	0.7	129
Fld Blank	0.12	58.2	0.081	19.4	0.009		avg	2.8	521
Dup Analysis..% of avg	101.8 %				Sample vol liters	sample vol dscf		bold = ND	
Break through as % of total	12.57 %			run #				0.081 =MDL	
				1	35.458	1.252			
				2	35.514	1.254			
				3	22.255	0.786			
				4	36.588	1.292			

Table AA-5. Method 308 Allyl Alcohol Carbon Bed Results (3-8-05)

(revised 7/25/05)

[illegible]

Table AA-6. Method 308 Allyl Alcohol Summary Results (3-21-05)
(revised 7/25/05)

Run #	Melter		HEPA		TCO		Carbon Bed	
	Conc. mg/dscf	Emission Rate mg/min	Conc. mg/dscf	Emission Rate mg/min	Conc. mg/dscf	Emission Rate mg/min	Conc. mg/dscf	Emission Rate mg/min
1	11.304	2354	3.839	799	< 0.0022	< 0.521	0.288	59.9
2	8.573	1785	3.377	703	< 0.0022	< 0.513	0.264	55.0
3	8.977	1869	3.638	757	< 0.0022	< 0.522	0.451	93.9
Avg.	9.618	2003	3.618	753	< 0.0022	< 0.519	0.334	69.6

Table AA-8. Method 308 Allyl Alcohol Results (Run 2 - 3/21/05)										
(revised 7/25/05)										
Location	Amount mg/L	Report Limit	Liquid Sample Vol Liters	Sample Vol Liters	Flow dscfm	Concentration mg/dscf	Emission Rate mg/min	Total Emission Rate mg/min		
Melter - A	92	0.5	0.0681	23.08	208.21	7.68763	1600.6	1785.0		
Melter - B	39	0.5	0.0185	23.08	208.21	0.88531	184.3			
Carbon Bed - A	3	0.5	0.0677	25.5	208.21	0.22556	47.0	55.0		
Carbon Bed - B	1.8	0.5	0.0192	25.5	208.21	0.03838	8.0			
HEPA - A	35	0.5	0.0645	24.95	208.21	2.56242	533.5	703.1		
HEPA - B	41	0.5	0.0175	24.95	208.21	0.81441	169.6			
TCO - A	0.081	0.5	0.0664	70.71	238.22	0.00215	0.51315	<	0.51315	<
TCO - B	0	0.5	0.0179	70.71	238.22	0.00000	0.00000		0.00000	

Appendix B

Data Sheets

- B.1 VOST**
- B.2 Semi-VOST**
- B.3 Dioxin/Furan/PCBs**
- B.4 Metals**
- B.5 Halogens/Acid Gases**
- B.6 Particle Size
Distribution**
- B.7 Total Organic Emissions
(TOE)**
- B.8 Allyl Alcohol**

Appendix B.1

VOST

Plant CUA - Melter
 Date 3/19-3/21/05 ~~03/20/2005~~
 Sample Type VOST
 Run Number 1
 Meter Number 1574
 Correction factor 0.997
 Barometric Pressure 29.9

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
1A	.00@12"	2355	171.47	0.9				93.2	91.4
			173.6	1				95	91.4
	.00@14"	0005	176.32						
		Averages		0.95				94.1	91.4
		Standard Meter Volume	4.627404529					92.75	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
1B	.00@14"	0017	176.62	1				96.8	95
			179.04	1.1				98.6	96.8
	.00@9"	0027	181.54						
		Averages		1.05				97.7	95.9
		Standard Meter Volume	4.661190953					96.8	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
1C	.00@9"	0035	181.71	1.1				98.6	98.6
			184.25	1.1				100.4	98.6
	.00@16"	0045	186.77						
		Averages		1.1				99.5	98.6
		Standard Meter Volume	4.775118387					99.05	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
1D	.00@16"	0054	187.12	1.1				100.4	98.6
			189.73	1.1				100.4	98.6
	.00@14"	0104	192.19						
		Averages		1.1				100.4	98.6
		Standard Meter Volume	4.780707212					99.5	

VOST FIELD DATA

1574

Plant	CUR	1200	Ambient Temp. (°F)	105°F	Meter Box Number	Revised.
Date	3/19/05	3/20/05	Barometric Pressure (in. H2O)	29.90	DGM Cal. Factor (Y)	0.997
Sampling Location	me/ken		Stack Temp. (°F)		Probe Length & Type	6' TFE
Sample Type	VOST		Average delta P (in. H2O)		Probe Heater Setting (°F)	N/A
Run Number	1		Static Pressure (±) (in. H2O)		Filter # & Type (if used)	N/A
Operator	MWH		Sample Rate (lpm)	0.5	Filter Temp. (°F)	N/A

Purpose: VOST @ me/ken 0.5 LPM for 10 min (TRAP SET)

Other Data/Notes:

LEAK CHECKS:		PRE TEST		POST TEST	
Set	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)	
A	0.00 @ 12"	0.00 @ 14"	0.00 @ 9"	0.00 @ 16"	
B	0.00 @ 14"	0.00 @ 9"	0.00 @ 16"	0.00 @ 14"	

Set: _____ Tenax Tube: _____ Additional Tubes: _____
Set: _____ Tenax Tube: _____ Additional Tubes: _____

Tenax Charcoal: _____
Tenax Charcoal: _____

Sampling Times	Run (min)	Clock (24hr)	Gas Meter Reading (Vol in L or ft3)	Rotameter Setting (lpm/ft3/min)	Meter Pressure (in. H2O)	Meter Temp. (°F)	Condenser Temperature A (°F)	Condenser Temperature B (°F)	Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)																																																																																																								
A	23:55		171.47	0.5	0.9	37/33	22	23	35	7150		7.5																																																																																																								
	24:00		173.60	0.5	1.0	35/33	21	23	35	7150		9.0																																																																																																								
	00:05		176.32	0.5																																																																																																																
B	00:17		176.62																																																																																																																	
	00:22		179.04	.5	1.0	36/35	21	23	35	7150		6.0																																																																																																								
	00:27		181.54	.5	1.1	37/36	21	22	35	7150		7.0																																																																																																								
C	00:35		181.71																																																																																																																	
	00:40		184.25	.5	1.1	37/37	22	22	35	7150		13.0																																																																																																								
	00:45		186.77	.5	1.1	38/37	20	20	35	7150		12.5																																																																																																								
D	00:54		187.12																																																																																																																	
	00:59		189.73	.5	1.1	38/37	23	23	35	7150		12																																																																																																								
	01:04		192.19	.5	1.1	38/37	21	20	35	7150		11.5																																																																																																								
<table border="1"> <tr> <td>0C</td><td>0F</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>33</td><td>91.4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>34</td><td>93.2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>35</td><td>95</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>36</td><td>96.8</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>37</td><td>98.6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>38</td><td>100.4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td>39</td><td>102.2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>													0C	0F												33	91.4												34	93.2												35	95												36	96.8												37	98.6												38	100.4												39	102.2											
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38	100.4																																																																																																																			
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Total Time		Total Volume Metered		Average Flow Rate		Average Pm		Average Tm																																																																																																												
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Comments:

Plant	CUA - Melter	Meter Number	1574
Date	03/20/2005	Correction factor	0.997
Sample Type	VOST	Barometric Pressure	29.9
Run Number	2		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
2A	0.00@14.5"	0206	195.1	1.1				96.8	96.8
			197.56	1.1				98.6	96.8
	0.00@16"	0216	200.31						
		Averages		1.1				97.7	96.8
	Standard Meter Volume		4.932554862					97.25	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
2B	.00@14"	0223	200.52	1.1				98.6	98.6
			203.27	1.1				98.6	98.6
	.00@9"	0233	205.69						
		Averages		1.1				98.6	98.6
	Standard Meter Volume		4.882855699					98.6	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
2C	0.00@16"	0240	205.92	1.1				98.6	98.6
			208.46	1.1				100.4	98.6
	0.00@15"	0250	210.83						
		Averages		1.1				99.5	98.6
	Standard Meter Volume		4.633563494					99.05	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
2D	0.00@15"	0258	211.02	1.1				98.6	98.6
			213.7	1.1				100.4	98.6
	0.00@16"	0308	216.18						
		Averages		1.1				99.5	98.6
	Standard Meter Volume		4.869488315					99.05	

VOST FIELD DATA

1574

Plant	CVA	1200	Ambient Temp. (°F)	110°F	Meter Box Number	Rental
Date	3/20/05	3/20/05	Barometric Pressure (in. H2O)	29.90	DGM Cal. Factor (Y)	0.997
Sampling Location	Miller		Stack Temp. (°F)		Probe Length & Type	
Sample Type	VOST		Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	2		Static Pressure (±) (in. H2O)	-4.9"	Filter # & Type (if used)	
Operator	Miller		Sample Rate (lpm)	0.5	Filter Temp. (°F)	

Purpose: VOST @ Miller 0.5 lpm for 10 min - 4 sets

Other Data/Notes:

LEAK CHECKS:		PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)	
A	0.00 @ 14.5	0.00 @ 16"	0.00 @ 16"	0.00 @ 15"	
B	0.00 @ 16.0	0.00 @ 15"	0.00 @ 15"	0.00 @ 16"	

Tenax Tube: _____ Tenax Charcoal: _____

Additional Tubes: _____

ORP-51444, Rev. 0

Sampling Times	Gas Meter Reading	Rollometer	Meter Pressure	Meter Temp.	Condenser Temperature	Line Temp.	Probe Temp.	Stack Temp.	Train Vacuum
(min)	(Vol in L or ft3)	(lpm/ft3/min)	(in. H2O)	(°F)	A (°F)	B (°F)	(°F)	(°F)	(in. Hg)
A	195.10	0.5	1.1	36/36	23	22			12.0
	197.56	0.5	1.4	37/36	22	21			12.5
B	200.31	0.5	1.1	37/37	22	22			13.0
	203.27	0.5	1.1	37/37	20	22			13.0
C	205.69	0.5	1.1	37/37	22	22			11.0
	208.46	0.5	1.1	38/37	22	22			11.5
D	210.83	0.5	1.1	37/37	22	22			10.0
	211.02	0.5	1.1	37/37	21	21			12.5
	213.90	0.5	1.1	38/37					
	216.18	0.5							
762									
Run Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm				Ts	Vacuum (in. Hg)

Comments:

Plant	CUA - Melter	Meter Number	1574
Date	03/20/2005	Correction factor	0.997
Sample Type	VOST	Barometric Pressure	29.9
Run Number	3		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature		Vacuum
					Coil 1	Coil 2	Probe	Inlet	Outlet	
3A	0.00@16"	408	229.76	1.1				96.8	96.8	
			232.2	1.1				98.6	96.8	
	0.00@16"	418	235							
		Averages		1.1				97.7	96.8	
		Standard Meter Volume	4.96095729					97.25		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature		Vacuum
					Coil 1	Coil 2	Probe	Inlet	Outlet	
3B	0.00@16"	425	235.32	1.1				98.6	98.6	
			238.05	1.1				100.4	98.6	
	0.00@16"	435	241.02							
		Averages		1.1				99.5	98.6	
		Standard Meter Volume	5.37908593					99.05		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature		Vacuum
					Coil 1	Coil 2	Probe	Inlet	Outlet	
3C	0.00@16"	442	241.51	1.1				100.4	100.4	
			244.15	1.1				102.2	100.4	
	0.00@14"	452	246.56							
		Averages		1.1				101.3	100.4	
		Standard Meter Volume	4.750386348					100.85		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature		Vacuum
					Coil 1	Coil 2	Probe	Inlet	Outlet	
3D	0.00@13"	459	246.74	1.1				100.4	100.4	
			249.24	1.1				100.4	100.4	
	0.00@15"	509	251.81							
		Averages		1.1				100.4	100.4	
		Standard Meter Volume	4.773029417					100.4		

VOST FIELD DATA

1574

Plant	CWA	1200	Ambient Temp. (°F)	110°F	Meter Box Number	Revised
Date	5/20/05		Barometric Pressure (in. H2O)	29.85	DGM Cal. Factor (Y)	0.97
Sampling Location	Melter		Stack Temp. (°F)		Probe Length & Type	10' TFE
Sample Type	VOST		Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	3		Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	WWD		Sample Rate (lpm)	0.5	Filter Temp. (°F)	

Purpose: VOST 0.5 LPM For 10 min @ melter.

Other Data/Notes:

LEAK CHECKS:		PRE TEST		POST TEST	
Set	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)
A	0.00 @ 16"	0.00 @ 16"	C	0.00 @ 16"	0.00 @ 14"
B	0.00 @ 16"	0.00 @ 13"	D	0.00 @ 13"	0.00 @ 15"

Set: _____
Set: _____

Tenax Tube: _____
Tenax Tube: _____

Additional Tubes: _____
Additional Tubes: _____

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Sampling Times	Run (min)	Clock (24hr)	Gas Meter Reading (Vol in L or ft3)	Rollometer Setting (lpm/ft3/min)	Meter Pressure (in. H2O)	Meter Temp. (°F)	Condenser Temperature A (°F) C B (°F) C	Line Temp. (°F) C	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
A	04:08	229.76	0.5	1.1	36/36	22	21	35			13.0
	04:13	232.20	0.5	1.1	37/36	21	20	35			13.0
	04:18	235.00	0.5	1.1	37/36	21	20	35			13.0
	04:25	235.32	0.5	1.1	37/37	22	21	35			13.0
B	04:30	238.05	0.5	1.1	38/37	20	20	35			13.0
	04:35	241.00	0.5	1.1	38/37	22	21	35			13.0
	04:42	241.51	0.5	1.1	38/38	22	21	35			9.5
C	04:47	244.15	0.5	1.1	39/38	21	20	35			10.0
	04:52	246.50	0.5	1.1	39/38	22	21	35			12.5
	04:59	246.74	0.5	1.1	39/38	22	21	35			12.5
D	05:04	249.24	0.5	1.1	38/38	21	21	35			12.5
	05:09	251.81	0.5	1.1	38/38	21	21	35			12.5
764	Run Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm					Ts	Vacuum (in. Hg)

Comments:

Plant	CUA - Melter	Meter Number	1574
Date	03/20/2005	Correction factor	0.997
Sample Type	VOST	Barometric Pressure	29.9
Run Number	4		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
4A	0.00@12"	2051	254.04	1.1				78.8	75.2
			256.85	1.1				82.4	78.8
	.00@11"	2101	259.14						
		Averages		1.1				80.6	77
		Standard Meter Volume	4.993750812					78.8	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
4B	0.00@10"	2110	259.32	1.1				86	84.2
			261.88	1.1				87.8	84.2
	0.00@13"	2120	264.42						
		Averages		1.1				86.9	84.2
		Standard Meter Volume	4.931963959					85.55	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
4C	0.00@13"	2126	264.79	1.1				89.6	87.8
			267.42	1.1				91.4	89.6
	0.00@12"	2136	269.69						
		Averages		1.1				90.5	88.7
		Standard Meter Volume	4.703635226					89.6	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
4D	.00@12"	2142	269.88	1.1				91.4	91.4
			272.48	1.1				91.4	93.2
	0.00@12"	2152	274.92						
		Averages		1.1				91.4	92.3
		Standard Meter Volume	4.818299234					91.85	

VOST FIELD DATA

Plant	CWA	1200	Ambient Temp. (°F)	110°F	Meter Box Number	Revised..
Date	3/20/05		Barometric Pressure (in. H2O)	29.80	DGM Cal. Factor (Y)	0.997
Sampling Location	Melter		Stack Temp. (°F)		Probe Length & Type	10' TFE
Sample Type	VOST		Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	4		Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	Musky		Sample Rate (lpm)	0.5 LPM	Filter Temp. (°F)	

Purpose: VOST @ molter 0.5 LPM for 10 minutes.

4A had broken ends ~~4A-1 and~~ charcoal

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)
A	2.00 @ 12"	0.00 @ 11"	0.00 @ 13"	0.00 @ 12"
B	0.00 @ 10"	0.00 @ 13"	0.00 @ 12"	0.00 @ 12"

Sat:

Tenax Tube:

Tenax Charcoal:

Additional Tubes:

Sat:

Tenax Tube:

Tenax Charcoal:

Additional Tubes:

Sampling Times		Gas Meter Reading (Vol in L or ft ³)	Rotameter Setting (lpm/ft ³ /min)	Meter Pressure (in. H ₂ O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
Run (min)	Clock (24hr)					A (°F)	B (°F)				
	20:51	254.04									
A	20:56	256.85	0.5	1.1	26/24	20	20	35			9.0
	21:01	259.14	0.5	1.1	28/26	18	19	35			7.0
B	21:10	259.32									
	21:15	261.55	0.5	1.1	30/29	20	20	35			10.0
C	21:20	264.42	0.5	1.1	31/29	18	19	35			10.0
	21:26	264.79									
D	21:31	267.42	0.5	1.1	32/31	20	20	35			8.0
	21:36	269.69	0.5	1.1	33/32	18	19	35			8.0
E	21:42	269.88									
	21:47	272.48	0.5	1.1	33/33	20	20	35			9.0
F	21:52	274.92	0.5	1.1	33/34	20	19	35			9.0
Total Time		Total Volume Metered	Average Flow Rate	Average Pm	Average Tm					Ts	Vacuum (in. Hg)
766										°C = °F	

Comments:

Plant	CUA - Melter	Meter Number	1574
Date	03/20/2005	Correction factor	0.997
Sample Type	VOST	Barometric Pressure	29.9
Run Number	5		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
5A	0.00@13"	1041	278.51	1.1				91.4	91.4
			281.22	1.1				93.2	91.4
	0.00@12"	1051	283.67						
		Averages		1.1				92.3	91.4
		Standard Meter Volume	4.933020645					91.85	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
5B	0.00@12"	1057	283.8	1.1				93.2	91.4
			286.51	1.1				93.2	91.4
	0.00@13"	1107	289.06						
		Averages		1.1				93.2	91.4
		Standard Meter Volume	5.024524627					92.3	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
5C	0.00@13"	1113	289.25	1.1				93.2	93.2
			291.81	1.1				95	93.2
	0.00@14"	1123	294.38						
		Averages		1.1				94.1	93.2
		Standard Meter Volume	4.888395539					93.65	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
5D	0.00@14"	1128	294.56	1.1				93.2	93.2
			297.21	1.1				95	93.2
	0.00@13"	1138	299.76						
		Averages		1.1				94.1	93.2
		Standard Meter Volume	4.955098792					93.65	

VOST FIELD DATA

Plant	CWA	1200	Ambient Temp. (°F)	110°F	Meter Box Number	Revised.
Date	3/20/05		Barometric Pressure (in. H2O)	24.80	DGM Cal. Factor (M)	0.197
Sampling Location	Melter		Stack Temp. (°F)	175°C	Probe Length & Type	10' TFE
Sample Type	VOST		Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	5		Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	MDJ		Sample Rate (lpm)	0.5	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)
A	0.00 @ 13"	0.00 @ 12"	0.00 @ 13"	0.00 @ 14"
B	0.00 @ 12"	0.00 @ 13"	0.00 @ 14"	0.00 @ 13"

Sat:

Tenax Tube:

Tenax Charcoal:

Additional Tubes:

Sai:

Tenax Tube:

Tenax Charcoal:

Additional Tubes:

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Sampling Times		Gas Meter Reading (Vol In L or ft3)	Rotameter Setting (lpm/ft3/ min)	Meter Pressure (in. H2O)	Meter Temp. (°F) C	Condenser Temperature		Line Temp. (°F) C	Probe Temp. (°F)	Stack Temp. (°F) C	Train Vacuum (in.Hg)
Run (min)	Clock (24hr)					A (°F) C	B (°F) C				
	10:41	278.51									
A	10:46	281.22	0.5	1.1	33/33	22	20	35.0		175	10.5
	10:51	283.67	0.5	1.1	34/33	19	20	35		175	9.0
	10:57	283.80									
B	11:02	286.51	0.5	1.1	34/33	21	21	35		175	10.0
	11:07	289.06	0.5	1.1	34/33	19	19	35		175	9.5
	11:13	289.25									
C	11:18	291.81	0.5	1.1	34/34	20	20	35		175	10.5
	11:23	294.38	0.5	1.1	35/34	20	19	35		175	10.5
	11:28	294.56									
D	11:33	297.21	0.5	1.1	34/34	20	21	35		175	7.5
	11:38	299.76	0.5	1.1	35/34	19	19	35		175	9.0
Run Time	Total Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm					Ts	Vacuum (in.Hg)

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Comments:

Plant	CUA - Melter	Meter Number	1574
Date	03/20/2005 3/21/05	Correction factor	0.997
Sample Type	VOST	Barometric Pressure	29.9
Run Number	6		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
6A	0.00@13.5"	0046	301.66	1.1				91.4	89.6
			304.41	1.1				91.4	89.6
	0.00@12"	0056	306.78						
		Averages		1.1				91.4	89.6
		Standard Meter Volume	4.906783723					90.5	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
6B	0.00@12"	0102	306.93	1.1				91.4	91.4
			309.52	1.1				93.2	91.4
	0.00@16"	0112	312.13						
		Averages		1.1				92.3	91.4
		Standard Meter Volume	4.971261115					91.85	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
6C	0.00@16"	0118	312.32	1.1				93.2	91.4
			314.78	1.1				93.2	91.4
	0.00@15"	0128	317.26						
		Averages		1.1				93.2	91.4
		Standard Meter Volume	4.718850125					92.3	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
6D	0.00@15"	0143	318.05	1.1				93.2	91.4
			320.52	1.1				93.2	91.4
	0.00@12"	0153	323.25						
		Averages		1.1				93.2	91.4
		Standard Meter Volume	4.967210658					92.3

VOST FIELD DATA

Plant	CWA	1200	Ambient Temp. (°F)	110°F	Meter Box Number	Revised.
Date	3/21/05		Barometric Pressure (in. H2O)	29.80	DGM Cal. Factor (Y)	0.997
Sampling Location	Melker		Stack Temp. (°F)	175	Probe Length & Type	10' TPE
Sample Type	VOST		Average delta P (in. H2O)		Probe Heater Setting (°F)	35°C
Run Number	6		Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	MWJ		Sample Rate (lpm)		Filter Temp. (°F)	

Purpose: VOST 4-10 min runs + blank @ 0.5 dpm
Other Data/Notes: Blank run between runs 6C and 6D. 2 leak checks at 15" Hg

LEAK CHECKS:		PRE TEST		POST TEST	
Set	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)
A	0.00 @ 13.5	0.00 @ 12"	C	0.00 @ 16"	0.00 @ 15"
B	0.00 @ 12.0	0.00 @ 16"	D	0.00 @ 15"	0.00 @ 12"

Set: _____ Tenax Tube: _____ Tenax Charcoal: _____ Additional Tubes: _____
Set: _____ Tenax Tube: _____ Tenax Charcoal: _____ Additional Tubes: _____

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Sampling Times		Gas Meter Reading (Vol in L or ft3)	Rotameter Setting (lpm/ft3/ min)	Meter Pressure (in. H2O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
Run (min)	Clock (24hr)					A (°F)	B (°F)				
A	00:46	301.66								175	
	00:51	304.41	0.5	1.1	33/32	22	21	35		175	9.0
	00:56	306.78	0.5	1.1	33/32	19	20	35		175	9.0
	01:02	306.93									
B	01:07	309.52	0.5	1.1	33/33	20	20	35		175	13.0
	01:12	312.13	0.5	1.1	34/33	19	20	35		175	13.0
	01:18	312.32									
	01:23	314.78	0.5	1.1	34/33	21	20	35		175	7.0
C	01:28	317.26	0.5	1.1	34/33	19	20	35		175	8.0
	01:43	318.05									
	01:48	320.52	0.5	1.1	34/33	21	21	35		175	9.0
	01:53	323.25	0.5	1.1	34/33	20	20	35		175	9.0
Run Time	Total Time		Average Flow Rate	Average Pm	Average Tm					Ts	Vacuum (in. Hg)
	770										

Comments:

Plant	CUA - TCO	Meter Number	1575
Date	03/20/2005	Correction factor	0.981
Sample Type	VOST	Barometric Pressure	29.8
Run Number	1		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
1A	0@14"	0011	108.98	1.1				95	95
			118.05	1.1				98.6	95
	0@17"	0031	127.43					100.4	96.8
	Averages			1.1				98	95.6
Standard Meter Volume			17.14368896					96.8	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
1B	0@17"	0040	127.66	1.1				98.6	98.6
			138.05	1.1				100.4	98.6
	0.01@18"	0100	147.67					102.2	100.4
	Averages			1.1				100.4	99.2
Standard Meter Volume			18.49359443					99.8	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
1C	0@18"	0111	148.14	1.1				100.4	102.2
			157.32	1.1				102.2	100.4
	0@21"	0131	166.29					102.2	102.2
	Averages			1.1				101.6	101.6
Standard Meter Volume			16.72078509					101.6	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
1D	0@21"	0140	167.18	1.2				102.2	102.2
			177.94	1.1				104	102.2
	0@17"	0200	187.58					104	102.2
	Averages			1.15				103.4	102.2
Standard Meter Volume			18.75584541					102.8	

VOST FIELD DATA

Plant	24A	Ambient Temp. (°F)	100	Meter Box Number	Serial 1576
Date	3-19-05	Barometric Pressure (in. H2O)	29.80	DGM Cal. Factor (Y)	0.981
Sampling Location	700 out	Stack Temp. (°F)	650	Probe Length & Type	
Sample Type	VOST	Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	1	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	WLG	Sample Rate (lpm)	1	Filter Temp. (°F)	

Purpose: _____

Other Data/Notes: 0 21 0 17

LEAK CHECKS:		PRE TEST	PRE TEST	POST TEST	POST TEST
Set		Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)
A	0	0	14	0	17
B	0	0	17	0.01	18
C	0	0	18	0	21

Set: _____ Tenax Tube: _____ Tenax Charcoal: _____ Additional Tubes: _____
Set: _____ Tenax Tube: _____ Tenax Charcoal: _____ Additional Tubes: _____

Sampling Times	Run (min)	Clock (24hr)	Gas Meter Reading (Vol in L or ft³)	Rotameter Setting (lpm/ft³/min)	Meter Pressure (in. H2O)	Meter Temp. (°F)	Condenser Temperature		Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
							A (°F)	B (°F)			
A-0	10	0011	0108.98	1.0	1.1	35/35	10	14		650	13
	20	0021	118.05	1.0	1.1	37/35	9	12		650	10
	30	0031	127.43	1.0		38/36	10	13		650	11
B-0	10	0040	127.66	1.0	1.1	37/37	13	15		648	12
	20	0050	138.05	1.0	1.1	38/37	10	13		647	12
	30	0100	147.67	1.0		39/38	9	13		648	13
C-0	10	0111	148.14	1.0	1.1	38/39	11	14		647	16
	20	0121	157.32	1.0	1.1	39/38	9	12		647	15
	30	0131	166.29	1.0		39/39	11	13		647	15
D-0	10	0140	167.18	1.0	1.2	39/39	10	15		647	12
	20	0150	177.94	1.0	1.1	40/39	10	13		647	12
	30	0200	187.58	Average Flow Rate	Average Pm	Average Tm	11	14			Vacuum (in. Hg)
772	Run Time	Total Time	Total Volume Metered								

Comments: _____
_____ 35 36 37 38
_____ 39 40 41 42
_____ 95 96.8 98.6 100.4

Plant	CUA - TCO	Meter Number	1575
Date	03/20/2005	Correction factor	0.981
Sample Type	VOST	Barometric Pressure	29.8
Run Number	2		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
2A	0@17"	0220	189	1.1				102.2	102.2
			198.52	1.1				102.2	100.4
	0@21"	0240	207.73	1.1				100.4	100.4
	Averages			1.1				101.6	101
Standard Meter Volume			17.26433561					101.3	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
2B	0.005@18"	0248	208.3	1.1				100.4	100.4
			218.05	1.1				100.4	98.6
	0@12"	0308	227.61	1.1				100.4	98.6
	Averages			1.1				100.4	99.2
Standard Meter Volume			17.8466421					99.8	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
2C	0@18"	0317	227.96	1.1				96.8	96.8
			237.6	1.1				98.6	98.6
	0.005@19"	0337	247.21	1.1				98.6	98.6
			Averages		1.1				98
Standard Meter Volume			17.84857998					98	

No 2D collected

VOST FIELD DATA

Plant	CUA	Ambient Temp. (°F)	105	Meter Box Number	8041575
Date	3-20-05	Barometric Pressure (in. H2O)	29.80	DGM Cal. Factor (Y)	0.981
Sampling Location	TEO	Stack Temp. (°F)		Probe Length & Type	
Sample Type	VOST	Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	2	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	WEG	Sample Rate (ipm)	1	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:	Set	PRE TEST Rate (in. Hg)	17	POST TEST Rate (in. Hg)	21	POST TEST Vacuum (in. Hg)	12
	B	0.005	21	0	12		
	C	0	18	0.005	19		

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Tenax Tube:

Tenax Charcoal:

Tenax Tube:

Set:

Set:

Additional Tubes:

Additional Tubes:

Sampling Times	Run (min)	Clock (24hr)	Gas Meter Reading Vol in L or m³	Rotameter Setting (ipm/m³ rate)	Meter Pressure (in. H2O)	Meter Temp. (°F)	Condenser Temperature A (°F) B (°F)	Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
A	0	0220	189.00	1.0	1.1	39/39	12 15			648	14
	10	0230	198.52	1.0	1.1	38/38	11 15			648	14
	20	0240	207.73		1.1	38/38	22 15			648	14
B	0	0248	208.30	1.0	1.1	38/38	12 14			647	9
	10	0258	218.05	1.0	1.1	38/37	11 13			648	8
	20	0308	227.61		1.1	38/37	11 13			648	9
C	0	0317	227.96	1.0	1.1	36/36	12 15			648	13
	10	0327	237.60	1.0	1.1	37/37	11 14			648	13
	20	0337	247.21		1.1	37/37	10 14			648	13
No D											
Run Time		Total Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm				Ts	Vacuum (in. Hg)

Comments:

Plant	CUA - TCO	Meter Number	1575
Date	03/20/2005	Correction factor	0.981
Sample Type	VOST	Barometric Pressure	29.8
Run Number	43		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
3A	0@19"	0352	248.55	1.1				96.8	96.8
			258.33	1.1				96.8	96.8
	0@19"	0412	267.78	1.1				98.6	96.8
		Averages		1.1				97.4	96.8
Standard Meter Volume			17.85884058					97.1	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
3B	0@20"	0420	268.31	1.1				96.8	96.8
			277.9	1.1				98.6	96.8
	0.005@19"	0440	287.81	1.1				98.6	98.6
		Averages		1.1				98	97.4
Standard Meter Volume			18.09010558					97.7	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
3C	0@20"	0449	288.24	1.1				96.8	98.6
			297.55	1.1				98.6	98.6
	0@21"	0509	307.2	1.1				98.6	98.6
		Averages		1.1				98	98.6
Standard Meter Volume			17.57024591					98.3	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
3D	0.005@21"	0517	307.67	1.1				96.8	98.6
			317.04	1.1				98.6	98.6
	0.005@20"	0537	326.41	1.1				98.6	98.6
		Averages		1.1				98	98.6
Standard Meter Volume			17.36637175					98.3	

AIR/TECH

Plant	CUA	Ambient Temp. (°F)	105	Meter Box Number	See # 15
Date	3-20-05	Barometric Pressure (in. H2O)	29.75	DGM Cal. Factor (Y)	2.981
Sampling Location	700	Stack Temp. (°F)		Probe Length & Type	
Sample Type	1027	Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	3	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	WLG	Sample Rate (lpm)	1.0	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg) ^{1/2}	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set				
C	0	20	0	21
D	0.005	21	0.005	20

Set: Set:

Tenax Tube: _____
Tenax Tube: _____

Tenax Charcoal:

Additional Tubes:
Additional Tubes:

Set:		Tenax Tube:		Rotameter		Meter Pressure (in.H ₂ O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in.Hg)
Run Time	Sampling Times Clock (min) (24hr)	Gas Meter Reading (Vol in L or ft³)	Setting (lpm/ft³/min)					A	B				
								(°C)	(°F)				
0	0449	288.24	1.0			1.1	36/37	13	16			647	15
10	0459	297.55	1.0			1.1	37/37	11	14			651	14
20	0509	297.55 307.20	1.0			1.1	37/37	10	14			651	14
0	0517	307.67	1.0			1.1	36/37	14	16			657	15
10	0527	319.04	1.0			1.1	37/37	13	16			657	14
20	0537	326.41	1.0			1.1	37/37	12	15			657	14
Run Time	Total Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm	Ts	Vacuum (in.Hg)						

Comments:

Plant	CUA - TCO	Meter Number	1575
Date	03/20/2005	Correction factor	0.981
Sample Type	VOST	Barometric Pressure	29.8
Run Number	4		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
4A	0@21"	2046	332.45	1.1				89.6	89.6
			341.65	1.1				91.4	91.4
	0@21"	2106	351.43	1.1				91.4	91.4
	Averages			1.1				90.8	90.8
Standard Meter Volume			17.82827856					90.8	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
4B	0@21"	2116	351.89	1.1				91.4	91.4
			362.28	1.1				93.2	93.2
	0@21"	2136	371.77	1.1				93.2	93.2
	Averages			1.1				92.6	92.6
Standard Meter Volume			18.61283958					92.6	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
4C	0@21"	2145	372.69	1.1				93.2	93.2
			382.51	1.1				95	93.2
	0@17"	2205	391.51	1.1				95	93.2
	Averages			1.1				94.4	93.2
Standard Meter Volume			17.58222374					93.8	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
4D	0@17"	2214	391.87	1.1				93.2	93.2
			401.16	1.1				95	93.2
	0@17"	2234	410.5	1.1				95	93.2
	Averages			1.1				94.4	93.2
Standard Meter Volume			17.40471989					93.8

VOST FIELD DATA

Run 4
Page 1 of 1

Plant	CUA	Ambient Temp. (°F)		Meter Box Number	564 1575
Date	3-20-05	Barometric Pressure (in. H2O)		DGM Cal. Factor (Y)	0.981
Sampling Location	700	Stack Temp. (°F)		Probe Length & Type	
Sample Type	VOST	Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	4	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	WCG	Sample Rate (lpm)	1.0	Filter Temp. (°F)	

Purpose:

Other Date/Notes:

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg) LPM	Vacuum (in. Hg)	Rate (in. Hg) LPM	Vacuum (in. Hg)
A	0	21	0	21
B	0	21	0	21
C	0	21	0	17

Set:

Set:

Tenax Tube:

Tenax Tube:

Tenax Charcoal:

Tenax Charcoal:

Additional Tubes:

Additional Tubes:

Sampling Times	Run (min)	Clock (24hr)	Gas Meter Reading (Vol in L @ 40)	Rotameter Setting (lpm/ft3/min)	Meter Pressure (in. H2O)	Meter Temp. (°F)	Condenser Temperature A (°F) B (°F)	Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
A-0	20	46	332.45	1.0	1.1	32/32	11 13			6027	14
10	20	56	341.65	1.0	1.1	33/33	7 11			6027	15
20	21	06	351.43	1.0	1.1	33/33	7 11			6027	15
B-0	21	06	351.89	1.0	1.1	33/33	12 14			6017	16
10	21	26	362.28	1.0	1.1	34/34	9 13			6017	15
20	21	36	371.77	1.0	1.1	34/34	10 12			6017	14
C-0	21	45	372.69	1.0	1.1	34/34	10 14			6017	12
10	21	55	382.51	1.0	1.1	35/34	10 14			6017	11
20	22	05	391.51	1.0	1.1	35/34	11 15			6017	12
D-0	22	14	391.87	1.0	1.1	34/34	13 17			6017	12
10	22	24	401.16	1.0	1.1	35/34	12 15			6017	12
20	22	34	410.50	1.0	1.1	35/34	11 14			6017	12
D-back check			0 @ 17 u		0 @ 17 u						
Run Time	779		Total Volume Metered	Average Flow Rate	Average Pm	Average Tm					

Comments:

°C
32
33
34
35

°F
89.6
91.4
93.2
95

Plant	CUA - TCO	Meter Number	1575
Date	03/20/2005	Correction factor	0.981
Sample Type	VOST	Barometric Pressure	29.8
Run Number	5		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature		Vacuum
					Coil 1	Coil 2	Probe	Inlet	Outlet	
5A	0@17"	2248	410.82	1.1				93.2	93.2	
			422.21	1.1				93.2	93.2	
	0@21"	2308	431.66	1.1				93.2	93.2	
	Averages			1.1				93.2	93.2	
Standard Meter Volume			19.49048642					93.2		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature		Vacuum
					Coil 1	Coil 2	Probe	Inlet	Outlet	
5B	0@21"	2317	432.29	1.1				93.2	93.2	
			442.27	1.1				93.2	93.2	
	0@22"	2337	451.81	1.1				93.2	93.2	
	Averages			1.1				93.2	93.2	
Standard Meter Volume			18.25596425					93.2		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature		Vacuum
					Coil 1	Coil 2	Probe	Inlet	Outlet	
5C	0@23"	2346	452.49	1.1				93.2	93.2	
			461.71	1.1				93.2	93.2	
	0@25"	0006	471	1.1				93.2	93.2	
	Averages			1.1				93.2	93.2	
Standard Meter Volume			17.31136774					93.2		

No D! collected

VOST FIELD DATA

Plant	CUA	Ambient Temp. (°F)		Meter Box Number	50415
Date	3-20-05	Barometric Pressure (in. H2O)	29.75	DGM Cal. Factor (Y)	0.981
Sampling Location	TCO	Stack Temp. (°F)	620	Probe Length & Type	
Sample Type	VOST	Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	5	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	WCG	Sample Rate (ipm)	1.0	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:		PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg) / Pm	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)
A	0	17	0	21	0
B	0	21	0	22	0
C	0	23	0	25	0

Set:
Set:

Tenax Tube:
Tenax Tube:

Tenax Charcoal:
Tenax Charcoal:

Additional Tubes:
Additional Tubes:

Sampling Times Run (min)	Clock (24hr)	Gas Meter Reading (Vol in L or ft3)	Rotameter Setting (ipm/ft3/ rate)	Meter Pressure (in. H2O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
						A (°F)	B (°F)				
0	2248	410.82	1.0	1.1	34/34	12	16			617	15
10	2258	422.21	1.0	1.1	34/34	11	14			617	15
20	2308	431.66	1.0	1.1	34/34	10	13			617	14
0	2317	432.29	1.0	1.1	34/34	10	14			617	16
10	2327	442.27	1.0	1.1	34/34	7	11			617	15
20	2337	451.81	1.0	1.1	34/34	8	11			617	16
0	2346	452.49	1.0	1.1	34/34	10	13			617	17
10	2356	461.71	1.0	1.1	34/34	9	13			617	18
20	0006	471.00	1.0	1.1	34/34	10	13			617	18
No D.											
Run Time	Total Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm					Ts	Vacuum (in. Hg)

Comments:

Plant	CUA - TCO	Meter Number	1575
Date	03/20/2005 3/21/05	Correction factor	0.981
Sample Type	VOST	Barometric Pressure	29.8
Run Number	6		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
6A	0@25"	0018	473.25	1.1				93.2	93.2
			483.05	1.1				93.2	93.2
	0@21"	0038	492.39	1.1				93.2	93.2
	Averages			1.1				93.2	93.2
	Standard Meter Volume			17.9005715				93.2	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
6B	0@21"	0047	492.84	1.1				93.2	93.2
			502.58	1.1				93.2	93.2
	0@22"	0107	512.27	1.1				93.2	93.2
	Averages			1.1				93.2	93.2
	Standard Meter Volume			18.17179228				93.2	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
6C	0@23"	0115	512.77	1.1				93.2	93.2
			522.68	1.1				93.2	93.2
	0@24"	0135	532.81	1.1				93.2	93.2
	Averages			1.1				93.2	93.2
	Standard Meter Volume			18.74229117				93.2	

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
6D	0@23"	0144	533.34	1.1				91.4	93.2
			543.11	1.1				91.4	91.4
	0@21"	0204	553.43	1.1				93.2	93.2
	Averages			1.1				92	92.6
	Standard Meter Volume			18.81967106				92.3

VOST FIELD DATA

Run
Page 1 of

6

Plant	CUA	Ambient Temp. (°F)	100	Meter Box Number	Serial 15
Date	3-21-05	Barometric Pressure (in. H2O)	29.80	DGM Cal. Factor (Y)	0.981
Sampling Location	VOST	Stack Temp. (°F)		Probe Length & Type	
Sample Type	TGO	Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	6	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	weg	Sample Rate (lpm)	1.0	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

D - for Solar

LEAK CHECKS:		PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg) LPM	Vacuum (in. Hg)	Rate (in. Hg) LPM	Vacuum (in. Hg)	
A	0	25	0	21	
B	0	21	0	22	
C	0	23	0	24	

Set:

Set:

Tenax Tube:

Tenax Tube:

Tenax Charcoal:

Tenax Charcoal:

Additional Tubes:

Additional Tubes:

Sampling Times	Run	Clock	Gas Meter Reading	Rotameter	Meter	Meter	Condenser Temperature	Line	Probe	Stack	Train
(min)	(24hr)	(Vol in L or ft3)	(lpm/ft3/min)	Pressure (in. H2O)	Temp. (°F)	A (°F)	B (°F)	Temp. (°F)	Temp. (°F)	Temp. (°F)	Vacuum (in. Hg)
A-0	0018	473.25	1.0	1.1	34/34	11	15			617	15
10	0028	483.05	1.0	1.1	34/34	10	13			620	15
20	0038	492.39	1.0	1.1	34/34	12	15			620	15
A-0	0047	492.84	1.0	1.1	34/34	12	14			620	17
10	0057	502.58	1.0	1.1	34/34	12	15			621	17
20	0107	512.27	1.0	1.1	34/34	11	14			621	16
C-0	0115	512.77	1.0	1.1	34/34	13	16			621	17
10	0125	522.68	1.0	1.1	34/34	13	15			621	17
20	0135	532.81	1.0	1.1	34/34	15	17			621	16
D-0	0144	533.34	1.0	1.1	33/34	10	13			621	16
10	0154	543.11	1.0	1.1	33/33	10	13			621	16
20	0204	553.43	1.0	1.1	34/34	10	14			621	15
0	0	Pre		Post							
0	0	0 @ 23"		0021"							
Total Time		Total Volume Metered	Average Flow Rate	Average Pm	Average Tm					Ts	Vacuum (in. Hg)

Comments:

Appendix B.2

Semi-VOST

Facility:	CUA /VSL	Start Time:	1130
Date:	03/09/05	End Time:	1230
Location:	Melter	Initial Leak Check:	0.00@16
Run Number:	1	Final Leak Check:	0.003@16
Sample Type:	SVOC		

Total Sampling Time (min)	✓	60.0
Corrected Barometric Pressure (in Hg)		30.59
Absolute Stack Pressure (in Hg)	✓	30.21
Stack Static Pressure (in H ₂ O)	✓	-5.20
Average Stack Temperature (°F)	✓	393.83
Stack Area (sq in)	✓	12.57
Actual Meter Volume (cu ft)	✓	44.580
Average Meter Pressure (in H ₂ O)	✓	1.67
Average Meter Temperature (°F)	✓	106.58
Moisture Collected (g)	✓	223.50
Carbon Dioxide Concentration (%V)		0.0
Oxygen Concentration (%V)		20.9
Nitrogen Concentration (%V)		79.1
Dry Gas Meter Factor	✓	1.0248
Nozzle Diameter (in)		0.251
Pitot Constant	✓	0.99
Average Sampling Rate (dscfm)		0.728
Standard Metered Volume (dscf)	✓	43.707
Standard Metered Volume (dscm)		1.238
Stack Moisture (%V)	✓	19.43
Mole Fraction Dry Stack Gas		0.806
Dry Molecular Weight		28.84
Wet Molecular Weight		26.73
Stack Gas Velocity (fpm)	✓	4444.28
Stack Gas Velocity (mpm)		1354.62
Volumetric Flow Rate (acfm)	✓	387.84
Volumetric Flow Rate (acmm)		10.98
Volumetric Flow Rate (dscfm)	✓	195.09
Volumetric Flow Rate (dscmm)		5.52
Percent Isokinetic		94.83
Percent Excess Air		-1174157.30
Concentration (g/dscm)		0.00
Concentration (kg/hr)		0.00
Concentration (ppmv)		0.00
Emissions (lb/hr)		0.00

Run MO-SVOC
Page of

(Diagram of Duct)

Read and Record All Data Every _____ Minutes

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US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/09/05
Melter/Location	DM 1200 Melter
Run Number	SEMI-Volatiles Melter Run 1
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	691.0	482.3	208.7
2	-	H2O	100	Modified	715.3g	715.4	-0.1
3	-	H2O	100	G/2	722.3	722.8	-0.5
4	-	KMnO4	200	Modified	727.4	726.5g 6	-0.9
5	N/A	Silica Gel	-	Modified	920.4	905.9g	14.5
Total Weight Gain (g):							223.05

Facility:	CUA /VSL	Start Time:	1524
Date:	03/09/05	End Time:	0
Location:	Melter	Initial Leak Check:	0.00@15 1624
Run Number:	2	Final Leak Check:	0.00@18
Sample Type:	SVOC		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.55
Absolute Stack Pressure (in Hg)			30.17
Stack Static Pressure (in H2O)			-5.20
Average Stack Temperature (°F)			423.00
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			45.413
Average Meter Pressure (in H2O)			1.80
Average Meter Temperature (°F)			100.83
Moisture Collected (g)			239.50
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0248
Nozzle Diameter (in)			0.251
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.749
Standard Metered Volume (dscf)			44.942
Standard Metered Volume (dscm)			1.273
Stack Moisture (%V)			20.08
Mole Fraction Dry Stack Gas			0.799
Dry Molecular Weight			28.84
Wet Molecular Weight			26.66
Stack Gas Velocity (fpm)			4681.28
Stack Gas Velocity (mpm)			1426.85
Volumetric Flow Rate (acfm)			408.52
Volumetric Flow Rate (acmm)			11.57
Volumetric Flow Rate (dscfm)			196.83
Volumetric Flow Rate (dscmm)			5.57
Percent Isokinetic			96.65
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	XAD Trap Number	Meter Box Number	ATD
Date	Filter Heater Setting (°F)	Meter Δ H @	1.809
Sampling Location	Probe Length & Type	DGM Factor (r _p)	1.0248
Sample Type	Probe Heater Setting (°F)	Nozzle Type & ID (in.)	Glass 0.251
Run Number	Minimum Sample Volume	Ambient Temperature (°F)	90
Operator	Initial Leak Check	Assumed Moisture (% H ₂ O)	19
Barometric Pressure (±) (in.)	Final Leak Check	K Factor	2.3
Static Pressure (in. H ₂ O)			

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

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US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/09/05
Melter/Location	DM 1200 Melter
Run Number	SEMI-Volatiles Melter Run 2
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	711.7g	488.5g	
2	-	H2O	100	Modified	757.6	757.5g	
3	-	H2O	100	G/2	723.1	723.1g	
4	-	KMnO4	200	Modified	735.7g	734.5g	
5	N/A	Silica Gel	-	Modified	1009.4	994.4g	
Total Weight Gain (g):							

Facility:	CUA /VSL	Start Time:	1902
Date:	03/09/05	End Time:	0
Location:	Melter	Initial Leak Check:	✓ 0.00@19 2002
Run Number:	3	Final Leak Check:	✓ 0.017@14
Sample Type:	SVOC		
Total Sampling Time (min)		✓	60.0
Corrected Barometric Pressure (in Hg)		✓	30.55
Absolute Stack Pressure (in Hg)			30.17
Stack Static Pressure (in H ₂ O)		✓	-5.20
Average Stack Temperature (°F)		✓	416.33
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)		✓	43.932
Average Meter Pressure (in H ₂ O)		✓	1.67
Average Meter Temperature (°F)			103.83
Moisture Collected (g)			219.10
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0248
Nozzle Diameter (in)			0.251
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.720
Standard Metered Volume (dscf)			43.229
Standard Metered Volume (dscm)			1.224
Stack Moisture (%V)			19.29
Mole Fraction Dry Stack Gas			0.807
Dry Molecular Weight			28.84
Wet Molecular Weight			26.75
Stack Gas Velocity (fpm)			4493.90
Stack Gas Velocity (mpm)			1369.74
Volumetric Flow Rate (acfm)			392.17
Volumetric Flow Rate (acmm)			11.11
Volumetric Flow Rate (dscfm)			192.27
Volumetric Flow Rate (dscmm)			5.45
Percent Isokinetic			95.17
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

Run

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/09/05
Melter/Location	DM 1200 Melter
Run Number	SEMI-Volatiles Melter Run 3
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	670.6	483.7	
2	-	H2O	100	Modified	706.8	715.4	
3	-	H2O	100	G/2	719.6g	722.3g	
4	-	KMnO4	200	Modified	726.8g	727.4	
5	N/A	Silica Gel	-	Modified	959.5	920.4g	
Total Weight Gain (g):							

Facility:	CUA /VSL	Start Time:	1030
Date:	03/09/05	End Time:	1330
Location:	TCO	Initial Leak Check:	0,012@15
Run Number:	1	Final Leak Check:	0.004@14
Sample Type:	SVOC		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			30.59
Absolute Stack Pressure (in Hg)			29.71
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			653.89
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			145.940
Average Meter Pressure (in H ₂ O)			1.75
Average Meter Temperature (°F)			105.03
Moisture Collected (g)			353.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.777
Standard Metered Volume (dscf)			139.919
Standard Metered Volume (dscm)			3.962
Stack Moisture (%V)			10.65
Mole Fraction Dry Stack Gas			0.894
Dry Molecular Weight			28.84
Wet Molecular Weight			27.68
Stack Gas Velocity (fpm)			6125.89
Stack Gas Velocity (mpm)			1867.17
Volumetric Flow Rate (acfm)			606.34
Volumetric Flow Rate (acmm)			17.17
Volumetric Flow Rate (dscfm)			254.94
Volumetric Flow Rate (dscmm)			7.22
Percent Isokinetic			104.60
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Plant	Probe Length & Type	Filter Number
Date	Nozzle ID (in.)	Height of Location (ft)
Sampling Location	Pitot Constant	Duct Dimensions (in.)
Sample Type	Meter Box Number	Stack Geometry (R or C)
Run Number	Meter $\Delta H@$	Assume Moisture (%)
Operator	Yd	O ₂ (%)
Ambient Temperature	K Factor	CO ₂ (%)
Barometric Pressure (in.)	Probe Heater Setting (°F)	Nitrogen (%)
Static Pressure (in. H ₂ O)	Heater Box Setting (°F)	Moisture Collected (g)
Initial Leak Check	Final Leak Check	

(Diagram of Duct)

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US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/09/05
Melter/Location	DM 1200 TCO
Run Number	SEMI-Volatiles TCO Outlet Run 1
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	823.1	498.0	325.1
2	-	H2O	100	Modified	728.8	733.8g	-5
3	-	H2O	100	G/2	752.4	760.1g 642.4g	- .7
4	-	KMnO4	200	Modified	704.7	700.2g	4.5
5	N/A	Silica Gel	-	Modified	963.7	933.9g	29.8
Total Weight Gain (g):							353.7

Facility:	CUA /VSL	Start Time:	1417
Date:	03/09/05	End Time:	1717
Location:	TCO	Initial Leak Check:	0.010@14
Run Number:	2	Final Leak Check:	0.00@10
Sample Type:	SVOC		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			30.55
Absolute Stack Pressure (in Hg)			29.67
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			665.00
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			143.778
Average Meter Pressure (in H2O)			1.65
Average Meter Temperature (°F)			107.72
Moisture Collected (g)			344.40
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.761
Standard Metered Volume (dscf)			136.962
Standard Metered Volume (dscm)			3.879
Stack Moisture (%V)			10.60
Mole Fraction Dry Stack Gas			0.894
Dry Molecular Weight			28.84
Wet Molecular Weight			27.69
Stack Gas Velocity (fpm)			5991.39
Stack Gas Velocity (mpm)			1826.18
Volumetric Flow Rate (acfm)			593.03
Volumetric Flow Rate (acmm)			16.79
Volumetric Flow Rate (dscfm)			246.69
Volumetric Flow Rate (dscmm)			6.99
Percent Isokinetic			105.81
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Plant	CWA/VSC	Probe Length & Type	Filter Number
Date	3/9/5	Nozzle ID (in.)	230
Sampling Location	100	Pilot Constant	84
Sample Type	SUDC	Meter Box Number	ATC
Run Number	2	Meter ΔH @	1.672
Operator	Don	Yd	999
Ambient Temperature	95	K Factor	1.64
Barometric Pressure (in. H ₂ O)	30.56	Probe Heater Setting (°F)	248-25
Static Pressure (in. H ₂ O)	-12	Heater Box Setting (°F)	
Initial Leak Check	0.010 @ 14	Final Leak Check	0.000 @ 10

(Diagram of Duct)

Read and Record All Data Every Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	0	1417	58.40	1.05	1.7	667	242	242	105	104	107	7
	10		66.45	1.05	1.7	664	251	246	107	104	52	7
	20		74.50	1.05	1.7	664	243	247	109	105	49	7
	30		82.68	1.05	1.7	663	254	248	110	105	49	7
	40		90.9	1.05	1.7	665	254	249	110	106	44	7
	50		98.88	1.05	1.7	665	255	250	111	106	43	7
	60	1517	106.98	1.05	1.7	667	246	248	110	104	43	7
	70		115.01	1.05	1.7	666	246	249	110	106	44	7
	80		122.96	1.05	1.7	665	246	249	110	106	44	7
	90		130.92	1.05	1.7	666	237	249	110	106	45	7
	100		138.98	1.05	1.7	666	236	249	110	106	47	7
	110		146.03	1.0	1.6	666	236	250	110	106	48	7
	120	1617	154.74	1.0	1.6	666	236	250	110	107	44	7
	130		162.7	1.0	1.6	666	235	247	110	106	43	7
	140		170.68	1.0	1.6	666	235	247	110	106	43	7
	150		178.67	.95	1.6	666	236	249	110	107	43	7
	160		186.60	.97	1.6	665	236	249	110	106	44	7
	170		194.38	.97	1.6	664	235	249	110	106	44	7
	180	1717	202.178	.97	1.6	664	236	250	111	107	47	7

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US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/09/05
Melter/Location	DM 1200 TCO
Run Number	SEMI-Volatiles TCO Outlet Run 2
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	812.7	494.2g	
2	-	H₂O 40% HNO ₃	100	Modified	759.3g	751.8g	
3	-	40% HNO ₃ H₂O	100	G/2	733.9g	734.4	
4	-	KMnO ₄	200	Modified	785.4	792.3g	
5	N/A	Silica Gel	-	Modified	961.4g	935.6g	
Total Weight Gain (g):							

Facility:	CUA /VSL	Start Time:	1803
Date:	03/09/05	End Time:	2103
Location:	TCO	Initial Leak Check:	0.11@12
Run Number:	3	Final Leak Check:	0.00@17
Sample Type:	SVOC		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			30.55
Absolute Stack Pressure (in Hg)			29.67
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			668.11
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			142.460
Average Meter Pressure (in H ₂ O)			1.62
Average Meter Temperature (°F)			106.89
Moisture Collected (g)			341.80
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.755
Standard Metered Volume (dscf)			135.837
Standard Metered Volume (dscm)			3.847
Stack Moisture (%V)			10.61
Mole Fraction Dry Stack Gas			0.894
Dry Molecular Weight			28.84
Wet Molecular Weight			27.69
Stack Gas Velocity (fpm)			5990.65
Stack Gas Velocity (mpm)			1825.95
Volumetric Flow Rate (acfm)			592.95
Volumetric Flow Rate (acmm)			16.79
Volumetric Flow Rate (dscfm)			245.96
Volumetric Flow Rate (dscmm)			6.97
Percent Isokinetic			105.25
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run TCO-SVOC - 3
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(Diagram of Duct)

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US EPA Method 4 Moisture Form

The Catholic University of America

Vitreous State Laboratory

Date	03/09/05
Melter/Location	DM 1200 TCO
Run Number	SEMI-Volatiles TCO Outlet Run 3
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	816.7	499.3	
2	-	H2O	100	Modified	726.8g	728.8	
3	-	H2O	100	G/2	758.2g	759.4	
4	-	KMnO4	200	Modified	709.5g	704.7g	
5	N/A	Silica Gel	-	Modified	986.3g	963.7	
Total Weight Gain (g):							

Facility:	CUA	Start Time:	1133
Date:	03/09/2005	End Time:	1233
Location:	HEPA Out	Initial Leak Check:	0.005@14
Run Number:	1	Final Leak Check:	0.000@12"
Sample Type:	SVOC		
Total Sampling Time (min).			60.0
Corrected Barometric Pressure (in Hg)			30.55
Absolute Stack Pressure (in Hg)			30.46
Stack Static Pressure (in H2O)			-1.30
Average Stack Temperature (°F)			176.00
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			36.273
Average Meter Pressure (in H2O)			1.14
Average Meter Temperature (°F)			104.17
Moisture Collected (g)			124.80
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9967
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.578
Standard Metered Volume (dscf)			34.651
Standard Metered Volume (dscm)			0.981
Stack Moisture (%V)			14.52
Mole Fraction Dry Stack Gas			0.855
Dry Molecular Weight			28.84
Wet Molecular Weight			27.26
Stack Gas Velocity (fpm)			2624.52
Stack Gas Velocity (mpm)			799.95
Volumetric Flow Rate (acfm)			259.77
Volumetric Flow Rate (acmm)			7.36
Volumetric Flow Rate (dscfm)			187.66
Volumetric Flow Rate (dscmm)			5.31
Percent Isokinetic			105.58
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

H.O. - Soc - R1
Run _____
Page 1 of 1

Plant	CVA/VSL	Probe Length & Type	20' TFE	Filter Number	SVOC
Date	3/9/05	Nozzle ID (in.)	.230	Height of Location (ft)	HePA Out
Sampling Location	HePA Out	Pitot Constant	0.99	Duct Dimensions (in.)	10
Sample Type	SVOC	Meter Box Number	ATB	Stack Geometry (R or C)	4
Run Number	1	Meter $\Delta H @$	1.769	Assume Moisture (%)	C
Operator	WPG	Yd	0.9967	O ₂ (%)	7
Ambient Temperature	90	K Factor	3.25	CO ₂ (%)	20.9
Barometric Pressure (in.)	30.56	Probe Heater Setting (°F)	250	Nitrogen (%)	0
Static Pressure (in. H ₂ O)	-1.3	Heater Box Setting (°F)	250	Moisture Collected (g)	79
Initial Leak Check	0.005 @ 14	Final Leak Check	0.000 @ 12		

HR 2

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US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/09/05
Melter/Location	DM 1200 HEPA Outlet
Run Number	SEMI-Volatiles HEPA Outlet Run 1
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate	-		-	600.2	489.2	111.0
2	-	H2O	100	Modified	717.8	717.8g	0
3	-	H2O	100	G/2	729.6	729.3g	0.3
4	-	KMnO4	200	Modified	775.8	774.5g 976.1g	1.3
5	N/A	Silica Gel	-	Modified	988.3	976.1	12.2
Total Weight Gain (g):							124.8

Facility:	CUA	Start Time:	1523
Date:	03/09/2005	End Time:	1623
Location:	HEPA Out	Initial Leak Check:	0.004@12"
Run Number:	2	Final Leak Check:	0.004@13"
Sample Type:	SVOC		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.55
Absolute Stack Pressure (in Hg)			30.46
Stack Static Pressure (in H ₂ O)			-1.30
Average Stack Temperature (°F)			175.00
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			35.783
Average Meter Pressure (in H ₂ O)			1.09
Average Meter Temperature (°F)			105.25
Moisture Collected (g)			112.80
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9967
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.569
Standard Metered Volume (dscf)			34.111
Standard Metered Volume (dscm)			0.966
Stack Moisture (%V)			13.49
Mole Fraction Dry Stack Gas			0.865
Dry Molecular Weight			28.84
Wet Molecular Weight			27.37
Stack Gas Velocity (fpm)			2563.89
Stack Gas Velocity (mpm)			781.47
Volumetric Flow Rate (acfm)			253.77
Volumetric Flow Rate (acmm)			7.19
Volumetric Flow Rate (dscfm)			185.82
Volumetric Flow Rate (dscmm)			5.26
Percent Isokinetic			104.96
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Plant	Probe Length & Type	Filter Number
Date	Nozzle ID (in.)	Height of Location (ft)
Sampling Location	Pitot Constant	Duct Dimensions (in.)
Sample Type	Meter Box Number	Stack Geometry (R or C)
Run Number	Meter $\Delta H @$	Assume Moisture (%)
Operator	Yd	O ₂ (%)
Ambient Temperature	K Factor	CO ₂ (%)
Barometric Pressure (in.)	Probe Heater Setting (°F)	Nitrogen (%)
Static Pressure (in. H ₂ O)	Heater Box Setting (°F)	Moisture Collected (g)
Initial Leak Check	Final Leak Check	

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(Diagram of Duct)

Read and Record All Data Every _____ Minutes

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Run

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/09/05
Melter/Location	DM 1200 HEPA Outlet
Run Number	SEMI-Volatiles HEPA Outlet Run 2
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	599.7	497.9 _g	
2	-	H2O	100	Modified	737.1	737.3 _g	
3	-	H2O	100	G/2	731.7	732.0 _g	
4	-	KMnO4	200	Modified	728.3	727.4 _g	
5	N/A	Silica Gel	-	Modified	937.0	926.4 _g	
Total Weight Gain (g):							112.8

Facility:	CUA	Start Time:	1903
Date:	03/09/2005	End Time:	2003
Location:	HEPA Out	Initial Leak Check:	0.004@13"
Run Number:	3	Final Leak Check:	0.004@10"
Sample Type:	SVOC		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.55
Absolute Stack Pressure (in Hg)			30.46
Stack Static Pressure (in H ₂ O)			-1.30
Average Stack Temperature (°F)			172.33
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			34.862
Average Meter Pressure (in H ₂ O)			1.00
Average Meter Temperature (°F)			104.42
Moisture Collected (g)			108.80
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9967
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.555
Standard Metered Volume (dscf)			33.275
Standard Metered Volume (dscm)			0.942
Stack Moisture (%V)			13.36
Mole Fraction Dry Stack Gas			0.866
Dry Molecular Weight			28.84
Wet Molecular Weight			27.39
Stack Gas Velocity (fpm)			2460.86
Stack Gas Velocity (mpm)			750.07
Volumetric Flow Rate (acfm)			243.58
Volumetric Flow Rate (acmm)			6.90
Volumetric Flow Rate (dscfm)			179.38
Volumetric Flow Rate (dscmm)			5.08
Percent Isokinetic			106.06
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	XAD Trap Number	HEPA out-Suoc -3	Meter Box Number
Date	Filter Heater Setting (°F)	250	Meter Δ H @
Sampling Location	Probe Length & Type	20' TFE	DGM Factor (γ _p)
Sample Type	Probe Heater Setting (°F)	250	Nozzle Type & ID (in.)
Run Number	Minimum Sample Volume		Ambient Temperature (°F)
Operator	Initial Leak Check	0.004 @ 13"	Assumed Moisture (% H ₂ O)
Barometric Pressure (±) (in. H ₂ O)	Final Leak Check	0.004 @ 10"	K Factor
Static Pressure (in. H ₂ O)			

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

[illegible]

Run

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/09/05
Melter/Location	DM 1200 HEPA Outlet
Run Number	SEMI-Volatiles HEPA Outlet Run 3
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	591.4g	490.9	
2	-	H2O	100	Modified	717.3g	717.8	
3	-	H2O	100	G/2	729.0g	729.6	
4	-	KMnO4	200	Modified	779.8g	778.0	
5	N/A	Silica Gel	-	Modified	995.2g	988.3	
Total Weight Gain (g):							108.8

Facility:	CUA	Start Time:	1031
Date:	03/09/2005	End Time:	1331
Location:	Carbon Bed Out	Initial Leak Check:	0.004@13
Run Number:	1	Final Leak Check:	0.004@10"
Sample Type:	SVOC		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			30.55
Absolute Stack Pressure (in Hg)			29.93
Stack Static Pressure (in H2O)			-8.50
Average Stack Temperature (°F)			164.72
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			112.261
Average Meter Pressure (in H2O)			1.13
Average Meter Temperature (°F)			102.78
Moisture Collected (g)			322.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.250
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.610
Standard Metered Volume (dscf)			109.733
Standard Metered Volume (dscm)			3.108
Stack Moisture (%V)			12.16
Mole Fraction Dry Stack Gas			0.878
Dry Molecular Weight			28.84
Wet Molecular Weight			27.52
Stack Gas Velocity (fpm)			2236.69
Stack Gas Velocity (mpm)			681.74
Volumetric Flow Rate (acfm)			221.39
Volumetric Flow Rate (acmm)			6.27
Volumetric Flow Rate (dscfm)			178.00
Volumetric Flow Rate (dscmm)			164.38
Percent Isokinetic			per Dr. Kim
Percent Excess Air			107.68
Concentration (g/dscm)			-1174157.30
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

CB-Suoc-RI
Run _____
Page 1 of 1

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(Diagram of Duct)

Read and Record All Data Every Minutes[illegible]

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US EPA Method 4 Moisture Form

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Vitreous State Laboratory

Date	03/09/05
Melter/Location	DM 1200 Carbon Outlet
Run Number	SEMI-Volatiles Carbon Outlet Run 1
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	773.4	478.5	294.9
2	-	H2O	100	Modified	716.4	717.8g	-1.4
3	-	H2O	100	G/2	722.6	725.1g	-2.5
4	-	KMnO4	200	Modified	752.4	750.7g	1.7
5	N/A	Silica Gel	-	Modified	981.4	951.9g	29.5
Total Weight Gain (g):							322.2

Facility:	CUA	Start Time:	1420
Date:	03/09/2005	End Time:	1720
Location:	Carbon Bed Out	Initial Leak Check:	0.000@11"
Run Number:	2	Final Leak Check:	0.004@10"
Sample Type:	SVOC		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			30.55
Absolute Stack Pressure (in Hg)			29.93
Stack Static Pressure (in H ₂ O)			-8.50
Average Stack Temperature (°F)			163.78
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			110.397
Average Meter Pressure (in H ₂ O)			1.08
Average Meter Temperature (°F)			103.81
Moisture Collected (g)			316.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.250
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.598
Standard Metered Volume (dscf)			107.705
Standard Metered Volume (dscm)			3.050
Stack Moisture (%V)			12.15
Mole Fraction Dry Stack Gas			0.878
Dry Molecular Weight			28.84
Wet Molecular Weight			27.52
Stack Gas Velocity (fpm)			2165.97
Stack Gas Velocity (mpm)			660.19
Volumetric Flow Rate (acfm)			214.39
Volumetric Flow Rate (acmm)			6.07
Volumetric Flow Rate (dscfm)			159.44
Volumetric Flow Rate (dscmm)			4.52
Percent Isokinetic			108.97
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

MODIFIED METHOD 5 FIELD DATA SHEET

Plant	XAD Trap Number	Meter Box Number
CWA/VSL		4TA
Date	Filter Heater Setting (°F)	Meter Δ H @
3/9/05		1.7282
Sampling Location	Probe Length & Type	DGM Factor (τ _p)
Carb. Bed Out		1.0175
Sample Type	Probe Heater Setting (°F)	Nozzle Type & ID (in.)
SVOC		0.250
Run Number	Minimum Sample Volume	Ambient Temperature (°F)
2		90
Operator	Initial Leak Check	Assumed Moisture (% H ₂ O)
WPG		7
Barometric Pressure (±) (in. H ₂ O)	Final Leak Check	K Factor
30.56		4.55
Static Pressure (in. H ₂ O)		diff. pressure = 0.99
-8.5		

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

ORP-51444, Rev. 0

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Run

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/09/05
Melter/Location	DM 1200 Carbon Outlet
Run Number	SEMI-Volatiles Carbon Outlet Run 2
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	799.3g	510.9g	
2	-	H2O	100	Modified	716.3	718.8g	
3	-	H2O	100	G/2	698.9g	700.6g	
4	-	KMnO4	200	Modified	760.3	754.1g	
5	N/A	Silica Gel	-	Modified	968.5	942.9g	
Total Weight Gain (g):							316

Facility:	CUA	Start Time:	1805
Date:	03/09/2005	End Time:	2105
Location:	Carbon Bed Out	Initial Leak Check:	0.000@10"
Run Number:	3	Final Leak Check:	0.000@12"
Sample Type:	SVOC		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			30.55
Absolute Stack Pressure (in Hg)			29.93
Stack Static Pressure (in H ₂ O)			-8.50
Average Stack Temperature (°F)			163.33
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			103.104
Average Meter Pressure (in H ₂ O)			0.93
Average Meter Temperature (°F)			104.58
Moisture Collected (g)			299.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.250
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.558
Standard Metered Volume (dscf)			100.409
Standard Metered Volume (dscm)			2.844
Stack Moisture (%V)			12.34
Mole Fraction Dry Stack Gas			0.877
Dry Molecular Weight			28.84
Wet Molecular Weight			27.50
Stack Gas Velocity (fpm)			1997.64
Stack Gas Velocity (mpm)			608.88
Volumetric Flow Rate (acfm)			197.73
Volumetric Flow Rate (acmm)			5.60
Volumetric Flow Rate (dscfm)			179.68
Volumetric Flow Rate (dscmm)			146.84
Percent Isokinetic			per Dr. Kim 4.16
Percent Excess Air			110.30
Concentration (g/dscm)			-1174157.30
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

$$P_{\text{tot}} + P_{\text{eff}} = 0.99$$

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Stack T _s (°F)	Orifice Pressure Differential Δh (in. H ₂ O)		Probe Temp. (°F)	Filter Temp. (°F)	Absorbent Trap Temp. (°F)	Dry Gas Meter Temperature (°F)		Impinger Exit (°F)	Pump Vacuum (in. Hg)
						Desired	Actual				Inlet	Outlet		
Center	0	18:05	709.330											
	10	18:15	715.16	0.21	162	0.96		230	242	40	102	101	68	7
	20		720.95	0.21	162	0.96		231	246	37	105	102	65	7
	30		726.73	0.21	162	0.96		236	248	37	107	102	62	7
	40		732.39	0.20	163	0.91		237	248	37	107	102	61	7
	50		738.13	0.21	163	0.96		236	248	37	107	103	61	7
	60		744.08	0.21	163	0.96		237	249	38	107	103	61	7
	70		749.85	0.21	164	0.96		237	250	38	107	103	58	7
	80		755.52	0.20	163	0.91		237	249	40	106	103	57	7
	90		761.23	0.21	163	0.96		253	249	43	106	103	59	7
	100		766.93	0.20	164	0.91		254	249	45	107	103	60	7
	110		772.73	0.21	164	0.96		254	250	40	107	103	61	7
	120		778.41	0.20	164	0.91		254	249	39	107	103	60	7
	130		784.10	0.20	164	0.91		254	249	38	107	103	61	7
	140		789.80	0.20	164	0.91		254	249	38	108	103	60	7
	150		795.45	0.20	163	0.91		254	249	37	107	103	60	7
	160		801.20	0.20	164	0.91		254	250	39	107	103	59	7
	170		806.75	0.20	164	0.91		254	249	39	106	103	59	7
	180		812.434	0.20	164	0.91		254	249	38	106	103	59	7

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/09/05
Melter/Location	DM 1200 Carbon Outlet
Run Number	SEMI-Volatiles Carbon Outlet Run 3
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	758.2	480.0	
2	-	H2O	100	Modified	714.9g	716.4	
3	-	H2O	100	G/2	720.0g	722.6g	
4	-	KMnO4	200	Modified	738.8g	734.8g	
5	N/A	Silica Gel	-	Modified	1003.0	981.4g	
Total Weight Gain (g):							299.7

Facility:	CUA	Start Time:	1054
Date:	03/22/2005	End Time:	1154
Location:	Melter	Initial Leak Check:	0.004@15"
Run Number:	4	Final Leak Check:	0.004@17"
Sample Type:	SVOC		
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	29.95		
Absolute Stack Pressure (in Hg)	29.45		
Stack Static Pressure (in H ₂ O)	-6.80		
Average Stack Temperature (°F)	337.00		
Stack Area (sq in)	12.57		
Actual Meter Volume (cu ft)	38.394		
Average Meter Pressure (in H ₂ O)	1.15		
Average Meter Temperature (°F)	103.83		
Moisture Collected (g)	182.10		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	0.9967		
Nozzle Diameter (in)	0.220		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.600		
Standard Metered Volume (dscf)	35.972		
Standard Metered Volume (dscm)	1.019		
Stack Moisture (%V)	19.27		
Mole Fraction Dry Stack Gas	0.807		
Dry Molecular Weight	28.84		
Wet Molecular Weight	26.75		
Stack Gas Velocity (fpm)	4461.26		
Stack Gas Velocity (mpm)	1359.79		
Volumetric Flow Rate (acfm)	389.32		
Volumetric Flow Rate (acmm)	11.03		
Volumetric Flow Rate (dscfm)	204.91		
Volumetric Flow Rate (dscmm)	5.80		
Percent Isokinetic	96.72		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

AIR TECH

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

Run

Plant	CWA - 1200
Date	3/22/05
Sampling Location	Melter
Run Number	4 - Semi Vost
Impinger Box Number	
Recovery Person	MWH
Recovery Rinses	
Sampling Identification	Semi Vost
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	Bowc	648.1g	483.4	164.7
2	H ₂ O	100	Mod	714.6g	714.6	0
3	H ₂ O	100	G/S	738.8g	738.5	0.3
4	KMnO ₄	100	Mod	860.3g	859.0	1.3
5	Silica gel	250g	Mod	978.1g	962.3	15.8
6						
7						
8						
9						
10						
Total Weight Gain (g)						182.1

Facility:	CUA	Start Time:	1410
Date:	03/22/2005	End Time:	1510
Location:	Melter	Initial Leak Check:	0.008@16"
Run Number:	5	Final Leak Check:	0.006@13"
Sample Type:	SVOC		
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	29.95		
Absolute Stack Pressure (in Hg)	29.45		
Stack Static Pressure (in H ₂ O)	-6.80		
Average Stack Temperature (°F)	335.00		
Stack Area (sq in)	12.57		
Actual Meter Volume (cu ft)	39.001		
Average Meter Pressure (in H ₂ O)	1.17		
Average Meter Temperature (°F)	104.33		
Moisture Collected (g)	184.10		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	0.9967		
Nozzle Diameter (in)	0.220		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.609		
Standard Metered Volume (dscf)	36.512		
Standard Metered Volume (dscm)	1.034		
Stack Moisture (%V)	19.21		
Mole Fraction Dry Stack Gas	0.808		
Dry Molecular Weight	28.84		
Wet Molecular Weight	26.75		
Stack Gas Velocity (fpm)	4497.68		
Stack Gas Velocity (mpm)	1370.89		
Volumetric Flow Rate (acfm)	392.50		
Volumetric Flow Rate (acmm)	11.12		
Volumetric Flow Rate (dscfm)	207.26		
Volumetric Flow Rate (dscmm)	5.87		
Percent Isokinetic	97.06		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

Run

Plant	CUA-1200
Date	3.22.5
Sampling Location	Melter R2
Run Number	5 / 2 - Semi Vost
Impinger Box Number	
Recovery Person	NO
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—		Bong	685.7g	513.7g	
2	H ₂ O	100	Mod.	726.5g	729.8	
3	H ₂ O	100	GIS	740.3	742.9g	
4	KMnO ₄	200	M	721.5g	719.7g	
5	Silica Gel	—	M	977.9	961.7	
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	1801
Date:	03/22/2005	End Time:	1901
Location:	Melter	Initial Leak Check:	0.00@15"
Run Number:		Final Leak Check:	0.006@20"
Sample Type:	SVOC / ⁶ Dioxin/Furan		
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	29.95		
Absolute Stack Pressure (in Hg)	29.45		
Stack Static Pressure (in H ₂ O)	-6.80		
Average Stack Temperature (°F)	345.67		
Stack Area (sq in)	12.57		
Actual Meter Volume (cu ft)	39.651		
Average Meter Pressure (in H ₂ O)	1.19		
Average Meter Temperature (°F)	102.00		
Moisture Collected (g)	181.70		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	0.9967		
Nozzle Diameter (in)	0.220		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.621		
Standard Metered Volume (dscf)	37.274		
Standard Metered Volume (dscm)	1.056		
Stack Moisture (%V)	18.69		
Mole Fraction Dry Stack Gas	0.813		
Dry Molecular Weight	28.84		
Wet Molecular Weight	26.81		
Stack Gas Velocity (fpm)	4564.28		
Stack Gas Velocity (mpm)	1391.19		
Volumetric Flow Rate (acfm)	398.31		
Volumetric Flow Rate (acmm)	11.28		
Volumetric Flow Rate (dscfm)	208.87		
Volumetric Flow Rate (dscmm)	5.92		
Percent Isokinetic	98.32		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

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Plant	CUA-1200
Date	3.22.15
Sampling Location	Melter
Run Number	3 - Sewi Vest + Dioxin / Furan GREEN
Impinger Box Number	R6
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	GREEN
XAD Number	GREEN

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—		Bong	655.7 815.6g	484.2g	
2	H ₂ O	100	M	732.1	732.9g	
3	H ₂ O	100	als	722.9g	724.4g	
4	KMnO ₄	200	m	862.7g	860.3g	
5	SG	—	m	988.2g	978.1g	
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	941
Date:	03/22/2005	End Time:	1241
Location:	TCO	Initial Leak Check:	0.008@16
Run Number:	4	Final Leak Check:	0.006@11
Sample Type:	SVOC		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			29.95
Absolute Stack Pressure (in Hg)			29.07
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			611.28
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			136.148
Average Meter Pressure (in H2O)			1.48
Average Meter Temperature (°F)			103.89
Moisture Collected (g)			340.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.711
Standard Metered Volume (dscf)			127.946
Standard Metered Volume (dscm)			3.623
Stack Moisture (%V)			11.15
Mole Fraction Dry Stack Gas			0.888
Dry Molecular Weight			28.84
Wet Molecular Weight			27.63
Stack Gas Velocity (fpm)			5680.39
Stack Gas Velocity (mpm)			1731.38
Volumetric Flow Rate (acfm)			562.24
Volumetric Flow Rate (acmm)			15.92
Volumetric Flow Rate (dscfm)			239.12
Volumetric Flow Rate (dscmm)			6.77
Percent Isokinetic			111.46
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

MODIFIED METHOD 5 FIELD DATA SHEET

TCC-SVOC-4
Run _____ of _____
Page _____

Plant	CWA	XAD Trap Number	TCC-SVOC-4	Meter Box Number	ATC
Date	3/22/05	Filter Heater Setting (°F)	250	Meter ΔH @	1.6719
Sampling Location	TCC	Probe Length & Type	20' TFE	DGM Factor (r _d)	0.999
Sample Type	SVOC	Probe Heater Setting (°F)	250	Nozzle Type & ID (in.)	0.220
Run Number	4	Minimum Sample Volume		Ambient Temperature (°F)	90
Operator	WPC	Initial Leak Check	0.008 @ 16	Assumed Moisture (% H ₂ O)	7
Barometric Pressure (±) (in. H ₂ O)	29.95	Final Leak Check	0.006 @ 11	K Factor	1.57
Static Pressure (in. H ₂ O)	0.008 @ 16				

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Stack T _s (°F)	Orifice Pressure Differential ΔH (in. H ₂ O)		Probe Temp. (°F)	Filter Temp. (°F)	Absorbent Trap Temp. (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
						Desired	Actual				Inlet (°F)	Outlet (°F)		
Center	0	9:41	596.900	0.97	594		1.53	256	259	46	99	98	52	6
	10		604.46	0.92	611		1.45	256	258	43	101	99	42	6
	20		611.95	0.92	611		1.45	256	260	42	103	99	44	6
	30		619.40	0.92	613		1.46	257	262	44	104	100	41	6
	40		626.77	0.93	613		1.48	257	263	46	105	101	41	6
	50		634.28	0.94	611		1.48	257	259	44	106	101	41	6
	60		641.78	0.94	611		1.48	257	261	44	106	102	42	6
	70		649.29	0.94	612		1.48	257	258	44	107	103	43	6
	80		656.7	0.94	611		1.5	257	261	44	107	103	43	7
	90		664.31	0.94	612		1.5	257	262	45	107	103	44	7
	100		671.90	0.94	612		1.5	257	243	47	108	104	42	7
	110		679.54	0.94	613		1.5	257	240	48	108	104	41	7
	120		687.15	0.92	613		1.45	257	248	48	107	104	41	7
	130		694.77	0.93	613		1.5	256	234	48.55	107	104	41	7
	140		702.40	0.97	612		1.53	257	242	57	106	104	42	7
	150		709.94	0.97	615		1.53	257	244	57	106	104	45	7
	160		717.49	0.97	615		1.45	256	238	59	106	104	47	7
	170		725.04	0.92	615		1.45	256	244	46	106	104	45	7
	180		733.048	0.92	613									
	190													
	200													
	210													
	220													
	230													
	240													
	250													
	260													
	270													
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	1000													

Plant	CVA - 1200
Date	3/22/05
Sampling Location	TCO
Run Number	1 - Semi Vost
Impinger Box Number	
Recovery Person	MWJL
Recovery Rinses	
Sampling Identification	Semi Vost
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	Bong		—	815.6	500.8	314.8
2	H ₂ O	100	Mod	706.2g	707.7	-1.5
3	H ₂ O	100	6/S	726.6g	730.6	-4.6
4	KMnO ₄	200	Mod	828.9g	825.1	3.8
5	Silica gel	250	Mod	983.2g	955.6	27.6
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	1309
Date:	03/22/2005	End Time:	1609
Location:	TCO	Initial Leak Check:	0.010@11"
Run Number:	5	Final Leak Check:	0.010@15"
Sample Type:	SVOC		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			29.95
Absolute Stack Pressure (in Hg)			29.07
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			612.28
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			136.233
Average Meter Pressure (in H ₂ O)			1.48
Average Meter Temperature (°F)			103.42
Moisture Collected (g)			327.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.712
Standard Metered Volume (dscf)			128.134
Standard Metered Volume (dscm)			3.629
Stack Moisture (%V)			10.76
Mole Fraction Dry Stack Gas			0.892
Dry Molecular Weight			28.84
Wet Molecular Weight			27.67
Stack Gas Velocity (fpm)			5695.23
Stack Gas Velocity (mpm)			1735.91
Volumetric Flow Rate (acfm)			563.71
Volumetric Flow Rate (acmm)			15.96
Volumetric Flow Rate (dscfm)			240.58
Volumetric Flow Rate (dscmm)			6.81
Percent Isokinetic			110.94
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	XAD Trap Number	Meter Box Number
CWA	700-5000-5	ATC
Date	3/22/05	Meter Δ H @ 1.6719
Sampling Location	TCO	DGM Factor (t _p) 0.999
Sample Type	SVC	Nozzle Type & ID (in.) 0.220
Run Number	5	Ambient Temperature (°F) 90
Operator	WPG	Assumed Moisture (% H ₂ O) 7
Barometric Pressure (±) (in.)	29.95	K Factor 1.57
Static Pressure (in. H ₂ O)	-12	

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

[illegible]

Plant	CUA -1200
Date	3.22.9
Sampling Location	TCD R2
Run Number	R2 -SVOC
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	BLUE
XAD Number	BLUE

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—		BONG	795.0	495.8	
2	H ₂ O	100	M	715.7g	717.4g	
3	H ₂ O	100	9/5	697.5g	698.3g	
4	KMnO ₄	200	M	757.5g	752.7g	
5	SG	—	M	995.0g	968.8	
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	1648
Date:	03/22/2005	End Time:	1948
Location:	TCO	Initial Leak Check:	0.010@15"
Run Number:	6	Final Leak Check:	0.010@11"
Sample Type:	SVOC		
Total Sampling Time (min)	180.0		
Corrected Barometric Pressure (in Hg)	29.95		
Absolute Stack Pressure (in Hg)	29.07		
Stack Static Pressure (in H ₂ O)	-12.00		
Average Stack Temperature (°F)	616.28		
Stack Area (sq in)	14.25		
Actual Meter Volume (cu ft)	132.456		
Average Meter Pressure (in H ₂ O)	1.39		
Average Meter Temperature (°F)	102.08		
Moisture Collected (g)	310.10		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	0.9990		
Nozzle Diameter (in)	0.220		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.694		
Standard Metered Volume (dscf)	124.850		
Standard Metered Volume (dscm)	3.536		
Stack Moisture (%V)	10.48		
Mole Fraction Dry Stack Gas	0.895		
Dry Molecular Weight	28.84		
Wet Molecular Weight	27.70		
Stack Gas Velocity (fpm)	5520.94		
Stack Gas Velocity (mpm)	1682.78		
Volumetric Flow Rate (acfm)	546.46		
Volumetric Flow Rate (acmm)	15.48		
Volumetric Flow Rate (dscfm)	233.07		
Volumetric Flow Rate (dscmm)	6.60		
Percent Isokinetic	111.58		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

MODIFIED METHOD 5 FIELD DATA SHEET

TCD-SUOC-6
DSC/M Run
Page 1 of 1

Plant	CWA	XAD Trap Number	TCD-SUOC-6	Meter Box Number	4TC
Date	3/22/05	Filter Heater Setting (°F)	250	Meter Δ H @	1.6719
Sampling Location	TRO	Probe Length & Type	20' TFE	DGM Factor (t _p)	0.999
Sample Type	SUOC/DIOXIN	Probe Heater Setting (°F)	250	Nozzle Type & ID (in.)	0.220
Run Number	6	Minimum Sample Volume		Ambient Temperature (°F)	90
Operator	WPG	Initial Leak Check	0.010 @ 15	Assumed Moisture (% H ₂ O)	7
Barometric Pressure (±) (in. H ₂ O)	29.95	Final Leak Check	0.010 @ 11	K Factor	1.56
Static Pressure (in. H ₂ O)	-12				

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Stack T _s (°F)	Orifice Pressure Differential ΔH (in. H ₂ O)		Probe Temp. (°F)	Filter Temp. (°F)	Absorbent Trap Temp. (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
						Desired	Actual				Inlet (°F)	Outlet (°F)		
001	10	16:46	878.170	0.85	610		1.34	242	249	42	100	100	59	6
002	20		885.35	0.85	613		1.34	242	254	41	102	101	49	6
003	30		892.63	0.85	614		1.34	242	250	43	103	101	47	6
004	40		899.95	0.85	615		1.34	243	255	43	104	101	47	6
005	50		907.2	0.85	615		1.3	242	254	44	103	101	47	6
006	60		914.44	0.85	615		1.3	242	252	45	104	101	48	6
007	70		921.65	0.85	614		1.3	243	254	42	104	101	50	6
008	80		928.85	0.84	614		1.3	243	250	42	104	101	50	6
009	90		935.98	0.84	615		1.3	243	252	42	104	101	50	6
010	100		943.00	0.86	613		1.36	243	255	42	104	101	51	6.5
011	110		950.20	0.92	616		1.45	243	254	43	103	101	51	7
012	120		957.61	0.92	620		1.45	242	251	40	103	101	46	7
013	130		965.04	0.92	619		1.45	242	252	41	103	101	46	7
014	140		972.49	0.93	618		1.5	242	252	41	103	101	46	7
015	150		980.07	0.94	618		1.5	242	252	42	103	101	47	7
016	160		987.65	0.93	620		1.5	242	251	44	104	101	48	7
017	170		995.30	0.94	622		1.5	242	254	44	104	101	48	7
018	180		1002.94	0.94	621		1.5	242	254	44	104	101	48	7
019			1010.626	0.94	620		1.5	242	252	45	103	101	49	7
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Plant	CUA-1200
Date	3.22.5
Sampling Location	T00R3 SVOC+D/F
Run Number	3
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	GREEN SVOC+D/F
XAD Number	SVOC+D/F

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—		Bag	787.5	499.4	
2	H ₂ O	100	M	724.8	727.5g	
3	H ₂ O	100	g/b	740.6	741.0g	
4	KMnO ₄	200	M	831.7	828.8	
5	SG	—	M	1005.4	983.2g	
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	1056
Date:	03/22/2005	End Time:	1156
Location:	HEPA Out	Initial Leak Check:	0.010@15"
Run Number:	4	Final Leak Check:	0.008@9"
Sample Type:	SVOC		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.95
Absolute Stack Pressure (in Hg)			29.84
Stack Static Pressure (in H ₂ O)			-1.50
Average Stack Temperature (°F)			173.50
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			39.538
Average Meter Pressure (in H ₂ O)			1.28
Average Meter Temperature (°F)			104.58
Moisture Collected (g)			119.80
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0248
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.634
Standard Metered Volume (dscf)			38.053
Standard Metered Volume (dscm)			1.078
Stack Moisture (%V)			12.93
Mole Fraction Dry Stack Gas			0.871
Dry Molecular Weight			28.84
Wet Molecular Weight			27.44
Stack Gas Velocity (fpm)			2818.23
Stack Gas Velocity (mpm)			859.00
Volumetric Flow Rate (acfm)			278.95
Volumetric Flow Rate (acmm)			7.90
Volumetric Flow Rate (dscfm)			201.88
Volumetric Flow Rate (dscmm)			5.72
Percent Isokinetic			107.77
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	XAD Trap Number	HEPA OUT-SUOC 4	Meter Box Number	ATD
Date	Filter Heater Setting (°F)	250	Meter Δ H @	1.809
Sampling Location	Probe Length & Type	20' TFE	DGM Factor (τ _p)	1.0248
Sample Type	Probe Heater Setting (°F)	250	Nozzle Type & ID (in.)	0.230
Run Number	Minimum Sample Volume		Ambient Temperature (°F)	90
Operator	Initial Leak Check		Assumed Moisture (% H ₂ O)	7
Barometric Pressure (±) (in. H ₂ O)	Final Leak Check		K Factor	3.2
Static Pressure (in. H ₂ O)				

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

[illegible]

Plant	COA - 1200
Date	3/22/05
Sampling Location	H
Run Number	1 - Semi Vost
Impinger Box Number	
Recovery Person	mwj
Recovery Rinses	
Sampling Identification	Semi Vost
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	Bone	MT -	-	595.1g	490.6	104.5
2	H ₂ O	100	Mod	715.9	717.6	-1.7
3	H ₂ O	100	G/S	726.4g	727.1	-0.7
4	KMnO ₄	100	Mod	759.7g	758.9	0.8
5	Sulic acid	250	Mod	938.2g	921.3	16.9
6						
7						
8						
9						
10						
Total Weight Gain (g)						119.8

Facility:	CUA	Start Time:	1413
Date:	03/22/2005	End Time:	1513
Location:	HEPA Out	Initial Leak Check:	0.004@9"
Run Number:	5	Final Leak Check:	0.004@6"
Sample Type:	SVOC		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.95
Absolute Stack Pressure (in Hg)			29.84
Stack Static Pressure (in H2O)			-1.50
Average Stack Temperature (°F)			173.33
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			38.816
Average Meter Pressure (in H2O)			1.24
Average Meter Temperature (°F)			104.08
Moisture Collected (g)			111.50
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0248
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.623
Standard Metered Volume (dscf)			37.385
Standard Metered Volume (dscm)			1.059
Stack Moisture (%V)			12.33
Mole Fraction Dry Stack Gas			0.877
Dry Molecular Weight			28.84
Wet Molecular Weight			27.50
Stack Gas Velocity (fpm)			2772.98
Stack Gas Velocity (mpm)			845.21
Volumetric Flow Rate (acfm)			274.47
Volumetric Flow Rate (acmm)			7.77
Volumetric Flow Rate (dscfm)			200.05
Volumetric Flow Rate (dscmm)			5.67
Percent Isokinetic			106.85
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	XAD Trap Number	HEPA Out - Svoc - S	Meter Box Number	ATD
Date	3/22/05	250	Meter Δ H @	1.809
Sampling Location	HEPA Out	20' TFE	DGM Factor (t _p)	1.0248
Sample Type	Svoc	250	Nozzle Type & ID (in.)	0.230
Run Number	5		Ambient Temperature (°F)	90
Operator	WPG		Assumed Moisture (% H ₂ O)	7
Barometric Pressure (±) (in.)	29.95	0.004 @ 9"	K Factor	3.2
Static Pressure (in. H ₂ O)	-1.5	0.004 @ 6"		

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

[illegible]

Plant	CVA 1200
Date	3.22.5
Sampling Location	HEPA R75
Run Number	57 - Semi Vost
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	BLUE - SV only
XAD Number	BLUE SV only

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—		Bug	579.5g	480.0	
2	H ₂ O	100	M	635.2g	636.7	
3	H ₂ O	100	gls	618.2g	620.4g	
4	KMnO ₄	200	M	743.3g	742.3g	
5	SG	—	M	971.9g	957.2g	
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	1753
Date:	03/22/2005	End Time:	1853
Location:	HEPA Out	Initial Leak Check:	0.004@10"
Run Number:	6	Final Leak Check:	0.004@6"
Sample Type:	SVOC		
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	29.95		
Absolute Stack Pressure (in Hg)	29.84		
Stack Static Pressure (in H ₂ O)	-1.50		
Average Stack Temperature (°F)	173.00		
Stack Area (sq in)	14.25		
Actual Meter Volume (cu ft)	37.580		
Average Meter Pressure (in H ₂ O)	1.16		
Average Meter Temperature (°F)	100.92		
Moisture Collected (g)	112.30		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	1.0248		
Nozzle Diameter (in)	0.230		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.606		
Standard Metered Volume (dscf)	36.389		
Standard Metered Volume (dscm)	1.031		
Stack Moisture (%V)	12.70		
Mole Fraction Dry Stack Gas	0.873		
Dry Molecular Weight	28.84		
Wet Molecular Weight	27.46		
Stack Gas Velocity (fpm)	2693.45		
Stack Gas Velocity (mpm)	820.96		
Volumetric Flow Rate (acfm)	266.60		
Volumetric Flow Rate (acmm)	7.55		
Volumetric Flow Rate (dscfm)	193.59		
Volumetric Flow Rate (dscmm)	5.48		
Percent Isokinetic	107.47		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

MODIFIED METHOD 5 FIELD DATA SHEET

Plant	CWA	XAD Trap Number	HEPA Out-500C-6	Meter Box Number	ATD
Date	3/22/05	Filter Heater Setting (°F)	250	Meter Δ H @	1.809
Sampling Location	HEPA Out	Probe Length & Type	20' TFE	DGM Factor (v)	1.0248
Sample Type	500C	Probe Heater Setting (°F)	250	Nozzle Type & ID (in.)	0.230
Run Number	6	Minimum Sample Volume		Ambient Temperature (°F)	90
Operator	WPG	Initial Leak Check	0.004 @ 10"	Assumed Moisture (% H ₂ O)	7
Barometric Pressure (±) (in.	29.95	Final Leak Check	0.004 @ 6"	K Factor	3.2
Static Pressure (in. H ₂ O)	-1.5				

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

[illegible]

Run

Plant	RVA-1200
Date	3.22.5
Sampling Location	HEPA SV R6
Run Number	SV only R6
Impinger Box Number	
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	BLU E
XAD Number	BLU E

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	Boyle	584.1	491.0g	
2	H ₂ O	100	M	715.8	715.9	
3	H ₂ O	100	q/s	726.2	727.1	
4	KMnO ₄	200	M	761.1	758.9	
5	SG	—	M	946.4	928.4	
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	1012
Date:	03/22/2005	End Time:	1212
Location:	Carbon Bed Out	Initial Leak Check:	0.004@22"
Run Number:	4	Final Leak Check:	0.004@21"
Sample Type:	SVOC		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			29.95
Absolute Stack Pressure (in Hg)			29.33
Stack Static Pressure (in H2O)			-8.50
Average Stack Temperature (°F)			162.92
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			87.120
Average Meter Pressure (in H2O)			1.60
Average Meter Temperature (°F)			99.58
Moisture Collected (g)			251.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.250
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.700
Standard Metered Volume (dscf)			84.055
Standard Metered Volume (dscm)			2.380
Stack Moisture (%V)			12.35
Mole Fraction Dry Stack Gas			0.876
Dry Molecular Weight			28.84
Wet Molecular Weight			27.50
Stack Gas Velocity (fpm)			2744.53
Stack Gas Velocity (mpm)			836.53
Volumetric Flow Rate (acfm)			271.65
Volumetric Flow Rate (acmm)			7.69
Volumetric Flow Rate (dscfm)			197.79
Volumetric Flow Rate (dscmm)			5.60
Percent Isokinetic			102.83
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	XAD Trap Number	Meter Box Number
CWA		ATA
3/22/05	Filter Heater Setting (°F)	Meter Δ H @ 1.728
Carbon Bed out	Probe Length & Type	DGM Factor (t _p) 1.0175
SVOC	Probe Heater Setting (°F)	Nozzle Type & ID (in.) 250
H	Minimum Sample Volume	Ambient Temperature (°F) 90
D	Initial Leak Check	Assumed Moisture (% H ₂ O) 8
2495	Final Leak Check	K Factor 4.2
-8.5"		

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

[illegible]

Plant	CVA - 1200
Date	3/22/05
Sampling Location	CC Run 1
Run Number	1 - Semi VOST
Impinger Box Number	
Recovery Person	MWH
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—		Bowen	717.2g	492.1	225.1
2	H ₂ O	100	Mod	730.5g	733.9	-3.4
3	H ₂ O	100	G/S	719.4g	723.4	-4
4	KMnO ₄	200	Mod	835.4g	831.2	4.2
5	CILICA Gel	250	Mod	1002.6g	973.3	29.3
6						
7						
8						
9						
10						
Total Weight Gain (g)						251.2

Facility:	CUA	Start Time:	1337
Date:	03/22/2005	End Time:	1537
Location:	Carbon Bed Out	Initial Leak Check:	0.006@2
Run Number:	5	Final Leak Check:	0.004@9
Sample Type:	SVOC		
Total Sampling Time (min)	120.0		
Corrected Barometric Pressure (in Hg)	29.95		
Absolute Stack Pressure (in Hg)	29.33		
Stack Static Pressure (in H2O)	-8.50		
Average Stack Temperature (°F)	160.25		
Stack Area (sq in)	14.25		
Actual Meter Volume (cu ft)	87.527		
Average Meter Pressure (in H2O)	1.59		
Average Meter Temperature (°F)	101.08		
Moisture Collected (g)	251.60		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	1.0175		
Nozzle Diameter (in)	0.250		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.702		
Standard Metered Volume (dscf)	84.220		
Standard Metered Volume (dscm)	2.385		
Stack Moisture (%V)	12.35		
Mole Fraction Dry Stack Gas	0.877		
Dry Molecular Weight	28.84		
Wet Molecular Weight	27.50		
Stack Gas Velocity (fpm)	2741.69		
Stack Gas Velocity (mpm)	835.67		
Volumetric Flow Rate (acfm)	271.37		
Volumetric Flow Rate (acmm)	7.69		
Volumetric Flow Rate (dscfm)	198.44		
Volumetric Flow Rate (dscmm)	5.62		
Percent Isokinetic	102.69		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

Run

Plant	CWA -1200
Date	3.22.5
Sampling Location	Carbon Outlet -SV ONLY
Run Number	2
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	BLUE
XAD Number	BLUE

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	Bug	729.4	500.3g	
2	H ₂ O	100	Mod.	726.8g	728.6g	
3	H ₂ O	100	GLS	727.8g	730.0g	
4	KMnO ₄	200	W	737.9	735.2g 729.6g	
5	SG	—	W	980.5g	956.7g	
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	1720
Date:	03/22/2005	End Time:	1920
Location:	Carbon Bed Out	Initial Leak Check:	0.004@11"
Run Number:	6	Final Leak Check:	0.004@11"
Sample Type:	SVOC		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			29.95
Absolute Stack Pressure (in Hg)			29.33
Stack Static Pressure (in H2O)			-8.50
Average Stack Temperature (°F)			158.17
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			82.716
Average Meter Pressure (in H2O)			1.45
Average Meter Temperature (°F)			99.50
Moisture Collected (g)			228.40
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.250
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.665
Standard Metered Volume (dscf)			79.787
Standard Metered Volume (dscm)			2.260
Stack Moisture (%V)			11.89
Mole Fraction Dry Stack Gas			0.881
Dry Molecular Weight			28.84
Wet Molecular Weight			27.55
Stack Gas Velocity (fpm)			2620.84
Stack Gas Velocity (mpm)			798.83
Volumetric Flow Rate (acfm)			259.41
Volumetric Flow Rate (acmm)			7.35
Volumetric Flow Rate (dscfm)			191.32
Volumetric Flow Rate (dscmm)			5.42
Percent Isokinetic			100.91
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	XAD Trap Number	Meter Box Number	ATA
Date	3/22/05	Meter Δ H @	1.728
Sampling Location	Carb. Bed. Out	DGM Factor (τ_d)	1.0115
Sample Type	SVOC	Nozzle Type & ID (in.)	.250
Run Number	1	Ambient Temperature ($^{\circ}$ F)	90
Operator	WPK	Assumed Moisture (% H ₂ O)	8
Barometric Pressure (±) (in.)	29.95	K Factor	4.2
Static Pressure (in. H ₂ O)	-8.5		

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

[illegible]

Plant	CUA-1200
Date	3.22.5
Sampling Location	CC Run 3 SV only
Run Number	CC Run 3 SV only
Impinger Box Number	
Recovery Person	MS
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—		Bury	698.4	490.3	
2	H ₂ O	100	m	729.8	730.4g	
3	H ₂ O	100	q/s	718.3	719.4g	
4	KMnO ₄	200	m	714.1g	711.4g	
5	SG	—	m	1021.9	1002.6g	
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Appendix B.3

Dioxin/Furan/PCBs

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Facility:	CUA	Start Time:	930
Date:	03/18/2005	End Time:	1050
Location:	Melter	Initial Leak Check:	0.008@19"
Run Number:	1	Final Leak Check:	0.006@25"
Sample Type:	CDD/CDF/PCB		
Total Sampling Time (min)			80.0
Corrected Barometric Pressure (in Hg)			30.71
Absolute Stack Pressure (in Hg)			30.28
Stack Static Pressure (in H ₂ O)			-5.80
Average Stack Temperature (°F)			524.88
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			57.709
Average Meter Pressure (in H ₂ O)			1.63
Average Meter Temperature (°F)			105.69
Moisture Collected (g)			394.90
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9967
Nozzle Diameter (in)			0.250
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.691
Standard Metered Volume (dscf)			55.318
Standard Metered Volume (dscm)			1.567
Stack Moisture (%V)			25.18
Mole Fraction Dry Stack Gas			0.748
Dry Molecular Weight			28.84
Wet Molecular Weight			26.11
Stack Gas Velocity (fpm)			5015.03
Stack Gas Velocity (mpm)			1528.58
Volumetric Flow Rate (acfm)			437.64
Volumetric Flow Rate (acmm)			12.39
Volumetric Flow Rate (dscfm)			177.62
Volumetric Flow Rate (dscmm)			5.03
Percent Isokinetic			99.66
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

Plant	XAD Trap Number	Meter Box Number
CUA VSL	W.O. - DF-1	AT B
Date	3/18/5	Meter Δ H @ 1,769
Sampling Location	Walter	DGM Factor (r _d) 1,967
Sample Type	CO ₂ /CAF/PCS	Nozzle Type & ID (in.) 250
Run Number	1	Ambient Temperature (°F) 90
Operator	John	Assumed Moisture (% H ₂ O) 25
Barometric Pressure (±) (in.)	30.71	K Factor 2.2 @ 100/400
Static Pressure (in. H ₂ O)	-5.8	

[illegible]

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	3/18/05
Melter/Location	DM 1200 Melter
Run Number	Dioxin/Furans Melter Run 1
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	856.3	489.1	367.2
2	-	H2O	100	Modified	718.7g	720.0	-1.3
3	-	H2O	100	G/2	727.4g	728.1	-0.7
4	-	KMnO4	200	Modified	804.7g	801.4g	3.3
5	N/A	Silica Gel	-	Modified	997.2g	970.8	26.4
Total Weight Gain (g):							

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Facility:	CUA	Start Time:	856
Date:	03/19/2005	End Time:	1016
Location:	Melter	Initial Leak Check:	0.001@20"
Run Number:	2	Final Leak Check:	0.004@22"
Sample Type:	CDD/CDF/PCB		
Total Sampling Time (min)			80.0
Corrected Barometric Pressure (in Hg)			30.83
Absolute Stack Pressure (in Hg)			30.37
Stack Static Pressure (in H ₂ O)			-6.20
Average Stack Temperature (°F)			514.13
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			43.199
Average Meter Pressure (in H ₂ O)			0.85
Average Meter Temperature (°F)			103.63
Moisture Collected (g)			306.80
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9967
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.521
Standard Metered Volume (dscf)			41.646
Standard Metered Volume (dscm)			1.179
Stack Moisture (%V)			25.78
Mole Fraction Dry Stack Gas			0.742
Dry Molecular Weight			28.84
Wet Molecular Weight			26.04
Stack Gas Velocity (fpm)			4729.45
Stack Gas Velocity (mpm)			1441.54
Volumetric Flow Rate (acfm)			412.72
Volumetric Flow Rate (acmm)			11.69
Volumetric Flow Rate (dscfm)			168.51
Volumetric Flow Rate (dscmm)			4.77
Percent Isokinetic			102.13
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	XAD Trap Number	Meter Box Number
Date	Filter Heater Setting (°F)	Meter Δ H @
Sampling Location	Probe Length & Type	DGM Factor (r _p)
Sample Type	Probe Heater Setting (°F)	Nozzle Type & ID (in.)
Run Number	Minimum Sample Volume	Ambient Temperature (°F)
Operator	Initial Leak Check	Assumed Moisture (% H ₂ O)
Barometric Pressure (±) (in.)	Final Leak Check	K Factor
Static Pressure (in. H ₂ O)		

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

[illegible]

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	3/18/05
Melter/Location	DM 1200 Melter
Run Number	Dioxin/Furans Melter Run 2
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	770.4	482.4g	
2	-	H2O	100	Modified	719.3	718.9g	
3	-	H2O	100	G/2	717.1g	717.1g	
4	-	KMnO4	200	Modified	750.9g	749.8g	
5	N/A	Silica Gel	-	Modified	949.5g	932.2g	
Total Weight Gain (g):							

2a see also SU run for extra DIF

Facility:	CUA	Start Time:	2320
Date:	03/21/2005 - 3/22/05	End Time:	120
Location:	Melter	Initial Leak Check:	.00@10"
Run Number:	3	Final Leak Check:	.00@16"
Sample Type:	CDD/CDF/PCB		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			29.95
Absolute Stack Pressure (in Hg)			29.52
Stack Static Pressure (in H ₂ O)			-5.80
Average Stack Temperature (°F)			341.17
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			92.517
Average Meter Pressure (in H ₂ O)			1.77
Average Meter Temperature (°F)			101.21
Moisture Collected (g)			422.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9967
Nozzle Diameter (in)			0.250
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.727
Standard Metered Volume (dscf)			87.223
Standard Metered Volume (dscm)			2.470
Stack Moisture (%V)			18.57
Mole Fraction Dry Stack Gas			0.814
Dry Molecular Weight			28.84
Wet Molecular Weight			26.82
Stack Gas Velocity (fpm)			4585.14
Stack Gas Velocity (mpm)			1397.55
Volumetric Flow Rate (acfm)			400.13
Volumetric Flow Rate (acmm)			11.33
Volumetric Flow Rate (dscfm)			211.83
Volumetric Flow Rate (dscmm)			6.00
Percent Isokinetic			87.84
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	XAD Trap Number	Meter Box Number
Date	Filter Heater Setting (°F)	Meter Δ H @
Sampling Location	Probe Length & Type	DGM Factor (r _p)
Sample Type	Probe Heater Setting (°F)	Nozzle Type & ID (in.)
Run Number	Minimum Sample Volume	Ambient Temperature (°F)
Operator	Initial Leak Check	Assumed Moisture (% H ₂ O)
Barometric Pressure (±) (in.	Final Leak Check	K Factor
Static Pressure (in. H ₂ O)		

Schematic of Traverse Point Layout

Read and Record All Data Every 10 Minutes[illegible]

Run

Plant	CUA
Date	2-21-05
Sampling Location	Metter
Run Number	3
Impinger Box Number	
Recovery Person	WEG
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	None	870.2	483.1	
2	H ₂ O	100	MGS	719.4	719.3	
3	H ₂ O	100	GS	717.4	717.1	
4	KMnO ₄	100	MGS	752.1	748.2	
5	silica gel	250	MGS	1008.7	978.1	
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	930
Date:	03/18/2005	End Time:	1130
Location:	TCO Out	Initial Leak Check:	0.004@12"
Run Number:	1	Final Leak Check:	0.004@12"
Sample Type:	Dioxin/Furan/PCB		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.71
Absolute Stack Pressure (in Hg)			29.83
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			649.92
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			85.700
Average Meter Pressure (in H2O)			1.32
Average Meter Temperature (°F)			104.33
Moisture Collected (g)			201.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.687
Standard Metered Volume (dscf)			82.476
Standard Metered Volume (dscm)			2.336
Stack Moisture (%V)			10.32
Mole Fraction Dry Stack Gas			0.897
Dry Molecular Weight			28.84
Wet Molecular Weight			27.72
Stack Gas Velocity (fpm)			5415.32
Stack Gas Velocity (mpm)			1650.59
Volumetric Flow Rate (acfm)			536.01
Volumetric Flow Rate (acmm)			15.18
Volumetric Flow Rate (dscfm)			227.91
Volumetric Flow Rate (dscmm)			6.45
Percent Isokinetic			113.07
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Schematic of Traverse Point Layout	Read and Record All Data Every	Minutes
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US EPA Method 4 Moisture Form
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Date	3/18/05
Melter/Location	DM 1200 TCO
Run Number	Dioxin/Furans Melter Run 7 1
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	673.7g	490.0	183.7
2	-	H2O	100	Modified	702.2	703.2	
3	-	H2O	100	G/2	721.8	722.6	
4	-	KMnO4	200	Modified	769.3	767.6 868.4 3/16/05 CB	
5	N/A	Silica Gel	-	Modified	966.3	948.7 926.1	
Total Weight Gain (g):							

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Facility:	CUA	Start Time:	900
Date:	03/19/2005	End Time:	1100
Location:	TCO Out	Initial Leak Check:	0.008@14"
Run Number:	2	Final Leak Check:	0.010@10"
Sample Type:	Dioxin/Furan/PCB		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.83
Absolute Stack Pressure (in Hg)			29.95
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			654.33
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			87.683
Average Meter Pressure (in H ₂ O)			1.39
Average Meter Temperature (°F)			103.08
Moisture Collected (g)			214.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.708
Standard Metered Volume (dscf)			84.916
Standard Metered Volume (dscm)			2.405
Stack Moisture (%V)			10.65
Mole Fraction Dry Stack Gas			0.893
Dry Molecular Weight			28.84
Wet Molecular Weight			27.68
Stack Gas Velocity (fpm)			5581.71
Stack Gas Velocity (mpm)			1701.31
Volumetric Flow Rate (acfm)			552.48
Volumetric Flow Rate (acmm)			15.65
Volumetric Flow Rate (dscfm)			234.04
Volumetric Flow Rate (dscmm)			6.63
Percent Isokinetic			113.37
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

Run

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	3/18/05
Melter/Location	DM 1200 TCO
Run Number	Dioxin/Furans TCO Run 2
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	694.4g	497.9g	196.5
2	-	H2O	100	Modified	723.6	723.7g	-0.1
3	-	H2O	100	G/2	726.1g	725.9g	0.2
4	-	KMnO4	200	Modified	784.8g	783.9g	0.9
5	N/A	Silica Gel	-	Modified	989.1g	976.9g	12.2
Total Weight Gain (g):							214.7

Facility:	CUA	Start Time:	1135
Date:	03/19/2005	End Time:	1335
Location:	TCO Out	Initial Leak Check:	0.009@13"
Run Number:	3	Final Leak Check:	0.010@12"
Sample Type:	Dioxin/Furan/PCB		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.83
Absolute Stack Pressure (in Hg)			29.95
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			652.83
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			87.561
Average Meter Pressure (in H ₂ O)			1.38
Average Meter Temperature (°F)			103.71
Moisture Collected (g)			207.50
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.706
Standard Metered Volume (dscf)			84.706
Standard Metered Volume (dscm)			2.399
Stack Moisture (%V)			10.35
Mole Fraction Dry Stack Gas			0.896
Dry Molecular Weight			28.84
Wet Molecular Weight			27.71
Stack Gas Velocity (fpm)			5551.29
Stack Gas Velocity (mpm)			1692.03
Volumetric Flow Rate (acfm)			549.47
Volumetric Flow Rate (acmm)			15.56
Volumetric Flow Rate (dscfm)			233.85
Volumetric Flow Rate (dscmm)			6.62
Percent Isokinetic			113.18
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Stack T _s (°F)	Orifice Pressure Differential ΔH (in. H ₂ O)		Probe Temp. (°F)	Filter Temp. (°F)	Absorbent Trap Temp. (°F)	Dry Gas Meter Temperature (°F)		Impinger Exit (°F)	Pump Vacuum (in. Hg)
						Desired	Actual				Inlet	Outlet		
101	0	11:35	944.150	0.73	653			731	234	41	101	101	61	0
↓	10		952.11	0.89	653		1.44	246	236	42	102	101	42	0
	20		959.40	0.90	655		1.38	249	240	42	104	102	41	0
	30		966.62	0.89	654		1.39	244	240	43	105	102	43	0
	40		974.00	0.89	655		1.38	249	241	44	106	103	44	0
	50		981.36	0.89	653		1.42	249	241	43	106	103	44	0
	60		988.68	0.92	654		1.42	249	241	44	105	103	45	0
	70		996.03	0.89	652		1.38	249	241	44	106	103	45	0
	80		1003.32	0.88	680		1.36	250	242	44	106	103	44	0
	90		1010.57	0.86	653		1.33	250	241	45	106	103	47	0
	100		1017.77	0.86	652		1.33	250	242	45	106	104	47	0
	120		1025.00	0.87	650		1.35	250	242	44	105	103	48	0
	120		1031.71	0.87	650		1.35	250	242	44	105	103	48	0

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	3/18/05
Melter/Location	DM 1200 TCO
Run Number	Dioxin/Furans TCO Run 3
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	Condensate			-	682.3g	490.5	
2	-	H2O	100	Modified	701.5g	702.2	
3	-	H2O	100	G/2	721.4g	721.8	
4	-	KMnO4	200	Modified	771.2g	769.3	
5	N/A	Silica Gel	-	Modified	981.2g	966.3	
Total Weight Gain (g):							

ja

Facility:	CUA	Start Time:	2322
Date:	03/21/2005 - 03/22/2005	End Time:	122
Location:	TCO Out	Initial Leak Check:	0.00@15"
Run Number:	4	Final Leak Check:	0.00@15"
Sample Type:	Dioxin/Furan/PCB		
Total Sampling Time (min)	120.0		
Corrected Barometric Pressure (in Hg)	29.95		
Absolute Stack Pressure (in Hg)	29.07		
Stack Static Pressure (in H ₂ O)	-12.00		
Average Stack Temperature (°F)	620.08		
Stack Area (sq in)	14.25		
Actual Meter Volume (cu ft)	89.511		
Average Meter Pressure (in H ₂ O)	1.46		
Average Meter Temperature (°F)	99.75		
Moisture Collected (g)	219.60		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	0.9990		
Nozzle Diameter (in)	0.220		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.706		
Standard Metered Volume (dscf)	84.740		
Standard Metered Volume (dscm)	2.400		
Stack Moisture (%V)	10.89		
Mole Fraction Dry Stack Gas	0.891		
Dry Molecular Weight	28.84		
Wet Molecular Weight	27.66		
Stack Gas Velocity (fpm)	5741.07		
Stack Gas Velocity (mpm)	1749.88		
Volumetric Flow Rate (acfm)	568.25		
Volumetric Flow Rate (acmm)	16.09		
Volumetric Flow Rate (dscfm)	240.42		
Volumetric Flow Rate (dscmm)	6.81		
Percent Isokinetic	110.13		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

Schematic of Traverse Point Layout

Read and Record All Data Every 10 Minutes[illegible]

Plant	CUN
Date	3-21-05
Sampling Location	TEO Outlet
Run Number	3 rd 4
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	None	686.8	499.1	
2	H ₂ O	100	MGS	718.4	723.4	
3	H ₂ O	100	GS	724.8	725.8	
4	KMnO ₄	100	MGS	813.2 921.3 106.9	808.7	
5	Silica	250	MGS	978.3	944.9	
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	220
Date:	03/22/2005	End Time:	420
Location:	TCO Out	Initial Leak Check:	.01@15"
Run Number:	5	Final Leak Check:	.00@15"
Sample Type:	Dioxin/Furan/PCB		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			29.95
Absolute Stack Pressure (in Hg)			29.07
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			611.67
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			88.530
Average Meter Pressure (in H2O)			1.41
Average Meter Temperature (°F)			100.71
Moisture Collected (g)			205.30
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.697
Standard Metered Volume (dscf)			83.656
Standard Metered Volume (dscm)			2.369
Stack Moisture (%V)			10.37
Mole Fraction Dry Stack Gas			0.896
Dry Molecular Weight			28.84
Wet Molecular Weight			27.71
Stack Gas Velocity (fpm)			5611.95
Stack Gas Velocity (mpm)			1710.52
Volumetric Flow Rate (acfm)			555.47
Volumetric Flow Rate (acmm)			15.73
Volumetric Flow Rate (dscfm)			238.23
Volumetric Flow Rate (dscmm)			6.75
Percent Isokinetic			109.72
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Schematic of Traverse Point Layout

Read and Record All Data Every 10 MinutesRun

Plant	CUA
Date	3-22-05
Sampling Location	TEO
Run Number	5
Impinger Box Number	
Recovery Person	WEG
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	—	675.4	490.2	
2	H ₂ O	100	MGS	711.1	711.0	
3	H ₂ O	100	GS	726.7	727.0	
4	KMnO ₄	100	MGS	725.4	722.4	
5	Silica gel	100	MGS	935.2	917.9	
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Appendix B.4

Metals

Facility:	CUA	Start Time:	1821
Date:	03/08/2005	End Time:	1921
Location:	Melter Out	Initial Leak Check:	0.004@13
Run Number:	1	Final Leak Check:	0.004@7"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.87
Absolute Stack Pressure (in Hg)			29.52
Stack Static Pressure (in H ₂ O)			-4.80
Average Stack Temperature (°F)			436.17
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			38.896
Average Meter Pressure (in H ₂ O)			1.33
Average Meter Temperature (°F)			102.42
Moisture Collected (g)			202.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0248
Nozzle Diameter (in)			0.251
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.625
Standard Metered Volume (dscf)			37.483
Standard Metered Volume (dscm)			1.062
Stack Moisture (%V)			20.28
Mole Fraction Dry Stack Gas			0.797
Dry Molecular Weight			28.84
Wet Molecular Weight			26.64
Stack Gas Velocity (fpm)			4114.63
Stack Gas Velocity (mpm)			1254.14
Volumetric Flow Rate (acfm)			359.07
Volumetric Flow Rate (acmm)			10.17
Volumetric Flow Rate (dscfm)			166.35
Volumetric Flow Rate (dscmm)			4.71
Percent Isokinetic			95.38
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Plant	CWA	Probe Length & Type	20 TFE	Filter Number	12704-1
Date	3/8/05	Nozzle ID (in.)	0.251	Height of Location (ft)	20
Sampling Location	Wellbore Out	Pitot Constant	0.99 2	Duct Dimensions (in.)	4
Sample Type	Metals	Meter Box Number	ATD	Stack Geometry (R or C)	C
Run Number	1	Meter $\Delta H @$ 1.809	1.0248	Assume Moisture (%)	19%
Operator	WPG	Yd	1.0248	O ₂ (%)	20.9
Ambient Temperature	95	K Factor	3.3	CO ₂ (%)	0
Barometric Pressure (in.)	29.88	Probe Heater Setting (°F)	250	Nitrogen (%)	79
Static Pressure (in. H ₂ O)	-4.8	Heater Box Setting (°F)	250	Moisture Collected (g)	
Initial Leak Check	0.004 @ 13	Final Leak Check	0.004 @ 7"		

(Diagram of Duct)

Read and Record All Data Every Minutes

[illegible]

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/08/05
Melter/Location	DM 1200 Melter
Run Number	1-metals
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	122704-1
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	HM0308051	10% H2O2 5% HNO3	100	Modified	884.9	730.2	154.7
2		10% H2O2 5% HNO3	100	G/S	768.9	740.4	28.5
3		KO	-	Modified	627.2	623.2g	4.0
4	-	KMnO4	250	Modified	730.8	726.4g	4.4
5	N/A	Silica Gel	-	Modified	919.1	908.5g	10.6
Total Weight Gain (g):							202.2

Facility:	CUA	Start Time:	2112
Date:	03/08/2005	End Time:	2212
Location:	Melter Out	Initial Leak Check:	0.008@12
Run Number:	2	Final Leak Check:	.005@12"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.87
Absolute Stack Pressure (in Hg)			29.52
Stack Static Pressure (in H2O)		✓	-4.80
Average Stack Temperature (°F)			422.67
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)		✓	42.676
Average Meter Pressure (in H2O)			1.46
Average Meter Temperature (°F)			104.58
Moisture Collected (g)			215.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0248
Nozzle Diameter (in)			0.251
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.683
Standard Metered Volume (dscf)			40.979
Standard Metered Volume (dscm)			1.161
Stack Moisture (%V)			19.85
Mole Fraction Dry Stack Gas			0.802
Dry Molecular Weight			28.84
Wet Molecular Weight			26.69
Stack Gas Velocity (fpm)			4254.87
Stack Gas Velocity (mpm)			1296.89
Volumetric Flow Rate (acfm)			371.31
Volumetric Flow Rate (acmm)			10.52
Volumetric Flow Rate (dscfm)			175.59
Volumetric Flow Rate (dscmm)			4.97
Percent Isokinetic			98.78
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

AIR/TECH

(Diagram of Duct)

UNY

US EPA Method 4 Moisture Form

The Catholic University of America

Vitreous State Laboratory

Date	03/08/05
Melter/Location	DM 1200 Melter
Run Number	2-metals
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	122704-3
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		10% H2O2 5% HNO3	100	Modified	903.2	694.4 733.9	169.3
2		10% H2O2 5% HNO3	100	G/S	761.5	733.2	28.3
3		KO	-	Modified	625.7	622.6	3.1
4	-	KMnO4	250	Modified	750.3	747.7g	2.6
5	N/A	Silica Gel	-	Modified	938.5	926.4g	12.1
Total Weight Gain (g):							215.4

Facility:	CUA	Start Time:	2333 -1133
Date:	03/08/2005 - 03/09/2005	End Time:	0033 1233
Location:	Melter Out	Initial Leak Check:	.001@13"
Run Number:	3	Final Leak Check:	.001@13"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.59
Absolute Stack Pressure (in Hg)			29.24
Stack Static Pressure (in H ₂ O)			-4.80
Average Stack Temperature (°F)			417.83
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			39.338
Average Meter Pressure (in H ₂ O)			1.34
Average Meter Temperature (°F)			104.50
Moisture Collected (g)			194.90
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0248
Nozzle Diameter (in)			0.251
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.624
Standard Metered Volume (dscf)			37.412
Standard Metered Volume (dscm)			1.059
Stack Moisture (%V)			19.72
Mole Fraction Dry Stack Gas			0.803
Dry Molecular Weight			28.84
Wet Molecular Weight			26.70
Stack Gas Velocity (fpm)			4092.37
Stack Gas Velocity (mpm)			1247.35
Volumetric Flow Rate (acfm)			357.13
Volumetric Flow Rate (acmm)			10.11
Volumetric Flow Rate (dscfm)			168.47
Volumetric Flow Rate (dscmm)			4.77
Percent Isokinetic			93.99
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	CVA	Probe Length & Type	20' TPE	Filter Number
Date	3/8/05 - 3/9/05	Nozzle ID (in.)	251	Height of Location (ft)
Sampling Location	Melter-out	Pilot Constant	99	Duct Dimensions (in.)
Sample Type	metals	Meter Box Number	ATD	Stack Geometry (R or C)
Run Number	3	Meter ΔH@	1.809	Assume Moisture (%)
Operator	Mugh.	Yd	1.0248	O ₂ (%)
Ambient Temperature	95°F	K Factor	2.3	CO ₂ (%)
Barometric Pressure (in.)	29.60	Probe Heater Setting (°F)		Nitrogen (%)
Static Pressure (in. H ₂ O)	-4.8"	Heater Box Setting (°F)		Moisture Collected (g)
Initial Leak Check	0.01 @ 13"	Final Leak Check	0.01 @ 13"	

(Diagram of Duct)

[illegible]

run

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/08/05
Melter/Location	DM 1200 Melter
Run Number	3-metals
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	122704-7
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		10% H2O2 5% HNO3	100	Modified	888.0	732.2	
2		10% H2O2 5% HNO3	100	G/S	763.7	741.8	
3		KO	-	Modified	626.0	623.2	
4	-	KMnO4	250	Modified	762.0	759.2	
5	N/A	Silica Gel	-	Modified	990.5	978.9	
Total Weight Gain (g):							

Facility:	CUA	Start Time:	1819
Date:	03/08/05	End Time:	1919
Location:	TCO Out	Initial Leak Check:	0.004@11
Run Number:	1	Final Leak Check:	0.00@9"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.87
Absolute Stack Pressure (in Hg)			28.99
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			668.67
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			47.877
Average Meter Pressure (in H ₂ O)			1.68
Average Meter Temperature (°F)			102.42
Moisture Collected (g)			119.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.750
Standard Metered Volume (dscf)			45.017
Standard Metered Volume (dscm)			1.275
Stack Moisture (%V)			11.14
Mole Fraction Dry Stack Gas			0.889
Dry Molecular Weight			28.84
Wet Molecular Weight			27.63
Stack Gas Velocity (fpm)			6100.58
Stack Gas Velocity (mpm)			1859.46
Volumetric Flow Rate (acfm)			603.83
Volumetric Flow Rate (acmm)			17.10
Volumetric Flow Rate (dscfm)			243.15
Volumetric Flow Rate (dscmm)			6.89
Percent Isokinetic			105.85
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/08/05
Melter/Location	DM 1200 TCO
Run Number	1-metals
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		10% H ₂ O ₂ 5% HNO ₃	100	Modified	779.7 779.5	694.4	85.30
2		10% H ₂ O ₂ 5% HNO ₃	100	G/S	757.5	731.3	26.20
3		KO	-	Modified	642.7	639.7 _g	3.00
4	-	KMnO ₄	250	Modified	763.0	760.5 _g	2.5
5	N/A	Silica Gel	-	Modified	938.2	929.5 _g	8.7
Total Weight Gain (g):							119.7

Facility:	CUA	Start Time:	2130
Date:	03/08/05	End Time:	2230
Location:	TCO Out	Initial Leak Check:	0.001@12"
Run Number:	2	Final Leak Check:	.001@13"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.87
Absolute Stack Pressure (in Hg)			28.99
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			674.83
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			49.812
Average Meter Pressure (in H ₂ O)			1.77
Average Meter Temperature (°F)			103.83
Moisture Collected (g)			116.60
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.779
Standard Metered Volume (dscf)			46.732
Standard Metered Volume (dscm)			1.323
Stack Moisture (%V)			10.53
Mole Fraction Dry Stack Gas			0.895
Dry Molecular Weight			28.84
Wet Molecular Weight			27.70
Stack Gas Velocity (fpm)			6281.68
Stack Gas Velocity (mpm)			1914.66
Volumetric Flow Rate (acfm)			621.76
Volumetric Flow Rate (acmm)			17.61
Volumetric Flow Rate (dscfm)			250.73
Volumetric Flow Rate (dscmm)			7.10
Percent Isokinetic			106.57
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

TCO OUT-net - RZ
Run
Page 1 of 1

(Diagram of Duct)

Run

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/08/05
Melter/Location	DM 1200 TCO
Run Number	2-metals
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	122704-4
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		10% H2O2 5% HNO3	100	Modified	803.4	716.0g	
2		10% H2O2 5% HNO3	100	G/S	760.9	742.6g	
3		KO	-	Modified	622.8	621.4g	
4	-	KMnO4	250	Modified	788.1	786.8g	
5	N/A	Silica Gel	-	Modified	887.2	879.0g	
Total Weight Gain (g):							

Facility:	CUA	Start Time:	2336
Date:	03/08/05 - 03/09/2005	End Time:	136
Location:	TCO Out	Initial Leak Check:	.001@13"
Run Number:	3	Final Leak Check:	.001@13"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.59
Absolute Stack Pressure (in Hg)			28.71
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			672.50
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			47.366
Average Meter Pressure (in H2O)			1.72
Average Meter Temperature (°F)			102.33
Moisture Collected (g)			111.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.736
Standard Metered Volume (dscf)			44.135
Standard Metered Volume (dscm)			1.250
Stack Moisture (%V)			10.66
Mole Fraction Dry Stack Gas			0.893
Dry Molecular Weight			28.84
Wet Molecular Weight			27.68
Stack Gas Velocity (fpm)			6210.56
Stack Gas Velocity (mpm)			1892.98
Volumetric Flow Rate (acfm)			614.72
Volumetric Flow Rate (acmm)			17.41
Volumetric Flow Rate (dscfm)			245.63
Volumetric Flow Rate (dscmm)			6.96
Percent Isokinetic			102.73
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

AIR/TECH

not ALS
~~not ALS~~
not ALS k3
~~not ALS~~

Read and Record All Data Every _____ Minutes

—
KUN

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/08/05
Melter/Location	DM.1200 TCO
Run Number	3-metals
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	122704-6
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1	HM0308053	10% H2O2 5% HNO3	100	Modified	793.4	707.0	
2		10% H2O2 5% HNO3	100	G/S	747.4	733.1	
3		KO	-	Modified	638.6	637.1	
4	-	KMnO4	250	Modified	795.6	794.2	
5	N/A	Silica Gel	-	Modified	979.1	971.0	
Total Weight Gain (g):							

Facility:	CUA	Start Time:	1328
Date:	03/18/2005	End Time:	1428
Location:	Melter	Initial Leak Check:	0.000@10"
Run Number:	1	Final Leak Check:	0.004@15"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.70
Absolute Stack Pressure (in Hg)			30.27
Stack Static Pressure (in H ₂ O)			-5.80
Average Stack Temperature (°F)			519.00
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			27.395
Average Meter Pressure (in H ₂ O)			0.90
Average Meter Temperature (°F)			107.67
Moisture Collected (g)			230.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9967
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.435
Standard Metered Volume (dscf)			26.129
Standard Metered Volume (dscm)			0.740
Stack Moisture (%V)			29.39
Mole Fraction Dry Stack Gas			0.706
Dry Molecular Weight			28.84
Wet Molecular Weight			25.65
Stack Gas Velocity (fpm)			4924.88
Stack Gas Velocity (mpm)			1501.10
Volumetric Flow Rate (acfm)			429.78
Volumetric Flow Rate (acmm)			12.17
Volumetric Flow Rate (dscfm)			165.55
Volumetric Flow Rate (dscmm)			4.69
Percent Isokinetic			86.96
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Plant	COA/VSL	Probe Length & Type	20' TFE	Filter Number	M.O. Metals - P1
Date	3/18/05	Nozzle ID (in.)	0.220	Height of Location (ft)	20
Sampling Location	weir bed	Pilot Constant	0.99 84	Duct Dimensions (in.)	4"
Sample Type	Metals	Meter Box Number	ATB	Stack Geometry (R or C)	C
Run Number	1	Meter ΔH@	1.769	Assume Moisture (%)	24
Operator	WFG	Yd	0.9967	O ₂ (%)	20.9
Ambient Temperature	95	K Factor	1.20	CO ₂ (%)	0
Barometric Pressure (in.)	30.71	Probe Heater Setting (°F)	250	Nitrogen (%)	79
Static Pressure (in. H ₂ O)	-5.8	Heater Box Setting (°F)	250	Moisture Collected (g)	
Initial Leak Check	0.000 @ 10"	Final Leak Check	0.004 @ 15"		

[illegible]

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	3/18/05
Melter/Location	DM 1200 Melter
Run Number	1-metals
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		10% H2O2 5% HNO3	100	Modified	893.9	713.3	180.6
2		10% H2O2 5% HNO3	100	G/S	775.9	746.2g	29.7
3		KO	-	Modified	634.0	630.7g	3.3
4	-	KMnO4	250	Modified	809.9	805.7g 737.5g	4.2
5	N/A	Silica Gel	-	Modified	917.3	904.4g	12.9
Total Weight Gain (g):							230.7

Facility:	CUA	Start Time:	1526
Date:	03/18/2005	End Time:	1626
Location:	Melter	Initial Leak Check:	0.012@15"
Run Number:	2	Final Leak Check:	0.018@14"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.70
Absolute Stack Pressure (in Hg)			30.27
Stack Static Pressure (in H ₂ O)			-5.80
Average Stack Temperature (°F)			521.83
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			33.395
Average Meter Pressure (in H ₂ O)			0.90
Average Meter Temperature (°F)			107.83
Moisture Collected (g)			213.50
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9967
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.530
Standard Metered Volume (dscf)			31.824
Standard Metered Volume (dscm)			0.901
Stack Moisture (%V)			24.03
Mole Fraction Dry Stack Gas			0.760
Dry Molecular Weight			28.84
Wet Molecular Weight			26.23
Stack Gas Velocity (fpm)			4875.23
Stack Gas Velocity (mpm)			1485.97
Volumetric Flow Rate (acfm)			425.44
Volumetric Flow Rate (acmm)			12.05
Volumetric Flow Rate (dscfm)			175.81
Volumetric Flow Rate (dscmm)			4.98
Percent Isokinetic			99.73
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

(Diagram of Duct)

905

US EPA Method 4 Moisture Form

The Catholic University of America

Vitreous State Laboratory

Date	03/18/05
Melter/Location	DM 1200 Melter
Run Number	2-metals
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		10% H2O2 5% HNO3	100	Modified	881.3g	708.4	
2		10% H2O2 5% HNO3	100	G/S	761.0g	737.5g	
3		KO	-	Modified	624.1g	621.1g	
4	-	KMnO4	250	Modified	792.3g	789.5g	
5	N/A	Silica Gel	-	Modified	948.8g	937.8g	
Total Weight Gain (g):							

Facility:	CUA	Start Time:	1811
Date:	03/18/2005	End Time:	1911
Location:	Melter	Initial Leak Check:	0.00@14
Run Number:	3	Final Leak Check:	0.004@15"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.70
Absolute Stack Pressure (in Hg)			30.27
Stack Static Pressure (in H2O)			-5.80
Average Stack Temperature (°F)			500.33
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			33.940
Average Meter Pressure (in H2O)			0.94
Average Meter Temperature (°F)			108.17
Moisture Collected (g)			204.50
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9967
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.539
Standard Metered Volume (dscf)			32.328
Standard Metered Volume (dscm)			0.916
Stack Moisture (%V)			22.97
Mole Fraction Dry Stack Gas			0.770
Dry Molecular Weight			28.84
Wet Molecular Weight			26.35
Stack Gas Velocity (fpm)			4924.64
Stack Gas Velocity (mpm)			1501.03
Volumetric Flow Rate (acfm)			429.76
Volumetric Flow Rate (acmm)			12.17
Volumetric Flow Rate (dscfm)			184.10
Volumetric Flow Rate (dscmm)			5.21
Percent Isokinetic			96.75
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	CWA/USL	Probe Length & Type	26' TFE	Height of Location (ft)	20
Date	3/18/05	Nozzle ID (in.)	0.220	Duct Dimensions (in.)	4
Sampling Location	Welder Out	Pilot Constant	0.99 X	Stack Geometry (R or C)	C
Sample Type	Metals	Meter Box Number	ATB	Filter Number	n.o. - metals - R3
Run Number	3	Meter $\Delta H@$	1.769	Assume Moisture (%)	24
Operator	WPK	Yd	0.9967	O ₂ (%)	20.9
Ambient Temperature	95	K Factor	1.2	CO ₂ (%)	0
Barometric Pressure (in.)	30.71	Probe Heater Setting (°F)	250	Nitrogen (%)	79
Static Pressure (in. H ₂ O)	-5.8	Heater Box Setting (°F)	250	Moisture Collected (g)	
		Initial Leak Check	0.00 @ 14	Final Leak Check	0.00 @ 15

(Diagram of Duct)

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US EPA Method 4 Moisture Form

The Catholic University of America

Vitreous State Laboratory

Date	03/18/05
Melter/Location	DM 1200 Melter
Run Number	3-metals
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		10% H2O2 5% HNO3	100	Modified	883.6g	729.9g	
2		10% H2O2 5% HNO3	100	G/S	781.8g	744.8g	
3		KO	-	Modified	619.4g	617.0	
4	-	KMnO4	250	Modified	812.7g	809.9	
5	N/A	Silica Gel	-	Modified	925.9g	917.3	
Total Weight Gain (g):							

26

Facility:	CUA	Start Time:	1327
Date:	03/18/2005	End Time:	1427
Location:	TCO Out	Initial Leak Check:	0.004@13
Run Number:	1	Final Leak Check:	0.006@6"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.70
Absolute Stack Pressure (in Hg)			29.82
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			646.50
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			42.884
Average Meter Pressure (in H2O)			1.33
Average Meter Temperature (°F)			105.33
Moisture Collected (g)			104.80
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.687
Standard Metered Volume (dscf)			41.191
Standard Metered Volume (dscm)			1.167
Stack Moisture (%V)			10.71
Mole Fraction Dry Stack Gas			0.893
Dry Molecular Weight			28.84
Wet Molecular Weight			27.68
Stack Gas Velocity (fpm)			5441.18
Stack Gas Velocity (mpm)			1658.47
Volumetric Flow Rate (acfm)			538.57
Volumetric Flow Rate (acmm)			15.25
Volumetric Flow Rate (dscfm)			228.65
Volumetric Flow Rate (dscmm)			6.48
Percent Isokinetic			112.58
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Tee-note-12-12
Run _____
Page 1 of 1

(Diagram of Duct)

(Diagram of Duct)

(Diagram of Duct)

US EPA Method 4 Moisture Form

The Catholic University of America

Vitreous State Laboratory

Date	03/18/05
Melter/Location	DM 1200 TCO
Run Number	1-metals
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		10% H2O2 5% HNO3	100	Modified	776.2g 893.9g ND 3.18.5	696.3	
2		10% H2O2 5% HNO3	100	G/S	763.2g 775.9g ND 3.18.5	749.4g	
3		KO	-	Modified	617.3g 634.0 ND 3.18.5	615.5g	
4	-	KMnO4	250	Modified	731.3	729.9g	
5	N/A	Silica Gel	-	Modified	945.2	937.3g	
Total Weight Gain (g):							

Facility:	CUA	Start Time:	1523
Date:	03/18/2005	End Time:	1723
Location:	TCO Out	Initial Leak Check:	0.00@10
Run Number:	2	Final Leak Check:	0.004@9"
Sample Type:	Metals		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.70
Absolute Stack Pressure (in Hg)			29.82
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			649.00
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			88.220
Average Meter Pressure (in H ₂ O)			1.40
Average Meter Temperature (°F)			107.33
Moisture Collected (g)			206.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.704
Standard Metered Volume (dscf)			84.451
Standard Metered Volume (dscm)			2.392
Stack Moisture (%V)			10.32
Mole Fraction Dry Stack Gas			0.897
Dry Molecular Weight			28.84
Wet Molecular Weight			27.72
Stack Gas Velocity (fpm)			5582.86
Stack Gas Velocity (mpm)			1701.66
Volumetric Flow Rate (acfm)			552.59
Volumetric Flow Rate (acmm)			15.65
Volumetric Flow Rate (dscfm)			235.09
Volumetric Flow Rate (dscmm)			6.66
Percent Isokinetic			112.25
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	CWA/VSC	Probe Length & Type	20' TFE	Height of Location (ft)	Wet TCO-R2
Date	3/18/05	Nozzle ID (in.)	0.220	Duct Dimensions (in.)	10
Sampling Location	TCO Out	Pilot Constant	0.97	Stack Geometry (R or C)	4.26
Sample Type	Wetals	Meter Box Number	ATC	Filter Number	C
Run Number	2	Meter $\Delta H@$	1.67	Assume Moisture (%)	7
Operator	WPC	Yd	0.999	O ₂ (%)	20.9
Ambient Temperature	90	K Factor	1.55	CO ₂ (%)	0
Barometric Pressure (in.)	30.71	Probe Heater Setting (°F)	250	Nitrogen (%)	79
Static Pressure (in. H ₂ O)	-12"	Heater Box Setting (°F)	250	Moisture Collected (g)	
		Initial Leak Check	0.00 @ 10	Final Leak Check	0.00 @ 29

(Diagram of Duct)

[illegible]

US EPA Method 4 Moisture Form

The Catholic University of America

Vitreous State Laboratory

Date	03/18/05
Melter/Location	DM 1200 TCO
Run Number	2-metals
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		10% H2O2 5% HNO3	100	Modified	899.2g	745.9g	
2		10% H2O2 5% HNO3	100	G/S	785.9g	754.0g	
3		KO	-	Modified	638.8g	634.0g	
4	-	KMnO4	250	Modified	763.3g	762.1g	
5	N/A	Silica Gel	-	Modified	976.8g	961.8g	
Total Weight Gain (g):							

Facility:	CUA	Start Time:	1803
Date:	03/18/2005	End Time:	2003
Location:	TCO Out	Initial Leak Check:	0.010@12"
Run Number:	3	Final Leak Check:	0.004@7"
Sample Type:	Metals		
Total Sampling Time (min)	120.0		
Corrected Barometric Pressure (in Hg)	30.70		
Absolute Stack Pressure (in Hg)	29.82		
Stack Static Pressure (in H2O)	-12.00		
Average Stack Temperature (°F)	649.17		
Stack Area (sq in)	14.25		
Actual Meter Volume (cu ft)	88.786		
Average Meter Pressure (in H2O)	1.44		
Average Meter Temperature (°F)	108.33		
Moisture Collected (g)	198.70		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	0.9990		
Nozzle Diameter (in)	0.220		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.707		
Standard Metered Volume (dscf)	84.855		
Standard Metered Volume (dscm)	2.403		
Stack Moisture (%V)	9.94		
Mole Fraction Dry Stack Gas	0.901		
Dry Molecular Weight	28.84		
Wet Molecular Weight	27.76		
Stack Gas Velocity (fpm)	5677.71		
Stack Gas Velocity (mpm)	1730.57		
Volumetric Flow Rate (acfm)	561.98		
Volumetric Flow Rate (acmm)	15.92		
Volumetric Flow Rate (dscfm)	240.06		
Volumetric Flow Rate (dscmm)	6.80		
Percent Isokinetic	110.45		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

Metals-Too-P3
Run _____
Page 1 of 1

(Diagram of Duct)

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US EPA Method 4 Moisture Form

The Catholic University of America

Vitreous State Laboratory

Date	03/18/05
Melter/Location	DM 1200 TCO
Run Number	3-metals
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		10% H2O2 5% HNO3	100	Modified	873.7g	722.4g	
2		10% H2O2 5% HNO3	100	G/S	710.8g	685.4g	
3		KO	-	Modified	619.0g	615.5g	
4	-	KMnO4	250	Modified	732.8g	731.3	
5	N/A	Silica Gel	-	Modified	962.2g	945.2	
Total Weight Gain (g):							

Appendix B.5

Halogens/Acid Gases

Facility:	CUA	Start Time:	144
Date:	03/09/05	End Time:	244
Location:	Melter Out	Initial Leak Check:	.02@13"
Run Number:	1	Final Leak Check:	.02@11"
Sample Type:	M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.60
Absolute Stack Pressure (in Hg)			29.25
Stack Static Pressure (in H ₂ O)			-4.80
Average Stack Temperature (°F)			409.33
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			44.061
Average Meter Pressure (in H ₂ O)			1.71
Average Meter Temperature (°F)			104.67
Moisture Collected (g)			209.30
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0248
Nozzle Diameter (in)			0.251
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.699
Standard Metered Volume (dscf)			41.948
Standard Metered Volume (dscm)			1.188
Stack Moisture (%V)			19.04
Mole Fraction Dry Stack Gas			0.810
Dry Molecular Weight			28.84
Wet Molecular Weight			26.77
Stack Gas Velocity (fpm)			4614.76
Stack Gas Velocity (mpm)			1406.58
Volumetric Flow Rate (acfm)			402.71
Volumetric Flow Rate (acmm)			11.40
Volumetric Flow Rate (dscfm)			193.51
Volumetric Flow Rate (dscmm)			5.48
Percent Isokinetic			91.75
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

AIR/TECH

(Diagram of Duct)

run

Plant	CUR
Date	3-9-05
Sampling Location	Melter Outlet
Run Number	M-26 1
Impinger Box Number	
Recovery Person	WLG
Recovery Rinses	H ₂ O
Sampling Identification	
Filter Number	061002-11
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1N H ₂ SO ₄	100	MGS	892.9	739.5	
2	0.1N H ₂ SO ₄	100	GS	757.4	725.6	
3	0.2N NaOH	100	MGS	728.2	722.3	
4	0.2N NaOH	100	GS	710.1	707.7	
5	KMnO ₄	100	GS	751.8	749.5	
6	Silica Gel	~250	MGS	1001.6	988.1	
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	○ 351
Date:	03/09/2005	End Time:	○ 451
Location:	Melter Out	Initial Leak Check:	.001@10"
Run Number:	2	Final Leak Check:	.001@12"
Sample Type:	M5/26		
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	29.70		
Absolute Stack Pressure (in Hg)	29.35		
Stack Static Pressure (in H ₂ O)	-4.80		
Average Stack Temperature (°F)	418.17		
Stack Area (sq in)	12.57		
Actual Meter Volume (cu ft)	40.949		
Average Meter Pressure (in H ₂ O)	1.55		
Average Meter Temperature (°F)	104.00		
Moisture Collected (g)	202.70		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	1.0248		
Nozzle Diameter (in)	0.251		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.652		
Standard Metered Volume (dscf)	39.145		
Standard Metered Volume (dscm)	1.109		
Stack Moisture (%V)	19.62		
Mole Fraction Dry Stack Gas	0.804		
Dry Molecular Weight	28.84		
Wet Molecular Weight	26.71		
Stack Gas Velocity (fpm)	4408.27		
Stack Gas Velocity (mpm)	1343.64		
Volumetric Flow Rate (acfm)	384.69		
Volumetric Flow Rate (acmm)	10.89		
Volumetric Flow Rate (dscfm)	182.31		
Volumetric Flow Rate (dscmm)	5.16		
Percent Isokinetic	90.89		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

924

Plant	C417
Date	3-9-05
Sampling Location	Melter
Run Number	RM26 2
Impinger Box Number	-
Recovery Person	WCS
Recovery Rinses	H ₂ O
Sampling Identification	
Filter Number	061002-12
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1N H ₂ SO ₄	100	MGS	880.6	728.9	
2	0.1N H ₂ SO ₄	100	GS	762.5	734.8	
3	0.2N NaOH	100	MGS	728.6	723.8	
4	0.2N NaOH	100	GS	743.5	741.3	
5	KMnO ₄	100	MGS	748.4	746.3	
6	Silica Gel	~250	MGS	964.1	949.9	
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	0547
Date:	03/09/2005	End Time:	0647
Location:	Melter Out	Initial Leak Check:	.01@12"
Run Number:	3	Final Leak Check:	.001@22"
Sample Type:	M5/26		
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	29.70		
Absolute Stack Pressure (in Hg)	29.35		
Stack Static Pressure (in H2O)	-4.80		
Average Stack Temperature (°F)	421.67		
Stack Area (sq in)	12.57		
Actual Meter Volume (cu ft)	46.831		
Average Meter Pressure (in H2O)	1.89		
Average Meter Temperature (°F)	103.42		
Moisture Collected (g)	207.10		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	1.0248		
Nozzle Diameter (in)	0.251		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.748		
Standard Metered Volume (dscf)	44.852		
Standard Metered Volume (dscm)	1.270		
Stack Moisture (%V)	17.88		
Mole Fraction Dry Stack Gas	0.821		
Dry Molecular Weight	28.84		
Wet Molecular Weight	26.90		
Stack Gas Velocity (fpm)	4864.73		
Stack Gas Velocity (mpm)	1482.77		
Volumetric Flow Rate (acfm)	424.53		
Volumetric Flow Rate (acmm)	12.02		
Volumetric Flow Rate (dscfm)	204.73		
Volumetric Flow Rate (dscmm)	5.80		
Percent Isokinetic	92.73		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

FIELD DATA SHEET

Plant	CWA	Probe Length & Type	20' TFE	Filter Number
Date	3/9/05	Nozzle ID (in.)	251	Height of Location (ft)
Sampling Location	Melter	Pitot Constant	99	Duct Dimensions (in.)
Sample Type	S/26	Meter Box Number	ATD	Stack Geometry (R or C)
Run Number	3	Meter ΔH@	1,809	Assume Moisture (%)
Operator	med	Yd	1,058 1,0248	O ₂ (%)
Ambient Temperature	100°F	K Factor	2.3	CO ₂ (%)
Barometric Pressure (in.)	29.70	Probe Heater Setting (°F)	250	Nitrogen (%)
Static Pressure (in. H ₂ O)	-4.8"	Heater Box Setting (°F)	250	Moisture Collected (g)
Initial Leak Check	0.1 @ 12"	Final Leak Check	0.00 @ 22"	

(Diagram of Duct)

[illegible]

Plant	CUA
Date	3-9-05
Sampling Location	Melter Outlet
Run Number	M-26 3
Impinger Box Number	
Recovery Person	WLB
Recovery Rinses	H ₂ O
Sampling Identification	
Filter Number	061002-14
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1 N H ₂ SO ₄	100	MGS	875.5	743.6	
2	0.1 N H ₂ SO ₄	100	GS	771.5	723.4	
3	0.2 N NaOH	100	MGS	729.7	723.2	
4	0.2 N NaOH	100	GS	713.6	711.3	
5	KMnO ₄	100	MGS	781.8	778.9	
6	Silica Gel	256	MGS	961.6	946.2	
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	147
Date:	03/09/05	End Time:	247
Location:	TCO	Initial Leak Check:	.02@13"
Run Number:	1	Final Leak Check:	.02@12"
Sample Type:	M5/26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.60
Absolute Stack Pressure (in Hg)			28.72
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			669.17
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			49.370
Average Meter Pressure (in H ₂ O)			1.80
Average Meter Temperature (°F)			100.50
Moisture Collected (g)			111.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.769
Standard Metered Volume (dscf)			46.170
Standard Metered Volume (dscm)			1.308
Stack Moisture (%V)			10.24
Mole Fraction Dry Stack Gas			0.898
Dry Molecular Weight			28.84
Wet Molecular Weight			27.73
Stack Gas Velocity (fpm)			6341.55
Stack Gas Velocity (mpm)			1932.91
Volumetric Flow Rate (acfm)			627.69
Volumetric Flow Rate (acmm)			17.78
Volumetric Flow Rate (dscfm)			252.79
Volumetric Flow Rate (dscmm)			7.16
Percent Isokinetic			104.43
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	CUA
Date	3-9-05
Sampling Location	TCO Outlet
Run Number	M-26 1
Impinger Box Number	
Recovery Person	WLG
Recovery Rinses	H ₂ O
Sampling Identification	
Filter Number	06 1002-10
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1 N H ₂ SO ₄	100	MGS	807.2	727.7	79.5
2	0.1 N H ₂ SO ₄	100	GS	755.6	739.0	16.6
3	0.2 N NaOH	100	MGS	721.9	718.0	3.9
4	0.2 N NaOH	100	GS	757.7	756.0	1.7
5	KMnO ₄	100	GS	729.0	728.1	0.9
6	Silica Gel	~250	MGS	933.6	924.5	9.1
7						
8						
9						
10						
Total Weight Gain (g)						111.7

(Diagram of Duct)

Read and Record All Data Every 10 MinutesRun

Facility:	CUA	Start Time:	0353
Date:	03/09/2005	End Time:	0453
Location:	TCO	Initial Leak Check:	.01@13"
Run Number:	2	Final Leak Check:	.001@13"
Sample Type:	M5/26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.70
Absolute Stack Pressure (in Hg)			28.82
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			661.83
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			45.840
Average Meter Pressure (in H2O)			1.54
Average Meter Temperature (°F)			102.33
Moisture Collected (g)			110.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.714
Standard Metered Volume (dscf)			42.842
Standard Metered Volume (dscm)			1.213
Stack Moisture (%V)			10.86
Mole Fraction Dry Stack Gas			0.891
Dry Molecular Weight			28.84
Wet Molecular Weight			27.66
Stack Gas Velocity (fpm)			5829.42
Stack Gas Velocity (mpm)			1776.81
Volumetric Flow Rate (acfm)			576.99
Volumetric Flow Rate (acmm)			16.34
Volumetric Flow Rate (dscfm)			233.08
Volumetric Flow Rate (dscmm)			6.60
Percent Isokinetic			105.09
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	CUIA
Date	3-9-05
Sampling Location	TCO outlet
Run Number	RM26 2
Impinger Box Number	
Recovery Person	WCG
Recovery Rinses	H ₂ O
Sampling Identification	
Filter Number	061002-13
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1N H ₂ SO ₄	100	MGS	787.8	706.4	
2	0.1N H ₂ SO ₄	100	GS	741.1	727.2	
3	0.2N NaOH	100	MGS	744.0	740.4	
4	0.2N NaOH	100	GS	727.2	726.1	
5	KMnO ₄	100	MGS	794.9	793.5	
6	Silica Gel	~250	MGS	976.0	966.7	
7						
8						
9						
10						
Total Weight Gain (g)						110.7

Facility:	CUA	Start Time:	549
Date:	03/09/05	End Time:	649
Location:	TCO	Initial Leak Check:	.01@12"
Run Number:	3	Final Leak Check:	0.001@12"
Sample Type:	Halogens M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.70
Absolute Stack Pressure (in Hg)			28.82
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			669.00
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			49.275
Average Meter Pressure (in H2O)			1.80
Average Meter Temperature (°F)			102.67
Moisture Collected (g)			120.60
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.768
Standard Metered Volume (dscf)			46.057
Standard Metered Volume (dscm)			1.304
Stack Moisture (%V)			10.99
Mole Fraction Dry Stack Gas			0.890
Dry Molecular Weight			28.84
Wet Molecular Weight			27.65
Stack Gas Velocity (fpm)			6339.37
Stack Gas Velocity (mpm)			1932.24
Volumetric Flow Rate (acfm)			627.47
Volumetric Flow Rate (acmm)			17.77
Volumetric Flow Rate (dscfm)			251.50
Volumetric Flow Rate (dscmm)			7.12
Percent Isokinetic			104.71
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run _____ of _____

(Diagram of Duct)

Read and Record All Data Every 10 MinutesRun

Plant	CUNA
Date	3-9-05
Sampling Location	TCD-Outlet
Run Number	m26 3
Impinger Box Number	
Recovery Person	WCG
Recovery Rinses	H ₂ O
Sampling Identification	
Filter Number	06002-15
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1 N H ₂ SO ₄	100	MGS	816.9	728.6	
2	0.1 N H ₂ SO ₄	100	GS	752.9	735.4	
3	0.2 N NaOH	100	MGS	721.5	718.7	
4	0.2 N NaOH	100	GS	756.1	754.4	
5	KMnO ₄	100	MGS	784.4	783.5	
6	Silica Gel	250	MGS	905.8	896.4	
7						
8						
9						
10						
Total Weight Gain (g)						

Facility:	CUA	Start Time:	1430
Date:	03/19/2005	End Time:	1530
Location:	Melter Out	Initial Leak Check:	0.008@21"
Run Number:	1	Final Leak Check:	0.004@15"
Sample Type:	Halide/PM		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.82
Absolute Stack Pressure (in Hg)			30.36
Stack Static Pressure (in H ₂ O)			-6.20
Average Stack Temperature (°F)			504.50
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			31.726
Average Meter Pressure (in H ₂ O)			0.80
Average Meter Temperature (°F)			100.50
Moisture Collected (g)			219.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9967
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.512
Standard Metered Volume (dscf)			30.740
Standard Metered Volume (dscm)			0.871
Stack Moisture (%V)			25.16
Mole Fraction Dry Stack Gas			0.748
Dry Molecular Weight			28.84
Wet Molecular Weight			26.11
Stack Gas Velocity (fpm)			4580.55
Stack Gas Velocity (mpm)			1396.15
Volumetric Flow Rate (acfm)			399.73
Volumetric Flow Rate (acmm)			11.32
Volumetric Flow Rate (dscfm)			166.15
Volumetric Flow Rate (dscmm)			4.71
Percent Isokinetic			101.94
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	CWA	Probe Length & Type	26' TFE	Height of Location (ft)	20
Date	3/19/05	Nozzle ID (in.)	0.220	Duct Dimensions (in.)	4
Sampling Location	Welder Out	Pilot Constant	0.99	Stack Geometry (R or C)	C
Sample Type	HALIDE / PM	Meter Box Number	ATB	Filter Number	072004-74
Run Number	1	Meter $\Delta H@$	1.7690	Assume Moisture (%)	24
Operator	WPC	Yd	0.9967	O ₂ (%)	20.9
Ambient Temperature	95	K Factor	1.2	CO ₂ (%)	0
Barometric Pressure (in.)	30.83	Probe Heater Setting (°F)	250	Nitrogen (%)	79
Static Pressure (in. H ₂ O)	-6.2	Heater Box Setting (°F)	250	Moisture Collected (g)	
		Initial Leak Check	0.008 @ 21"	Final Leak Check	0.004 @ 15

[illegible]

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/18/05 3:19.5
Melter/Location	DM 1200 Melter
Run Number	1-halogens
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		0.1N H ₂ SO ₄	100	Modified	904.2	730.2g	174.0
2		0.1N H ₂ SO ₄	100	G/S	754.3g	730.8g	23.5
3		0.2 N NaOH	100	Modified	746.2g	741.3g	4.90
4		0.2 N NaOH	100	G/S	727.9g	726.3	1.6
5	-	KMnO ₄	250	Modified	726.5g	724.4g	2.1
6	N/A	Silica Gel	-	Modified	918.3g	905.2	13.1
Total Weight Gain (g):							219.2

Facility:	CUA	Start Time:	1647
Date:	03/19/2005	End Time:	1747
Location:	Melter Out	Initial Leak Check:	0.010@15
Run Number:	2	Final Leak Check:	0.008@15
Sample Type:	Halide/PM		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.82
Absolute Stack Pressure (in Hg)			30.36
Stack Static Pressure (in H ₂ O)			-6.20
Average Stack Temperature (°F)			526.83
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			32.607
Average Meter Pressure (in H ₂ O)			0.84
Average Meter Temperature (°F)			103.25
Moisture Collected (g)			226.50
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9967
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.524
Standard Metered Volume (dscf)			31.443
Standard Metered Volume (dscm)			0.890
Stack Moisture (%V)			25.35
Mole Fraction Dry Stack Gas			0.746
Dry Molecular Weight			28.84
Wet Molecular Weight			26.09
Stack Gas Velocity (fpm)			4738.55
Stack Gas Velocity (mpm)			1444.31
Volumetric Flow Rate (acfm)			413.52
Volumetric Flow Rate (acmm)			11.71
Volumetric Flow Rate (dscfm)			167.56
Volumetric Flow Rate (dscmm)			4.75
Percent Isokinetic			103.39
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	CLT	Probe Length & Type	20' TFE	Height of Location (ft)	20
Date	3/19/05	Nozzle ID (in.)	0.220	Duct Dimensions (in.)	4
Sampling Location	Melter Out	Pilot Constant	0.99	Stack Geometry (R or C)	C
Sample Type	Halide / PM	Meter Box Number	ATB	Filter Number	672004-072
Run Number	2	Meter $\Delta H@$	1.769	Assume Moisture (%)	24
Operator	WPK	Yd	0.9167	O ₂ (%)	20.9
Ambient Temperature	95	K Factor	1.2	CO ₂ (%)	0
Barometric Pressure (in.)	30.83	Probe Heater Setting (°F)	250	Nitrogen (%)	79
Static Pressure (in. H ₂ O)	-6.2	Heater Box Setting (°F)	250	Moisture Collected (g)	
		Initial Leak Check	0.010 @ 15	Final Leak Check	0.008 @ 15

(Diagram of Duct)

[illegible]

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/19/05
Melter/Location	DM 1200 Melter
Run Number	2-halogens
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		0.1N H ₂ SO ₄	100	Modified	897.0g	717.0g	
2		0.1N H ₂ SO ₄	100	G/S	749.7g	722.3g	
3		0.2 N NaOH	100	Modified	728.8g	724.5g	
4		0.2 N NaOH	100	G/S	764.3g	762.3g	
5	-	KMnO ₄	250	Modified	754.8g	753.3	
6	N/A	Silica Gel	-	Modified	952.1g	940.8g 944.6g	
Total Weight Gain (g):							

Facility:	CUA	Start Time:	1908
Date:	03/19/2005	End Time:	2008
Location:	Melter Out	Initial Leak Check:	0.008@15"
Run Number:	3	Final Leak Check:	0.004@15"
Sample Type:	Halide/PM		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.82
Absolute Stack Pressure (in Hg)			30.36
Stack Static Pressure (in H ₂ O)			-6.20
Average Stack Temperature (°F)			532.50
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			32.043
Average Meter Pressure (in H ₂ O)			0.81
Average Meter Temperature (°F)			102.83
Moisture Collected (g)			214.40
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9967
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.515
Standard Metered Volume (dscf)			30.920
Standard Metered Volume (dscm)			0.876
Stack Moisture (%V)			24.64
Mole Fraction Dry Stack Gas			0.754
Dry Molecular Weight			28.84
Wet Molecular Weight			26.17
Stack Gas Velocity (fpm)			4645.07
Stack Gas Velocity (mpm)			1415.82
Volumetric Flow Rate (acfm)			405.36
Volumetric Flow Rate (acmm)			11.48
Volumetric Flow Rate (dscfm)			164.88
Volumetric Flow Rate (dscmm)			4.67
Percent Isokinetic			103.32
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Read and Record All Data Every _____ Minutes945

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/19/05
Melter/Location	DM 1200 Melter
Run Number	3-halogens
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		0.1N H2SO4	100	Modified	909.2 711.4 ND 3.195	736.5g	
2		0.1N H2SO4	100	G/S	773.9 771.1g ND 3.195	752.4g	
3		0.2 N NaOH	100	Modified	728.4g 703.0 ND 3.195	724.6g	
4		0.2 N NaOH	100	G/S	756.9g 671.1g ND 3.195	754.5g	
5	-	KMnO4	250	Modified	837.8 730.2 ND 3.195	835.2g	
6	N/A	Silica Gel	-	Modified	969.5g 957.8g ND 3.195	958.1g	
Total Weight Gain (g):							

Facility:	CUA	Start Time:	1402
Date:	03/19/2005	End Time:	1602
Location:	TCO Out	Initial Leak Check:	0.006@13"
Run Number:	1	Final Leak Check:	0.004@7"
Sample Type:	Halide/PM		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.82
Absolute Stack Pressure (in Hg)			29.94
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			647.33
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			89.120
Average Meter Pressure (in H2O)			1.45
Average Meter Temperature (°F)			101.13
Moisture Collected (g)			198.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.722
Standard Metered Volume (dscf)			86.607
Standard Metered Volume (dscm)			2.453
Stack Moisture (%V)			9.73
Mole Fraction Dry Stack Gas			0.903
Dry Molecular Weight			28.84
Wet Molecular Weight			27.78
Stack Gas Velocity (fpm)			5668.95
Stack Gas Velocity (mpm)			1727.90
Volumetric Flow Rate (acfm)			561.11
Volumetric Flow Rate (acmm)			15.89
Volumetric Flow Rate (dscfm)			241.62
Volumetric Flow Rate (dscmm)			6.84
Percent Isokinetic			112.00
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

TCO - HADES/pu - R1

Run

Page 1 of 1

FIELD DATA SHEET

(Diagram of Duct)

~~ORP-51444 Rev. 0~~

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/18/05 3.19.5
Melter/Location	DM 1200 TCO
Run Number	1-halogens
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		0.1N H2SO4	100	Modified	863.3	713.9g	
2		0.1N H2SO4	100	G/S	793.9g	767.3g	
3		0.2 N NaOH	100	Modified	746.2g	742.4	
4		0.2 N NaOH	100	G/S	682.4g	681.5g	
5	-	KMnO4	250	Modified	730.3g	728.2g	
6	N/A	Silica Gel	-	Modified	957.8g	942.6	
Total Weight Gain (g):							

Facility:	CUA	Start Time:	1621
Date:	03/19/2005	End Time:	1821
Location:	TCO Out	Initial Leak Check:	0.010@13
Run Number:	2	Final Leak Check:	0.006@11
Sample Type:	Halide/PM		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.82
Absolute Stack Pressure (in Hg)			29.94
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			659.58
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			86.680
Average Meter Pressure (in H2O)			1.38
Average Meter Temperature (°F)			101.96
Moisture Collected (g)			214.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.701
Standard Metered Volume (dscf)			84.097
Standard Metered Volume (dscm)			2.382
Stack Moisture (%V)			10.74
Mole Fraction Dry Stack Gas			0.893
Dry Molecular Weight			28.84
Wet Molecular Weight			27.67
Stack Gas Velocity (fpm)			5593.74
Stack Gas Velocity (mpm)			1704.97
Volumetric Flow Rate (acfm)			553.67
Volumetric Flow Rate (acmm)			15.68
Volumetric Flow Rate (dscfm)			233.16
Volumetric Flow Rate (dscmm)			6.60
Percent Isokinetic			112.70
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

(Diagram of Duct)

~~ORP-51444 Rev. 0~~

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/19/05
Melter/Location	DM 1200 TCO
Run Number	2-halogens
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		0.1N H ₂ SO ₄	100	Modified	897.3g	731.7	
2		0.1N H ₂ SO ₄	100	G/S	783.8g	756.5	
3		0.2 N NaOH	100	Modified	768.9g	764.9	
4		0.2 N NaOH	100	G/S	728.6g	727.3	
5	-	KMnO ₄	250	Modified	764.2g	763.3	
6	N/A	Silica Gel	-	Modified	957.8g	941.9	
Total Weight Gain (g):							

Facility:	CUA	Start Time:	1846
Date:	03/19/2005	End Time:	2046
Location:	TCO Out	Initial Leak Check:	0.016@10"
Run Number:	3	Final Leak Check:	0.012@9"
Sample Type:	Halide/PM		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.82
Absolute Stack Pressure (in Hg)			29.94
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			655.50
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			86.307
Average Meter Pressure (in H ₂ O)			1.35
Average Meter Temperature (°F)			101.71
Moisture Collected (g)			212.90
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.698
Standard Metered Volume (dscf)			83.767
Standard Metered Volume (dscm)			2.372
Stack Moisture (%V)			10.70
Mole Fraction Dry Stack Gas			0.893
Dry Molecular Weight			28.84
Wet Molecular Weight			27.68
Stack Gas Velocity (fpm)			5509.93
Stack Gas Velocity (mpm)			1679.43
Volumetric Flow Rate (acfm)			545.37
Volumetric Flow Rate (acmm)			15.44
Volumetric Flow Rate (dscfm)			230.62
Volumetric Flow Rate (dscmm)			6.53
Percent Isokinetic			113.49
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

from
off @ 19:29
for 1/2 hr

(Diagram of Duct)

[illegible]

US EPA Method 4 Moisture Form

The Catholic University of America
Vitreous State Laboratory

Date	03/19/05
Melter/Location	DM 1200 TCO
Run Number	3-halogens
Impinger Box Number	1
Recovery Person	Nick D'Angelo
Filter Number	
Notes	

Impinger Number	Sample Name	Solution	Solution Mass	Impinger Type	Impinger Weight		
					Final (g)	Initial (g)	Net Gain (g)
1		0.1N H ₂ SO ₄	100	Modified	865.8	711.4	
2		0.1N H ₂ SO ₄	100	G/S	803.7g	771.1	
3		0.2 N NaOH	100	Modified	709.8g	702.0	
4		0.2 N NaOH	100	G/S	672.9g	671.1	
5	-	KMnO ₄	250	Modified	732.9g	730.3	
6	N/A	Silica Gel	-	Modified	972.5g	957.8	
Total Weight Gain (g):							

Appendix B.6

Particle Size Distribution

TCO PSD Test # 1	One run only		3/08/05-3/10/05	
	Filter #	grams Tare Wt	Final Wt	Net Gain
	Stage 1 42903-10	0.25145	0.25159	0.00014
	Stage 5 82403-3	0.13270	0.13290	0.00020
	Final Filter 091504-9	0.11090	0.11108	0.00018

total Wt	0.00014
gain	0.00020
	0.00018

Beaker #	Tare Wt	Final Wt	Net Gain
NA	0	0	0

Stage	Cut Point, u	Net Weight, ug	Conc, ug/dscf	Emission Rate, ug/min	Mass Fraction, %
1	> 10	140	0.267	62.9	27.00
5	1-10	200	0.381	89.8	38.00
8	<1	180	0.343	80.8	35.00
					100.00
			part 1	part 2	
	sample vol	265.529	259.451	524.98 dscf	
	flow	231.51	240.09	235.8 dscfm	

ORP-51444, Rev. 0

PARTICLE SIZE DISTRIBUTION:

by Glenn Rives (Radian), Modified by Charlie Parrish (12/90)

Facility: CUA 1200 Melter 323.75

Date: 03/08/05

Run: TCO-01

Filter Set :

W/ preimpactor, density = 1.00

TIME 1440 Qm 0.38834722
VOLUME 559.22 Pm 29.5764706
Ts 780.00 Tm 555.5
T 421.88889 Qa 288.026006
%M 0.1 u 0.00023176
MW 24.552 Lambda 1.086E-05
Ps 28.61 Pvac 15
Meter Y 0.999 Vm(std) 524.907528

TIME=MINUTES
VOLUME=dcf MEASURED AT METER
Ts=IMPACTOR TEMPERATURE (R) (F+460)
T=IMPACTOR TEMPERATURE (K)
%M=STACK MOISTURE FRACTION (%/100)
MW=STACK GAS MOLECULAR WEIGHT WET BASIS
Ps=ABSOLUTE STACK GAS PRESSURE
Y=Gas meter correction factor

Qm=SAMPLING RATE AT METER (DCFM)
Pm=PRESSURE AT THE METER (BAROMETRIC+ave delta H/13.59) (IN. HG)
Tm=AVERAGE METER TEMPERATURE (R)
Qa=ACTUAL VOL. FLOW RATE THROUGH IMPACTOR (cm3/sec)
u=STACK GAS VISCOSITY (poise)
Lambda=GAS MEAN FREE PATH (cm)
Pvac=PRESSURE DROP ACROSS IMPACTOR (in. Hg)
Wm= width of jet (cm ??)

STAGE	Wb	Vo	N	Dp 50	Pi	Wm	Vom
1	0.1651	254.65533	1	15.123359	1.12	0.5	1.27
2	0.12446	205.02477	6	11.407341	1.125	0.228	0.57912
3	0.094	585.42972	12	4.4094083	1.139	0.096	0.24384
4	0.07493	761.05741	90	2.219016	1.158	0.031	0.07874
5	0.05334	1545.0881	110	1.2761789	1.196	0.02	0.0508
6	0.03708	3572.6056	110	0.7167816	1.26	0.0135	0.03429
7	0.02718	8589.5647	90	0.4281189	1.36	0.01	0.0254
8	0.02438	NA	0		1.56	0	0

Vo=jet velocity (cm/sec)

Wb=diameter of jet (cm)/ Incorporating Pi

N=number of jets on a stage

Pi=pressure drop across the stage

THESE RESULTS KEEP PRESEP CATCH SEPARATE FROM STAGE 1
(See below for combined results)

STAGE	Dp50 micron	Net Weight (grams)	Mass Fraction	Mass Fract. Less Than	PM Conc. (gr/dscf)	Interval Geometric Midpoint	dM/dlog dP (gr/dscf)	Log Dp50	50n-1)-(Log Dp50n) gr/dscf
1	15.123359	0.00014	0.26923077	0.7307692	4.12E-06	27.498508	7.926E-06	1.17964827	0.5193217
2	11.407341	0	0	0.7307692	0.00E+00	13.134585	0.000E+00	1.057184437	0.1224638
3	4.4094083	0	0	0.7307692	0.00E+00	7.0922229	0.000E+00	0.644380314	0.4128041
4	2.219016	0	0	0.7307692	0.00E+00	3.1280261	0.000E+00	0.346160431	0.2982199
5	1.2761789	0.00020	0.38461538	0.3461538	5.88E-06	1.6828135	2.447E-05	0.105911554	0.2402489
6	0.7167816	0	0	0.3461538	0.00E+00	0.9564212	0.000E+00	-0.144613136	0.2505247
7	0.4281189	0	0	0.3461538	0.00E+00	0.5539564	0.000E+00	-0.36843563	0.2238225
8		0.00018	0.34615385	0	5.29E-06	0.0462666	2.738E-06	-2.301029996	1.9325944
TOTAL		0.00052	1		1.53E-05				

* these values assume top end and bottom end dp50s of 50 and .005 um.

EXPLANATION: This spreadsheet calculates cut size (Dp50) based on a set of equations from D. Balfours PSD manual (Radian, April 1986)
Preseparator Dp50 calcs are taken from Andersons Mk III
presep manual. NOTE: If the presep Dp50 is GREATER than or
SIMILAR TO stage 1 dp50, then ypu can combine presep catch with
stage 1 catch as done below
A particle density of 1.00 grams/cm3 was used in calculating cut sizes (Dp50)

Part 1

Facility:	CUA	Start Time:	2056
Date:	03/07 - 3/08/05	End Time:	846
Location:	TCO Outlet	Initial Leak Check:	0.011@24"
Run Number:	1	Final Leak Check:	0
Sample Type:	PDS		
Total Sampling Time (min)			730.0
Corrected Barometric Pressure (in Hg)			29.49
Absolute Stack Pressure (in Hg)			28.61
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			647.73
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)		✓	281.708
Average Meter Pressure (in H ₂ O)			0.36
Average Meter Temperature (°F)			95.37
Moisture Collected (g)			0.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.160
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.364
Standard Metered Volume (dscf)			265.529
Standard Metered Volume (dscm)			7.520
Stack Moisture (%V)		102	0.00
Mole Fraction Dry Stack Gas			1.000
Dry Molecular Weight			28.84
Wet Molecular Weight		27.69	28.84
Stack Gas Velocity (fpm)			5612.87
Stack Gas Velocity (mpm)			1710.80
Volumetric Flow Rate (acfm)			555.56
Volumetric Flow Rate (acmm)			15.73
Volumetric Flow Rate (dscfm)		231.51	253.16
Volumetric Flow Rate (dscmm)			7.17
Percent Isokinetic		111.4	101.85
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Run PSO-1
Page 1 of 1

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Plant	CWA	Probe Length & Type	NA	Filter Number	NA
Date	3/7	Nozzle ID (in.)	0.160	Height of Location (ft)	10
Sampling Location	TCO Outlet	Pitot Constant	0.99	Duct Dimensions (in.)	4.26
Sample Type	PSD	Meter Box Number	ATC	Stack Geometry (R or C)	C
Run Number	1	Meter $\Delta H @$	1.672	Assume Moisture (%)	7
Operator	WCG	Yd	999	O ₂ (%)	20.9
Ambient Temperature	93	K Factor	0.46	CO ₂ (%)	0
Barometric Pressure (in.)	29.3	Probe Heater Setting (°F)	NA	Nitrogen (%)	79
Static Pressure (in. H ₂ O)	-12	Heater Box Setting (°F)	NA	Moisture Collected (g)	
Initial Leak Check	0.011 @ 24"	Final Leak Check			

(Diagram of Duct)

Read and Record All Data Every 1 Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
Center	0	20:56	622.918	0.87	0.35	633	NA	242	94	95	58	5
	10	21:06	626.7	0.89	0.36	634		272	95	95	45	5
	20	21:16	630.2	0.90	0.36	635		303	95	95	44	5
	30	21:26	634.0	0.88	0.35	635		311	96	95	44	5
	40	21:36	637.8	0.87	0.35	635		307	96	95	44	5
	50	21:46	641.6	0.88	0.35	639		303	96	95	44	5
	60	21:56	645.4	0.89	0.36	640		307	97	96	44	5
	70	22:06	649.3	0.89	0.36	640		309	97	96	45	5
	80	22:16	653.1	0.89	0.36	643		310	97	96	45	5
	90	22:36	656.1	0.91	0.36	643		310	97	96	45	5
	100	22:46	660.3	0.91	0.36	643		309	97	96	45	5
	110	22:56	664.5	0.91	0.36	644		307	97	96	45	5
	120	23:06	668.7	0.92	0.37	644		304	97	96	45	5
	130	23:16	672.8	0.91	0.37	644		304	97	96	45	5
	140	23:26	676.9	0.91	0.37	644		303	97	96	45	5
	150	23:36	680.6	0.91	0.37	644		303	97	96	45	5
	160	23:46	684.8	0.91	0.37	644		303	97	96	45	5
	170	23:56	688.7	0.89	0.36	644		304	97	97	45	5
	180	24:06	692.5	0.89	0.36	644		303	97	95	45	5
	190	24:16	696.4	0.89	0.36	644		303	97	95	45	5
	200	24:26	700.5	0.89	0.36	644		303	97	96	46	5
	210	24:36	704.7	0.91	0.36	643		303	97	96	45	5
	220	24:46	709.8	0.91	0.36	643		303	97	96	44	5
	230	24:56	713.6	0.92	0.37	645		302	97	96	43	5
	240	25:06	717.6	0.93	0.37	647		302	96	96	42	5
	250	25:16	721.7	0.92	0.37	649		301	96	96	41	5
	260	25:26	725.8	0.91	0.36	649		302	97	96	41	5
	270	25:36	729.5	0.91	0.36	649		302	97	96	41	5

Run

Plant	CleA/VSL	Location	T-CO	Run Number	1
Date	3/7/8/5	Sample Type	PSO	Operator	WCO- et. al.

Read and Record All Data Every Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Exhaust Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	280	0136	733.5	0.92	0.37	649		303	97	96	41	5
	290	0146	737.5	0.91	0.36	650		304	97	96	41	5
	300	0156	741.5	0.91	0.36	650	N/A	305	97	96	42	5
	310	0206	745.5	0.92	0.37	652		305	97	96	42	5
	320	0216	749.5	0.91	0.36	650		305	97	96	42	5
	330	0226	753.5	0.93	0.37	652		305	97	96	42	5
	340	0236	757.5	0.92	0.37	651		305	97	96	42	5
	350	0246	761.5	0.92	0.37	652		305	97	96	43	5
	360	0256	765.5	0.91	0.36	653		306	97	96	43	5
	370	0306	769.4	0.92	0.37	653		306	97	96	42	5
	380	0316	773.4	0.93	0.37	654		306	96	96	41	6
	390	0326	777.4	0.92	0.37	654		307	96	96	41	6
	400	0336	781.4	0.92	0.37	654		307	96	96	41	6
	410	0346	785.4	0.91	0.36	653		306	96	96	41	6
	420	0356	789.5	0.91	0.36	653		306	96	96	41	6
	430	0406	793.5	0.91	0.36	653		306	96	96	41	6
	440	0416	797.4	0.91	0.36	653		305	96	96	42	6
	450	0426	801.4	0.90	0.36	653		305	96	96	42	6
	460	0436	805.3	0.92	0.37	654		304	96	96	43	6
	470	0446	809.2	0.90	0.36	652		304	95	95	42	6
	480	0456	813.2	0.90	0.36	652		304	95	95	43	6
	490	0506	817.1	0.91	0.36	652		303	95	95	43	6
	500	0516	821.0	0.92	0.37	651		303	94	95	43	6
	510	0526	825.0	0.92	0.37	650		304	94	94	43	6
	520	0536	829.0	0.92	0.37	652		304	93	94	43	6
	530	0546	833.2	0.86	0.34	650		304	93	93	43	6

Part 2

Facility:	CUA	Start Time:	1100
Date:	03/09-03/10/05	End Time:	1050 2250
Location:	TCO Outlet	Initial Leak Check:	okay
Run Number:	1	Final Leak Check:	0
Sample Type:	PDS		

Total Sampling Time (min)	710.0
Corrected Barometric Pressure (in Hg)	29.59
Absolute Stack Pressure (in Hg)	28.71
Stack Static Pressure (in H ₂ O)	-12.00
Average Stack Temperature (°F)	661.34
Stack Area (sq in)	14.25
Actual Meter Volume (cu ft)	✓ 277.510
Average Meter Pressure (in H ₂ O)	0.37
Average Meter Temperature (°F)	98.64
Moisture Collected (g)	0.00
Carbon Dioxide Concentration (%V)	0.0
Oxygen Concentration (%V)	20.9
Nitrogen Concentration (%V)	79.1
Dry Gas Meter Factor	0.9990
Nozzle Diameter (in)	0.160
Pitot Constant	0.99
Average Sampling Rate (dscfm)	0.365
Standard Metered Volume (dscf)	✓ 259.451
Standard Metered Volume (dscm)	7.348
Stack Moisture (%V)	102 0.00
Mole Fraction Dry Stack Gas	1.000
Dry Molecular Weight	✓ 28.84
Wet Molecular Weight	27.69 28.84
Stack Gas Velocity (fpm)	5883.60
Stack Gas Velocity (mpm)	1793.32
Volumetric Flow Rate (acfm)	582.36
Volumetric Flow Rate (acmm)	16.49
Volumetric Flow Rate (dscfm)	240.09 263.07
Volumetric Flow Rate (dscmm)	7.45
Percent Isokinetic	107.89 98.47
Percent Excess Air	-1174157.30
Concentration (g/dscm)	0.00
Concentration (kg/hr)	0.00
Concentration (ppmv)	0.00
Emissions (lb/hr)	0.00

FIELD DATA SHEET

Run _____ of _____
Page _____ of _____

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Plant	CWA	Probe Length & Type	Filter Number
Date	3/9/05-3/10/05	Nozzle ID (in.)	160
Sampling Location	TEA OUT	Pilot Constant	.99
Sample Type	PSD	Meter Box Number	ATC
Run Number	1	Meter $\Delta H @$	1.672
Operator	mmf	Yd	.999
Ambient Temperature	100°F	K Factor	.46
Barometric Pressure (in.)	29.60	Probe Heater Setting (°F)	N/A
Static Pressure (in. H ₂ O)	-12"	Heater Box Setting (°F)	N/A
Initial Leak Check	OK	Final Leak Check	

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Exit Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. HgD)
									Inlet (°F)	Outlet (°F)		
	730	11:00	645.900	1.0	.37	665	172		98	99	83	4.0
	740	11:10	649.27	.95	.37	664	163		99	99	70	4.0
	750	11:20	653.0	.95	.37	664	187		100	99	49	4.0
	760	11:30	656.90	.95	.37	665	213		101	99	49	4.0
	770	11:40	660.8	.95	.37	664	231		101	100	49	4.0
	780	11:50	665.10	.95	.37	663	258		102	100	50	4.0
	790	12:00	670.0	.95	.37	662	274		102	100	51	4.0
	800	12:10	674.5	.95	.37	662	285		102	101	52	4.0
	810	12:20	676.70	.95	.37	663	295		102	101	52	4.0
	820	12:30	680.6	.95	.37	664	297		102	101	52	4.0
	830	12:40	685.1	.95	.37	665	301		102	101	53	4.0
	840	12:50	689.2	.93	.37	665	303		102	101	53	4.0
	850	01:00	693.6	.95	.37	665	305		102	101	54	4.0
	860	01:10	697.0	1.0	.37	666	304		102	101	55	4.0
	870	01:20	701.1	.95	.37	666	302		102	101	55	4.0
	880	01:30	705.8	1.0	.37	667	300		102	101	56	4.0
	890	01:40	709.0	1.0	.37	668	297		102	101	56	4.0
	900	01:50	712.3	1.0	.37	668	295		102	101	57	4.0
	910	02:00	715.65	1.0	.37	667	295		102	101	57	4.0
	920	02:10	719.4	1.0	.37	667	294		102	101	57	4.0
	930	02:20	723.3	1.0	.37	667	294		102	101	58	4.0
	940	02:30	727.4	1.0	.37	667	294		102	101	58	4.0
	950	02:40	731.3	1.0	.37	667	294		102	101	58	4.0
	960	02:50	735.1	1.0	.37	666	294		101	101	58	4.0
	970	03:00	739.0	1.0	.37	666	294		101	101	58	4.0
	980	03:10	743.0	1.0	.37	666	294		101	101	58	4.0

Run _____

5

Plant	CJA	Location	TLO	Run Number	1 CONT.
Date	3/10/05	Sample Type	PS.	Operator	MW

Read and Record All Data Every Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	980	03:10	743.0	1.0	.37	666	294		101	101	58	4.0
	990	03:20	747.0	1.0	.37	666	294		101	101	59	4.0
	1000	03:30	751.0	1.0	.37	666	293		101	100	60	4.0
	1010	03:40	755.0	1.0	.37	665	293		101	101	60	4.0
	1020	03:50	759.0	1.0	.37	665	293		101	101	60	4.0
	1030	04:00	762.8	1.0	.37	664	293		101	101	60	4.0
	1040	04:10	766.7	1.0	.37	664	294		101	101	60	4.0
	1050	04:20	770.6	1.0	.37	664	294		101	101	54	4.0
	1060	04:30	774.5	1.0	.37	664	294		101	101	45	4.0
	1070	04:40	778.5	1.0	.37	663	294		101	101	45	4.0
	1080	04:50	782.4	1.0	.37	662	294		101	101	46	4.0
	1090	05:00	786.3	1.0	.37	660	294		101	101	46	4.0
	1100	05:10	790.2	1.0	.37	659	293		101	100	47	4.0
	1110	05:20	794.1	1.0	.37	659	292		101	100	47	4.0
	1120	05:30	798.0	1.0	.37	660	292		101	100	48	4.0
	1130	05:40	801.6	1.0	.37	659	292		101	100	49	4.0
	1140	05:50	804.3	1.0	.37	658	291		99	99	50	4.0
	1150	06:00	808.2	1.0	.37	658	290		99	99	52	4.0
	1160	06:10	812.1	1.0	.37	659	288		100	99	54	4.0
	1170	06:20	816.1	1.0	.37	659	288		100	99	54	4.0
	1180	06:30	820.9	1.0	.37	659	286		100	99	52	4.0
	1190	06:40	824.8	1.0	.37	658	285		100	99	50	4.0
	1200	06:50	828.8	1.0	.37	658	284		99	99	46	4.0
	1210	07:00	833.0	1.0	.37	658	269		99	99	46	4.0
	1220	07:10	837.2	1.0	.37	658						
	1230	07:20	841.0	1.0	.37	658						

Plant:	Operator:
Date:	Used for Runs: PSD @ TCO
Location/Sampling Train:	

C_p (S-type: 0.84; Std.: 0.99)	.99
P_b (barometric pressure at location)	30
D_n (nozzle diameter, inches)	.160
B_w (moisture in gas stream, fractional percent)	.07
P_m (barometric pressure at meter, Hg) = (Average ΔH / 13.6) + P_b	30
$\Delta H@$ (pressure differential of orifice in meter box, H ₂ O)	1.672
P_s (stack pressure, in. Hg) = $P_b \pm$ (stack static pressure (in. H ₂ O) / 13.6)	29.12 (-12" H ₂ O)
T_s (average stack temperature, °R) = 625°F + 460 = ____°R	1085
T_m (average stack temperature, °R) = $T_{\text{ambient}} + 20^\circ\text{F} + 460 = \text{____}^\circ\text{R}$	550 (90)
M_d (molecular weight of stack gas, dry, lb/lb-mole) = (0.44 x %CO ₂) + (0.32 x %O ₂) + (0.28 x %N ₂)	28.84
M_s (molecular weight of stack gas with water vapor, lb/lb-mole) = [$M_d \times (1 - B_w)$] + [18 x B_w]	28.08
K (846.720) (D_n) ⁴ ($\Delta H@$) (C_p) ² (1- B_w) ² (M_d / M_s) (P_s / P_m) (T_m / T_s)	0.40

$\Delta H = K \Delta P$
Correlation Chart

1		2		3	
ΔH	ΔP	ΔH	ΔP	ΔH	ΔP

Comments: _____

Mike -

Do - PSD

Method 308 blank

~~#~~ SVOC Field blank @ melfer

Bring to Raleigh - 2 VOST - 1 broken
1 rented

File next to meters

Facility:	CUA	Start Time:	2027
Date:	3/17-3/19/5	End Time:	827
Location:	TCO Out	Initial Leak Check:	0.00@11
Run Number:	1a	Final Leak Check:	0
Sample Type:	PSD		
Total Sampling Time (min)			720.0
Corrected Barometric Pressure (in Hg)			30.68
Absolute Stack Pressure (in Hg)			29.80
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			622.68
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			291.535
Average Meter Pressure (in H ₂ O)			0.39
Average Meter Temperature (°F)			100.99
Moisture Collected (g)			0.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.160
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.391
Standard Metered Volume (dscf)			281.338
Standard Metered Volume (dscm)			7.967
Stack Moisture (%V)			10.50
Mole Fraction Dry Stack Gas			0.895
Dry Molecular Weight			28.84
Wet Molecular Weight			27.70
Stack Gas Velocity (fpm)			5279.36
Stack Gas Velocity (mpm)			1609.15
Volumetric Flow Rate (acfm)			522.55
Volumetric Flow Rate (acmm)			14.80
Volumetric Flow Rate (dscfm)			227.08
Volumetric Flow Rate (dscmm)			6.43
Percent Isokinetic			121.98
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Facility:	CUA	Start Time:	2019
Date:	3/17-3/19/5	End Time:	819
Location:	TCO Out	Initial Leak Check:	0.00@11
Run Number:	1b	Final Leak Check:	0
Sample Type:	PSD		
Total Sampling Time (min)			720.0
Corrected Barometric Pressure (in Hg)			30.68
Absolute Stack Pressure (in Hg)			29.80
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			655.13
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			305.840
Average Meter Pressure (in H ₂ O)			0.43
Average Meter Temperature (°F)			104.03
Moisture Collected (g)			0.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.160
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.408
Standard Metered Volume (dscf)			293.583
Standard Metered Volume (dscm)			8.314
Stack Moisture (%V)			10.50
Mole Fraction Dry Stack Gas			0.895
Dry Molecular Weight			28.84
Wet Molecular Weight			27.70
Stack Gas Velocity (fpm)			5560.72
Stack Gas Velocity (mpm)			1694.91
Volumetric Flow Rate (acfm)			550.40
Volumetric Flow Rate (acmm)			15.59
Volumetric Flow Rate (dscfm)			232.22
Volumetric Flow Rate (dscmm)			6.58
Percent Isokinetic			124.47
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Run
Page 1 of 3

Plant	CLWA/USL	Probe Length & Type	Filter Number
Date	3/17/15	Nozzle ID (in.)	160
Sampling Location	TGO	Pilot Constant	.99 84
Sample Type	PSD	Meter Box Number	ATC
Run Number	1	Meter ΔH @	1.672
Operator	WCG	Yd	.999
Ambient Temperature	85	K Factor	.48
Barometric Pressure (in. H ₂ O)	30.48	Probe Heater Setting (°F)	300
Static Pressure (in. H ₂ O)		Heater Box Setting (°F)	
Initial Leak Check	0.00011	Final Leak Check	

(Diagram of Duct)

Read and Record All Data Every _____ Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
Center	0	2027	937.765	0.78	0.37	613	219	NA	96	97	55	4
	10	2037	941.7	0.8	0.38	614	240		97	97	49	4
	20	2047	945.5	0.81	0.39	614	271		98	97	47	5
	30	2057	949.4	0.81	0.39	614	298		99	98	46	5
	40	2107	953.4	0.81	0.39	614	307		100	98	46	5
	50	2117	957.4	0.82	0.39	615	314		100	98	45	5
	60	2127	961.6	0.86	0.41	616	325		101	99	45	5
	70	2137	965.4	0.75	0.36	615	322		101	99	46	5
	80	2147	969.5	0.77	0.37	601	313		101	99	47	5
	90	2157	973.6	0.81	0.39	600	311		101	99	48	5
	100	2207	977.3	0.80	0.38	604	307		101	99	46	5
	110	2217	981.4	0.80	0.38	606	306		101	99	46	5
	120	2227	985.4	0.80	0.38	606	302		101	99	46	5
	130	2237	989.3	0.80	0.38	606	302		101	100	46	5
	140	2247	993.2	0.79	0.38	607	300		100	100	46	5
	150	2257	997.1	0.82	0.39	608	298		101	100	46	5
	160	2307	01.2	0.81	0.39	608	299		102	100	47	5
	170	2317	5.1	0.82	0.39	609	300		102	100	47	5
	180	2327	9.0	0.80	0.38	612	301		102	100	48	5
	190	2337	13.0	0.82	0.39	613	301		102	101	48	5
	200	2347	17.1	0.82	0.39	613	303		102	101	48	5
	210	2357	21.2	0.82	0.39	615	303		102	101	48	5
	220	0007	25.2	0.82	0.39	615	304		102	101	48	5
	230	0017	29.1	0.81	0.39	614	305		102	101	49	5
	240	0027	33.1	0.78	0.37	613	305		102	101	47	5

Run _____

FIELD DATA SHEET

Plant	CWA/VSL		Probe Length & Type	Filter Number
Date	3/18/05		Nozzle ID (in.)	0.160
Sampling Location	T20		Pilot Constant	0.99
Sample Type	PSD		Meter Box Number	ATC
Run Number	1		Meter $\Delta H @$	1.672
Operator	WLG		Yd	0.999
Ambient Temperature	90		K Factor	0.48
Barometric Pressure (in. H ₂ O)	30.68		Probe Heater Setting (°F)	300
Static Pressure (in. H ₂ O)			Heater Box Setting (°F)	
Initial Leak Check			Final Leak Check	

(Diagram of Duct)

Read and Record All Data Every Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	250	0037	33.1	0.82	0.39	616	304	NA	102	101	47	5
	260	0047	41.1	0.81	0.39	616	305		102	101	47	5
	270	57	45.2	0.81	0.39	616	306		102	101	47	5
	280	0107	49.4	0.81	0.39	616	305		102	101	47	5
	290	0117	53.2	0.77	0.37	616	306		102	101	47	5
	300	0127	57.1	0.78	0.37	614	304		102	101	47	5
	310	0137	61.2	0.75	0.36	611	304		102	101	47	5
	320	0147	65.0	0.84	0.40	612	304		102	101	47	5
	330	0157	69.1	0.79	0.38	616	306		102	101	47	5
	340	0207	73.1	0.82	0.39	618	305		102	101	47	5
	350	0217	77.1	0.81	0.39	620	306		102	101	47	5
	360	0227	81.5	0.81	0.39	621	307		102	101	47	5
	370	0237	85.3	0.82	0.39	621	307		102	101	47	5
	380	0247	89.3	0.82	0.39	621	308		102	101	47	5
	390	0257	92.0	0.84	0.40	621	308		102	101	47	5
	400	0307	96.2	0.8	0.39	624	308		102	101	47	5
	410	0317	100.9	0.8	0.39	627	308		102	101	47	5
	420	0327	105.5	0.83	0.40	628	308		102	101	47	5
	430	0337	110.0	0.82	0.39	628	309		102	101	47	5
	440	0347	113.7	0.87	0.42	629	309		102	101	47	5
	450	0357	117.9	0.84	0.40	629	311		102	101	47	5
	460	0407	122.3	0.82	0.39	631	310		102	101	47	5
	470	0417	125.7	0.82	0.39	628	311		102	101	47	5
	480	0427	129.5	0.84	0.40	630	310		102	101	47	5
	490	0437	134.0	0.84	0.40	632	311		102	101	47	5

Run

Plant	CUA/USL	Location	TCO	Run Number	1
Date	2/18/05	Sample Type	PSD	Operator	weg

Read and Record All Data Every Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	490	0437	134.2	0.84	0.40	632	311	ATA	102	101	44	6
	500	0447	138.3	0.84	0.40	634	311		102	101	43	6
	510	0457	142.3	0.84	0.40	633	311		102	101	42	6
	520	0507	146.5	0.84	0.41	636	312		102	101	42	6
	530	0517	150.7	0.84	0.43	634	313		102	101	43	6
	540	0527	154.8	0.87	0.42	635	312		102	101	43	6
	550	0537	159.2	0.83	0.40	635	311		102	100	43	6
	560	0547	163.2	0.83	0.40	636	308		102	100	43	6
	570	0557	167.2	0.83	0.41	636	308		102	101	43	6
	580	0607	171.2	0.84	0.42	636	308		102	101	44	6
	590	0617	175.4	0.87	0.42	637	307		102	101	44	6
	600	0627	179.5	0.87	0.41	636	306		102	101	44	6
	610	0637	184.6	0.87	0.42	636	307		102	101	44	6
	620	0647	188.0	0.84	0.42	636	307		102	101	44	6
	630	0657	194.2	0.85	0.42	637	306		102	101	44	6
	640	0707	196.2	0.83	0.42	639	307		102	101	45	6
	650	0717	200.4	0.87	0.40	640	308		102	101	45	6
	660	0727	204.4	0.87	0.42	640	307		102	101	45	6
	670	0737	208.7	0.87	0.42	640	307		102	101	45	6
	680	0747	212.8	0.82	0.41	640	307		102	101	45	6
	690	0757	216.9	0.85	0.41	640	307		102	101	45	6
	700	0807	221.0	0.86	0.41	640	307		102	101	45	6
	710	0817	225.0	0.86	0.41	640	307		102	101	45	6
	720	0827	229.300									

yellow trap

16

Plant	CWA	Location	TRC out	Run Number	1
Date	3/18	Sample Type	PSD	Operator	

Plan = 30.71

Read and Record All Data Every Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Exit Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	720	20:19	547.850	0.94	0.43	650	NA	257	107	107	68	6
	730	20:29	552.24	0.92	0.43	652		270	107	107	65	6
	740	20:39	556.50	0.95		652		283	107	106	53	6
	750	20:49	560.77	0.93		652		298	106	106	49	6
	760	20:59	565.00	0.91		650		306	106	105	49	6
	770	21:09	569.27	0.88		646		305	105	104	48	6
	780	21:19	573.55	0.90	0.43	647		304	105	104	47	6
	790	21:29	577.80	0.92		647		304	105	104	47	6
	800	21:39	582.97	0.94		648		303	105	104	47	6
	810	21:49	586.23	0.94		649		303	105	104	47	6
	820	21:59	590.46	0.94		647		303	105	104	47	6
	830	22:09	594.69	0.94		647		303	105	104	47	6
	840	22:19	598.81	0.94		647		303	105	104	47	6
	850	22:29	603.15	0.92		647		303	105	104	47	6
	860	22:39	607.37	0.93		648		302	105	104	47	6
	870	22:49	611.62	0.97		654		303	105	104	47	6
	880	22:59	615.87	0.92		656		303	105	104	47	6
	890	23:09	620.31	0.92	0.43	656		303	105	104	47	6
	900	23:19	624.58	0.91		656		303	105	104	47	6
	910	23:29	628.65	0.88		655		303	105	104	47	6
	920	23:39	632.88	0.88		656		303	105	104	47	6
	930	23:49	637.21	0.88		658		303	105	104	47	6
	940	23:59	641.40	0.87		657		303	105	104	47	6
	950	00:09	645.66	0.84		656		303	105	104	47	6
	960	00:19	649.91	0.87		656		303	105	104	47	6
	970	00:29	654.20	0.89		656		303	105	104	47	6
	980	00:39	658.41	0.91		656		303	105	104	47	6

Plant	C4A	Location	720 Out	Run Number	1
Date	3/19/05	Sample Type	P30	Operator	WCG

Read and Record All Data Every Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	930	0039	658.41	0.87	0.43	656	NA	303	105	104	44	7
	990	0049	662.65	0.87		656		303	105	104	45	7
	1000	0059	666.91	0.86		654		303	105	104	45	7
	1010	0109	671.18	0.89		653		303	106	104	45	7
	1020	0119	675.43	0.88		654		303	106	104	45	7
	1030	0129	679.75	0.88		653		303	105	104	46	7
	1040	0139	683.94	0.86		653		303	105	104	46	7
	1050	0149	688.13	0.86		652		302	105	104	46	7
	1060	0159	692.44	0.84		653		302	105	104	46	7
	1070	0209	696.70	0.85		653		302	105	104	46	7
	1080	0219	700.95	0.84		653		302	105	104	46	7
	1090	0229	705.19	0.91		652		302	105	103	46	7
	1100	0239	709.45	0.84		651		302	105	103	47	7
	1110	0249	713.65	0.91		653		302	105	103	47	7
	1120	0259	717.93	0.85		654		302	105	103	47	7
	1130	0309	722.22	0.90		655		302	104	103	47	7
	1140	0319	726.39	0.88		655		301	104	103	47	7
	1150	0329	730.66	0.87		655		302	104	103	48	7
	1160	0339	734.91	0.85		655		302	104	103	48	7
	1170	0349	739.16	0.84		654		302	104	103	47	7
	1180	0359	743.41	0.82		653		303	104	103	40	7
	1190	0409	747.78	0.83		654		303	104	103	40	7
	1200	0419	751.95	0.84		656		302	104	102	40	7
	1210	0429	756.12	0.84		656		302	104	102	41	7
	1220	0439	760.34	0.83		657		302	103	102	41	7
	1230	0449	764.67	0.83		656		302	104	102	42	7
	1240	0459	768.82	0.88		656		303	104	102	42	7

[illegible]

Appendix B.7

Total Organic Emissions (TOE)

Facility:	CUA	Start Time:	1101
Date:	03/21/2005	End Time:	1301
Location:	TCO Out	Initial Leak Check:	0.010@13"
Run Number:	1	Final Leak Check:	0.006@11"
Sample Type:	TOE/SVOC		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			29.99
Absolute Stack Pressure (in Hg)			29.11
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			608.50
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			88.820
Average Meter Pressure (in H ₂ O)			1.42
Average Meter Temperature (°F)			100.71
Moisture Collected (g)			200.90
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.220
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.700
Standard Metered Volume (dscf)			84.054
Standard Metered Volume (dscm)			2.380
Stack Moisture (%V)			10.13
Mole Fraction Dry Stack Gas			0.899
Dry Molecular Weight			28.84
Wet Molecular Weight			27.74
Stack Gas Velocity (fpm)			5563.61
Stack Gas Velocity (mpm)			1695.79
Volumetric Flow Rate (acfm)			550.69
Volumetric Flow Rate (acmm)			15.60
Volumetric Flow Rate (dscfm)			237.89
Volumetric Flow Rate (dscmm)			6.74
Percent Isokinetic			110.40
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Time	Activity	Time	Activity
11:04	start	9:45	
12:36	stop	9:45	

Schematic of Traverse Point Layout

Read and Record All Data Every _____ Minutes

Run

Plant	VSC
Date	3.21.5
Sampling Location	TCO outlet
Run Number	1 of 1 TOE
Impinger Box Number	1
Recovery Person	ND
Recovery Rinses	50/50 MeOH/MeCl
Sampling Identification	
Filter Number	Unspiked RED
XAD Number	Unspiked XAD-2 RED

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KO	—	—	669.5g	490.0	
2	H ₂ O	~100	m	717.6g	718.7g	
3	H ₂ O	~100	g/s	727.1g	727.1g	
4	KMnO ₄	~100	m	789.0g	785.5g	
5	SilicaGel	—	m	939.2g	920.2g	
6						
7						
8						
9						
10						
Total Weight Gain (g)						

Appendix B.8

Allyl Alcohol

MIDGET SAMPLING TRAIN FIELD DATA

Run Allyl Spike
Page 1 of 1

Plant	CUA	Ambient Temp. (°F)	90	Meter Box Number	V-1
Date	3/7/05	Barometric Pressure (in. H2O)	30.0	DGM Cal. Factor (Y)	1.01
Sampling Location	TCO OUT	Stack Temp. (°F)	627	Probe Length & Type	15' TFE
Sample Type	Spike	Average delta P (in. H2O)	0.81	Probe Heater Setting (°F)	NA
Run Number	Allyl	Static Pressure (±) (in. H2O)	2-12"	Filter # & Type (if used)	Glass wool
Operator	WPK	Sample Rate (lpm)	0.75	Filter Temp. (°F)	Stack Temp

Purpose:

Other Data/Notes:

Start time change due
Step to difficulty opening sample
port. WPK

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)
Initial	0.00 lpm	7"		
Final	0.00 lpm	6"		

Vacuum checks
Leak checks

Run	Sampling Times (24hr)	Gas Meter Reading (Vol in L or ft3)	Rotameter Setting (lpm/ft3/min)	Meter Pressure (in.H2O)	Meter Temp. (°F)	Probe Temp. (°F)	Stack Temp/ΔP (°F)/"H2O	Train Vacuum (in.Hg)
0	18:45	28.23	0.75	2.1	92.5	NA	622/.84	1
10	19:02	35.52	0.75	2.2	95.5	↓	625/.84	1
20	19:12	42.72	0.75	2.2	96.5		626/.85	1
30	19:22	50.20	0.75	2.2	97	↓	628/.86	1
40	19:32	57.63	0.75	2.3	98	↓	630/.86	1
50	19:42	65.03	0.75	2.3	99	↓	631/.86	1
60	19:52	72.68	0.75	2.3	100	↓	634/.87	1
70	20:02	80.40	0.75	2.3	101	↓	636/.88	1
80	20:12	88.15	0.75	2.3	101	↓	637/.89	1
90	20:22	95.82	0.75	2.3	101	↓	637/.89	1
100	20:32	103.44	0.75	2.3	101			
		75.210		2.5	98.15			
		77.460						
Allyl Spike 1 min 1000 ppm Allyl								
TCO 3.7.5								
Run Time	Total Time	Total Volume Metered	Flow Rate	Average Pm	Average Tm	Average Ts	Highest Vacuum (in.Hg)	
982								

Comments:

Comments:

Run T20308-2
Page 1 of 1

100

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in.Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in.Hg)
Set				
Init	0.00 bpm	6"	0.00 bpm	6"

984**Comments:**

Comments:

MIDGET SAMPLING TRAIN FIELD DATA

Run
Page 1 of 1

Plant	CUA / VJL	Ambient Temp. (°F)	85	Meter Box Number	118
Date	3/8/15	Barometric Pressure (in. H2O)	29.88	DGM Cal. Factor (V)	1998
Sampling Location	CB Out	Stack Temp. (°F)		Probe Length & Type	20' TFE
Sample Type	2308	Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	1	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	NA
Operator	WPG	Sample Rate (lpm)	0.75	Filter Temp. (°F)	

100 min

Purpose: _____
Other Data/Notes: _____

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)
Initial	0.0005		0.00	4"

Run (min)	Sampling Times Clock (24hr)	Gas Meter Reading Vol in L or ft3	Rotameter Setting (lpm/ft3/min)	Meter Pressure (in. H2O)	Meter Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
0	1031	59.10	0.75	2.0	92.5	NA	NA	1
10	1041	64.65	0.75	2.0	93.5	✓	✓	1
20	1051	74.10	0.75	2.0	95.5	✓	✓	1
30	1101	81.64	0.75	2.0	96.5	✓	✓	1
40	1111	88.85	0.75	2.0	98	✓	✓	1
50	1121	96.65	0.75	2.0	98.5	✓	✓	1
60	1131	104.04	0.75	2.0	99.5	✓	✓	1
70	1141	111.60	0.75	2.0	100	✓	✓	1
80	1151	118.45	0.75	2.0	100	✓	✓	1
90	1201	126.20	0.75	2.0	100.5	✓	✓	1
100	1211	133.73	0.75	2.0	100.5	✓	✓	1
		74.6		2.0	97.5			
		70.817						
Run Time	Total Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm	Average Ts	Highest Vacuum (in. Hg)	

Comments:

10/10/10

Purpose: _____
 Other Data/Notes: _____

ORP-51444, Rev. 0**Comments:**

MIDGET SAMPLING TRAIN FIELD DATA

3305

Plant	CUA VSL	Ambient Temp. (°F)	85	Meter Box Number	V1
Date	3/8/15	Barometric Pressure (in. H2O)	29.88	DGM Cal. Factor (M)	1.0126
Sampling Location	HEPA OUT	Stack Temp. (°F)	NA	Probe Length & Type	
Sample Type	W308	Average delta P (in. H2O)	NA	Probe Heater Setting (°F)	
Run Number	1	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	NA
Operator	WPG-	Sample Rate (lpm)	0.75	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set	0.00	5"	0.00	6"
Initial				

[illegible]

Comments:

MIDGET SAMPLING TRAIN FIELD DATA

Run HEPA 300-2
Page 1 of 1

50 min

Plant	CWA / VSL	Ambient Temp. (°F)	90	Meter Box Number	V1
Date	3/8/15	Barometric Pressure (in. H2O)	29.88	DGM Cal. Factor (V)	1.0126
Sampling Location	HEPA OUT	Stack Temp. (°F)	NA	Probe Length & Type	20' TFE
Sample Type	308	Average delta P (in. H2O)	NA	Probe Heater Setting (°F)	NA
Run Number	2	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	NA
Operator	WPG	Sample Rate (lpm)	0.75	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in.Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in.Hg)
Set				
Inlet / Fin	0.00 @	5"	0.00 lpm	6"

[illegible]

·990

Comments:

Run HEPA 308-3
Page 1 of 1

53

Plant	CWA/VSL	Ambient Temp. (°F)	95	Meter Box Number	V1
Date	3/8/5	Barometric Pressure (in. H2O)	29.88	DGM Cal. Factor (Y)	1.0126
Sampling Location	HEPA OUT	Stack Temp. (°F)	NA	Probe Length & Type	20' TFF
Sample Type	308	Average delta P (in.H2O)	NA	Probe Heater Setting (°F)	NA
Run Number	3	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	↓
Operator	WPK	Sample Rate (lpm)	0.75	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set	0.00 LPM	6"		
	0.00	6"		

[illegible]

Comments:

MIDGET SAMPLING TRAIN FIELD DATA

Run MO-3082
Page 1 of 1

Plant	CO4/02	Ambient Temp. (°F)	95	Meter Box Number	1574 (ES)
Date	3/8/05	Barometric Pressure (in. H2O)	29.88	DGM Cal. Factor (M)	0.97
Sampling Location	MO/Na Out	Stack Temp. (°F)	NA	Probe Length & Type	20' TFE
Sample Type	MO-308	Average delta P (in. H2O)	NA	Probe Heater Setting (°F)	Glasshead Plug
Run Number	2	Static Pressure (±) (in. H2O)	4.5	Filter # & Type (if used)	Stack
Operator	WPG	Sample Rate (lpm)	0.75	Filter Temp. (°F)	

50 min

Purpose:

Other Data/Notes:

LEAK CHECKS:		PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)
Tair	0.00 lpm	0.00 lpm	5.1	0.00 lpm	6.1

Run (min)	Sampling Times Clock (24hr)	Gas Meter Reading (Vol in L or ft3)	Rotameter Setting (lpm/ft3/min)	Meter Pressure (in. H2O)	Meter Temp. (°C)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
0	12:43	99.30	0.75	1.2	38	NA	NA	1.0
10	12:53	106.51	0.75	1.1	38	↓	↓	1.0
20	13:03	113.85	0.75	1.2	38.5	↓	↓	1.0
30	13:13	121.25	0.75	1.2	38.5	↓	↓	1.0
40	13:23	128.35	0.75	1.2	38.5	↓	↓	1.0
50	13:33	134.71	0.75	1.2	38.5	↓	↓	1.0
49	13:32	35.41		1.2	38.3°C			
①	Stopped early	33.790			100.74°F			
Run Time	Total Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm	Average Ts	Highest Vacuum (in. Hg)	

Comments:

Comments:

Comments:

Plant **CUA - Melter** Meter Number **1575**
 Date **3/12/05** ~~03/21/2005~~ Correction factor **0.981**
 Sample Type **Allyl M308** Barometric Pressure **30**
 Run Number **1 - spiked**

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature		Vacuum
					Coil 1	Coil 2	Probe	Inlet	Outlet	
1	0 lpm @5"	1740	65.72	1				86	82.4	
		1750		1				89.6	86	
		1800		1				93.2	89.6	
		1810		1				93.2	91.4	
		1820		1				93.2	89.6	
	0 lpm @3"	1830	99.15	1				95	91.4	
	Averages			1				91.7	88.4	
Standard Meter Volume			31.64698377 ✓				90.05			

33.43

Red Miter Pressure

Schematic of Traverse Point Layout

Read and Record All Data Every	10 Minutes
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[illegible]

Plant CUA - Melter Meter Number 1575
 Date 03/21/2005 Correction factor 0.981
 Sample Type Allyl M308 Barometric Pressure 30
 Run Number 1

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature		Vacuum
					Coil 1	Coil 2	Probe	Inlet	Outlet	
1	0 lpm @ 11"	1442	57.5	0.8				89.6	89.6	
		1452	62.15	0.9				90.5	90.5	
		1502	67.15	0.9				92.3	92.3	
		1512	72.05	0.9				92.3	92.3	
		1522	76.95	0.9				93.2	93.2	
		1532	82.34							
	0.00 lpm @ 11"	Averages		0.88						
		Standard Meter Volume	23.44303078				91.58	91.58		

ds Liters →

Plant CUA - Melter Meter Number 1575
 Date 03/21/2005 Correction factor 0.981
 Sample Type Allyl M308 Barometric Pressure 30
 Run Number 2

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature		Vacuum
					Coil 1	Coil 2	Probe	Inlet	Outlet	
2	0 lpm @ 12"	1633	585.15	1				91.4	91.4	
		1643	589.9	1				92.3	92.3	
		1653	594.99	1				92.3	92.3	
		1703	600	1				93.2	93.2	
		1710	604.98	1				94.1	94.1	
		1723	609.65							
	0.00 lpm @ 9"	Averages		1						
		Standard Meter Volume	23.0837397				92.66	92.66		

Plant CUA - Melter Meter Number 1575
 Date 03/21/2005 Correction factor 0.981
 Sample Type Allyl M308 Barometric Pressure 30
 Run Number 3

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature		Vacuum
					Coil 1	Coil 2	Probe	Inlet	Outlet	
3	0.00 lpm @ 11"	1834	611.5	1				93.2	93.2	
		1844	616.3	1				93.2	93.2	
		1854	620.99	1				94.1	94.1	
		1904	625.95	1				95	95	
		1914	630.9	1				95.9	95.9	
		1924	635.35							
	0.00 lpm @ 7"	Averages		1						
		Standard Meter Volume	22.40563681				94.28	94.28		

MIDGET SAMPLING TRAIN FIELD DATA

0.5 spec-
150 min

Plant	CYA VSL	Ambient Temp. (°F)	90	Meter Box Number	1575
Date	3/21/5	Barometric Pressure (in. H ₂ O)		DGM Cal. Factor (M)	0.981
Sampling Location	Walter	Stack Temp. (°F)	4300 350	Probe Length & Type	25' TFE
Sample Type	Allyl W308	Average delta P (in. H ₂ O)	20.7	Probe Heater Setting (°F)	NA
Run Number	1	Static Pressure (±) (in. H ₂ O)	-5	Filter # & Type (if used)	NA
Operator	Green	Sample Rate (ipm)	150	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST		POST TEST	
	Set	Rate (in. Hg)	PRE Vacuum	POST Rate (in. Hg)
Pushed	0	11	0.00 gpm	0.11

Had a surge in sample rate
@ end of test (rotator = 2 spins)
due to backing off of glass wool
plug in nozzle-filter. No juice
in last 4 samples.

Sampling Times		Gas Meter Reading Vol In L or ft ³	Rotameter Setting (lpm, ft ³ /min)	Meter Pressure (in Hg)	Meter Temp. (°C)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in.Hg)
Run (min)	Clock (24hr)							
0	14:42	57.50	0.55	00.9	32	NA	371	4.0
16		62.15	0.6	00.9	32.5	↓	353	4.0
20		67.15	0.6	00.9	33.5		355	4.0
30		72.05	0.6	00.9	33.5		360	5.0
40		76.95	0.6	00.9	34		369	7.0
50		82.34	0.6	00.9				
		Total Volume Metered		Average Tm			Average Ts	Highest Vacuum (in.Hg)
Run Time	Total Time							

Comments:

MIDGET SAMPLING TRAIN FIELD DATA

Plant	CWA/VSL	Ambient Temp. (°F)	90	Meter Box Number	1575
Date	3/26/05	Barometric Pressure (in. H2O)		DGM Cal. Factor (M)	0.981
Sampling Location	Wetland	Stack Temp. (°F)	4350	Probe Length & Type	25' TFE
Sample Type	Allyl	Average delta P (in. H2O)	-	Probe Heater Setting (°F)	-
Run Number	2	Static Pressure (±) (in. H2O)	2-5	Filter # & Type (if used)	-
Operator	WAC	Sample Rate (ppm)	0.5	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:		PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in.Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in.Hg)
Set		0	12"	0.00 gpm	7.2

Sampling Times		Gas Meter Reading (Vol in L or ft ³)	Rotameter Setting (lpm/ft ³ / min)	Meter Pressure (in.H ₂ O)	Meter Temp. (°F) °C	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in.Hg)
Run (min)	Clock (24hr)							
0	16:33	585.15			97 °C			
10		589.90	0.6	1.0	33.914	N/A	353	0
20		594.49	0.6	1.0	33.512.3	↓	330	0
30		600.0	0.6	1.0	33.5-92.3		359	0
40		604.98	0.6	1.0	34.93.2		350	0
50		609.65	0.6	1.0	34.5-94.1		355	0
Run Time	Total Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm		Average Ts	Highest Vacuum (in.Hg)

Comments:

MIDGET SAMPLING TRAIN FIELD DATA

ORP-51444, Rev. 0

Run — Page 1 of 1

0.5 liter @ 50 min

Plant	CUA	Ambient Temp. (°F)	90	Meter Box Number	1575
Date	3/21/05	Barometric Pressure (in. H2O)	30.0	DGM Cal. Factor (Y)	0.981
Sampling Location	W414L	Stack Temp. (°F)	2350	Probe Length & Type	25' TFE
Sample Type	A141	Average delta P (in.H2O)		Probe Heater Setting (°F)	
Run Number	3	Static Pressure (±) (in. H2O)	4 -5	Filter # & Type (if used)	
Operator	wfb	Sample Rate (pm)	0.5	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:		PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set		0.50 gpm	21"	0.50 gpm	21"

[illegible]**Comments:**

Plant	CUA - TCO	Meter Number	V2
Date	03/21/2005	Correction factor	0.9981
Sample Type	M308	Barometric Pressure	30
Run Number	1		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
1	0.01 lpm @ 8"	1409	82.85	2				85	85
				2				88	88
				2				90	90
				2				92	92
				2				94	94
				2				95	95
				2				96.5	96.5
				2				97	97
				2				98	98
				2				98.5	98.5
				2					
				2					
				2					
	0.00 lpm @ 6"	1549	153.81	2					
	Averages			2				93.4	93.4
	Standard Meter Volume		68.09859719					93.4	

ds lites

Plant	CUA - TCO	Meter Number	V2
Date	03/21/2005	Correction factor	0.9981
Sample Type	M308	Barometric Pressure	30
Run Number	2		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
2	0.00 lpm @ 6"	1601	356.95	2				98.5	98.5
				2				99	99
				2				99.5	99.5
				2				100	100
				2				100.5	100.5
				2				101	101
				2				101.5	101.5
				2				102	102
				2				102.5	102.5
				2				102.5	102.5
				2					
				2					
				2					
	0.010 lpm @ 6"	1742	431.6	2					
	Averages			2				100.7	100.7
	Standard Meter Volume		70.70709093					100.7	

Plant	CUA - TCO	Meter Number	V2
Date	03/21/2005	Correction factor	0.9981
Sample Type	M308	Barometric Pressure	30
Run Number	3		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
3	0.00 lpm @ 8"	1807	432.55	2				101	101
				2				101	101
				2				101	101
				2				101.5	101.5
				2				101.5	101.5
				2				102	102
				2				102.5	102.5
				2				102.5	102.5
				2				103.5	103.5
				2				103.5	103.5
				2					
				2					
				2					
	0.00 lpm @ 7"	1947	506.16	2					
	Averages			2				102	102
	Standard Meter Volume		69.56074358					102	

MIDGET SAMPLING TRAIN FIELD DATA

Plant	CWA	Ambient Temp. (°F)	90	Meter Box Number	V2
Date	3/21/05	Barometric Pressure (in. H2O)		DGM Cal. Factor (Y)	0.9981
Sampling Location	TCO	Stack Temp. (°F)	610	Probe Length & Type	10' TFE
Sample Type	M308	Average delta P (in. H2O)	5.0	Probe Heater Setting (°F)	NA
Run Number	1	Static Pressure (±) (in. H2O)	4.12"	Filter # & Type (if used)	
Operator	WPG	Sample Rate (ppm)	0.75	Filter Temp. (°F)	

3
75 ppm
@ 100 ft/min

Purpose:

Other Data/Notes:

LEAK CHECKS:		PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)
	0.01 ppm	8"		
	0.00 ppm	6"		

Sampling Times		Gas Meter Reading		Rotameter	Meter	Meter	Probe	Stack	Train
Run	Clock	(Vol in L or ft3)	(lpm/ft3/min)	Pressure	Temp.	Temp.	Temp.	Temp.	Vacuum
(min)	(24hr)			(in. H2O)	(°F)	(°F)	(°F)	(°F)	(in. Hg)
0	14:09	82.85	0.75	2.0	85	NA	NA	611/0.88	1
10	14:19	89.9	0.75	2.0	88			613/0.92	1
20	14:29	97.05	0.75	2.0	90			616/0.92	1
30	14:39	104.35	0.75	2.0	92			617/0.92	1
40	14:49	111.32	0.75	2.0	94			619/0.92	1
50	14:59	118.40	0.75	2.0	95			619/0.93	1
60	15:09	125.55	0.75	2.0	96.5			618/0.94	1
70	15:19	132.50	0.75	2.0	97			620/0.93	1
80	15:29	139.60	0.75	2.0	98			620/0.93	1
90	15:39	146.63	0.75	2.0	98.5				
100	15:49	153.81	0.75	2.0					
Total Time		Total Volume Metered	Average Flow Rate	Average Pm	Average Tm	Average Ts	Highest Vacuum (in. Hg)		

MIDGET SAMPLING TRAIN FIELD DATA

Plant	CWA	Ambient Temp. (°F)	90	Meter Box Number	VZ
Date	3/21/05	Barometric Pressure (in. H2O)	30.0	DGM Cal. Factor (M)	0.9981
Sampling Location	TCO	Stack Temp. (°F)	610	Probe Length & Type	10' TFE
Sample Type	A141	Average delta P (in. H2O)	See below	Probe Heater Setting (°F)	NA
Run Number	3	Static Pressure (±) (in. H2O)	2-12	Filter # & Type (if used)	✓
Operator	WPG	Sample Rate (ppm)	0.75	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:		PRE TEST	PRE TEST	POST TEST	POST TEST
	Set	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)
		0.00 gpm	8"	0.00 gpm	27"

Sampling Times		Gas Meter Reading Vol in L or ft ³	Rotameter Setting (lpm/ft ³ /min)	Meter Pressure (in.H ₂ O)	Meter Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F) ΔP	Train Vacuum (in.Hg)
Run (min)	Clock (24 hr)							
0	1807	432.55	0.75	2.0	101	N/A	621/0.90	Z
10	1817	439.85	0.75	2.0	101		621/0.91	Z
20	1827	447.37	0.75	2.0	101		621/0.92	Z
30	1837	454.55	0.75	2.0	101.5		620/0.90	Z
40	1847	461.75	0.75	2.0	101.5		621/0.90	Z
50	1857	468.85	0.75	2.0	102		622/0.91	Z
60	1907	476.21	0.75	2.0	102.5		622/0.89	Z
70	1917	483.55	0.75	2.0	102.5		622/0.92	Z
80	1927	491.0	0.75	2.0	103.5		625/0.90	Z
90	1937	498.8	0.75	2.0	103.5		621/0.88	Z
100	1947	506.16	0.75	2.0	103.5			
		Total Volume Metered	Average Flow Rate	Average Pm	Average Tm		Average Ts	Highest Vacuum (in.Hg)
Run Time	Total Time							

Comments:

Plant	CUA - HEPA Out	Meter Number	V1
Date	03/21/2005	Correction factor	1.0641
Sample Type	M308	Barometric Pressure	30
Run Number	1		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
1	0 lpm @ 11"	1446	91.05	1.8				97.5	97.5
				1.7				98.5	98.5
				1.8				100.5	100.5
				1.8				101.5	101.5
				1.8				103	103
	0.01 lpm @ 5"	1636	116.07						
		Averages		1.78				100.2	100.2
	Standard Meter Volume		25.27453671					100.2	

ds 1 liter

Plant	CUA - HEPA Out	Meter Number	V1
Date	03/21/2005	Correction factor	1.0641
Sample Type	M308	Barometric Pressure	30
Run Number	2		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
2	0.00 lpm @ 8"	1638	317.75	1.8				106	106
				1.8				107	107
				1.8				107	107
				1.8				108	108
				1.8				108	108
	0.00 lpm @ 8"	1728	342.76						
		Averages		1.8				107.2	107.2
	Standard Meter Volume		24.95385621					107.2	

Plant	CUA - HEPA Out	Meter Number	V1
Date	03/21/2005	Correction factor	1.0641
Sample Type	M308	Barometric Pressure	30
Run Number	3		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
3	0.00 lpm @ 11"	1837	349	1.8				101	101
				1.8				101	101
				1.8				102	102
				1.7				103.5	103.5
				1.8				104.5	104.5
	0.00 lpm @ 10"	1927	377.401						
		Averages		1.78				102.4	102.4
	Standard Meter Volume		28.57770327					102.4	

Run 1
Page 1 of 1

0.5 gpm
50 mm

Other Data/Notes:

52

1008

Comments:

MIDGET SAMPLING TRAIN FIELD DATA

Run
Page 1 of

Plant	CUA	Ambient Temp. (°F)	90	Meter Box Number	V-1
Date	3/21/05	Barometric Pressure (in. H2O)	30.0	DGM Cal. Factor (V)	1.0641
Sampling Location	HEAD OUT	Stack Temp. (°F)	2175	Probe Length & Type	20' TFE
Sample Type	ALLYL	Average delta P (in.H2O)	-	Probe Heater Setting (°F)	NA
Run Number	2	Static Pressure (±) (in. H2O)	-	Filter # & Type (if used)	NA
Operator	WPC	Sample Rate (ipm)	0.5	Filter Temp. (°F)	NA

05 Apr 50

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in.Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in.Hg)
Set				
Initial	0.00	Set 3"	0.00	8"

[illegible]

1009

Comments:

MIDGET SAMPLING TRAIN FIELD DATA

Plant	CUA	Ambient Temp. (°F)	90	Meter Box Number	V-1
Date	3/21/05	Barometric Pressure (in. H2O)	30.0	DGM Cal. Factor (Y)	1.0641
Sampling Location	HEPA OUT	Stack Temp. (°F)	-	Probe Length & Type	20' TFE
Sample Type	AU4C	Average delta P (in. H2O)	-	Probe Heater Setting (°F)	NA
Run Number	3	Static Pressure (±) (in. H2O)	-	Filter # & Type (if used)	NA
Operator	WPG	Sample Rate (lpm)	0.5	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set	0.00 gpm	11"	0.00 gpm	10"

[illegible]**Comments:**

Plant	CUA - Carbon Bed Out	Meter Number	935064
Date	03/21/2005	Correction factor	0.997
Sample Type	M308	Barometric Pressure	30
Run Number	1		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
1	0.01 lpm@8"	1445	34.8	1				77.9	77.9
				1				79.7	79.7
				1.1				81.5	81.5
				1				83.3	83.3
	0.01 lpm@10"	1635	60.56				84.2	84.2	
	Averages			1.025				81.32	81.32
	Standard Meter Volume		25.18503731					81.32	

Plant	CUA - Carbon Bed Out	Meter Number	935064
Date	03/21/2005	Correction factor	0.997
Sample Type	M308	Barometric Pressure	30
Run Number	2		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
2	0lpm@10"	1636	364.1	1				92.3	92.3
				1				92.3	92.3
				1				94.1	94.1
				1				94.1	94.1
	0.01 lpm@9"	1716	390.77				95	95	
	Averages			1				93.56	93.56
	Standard Meter Volume		25.49661832					93.56	

Plant	CUA - Carbon Bed Out	Meter Number	935064
Date	03/21/2005	Correction factor	0.997
Sample Type	M308	Barometric Pressure	30
Run Number	3		

Run Number	Leak Rate	Time	Volume	Pressure	Temperature			Meter Temperature	
					Coil 1	Coil 2	Probe	Inlet	Outlet
3	0.00 lpm @11"	1836	410.05	1				93.2	93.2
				1				94.1	94.1
				1				94.1	94.1
				1				94.1	94.1
	0.00 lpm @8"	1916	435.57				95	95	
	Averages			1				94.1	94.1
	Standard Meter Volume		24.37343769					94.1	

MIDGET SAMPLING TRAIN FIELD DATA

Plant	CWA	Ambient Temp. (°F)	90	Meter Box Number	120 CABEL
Date	3/21/05	Barometric Pressure (in. H2O)	30.0	DGM Cal. Factor (Y)	.997
Sampling Location	CABES OUT	Stack Temp. (°F)	-	Probe Length & Type	20' TFE
Sample Type	in 308	Average delta P (in. H2O)	-	Probe Heater Setting (°F)	NA
Run Number	1	Static Pressure (±) (in. H2O)	-	Filter # & Type (if used)	↓
Operator	WDL	Sample Rate (ppm)	0.5	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in.Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in.Hg)
Set	0.01 <i>2pm</i>	8"		
	0.01 <i>2pm</i>	10"		

[illegible]

Comments:

MIDGET SAMPLING TRAIN FIELD DATA

Run _____
Page 1 of 1

Plant	CWA	Ambient Temp. (°F)	90	Meter Box Number	Water 935064
Date	3/21/05	Barometric Pressure (in. H2O)	30.0	DGM Cal. Factor (M)	
Sampling Location	ARB. OUT	Stack Temp. (°F)	-	Probe Length & Type	20' TFE
Sample Type	ALLYL	Average delta P (in. H2O)	-	Probe Heater Setting (°F)	
Run Number	2	Static Pressure (±) (in. H2O)	-	Filter # & Type (if used)	
Operator	WPG	Sample Rate (ppm)	0.5	Filter Temp. (°F)	

Q. 50 per
for 50 in

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in.Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in.Hg)
Set				
initial	0	10	0.01 bpm	94

[illegible]

1013

Comments:

MIDGET SAMPLING TRAIN FIELD DATA

Plant	CCA	Ambient Temp. (°F)	90	Meter Box Number	Water	935064
Date	3/21/05	Barometric Pressure (in. H2O)	30.0	DGM Cal. Factor (Y)		
Sampling Location	carb. out	Stack Temp. (°F)	-	Probe Length & Type		20' TFE
Sample Type	ALVCL	Average delta P (in. H2O)	-	Probe Heater Setting (°F)		NA
Run Number	3	Static Pressure (±) (in. H2O)	-	Filter # & Type (if used)		NA
Operator	WPK	Sample Rate (lpm)	0.5	Filter Temp. (°F)		NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in.Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in.Hg)
Set	0.00 lps	11"	0.00 lps	22"

[illegible]

Comments:

Appendix C

Chain of Custody

Chain of Custody Record

[illegible]

LAB USE ONLY									
RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO	OPENED BY:	DATE	TIME	TEMP °C	SEAL #	CONDITION
REMARKS:									

Chain of Custody Record

[illegible]

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page _____ of _____			
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
				1			X						260.2	
				1			X							
				1			X						203.8	
				1			X							
				1			X						260.9	
				1			X							
				1			X						134.6	
				1			X							
				1			X						258.8	
				1			X							
				1			X						179.9	
				1			X							
Notes:														
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)											

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Page 1 of 14			
Collected By:						
Sampling Set: Modified 308 Alloy						
SAMPLE ID	Matrix	Date	No. of Containers	Analyses	REMARKS	LAB USE
OHTA0307051	0.2M NaOH	3/7/05	1	Mod. 308 (Allyl)	59.6 ✓	
OHTB0307051	0.2M NaOH	3/7/05	1	Mod. 308 (Allyl)	19.2 ✓	
OHMA0308051	0.2M NaOH	3/8/05	1	Mod. 308 (Allyl)	64.4 ✓	
OHMB0308051	0.2M NaOH	3/8/05	1	Mod. 308 (Allyl)	19.5 ✓	
OHHA0308051	0.2M NaOH	3/8/05	1	Mod. 308 (Allyl)	60.9 ✓	
OHHB0308051	0.2M NaOH	3/8/05	1	Mod. 308 (Allyl)	18.2 ✓	
OHCA0308051	0.2M NaOH	3/8/05	1	Mod. 308 (Allyl)	71.6 ✓	
OHCB0308051	0.2M NaOH	3/8/05	1	Mod. 308 (Allyl)	18.6 ✓	
OHTA0308051	0.2M NaOH	3/8/05	1	Mod. 308 (Allyl)	61.7 ✓	
OHTB0308051	0.2M NaOH	3/8/05	1	Mod. 308 (Allyl)	18.7 ✓	
OHMA0308052	0.2M NaOH	3/8/05	1	Mod. 308 (Allyl)	64.9 ✓	
OHMB0308052	0.2M NaOH	3/8/05	1	Mod. 308 (Allyl)	20.0 ✓	
Notes:						
Relinquished by: <i>W.P. Gergen</i>			Received By: <i>Matthew J. Gergen</i>		3-10-05 16:40 16:40	
(Signature & Date)			(Sig. & Date)			

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses							Page 2 of 14				
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: Modified 308 Allyl			Date		Matrix	SAMPLE ID								
			3/8/05		0.2M NaOH	OHHA0308052	1	✓					81.0	✓
			3/8/05		0.2M NaOH	OHHA0308052	+	✓					Combined with A	
			3/8/05		0.2M NaOH	OHHA0308052	1	✓					64.9	✓
			3/8/05		0.2M NaOH	OHHA0308052	+	✓					49.4	
			3/8/05		0.2M NaOH	OHHA0308052	1	✓					57.0	✓
			3/8/05		0.2M NaOH	OHHA0308052	1	✓					18.8	✓
			3/8/05		0.2M NaOH	OHHA0308053	1	✓					63.7	✓
			3/8/05		0.2M NaOH	OHHA0308053	+	✓					47.0	
			3/8/05		0.2M NaOH	OHHA0308053	1	✓					103.9	✓
			3/8/05		0.2M NaOH	OHHA0308053	1	✓					16.8	✓
			3/8/05		0.2M NaOH	OHHA0308053	1	✓					61.5	✓
			3/8/05		0.2M NaOH	OHHA0308053	1	✓					18.3	✓
Notes:														
Relinquished by: W.P. Gergen 3/10/5 16:40			Received By: Matthew J. Hume		3-10-05 16:40									

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Page <u>5</u> of <u>14</u>										
Collected By:													
Sampling Set: Modified 308 Allyl													
SAMPLE ID	Matrix	Date	No. of Containers	Analyses							REMARKS	LAB USE	
OHTA0308053	0.2M NaOH	3/8/05	1	✓								61.7	✓
OHTB0308052	0.2M NaOH	3/8/05	1	✓								19.0	
OHTA0309054	0.2M NaOH	3/9/05	1	✓								68.3	
OHTB0309054	0.2M NaOH	3/9/05	1	✓								17.6	
OHTA0309054	0.2M NaOH	3/9/05	1	✓								61.4	✓
OHTB0309054	0.2M NaOH	3/9/05	1	✓								18.6	
S-12D-126A	SBS Soln.	3/9/05	1	✓								141.3	
S-12E-20A	SBS Soln.	3/9/05	1									135.9	
F-12D-129A	Feed Soln.	3/9/05	1		✓							204.3	
OHTA030905MB	0.2M NaOH	3/9/05	1	✓								58.2	✓
OHTB030905MB	0.2M NaOH	3/9/05	1	✓								19.4	✓
Notes:													
Relinquished by: <u>W.P. Bergen</u> 3/10/5 16:40			Received By: <u>Matthew D. Hansen</u> 3-10-05 16:40										

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Page <u>4</u> of <u>14</u>										
Collected By:													
Sampling Set: Metals													
SAMPLE ID	Matrix	Date	No. of Containers	Mod. 308 (Allyl)	Semt-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
NM0308051	0.1 M NHO3	3/8/05	1				✓					167.8	
NT0308051	0.1 M NHO3	3/8/05	1				✓					154.5	
NM0308052	0.1 M NHO3	3/8/05	1				✓					160.3	
NT0308052	0.1 M NHO3	3/8/05	1				✓					152.7	
NM0308053	0.1 M NHO3	3/8/05	1				✓					120.9	
NT0309053	0.1 M NHO3	3/8/05	1				✓					59.8	
5M0308051	low metals quartz	3/8/05	1				✓						
5T0308051	low metals quartz	3/8/05	1				✓						
5M0308052	low metals quartz	3/8/05	1				✓						
5T0308052	low metals quartz	3/8/05	1				✓						
5M0308053	low metals quartz	3/8/05	1				✓						
5T0309053	low metals quartz	3/8/05	1				✓						
Notes:													
Relinquished by: <u>W.P. Ceylan</u>			3/10/5	16:10	Received By: <u>Matthew J. Powell</u>		3-10-05		16:40				

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses								Page <u>6</u> of <u>14</u>					
Collected By: Sampling Set: Halogens			No. of Containers		Mod. 308 (Allyl) Semi-Vol (Naph.) SW-846-0010 Halides (Cl, F) Metals SW-846-0060 TOE - EPA 0040 VOST SW-846-0031 Dioxins, Furans, PCBs Gravimetric								REMARKS	LAB USE		
SAMPLE ID	Matrix	Date														
WM0309051	H2O	3/9/05	1		✓										171.3	
WT0309051	H2O	3/9/05	1		✓										143.1	
WM0309052	H2O	3/9/05	1		✓										181.3	
WT0309052	H2O	3/9/05	1		✓										187.4	
WM0309053	H2O	3/9/05	1		✓										291.6	
WT0309053	H2O	3/9/05	1		✓										232.1	
26M0309051	M-26 filter	3/9/05	1		✓											
26T0309051	M-26 filter	3/9/05	1		✓											
26M0309052	M-26 filter	3/9/05	1		✓											
26T0309052	M-26 filter	3/9/05	1		✓											
26M0309053	M-26 filter	3/9/05	1		✓											
26T0309053	M-26 filter	3/9/05	1		✓											
Notes:																
Relinquished by: (Signature & Date) <i>W.P. Coger</i> 3/6/05 16:40			Received By: (Sig. & Date) <i>Matthew D. Howard</i> 3-10-05 16:40													
RELINQUISHED BY <i>Danah Johnson</i> 3-11-05 14:30																
REMARKS																

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1			Page 6 of 14									
Collected By: Dr. Keith Matlack												
Sampling Set: Halogens												
SAMPLE ID	Matrix	Date	Analyses					REMARKS	LAB USE			
WM0309051	H2O	3/9/05	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	171.3	
WT0309051	H2O	3/9/05			✓						143.1	
WM0309052	H2O	3/9/05			✓						181.3	
WT0309052	H2O	3/9/05			✓						187.4	
WM0309053	H2O	3/9/05			✓						291.6	
WT0309053	H2O	3/9/05			✓						232.1	
26M0309051	M-26 filter	3/9/05			✓							
26T0309051	M-26 filter	3/9/05			✓							
26M0309052	M-26 filter	3/9/05			✓							
26T0309052	M-26 filter	3/9/05			✓							
26M0309053	M-26 filter	3/9/05			✓							
26T0309053	M-26 filter	3/9/05			✓							
Notes:												
Relinquished by: <i>W.P. Gage</i> 3/10/5 16:40			Received By: <i>Matthew Howard</i> 3-10-05 16:40									

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Page 7 of 14																	
Collected By:			Analyses																	
Sampling Set: Halogens			<table border="1"> <tr> <td>Mod. 308 (Allyl)</td> <td>Semi-Vol (Naph.) SW-846-0010</td> <td>Halides (Cl, F)</td> <td>Metals SW-846-0060</td> <td>TOE - EPA 0040</td> <td>VOST SW-846-0031</td> <td>Dioxins, Furans, PCBs</td> <td>Gravimetric</td> <td>REMARKS</td> <td>LAB USE</td> </tr> </table>								Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE											
SAMPLE ID	Matrix	Date	No. of Containers																	
FM0309051	H2SO4	3/9/05	1	✓				512.1												
FT0309051	H2SO4	3/9/05	1	✓				442.5												
FM0309052	H2SO4	3/9/05	1	✓				521.7												
FT0309052	H2SO4	3/9/05	1	✓				462.1												
FM0309053	H2SO4	3/9/05	1	✓				521.2												
FT0309053	H2SO4	3/9/05	1	✓				487.6												
BM0309051	NaOH	3/9/05	1	✓				299.7												
BT0309051	NaOH	3/9/05	1	✓				332.8												
BM0309052	NaOH	3/9/05	1	✓				327.7												
BT0309052	NaOH	3/9/05	1	✓				296.1												
BM0309053	NaOH	3/9/05	1	✓				345.9												
BT0309053	NaOH	3/9/05	1	✓				323.4												
Notes:																				
Relinquished by: W. P. Geyer 3/16/05			16:40	Received By: Matthew J. Hearn		3-10-05		16:40												

REMARKS

Fiber Blk?
What is it?

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Page <u>8</u> of <u>14</u>										
Collected By:													
Sampling Set: Semi-Volatile													
SAMPLE ID	Matrix	Date	No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
SVMX0309051	XAD-2		1	✓									
SVMP0309051	filter		1	✓									
SVMF0309051	F 1/4 50/50		1	✓								111.5	
SVMB0309051	B 1/4 50/50		1	✓								53.5	
SVMC0309051	condensate		1	✓								206.4	
SVHX0309051	XAD-2		1	✓									
SVHP0309051	filter		1	✓									
SVHF0309051	F 1/4 50/50		1	✓								85.9	
SVHB0309051	B 1/4 50/50		1	✓								58.1	
SVHC0309051	condensate		1	✓								109.5	
Notes:													
Relinquished By: (Signature & Date)			3/10/05 16:40		Received By: (Sig. & Date)		Matthew J. Hornum		3-10-05 16:40				

REMARKS

Test # 1 3/9/05

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Page 9 of 14										
Collected By:													
Sampling Set: Semi-Volatile													
SAMPLE ID	Matrix	Date	No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
SVCX0309051	XAD-2	3/9/05	1	✓									
SVCP0309051	filter	3/9/05	1	✓									
SVCF0309051	F 1/2 50/50	3/9/05	1	✓								86.4	
SVCB0309051	B 1/2 50/50	3/9/05	1	✓								62.7	
SVCC0309051	condensate	3/9/05	1	✓								293.2	
SVTX0309051	XAD-2	3/9/05	1	✓									
SVTP0309051	filter	3/9/05	1	✓									
SVTF0309051	F 1/2 50/50	3/9/05	1	✓								101.4	
SVTB0309051	B 1/2 50/50	3/9/05	1	✓								38.4	
SVTC0309051	condensate	3/9/05	1	✓								321.0	
Notes:													
Relinquished by: Dr. P. Gergen 3/10/05 16:40			Received By: Matthew F. Kocum 3-10-05 16:40										

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Page 10 of 14										
Collected By:													
Sampling Set: Semi-Volatile													
SAMPLE ID	Matrix	Date	No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
SVMX0309052	XAD-2	3/9/05	1	✓									
SVMF0309052	filter	3/9/05	1	✓									
SVMF0309052	F 1/2 50/50	3/9/05	1	✓								160.8	
SVMB0309052	B 1/2 50/50	3/9/05	1	✓								68.6	
SVMC0309052	condensate	3/9/05	1	✓								221.3	
SVHX0309052	XAD-2	3/9/05	1	✓									
SVHP0309052	filter	3/9/05	1	✓									
SVHF0309052	F 1/2 50/50	3/9/05	1	✓								53.0	
SVHB0309052	B 1/2 50/50	3/9/05	1	✓								43.5	
SVHC0309052	condensate	3/9/05	1	✓								99.9	
Notes:													
Relinquished by: W.P. Gergen 3/10/5 16:40			Received By: Matthew F. Howard 3-10-05 16:40										
(Signature & Date)			(Sig. & Date)										

REMARKS

919 572 2203

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1			Page 11 of 14										
Collected By: Dr. Keith Matlack													
Sampling Set: Semi-Volatile													
SAMPLE ID	Matrix	Date	No. of Containers	Analyses							REMARKS	LAB USE	
SVCX0309052	XAD-2	3/9/05	1	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric		
SVCP0309052	filter	3/9/05	1		✓								
SVCF0309052	F 1/4 50/50	3/9/05	1		✓							70.7	
SVCB0309052	B 1/4 50/50	3/9/05	1		✓							27.2	
SVCC0309052	condensate	3/9/05	1		✓							287.0	
SVTX0309052	XAD-2	3/9/05	1		✓								
SVTP0309052	filter	3/9/05	1		✓								
SVTF0309052	F 1/4 50/50	3/9/05	1		✓							49.6	
SVTB0309052	B 1/4 50/50	3/9/05	1		✓							47.0	
SVTC0309052	condensate	3/9/05	1		✓							317.0	
Notes:													
Relinquished by: J.P. Gergen 3/10/05 16:40			Received By: Matthew Z. Howard 3-10-05 16:40										

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Page 12 of 14											
Collected By:			Analyses								REMARKS		LAB USE	
Sampling Set: Semi-Volatile			No. of Containers											
SAMPLE ID	Matrix	Date	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric				
SVMX0309053	XAD-2	3/9/05	1	✓										
SVMP0309053	filter	3/9/05	1	✓										
SVMF0309053	F 1/2 50/50	3/9/05	1	✓										
SVMB0309053	B 1/2 50/50	3/9/05	1	✓							126.0			
SVMC0309053	condensate	3/9/05	1	✓							52.6			
SVHX0309053	XAD-2	3/9/05	1	✓							185.9			
SVHP0309053	filter	3/9/05	1	✓										
SVHF0309053	F 1/2 50/50	3/9/05	1	✓							75.2			
SVHB0309053	B 1/2 50/50	3/9/05	1	✓							45.1			
SVHC0309053	condensate	3/9/05	1	✓							100.8			
Notes:														
Relinquished by: <i>W.P. Gergen</i> 3/10/5 16:10			Received By: <i>Matthew J. Brown</i> 3-10-05 16:40											

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Page <u>13</u> of <u>14</u>									
Collected By: _____												
Sampling Set: Semi-Volatile												
SAMPLE ID	Matrix	Date	No. of Containers	Analyses						REMARKS	LAB USE	
SVCX0309053	XAD-2	3/9/05	1	✓								
SVCP0309053	filter	3/9/05	1	✓								
SVCF0309053	F 1/2 50/50	3/9/05	1	✓							119.1	
SVCB0309053	B 1/2 50/50	3/9/05	1	✓							45.6	
SVCC0309053	condensate	3/9/05	1	✓							277.5	
SVTX0309053	XAD-2	3/9/05	1	✓								
SVTP0309053	filter	3/9/05	1	✓								
SVTF0309053	F 1/2 50/50	3/9/05	1	✓							105.6	
SVTB0309053	B 1/2 50/50	3/9/05	1	✓							53.9	
SVTC0309053	condensate	3/9/05	1	✓							316.4	
Notes: _____												
Relinquished by: (Signature & Date) <u>W.P. Geygen 3/10/05 16:40</u>			Received By: (Sig. & Date) <u>Matthew F. Hornum 3-10-05 16:40</u>									

REMARKS _____	
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RSR011

**SEVERN TRENT LABORATORIES, INC.
SAMPLE CONFIRMATION REPORT**

Run Date: 3/28/05
Page : 1
Time : 9:41:05

The following samples have been received by Severn Trent Laboratories, Inc. at Knoxville, Tennessee. Please verify that the sample ID's and the requested tests are correct. Contact the STL project manager listed below to resolve any discrepancies.

Report to:

Dr. Keith Matlack
Catholic University of America
Cardinal Station
Leahy Hall #LL60
Washington, DC20064

Bill to:

Accounts Payable
Catholic University of America
Cardinal Station
Leahy Hall #LL60
Washington, DC 20064

Client

Project : VSL DM1200 LAW MACT 2A+2B 9056
Number :
Manager : Dr. Keith Matlack

STL

Date Rec: 3/23/05
Quote No: 061802
Manager : Richard J. Lafond

Due Dates

Preliminary: 4/13/05
Hard Copy : 4/14/05

Analytical TAT: 21

Client ID: FM0319051

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-001 Matrix: AIR

Parameter	Method	Rep
AIR, 0050/9056 (HCl) Acid Impinger	SW846 9056	
AIR, 0050/9056 (HF) Acid Impinger	SW846 9056	

Client ID: BM0319051

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-002 Matrix: AIR

Parameter	Method	Rep
AIR, 0050/9056 (HCl) Base Impinger	SW846 9056	
AIR, 0050/9056 (HF) Base Impinger	SW846 9056	

Client ID: FT0319051

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-003 Matrix: AIR

Parameter	Method	Rep
AIR, 0050/9056 (HCl) Acid Impinger	SW846 9056	
AIR, 0050/9056 (HF) Acid Impinger	SW846 9056	

Client ID: BT0319051

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-004 Matrix: AIR

Parameter	Method	Rep
AIR, 0050/9056 (HCl) Base Impinger	SW846 9056	
AIR, 0050/9056 (HF) Base Impinger	SW846 9056	

RSR011

SEVERN TRENT LABORATORIES, INC.
SAMPLE CONFIRMATION REPORT

Run Date: 3/28/05
Page : 2
Time : 9:41:05

Client

Project : VSL DM1200 LAW MACT 2A+2B 9056
Number :
Manager : Dr. Keith Matlack

STL

Date Rec: 3/23/05
Quote No: 061802
Manager : Richard J. Lafond

Due Dates

Preliminary: 4/13/05
Hard Copy : 4/14/05

Analytical TAT: 21

Client ID: FM0319052

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-005 Matrix: AIR

Parameter	Method	Rep
AIR, 0050/9056 (HCl) Acid Impinger	SW846 9056	
AIR, 0050/9056 (HF) Acid Impinger	SW846 9056	

Client ID: BM0319052

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-006 Matrix: AIR

Parameter	Method	Rep
AIR, 0050/9056 (HCl) Base Impinger	SW846 9056	
AIR, 0050/9056 (HF) Base Impinger	SW846 9056	

Client ID: FT0319052

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-007 Matrix: AIR

Parameter	Method	Rep
AIR, 0050/9056 (HCl) Acid Impinger	SW846 9056	
AIR, 0050/9056 (HF) Acid Impinger	SW846 9056	

Client ID: BT0319052

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-008 Matrix: AIR

Parameter	Method	Rep
AIR, 0050/9056 (HCl) Base Impinger	SW846 9056	
AIR, 0050/9056 (HF) Base Impinger	SW846 9056	

Client ID: FM0319053

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-009 Matrix: AIR

Parameter	Method	Rep
AIR, 0050/9056 (HCl) Acid Impinger	SW846 9056	
AIR, 0050/9056 (HF) Acid Impinger	SW846 9056	

Client ID: BM0319053

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-010 Matrix: AIR

Parameter	Method	Rep
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RSR011

SEVERN TRENT LABORATORIES, INC.
SAMPLE CONFIRMATION REPORT

Run Date: 3/28/05
Page : 3
Time : 9:41:05

Client

Project : VSL DM1200 LAW MACT 2A+2B 9056
Number :
Manager : Dr. Keith Matlack

STL

Date Rec: 3/23/05
Quote No: 061802
Manager : Richard J. Lafond

Due Dates

Preliminary: 4/13/05
Hard Copy : 4/14/05

Analytical TAT: 21

Client ID: BM0319053

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-010 Matrix: AIR

<u>Parameter</u>	<u>Method</u>	<u>Rep</u>
* Continued*		
AIR, 0050/9056 (HCl) Base Impinger	SW846 9056	
AIR, 0050/9056 (HF) Base Impinger	SW846 9056	

Client ID: FT0319053

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-011 Matrix: AIR

<u>Parameter</u>	<u>Method</u>	<u>Rep</u>
AIR, 0050/9056 (HCl) Acid Impinger	SW846 9056	
AIR, 0050/9056 (HF) Acid Impinger	SW846 9056	

Client ID: BT0319053

Date Sampled: 3/19/05 Time Sampled: :00
LAB ID: H5C240366-012 Matrix: AIR

<u>Parameter</u>	<u>Method</u>	<u>Rep</u>
AIR, 0050/9056 (HCl) Base Impinger	SW846 9056	
AIR, 0050/9056 (HF) Base Impinger	SW846 9056	

Client ID: BT032305MB

Date Sampled: 3/23/05 Time Sampled: :00
LAB ID: H5C240366-013 Matrix: AIR

<u>Parameter</u>	<u>Method</u>	<u>Rep</u>
AIR, 0050/9056 (HCl) Base Impinger	SW846 9056	
AIR, 0050/9056 (HF) Base Impinger	SW846 9056	

Client ID: FT032305MB

Date Sampled: 3/23/05 Time Sampled: :00
LAB ID: H5C240366-014 Matrix: AIR

<u>Parameter</u>	<u>Method</u>	<u>Rep</u>
AIR, 0050/9056 (HCl) Acid Impinger	SW846 9056	
AIR, 0050/9056 (HF) Acid Impinger	SW846 9056	

RSR011

SEVERN TRENT LABORATORIES, INC.
SAMPLE CONFIRMATION REPORT

Run Date: 3/28/05
Page : 1
Time : 8:50:44

The following samples have been received by Severn Trent Laboratories, Inc. at Knoxville, Tennessee. Please verify that the sample ID's and the requested tests are correct. Contact the STL project manager listed below to resolve any discrepancies.

Report to:

Dr. Keith Matlack
Catholic University of America
Cardinal Station
Leahy Hall #LL60
Washington, DC20064

Bill to:

Accounts Payable
Catholic University of America
Cardinal Station
Leahy Hall #LL60
Washington, DC 20064

Client

Project : VSL DM1200 LAW MACT 2A+2B 0060
Number :
Manager : Dr. Keith Matlack

STL

Date Rec: 3/24/05
Quote No: 061802
Manager : Richard J. Lafond

Due Dates

Preliminary: 4/14/05
Hard Copy : 4/15/05

Analytical TAT: 21

Client ID: NM0318051/5M0318051

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-001 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B Filter/Rinse	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: HM0318051

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-002 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B H2O2/HNO3	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: NM0318052/5M0318052

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-003 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B Filter/Rinse	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: HM0318052

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-004 Matrix: AIR

Parameter	Method	Rep
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RSR011

SEVERN TRENT LABORATORIES, INC.
SAMPLE CONFIRMATION REPORT

Run Date: 3/28/05
Page : 2
Time : 8:50:44

Client

Project : VSL DM1200 LAW MACT 2A+2B 0060
Number :
Manager : Dr. Keith Matlack

STL

Date Rec: 3/24/05
Quote No: 061802
Manager : Richard J. Lafond

Due Dates

Preliminary: 4/14/05
Hard Copy : 4/15/05

Analytical TAT: 21

Client ID: HM0318052

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-004 Matrix: AIR

Parameter	Method	Rep
* Continued*		
AIR, SW-846 0060/6010B H2O2/HNO3	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: NM0318053/5M0318053

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-005 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B Filter/Rinse	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: HM0318053

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-006 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B H2O2/HNO3	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: NT0318051/5T0318051

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-007 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B Filter/Rinse	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: HT0318051

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-008 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B H2O2/HNO3	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

RSR011

SEVERN TRENT LABORATORIES, INC.
SAMPLE CONFIRMATION REPORT

Run Date: 3/28/05
Page : 3
Time : 8:50:44

Client

Project : VSL DM1200 LAW MACT 2A+2B 0060
Number :
Manager : Dr. Keith Matlack

STL

Date Rec: 3/24/05
Quote No: 061802
Manager : Richard J. Lafond

Due Dates

Preliminary: 4/14/05
Hard Copy : 4/15/05

Analytical TAT: 21

Client ID: NT0318052/5T0318052

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-009 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B Filter/Rinse	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: HT0318052

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-010 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B H2O2/HNO3	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: NT0318053/5T0318053

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-011 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B Filter/Rinse	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: F-12F-21A

Date Sampled: 3/22/05 Time Sampled: :00
LAB ID: H5C240373-012 Matrix: SOLID

Parameter	Method	Rep
SOLID, RCRA Metals by 6010B (Feed)	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: F-12F-104A

Date Sampled: 3/22/05 Time Sampled: :00
LAB ID: H5C240373-013 Matrix: SOLID

Parameter	Method	Rep
SOLID, RCRA Metals by 6010B (Feed)	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: HT031205MB

Date Sampled: 3/23/05 Time Sampled: :00
STL Knoxville is a part of Severn Trent Laboratories, Inc.

LAB ID: H5C240373-014

Matrix: AIR

<u>Parameter</u>	<u>Method</u>	<u>Rep</u>
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RSR011

SEVERN TRENT LABORATORIES, INC.
SAMPLE CONFIRMATION REPORT

Run Date: 3/28/05
Page : 4
Time : 8:50:44

Client

Project : VSL DM1200 LAW MACT 2A+2B 0060
Number :
Manager : Dr. Keith Matlack

STL

Date Rec: 3/24/05
Quote No: 061802
Manager : Richard J. Lafond

Due Dates

Preliminary: 4/14/05
Hard Copy : 4/15/05

Analytical TAT: 21

Client ID: HT031205MB

Date Sampled: 3/23/05 Time Sampled: :00
LAB ID: H5C240373-014 Matrix: AIR

Parameter	Method	Rep
* Continued*		
AIR, SW-846 0060/6010B Filter/Rinse	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: NRB032205

Date Sampled: 3/23/05 Time Sampled: :00
LAB ID: H5C240373-015 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B Filter/Rinse	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: HBLK032205RB

Date Sampled: 3/23/05 Time Sampled: :00
LAB ID: H5C240373-016 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B H2O2/HNO3	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: HT0318053

Date Sampled: 3/18/05 Time Sampled: :00
LAB ID: H5C240373-017 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B H2O2/HNO3	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

Client ID: NT032205MB

Date Sampled: 3/22/05 Time Sampled: :00
LAB ID: H5C240373-018 Matrix: AIR

Parameter	Method	Rep
AIR, SW-846 0060/6010B Filter/Rinse	SW846 6010B	
Metals: AG AS BA CD CR CU MN NI PB SB SE		
ZN		

[illegible]

Relinquished by: <u>Wesley P. Geyer</u>	3/23/05	16:30	Received By: <u>Matthew Howard</u>	3-23-05
(Signature & Date)			(Sig. & Date)	16:30

REMARKS
* logged as train "SVT 032005 MB"
** logged on separate lot

H 50260330

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page 15 of 15			
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
SAMPLE ID	Matrix	Date												
① - SVHX0322054 ✓	XAD-2	3/22/05	1		X									
- SVHP0322054	FILTER	3/22/05	1		X									
- SVHF0322054	50/50	3/22/05	1		X							71.1		
- SVHB0322054	50/50	3/22/05	1		X							44.2		
✓ - SVHC0322054 ✓	Condensate	3/22/05	1		X							104.7		
② - SVCX0322054	XAD-2	3/22/05	1		X									
- SVCP0322054	FILTER	3/22/05	1		X									
- SVCF0322054	50/50	3/22/05	1		X							88.0		
- SVCB0322054	50/50	3/22/05	1		X							61.1		
✓ - SVCC0322054	Condensate	3/22/05	1		X							226.1		
Notes:														
Relinquished by: <i>Dr. Keith Matlack</i> 3/23/05 16:30			Received By: <i>Matthew Howard</i> 3-23-05 16:30											

REMARKS ① - logged train as "SVH 032205 R4"
② - ↓ ↓ "SVC032205 R4"
Rec'd temp. 2°C
No Custody Seals
Hand delivered
MFT 3-25-05
RR 03/28/05

45C290330

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack				Analytes							Page 16 of 16			
Collected By:				No. of Containers							REMARKS		LAB USE	
Sampling Set: Semi-Volatile														
SAMPLE ID	Matrix	Date		Mod. 308 (Allyl)	Seml-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric			
① SVHX0322056	XAD-2	3/22/05	1	X										
SVHP0322056	FILTER	3/22/05	1	X										
SVHF0322056	50/50	3/22/05	1	X								103.9		
SVHB0322056	50/50	3/22/05	1	X								104.8		
SVHC0322056	Condensate	3/22/05	1	X								93.3		
SVCX0322056	XAD-2	3/22/05	1	X										
SVCP0322056	FILTER	3/22/05	1	X										
SVCF0322056	50/50	3/22/05	1	X								86.2		
SVCB0322056	50/50	3/22/05	1	X								115.7		
SVCC0322056	Condensate	3/22/05	1	X								207.1		
Notes:														
Relinquished by: W.P. Geyer 3/23/05 16:30				Received By: Matthew Howard 3-23-05										
(Signature & Date)				(Sig. & Date)										

REMARKS ① logged train as "SVH 032205 RB"
 ② ↓ ↓ ↓ "SVC 032205 RB"
 3/23/05

45C290330

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack				Analyses								Page 17 of								
Collected By:				No. of Containers		Mod. 308 (Allyl)							REMARKS		LAB USE					
Sampling Set: Semi-Volatile				Matrix		Date		SW-846-0010 (Naph.)							Dioxins, Furans, PCBs		Gravimetric			
SAMPLE ID				Matrix		Date		SW-846-0060 Metals							TOE - EPA 0040		VOST SW-846-0031			
-	SVHX0322055	①	XAD-2	3/22/05	1			X												
-	SVHP0322055		FILTER	3/22/05	1			X												
-	SVHF0322055		50/50	3/22/05	1			X									127.8			
-	SVHB0322055		50/50	3/22/05	1			X									90.8			
-	SVHC0322055		Condensate	3/22/05	1			X									229.6			
-	SVCX0322055	②	XAD-2	3/22/05	1			X												
-	SVCF0322055		FILTER	3/22/05	1			X												
-	SVCF0322055		50/50	3/22/05	1			X									172.3			
-	SVCB0322055		50/50	3/22/05	1			X									106.3			
-	SVCC0322055		Condensate	3/22/05	1			X									99.4			
Notes:																				
Relinquished by: W.P. Cogan				3/23/05		16:30		Received By: Matthew A. Berry		3-23-05		16:30								

REMARKS
 ① - logged as train "SVH 032205 R5"
 ② - ↓ "SVC 032205 R5"
 ↓
 ROR - 03/28/05

45C250330

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Collected By: Dr. Keith Matlack			Analytes Mod. 308 (Allyl) Semi-Vol (Naph) SW-846-0010 Halides (Cl, F) Metals SW-846-0060 TOE - EPA 0040 VOST SW-846-0031 Dioxins, Furans, PCBs Gravimetric							Page 18 of ____		
Sampling Set: Semi-Volatile			No. of Containers									
SAMPLE ID	Matrix	Date	Mod. 308 (Allyl)	Semi-Vol (Naph) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
- SVMX0322054 ①	XAD-2	3/22/05	X									
- SVMF0322054	FILTER	3/22/05	X									
- SVMF0322054	50/50	3/22/05	X								68.7	
- SVMB0322054	50/50	3/22/05	X								68.5	
- SVMC0322054	Condensate	3/22/05	X								163.8	
- SVTX0322054 ②	XAD-2	3/22/05	X									
- SVTF0322054	FILTER	3/22/05	X									
- SVTF0322054	50/50	3/22/05	X								110.8	
- SVTB0322054	50/50	3/22/05	X								113.3	
- SVTC0322054	Condensate	3/22/05	X								298.6	
Notes:												
Relinquished By: <i>D.P. Gergen</i> 3/23/05 16:30			Received By: <i>Matthew Howard</i> 3-23-05 16:30									

REMARKS
 ① logged train as "SVM032205 R4"
 ② not logged on this lot. The XAD for this train was not received.

H5C250 330

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack				Analyses								Page 19 of					
Collected By:				No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph)	SW-846-0010	Halides (Cl, F)	Metals	SW-846-0060	TOE - EPA 0040	VOST	SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
SAMPLE ID	Matrix	Date															
- SVMX0322055	XAD-2	3/22/05	①	1	X												
- SVMPO322055	FILTER	3/22/05		1	X												
- SVMFO322055	50/50	3/22/05		1	X											155.4	
- SVMBO322055	50/50	3/22/05		1	X											134.1	
- SVMCO322055	Condensate	3/22/05		1	X											172.8	
- SVTX0322055	XAD-2	3/22/05	②	1	X												
- SVTP0322055	FILTER	3/22/05		1	X												
- SVTF0322055	50/50	3/22/05		1	X											57.8	
- SVTB0322055	50/50	3/22/05		1	X											52.5	
- SVTC0322055	Condensate	3/22/05		1	X											315.9	
Notes:																	
Relinquished By: <u>W.P. Goggen</u> 3/23/05 16:30				Received By: 3-23-05 16:30													

REMARKS

① logged as train "SVM 032205 RS"

② ↓ ↓ ↓ "SVT 032205 RS" 50L 08/28/05

[illegible]

REMARKS RCRA metals: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn

* logged on separate lots for 03/28/05

H5C240373

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page <u>1</u> of <u> </u>		
Collected By:			No. of Containers										
Sampling Set: Blanks													
SAMPLE ID	Matrix	Date	Mod. 308 (Allyl)	Seml-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	Dioxins, Furans	REMARKS	LAB USE
DFBA032205RB	Acetone/Meth Cl	3/22/05	1									59.9	
DFBT032205RB	Toluene	3/22/05	1									46.8	
NT032205MB	HNO3	3/22/05	1									81.9	
SVB032205RB	50/50	3/22/05	1									55.4	
① HT031205MB	HNO3	3/23/05	1									286.3	
② NRB032205	HNO3	3/22/05	1									253.3	
HBLK032205RB	H2O2/HNO3	3/22/05	1									249.9	
BT032305MB	NaOH	3/23/05	1									273.9	
FT032305MB	H2SO4	3/23/05	1									304.8	
Notes:													
Relinquished by: <u>W.P. Boyer</u> 3/23/05 16:30			Received By: <u>Mattman J Howard</u> 3-23-05 16:30										

REMARKS ① assumed to be nitric probe rinse method blank
 ② ↓ ↓ reagent blank
 * logged on separate lot

HS C240373

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack				Analyses							Page <u>2</u> of <u> </u>			
Collected By:				No. of Containers		Mod. 308 (Allyl) Semi-Vol (Naph) SW-846-0010 Halides (Cl, F) Metals SW-846-0060 TOE - EPA 0040 VOST SW-846-0031 Dioxins, Furans, PCBs Gravimetric								
Sampling Set: Metals				SAMPLE ID		Matrix		Date		REMARKS			LAB USE	
				NM0318051		0.1 M NHO3		3/18/05		X			230.6	
				5M0318051		low metals quartz		3/18/05		X				
				HM0318051		H2O2/HNO3		3/18/05		X			549.4	
				NM0318052		0.1 M NHO3		3/18/05		X			143.8	
				5M0318052		low metals quartz		3/18/05		X				
				HM0318052		H2O2/HNO3		3/18/05		X			559.0	
				NM0318053		0.1 M NHO3		3/18/05		X			149.9	
				5M0318053		low metals quartz		3/18/05		X				
				HM0318053		H2O2/HNO3		3/18/05		X			528.8	
													Hand dissolved	
													No analytical value	
													revised at ambient temp	
													bld 3-23-05	
Notes:														
Relinquished by: <u>W.P. Geyer</u> 3/23/05 16:30				Received By: <u>Matthew Howard</u> 3-23-05 16:30										

REMARKS: Any 0.1 M NHO3 is assumed to be the probe rinse. 3/23/05 16:30

Chain of Custody Record

H5C240373

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack				Analyses							Page 3 of 3			
Collected By:				No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
SAMPLE ID	Matrix	Date												
NT0318051	0.1 M NHO3 *	3/18/05		1				X					88.4	
5T0318051	low metals quartz	3/18/05		1				X						
HT0318051	H2O2/HNO3	3/18/05		1				X					420.0	
NT0318052	0.1 M NHO3 *	3/18/05		1				X					95.1	
5T0318052	low metals quartz	3/18/05		1				X						
HT0318052	H2O2/HNO3	3/18/05		1				X					550.1	
NT0318053	0.1 M NHO3 *	3/18/05		1				X					87.2	
5T0318053	low metals quartz	3/18/05		1				X						
HT0318053	H2O2/HNO3	3/18/05		1				X					530.7	
Notes:														
Relinquished by: <i>W. P. Copen</i> 3/23/05 16:30				Received By: <i>Matthew Howard</i> 3-23-05 16:30										

REMARKS: * any 0.1M HNO3 is assumed to be the probe rinse.
RO 03/25/05

[illegible]

REMARKS RCRA metals: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn

* logged on separate lot

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack				Analyses								Page 26 of 16 SAME AS PAGE 16			
Collected By:				No. of Containers								REMARKS		LAB USE	
Sampling Set: Semi-Volatile				SAMPLE ID	Matrix	Date	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	
	SVHX0322056	XAD-2	3/22/05	1			X								
	SVHP0322056	FILTER	3/22/05	1			X								
	SVHF0322056	50/50	3/22/05	1			X						103.9		
	SVHB0322056	50/50	3/22/05	1			X						104.8		
	SVHC0322056	Condensate	3/22/05	1			X						93.3		
	SVCX0322056	XAD-2	3/22/05	1			X								
	SVCP0322056	FILTER	3/22/05	1			X								
	SVCF0322056	50/50	3/22/05	1			X						86.2		
	SVCB0322056	50/50	3/22/05	1			X						115.7		
	SVCC0322056	Condensate	3/22/05	1			X						207.1		

Notes:

Relinquished by: *Dr. Keith Matlack* 3/23/05 16:30
 (Signature & Date)

Received By: *Matthew F. Howard* 3-23-05
 (Signature & Date)

REMARKS	DATE
⊗ This submitted COC page is a duplicate but has a different number for the page	FOR 03/28/05

Chain of Custody Record

[illegible]

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack														
Collected By:														
Sampling Set: Dioxin/Furan														
SAMPLE ID	Matrix	Date	No. of Containers	Analyses										
DFTX0322054	XAD-2	3/22/05	1	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric			
DFTP0322054	Filter	3/22/05	1							X				
DFTFA0322054	Acetone/Methylene chloride	3/22/05	1							X			116.1	
DFTFT0322054	Toluene	3/22/05	1							X			84.7	
DFTBA0322054	Acetone/Methylene chloride	3/22/05	1							X			169.4	ORP-51444, Rev. 0
DFTBT0322054	Toluene	3/22/05	1							X			53.4	
DFTC0322054	Condensate	3/22/05	1							X			441.9	

Notes:

Relinquished by: W Corp 3/23/05 Received By: (Signature & Date) (Signature & Date)

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page <u>3</u> of <u>4</u>			
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: Semi-Volatile			SAMPLE ID		Matrix	Date								
			SVMX0322056		XAD-2	3/22/05	X							
			SVMP0322056		FILTER	3/22/05	X							
			SVMF0322056		50/50	3/22/05	X							
			SVMB0322056		50/50	3/22/05	X							
			SVMC0322056		Condensate	3/22/05	X							ORP-51444, Rev. 0
			SVTX0322056		XAD-2	3/22/05	X							
			SVTP0322056		FILTER	3/22/05	X							
			SVTF0322056		50/50	3/22/05	X							
			SVTB0322056		50/50	3/22/05	X							
			SVTC0322056		Condensate	3/22/05	X							
Notes:														
Relinquished by: <i>W. Gough</i> 3/23/05							Received By: (Sig. & Date)							

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page <u>4</u> of <u>4</u>		
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	Dioxins, Furans
Sampling Set: Blanks													
SAMPLE ID	Matrix	Date											
SVTB032205MB	50/50MB	3/22/05	1		X								91.8
SVTP032205MB	SV Filter MB	3/22/05	1		X								
SVTF032205MB	50/50 MB	3/22/05	1		X								59.3
TOTX032205RB	TOE XAD-2 RB	3/22/05	1						X				
TOTP032105RB	TOE Filter RB	3/21/05							X				
SVTX032205MB	SV XAD-2 MB	3/22/05	1		X								
Notes:													
Relinquished by: (Signature & Date)			W Gager 3/23/05					Received By: (Sig. & Date)					

REMARKS

CofC for Test #1 3/9/05

S.O. Vol. as received by JPL
Discrepancies
HSC 110227

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses							Page 8 of 14		
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric
Sampling Set: Semi-Volatile			Date		Matrix							
SAMPLE ID	Matrix	Date										
SVMX0309051	XAD-2		1	✓								
SVMP0309051	filter		1	✓								
SVMF0309051	F 1/2 50/50		1	✓							111.5	
SVMB0309051	B 1/2 50/50		1	✓							53.5	
SVMC0309051	condensate		1	✓							206.4	
SVHX0309051	XAD-2		1	✓								
SVHP0309051	filter		1	✓								
SVHF0309051	F 1/2 50/50		1	✓							85.9	
SVHB0309051	B 1/2 50/50		1	✓							58.1	189.6
SVHC0309051	condensate		1	✓							109.5	
Notes:												
Relinquished by: <i>Dr. P. Geyer</i> 3/10/05 16:40			Received By: <i>Matthew J. Howard</i> 3-10-05 16:40									

REMARKS

Chain of Custody Record

HSC110227

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses							Page <u>10</u> of <u>14</u>		
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric
Sampling Set: Semi-Volatile	SAMPLE ID	Matrix	Date	1	✓	✓	✓	✓	✓	✓	✓	✓
	SVMX0309052	XAD-2	3/9/05	1	✓							
	SVMP0309052	filter	3/9/05	1	✓							
	SVMF0309052	F 1/2 50/50	3/9/05	1	✓						160.8	
	SVMB0309052	B 1/2 50/50	3/9/05	1	✓						68.6	199.8
	SVMC0309052	condensate	3/9/05	1	✓						221.3	
	SVHX0309052	XAD-2	3/9/05	1	✓							
	SVHP0309052	filter	3/9/05	1	✓							
	SVHF0309052	F 1/2 50/50	3/9/05	1	✓						53.0	
	SVHB0309052	B 1/2 50/50	3/9/05	1	✓						43.5	173.0
	SVHC0309052	condensate	3/9/05	1	✓						99.9	
Notes:												
Relinquished by: <u>Dr. P. Geyger</u> 3/10/5 16:40			Received By: <u>Matthew F. Howard</u> 3-10-05 16:40									

REMARKS

HSC110227

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses								Page 11 of 14			
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: Semi-Volatile			SAMPLE ID	Matrix	Date									
			SVCX0309052	XAD-2	3/9/05	1	✓							
			SVCP0309052	filter	3/9/05	1	✓							
			SVCB0309052	F ½ 50/50	3/9/05	1	✓						70.7	
			SVCB0309052	B ½ 50/50	3/9/05	1	✓						27.2	
			SVCC0309052	condensate	3/9/05	1	✓						287.0	
			SVTX0309052	XAD-2	3/9/05	1	✓							
			SVTP0309052	filter	3/9/05	1	✓							
			SVTF0309052	F ½ 50/50	3/9/05	1	✓						49.6	
			SVTB0309052	B ½ 50/50	3/9/05	1	✓						47.0	162.4
			SVTC0309052	condensate	3/9/05	1	✓						317.0	
Notes:														
Relinquished by: <i>W.P. Ceylan</i> 3/10/5 16:40			Received By: <i>Matthew Z. Howell</i> 3-10-05 16:40											

REMARKS

Chain of Custody Record

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Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses							Page <u>12</u> of <u>14</u>		
Collected By: _____			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric
Sampling Set: Semi-Volatile	SAMPLE ID	Matrix	Date									
	SVMX0309053	XAD-2	3/9/05	1	✓							
	SVMF0309053	filter	3/9/05	1	✓							
	SVMF0309053	F ½ 50/50	3/9/05	1	✓						126.0	
	SVMB0309053	B ½ 50/50	3/9/05	1	✓						52.6	183.3
	SVMC0309053	condensate	3/9/05	1	✓						185.9	
	SVHX0309053	XAD-2	3/9/05	1	✓							
	SVHP0309053	filter	3/9/05	1	✓							
	SVHF0309053	F ½ 50/50	3/9/05	1	✓						75.2	
	SVHB0309053	B ½ 50/50	3/9/05	1	✓						45.1	
	SVHC0309053	condensate	3/9/05	1	✓						100.8	
Notes:												
Relinquished by: <u>W.P. Gager</u> 3/10/5 16:10			Received By: <u>Matthew Arnold</u>		(Sig. & Date)		3-10-05 16:40					

REMARKS

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Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses								Page 13 of 14			
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
SAMPLE ID	Matrix	Date												
✓ SVCX0309053	XAD-2	3/9/05	1		✓									
✓ SVCP0309053	filter	3/9/05	1		✓									
✓ SVCF0309053	F ½ 50/50	3/9/05	1		✓								119.1	
✓ SVCB0309053	B ½ 50/50	3/9/05	1		✓								45.6	175.2
✓ SVCC0309053	condensate	3/9/05	1		✓								277.5	
✓ SVTX0309053	XAD-2	3/9/05	1		✓									
✓ SVTP0309053	filter	3/9/05	1		✓									
✓ SVTF0309053	F ½ 50/50	3/9/05	1		✓								105.6	
✓ SVTB0309053	B ½ 50/50	3/9/05	1		✓								53.9	
✓ SVTC0309053	condensate	3/9/05	1		✓								316.4	
Notes:														
Relinquished by: <i>W.P. Beynon</i> 3/10/05 16:40					Received By: <i>Matthew F. Hornum</i>								3-10-05 16:40	

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page ____ of ____			
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
SAMPLE ID	Matrix	Date	1	X	X	X	X	X	X	X	X	X	68.7	68.5
SVMX0322054	XAD-2	3/22/05	1	X	X	X	X	X	X	X	X	X	163.8	110.8
SVMP0322054	FILTER	3/22/05	1	X	X	X	X	X	X	X	X	X	113.3	298.6
SVMF0322054	50/50	3/22/05	1	X	X	X	X	X	X	X	X	X	110.8	113.3
SVMB0322054	50/50	3/22/05	1	X	X	X	X	X	X	X	X	X	110.8	113.3
SVMC0322054	Condensate	3/22/05	1	X	X	X	X	X	X	X	X	X	110.8	113.3
SVTX0322054	XAD-2	3/22/05	1	X	X	X	X	X	X	X	X	X	110.8	113.3
SVTP0322054	FILTER	3/22/05	1	X	X	X	X	X	X	X	X	X	110.8	113.3
SVTF0322054	50/50	3/22/05	1	X	X	X	X	X	X	X	X	X	110.8	113.3
SVTB0322054	50/50	3/22/05	1	X	X	X	X	X	X	X	X	X	110.8	113.3
SVTC0322054	Condensate	3/22/05	1	X	X	X	X	X	X	X	X	X	110.8	113.3
Notes:														
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)											

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page _____ of _____	
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric
Sampling Set: Semi-Volatile			SAMPLE ID	Matrix	Date							
			SVHX0322054	XAD-2	3/22/05	1	X					
			SVHP0322054	FILTER	3/22/05	1	X					
			SVHF0322054	50/50	3/22/05	1	X					71.1
			SVHB0322054	50/50	3/22/05	1	X					44.2
			SVHC0322054	Condensate	3/22/05	1	X					104.7
			SVCX0322054	XAD-2	3/22/05	1	X					
			SVCP0322054	FILTER	3/22/05	1	X					
			SVCF0322054	50/50	3/22/05	1	X					88.0
			SVCB0322054	50/50	3/22/05	1	X					61.1
			SVCC0322054	Condensate	3/22/05	1	X					226.1
Notes:												
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)									

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page ____ of ____			
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph. SW-846-0010)	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: Semi-Volatile			SAMPLE ID		Matrix	Date								
			SVMX0322055		XAD-2	3/22/05								
			SVMP0322055		FILTER	3/22/05								
			SVMF0322055		50/50	3/22/05	X						155.4	
			SVMB0322055		50/50	3/22/05	X						134.1	
			SVMC0322055		Condensate	3/22/05	X						172.8	
			SVTX0322055		XAD-2	3/22/05	X							ORP-51444, Rev. 0
			SVTP0322055		FILTER	3/22/05	X							
			SVTF0322055		50/50	3/22/05	X						57.8	
			SVTB0322055		50/50	3/22/05	X						52.5	
			SVTC0322055		Condensate	3/22/05	X						315.9	
Notes:														
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)											

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page ____ of ____			
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: Semi-Volatile			SAMPLE ID		Matrix	Date								
			SVHX0322055		XAD-2	3/22/05		X						
			SVHP0322055		FILTER	3/22/05		X						
			SVHF0322055		50/50	3/22/05		X					127.8	
			SVHB0322055		50/50	3/22/05		X					90.8	
			SVHC0322055		Condensate	3/22/05		X					229.6	
			SVCX0322055		XAD-2	3/22/05		X						ORP-51444, Rev. 0
			SVCPO322055		FILTER	3/22/05		X						
			SVCFO322055		50/50	3/22/05		X					172.3	
			SVCBO322055		50/50	3/22/05		X					106.3	
			SVCC0322055		Condensate	3/22/05		X					99.4	
Notes:														
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)											

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Page _____ of _____	
Collected By: _____				
Sampling Set: Semi-Volatile				
SAMPLE ID	Matrix	Date		
SVMX0322056	XAD-2	3/22/05		
SVMP0322056	FILTER	3/22/05		
SVMF0322056	50/50	3/22/05		
SVMB0322056	50/50	3/22/05		
SVMC0322056	Condensate	3/22/05		
SVTX0322056	XAD-2	3/22/05		
SVTP0322056	FILTER	3/22/05		
SVTF0322056	50/50	3/22/05		
SVTB0322056	50/50	3/22/05		
SVTC0322056	Condensate	3/22/05		
Notes:				
Relinquished by: _____			Received By: _____	
(Signature & Date)			(Sig. & Date)	

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page ____ of ____			
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: Semi-Volatile														
SAMPLE ID	Matrix	Date												
SVHX0322056	XAD-2	3/22/05			1	X								
SVHP0322056	FILTER	3/22/05			1	X								
SVHF0322056	50/50	3/22/05			1	X						103.9		
SVHB0322056	50/50	3/22/05			1	X						104.8		
SVHC0322056	Condensate	3/22/05			1	X						93.3		
SVCX0322056	XAD-2	3/22/05			1	X								
SVCP0322056	FILTER	3/22/05			1	X								
SVCF0322056	50/50	3/22/05			1	X						86.2		
SVCB0322056	50/50	3/22/05			1	X						115.7		
SVCC0322056	Condensate	3/22/05			1	X						207.1		
Notes:														
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)											

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page ____ of ____			
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	Dioxins, Furans	
SAMPLE ID SVMF0322056	Matrix 50/50	Date 3/22/05	1		X								REMARKS 111.8	LAB USE
SVMFT0322056	Toluene	3/22/05	1		X								104.6	
SVMFP0322056	Filter	3/22/05	1		X									
SVMCP0322056	Condensate	3/22/05	1		X								171.5	
SVMBP0322056	50/50	3/22/05	1		X								126.6	
SVMBT0322056	Toluene	3/22/05	1		X								96.2	
SVTTF0322056	50/50	3/22/05	1		X								104.2	
SVTFT0322056	Toluene	3/22/05	1		X								66.7	
SVTTP0322056	Filter	3/22/05	1		X									
SVTTC0322056	Condensate	3/22/05	1		X								286.5	
SVTBP0322056	50/50	3/22/05	1		X								91.4	
SVTBT0322056	Toluene	3/22/05	1		X								80.6	
Notes:														
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)											

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack						Page _____ of _____								
Collected By:														
Sampling Set: FEED/SBS														
SAMPLE ID	Matrix	Date	No. of Containers	Analyses								REMARKS	LAB USE	
F-12F-21A		3/22/05	1	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	115.1		
F-12F-104A		3/22/05	1									111.8		
S-12F-141A		3/22/05	1									70.2		
S-12F-102A		3/22/05	1									67.32		
													ORP-51444 Rev. 0	
Notes:														
Relinquished by: _____ Received By: _____ (Signature & Date) (Sig. & Date)														

REMARKS RCRA metals: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn

Chain of Custody Record

[illegible]

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page ____ of ____		
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	Dioxins, Furans
Sampling Set: Blanks	SAMPLE ID	Matrix	Date										
	DFBA032205RB	Acetone/Meth Cl	3/22/05	1									59.9
	DFBT032205RB	Toluene	3/22/05	1									46.8
	NT032205MB	HNO3	3/22/05	1									81.9
	SVB032205RB	50/50	3/22/05	1									55.4
	HT031205MB	HNO3	3/23/05	1									286.3
	NRB032205	HNO3	3/22/05	1									253.3
	HBLK032205RB	H2O2/HNO3	3/22/05	1									249.9
	BT032305MB	NaOH	3/23/05	1									273.9
	FT032305MB	H2SO4	3/23/05	1									304.8
Notes:													
Relinquished by: (Signature & Date)				Received By: (Sig. & Date)				ORP-51444, Rev. 0					

REMARKS

Chain of Custody Record

[illegible]

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B			Page _____ of _____										
Collected By: Dr. Keith Matlack													
Sampling Set: VOST													
SAMPLE ID	Matrix	Date	No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
VM0320051A		3/20/05	3						X				
VM0320051B		3/20/05	3						X				
VM0320051C		3/20/05	3						X				
VM0320051D		3/20/05	4						X				
VT0320051A		3/20/05	3						X				ORP-51444 Rev. 0
VT0320051B		3/20/05	3						X				
VT0320051C		3/20/05	3						X				
VT0320051D		3/20/05	4						X				
Notes:													
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)										

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page ____ of ____		
Collected By:			No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: VOST													
SAMPLE ID	Matrix	Date											
VM0320052A		3/20/05	3						X				
VM0320052B		3/20/05	3						X				
VM0320052C		3/20/05	3						X				
VM0320052D		3/20/05	4						X				
VT0320052A		3/20/05	3						X				
VT0320052B		3/20/05	3						X				
VT0320052C		3/20/05	4						X				
Notes:													
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)										

REMARKS

Chain of Custody Record

[illegible]

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack						Page _____ of _____											
Collected By:						Analyses								REMARKS	LAB USE		
						No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE – EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs			Gravimetric	
Sampling Set: VOST						SAMPLE ID	Matrix	Date									
						VM0320054A		3/20/05	3			X					
						VM0320054B		3/20/05	3			X					
						VM0320054C		3/20/05	3			X					
						VM0320054D		3/20/05	4			X					
						VT0320054A		3/20/05	3			X					
						VT0320054B		3/20/05	3			X					
						VT0320054C		3/20/05	3			X					
						VT0320054D		3/20/05	4			X					
Notes:																	
Relinquished by:						Received By:											
(Signature & Date)						(Sig. & Date)											

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack						Page _____ of _____										
			No. of Containers	Analyses								REMARKS	LAB USE			
				Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE – EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric					
Collected By:			SAMPLE ID	Matrix	Date											
Sampling Set: VOST			VM032005A		3/20/05					X						
			VM032005B		3/20/05					X						
			VM032005C		3/20/05					X						
			VM032005D		3/20/05					X						
			VT032005A		3/20/05					X				ORP-51444, Rev. 0		
			VT032005B		3/20/05					X						
			VT032005C		3/20/05					X						
Notes:																
Relinquished by: _____ Received By: _____ (Signature & Date) (Sig. & Date)																

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack						Analyses								Page _____ of _____							
Collected By:						No. of Containers						Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE – EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric		
Sampling Set: VOST						SAMPLE ID	Matrix	Date										REMARKS	LAB USE		
						VM0320056A		3/20/05										X			
						VM0320056B		3/20/05										X			
						VM0320056C		3/20/05										X			
						VM0320056D		3/20/05										X			
						VT0320056A		3/20/05										X			
						VT0320056B		3/20/05										X			
						VT0320056C		3/20/05										X			
						VT0320056D		3/20/05										X			
						VM032005MB		3/20/05										X			
						VT032005MB		3/20/05										X			
Notes:																					
Relinquished by: (Signature & Date)						Received By: (Sig. & Date)															

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #2A+2B Dr. Keith Matlack			Analyses								Page _____ of _____	
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric
Sampling Set: TOE												
SAMPLE ID	Matrix	Date										
TOTX0321051	XAD-2	3/21/05			1							
TOTP0321051	Filter	3/21/05			1							
TOTF0321051	50/50	3/21/05			1						90.3	
TOTB0321051	50/50	3/21/05			1						55.4	
TOTC0321051	Condensate	3/21/05			1						179.1	
TOTC0321051	Condensate	3/21/05			1						24.2	
Notes:			ORP-51444, Rev. 0									
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)									

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Page _____ of _____											
Collected By: _____														
Sampling Set: Metals														
SAMPLE ID	Matrix	Date	No. of Containers	Analyses								REMARKS	LAB USE	
NM0308051	0.1 M NHO3	3/8/05	1										167.8	
NT0308051	0.1 M NHO3	3/8/05	1										154.5	
NM0308052	0.1 M NHO3	3/8/05	1										160.3	
NT0308052	0.1 M NHO3	3/8/05	1										152.7	
NM0308053	0.1 M NHO3	3/8/05	1										120.9	
NT0309053	0.1 M NHO3	3/8/05	1										59.8	ORP-51444, Rev. 0
5M0308051	low metals quartz	3/8/05	1											
5T0308051	low metals quartz	3/8/05	1											
5M0308052	low metals quartz	3/8/05	1											
5T0308052	low metals quartz	3/8/05	1											
5M0308053	low metals quartz	3/8/05	1											
5T0309053	low metals quartz	3/8/05	1											
Notes:														
Relinquished by: _____				Received By: _____										
(Signature & Date)				(Sig. & Date)										

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Page _____ of _____											
Collected By:														
Sampling Set: Metals														
SAMPLE ID	Matrix	Date	No. of Containers	Analyses								REMARKS	LAB USE	
HM0308051	H2O2/HNO3	3/8/05	1	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric		559.2	
HT0308051	H2O2/HNO3	3/8/05	1				✓						548.0	
HM0308052	H2O2/HNO3	3/8/05	1				✓						560.8	
HT0308052	H2O2/HNO3	3/8/05	1				✓						494.1	
HM0308053	H2O2/HNO3	3/8/05	1				✓						553.4	
HT0309053	H2O2/HNO3	3/8/05	1				✓						517.9	
														ORP-51444, Rev. 0
Notes:														
Relinquished by: (Signature & Date)				Received By: (Sig. & Date)										

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses								Page ____ of ____		
Collected By:			No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: Halogens													
SAMPLE ID	Matrix	Date											
WM0309051	H2O	3/9/05	1			✓						171.3	
WT0309051	H2O	3/9/05	1			✓						143.1	
WM0309052	H2O	3/9/05	1			✓						181.3	
WT0309052	H2O	3/9/05	1			✓						187.4	
WM0309053	H2O	3/9/05	1			✓						291.6	ORP-51444, Rev. 0
WT0309053	H2O	3/9/05	1			✓						232.1	
26M0309051	M-26 filter	3/9/05	1			✓							
26T0309051	M-26 filter	3/9/05	1			✓							
26M0309052	M-26 filter	3/9/05	1			✓							
26T0309052	M-26 filter	3/9/05	1			✓							
26M0309053	M-26 filter	3/9/05	1			✓							
26T0309053	M-26 filter	3/9/05	1			✓							
Notes:													
Relinquished by:			Received By:										
(Signature & Date)			(Sig. & Date)										

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Page ____ of ____										
Collected By:													
Sampling Set: Halogens													
SAMPLE ID	Matrix	Date	No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
FM0309051	H2SO4	3/9/05	1			✓						512.1	
FT0309051	H2SO4	3/9/05	1			✓						442.5	
FM0309052	H2SO4	3/9/05	1			✓						521.7	
FT0309052	H2SO4	3/9/05	1			✓						462.1	
FM0309053	H2SO4	3/9/05	1			✓						521.2	ORP-51444, Rev. 0
FT0309053	H2SO4	3/9/05	1			✓						487.6	
BM0309051	NaOH	3/9/05	1			✓						299.7	
BT0309051	NaOH	3/9/05	1			✓						332.8	
BM0309052	NaOH	3/9/05	1			✓						327.7	
BT0309052	NaOH	3/9/05	1			✓						296.1	
BM0309053	NaOH	3/9/05	1			✓						345.9	
BT0309053	NaOH	3/9/05	1			✓						323.4	
Notes:													
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)										

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1			Analyses								Page ____ of ____			
Collected By: Dr. Keith Matlack			No. of Containers		Mod. 308 (Allyl)	SW-846-0010 (Naph.)	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: Semi-Volatile														
SAMPLE ID	Matrix	Date												
SVMX0309051	XAD-2		1											
SVMF0309051	filter		1											
SVMF0309051	F ½ 50/50		1										111.5	
SVMB0309051	B ½ 50/50		1										53.5	
SVMC0309051	condensate		1										206.4	
SVHX0309051	XAD-2		1											ORP-51444, Rev. 0
SVHP0309051	filter		1											
SVHF0309051	F ½ 50/50		1										85.9	
SVHB0309051	B ½ 50/50		1										58.1	
SVHC0309051	condensate		1										109.5	
Notes:														
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)											

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses								Page ____ of ____			
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric		
Sampling Set: Semi-Volatile			SAMPLE ID	Matrix	Date									
			SVCX0309051	XAD-2	3/9/05	1	✓							
			SVCP0309051	filter	3/9/05	1	✓							
			SVCF0309051	F ½ 50/50	3/9/05	1	✓						86.4	
			SVCB0309051	B ½ 50/50	3/9/05	1	✓						62.7	
			SVCC0309051	condensate	3/9/05	1	✓						293.2	ORP-51444, Rev. 0
			SVTX0309051	XAD-2	3/9/05	1	✓							
			SVTP0309051	filter	3/9/05	1	✓							
			SVTF0309051	F ½ 50/50	3/9/05	1	✓						101.4	
			SVTB0309051	B ½ 50/50	3/9/05	1	✓						38.4	
			SVTC0309051	condensate	3/9/05	1	✓						321.0	
Notes:														
Relinquished by: (Signature & Date)						Received By: (Sig. & Date)								

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses								Page ____ of ____		
Collected By:			No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: Semi-Volatile													
SAMPLE ID	Matrix	Date											
SVMX0309052	XAD-2	3/9/05	1	✓									
SVMP0309052	filter	3/9/05	1	✓									
SVMF0309052	F ½ 50/50	3/9/05	1	✓								160.8	
SVMB0309052	B ½ 50/50	3/9/05	1	✓								68.6	
SVMC0309052	condensate	3/9/05	1	✓								221.3	ORP-51444, Rev. 0
SVHX0309052	XAD-2	3/9/05	1	✓									
SVHP0309052	filter	3/9/05	1	✓									
SVHF0309052	F ½ 50/50	3/9/05	1	✓								53.0	
SVHB0309052	B ½ 50/50	3/9/05	1	✓								43.5	
SVHC0309052	condensate	3/9/05	1	✓								99.9	
Notes:													
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)										

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses								Page ____ of ____		
Collected By:			No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: Semi-Volatile													
SAMPLE ID	Matrix	Date											
SVCX0309052	XAD-2	3/9/05	1	✓									
SVCP0309052	filter	3/9/05	1	✓									
SVCF0309052	F ½ 50/50	3/9/05	1	✓								70.7	
SVCB0309052	B ½ 50/50	3/9/05	1	✓								27.2	
SVCC0309052	condensate	3/9/05	1	✓								287.0	ORP-51444, Rev. 0
SVTX0309052	XAD-2	3/9/05	1	✓									
SVTP0309052	filter	3/9/05	1	✓									
SVTF0309052	F ½ 50/50	3/9/05	1	✓								49.6	
SVTB0309052	B ½ 50/50	3/9/05	1	✓								47.0	
SVTC0309052	condensate	3/9/05	1	✓								317.0	
Notes:													
Relinquished by:			Received By:										
(Signature & Date)			(Sig. & Date)										

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses								Page _____ of _____			
Collected By:			No. of Containers		Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: Semi-Volatile			SAMPLE ID	Matrix	Date									
			SVCX0309053	XAD-2	3/9/05	1	✓							
			SVCP0309053	filter	3/9/05	1	✓							
			SVCF0309053	F ½ 50/50	3/9/05	1	✓						119.1	
			SVCB0309053	B ½ 50/50	3/9/05	1	✓						45.6	
			SVCC0309053	condensate	3/9/05	1	✓						277.5	ORP-51444, Rev. 0
			SVTX0309053	XAD-2	3/9/05	1	✓							
			SVTP0309053	filter	3/9/05	1	✓							
			SVTF0309053	F ½ 50/50	3/9/05	1	✓						105.6	
			SVTB0309053	B ½ 50/50	3/9/05	1	✓						53.9	
			SVTC0309053	condensate	3/9/05	1	✓						316.4	
Notes:														
Relinquished by: (Signature & Date)			Received By: (Sig. & Date)											

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack			Analyses								Page _____ of _____			
Collected By:			No. of Containers		Mod. 308 (Allyl)	SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE - EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric	REMARKS	LAB USE
Sampling Set: METALS			SAMPLE ID	Matrix	Date									
			NT031005MB	0.1M NHO3	3/10/05	1			✓				224.6	
			5T031005MB	Low metals quartz	3/10/05	1			✓					
			HT031005MB	H2O2/HNO3	3/10/05	1			✓				309.0	
			NT031005RB	0.1M NHO3	3/10/05	1			✓				286.2	
			5T031005RB	Low metals quartz	3/10/05	1			✓					
			HT031005RB	H2O2/HNO3	3/10/05	1			✓				298.7	ORP-51444, Rev. 0
Notes:														
Relinquished by: (Signature & Date)						Received By: (Sig. & Date)								

REMARKS

Chain of Custody Record

Project: VSL DM1200 LAW MACT Test #1 Dr. Keith Matlack						Page ____ of ____								
Collected By:														
Sampling Set: HALOGENS														
SAMPLE ID	Matrix	Date	Analyses							REMARKS	LAB USE			
WT031005MB	H ₂ O	3/10/05	No. of Containers	Mod. 308 (Allyl)	Semi-Vol (Naph.) SW-846-0010	Halides (Cl, F)	Metals SW-846-0060	TOE – EPA 0040	VOST SW-846-0031	Dioxins, Furans, PCBs	Gravimetric		175.2	
" 26T031005MB	M-26 Filter	3/10/05	1			✓	✓							
FT031005MB	H ₂ SO ₄	3/10/05	1			✓	✓						247.6	
BT031005MB	NaOH	3/10/05	1			✓	✓						285.3	
WT031005RB	H ₂ O	3/10/05	1			✓	✓						262.6	ORP-51444 Rev. 0
26T031005RB	M-26 Filter	3/10/05	1			✓	✓							
FT031005RB	H ₂ SO ₄	3/10/05	1			✓	✓						238.4	
BT031005RB	NaOH	3/10/05	1			✓	✓						284.3	
Notes:														
Relinquished by:			Received By:											
(Signature & Date)			(Sig. & Date)											

REMARKS

Appendix D

Meter Box Calibrations

3/30/5

ORP-51444, Rev. 0

CUA Post

V-2

 $P_b = 29.85$

①	θ	V_{mi}	Q_i	T_{mi}	T_{ai}	V_{mf}	Q_f	T_{mf}	T_{af}
	9.09	16.95	400/38.5 400/38.7	12/70	71	22.55	400/39.2 400/39.0	74/72	71
		$Q = .613 \text{ SLPm}$ $y_d = 1.0046$							

②	27.55	23.00	400/39.0 400/39.0	74/72	71	40.35	400/38.2 400/37.9	82/80	73
---	-------	-------	----------------------	-------	----	-------	----------------------	-------	----

$$Q = .617 \text{ SLPm} \quad y_d = .9987$$

③	10.47	40.6	400/37.9 400/38.1	82/80	73	47.25	400/38.4 400/38.0	84/82	73
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$$Q = .622 \text{ SLPm} \quad y_d = 1.0085$$

3/30/5

ORP-51444, Rev. 0

Curt Post

N-1

 $P_b = 29.85$

	θ	V_{in}	T_{in}	T_{ai}	Q_i	V_{mf}	T_{mf}	T_{af}	Q_F
①	8.1"	39.70	80/80	71	300/25.3 400/34.2	45.20	80/80	72	400/34.3 400/34.1
					$Q = .690 \text{ SLPM}$		$\gamma = 1.0536$		
②	7.4"	45.7	80/80	72	400/34.2 400/34.0	50.70	80/81	72	400/33.8 400/34.2
					$Q = .698 \text{ SLPM}$		$\gamma_d = 1.0589$		
③	11.2	51.1	81/81	72	400/34.2 400/34.0	58.65	81/81	72	400/34.1 400/34.6
					$Q = \frac{0.694}{0.701} \text{ SLPM}$		$\gamma_d = 1.0579$		

3/30/5

ORP-51444, Rev. 0

CUA Post

Meter S.#

		l	ml/sec	°C	°C	l	°C	°C	ml/sec
	⊖	V_{mi}	Q_i	T_{mi}	T_{ai}	V_{mf}	T_{mf}	T_{af}	Q_f
①	10.68	49.6	400/38.2	18/15	15	56.20	19/17	15	400/38.2
			400/38.3						400/38.5

$$Q = .636 \text{ SLPM}$$

$$y_d = 1.0219$$

②	11.00	56.45	400/38.4	19/17	15	63.2	20/18	16	400/38.6
			400/38.2						400/38.6

$$Q = \frac{.632}{.679} \text{ SLPM}$$

$$y_d = \frac{1.0252}{1.0278}$$

③	11.85	63.6	400/38.6	20/18	16	70.85	23/20	16	400/38.3
			400/38.7						400/38.4

$$Q = .630$$

$$y_d = 1.0294$$

3/20/5

ORP-51444, Rev. 0

CUA Post Test

Reed Sand #1575

$$P_b = 29.83$$

①

V _{ini} (L)	Q _g (ml/sec)	T _{ini} (°C)	T _a (°C)	V _{mf} (L)	T _{mf} (°C)
46.20	300/28.75	15/12	10	51.6	16/13
	400/37.5		12		
	400/37.2				
	400/37.1				
	400/37.6				
	400/37.1				

$\Theta = 8.50 \text{ min}$
 $Q = \text{H. ~~0.45~~ } 0.661 \text{ slpm}$
 $\gamma_b = \text{1.058 } 1.0221$

②

52.2	400/37.1	16/13	12	62.51	16/18
	300/28.8		13		
	400/37.7				
	400/36.7				

$Q = .656 \text{ slpm}$
 $\gamma_b = 1.0256$
 $\Theta = 16.32''$

③

63.20	400/37.0	19/16	13	69.20	20/17
	400/37.4	20/17	13		
	400/37.8				
	400/37.6				

$Q = .655 \text{ slpm}$
 $\Theta = 9.50''$
 $\gamma = 1.0324$

Post CUA

ORP-51444, Rev. 0

ATC

$P_b = 29.00$

# 52	$\ominus$	T_o	V_{mi}	T_{mi}	V_{mf}	T_{mf}	ΔH	"H _g
①	10.25	67	19.300	67/66	27.67	68/66	1.7	19
②	14.00	67	27.67	68/66	39.08	70/68	1.7	19
③	18.15	68	39.08	70/68	47.83	72/69	1.7	19

52

ATD

	$\ominus$	T_o	V_{mi}	T_{mi}	V_{mf}	T_{mf}	ΔH	"H _g
①	10	68/68	34.60	65/64	42.56	67/65	1.8	17
②	10	68/69	42.56	67/65	50.48	69/66	1.8	17
③	10	69/68	50.48	69/64	58.41	70/68	1.8	17

52

ATA

	$\ominus$	T_o	V_{mi}	T_{mi}	V_{mf}	T_{mf}	ΔH	"H _g
①	15	68/66	82.100	67/66	93.86	69/68	1.8	18
②	15	66/65	93.86	69/68	105.62	68/70	1.8	18
③	15	65/64	5.62	70/68	17.39	71/69	1.8	18

52

ATB

$P_b = 28.95$

	$\ominus$	T_o	V_{mi}	T_{mi}	V_{mf}	T_{mf}	ΔH	"H _g
①	10	66/65	39.50	67/67	47.58	67/67	1.8	21
②	20.10	65/65	47.58	67/67	55.66	69/67	1.8	21
③	15	65/64	55.66	69/67	67.75	72/69	1.8	21

Method 5 Dry Gas Meter Calibrations For:

CUA

**** POST CALIBRATION ****

Air-Tech

- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 3/28/05		METER SERIAL #: 1375		BAROMETRIC PRESSURE (in Hg): 29		INITIAL 29		FINAL 29		AVG (P _{bar}) 29		Pre Test "YD" = 1.0175		DH = 1.7282	
METER PART #: ATA		CRITICAL ORIFICE SET SERIAL #:										IF Y VARIATION EXCEEDS 5.00%,			
												ORIFICE SHOULD BE RECALIBRATED			

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT ³)				TEMPERATURES °F				DGM ΔH (in H ₂ O)	VARI (%)				ΔH _g
				INITIAL	FINAL	NET (V _m)	AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL		(1) V _m (STD)	(2) V _{cr} (STD)	(3) Y	Y	
52	1	0.6051	18	82.10	93.860	11.760	67	67	66	69	68	1.8	11.4634	11.4694	1.0005		1.6886
52	2	0.6051	18	93.860	105.620	11.760	65.5	69	68	70	68	1.8	11.4363	11.4857	1.0043		1.6793
52	3	0.6051	18	5.620	17.390	11.770	64.5	90	68	71	69	1.8	11.3228	11.4967	1.0154		1.6581
													AVG = 1.0067		-1.06		

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 1.0067

AVERAGE ΔH_g = 1.6752

$$(1) V_m (std) = K_1 V_m \frac{P_{bar} + (\Delta H/13.6)}{T_m} = \text{Net volume of gas sample passed through DGM, corrected to standard conditions}$$

$$K_1 = 17.64 \text{ } ^\circ\text{R/in. Hg (English), } 0.3858 \text{ } ^\circ\text{K/mm Hg (Metric)}$$

$$T_m = \text{Absolute DGM avg. temperature (} ^\circ\text{R - English, } ^\circ\text{K - Metric)}$$

$$(2) V_{cr} (std) = K' \sqrt{\frac{P_{bar}}{T_{amb}}} = \text{Volume of gas sample passed through the critical orifice, corrected to standard conditions}$$

$$T_{amb} = \text{Absolute ambient temperature (} ^\circ\text{R - English, } ^\circ\text{K - Metric)}$$

K' = Average K' factor from Critical Orifice Calibration

$$(3) Y = \frac{V_{cr} (std)}{V_m (std)} = \text{DGM calibration factor}$$

$$\Delta H_g = \frac{0.75 \theta}{V_{cr}(std)} \Delta H \frac{V_m(std)}{V_m}$$

Method 5 Dry Gas Meter Calibrations For:

CUA

**** POST CALIBRATION ****

- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report) for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record readings in outlined boxes below, other columns are automatically calculated.

Air-Tech

DATE: 3/28/05		METER SERIAL #: 1375		INITIAL 28.95		FINAL 28.95		AVG (P _{bar}) 28.95		Pre Test "VD" = 1.008		DH = 1.6904	
METER PART #: ATB		CRITICAL ORIFICE SET SERIAL #:		BAROMETRIC PRESSURE (in Hg):						IF Y VARIATION EXCEEDS 5.00%,			
										ORIFICE SHOULD BE RECALIBRATED			

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT ³)				TEMPERATURES °F				ELAPSED TIME (MIN)	DGM ΔH (in H ₂ O)	(1) V _m (STD)	(2) V _a (STD)	(3) Y	VARI (%)	ΔH _g
				INITIAL	FINAL	NET (V _m)		AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL						
52	1	0.6051	21	39.50	47.580	8.080		65.5	67	67	67	67	10.00	1.8	7.8702	7.6439	0.9713	1.6878
52	2	0.6051	21	47.580	55.660	8.080		65	67	67	69	67	10.00	1.8	7.8627	7.6476	0.9726	1.6846
52	3	0.6051	21	55.660	67.750	12.090		64.5	69	67	72	69	15.00	1.8	11.7259	11.4768	0.9788	1.6775
														AVG = 0.9742		-3.35		

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_a (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.9742

AVERAGE ΔH_g = 1.6833

$$(1) V_m (std) = K_1 V_m \frac{P_{bar} + (\Delta H / 13.6)}{T_m} = \text{Net volume of gas sample passed through DGM, corrected to standard conditions}$$

K₁ = 17.64 °R/in. Hg (English), 0.3859 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

$$(2) V_a (std) = K' \sqrt{\frac{P_{bar}}{T_{amb}}} = \text{Volume of gas sample passed through the critical orifice, corrected to standard conditions}$$

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

$$(3) Y = \frac{V_a (std)}{V_m (std)} = \text{DGM calibration factor}$$

$$\Delta H_g = \frac{Q_{75\%}}{V_a (std)} \Delta H \frac{V_m (std)}{V_m}$$

4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: **3/28/05** METER SERIAL #: **1375** METER PART #: **ATC**

CRITICAL ORIFICE SET SERIAL #: **1375**

INITIAL **29** FINAL **29** AVG (P_{bar}) **29** Pre Test "YD" = **0.999** DH = **1.6719**

BAROMETRIC PRESSURE (in Hg): **29** IF Y VARIATION EXCEEDS 5.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	TEMPERATURES °F				ELAPSED TIME (MIN)	DGM ΔH (in H ₂ O)	VARI (%)				ΔH _g
				AMBIENT	DGM INLET	DGM OUTLET	DGM AVG			(1) V _m (STD)	(2) V _{cr} (STD)	(3) Y	Y	
52	1	0.6051	19	67	67	68	66	10.25	1.7	8.1685	7.8374	0.9595		1.5962
52	2	0.6051	19	67	68	70	68	14.00	1.7	11.1089	10.7047	0.9636		1.5924
52	3	0.6051	19	68	70	72	69	10.75	1.7	8.4909	8.2119	0.9671		1.5902

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = **0.9634** -3.56

AVERAGE ΔH_g = **1.5929**

(1) $V_m (std) = K' V_m \frac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions

$K' = 17.64 \text{ } ^\circ R/in. Hg \text{ (English), } 0.3858 \text{ } ^\circ K/mm Hg \text{ (Metric)}$
 T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $V_{cr} (std) = K' \sqrt{\frac{P_{bar} \theta}{T_{amb}}}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) $Y = \frac{V_{cr} (std)}{V_m (std)}$ = DGM calibration factor

$\Delta H_g = \frac{0.75 \theta}{V_{cr} (std)} \Delta H \frac{V_m (std)}{V_m}$

Method 5 Dry Gas Meter Calibrations For:

CUA

**** POST CALIBRATION ****

- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record readings in outlined boxes below; other columns are automatically calculated.

Air-Tech

DATE: 3/28/05		METER SERIAL #: ATD		METER SERIAL #: 1375		CRITICAL ORIFICE SET SERIAL #:		INITIAL 29		FINAL 29		AVG (P _{bar}) 29		Pre Test "YD" = 1.0248		DH = 1.809	
BAROMETRIC PRESSURE (in Hg): IF Y VARIATION EXCEEDS 5.00%, ORIFICE SHOULD BE RECALIBRATED																	
ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT ³)		TEMPERATURES °F				ELAPSED TIME (MIN)	DGM ΔH (in H ₂ O)	(1) V _m (STD)	(2) V _a (STD)	(3) Y	VARI (%)	ΔH _e	
				INITIAL	FINAL	NET (V _m)	AMBIENT	DGM INLET INITIAL	DGM INLET FINAL								DGM OUTLET INITIAL
52	1	0.6051	17	34.60	42.560	7.960	68	65	64	67	65	10.00	1.8	7.7925	7.6390	0.9803	1.6986
52	2	0.6051	17	42.560	50.480	7.920	68.5	66	69	69	68	10.00	1.8	7.7129	7.6354	0.9899	1.6913
52	3	0.6051	17	50.480	58.410	7.930	98.5	70	68	69	68	10.00	1.8	7.7117	7.4274	0.9631	1.7849
													AVG = 0.9778		-4.59		

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_a (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.9778

AVERAGE ΔH_e = 1.7249

$$(1) V_m (std) = K_1 V_m \frac{P_{bar} + (\Delta H / 13.6)}{T_m} = \text{Net volume of gas sample passed through DGM, corrected to standard conditions}$$

$$K_1 = 17.64 \text{ } ^\circ\text{R/in. Hg (English), } 0.3858 \text{ } ^\circ\text{K/mm Hg (Metric)}$$

$$T_m = \text{Absolute DGM avg. temperature (} ^\circ\text{R - English, } ^\circ\text{K - Metric)}$$

$$(2) V_a (std) = K' \sqrt{\frac{P_{bar} \theta}{T_{amb}}} = \text{Volume of gas sample passed through the critical orifice, corrected to standard conditions}$$

$$T_{amb} = \text{Absolute ambient temperature (} ^\circ\text{R - English, } ^\circ\text{K - Metric)}$$

$$K' = \text{Average K' factor from Critical Orifice Calibration}$$

$$(3) Y = \frac{V_a (std)}{V_m (std)} = \text{DGM calibration factor}$$

Rental Vost Box

ENVIRONMENTAL SUPPLY COMPANY

2142 E. Geer Street, Durham, North Carolina 27704
(919) 958-9688 • FAX: (919) 682-0333

Date: 1/4/2005
Model: ROCKWELL S-110
S/N: 1575
DGM S/N: 916337

Reference Meter
Type: American
Model: DTM-115
Yc: 1.000

Barometric Pressure (in Hg) 29.78

UNI-VOS CONSOLE

Rotameter (ppm)	DGM Initial (liters)	DGM Final (liters)	Volume Total (liters)	DGM Temp. Initial (°C)	DGM Temp. Final (°C)	Average Temp. (°F)	DGM Pressure (in H ₂ O)
1.8	10.780	17.870	7.090	16.0	17.0	61.7	2
	17.870	24.930	7.060	16.5	17.0	62.2	2
	24.930	32.170	7.240	17.0	18.0	63.5	2
1	32.860	40.490	7.630	17.0	19.0	64.4	1.1
	40.490	47.950	7.460	19.0	19.5	66.7	1.1
	47.950	55.450	7.500	19.5	20.0	67.6	1.1
0.5							

REFERENCE METER

Volume Initial (liters)	Volume Final (liters)	Volume Total (liters)	Temperature (°F)	Yc	Yc Avg	% deviation
566.075	573.640	8.965	61	0.979	0.984	0.5%
573.640	580.610	6.970	61	0.985		-0.1%
580.610	587.765	7.155	61	0.888		-0.4%
588.390	595.760	7.370	61	0.970		1.1%
595.760	603.120	7.360	62.5	0.992	0.981	-1.1%
603.120	610.425	7.305	62.5	0.981		0.0%

Calibration performed by:

Rental Post Box

ENVIRONMENTAL SUPPLY COMPANY
 2142 E. Geer Street, Durham, North Carolina 27704
 (919) 956-9688 • FAX: (919) 582-0333

Date: 1/4/2005
 Model: ROCKWELL S-110
 S/N: 1574
 DGM S/N: 933064

120VAC

Barometric Pressure (in Hg): 29.90

Reference Meter:
 Type: American
 Model: DTM-115
 Y_c: 1.000

UNI-VOS CONSOLE

REFERENCE METER

Rotameter (gpm)	DGM Initial (liters)	DGM Final (liters)	Volume Total (liters)	DGM Temp. Initial (°C)	DGM Temp. Final (°C)	Average Temp. (°F)	DGM Pressure (in H ₂ O)
1.8	12.220	19.415	7.195	16.0	16.5	61.3	2.2
	19.415	26.630	7.215	16.5	17.0	62.2	2.2
	26.630	33.810	7.180	17.0	17.5	63.1	2.2
1	34.030	41.800	7.770	17.5	18.0	64.0	1.3
	41.800	49.660	7.860	18.0	18.5	64.9	1.3
	49.660	57.270	7.610	18.5	19.5	66.2	1.3
0.5							

Volume Initial (liters)	Volume Final (liters)	Volume Total (liters)	Temperature (°F)	Y _c	Y _c Avg	% deviation
514.500	521.780	7.280	61	1.007	1.001	-0.5%
521.780	529.000	7.220	61	0.998		0.4%
529.000	536.210	7.210	62.5	1.000		0.2%
536.550	544.325	7.775	61	1.003		-0.6%
544.325	552.030	7.705	62.5	0.982	0.997	1.6%
552.030	559.660	7.630	62.5	1.007		-0.9%

Calibration performed by: _____

Appendix E

Gravimetric Raw Data

From Page No. —

DATE	6-18-02	6-19-02	6-24-02	
TIME	08:30	07:00	07:00	
%RH	65	65	65	
TEMP	72	72	70	
100 G	100.0003	100.0003	100.0004	
1 G	1.00001	1.00001	1.00001	
061602 -	1	0.7233	0.7233	✓
	2	0.7325	0.7325	✓
	3	0.7190	0.7190	✓
	4	0.7326	0.7327	✓
	5	0.7430	0.7431	✓
	6	0.7388	0.7389	✓
	7	0.7226	0.7225	✓
	8	0.7436	0.7436	✓
	9	0.7382	0.7382	✓
	10	0.7402	0.7402	✓
	11	0.7107	0.7108	✓
	12	0.7163	0.7164	✓
	13	0.7064	0.7063	✓
	14	0.7083	0.7083	✓
	15	0.7149	0.7149	✓
	16	0.7032	0.7033	✓
	17	0.7120	0.7120	✓
	18	0.7109	0.7110	✓
	19	0.7111	0.7111	✓
	20	0.7229	0.7229	✓
	21	0.	0.7187	0.7187 ✓
	22		0.7429	0.7430 ✓
	23		0.7333	0.7333 ✓
	24		0.7296	0.7296 ✓
	25		0.7316	0.7317 ✓
	26		0.7250	0.7250 ✓
	27		0.7342	0.7343 ✓
	28		0.7281	0.7281 ✓
	29		0.7294	0.7293 ✓

No. —

Witnessed & Understood by me,

Date

Invented by

Recorded by

CDA Test 2 3/17/05

DATE:

[illegible]

Description:

Date:	3/22/05	3/23/05		
Time:	10:30	08:30		
% RH:	62	68		
Temp:	65	68		
100 G	100.0009	100.0012		
1G	1.00009	1.00011		
AA-1	79.4492	79.4506	79.4506 ✓	
AA-2	83.5367	83.5380	83.5382 ✓	
AA-3	73.7137	73.7168	73.7172 ✓	
AA-4	80.0137	80.0151	80.0153 ✓	
AA-5	86.2902	86.2918	86.2920 ✓	
AA-6	81.9088	81.9092	✓	
AA-7	74.3223	74.3232	74.3232 ✓	
AA-8	80.6310	80.6329	80.6330 ✓	
Final Wts - Beakers CUA 3-05				
Date:	4-1-05	4/4/05	4/5/05	
Time:	6:35	08:30	06:55	
% RH:	82	75	77	
Temp:	62	61	60	
100 G	100.0000	100.0000	100.0000	
1 G	1.00014	1.00003	1.00005	
AA-1	83.77388	79.9970	79.9968 ✓	
AA-2	84.1288	84.1282	84.1278 ✓	
AA-3	74.3339	74.3326	74.3327 ✓	
AA-4	80.0150	80.0148	✓	
AA-5	86.2900	86.2896	✓	
AA-6	81.9074	81.9069	✓	
AA-7	74.3217	74.3212	✓	
AA-8				

ORP-51444, Rev. 0

1113

TITLE

4" 0126 FILTER TARES

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Book No

From Page No.____

DATE

6-10-02

6-11-02

TIME

07:00

07:00

% RH

68

65

TEMP

70

72

100 G

100.0003

100.0004

1 G

1.00003

1.00005

061002-1

0.7061

0.7061

✓

2

0.7256

0.7256

✓

3

0.7148

0.7148

✓

4

0.7139

0.7139

✓

5

0.7224

0.7224

✓

6

0.7130

0.7130

✓

7

0.7173

0.7173

✓

8

0.7127

0.7127

✓

9

0.7177

0.7177

✓

10

0.7207

0.7207

✓

11

0.7125

0.7125

✓

12

0.6981

0.6981

✓

13

0.7067

0.7066

✓

14

0.7263

0.7263

✓

15

0.7084

0.7084

✓

16

0.7114

0.7113

✓

17

0.7169

0.7169

✓

18

0.7163

0.7162

✓

19

0.7228

0.7229

✓

20

0.6914

0.6914

✓

To Page No.____

Witnessed & Understood by me,

Date

Invented by

1114

Recorded by

Description: 4''

[illegible]

Description:

ORP-51444, Rev. 0

Date:	2-9-04	2-12-04	2-16-04	2/2/04
Time:	1030	0800	1030	11.15
% RH:	55	56	54	75
Temp:	68	69	70	72
100 G	100.0004	100.0003	100.0001	100.0000
1G	1.00010	1.00003	1.00005	
B B 525	111.3456	111.3452 ✓	✓	
526	107.0725	107.0713	107.0717 ✓	107.0700
527	109.2563	109.2549	109.2553 ✓	109.2534
528	108.4039	108.4026	108.4029 ✓	108.4015
529	118.7686	118.7673	118.7671 ✓	
530	106.3838	106.3825	106.3827 ✓	106.3813
531	108.4243	108.4240 ✓	✓	108.4214
532	119.4255	119.4244	119.4245 ✓	119.4229
533	107.4422	107.4409	107.4409 ✓	
534	107.7762	107.7750	107.7750 ✓	
535	110.1065	110.1052	110.1053 ✓	110.1042
536	117.1258	117.1242	117.1240 ✓	117.1225
537	108.1232	108.1218	108.1220 ✓	
538	109.1965	109.1951	109.1955 ✓	
539	109.4226	109.4224 ✓	✓	
540	112.7552	112.7539	112.7542 ✓	
541	104.4086	104.4072	104.4074 ✓	
542	108.0296	108.0281	108.0285 ✓	
543	110.1994	110.1980	110.1983 ✓	
544	108.8617	108.8605	108.8608 ✓	
545	107.8465	107.8462 ✓	✓	
546	112.6491	112.6473	112.6477 ✓	
547	113.0683	113.0669	113.0673 ✓	
548	107.1710	107.1706 ✓	✓	

Description:

Date:	10-15-03	10-15-03	10-16-03			
Time:	0830	1500	0930			
% RH:	79	76	78			
Temp:	68	68	68			
100 G	100.0001	100.0001	100.0001			
1G	1,00006	1,00005	1,00003			
BB 451	113.8927	113.8925	✓	✓		
452	121.4074	121.4073	✓	✓		
453	116.1920	116.1920	✓	✓		
454	119.1127	119.1127	✓	✓		
455	114.3730	114.3729	✓	✓		
456	117.3349	117.3352	✓	✓		
457	114.1738	114.1737	✓	✓		
458	115.6514	115.6512	✓	✓		
459	112.5223	112.5221	✓	✓		
460	114.4427	114.4430	✓	✓		
461	114.7290	114.7290	✓	✓		
462	114.6395	114.6394	✓	✓		
463	117.1300	117.1298	✓	✓		
464	114.0110		114.0112	✓		
465	115.6545	115.6544	✓	✓		
466	118.7527	118.7529	✓	✓		
467	116.4302	116.4301	✓	✓		
468	118.1506	118.1506	✓	✓		
469	120.5473	120.5487	120.5484	✓		
470	116.0757	116.0757	✓	✓		
471	115.7253	115.7252	✓	✓		
472	116.1316	116.1316	✓	✓		
473	115.6868	115.6867	✓	✓		
474	115.7730	115.7731	✓	✓		
475	114.4463	114.4465	✓	✓		
476	115.1447	115.1461	115.1458	✓		
477	114.9079		114.9082	✓		
478	117.5057		117.5060	✓		
479	112.9486		112.9489	✓		
BB 480	113.4923	113.4923	✓	✓		

ORP-51444, Rev. 0

Description:

[illegible]

CUA 3/9/05 Tot m-26 PM Final 4th.

Project Name:

Description:

Date:	3/17/05	3/18/05	3/21/05	3/21/05	3/22/05	3/22/05
Time:	15:00	08:30	12:00	16:30	10:30	16:10
% RH:	62	60	64	64	62	63
Temp:	66	64	64	68	65	66
100 G	100.0009	100.0010	100.0010	100.0009	100.0009	100.0009
1G	1.000107	1.00009	1.00006	1.00006	1.00009	1.00009
BB - 442 R-1			114.7538	114.7546	114.7534	114.7538
- 515 R-2			119.0987	119.0995	119.0984	119.0988
- 516 R-3			121.2274	121.2283	121.2271	121.2276
- 525 R-1			111.3458	111.3463		
- 529 R-2			118.7702	118.7707		
- 533 R-3			107.4425	107.4435	107.4430	
- 534 BIK			107.7755	107.7765	107.7764	
<u>m-26</u>						
R1 061002 -11	1.0746	1.0745				
R2 " -12	1.0958	1.0951				
R3 " -14	1.1153	1.1153				
<u>T-26</u>						
R1 061002 -10	0.7224	0.7223				
R2 " -13	0.7077	0.7078				
R3 " -15	0.7091	0.7091				
<u>PSD</u>						
Step 1 43903 -10	0.25157	0.25160				
Step 2 83403 -3	0.13291	0.13289				
Step 3 091584 -9	0.11105	0.11110				

mod. p-26 F-40

CO p-26 F-40

BIK

R1

R2

R3

R1

R2

R3

PSD

Step 1

Step 2

Step 3

Final

Description:

Date:	09/14/04	09/15/04			
Time:	0845	0950			
% RH:	73	71			
Temp:	70	77			
100 G	100.0000	100.0000			
1G	1.00005	1.0001			
082404-1	0.1321	0.1322 ✓			
2	0.1329	0.1329 ✓			
3	0.1327	0.1327 ✓			
4	0.1317	0.1317 ✓			
5	0.1334	0.1334 ✓			
6	0.1310	0.1310 ✓			
7	0.1327	0.1326 ✓			
8	0.1330	0.1330 ✓			
9	0.1313	0.1313 ✓			
10	0.1339	0.1339 ✓			
11	0.1337	0.1338 ✓			
12	0.1315	0.1315 ✓			
13	0.1325	0.1324 ✓			
14	0.1332	0.1332 ✓			
15	0.1321	0.1321 ✓			
16	0.1323	0.1324 ✓			
17	0.1337	0.1337 ✓			
18	0.1324	0.1325 ✓			
19	0.1325	0.1325 ✓			
20	0.1317	0.1317 ✓			
21	0.1322	0.1324 ✓			
22	0.0989	0.0989 ✓			
23	0.0988	0.0990 ✓			
24	0.0988	0.0988 ✓			
25	0.0985	0.0985 ✓			
26	0.0990	0.0989 ✓			
27	0.0989	0.0989 ✓			
28	0.0985	0.0985 ✓			
29	0.0988	0.0988 ✓			
30	0.0991	0.0991 ✓			

rom Page No. —

DATE	5-5-03	5-5-03	5-6-03		
TIME	0930	"	1030		
% RH	73	"	77		
TEMP	68	"	70		
100 G	100.0001	"	100.0003		
1 G	1.00005	"	1.00007		
42903 - 1	0.24837		0.24837	✓	
2	0.26538		0.26539	✓	
3	0.25194		0.25194	✓	
4	0.23353		0.23352	✓	
5	0.24425		0.24421	✓	
6	0.24615		0.24615	✓	
7	0.25455		0.25453	✓	
8	0.25344		0.25341	✓	
9	0.20529		0.20530	✓	
10	0.25145		0.25144	✓	
11	0.25207		0.25208	✓	
12	0.26232		0.26231	✓	
13	0.25945		0.25941	✓	
14	0.25973		0.25970	✓	
15	0.21413		0.21413	✓	
16	0.24486		0.24488	✓	
17	0.24802		0.24799	✓	
18	0.21733		0.21731	✓	
19	0.22878		0.22875	✓	
20	0.25349		0.25347	✓	
21	0.26394	0.25143	0.25144	✓	
22	0.23196	0.26016	0.26013	✓	
23	0.23047		0.23047	✓	
24	0.23196		0.23195	✓	
25	0.26394		0.26395	✓	
26	0.26637		0.26635	✓	
27	0.21975		0.21971	✓	
28	0.25494		0.25490	✓	
29	0.21534		0.21533	✓	
30	0.25216		0.25214	✓	

To Page N

Witnessed & Understood by me,

Date

Invented by

Date

1121

Description: 2" Filters

Date:	091604	091704	10704
Time:	0812	0830	1100
% RH:	77%	75%	40% ¹⁰
Temp:	71	72	64
100 G	100.0001	100.0002	100.0001
1G	1.0000	1.0000	1.00009
091504-1	0.1117	0.1116 ✓	
2	0.1123	0.1122 ✓	
3	0.1131	0.1130 ✓	
4	0.1122	0.1121 ✓	
5	0.1100	0.1099 ✓	
6	0.1127	0.1126 ✓	
7	0.1118	0.1116 ✓	
8	0.1130	0.1129 ✓	
9	0.1109	0.1108 ✓	
10	0.1116	0.1115 ✓	
11	0.1116	0.1116 ✓	
12	0.1116	0.1114 ✓	
091604-1		0.1121	0.1119 ✓
2		0.1125	0.1123 ✓
3		0.1132	0.1130 ✓
4		0.1115	0.1113 ✓
5		0.1115	0.1114 ✓
6		0.1117	0.1116 ✓
7		0.1126	0.1124 ✓
8		0.1132	0.1131 ✓
9		0.1121	0.1121 ✓
10		0.1119	0.1119 ✓
11		0.1113	0.1112 ✓
12		0.1104	0.1103 ✓
13		0.1127	0.1125 ✓
14		0.1118	0.1116 ✓

TEST REPORT

for

**Emissions Sampling of the 1200 Melter
The Vitrification Unit
at The Catholic University of America
(High Level Waste)
Updated 10-14-05**

Prepared for:

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February 23, 2005

Air-Tech Environmental, LLC

Report Certification

This report has been reviewed by the following *Air-Tech Environmental, LLC* personnel and is a true representation of the results obtained for the sampling program at the 1200 Melter The Vitrification Unit at The Catholic University of America. The sampling and analytical methods were performed in accordance applicable EPA reference methods except where noted in this report.

Approvals:

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8/8/05
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Appendix D Meter Box Calibrations

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1.0 INTRODUCTION

Air-Tech Environmental provided off-gas sampling and particulate analytical services for The Catholic University of America (CUA) Vitrification State Laboratory (VSL) in Washington, D.C. This report covers the test program conducted in November and December 2004.

The testing objective was to characterize the off-gas exiting the melter for selected compounds of interest and to assess the performance of various control devices. The sampling locations were: (1) the outlet of the melter, (2) the outlet of the high efficiency particulate filter (HEPA), (3) the outlet of the carbon bed, and (4) the outlet of the hybrid catalytic unit, also known as the thermal catalytic oxidizer (TCO). A schematic of the VSL melter and off-gas handling system, showing the sampling locations, is depicted in Figure 1.

Testing was performed over two mobilizations for three distinct test segments: Segment #1, Segment #2A and Segment #2B.

Testing for the determination of Destruction and Removal Efficiency (DRE) was conducted while the melter was spiked with allyl alcohol and naphthalene. The determination of DRE (to be calculated by CUA) will be made by comparing the mass of each compound detected at each location to the mass spiked. Additional testing, for parameters such as particulate matter, was performed during non-spiking conditions.

All samples were collected from the midpoint of four-inch ducts. Velocity measurements were made following the procedures of EPA Method 1A, *Sample and Velocity Measurements for Stationary Sources with Small Stacks or Ducts* and EPA Method 2, *Determination of Stack Gas Velocity and Volumetric Flow Rate*. Four (4) types of samples of the flue gas were collected for analysis. The complete target analyte list includes metals, anions, particulate matter (both total and by size distribution), semi-volatile organics and volatile organics. A Method 26 sampling train was employed for collection of particulate, halides and acid gas samples. Samples for the determination of particle size distributions were collected using a Pilat (University of Washington) Mark 3 cascade impactor. Samples of semi-volatiles and volatiles were collected by employing EPA SW 846 Methods 0010, 0023 and 0031 respectively.

In addition, a single sample was collected at the TCO for total organic emissions (TOE) employing EPA methods 0040 and 0010.

Table 1-1 provides a summary of the analytes and methods performed during each test condition. Tables 1-2 and 1-3 show the number of runs of each type performed at the various locations.

Air-Tech Environmental provided only the particulate analysis for the samples that were collected. Severn Trent Laboratories (STL) performed analyses for halogens, metals, volatile organics and semi-volatile organics.

Table 1-1. Summary of Analytes and Methods Per Test Event

<i>Parameter</i>	<i>Analyte</i>	<i>Sampling Method</i>	<i>Analysis Method</i>
Total Particulate	Particulate matter	M-26A (Filter, Probe Rinse)	Gravimetric
Particle Size	Particulate matter	Impactor (3 stages) CARB 501	Gravimetric
Halogens/Halides	HCl, HF Cl ₂ , F ₂	M-26A (Acidic Impingers) M-26A (Caustic Impingers)	EPA 9057/340 (IC/ISE)
Total Metals	See footnote 1	M-0060	ICPES/ICPMS
Semi-volatile organics	See Footnote 2	SW 846 Method M-0010	EPA 8270C
THC	Total hydrocarbons	M-25A	NA
PCB / Dioxins	WHO ⁴ List; D/F	SW 846 Method 0023A	EPA 1668A / 8290A
Volatile organics	See Footnote 3	SW 846 Method 0031	EPA 8260B
Total Organic Emissions (TOE) ⁵	Volatiles Semi-Volatiles Non-volatiles	M-0040 M-0010 M-0010	GC/FID GC/FID GC/FID

¹ Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn.

² Semi-volatile organic compound target list from Method 8270 C.

³ Volatile organic compound target list from Method 0031. Each run consisted of 3 sets of tubes, designated as pair A, pair B, and pair C.

⁴ World Health Organization List of PCBs

⁵ Refer to "Guidance for Total Organics", EPA/600/R-96/033, March, 1996.

The testing locations are as described in Section 1 and Section 3.

This report consists of the following sections: Section 2- results; Section 3 - sampling location descriptions; Section 4 - sampling methodologies; and Section 5 - Quality Control. All results tables, field and gravimetric analytical data, calibrations and example calculations are appended.

Table 1-2. Sampling Time Table for November, 2004 Mobilization

<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Test Time</i>
Melter	Allyl Alcohol	11/15/04	Spiked	2100 - 2240
		11/16/04	1	1212 - 1242
			2	1359 - 1429
			3	1543 - 1613
HEPA	Allyl Alcohol	11/16/04	1	1207 - 1307
			2	1356 - 1546
			3	1541 - 1641
TCO	Allyl Alcohol	11/16/04	1	1210 - 1350
			2	1354 - 1534
			3	1539 - 1719
Melter	SVOC	11/17/04	1	1243 - 1543
HEPA	SVOC	11/17/04	1	1243-1543
TCO	SVOC	11/17/04	1	1240 - 1540
TCO	PSD	11/15 - 11/16/04	1	2249 - 1025
		11/16 - 11/17/04	1 (con'td)	2204 - 1004

Table 1-3. Sampling Time Table for December, 2004 Mobilization (Revised 9-20-50)

<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Time</i>
Melter	Dioxin/ Furan/PCB	12/07 - 12/08/04	1	2235-0035
		12/08/04	2	0200-0400
		12/10/04	3	1343-1543
		12/10/04	4	1723-1923
TCO	Dioxin/ Furan/ PCB	12/07/04	1	1943-2143
		12/07 - 12/08/04	2	2230-0030
		12/08/04	3	0204-0404
		12/10/04	4	1100-1300
		12/10/04	5	1349-1549
		12/10/04	6	1715-1915
Melter	M-26 & PM	12/10/04	1	0521-0621
			2	0700-0800
			3	0836-0926
		12/11/04	4	0330-0445
			5	0526-0626
			6	0714-0814
TCO	M-26 & PM	12/10/04	1	0526-0626
			2	0703-0803
			3	0839-0939
		12/11/04	4	0333-0433
			5	0525-0625
			6	0713-0813
Melter	Metals	12/09/04	1	2227-2327
		12/10/04	2	0020-0120
		12/10/04	3	0210-0310
		12/11/04	4	0901-1001
		12/11/04	5	1051-1151
		12/11/04	6	1234-1334
TCO	Ally Alcohol	12/06/04	1	1730-1912
Melter	Ally Alcohol	12/07/04	1	1158-1248
			2	1358-1448
			3	1558-1648
TCO	Ally Alcohol	12/07/04	1	1200-1340
			2	1400-1540
			3	1559-1739 1130

Table 1-3. Sampling Time Table for December, 2004 Mobilization (cont'd)

<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Time</i>
Carbon Out	Ally Alcohol	12/07/04	1	1156-1336
			2	1358-1538
			3	1558-1738
TCO	Metals	12/09/04	1	2230-2330
		12/10/04	2	0021-0121
		12/10/04	3	0212-0312
		12/11/04	4	0857-0957
			5	1053-1153
			6	1235-1335
			7	1359-1459
Melter	SVOC	12/08/04	1	1118-1218
			2	1501-1601
			3	1844-1944
		12/09/04	4	1430-1530
			5	1751-1851
TCO	SVOC	12/08/04	1	1111-1411
			2	1455-1755
			3	1843-2130
		12/09/04	4	1428-1728
			5	1747-2047
HEPA	SVOC	12/08/04	1	1113-1313
			2	1457-1657
			3	1846-2046
		12/09/04	4	1430-1630
			5	1750-1950
Carbon Bed	SVOC	12/08/04	1	1115-1415
			2	1455-1755
			3	1844-2130
TCO	PSD	12/11 - 12/12/04	1	1533-1440
Melter	VOST	12/09/04	1	0350-0513
			2	0539-0709
			3	0737-0857
		12/10 - 12/11/04	4	2153-2307
			5	2337-0050
			6	0128-0247
TCO	VOST	12/09/04	1	0345-1515
			2	0543-0710
			3	0737-0910
		12/10 - 12/11/04	4	2130-2252
			5	2311-0030

Figure 1. DM 1200 Melter and Flue Gas Cleanup System

2.0 RESULTS

A sampling and analytical summary of the characterizations conducted during this test program is contained in Tables 1-2 and 1-3. These tables present the complete list of samples collected and dates and time of collection. A presentation of results has been organized by analyte with discussions presented in the following sections.

2.1 Volatile Compounds

Twelve (12) sampling runs for the determination of volatile organic compound emission rates were performed: six at the melter and six at the TCO outlet.

Each run consisted of the collection of three sets of sorbent tubes designated as Set A, Set B, and Set C. A set of sorbent tubes consisted of two Tenax tubes and one Anasorb-747 tube.

Tables 2-1 and 2-2 provide the date and time of collection of each set of the tubes along with the sample volume and stack flow rate. For analysis, the two Tenax tubes were thermally desorbed as a pair and the Anasorb desorbed separately. The analytical results were reported from the laboratory as total micrograms (ug) for the combined Tenax tubes and total ug for the Anasorb tube. In addition, an aqueous condensate sample was collected during each run (composite over the three sets of tubes). The condensate was analyzed using the purge and trap procedure and the results reported from the laboratory in units of ug/liter of aqueous condensate. The calculation of concentration (ug/dscf) and emission rate (ug/min) was performed as follows. The mass detected for each target compound in Set A Tenax and Set A Anasorb was summed to get a subtotal. The mass subtotal by compound for each set was divided by the sample volume (nominally 20 liters) collected for that set to get a concentration and then the concentration value was multiplied by the stack flow rate (dscfm) to get the emission rate. This was repeated for Set B and Set C. An average value by compound for the concentration and emission rate was then calculated. The mass detected for each compound in the condensate sample was calculated by multiplying the reported concentration (ug/L) by the liquid volume of the condensate collected plus rinse (i.e., 40 mL collected and recovered into a 40 mL VOA vial). Since the condensate was an integrated sample collected over the three sets of tubes, the gaseous sample volumes for the corresponding three sets of tubes were summed and this sum was used for the calculation of concentration and subsequently the emission rate. The total concentration and emission rate by compound for each run was calculated by summing the averaged value for the tube sets and the value for the condensate. If a target was not detected (ND), the analytical method detection limit (MDL) was used rather than a zero value for the purpose of calculations and the final results are reported as a "less than values". If a ND was reported for a target in one or more of the sample components (i.e., Tenax, Anasorb and/or condensate) the total for that compound for the run was reported as "less than" value. The results, as reported here, have not been blank corrected.

The results of the VOST sampling (samples and blank) can be found in Appendix A.1 and the corresponding field data sheets in Appendix B.1.

Table 2-1. Summary of Melter Volatile Sample Volumes and Stack Flow Rates

<i>Location</i>	<i>Run Number</i>	<i>Sample Volume liters</i>	<i>Flow Rate dscfm</i>	<i>Date</i>	<i>Time</i>	
Melter	1A	20.658	173.28*	12/09/04	0350-0410	
	1B	19.095			0424-0444	
	1C	19.543			0453-0513	
	2A	19.566	173.28*	12/09/04	0539-0559	
	2B	19.626			0617-0637	
	2C	18.291			0649-0709	
	3A	18.862	173.28*	12/09/04	0737-0757	
	3B	23.487			0807-0827	
	3C	19.686			0837-0857	
	4A	19.778	182.67**	12/10/04	2153-2213	
	4B	19.815			2220-2240	
	4C	20.998			2247-2307	
	5A	20.117	182.67**	12/10/04	2337-2357	
	5B	19.757		12/11/04	0004-0024	
	5C	20.465			0030-0050	
	6A	20.417	182.67**	12/11/04	0128-0148	
	6B	20.428			0156-0216	
	6C	21.083			0227-0247	

* Flow from average of 0010 tests performed on 12/8/04.

** Flow from average of 0010 tests performed on 12/9/04.

Table 2-2. Summary of TCO Outlet Volatile Sample Volumes and Stack Flow Rates

Location	Run Number	Sample Volume liters	Flow Rate dscfm*	Date	Time
TCO Outlet	1A	18.188	186.69*	12/09/04	0345-0405
	1B	18.813			0422-0442
	1C	20.637			1455-1515
	2A	20.515	186.69*	12/09/04	0543-0603
	2B	19.087			0616-0636
	2C	20.634			0650-0710
	3A	25.831	186.69*	12/09/04	0737-0803
	3B	19.594			0816-0836
	3C	19.918			0850-0910
	4A	19.681	187.41**	12/10/04	2130-2150
	4B	19.818			2202-2222
	4C	20.569			2232-2252
	5A	21.676	187.41**	12/10/04	2311-2331
	5B	21.109			2340-2400
	5C	20.927		12/11/04	0010-0030
	6A	20.979	187.41**	12/11/04	0045-0105
	6B	19.804			0115-0135
	6C	20.344			0145-0208

* Flow from average of 0010 tests performed on 12/8/04.

** Flow from average of 0010 tests performed on 12/9/04.

2.2 *Semi-Volatiles*

Twenty-one (21) samples were collected for the determination of semi-volatile organic compounds - six each at the melter, HEPA and TCO, and three at the carbon bed. Table 2-3 shows the summary of semi-volatile sampling, including date, sample volume and flow rate for each sample collected. The sampling method (EPA Method 0010) and the analysis method (EPA SW-846 Method 8270C) procedures were followed for the determination of semi-volatile organic compounds.

A summary of the results for the semi-volatile sampling is presented in Appendix A.2, showing the stack gas concentrations in ug/dscf and the emission rates in µg/min. The concentration values were calculated by dividing the laboratory reported results, in ug, by the sampled volume, in cubic feet, on a dry basis and corrected to standard conditions of 1 atmosphere and 68 degrees F. All runs were performed while spiking naphthalene into the melter.

Due to high concentrations of naphthalene found at the melter and HEPA outlets, extracts required dilution before analysis. As a consequence, some compounds present may have been diluted to a level so as not to be detectable and are reported as ND in the laboratory results.

All field data sheets associated with these analyses can be found as Appendix B.2.

The recovered sampling train fractions for each sample were prepared in the laboratory and the extracts combined for analysis. If a compound was not detected, a "ND" is listed in the laboratory results indicating that it may be present but at a level less than the MDL. The MDL varies from compound to compound based on instrument sensitivity and increases proportionally with any required sample dilution. If a target was not detected (ND), the analytical method detection limit (MDL) was used rather than a zero value for the purpose of calculations and the final results are reported as "less than values". The results, as reported here, have not been blank corrected.

Table 2-3. Summary of Semi-Volatile Sampling (corrected)

Location	Run Number	Date	Sample Volume dscf	Flow Rate dscfm
Melter	1	11/17/04	69.647	175.65
	1	12/08/04	23.220	178.09
	2		22.986	172.39
	3		21.842	169.37
	4	12/09/04	25.795	186.71
	5		24.407	178.62
HEPA	1	11/17/04	101.559	186.15
	1	12/08/04	44.302	182.49
	2		45.193	179.66
	3		45.314	178.98
	4	12/09/04	45.372	182.37
	5		44.849	180.01
TCO	1	11/17/04	106.582	177.66
	1	12/08/04	138.661	190.52
	2		137.547	179.64
	3		126.747	189.92
	4	12/09/04	132.945	188.22
	5		133.289	186.59
Carbon Bed	1	12/08/04	99.300	181.84
	2		97.707	177.66
	3		89.688	180.58

2.3 Dioxins/Furans/PCB

Chlorinated dioxins and furans (D/F) were determined in combination with the polychlorinated biphenyls (PCB) using a modified Method 0023 sampling train. Table 2-4 shows the sample volume and stack flow rate for each sample.

During sample preparation, each sample extract was split: one-half for D/F analysis and one-half for PCB analysis (following analytical procedures of EPA Method 1668). A total of four (4) samples were collected at the melter and six (6) at the TCO. Each sample was analyzed by high resolution gas chromatography (HRGC) / high resolution mass spectrometry (HRMS). The results of the analysis for D/F are given in Appendix A.3. For the melter samples, all congeners were detected in all samples except for run 2, where 2,3,7,8-TCDD was not detected. In the TCO samples, generally speaking, most of the congeners were not detected or detected at low levels, except for run 2 where all were detected except for 2,3,7,8-TCDD. OCDD was the predominant congener detected in all TCO samples. If a target was not detected (ND), the analytical method detection limit (MDL) was used rather than a zero value for the purpose of calculations and the final results are reported as "less than values". OCDD was the only congener detected in the field blank and present at trace levels. The results, as reported here, have not been blank corrected.

Also found in Appendix A.3 are the D/F results presented in terms of 2,3,7,8 TCDD equivalents (TEQ).

The results of the PCB sampling and analysis are given in Appendix A.4. For the melter samples, PCB 77, PCB 105 and PCB 188 were detected at the highest amounts. For the TCO samples, PCB 105 and PCB 188 were detected at the highest amounts. All others were either not detected or detected at levels less than 5 times the MDL. PCB 118 was the only target detected in the field blank at a level of 0.019 ng which is just above the MDL of 0.012 ng.

All field data sheets associated with these analyses can be found in Appendix B.3 and B.4 for D/F and PCB respectively.

2.4 Metals

Samples for the determination of metals emissions were collected at the outlet of the melter (6 runs) and the outlet of the TCO (7 runs). Thirteen (13) Method 0060 samples were collected.

Table 2-5 gives the sample volumes and stack flow rates.

The results for the Method 0060 test runs performed are summarized in Appendix A.5 in units of concentration and emission rates respectively and have been blank corrected. The field data sheets are given in Appendix B.4.

The front and back half components of the sampling train were digested with acid and using inductively coupled argon plasma emission spectrometry (ICPES). The laboratory results, reported in total ug, the volume of sample collected and the stack gas flow rates were used to calculate the stack gas concentration and emission rates respectively.

Table 2-4. Summary of D/F/PCB Sample Volumes and Stack Flow Rates (Revised 9-20-05)

<i>Location</i>	<i>Run Number</i>	<i>Date</i>	<i>Sample Volume dscf</i>	<i>Flow Rate dscfm</i>
Melter	1	12/07-12/08/04	44.054	176.61
	2	12/08/04	44.972	175.65
	3	12/10/04	57.481	189.03
	4	12/10/04	49.913	164.06
TCO	1	12/07/04	96.177	194.54
	2	12/07-12/08/04	95.389	214.38
	3	12/08/04	97.051	209.59
	4	12/10/04	91.212	193.09
	5		96.224	196.84
	6		92.563	186.59

Table 2-5. Summary of Metals Sample Volumes and Stack Flow Rates

Location	Run Number	Date	Sample Volume dscf	Flow Rate dscfm
Melter	1	12/09/04	21.054	148.01
	2	12/10/04	22.077	135.92
	3		22.670	152.66
	4	12/11/04	27.841	182.92
	5		27.926	174.17
	6		29.933	179.80
TCO	1	12/09/04	44.510	183.33
	2	12/10/04	45.572	184.24
	3		45.419	186.18
	4	12/11/04	48.622	193.67
	5		47.875	193.15
	6		48.789	194.22
	7		49.532	192.95

A review of the melter result show the data to be generally consistent for Runs 1-3 (process condition 1) and for Runs 4-6 (process condition 2). This was also the case for the corresponding TCO samples. TCO Run 7 results were noticeably lower than any of the other TCO runs. Selenium was present at the highest levels and all samples required dilution to bring several metals within the calibration range. If a target was not detected (ND), the analytical method detection limit (MDL) was used rather than a zero value for the purpose of calculations and the final results are reported as "less than values".

2.5 Hydrogen Chloride, Hydrogen Fluoride, and Halogens

Samples for the determination of hydrochloric acid (HCl), hydrofluoric acid (HF) and the halogen gases chlorine (Cl₂), fluorine (F₂) were collected in a Method 26A train which employed two impingers containing dilute sulfuric acid solution to facilitate collection of the acid gases and two impingers containing dilute sodium hydroxide to facilitate collection of the halogen gases. Table 2-6 provides the sample volumes and stack flow rates. Summary tables of the results of the sampling are presented in Appendix A.6.

The melter and TCO data show that HF and HCl were detected in all runs with HCl being predominant. Fluorine was not detected in any of the samples.

Melter run1 and TCO run1 were sampled simultaneously, as were the other runs. When comparing the results for Melter runs 1-3 and TCO runs 1-3, it was apparent that the results for the acidic impingers for Run 3 melter were not consistent with runs 1 and 2. This was also the case for the TCO run 3 acidic impinger results. The results for the other train components (i.e., particulate catch on the filter and caustic impinger) were consistent across the three runs for both the melter and TCO. The laboratory re-analyzed the acidic impinger samples for run 3 melter and TCO and confirmed the results as previously reported. If the results as reported from the laboratory for the acidic impinger samples of run 3 Melter and TCO are reversed, the results show consistency across the three runs. Therefore it was concluded that these two samples were mislabeled at the time of sample recovery.

The field data sheets can be found in Appendix B.5.

2.6 Particle Size Determination Results

Particle size determination (PSD) was conducted with a two-stage cascade impactor with a final filter. These devices separate particles by inertia and particle size classifications are performed solely on a mass per unit volume basis. PM is collected on a separate substrate in each of the stages with the diameter of the particles collected becoming smaller and smaller as the gas stream passes sequentially through the device. For this study, two sampling runs were performed at the TCO outlet.

The results of the PSD gravimetric analysis are presented in Appendix A.7 and the raw laboratory and field data are found in Appendix B.6. All runs were performed in a similar fashion, resulting in the collection of sufficient material to be gravimetrically meaningful for all runs. Each sample was collected for nominally 24 hours with the results being reported at three cut points: greater than 10 microns, 1-10 microns and less than 1 micron.

Table 2-6. Summary of Halogens Sample Volumes and Stack Flow Rates

Location	Run Number	Date	Sample Volume dscf	Flow Rate dscfm
Melter	1	12/10/04	20.100	151.79
	2		21.974	153.89
	3		15.315	131.75
	4	12/11/04	25.009	154.51
	5		25.940	156.83
	6		24.632	154.37
TCO	1	12/10/04	43.662	182.76
	2		45.462	186.20
	3		44.254	186.32
	4	12/11/04	45.510	192.27
	5		46.143	191.63
	6		46.607	189.80

2.7 *Particulate Matter Results*

A summary of the particulate sampling results is presented in Appendix A.8. Twelve (12) tests for total particulate matter (PM) were performed - six at the melter and six at the TCO. These tests were performed in conjunction with the Method 26 tests. Sample dates, sample volumes and flow rates are given in Table 2-6.

2.8 *Total Organic Emissions (TOE)*

The determination of Total Organic Emissions (TOE) involves the measurement of organic compounds over three fractions distinguished by boiling point ranges: 1) volatile compounds; 2) semi-volatile compounds also known as total chromatographable organics (TCO) and 3) nonvolatile compounds also known as gravimetric (Grav). These measurements are performed using a combination of two sampling methods, Method 0040 and Method 0010. One TOE test run was performed at the outlet of the TCO on 12/9/04. The results are given in Appendix A.9 and the field data sheets given Appendix B.7.

2.9 *Total Hydrocarbon (THC) Testing*

Investigative total hydrocarbon (THC) testing was performed at various sampling points during the organic spiking. Sample gas was extracted from the source via heated head pump and directed to the analyzer through a heated Teflon line. The analyzer utilized a flame ionization detector (FID) to detect the presence of any volatile organic material in the gas stream. The FID operates on the principle of flame ionization where organic compounds entering the flame are combusted, forming positive and negatively charged ions that give rise to a small current between two electrodes. This analog signal is then converted to a digital readout and displayed on a computer screen. The data then is stored electronically for subsequent data reduction. The generated signal is roughly proportional to the number of carbon atoms present in the sampled gas. The response represents the total hydrocarbon concentration present and not that of individual compounds.

The sampling was performed following the protocol of EPA Method 25A. Prior to actual sampling, the analyzer was calibrated directly with a series of Protocol gaseous standards (methane in this case) followed by a system bias check where a calibration gas is introduced between the probe and the heated sample line. The calibration drift and bias check QC parameters were all within method specifications. An electronic version of the complete data set has been given to Dr. Matlack.

2.10 *Allyl Alcohol by Method 308*

Sampling for the determination of allyl alcohol was performed during each of two mobilizations. During the November 2004 test three samples were collected at the melter, the HEPA and the TCO. Sampling at the three locations was performed simultaneously. In addition, one run at the melter was performed after the train had been pre-spiked with a known amount of allyl alcohol. This testing was repeated during the December 2004 mobilization when one additional spiked train run was performed at the TCO location. Analyte breakthrough from the first two impingers was determined for one run at each of the sampling locations. Breakthrough was determined by analyzing the contents of the fourth impinger. Breakthrough was found to be less than 1% in all cases. The results of the Method 308 tests are given in Appendix A.10 and

the corresponding field data sheets are given in Appendix B.8. Table 2-7 provides the sample volumes and flow rates.

**Table 2-7 Summary of Method 308 Sample Volumes and Stack Flow Rates
(corrected 7-27-05)**

Please Note: The flow rates for the Melter, HEPA, and Carbon Bed Outlet are calculated from the average of all the isokinetic samples at those locations during each test segment. The TCO flow rates are calculate from the average of all the isokinetic samples at the TCO during each test segment.

<u>Location</u>	<u>Run Number</u>	<u>Date</u>	<u>Sample Volume, dscf</u>	<u>Flow Rate, dscfm</u>
Melter	1 (spiked)	11/15/04	2.168	183.50
	2	11/16/04	0.494	183.50
	3	11/16/04	0.520	183.50
	4	11/16/04	0.519	183.50
HEPA *	1	11/16/04	1.045	183.50
	2	11/16/04	1.034	183.50
	3	11/16/04	1.035	183.50
TCO	1	11/16/04	2.559	181.96
	2	11/16/04	2.587	181.96
	3	11/16/04	2.591	181.96
Melter	1	12/07/04	1.047	173.28
	2	12/07/04	0.822	173.28
	3	12/07/04	0.827	173.28
HEPA *	1	12/07/04	0.908	173.28
	2	12/07/04	0.877	173.28
	3	12/07/04	0.889	173.28
TCO	1 (spiked)	12/06/04	2.926	186.69
	2	12/07/04	2.510	186.69
	3	12/07/04	2.509	186.69
	4	12/07/04	2.516	186.69
Carbon Bed	1	12/07/04	2.629	173.28
	2	12/07/04	2.644	173.28
	3	12/07/04	2.645	173.28

2.11 Carbon Monoxide (EPA Method 10)

As a safety measure carbon monoxide content of the gas stream was monitored at the outlet of the carbon bed during periods of organic spiking of the waste feed. This sampling was conducted using a non-dispersive infrared analyzer according to the procedures of EPA Method 10.

Gas samples were withdrawn from the carbon bed exhaust through a filter and chilled condenser. The dried flue gas was then directed to a CO analyzer in excess of instrument demand. A slipstream of the dried sample was drawn into the analyzer sample cell. CO concentrations were determined by the amount of infrared absorption occurring as the sample passed through the cell.

3.0 SAMPLING LOCATIONS

Samples were collected from four locations: melter outlet, HEPA outlet, carbon bed outlet and the TCO outlet. See Figure 1 for a diagram of these locations.

4.0 DISCUSSION OF SAMPLING METHODS BY ANALYTE

This section describes the methods that were employed by *Air-Tech Environmental* personnel to accomplish the prescribed testing program. The gas sample collection procedures employed during this test program are briefly discussed in the following sections. Except as noted, sampling methodologies adhered to procedures described in appropriate reference methodologies.

4.1 Volatile Organics Testing

SW 846 Method 0031 was employed for the characterization of gas stream volatile organic content. Each run consisted of three samples (*i.e.*, three sets of tubes: two tubes of each set containing Tenax and the other containing Anasorb-747). Each set of tube samples was collecting sample at a nominal rate of 1.0 liter per minute using the volatile organic sampling train (VOST) as described in the sampling method. One field blank (one set of tubes) was collected during one of the test runs. Figure 2 is a drawing of a VOST train; and Figure 3 shows the VOST Tube Components.

4.2 Semi-Volatile Sampling (including Dioxin/Furan/PCBs)

A single sampling train (depicted in Figure 4) was used for the collection of semi-volatile organic compounds (SVOCs), dioxin/furan and PCBs. Glassware preparation and sampling procedures followed those presented in the respective methods. Sample recovery procedures resulted in the following five sample fractions being presented for analysis when employing Method 23:

- Fraction 1- XAD-2: resin trap, sealed and stored on ice;
- Fraction 2- Filter: removed from housing and sealed in a glass petri dish;
- Fraction 3- Acetone followed by methylene chloride rinses of the front half of the train (nozzle, probe, by-pass and front half of filter holder);
- Fraction 4- Acetone followed by methylene chloride rinse of the back half of the train components (back half of filter, condenser and knock-out);
- Fraction 5- Toluene rinse of the front half of the train when required;
- Fraction 6- Toluene rinse of the back half of the train;
- Fraction 7- Aqueous condensate.

These samples were analyzed for dioxin/furans by Method 8290. The PCBs were analyzed by water method 1668A for the World Health Organization (WHO) list of PCBs.

When only Method 0010 was required, the train was recovered in the following fractions:

Fraction 1 - XAD-2;

Fraction 2 - Filter;

Fraction 3 - 50:50 acetone/methanol rinse of front-half of the train;

Fraction 4 - 50:50 acetone/methanol rinse of the back half of the train;

Fraction 5 - Aqueous condensate.

The aqueous impingers of the Method 0010 train are for the purpose of determining the moisture content of the sample gas, and the contents of which are typically discarded after each run.

4.3 Metals

The metals samples were collected using a modified EPA Method 0060 sampling train. Figure 5 contains a schematic of this modified sampling train. Modifications to the sampling methodology included the removal of acidic potassium permanganate impingers from the condenser train to eliminate mercury samples (which was not a target compound).

Sample recovery resulted in the following sample fractions:

Front half nitric: 0.1N nitric acid rinses of the probe, nozzle, inlet of the filter holder, and connecting glassware;

Filter: the tared filter placed in a properly labeled petri dish;

Back half nitric: nitric acid/hydrogen peroxide impinger contents plus 0.1N nitric acid rinses of the filter support, outlet of the filter housing, the first three impingers, and all connecting glassware;

The filter, along with the acidic rinses and acidic impinger contents, were submitted for metals analysis.

Figure 2. Schematic of Volatile Organic Sampling Train (VOST)

Figure 3. VOST Tube Components

3504408R

Figure 4. Semi-Volatile Sampling Train Configuration

4.4 Particulate Matter (PM)

Total particulate matter (PM) and fractionated PM was determined during this testing. The procedures for both are briefly discussed below.

Total PM

Total PM was determined in conjunction with the Method 26A sampling. The filters used in this train were weighed to a constant value prior to sampling. The filters were recovered from each train following sample collection and returned to the laboratory for the gravimetric determination of weight gain. Each filter was desiccated for 24 hours and then weighed to a constant weight to the nearest 0.5 milligrams. A constant weight is defined as two consecutive weights 24 hours apart that do not differ by more than 0.5 milligrams. The initial filter tare weight was subtracted from the sample filter weight to calculate the mass of PM collected. In addition, the mass of PM recovered from the aqueous rinse of the front half of the train also was determined as above and added to the mass collected on the filter.

Fractionated PM

Particle size distribution was determined using a Method 5-type train equipped with a cascade impactor. The impactor contained three (3) stages each containing a separate pre-weighed substrate. As the sample gas passed through the impactor, the PM was separated by particle size. After sampling, each substrate was removed and weighed as discussed above to determine the mass at each cut size.

4.5 Halogens

EPA Method 26A was used for the determination of the halogens chlorine (Cl_2) and fluorine (F_2) and hydrogen halides hydrochloric acid (HCl) and hydrofluoric acid (HF). Samples taken for the determination of the halogens were sampled isokinetically according to the protocol of EPA Method 26A. Figure 6 shows a schematic of this sampling train. Sample fractions submitted for analyses consisted of sulfuric acid impinger solutions (for analyses of HCl and HF) and NaOH impinger solutions (for analyses of Cl_2 and F_2) with their respective impinger rinses.

4.6 Stack Gas Flow Rates

The flow rate of the sample stream at each location was determined during all tests using the procedures outlined in EPA Methods 2-4. These methods are incorporated into EPA Methods 0060, 26A, 0010 and 23.

4.7 Total Hydrocarbons by Method 25A

A total hydrocarbon (THC) analyzer was used to measure the concentration of any volatile organics that was present in the gas stream. This analyzer does not speciate the compounds present, but rather presents a total concentration in ppm relative to a calibration standard that is typically methane or propane. The detector is a flame ionization detector (FID). Sample was extracted from the source and directed to the THC analyzer through a heated Teflon® sample line. The instrument was calibrated with protocol methane compressed gas standards following the procedures of EPA Method 25A.

3504411R

Figure 5. Schematic of Metals Sampling Train

4715624R

Figure 6. Method 26A Sampling Train Configuration

4.8 Allyl Alcohol by Modified EPA Method 308

Samples for the determination of allyl alcohol were collected by using a Method 308 sampling train, modified as discussed below. Method 308 utilizes a single midget impinger containing 15 mL of organic free water followed by a single two stage silica gel adsorbent tube. Alcohols are collected mainly in the water fraction, with the silica gel tube collecting any small amount of alcohol that may "break through" the impinger. The silica gel tube fraction is desorbed in the laboratory using the prescribed desorbing solution and then this solution along with the water fraction are analyzed separately by using a gas chromatograph equipped with a flame ionization detector (FID).

Due to the unique sample matrix encountered at the vitrification unit (high moisture and high levels of oxides of nitrogen), the Method 308 train used was modified by: (1) placing an optional chilled glass condenser prior to the first impinger; (2) adding three additional midget impingers; (3) replacing the organic free water adsorbing solution with an aqueous 0.2 M sodium hydroxide solution in the first, second and fourth impingers; and (4) removing the silica gel tube. This modified train is depicted in Figure 7.

The chilled condenser facilitated the condensation of the water vapor in the gas stream and this condensate was collected in the first impinger. The second and fourth impingers each contained nominally 15 mL of 0.2 M sodium hydroxide solution. The third impinger remained empty. Samples were collected for nominally 100 minutes at a nominal sampling rate of 0.75 liter per minute. Upon completion of sampling, the volume of the contents of the four impingers was determined for the calculation of gas stream moisture content. The contents of the first three impingers, along with water rinses of the sampling line, chilled condenser, impingers and connecting glassware, were combined and placed in an amber glass bottle. The contents of the fourth impinger was collected separately and analyzed to determine if breakthrough occurred.

4.9 Total Organic Emissions (TOE)

A discussion of TOE is provided in the EPA document entitled "Risk Burn Guidance for Hazardous Waste Combustors" (EPA 530-R-01-001, July 2001) which references sampling and analysis procedures given in the EPA document entitled "Guidance for Total Organics" (EPA/600/R-96/033, March 1996).

The determination of TOE involves the measurement of organic compounds over three fractions distinguished by boiling point ranges: 1) volatile compounds with boiling points less than 100 °C; 2) semi-volatile compounds (also known as total chromatographable organics or TCO) with boiling points ranging between 100 and 300 °C; and 3) non-volatile compounds (also known as GRAV) with boiling points greater than 300 °C. The sum of the three fractions represents the total organic mass and is typically expressed in units of mass per unit of volume of sample collected. The collection of the samples for the determination of TOE involves two sampling methods; Method 0040 and Method 0010. Samples, using these two methods, were collected simultaneously.

4.9.1 Volatile Fraction

The procedures outlined in Method 0040 were used for the collection of the *volatile organic fraction*. This fraction was comprised of two recovered samples, an aqueous condensate and a

gaseous sample collected in a Tedlar bag. Components of the sampling train are shown in Figure 8. Sample gas is withdrawn from the stack at a constant rate through a heated probe and filter, a chilled condenser and a water knockout trap and collected in a Tedlar bag. Sample was collected at a nominal rate of 0.5 liters per minute for one hour. Upon completion of sampling, the train components were recovered as follows:

- Condensate: Collected aqueous condensate plus organic free water rinses of the condenser and knockout trap were combined in a glass bottle and thoroughly mixed. The contents of the bottle was transferred to a 40 mL VOA vial and sealed with a Teflon lined cap in a fashion such that no void space (bubble) was present. This sample was stored on ice for transport to the laboratory.
- Tedlar Bag: The inlet to the Tedlar bag was sealed and the bag placed in a rigid container that protects the sample from light.

The gaseous Tedlar bag sample was analyzed on-site using a gas chromatograph equipped with a FID (GC/FID). The analysis procedure, given in "EPA/600/R-96/033", is summarized below.

The GC/FID was calibrated at three concentration levels using a gaseous standard composed of a mixture of C1 to C7 alkanes (methane, ethane, propane....). The retention time of each alkane is graphed against its corresponding boiling point using a x-y plot. Using method-specified boiling point ranges on either side of each alkane, a retention time window is determined for each of the alkanes. For the analysis, the area count of each peak falling within each retention time window is summed and a value (mass) is calculated based on the three-point calibration curve.

The condensate was shipped to the laboratory for analysis by GC/FID using a purge and trap method as specified in EPA/600/R-96/033.

4.9.2 Total Chromatographable Organics Fraction (TCO)

The procedures outlined in Method 0010 was used for the collection of the *TCO fraction*. This fraction was comprised of the combined extracts from the various train components that were recovered upon completion of the sampling. Components of the sampling train are shown in Figure 4 and the recovery procedure is discussed in Section 4.2. The combined extract was available for two analyses, the *TCO fraction* analysis and the *gravimetric (GRAV) fraction* analysis. The TCO fraction was prepared and analyzed by the GC/FID procedures given in EPA /600/R-96/033.

4.9.3 Gravimetric Fraction (GRAV)

A measured aliquot (typically 1 mL) of the Method 0010 combined methylene chloride extract described above is placed in a clean, pre-weighed aluminum weighing pan and allowed to evaporate following the procedures given in EPA /600/R-96/033. The pan, plus sample residue, is weighed to a constant weight and the weight gained is designated as the GRAV fraction.

Since the sample collected for the TOE was for "engineering formation", the level of quality control activities was reduced from those prescribed in the method, but included the following:

- leak check of new, unused Tedlar bags;
- collection of a field blank consisting of a Tedlar bag filled with high purity nitrogen and a water rinse of the condensate knockout trap collected in a VOA vial;
- leak check of the sampling train; and
- use of organic free reagents.

The collection of only one sample at the TCO outlet while spiking allyl alcohol and naphthalene into the melter was performed.

Figure 7. Modified Method 308 Train

Figure 8. Method 0040 Sampling Train

5.0 QUALITY CONTROL

The sampling and analytical quality control measures employed during this test program included those specified in Method 5 for meter calibrations, sampling rates, and sample train integrity. These parameters are summarized for each method in Tables 5-1 and 5-2 below.

Table 5-1. Sampling Summary - November, 2004 Mobilization

Location	Sample Type	Date	Run #	Leak Check Initial	Leak Check Final	% Iso	Moisture %
Melter	SVOC	11/17/04	1	0.004@10"	0.00@9"	99.72	25.13
HEPA				0.015@10"	0.004@15"	103.98	14.56
TCO				0.004@10"	0.01@20"	100.82	9.58
Melter	M-308	11/16/04	1 (spike)	0.01 lpm @7"	0.00 lpm @2"	--	--
			2	0.01 lpm @5"	0.00 lpm @2"	--	--
			3	0.00 lpm @4"	0.00 lpm @2"	--	--
			4	0.00 lpm @3"	0.00 lpm @2"	--	--
HEPA	M-308	11/16/04	1	0.00 lpm @4"	0.00 lpm @7"	--	--
			2	0.00 lpm @7"	0.00 lpm @7"	--	--
			3	0.00 lpm @ 7"	0.00 lpm @6"	--	--
TCO	M-308	11/16/04	1	0.01 lpm @5"	0.00 lpm @6"	--	--
			2	0.00 lpm @6"	0.00 lpm @6"	--	--
			3	0.00 lpm @6"	0.00 lpm @6"	--	--

Table 5.2 Sampling Summary - December, 2004 Mobilization (Revised 9-20-05)

Location	Sample Type	Date	Run #	Initial Leak Check ^a	Final Leak Check	% Iso ^b	Moisture (%)
Melter	Dioxin/ Furan	12/07-12/08/04	1	0.00@13"	0.002@12"	94.1	21.26
		12/08/04	2	.01@20"	.001@20"	95.6	22.20
		12/10/04	3	0.00@13"	0.002@14"	114.7	34.41
		12/10/04	4	0.000@13"	0.000@8"	114.8	34.56
TCO	Dioxin/ Furan	12/07/04	1	0.004@10"	0.004@15"	103.6	12.34
		12/07-12/08/04	2	.01@10"	.001@20"	93.3	12.42
		12/08/04	3	.01@20"	.001@20"	97.0	12.13
		12/10/04	4	0.006@12"	0.002@6.5"	99.0	12.12
		12/10/04	5	0.004@6"	0.000@14"	102.5	12.62
		12/10/04	6	0.01@15"	0.01@15"	104.0	12.12
Melter	M-26	12/10/04	1	.00@13"	.001@12"	99.9	32.55
			2	.00@8"	.001@8"	107.7	27.63
			3	.001@8"	.001@25"	105.2	39.10
		12/11/04	4	0.0@15"	.001@20"	122.1	36.42
			5	.001@8"	.001@12"	124.8	37.03
			6	.001@8"	Not Recorded	120.4	36.71
TCO	M-26	12/10/04	1	0.0@16"	.001@7"	100.1	10.45
			2	0.01@15"	.001@13"	102.3	10.13
			3	.001@8"	.001@8"	99.6	9.85
		12/11/04	4	0.0@16"	.001@8"	99.2	13.07
			5	.001@10"	.001@12"	100.9	13.17
			6	.001@8"	Not Recorded	102.9	13.14
Melter Out	Metals	12/09/04	1	0.000@14"	.001@16"	107.3	29.33
		12/10/04	2	0.0@14"	.001@14"	122.6	38.32
		12/10/04	3	.00@23"	.02@8"	112.0	30.36
		12/11/04	4	0.000@13"	0.000@6"	114.8	36.42
		12/11/04	5	0.000@10"	0.000@8"	121.0	37.54
		12/11/04	6	0.000@10"	0.000@6"	125.6	36.92

^a Acceptance criteria = 0.02 cfm @ > maximum test vacuum

^b Acceptance criteria = 90 ≤ % Iso ≤ 110

Table 5.2 Sampling Summary - December, 2004 Mobilization (cont')

<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Initial Leak Check^a</i>	<i>Final Leak Check</i>	<i>% Iso^b</i>	<i>Moisture (%)</i>
TCO	Metals	12/09/04	1	0.006@16"	0.000@17"	101.8	9.96
		12/10/04	2	.00@16"	.001@8"	103.7	11.37
		12/10/04	3	0.0@15"	.001@13"	102.3	10.14
		12/11/04	4	0.001@8"	0.000@6"	105.2	12.79
			5	0.000@10"	0.000@7"	103.9	12.53
			6	0.000@10"	0.000@8"	105.3	12.90
			7	0.000@10"	0.000@8"	107.6	12.86
Melter	SVOC	12/08/04	1	0.000@13"	0.000@6"	98.4	23.86
			2	0.000@7"	0.000@6"	100.6	25.54
			3	0.000@11"	0.000@8"	97.3	23.37
		12/09/04	4	0.000@12"	0.000@13"	104.2	25.94
			5	0.000@11"	0.000@12"	103.1	27.18
TCO	SVOC	12/08/04	1	0.010@13"	0.000@17"	101.7	11.86
			2	0.008@12"	0.006@11"	107.0	17.81
			3	0.000@12"	0.004@15"	100.5	11.75
		12/09/04	4	0.000@12"	0.002@13"	98.7	9.09
			5	0.006@13"	0.015@15"	99.8	9.42
HEPA Out	SVOC	12/08/04	1	0.000@10"	0.004@7"	103.9	11.82
			2	0.004@10"	0.004@10"	107.6	11.14
			3	0.004@10"	0.000@10"	108.3	11.38
		12/09/04	4	0.000@15"	0.004@8"	106.5	8.87
			5	0.008@8"	0.010@8"	106.6	8.94
Carbon Out	SVOC	12/08/04	1	0.000@10"	0.007@7"	104.1	12.70
			2	0.006@9"	0.004@9"	104.8	12.67
			3	0.004@9"	0.008@10"	102.6	10.10

^a Acceptance criteria = 0.02 cfm @ > maximum test vacuum

^b Acceptance criteria = 90 ≤ % Iso ≤ 110

Table 5.2 Sampling Summary - December, 2004 Mobilization (cont')

<i>Location</i>	<i>Sample Type</i>	<i>Date</i>	<i>Run #</i>	<i>Initial Leak Check ^a</i>	<i>Final Leak Check</i>	<i>% Iso</i>	<i>Moisture (%)</i>
Melter	M-308	12/07/04	1	0.00 lpm @7"	0.00 lpm @4"	--	--
			2	0.00 lpm @3"	0.00 lpm @4"	--	--
			3	0.00 lpm @8"	0.00 lpm @10"	--	--
HEPA	M-308	12/07/04	1	0.00 lpm @10"	0.00 lpm @4"	--	--
			2	0.00 lpm @5"	0.00 lpm @6"	--	--
			3	0.00 lpm @9"	0.00 lpm @8"	--	--
TCO	M-308	12/06/04	1 (spike)	0.00 lpm @7"	0.00 lpm @8"	--	--
		12/07/04	2	0.00 lpm @7"	0.00 lpm @5"	--	--
			3	0.00 lpm @5"	0.00 lpm @5"	--	--
			4	0.00 lpm @5"	0.00 lpm @5"	--	--
Carbon Bed	M-308	12/07/04	1	0.00 lpm @5"	0.00 lpm @7"	--	--
			2	0.00 lpm @7"	0.00 lpm @7"	--	--
			3	0.00 lpm @7"	0.00 lpm @7"	--	--

^a Acceptance criteria = 0.02 cfm @ > maximum test vacuum

^b Acceptance criteria = 90 ≤ % Iso ≤ 110

The acceptable range for % isokinetic sampling is 90-110%. Of the 56 sampling runs that required isokinetic sampling, 10 tests exceeded the upper limit. Of the 10, 4 were in the 110-115% range and 6 in the 110-126% range. Sampling at a rate above the 100% would have the effect of biasing the results towards smaller sized PM.

Appendix A

Data Tables

Appendix A.1

VOST

Table 1. Melter - Run 1 / December 9, 2004

	Run 1A Test 2			Run 1B Test 2			Run 1C Test 2			Condensate Run 1A - 1C Test 2			Avg. of Tubes A-C			Total (Tube Avg. + Condensate)		
	Conc ug/dscf	Emission Rate ug/min		Conc ug/dscf	Emission Rate ug/min		Conc ug/dscf	Emission Rate ug/min		Conc ug/dscf	Emission Rate ug/min		Conc ug/dscf	Emission Rate ug/min		Conc ug/dscf	Emission Rate ug/min	
Acetone	2.58	447		3.23	560		2.99	517		0.132	22.8		2.93	508		3.06	531	
Acetonitrile	31.3	5416		24.3	4215		13.5	2335		1.26	218		23.0	3989		24.3	4207	
Acrylonitrile	<	185		<	169		<	200		<	43.0		<	185		<	228	
Benzene	2.20	382		2.08	361		1.90	329		0.248	1.66		1.07	358		1.31	359	
Bromodichloromethane	<	0.012		<	2.26		<	2.21		0.010	1.66		2.06	2.19		2.07	3.84	
Bromoform	<	0.018		<	3.09		<	3.26		0.013	2.28		0.019	3.23		0.032	5.52	
Bromomethane	<	0.026		<	4.55		<	3.92		0.036	6.29		0.025	4.31		0.061	10.6	
2-Butanone	<	0.277		<	48.0		<	50.72		0.073	12.6		0.290	50.2		0.362	62.8	
Carbon disulfide	<	0.021		<	3.61		<	3.31		0.010	1.69		0.020	3.52		0.030	5.21	
Carbon tetrachloride	<	0.024		<	4.13		<	4.12		0.012	2.05		0.023	4.07		0.035	6.12	
Chlorobenzene	<	1.38		<	239		<	1.38		0.010	1.75		1.41	244		1.42	245	
Dibromochloromethane	<	0.010		<	1.81		<	1.91		0.019	3.24		0.011	1.89		0.030	5.13	
Chloroethane	<	0.011		<	1.85		<	1.96		0.023	3.97		0.011	1.94		0.034	5.91	
Chloroform	<	0.046		<	7.98		<	7.68		0.010	1.66		0.044	7.67		0.054	9.33	
Chloromethane	3.03	524		2.23	387		0.084	14.6		0.011	1.99		1.78	309		1.79	311	
1,1-Dichloroethane	<	0.009		<	1.62		<	1.71		0.010	1.66		0.010	1.69		0.019	3.35	
1,2-Dichloroethane	<	0.013		<	2.28		<	2.41		0.010	1.66		0.014	2.39		0.023	4.04	
1,1-Dichloroethene	<	0.016		<	2.71		<	2.86		0.010	1.66		0.016	2.83		0.026	4.49	
1,2-Dichloroethene (total)	<	0.023		<	4.04		<	4.27		0.019	3.31		0.024	4.23		0.043	7.54	
1,2-Dichloropropane	<	0.012		<	2.14		<	2.26		0.010	1.66		0.013	2.24		0.022	3.89	
cis-1,3-Dichloropropene	<	0.011		<	1.85		<	1.96		0.010	1.66		0.011	1.94		0.021	3.59	
trans-1,3-Dichloropropene	<	0.011		<	1.85		<	1.96		0.011	1.82		0.011	1.94		0.022	3.76	
Ethylbenzene	0.966	11.4		0.058	10.1		0.061	10.6		0.010	1.69		0.062	10.7		0.071	12.4	
2-Hexanone	<	0.059		<	10.2		<	9.04		0.073	12.6		0.055	9.50		0.127	22.1	
Iodomethane	<	0.022		<	3.80		<	2.59		0.011	1.99		0.018	3.05		0.029	5.03	
Methylene chloride	1.00	173		0.768	133		0.913	158		0.082	14.2		0.894	155		0.976	169	
4-Methyl-2-pentanone	<	0.080		<	13.8		<	14.6		0.038	6.62		0.083	14.4		0.121	21.0	
Styrene	<	0.013		<	2.33		<	2.46		0.010	1.66		0.014	2.44		0.024	4.09	
1,1,2,2-Tetrachloroethane	<	0.018		<	3.18		<	3.36		0.015	2.52		0.019	3.33		0.034	5.85	
Tetrachloroethene	0.042	7.27		0.035	6.01		0.027	4.62		0.010	1.72		0.034	5.97		0.044	7.69	
Toluene	0.429	74.4		0.375	64.9		0.337	58.4		0.010	1.66		0.380	65.9		0.390	67.6	
1,1,1-Trichloroethane	<	0.014		<	2.42		<	2.56		0.010	1.66		0.015	2.54		0.024	4.19	
1,1,2-Trichloroethane	<	0.015		<	2.66		<	2.81		0.023	3.97		0.016	2.78		0.039	6.76	
Trichloroethene	<	0.027		<	4.70		<	4.97		0.010	1.66		0.028	4.92		0.038	6.58	
Vinyl chloride	0.016	2.85		0.018	3.06		0.025	4.34		0.023	3.97		0.020	3.42		0.043	7.39	
Xylenes (total)	0.326	56.5		0.285	49.34		0.293	50.7		0.029	4.97		0.301	52.2		0.330	57.2	

Table 3. Melter - Run 3 / December 9, 2004

	Run 3A Test 2			Run 3B Test 2			Run 3C Test 2			3A - 3C Test 2			Avg of Tubes A-C			Total		
	Conc ug/dscf	Rate ug/min	Emission ug/min	Conc ug/dscf	Rate ug/min	Emission ug/min	Conc ug/dscf	Rate ug/min	Emission ug/min	Conc ug/dscf	Rate ug/min	Emission ug/min	Conc ug/dscf	Rate ug/min	Emission ug/min	Conc ug/dscf	Rate ug/min	Emission ug/min
Acetone	4.65	807	501	2.89	501	1880	10.1	1747	1147	0.126	21.8	1018	5.88	1018	1018	6.00	1040	1040
Acetonitrile	26.7	4631	1880	10.9	1880	1880	2.88	499	209	1.21	209	2337	13.5	2337	2337	14.7	2545	2545
Acrylonitrile	1.55	268	184	1.06	184	184	0.961	167	167	0.237	41.1	206	1.19	206	206	1.43	247	247
Benzene	2.26	392	315	1.82	315	315	2.17	376	376	0.009	1.58	361	2.08	361	361	2.09	362	362
Bromodichloromethane	< 0.013	< 2.29	< 1.84	< 0.011	< 1.84	< 2.72	< 0.013	< 2.19	< 2.19	< 0.009	< 1.58	< 2.11	< 0.012	< 2.11	< 2.11	< 0.021	< 3.69	< 3.69
Bromoform	< 0.020	< 3.38	< 3.26	< 0.016	< 3.26	< 3.26	< 0.019	< 3.24	< 3.24	< 0.013	< 2.18	< 3.11	< 0.018	< 3.11	< 3.11	< 0.031	< 5.30	< 5.30
Bromomethane	< 0.023	< 4.06	< 3.26	< 0.019	< 3.26	< 3.26	< 0.022	< 3.89	< 3.89	< 0.035	< 6.01	< 3.74	< 0.022	< 3.74	< 3.74	< 0.056	< 9.75	< 9.75
2-Butanone	0.315	54.6	42.2	0.244	42.2	42.2	0.247	42.9	42.9	0.069	12.0	46.6	0.269	46.6	46.6	0.338	58.6	58.6
Carbon disulfide	< 0.019	< 3.30	< 2.67	< 0.015	< 2.67	< 3.43	< 0.019	< 3.29	< 3.29	< 0.009	< 1.61	< 3.09	< 0.018	< 3.09	< 3.09	< 0.027	< 4.70	< 4.70
Carbon tetrachloride	< 0.022	< 3.75	< 3.43	< 0.020	< 3.43	< 3.43	< 0.022	< 3.84	< 3.84	< 0.011	< 1.96	< 3.67	< 0.021	< 3.67	< 3.67	< 0.033	< 5.63	< 5.63
Chlorobenzene	< 1.06	< 183	< 231	< 1.33	< 231	< 159	< 1.37	< 238	< 238	< 0.009	< 3.10	< 1.82	< 1.25	< 217	< 217	< 1.26	< 219	< 219
Dibromochloromethane	< 0.011	< 1.98	< 1.59	< 0.009	< 1.59	< 1.63	< 0.011	< 1.89	< 1.89	< 0.018	< 3.80	< 1.87	< 0.011	< 1.87	< 1.87	< 0.028	< 4.92	< 4.92
Chloroethane	< 0.012	< 2.03	< 1.63	< 0.009	< 1.63	< 1.63	< 0.011	< 1.94	< 1.94	< 0.022	< 3.80	< 1.87	< 0.011	< 1.87	< 1.87	< 0.033	< 5.66	< 5.66
Chloroform	< 0.061	< 10.6	< 6.60	< 0.038	< 6.60	< 6.60	< 0.043	< 7.38	< 7.38	< 0.011	< 1.58	< 8.18	< 0.047	< 8.18	< 8.18	< 0.056	< 9.76	< 9.76
Chloromethane	< 0.123	< 21.3	< 8.59	< 0.050	< 8.59	< 8.59	< 0.035	< 5.98	< 5.98	< 0.011	< 1.90	< 12.0	< 0.069	< 12.0	< 12.0	< 0.080	< 13.9	< 13.9
1,1-Dichloroethane	< 0.061	< 1.77	< 2.01	< 0.008	< 2.01	< 2.38	< 0.010	< 1.70	< 1.70	< 0.009	< 1.58	< 1.63	< 0.009	< 1.63	< 1.63	< 0.019	< 3.21	< 3.21
1,2-Dichloroethane	< 0.014	< 2.50	< 2.38	< 0.012	< 2.38	< 2.38	< 0.014	< 2.39	< 2.39	< 0.009	< 1.58	< 2.30	< 0.013	< 2.30	< 2.30	< 0.022	< 3.88	< 3.88
1,1-Dichloroethene	< 0.017	< 2.97	< 3.55	< 0.014	< 3.55	< 3.55	< 0.016	< 2.84	< 2.84	< 0.009	< 1.58	< 2.73	< 0.016	< 2.73	< 2.73	< 0.025	< 4.31	< 4.31
1,2-Dichloroethene (total)	< 0.026	< 4.42	< 4.42	< 0.020	< 4.42	< 4.42	< 0.024	< 4.24	< 4.24	< 0.018	< 3.16	< 4.07	< 0.023	< 4.07	< 4.07	< 0.042	< 7.24	< 7.24
1,2-Dichloropropane	< 0.014	< 2.34	< 1.88	< 0.011	< 1.88	< 1.88	< 0.013	< 2.24	< 2.24	< 0.009	< 1.58	< 2.16	< 0.012	< 2.16	< 2.16	< 0.020	< 3.74	< 3.74
cis-1,3-Dichloropropene	< 0.012	< 2.03	< 1.63	< 0.009	< 1.63	< 1.63	< 0.011	< 1.94	< 1.94	< 0.010	< 1.74	< 1.87	< 0.011	< 1.87	< 1.87	< 0.021	< 3.61	< 3.61
trans-1,3-Dichloropropene	< 0.050	< 8.64	< 11.3	< 0.065	< 11.3	< 11.3	< 0.061	< 10.5	< 10.5	< 0.009	< 1.61	< 10.2	< 0.059	< 10.2	< 10.2	< 0.068	< 11.8	< 11.8
Ethylbenzene	< 0.054	< 9.37	< 7.52	< 0.043	< 7.52	< 7.52	< 0.052	< 8.97	< 8.97	< 0.069	< 12.0	< 8.62	< 0.050	< 8.62	< 8.62	< 0.119	< 20.6	< 20.6
2-Hexanone	< 0.016	< 2.81	< 2.09	< 0.012	< 2.09	< 2.09	< 0.014	< 2.49	< 2.49	< 0.011	< 1.90	< 2.46	< 0.014	< 2.46	< 2.46	< 0.025	< 4.36	< 4.36
Iodomethane	0.901	156	148	0.856	148	148	0.820	142	142	0.055	9.49	149	0.859	149	149	0.914	158	158
Methylene chloride	< 0.087	< 15.1	< 12.1	< 0.070	< 12.1	< 12.1	< 0.083	< 14.5	< 14.5	< 0.037	< 6.33	< 13.9	< 0.080	< 13.9	< 13.9	< 0.117	< 20.2	< 20.2
4-Methyl-2-pentanone	< 0.015	< 2.55	< 2.05	< 0.012	< 2.05	< 2.05	< 0.014	< 2.44	< 2.44	< 0.009	< 1.58	< 2.35	< 0.014	< 2.35	< 2.35	< 0.023	< 3.93	< 3.93
Styrene	< 0.020	< 3.49	< 2.80	< 0.016	< 2.80	< 2.80	< 0.019	< 3.34	< 3.34	< 0.014	< 2.40	< 3.21	< 0.019	< 3.21	< 3.21	< 0.032	< 5.61	< 5.61
Tetrachloroethene	< 0.031	< 5.31	< 4.89	< 0.028	< 4.89	< 4.89	< 0.034	< 5.83	< 5.83	< 0.009	< 1.65	< 5.34	< 0.031	< 5.34	< 5.34	< 0.040	< 6.99	< 6.99
Toluene	0.395	68.4	61.2	0.353	61.2	61.2	0.335	58.0	58.0	0.009	1.58	62.5	0.361	62.5	62.5	0.370	64.1	64.1
1,1,1-Trichloroethane	< 0.015	< 2.65	< 2.13	< 0.012	< 2.13	< 2.13	< 0.015	< 2.54	< 2.54	< 0.009	< 1.58	< 2.44	< 0.014	< 2.44	< 2.44	< 0.023	< 4.02	< 4.02
1,1,2-Trichloroethane	< 0.017	< 2.91	< 2.34	< 0.014	< 2.34	< 2.34	< 0.016	< 2.79	< 2.79	< 0.022	< 3.80	< 2.68	< 0.015	< 2.68	< 2.68	< 0.037	< 6.48	< 6.48
Trichloroethene	< 0.030	< 5.15	< 4.16	< 0.024	< 4.16	< 4.16	< 0.028	< 4.94	< 4.94	< 0.009	< 1.58	< 4.75	< 0.027	< 4.75	< 4.75	< 0.046	< 7.93	< 7.93
Vinyl chloride	0.017	2.94	4.32	0.025	4.32	4.32	0.030	5.14	5.14	0.022	< 3.80	< 4.13	0.024	< 4.13	< 4.13	< 0.037	< 6.33	< 6.33
Xylenes (total)	< 0.243	< 42.1	< 56.8	< 0.328	< 56.8	< 56.8	< 0.291	< 50.4	< 50.4	< 0.027	< 4.75	< 49.8	< 0.287	< 49.8	< 49.8	< 0.315	< 54.5	< 54.5

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Table 5. Melter - Run 5 / December 10, 2004

	Run 5A Test 2						Run 5B Test 2						Run 5C Test 2						Avg of Tubes A-C						Total											
	Conc			Emission			Conc			Emission			Conc			Emission			Conc			Emission			Conc			Emission			Conc			Emission		
	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min			
Acetone	8.31	1517		6.88	1257		5.37	981		0.131	24.0		6.85	1252		6.98	1276																			
Acetonitrile	43.6	7972		36.0	6572		37.2	6800		2.07	377		2.44	44.6		38.9	7115																			
Acrylonitrile	2.93	535		3.20	584		3.17	579		0.009	1.71		0.009	1.71		3.10	566																			
Benzene	3.81	696		3.59	656		4.31	788		0.012	2.22		0.009	1.71		3.91	714																			
Bromodichloromethane	<	2.26		<	2.30		<	2.22		<	0.018		<	0.009		<	2.26																			
Bromochloromethane	<	3.34		<	3.40		<	3.29		<	0.013		<	0.018		<	2.32																			
Bromomethane	<	4.01		<	4.08		<	3.94		<	0.022		<	0.036		<	4.01																			
2-Butanone	<	77.7		<	68.6		<	51.8		<	0.284		<	13.0		<	66.0																			
Carbon disulfide	0.027	5.01		0.027	4.87		0.027	4.95		0.010	17.5		0.027	4.95		0.037	6.70																			
Carbon tetrachloride	<	4.47		<	4.29		<	4.90		<	0.012		<	2.13		<	4.56																			
Chlorobenzene	1.26	230		1.18	216		2.220	406		0.009	1.71		0.009	1.71		1.55	284																			
Dibromochloromethane	<	1.95		<	1.99		<	1.92		<	0.011		<	3.36		<	1.96																			
Chloroethane	<	2.01		<	2.04		<	1.97		<	0.023		<	4.12		<	2.01																			
Chloroform	<	11.0		<	10.6		<	11.3		<	0.062		<	1.71		<	11.0																			
Chloromethane	0.070	12.7		0.080	14.6		0.044	8.01		0.011	2.06		0.011	2.06		0.065	11.8																			
1,1-Dichloroethane	<	1.75		<	1.78		<	1.72		<	0.009		<	1.71		<	1.75																			
1,2-Dichloroethane	<	2.47		<	2.51		<	2.43		<	0.013		<	1.71		<	2.47																			
1,1-Dichloroethene	<	2.93		<	2.98		<	2.88		<	0.016		<	1.71		<	2.93																			
1,2-Dichloroethene (total)	<	4.37		<	4.45		<	4.30		<	0.024		<	3.43		<	4.37																			
1,2-Dichloropropane	<	2.31		<	2.36		<	2.28		<	0.012		<	1.71		<	2.32																			
cis-1,3-Dichloropropene	<	2.01		<	2.04		<	1.97		<	0.011		<	1.71		<	2.01																			
trans-1,3-Dichloropropene	<	2.01		<	2.04		<	1.97		<	0.011		<	1.89		<	2.01																			
Ethylbenzene	<	7.77		<	7.91		<	12.2		<	0.067		<	13.0		<	9.29																			
2-Hexanone	<	9.26		<	9.43		<	12.9		<	0.071		<	13.0		<	10.5																			
Iodomethane	<	3.50		<	3.06		<	2.86		<	0.016		<	2.06		<	3.14																			
Methylene chloride	0.493	90.0		0.338	61.8		0.374	68.3		0.080	14.7		0.047	8.57		0.402	73.4																			
4-Methyl-2-pentanone	<	14.9		<	15.2		<	14.7		<	0.038		<	6.86		<	14.9																			
Styrene	<	2.52		<	2.57		<	2.48		<	0.014		<	1.71		<	2.52																			
1,1,2,2-Tetrachloroethane	<	3.45		<	3.51		<	3.39		<	0.019		<	2.61		<	3.45																			
Tetrachloroethene	<	3.57		<	3.30		<	3.29		<	0.018		<	1.78		<	3.39																			
Toluene	0.652	119		<	105		<	140		<	0.765		<	1.71		<	121																			
1,1,1-Trichloroethane	<	2.62		<	2.67		<	2.58		<	0.014		<	1.71		<	2.62																			
1,1,2-Trichloroethane	<	2.88		<	2.93		<	2.83		<	0.015		<	4.12		<	2.88																			
Trichloroethene	<	5.63		<	5.47		<	5.79		<	0.032		<	1.71		<	5.63																			
Vinyl chloride	0.144	26.2		0.153	28.0		0.137	25.1		<	0.137		<	4.12		<	26.4																			
Xylenes (total)	<	36.5		<	34.6		<	56.1		<	0.307		<	5.14		<	42.4																			

Table 9. TCO Run 2 - December 9, 2004

Chemical	Run 2A Test 2						Run 2B Test 2						Run 2C Test 2						Run 2A-2C Test 2						Avg of Tubes A-C						Total (Tube Avg + Condensate)							
	Emission			Emission			Emission			Emission			Emission			Emission			Emission			Emission			Emission			Emission			Emission			Emission				
	Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min			
Acetone	5.54	1033		2.88	537		2.87	499		2.47	382		0.414	77.2		1.24	232		3.49	651		3.90	728		3.90	728		3.90	728		3.90	728		3.90	728		3.90	728
Acetonitrile	2.48	464	<	2.67	464	<	2.67	464	<	2.47	461	<	1.24	232	<	2.47	461	<	2.54	475	<	3.78	706	<	3.78	706	<	3.78	706	<	3.78	706	<	3.78	706	<	3.78	706
Acrylonitrile	0.271	50.5	<	0.291	54.3	<	0.291	54.3	<	0.269	50.2	<	0.244	45.6	<	0.269	50.2	<	0.277	51.7	<	0.521	97.3	<	0.521	97.3	<	0.521	97.3	<	0.521	97.3	<	0.521	97.3	<	0.521	97.3
Benzene	0.213	39.8	<	0.259	48.3	<	0.259	48.3	<	0.212	39.5	<	0.009	1.76	<	0.212	39.5	<	0.228	42.5	<	0.237	44.3	<	0.237	44.3	<	0.237	44.3	<	0.237	44.3	<	0.237	44.3	<	0.237	44.3
Bromodichloromethane	0.012	2.27	<	0.013	2.44	<	0.013	2.44	<	0.012	2.25	<	0.009	1.76	<	0.009	1.76	<	0.012	2.32	<	0.022	4.08	<	0.022	4.08	<	0.022	4.08	<	0.022	4.08	<	0.022	4.08	<	0.022	4.08
Bromoform	0.018	3.35	<	0.019	3.60	<	0.019	3.60	<	0.018	3.33	<	0.013	2.42	<	0.018	3.33	<	0.018	3.43	<	0.031	5.85	<	0.031	5.85	<	0.031	5.85	<	0.031	5.85	<	0.031	5.85	<	0.031	5.85
Bromomethane	0.022	4.02	<	0.023	4.32	<	0.023	4.32	<	0.021	4.00	<	0.036	6.67	<	0.021	4.00	<	0.022	4.11	<	0.058	10.8	<	0.058	10.8	<	0.058	10.8	<	0.058	10.8	<	0.058	10.8	<	0.058	10.8
2-Butanone	0.088	16.5	<	0.105	19.7	<	0.105	19.7	<	0.088	16.4	<	0.071	13.3	<	0.088	16.4	<	0.094	17.5	<	0.165	30.9	<	0.165	30.9	<	0.165	30.9	<	0.165	30.9	<	0.165	30.9	<	0.165	30.9
Carbon disulfide	0.017	3.25	<	0.018	3.30	<	0.018	3.30	<	0.015	2.84	<	0.010	1.79	<	0.015	2.84	<	0.017	3.13	<	0.026	4.92	<	0.026	4.92	<	0.026	4.92	<	0.026	4.92	<	0.026	4.92	<	0.026	4.92
Carbon tetrachloride	0.009	1.75	<	0.010	1.88	<	0.010	1.88	<	0.009	1.74	<	0.012	2.18	<	0.009	1.74	<	0.012	2.18	<	0.021	3.97	<	0.021	3.97	<	0.021	3.97	<	0.021	3.97	<	0.021	3.97	<	0.021	3.97
Chlorobenzene	0.012	2.22	<	0.013	2.38	<	0.013	2.38	<	0.012	2.20	<	0.009	1.76	<	0.012	2.20	<	0.012	2.27	<	0.022	4.02	<	0.022	4.02	<	0.022	4.02	<	0.022	4.02	<</					

Table 10. TCO Run 3 - December 9, 2004

	Run 3A Test 2			Run 3B Test 2			Run 3C Test 2			Run 3A-3C Test 2			Avg of Tubes A-C			Total (Tube Avg + Condensate)		
	Conc ug/dscf	Emission Rate ug/min		Conc ug/dscf	Emission Rate ug/min		Conc ug/dscf	Emission Rate ug/min		Conc ug/dscf	Emission Rate ug/min		Conc ug/dscf	Emission Rate ug/min		Conc ug/dscf	Emission Rate ug/min	
Acetone	1.18	221		1.68	313		1.14	213		0.347	64.7		1.33	249		1.68	314	
Acetonitrile	< 1.97	< 368		< 2.60	< 486		< 2.56	< 478		< 1.14	< 214		< 2.38	< 444		< 3.52	< 658	
Acrylonitrile	< 0.215	< 40.1		< 0.283	< 52.9		< 0.279	< 52.0		< 0.225	< 42.1		< 0.225	< 48.3		< 0.484	< 90.4	
Benzene	< 0.290	< 54.1		< 0.266	< 49.7		< 0.191	< 35.6		< 0.009	< 1.62		< 0.249	< 46.5		< 0.258	< 48.1	
Bromodichloromethane	< 0.010	< 1.80		< 0.013	< 2.37		< 0.013	< 2.34		< 0.009	< 1.62		< 0.012	< 2.17		< 0.020	< 3.79	
Bromoforn	< 0.014	< 2.66		< 0.019	< 3.51		< 0.018	< 3.45		< 0.012	< 2.23		< 0.017	< 3.21		< 0.029	< 5.44	
Bromomethane	< 0.017	< 3.19		< 0.023	< 4.21		< 0.022	< 4.14		< 0.033	< 6.15		< 0.021	< 3.85		< 0.054	< 10.0	
2-Butanone	< 0.070	< 13.1		< 0.093	< 17.3		< 0.091	< 17.0		< 0.066	< 12.3		< 0.085	< 15.8		< 0.150	< 28.1	
Carbon disulfide	< 0.013	< 2.42		< 0.019	< 3.62		< 0.015	< 2.87		< 0.009	< 1.65		< 0.016	< 2.97		< 0.025	< 4.62	
Carbon tetrachloride	< 0.007	< 1.39		< 0.010	< 1.83		< 0.010	< 1.81		< 0.011	< 2.01		< 0.009	< 1.68		< 0.020	< 3.68	
Chlorobenzene	< 0.009	< 1.76		< 0.012	< 2.32		< 0.012	< 2.28		< 0.009	< 1.62		< 0.011	< 2.12		< 0.020	< 3.74	
Dibromochloromethane	< 0.008	< 1.56		< 0.011	< 2.05		< 0.011	< 2.02		< 0.017	< 3.17		< 0.010	< 1.87		< 0.027	< 5.05	
Chloroethane	< 0.009	< 1.60		< 0.011	< 2.10		< 0.011	< 2.07		< 0.021	< 3.88		< 0.010	< 1.92		< 0.031	< 5.81	
Chloroform	< 0.010	< 1.88		< 0.013	< 2.48		< 0.013	< 2.44		< 0.009	< 1.62		< 0.012	< 2.27		< 0.021	< 3.89	
Chloromethane	0.068	12.7		0.115	21.4		0.126	23.5		< 0.009	< 1.94		< 0.103	< 19.2		< 0.113	< 21.2	
1,1-Dichloroethane	< 0.007	< 1.39		< 0.010	< 1.83		< 0.010	< 1.81		< 0.009	< 1.62		< 0.009	< 1.68		< 0.018	< 3.30	
1,2-Dichloroethane	< 0.011	< 1.96		< 0.014	< 2.59		< 0.014	< 2.55		< 0.009	< 1.62		< 0.013	< 2.37		< 0.021	< 3.99	
1,1-Dichloroethene	< 0.012	< 2.33		< 0.016	< 3.08		< 0.016	< 3.03		< 0.009	< 1.62		< 0.015	< 2.81		< 0.024	< 4.43	
1,2-Dichloroethene (total)	< 0.019	< 3.48		< 0.025	< 4.59		< 0.024	< 4.51		< 0.017	< 3.24		< 0.022	< 4.19		< 0.040	< 7.43	
1,2-Dichloropropene	< 0.010	< 1.84		< 0.013	< 2.43		< 0.013	< 2.39		< 0.009	< 1.62		< 0.012	< 2.22		< 0.021	< 3.84	
cis-1,3-Dichloropropene	< 0.009	< 1.60		< 0.011	< 2.10		< 0.011	< 2.07		< 0.009	< 1.62		< 0.010	< 1.92		< 0.019	< 3.54	
trans-1,3-Dichloropropene	< 0.009	< 1.60		< 0.011	< 2.10		< 0.011	< 2.07		< 0.010	< 1.78		< 0.010	< 1.92		< 0.020	< 3.70	
Ethylbenzene	< 0.007	< 1.31		< 0.009	< 1.73		< 0.009	< 1.70		< 0.009	< 1.65		< 0.008	< 1.58		< 0.017	< 3.23	
2-Hexanone	< 0.039	< 7.37		< 0.052	< 9.71		< 0.051	< 9.56		< 0.066	< 12.3		< 0.048	< 8.88		< 0.113	< 21.2	
Iodomethane	< 0.011	< 2.05		< 0.014	< 2.70		< 0.014	< 2.65		< 0.010	< 1.94		< 0.013	< 2.47		< 0.024	< 4.41	
Methylene chloride	0.526	98.2		0.968	181		0.624	117		0.277	51.8		0.706	132		0.984	184	
4-Methyl-2-pentanone	< 0.064	< 11.9		< 0.084	< 15.7		< 0.082	< 15.4		< 0.035	< 6.47		< 0.077	< 14.3		< 0.111	< 20.8	
Styrene	< 0.011	< 2.01		< 0.014	< 2.64		< 0.014	< 2.60		< 0.009	< 1.62		< 0.013	< 2.42		< 0.022	< 4.04	
1,1,2,2-Tetrachloroethane	< 0.015	< 2.74		< 0.019	< 3.62		< 0.019	< 3.56		< 0.013	< 2.46		< 0.018	< 3.31		< 0.031	< 5.76	
Tetrachloroethene	< 0.021	< 3.97		< 0.020	< 3.75		< 0.020	< 3.82		< 0.009	< 1.68		< 0.021	< 3.85		< 0.030	< 5.53	
Toluene	0.013	2.37		0.042	7.83		0.013	2.39		< 0.009	< 1.62		< 0.022	< 4.20		< 0.031	< 5.81	
1,1,1-Trichloroethane	< 0.011	< 2.09		< 0.015	< 2.75		< 0.015	< 2.71		< 0.009	< 1.82		< 0.013	< 2.52		< 0.022	< 4.13	
1,1,2-Trichloroethane	< 0.012	< 2.29		< 0.016	< 3.02		< 0.016	< 2.97		< 0.021	< 3.88		< 0.015	< 2.76		< 0.036	< 6.65	
Trichloroethene	< 1.66	< 309		< 1.40	< 262		< 1.44	< 268		< 0.009	< 1.62		< 1.50	< 280		< 1.51	< 281	
Vinyl chloride	0.012	2.17		< 0.012	< 2.24		< 0.012	< 2.18		< 0.021	< 3.88		< 0.012	< 2.20		< 0.033	< 6.08	
Xylenes (total)	< 0.026	< 4.91		< 0.035	< 6.48		< 0.034	< 6.37		< 0.026	< 4.85		< 0.032	< 5.92		< 0.058	< 10.8	

Table 12. TCO Run 5 - December 10, 2004

	Run 5A Test 2				Run 5B Test 2				Run 5C Test 2				Run 5A-5C Test 2				Avg of Tubes A-C				Total (Tube Avg + Condensate)			
	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min
Acetone	1.83	343	1.25	234	2.12	398	0.123	23.0	1.73	325	1.86	348	1.73	325	1.86	348	1.73	325	1.86	348	1.86	348	1.86	348
Acetonitrile	2.35	441	2.41	453	2.44	457	1.17	219	2.40	450	3.57	669	2.40	450	3.57	669	2.40	450	3.57	669	3.57	669	3.57	669
Acrylonitrile	0.256	48.0	0.263	49.3	0.265	49.7	0.231	43.2	0.261	49.0	0.493	92.1	0.231	43.2	0.493	92.1	0.261	49.0	0.493	92.1	0.493	92.1	0.493	92.1
Benzene	0.228	42.7	0.220	41.3	0.209	39.1	0.009	1.66	0.219	41.0	0.228	42.7	0.009	1.66	0.219	41.0	0.219	41.0	0.228	42.7	0.228	42.7	0.228	42.7
Bromodichloromethane	0.011	2.15	0.012	2.21	0.012	2.23	0.009	1.66	0.012	2.20	0.021	3.86	0.009	1.66	0.012	2.20	0.012	2.20	0.021	3.86	0.021	3.86	0.021	3.86
Bromoforn	0.017	3.18	0.017	3.27	0.018	3.30	0.012	2.29	0.017	3.25	0.030	5.54	0.012	2.29	0.017	3.25	0.017	3.25	0.030	5.54	0.030	5.54	0.030	5.54
Bromomethane	0.020	3.82	0.021	3.92	0.021	3.96	0.034	6.31	0.021	3.90	0.055	10.2	0.034	6.31	0.021	3.90	0.021	3.90	0.055	10.2	0.055	10.2	0.055	10.2
2-Butanone	0.122	22.8	0.097	18.1	0.087	16.2	0.068	12.6	0.068	12.6	0.169	31.6	0.068	12.6	0.102	19.0	0.102	19.0	0.169	31.6	0.169	31.6	0.169	31.6
Carbon disulfide	0.015	2.72	0.015	2.79	0.015	2.76	0.009	1.69	0.015	2.76	0.024	4.45	0.009	1.69	0.015	2.76	0.015	2.76	0.024	4.45	0.024	4.45	0.024	4.45
Carbon tetrachloride	0.009	1.67	0.009	1.71	0.009	1.72	0.011	1.66	0.009	1.70	0.020	3.76	0.011	1.66	0.009	1.70	0.009	1.70	0.020	3.76	0.020	3.76	0.020	3.76
Chlorobenzene	0.011	2.11	0.012	2.16	0.012	2.18	0.009	1.66	0.011	2.15	0.020	3.81	0.009	1.66	0.011	2.15	0.011	2.15	0.020	3.81	0.020	3.81	0.020	3.81
Dibromochloromethane	0.010	1.86	0.010	1.91	0.010	1.93	0.017	3.25	0.010	1.90	0.028	5.15	0.017	3.25	0.010	1.90	0.010	1.90	0.028	5.15	0.028	5.15	0.028	5.15
Chloroethane	0.010	1.91	0.010	1.96	0.011	1.98	0.021	3.98	0.010	1.95	0.032	5.93	0.021	3.98	0.010	1.95	0.010	1.95	0.032	5.93	0.032	5.93	0.032	5.93
Chloroform	0.012	2.25	0.012	2.31	0.012	2.33	0.009	1.66	0.012	2.30	0.021	3.96	0.009	1.66	0.012	2.30	0.012	2.30	0.021	3.96	0.021	3.96	0.021	3.96
Chloromethane	0.025	4.68	0.043	8.12	0.086	16.1	0.011	1.99	0.051	9.64	0.062	11.6	0.011	1.99	0.051	9.64	0.051	9.64	0.062	11.6	0.062	11.6	0.062	11.6
1,1-Dichloroethane	0.009	1.67	0.009	1.71	0.009	1.72	0.009	1.66	0.009	1.66	0.018	3.36	0.009	1.66	0.009	1.70	0.009	1.70	0.018	3.36	0.018	3.36	0.018	3.36
1,2-Dichloroethane	0.013	2.35	0.013	2.41	0.013	2.43	0.009	1.66	0.013	2.40	0.022	4.06	0.009	1.66	0.013	2.40	0.013	2.40	0.022	4.06	0.022	4.06	0.022	4.06
1,1-Dichloroethene	0.015	2.79	0.015	2.87	0.015	2.89	0.009	1.66	0.015	2.85	0.024	4.51	0.009	1.66	0.015	2.85	0.015	2.85	0.024	4.51	0.024	4.51	0.024	4.51
1,2-Dichloroethene (total)	0.022	4.16	0.023	4.27	0.023	4.31	0.018	3.32	0.023	4.25	0.040	7.57	0.023	4.31	0.023	4.25	0.023	4.25	0.040	7.57	0.040	7.57	0.040	7.57
cis-1,3-Dichloropropene	0.012	2.20	0.012	2.26	0.012	2.28	0.009	1.66	0.012	2.25	0.021	3.91	0.009	1.66	0.012	2.25	0.012	2.25	0.021	3.91	0.021	3.91	0.021	3.91
trans-1,3-Dichloropropene	0.010	1.91	0.010	1.96	0.010	1.98	0.011	1.83	0.010	1.95	0.019	3.61	0.011	1.83	0.010	1.95	0.010	1.95	0.019	3.61	0.019	3.61	0.019	3.61
Ethylbenzene	0.008	1.57	0.009	1.61	0.009	1.62	0.009	1.69	0.009	1.60	0.020	3.78	0.009	1.69	0.009	1.60	0.009	1.60	0.020	3.78	0.020	3.78	0.020	3.78
2-Hexanone	0.047	8.81	0.048	9.05	0.049	9.13	0.068	12.6	0.048	9.00	0.116	21.6	0.068	12.6	0.048	9.00	0.048	9.00	0.116	21.6	0.116	21.6	0.116	21.6
Iodomethane	0.013	2.45	0.013	2.51	0.014	2.54	0.011	1.99	0.014	2.50	0.024	4.49	0.011	1.99	0.014	2.50	0.014	2.50	0.024	4.49	0.024	4.49	0.024	4.49
Methylchloride	0.719	135	0.581	109	0.409	76.6	0.027	4.98	0.409	76.6	0.596	112	0.027	4.98	0.409	76.6	0.409	76.6	0.596	112	0.596	112	0.596	112
4-Methyl-2-pentanone	0.076	14.2	0.078	14.58	0.078	14.7	0.036	6.64	0.078	14.5	0.113	21.1	0.036	6.64	0.078	14.5	0.078	14.5	0.113	21.1	0.113	21.1	0.113	21.1
Styrene	0.013	2.40	0.013	2.46	0.013	2.49	0.009	1.66	0.013	2.45	0.022	4.11	0.009	1.66	0.013	2.45	0.013	2.45	0.022	4.11	0.022	4.11	0.022	4.11
1,1,2,2-Tetrachloroethane	0.018	3.28	0.018	3.37	0.018	3.40	0.014	2.52	0.014	2.52	0.031	5.87	0.014	2.52	0.014	2.52	0.014	2.52	0.031	5.87	0.031	5.87	0.031	5.87
Tetrachloroethene	0.036	6.71	0.038	7.14	0.036	6.70	0.009	1.73	0.036	6.85	0.046	8.57	0.009	1.73	0.036	6.85	0.036	6.85	0.046	8.57	0.046	8.57	0.046	8.57
Toluene	0.017	3.26	0.021	3.95	0.020	3.73	0.009	1.66	0.020	3.64	0.028	5.30	0.009	1.66	0.019	3.64	0.019	3.64	0.028	5.30	0.028	5.30	0.028	5.30
1,1,1-Trichloroethane	0.013	2.50	0.014	2.56	0.014	2.59	0.009	1.66	0.014	2.55	0.022	4.21	0.009	1.66	0.014	2.55	0.014	2.55	0.022	4.21	0.022	4.21	0.022	4.21
1,1,2-Trichloroethane	0.015	2.74	0.015	2.82	0.015	2.84	0.021	3.98	0.015	2.80	0.036	6.78	0.021	3.98	0.015	2.80	0.015	2.80	0.036	6.78	0.036	6.78	0.036	6.78
Trichloroethene	2.89	541	2.831	530	2.855	535	0.009	1.66	2.855	535	2.87	537	0.009	1.66	2.86	536	2.86	536	2.87	537	2.87	537	2.87	537
Vinyl chloride	0.008	1.57	0.009	1.61	0.009	1.62	0.021	3.98	0.009	1.60	0.030	5.58	0.021	3.98	0.009	1.60	0.009	1.60	0.030	5.58	0.030	5.58	0.030	5.58
Xylenes (total)	0.031	5.88	0.032	6.03	0.032	6.09	0.027	4.98	0.032	6.00	0.059	11.0	0.027	4.98	0.032	6.00	0.032	6.00	0.059	11.0	0.059	11.0	0.059	11.0

Table 13. TCO Run 6 - December 11, 2004

	Run 6A Test 2			Run 6B Test 2			Run 6C Test 2			Run 6A - 6C Test 2			Avg of Tubes A-C			Total (Tube Avg + Condensate)			
	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission	
Acetone	1.19	223	<	1.56	292	<	0.237	<	44.4	<	0.128	<	0.994	<	186	<	1.12	<	210
Acetonitrile	2.43	<	455	2.57	<	482	2.51	<	470	1.22	<	228	2.50	<	469	3.73	<	697	
Acrylonitrile	<	0.265	<	0.280	<	52.5	0.273	<	51.1	0.241	<	45.0	<	0.273	<	51.1	<	96.1	
Benzene	0.208	<	39.0	0.143	<	26.9	0.160	<	29.9	0.009	<	1.73	0.171	<	32.0	0.180	<	33.7	
Bromodichloromethane	<	0.012	<	0.013	<	2.36	0.012	<	2.30	0.009	<	1.73	0.012	<	2.29	0.022	<	4.02	
Bromoform	0.018	<	3.29	0.019	<	3.48	0.018	<	3.39	0.013	<	2.39	0.018	<	3.39	0.031	<	5.78	
Bromomethane	<	0.021	<	0.022	<	4.18	0.022	<	4.07	0.035	<	6.57	0.022	<	4.07	0.057	<	10.6	
2-Butanone	<	0.086	<	0.092	<	17.2	0.089	<	16.7	0.070	<	13.1	0.089	<	16.7	0.159	<	29.8	
Carbon disulfide	<	0.013	<	0.012	<	2.25	0.012	<	2.19	0.009	<	1.76	0.012	<	2.30	0.022	<	4.06	
Carbon tetrachloride	<	0.009	<	0.010	<	1.82	0.009	<	1.77	0.011	<	2.15	0.009	<	1.77	0.021	<	3.92	
Chlorobenzene	<	0.012	<	0.012	<	2.30	0.012	<	2.24	0.009	<	1.73	0.012	<	2.24	0.021	<	3.97	
Dibromochloromethane	<	0.010	<	0.011	<	2.04	0.011	<	1.98	0.018	<	3.39	0.011	<	1.98	0.029	<	5.37	
Chloroethane	<	0.011	<	0.011	<	2.09	0.011	<	2.03	0.022	<	4.15	0.011	<	2.03	0.033	<	6.18	
Chloroform	<	0.012	<	0.013	<	2.47	0.013	<	2.40	0.009	<	1.73	0.013	<	2.40	0.022	<	4.13	
Chloromethane	0.116	<	21.8	0.054	<	10.2	0.032	<	6.00	0.011	<	2.08	0.067	<	12.6	0.079	<	14.7	
1,1-Dichloroethane	<	0.009	<	0.010	<	1.82	0.009	<	1.77	0.009	<	1.73	0.009	<	1.77	0.019	<	3.50	
1,2-Dichloroethane	<	0.013	<	0.014	<	2.57	0.013	<	2.50	0.009	<	1.73	0.013	<	2.50	0.023	<	4.23	
1,1-Dichloroethene	<	0.015	<	0.016	<	3.06	0.016	<	2.97	0.009	<	1.73	0.016	<	2.97	0.025	<	4.70	
1,2-Dichloroethene (total)	<	0.023	<	0.024	<	4.56	0.024	<	4.44	0.019	<	3.46	0.019	<	4.43	0.042	<	7.89	
1,2-Dichloropropane	<	0.012	<	0.013	<	2.41	0.013	<	2.35	0.009	<	1.73	0.013	<	2.35	0.022	<	4.08	
cis-1,3-Dichloropropene	<	0.011	<	0.011	<	2.09	0.011	<	2.03	0.009	<	1.73	0.011	<	2.03	0.020	<	3.76	
trans-1,3-Dichloropropene	<	0.011	<	0.011	<	2.09	0.011	<	2.03	0.010	<	1.90	0.011	<	2.03	0.021	<	3.94	
Ethylbenzene	<	0.009	<	0.009	<	1.72	0.009	<	1.67	0.009	<	1.76	0.009	<	1.67	0.018	<	3.43	
2-Hexanone	0.049	<	9.11	0.051	<	9.65	0.050	<	9.39	0.070	<	13.1	0.050	<	9.38	0.120	<	22.5	
Iodomethane	<	0.013	<	0.014	<	2.68	0.014	<	2.61	0.011	<	2.08	0.014	<	2.61	0.025	<	4.68	
Methylene chloride	0.327	<	61.2	0.236	<	44.2	0.306	<	57.4	0.022	<	4.15	0.290	<	54.3	0.312	<	58.4	
4-Methyl-2-pentanone	<	0.078	<	0.083	<	15.5	0.081	<	15.1	0.037	<	6.92	0.081	<	15.1	0.118	<	22.0	
Styrene	<	0.013	<	0.014	<	2.63	0.014	<	2.56	0.009	<	1.73	0.014	<	2.55	0.023	<	4.28	
1,1,2,2-Tetrachloroethane	<	0.018	<	0.019	<	3.59	0.019	<	3.50	0.014	<	2.63	0.019	<	3.49	0.033	<	6.12	
Tetrachloroethene	<	0.041	<	0.039	<	7.34	0.042	<	7.93	0.010	<	1.80	0.041	<	7.65	0.050	<	9.45	
Toluene	<	0.017	<	0.017	<	3.11	0.018	<	3.31	0.009	<	1.73	0.017	<	3.21	0.026	<	4.94	
1,1,1-Trichloroethane	<	0.014	<	0.015	<	2.73	0.014	<	2.66	0.009	<	1.73	0.014	<	2.66	0.023	<	4.39	
1,1,2-Trichloroethane	<	0.015	<	0.016	<	3.00	0.016	<	2.92	0.022	<	4.15	0.016	<	2.92	0.038	<	7.07	
Trichloroethene	<	3.12	<	3.02	<	565	3.35	<	629	0.009	<	1.73	3.16	<	593	3.17	<	595	
Vinyl chloride	<	0.011	<	0.009	<	1.72	0.009	<	1.67	0.022	<	4.15	0.010	<	1.82	0.032	<	5.97	
Xylenes (total)	<	0.032	<	0.034	<	6.43	0.033	<	6.26	0.028	<	5.19	0.033	<	6.25	0.061	<	11.4	

Table 14. TCO Method Blank - December 11, 2004

	<i>Method Blank</i>	<i>Condensate</i>
	<i>Test 2</i>	<i>Method Blank</i>
	<i>Total</i>	<i>total</i>
	<i>ug</i>	<i>ug</i>
Acetone	< 0.240	< 0.276
Acetonitrile	< 1.80	< 2.64
Acrylonitrile	< 0.196	< 0.520
Benzene	< 0.009	< 0.020
Bromodichloromethane	< 0.009	< 0.020
Bromoform	< 0.013	< 0.028
Bromomethane	< 0.016	< 0.076
2-Butanone	< 0.064	< 0.152
Carbon disulfide	< 0.008	< 0.020
Carbon tetrachloride	< 0.007	< 0.025
Chlorobenzene	< 0.009	< 0.020
Dibromochloromethane	< 0.008	< 0.039
Chloroethane	< 0.008	< 0.048
Chloroform	< 0.009	< 0.020
Chloromethane	< 0.034	< 0.024
1,1-Dichloroethane	< 0.007	< 0.020
1,2-Dichloroethane	< 0.010	< 0.020
1,1-Dichloroethene	< 0.011	< 0.020
1,2-Dichloroethene (total)	< 0.017	< 0.040
1,2-Dichloropropane	< 0.009	< 0.020
cis-1,3-Dichloropropene	< 0.008	< 0.020
trans-1,3-Dichloropropene	< 0.008	< 0.022
Ethylbenzene	< 0.006	< 0.020
2-Hexanone	< 0.036	< 0.152
Iodomethane	< 0.010	< 0.024
Methylene chloride	0.182	0.044
4-Methyl-2-pentanone	< 0.058	< 0.080
Styrene	< 0.010	< 0.020
1,1,2,2-Tetrachloroethane	< 0.013	< 0.030
Tetrachloroethene	< 0.009	< 0.021
Toluene	< 0.008	< 0.020
1,1,1-Trichloroethane	< 0.010	< 0.020
1,1,2-Trichloroethane	< 0.011	< 0.048
Trichloroethene	< 0.020	< 0.020
Vinyl chloride	< 0.006	< 0.048
Xylenes (total)	< 0.024	< 0.060

Chemical	Run 1A Test 2						Run 1B Test 2						Run 1C Test 2						Run 1A - 1C Test 2						Avg. of Tubes A-C						Total	
	Emission			Emission			Emission			Emission			Emission			Emission			Emission			Emission			Emission			Emission				
	Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min		Conc ug/dscf	Rate ug/min	Conc ug/dscf	Rate ug/min				
Acetone	2.58	447		3.23	560		2.99	517		2.99	517		2.99	517		2.99	517		2.99	517		2.93	508		2.93	508		2.93	508			
Acetonitrile	31.3	5416		24.3	4215		13.5	2335		13.5	2335		13.5	2335		13.5	2335		13.5	2335		23.0	3989		23.0	3989		23.0	3989			
Acrylonitrile	0.932	162		0.831	144		1.01	176		1.01	176		1.01	176		1.01	176		1.01	176		0.926	160		0.926	160		0.926	160			
Benzene	2.20	382		2.08	361		1.90	329		1.90	329		1.90	329		1.90	329		1.90	329		2.06	358		2.06	358		2.06	358			
Bromodichloromethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000			
Bromoform	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000			
Bromomethane	0.015	2.61		0.015	2.54		0.015	2.54		0.015	2.54		0.015	2.54		0.015	2.54		0.015	2.54		0.010	1.72		0.010	1.72		0.010	1.72			
2-Butanone	0.233	40.4		0.252	43.7		0.246	42.7		0.246	42.7		0.246	42.7		0.246	42.7		0.246	42.7		0.244	42.3		0.244	42.3		0.244	42.3			
Carbon disulfide	0.019	2.61		0.015	2.57		0.013	2.26		0.013	2.26		0.013	2.26		0.013	2.26		0.013	2.26		0.014	2.48		0.014	2.48		0.014	2.48			
Carbon tetrachloride	0.019	3.33		0.018	3.08		0.019	3.26		0.019	3.26		0.019	3.26		0.019	3.26		0.019	3.26		0.019	3.22		0.019	3.22		0.019	3.22			
Chlorobenzene	1.37	238		1.45	252		1.38	239		1.38	239		1.38	239		1.38	239		1.38	239		1.40	243		1.40	243		1.41	244			
Dibromochloromethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000			
Chloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000			
Chloroform	0.040	6.89		0.036	6.17		0.038	6.53		0.038	6.53		0.038	6.53		0.038	6.53		0.038	6.53		0.038	6.53		0.038	6.53		0.038	6.53			
Chloromethane	3.03	524		2.22	385		2.22	385		2.22	385		2.22	385		2.22	385		2.22	385		1.78	308		1.78	308		1.78	308			
1,1-Dichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.00																						

Table 3. Melter - Run 3 (with MDL as "0") / December 9, 2004

	Run 3A Test 2						Run 3B Test 2						Run 3C Test 2						Avg of Tubes A-C						Total Tube Avg + Condensate					
	Conc			Emission			Conc			Emission			Conc			Emission			Conc			Emission			Conc			Emission		
	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min	ug/dscf	Rate	ug/min
Acetone	4.55	807		2.89	501		10.1	1747		0.000	0.000		0.000	0.000		5.88	1018		5.88	1018		5.88	1018		5.88	1018		5.88	1018	
Acetonitrile	26.7	4631		10.9	1880		1.58	274		0.000	0.000		0.000	0.000		13.1	2262		13.1	2262		13.1	2262		13.1	2262		13.1	2262	
Acrylonitrile	1.55	268		1.06	184		0.820	142		0.000	0.000		0.000	0.000		1.14	198		1.14	198		1.14	198		1.14	198		1.14	198	
Benzene	2.26	392		1.82	315		2.17	376		0.000	0.000		0.000	0.000		2.08	361		2.08	361		2.08	361		2.08	361		2.08	361	
Bromodichloromethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
Bromoform	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
Bromomethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
2-Butanone	0.315	54.6		0.205	35.5		0.201	34.9		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
Carbon disulfide	0.013	2.21		0.010	1.80		0.013	2.24		0.000	0.000		0.000	0.000		0.012	2.08		0.012	2.08		0.012	2.08		0.012	2.08		0.012	2.08	
Carbon tetrachloride	0.017	2.86		0.016	2.72		0.017	2.99		0.000	0.000		0.000	0.000		0.016	2.86		0.016	2.86		0.016	2.86		0.016	2.86		0.016	2.86	
Chlorobenzene	1.05	182		1.33	230		1.37	237		0.000	0.000		0.000	0.000		1.25	216		1.25	216		1.25	216		1.25	216		1.25	216	
Dibromochloromethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
Chloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
Chloroform	0.054	9.4		0.033	5.64		0.036	6.23		0.000	0.000		0.000	0.000		0.041	7.08		0.041	7.08		0.041	7.08		0.041	7.08		0.041	7.08	
Chloromethane	0.114	19.8		0.050	8.59		0.026	4.49		0.000	0.000		0.000	0.000		0.063	10.9		0.063	10.9		0.063	10.9		0.063	10.9		0.063	10.9	
1,1-Dichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
1,2-Dichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
1,1-Dichloroethene (total)	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
1,2-Dichloroethene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
1,2-Dichloropropane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
cis-1,3-Dichloropropene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
trans-1,3-Dichloropropene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
Ethylbenzene	0.045	7.81		0.061	10.7		0.056	9.72		0.000	0.000		0.000	0.000		0.054	9.39		0.054	9.39		0.054	9.39		0.054	9.39		0.054	9.39	
2-Hexanone	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
Iodomethane	0.009	1.51		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.003	0.503		0.003	0.503		0.003	0.503		0.003	0.503		0.003	0.503	
Methylene chloride	0.901	156		0.856	148		0.820	142		0.000	0.000		0.055	9.49		0.859	149		0.859	149		0.859	149		0.859	149		0.859	149	
4-Methyl-2-pentanone	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
Styrene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
1,1,2,2-Tetrachloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
Tetrachloroethene	0.024	4.16		0.023	3.97		0.027	4.74		0.000	0.000		0.000	0.000		0.025	4.29		0.025	4.29		0.025	4.29		0.025	4.29		0.025	4.29	
Toluene	0.395	68.4		0.350	60.6		0.331	57.3		0.000	0.000		0.000	0.000		0.358	62.1		0.358	62.1		0.358	62.1		0.358	62.1		0.358	62.1	
1,1,1-Trichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
1,1,2-Trichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000	
Trichloroethene	0.000	0.000		0.012	2.09		0.000	0.000		0.000	0.000		0.000	0.000		0.004	0.696		0.004	0.696		0.004	0.696		0.004	0.696		0.004	0.696	
Vinyl chloride	0.017	2.94		0.025	4.32		0.030	5.14		0.000	0.000		0.000	0.000		0.024	4.13		0.024	4.13		0.024	4.13		0.024	4.13		0.024	4.13	
Xylenes (total)	0.225	39.0		0.314	54.3		0.273	47.4		0.000	0.000		0.000	0.000		0.271	46.9		0.271	46.9		0.271	46.9		0.271	46.9		0.271	46.9	

Table 6. Melter - Run 6 (with MDL as "0") / December 11, 2004

	Run 6A Test 2						Run 6B Test 2						Run 6C Test 2						Avg of Tubes A-C						Total (Tube Avg + Condensate)							
	Emission			Emission			Emission			Emission			Emission			Emission			Emission			Emission			Emission			Emission				
	Conc	Rate	ug/dscf	Conc	Rate	ug/dscf	Conc	Rate	ug/dscf	Conc	Rate	ug/dscf	Conc	Rate	ug/dscf	Conc	Rate	ug/dscf	Conc	Rate	ug/dscf	Conc	Rate	ug/dscf	Conc	Rate	ug/dscf	Conc	Rate	ug/dscf		
Acetone	5.96	1090		6.38	1165		3.86	704		0.172	31.4		5.40	986		5.57	1018		5.40	986		5.57	1018		5.57	1018		5.57	1018		5.57	1018
Acetonitrile	33.4	6106		39.1	7141		32.2	5889		1.37	251		34.9	6379		36.3	6630		34.9	6379		36.3	6630		36.3	6630		36.3	6630		36.3	6630
Acrylonitrile	3.19	583		3.63	663		2.75	503		0.000	0.000		3.19	583		3.19	583		3.19	583		3.19	583		3.19	583		3.19	583		3.19	583
Benzene	4.12	752		3.99	728		3.66	668		0.000	0.000		3.92	716		3.92	716		3.92	716		3.92	716		3.92	716		3.92	716		3.92	716
Bromodichloromethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Bromoform	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Bromomethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
2-Butanone	0.350	63.9		0.485	88.6		0.188	34.4		0.000	0.000		0.341	62.3		0.341	62.3		0.341	62.3		0.341	62.3		0.341	62.3		0.341	62.3		0.341	62.3
Carbon disulfide	0.021	3.85		0.022	3.98		0.028	5.10		0.000	0.000		0.024	4.31		0.024	4.31		0.024	4.31		0.024	4.31		0.024	4.31		0.024	4.31		0.024	4.31
Carbon tetrachloride	0.023	4.28		0.024	4.36		0.016	2.94		0.000	0.000		0.021	3.86		0.021	3.86		0.021	3.86		0.021	3.86		0.021	3.86		0.021	3.86		0.021	3.86
Chlorobenzene	1.66	304		1.80	329		0.833	152		0.000	0.000		1.43	262		1.43	262		1.43	262		1.43	262		1.43	262		1.43	262		1.43	262
Dibromochloromethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Chloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Chloroform	0.046	8.41		0.054	9.80		0.040	7.36		0.000	0.000		0.047	8.52		0.047	8.52		0.047	8.52		0.047	8.52		0.047	8.52		0.047	8.52		0.047	8.52
Chloromethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,1-Dichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,2-Dichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,1-Dichloroethene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,2-Dichloroethene (total)	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,2-Dichloropropane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
cis-1,3-Dichloropropene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
trans-1,3-Dichloropropene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Ethylbenzene	0.053	9.63		0.047	8.61		0.021	3.93		0.000	0.000		0.040	7.39		0.040	7.39		0.040	7.39		0.040	7.39		0.040	7.39		0.040	7.39		0.040	7.39
2-Hexanone	0.043	7.85		0.057	10.38		0.000	0.000		0.000	0.000		0.033	6.08		0.033	6.08		0.033	6.08		0.033	6.08		0.033	6.08		0.033	6.08		0.033	6.08
Iodomethane	0.011	2.05		0.012	2.10		0.013	2.40		0.000	0.000		0.012	2.19		0.012	2.19		0.012	2.19		0.012	2.19		0.012	2.19		0.012	2.19		0.012	2.19
Methylene chloride	0.291	53.2		0.402	73.4		0.239	43.7		0.000	0.000		0.311	56.78		0.311	56.78		0.311	56.78		0.311	56.78		0.311	56.78		0.311	56.78		0.311	56.78
4-Methyl-2-pentanone	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Styrene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,1,2,2-Tetrachloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Tetrachloroethene	0.012	2.15		0.011	1.95		0.008	1.52		0.000	0.000		0.010	1.87		0.010	1.87		0.010	1.87		0.010	1.87		0.010	1.87		0.010	1.87		0.010	1.87
Toluene	0.643	117		0.582	106		0.363	66.3		0.000	0.000		0.529	96.7		0.529	96.7		0.529	96.7		0.529	96.7		0.529	96.7		0.529	96.7		0.529	96.7
1,1,1-Trichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,1,2-Trichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Trichloroethene	0.014	2.53		0.015	2.79		0.015	2.70		0.000	0.000		0.015	2.67		0.015	2.67		0.015	2.67		0.015	2.67		0.015	2.67		0.015	2.67		0.015	2.67
Vinyl chloride	0.092	16.8		0.102	18.6		0.188	34.3		0.000	0.000		0.127	23.3		0.127	23.3		0.127	23.3		0.127	23.3		0.127	23.3		0.127	23.3		0.127	23.3
Xylenes (total)	0.236	43.1		0.236	43.1		0.101	18.4		0.000	0.000		0.191	34.8		0.191	34.8		0.191	34.8		0.191	34.8		0.191	34.8		0.191	34.8		0.191	34.8

Table 2. TCO Run 2 (with MDL listed at "0") - December 9, 2004

	Condensate												Total (Tube Avg + Condensate)									
	Run 2A Test 2				Run 2B Test 2				Run 2C Test 2					Run 2A-2C Test 2				Avg of Tubes A-C				
	Conc ug/dscf	Rate ug/min	Emission		Conc ug/dscf	Rate ug/min	Emission		Conc ug/dscf	Rate ug/min	Emission			Conc ug/dscf	Rate ug/min	Emission		Conc ug/dscf	Rate ug/min	Emission		
Acetone	5.54	1033			2.88	537			2.05	382			0.414	77.2			3.49	651			3.90	728
Acetonitrile					0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Acrylonitrile	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Benzene	0.207	38.7			0.252	47.1			0.206	38.4			0.00	0.00			0.222	41.4			0.222	41.4
Bromodichloromethane	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Bromoform	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Bromomethane	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
2-Butanone	0.00	0.00			0.058	10.8			0.00	0.00			0.00	0.00			0.019	3.60			0.019	3.60
Carbon disulfide	0.012	2.16			0.011	2.13			0.009	1.77			0.00	0.00			0.011	2.02			0.011	2.02
Carbon tetrachloride	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Chlorobenzene	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Dibromochloromethane	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Chloroethane	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Chloroform	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Chloromethane	0.136	25.4			0.104	19.5			0.124	23.1			0.00	0.00			0.121	22.7			0.121	22.7
1,1-Dichloroethane	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
1,2-Dichloroethane	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
1,1,1-Dichloroethene	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
1,2-Dichloroethene (total)	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
1,2-Dichloropropane	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
cis-1,3-Dichloropropene	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
trans-1,3-Dichloropropene	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
2-Hexanone	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
2-Hexanone	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Iodomethane	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Methylene chloride	0.842	157			0.801	150			0.810	151			0.282	52.7			0.818	153			1.10	205
4-Methyl-2-pentanone	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Styrene	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
1,1,1,2-Tetrachloroethane	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Tetrachloroethene	0.011	2.04			0.011	1.99			0.013	2.51			0.00	0.00			0.012	2.18			0.012	2.18
Toluene	0.015	2.78			0.010	1.80			0.010	1.82			0.00	0.00			0.011	2.13			0.011	2.13
1,1,1-Trichloroethane	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
1,1,1,2-Trichloroethane	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00
Trichloroethene	1.02	191			1.37	255			1.22	228			0.00	0.00			1.20	225			1.20	225
Vinyl chloride	0.007	1.34			0.015	2.77			0.014	2.61			0.00	0.00			0.012	2.24			0.012	2.24
Xylenes (total)	0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00			0.00	0.00

Table 3. TCO Run 3 (with MDL listed at "0") - December 9, 2004

	Condensate												Total (Tube Avg + Condensate)				
	Run 3A Test 2			Run 3B Test 2			Run 3C Test 2			Run 3A-3C Test 2							
	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission		
Acetone	1.18	221		1.68	313		1.14	213		0.347	64.7		1.33	249		1.68	314
Acetonitrile	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Acrylonitrile	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Benzene	0.285	53.2		0.260	48.6		0.185	34.5		0.000	0.000		0.243	45.4		0.243	45.4
Bromodichloromethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Bromoform	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Bromomethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
2-Butanone	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Carbon disulfide	0.008	1.56		0.013	2.48		0.009	1.75		0.000	0.000		0.010	1.93		0.010	1.93
Carbon tetrachloride	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Chlorobenzene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Dibromochloromethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Chloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Chloroform	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Chloromethane	0.068	12.7		0.115	21.4		0.126	23.5		0.000	0.000		0.103	19.2		0.103	19.2
1,1-Dichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,2-Dichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,1-Dichloroethene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,2-Dichloroethene (total)	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,2-Dichloropropane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
cis-1,3-Dichloropropene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
trans-1,3-Dichloropropene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Ethylbenzene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
2-Hexanone	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Iodomethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Methylene chloride	0.526	98.2		0.968	181		0.624	117		0.277	51.8		0.706	132		0.984	184
4-Methyl-2-pentanone	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Styrene	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,1,2,2-Tetrachloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Tetrachloroethene	0.016	3.07		0.014	2.56		0.014	2.65		0.000	0.000		0.015	2.76		0.015	2.76
Toluene	0.013	2.37		0.042	7.83		0.009	1.67		0.000	0.000		0.021	3.96		0.021	3.96
1,1,1-Trichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
1,1,2-Trichloroethane	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000
Trichloroethene	1.64	307		1.39	259		1.42	265		0.000	0.000		1.48	277		1.48	277
Vinyl chloride	0.012	2.17		0.007	1.38		0.007	1.33		0.000	0.000		0.009	1.62		0.009	1.62
Xylenes (total)	0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000		0.000	0.000

[illegible]

Table 5. TCO Run 5 (with MDL listed at "0") - December 10, 2004

	Run 5A Test 2			Run 5B Test 2			Run 5C Test 2			Run 5A-5C Test 2			Avg of Tubes A-C			Total (Tube Avg + Condensate)		
	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission	Conc ug/dscf	Rate ug/min	Emission
Acetone	1.83	343	0.000	1.25	234	0.000	2.12	398	0.000	0.000	0.000	0.000	1.73	325	0.000	1.73	325	0.000
Acetonitrile	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Acrylonitrile	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Benzene	0.222	41.6	0.000	0.215	40.2	0.000	0.203	38.0	0.000	0.000	0.000	0.000	0.213	40.0	0.000	0.213	40.0	0.000
Bromodichloromethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bromoform	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bromomethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2-Butanone	0.080	14.9	0.000	0.054	10.1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.044	8.33	0.000	0.044	8.33	0.000
Carbon disulfide	0.009	1.69	0.000	0.009	1.73	0.000	0.009	1.70	0.000	0.000	0.000	0.000	0.009	1.71	0.000	0.009	1.71	0.000
Carbon tetrachloride	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chlorobenzene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Dibromochloromethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chloroethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chloroform	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chloromethane	0.025	4.68	0.000	0.043	8.12	0.000	0.086	16.1	0.000	0.000	0.000	0.000	0.051	9.64	0.000	0.051	9.64	0.000
1,1-Dichloroethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1,2-Dichloroethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1,1-Dichloroethene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1,2-Dichloroethene (total)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1,2-Dichloropropane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
cis-1,3-Dichloropropene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
trans-1,3-Dichloropropene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ethylbenzene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2-Hexanone	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Iodomethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Methylene chloride	0.719	135	0.000	0.581	109	0.000	0.409	76.6	0.000	0.027	4.98	0.000	0.569	107	0.000	0.596	112	0.000
4-Methyl-2-pentanone	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Styrene	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1,1,2,2-Tetrachloroethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Tetrachloroethene	0.030	5.63	0.000	0.032	6.03	0.000	0.030	5.58	0.000	0.000	0.000	0.000	0.031	5.75	0.000	0.031	5.75	0.000
Toluene	0.017	3.26	0.000	0.017	3.27	0.000	0.016	3.04	0.000	0.000	0.000	0.000	0.017	3.19	0.000	0.017	3.19	0.000
1,1,1-Trichloroethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1,1,2-Trichloroethane	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Trichloroethene	2.87	539	0.000	2.817	528	0.000	2.84	533	0.000	0.000	0.000	0.000	2.84	533	0.000	2.84	533	0.000
Vinyl chloride	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Xylenes (total)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 6. TCO Run 6 (with MDL listed at "0") - December 11, 2004

	Condensate												Total (Tube Avg + Condensate)								
	Run 6A Test 2				Run 6B Test 2				Run 6C Test 2					Run 6A - 6C Test 2				Avg of Tubes A-C			
	Conc ug/dscf	Rate ug/min	Emission		Conc ug/dscf	Rate ug/min	Emission		Conc ug/dscf	Rate ug/min	Emission			Conc ug/dscf	Rate ug/min	Emission		Conc ug/dscf	Rate ug/min	Emission	
Acetone	1.19	223	0.000		1.56	292	0.000		0.153	28.7	0.000		0.000	0.000	0.000		0.967	181	0.000		
Acetonitrile	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Acrylonitrile	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Benzene	0.202	37.9	0.000		0.137	25.7	0.000		0.160	29.9	0.000		0.000	0.000	0.000		0.167	31.2	0.167	31.2	
Bromodichloromethane	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Bromoform	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Bromomethane	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
2-Butanone	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Carbon disulfide	0.007	1.39	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.002	0.464	0.002	0.464	
Carbon tetrachloride	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Chlorobenzene	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Dibromochloromethane	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Chloroethane	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Chloroform	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Chloromethane	0.116	21.8	0.000		0.046	8.58	0.000		0.024	4.44	0.000		0.000	0.000	0.000		0.062	11.6	0.062	11.6	
1,1-Dichloroethane	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
1,2-Dichloroethane	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
1,1,1-Dichloroethene	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
1,2-Dichloroethene (total)	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
1,2-Dichloropropane	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
cis-1,3-Dichloropropene	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
trans-1,3-Dichloropropene	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Ethylbenzene	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
2-Hexanone	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Iodomethane	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Methylene chloride	0.327	61.2	0.000		0.236	44.2	0.000		0.306	57.4	0.022		0.000	0.000	4.15		0.290	54.3	0.312	58.4	
4-Methyl-2-pentanone	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Styrene	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
1,1,2,2-Tetrachloroethane	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Tetrachloroethene	0.035	6.58	0.000		0.033	6.16	0.000		0.036	6.78	0.000		0.000	0.000	0.000		0.035	6.51	0.035	6.51	
Toluene	0.013	2.53	0.000		0.013	2.39	0.000		0.014	2.61	0.000		0.000	0.000	0.000		0.013	2.51	0.013	2.51	
1,1,1-Trichloroethane	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
1,1,1,2-Trichloroethane	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		
Trichloroethene	3.10	582	0.000		3.00	563	0.000		3.34	626	0.000		0.000	0.000	0.000		3.15	590	3.15	590	
Vinyl chloride	0.007	1.26	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.002	0.422	0.002	0.422	
Xylenes (total)	0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		0.000	0.000	0.000		

Table 14. TCO Method Blank - December 11, 2004

	<i>Method Blank Test 2 Total ug</i>	<i>Condensate Method Blank total ug</i>
Acetone	0.240	0.276
Acetonitrile	1.80	2.64
Acrylonitrile	0.196	0.520
Benzene	0.009	0.020
Bromodichloromethane	0.009	0.020
Bromoform	0.013	0.028
Bromomethane	0.016	0.076
2-Butanone	0.064	0.152
Carbon disulfide	0.008	0.020
Carbon tetrachloride	0.007	0.025
Chlorobenzene	0.009	0.020
Dibromochloromethane	0.008	0.039
Chloroethane	0.008	0.048
Chloroform	0.009	0.020
Chloromethane	0.034	0.024
1,1-Dichloroethane	0.007	0.020
1,2-Dichloroethane	0.010	0.020
1,1-Dichloroethene	0.011	0.020
1,2-Dichloroethene (total)	0.017	0.040
1,2-Dichloropropane	0.009	0.020
cis-1,3-Dichloropropene	0.008	0.020
trans-1,3-Dichloropropene	0.008	0.022
Ethylbenzene	0.006	0.020
2-Hexanone	0.036	0.152
Iodomethane	0.010	0.024
Methylene chloride	0.182	0.044
4-Methyl-2-pentanone	0.058	0.080
Styrene	0.010	0.020
1,1,2,2-Tetrachloroethane	0.013	0.030
Tetrachloroethene	0.009	0.021
Toluene	0.008	0.020
1,1,1-Trichloroethane	0.010	0.020
1,1,2-Trichloroethane	0.011	0.048
Trichloroethene	0.020	0.020
Vinyl chloride	0.006	0.048
Xylenes (total)	0.024	0.060

Appendix A.2

Semi-VOST

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Table SV-1. Semi-VOST Melter Runs 1-3 (Test 2)

Compound	Run 1 (12/8/04)		Run 2 (12/8/04)		Run 3 (12/8/04)	
	Emission		Emission		Emission	
	Conc ug/dscf	Rate ug/min	Conc ug/dscf	Rate ug/min	Conc ug/dscf	Rate ug/min
Acenaphthene	< 73.2	< 13038	< 74.0	< 12750	< 77.8	< 13182
Acenaphthylene	< 68.9	< 12271	< 69.6	< 12000	< 73.3	< 12407
Anthracene	< 68.9	< 12271	< 69.6	< 12000	< 73.3	< 12407
Benzo(a)anthracene	< 90.4	< 16106	< 91.4	< 15750	< 96.1	< 16284
Benzo(b)fluoranthene	< 177	< 31446	< 178	< 30749	< 188	< 31793
Benzo(k)fluoranthene	< 207	< 36814	< 209	< 35999	< 220	< 37221
Benzo(ghi)perylene	< 181	< 32213	< 183	< 31499	< 192	< 32568
Benzo(a)pyrene	< 94.7	< 16873	< 95.7	< 16500	< 101	< 17060
bis(2-Chloroethoxy)methane	< 77.5	< 13805	< 78.3	< 13500	< 82.4	< 13958
bis(2-Chloroethyl) ether	< 86.1	< 15339	< 87.0	< 15000	< 91.6	< 15509
bis(2-Chloroisopropyl) ether	< 103.4	< 18407	< 104	< 17999	< 110	< 18610
bis(2-Ethylhexyl) phthalate	< 603	< 107376	< 609	< 104997	< 641	< 108561
4-Bromophenyl phenyl ether	< 68.9	< 12271	< 69.6	< 12000	< 73.3	< 12407
Butyl benzyl phthalate	< 112	< 19941	< 113	< 19499	< 119	< 20161
4-Chloroaniline	< 431	< 76697	< 435	< 74998	< 458	< 77543
4-Chloro-3-methylphenol	< 177	< 31446	< 178	< 30749	< 188	< 31793
2-Chloronaphthalene	< 64.6	< 11505	< 65.3	< 11250	< 68.7	< 11631
2-Chlorophenol	< 90.4	< 16106	< 91.4	< 15750	< 96.1	< 16284
4-Chlorophenyl phenyl ether	< 94.7	< 16873	< 95.7	< 16500	< 101	< 17060
Chrysene	< 86.1	< 15339	< 87.0	< 15000	< 91.6	< 15509
Dibenz(a,h)anthracene	< 159	< 28378	< 161	< 27749	< 169	< 28691
Dibenzofuran	< 90.4	< 16106	< 91.4	< 15750	< 96.1	< 16284
Di-n-butyl phthalate	< 517	< 92036	< 522	< 89997	< 549	< 93052
1,2-Dichlorobenzene	< 86.1	< 15339	< 87.0	< 15000	< 91.6	< 15509
1,3-Dichlorobenzene	< 99.1	< 17640	< 100	< 17249	< 105	< 17835
1,4-Dichlorobenzene	< 103	< 18407	< 104	< 17999	< 110	< 18610
3,3'-Dichlorobenzidine	< 560	< 99706	< 566	< 97497	< 595	< 100806
2,4-Dichlorophenol	< 125	< 22242	< 126	< 21749	< 133	< 22488
Diethyl phthalate	< 121	< 21475	< 122	< 20999	< 128	< 21712
2,4-Dimethylphenol	< 422	< 75163	< 426	< 73498	< 449	< 75992
Dimethyl phthalate	< 68.9	< 12271	< 69.6	< 12000	< 73.3	< 12407
4,6-Dinitro-2-methylphenol	< 603	< 107376	< 609	< 104997	< 641	< 108561
2,4-Dinitrophenol	< 1249	< 222421	< 1262	< 217494	< 1328	< 224875
2,4-Dinitrotoluene	< 134	< 23776	< 135	< 23249	< 142	< 24038
2,6-Dinitrotoluene	< 112	< 19941	< 113	< 19499	< 119	< 20161
Di-n-octyl phthalate	< 155	< 27611	< 157	< 26999	< 165	< 27916
Fluoranthene	< 73.2	< 13038	< 74.0	< 12750	< 77.8	< 13182
Fluorene	< 86.1	< 15339	< 87.0	< 15000	< 91.6	< 15509
Hexachlorobenzene	< 90.4	< 16106	< 91.4	< 15750	< 96.1	< 16284
Hexachlorobutadiene	< 125	< 22242	< 126	< 21749	< 133	< 22488
Hexachlorocyclopentadiene	< 991	< 176403	< 1001	< 172495	< 1053	< 178350
Hexachloroethane	< 164	< 29145	< 165	< 28499	< 174	< 29466
Indeno(1,2,3-cd)pyrene	< 151	< 26844	< 152	< 26249	< 160	< 27140
Isophorone	< 77.5	< 13805	< 78.3	< 13500	< 82.4	< 13958
2-Methylnaphthalene	< 81.8	< 14572	< 82.7	< 14250	< 87.0	< 14733
2-Methylphenol	< 263	< 46785	< 265	< 45749	< 279	< 47301
Naphthalene	4737	843665	5221	899974	5494	930519
2-Nitroaniline	< 94.7	< 16873	< 95.7	< 16500	< 101	< 17060
3-Nitroaniline	< 327	< 58290	< 331	< 56998	< 348	< 58933
4-Nitroaniline	< 250	< 44484	< 252	< 43499	< 266	< 44975
Nitrobenzene	< 81.8	< 14572	< 82.7	< 14250	< 87.0	< 14733
2-Nitrophenol	< 202	< 36048	< 204	< 35249	< 215	< 36445
4-Nitrophenol	< 349	< 62124	< 352	< 60748	< 371	< 62810
N-Nitrosodiphenylamine	< 86.1	< 15339	< 87.0	< 15000	< 91.6	< 15509
N-Nitrosodi-n-propylamine	< 90.4	< 16106	< 91.4	< 15750	< 96.1	< 16284
Pentachlorophenol	< 2196	< 391154	< 2219	< 382489	< 2335	< 395471
Phenanthrene	< 73.2	< 13038	< 74.0	< 12750	< 77.8	< 13182
Phenol	< 121	< 21475	< 122	< 20999	< 128	< 21712
Pyrene	< 77.5	< 13805	< 78.3	< 13500	< 82.4	< 13958
1,2,4-Trichlorobenzene	< 90.4	< 16106	< 91.4	< 15750	< 96.1	< 16284
2,4,5-Trichlorophenol	< 189	< 33747	< 191	< 32999	< 201	< 34119
2,4,6-Trichlorophenol	< 134	< 23776	< 135	< 23249	< 142	< 24038

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Table SV-2. Semi-VOST Melter Runs 4-5 (Test 1)

Compound	Run 4 (12/9/04)		Run 5 (12/9/04)	
	Conc ug/dscf	Emission	Conc ug/dscf	Emission
		Rate ug/min		Rate ug/min
Acenaphthene	< 65.9	< 12305	< 69.7	< 12441
Acenaphthylene	< 62.0	< 11581	< 65.6	< 11709
Anthracene	< 62.0	< 11581	< 65.6	< 11709
Benzo(a)anthracene	< 81.4	< 15200	< 86.0	< 15369
Benzo(b)fluoranthene	< 159	< 29677	< 168	< 30005
Benzo(k)fluoranthene	< 186	< 34743	< 197	< 35128
Benzo(ghi)perylene	< 163	< 30401	< 172	< 30737
Benzo(a)pyrene	< 85.3	< 15924	< 90.1	< 16100
bis(2-Chloroethoxy)methane	< 69.8	< 13029	< 73.7	< 13173
bis(2-Chloroethyl) ether	< 77.5	< 14476	< 81.9	< 14637
bis(2-Chloroisopropyl) ether	< 93.0	< 17372	< 98.3	< 17564
bis(2-Ethylhexyl) phthalate	< 543	< 101335	< 574	< 102457
4-Bromophenyl phenyl ether	< 62.0	< 11581	< 65.6	< 11709
Butyl benzyl phthalate	< 101	< 18819	< 107	< 19028
4-Chloroaniline	< 388	< 72382	< 410	< 73184
4-Chloro-3-methylphenol	< 159	< 29677	< 168	< 30005
2-Chloronaphthalene	< 58.2	< 10857	< 61.5	< 10978
2-Chlorophenol	< 81.4	< 15200	< 86.0	< 15369
4-Chlorophenyl phenyl ether	< 85.3	< 15924	< 90.1	< 16100
Chrysene	< 77.5	< 14476	< 81.9	< 14637
Dibenz(a,h)anthracene	< 143	< 26781	< 152	< 27078
Dibenzofuran	< 81	< 15200	< 86.0	< 15369
Di-n-butyl phthalate	< 465	< 86859	< 492	< 87821
1,2-Dichlorobenzene	< 77.5	< 14476	< 81.9	< 14637
1,3-Dichlorobenzene	< 89.2	< 16648	< 94.2	< 16832
1,4-Dichlorobenzene	< 93.0	< 17372	< 98.3	< 17564
3,3'-Dichlorobenzidine	< 504	< 94097	< 533	< 95139
2,4-Dichlorophenol	< 112	< 20991	< 119	< 21223
Diethyl phthalate	< 109	< 20267	< 115	< 20491
2,4-Dimethylphenol	< 380	< 70935	< 402	< 71720
Dimethyl phthalate	< 62.0	< 11581	< 65.6	< 11709
4,6-Dinitro-2-methylphenol	< 543	< 101335	< 574	< 102457
2,4-Dinitrophenol	< 1124	< 209909	< 1188	< 212233
2,4-Dinitrotoluene	< 120	< 22438	< 127	< 22687
2,6-Dinitrotoluene	< 101	< 18819	< 107	< 19028
Di-n-octyl phthalate	< 140	< 26058	< 147	< 26346
Fluoranthene	< 65.9	< 12305	< 69.7	< 12441
Fluorene	< 77.5	< 14476	< 81.9	< 14637
Hexachlorobenzene	< 81.4	< 15200	< 86.0	< 15369
Hexachlorobutadiene	< 112	< 20991	< 119	< 21223
Hexachlorocyclopentadiene	< 892	< 166479	< 942	< 168323
Hexachloroethane	< 147	< 27505	< 156	< 27810
Indeno(1,2,3-cd)pyrene	< 136	< 25334	< 143	< 25614
Isophorone	< 69.8	< 13029	< 73.7	< 13173
2-Methylnaphthalene	< 73.7	< 13753	< 77.8	< 13905
2-Methylphenol	< 236	< 44153	< 250	< 44642
Naphthalene	4652	868587	4917	878207
2-Nitroaniline	< 85.3	< 15924	< 90.1	< 16100
3-Nitroaniline	< 295	< 55011	< 311	< 55620
4-Nitroaniline	< 225	< 41982	< 238	< 42447
Nitrobenzene	< 73.7	< 13753	< 77.8	< 13905
2-Nitrophenol	< 182	< 34020	< 193	< 34396
4-Nitrophenol	< 314	< 58630	< 332	< 59279
N-Nitrosodiphenylamine	< 77.5	< 14476	< 81.9	< 14637
N-Nitrosodi-n-propylamine	< 81.4	< 15200	< 86.0	< 15369
Pentachlorophenol	< 1977	< 369149	< 2090	< 373238
Phenanthrene	< 65.9	< 12305	< 69.7	< 12441
Phenol	< 109	< 20267	< 115	< 20491
Pyrene	< 69.8	< 13029	< 73.7	< 13173
1,2,4-Trichlorobenzene	< 81.4	< 15200	< 86.0	< 15369
2,4,5-Trichlorophenol	< 171	< 31848	< 180	< 32201
2,4,6-Trichlorophenol	< 120	< 22438	< 127	< 22687

Table H-1. ^{ORP-51444 Rev. 0}
Semi-VOST HEPA Runs 1-3 (Test 2)
(corrected)

Compound	Run 1 (12/8/04)		Run 2 (12/8/04)		Run 3 (12/8/04)	
	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min
Acenaphthene	< 38.4	< 7003	< 37.6	< 6758	< 37.5	< 6715
Acenaphthylene	< 36.1	< 6591	< 35.4	< 6361	< 35.3	< 6320
Anthracene	< 36.1	< 6591	< 35.4	< 6361	< 35.3	< 6320
Benzo(a)anthracene	< 47.4	< 8650	< 46.5	< 8348	< 46.3	< 8295
Benzo(b)fluoranthene	< 92.5	< 16889	< 90.7	< 16299	< 90.5	< 16194
Benzo(k)fluoranthene	< 108	< 19772	< 106	< 19082	< 106	< 18959
Benzo(ghi)perylene	< 94.8	< 17301	< 92.9	< 16697	< 92.7	< 16589
Benzo(a)pyrene	< 49.7	< 9062	< 48.7	< 8746	< 48.6	< 8689
bis(2-Chloroethoxy)methane	< 40.6	< 7415	< 39.8	< 7156	< 39.7	< 7110
bis(2-Chloroethyl) ether	< 45.1	< 8238	< 44.3	< 7951	< 44.1	< 7900
bis(2-Chloroisopropyl) ether	< 54.2	< 9886	< 53.1	< 9541	< 53.0	< 9479
bis(2-Ethylhexyl) phthalate	< 316	< 57669	< 310	< 55656	< 309	< 55297
4-Bromophenyl phenyl ether	< 36.1	< 6591	< 35.4	< 6361	< 35.3	< 6320
Butyl benzyl phthalate	< 58.7	< 10710	< 57.5	< 10336	< 57.4	< 10269
4-Chloroaniline	< 226	< 41192	< 221	< 39754	< 221	< 39498
4-Chloro-3-methylphenol	< 92.5	< 16889	< 90.7	< 16299	< 90.5	< 16194
2-Chloronaphthalene	< 33.9	< 6179	< 33.2	< 5963	< 33.1	< 5925
2-Chlorophenol	< 47.4	< 8650	< 46.5	< 8348	< 46.3	< 8295
4-Chlorophenyl phenyl ether	< 49.7	< 9062	< 48.7	< 8746	< 48.6	< 8689
Chrysene	< 45.1	< 8238	< 44.3	< 7951	< 44.1	< 7900
Dibenz(a,h)anthracene	< 83.5	< 15241	< 81.9	< 14709	< 81.7	< 14614
Dibenzofuran	< 47.4	< 8650	< 46.5	< 8348	< 46.3	< 8295
Di-n-butyl phthalate	< 271	< 49431	< 266	< 47705	< 265	< 47397
1,2-Dichlorobenzene	< 45.1	< 8238	< 44.3	< 7951	< 44.1	< 7900
1,3-Dichlorobenzene	< 51.9	< 9474	< 50.9	< 9143	< 50.8	< 9084
1,4-Dichlorobenzene	< 54.2	< 9886	< 53.1	< 9541	< 53.0	< 9479
3,3'-Dichlorobenzidine	< 293	< 53550	< 288	< 51680	< 287	< 51347
2,4-Dichlorophenol	< 65.5	< 11946	< 64.2	< 11529	< 64.0	< 11454
Diethyl phthalate	< 63.2	< 11534	< 62.0	< 11131	< 61.8	< 11059
2,4-Dimethylphenol	< 221	< 40368	< 217	< 38959	< 216	< 38708
Dimethyl phthalate	< 36.1	< 6591	< 35.4	< 6361	< 35.3	< 6320
4,6-Dinitro-2-methylphenol	< 316	< 57669	< 310	< 55656	< 309	< 55297
2,4-Dinitrophenol	< 655	< 119458	< 642	< 115286	< 640	< 114543
2,4-Dinitrotoluene	< 70.0	< 12770	< 68.6	< 12324	< 68.4	< 12244
2,6-Dinitrotoluene	< 58.7	< 10710	< 57.5	< 10336	< 57.4	< 10269
Di-n-octyl phthalate	< 81.3	< 14829	< 79.7	< 14311	< 79.4	< 14219
Fluoranthene	< 38.4	< 7003	< 37.6	< 6758	< 37.5	< 6715
Fluorene	< 45.1	< 8238	< 44.3	< 7951	< 44.1	< 7900
Hexachlorobenzene	< 47.4	< 8650	< 46.5	< 8348	< 46.3	< 8295
Hexachlorobutadiene	< 65.5	< 11946	< 64.2	< 11529	< 64.0	< 11454
Hexachlorocyclopentadiene	< 519	< 94742	< 509	< 91434	< 508	< 90845
Hexachloroethane	< 85.8	< 15653	< 84.1	< 15106	< 83.9	< 15009
Indeno(1,2,3-cd)pyrene	< 79.0	< 14417	< 77.4	< 13914	< 77.2	< 13824
Isophorone	< 40.6	< 7415	< 39.8	< 7156	< 39.7	< 7110
2-Methylnaphthalene	< 42.9	< 7827	< 42.0	< 7553	< 41.9	< 7505
2-Methylphenol	< 138	< 25127	< 135	< 24250	< 135	< 24094
Naphthalene	3837	700269	4204	755325	5296	908448
2-Nitroaniline	< 49.7	< 9062	< 48.7	< 8746	< 48.6	< 8689
3-Nitroaniline	< 172	< 31306	< 168	< 30213	< 168	< 30018
4-Nitroaniline	< 131	< 23892	< 128	< 23057	< 128	< 22909
Nitrobenzene	< 42.9	< 7827	< 42.0	< 7553	< 41.9	< 7505
2-Nitrophenol	< 106	< 19360	< 104	< 18684	< 104	< 18564
4-Nitrophenol	< 183	< 33366	< 179	< 32201	< 179	< 31993
N-Nitrosodiphenylamine	< 45.1	< 8238	< 44.3	< 7951	< 44.1	< 7900
N-Nitrosodi-n-propylamine	< 47.4	< 8650	< 46.5	< 8348	< 46.3	< 8295
Pentachlorophenol	< 1151	< 210081	< 1128	< 202745	< 1125	< 201438
Phenanthrene	< 38.4	< 7003	< 37.6	< 6758	< 37.5	< 6715
Phenol	< 63.2	< 11534	< 62.0	< 11131	< 61.8	< 11059
Pyrene	< 40.6	< 7415	< 39.8	< 7156	< 39.7	< 7110
1,2,4-Trichlorobenzene	< 47.4	< 8650	< 46.5	< 8348	< 46.3	< 8295
2,4,5-Trichlorophenol	< 99.3	< 18125	< 97.4	< 17492	< 97.1	< 17379
2,4,6-Trichlorophenol	< 70.0	< 12770	< 68.6	< 12324	< 68.4	< 12244

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Table H-2. Semi-VOST HEPA Runs 4-5 (Test 1)
(corrected)

Compound	Run 4 (12/9/04)		Run 5 (12/9/04)	
	Conc ug/dscf	Emission	Conc ug/dscf	Emission
		Rate ug/min		Rate ug/min
Acenaphthene	< 37.5	< 6833	< 37.9	< 6823
Acenaphthylene	< 35.3	< 6431	< 35.7	< 6422
Anthracene	< 35.3	< 6431	< 35.7	< 6422
Benzo(a)anthracene	< 46.3	< 8441	< 46.8	< 8429
Benzo(b)fluoranthene	< 90.4	< 16480	< 91.4	< 16456
Benzo(k)fluoranthene	< 106	< 19293	< 107	< 19266
Benzo(ghi)perylene	< 92.6	< 16882	< 93.6	< 16857
Benzo(a)pyrene	< 48.5	< 8843	< 49.1	< 8830
bis(2-Chloroethoxy)methane	< 39.7	< 7235	< 40.1	< 7225
bis(2-Chloroethyl) ether	< 44.1	< 8039	< 44.6	< 8027
bis(2-Chloroisopropyl) ether	< 52.9	< 9647	< 53.5	< 9633
bis(2-Ethylhexyl) phthalate	< 309	< 56272	< 312	< 56192
4-Bromophenyl phenyl ether	< 35.3	< 6431	< 35.7	< 6422
Butyl benzyl phthalate	< 57.3	< 10451	< 58.0	< 10436
4-Chloroaniline	< 220	< 40194	< 223	< 40137
4-Chloro-3-methylphenol	< 90.4	< 16480	< 91.4	< 16456
2-Chloronaphthalene	< 33.1	< 6029	< 33.4	< 6021
2-Chlorophenol	< 46.3	< 8441	< 46.8	< 8429
4-Chlorophenyl phenyl ether	< 48.5	< 8843	< 49.1	< 8830
Chrysene	< 44.1	< 8039	< 44.6	< 8027
Dibenz(a,h)anthracene	< 81.5	< 14872	< 82.5	< 14851
Dibenzofuran	< 46.3	< 8441	< 46.8	< 8429
Di-n-butyl phthalate	< 264	< 48233	< 268	< 48164
1,2-Dichlorobenzene	< 44.1	< 8039	< 44.6	< 8027
1,3-Dichlorobenzene	< 50.7	< 9245	< 51.3	< 9231
1,4-Dichlorobenzene	< 52.9	< 9647	< 53.5	< 9633
3,3'-Dichlorobenzidine	< 287	< 52253	< 290	< 52178
2,4-Dichlorophenol	< 63.9	< 11656	< 64.7	< 11640
Diethyl phthalate	< 61.7	< 11254	< 62.4	< 11238
2,4-Dimethylphenol	< 216	< 39391	< 219	< 39334
Dimethyl phthalate	< 35.3	< 6431	< 35.7	< 6422
4,6-Dinitro-2-methylphenol	< 309	< 56272	< 312	< 56192
2,4-Dinitrophenol	< 639	< 116564	< 647	< 116397
2,4-Dinitrotoluene	< 68.3	< 12460	< 69.1	< 12442
2,6-Dinitrotoluene	< 57.3	< 10451	< 58.0	< 10436
Di-n-octyl phthalate	< 79.3	< 14470	< 80.3	< 14449
Fluoranthene	< 37.5	< 6833	< 37.9	< 6823
Fluorene	< 44.1	< 8039	< 44.6	< 8027
Hexachlorobenzene	< 46.3	< 8441	< 46.8	< 8429
Hexachlorobutadiene	< 63.9	< 11656	< 64.7	< 11640
Hexachlorocyclopentadiene	< 507	< 92447	< 513	< 92315
Hexachloroethane	< 83.8	< 15274	< 84.7	< 15252
Indeno(1,2,3-cd)pyrene	< 77.1	< 14068	< 78.0	< 14048
Isophorone	< 39.7	< 7235	< 40.1	< 7225
2-Methylnaphthalene	< 41.9	< 7637	< 42.4	< 7626
2-Methylphenol	< 134	< 24519	< 136	< 24484
Naphthalene	3526	643110	3790	682327
2-Nitroaniline	< 48.5	< 8843	< 49.1	< 8830
3-Nitroaniline	< 168	< 30548	< 169	< 30504
4-Nitroaniline	< 128	< 23313	< 129	< 23279
Nitrobenzene	< 41.9	< 7637	< 42.4	< 7626
2-Nitrophenol	< 104	< 18891	< 105	< 18864
4-Nitrophenol	< 179	< 32557	< 181	< 32511
N-Nitrosodiphenylamine	< 44.1	< 8039	< 44.6	< 8027
N-Nitrosodi-n-propylamine	< 46.3	< 8441	< 46.8	< 8429
Pentachlorophenol	< 1124	< 204991	< 1137	< 204698
Phenanthrene	< 37.5	< 6833	< 37.9	< 6823
Phenol	< 61.7	< 11254	< 62.4	< 11238
Pyrene	< 39.7	< 7235	< 40.1	< 7225
1,2,4-Trichlorobenzene	< 46.3	< 8441	< 46.8	< 8429
2,4,5-Trichlorophenol	< 97.0	< 17686	< 98.1	< 17660
2,4,6-Trichlorophenol	< 68.3	< 12460	< 69.1	< 12442

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Table CB-1. Semi-VOST Carbon Bed Runs 1-3 (Test 2)
(corrected)

Compound	Run 1 (12/8/04)		Run 2 (12/8/04)		Run 3 (12/8/04)	
	Emission		Emission		Emission	
	Conc ug/dscf	Rate ug/min	Conc ug/dscf	Rate ug/min	Conc ug/dscf	Rate ug/min
Acenaphthene	< 0.017	< 3.11	< 0.035	< 6.18	< 0.019	< 3.42
Acenaphthylene	< 0.016	< 2.93	< 0.033	< 5.82	< 0.018	< 3.22
Anthracene	< 0.016	< 2.93	< 0.033	< 5.82	< 0.018	< 3.22
Benzo(a)anthracene	< 0.021	< 3.85	< 0.043	< 7.64	< 0.023	< 4.23
Benzo(b)fluoranthene	< 0.041	< 7.51	< 0.084	< 14.9	< 0.046	< 8.26
Benzo(k)fluoranthene	< 0.048	< 8.79	< 0.098	< 17.5	< 0.054	< 9.66
Benzo(ghi)perylene	< 0.042	< 7.69	< 0.086	< 15.3	< 0.047	< 8.46
Benzo(a)pyrene	< 0.022	< 4.03	< 0.045	< 8.00	< 0.025	< 4.43
bis(2-Chloroethoxy)methane	< 0.018	< 3.30	< 0.037	< 6.55	< 0.020	< 3.62
bis(2-Chloroethyl) ether	< 0.020	< 3.66	< 0.041	< 7.27	< 0.022	< 4.03
bis(2-Chloroisopropyl) ether	< 0.024	< 4.39	< 0.049	< 8.73	< 0.027	< 4.83
bis(2-Ethylhexyl) phthalate	< 0.141	< 25.6	< 0.287	< 50.9	0.201	36.2
4-Bromophenyl phenyl ether	< 0.016	< 2.93	< 0.033	< 5.82	< 0.018	< 3.22
Butyl benzyl phthalate	0.026	4.76	< 0.053	< 9.46	0.036	6.44
4-Chloroaniline	< 0.101	< 18.3	< 0.205	< 36.4	< 0.111	< 20.1
4-Chloro-3-methylphenol	< 0.041	< 7.51	< 0.084	< 14.9	< 0.046	< 8.26
2-Chloronaphthalene	< 0.015	< 2.75	< 0.031	< 5.45	< 0.017	< 3.02
2-Chlorophenol	< 0.021	< 3.85	< 0.043	< 7.64	< 0.023	< 4.23
4-Chlorophenyl phenyl ether	< 0.022	< 4.03	< 0.045	< 8.00	< 0.025	< 4.43
Chrysene	< 0.020	< 3.66	< 0.041	< 7.27	< 0.022	< 4.03
Dibenz(a,h)anthracene	< 0.037	< 6.78	< 0.076	< 13.5	< 0.041	< 7.45
Dibenzofuran	< 0.021	< 3.85	< 0.043	< 7.64	< 0.023	< 4.23
Di-n-butyl phthalate	< 0.121	< 22.0	< 0.246	< 43.6	< 0.134	< 24.2
1,2-Dichlorobenzene	< 0.020	< 3.66	< 0.041	< 7.27	< 0.022	< 4.03
1,3-Dichlorobenzene	< 0.023	< 4.21	< 0.047	< 8.36	< 0.026	< 4.63
1,4-Dichlorobenzene	< 0.024	< 4.39	< 0.049	< 8.73	< 0.027	< 4.83
3,3'-Dichlorobenzidine	< 0.131	< 23.8	< 0.266	< 47.3	< 0.145	< 26.2
2,4-Dichlorophenol	< 0.029	< 5.31	< 0.059	< 10.55	< 0.032	< 5.84
Diethyl phthalate	< 0.028	< 5.13	< 0.057	< 10.18	< 0.031	< 5.64
2,4-Dimethylphenol	< 0.099	< 17.9	< 0.205	< 36.4	< 0.109	< 19.7
Dimethyl phthalate	< 0.016	< 2.93	< 0.033	< 5.82	< 0.018	< 3.22
4,6-Dinitro-2-methylphenol	< 0.141	< 25.6	< 0.287	< 50.9	< 0.156	< 28.2
2,4-Dinitrophenol	< 0.292	< 53.1	< 0.594	< 105.5	< 0.323	< 58.4
2,4-Dinitrotoluene	< 0.031	< 5.68	< 0.063	< 11.27	< 0.035	< 6.24
2,6-Dinitrotoluene	< 0.026	< 4.76	< 0.053	< 9.46	< 0.029	< 5.23
Di-n-octyl phthalate	< 0.036	< 6.59	< 0.074	< 13.1	< 0.040	< 7.25
Fluoranthene	< 0.017	< 3.11	< 0.035	< 6.18	< 0.019	< 3.42
Fluorene	< 0.020	< 3.66	< 0.041	< 7.27	< 0.022	< 4.03
Hexachlorobenzene	< 0.021	< 3.85	< 0.043	< 7.64	< 0.023	< 4.23
Hexachlorobutadiene	< 0.029	< 5.31	< 0.059	< 10.55	< 0.032	< 5.84
Hexachlorocyclopentadiene	< 0.232	< 42.1	< 0.471	< 83.6	< 0.256	< 46.3
Hexachloroethane	< 0.038	< 6.96	< 0.078	< 13.8	< 0.042	< 7.65
Indeno(1,2,3-cd)pyrene	< 0.035	< 6.41	< 0.072	< 12.7	< 0.039	< 7.05
Isophorone	< 0.018	< 3.30	< 0.037	< 6.55	< 0.020	< 3.62
2-Methylnaphthalene	< 0.019	< 3.48	< 0.039	< 6.91	< 0.021	< 3.83
2-Methylphenol	< 0.061	< 11.17	< 0.123	< 21.8	< 0.068	< 12.3
Naphthalene	0.044	8.06	< 0.037	< 6.55	0.050	9.06
2-Nitroaniline	< 0.022	< 4.03	< 0.045	< 8.00	< 0.025	< 4.43
3-Nitroaniline	< 0.077	< 13.9	< 0.154	< 27.3	< 0.085	< 15.3
4-Nitroaniline	< 0.058	< 10.62	< 0.123	< 21.8	< 0.065	< 11.7
Nitrobenzene	< 0.019	< 3.48	< 0.039	< 6.91	< 0.021	< 3.83
2-Nitrophenol	< 0.047	< 8.61	< 0.096	< 17.1	< 0.052	< 9.46
4-Nitrophenol	< 0.082	< 14.8	< 0.164	< 29.1	< 0.090	< 16.3
N-Nitrosodiphenylamine	< 0.020	< 3.66	< 0.041	< 7.27	< 0.022	< 4.03
N-Nitrosodi-n-propylamine	< 0.021	< 3.85	< 0.043	< 7.64	< 0.023	< 4.23
Pentachlorophenol	< 0.514	< 93.4	< 1.023	< 182	< 0.569	< 102.7
Phenanthrene	< 0.017	< 3.11	< 0.035	< 6.18	< 0.019	< 3.42
Phenol	0.028	5.13	< 0.057	< 10.18	0.035	6.24
Pyrene	< 0.018	< 3.30	< 0.037	< 6.55	< 0.020	< 3.62
1,2,4-Trichlorobenzene	< 0.021	< 3.85	< 0.043	< 7.64	< 0.023	< 4.23
2,4,5-Trichlorophenol	< 0.044	< 8.06	< 0.090	< 16.0	< 0.049	< 8.86
2,4,6-Trichlorophenol	< 0.031	< 5.68	< 0.063	< 11.27	< 0.035	< 6.24

Table T-1. Semi-VOST TCO Runs 1-3 (Test 2)

Compound	Run 1 (12/8/04)		Run 2 (12/8/04)		Run 3 (12/8/04)	
	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min	Conc ug/dscf	Emission Rate ug/min
Acenaphthene	< 0.012	< 2.34	< 0.012	< 2.22	< 0.013	< 2.55
Acenaphthylene	< 0.012	< 2.20	< 0.012	< 2.09	< 0.013	< 2.40
Anthracene	< 0.012	< 2.20	< 0.012	< 2.09	< 0.013	< 2.40
Benzo(a)anthracene	< 0.015	< 2.89	< 0.015	< 2.74	< 0.017	< 3.15
Benzo(b)fluoranthene	< 0.030	< 5.63	< 0.030	< 5.35	< 0.032	< 6.14
Benzo(k)fluoranthene	< 0.035	< 6.60	< 0.035	< 6.27	< 0.038	< 7.19
Benzo(ghi)perylene	< 0.030	< 5.77	< 0.031	< 5.49	< 0.033	< 6.29
Benzo(a)pyrene	< 0.016	< 3.02	< 0.016	< 2.87	< 0.017	< 3.30
bis(2-Chloroethoxy)methane	< 0.013	< 2.47	< 0.013	< 2.35	< 0.014	< 2.70
bis(2-Chloroethyl) ether	< 0.014	< 2.75	< 0.015	< 2.61	< 0.016	< 3.00
bis(2-Chloroisopropyl) ether	< 0.017	< 3.30	< 0.017	< 3.13	< 0.019	< 3.60
bis(2-Ethylhexyl) phthalate	< 0.101	< 19.2	< 0.102	< 18.3	0.134	25.5
4-Bromophenyl phenyl ether	< 0.012	< 2.20	< 0.012	< 2.09	< 0.013	< 2.40
Butyl benzyl phthalate	< 0.019	< 3.57	< 0.019	< 3.40	0.024	4.50
4-Chloroaniline	< 0.072	< 13.7	< 0.073	< 13.1	< 0.079	< 15.0
4-Chloro-3-methylphenol	< 0.030	< 5.63	< 0.030	< 5.35	< 0.032	< 6.14
2-Chloronaphthalene	< 0.011	< 2.06	< 0.011	< 1.96	< 0.012	< 2.25
2-Chlorophenol	< 0.015	< 2.89	< 0.015	< 2.74	< 0.017	< 3.15
4-Chlorophenyl phenyl ether	< 0.016	< 3.02	< 0.016	< 2.87	< 0.017	< 3.30
Chrysene	< 0.014	< 2.75	< 0.015	< 2.61	< 0.016	< 3.00
Dibenz(a,h)anthracene	< 0.027	< 5.08	< 0.027	< 4.83	< 0.029	< 5.54
Dibenzofuran	< 0.015	< 2.89	< 0.015	< 2.74	< 0.017	< 3.15
Di-n-butyl phthalate	< 0.087	< 16.5	< 0.087	< 15.7	< 0.095	< 18.0
1,2-Dichlorobenzene	< 0.014	< 2.75	< 0.015	< 2.61	< 0.016	< 3.00
1,3-Dichlorobenzene	< 0.017	< 3.16	< 0.017	< 3.00	< 0.018	< 3.45
1,4-Dichlorobenzene	< 0.017	< 3.30	< 0.017	< 3.13	< 0.019	< 3.60
3,3'-Dichlorobenzidine	< 0.094	< 17.9	< 0.095	< 17.0	< 0.103	< 19.5
2,4-Dichlorophenol	< 0.021	< 3.98	< 0.021	< 3.79	< 0.023	< 4.35
Diethyl phthalate	< 0.020	< 3.85	< 0.020	< 3.66	< 0.022	< 4.20
2,4-Dimethylphenol	< 0.071	< 13.5	< 0.071	< 12.8	< 0.077	< 14.7
Dimethyl phthalate	< 0.012	< 2.20	< 0.012	< 2.09	< 0.013	< 2.40
4,6-Dinitro-2-methylphenol	< 0.101	< 19.2	< 0.102	< 18.3	< 0.110	< 21.0
2,4-Dinitrophenol	< 0.209	< 39.8	< 0.211	< 37.9	< 0.229	< 43.5
2,4-Dinitrotoluene	< 0.022	< 4.26	< 0.023	< 4.05	< 0.024	< 4.65
2,6-Dinitrotoluene	< 0.019	< 3.57	< 0.019	< 3.40	< 0.021	< 3.90
Di-n-octyl phthalate	< 0.026	< 4.95	< 0.026	< 4.70	< 0.028	< 5.39
Fluoranthene	< 0.012	< 2.34	< 0.012	< 2.22	< 0.013	< 2.55
Fluorene	< 0.014	< 2.75	< 0.015	< 2.61	< 0.016	< 3.00
Hexachlorobenzene	< 0.015	< 2.89	< 0.015	< 2.74	< 0.017	< 3.15
Hexachlorobutadiene	< 0.021	< 3.98	< 0.021	< 3.79	< 0.023	< 4.35
Hexachlorocyclopentadiene	< 0.166	< 31.6	< 0.167	< 30.0	< 0.181	< 34.5
Hexachloroethane	< 0.027	< 5.22	< 0.028	< 4.96	< 0.030	< 5.69
Indeno(1,2,3-cd)pyrene	< 0.025	< 4.81	< 0.025	< 4.57	< 0.028	< 5.24
Isophorone	< 0.013	< 2.47	< 0.013	< 2.35	< 0.014	< 2.70
2-Methylnaphthalene	< 0.014	< 2.61	< 0.014	< 2.48	< 0.015	< 2.85
2-Methylphenol	< 0.044	< 8.38	< 0.044	< 7.97	< 0.048	< 9.14
Naphthalene	< 0.013	< 2.47	< 0.013	< 2.35	< 0.014	< 2.70
2-Nitroaniline	< 0.016	< 3.02	< 0.016	< 2.87	< 0.017	< 3.30
3-Nitroaniline	< 0.055	< 10.4	< 0.055	< 9.93	< 0.060	< 11.4
4-Nitroaniline	< 0.042	< 7.97	< 0.042	< 7.57	< 0.046	< 8.69
Nitrobenzene	< 0.014	< 2.61	< 0.014	< 2.48	< 0.015	< 2.85
2-Nitrophenol	< 0.034	< 6.46	< 0.034	< 6.14	< 0.037	< 7.04
4-Nitrophenol	< 0.058	< 11.1	< 0.059	< 10.6	< 0.064	< 12.1
N-Nitrosodiphenylamine	< 0.014	< 2.75	< 0.015	< 2.61	< 0.016	< 3.00
N-Nitrosodi-n-propylamine	< 0.015	< 2.89	< 0.015	< 2.74	< 0.017	< 3.15
Pentachlorophenol	< 0.368	< 70.1	< 0.371	< 66.6	< 0.402	< 76.4
Phenanthrene	< 0.012	< 2.34	< 0.012	< 2.22	< 0.013	< 2.55
Phenol	0.037	7.01	0.087	15.7	0.039	7.49
Pyrene	< 0.013	< 2.47	< 0.013	< 2.35	< 0.014	< 2.70
1,2,4-Trichlorobenzene	< 0.015	< 2.89	< 0.015	< 2.74	< 0.017	< 3.15
2,4,5-Trichlorophenol	< 0.032	< 6.05	< 0.032	< 5.75	< 0.035	< 6.59
2,4,6-Trichlorophenol	< 0.022	< 4.26	< 0.023	< 4.05	< 0.024	< 4.65

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Table T-21. Semi-VOST TCO Runs 4-5 (Test 2)

Compound	Run 4 (12/9/04)		Run 5 (12/9/04)	
	Emission		Emission	
	Conc ug/dscf	Rate ug/min	Conc ug/dscf	Rate ug/min
Acenaphthene	< 0.013	< 2.41	< 0.013	< 2.38
Acenaphthylene	< 0.012	< 2.27	< 0.012	< 2.24
Anthracene	< 0.012	< 2.27	< 0.012	< 2.24
Benzo(a)anthracene	< 0.016	< 2.97	< 0.016	< 2.94
Benzo(b)fluoranthene	< 0.031	< 5.80	< 0.031	< 5.74
Benzo(k)fluoranthene	< 0.036	< 6.80	< 0.036	< 6.72
Benzo(ghi)perylene	< 0.032	< 5.95	< 0.032	< 5.88
Benzo(a)pyrene	< 0.017	< 3.11	< 0.017	< 3.08
bis(2-Chloroethoxy)methane	< 0.014	< 2.55	< 0.014	< 2.52
bis(2-Chloroethyl) ether	< 0.015	< 2.83	< 0.015	< 2.80
bis(2-Chloroisopropyl) ether	< 0.018	< 3.40	< 0.018	< 3.36
bis(2-Ethylhexyl) phthalate	< 0.105	< 19.8	0.128	23.8
4-Bromophenyl phenyl ether	< 0.012	< 2.27	< 0.012	< 2.24
Butyl benzyl phthalate	< 0.020	< 3.68	< 0.020	< 3.64
4-Chloroaniline	< 0.075	< 14.2	< 0.075	< 14.0
4-Chloro-3-methylphenol	< 0.031	< 5.80	< 0.031	< 5.74
2-Chloronaphthalene	< 0.011	< 2.12	< 0.011	< 2.10
2-Chlorophenol	< 0.016	< 2.97	< 0.016	< 2.94
4-Chlorophenyl phenyl ether	< 0.017	< 3.11	< 0.017	< 3.08
Chrysene	< 0.015	< 2.83	< 0.015	< 2.80
Dibenz(a,h)anthracene	< 0.028	< 5.24	< 0.028	< 5.18
Dibenzofuran	< 0.016	< 2.97	< 0.016	< 2.94
Di-n-butyl phthalate	< 0.090	< 17.0	< 0.090	< 16.8
1,2-Dichlorobenzene	< 0.015	< 2.83	< 0.015	< 2.80
1,3-Dichlorobenzene	< 0.017	< 3.26	< 0.017	< 3.22
1,4-Dichlorobenzene	< 0.018	< 3.40	< 0.018	< 3.36
3,3'-Dichlorobenzidine	< 0.098	< 18.4	< 0.098	< 18.2
2,4-Dichlorophenol	0.022	4.11	< 0.022	< 4.06
Diethyl phthalate	< 0.021	< 3.96	0.026	4.76
2,4-Dimethylphenol	< 0.074	< 13.9	0.074	13.7
Dimethyl phthalate	< 0.012	< 2.27	< 0.012	< 2.24
4,6-Dinitro-2-methylphenol	< 0.105	< 19.8	< 0.105	< 19.6
2,4-Dinitrophenol	< 0.504	< 94.9	< 1.350	< 252
2,4-Dinitrotoluene	< 0.023	< 4.39	< 0.023	< 4.34
2,6-Dinitrotoluene	< 0.020	< 3.68	< 0.020	< 3.64
Di-n-octyl phthalate	< 0.027	< 5.10	< 0.027	< 5.04
Fluoranthene	< 0.013	< 2.41	< 0.013	< 2.38
Fluorene	< 0.015	< 2.83	< 0.015	< 2.80
Hexachlorobenzene	< 0.016	< 2.97	< 0.016	< 2.94
Hexachlorobutadiene	< 0.022	< 4.11	< 0.022	< 4.06
Hexachlorocyclopentadiene	< 0.173	< 32.6	< 0.173	< 32.2
Hexachloroethane	< 0.029	< 5.38	< 0.029	< 5.32
Indeno(1,2,3-cd)pyrene	< 0.026	< 4.96	< 0.026	< 4.90
Isophorone	< 0.014	< 2.55	< 0.014	< 2.52
2-Methylnaphthalene	< 0.014	< 2.69	< 0.014	< 2.66
2-Methylphenol	< 0.046	< 8.64	< 0.046	< 8.54
Naphthalene	0.113	21.2	0.615	115
2-Nitroaniline	< 0.017	< 3.11	< 0.017	< 3.08
3-Nitroaniline	< 0.057	< 10.8	< 0.057	< 10.6
4-Nitroaniline	< 0.044	< 8.21	< 0.044	< 8.12
Nitrobenzene	< 0.014	< 2.69	< 0.014	< 2.66
2-Nitrophenol	0.978	184	0.750	140
4-Nitrophenol	0.173	32.6	0.180	33.6
N-Nitrosodiphenylamine	< 0.015	< 2.83	< 0.015	< 2.80
N-Nitrosodi-n-propylamine	< 0.016	< 2.97	< 0.016	< 2.94
Pentachlorophenol	< 0.384	< 72.20	< 0.383	< 71.4
Phenanthrene	< 0.013	< 2.41	< 0.013	< 2.38
Phenol	< 0.021	< 3.96	0.044	8.12
Pyrene	< 0.014	< 2.55	< 0.014	< 2.52
1,2,4-Trichlorobenzene	< 0.016	< 2.97	< 0.016	< 2.94
2,4,5-Trichlorophenol	< 0.033	< 6.23	< 0.033	< 6.16
2,4,6-Trichlorophenol	< 0.023	< 4.39	< 0.023	< 4.34

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Table B-1. Semi-VOST Blank

<i>Compound</i>	<i>Total ug</i>
Acenaphthene	< 1.70
Acenaphthylene	< 1.60
Anthracene	< 1.60
Benzo(a)anthracene	< 2.10
Benzo(b)fluoranthene	< 4.10
Benzo(k)fluoranthene	< 4.80
Benzo(ghi)perylene	< 4.20
Benzo(a)pyrene	< 2.20
bis(2-Chloroethoxy)methane	< 1.80
bis(2-Chloroethyl) ether	< 2.00
bis(2-Chloroisopropyl) ether	< 2.40
bis(2-Ethylhexyl) phthalate	< 14.0
4-Bromophenyl phenyl ether	< 1.60
Butyl benzyl phthalate	< 2.60
4-Chloroaniline	< 10.0
4-Chloro-3-methylphenol	< 4.10
2-Chloronaphthalene	< 1.50
2-Chlorophenol	< 2.10
4-Chlorophenyl phenyl ether	< 2.20
Chrysene	< 2.00
Dibenz(a,h)anthracene	< 3.70
Dibenzofuran	< 2.10
Di-n-butyl phthalate	< 12.0
1,2-Dichlorobenzene	< 2.00
1,3-Dichlorobenzene	< 2.30
1,4-Dichlorobenzene	< 2.40
3,3'-Dichlorobenzidine	< 13.0
2,4-Dichlorophenol	< 2.90
Diethyl phthalate	< 2.80
2,4-Dimethylphenol	< 9.80
Dimethyl phthalate	< 1.60
4,6-Dinitro-2-methylphenol	< 14.0
2,4-Dinitrophenol	< 29.0
2,4-Dinitrotoluene	< 3.10
2,6-Dinitrotoluene	< 2.60
Di-n-octyl phthalate	< 3.60
Fluoranthene	< 1.70
Fluorene	< 2.00
Hexachlorobenzene	< 2.10
Hexachlorobutadiene	< 2.90
Hexachlorocyclopentadiene	< 23.0
Hexachloroethane	< 3.80
Indeno(1,2,3-cd)pyrene	< 3.50
Isophorone	< 1.80
2-Methylnaphthalene	< 1.90
2-Methylphenol	< 6.10
Naphthalene	< 9.40
2-Nitroaniline	< 2.20
3-Nitroaniline	< 7.60
4-Nitroaniline	< 5.80
Nitrobenzene	< 1.90
2-Nitrophenol	< 4.70
4-Nitrophenol	< 8.10
N-Nitrosodiphenylamine	< 2.00
N-Nitrosodi-n-propylamine	< 2.10
Pentachlorophenol	< 51.0
Phenanthrene	< 1.70
Phenol	< 2.80
Pyrene	< 1.80
1,2,4-Trichlorobenzene	< 2.10
2,4,5-Trichlorophenol	< 4.40
2,4,6-Trichlorophenol	< 3.10

Appendix A.3

Dioxin/Furan

Table DF-1. Melter Dioxin/Furan Results

Compound	Run 1 (12/7/04)			Run 2 (12/8/04)			Run 3 (12/10/04)			Run 4 (12/10/04)		
	Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min	
2,3,7,8-TCDD	0.272	48.1	<	0.356	<	62.5	0.383	72.3	0.321	52.6		
1,2,3,7,8-PeCDD	2.11	373		2.18	383		2.78	526	3.41	559		
1,2,3,4,7,8-HxCDD	2.13	377		2.67	469		3.13	592	4.01	657		
1,2,3,6,7,8-HxCDD	1.63	289		1.67	293		2.26	428	2.60	427		
1,2,3,7,8,9-HxCDD	1.93	341		2.45	430		2.78	526	3.21	526		
1,2,3,4,6,7,8-HpCDD	4.99	882		6.45	1133		8.35	1579	9.22	1512		
OCDD	4.09	722		5.11	898		9.22	1743	7.81	1282		
2,3,7,8-TCDF	4.09	722		4.67	820		6.44	1217	6.81	1118		
1,2,3,7,8-PeCDF	0.636	112		0.889	156		1.15	217	1.82	299		
2,3,4,7,8-PeCDF	0.386	68.2		0.712	125		0.539	102	0.721	118		
1,2,3,4,7,8-HxCDF	2.13	377		3.78	664		3.31	625	4.21	690		
1,2,3,6,7,8-HxCDF	0.197	34.9		0.756	133		0.435	82.2	0.481	78.9		
2,3,4,6,7,8-HxCDF	0.107	18.8		0.400	70.3		0.150	28.3	0.240	39.4		
1,2,3,7,8,9-HxCDF	0.052	9.2		0.185	32.4		0.056	10.5	0.094	15.4		
1,2,3,4,6,7,8-HpCDF	0.499	88.2		3.11	547		0.992	187	1.14	187		
1,2,3,4,7,8,9-HpCDF	0.104	18.4		1.33	234		0.209	39.5	0.301	49.3		
OCDF	0.318	56.1		2.89	508		1.43	270	0.761	125		

Table T-1. TEQ Results for Melter Runs 1-2

Compound	Sample Concentration Average (pg/dscf)	TE Factor	Toxic Equivalent (pg/dscf)
2,3,7,8-TCDD	< 0.314	1	< 0.314
1,2,3,7,8-PeCDD	2.15	0.5	1.07
1,2,3,4,7,8-HxCDD	2.40	0.1	0.240
1,2,3,6,7,8-HxCDD	1.65	0.1	0.165
1,2,3,7,8,9-HxCDD	2.19	0.1	0.219
1,2,3,4,6,7,8-HpCDD	5.72	0.01	0.057
OCDD	4.60	0.001	0.005
2,3,7,8-TCDF	4.38	0.1	0.438
1,2,3,7,8-PeCDF	0.76	0.05	0.038
2,3,4,7,8-PeCDF	0.549	0.5	0.274
1,2,3,4,7,8-HxCDF	2.96	0.1	0.296
1,2,3,6,7,8-HxCDF	0.477	0.1	0.048
2,3,4,6,7,8-HxCDF	0.253	0.1	0.025
1,2,3,7,8,9-HxCDF	0.118	0.1	0.012
1,2,3,4,6,7,8-HpCDF	1.81	0.01	0.018
1,2,3,4,7,8,9-HpCDF	0.719	0.01	0.007
OCDF	1.60	0.001	0.002
Total Toxic Equivalent			< 3.23

Table T-2. TEQ Results for Melter Runs 3-4

Compound	Sample Concentration Average (pg/dscf)	TE Factor	Toxic Equivalent (pg/dscf)
2,3,7,8-TCDD	0.352	1	0.352
1,2,3,7,8-PeCDD	3.09	0.5	1.547
1,2,3,4,7,8-HxCDD	3.57	0.1	0.357
1,2,3,6,7,8-HxCDD	2.43	0.1	0.243
1,2,3,7,8,9-HxCDD	2.99	0.1	0.299
1,2,3,4,6,7,8-HpCDD	8.8	0.01	0.088
OCDD	8.5	0.001	0.009
2,3,7,8-TCDF	6.62	0.1	0.662
1,2,3,7,8-PeCDF	1.49	0.05	0.074
2,3,4,7,8-PeCDF	0.630	0.5	0.315
1,2,3,4,7,8-HxCDF	3.76	0.1	0.376
1,2,3,6,7,8-HxCDF	0.458	0.1	0.046
2,3,4,6,7,8-HxCDF	0.195	0.1	0.020
1,2,3,7,8,9-HxCDF	0.075	0.1	0.007
1,2,3,4,6,7,8-HpCDF	1.07	0.01	0.011
1,2,3,4,7,8,9-HpCDF	0.255	0.01	0.003
OCDF	1.09	0.001	0.001
Total Toxic Equivalent			4.41

Table T-3. TEQ Results for TCO Runs 1-3

<i>Compound</i>		<i>Sample Concentration Average (pg/dscf)</i>	<i>TE Factor</i>		<i>Toxic Equivalent (pg/dscf)</i>
2,3,7,8-TCDD	<	0.148	1	<	0.148
1,2,3,7,8-PeCDD	<	0.063	0.5	<	0.032
1,2,3,4,7,8-HxCDD	<	0.044	0.1	<	0.004
1,2,3,6,7,8-HxCDD	<	0.067	0.1	<	0.007
1,2,3,7,8,9-HxCDD	<	0.068	0.1	<	0.007
1,2,3,4,6,7,8-HpCDD		0.340	0.01		0.003
OCDD		1.17	0.001		0.001
2,3,7,8-TCDF	<	0.207	0.1	<	0.021
1,2,3,7,8-PeCDF	<	0.43	0.05	<	0.021
2,3,4,7,8-PeCDF	<	0.37	0.5	<	0.186
1,2,3,4,7,8-HxCDF		1.37	0.1		0.137
1,2,3,6,7,8-HxCDF		0.64	0.1		0.064
2,3,4,6,7,8-HxCDF	<	0.227	0.1	<	0.023
1,2,3,7,8,9-HxCDF	<	0.113	0.1	<	0.011
1,2,3,4,6,7,8-HpCDF		1.94	0.01		0.019
1,2,3,4,7,8,9-HpCDF		0.96	0.01		0.010
OCDF		2.50	0.001		0.003
Total Toxic Equivalent				<	0.696

Table T-4. TEQ Results for TCO Runs 4-6

<i>Compound</i>		<i>Sample Concentration Average (pg/dscf)</i>	<i>TE Factor</i>		<i>Toxic Equivalent (pg/dscf)</i>
2,3,7,8-TCDD	<	0.093	1	<	0.093
1,2,3,7,8-PeCDD	<	0.025	0.5	<	0.012
1,2,3,4,7,8-HxCDD	<	0.016	0.1	<	0.002
1,2,3,6,7,8-HxCDD	<	0.016	0.1	<	0.002
1,2,3,7,8,9-HxCDD	<	0.015	0.1	<	0.001
1,2,3,4,6,7,8-HpCDD		0.076	0.01		0.001
OCDD		0.54	0.001		0.001
2,3,7,8-TCDF	<	0.094	0.1	<	0.009
1,2,3,7,8-PeCDF	<	0.026	0.05	<	0.001
2,3,4,7,8-PeCDF	<	0.024	0.5	<	0.012
1,2,3,4,7,8-HxCDF		0.027	0.1		0.003
1,2,3,6,7,8-HxCDF	<	0.017	0.1	<	0.002
2,3,4,6,7,8-HxCDF	<	0.016	0.1	<	0.002
1,2,3,7,8,9-HxCDF	<	0.014	0.1	<	0.001
1,2,3,4,6,7,8-HpCDF		0.097	0.01		0.001
1,2,3,4,7,8,9-HpCDF	<	0.030	0.01	<	0.0003
OCDF		0.197	0.001		0.0002
Total Toxic Equivalent				<	0.143

Table DF-2. TCO Dioxin/Furan Results

Compound	Run 1 (12/7/04)			Run 2 (12/7/04)			Run 3 (12/8/04)			Run 4 (12/10/04)			Run 5 (12/10/04)			Run 6 (12/10/04)		
	Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min		Concentration pg/dscf	Emission Rate pg/min	
2,3,7,8-TCDD	< 0.049	9.51	<	0.168	36.0	<	0.227	47.5	<	0.121	23.3	<	0.100	19.6	<	0.059	11.1	<
1,2,3,7,8-PeCDD	0.042	8.09		0.104	22.2	<	0.044	9.29	<	0.026	5.08	<	0.026	5.11	<	0.022	4.03	<
1,2,3,4,7,8-HxCDD	< 0.011	2.23	<	0.095	20.5	<	0.025	5.18	<	0.014	2.75	<	0.019	3.68	<	0.014	2.62	<
1,2,3,6,7,8-HxCDD	0.030	5.87		0.147	31.5	<	0.025	5.18	<	0.014	2.75	<	0.019	3.68	<	0.014	2.62	<
1,2,3,7,8,9-HxCDD	0.035	6.88		0.147	31.5	<	0.023	4.75	<	0.013	2.54	<	0.018	3.48	<	0.013	2.42	<
1,2,3,4,6,7,8-HpCDD	0.250	48.5		0.671	144		0.101	21.2		0.080	15.5		0.079	15.5		0.070	13.1	
OCDD	1.87	364		0.944	202		0.701	147		0.767	148		0.364	71.6		0.486	90.7	
2,3,7,8-TCDF	< 0.048	9.30	<	0.367	78.7	<	0.206	43.2	<	0.132	25.4	<	0.099	19.4	<	0.051	9.47	<
1,2,3,7,8-PeCDF	0.074	14.4		1.15	247	<	0.053	11.0	<	0.033	6.35	<	0.027	5.32	<	0.018	3.43	<
2,3,4,7,8-PeCDF	0.059	11.5		1.01	216	<	0.049	10.4	<	0.031	5.93	<	0.025	4.91	<	0.017	3.23	<
1,2,3,4,7,8-HxCDF	0.218	42.5		3.77	809		0.124	25.9		0.027	5.29		0.022	4.30		0.031	5.85	
1,2,3,6,7,8-HxCDF	0.085	16.6		1.78	382		0.042	8.85		0.019	3.60		0.022	4.30		0.010	1.94	
2,3,4,6,7,8-HpCDF	0.043	8.29		0.619	133	<	0.021	4.32	<	0.013	2.54	<	0.023	4.50	<	0.012	2.22	<
1,2,3,7,8,9-HxCDF	< 0.012	2.43	<	0.304	65.2	<	0.022	4.54	<	0.013	2.54	<	0.016	3.07	<	0.013	2.42	<
1,2,3,4,6,7,8-HpCDF	0.478	93.0		5.14	1101		0.196	41.0		0.100	19.3		0.114	22.5		0.076	14.1	
1,2,3,4,7,8,9-HpCDF	0.177	34.4		2.62	562		0.095	19.9		0.026	5.08		0.049	9.61		0.014	2.62	
OCDF	0.749	146		6.50	1393		0.258	54.0		0.230	44.5		0.177	34.8		0.184	34.3	

D/F Field Blank Results

		MDL	
2,3,7,8-TCDD	ND	15	pg/sampl
1,2,3,7,8-PeCDD	ND	2.6	pg/sampl
1,2,3,4,7,8-HxCDD	ND	1.9	pg/sampl
1,2,3,6,7,8-HxCDD	ND	1.9	pg/sampl
1,2,3,7,8,9-HxCDD	ND	1.8	pg/sampl
1,2,3,4,6,7,8-HpCDD	ND	1.7	pg/sampl
OCDD	5.9 B J	1.5	pg/sampl
2,3,7,8-TCDF	ND	14	pg/sampl
1,2,3,7,8-PeCDF	ND	3.1	pg/sampl
2,3,4,7,8-PeCDF	ND	2.9	pg/sampl
1,2,3,4,7,8-HxCDF	ND	1.3	pg/sampl
1,2,3,6,7,8-HxCDF	ND	1.2	pg/sampl
2,3,4,6,7,8-HxCDF	ND	1.4	pg/sampl
1,2,3,7,8,9-HxCDF	ND	1.5	pg/sampl
1,2,3,4,6,7,8-HpCDF	ND	1.3	pg/sampl
1,2,3,4,7,8,9-HpCDF	ND	1.6	pg/sampl
OCDF	ND	1.7	pg/sampl

Appendix A.4

PCB

Table PBC-1. Melter PCB Results

Compound	Run 1 (12/7/04)			Run 2 (12/8/04)			Run 3 (12/10/04)			Run 4 (12/10/04)		
	Concentration ng/dscf	Emission Rate ng/min		Concentration ng/dscf	Emission Rate ng/min		Concentration ng/dscf	Emission Rate ng/min		Concentration ng/dscf	Emission Rate ng/min	
PCB 77 (BZ)	0.012	2.20		0.015	2.62		0.017	3.19		0.018	2.96	
PCB 81 (BZ)	0.001	0.237		0.003	0.469		0.002	0.362		0.003	0.460	
PCB 126 (BZ)	<	0.176	<	0.001	0.223		0.001	0.250	<	0.001	0.154	
PCB 105 (BZ)	0.019	3.37		0.015	2.62		0.010	1.97		0.019	3.09	
PCB 118 (BZ)	0.050	8.82		0.031	5.47		0.021	3.95		0.042	6.90	
PCB 123 (BZ)	<	0.136	<	0.001	0.187		0.001	0.243	<	0.001	0.131	
PCB 114 (BZ)	0.002	0.341		0.002	0.430		0.002	0.428		0.002	0.362	
PCB 169 (BZ)	<	0.148	<	0.001	0.199		<	0.115	<	0.001	0.131	
PCB 156 (BZ)	0.004	0.641		0.004	0.664		0.003	0.526		0.005	0.789	
PCB 157 (BZ)	0.004	0.641		0.004	0.664		0.003	0.526		0.005	0.789	
PCB 167 (BZ)	0.002	0.313	<	0.001	0.187	<	<	0.105	<	0.002	0.289	
PCB 189 (BZ)	<	0.124	<	0.001	0.152	<	<	0.102	<	0.001	0.125	

Table PBC-2. TCO PCB Results

Compound	Run 1 (12/7/04)		Run 2 (12/7/04)		Run 3 (12/8/04)	
	Emission		Emission		Emission	
	Concentration ng/dscf	Rate ng/min	Concentration ng/dscf	Rate ng/min	Concentration ng/dscf	Rate ng/min
PCB 77 (BZ)	0.001	0.223	0.002	0.382	0.001	0.160
PCB 81 (BZ)	< 0.0002	0.036	0.001	0.171	< 0.0002	0.045
PCB 126 (BZ)	< 0.0003	0.053	0.001	0.315	< 0.0003	0.060
PCB 105 (BZ)	0.011	2.23	0.004	0.899	0.002	0.518
PCB 118 (BZ)	0.025	4.85	0.009	1.98	0.005	0.972
PCB 123 (BZ)	< 0.0002	0.040	0.0003	0.074	< 0.0002	0.048
PCB 114 (BZ)	0.001	0.148	0.001	0.112	< 0.0002	0.043
PCB 169 (BZ)	< 0.0003	0.057	< 0.0003	0.072	< 0.0003	0.054
PCB 156 (BZ)	0.002	0.465	0.001	0.292	0.001	0.149
PCB 157 (BZ)	0.002	0.465	0.001	0.292	0.001	0.149
PCB 167 (BZ)	0.001	0.158	0.001	0.200	< 0.0002	0.045
PCB 189 (BZ)	< 0.0002	0.047	0.001	0.169	< 0.0003	0.054

Compound	Run 4 (12/10/04)		Run 5 (12/10/04)		Run 6 (12/10/04)	
	Emission		Emission		Emission	
	Concentration ng/dscf	Rate ng/min	Concentration ng/dscf	Rate ng/min	Concentration ng/dscf	Rate ng/min
PCB 77 (BZ)	0.001	0.125	0.001	0.100	0.001	0.177
PCB 81 (BZ)	< 0.0002	0.034	< 0.0002	0.041	< 0.0003	0.048
PCB 126 (BZ)	< 0.0003	0.051	< 0.0003	0.057	< 0.0003	0.052
PCB 105 (BZ)	0.002	0.318	0.004	0.777	0.003	0.564
PCB 118 (BZ)	0.004	0.720	0.010	2.046	0.008	1.49
PCB 123 (BZ)	< 0.0002	0.040	< 0.0002	0.049	< 0.0002	0.042
PCB 114 (BZ)	< 0.0002	0.038	< 0.0002	0.045	< 0.0002	0.042
PCB 169 (BZ)	< 0.0002	0.047	< 0.0003	0.051	< 0.0003	0.058
PCB 156 (BZ)	0.001	0.140	0.001	0.170	0.001	0.153
PCB 157 (BZ)	0.001	0.140	0.001	0.170	0.001	0.153
PCB 167 (BZ)	< 0.0002	0.038	< 0.0002	0.047	< 0.0003	0.050
PCB 189 (BZ)	< 0.0002	0.044	< 0.0003	0.053	< 0.0003	0.050

PCB Field Blank Results

PCB 77 (BZ)	ND	0.021 ng/sampl
PCB 81 (BZ)	ND	0.022 ng/sampl
PCB 126 (BZ)	ND	0.017 ng/sampl
PCB 105 (BZ)	ND	0.015 ng/sampl
PCB 118 (BZ)	0.019 Q J	0.012 ng/sampl
PCB 123 (BZ)	ND	0.011 ng/sampl
PCB 114 (BZ)	ND	0.012 ng/sampl
PCB 169 (BZ)	ND	0.018 ng/sampl
PCB 156 (BZ)	ND	0.018 ng/sampl
PCB 157 (BZ)	ND	0.018 ng/sampl
PCB 167 (BZ)	ND	0.016 ng/sampl
PCB 189 (BZ)	ND	0.014 ng/sampl

Appendix A.5

Metals

Table MM-1. Melter Metals Results

Metal	Run 1 (12/9/04)		Run 2 (12/10/04)		Run 3 (12/10/04)		Run 4 (12/11/04)		Run 5 (12/11/04)		Run 6 (12/11/04)	
	Conc.	Emission	Conc.	Emission	Conc.	Emission	Conc.	Emission	Conc.	Emission	Conc.	Emission
	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min	ug/dscf	ug/min
Antimony	45.1	6669	24.5	3329	35.5	5414	89.0	16284	91.1	15862	76.6	13767
Arsenic	91.3	13520	82.0	11141	73.6	11230	167	30615	174	30357	160	28806
Barium	3.49	516	0.534	73	1.86	284	3.48	637	3.70	644	2.40	432
Cadmium	39.0	5770	23.4	3184	29.2	4464	59.3	10843	61.7	10738	53.9	9692
Chromium	55.4	8198	46.7	6342	46.8	7140	73.0	13354	86.1	14992	65.4	11761
Copper	4.36	645	1.71	232	2.87	438	7.38	1351	7.91	1377	5.73	1030
Lead	43.1	6375	24.3	3298	31.9	4865	63.9	11686	69.1	12041	55.2	9920
Manganese	50.9	7528	6.20	843	29.9	4564	119	21748	126	21957	88.9	15981
Nickel	19.2	2842	2.30	313	7.78	1188	21.0	3847	24.4	4252	16.2	2911
Selenium	2803	414837	1957	266024	2553	389760	4678	855695	5214	908080	4469	803579
Silver	0.066	9.8	0.047	6.4	0.0	0.0	0.086	15.8	0.096	16.7	0.064	11.5
Zinc	146	21676	30.0	4083	95.7	14610	280	51184	311.4	54241	219	39345

Notes:

If the lab results was ND for either FH or BH, the MDL value was used

If the reagent blank value used for Blank Correction was larger than the report value or the MDL, a zero was used

If ND was reported for both FH and BH sample and reagent blank, the MDL value was used and reported as a less than value (applies to silver)

These results have been blank corrected

Table MT-1. TCO Metals Results

Metal	Run 1 (12/9/04)		Run 2 (12/10/04)		Run 3 (12/10/04)		Run 4 (12/11/04)		Run 5 (12/11/04)		Run 6 (12/11/04)		Run 7 (12/11/04)	
	Conc. ug/dscf	Emission ug/min	Conc. ug/dscf	Emission ug/min	Conc. ug/dscf	Emission ug/min	Conc. ug/dscf	Emission ug/min	Conc. ug/dscf	Emission ug/min	Conc. ug/dscf	Emission ug/min	Conc. ug/dscf	Emission ug/min
Antimony	0.038	7.0	0.12	21.8	0.013	2.5	0.002	0.40	0.004	0.81	0.004	0.80	0.0	0.0
Arsenic	0.049	8.9	0.049	9.0	0.007	1.27	0.013	2.51	0.011	2.18	0.003	0.56	0.0	0.0
Barium	0.072	13.2	0.039	7.3	0.029	5.3	0.041	8.0	0.027	5.2	0.000	0.00	0.0	0.0
Cadmium	0.040	7.33	0.044	8.05	0.028	5.26	0.023	4.38	0.010	1.92	0.013	2.43	0.008	1.60
Chromium	0.062	11.3	0.030	5.50	0.022	4.10	0.044	8.5	0.052	10.0	0.057	11.1	0.023	4.48
Copper	0.225	41.2	0.145	26.7	0.110	20.5	0.144	27.9	0.136	26.2	0.105	20.3	0.017	3.31
Lead	0.189	34.6	0.101	18.6	0.043	8.0	0.082	15.9	0.051	9.8	0.011	2.11	0.005	0.93
Manganese	0.084	15.3	0.082	15.1	0.029	5.41	0.059	11.4	0.063	12.1	0.021	4.02	0.003	0.58
Nickel	0.101	18.5	0.072	13.3	0.062	11.5	0.059	11.4	0.055	10.6	0.009	1.7	0.008	1.56
Selenium	0.598	110	2.16	397	0.317	59.0	0.710	137	0.648	125	0.547	106	0.055	10.6
Silver	0.016	2.92	0.016	2.87	0.016	2.91	< 0.015	< 2.8	< 0.015	< 2.86	0.015	2.99	0.014	2.77
Zinc	1.32	243	1.22	225	1.60	297.4	0.572	111	1.05	204	0.357	69.3	0.030	5.8

Notes:

If the lab results was ND for either FH or BH, the MDL value was used

If the reagent blank value used for Blank Correction was larger than the report value or the MDL, a zero was used

If ND was reported for both FH and BH sample and reagent blank, the MDL value was used and reported as a less than value (applies to silver)

These results have been blank corrected

TCO Method	FH	BH	Total, ug
Antimony	8.9	ND	8.9
Arsenic	3.4	ND	3.4
Barium	4.7	ND	4.7
Cadmium	0.27	0.084	0.35
Chromium	1.7	ND	1.7
Copper	1.2	3	4.2
Lead	3.6	0.66	4.26
Manganese	2.2	0.27	2.47
Nickel	5.4	0.51	5.91
Selenium	32.2	26.5	58.7
Silver	0	ND	0
Zinc	6	59	65

MDL	FH	BH	Total, ug
Antimony	0.6	0.6	1.2
Arsenic	0.35	0.23	0.58
Barium	0.35	0.3	0.65
Cadmium	0.05	0.05	0.1
Chromium	0.25	0.23	0.48
Copper	0.25	0.25	0.5
Lead	0.2	0.24	0.44
Manganese	0.15	0.15	0.3
Nickel	0.44	0.4	0.84
Selenium	0.35	0.22	0.57
Silver	0.71	0.25	0.96
Zinc	0.23	0.45	0.68

Reagent Blank Results

Reagent	FH Rinse= 0				BH Rinse= 0			
	Front Half		Back Half		Front Half		Back Half	
	ug	Filter	ug	Impinger	ug	Filter	ug	Impinger
Antimony	8.9	0.37	0.6	0.93	8.9	0.37	0.6	0.93
Arsenic	3.4	0.35	0.35	0.32	3.4	0.35	0.35	0.32
Barium	4.7	0.35	0.35	20	4.7	0.35	0.35	20
Cadmium	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Chromium	0.45	0.25	0.25	0.25	0.45	0.25	0.25	0.25
Copper	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lead	2.2	0.2	0.2	0.24	2.2	0.2	0.2	0.24
Manganese	0.98	0.15	0.15	0.15	0.98	0.15	0.15	0.15
Nickel	5.2	0.44	0.44	0.4	5.2	0.44	0.44	0.4
Selenium	0.6	0.35	0.35	0.22	0.6	0.35	0.35	0.22
Silver	0.71	0.71	0.71	0.46	0.71	0.71	0.71	0.46
Zinc	1.2	0.23	0.23	17.5	1.2	0.23	0.23	17.5

Front half blank = filter ug plus FH nitric rinse corrected to actual mL rinse volume
since all values were ND for nitric acid rinse...zero is used

Back half blank = total ug of nitric/peroxide corrected to 200 mL plus total ug of nitric rinse corrected to actual rinse volume mL
since all values were ND for nitric acid rinse...zero is used

If results were neg after blank correction the value was set to zero

Appendix A.6

Halogens/Acid Gases

Table M-1. Halogens Test Results at Melter (12/04 test)

Run #	Compound		Conc. ug/dscf		Emission ug/min	Test Date
1	HCl		834		126540	12/10/2004
	HF		522		79202	
	Cl ₂		8.31		1261	
	F ₂	<	32.5	<	4939	
2	HCl		557		85672	12/10/2004
	HF		395		60839	
	Cl ₂		11.7		1807	
	F ₂	<	27.1	<	4174	
3	HCl		832		109660	12/10/2004
	HF		467.5		61599	
	Cl ₂	<	7.6	<	998	
	F ₂	<	50.3	<	6624	
4	HCl		1632		252141	12/11/2004
	HF		935		144425	
	Cl ₂		44.4		6858	
	F ₂	<	101	<	15569	
5	HCl		1874		293977	12/11/2004
	HF		1011		158521	
	Cl ₂	<	6.71	<	1052	
	F ₂	<	112	<	17533	
6	HCl		1477		228066	12/11/2004
	HF		1094		168940	
	Cl ₂	<	7.51	<	1159	
	F ₂	<	125	<	19303	

Table M-2. Halogens Test Results at TCO (12/04 test)

<i>Run #</i>	<i>Compound</i>		<i>Conc.</i> <i>ug/dscf</i>	<i>Emission</i> <i>ug/min</i>	<i>Test Date</i>
1	HCl		48.0	8778	12/10/04
	HF	<	20.0	< 3658	
	Cl ₂		4.49	820	
	F ₂	<	13.3	< 2428	
2	HCl		56.1	10442	12/10/04
	HF	<	17.8	< 3321	
	Cl ₂	<	4.03	< 750	
	F ₂	<	13.4	< 2498	
3	HCl		43.9	8180	
	HF	<	15.0	< 2793	
	Cl ₂		19.7	3667	
	F ₂	<	13.8	< 2568	
4	HCl		66.2	12725	12/11/04
	HF	<	49.1	< 9431	
	Cl ₂	<	3.49	< 672	
	F ₂	<	58.2	< 11196	
5	HCl		65.1	12466	12/11/04
	HF	<	45.6	< 8746	
	Cl ₂	<	3.77	< 723	
	F ₂	<	62.8	< 12044	
6	HCl		66.4	12601	12/11/04
	HF	<	47.0	< 8919	
	Cl ₂	<	3.73	< 709	
	F ₂	<	62.2	< 11810	

Table M-3. Halogens Blank Results at Melter (12/04 test)

CUA Halogens 12/04 Test						
		Note: bold = ND...use MDL				
					Reporting Limit	Test Date
Field Blank	Compound		MDL			
	HCl	ND	30		100	12/10/04
	HF	ND	200		200	
	Cl ₂	ND	30		100	
	F ₂	ND	500		500	

Appendix A.7

Particle Size Distribution

TCO PSD		One run only		11/15/04 Test			
		grams					
Stage 1 Stage 5 Final Filter	Filter #	Tare Wt	Final Wt	Net Gain	Beaker #	Tare Wt	Final Wt
	82404-29	0.0988	0.09863	-0.00017	no		
	82404-15	0.1321	0.13215	0.00005	rinse		
Final Filter		0.0985	0.09876	0.00026			
				sum			0.00031
							total Wt
							gain
							-0.00017
							0.00005
							0.00026
							0.00031

Stage	Cut Point, um	Net Weight, ug	Conc, ug/dscf	Emission Rate, ug/min	Mass Fraction
1	> 10	0.0	0.0	0.0	0.0
5	1-10	0.0	0.0	0.0	0.0
8	<1	310	0.294	58.7	1.0

sample vol 1055.71 dscf
flow 199.81 dscfm

PARTICLE SIZE DISTRIBUTION:

by Glenn Rives (Radian), Modified by Charlie Parrish (12/90)

Facility: CUA 1200 Melter 323.75

Date: 11/15/04

Run: TCO-01

Filter Set :

W/ preimpactor, density = 1.00

TIME 1427 Qm 0.777953749
VOLUME 1110.14 Pm 30.13411765
Ts 1054.76 Tm 552.62
T 585.64444 Qa 867.412192
%M 0.1 u 0.000297258
MW 28.512 Lambda 1.523E-05
Ps 27.05 Pvac 15
Meter Y 1.0175 Vm(std) 1055.71

TIME=MINUTES
VOLUME=dcf MEASURED AT METER
Ts=IMPACTOR TEMPERATURE (R) (F+460)
T=IMPACTOR TEMPERATURE (K)
%M=STACK MOISTURE FRACTION (%/100)
MW=STACK GAS MOLECULAR WEIGHT WET BASI
Ps=ABSOLUTE STACK GAS PRESSURE
Y=Gas meter correction factor

STAGE	Wb	Vo	N	Dp 50	Pi	Wm	Vom
1	0.1651	766.91386	1	9.8711201	1.12	0.5	1.27
2	0.12446	617.44766	6	7.4464783	1.125	0.228	0.57912
3	0.094	1763.0661	12	2.8826038	1.139	0.096	0.24384
4	0.07493	2291.9822	90	1.4580236	1.158	0.031	0.07874
5	0.05334	4653.1503	110	0.8498995	1.196	0.02	0.0508
6	0.03708	10759.173	110	0.4975108	1.26	0.0135	0.03429
7	0.02718	25868.126	90	0.3267475	1.36	0.01	0.0254
8	0.02438	NA	0		1.56	0	0

Vo=jet velocity (cm/sec)

Wb=diameter of jet (cm)/ Incorporating Pi

N=number of jets on a stage

Pi=pressure drop across the s

THESE RESULTS KEEP PRESEP CATCH SEPARATE FROM STAGE 1

(See below for combined results)

STAGE	Dp50 micron	Net Weight (grams)	Mass Fraction	Less Than	PM Conc. (gr/dscf)	Interval Geometric Midpoint	dM/dlog dP (gr/dscf)	Log Dp50
1	9.8711201	0.00000	0	1	0.00E+00	22.21612	0.000E+00	0.994366437
2	7.4464783	0	0	1	0.00E+00	8.5735104	0.000E+00	0.871950926
3	2.8826038	0	0	1	0.00E+00	4.6330602	0.000E+00	0.459784954
4	1.4580236	0	0	1	0.00E+00	2.0500986	0.000E+00	0.163764546
5	0.8498995	0.00005	0.161290323	0.8387097	7.31E-07	1.1131817	3.118E-06	-0.070632403
6	0.4975108	0	0	0.8387097	0.00E+00	0.650257	0.000E+00	-0.303197471
7	0.3267475	0	0	0.8387097	0.00E+00	0.4031878	0.000E+00	-0.485787734
8		0.00026	0.838709677	0	3.80E-06	0.0404195	2.094E-06	-2.301029996
TOTAL		0.00031	1		4.53E-06			

* these values assume top end and bottom end dp50s of 50 and .0

EXPLANATION: This spreadsheet calculates cut size (Dp50) based on a set

of equations from D. Balfours PSD manual (Radian, April 1986)

Preseparator Dp50 calcs are taken from Andersons Mk III

presepar manual. NOTE: If the presepar Dp50 is GREATER than or

SIMILAR TO stage 1 dp50, then ypu can combine presepar catch with

stage 1 catch as done below

A particle density of

1.00 grams/cm3 was used in calculating cut sizes (Dp50)

TCO PSD

One run only

12/6/04 Test

	Filter #	grams		Final Wt	Net Gain	Beaker #	Tare Wt	Final Wt	Net Gain	total Wt gain
		Tare Wt								
Stage 1	82404-27	0.0989		0.09893	0.00003	BB-509	108.6902	108.6914	0.0012	0.00123
Stage 5	82404-12	0.1315		0.13153	0.00003					0.00003
Final Filter	82404-28	0.0985		0.09914	0.00064					0.00064

Stage	Cut Point, u	Net Weight, ug	Conc, ug/dscf	Emission Rate, ug/min	Mass Fraction
1	> 10	1230	1.47	286	0.64
5	1-10	30	0.036	6.98	0.02
8	<1	640	0.763	149	0.34

sample vol 839.284 dscf
flow 195.14 dscfm

PARTICLE SIZE DISTRIBUTION:

by Glenn Rives (Radian), Modified by Charlie Parrish (12/90)

Facility: CUA 1200 Melter 323.75
Run: TCO-01

Date: 12/11/04
Filter Set :

W/ preimpactor, density = 1.00

TIME 1440 Qm 0.59855625
VOLUME 861.921 Pm 29.48823529
Ts 1026.56 Tm 549.81
T 569.97778 Qa 606.7907512
%M 0.1 u 0.000290991
MW 28.152 Lambda 1.480E-05
Ps 28.48 Pvac 15
Meter Y 1.029 Vm(std) 839.4432066

TIME=MINUTES Qm=SAMP
VOLUME=dcf MEASURED AT METER Pm=PRES
Ts=IMPACTOR TEMPERATURE (R) (F+460) Tm=AVER
T=IMPACTOR TEMPERATURE (K) Qa=ACTU
%M=STACK MOISTURE FRACTION (%/100) u=STACK
MW=STACK GAS MOLECULAR WEIGHT WET BASIS Lambda=G
Ps=ABSOLUTE STACK GAS PRESSURE Pvac=PRE
Y=Gas meter correction factor Wm= width

STAGE	Wb	Vo	N	Dp 50	Pi	Wm	Vom
1	0.1651	536.48801	1	11.676336	1.12	0.5	1.27
2	0.12446	431.93021	6	8.8078723	1.125	0.228	0.57912
3	0.094	1233.3377	12	3.4075366	1.139	0.096	0.24384
4	0.07493	1603.3365	90	1.7199353	1.158	0.031	0.07874
5	0.05334	3255.0713	110	0.9970701	1.196	0.02	0.0508
6	0.03708	7526.4872	110	0.574201	1.26	0.0135	0.03429
7	0.02718	18095.826	90	0.3643344	1.36	0.01	0.0254
8	0.02438	NA	0		1.56	0	0

Vo=jet velocity (cm/sec)

Wb=diameter of jet (cm)/ Incorporating Pi

N=number of jets on a stage

Pi=pressure drop across the stage

THESE RESULTS KEEP PRESEP CATCH SEPARATE FROM STAGE 1
(See below for combined results)

STAGE	Dp50 micron	Net Weight (grams)	Mass Fraction	Mass Less Than	PM Conc. (gr/dscf)	Interval Geometric Midpoint	dM/dlog dP (gr/dscf)	Log Dp50	50n-1)-(Log
1	11.676336	0.00123	0.647368421	0.3526316	2.26E-05	24.162301	3.580E-05	1.067306576	0.6316634
2	8.8078723	0	0	0.3526316	0.00E+00	10.141187	0.000E+00	0.944871012	0.1224356
3	3.4075366	0	0	0.3526316	0.00E+00	5.4784257	0.000E+00	0.532440535	0.4124305
4	1.7199353	0	0	0.3526316	0.00E+00	2.420897	0.000E+00	0.235512105	0.2969284
5	0.9970701	0.00003	0.015789474	0.3368421	5.51E-07	1.3095404	2.329E-06	-0.001274326	0.2367864
6	0.574201	0	0	0.3368421	0.00E+00	0.7566496	0.000E+00	-0.240936047	0.2396617
7	0.3643344	0	0	0.3368421	0.00E+00	0.4573852	0.000E+00	-0.438499779	0.1975637
8		0.00064	0.336842105	0	1.18E-05	0.0426811	6.317E-06	-2.301029996	1.8625302
TOTAL		0.0019	1		3.49E-05				

* these values assume top end and bottom end dp50s of 50 and .005 um.

EXPLANATION: This spreadsheet calculates cut size (Dp50) based on a set of equations from D. Balfours PSD manual (Radian, April 1986)
Preseparator Dp50 calcs are taken from Andersons Mk III presep manual. NOTE: If the presep Dp50 is GREATER than or SIMILAR TO stage 1 dp50, then ypu can combine presep catch with stage 1 catch as done below

A particle density of 1.00 grams/cm3 was used in calculating cut sizes (Dp50)

Appendix A.8

Total Particulate Matter

Table PM-1. Total PM by Method 26 (corrected 9/28/05)					
<i>Location</i>	<i>Run #</i>	<i>Conc mg/dscf</i>	<i>Emission mg/min</i>	<i>Moisture % vol</i>	<i>Test date</i>
Melter Out	1	12.21393	1854	32.55	12/10/04
Melter Out	2	10.72631	1651	27.63	12/10/04
Melter Out	3	14.81554	1952	39.1	12/10/04
Melter Out	4	30.92487	4778	36.42	12/11/04
Melter Out	5	23.46955	3681	37.03	12/11/04
Melter Out	6	23.61968	3646	36.71	12/11/04
TCO	1	0.02519	4.6044	10.45	12/10/04
TCO	2	0.01540	2.8670	10.13	12/10/04
TCO	3	0.00000	0.0000	9.85	12/10/04
TCO	4	0.00000	0.0000	13.07	12/11/04
TCO	5	0.02601	4.9836	13.17	12/11/04
TCO	6	0.00215	0.40723	13.14	12/11/04

Appendix A.9

Total Organic Emissions (TOE)

TOE Summary

TOE = Field GC + Purge and Trap + TCO + Grav

in units of mg/m3

Field GC	C1	C2	C3	C4	C5	C6	C7	Total	
	1.69	0	2.26	0	0	0	0	3.95	mg/m3
P and T								0.0159	mg/m3
TCO								0.437	mg/m3
Grav								1.34	mg/m3
TOE								5.7	mg/m3

Summary of TCO, Condensate and Gravimetric results						
TCO, mg	Sample Results	Blk	Blk Corr.	total mass, mg	Sample Vol, m3	Conc mg/m3
	1.9	0.56	1.34	1.34	3.068	0.437
Condensate C4, ug/L	3	0	3	0.0000852		
Condensate C5, ug/L	2.5	0	2.5	0.000071		
Condensate C6, ug/L	0	0	0	0		
Condensate C7, ug/L	0	0	0	0		
Total Cond, ug/L			5.5	0.0001562	0.0098	0.0159
Gravimetric, mg	4.1	0	4.1	4.1	3.068	1.336

Appendix A.10

Allyl Alcohol

Table AA-1. Melter Allyl Alcohol Results				
Sample date	11/16/2004 for Runs 2-4			Not blk corrected
	11/15/04 for Run 1			
Run #		Conc mg/dscf	Emission Rate mg/min	
1(spike)		0.091		16.7
2		85.7		15723
3		48.3		8854
4		85.2		15636
	Average	73.0		13404

average is for Runs 2-4
 Field Blank Results
 FH was not detected with MDL of 0.081 mg/L
 BH was not detected with MDL of 0.081 mg/L

Table AA-2. HEPA Allyl Alcohol Results			
(Corrected 7/26/05)			
Sample date		11/16/2004	
<i>Run #</i>		<i>Conc mg/dscf</i>	<i>Emission Rate mg/min</i>
1		23.9	4383
1 (Dup)		24.4	4483
2		40.9	7509
3		48.6	8918
	Average	34.4	6323

Table AA-3. TCO Allyl Alcohol Results						
Sample date			11/16/2004			
Run #		Conc mg/dscf			Emission Rate mg/min	
1	<	0.002		<	0.34	
2	<	0.002		<	0.37	
3	<	0.002		<	0.36	
	Average	<	0.002	<	0.36	

Table AA-4. Melter Allyl Alcohol Results (December 7, 2004)			
Run #	Conc mg/dscf	Emission Rate mg/min	
1	178	30862	
2	114	19735	
3	144	24976	
	Average	145	
		25191	

Results for Field Blank

FH was 8.7 mg/L

BH was 0.2 mg/L

Table AA-5. HEPA Allyl Alcohol Results (December 7, 2004)			
(Corrected 7/26/05)			
<i>Run #</i>		<i>Conc mg/dscf</i>	<i>Emission Rate mg/min</i>
1		68.2	11825
1 Duplicate		66.7	11565
2		97.4	16883
3		113	19539
	Average	92.8	16082

Table AA-6. TCO Allyl Alcohol Results (Corrected 7/26/05)					
Sample date		Run 1 on 12/6/04...Runs 2-4 on 12/7/04			
		Run 1 was spiked in impingers			
<i>Run #</i>		<i>Conc</i> <i>mg/dscf</i>		<i>Emission Rate</i> <i>mg/min</i>	
1(spiked)		0.067		12.6	
2	<	0.002	<	0.37	
3	<	0.002	<	0.39	
4	<	0.003	<	0.39	
Average		0.002		0.38	

Table AA-7. Carbon Bed Allyl Alcohol Results (December 7, 2004)			
		<i>Conc</i>	<i>Emission Rate</i>
<i>Run #</i>		<i>mg/dscf</i>	<i>mg/min</i>
1		0.378	65.5
2		6.11	1058
3		21.2	3677
	Average	9.24	1600

Appendix B

Data Sheets

- B.1 VOST**
- B.2 Semi-VOST**
- B.3 Dioxin/Furan/PCBs**
- B.4 Metals**
- B.5 Halogens/Acid Gases**
- B.6 Particle Size
Distribution**
- B.7 Total Organic Emissions
(TOE)**
- B.8 Allyl Alcohol**

Appendix B.1

VOST

12/9/04

CUA - Melter
12/08/2004

Meter Number VOST 5
Correction factor 1.034
Barometric Pressure 29.95

Plant
Date
Sample Type
Run Number

VOST

1

Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
1A	.00@12"	0350	4.47	0.8				82	82	
	.00@16"	0410	14.72	0.9				82	82	
			24.911	0.9				82	82	
		Averages		0.866666667				82	82	
	Standard Meter Volume		20.65798731					82		

Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
1B	.00@12"	0424	25.78					83	83	
	.00@18"	0444	35.6	0.9				83	83	
			44.71	0.8				83	83	
		Averages		0.85				83	83	
	Standard Meter Volume		19.09493595					83		

Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
1C	.00@12"	0453	45.01							
	.00@16"	0513	55.3	0.9				84	84	
			64.42	0.8				84	84	
		Averages		0.85				84	84	
	Standard Meter Volume		19.54312713					84		

12/9/04

VOST FIELD DATA

Plant	CWA	VS L	Ambient Temp. (°F)	90°	Meter Box Number	V-5
Date	12/8/04		Barometric Pressure (in. H2O)	29.95	DGM Cal. Factor (Y)	1.034
Sampling Location		meter	Stack Temp. (°F)	350°F	Probe Length & Type	10" Glass
Sample Type		VOST	Average delta P (in. H2O)	.99	Probe Heater Setting (°F)	250°
Run Number		1-0	Static Pressure (±) (in. H2O)	-.5"	Filter # & Type (if used)	-
Operator		Muel	Sample Rate (lpm)	1.0	Filter Temp. (°F)	-

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set A	.00 @ 12"		.00 @ 16"	
B	.00 @ 12"		.00 @ 18"	

Set: A

Tenax Tube:
Tenax Tube:

Tenax Charcoal:

Additional Tubes:
Additional Tubes:

51444, Rev. 0

Set: Tenax Tube: Tenax Charcoal: Additional Tubes:

Sampling Times		Gas Meter Reading (Vol in L or ft3)	Rotameter Setting (lpm/ft3/ min)	Meter Pressure (in.H2O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in.Hg)
Run Time (min)	Clock (24hr)					A (°F)	B (°F)				
A	03:50	4.47	0.9	6.8	82	54	63	—	250°	360°	7.3
	04:00	14.72	1.0	0.9	82	53	63	—	250°	360°	8.5
	04:10	24.911	1.0	0.9	82	53	63		250	360°	12.0
B	4:24	25.78									
	4:34	35.60	0.9	0.9	83	55	65	—	250	360	11.0
	4:44	44.71	0.8	0.8	83	52	62	—	250	360	13.5
C	4:53	48.01									
	5:03	55.30	1.0	0.9	84	52	59	—	250	360	10.5
	5:13	64.42	0.9	0.8	84	53	61	—	250	360	11.5
Run Time	Total Time	Total Volume Metered	Average Flow Rate	Average P _m	Average T _m					T _s	Vacuum (in.Hg)

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Comments:

12/9/04

Plant	CUA - Melter				Meter Number	VOST 5				
Date	12/09/2004				Correction factor	1.034				
Sample Type	VOST				Barometric Pressure	29.95				
Run Number	2									
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Outlet	Vacuum
2A	.00@12"	0539	67.32	0.9				84	84	
	.00@19"	0559	86.75	0.9				84	84	
	Averages			0.9				84	84	
	Standard Meter Volume		19.56566077							
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Outlet	Vacuum
2B	.00@18.5"	617	5.97	0.9				84	84	
	.00@17"	0637	15.4	0.8				85	85	
	Averages			0.85				84.5	84.5	
	Standard Meter Volume		19.62577461							
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Outlet	Vacuum
2C	.00@15"	0649	25.88	0.9				85	85	
	.00@20"	0709	35	0.8				85	85	
	Averages			0.85				85	85	
	Standard Meter Volume		18.29120458							

Plant	CWA	USC	Ambient Temp. (°F)	86°F	Meter Box Number	V-5
Date	12/9/04		Barometric Pressure (in. H2O)	29.95	DGM Cal. Factor (Y)	1.035
Sampling Location	Melter		Stack Temp. (°F)	365°	Probe Length & Type	30" Pyrex
Sample Type	UGT		Average delta P (in. H2O)	.99 STD	Probe Heater Setting (°F)	250
Run Number	2		Static Pressure (±) (in. H2O)	--5"	Filter # & Type (if used)	—
Operator	MMWJ		Sample Rate (ipm)	1.0	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set A	.00 @ 12"		.00 @ 19"	
Set B	.00 @ 18.5"		.00 @ 17"	

Set:

Tenax Tube:

Tenax Charcoal:

Additional Tubes:

Set:		Tenax Tube:		Tenax Charcoal:						Additional Tubes:			
Sampling Time's Run (min)	Clock (24hr)	Gas Meter Reading (Vol In L or ft3)	Rotameter Setting (lpm/ft3/min)	Meter Pressure (in.H2O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in.Hg)		
						A (°F)	B (°F)						
A		5:39											
		5:49	1.0	0.9	84	54	66		250	365	15.0		
		5:59	1.0	0.9	84	50	64		250	365	15.0		
B.		6:17											
		6:27	1.0	0.9	84	57	63		250	365	12.5		
		6:37	1.0	0.9	85	54	64		250	365	13.5		
C		6:49											
		6:59	1.0	0.9	85	52	64		250	365	13.5		
		7:09	1.0	0.9	85	48	62		250	365	16.5		
Run Time	Total Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm					Ts	Vacuum (In.Hg)		

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Comments:

Plant	CUA - Melter				Meter Number	VOST 5				
Date	12/09/2004				Correction factor	1.034				
Sample Type	VOST				Barometric Pressure	29.95				
Run Number	3									
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
3A	.00@20"	0737	46.68	0.9				87	87	
	.00@19"	0757	56.1	0.9				85	85	
		Averages	65.48	0.9				86	86	
	Standard Meter Volume		18.86191681							
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
3B	.00@16"	0807	66.3					90	90	
	.00@20"	0827	79.1	0.9				82	82	
		Averages	89.71	0.9				86	86	
	Standard Meter Volume		23.4870996							
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
3C	.00@20 "	0837	90.13					87	87	
	.00@24"	0857	99.81	0.9				87	87	
		Averages	109.79	0.8				87	87	
	Standard Meter Volume		19.68627777	0.85						

Run

Plant	Ambient Temp. (°F)	Meter Box Number
CUA	85°	V-5
Date	Barometric Pressure (in. H ₂ O)	DGM Cal. Factor (M)
12/9/04	36.95	1.034
Sampling Location	Stack Temp. (°F)	Probe Length & Type
Melton	365	6" PEX/200
Sample Type	Average delta P (in. H ₂ O)	Probe Heater Setting (°F)
VOST	570	6
Run Number	Static Pressure (±) (in. H ₂ O)	Filter # & Type (if used)
3	Sample Rate (lpm)	Filter Temp. (°F)
max.		-

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set				
1.0	.00 @ 20"		.00 @ 19"	
β	.00 @ 16		.00 @ 20"	

Additional Tubes:

Additional Tubes:

Tenax Charcoal:

Tenax Charcoal:

Set:		Tenax Tube:		Rotameter Setting (lpm/ft ³ /min)	Meter Pressure (in.H ₂ O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in.Hg)
Sampling Times Run (min)	Clock (24hr)	Gas Meter Reading (Vol in L or ft ³)	A (°F)				B (°F)					
A		7:37		1.0	.90	87	53	64	-	250	365	14.0
		7:47		1.0	.90	85	56	62	-	250	365	15.0
		7:57		1.0	.90							
B		8:07		1.0	.90	90	56	64		250	365	14.5
		8:17		1.0	.90	87	56	62		250	365	14.5
		8:27										
C		8:37		1.0	.90	87	57	64		250	365	13.5
		8:47		1.0	.90	87	53	61		250	365	15.0
		8:57		1.0	.90							
Run Time	Total Time	Total Volume Metered		Average Flow Rate	Average P _m	Average T _m					T _s	Vacuum (in.Hg)

Comments:

Plant	CUA - Melter				Meter Number		VOST 5	
Date	12/10/2004				Correction factor		1.034	
Sample Type	VOST				Barometric Pressure		29.3	
Run Number	4							
<i>Run No.</i>	<i>Leak Rate</i>	<i>Time</i>	<i>Volume</i>	<i>Pressure</i>	<i>Coil 1</i>	<i>Temperature Coil 2</i>	<i>Probe</i>	<i>Meter Temperature Inlet Outlet</i>
4A	.00@20"	0953	14.1					<i>Vacuum</i>
	.001@18"	1013	23.7	1				84 84
			33.7	1				82 82
		Averages		1				83 83
	Standard Meter Volume		19.77803926					
<i>Run No.</i>	<i>Leak Rate</i>	<i>Time</i>	<i>Volume</i>	<i>Pressure</i>	<i>Coil 1</i>	<i>Temperature Coil 2</i>	<i>Probe</i>	<i>Meter Temperature Inlet Outlet</i>
4B	.00@20"	1020	34.06					<i>Vacuum</i>
	.001@20"	1040	43.4	1				86 86
			53.805	1				86 86
		Averages		1				86 86
	Standard Meter Volume		19.8148819					
<i>Run No.</i>	<i>Leak Rate</i>	<i>Time</i>	<i>Volume</i>	<i>Pressure</i>	<i>Coil 1</i>	<i>Temperature Coil 2</i>	<i>Probe</i>	<i>Meter Temperature Inlet Outlet</i>
4C	.00@20"	1047	54.37					<i>Vacuum</i>
	.001@23"	1107	64.7	1				89 89
			75.39	1				88 88
		Averages		1				88.5 88.5
	Standard Meter Volume		20.99824858					

VOST FIELD DATA

Plant	CVA-VSL	Ambient Temp. (°F)	95°	Meter Box Number	V-5
Date	12/10/04	Barometric Pressure (in. H2O)	29.30	DGM Cal. Factor (Y)	1.034
Sampling Location	Melter	Stack Temp. (°F)	420°	Probe Length & Type	6" Pyrex
Sample Type	UOST	Average delta P (in. H2O)	.6	Probe Heater Setting (°F)	250
Run Number	4	Static Pressure (±) (in. H2O)	-5.0	Filter # & Type (if used)	-
Operator	MWA	Sample Rate (lpm)	1.0	Filter Temp. (°F)	-

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set				
00 @ 20"			00 @ 18"	
00 @ 20"			00 @ 20"	

Set: Set:

Tenax Tube:

Tenax Charcoal:

Additional Tubes:
Additional Tubes:

Set:		Tenax Tube:		Tenax Charcoal:		Additional Tubes:					
Run	Sampling Times	Gas Meter Reading (Vol in L or ft3)	Rotameter Setting (lpm/ft3/ min)	Meter Pressure (in. H2O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
Time (min)	Clock (24hr)	(Vol in L or ft3)				A (°F)	B (°F)				
A	PM 9:53	14.10	1.0	1.0	84	71	58	-	250	420	10.0
	10:05	23.70	1.0	1.0	82	40	52	-	250	420	13.0
	10:13	33.700									
B	10:20	34.06									
	10:30	43.4	1.0	1.0	86	46	58	-	250	420	9.5
	10:40	53.805	1.0	1.0	86	42	55	-	250	420	13.5
C	10:47	54.37									
	10:57	64.70	1.0	1.0	89	50	61		250	420	9.5
	11:07	75.139	1.0	1.0	88	44	55		250	420	14.0
Run Time	Total Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm					Ts	Vacuum (in. Hg)

Comments:

Plant	CUA - Melter				Meter Number		VOST 5	
Date	12/10/2004				Correction factor		1.034	
Sample Type	VOST				Barometric Pressure		29.3	
Run Number	5							
<i>Run No.</i>	<i>Leak Rate</i>	<i>Time</i>	<i>Volume</i>	<i>Pressure</i>	<i>Coil 1</i>	<i>Temperature Coil 2</i>	<i>Probe</i>	<i>Meter Temperature Inlet Outlet Vacuum</i>
5A	.001@20"	1137	77.15					
			86.94	1				91 91
	.001@24"	1157	97.38	1				91 91
		Averages		1				91 91
	Standard Meter Volume		20.11737339					
<i>Run No.</i>	<i>Leak Rate</i>	<i>Time</i>	<i>Volume</i>	<i>Pressure</i>	<i>Coil 1</i>	<i>Temperature Coil 2</i>	<i>Probe</i>	<i>Meter Temperature Inlet Outlet Vacuum</i>
5B	.001@22"	1204	97.68					
			108	1				90 90
	.001@25"	1224	117.53	1				91 91
		Averages		1				90.5 90.5
	Standard Meter Volume		19.75741766					
<i>Run No.</i>	<i>Leak Rate</i>	<i>Time</i>	<i>Volume</i>	<i>Pressure</i>	<i>Coil 1</i>	<i>Temperature Coil 2</i>	<i>Probe</i>	<i>Meter Temperature Inlet Outlet Vacuum</i>
5C	.001@25"	1230	18.48					
			28.91	1				91 91
	.001@24"	1250	39.06	1				91 91
		Averages		1				91 91
	Standard Meter Volume		20.46542483					

Plant	CUA VSL	Ambient Temp. (°F)	95.0	Meter Box Number	V-5
Date	12/10/04	Barometric Pressure (in. H2O)	29.30	DGM Cal. Factor (Y)	1.034
Sampling Location	M2 H2	Stack Temp. (°F)	420	Probe Length & Type	6' Polyex
Sample Type	VOST	Average delta P (in. H2O)	.6	Probe Heater Setting (°F)	250°
Run Number	5	Static Pressure (±) (in. H2O)	-5.0	Filter # & Type (if used)	—
Operator	MWH	Sample Rate (ipm)	1.0	Filter Temp. (°F)	—

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set				
.001 @ 20"		.001 @ 24"		
.001 @ 22"		.001 @ 25"		

Tenax Tube:

Tenax Tube:

Tenax Charcoal:

Tenax Charcoal:

Additional Tubes:

Additional Tubes:

Set:		Tenax Tube:		Rotameter		Tenax Charcoal:		Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in.Hg)
Run (min)	Sampling Time's Clock (24hr)	Gas Meter Reading (Vol in L or ft3)	Setting (lpm/ft3/min)	Meter Pressure (in.H2O)	Meter Temp. (°F)	A (°F)	B (°F)						
A	11:37	77.15											
	11:47	86.94	1.0	1.0	91	54	61			250	430	17.0	
	11:57	97.38	1.0	1.0	91	46	55			250	430	19.0	
B	12:09	97.68											
	12:14	108.0	1.0	1.0	90	48	60			250	430	14.0	
	12:24	117.53	1.0	1.0	91	46	57			250	430	19.0	
C	12:30	18.48											
	12:40	28.91	1.0	1.0	91	47	58			250	430	13	
	12:50	37.06	1.0	1.0	91	44	57			250	430	17	
Run Time	Total Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm							Ts	Vacuum (in.Hg)

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Comments:

Plant	CUA - Melter			Meter Number		VOST 5	
Date	12/11/2004			Correction factor		1.034	
Sample Type	VOST			Barometric Pressure		29.25	
Run Number	6						

1ST 2 Rows
A, B were
with air topic
tubes C 3rd
Superco

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Other Data/Notes:

Additional Tubes:

Tenax Charcoal:

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Comments:

Plant	CUA - TCO			Meter Number		VOST 3				
Date	12/09/2004			Correction factor		1.027				
Sample Type	VOST			Barometric Pressure		29.95				
Run Number	1									
<i>Run No.</i>	<i>Leak Rate</i>	<i>Time</i>	<i>Volume</i>	<i>Pressure</i>	<i>Coil 1</i>	<i>Temperature Coil 2</i>	<i>Probe</i>	<i>Meter Temperature Inlet</i>	<i>Meter Temperature Outlet</i>	<i>Vacuum</i>
1A	0.00 lpm@8"	0345	83.205	0.8				91.9	91.9	
			87.6	0.8				92.2	92.2	
			92.3	0.8				91.7	91.7	
			96.9	0.8				91.7	91.7	
	0.0 lpm@8.1"	0405	101.661					92.4	92.4	
	<i>Averages</i>			<i>0.8</i>				<i>91.98</i>	<i>91.98</i>	
	<i>Standard Meter Volume</i>		<i>18.1877243</i>							
<i>Run No.</i>	<i>Leak Rate</i>	<i>Time</i>	<i>Volume</i>	<i>Pressure</i>	<i>Coil 1</i>	<i>Temperature Coil 2</i>	<i>Probe</i>	<i>Meter Temperature Inlet</i>	<i>Meter Temperature Outlet</i>	<i>Vacuum</i>
1B	0.0 lpm@8"	0422	101.87					92.7	92.7	
			107.1	0.8				92.7	92.7	
			111.5	0.9				92.6	92.6	
			116.1	0.9				93.3	93.3	
	0.00 lpm@13.5"	0442	120.99	0.9				93.3	93.3	
	<i>Averages</i>			<i>0.875</i>				<i>92.92</i>	<i>92.92</i>	
	<i>Standard Meter Volume</i>		<i>18.81349638</i>							
<i>Run No.</i>	<i>Leak Rate</i>	<i>Time</i>	<i>Volume</i>	<i>Pressure</i>	<i>Coil 1</i>	<i>Temperature Coil 2</i>	<i>Probe</i>	<i>Meter Temperature Inlet</i>	<i>Meter Temperature Outlet</i>	<i>Vacuum</i>
1C	0.0 lpm@14"	1455	121.525							
			127.4	1				93.8	93.8	
			131.8	0.9				93.6	93.6	
			137.8	0.9				94.6	94.6	
	0.0 lpm@15"	1515	142.54	0.9				94.4	94.4	
	<i>Averages</i>			<i>0.925</i>				<i>94.1</i>	<i>94.1</i>	
	<i>Standard Meter Volume</i>		<i>20.63661032</i>							

VOST FIELD DATA

Plant		Ambient Temp. (°F)	92	Meter Box Number	V3
Date	12/9/04	Barometric Pressure (in. H2O)	29.95	DGM Cal. Factor (Y)	1.027
Sampling Location	TCO	Stack Temp. (°C)	365	Probe Length & Type	Glass
Sample Type		Average delta P (in. H2O)		Probe Heater Setting (°F)	NA
Run Number	1	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	NA
Operator	LLG	Sample Rate (lpm)	1	Filter Temp. (°F)	NA

Purpose: _____

Other Data/Notes: _____

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (#-Hg) LPM	Vacuum (in. Hg)	Rate (#-Hg) LPM	Vacuum (in. Hg)
A	0.00	8.0	0.0	8.1
B	0.0	8.0	13.5 0.0	13.5

Set

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

Additional Tubes: _____

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Sampling Times	Gas Meter Reading	Rotameter	Meter	Meter	Condenser Temperature	Line	Probe	Stack	Train
Run (min)	(Vol in L or ft³)	Setting (lpm/ft³/min)	Pressure (in. H2O)	Temp. (°F)	A (°F)	B (°F)	Temp. (°F)	Temp. (°C)	Vacuum (in. Hg)
0	83.205	1.0	0.8	91.9	69	54	NA	365	5
5	87.6	1.0	0.8	92.2	65	53	—	365	5
10	92.3	1.0	0.8	91.7	65	52	—	365	5
15	94.7 96.9	1.0	0.8	91.7	65	53	—	365	5
20	101.661			92.4					
0	101.870	1.0	0.8	92.7	70.5	56	—	365	5
5	107.1	1.0	0.9	92.7	65	54	—	365	5
10	111.5	1.0	0.9	92.6	65	54	—	365	8
15	116.1	1.0	0.9	93.3	65	55	—	365	10
20	120.990			93.3					
0									
5									
10									
15									
20									
Run Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm				Ts	Vacuum (in. Hg)

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Comments: _____

12/5

Purpose: _____

Other Data/Notes: _____

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

OR

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

Comments:

12/9/04

Plant	CUA - TCO	Meter Number	VOST 3	
Date	12/9/2004	Correction factor	1.027	
Sample Type	VOST	Barometric Pressure	29.95	
Run Number	2			

Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
2A	0.0 lpm@12"	0543	147.425	0.8				95	95	
			152.8	0.9				94.8	94.8	
			158.1	0.9				95	95	
	0.0 lpm@11"	0603	163.4	0.9				95.5	95.5	
		Averages	168.355	0.875				95.075	95.075	
	Standard Meter Volume		20.51452598					95.075		

Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
2B	0.0 lpm@11"	0616	168.72	0.9				95.9	95.9	
			173.9	0.9				96	96	
			178.7	0.9				96.1	96.1	
	0.0 lpm@15"	0636	183.4	0.8				96.3	96.3	
		Averages	188.229	0.875				96.075	96.075	
	Standard Meter Volume		19.08734678					96.075		

Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
2C	0.0 lpm@15"	0650	188.772	0.9				96.7	96.7	
			194.3	0.9				96.6	96.6	
			199.6	0.9				96.6	96.6	
	0.0 lpm@15"	0710	204.9	0.9				96.7	96.7	
		Averages	209.89	0.9				97.6	97.6	
	Standard Meter Volume		20.63444936	0.9				96.84	96.84	

VOST FIELD DATA

Plant		Ambient Temp. (°F)	92	Meter Box Number	V3
Date	12/4/04	Barometric Pressure (in. H2O)	29.95	DGM Cal. Factor (Y)	1.027
Sampling Location	TCD	Stack Temp. (°F)	365	Probe Length & Type	Glass
Sample Type		Average delta P (in. H2O)	—	Probe Heater Setting (°F)	NA
Run Number	2	Static Pressure (±) (in. H2O)	—	Filter # & Type (if used)	NA
Operator	WCG	Sample Rate (ipm)	1.0	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg) LPM	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)
A	0.0	12	0.0	11
B	0.0	11	0.0	15

Tenax Tube:

Tenax Charcoal:

Tenax Tube:

Set:

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Sampling Times	Gas Meter Reading	Rotameter	Meter	Meter	Condenser Temperature	Line	Probe	Stack	Train
Run (min)	(Vol in L or ft³)	Setting (ipm/ft³/min)	Pressure (in. H2O)	Temp. (°F)	A (°F)	B (°F)	Temp. (°F)	Temp. (°F)	Vacuum (in. Hg)
0	147.425	1.0	0.8	95.0	72	59	—	365	8
5	152.8	1.0	0.9	94.8	70	57	—	365	8
10	158.1	1.0	0.9	95.0	68	58	—	365	8
15	163.4	1.0	0.9	95.5	66	54	—	365	8
20	168.355								
0	168.720	1.0	0.9	95.9	71	58	—	365	8
5	173.9	1.0	0.9	96.0	67	53	—	365	8
10	178.7	1.0	0.9	96.1	67	53	—	365	9
15	183.4	1.0	0.9	96.3	67	53	—	365	11
20	188.229								
Total Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm				Ts	Vacuum (in. Hg)

Comments:

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Purpose: _____
 Other Data/Notes: _____

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

Comments:

Plant	CUA - TCO			Meter Number	VOST 3			
Date	12/14/2004			Correction factor	1.027			
Sample Type	VOST			Barometric Pressure	29.95			
Run Number	3							
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Meter Temperature Inlet Outlet	Vacuum
3A	0.0 lpm @15"	0737	213.18	0.9			96.2 96.2	
			218.6	0.9			95.4 95.4	
			224.3	0.9			95.4 95.4	
			229.6	0.9			96.3 96.3	
	0.0 lpm@14"	0803	239.568					
	Averages			0.9			95.825 95.825	
	Standard Meter Volume		25.83086336					
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Meter Temperature Inlet Outlet	Vacuum
3B	0.0 lpm@14"	0816	240.028	0.9			97 97	
			245.3	0.9			96.7 96.7	
			250.2	0.9			96.7 96.7	
			255.2	0.9			96.6 96.6	
	0.0 lpm@14"	0836	260.078				96.7 96.7	
	Averages			0.9			96.74 96.74	
	Standard Meter Volume		19.59442282					
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Meter Temperature Inlet Outlet	Vacuum
3C	0.0 lpm@14"	0850	260.662				97 97	
			266.1	0.9			97 97	
			270.9	0.8			96.6 96.6	
			275.9	0.8			96.8 96.8	
	0.0 lpm@12"	0910	281.051	0.8			96.9 96.9	
	Averages			0.825			96.86 96.86	
	Standard Meter Volume		19.91776611					

VOST FIELD DATA

Plant		Ambient Temp. (°F)	9.5	Meter Box Number	13
Date	12/4/04	Barometric Pressure (in. H2O)	29.95	DGM Cal. Factor (Y)	1.027
Sampling Location	TEO	Stack Temp. (°F)	365	Probe Length & Type	Glass
Sample Type		Average delta P (in. H2O)	—	Probe Heater Setting (°F)	—
Run Number	3	Static Pressure (±) (in. H2O)	—	Filter # & Type (if used)	—
Operator	WCG	Sample Rate (ipm)	1.0	Filter Temp. (°F)	—

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg) LPM	Vacuum (in. Hg)	Rate (in. Hg) LPM	Vacuum (in. Hg)
A	0.0	1.5	0.0	1.4
B	0.0	1.4	0.0	1.4

Set:
Set:

Tenax Tube:
Tenax Tube:

Tenax Charcoal:
Tenax Charcoal:

Additional Tubes:
Additional Tubes:

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Sampling Times Run (min)	Clock (24hr)	Gas Meter Reading (Vol in L or ft3)	Rotameter Setting (ipm/ft3/min)	Meter Pressure (in. H2O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
						A (°F)	B (°F)				
A 0 0737 5 0742 10 0747 15 0752 20 0757		213.180	1.0	0.9	96.2	70	59	—	—	365	10
		218.16	1.0	0.9	95.4	64	53	—	—	365	9
		224.3	1.0	0.9	95.4	64	53	—	—	365	9
		229.6	1.0	0.9	96.3	66	56	—	—	365	9
		239.568									
B 0 0816 5 0821 10 0826 15 0831 20 0836		240.028	1.0	0.9	97.0	68	56	—	—	365	6
		245.3	1.0	0.9	96.7	63	53	—	—	365	7
		250.2	1.0	0.9	96.7	62	53	—	—	365	8
		255.2	1.0	0.9	96.6	62	51	—	—	365	10
		260.078									
Total Volume Metered		Average Flow Rate		Average Pm		Average Tm				Ts	
Run Time											Vacuum (in. Hg)

Comments:

VOST FIELD DATA

Plant		Ambient Temp. (°F)		Meter Box Number	✓3
Date	12/9/04	Barometric Pressure (in. H2O)		DGM Cal. Factor (Y)	1.027
Sampling Location	7C2	Stack Temp. (°F)	365	Probe Length & Type	5/0.25
Sample Type		Average delta P (in. H2O)		Probe Heater Setting (°F)	—
Run Number	3	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	—
Operator	WLG	Sample Rate (lpm)		Filter Temp. (°F)	—

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in.Hg) $\angle PM$	PRE TEST Vacuum (in.Hg)	POST TEST Rate (in.Hg) $\angle PM$	POST TEST Vacuum (in.Hg)
Set				
C	0.0	14	0.0	12

Sat: Sat:

Tenax Tube:
Tenax Tube:

Tenax Charcoal:

Additional Tubes:
Additional Tubes:

[illegible]**Comments:**

Plant	CUA - TCO				Meter Number	VOST 3				
Date	12/10/2004				Correction factor	1.027				
Sample Type	VOST				Barometric Pressure	29.3				
Run Number	4									
<i>Run No.</i>	<i>Leak Rate</i>	<i>Time</i>	<i>Volume</i>	<i>Pressure</i>	<i>Coil 1</i>	<i>Coil 2</i>	<i>Probe</i>	<i>Meter Temperature Inlet</i>	<i>Meter Temperature Outlet</i>	<i>Vacuum</i>
4A	0.0 lpm@12"	2130	283.908	0.9				92.6	92.6	
			294.2	0.9				92.6	92.6	
	0.0 lpm@13"	2150	303.9	0.9				92.9	92.9	
	Averages			0.9				92.7	92.7	
	Standard Meter Volume		19.6805532							
<i>Run No.</i>	<i>Leak Rate</i>	<i>Time</i>	<i>Volume</i>	<i>Pressure</i>	<i>Coil 1</i>	<i>Coil 2</i>	<i>Probe</i>	<i>Meter Temperature Inlet</i>	<i>Meter Temperature Outlet</i>	<i>Vacuum</i>
4B	0.0 lpm@13"	2202	304.32	0.9				92.7	92.7	
			313.7	0.9				92.7	92.7	
	0.0 lpm@17"	2222	324.454	0.9				92.9	92.9	
	Averages			0.9				92.7666667	92.7666667	
	Standard Meter Volume		19.8179506							
<i>Run No.</i>	<i>Leak Rate</i>	<i>Time</i>	<i>Volume</i>	<i>Pressure</i>	<i>Coil 1</i>	<i>Coil 2</i>	<i>Probe</i>	<i>Meter Temperature Inlet</i>	<i>Meter Temperature Outlet</i>	<i>Vacuum</i>
4C	0.0 lpm@18"	2232	325.155	0.9				92.8	92.8	
			336.2	0.9				92.9	92.9	
	0.0 lpm@16"	2252	346.05	0.9				92.4	92.4	
	Averages			0.9				92.7	92.7	
	Standard Meter Volume		20.56948575							

VOST FIELD DATA

Plant		Ambient Temp. (°F)	96	Meter Box Number	V3
Date	12/10/04	Barometric Pressure (in. H2O)	29.30	DGM Cal. Factor (V)	1.027
Sampling Location	700	Stack Temp. (°F)		Probe Length & Type	8/12.5
Sample Type	VOST	Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	4	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	WCG	Sample Rate (ppm)	1.0	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg) LPM	Vacuum (in. Hg)	Rate (in. Hg) LPM	Vacuum (in. Hg)
A	0.0	12	0.0	13
B	0.0	13	0.0	17
C	0.0	18	0.0	16

Tenax Tube:

Tenax Charcoal:

Additional Tubes:

Additional Tubes:

Sampling Times	Run (min)	Clock (24hr)	Gas Meter Reading (Vol in L or ft3)	Rotameter Setting (lpm/ft3/min)	Meter Pressure (in. H2O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
							A (°F)	B (°F)				
A	0	2130	283.908	1.0	0.9	92.6	71.7	62.2				7
	10	2140	294.2	1.0	0.9	92.6	64	59				8
	20	2150	303.900	1.0	0.9	92.9	61	53				9
B	0	1002 PM	304.320	1.0	0.9	92.7	63	55				9
	10	1012 PM	313.7	1.0	0.9	92.7	60	54				12
	20	1022 PM	324.454	1.0	0.9	92.9	59	54				12
C	0	1032 PM	325.155	1.0	0.9	92.8	61	55				10
	10	1042 PM	336.2	1.0	0.9	92.9	61	54				11
	20	1052 PM	346.050	1.0	0.9	92.4	59	54				12
Run Time												
Total Time												
Total Volume Metered												
Average Flow Rate												
Average Pm												
Average Tm												
Comments:												

Plant	CUA - TCO		Meter Number	VOST 3						
Date	12/101/2004		Correction factor	1.027						
Sample Type	VOST		Barometric Pressure	29.35						
Run Number	5									
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
5A	0.0 lpm@16"	2311	350.4	0.9				93	93	
			362.4	0.9				93.3	93.3	
	0.0 lpm@13"	2331	372.436	0.9				93.1	93.1	
	Averages			0.9				93.1333333	93.1333333	
	Standard Meter Volume		21.67571619							
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
5B	0.0 lpm@13"	2340	374.025	0.9				92.7	92.7	
			385.1	0.9				92.9	92.9	
	0.0 lpm@12"	2400	395.475	0.9				93	93	
	Averages			0.9				92.8666667	92.8666667	
	Standard Meter Volume		21.10947408							
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
5C	0.0 lpm@12"	0010	395.89	0.9				93.1	93.1	
			406.3	0.9				93	93	
	0.0 lpm@15"	0030	417.161	0.9				93	93	
	Averages			0.9				93.0333333	93.0333333	
	Standard Meter Volume		20.92700713							

VOST FIELD DATA

Plant		Ambient Temp. (°F)	95	Meter Box Number	V3
Date	12/10/04	Barometric Pressure (in. H2O)	29.35	DGM Cal. Factor (Y)	1.027
Sampling Location	TCO	Stack Temp. (°F)		Probe Length & Type	9655
Sample Type	VOST	Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	5	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	wlg	Sample Rate (ipm)	1.0	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg) LPM	Vacuum (in. Hg)	Rate (in. Hg) LPM	Vacuum (in. Hg)
A	0.0	1.0	0.0	1.3
B	0.0	1.3	0.0	1.2
C	0.0	1.2	0.0	1.5

Set: Tenax Tube: Additional Tubes:

Set: Tenax Tube: Additional Tubes:

Sampling Times	Gas Meter Reading	Rotameter	Meter	Meter	Condenser Temperature	Line	Probe	Stack	Train
Run (min)	(Vol in L or ft3)	Setting (lpm/ft3/min)	Pressure (in. H2O)	Temp. (°F)	A (°F)	B (°F)	Temp. (°F)	Temp. (°F)	Vacuum (in. Hg)
0	350.400	1.0	0.9	93.0	63	58			108
10	362.4	1.0	0.9	93.3	61	58			8
20	372.436	1.0	0.9	93.1	61	55			9
0	374.025	1.0	0.9	92.7	60	60			7
10	385.1	1.0	0.9	92.9	60	60			9
20	395.475	1.0	0.9	93.0	59	59			10
0	395.890	1.0	0.9	93.1	64	58			8
10	406.3	1.0	0.9	93.0	60	56			11
20	417.161	1.0	0.9	93.0	61	55			12
Run Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm				Ts	Vacuum (in. Hg)

Comments:

Plant	CUA - TCO				Meter Number		VOST 3	
Date	12/11/2004				Correction factor		1.027	
Sample Type	VOST				Barometric Pressure		29.35	
Run Number	6							

VOST FIELD DATA

Plant		Ambient Temp. (°F)	93	Meter Box Number	V3
Date	12/11/04	Barometric Pressure (in. H2O)	29.25	DGM Cal. Factor (Y)	1.027
Sampling Location	TCO	Stack Temp. (°F)		Probe Length & Type	9/025
Sample Type	VOST	Average delta P (in. H2O)		Probe Heater Setting (°F)	
Run Number	6	Static Pressure (±) (in. H2O)		Filter # & Type (if used)	
Operator	WCG	Sample Rate (pm)	1.0	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg) LPM	Vacuum (in. Hg)	Rate (in. Hg) LPM	Vacuum (in. Hg)
A	0.0	16	0.0	13
B	0.0	13	0.0	16
C	0.0	15	0.0	14

Tenax Tube: _____

Tenax Tube: _____

Tenax Charcoal: _____

Tenax Charcoal: _____

Additional Tubes: _____

Additional Tubes: _____

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Sampling Times	Run (min)	Clock (24hr)	Gas Meter Reading (Vol in L or ft³)	Rotameter Setting (lpm/ft³/min)	Meter Pressure (in. H2O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in. Hg)
							A (°F)	B (°F)				
CO	0045		420.210	1.0	0.9	93.0	61	56				10
A310	0055		431.3	1.0	0.9	93.0	61	56				8
20	0105		441.536	1.0	0.9	93.3	59	54				9
			441.536	1.0	0.9	93.3	59	54				
CO	0115		441.955	1.0	0.9	93.0	64	56				9
310	0125		457.9	1.0	0.9	93.2	59	54				12
20	0135		462.077	1.0	0.9	92.3	58	52				12
CO	0145		462.592	1.0	0.9	92.8	64	57				7
210	0155		473.2	1.0	0.9	92.8	61	56				8
20	0205		483.262	1.0	0.9	92.8	60	54				10
Methanol	Blank		0.0 @ 14" Hg	Average			0.0 @	14" Hg				
Run Time		Total Volume Metered		Average Flow Rate	Average Pm	Average Tm					Ts	Vacuum (in. Hg)

1264

Comments:

Appendix B.2

Semi-VOST

Facility:	CUA	Start Time:	1243
Date:	11/17/2004	End Time:	1543
Location:	Melter Out	Initial Leak Check:	0.004@10"
Run Number:	1	Final Leak Check:	0.00@9"
Sample Type:	SVOC		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			30.09
Absolute Stack Pressure (in Hg)			29.72
Stack Static Pressure (in H ₂ O)			-5.00
Average Stack Temperature (°F)			419.39
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			70.956
Average Meter Pressure (in H ₂ O)			0.49
Average Meter Temperature (°F)			91.11
Moisture Collected (g)			495.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.387
Standard Metered Volume (dscf)			69.647
Standard Metered Volume (dscm)			1.972
Stack Moisture (%V)			25.13
Mole Fraction Dry Stack Gas			0.749
Dry Molecular Weight			28.84
Wet Molecular Weight			26.11
Stack Gas Velocity (fpm)			4508.24
Stack Gas Velocity (mpm)			1374.11
Volumetric Flow Rate (acfm)			393.42
Volumetric Flow Rate (acmm)			11.14
Volumetric Flow Rate (dscfm)			175.65
Volumetric Flow Rate (dscmm)			4.97
Percent Isokinetic			99.72
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Read and Record All Data Every Minutes1267

Plant	USL
Date	11.17.7
Sampling Location	Melter
Run Number	1
Impinger Box Number	M1
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	Carboxate			976.7g	301.6	
2	H ₂ O	100	m	734.3	734.7	
3	H ₂ O	100	g/s	723.2	723.6	
4	KO			630.9g	629.6	
5	SG		m	929.8g	909.7	
6						
7				3994.9	3499.2	
8						
9						
10						
Total Weight Gain (g)						495.7

Corrected

Facility:	CUA	Start Time:	1243
Date:	11/17/2004	End Time:	1543
Location:	HEPA	Initial Leak Check:	.015@10"
Run Number:	1	Final Leak Check:	.004@15"
Sample Type:	SV Napthalene		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			30.09
Absolute Stack Pressure (in Hg)			30.02
Stack Static Pressure (in H2O)			-1.00
Average Stack Temperature (°F)			168.22
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			104.740
Average Meter Pressure (in H2O)			1.04
Average Meter Temperature (°F)			93.39
Moisture Collected (g)			367.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0080
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.564
Standard Metered Volume (dscf)			101.559
Standard Metered Volume (dscm)			2.876
Stack Moisture (%V)			14.56
Mole Fraction Dry Stack Gas			0.854
Dry Molecular Weight			28.84
Wet Molecular Weight			27.26
Stack Gas Velocity (fpm)			2610.79
Stack Gas Velocity (mpm)			795.77
Volumetric Flow Rate (acfm)			258.42
Volumetric Flow Rate (acmm)			7.32
Volumetric Flow Rate (dscfm)			186.15
Volumetric Flow Rate (dscmm)			5.27
Percent Isokinetic			103.98
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Run _____ of _____
Page _____ of _____

Plant	CUA	Probe Length & Type	6" Rylex	Filter Number	NA
Date	11/17/04	Nozzle ID (in.)	1.230	Height of Location (ft)	20
Sampling Location	HEPA	Pitot Constant	1.99	Duct Dimensions (in.)	4" 4.26
Sample Type	SU	Meter Box Number	ATB	Stack Geometry (R or C)	C
Run Number	1	Meter $\Delta H@$	1.69	Assume Moisture (%)	
Operator	MWH	Yd	1.008	O ₂ (%)	
Ambient Temperature	75°	K Factor	3.02	CO ₂ (%)	
Barometric Pressure (in.)	30.10	Probe Heater Setting (°F)	250	Nitrogen (%)	
Static Pressure (in. H ₂ O)	-1	Heater Box Setting (°F)	250	Moisture Collected (g)	
Initial Leak Check	0.015 @ 10"	Final Leak Check	0.004 @ 15"		

BIRING- SMALLER
NOZZLE FOR THIS
LOCATION.

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	0	12:43	668.994	1.35	1.06	166	264	247	92	89	56	6.0
	10	12:53	675.40	1.35	1.06	167	263	247	93	90	48	6.0
	20	13:03	680.40	1.35	1.06	168	264	247	93	90	50	6.0
	30	13:13	685.32	1.35	1.02	169	264	247	93	91	52	6.0
	40	13:23	690.40	1.34	1.02	169	264	247	93	91	52	6.0
	50	13:33	695.24	1.34	1.02	169	264	247	93	91	52	6.0
	60	13:43	702.40	1.34	1.02	169	264	247	93	91	52	6.0
	70	13:53	706.75	1.34	1.02	169	264	247	96	91	45	6.0
	80	14:03	713.25	1.35	1.06	169	264	247	96	91	42	7.0
	90	14:13	719.10	1.35	1.06	169	263	248	96	91	43	7.0
	100	14:23	724.9	1.34	1.02	169	263	247	96	91	43	7.0
	110	14:33	730.8	1.34	1.02	168	263	247	96	91	44	7.3
	120	14:43	736.82	1.34	1.02	168	263	246	96	92	45	7.5
	130	14:53	743.10	1.34	1.02	168	263	247	96	92	45	7.5
	140	15:03	749.0	1.35	1.06	168	264	246	96	92	43	8
	150	15:13	754.7	1.35	1.06	168	264	247	96	92	44	9.0
	160	15:23	761.3	1.34	1.02	168	264	247	96	92	45	9.5
	170	15:33	767.40	1.35	1.06	168	264	247	97	92	46	10
	180	15:43	773.734	1.34	1.02	168	264	248	97	92	46	10.5

Plant	VSL
Date	11.17.9
Sampling Location	HEPA OUT
Run Number	1
Impinger Box Number	H1
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	Condensate		—	744.9	401.9	
2	H ₂ O	100	M	721.8g	728.0	
3	H ₂ O	100	M	713.2g	718.6	
4	KO		M	626.2g	623.4	
5	SG		M	944.9g	912.1g	
6						
7				3751	3384	
8						
9						
10						
Total Weight Gain (g)						367

Facility:	CUA - 1200	Start Time:	1240
Date:	11/17/2004	End Time:	1540
Location:	HEPA TCO	Initial Leak Check:	0.004@10"
Run Number:	1	Final Leak Check:	.01@20"
Sample Type:	SV Napthalene		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			30.09
Absolute Stack Pressure (in Hg)			29.21
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			597.33
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			110.782
Average Meter Pressure (in H2O)			1.27
Average Meter Temperature (°F)			93.50
Moisture Collected (g)			239.60
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9996
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.592
Standard Metered Volume (dscf)			106.582
Standard Metered Volume (dscm)			3.018
Stack Moisture (%V)			9.58
Mole Fraction Dry Stack Gas			0.904
Dry Molecular Weight			28.84
Wet Molecular Weight			27.80
Stack Gas Velocity (fpm)			4618.74
Stack Gas Velocity (mpm)			1407.79
Volumetric Flow Rate (acfm)			457.16
Volumetric Flow Rate (acmm)			12.95
Volumetric Flow Rate (dscfm)			201.47
Volumetric Flow Rate (dscmm)			5.71
Percent Isokinetic			100.82
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

= 177.66 @
 4" Ø

Read and Record All Data Every
Minutes

1273

Plant	VSC
Date	11.17.14
Sampling Location	TCO outlet
Run Number	1
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	Condensate		—	613.1	397.6g	
2	H ₂ O	100	m	717.0g	720.3g	
3	H ₂ O	100	m	724.7	722.7g	
4	KO		m	620.3	619.5g	
5	SG		m	908.5g	883.9	
6						
7				3583.6	3344	
8						
9						
10						
Total Weight Gain (g)						239.6

Facility:	CUA	Start Time:	1118
Date:	12/08/2004	End Time:	1218
Location:	Melter	Initial Leak Check:	0.000@13"
Run Number:	1 <i>Test 2</i>	Final Leak Check:	0.000@6"
Sample Type:	SV OC		
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	30.00		
Absolute Stack Pressure (in Hg)	29.67		
Stack Static Pressure (in H ₂ O)	-4.50		
Average Stack Temperature (°F)	356.00		
Stack Area (sq in)	12.57		
Actual Meter Volume (cu ft)	23.815		
Average Meter Pressure (in H ₂ O)	0.51		
Average Meter Temperature (°F)	93.17		
Moisture Collected (g)	154.30		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	1.0175		
Nozzle Diameter (in)	0.188		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.387		
Standard Metered Volume (dscf)	23.220		
Standard Metered Volume (dscm)	0.658		
Stack Moisture (%V)	23.86		
Mole Fraction Dry Stack Gas	0.761		
Dry Molecular Weight	28.84		
Wet Molecular Weight	26.25		
Stack Gas Velocity (fpm)	4177.93		
Stack Gas Velocity (mpm)	1273.43		
Volumetric Flow Rate (acfm)	364.59		
Volumetric Flow Rate (acmm)	10.33		
Volumetric Flow Rate (dscfm)	178.09		
Volumetric Flow Rate (dscmm)	5.04		
Percent Isokinetic	98.37		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

FIELD DATA SHEET

Plant	Probe Length & Type	Filter Number
Date	Nozzle ID (in.)	Height of Location (ft)
Sampling Location	Pilot Constant	Duct Dimensions (in.)
Sample Type	Meter Box Number	Stack Geometry (R or C)
Run Number	Meter $\Delta H @$	Assume Moisture (%)
Operator	Yd	O ₂ (%)
Ambient Temperature	K Factor	CO ₂ (%)
Barometric Pressure (in.)	Probe Heater Setting (°F)	Nitrogen (%)
Static Pressure (in. H ₂ O)	Heater Box Setting (°F)	Moisture Collected (g)
Initial Leak Check	Final Leak Check	

(Diagram of Duct)

Minutes

Read and Record All Data Every

[illegible]

Plant	VSC
Date	12/8/04
Sampling Location	Melter
Run Number	1 Semi VOST
Impinger Box Number	Melter 1
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
Bowl 1	N/A	-	Bowl	642.8	500.9	
2	H ₂ O	100	G/S	736.5	735.2	
3	N/A	-	Mon	626.5	625.8	
4	Silica gel	250g	Mon	989.3	978.9	
5						
6				2995.1	2840.8	
7						
8						
9						
10						

Total Weight Gain (g)

154.3

Facility:	CUA	Start Time:	1501
Date:	12/08/2004	End Time:	1601
Location:	Melter	Initial Leak Check:	0.000@7"
Run Number:	2	Final Leak Check:	0.000@6"
Sample Type:	SV OC		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.00
Absolute Stack Pressure (in Hg)			29.67
Stack Static Pressure (in H ₂ O)			-4.50
Average Stack Temperature (°F)			354.67
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			23.600
Average Meter Pressure (in H ₂ O)			0.50
Average Meter Temperature (°F)			93.75
Moisture Collected (g)			167.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.383
Standard Metered Volume (dscf)			22.986
Standard Metered Volume (dscm)			0.651
Stack Moisture (%V)			25.54
Mole Fraction Dry Stack Gas			0.745
Dry Molecular Weight			28.84
Wet Molecular Weight			26.07
Stack Gas Velocity (fpm)			4128.90
Stack Gas Velocity (mpm)			1258.49
Volumetric Flow Rate (acfm)			360.31
Volumetric Flow Rate (acmm)			10.20
Volumetric Flow Rate (dscfm)			172.39
Volumetric Flow Rate (dscmm)			4.88
Percent Isokinetic			100.60
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	CCH	Probe Length & Type	20' TFE	Filter Number	
Date	12-8-04	Nozzle ID (in.)	0.188	Height of Location (ft)	
Sampling Location	melter outlet	Pilot Constant	0.99	Duct Dimensions (in.)	4"
Sample Type	SVOC	Meter Box Number	ATA	Stack Geometry (R or C)	C
Run Number	2	Meter $\Delta H @$	1.7282	Assume Moisture (%)	21
Operator	HFT	Yd	1.0175	O ₂ (%)	20.9
Ambient Temperature	90	K Factor	0.79	CO ₂ (%)	0
Barometric Pressure (in.)	30	Probe Heater Setting (°F)	250 ± 25	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-4.5	Heater Box Setting (°F)	250 ± 25	Moisture Collected (g)	167.2
Initial Leak Check	0.0007"	Final Leak Check	0.00016"		

(Diagram of Duct)

(Diagram of Duct)

[illegible]

Plant	CUA - VSL
Date	12.8.4
Sampling Location	Melter
Run Number	2 - SemiVOST
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	—	561.9	408.1g	
2	H ₂ O	106	q/s	717.0g	716.3g	
3	—	—	Mod	607.6g	607.4g	
4	Silica Gel	ZSO	Mod	946.9g	934.4	
5						
6				2833.4	2666.2	
7						
8						
9						
10						
Total Weight Gain (g)						167.2

Facility:	CUA	Start Time:	1844
Date:	12/08/2004	End Time:	1944
Location:	Melter	Initial Leak Check:	0.000@11"
Run Number:	3	Final Leak Check:	0.000@8"
Sample Type:	SV OC		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.00
Absolute Stack Pressure (in Hg)			29.67
Stack Static Pressure (in H ₂ O)			-4.50
Average Stack Temperature (°F)			350.67
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			22.445
Average Meter Pressure (in H ₂ O)			0.45
Average Meter Temperature (°F)			94.17
Moisture Collected (g)			141.30
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.364
Standard Metered Volume (dscf)			21.842
Standard Metered Volume (dscm)			0.619
Stack Moisture (%V)			23.37
Mole Fraction Dry Stack Gas			0.766
Dry Molecular Weight			28.84
Wet Molecular Weight			26.30
Stack Gas Velocity (fpm)			3922.48
Stack Gas Velocity (mpm)			1195.57
Volumetric Flow Rate (acfm)			342.30
Volumetric Flow Rate (acmm)			9.69
Volumetric Flow Rate (dscfm)			169.37
Volumetric Flow Rate (dscmm)			4.80
Percent Isokinetic			97.30
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run 3 of

(Diagram of Duct)

Read and Record All Data Every Minutes

Plant	VSL
Date	12.8.4
Sampling Location	Melter R3
Run Number	3
Impinger Box Number	M1
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KO	—	—	637.7g	502.0	
2	10 H ₂ O	100	G/S	736.3g	736.3g	
3	KO	—	m	626.5g	626.3g	
4	SG	250	m	994.5g	989.1g	
5						
6				2995	2853.7	
7						
8						
9						
10						
Total Weight Gain (g)						141.3

Facility:	CUA	Start Time:	1430
Date:	12/09/2004	End Time:	1530
Location:	Melter	Initial Leak Check:	0.000@12"
Run Number:	4	Final Leak Check:	0.000@13"
Sample Type:	SV OC		
TEST 1			
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	30.10		
Absolute Stack Pressure (in Hg)	29.81		
Stack Static Pressure (in H ₂ O)	-4.00		
Average Stack Temperature (°F)	422.67		
Stack Area (sq in)	12.57		
Actual Meter Volume (cu ft)	26.415		
Average Meter Pressure (in H ₂ O)	0.63		
Average Meter Temperature (°F)	94.33		
Moisture Collected (g)	191.60		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	1.0175		
Nozzle Diameter (in)	0.188		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.430		
Standard Metered Volume (dscf)	25.795		
Standard Metered Volume (dscm)	0.731		
Stack Moisture (%V)	25.94		
Mole Fraction Dry Stack Gas	0.741		
Dry Molecular Weight	28.84		
Wet Molecular Weight	26.03		
Stack Gas Velocity (fpm)	4849.04		
Stack Gas Velocity (mpm)	1477.99		
Volumetric Flow Rate (acfm)	423.16		
Volumetric Flow Rate (acmm)	11.98		
Volumetric Flow Rate (dscfm)	186.71		
Volumetric Flow Rate (dscmm)	5.29		
Percent Isokinetic	104.24		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

Run 4 of Page of

(Diagram of Duct)

2

~~ORP-51444, Rev. 0~~

Plant	USC
Date	12-9-4
Sampling Location	Melter SV
Run Number	4
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KO	—	—	687.4	501.5	
2	H ₂ O	106	9/3	736.2	736.3g	
3	—	—	m	627.4	626.5g	
4	SG	256	m	1041.4g	1036.5g	
5						
6				3092.4	2900.8	
7						
8						
9						
10						
Total Weight Gain (g)						191.6

Facility:	CUA	Start Time:	1751
Date:	12/09/2004	End Time:	1851
Location:	Melter	Initial Leak Check:	0.000@11"
Run Number:	5	Final Leak Check:	0.000@12"
Sample Type:	SV OC		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.10
Absolute Stack Pressure (in Hg)			29.81
Stack Static Pressure (in H2O)			-4.00
Average Stack Temperature (°F)			426.50
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			25.025
Average Meter Pressure (in H2O)			0.58
Average Meter Temperature (°F)			94.92
Moisture Collected (g)			193.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.407
Standard Metered Volume (dscf)			24.407
Standard Metered Volume (dscm)			0.691
Stack Moisture (%V)			27.18
Mole Fraction Dry Stack Gas			0.728
Dry Molecular Weight			28.84
Wet Molecular Weight			25.89
Stack Gas Velocity (fpm)			4738.48
Stack Gas Velocity (mpm)			1444.29
Volumetric Flow Rate (acfm)			413.51
Volumetric Flow Rate (acmm)			11.71
Volumetric Flow Rate (dscfm)			178.62
Volumetric Flow Rate (dscmm)			5.06
Percent Isokinetic			103.09
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Plant	Probe Length & Type	Filter Number	Diagram of Duct
Date	Nozzle ID (in.)	Height of Location (ft)	
Sampling Location	Pitot Constant	Duct Dimensions (in.)	
Sample Type	Meter Box Number	Stack Geometry (R or C)	
Run Number	Meter $\Delta H @$	Assume Moisture (%)	
Operator	Yd	O ₂ (%)	
Ambient Temperature	K Factor	CO ₂ (%)	
Barometric Pressure (in.)	Probe Heater Setting (°F)	Nitrogen (%)	
Static Pressure (in. H ₂ O)	Heater Box Setting (°F)	Moisture Collected (g)	
Initial Leak Check	Final Leak Check		

(Diagram of Duct)

Minutes

Read and Record All Data Every

[illegible]

Plant	USL
Date	12.9.9
Sampling Location	Melter R5 SV
Run Number	R5
Impinger Box Number	
Recovery Person	MD
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KO	—	—	593.7	409.7g	
2	H ₂ O	100	9/s	717.2g	717.0g	
3	—	—	m	607.6g	607.5g	
4	SG	250	m	955.7g	946.8g	
5						
6				2874.2	2681	
7						
8						
9						
10						
Total Weight Gain (g)						193.2

Facility:	CUA	Start Time:	1111
Date:	12/08/2004	End Time:	1411
Location:	TCO	Initial Leak Check:	0.010@13"
Run Number:	1 <i>Test 2</i>	Final Leak Check:	0.000@17"
Sample Type:	SVOC		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			30.00
Absolute Stack Pressure (in Hg)			29.12
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			550.67
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			145.785
Average Meter Pressure (in H2O)			1.84
Average Meter Temperature (°F)			98.56
Moisture Collected (g)			395.80
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.770
Standard Metered Volume (dscf)			138.661
Standard Metered Volume (dscm)			3.927
Stack Moisture (%V)			11.86
Mole Fraction Dry Stack Gas			0.881
Dry Molecular Weight			28.84
Wet Molecular Weight			27.55
Stack Gas Velocity (fpm)			4316.98
Stack Gas Velocity (mpm)			1315.82
Volumetric Flow Rate (acfm)			425.29
Volumetric Flow Rate (acmm)			12.04
Volumetric Flow Rate (dscfm)			190.52
Volumetric Flow Rate (dscmm)			5.40
Percent Isokinetic			101.68
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	CVA - VSL
Date	12/8/04
Sampling Location	TCO -
Run Number	1 - Sem. Vost
Impinger Box Number	
Recovery Person	mwel
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	Bow C	853.9	484.3	
2	H ₂ O	100	G/S	662.9g	666.0	
3	—	—	mod	611.1g	610.1	
4	SILICA cel	250g	mod	987.6g	989.3	
5						
6				3115.5	2719.7	
7						
8						
9						
10						

Total Weight Gain (g)

395.8

Facility:	CUA	Start Time:	1455
Date:	12/08/2004	End Time:	1755
Location:	TCO	Initial Leak Check:	0.008@12"
Run Number:	2	Final Leak Check:	0.006@11"
Sample Type:	SVOC		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			30.00
Absolute Stack Pressure (in Hg)			29.12
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			557.11
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			144.755
Average Meter Pressure (in H ₂ O)			1.84
Average Meter Temperature (°F)			99.11
Moisture Collected (g)			632.30
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.764
Standard Metered Volume (dscf)			137.547
Standard Metered Volume (dscm)			3.895
Stack Moisture (%V)			17.81
Mole Fraction Dry Stack Gas			0.822
Dry Molecular Weight			28.84
Wet Molecular Weight			26.91
Stack Gas Velocity (fpm)			4393.06
Stack Gas Velocity (mpm)			1339.01
Volumetric Flow Rate (acfm)			432.79
Volumetric Flow Rate (acmm)			12.26
Volumetric Flow Rate (dscfm)			179.64
Volumetric Flow Rate (dscmm)			5.09
Percent Isokinetic			106.97
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Run 2
Page of

Plant	CUPA	Probe Length & Type	20' TFE	Filter Number	
Date	12-8-04	Nozzle ID (in.)	0.268	Height of Location (ft)	10'
Sampling Location	TLO	Pilot Constant	99	Duct Dimensions (in.)	4.35"
Sample Type	SVOC	Meter Box Number	ATC	Stack Geometry (R or C)	C
Run Number	2	Meter ΔH@	0.079	Assume Moisture (%)	21.0
Operator	HFG	Yd	0.999	O ₂ (%)	20.9
Ambient Temperature	90	K Factor	3.2	CO ₂ (%)	0
Barometric Pressure (in.)	+30	Probe Heater Setting (°F)	250 ± 25	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-12	Heater Box Setting (°F)	250 ± 25	Moisture Collected (g)	632.3
Initial Leak Check	0.008 @ 12"	Final Leak Check	0.006 @ 11"		

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	0	14:55	899.45	0.58	1.9	557	249	255	96	95	52	5
	10		907.16	0.58	1.9	555	250	257	100	95	58	6.5
	20		915.43	0.58	1.8	555	251	256	102	96	58	6.5
	30		923.68	0.57	1.8	557	251	255	102	96	60	6.5
	40		931.77	0.57	1.8	557	251	255	102	97	60	6.5
	50		939.95	0.57	1.8	557	251	255	102	97	61	6.5
	60		948.36	0.58	1.9	559	251	255	102	97	59	6.5
	70		956.36	0.57	1.8	559	251	256	102	97	57	6.5
	80		964.40	0.60	1.9	559	251	256	102	97	59	6.5
	90		972.30	0.57	1.8	557	251	256	102	97	59	6.5
	100		980.39	0.60	1.9	557	251	256	102	97	59	6.5
	110		989.20	0.58	1.9	557	251	255	102	97	58	6.5
	120		996.80	0.58	1.9	557	251	256	102	97	58	6.5
	130		1004.66	0.57	1.8	557	250	256	102	97	54	6.5
	140		1012.57	0.58	1.9	557	251	256	102	97	54	6.5
	150		1020.47	0.57	1.8	557	251	256	102	97	56	6.5
	160		1028.40	0.57	1.8	557	251	257	102	95	57	6.5
	170		1036.17	0.57	1.8	557	250	256	102	98	59	6.5
	180	17:55	1044.20	0.57	1.8	557	250	255	102	98	59	6.5

Plant	VSL
Date	12.8.4
Sampling Location	TCO outlet
Run Number	2
Impinger Box Number	TCO 2 Semi VOST
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	K ₂ O		—	962.2g	398.0	
2	H ₂ O	100	4/5	754.8g	719.2	
3	K ₂ O		m	638.9g	636.3g	
4	Silica Gel	250	m	943.1g	913.2g	
5						
6				3299	2666.7	
7						
8						
9						
10						
Total Weight Gain (g)						632.3

Facility:	CUA	Start Time:	1843
Date:	12/08/2004	End Time:	21:30
Location:	TCO	Initial Leak Check:	0.000@12"
Run Number:	3	Final Leak Check:	0.004@15"
Sample Type:	SVOC		
Total Sampling Time (min)			167.0
Corrected Barometric Pressure (in Hg)			30.00
Absolute Stack Pressure (in Hg)			29.12
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			551.41
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			133.455
Average Meter Pressure (in H ₂ O)			1.81
Average Meter Temperature (°F)			99.35
Moisture Collected (g)			357.80
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.759
Standard Metered Volume (dscf)			126.747
Standard Metered Volume (dscm)			3.589
Stack Moisture (%V)			11.75
Mole Fraction Dry Stack Gas			0.883
Dry Molecular Weight			28.84
Wet Molecular Weight			27.56
Stack Gas Velocity (fpm)			4300.88
Stack Gas Velocity (mpm)			1310.91
Volumetric Flow Rate (acfm)			423.70
Volumetric Flow Rate (acmm)			12.00
Volumetric Flow Rate (dscfm)			189.92
Volumetric Flow Rate (dscmm)			5.38
Percent Isokinetic			100.50
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

(Diagram of Duct)

Read and Record All Data Every _____ Minutes

Plant	VSL
Date	12.8.4
Sampling Location	TCO
Run Number	3
Impinger Box Number	TCO 1
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	—	817.4	484.1	
2	H ₂ O	100	G/S	657.2	662.9g	
3	—	—	M	613.9	611.0g	
4	SG	250	M	1011.9	984.6g	
5						
6				3100.4	2742.6	
7						
8						
9						
10						
Total Weight Gain (g)						357.8

Facility:	CUA	Start Time:	1428
Date:	12/09/2004	End Time:	1728
Location:	TCO	Initial Leak Check:	0.000@12"
Run Number:	4 <i>Total</i>	Final Leak Check:	0.002@13"
Sample Type:	SVOC		
Total Sampling Time (min)	180.0		
Corrected Barometric Pressure (in Hg)	30.10		
Absolute Stack Pressure (in Hg)	29.22		
Stack Static Pressure (in H ₂ O)	-12.00		
Average Stack Temperature (°F)	586.89		
Stack Area (sq in)	14.19		
Actual Meter Volume (cu ft)	139.085		
Average Meter Pressure (in H ₂ O)	1.71		
Average Meter Temperature (°F)	97.44		
Moisture Collected (g)	282.10		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	0.9990		
Nozzle Diameter (in)	0.268		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.739		
Standard Metered Volume (dscf)	132.945		
Standard Metered Volume (dscm)	3.765		
Stack Moisture (%V)	9.09		
Mole Fraction Dry Stack Gas	0.909		
Dry Molecular Weight	28.84		
Wet Molecular Weight	27.85		
Stack Gas Velocity (fpm)	4268.53		
Stack Gas Velocity (mpm)	1301.05		
Volumetric Flow Rate (acfm)	420.52		
Volumetric Flow Rate (acmm)	11.91		
Volumetric Flow Rate (dscfm)	188.22		
Volumetric Flow Rate (dscmm)	5.33		
Percent Isokinetic	98.68		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

FIELD DATA SHEET

(Diagram of Duct)

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
K-3.1	0	142.8	292.45	0.5	1.6	586	260	254	93	93	60	6
	10		299.54	0.55	1.8	580	260	256	95	93	58	6
	20		306.66	0.55	1.8	580	260	256	97	93	54	7
	30		314.54	0.55	1.8	580	260	256	99	94	53	7
	40		322.45	0.55	1.7	585	260	255	100	94	52	7
	50		330.30	0.56	1.7	585	260	255	100	94	52	7
	60		338.11	0.55	1.7	585	260	255	100	95	53	7
	70		346.01	0.55	1.7	587	260	255	100	95	51	7
	80		353.71	0.55	1.7	587	261	255	101	96	63	7
	90		361.56	0.55	1.7	587	261	255	101	96	65	7
	100		369.24	0.55	1.7	587	261	255	101	96	62	7
	110		376.93	0.55	1.7	589	261	255	101	97	67	7
	120		384.72	0.55	1.7	589	261	255	101	97	67	7.5
	130	382.57	392.41	0.55	1.7	589	261	255	101	97	67	7.5
	140		400.3	0.55	1.7	589	261	255	101	97	60	7.5
	150		408.13	0.56	1.7	589	261	255	101	96	54	7.5
	160		415.92	0.55	1.7	589	260	255	101	96	52	7.5
	170	1716	423.72	0.55	1.7	593	260	254	101	96	52	7.5
	180	172.8	431.535	0.55	1.7	593	261	256	101	97	54	7.5

Plant	NSL
Date	12.24
Sampling Location	TCO SV
Run Number	R4
Impinger Box Number	TCO-1
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KO		—	742.6	483.5g	
2	H ₂ O	100	4/5	667.7g	673.6g	
3	—		M	612.3g	610.4	
4	SG	250	m	1038.6g	1011.6g	
5						
6				3061.2	2779.1	
7						
8						
9						
10						
Total Weight Gain (g)						282.1

Facility:	CUA	Start Time:	1747
Date:	12/09/2004	End Time:	2047
Location:	TCO	Initial Leak Check:	0.006@13"
Run Number:	5	Final Leak Check:	0.015@15"
Sample Type:	SVOC		
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			30.10
Absolute Stack Pressure (in Hg)			29.22
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			590.50
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			139.435
Average Meter Pressure (in H ₂ O)			1.70
Average Meter Temperature (°F)			97.42
Moisture Collected (g)			294.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.740
Standard Metered Volume (dscf)			133.289
Standard Metered Volume (dscm)			3.775
Stack Moisture (%V)			9.42
Mole Fraction Dry Stack Gas			0.906
Dry Molecular Weight			28.84
Wet Molecular Weight			27.82
Stack Gas Velocity (fpm)			4261.47
Stack Gas Velocity (mpm)			1298.90
Volumetric Flow Rate (acfm)			419.82
Volumetric Flow Rate (acmm)			11.89
Volumetric Flow Rate (dscfm)			186.59
Volumetric Flow Rate (dscmm)			5.28
Percent Isokinetic			99.80
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

(Diagram of Duct)

Read and Record All Data Every Minutes												
Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	0	1747	432.00									
	10	1757	439.45	0.56	1.7	590	235	240	98	95	65	10
	20		447.10	0.54	1.7	590	256	241	99	95	59	11
	30		454.91	0.54	1.7	590	259	247	100	95	56	11
	40		462.62	0.54	1.7	590	260	250	99	95	55	11.5
	50		470.32	0.55	1.7	590	260	250	99	95	55	11.5
	60	1847	478.05	0.54	1.7	591	260	251	100	95	58	11.5
	70	1857	485.09	0.53	1.6	591	260	253	100	93	100	11.5
	80		493.44	0.54	1.7	591	260	253	100	95	102	11.5
	90		501.10	0.54	1.7	590	260	261	100	95	103	12
	100		508.99	0.54	1.7	590	260	253	100	95	100	12
	110		516.75	0.54	1.7	590	261	253	100	95	55	12
	120	1947	524.54	0.55	1.7	591	260	251	100	95	55	12
	130	1957	532.35	0.55	1.7	591	261	253	100	95	57	12
	140		540.16	0.56	1.7	591	261	253	100	95	58	12
	150		547.96	0.55	1.7	591	261	253	100	95	58	12
	160		555.78	0.55	1.7	591	260	253	100	95	58	12
	170	2017	563.78	0.55	1.7	591	261	253	100	95	58	12
	180	2047	571.435	0.55	1.7	591	261	253	100	95	58	12

Plant	VSC
Date	12.9.4
Sampling Location	TCO RS SV
Run Number	5
Impinger Box Number	TCO RS
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—		—	766.2	499.0	
2	H ₂ O	100	9/5	729.0	732.1g	
3	—	—	m	632.4g	630.2g	
4	SG	—	m	1013.5g	985.8g	
5						
6				3141.1	2847.1	
7						
8						
9						
10						
Total Weight Gain (g)						294

Corrected

Facility:	CUA	Start Time:	1113
Date:	12/08/2004	End Time:	1313
Location:	HEPA Out	Initial Leak Check:	0.000@10"
Run Number:	1	Final Leak Check:	0.004@7"
Sample Type:	SVOC		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			29.90
Absolute Stack Pressure (in Hg)			29.75
Stack Static Pressure (in H ₂ O)			-2.00
Average Stack Temperature (°F)			174.00
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			45.996
Average Meter Pressure (in H ₂ O)			0.41
Average Meter Temperature (°F)			92.75
Moisture Collected (g)			125.90
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0080
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.369
Standard Metered Volume (dscf)			44.302
Standard Metered Volume (dscm)			1.255
Stack Moisture (%V)			11.82
Mole Fraction Dry Stack Gas			0.882
Dry Molecular Weight			28.84
Wet Molecular Weight			27.56
Stack Gas Velocity (fpm)			2524.77
Stack Gas Velocity (mpm)			769.55
Volumetric Flow Rate (acfm)			249.90
Volumetric Flow Rate (acmm)			7.08
Volumetric Flow Rate (dscfm)			182.49
Volumetric Flow Rate (dscmm)			5.17
Percent Isokinetic			103.88
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	CUA - VSL
Date	12/8/04
Sampling Location	HEPA
Run Number	1 - Semi VOST
Impinger Box Number	
Recovery Person	mugl
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	Bowl	602.4	487.6	
2	H ₂ O	100	G/S	727.2g	727.4	
3	—	—	MOD	632.4	632.4	
4	SILICA gel	250	MOD	986.2g	974.9	
5						
6				2948.2	2822.3	
7						
8						
9						
10						
Total Weight Gain (g)						125.9

Corrected

Facility:	CUA	Start Time:	1457
Date:	12/08/2004	End Time:	1657
Location:	HEPA Out	Initial Leak Check:	0.004@10"
Run Number:	2	Final Leak Check:	0.004@10"
Sample Type:	SVOC		
<i>Test 2</i>			
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			29.90
Absolute Stack Pressure (in Hg)			29.75
Stack Static Pressure (in H ₂ O)			-2.00
Average Stack Temperature (°F)			175.00
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			46.986
Average Meter Pressure (in H ₂ O)			0.39
Average Meter Temperature (°F)			93.50
Moisture Collected (g)			120.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0080
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.377
Standard Metered Volume (dscf)			45.193
Standard Metered Volume (dscm)			1.280
Stack Moisture (%V)			11.14
Mole Fraction Dry Stack Gas			0.889
Dry Molecular Weight			28.84
Wet Molecular Weight			27.63
Stack Gas Velocity (fpm)			2470.76
Stack Gas Velocity (mpm)			753.09
Volumetric Flow Rate (acfm)			244.56
Volumetric Flow Rate (acmm)			6.93
Volumetric Flow Rate (dscfm)			179.66
Volumetric Flow Rate (dscmm)			5.09
Percent Isokinetic			107.63
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

25

HEPA DUT SUCC 2

Run _____
Page 1 of 2

Plant	CWA	Probe Length & Type	20' TFE	Filter Number	NA
Date	12/8/04	Nozzle ID (in.)	0.188	Height of Location (ft)	10
Sampling Location	HEPA OUT	Pilot Constant	0.99 84	Duct Dimensions (in.)	4 (4.26)
Sample Type	SVOC	Meter Box Number	ATB	Stack Geometry (R or C)	C
Run Number	2	Meter ΔH@	1.69	Assume Moisture (%)	10
Operator	WPG	Yd	1.008	O ₂ (%)	20.9
Ambient Temperature	90	K Factor	1.28	CO ₂ (%)	0
Barometric Pressure (in.)	29.9	Probe Heater Setting (°F)	250	Nitrogen (%)	79
Static Pressure (in. H ₂ O)	-2.0	Heater Box Setting (°F)	250	Moisture Collected (g)	120.2
Initial Leak Check	0.004 @ 10"	Final Leak Check	0.004 @ 10"		

(Diagram of Duct)

[illegible]

Plant	CUA-VSC
Date	12-8-1
Sampling Location	HEPA
Run Number	R2 Semi VAST
Impinger Box Number	4 2
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—		—	598.0	489.6	
2	H ₂ O	100	915	718.0g	717.6g	
3	—		m	592.1g	591.7g	
4	Silicabell	250	m	934.0g	923.0g	
5						
6				2842.1	2721.9	
7						
8						
9						
10						
Total Weight Gain (g)						120.2

Corrected

Facility:	CUA	Start Time:	1846
Date:	12/08/2004	End Time:	2046
Location:	HEPA Out	Initial Leak Check:	0.004@10"
Run Number:	3	Final Leak Check:	0.000@10"
Sample Type:	SVOC		
<i>Test 2</i>			
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			29.90
Absolute Stack Pressure (in Hg)			29.75
Stack Static Pressure (in H2O)			-2.00
Average Stack Temperature (°F)			175.25
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			47.069
Average Meter Pressure (in H2O)			0.39
Average Meter Temperature (°F)			93.00
Moisture Collected (g)			123.40
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0080
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.378
Standard Metered Volume (dscf)			45.314
Standard Metered Volume (dscm)			1.283
Stack Moisture (%V)			11.38
Mole Fraction Dry Stack Gas			0.886
Dry Molecular Weight			28.84
Wet Molecular Weight			27.60
Stack Gas Velocity (fpm)			2468.87
Stack Gas Velocity (mpm)			752.51
Volumetric Flow Rate (acfm)			244.37
Volumetric Flow Rate (acmm)			6.92
Volumetric Flow Rate (dscfm)			178.98
Volumetric Flow Rate (dscmm)			5.07
Percent Isokinetic			108.33
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

2. Wert

HepA Out Subc Run 3

(Diagram of Duct)

Read and Record All Data Every _____ Minutes

Plant	VSC
Date	12-8-14
Sampling Location	HEPA
Run Number	3
Impinger Box Number	H 1
Recovery Person	ND
Recovery Rinses	SD/SD Mel / MeSH
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	—	607.0	487.5g	
2	H ₂ O	100	913	726.7g	727.2g	
3	—	—	m	632.3g	632.3g	
4	Silica Gel	250	m	995.6g	986.2g	
5						
6				2956.6	2833.2	
7						
8						
9						
10						
Total Weight Gain (g)						123.4

Corrected

Facility:	CUA	Start Time:	1430
Date:	12/09/2004	End Time:	1630
Location:	HEPA Out	Initial Leak Check:	0.000@15"
Run Number:	4	Final Leak Check:	0.004@8"
Sample Type:	SVOC		
<i>Test 1</i>			
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.09
Absolute Stack Pressure (in Hg)			29.87
Stack Static Pressure (in H ₂ O)			-3.10
Average Stack Temperature (°F)			172.75
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			46.702
Average Meter Pressure (in H ₂ O)			0.38
Average Meter Temperature (°F)			91.54
Moisture Collected (g)			93.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0080
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.378
Standard Metered Volume (dscf)			45.372
Standard Metered Volume (dscm)			1.285
Stack Moisture (%V)			8.87
Mole Fraction Dry Stack Gas			0.911
Dry Molecular Weight			28.84
Wet Molecular Weight			27.87
Stack Gas Velocity (fpm)			2427.51
Stack Gas Velocity (mpm)			739.91
Volumetric Flow Rate (acfm)			240.27
Volumetric Flow Rate (acmm)			6.80
Volumetric Flow Rate (dscfm)			182.37
Volumetric Flow Rate (dscmm)			5.16
Percent Isokinetic			106.46
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

(Diagram of Duct)

Read and Record All Data Every _____ Minutes1315

Plant	VSL
Date	12-9-4
Sampling Location	HEPA SV
Run Number	R4
Impinger Box Number	14421
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KD	—		576.1g	491.0	
2	H ₂ O	100		718.1	717.9	
3	—	—		592.3	592.1	
4	SG	256		942.2g	934.0	
5						
6				2828.7	2735	
7						
8						
9						
10						
Total Weight Gain (g)						93.7

Corrected

Facility:	CUA	Start Time:	1750
Date:	12/09/2004	End Time:	1950
Location:	HEPA Out	Initial Leak Check:	0.008@8"
Run Number:	5	Final Leak Check:	0.010@8"
Sample Type:	SVOC		
<i>Test 1</i>			
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.09
Absolute Stack Pressure (in Hg)			29.87
Stack Static Pressure (in H ₂ O)			-3.10
Average Stack Temperature (°F)			172.42
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			46.283
Average Meter Pressure (in H ₂ O)			0.37
Average Meter Temperature (°F)			92.96
Moisture Collected (g)			93.40
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0080
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.374
Standard Metered Volume (dscf)			44.849
Standard Metered Volume (dscm)			1.270
Stack Moisture (%V)			8.94
Mole Fraction Dry Stack Gas			0.911
Dry Molecular Weight			28.84
Wet Molecular Weight			27.87
Stack Gas Velocity (fpm)			2396.63
Stack Gas Velocity (mpm)			730.49
Volumetric Flow Rate (acfm)			237.22
Volumetric Flow Rate (acmm)			6.72
Volumetric Flow Rate (dscfm)			180.01
Volumetric Flow Rate (dscmm)			5.10
Percent Isokinetic			106.61
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

(Diagram of Duct)

[illegible]

Plant	VSC
Date	12.9.4
Sampling Location	HEPA R5 SV
Run Number	5
Impinger Box Number	Hepa 2
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KO		—	571.7g 766.3	486.3g	
2	H ₂ O	100	G/S	723.6	723.8g	
3	—		m	637.6	637.4	
4	SG	250	m	1003.6	995.6g	
5						
6				2936.5	2843.1	
7						
8						
9						
10						
Total Weight Gain (g)						93.4

corrected

Facility:	CUA	Start Time:	1115
Date:	12/08/2004	End Time:	1415
Location:	Carbon Out	Initial Leak Check:	0.000@10"
Run Number:	1	Final Leak Check:	0.007@7"
Sample Type:	SVOC		
<i>Test 2</i>			
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			29.89
Absolute Stack Pressure (in Hg)			29.31
Stack Static Pressure (in H ₂ O)			-8.00
Average Stack Temperature (°F)			165.11
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			101.432
Average Meter Pressure (in H ₂ O)			0.98
Average Meter Temperature (°F)			93.58
Moisture Collected (g)			306.30
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0248
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.552
Standard Metered Volume (dscf)			99.300
Standard Metered Volume (dscm)			2.812
Stack Moisture (%V)			12.70
Mole Fraction Dry Stack Gas			0.873
Dry Molecular Weight			28.84
Wet Molecular Weight			27.46
Stack Gas Velocity (fpm)			2543.76
Stack Gas Velocity (mpm)			775.34
Volumetric Flow Rate (acfm)			251.78
Volumetric Flow Rate (acmm)			7.13
Volumetric Flow Rate (dscfm)			181.84
Volumetric Flow Rate (dscmm)			5.15
Percent Isokinetic			104.08
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

55

FIELD DATA SHEET

180
1/5

CARBON OUT SUCC 1
Run _____
Page 1 of 1

Plant	CWA	Probe Length & Type	20' TFE	Filter Number	NA
Date	12/8/04	Nozzle ID (in.)	.230	Height of Location (ft)	10'
Sampling Location	Carben out	Pitot Constant	.84	Duct Dimensions (in.)	4"
Sample Type	SVOC	Meter Box Number	ATD	Stack Geometry (R or C)	C
Run Number	1	Meter $\Delta H @$	1.81	Assume Moisture (%)	10
Operator	WPC	Yd	1.0248	O ₂ (%)	20.9
Ambient Temperature	90	K Factor	3.02	CO ₂ (%)	0
Barometric Pressure (in.)	29.9	Probe Heater Setting (°F)	250	Nitrogen (%)	79
Static Pressure (in. H ₂ O)	-8.0	Heater Box Setting (°F)	250	Moisture Collected (g)	306.3
Initial Leak Check	0.0000 10"	Final Leak Check	0.007 07"		

(Diagram of Duct)

[illegible]

MOISTURE RECOVERY FORM FOR METHOD 4

Plant	CVA - VSL
Date	12/8/04
Sampling Location	CARBON - C
Run Number	1 - Semi VOST
Impinger Box Number	
Recovery Person	muyf.
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	Bowls	759.8g	480.4	
2	H ₂ O	100	G/S	664.4g	658.1	
3	—	—	MOD	575.8g	573.3	
4	SILICA gel	250	MOD	1024.3g	1006.2	
5						
6				3024.3	2718	
7						
8						
9						
10						
Total Weight Gain (g)						306 ³

Corrected

Facility:	CUA	Start Time:	1455
Date:	12/08/2004	End Time:	1755
Location:	Carbon Out	Initial Leak Check:	0.006@9"
Run Number:	2	Final Leak Check:	0.004@9"
Sample Type:	SVOC		
<i>Test 2</i>			
Total Sampling Time (min)			180.0
Corrected Barometric Pressure (in Hg)			29.89
Absolute Stack Pressure (in Hg)			29.31
Stack Static Pressure (in H2O)			-8.00
Average Stack Temperature (°F)			169.44
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			99.835
Average Meter Pressure (in H2O)			0.94
Average Meter Temperature (°F)			93.69
Moisture Collected (g)			300.60
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0248
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.543
Standard Metered Volume (dscf)			97.707
Standard Metered Volume (dscm)			2.767
Stack Moisture (%V)			12.67
Mole Fraction Dry Stack Gas			0.873
Dry Molecular Weight			28.84
Wet Molecular Weight			27.46
Stack Gas Velocity (fpm)			2501.61
Stack Gas Velocity (mpm)			762.49
Volumetric Flow Rate (acfm)			247.61
Volumetric Flow Rate (acmm)			7.01
Volumetric Flow Rate (dscfm)			177.66
Volumetric Flow Rate (dscmm)			5.03
Percent Isokinetic			104.82
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Plant	CWA	Probe Length & Type	20' TFE	Filter Number	NA
Date	12/8/04	Nozzle ID (in.)	0.250	Height of Location (ft)	10'
Sampling Location	Carbon Out	Pitot Constant	0.99	Duct Dimensions (in.)	4"
Sample Type	SVOC	Meter Box Number	ATD	Stack Geometry (R or C)	C
Run Number	2	Meter $\Delta H @$	1.81	Assume Moisture (%)	10
Operator	WPG	Yd	1.0248	O ₂ (%)	20.7
Ambient Temperature	90	K Factor	3.02	CO ₂ (%)	0
Barometric Pressure (in.)	29.9	Probe Heater Setting (°F)	250	Nitrogen (%)	79
Static Pressure (in. H ₂ O)	-8.0	Heater Box Setting (°F)	250	Moisture Collected (g)	300.6
Initial Leak Check	0.006 @ 9"	Final Leak Check	0.004 @ 9"		

(Diagram of Duct)

(Diagram of Duct)

[illegible]

Plant	VSL
Date	12.8.4
Sampling Location	Carban
Run Number	R2 Semivost
Impinger Box Number	Carban 2
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	iso	—	—	778.3	499.4	
2	H ₂ O	100	gls	732.2g	731.8g	
3	—	—	m	631.2g	630.2g	
4	Silica Gel	250	m	986.0g	965.7g	
5						
6				3127.7	2827.1	
7						
8						
9						
10						
Total Weight Gain (g)						300.6

Corrected

Facility:	CUA	Start Time:	1844
Date:	12/08/2004	End Time:	2130
Location:	Carbon Out	Initial Leak Check:	0.004@9"
Run Number:	3	Final Leak Check:	0.008@10"
Sample Type:	SVOC		
<i>Test 2</i>			
Total Sampling Time (min)			166.0
Corrected Barometric Pressure (in Hg)			29.89
Absolute Stack Pressure (in Hg)			29.31
Stack Static Pressure (in H2O)			-8.00
Average Stack Temperature (°F)			168.29
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			91.658
Average Meter Pressure (in H2O)			0.93
Average Meter Temperature (°F)			93.79
Moisture Collected (g)			213.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0248
Nozzle Diameter (in)			0.230
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.540
Standard Metered Volume (dscf)			89.688
Standard Metered Volume (dscm)			2.540
Stack Moisture (%V)			10.10
Mole Fraction Dry Stack Gas			0.899
Dry Molecular Weight			28.84
Wet Molecular Weight			27.74
Stack Gas Velocity (fpm)			2465.58
Stack Gas Velocity (mpm)			751.51
Volumetric Flow Rate (acfm)			244.04
Volumetric Flow Rate (acmm)			6.91
Volumetric Flow Rate (dscfm)			180.58
Volumetric Flow Rate (dscmm)			5.11
Percent Isokinetic			102.64
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

AIR/TECH

3

Run 3
Page 1 of 1

Plant	CWA	Probe Length & Type	20' TFE	Filter Number	NA
Date	12/8/04	Nozzle ID (in.)	0.230	Height of Location (ft)	10'
Sampling Location	CARBON OUT	Pitot Constant	0.99	Duct Dimensions (in.)	4
Sample Type	SVOC	Meter Box Number	ATD	Stack Geometry (R or C)	C
Run Number	3	Meter $\Delta H @$	1.81	Assume Moisture (%)	10
Operator	WPK	Yd	1.0248	O ₂ (%)	20.9
Ambient Temperature	90	K Factor	3.02	CO ₂ (%)	0
Barometric Pressure (in.)	29.9	Probe Heater Setting (°F)	250	Nitrogen (%)	79
Static Pressure (in. H ₂ O)	-8.0	Heater Box Setting (°F)	250	Moisture Collected (g)	213.7
Initial Leak Check	0.004 @ 9"	Final Leak Check	0.006 @ 10"		

(Diagram of Duct)

Read and Record All Data Every _____ Minutes

[illegible]

Plant	VSC
Date	12.8.4
Sampling Location	Carbon outlet -
Run Number	3
Impinger Box Number	M1
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	Ko	—	5	682.2	480.9	
2	H ₂ O	100	9/5	662.6	664.4	
3	Ko	—	M	577.6	575.8	
4	SG	250	M	1036.7	1024.3	
5						
6				2959.1	2745.4	
7						
8						
9						
10						
Total Weight Gain (g)						213.7

Appendix B.3

Dioxin/Furan/PCBs

Facility:	CUA	Start Time:	1035
Date:	12/07/2004 - 12/08/2004	End Time:	1235
Location:	Melter	Initial Leak Check:	0.00@13"
Run Number:	1	Final Leak Check:	0.002@12"
Sample Type:	CDD/CDF/PCB		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			29.96
Absolute Stack Pressure (in Hg)			29.63
Stack Static Pressure (in H2O)			-4.50
Average Stack Temperature (°F)			342.00
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			45.248
Average Meter Pressure (in H2O)			0.44
Average Meter Temperature (°F)			93.17
Moisture Collected (g)			252.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.367
Standard Metered Volume (dscf)			44.054
Standard Metered Volume (dscm)			1.248
Stack Moisture (%V)			21.26
Mole Fraction Dry Stack Gas			0.787
Dry Molecular Weight			28.84
Wet Molecular Weight			26.53
Stack Gas Velocity (fpm)			3942.36
Stack Gas Velocity (mpm)			1201.63
Volumetric Flow Rate (acfm)			344.04
Volumetric Flow Rate (acmm)			9.74
Volumetric Flow Rate (dscfm)			176.61
Volumetric Flow Rate (dscmm)			5.00
Percent Isokinetic			94.10
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run Defrag - 0001
Page 1 of 1

(Diagram of Duct)

Read and Record All Data Every Minutes

Plant	VSL
Date	12.7.4
Sampling Location	Melter
Run Number	1 Dioxin/Furan
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KO		—	623.8 (578.2 w/o cap)	398.8g	
2	NO/2.74 H ₂ O KO		2/s	564.7	564.6g	
3	NO/2.74 H ₂ O KO		M	573.1	573.0	
4	SG			1005.8	988.8g	
5						
6				2117.4	2525.2	
7						
8						
9						
10						
Total Weight Gain (g)						252.2

Facility:	CUA	Start Time:	0200
Date:	12/08/2004	End Time:	0400
Location:	Melter	Initial Leak Check:	.01@20"
Run Number:	2	Final Leak Check:	.001@20"
Sample Type:	CDD/CDF/PCB		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			29.59
Absolute Stack Pressure (in Hg)			29.26
Stack Static Pressure (in H ₂ O)			-4.50
Average Stack Temperature (°F)			341.17
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			46.812
Average Meter Pressure (in H ₂ O)			0.45
Average Meter Temperature (°F)			93.75
Moisture Collected (g)			272.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.375
Standard Metered Volume (dscf)			44.972
Standard Metered Volume (dscm)			1.274
Stack Moisture (%V)			22.20
Mole Fraction Dry Stack Gas			0.778
Dry Molecular Weight			28.84
Wet Molecular Weight			26.43
Stack Gas Velocity (fpm)			4014.45
Stack Gas Velocity (mpm)			1223.60
Volumetric Flow Rate (acfm)			350.33
Volumetric Flow Rate (acmm)			9.92
Volumetric Flow Rate (dscfm)			175.65
Volumetric Flow Rate (dscmm)			4.97
Percent Isokinetic			96.59
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run _____
Page _____ of _____

(Diagram of Duct)

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~~ORP-51444, Rev. 0~~

Plant	VSL
Date	12-7-4
Sampling Location	Melter
Run Number	R2
Impinger Box Number	2 Dioxin / Furan
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KO	—	—	756.7	498.0	258.7
2	KO	—	GLS	634.2	633.9g	.3
3	KO	—	M	625.9	625.8g	.1
4	SG	—	M	974.5	961.4g	13.1
5						
6				2991.3	2719.1	
7						
8						
9						
10						
Total Weight Gain (g)						272.2

Facility:	CUA	Start Time:	1343
Date:	12/10/2004	End Time:	1543
Location:	Melter Out	Initial Leak Check:	0.00@13"
Run Number:	3	Final Leak Check:	0.002@14"
Sample Type:	Dioxin		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.09
Absolute Stack Pressure (in Hg)			29.73
Stack Static Pressure (in H ₂ O)			-5.00
Average Stack Temperature (°F)			529.42
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			59.335
Average Meter Pressure (in H ₂ O)			0.77
Average Meter Temperature (°F)			98.88
Moisture Collected (g)			639.50
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.479
Standard Metered Volume (dscf)			57.481
Standard Metered Volume (dscm)			1.628
Stack Moisture (%V)			34.41
Mole Fraction Dry Stack Gas			0.656
Dry Molecular Weight			28.84
Wet Molecular Weight			25.11
Stack Gas Velocity (fpm)			6230.20
Stack Gas Velocity (mpm)			1898.97
Volumetric Flow Rate (acfm)			543.69
Volumetric Flow Rate (acmm)			15.40
Volumetric Flow Rate (dscfm)			189.03
Volumetric Flow Rate (dscmm)			5.35
Percent Isokinetic			114.71
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run 3
Page of

(Diagram of Duct)

**Read and Record All Data Every
Minutes**

Plant	VSL
Date	12/10/04
Sampling Location	Melter
Run Number	R3
Impinger Box Number	Melter Dioxin 1
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—		—	1159.0	489.3	
2	H ₂ O	100	GS	667.9	717.9	
3	—	—	MGS	592.3 637.1g	591.9	
4	SG	~250	MGS	963.5 973.3	948.7	
5						
6				3437.3	2797.8	
7						
8						
9						
10						
Total Weight Gain (g)						639.5

Facility:	CUA	Start Time:	1723
Date:	12/10/2004	End Time:	1923
Location:	Melter Out	Initial Leak Check:	0.000@13"
Run Number:	4	Final Leak Check:	0.000@8"
Sample Type:	Dioxin		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.09
Absolute Stack Pressure (in Hg)			29.73
Stack Static Pressure (in H ₂ O)			-5.00
Average Stack Temperature (°F)			552.08
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			51.545
Average Meter Pressure (in H ₂ O)			0.58
Average Meter Temperature (°F)			98.88
Moisture Collected (g)			559.10
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.416
Standard Metered Volume (dscf)			49.913
Standard Metered Volume (dscm)			1.414
Stack Moisture (%V)			34.56
Mole Fraction Dry Stack Gas			0.654
Dry Molecular Weight			28.84
Wet Molecular Weight			25.09
Stack Gas Velocity (fpm)			5544.07
Stack Gas Velocity (mpm)			1689.83
Volumetric Flow Rate (acfm)			483.81
Volumetric Flow Rate (acmm)			13.70
Volumetric Flow Rate (dscfm)			164.06
Volumetric Flow Rate (dscmm)			4.65
Percent Isokinetic			114.77
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run 4
Page of

(Diagram of Duct)

Read and Record All Data Every _____ Minutes

Plant	12.104 VSC
Date	12.10.4
Sampling Location	Melter
Run Number	Dioxin / Furan RZ/4
Impinger Box Number	Melter-2
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	K ₂ O	—	—	941.5	410.7	
2	H ₂ O	100	gls	731.0g	716.6	
3	—	—	m	607.1g	607.3g	
4	Sb	N ₂ SO	m	969.7g	955.6g	
5						
6				3249.3	2690.2	
7						
8						
9						
10						
Total Weight Gain (g)						559.1

Facility:	CUA	Start Time:	1943
Date:	12/07/2004	End Time:	2143
Location:	TCO	Initial Leak Check:	0.004@10"
Run Number:	1	Final Leak Check:	0.004@15"
Sample Type:	Dioxin/PCB		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			29.59
Absolute Stack Pressure (in Hg)			28.71
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			556.58
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			101.903
Average Meter Pressure (in H ₂ O)			1.96
Average Meter Temperature (°F)			95.50
Moisture Collected (g)			287.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.801
Standard Metered Volume (dscf)			96.177
Standard Metered Volume (dscm)			2.724
Stack Moisture (%V)			12.34
Mole Fraction Dry Stack Gas			0.877
Dry Molecular Weight			28.84
Wet Molecular Weight			27.50
Stack Gas Velocity (fpm)			4520.90
Stack Gas Velocity (mpm)			1377.97
Volumetric Flow Rate (acfm)			445.38
Volumetric Flow Rate (acmm)			12.61
Volumetric Flow Rate (dscfm)			194.54
Volumetric Flow Rate (dscmm)			5.51
Percent Isokinetic			103.61
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

(Diagram of Duct)

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Onifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
1	10	19.43	444.512	0.10	1.92	564	263	256	92	88	52	9
1	20		441.11	0.101	1.9	564	263	258	96	89	50	9
1	30		440.85	0.102	2.0	564	261	257	98	90	48	10
1	40		438.4	0.102	2.0	565	263	256	98	91	47	10
1	50		436.85	0.102	2.0	565	263	256	99	92	47	10
1	60		435.54	0.102	2.0	565	263	256	99	93	50	10
1	70		504.11	0.102	2.0	565	263	255	100	93	51	10
1	80		512.78	0.105	2.1	534	262	256	100	94	51	10
1	90		521.22	0.101	1.9	534	263	257	100	94	53	10
1	100		529.63	0.101	1.9	534	263	257	100	95	55	10
1	110	538.05	538.05	0.101	1.9	564	263	257	100	95	55	10
1	120	541.43	546.415	0.100	1.9	561	263	256	101	95	60	10

Plant	USL
Date	12.7.4
Sampling Location	TCO
Run Number	1
Impinger Box Number	1 Dickinson / Furan
Recovery Person	WCG
Recovery Rinses	Meth / Toluene
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KO	—		766.5	499.7	
2	KO	—		560.4	560.9	
3	KO	—		609.5	609.1g	
4	SG	—		1017.0	996.5g	
5						
6				2953.4	2666.2	
7						
8						
9						
10						
Total Weight Gain (g)						287.2

Facility:	CUA	Start Time:	1030
Date:	12/07/2004 - 12/08/04	End Time:	1230
Location:	TCO	Initial Leak Check:	.01@10"
Run Number:	2	Final Leak Check:	.001@20"
Sample Type:	Dioxin/PCB		
Total Sampling Time (min)	120.0		
Corrected Barometric Pressure (in Hg)	29.59		
Absolute Stack Pressure (in Hg)	28.71		
Stack Static Pressure (in H ₂ O)	-12.00		
Average Stack Temperature (°F)	368.00		
Stack Area (sq in)	14.19		
Actual Meter Volume (cu ft)	101.387		
Average Meter Pressure (in H ₂ O)	1.95		
Average Meter Temperature (°F)	97.21		
Moisture Collected (g)	287.00		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	0.9990		
Nozzle Diameter (in)	0.268		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.795		
Standard Metered Volume (dscf)	95.389		
Standard Metered Volume (dscm)	2.701		
Stack Moisture (%V)	12.42		
Mole Fraction Dry Stack Gas	0.876		
Dry Molecular Weight	28.84		
Wet Molecular Weight	27.49		
Stack Gas Velocity (fpm)	4061.34		
Stack Gas Velocity (mpm)	1237.90		
Volumetric Flow Rate (acfm)	400.11		
Volumetric Flow Rate (acmm)	11.33		
Volumetric Flow Rate (dscfm)	214.38		
Volumetric Flow Rate (dscmm)	6.07		
Percent Isokinetic	93.25		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

FIELD DATA SHEET

Plant	CWA	Probe Length & Type	20' TFE	Filter Number	NA
Date	12-07-04	Nozzle ID (in.)	0.268	Height of Location (ft)	10'
Sampling Location	TCO	Pitot Constant	0.99	Duct Dimensions (in.)	4.26"
Sample Type	Dioxin/PCB	Meter Box Number	ATC	Stack Geometry (R or C)	C
Run Number	2	Meter ΔH@	1.6719	Assume Moisture (%)	25.10
Operator	MULL.	Yd	0.999	O ₂ (%)	20.9
Ambient Temperature	90	K Factor	3.20	CO ₂ (%)	0
Barometric Pressure (in.)	30.29.60	Probe Heater Setting (°F)	250 ± 25	Nitrogen (%)	29.179.1
Static Pressure (in. H ₂ O)	-12	Heater Box Setting (°F)	250 ± 25	Moisture Collected (g)	287
Initial Leak Check	101 @ 10"	Final Leak Check	101 @ 20"		

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

[illegible]

Plant	VSL
Date	12-7-4
Sampling Location	TCO outlet
Run Number	2
Impinger Box Number	2 Dioxin/Furan (Green)
Recovery Person	WPG
Recovery Rinses	MeCl / Toluene
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KO	—	—	749.4 766.5	482.4	
2	KO	—	9/8	631.7	631.1g	
3	KO	—	m	632.0	632.1g	
4	SG	—	m	978.6	959.1g	
5						
6				2991.7	2704.7	
7						
8						
9						
10						
Total Weight Gain (g)						287

Facility:	CUA	Start Time:	204
Date:	12/08/2004	End Time:	404
Location:	TCO	Initial Leak Check:	.01@20"
Run Number:	3	Final Leak Check:	.001@20"
Sample Type:	Dioxin/PCB		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			29.59
Absolute Stack Pressure (in Hg)			28.71
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			368.33
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			102.888
Average Meter Pressure (in H ₂ O)			1.95
Average Meter Temperature (°F)			95.75
Moisture Collected (g)			284.10
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.809
Standard Metered Volume (dscf)			97.051
Standard Metered Volume (dscm)			2.748
Stack Moisture (%V)			12.13
Mole Fraction Dry Stack Gas			0.879
Dry Molecular Weight			28.84
Wet Molecular Weight			27.52
Stack Gas Velocity (fpm)			3958.82
Stack Gas Velocity (mpm)			1206.65
Volumetric Flow Rate (acfm)			390.01
Volumetric Flow Rate (acmm)			11.04
Volumetric Flow Rate (dscfm)			209.59
Volumetric Flow Rate (dscmm)			5.94
Percent Isokinetic			97.04
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Run _____ of _____
Page _____ of _____

Plant	CUPA-1200	Probe Length & Type	20' TFE	Filter Number	
Date	12/8/04	Nozzle ID (in.)	.268	Height of Location (ft)	0
Sampling Location	TCO	Pitot Constant	.99	Duct Dimensions (in.)	4.25"
Sample Type	Diox in / PCB	Meter Box Number	ATC	Stack Geometry (R or C)	C
Run Number	3	Meter ΔH@	1.67	Assume Moisture (%)	10
Operator	MWU	Yd	0.999	O ₂ (%)	20.9
Ambient Temperature	90	K Factor	3.20	CO ₂ (%)	0
Barometric Pressure (in.)	29.60	Probe Heater Setting (°F)	250	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-12.0"	Heater Box Setting (°F)	250	Moisture Collected (g)	284.1
Initial Leak Check	.01 @ 20"	Final Leak Check	.001 @ 20"		

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
0	0	2:04	649.52	.61	1.95	366	235	237	93	92	68	7.0
10	10	2:14	657.91	.61	1.95	366	264	258	96	92	52	7.0
20	20	2:24	664.8	.61	1.95	366	251	256	98	93	52	7.0
30	30	2:34	672.9	.61	1.95	366	251	250	98	93	52	7.0
40	40	2:44	680.8	.61	1.95	368	250	251	98	94	52	7.0
50	50	2:54	690.7	.61	1.95	368	251	251	99	94	54	7.0
60	60	3:04	699.4	.61	1.95	368	251	251	99	94	50	7.0
70	70	3:14	708.4	.61	1.95	368	251	250	99	94	49	7.0
80	80	3:24	716.9	.61	1.95	368	251	251	99	94	48	7.0
90	90	3:34	725.8	.61	1.95	371	251	250	99	94	49	7.0
100	100	3:44	734.7	.61	1.95	371	251	251	99	94	49	7.0
110	110	3:54	743.5	.61	1.95	371	251	251	99	94	51	7.0
120	120	4:04	752.408	.60	1.92	371	251	251	99	94	51	7.0

Plant	VSL
Date	12/7/04
Sampling Location	TCO
Run Number	3
Impinger Box Number	TCO Dioxin/Furan
Recovery Person	WEG
Recovery Rinses	Acetone/MeCl/Toluene
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KO			765.6	502.7	
2	KO			560.3	560.3	
3	KO			610.0	609.3	
4	SG			959.2	938.7	
5						
6				2895.1	2611	
7						
8						
9						
10						
Total Weight Gain (g)						284.1

Facility:	CUA	Start Time:	1100
Date:	12/10/2004	End Time:	1300
Location:	TCO	Initial Leak Check:	0.006@12"
Run Number:	4	Final Leak Check:	0.002@6.5"
Sample Type:	Dioxin/PCB		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.09
Absolute Stack Pressure (in Hg)			29.21
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			550.50
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			95.790
Average Meter Pressure (in H ₂ O)			1.86
Average Meter Temperature (°F)			99.71
Moisture Collected (g)			266.80
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.760
Standard Metered Volume (dscf)			91.212
Standard Metered Volume (dscm)			2.583
Stack Moisture (%V)			12.12
Mole Fraction Dry Stack Gas			0.879
Dry Molecular Weight			28.84
Wet Molecular Weight			27.52
Stack Gas Velocity (fpm)			4373.13
Stack Gas Velocity (mpm)			1332.93
Volumetric Flow Rate (acfm)			430.82
Volumetric Flow Rate (acmm)			12.20
Volumetric Flow Rate (dscfm)			193.09
Volumetric Flow Rate (dscmm)			5.47
Percent Isokinetic			98.99
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

2 hr

FIELD DATA SHEET

Run 4
Page of

Plant	CWA	Probe Length & Type	20' TFE	Filter Number	
Date	12-10-04	Nozzle ID (in.)	268	Height of Location (ft)	10'
Sampling Location	TOC	Pitot Constant	.99	Duct Dimensions (in.)	4.25"
Sample Type	Dioxin	Meter Box Number	ATC	Stack Geometry (R or C)	C
Run Number	4	Meter ΔH @	1.6719	Assume Moisture (%)	10
Operator	HFE	Yd	0.999	O ₂ (%)	20.9
Ambient Temperature	90	K Factor	3.1	CO ₂ (%)	0
Barometric Pressure (in.)	30.1	Probe Heater Setting (°F)	250 ± 25	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-12	Heater Box Setting (°F)	250 ± 25	Moisture Collected (g)	266.8
Initial Leak Check	0.006 @ 12"	Final Leak Check	0.002 @ 6.5"		

(Diagram of Duct)

Changed to Because of
Drop in Stack Temp

Read and Record All Data Every 10 Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	0	11:00	883.500	0.106	2.0	5100	225	225	96	95	562	4
	10		891.500	0.105	2.0	560	230	230	100	95	48	5
	20		899.01	0.101	1.9	5100	251	254	102	96	49	5
	30		901.6	0.101	1.9	557	265	267	103	97	53	5
	40		914.1	0.101	1.7	557	275	267	103	98	48	5
	50		921.98	0.154	1.7	557	208	267	103	98	49	5
	60		928.95	0.150	1.7	549	256	268	103	98	51	5
K=3.2	70		938.06	0.155	1.8	549	255	268	103	98	55	5
	80		945.07	0.41	1.3	549	255	267	103	98	57	5
	90		954.25	0.088	2.2	536	255	268	104	98	56	5
	100		962.77	0.105	2.0	536	255	268	103	98	59	5
	110		971.00	0.59	1.9	536	255	268	103	98	61	5
	120	13:00	979.29	0.100	1.9	536	255	269	103	98		5

MOISTURE RECOVERY FORM FOR METHOD 4

Plant	VSL
Date	12/10/04
Sampling Location	TCO R4
Run Number	4 - Dioxin
Impinger Box Number	TCO - Dioxin 4
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	—	735.0g	486.3	
2	H ₂ O	100	GS	722.2g	723.2	
3	—	—	MGS	637.1	636.6	
4	SG	~250	MGS	973.3	954.7	
5						
6				3867.6	2800.8	
7						
8						
9						
10						
Total Weight Gain (g)						266.8

Facility:	CUA	Start Time:	1349
Date:	12/10/2004	End Time:	1549
Location:	TCO	Initial Leak Check:	0.004@6"
Run Number:	5	Final Leak Check:	0.000@14"
Sample Type:	Dioxin/PCB		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.09
Absolute Stack Pressure (in Hg)			29.21
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			553.00
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			101.235
Average Meter Pressure (in H ₂ O)			1.95
Average Meter Temperature (°F)			100.83
Moisture Collected (g)			294.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.802
Standard Metered Volume (dscf)			96.224
Standard Metered Volume (dscm)			2.725
Stack Moisture (%V)			12.62
Mole Fraction Dry Stack Gas			0.874
Dry Molecular Weight			28.84
Wet Molecular Weight			27.47
Stack Gas Velocity (fpm)			4494.52
Stack Gas Velocity (mpm)			1369.93
Volumetric Flow Rate (acfm)			442.78
Volumetric Flow Rate (acmm)			12.54
Volumetric Flow Rate (dscfm)			196.84
Volumetric Flow Rate (dscmm)			5.57
Percent Isokinetic			102.45
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

(Diagram of Duct)

X0
54
54
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54
49
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48

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Plant	VSL
Date	12.10.4
Sampling Location	TCO Dioxin / Furan R5
Run Number	5
Impinger Box Number	TCO-2
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	—	—	—	758.4	484.4	
2	H ₂ O	100	9/s	662.5g	667.4 778.1	
3	—	—	m	613.5	611.7g 667.	
4	SG	~250	m	961.1	937.3g	
5						
6				2995.5	2700.8	
7						
8						
9						
10						
Total Weight Gain (g)						294.7

Facility:	CUA	Start Time:	1715
Date:	12/10/2004	End Time:	1915
Location:	TCO	Initial Leak Check:	0.01@15"
Run Number:	6	Final Leak Check:	0.01@15"
Sample Type:	Dioxin/PCB		
Total Sampling Time (min)			120.0
Corrected Barometric Pressure (in Hg)			30.09
Absolute Stack Pressure (in Hg)			29.21
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			551.33
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			97.215
Average Meter Pressure (in H2O)			1.77
Average Meter Temperature (°F)			99.63
Moisture Collected (g)			270.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.771
Standard Metered Volume (dscf)			92.563
Standard Metered Volume (dscm)			2.621
Stack Moisture (%V)			12.12
Mole Fraction Dry Stack Gas			0.879
Dry Molecular Weight			28.84
Wet Molecular Weight			27.52
Stack Gas Velocity (fpm)			4229.20
Stack Gas Velocity (mpm)			1289.06
Volumetric Flow Rate (acfm)			416.64
Volumetric Flow Rate (acmm)			11.80
Volumetric Flow Rate (dscfm)			186.59
Volumetric Flow Rate (dscmm)			5.28
Percent Isokinetic			103.96
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Plant	CUA	Probe Length & Type	20' TFE	Filter Number	
Date	12-10-04	Nozzle ID (in.)	268	Height of Location (ft)	10'
Sampling Location	Tco	Pilot Constant	.99	Duct Dimensions (in.)	4.25"
Sample Type	Dioxin	Meter Box Number	ATC	Stack Geometry (R or C)	C
Run Number	6	Meter $\Delta H @$	1.6719	Assume Moisture (%)	10
Operator	HFF	Yd	.999	O ₂ (%)	20.9
Ambient Temperature	90	K Factor	3.2	CO ₂ (%)	0
Barometric Pressure (in.)	30.1	Probe Heater Setting (°F)	250 ± 25	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-12	Heater Box Setting (°F)	250 ± 25	Moisture Collected (g)	270.7
Initial Leak Check	0.0117	Final Leak Check	0.0117		

(Diagram of Duct)

Read and Record All Data Every Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
0	10	17:15	088.48	1.8	1.8	560	267	252	98	92	57	6
20	30		104.53	0.55	1.8	555	267	251	100	95	53	6
30	40		113.00	0.55	1.8	555	267	254	102	96	51	6
40	50		120.70	0.54	1.7	555	267	254	102	96	51	6
50	60		128.62	0.54	1.7	555	267	254	103	97	51	6
60	70		136.99	0.55	1.8	555	267	255	103	98	51	7
70	80		145.07	0.54	1.7	555	267	254	103	98	51	7
80	90		153.07	0.54	1.7	555	267	255	103	98	57	7
90	100		161.13	0.54	1.7	555	267	255	103	98	58	7
100	110		169.35	0.55	1.8	555	267	256	103	99	59	6
110	120		177.75	0.54	1.9	550	267	258	103	99	59	6
120		19:15	185.695	0.54	1.8	511	268	255	103	99	60	6

Plant	VSL
Date	12.10.4
Sampling Location	TCO D/F R6
Run Number	6
Impinger Box Number	
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	KO	—	—	739.2g	489.6	
2	H ₂ O	100	g/s	719.1g	722.2	
3	—	—	m	637.8g	637.1	
4	SG	~250	m	996.8g	973.3	
5						
6				3092.9	2822.2	
7						
8						
9						
10						
Total Weight Gain (g)						270.7

Appendix B.4

Metals

Facility:	CUA	Start Time:	1027
Date:	12/09/2004	End Time:	1127
Location:	Melter Out	Initial Leak Check:	0.000@14"
Run Number:	1	Final Leak Check:	.001@16"
Sample Type:	Metals		
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	29.60		
Absolute Stack Pressure (in Hg)	29.23		
Stack Static Pressure (in H ₂ O)	-5.00		
Average Stack Temperature (°F)	425.17		
Stack Area (sq in)	12.57		
Actual Meter Volume (cu ft)	21.912		
Average Meter Pressure (in H ₂ O)	0.42		
Average Meter Temperature (°F)	93.75		
Moisture Collected (g)	185.30		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	1.0175		
Nozzle Diameter (in)	0.188		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.351		
Standard Metered Volume (dscf)	21.054		
Standard Metered Volume (dscm)	0.596		
Stack Moisture (%V)	29.33		
Mole Fraction Dry Stack Gas	0.707		
Dry Molecular Weight	28.84		
Wet Molecular Weight	25.66		
Stack Gas Velocity (fpm)	4118.96		
Stack Gas Velocity (mpm)	1255.46		
Volumetric Flow Rate (acfm)	359.45		
Volumetric Flow Rate (acmm)	10.18		
Volumetric Flow Rate (dscfm)	148.01		
Volumetric Flow Rate (dscmm)	4.19		
Percent Isokinetic	107.32		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

FIELD DATA SHEET

(Diagram of Duct)

~~ORP-51444, Rev. 0~~

Plant	VSC
Date	12.9.4 Melter
Sampling Location	Melter Metals
Run Number	1 NO 12.9.4
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ O ₂ /HNO ₃	100	m	839.1	709.0	130
2	H ₂ O ₂ /HNO ₃	100	gls	760.7	729.3	31.4
3	—	—	m	630.4	618.9	11.5
4	SG	—	m	949.1	937.1	172.9
5						
6				3179.6	2994.3	
7						
8						
9						
10						
Total Weight Gain (g)						185.3

172.9
+ 200.0
372.9

358.3

Facility:	CUA	Start Time:	1220
Date:	12/10/2004	End Time:	1320
Location:	Melter Out	Initial Leak Check:	0.0@14"
Run Number:	2	Final Leak Check:	.001@14"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.60
Absolute Stack Pressure (in Hg)			29.23
Stack Static Pressure (in H ₂ O)			-5.00
Average Stack Temperature (°F)			447.83
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			23.045
Average Meter Pressure (in H ₂ O)			0.45
Average Meter Temperature (°F)			95.42
Moisture Collected (g)			290.90
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.368
Standard Metered Volume (dscf)			22.077
Standard Metered Volume (dscm)			0.625
Stack Moisture (%V)			38.32
Mole Fraction Dry Stack Gas			0.617
Dry Molecular Weight			28.84
Wet Molecular Weight			24.68
Stack Gas Velocity (fpm)			4444.81
Stack Gas Velocity (mpm)			1354.78
Volumetric Flow Rate (acfm)			387.88
Volumetric Flow Rate (acmm)			10.98
Volumetric Flow Rate (dscfm)			135.92
Volumetric Flow Rate (dscmm)			3.85
Percent Isokinetic			122.56
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run _____ of _____

(Diagram of Duct)

~~ORP-51444 Rev. 0~~

Plant	VSL
Date	12-9-4
Sampling Location	Melter R2
Run Number	2
Impinger Box Number	M-29
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ O ₂ /HNO ₃			893.2	735.6g	157.6
2	H ₂ O ₂ /HNO ₃			809.3	681.3g	128.0
3	Kb			625.5	624.4g	1.1
4	SG			969.4	965.2g	286.70
5						
6				3297.4	3006.5	
7						
8						
9						
10						
Total Weight Gain (g)						296.9

Facility:	CUA	Start Time:	210
Date:	12/10/2004	End Time:	310
Location:	Melter Out	Initial Leak Check:	.00@23"
Run Number:	3	Final Leak Check:	.02@8"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.60
Absolute Stack Pressure (in Hg)			29.23
Stack Static Pressure (in H2O)			-5.00
Average Stack Temperature (°F)			426.67
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			23.663
Average Meter Pressure (in H2O)			0.47
Average Meter Temperature (°F)			95.42
Moisture Collected (g)			209.60
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.378
Standard Metered Volume (dscf)			22.670
Standard Metered Volume (dscm)			0.642
Stack Moisture (%V)			30.36
Mole Fraction Dry Stack Gas			0.696
Dry Molecular Weight			28.84
Wet Molecular Weight			25.55
Stack Gas Velocity (fpm)			4318.67
Stack Gas Velocity (mpm)			1316.33
Volumetric Flow Rate (acfm)			376.88
Volumetric Flow Rate (acmm)			10.67
Volumetric Flow Rate (dscfm)			152.66
Volumetric Flow Rate (dscmm)			4.32
Percent Isokinetic			112.04
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

Plant	
Date	12/10/04
Sampling Location	Melter
Run Number	3
Impinger Box Number	Melter R1
Recovery Person	weg
Recovery Rinses	0.1 N HNO ₃
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	5% HNO ₃ 10% H ₂ O ₂	100	M&S	889.7	710.4	179.3
2	5% HNO ₃ 10% H ₂ O ₂	100	GS	703.8	684.1	19.7
3	—	—	M&S	623.1	621.6	1.5
4	3.6 _i	~250	M&S	926.9	920.5	200.5
5						
6				3146.5	2936.6	
7						
8						
9						
10						
Total Weight Gain (g)						209.6

Facility:	CUA	Start Time:	901
Date:	12/11/2004	End Time:	1001
Location:	Melter Out	Initial Leak Check:	0.000@13"
Run Number:	4	Final Leak Check:	0.000@6"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.10
Absolute Stack Pressure (in Hg)			29.73
Stack Static Pressure (in H ₂ O)			-5.00
Average Stack Temperature (°F)			559.00
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			28.780
Average Meter Pressure (in H ₂ O)			0.78
Average Meter Temperature (°F)			99.75
Moisture Collected (g)			338.20
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.464
Standard Metered Volume (dscf)			27.841
Standard Metered Volume (dscm)			0.788
Stack Moisture (%V)			36.42
Mole Fraction Dry Stack Gas			0.636
Dry Molecular Weight			28.84
Wet Molecular Weight			24.89
Stack Gas Velocity (fpm)			6404.29
Stack Gas Velocity (mpm)			1952.03
Volumetric Flow Rate (acfm)			558.88
Volumetric Flow Rate (acmm)			15.83
Volumetric Flow Rate (dscfm)			182.92
Volumetric Flow Rate (dscmm)			5.18
Percent Isokinetic			114.84
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run _____
Page _____ of _____

(Diagram of Duct)

[illegible]

Plant	VSL
Date	10/12/11/8
Sampling Location	Melter
Run Number	Metals - 4
Impinger Box Number	Melt
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	072004-29
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ O ₂ /HNO ₃	119.1	MGS	1007.2g	611.7 / 730.8	276.4
2	H ₂ O ₂ /HNO ₃	127.2	GS	757.6g	580.3 / 707.5	50.1
3	MT		MGS	607.9g	605.2	2.7
4	Silica Gel		MGS	921.0g	912.0	329.2
5						
6				3293.7	2955.5	
7						
8						
9						
10						
Total Weight Gain (g)						338.2

Facility:	CUA	Start Time:	1051
Date:	12/11/2004	End Time:	1151
Location:	Melter Out	Initial Leak Check:	0.000@10"
Run Number:	5	Final Leak Check:	0.000@8"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.10
Absolute Stack Pressure (in Hg)			29.73
Stack Static Pressure (in H ₂ O)			-5.00
Average Stack Temperature (°F)			586.67
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			28.830
Average Meter Pressure (in H ₂ O)			0.71
Average Meter Temperature (°F)			98.92
Moisture Collected (g)			356.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.465
Standard Metered Volume (dscf)			27.926
Standard Metered Volume (dscm)			0.791
Stack Moisture (%V)			37.54
Mole Fraction Dry Stack Gas			0.625
Dry Molecular Weight			28.84
Wet Molecular Weight			24.77
Stack Gas Velocity (fpm)			6376.17
Stack Gas Velocity (mpm)			1943.46
Volumetric Flow Rate (acfm)			556.43
Volumetric Flow Rate (acmm)			15.76
Volumetric Flow Rate (dscfm)			174.17
Volumetric Flow Rate (dscmm)			4.93
Percent Isokinetic			120.98
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	CUA	Probe Length & Type	20' TFE	Filter Number	
Date	12-11-04	Nozzle ID (in.)	.188	Height of Location (ft)	
Sampling Location	metal/fer out	Pitot Constant	.99	Duct Dimensions (in.)	
Sample Type	metals	Meter Box Number	ATA	Stack Geometry (R or C)	C
Run Number	23	Meter $\Delta H @$	1.0282	Assume Moisture (%)	21
Operator	HFG	Yd	1.0175	O ₂ (%)	20.7
Ambient Temperature	90	K Factor	0.67	CO ₂ (%)	0
Barometric Pressure (in.)	30.1	Probe Heater Setting (°F)	250 $\pm$ 25	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-5	Heater Box Setting (°F)	250 $\pm$ 25	Moisture Collected (g)	356
Initial Leak Check	0.000 (D) 10"	Final Leak Check	0.000 (D) 8"		

Exchanged Due to increase in stack temp.

(Diagram of Duct)

[illegible]

Plant	VSL
Date	12/11/4
Sampling Location	MELTER
Run Number	M2A-5
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ O ₂ / H ₂ O ₃	107.4	MGS	960.4	620.7 / 728.1	232.3
2	↓	184.6	GS	818.5g	584.6 / 709.2	109.3
3	WT		MGS	610.3g	606.2	4.1
4	Solua Gel		MGS	843.3g	833.0	345.3
5						
6				3232.5	2876.5	
7						
8						
9						
10						
Total Weight Gain (g)						356

Facility:	CUA	Start Time:	1234
Date:	12/11/2004	End Time:	1334
Location:	Melter Out	Initial Leak Check:	0.000@10"
Run Number:	6	Final Leak Check:	0.000@6"
Sample Type:	Metals		
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	30.10		
Absolute Stack Pressure (in Hg)	29.73		
Stack Static Pressure (in H ₂ O)	-5.00		
Average Stack Temperature (°F)	553.33		
Stack Area (sq in)	12.57		
Actual Meter Volume (cu ft)	30.935		
Average Meter Pressure (in H ₂ O)	0.69		
Average Meter Temperature (°F)	99.50		
Moisture Collected (g)	371.50		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	1.0175		
Nozzle Diameter (in)	0.188		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.499		
Standard Metered Volume (dscf)	29.933		
Standard Metered Volume (dscm)	0.848		
Stack Moisture (%V)	36.92		
Mole Fraction Dry Stack Gas	0.631		
Dry Molecular Weight	28.84		
Wet Molecular Weight	24.84		
Stack Gas Velocity (fpm)	6309.56		
Stack Gas Velocity (mpm)	1923.15		
Volumetric Flow Rate (acfm)	550.61		
Volumetric Flow Rate (acmm)	15.59		
Volumetric Flow Rate (dscfm)	179.80		
Volumetric Flow Rate (dscmm)	5.09		
Percent Isokinetic	125.61		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

Run 3

(Diagram of Duct)

~~ORP-51444-Rev: 0~~

Plant	VSL
Date	12.11.4
Sampling Location	Melter
Run Number	Metals Co
Impinger Box Number	Melter
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ O ₂ /HNO ₃	93.7	M	6026.9	617.2 / 710.9	316.0
2	H ₂ O ₂ /HNO ₃	95.7	Qls	734.5g	595.4 / 691.1	43.4
3	MT		M	613.7g	610.3	3.4
4	SG		M	929.7g	921.0	352.8
5						
6				3304.8	2933.3	
7						
8						
9						
10						
Total Weight Gain (g)						371.5

Facility:	CUA	Start Time:	1030
Date:	12/09/2004	End Time:	1130
Location:	TCO	Initial Leak Check:	0.006@16"
Run Number:	1	Final Leak Check:	0.000@17"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.60
Absolute Stack Pressure (in Hg)			28.72
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			589.50
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			47.020
Average Meter Pressure (in H ₂ O)			1.67
Average Meter Temperature (°F)			93.50
Moisture Collected (g)			104.40
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.742
Standard Metered Volume (dscf)			44.510
Standard Metered Volume (dscm)			1.261
Stack Moisture (%V)			9.96
Mole Fraction Dry Stack Gas			0.900
Dry Molecular Weight			28.84
Wet Molecular Weight			27.76
Stack Gas Velocity (fpm)			4281.20
Stack Gas Velocity (mpm)			1304.91
Volumetric Flow Rate (acfm)			421.77
Volumetric Flow Rate (acmm)			11.94
Volumetric Flow Rate (dscfm)			183.33
Volumetric Flow Rate (dscmm)			5.19
Percent Isokinetic			101.76
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

(Diagram of Duct)

[illegible]

Plant	VSL
Date	12-9-4
Sampling Location	TCO Metals
Run Number	1
Impinger Box Number	TCO 1
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ O ₂ /HNO ₃		m	737.9	692.4	45.5
2	H ₂ O ₂ /HNO ₃		gls	725.3	693.4	31.9
3	TCO		m	612.1	600.9g	11.2
4	SG		m	1005.3	989.5g	88.6
5						
6				3080.6	2976.2	
7						
8						
9						
10						
Total Weight Gain (g)						104.4

Facility:	CUA	Start Time:	1221
Date:	12/10/2004	End Time:	1321
Location:	TCO	Initial Leak Check:	.00@16"
Run Number:	2	Final Leak Check:	.001@8"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.60
Absolute Stack Pressure (in Hg)			28.68
Stack Static Pressure (in H2O)			-12.50
Average Stack Temperature (°F)			588.50
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			48.289
Average Meter Pressure (in H2O)			1.74
Average Meter Temperature (°F)			95.33
Moisture Collected (g)			124.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.760
Standard Metered Volume (dscf)			45.572
Standard Metered Volume (dscm)			1.291
Stack Moisture (%V)			11.37
Mole Fraction Dry Stack Gas			0.886
Dry Molecular Weight			28.84
Wet Molecular Weight			27.60
Stack Gas Velocity (fpm)			4372.55
Stack Gas Velocity (mpm)			1332.75
Volumetric Flow Rate (acfm)			430.76
Volumetric Flow Rate (acmm)			12.20
Volumetric Flow Rate (dscfm)			184.24
Volumetric Flow Rate (dscmm)			5.22
Percent Isokinetic			103.67
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	VSL
Date	12.9.4
Sampling Location	TCO R2
Run Number	2
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ O/HNO ₃		m	812.7	745.5g	67.2
2	H ₂ O/HNO ₃		a/b	735.6	713.2g	22.4
3	KO		m	636.4	613.0g	23.4
4	SG		m	879.1	868.1g	11.0
5						
6				3063.8	2939.8	
7						
8						
9						
10						
Total Weight Gain (g)						124

Facility:	CUA	Start Time:	212
Date:	12/10/2004	End Time:	312
Location:	TCO	Initial Leak Check:	0.0@15"
Run Number:	3	Final Leak Check:	.001@13"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.60
Absolute Stack Pressure (in Hg)			28.68
Stack Static Pressure (in H ₂ O)			-12.50
Average Stack Temperature (°F)			584.17
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			48.286
Average Meter Pressure (in H ₂ O)			1.73
Average Meter Temperature (°F)			97.08
Moisture Collected (g)			108.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.757
Standard Metered Volume (dscf)			45.419
Standard Metered Volume (dscm)			1.286
Stack Moisture (%V)			10.14
Mole Fraction Dry Stack Gas			0.899
Dry Molecular Weight			28.84
Wet Molecular Weight			27.74
Stack Gas Velocity (fpm)			4339.92
Stack Gas Velocity (mpm)			1322.81
Volumetric Flow Rate (acfm)			427.55
Volumetric Flow Rate (acmm)			12.11
Volumetric Flow Rate (dscfm)			186.18
Volumetric Flow Rate (dscmm)			5.27
Percent Isokinetic			102.25
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

(Diagram of Duct)

Read and Record All Data Every _____ Minutes

Plant	
Date	12/10/04
Sampling Location	TCO
Run Number	3
Impinger Box Number	M-29
Recovery Person	
Recovery Rinses	0.1 HNO ₃
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	5% HNO ₃ 10% H ₂ O ₂	100	MGS	781.7	703.1	78.6
2	5% HNO ₃ 10% H ₂ O ₂	100	GS	711.5	694.8	16.7
3	—	—	MGS	603.2	600.1	3.1
4	SG	~250	MGS	998.8	988.5	99.4
5						
6				3095.2	2986.5	
7						
8						
9						
10						
Total Weight Gain (g)						108.7

Facility:	CUA	Start Time:	857
Date:	12/11/2004	End Time:	957
Location:	TCO	Initial Leak Check:	0.001@8"
Run Number:	4	Final Leak Check:	0.000@6"
Sample Type:	Metals		
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	30.10		
Absolute Stack Pressure (in Hg)	29.22		
Stack Static Pressure (in H ₂ O)	-12.00		
Average Stack Temperature (°F)	559.67		
Stack Area (sq in)	14.19		
Actual Meter Volume (cu ft)	51.115		
Average Meter Pressure (in H ₂ O)	1.93		
Average Meter Temperature (°F)	100.50		
Moisture Collected (g)	151.20		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	0.9990		
Nozzle Diameter (in)	0.268		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.810		
Standard Metered Volume (dscf)	48.622		
Standard Metered Volume (dscm)	1.377		
Stack Moisture (%V)	12.79		
Mole Fraction Dry Stack Gas	0.872		
Dry Molecular Weight	28.84		
Wet Molecular Weight	27.45		
Stack Gas Velocity (fpm)	4458.93		
Stack Gas Velocity (mpm)	1359.08		
Volumetric Flow Rate (acfm)	439.27		
Volumetric Flow Rate (acmm)	12.44		
Volumetric Flow Rate (dscfm)	193.67		
Volumetric Flow Rate (dscmm)	5.48		
Percent Isokinetic	105.23		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

AIR/TECH

(Diagram of Duct)

~~ORP-51444, Rev. 0~~

Plant	VSC
Date	12/11/4
Sampling Location	TCO
Run Number	4
Impinger Box Number	TCO
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	072004-036
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ O ₂ /HNO ₃	99.7	MGS	813.4	600.5 700.2	113.2
2	H ₂ O ₂ /HNO ₃	108.9	GS	731.8 _r	600.9 709.8	22.0
3	MT		MGS	617.8 _g	613.8	4.0
4	Silica Gel		MGS	883.3 _r	871.3	12.0
5						
6				3046.3	2895.1	
7						
8						
9						
10						
Total Weight Gain (g)						151.2

Facility:	CUA	Start Time:	1053
Date:	12/11/2004	End Time:	1153
Location:	TCO	Initial Leak Check:	0.000@10"
Run Number:	5	Final Leak Check:	0.000@7"
Sample Type:	Metals		
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	30.10		
Absolute Stack Pressure (in Hg)	29.22		
Stack Static Pressure (in H ₂ O)	-12.00		
Average Stack Temperature (°F)	558.67		
Stack Area (sq in)	14.19		
Actual Meter Volume (cu ft)	50.250		
Average Meter Pressure (in H ₂ O)	1.92		
Average Meter Temperature (°F)	99.58		
Moisture Collected (g)	145.50		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	0.9990		
Nozzle Diameter (in)	0.268		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.798		
Standard Metered Volume (dscf)	47.875		
Standard Metered Volume (dscm)	1.356		
Stack Moisture (%V)	12.53		
Mole Fraction Dry Stack Gas	0.875		
Dry Molecular Weight	28.84		
Wet Molecular Weight	27.48		
Stack Gas Velocity (fpm)	4429.89		
Stack Gas Velocity (mpm)	1350.23		
Volumetric Flow Rate (acfm)	436.41		
Volumetric Flow Rate (acmm)	12.36		
Volumetric Flow Rate (dscfm)	193.15		
Volumetric Flow Rate (dscmm)	5.47		
Percent Isokinetic	103.89		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

Run 2 Page of

1392

Plant	VSC
Date	12/11/18
Sampling Location	T Co
Run Number	5 METALS
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	072004-035
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ O ₂ /HNO ₃	100.4	1	829.4	619.5 / 719.9	109.5
2	↓	116.2		877.3	633.7 / 749.9	21.4
3	MT			624.3	620.8	3.5
4	Silica Gel			860.7g	849.6	134.4
5						
6				3085.7	2940.2	
7						
8						
9						
10						
Total Weight Gain (g)						145.5

Facility:	CUA	Start Time:	1235
Date:	12/11/2004	End Time:	1335
Location:	TCO	Initial Leak Check:	0.000@10"
Run Number:	6	Final Leak Check:	0.000@8"
Sample Type:	Metals		
Total Sampling Time (min)	60.0		
Corrected Barometric Pressure (in Hg)	30.10		
Absolute Stack Pressure (in Hg)	29.22		
Stack Static Pressure (in H ₂ O)	-12.00		
Average Stack Temperature (°F)	557.17		
Stack Area (sq in)	14.19		
Actual Meter Volume (cu ft)	51.300		
Average Meter Pressure (in H ₂ O)	2.00		
Average Meter Temperature (°F)	100.67		
Moisture Collected (g)	153.30		
Carbon Dioxide Concentration (%V)	0.0		
Oxygen Concentration (%V)	20.9		
Nitrogen Concentration (%V)	79.1		
Dry Gas Meter Factor	0.9990		
Nozzle Diameter (in)	0.268		
Pitot Constant	0.99		
Average Sampling Rate (dscfm)	0.813		
Standard Metered Volume (dscf)	48.789		
Standard Metered Volume (dscm)	1.382		
Stack Moisture (%V)	12.90		
Mole Fraction Dry Stack Gas	0.871		
Dry Molecular Weight	28.84		
Wet Molecular Weight	27.44		
Stack Gas Velocity (fpm)	4466.68		
Stack Gas Velocity (mpm)	1361.44		
Volumetric Flow Rate (acfm)	440.04		
Volumetric Flow Rate (acmm)	12.46		
Volumetric Flow Rate (dscfm)	194.22		
Volumetric Flow Rate (dscmm)	5.50		
Percent Isokinetic	105.29		
Percent Excess Air	-1174157.30		
Concentration (g/dscm)	0.00		
Concentration (kg/hr)	0.00		
Concentration (ppmv)	0.00		
Emissions (lb/hr)	0.00		

Plant	VSL
Date	12.11.4
Sampling Location	TCO Metals
Run Number	6 - Metals
Impinger Box Number	TCO
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ O ₂ /HNO ₃	73.9	m	809.6g	604.9/698.8g	110.8
2	H ₂ O ₂ /HNO ₃	100.9	g/s	733.1g	606.6/707.4	25.7
3	KO		m	622.9	617.5g	5.4
4	SH		m	894.7g	883.3	141.8
5						
6				3060.3	2907	
7						
8						
9						
10						
Total Weight Gain (g)						153.3

Facility:	CUA	Start Time:	1359
Date:	12/11/2004	End Time:	1459
Location:	TCO	Initial Leak Check:	0.000@10"
Run Number:	7	Final Leak Check:	0.000@8"
Sample Type:	Metals		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			30.10
Absolute Stack Pressure (in Hg)			29.22
Stack Static Pressure (in H ₂ O)			-12.00
Average Stack Temperature (°F)			557.50
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			51.930
Average Meter Pressure (in H ₂ O)			2.00
Average Meter Temperature (°F)			99.08
Moisture Collected (g)			155.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.826
Standard Metered Volume (dscf)			49.532
Standard Metered Volume (dscm)			1.403
Stack Moisture (%V)			12.86
Mole Fraction Dry Stack Gas			0.871
Dry Molecular Weight			28.84
Wet Molecular Weight			27.44
Stack Gas Velocity (fpm)			4436.52
Stack Gas Velocity (mpm)			1352.25
Volumetric Flow Rate (acfm)			437.07
Volumetric Flow Rate (acmm)			12.38
Volumetric Flow Rate (dscfm)			192.95
Volumetric Flow Rate (dscmm)			5.46
Percent Isokinetic			107.60
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run _____
Page _____ of _____

(Diagram of Duct)

Minutes[illegible]

Plant	VSC
Date	12.11.4
Sampling Location	TEO Metals
Run Number	R6 R7
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ O ₂ /HNO ₃	85.0 86.0	m	823.9 760.5	622.2 / 768.2	115.7
2	H ₂ O ₂ /HNO ₃	87.6	g/s	749.1	637.4 / 725.0	24.1
3	ISO		m	627.7	624.0	3.7
4	SG		m	872.2	860.7	143.5
5						
6				3072.9	2917.9	
7						
8						
9						
10						
Total Weight Gain (g)						155

Appendix B.5

Halogens/Acid Gases

Facility:	CUA	Start Time:	521
Date:	12/10/2004	End Time:	621
Location:	Melter	Initial Leak Check:	.00@13"
Run Number:	1	Final Leak Check:	.001@12"
Sample Type:	M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.50
Absolute Stack Pressure (in Hg)			29.13
Stack Static Pressure (in H2O)			-5.00
Average Stack Temperature (°F)			417.67
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			21.070
Average Meter Pressure (in H2O)			0.49
Average Meter Temperature (°F)			95.92
Moisture Collected (g)			205.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.335
Standard Metered Volume (dscf)			20.100
Standard Metered Volume (dscm)			0.569
Stack Moisture (%V)			32.55
Mole Fraction Dry Stack Gas			0.675
Dry Molecular Weight			28.84
Wet Molecular Weight			25.31
Stack Gas Velocity (fpm)			4403.38
Stack Gas Velocity (mpm)			1342.15
Volumetric Flow Rate (acfm)			384.27
Volumetric Flow Rate (acmm)			10.88
Volumetric Flow Rate (dscfm)			151.79
Volumetric Flow Rate (dscmm)			4.30
Percent Isokinetic			99.91
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run _____
Page _____ of _____

(Diagram of Duct)

0

~~ORP-51444, Rev. 0~~

Plant	COA VSC
Date	12/10/04
Sampling Location	Melter - HCl
Run Number	1 - HCl
Impinger Box Number	
Recovery Person	myl.
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	.1N H ₂ SO ₄	100	MON	902.7g	722.3	
2	.1N H ₂ SO ₄	100	MON	741.7g	727.3	
3	.1N NaOH	100	G/S	719.4	718.1	
4	.1N NaOH	100	G/S	724.5g	724.1	
5	Silica gel	250	MON	905.0g	895.8	
6						
7				3993.3	3987.6	
8						
9						
10						
Total Weight Gain (g)						205.17

Facility:	CUA	Start Time:	700
Date:	12/10/2004	End Time:	800
Location:	Melter	Initial Leak Check:	.00@8"
Run Number:	2	Final Leak Check:	.001@8"
Sample Type:	M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.50
Absolute Stack Pressure (in Hg)			29.13
Stack Static Pressure (in H ₂ O)			-5.00
Average Stack Temperature (°F)			413.17
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			23.040
Average Meter Pressure (in H ₂ O)			0.44
Average Meter Temperature (°F)			96.00
Moisture Collected (g)			177.90
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.366
Standard Metered Volume (dscf)			21.974
Standard Metered Volume (dscm)			0.622
Stack Moisture (%V)			27.63
Mole Fraction Dry Stack Gas			0.724
Dry Molecular Weight			28.84
Wet Molecular Weight			25.84
Stack Gas Velocity (fpm)			4139.33
Stack Gas Velocity (mpm)			1261.67
Volumetric Flow Rate (acfm)			361.22
Volumetric Flow Rate (acmm)			10.23
Volumetric Flow Rate (dscfm)			153.89
Volumetric Flow Rate (dscmm)			4.36
Percent Isokinetic			107.73
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run _____
Page _____ of _____

(Diagram of Duct)

~~ORP-51444, Rev. 0~~

Plant	USL
Date	12.10.4
Sampling Location	Melter
Run Number	2 Halogens
Impinger Box Number	Melter - 2
Recovery Person	
Recovery Rinses	
Sampling Identification	RM-26
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1 N H ₂ SO ₄			850.7	697.8	
2	0.1 N H ₂ SO ₄			710.6	696.0	
3	0.1 N NaOH			740.9g	739.4	
4	0.1 N NaOH			685.7g	685.3	
5	SG	~250	MGS	1007.2g	998.7	
6						
7				3995.1	3817.2	
8						
9						
10						
Total Weight Gain (g)						177.9

Facility:	CUA	Start Time:	836
Date:	12/10/2004	End Time:	926
Location:	Melter	Initial Leak Check:	.001@8"
Run Number:	3	Final Leak Check:	.001@25"
Sample Type:	M-26		
Total Sampling Time (min)			50.0
Corrected Barometric Pressure (in Hg)			29.50
Absolute Stack Pressure (in Hg)			29.13
Stack Static Pressure (in H ₂ O)			-5.00
Average Stack Temperature (°F)			417.60
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			15.904
Average Meter Pressure (in H ₂ O)			0.39
Average Meter Temperature (°F)			91.00
Moisture Collected (g)			208.50
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.306
Standard Metered Volume (dscf)			15.315
Standard Metered Volume (dscm)			0.434
Stack Moisture (%V)			39.10
Mole Fraction Dry Stack Gas			0.609
Dry Molecular Weight			28.84
Wet Molecular Weight			24.60
Stack Gas Velocity (fpm)			4232.64
Stack Gas Velocity (mpm)			1290.11
Volumetric Flow Rate (acfm)			369.37
Volumetric Flow Rate (acmm)			10.46
Volumetric Flow Rate (dscfm)			131.75
Volumetric Flow Rate (dscmm)			3.73
Percent Isokinetic			105.24
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Plant	VSL
Date	12/10/04
Sampling Location	3- Meltex Halogens
Run Number	3
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	RM-26 HCL
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1N H ₂ SO ₄	100	MGS	805.3g	726.5	
2	0.1N H ₂ SO ₄	100	MGS	654.8g	722.6	
3	0.1N NaOH	100	GS	775.2g	689.2	
4	0.1N NaOH	100	GS	728.4g	728.1	
5	SG	~250	MGS	975.6g	964.4	
6						
7				3939.3	3730.8	
8						
9						
10						
Total Weight Gain (g)						208.5

Facility:	CUA	Start Time:	330
Date:	12/11/2004	End Time:	445
Location:	Melter	Initial Leak Check:	0.0@15"
Run Number:	4	Final Leak Check:	.001@20"
Sample Type:	M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.30
Absolute Stack Pressure (in Hg)			28.93
Stack Static Pressure (in H2O)			-5.00
Average Stack Temperature (°F)			530.67
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			26.470
Average Meter Pressure (in H2O)			0.62
Average Meter Temperature (°F)			97.50
Moisture Collected (g)			303.80
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.417
Standard Metered Volume (dscf)			25.009
Standard Metered Volume (dscm)			0.708
Stack Moisture (%V)			36.42
Mole Fraction Dry Stack Gas			0.636
Dry Molecular Weight			28.84
Wet Molecular Weight			24.89
Stack Gas Velocity (fpm)			5404.47
Stack Gas Velocity (mpm)			1647.28
Volumetric Flow Rate (acfm)			471.63
Volumetric Flow Rate (acmm)			13.36
Volumetric Flow Rate (dscfm)			154.51
Volumetric Flow Rate (dscmm)			4.38
Percent Isokinetic		✓ →	122.12
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

K factor figure was
due to incorrect ~~used~~
stack Temp.

FIELD DATA SHEET

Run _____ of _____
Page _____ of _____

Plant	CVA - VSL	Probe Length & Type	20' TFE	Filter Number	-
Date	12/11/04	Nozzle ID (in.)	.188	Height of Location (ft)	0
Sampling Location	Melter	Pitot Constant	.99	Duct Dimensions (in.)	4.25
Sample Type	M-26	Meter Box Number	ATA	Stack Geometry (R or C)	C
Run Number	4	Meter ΔH@	1.73	Assume Moisture (%)	21
Operator	MWJ	Yd	1.0175	O ₂ (%)	20.9
Ambient Temperature	95°	K Factor	.75	CO ₂ (%)	0
Barometric Pressure (in.)	29.30	Probe Heater Setting (°F)	250	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-5.0	Heater Box Setting (°F)	250	Moisture Collected (g)	303.8
Initial Leak Check	0.0 @ 15"	Final Leak Check	0.0 @ 20"		

(Diagram of Duct)

Read and Record All Data Every 10 Minutes												
Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
0	0	03:30	808.13	.70	.51	528	250	245	96	94	57	5.0
10	10	03:40	812.4	.71	.52	521	254	249	97	95	59	15.0
20	20	03:50	814.058		CHANGE FILTER							
30	30	04:00	STOP									
40	40	04:10	814.21	1.0	.75	529	265	230	98	97	66	3
50	50	04:20	818.74	.85	.64	536	247	241	99	97	51	3
60	60	04:30	825.4	.85	.64	541	246	243	100	98	49	4.0
70	70	04:40	830.1	.85	.64	535	246	242	101	98	52	4.0
80	80	04:50	834.600									
90												
100												
110												
120												
130												
140												
150												
160												
170												
180												
190												
200												

Plant	VSC
Date	12.10.4
Sampling Location	Melter
Run Number	4 Halogens
Impinger Box Number	M-2
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1N H ₂ SO ₄			913.5	681.48	
2	0.1N H ₂ SO ₄			736.2	680.4	
3	0.1N NaOH			721.8	718.0	
4	0.1N NaOH			671.0	670.3	
5	SG			1018.8	1007.4	
6						
7				4061.3	3957.5	
8						
9						
10						
Total Weight Gain (g)						303.8

Facility:	CUA	Start Time:	526
Date:	12/11/2004	End Time:	626
Location:	Melter	Initial Leak Check:	.001@8"
Run Number:	5	Final Leak Check:	.001@12"
Sample Type:	M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.30
Absolute Stack Pressure (in Hg)			28.93
Stack Static Pressure (in H2O)			-5.00
Average Stack Temperature (°F)			557.17
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			27.590
Average Meter Pressure (in H2O)			0.67
Average Meter Temperature (°F)			100.50
Moisture Collected (g)			323.50
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.432
Standard Metered Volume (dscf)			25.940
Standard Metered Volume (dscm)			0.735
Stack Moisture (%V)			37.03
Mole Fraction Dry Stack Gas			0.630
Dry Molecular Weight			28.84
Wet Molecular Weight			24.82
Stack Gas Velocity (fpm)			5687.16
Stack Gas Velocity (mpm)			1733.45
Volumetric Flow Rate (acfm)			496.30
Volumetric Flow Rate (acmm)			14.06
Volumetric Flow Rate (dscfm)			156.83
Volumetric Flow Rate (dscmm)			4.44
Percent Isokinetic			124.80
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Plant	CVA-VSL	Probe Length & Type	20' TFE	Filter Number	-
Date	12/11/04	Nozzle ID (in.)	2188	Height of Location (ft)	0
Sampling Location	Melter	Pitot Constant	199	Duct Dimensions (in.)	4.25
Sample Type	M-ZC	Meter Box Number	ATA	Stack Geometry (R or C)	C
Run Number	S	Meter $\Delta H @$	1.73	Assume Moisture (%)	21
Operator	Mudl.	Yd	1.0175	O ₂ (%)	20.9
Ambient Temperature	95°	K Factor	175	CO ₂ (%)	0
Barometric Pressure (in.)	29.30	Probe Heater Setting (°F)	250	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-5.0	Heater Box Setting (°F)	250	Moisture Collected (g)	323.5
Initial Leak Check	.001 @ 8"	Final Leak Check	.001 @ 12"		

(Diagram of Duct)

[illegible]

~~ORP-51444 Rev 0~~

Plant	VSC
Date	12.10.4
Sampling Location	Melter
Run Number	5 Halogens
Impinger Box Number	M-3
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1N H ₂ SO ₄	100	m	1004.5g	726.4g	
2	0.1N H ₂ SO ₄	100	m	744.4g	711.8g	
3	0.1N NaOH	100	q/s	679.4g	676.7g	
4	0.1N NaOH	100	q/s	731.5g	730.6g	
5	SG		m	984.3g	975.4	
6						
7				4144.1	3820.6	
8						
9						
10						
Total Weight Gain (g)						323.5

Facility:	CUA	Start Time:	714
Date:	12/11/2004	End Time:	814
Location:	Melter	Initial Leak Check:	.001@8"
Run Number:	6	Final Leak Check:	0
Sample Type:	M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.25
Absolute Stack Pressure (in Hg)			28.88
Stack Static Pressure (in H ₂ O)			-5.00
Average Stack Temperature (°F)			541.33
Stack Area (sq in)			12.57
Actual Meter Volume (cu ft)			26.248
Average Meter Pressure (in H ₂ O)			0.63
Average Meter Temperature (°F)			100.58
Moisture Collected (g)			303.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.188
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.411
Standard Metered Volume (dscf)			24.632
Standard Metered Volume (dscm)			0.698
Stack Moisture (%V)			36.71
Mole Fraction Dry Stack Gas			0.633
Dry Molecular Weight			28.84
Wet Molecular Weight			24.86
Stack Gas Velocity (fpm)			5492.46
Stack Gas Velocity (mpm)			1674.10
Volumetric Flow Rate (acfm)			479.31
Volumetric Flow Rate (acmm)			13.57
Volumetric Flow Rate (dscfm)			154.37
Volumetric Flow Rate (dscmm)			4.37
Percent Isokinetic			120.39
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

~~ORP-51444, Rev. 0~~

Plant	
Date	12/11/04
Sampling Location	Melter
Run Number	6 Halogens
Impinger Box Number	Melter R6
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ SO ₄			950.6g	697.3	
2	H ₂ SO ₄			732.2g	695.9	
3	NaOH			742.7g	739.5	
4	NaOH			691.4	690.5	
5	SG			1028.0	1018.7	
6						
7				4144.9	3841.9	
8						
9						
10						
Total Weight Gain (g)						303

Facility:	CUA	Start Time:	526
Date:	12/10/2004	End Time:	626
Location:	TCO	Initial Leak Check:	0.0@16"
Run Number:	1	Final Leak Check:	.001@7"
Sample Type:	M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.50
Absolute Stack Pressure (in Hg)			28.58
Stack Static Pressure (in H ₂ O)			-12.50
Average Stack Temperature (°F)			581.50
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			46.542
Average Meter Pressure (in H ₂ O)			1.67
Average Meter Temperature (°F)			96.67
Moisture Collected (g)			108.10
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.728
Standard Metered Volume (dscf)			43.662
Standard Metered Volume (dscm)			1.237
Stack Moisture (%V)			10.45
Mole Fraction Dry Stack Gas			0.895
Dry Molecular Weight			28.84
Wet Molecular Weight			27.70
Stack Gas Velocity (fpm)			4279.18
Stack Gas Velocity (mpm)			1304.29
Volumetric Flow Rate (acfm)			421.57
Volumetric Flow Rate (acmm)			11.94
Volumetric Flow Rate (dscfm)			182.76
Volumetric Flow Rate (dscmm)			5.18
Percent Isokinetic			100.13
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Plant	Probe Length & Type	Filter Number	~
CWA-VSL	Nozzle ID (in.)	Height of Location (ft)	0
12/10/04	Pitot Constant	Duct Dimensions (in.)	4.25
TCO	Meter Box Number	Stack Geometry (R or C)	C
M-26	Meter ΔH@	Assume Moisture (%)	10
1	Yd	O ₂ (%)	20.9
Muff.	K Factor	CO ₂ (%)	0
90°	Probe Heater Setting (°F)	Nitrogen (%)	79.1
29.50	Heater Box Setting (°F)	Moisture Collected (g)	108.1
-12.5	Final Leak Check		
0.0016"			

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

[illegible]

Plant	CVA - USL
Date	12/10/04
Sampling Location	TCO
Run Number	1 M-26
Impinger Box Number	
Recovery Person	MWH
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	.1N H ₂ SO ₄	100	Mon	796.4g	717.6	
2	.1N H ₂ SO ₄	100	Mon	757.2g	742.5	
3	.1N NaOH	100	G/S	740.1g	736.1	
4	.1N NaOH	100	G/S	728.6g	727.7	
5	Silica gel	250g	Mon	902.5g	892.8	
6						
7				3924.8	3816.7	
8						
9						
10						
Total Weight Gain (g)						108.1

Facility:	CUA	Start Time:	703
Date:	12/10/2004	End Time:	803
Location:	TCO	Initial Leak Check:	0.01@15"
Run Number:	2	Final Leak Check:	.001@13"
Sample Type:	M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.45
Absolute Stack Pressure (in Hg)			28.53
Stack Static Pressure (in H ₂ O)			-12.50
Average Stack Temperature (°F)			584.83
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			48.525
Average Meter Pressure (in H ₂ O)			1.74
Average Meter Temperature (°F)			96.58
Moisture Collected (g)			108.70
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.758
Standard Metered Volume (dscf)			45.462
Standard Metered Volume (dscm)			1.287
Stack Moisture (%V)			10.13
Mole Fraction Dry Stack Gas			0.899
Dry Molecular Weight			28.84
Wet Molecular Weight			27.74
Stack Gas Velocity (fpm)			4365.75
Stack Gas Velocity (mpm)			1330.68
Volumetric Flow Rate (acfm)			430.09
Volumetric Flow Rate (acmm)			12.18
Volumetric Flow Rate (dscfm)			186.20
Volumetric Flow Rate (dscmm)			5.27
Percent Isokinetic			102.33
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Plant	CWA - USL	Probe Length & Type	20' TFE	Filter Number	
Date	12/10/04	Nozzle ID (in.)	.268	Height of Location (ft)	0
Sampling Location	TCD	Pitot Constant	.99	Duct Dimensions (in.)	4.25
Sample Type	M-26	Meter Box Number	ATC	Stack Geometry (R or C)	C
Run Number	3	Meter ΔH@	1.67	Assume Moisture (%)	10
Operator	mobl	Yd	0.999	O ₂ (%)	20.9
Ambient Temperature	90°	K Factor	3.1	CO ₂ (%)	0
Barometric Pressure (in.)	29.45	Probe Heater Setting (°F)	250	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-12.5	Heater Box Setting (°F)	250	Moisture Collected (g)	108.7
Initial Leak Check	0.01 @ 15"	Final Leak Check	0.01 @ 13"		

(Diagram of Duct)

[illegible]

Plant	
Date	
Sampling Location	TCO
Run Number	2
Impinger Box Number	TCO-2
Recovery Person	WEG
Recovery Rinses	
Sampling Identification	RM-24
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1 N H_2SO_4	100	MGS	785.4	706.5	
2	0.1 N H_2SO_4	100	MGS	738.2g	721.7	
3	0.1 N NaOH	100	GS	673.7g	671.4	
4	0.1 N NaOH	100	GS	709.0g	708.5	
5	SG	~250	MGS	937.4g	926.9	
6						
7				3843.7	3735	
8						
9						
10						
Total Weight Gain (g)						108.7

Facility:	CUA	Start Time:	839
Date:	12/10/2004	End Time:	939
Location:	TCO	Initial Leak Check:	.001@8"
Run Number:	3	Final Leak Check:	.001@8"
Sample Type:	M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.50
Absolute Stack Pressure (in Hg)			28.58
Stack Static Pressure (in H ₂ O)			-12.50
Average Stack Temperature (°F)			587.50
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			46.847
Average Meter Pressure (in H ₂ O)			1.68
Average Meter Temperature (°F)			92.92
Moisture Collected (g)			102.60
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.738
Standard Metered Volume (dscf)			44.254
Standard Metered Volume (dscm)			1.253
Stack Moisture (%V)			9.85
Mole Fraction Dry Stack Gas			0.901
Dry Molecular Weight			28.84
Wet Molecular Weight			27.77
Stack Gas Velocity (fpm)			4358.60
Stack Gas Velocity (mpm)			1328.50
Volumetric Flow Rate (acfm)			429.39
Volumetric Flow Rate (acmm)			12.16
Volumetric Flow Rate (dscfm)			186.32
Volumetric Flow Rate (dscmm)			5.28
Percent Isokinetic			99.55
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run _____
Page _____ of _____

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

Plant	USC
Date	12/10/04
Sampling Location	Met/fer TCO R3
Run Number	HCP-3
Impinger Box Number	
Recovery Person	ND
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1 N H ₂ SO ₄	100	MGS	847.4 _g	720.6	
2	0.1 N H ₂ SO ₄	100	MGS	730.4	716.7	
3	0.1 N NaOH	100	GS	724.9	271.8	
4	0.1 N NaOH	100	GS	712.4	711.6	
5	SG	~250	MGS	922.8	914.6	
6						
7				3937.9	3835.3	
8						
9						
10						
Total Weight Gain (g)						102.6

Facility:	CUA	Start Time:	333
Date:	12/11/2004	End Time:	433
Location:	TCO	Initial Leak Check:	0.0@16"
Run Number:	4	Final Leak Check:	.001@8"
Sample Type:	M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.30
Absolute Stack Pressure (in Hg)			28.38
Stack Static Pressure (in H ₂ O)			-12.50
Average Stack Temperature (°F)			567.00
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			49.050
Average Meter Pressure (in H ₂ O)			1.86
Average Meter Temperature (°F)			99.25
Moisture Collected (g)			145.10
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.758
Standard Metered Volume (dscf)			45.510
Standard Metered Volume (dscm)			1.289
Stack Moisture (%V)			13.07
Mole Fraction Dry Stack Gas			0.869
Dry Molecular Weight			28.84
Wet Molecular Weight			27.42
Stack Gas Velocity (fpm)			4604.98
Stack Gas Velocity (mpm)			1403.60
Volumetric Flow Rate (acfm)			453.66
Volumetric Flow Rate (acmm)			12.85
Volumetric Flow Rate (dscfm)			192.27
Volumetric Flow Rate (dscmm)			5.45
Percent Isokinetic			99.21
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

Run _____
Page _____ of _____

(Diagram of Duct)

01

~~ORP-51444, Rev. 0~~

Plant	VSL
Date	12.11.4
Sampling Location	TCO - Halogen
Run Number	R4 R4 - Halogen
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1M H_2SO_4			808.3	699.8	
2	0.1M H_2SO_4			711.2	692.0	
3	0.1M $NaOH$			717.7	713.3g	
4	0.1M $NaOH$			715.5	714.1g	
5	SG			916.4	904.8	
6						
7				3869.1	3724	
8						
9						
10						
Total Weight Gain (g)						145.1

Facility:	CUA	Start Time:	525
Date:	12/11/2004	End Time:	625
Location:	TCO	Initial Leak Check:	.001@10"
Run Number:	5	Final Leak Check:	.001@12"
Sample Type:	M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.30
Absolute Stack Pressure (in Hg)			28.38
Stack Static Pressure (in H ₂ O)			-12.50
Average Stack Temperature (°F)			566.50
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			49.890
Average Meter Pressure (in H ₂ O)			1.92
Average Meter Temperature (°F)			101.17
Moisture Collected (g)			148.40
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.769
Standard Metered Volume (dscf)			46.143
Standard Metered Volume (dscm)			1.307
Stack Moisture (%V)			13.17
Mole Fraction Dry Stack Gas			0.868
Dry Molecular Weight			28.84
Wet Molecular Weight			27.41
Stack Gas Velocity (fpm)			4592.51
Stack Gas Velocity (mpm)			1399.80
Volumetric Flow Rate (acfm)			452.43
Volumetric Flow Rate (acmm)			12.81
Volumetric Flow Rate (dscfm)			191.63
Volumetric Flow Rate (dscmm)			5.43
Percent Isokinetic			100.93
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

(Diagram of Duct)

Read and Record All Data Every 60 Minutes[illegible]

Plant	VSL
Date	12.11.4
Sampling Location	TC8 Halogens
Run Number	R5
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	0.1M H_2SO_4	100	m	825.3	712.2	
2	0.1N H_2SO_4	100	m	726.2g	706.9	
3	0.1N $NaOH$	100	G/S	719.2g	715.2	
4	0.1N $NaOH$	100	G/S	703.1g	701.6g	
5	SC1	~250	m	933.0g	922.5	
6						
7				3906.8	3758.4	
8						
9						
10						
Total Weight Gain (g)						148.4

Facility:	CUA	Start Time:	713
Date:	12/11/2004	End Time:	813
Location:	TCO	Initial Leak Check:	.001@8"
Run Number:	6	Final Leak Check:	0
Sample Type:	M-26		
Total Sampling Time (min)			60.0
Corrected Barometric Pressure (in Hg)			29.25
Absolute Stack Pressure (in Hg)			28.33
Stack Static Pressure (in H ₂ O)			-12.50
Average Stack Temperature (°F)			568.00
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			50.530
Average Meter Pressure (in H ₂ O)			1.89
Average Meter Temperature (°F)			101.75
Moisture Collected (g)			149.60
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.777
Standard Metered Volume (dscf)			46.607
Standard Metered Volume (dscm)			1.320
Stack Moisture (%V)			13.14
Mole Fraction Dry Stack Gas			0.869
Dry Molecular Weight			28.84
Wet Molecular Weight			27.41
Stack Gas Velocity (fpm)			4562.32
Stack Gas Velocity (mpm)			1390.60
Volumetric Flow Rate (acfm)			449.46
Volumetric Flow Rate (acmm)			12.73
Volumetric Flow Rate (dscfm)			189.80
Volumetric Flow Rate (dscmm)			5.38
Percent Isokinetic			102.92
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

(Diagram of Duct)

~~ORP-51444 Rev 0~~

Plant	
Date	12/11/04
Sampling Location	TCO
Run Number	6 HCL
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	H ₂ SO ₄			831.8	718.2	
2	H ₂ SO ₄			737.8	718.3	
3	NaOH			729.3g	725.0	
4	NaOH			722.4	720.8	
5	SG			968.2g	957.6	
6						
7				3989.5	3839.9	
8						
9						
10						
Total Weight Gain (g)						149.6

Appendix B.6

Particle Size Distribution

Corrected

Facility:	CUA	
Date:	11/15/2004 - 11/16/2004	
Location:	Inlet to Pack Bed Scrubber	Average
Run Number:	1 & 2	
Sample Type:	PSD	
Total Sampling Time (min)		1420.0
Corrected Barometric Pressure (in Hg)		29.99
Absolute Stack Pressure (in Hg)		27.05
Stack Static Pressure (in H ₂ O)		-40.00
Average Stack Temperature (°F)		594.76
Stack Area (sq in)		14.25
Actual Meter Volume (cu ft)		1087.99
Average Meter Pressure (in H ₂ O)		1.96
Average Meter Temperature (°F)		92.62
Moisture Collected (g)		0.00
Carbon Dioxide Concentration (%V)		0.00
Oxygen Concentration (%V)		20.90
Nitrogen Concentration (%V)		79.10
Dry Gas Meter Factor		1.01
Nozzle Diameter (in)		0.26
Pitot Constant		0.99
Average Sampling Rate (dscfm)		0.74
Standard Metered Volume (dscf)		1055.71
Standard Metered Volume (dscm)		29.90
Stack Moisture (%V)		9.58
Mole Fraction Dry Stack Gas		0.90
Dry Molecular Weight		28.84
Wet Molecular Weight		27.80
Stack Gas Velocity (fpm)		4934.57
Stack Gas Velocity (mpm)		1504.06
Volumetric Flow Rate (acfm)		488.42
Volumetric Flow Rate (acmm)		13.83
Volumetric Flow Rate (dscfm)		199.85
Volumetric Flow Rate (dscmm)		5.66
Percent Isokinetic		100.59
Percent Excess Air		-1174157.30
Concentration (g/dscm)		0.00
Concentration (kg/hr)		0.00
Concentration (ppmv)		0.00
Emissions (lb/hr)		0.00

Corrected

Facility:	CUA	Start Time:	1049
Date:	11/15/2004	End Time:	2229
Location:	Inlet to Pack Bed Scrubber	Initial Leak Check:	.005@10"
Run Number:	1	Final Leak Check:	0
Sample Type:	PSD		
Total Sampling Time (min)			700.0
Corrected Barometric Pressure (in Hg)			29.99
Absolute Stack Pressure (in Hg)			27.05
Stack Static Pressure (in H2O)			-40.00
Average Stack Temperature (°F)			598.36
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			518.970
Average Meter Pressure (in H2O)			1.83
Average Meter Temperature (°F)			93.09
Moisture Collected (g)			0.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0175
Nozzle Diameter (in)			0.259
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.725
Standard Metered Volume (dscf)			507.635
Standard Metered Volume (dscm)			14.376
Stack Moisture (%V)			9.58
Mole Fraction Dry Stack Gas			0.904
Dry Molecular Weight			28.84
Wet Molecular Weight			27.80
Stack Gas Velocity (fpm)			4890.57
Stack Gas Velocity (mpm)			1490.65
Volumetric Flow Rate (acfm)			484.07
Volumetric Flow Rate (acmm)			13.71
Volumetric Flow Rate (dscfm)			197.38
Volumetric Flow Rate (dscmm)			5.59
Percent Isokinetic			99.40
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Run 1
Page 1 of 3

Plant	CLIA	Probe Length & Type	6" Glass	Filter Number	
Date	11-15-04	Nozzle ID (in.)	259	Height of Location (ft)	10'
Sampling Location	Outlet to Bed	Pilot Constant	99	Duct Dimensions (in.)	4.26
Sample Type	PSD	Meter Box Number	ATA	Stack Geometry (R or C)	C
Run Number	1	Meter ΔH@	1.7282	Assume Moisture (%)	6
Operator	CS	Yd	1.0775	O ₂ (%)	20.9
Ambient Temperature	79	K Factor	2.79	CO ₂ (%)	0
Barometric Pressure (in.)	30	Probe Heater Setting (°F)	N/A	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-40.0"	Heater Box Setting (°F)	N/A	Moisture Collected (g)	
Initial Leak Check	0.05 @ 10"	Final Leak Check			

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	0	1049	340.220	.65	1.80	585	N/A	N/A	85	85	60	6
	10		356.10	.65	1.80	585			89	86	57	6
	20		363.08	.65	1.80	585			90	86	51	7
	30		370.58	.65	1.80	584			92	87	47	7
	40		377.96	.65	1.80	585			93	88	48	7
	50		385.38	.66	1.83	585			93	88	49	7
	60	1149	392.95	.66	1.83	595			93	89	49	7
	70		400.43	.65	1.80	595			93	89	50	7
	80		407.94	.66	1.83	595			93	89	50	7
	90		415.30	.66	1.83	595			93	90	51	7
	100		422.72	.67	1.86	595			93	90	50	7
	110		430.23	.65	1.80	595			94	90	51	7
	120	1249	437.73	.65	1.80	597			94	90	52	7
	130		445.25	.67	1.86	597			94	90	50	7
	140		452.79	.66	1.83	597			94	90	45	8
	150		460.28	.65	1.80	597			94	90	44	8
	160		467.71	.66	1.83	597			94	90	46	8
	170		475.09	.66	1.83	597			95	91	46	8
	180	0149	482.49	.66	1.83	600			95	91	47	8
	190		489.98	.66	1.83	600			95	91	47	8
	200		497.35	.65	1.80	600			96	92	46	8
	210		504.81	.65	1.80	600			96	92	48	8
	220		512.25	.65	1.80	600			96	92	48	8
	230		519.70	.66	1.83	600			96	92	49	8
	240	0249	527.15	.66	1.83	603			96	92	51	8

FIELD DATA SHEET

Run 1 of 3
Page 2 of 3

Plant	CUA	Probe Length & Type	6' Glass	Filter Number	
Date	11-16-04	Nozzle ID (in.)	.259	Height of Location (ft)	10'
Sampling Location	Inlet to Packaged Submitter	Pilot Constant	.99	Duct Dimensions (in.)	4.26
Sample Type	PSD	Meter Box Number	ATA	Stack Geometry (R or C)	C
Run Number	1	Meter ΔH@	1.7282	Assume Moisture (%)	6
Operator	CJ	Yd	1.0175	O ₂ (%)	20.9
Ambient Temperature	79	K Factor	2.78	CO ₂ (%)	0
Barometric Pressure (in.)	30.0	Probe Heater Setting (°F)	N/A	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-40.0	Heater Box Setting (°F)	N/A	Moisture Collected (g)	
Initial Leak Check	.005 @ 10"	Final Leak Check	N/A		

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	250		534.58	.65	1.80	603	N/A	N/A	96	92	52	8
	260		542.08	.65	1.80	603			96	92	47	8
	270		549.56	.66	1.83	603			96	92	45	8
	280		557.04	.66	1.83	603			96	93	46	8
	290		564.51	.65	1.80	603			96	93	45	8
	300	0349	571.99	.65	1.80	602			96	93	47	8
	310		579.46	.65	1.80	602			96	93	46	8
	320		586.92	.67	1.86	602			96	93	47	8
	330		594.36	.67	1.86	602			96	93	47	8
	340		601.9	.66	1.83	602			96	93	48	8
	350		609.22	.67	1.86	602			96	93	48	8
	360	0449	616.65	.66	1.83	604			96	93	48	8
	370		624.07	.65	1.80	604			96	93	48	8
	380		631.46	.65	1.80	604			96	93	47	8
	390		638.85	.66	1.83	604			96	93	48	8
	400		646.35	.65	1.80	604			96	93	48	8
	410		653.84	.66	1.83	604			96	93	43	8
	420	0549	661.34	.67	1.86	603			96	93	43	8
	430		668.84	.65	1.80	603			96	93	42	8
	440		676.33	.65	1.80	603			96	93	43	8
	450		683.80	.65	1.80	603			95	92	43	8
	460		691.24	.65	1.80	603			95	92	43	8
	470		698.81	.65	1.80	603			95	92	43	8
	480	0649	706.34	.65	1.80	603			95	92	42	8

FIELD DATA SHEET

Run 1
Page 3 of 3

Plant	CWA	Probe Length & Type	6' Glass	Filter Number	
Date	11-16-04	Nozzle ID (in.)	.259	Height of Location (ft)	10'
Sampling Location	Inlet to Pack bed scrubber	Pitot Constant	.99	Duct Dimensions (in.)	4.26
Sample Type	PSD	Meter Box Number	ATA	Stack Geometry (R or C)	C
Run Number	1	Meter ΔH@	1.7282	Assume Moisture (%)	6
Operator	CJ	Yd	1.0175	O ₂ (%)	20.9
Ambient Temperature	79	K Factor	2.78	CO ₂ (%)	0
Barometric Pressure (in.)	30	Probe Heater Setting (°F)	N/A	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-40.0"	Heater Box Setting (°F)	N/A	Moisture Collected (g)	
Initial Leak Check	.005 @ 10"	Final Leak Check	N/A		

Head Exit 380°F

(Diagram of Duct)

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	490		713.84	.65	1.80	603	N/A	N/A	95	92	41	9
	500		721.32	.65	1.80	603			95	91	42	9
	510		728.88	.63	1.75	603			95	91	42	9
	520		736.28	.67	1.86	603			95	91	42	9
	530		743.74	.67	1.86	603			95	91	41	9
	540	0749	751.14	.67	1.86	597			95	91	43	9
	550		759.53	.67	1.86	597			95	91	43	9
	560		765.94	.67	1.86	597			95	91	41	9
	570		773.28	.67	1.86	597			95	91	41	9
	580		780.68	.67	1.86	597			95	91	37	9
	590		788.15	.68	1.89	597			95	91	36	10
	600	0849	795.60	.68	1.89	595			95	92	38	10
	610		803.23	.68	1.89	595			95	92	37	10
	620		810.89	.67	1.86	595			95	92	38	10
	630		818.53	.67	1.86	595			96	92	39	10
	640		825.86	.68	1.89	595			96	92	41	10
	650		833.29	.66	1.83	595			96	92	38	10
	660	0949	840.66	.67	1.86	595			96	93	40	10
	670		847.97	.67	1.86	595			96	93	39	10
	680		855.33	.66	1.83	595			96	93	39	11
	690		862.73	.67	1.86	595			96	93	37	11
696	700	10125	867.190						96	93	38	11
	710											
	720	1049										

Corrected

Facility:	CUA	Start Time:	1004
Date:	11/16/2004	End Time:	2204
Location:	Inlet to Pack Bed Scrubber	Initial Leak Check:	.002@10"
Run Number:	2	Final Leak Check:	0
Sample Type:	PSD		
Total Sampling Time (min)			720.0
Corrected Barometric Pressure (in Hg)			29.99
Absolute Stack Pressure (in Hg)			27.05
Stack Static Pressure (in H ₂ O)			-40.00
Average Stack Temperature (°F)			591.17
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			569.020
Average Meter Pressure (in H ₂ O)			2.10
Average Meter Temperature (°F)			92.15
Moisture Collected (g)			0.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9996
Nozzle Diameter (in)			0.259
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.761
Standard Metered Volume (dscf)			548.076
Standard Metered Volume (dscm)			15.522
Stack Moisture (%V)			9.58
Mole Fraction Dry Stack Gas			0.904
Dry Molecular Weight			28.84
Wet Molecular Weight			27.80
Stack Gas Velocity (fpm)			4978.57
Stack Gas Velocity (mpm)			1517.47
Volumetric Flow Rate (acfm)			492.78
Volumetric Flow Rate (acmm)			13.96
Volumetric Flow Rate (dscfm)			202.31
Volumetric Flow Rate (dscmm)			5.73
Percent Isokinetic			101.79
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Run 2
Page 1 of 3

Plant	CUA	Probe Length & Type	6" Glass	Filler Number	
Date	11-16-04	Nozzle ID (in.)	259	Height of Location (ft)	10'
Sampling Location	P50 Inlet Valve	Pilot Constant	99	Duct Dimensions (in.)	4.26
Sample Type	P50	Meter Box Number	CUA Box 2	Stack Geometry (R or C)	C
Run Number	2	Meter ΔH@	1.920	Assume Moisture (%)	6
Operator	CJ	Yd	9996	O ₂ (%)	20.9
Ambient Temperature	80	K Factor	3.1	CO ₂ (%)	0
Barometric Pressure (in.)	30.0	Probe Heater Setting (°F)	N/A	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-40.0	Heater Box Setting (°F)	N/A	Moisture Collected (g)	
Initial Leak Check	0.02 @ 10"	Final Leak Check	N/A		

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	0	1004	617.88	.70	2.17	578	N/A	N/A	88		59	2
	10		625.69	.70	2.17	578			89		51	3
	20		633.63	.70	2.17	578			90		51	3
	30		641.60	.70	2.17	580			91		51	3
	40		649.47	.70	2.17	581			91		53	3
	50		657.36	.70	2.17	583			92		53	3
	60	1104	665.30	.70	2.17	583			92		53	3
	70		673.26	.70	2.17	583			92		53	3
	80		681.20	.70	2.17	583			92		54	3
	90		689.23	.70	2.17	583			93		54	3
	100		697.30	.70	2.17	584			93		54	3
	110		705.28	.70	2.17	586			93		54	3
	120	1204	713.22	.70	2.17	587			93		55	3
	130		721.18	.70	2.17	589			93		55	3
	140		729.14	.70	2.17	590			93		55	3
	150		737.06	.70	2.17	590			93		56	3
	160		744.98	.70	2.17	590			93		56	3
	170		753.29	.70	2.17	591			93		56	3
	180	0104	761.40	.70	2.17	591			93		49	3
	190		769.49	.70	2.17	591			93		45	3
	200		777.50	.70	2.17	591			93		44	3
	210		785.58	.70	2.17	591			93		44	3
	220		793.50	.70	2.17	591			93		44	3
	230		801.48	.70	2.17	591			93		44	3
	240	0204	809.48	.70	2.17	591			93		45	3

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FIELD DATA SHEET

Run 2
Page 2 of 3

Plant	CWA	Probe Length & Type	6" C-lass	Filter Number	
Date	11-16-04	Nozzle ID (in.)	.259	Height of Location (ft)	10'
Sampling Location	Inlet Pack bed	Pitot Constant	.99	Duct Dimensions (in.)	4.26
Sample Type	PSO	Meter Box Number	CWA Bk 2	Stack Geometry (R or C)	C
Run Number	2	Meter ΔH @	1.920	Assume Moisture (%)	6
Operator	CJ	Yd	.9996	O ₂ (%)	20.9
Ambient Temperature	80	K Factor	3.1	CO ₂ (%)	0
Barometric Pressure (in.)	30	Probe Heater Setting (°F)	N/A	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-40.0	Heater Box Setting (°F)	N/A	Moisture Collected (g)	
Initial Leak Check	0.02 @ 10"	Final Leak Check	N/A		

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	250		812.43	.70	2.17	591	N/A	N/A	93		45	3
	260		815.46	.70	2.17	591			93		45	3
	270		833.57	.70	2.17	591			93		45	3
	280		841.55	.70	2.17	591			93		45	3
	290		849.66	.70	2.17	593			93		45	3
	300	0304	857.66	.70	2.17	593			93		45	4
	310		865.53	.70	2.17	596			93		45	4
	320		873.57	.70	2.17	596			93		45	4
	330		881.36	.69	2.14	596			93		45	4
	340		889.32	.69	2.14	596			92		50	4
	350		897.10	.69	2.14	596			92		50	4
	360	0404	905.15	.69	2.14	596			92		50	4
	370		913.17	.69	2.14	596			92		50	4
	380		920.62	.69	2.14	596			92		50	4
	390		928.62	.69	2.14	597			92		50	4
	400		936.72	.69	2.14	597			92		50	4
	410		944.77	.69	2.14	597			92		49	4
	420	0504	952.73	.67	2.07	597			92		48	4
	430		960.57	.68	2.11	597			92		44	4
	440		968.41	.68	2.11	597			92		44	4
	450		976.25	.68	2.11	596			92		45	4
	460		983.98	.68	2.11	595			92		46	4
	470		991.94	.68	2.11	595			92		46	4
	480	0604	999.53	.68	2.11	595			92		46	4

FIELD DATA SHEET

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

1446

Facility:	CUA	Start Time:	1533
Date:	12/11/2004	End Time:	1553
Location:	TCO	Initial Leak Check:	0.000@7"
Run Number:	1	Final Leak Check:	0
Sample Type:	Particle Size		
Total Sampling Time (min)			1440.0
Corrected Barometric Pressure (in Hg)			29.40
Absolute Stack Pressure (in Hg)			28.48
Stack Static Pressure (in H2O)			-12.50
Average Stack Temperature (°F)			566.56
Stack Area (sq in)			14.25
Actual Meter Volume (cu ft)			861.921
Average Meter Pressure (in H2O)			1.20
Average Meter Temperature (°F)			89.81
Moisture Collected (g)			0.00
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			1.0290
Nozzle Diameter (in)			0.000
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.583
Standard Metered Volume (dscf)			839.284
Standard Metered Volume (dscm)			23.769
Stack Moisture (%V)			10? 0.00
Mole Fraction Dry Stack Gas			1.000
Dry Molecular Weight			28.84
Wet Molecular Weight			28.84
Stack Gas Velocity (fpm)			4568.66
Stack Gas Velocity (mpm)			1392.53
Volumetric Flow Rate (acfm)			452.20
Volumetric Flow Rate (acmm)			12.81
Volumetric Flow Rate (dscfm)			221.34
Volumetric Flow Rate (dscmm)			6.27
Percent Isokinetic			ERR
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

FIELD DATA SHEET

Run _____
Page 1 of _____

Plant	CWA	Probe Length & Type	22' 6" RYDEX	Filter Number	-
Date	12-11-04	Nozzle ID (in.)		Height of Location (ft)	0
Sampling Location	TCO OUT.	Pitot Constant	.99	Duct Dimensions (in.)	4.5"
Sample Type	Part. Size.	Meter Box Number	LAKE APEX CWA	Stack Geometry (R or C)	C
Run Number	1	Meter ΔH@	1.892	Assume Moisture (%)	10
Operator	MWJ.	Yd	1.029	O ₂ (%)	20.9
Ambient Temperature	90°	K Factor	1.92	CO ₂ (%)	0
Barometric Pressure (in.)	29.40	Probe Heater Setting (°F)	250	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-12.5	Heater Box Setting (°F)	250	Moisture Collected (g)	
Initial Leak Check	0.00007"	Final Leak Check			

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
10	15:33	773.98	780.3	0.65	1.2	560			87	82	47	4
20	15:43	780.3	786.0	0.63	1.2	560			90	82	47	4
30	15:53	786.0	792.05	0.65	1.2	560			90	84	48	4
40	16:03	792.05	798.40	0.65	1.2	560			90	84	48	4
50	16:13	798.40	804.50	0.65	1.2	560			90	84	48	4
60	16:23	804.50	810.32	0.65	1.2	560			91	87	57	4
70	16:33	810.32	816.28	0.70	1.3	560			91	85	57	4
80	16:43	816.28	822.62	0.65	1.2	560			92	85	58	14
90	16:53	822.62	829.00	0.65	1.2	560			93	87	61	4
100	17:03	829.00	834.99	0.65	1.2	560			93	88	45	4
110	17:13	834.99	841.17	0.65	1.2	560			93	88	44	4
120	17:23	841.17	846.50	0.65	1.2	560			93	88	47	4
130	17:33	846.50	852.00	0.65	1.2	570			93	88	45	4
140	17:43	852.00	857.50	0.65	1.2	560			93	88	45	4
150	17:53	857.50	863.7	0.65	1.2	570			93	88	47	4
160	18:03	863.7	872.1	0.63	1.2	568			93	88	48	4
170	18:13	872.1	878.3	0.63	1.2	572			93	88	50	4
180	18:23	878.3	883.4	0.63	1.2	565			92	87	52	4
190	18:33	883.4	889.6	0.64	1.2	559			92	87	54	4
200	18:43	889.6	896.3	0.64	1.2	559			92	88	55	4
210	18:53	896.3	902.6	0.61	1.2	559			93	88	56	5
220	19:03	902.6	908.4	0.66	1.2	559			93	88	56	5
230	19:13	908.4	916.2	0.66	1.2	566			92	88	52	5
240	19:23	916.2	921.4	0.66	1.2	566			92	88	51	5
250	19:33	921.4		0.65								
260	19:43											
270	19:53											

FIELD DATA SHEET

Run _____
Page 2 of _____

Plant	CWA/VSL	Probe Length & Type	6" Pyrex	Filter Number	
Date	12/11/04	Nozzle ID (in.)		Height of Location (ft)	
Sampling Location	20-05T	Pitot Constant	99.34	Duct Dimensions (in.)	4.33
Sample Type	P.S.	Meter Box Number	CWA-LA242	Stack Geometry (R or C)	
Run Number	1 (cont.)	Meter ΔH@	1.892	Assume Moisture (%)	
Operator	mxl	Yd	1.029	O ₂ (%)	
Ambient Temperature	90°	K Factor	1.92	CO ₂ (%)	
Barometric Pressure (in.)	29.40	Probe Heater Setting (°F)	250	Nitrogen (%)	
Static Pressure (in. H ₂ O)	-12.5	Heater Box Setting (°F)	250	Moisture Collected (g)	
Initial Leak Check		Final Leak Check			

(Diagram of Duct)

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Minutes	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
	240	19:33	921.4	.66	1.2	566	-	337	92	88	47	5.0
	260	19:53	931.8	.66	1.2	566	-	338	92	88	47	5.0
	280	20:13	943.6	.66	1.2	566	-	337	93	88	48	5.0
	300	20:33	955.4	.66	1.2	567	-	337	92	88	49	5.0
	320	20:53	967.8	.66	1.2	568	-	336	92	88	49	5.0
	340	21:13	978.5	.64	1.2	568	-	329	92	88	52	4.0
	360	21:33	989.92	.67	1.2	568	-	331	92	87	45	4.0
	380	21:53	1001.1	.72	1.2	566	-	335	93	88	46	4.0
	400	22:13	1025.3	.67	1.2	566	-	336	93	88	47	4.0
	420	22:33	1025.8	.64	1.2	566	-	337	93	88	49	4.0
	440	22:53	1038.1	.66	1.2	569	-	338	93	88	49	4.2
	460	23:13	1050.2	.64	1.2	568	-	338	93	88	50	4.4
	480	23:33	1062.1	.64	1.2	568	-	337	92	88	50	4.4
	500	23:53	1074.4	.66	1.2	568	-	337	92	88	51	4.4
	520	00:13	1086.5	.66	1.2	568	-	338	93	88	49	4.5
	540	00:33	1098.4	.66	1.2	568	-	338	93	88	49	4.5
	560	00:53	1110.9	.66	1.2	569	-	338	93	88	50	5.0
	580	01:13	1123.1	.66	1.2	569	-	338	93	88	51	5.0
	600	01:33	1134.7	.66	1.2	568	-	339	93	88	52	5.0
	620	01:53	1146.3	.66	1.2	568	-	340	92	88	52	5.0
	640	02:13	1158.6	.65	1.2	568	-	339	93	88	51	5.0
	660	02:33	1171.0	.67	1.2	569	-	339	93	88	50	5.0
	680	02:53	1182.7	.66	1.2	569	-	340	93	88	51	5.0
	700	03:13	1194.8	.65	1.2	568	-	339	93	88	52	5.0
	720	03:33	1205.7	.64	1.2	568	-	339	93	88	52	5.0

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(cont.)
H₂O

FIELD DATA SHEET

Run _____
Page 3 of _____

Plant	CVA - USL	Probe Length & Type	6" P/REX	Filter Number	
Date	12/12/04	Nozzle ID (in.)		Height of Location (ft)	
Sampling Location	TCO - OUT	Pitot Constant	1.99	Duct Dimensions (in.)	4x35
Sample Type	PARTICLE SIZE	Meter Box Number	CVA - LARGE	Stack Geometry (R or C)	
Run Number	1 (CONT)	Meter ΔH @	1.892	Assume Moisture (%)	
Operator	MWJL	Yd	1.029	O ₂ (%)	39.6
Ambient Temperature	90°F	K Factor	1.92	CO ₂ (%)	0
Barometric Pressure (in.)	29.40"	Probe Heater Setting (°F)	250	Nitrogen (%)	79.1
Static Pressure (in. H ₂ O)	-12.5	Heater Box Setting (°F)	250	Moisture Collected (g)	
Initial Leak Check		Final Leak Check			

(Diagram of Duct)

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V_m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Minutes		Dry Gas Meter Temperature	Impinger Exit (°F)	Pump Vacuum (in. Hg)
								Read	Record	Inlet (°F)	Outlet (°F)	
	720	03:33	1205.7	1.64	1.2	571	-	PSD	EX-11	91	88	4.0
	740	03:53	1217.2	1.65	1.2	571	-			92	88	4.0
	760	04:13	1229.4	1.67	1.2	571	-			92	88	4.2
	780	04:33	1242.0	1.66	1.2	572	-			92	88	4.0
	800	04:53	1254.1	1.65	1.2	571	-			92	88	4.0
	820	05:13	1266.3	1.64	1.2	569	-			92	88	4.2
	840	05:33	1278.5	1.65	1.2	569	-			92	88	4.2
	860	05:53	1290.8	1.68	1.2	569	-			91	87	4.5
	880	06:13	1303.1	1.64	1.2	569	-			91	87	4.5
	900	06:33	1315.4	1.65	1.2	567	-			91	87	5.0
	920	06:53	1327	1.64	1.2	567	-			92	87	5.0
	940	07:13	1339.0	1.65	1.2	567	-			91	87	5.0
	960	07:33	1351.1	1.64	1.2	567	-			91	87	5.0
	980	07:53	1363	1.63	1.2	568	-			91	87	5.0
	1000	08:13	1375	1.63	1.2	568	-			91	87	5.0
	1020	08:33	1386.9	1.64	1.2	568	-			91	87	5.0
	1040	08:53	1398	1.64	1.2	568	-			91	87	5.0
	1060	09:13	1410.5	1.64	1.2	568	-			91	87	5.0
	1080	09:33	1422	1.64	1.2	568	-			91	87	5.0
	1100	09:53	1434	1.63	1.2	568	-			91	87	5.0
	1120	10:13	1445.5	1.63	1.2	568	-			91	87	5.0
	1140	10:33	1457	1.65	1.2	568	-			91	87	5.0
	1160	10:53	1469	1.63	1.2	568	-			91	87	5.0
	1180	11:13	1481.6	1.63	1.2	568	-			93	88	4.0
	1200	11:33	1494	1.65	1.2	568	-			93	88	4.0

AIR/Travel

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Run

Appendix B.7

Total Organic Emissions (TOE)

Facility:	CUA	Start Time:	1100
Date:	12/09/2004	End Time:	1322.3
Location:	TCO	Initial Leak Check:	0.002@11"
Run Number:	1	Final Leak Check:	0.004@12"
Sample Type:	TOE / SVOC		
Total Sampling Time (min)			142.3
Corrected Barometric Pressure (in Hg)			30.09
Absolute Stack Pressure (in Hg)			29.21
Stack Static Pressure (in H2O)			-12.00
Average Stack Temperature (°F)			547.20
Stack Area (sq in)			14.19
Actual Meter Volume (cu ft)			113.075
Average Meter Pressure (in H2O)			1.80
Average Meter Temperature (°F)			96.23
Moisture Collected (g)			296.30
Carbon Dioxide Concentration (%V)			0.0
Oxygen Concentration (%V)			20.9
Nitrogen Concentration (%V)			79.1
Dry Gas Meter Factor			0.9990
Nozzle Diameter (in)			0.268
Pitot Constant			0.99
Average Sampling Rate (dscfm)			0.761
Standard Metered Volume (dscf)			108.349
Standard Metered Volume (dscm)			3.068
Stack Moisture (%V)			11.42
Mole Fraction Dry Stack Gas			0.886
Dry Molecular Weight			28.84
Wet Molecular Weight			27.60
Stack Gas Velocity (fpm)			4249.31
Stack Gas Velocity (mpm)			1295.19
Volumetric Flow Rate (acfm)			418.62
Volumetric Flow Rate (acmm)			11.86
Volumetric Flow Rate (dscfm)			189.74
Volumetric Flow Rate (dscmm)			5.37
Percent Isokinetic			100.92
Percent Excess Air			-1174157.30
Concentration (g/dscm)			0.00
Concentration (kg/hr)			0.00
Concentration (ppmv)			0.00
Emissions (lb/hr)			0.00

TCE/suoc #1
Run 1
Page 1 of 1

FIELD DATA SHEET

3hr

Plant	C4A	Probe Length & Type	20' TFE	Filter Number	
Date	12/9/04	Nozzle ID (in.)	268	Height of Location (ft)	10'
Sampling Location	TCE	Pitot Constant	0.99	Duct Dimensions (in.)	42x60"
Sample Type	TCE/suoc	Meter Box Number	ATC	Stack Geometry (R or C)	C
Run Number	1	Meter ΔH@	1.6719	Assume Moisture (%)	10
Operator	HFG	Yd	0.999	O ₂ (%)	20.9
Ambient Temperature	90	K Factor	3.2	CO ₂ (%)	0
Barometric Pressure (in.)	30.1	Probe Heater Setting (°F)	250 ± 25	Nitrogen (%)	29.1
Static Pressure (in. H ₂ O)	-12	Heater Box Setting (°F)	250 ± 25	Moisture Collected (g)	296.3
Initial Leak Check	0.002 @ 11"	Final Leak Check	0.004 @ 12"		

(Diagram of Duct)

Read and Record All Data Every 10 Minutes

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr)	Gas Meter Reading V _m (ft ³)	Velocity Head ΔP (in. H ₂ O)	Orifice Pressure Differential ΔH (in. H ₂ O)	Flue Gas Temperature (°F)	Probe Temperature (°F)	Filter Temperature (°F)	Dry Gas Meter Temperature		Impinger Exit (°F)	Pump Vacuum (in. Hg)
									Inlet (°F)	Outlet (°F)		
0	0	11:00	178.800	0.57	1.8	546	261	256	91	91	62	6
10	10	11:10	186.61	0.56	1.8	546	260	255	93	90	54	6
20	20	11:20	194.14	0.56	1.8	546	260	255	96	92	510	6
30	30		202.15	0.56	1.8	546	260	255	97	93	57	6
40	40		209.87	0.56	1.8	550	261	255	99	94	59	6
50	50		217.06	0.57	1.9	550	261	255	99	95	56	6
60	60	12:00	225.79	0.56	1.8	550	261	256	100	95	56	7
70	70		233.84	0.56	1.8	550	261	256	100	95	57	7
80	80		241.87	0.56	1.8	550	261	256	100	95	57	7
90	90		249.90	0.56	1.8	544	261	255	100	95	59	7
100	100		258.05	0.56	1.8	544	261	255	100	95	59	7
110	110		266.09	0.56	1.8	544	261	255	100	95	59	7
120	120	13:00	273.95	0.56	1.8	544	261	255	100	95	62	7
130	130		281.98	0.56	1.8	544	261	255	100	95	58	7
140	140		290.03	0.56	1.8	552	261	255	100	95	56	7
150	150	13:30	291.875	0.56	1.8	552	261	255	101	96	58	7
160	160	13:23										
170	170											
180	180											
END	150	14:30										

Plant	VSL
Date	12.9.4
Sampling Location	TCO outlet TOE
Run Number	1
Impinger Box Number	
Recovery Person	
Recovery Rinses	
Sampling Identification	
Filter Number	
XAD Number	

Impinger Number	Impinger Solution	Amount of Solution (g)	Impinger Tip Configuration	Impinger Weight		
				Final (g)	Initial (g)	Weight Gain (g)
1	1 —	—	—	671.7g	397.3	
2	H ₂ O	100	9/8	746.9g	749.5g	
3	KO	—	M	639.0g	637.7	
4	SG	250	M	948.9g	925.1g	
5						
6				3006.5	2709.6	
7						
8						
9						
10						
Total Weight Gain (g)						296.9

VOST FIELD DATA

Plant	0444	Ambient Temp. (°F)	90	Meter Box Number	214
Date	12/9/14	Barometric Pressure (in. H2O)		DGM Cal. Factor (Y)	
Sampling Location	TCO	Stack Temp. (°F)		Probe Length & Type	
Sample Type	TCOE	Average delta P (in. H2O)	See S.V.	Probe Heater Setting (°F)	
Run Number	1	Static Pressure (±) (in. H2O)	1	Filter # & Type (if used)	
Operator	John	Sample Rate (ipm)		Filter Temp. (°F)	

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set				
<i>Initial</i>	0.00 @ 10			

Set: _____
Set: _____

Tenax Charcoal:

Additional Tubes:
Additional Tubes:

[illegible]**Comments:**

Appendix B.8

Allyl Alcohol

Plant	CUA - Melter Outt	Meter Number	VOST 2
Date	12/07/2004	Correction factor	1.028
Sample Type	M308	Barometric Pressure	30
Run Number	1		

Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
1	0.00 lpm@7"	1158	2744.35	1.6				88	86	
			2751.3	1.8				87	86	
			2756.3	1.6				87	86	
			2761.25	1.8				88	87	
			2768.04	1.8				89	87	
	0.00 lpm@4"	1248	2774.03	1.7				90	88	
		Averages		1.71666667				88.1666667	86.6666667	
		Standard Meter Volume	29.63660334					87.4166667		

Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
2	0.00 lpm@3"	1358	2774.78	1.6				87	86	
			2779.85	1.6				88	86	
			2784.4	1.6				89	87	
			2788.85	1.6				90	88	
			2793.8	1.6				91	89	
	0.00 lpm@4"	1448	2798.16	1.6				92	90	
		Averages		1.6				89.5	87.6666667	
		Standard Meter Volume	23.28953201					88.58333333		

Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
3	0.00 lpm@8"	1558	2799.31	1.6				90	89	
			2804	1.6				90	89	
			2808.55	1.6				90	89	
			2813.58	1.6				90	89	
			2818.54	1.6				91	90	
	0.00 lpm@10"	1648	2822.87	1.6				91	90	
		Averages		1.6				90.33333333	89.33333333	
		Standard Meter Volume	23.41548108					89.83333333		

AIR/TECH

Run 1
Page 1 of

Purpose: _____
Other Data/Notes: _____

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

Comments:

Plant	C4A	Ambient Temp. (°F)	90	Meter Box Number	60512
Date	12-7-04	Barometric Pressure (in. H2O)	30	DGM Cal. Factor (Y)	1.028
Sampling Location	meter air	Stack Temp. (°F)	372	Probe Length & Type	NA
Sample Type	DM-308	Average delta P (in. H2O)	0.57	Probe Heater Setting (°F)	NA
Run Number	2	Static Pressure (±) (in. H2O)	-4.2"	Filter # & Type (if used)	NA
Operator	14FG/jwff	Sample Rate (ipm)	0.5	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS: Set	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Initial Leak V 0.0003"			Final Leak V 0.0004"	

Set:

Set:

Tenax Tube:

Tenax Tube:

Tenax Charcoal:

Tenax Charcoal:

Additional Tubes:

Additional Tubes:

Sampling Times		Gas Meter Reading (Vol in L or ft3)	Rotameter Setting (lpm/ft3/ min)	Meter Pressure (in.H2O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in.Hg)
Run (min)	Clock (24hr)					A (°F)	B (°F)				
0	1358	2714.78	0.5	1.6	87/86	N/A	N/A	N/A	N/A	N/A	0
70		2714.78 2719.85	0.5	1.6	88/86						0
80		2784.7	0.5	1.6	89/87						0
30		2788.85	0.5	1.6	90/88						0
40		2793.80	0.5	1.6	91/89						0
50	1448	2798.16	0.5	1.6	92/90						0
Total Time		Total Volume Metered	Average Flow Rate	Average Pm	Average Tm					Ts	Vacuum (in.Hg)

Comments:

VOST FIELD DATA

Post test leak ✓
0.00 @ 10" after

Purpose: Writing implications

Other Data/Notes: 1. 2. 3. 4.

Initial	Leak v20.0008
---------	---------------

Tenax Charcoal:

Additional Tubes:
Additional Tubes:

Comments:

Plant Date Sample Type Run Number	CUA - TCO Out 12/07/2004 M308 1	Meter Number Correction factor Barometric Pressure	VOST 1 1.002 29.97							
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
1	0.00 lpm@7"	1200	1841.4					99	98	
			1848.87	2.4				98	98	
			1856.1	2.4				98	97	
			1863.68	2.4				98	98	
			1871.1	2.4				98	98	
			1878.52	2.4				98	98	
			1886	2.4				98	98	
			1893.41	2.4				97	96	
			1900.75	2.3				96	96	
			1908.2	2.3				98	96	
			1915.72	2.4				98	97	
	0.00 lpm@5"	1340						97.8	97.2	
	Averages			2.38				97.5		
	Standard Meter Volume		71.07036547							
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
2	0.00 lpm@5"	1400	1918					97	97	
			1925.58	2.3				99	97	
			1932.95	2.3				99	98	
			1940.48	2.3				101	99	
			1947.93	2.3				101	99	
			1955.35	2.3				101	99	
			1962.85	2.3				100	100	
			1970.3	2.3				101	100	
			1977.7	2.3				101	100	
			1985.13	2.2				102	100	
			1992.6	2.2				102	100	
	0.00 lpm@5"	1540						100.3	99	
	Averages			2.28				99.65		
	Standard Meter Volume		71.04672989							
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
3	0.00 lpm@5"	1559	1994					98	99	
			2001.52	2.4				101	99	
			2009.15	2.4				101	99	
			2016.5	2.4				101	99	
			2024.05	2.3				101	99	
			2031.55	2.4				101	99	
			2039.04	2.3				101	100	
			2046.55	2.3				101	100	
			2054.05	2.2				101	100	
			2061.45	2.2				101	100	
			2068.88	2.4				101	100	
	0.00 lpm@5"	1739						100.7	99.5	
	Averages			2.33				100.1		
	Standard Meter Volume		71.26479053							

00/52

VOST FIELD DATA

Plant	CLARA	Ambient Temp. (°F)	90	Meter Box Number	WST 1
Date	12/7/4	Barometric Pressure (in. H2O)	29.97	DGM Cal. Factor (Y)	1.002
Sampling Location	TGO 02T	Stack Temp. (°F)	557	Probe Length & Type	20' TFE
Sample Type	M 308	Average delta P (in. H2O)	0.166	Probe Heater Setting (°F)	NA
Run Number	1	Static Pressure (±) (in. H2O)	8-12"	Filter # & Type (if used)	NA
Operator	WPG/HFG	Sample Rate (lpm)	0.75	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set				
Initial leak $\checkmark$ =	0.00 @ 7"			
Final = 0.00 @ 5"				

Set:

Set:

Tenax Tube:

Tenax Tube:

Tenax Charcoal:

Tenax Charcoal:

Additional Tubes:

Additional Tubes:

Sampling Times		Gas Meter Reading (Vol in L or ft ³)	Rotameter Setting (lpm/ft ³ / min)	Meter Pressure (in.H ₂ O)	Meter Temp. (°F)	Condenser Temperature		Line Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in.Hg)
Run (min)	Clock (24hr)					A (°F)	B (°F)				
0	12:00	1841.40	0.75	2.4	94/98	N/A	N/A	N/A	N/A	N/A	
10	12:10	1848.87	0.75	2.4	98/98						
20	12:20	1856.10	0.75	2.4	98/97						
30	12:30	1863.68	0.75	2.4	98/98						
40	12:40	1871.10	0.75	2.4	98/98						
50	12:50	1878.52	0.75	2.4	98/98						
60	13:00	1886.0	0.75	2.4	97/96						
70	13:10	1893.41	0.75	2.3	96/96						
80	13:20	1900.75	0.75	2.3	98/96						
90	13:30	1908.20	0.75	2.4	98/97						
100	13:40	1915.92	0.75	2.4	98/97						
Run Time	Total Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm					Ts	Vacuum (in.Hg)

Comments:

Run TCO Oct 2
Page 1 of 1

Purpose: _____
 Other Data/Notes: _____

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

Comments:

0.75 μ m @ 100m

VOST FIELD DATA

Plant	Ambient Temp. (°F)	Meter Box Number
Date	Barometric Pressure (in. H2O)	DGM Cal. Factor (M)
Sampling Location	Stack Temp. (°F)	Probe Length & Type
Sample Type Alcohol	Average delta P (in. H2O)	Probe Heater Setting (°F)
Run Number	Static Pressure (±) (in. H2O)	Filter # & Type (if used)
Operator	Sample Rate (lpm)	Filter Temp. (°F)

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set	6.00 Lpm @ 5" Hg		0.00 @ 5" Hg	

Set: Set:

Tenax Tube:
Tenax Tube:

Tenax Charcoal:

Additional Tubes:
Additional Tubes:

[illegible]

Comments:

Plant	CUA - HEPA Out		Meter Number	VOST 5
Date	12/07/2004		Correction factor	1.034
Sample Type	M-308		Barometric Pressure	29.97
Run Number	1			

Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
1	0.00 lpm@10"	1158	6673.46							
			6678.8	0.8				84	84	
			6683.8	0.8				82	82	
			6689	0.7				83	83	
			6694	0.7				89	89	
	0.00 lpm@4"	1248	6699.02	0.7				85	85	
		Averages		0.74				84.6	84.6	
	Standard Meter Volume		25.71715773					84.6		

Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
2	0.00 lpm@5"	1402	6703.7							
			6708.71	0.8				85	85	
			6713.62	0.7				86	86	
			6718.6	0.7				87	87	
			6823.6	0.7				88	88	
	0.00 lpm@6"	1452	6728.5	0.6				89	89	
		Averages		0.7				87	87	
	Standard Meter Volume		24.84057046					87		

Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
3	0.00 lpm@9"	1600	6729.5							
			6734.5	0.8				87	87	
			6739.45	0.7				87	87	
			6744.5	0.7				88	88	
			6749.55	0.7				89	89	
	0.00 lpm@8"	1650	6754.68	0.6				90	90	
		Averages		0.7				88.2	88.2	
	Standard Meter Volume		25.16598337					88.2		

$$0.05 \text{ cm}^2/\text{m}^2$$

VOST FIELD DATA

Plant	CWA	Ambient Temp. (°F)	Meter Box Number	UO2T S
Date	12/17/14	Barometric Pressure (in. H2O)	DGM Cal. Factor (Y)	1.034
Sampling Location	HePA Out	Stack Temp. (°F)	Probe Length & Type	20' TFE
Sample Type	W308	Average delta P (in. H2O)	Probe Heater Setting (°F)	NA
Run Number	1	Static Pressure (±) (in. H2O)	Filter # & Type (if used)	NA
Operator	WPG/HCB	Sample Rate (lpm)	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set				
LEAK ✓ 0.00 gpm @ 10"			0.00 1 pm	@ 4"

Central

Sat: Sat:

Tenax Tube:
Tenax Tube:

Tenax Charcoal:

Additional Tubes: _____
Additional Tubes: _____

[illegible]**Comments:**

VOST FIELD DATA

Purpose: _____
 Other Data/Notes: _____

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

OR

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

Comments:

VOST FIELD DATA

Purpose: _____
Other Data/Notes: _____

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

Set: _____

Tenax Tube: _____

Tenax Charcoal: _____

Additional Tubes: _____

ORP-51444, Rev. 0

Comments:

Plant	CUA - TCO	Meter Number	VOST 3
Date	12/06/2004	Correction factor	1.027
Sample Type	Alcohol	Barometric Pressure	30
Run Number	1		

Run Number	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Outlet	Vacuum
1	0.00 lpm @7"	1730	0							
			9.95	0.8				75	75	
			20.05	0.8				75.1	75.1	
			28.2	0.75				77	77	
			35.6	0.7				78	78	
			43.12	0.7				79	79	
			50.65	0.7				79	79	
			58.2	0.7				81	81	
			65.69	0.7				82	82	
			73.27	0.7				82	82	
			80.6	0.7				83	83	
	0.00 lpm @ 8"	1912	82.05	0.7				83	83	
	Averages			0.72272727				79.4636364	79.4636364	
	Standard Meter Volume		82.85551907					79.4636364		

VOST FIELD DATA

Plant	CWA	Ambient Temp. (°F)	75	Meter Box Number	V0513
Date	12/06/04	Barometric Pressure (in. H2O)	30.0	DGM Cal. Factor (M)	1.027
Sampling Location TCO	Outlet	Stack Temp. (°C)	283°C	Probe Length & Type	15' TFE
Sample Type	Air	Average delta P (in. H2O)		Probe Heater Setting (°F)	NA
Run Number	1	Static Pressure (±) (in. H2O)	2-12"	Filter # & Type (if used)	NA
Operator	WPC	Sample Rate (lpm)	1.0	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in.Hg) μm	PRE TEST Vacuum (in.Hg)	POST TEST Rate (in.Hg) μm	POST TEST Vacuum (in.Hg)
Initial	0.00	7"	0.00	8"

Set: Set:

Tenax Tube: _____

Tenax Tube: _____

Tenax Charcoal:

Additional Tubes:
Additional Tubes:

[illegible]

Comments:

ORP-51444-Rev.0

Plant	CUA - Carbon Out				Meter Number	VOST 3				
Date	12/07/2004				Correction factor	1.027				
Sample Type	Alcohol				Barometric Pressure	29.97				
Run Number	1									
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
1	0.00 lpm@5"	1156	0							
			7.43	0.7				80	80	
			14.91	0.7				81	81	
			22.2	0.7				83	83	
			29.55	0.7				84	84	
			37	0.6				84	84	
			44.5	0.7				81	81	
			51.95	0.7				80	80	
			59.3	0.7				81	81	
			66.66	0.7				84	84	
			74.16	0.7				83	83	
	0.00 lpm@7"	1336						82.1	82.1	
	Averages			0.69						
	Standard Meter Volume		74.44350151							
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
2	0.00 lpm@7"	1358	0							
			7.4	0.7				88	88	
			14.82	0.7				85	85	
			22.5	0.7				86	86	
			30.12	0.8				85	85	
			37.65	0.8				86	86	
			45	0.7				86	86	
			52.45	0.7				86	86	
			59.87	0.7				87	87	
			67.48	0.7				86	86	
			75.16	0.7				87	87	
	0.00 lpm@7"	1538						86.2	86.2	
	Averages			0.72						
	Standard Meter Volume		74.88648811							
Run No.	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
3	0.00 lpm@7"	1558	0							
			7.5	0.8				85	85	
			14.91	0.7				86	86	
			22.35	0.8				85	85	
			29.85	0.7				86	86	
			37.5	0.7				85	85	
			45.06	0.8				86	86	
			52.52	0.8				84	84	
			60.03	0.7				83	83	
			67.48	0.7				85	85	
			75.01	0.7				85	85	
	0.00 lpm@7"	1738						85	85	
	Averages			0.74						
	Standard Meter Volume		74.90526141							

VOST FIELD DATA

Plant	CLIA	Ambient Temp. (°F)	90	Meter Box Number	VOST 3
Date	12/7/04	Barometric Pressure (in. H2O)	29.97	DGM Cal. Factor (Y)	1.027
Sampling Location	CARB. OUT	Stack Temp. (°F)	168	Probe Length & Type	20' TAE
Sample Type	Alcohol	Average delta P (in. H2O)	0.33	Probe Heater Setting (°F)	NA
Run Number	1	Static Pressure (±) (in. H2O)	-8.0"	Filter # & Type (if used)	NA
Operator	WPG	Sample Rate (lpm)	0.75	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg) 10 min	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set 1	6.00	5"	6.00	7"

Set:

Set:

Tenax Charcoal:

Tenax Charcoal:

Tenax Tube:

Tenax Tube:

Additional Tubes:

Additional Tubes:

[illegible]

Comments:

0.75 gpm for 100 min

VOST FIELD DATA

Plant	COA	Ambient Temp. (°F)	90	Meter Box Number	U05T 3
Date	12/7/04	Barometric Pressure (in. H2O)	29.97	DGM Cal. Factor (Y)	1.027
Sampling Location	CAEB.05T	Stack Temp. (°F)	187	Probe Length & Type	220' TFE
Sample Type	Alcohol	Average delta P (in. H2O)	0.36	Probe Heater Setting (°F)	NA
Run Number	2	Static Pressure (±) (in. H2O)	-7.6	Filter # & Type (if used)	↓
Operator	wpe	Sample Rate (lpm)	0.75	Filter Temp. (°F)	

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg) $\frac{\text{gpm}}{\text{in.}}$	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)
	0.00 $\frac{\text{gpm}}{\text{in.}}$ @ 7"		0.00 $\frac{\text{gpm}}{\text{in.}}$ @ 74	

Set:

Set:

Tenax Tube:

Tenax Tube:

Tenax Charcoal:

Tenax Charcoal:

Additional Tubes:

Additional Tubes:

[illegible]**Comments:**

0.75 lpm 100 min

VOST FIELD DATA

Plant	CWA	Ambient Temp. (°F)	90	Meter Box Number	UOST 3
Date	12/7/04	Barometric Pressure (in. H2O)	29.97	DGM Cal. Factor (Y)	1.027
Sampling Location	CARB DUT	Stack Temp. (°F)	181	Probe Length & Type	220' FE
Sample Type	Alcohol	Average delta P (in. H2O)	0.34	Probe Heater Setting (°F)	NA
Run Number	3	Static Pressure (±) (in. H2O)	1.2-1.4	Filter # & Type (if used)	NA
Operator	WDP	Sample Rate (lpm)	0.75	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST	PRE TEST	POST TEST	POST TEST
Set	Rate (in. Hg)	Vacuum (in. Hg)	Rate (in. Hg)	Vacuum (in. Hg)
	0.00 @ 7" Hg		0.00 @ 7"	

Set:
Set:

Tenax Tube:
Tenax Tube:

Tenax Charcoal:
Tenax Charcoal:

Additional Tubes:
Additional Tubes:

Sampling Times	Gas Meter Reading	Rotameter	Meter	Meter	Condenser Temperature	Line	Probe	Stack	Train
Run (min)	(Vol in L or ft3)	Setting (lpm/ft3/min)	Pressure (in. H2O)	Temp. (°F)	A (°F)	B (°F)	Temp. (°F)	Temp. (°F)	Vacuum (in. Hg)
0	0.00	0.75	0.8	85	NA	NA	NA	NA	-
10	7.50	0.75	0.7	86	↓	↓	↓	↓	↓
20	14.91	0.75	0.8	85	↓	↓	↓	↓	↓
30	22.35	0.75	0.7	86					
40	29.85	0.75	0.7	85					
50	37.50	0.75	0.7	85					
60	45.06	0.75	0.8	86					
70	52.52	0.75	0.8	84					
80	60.03	0.75	0.7	83					
90	67.48	0.75	0.7	85					
100	75.01	0.75	0.7	85					
Run Time	Total Volume Metered	Average Flow Rate	Average Pm	Average Tm				Ts	Vacuum (in. Hg)

Plant
Date
Sample Type

CUA - Melter Outlet Spike
11/15/2004
308 Alcohol

Meter Number
Correction factor
Barometric Pressure

VOST #2
1.028
30

Run Number	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
1	0.01 lpm @7"	2100	2601.27	1.6				88	86	
			2609	1.6				89	87	
			2614	1.7				90	88	
			2620	1.7				91	89	
			2626	1.7				93	91	
			2632	1.7				93	91	
			2638	1.7				94	92	
			2644.05	1.7				95	93	
			2650.1	1.7				95	93	
			2656.05	1.7				96	94	
	0.00 lpm @2"	2240	2663.27							
	Averages			1.68				92.4	90.4	
	Standard Meter Volume		61.39682816					91.4		

Run Number	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
2	0.01 lpm @5"	1212	66.8	1.6				88	88	
			71.5	1.6				88	90	
			76.1	1.6				90	92	
	0.00 lpm @2"	1242	80.87							
	Averages			1.6				88.6666667	90	
	Standard Meter Volume		13.982806177					89.3333333		

Run Number	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
3	0.00 lpm @4"	1359	2682.3	1.6				93	92	
			2687.3	1.6				94	92	
			2692.2	1.6				95	93	
	0.00 lpm @2"	1429	2697.22							
	Averages			1.6				94	92.3333333	
	Standard Meter Volume		14.724786755					93.1666667		

Run Number	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
4	0.00 lpm @3"	1543	2698.75	1.6				96	95	
			2703.6	1.6				97	95	
			2708.6	1.6				98	96	
	0.00 lpm @2"	1613	2713.74							
	Averages			1.6				97	95.3333333	
	Standard Meter Volume		14.714071751					96.1666667		

Flow
81.91 lpm
183.5 lpm
P-5144, Rev. 0

ORP-51444 Rev. 0

MATRIX SPIKE - 250 μ l of 1000 ppm Allyl

Other Data/Notes:

[illegible]

Comments:

30 min

MIDGET SAMPLING TRAIN FIELD DATA

Plant	CWA	Ambient Temp. (°F)	75	Meter Box Number	Vest 2
Date	11/16/04	Barometric Pressure (in. H2O)	30.0	DGM Cal. Factor (M)	1.028
Sampling Location	Meiner Out	Stack Temp. (°F)		Probe Length & Type	20' TFE
Sample Type	3CE	Average delta P (in. H2O)		Probe Heater Setting (°F)	NA
Run Number	1	Static Pressure (±) (in. H2O)	± -6"	Filter # & Type (if used)	Q-1055 W001
Operator	wplc	Sample Rate (lpm)	0.600	Filter Temp. (°F)	in stack

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set				
Initial	0.01 Lpm	5"		
Final	0.00 Lpm	2 1/2"		

[illegible]

Comments:

MIDGET SAMPLING TRAIN FIELD DATA

Plant	CUA	Ambient Temp. (°F)	75	Meter Box Number	VOST-2
Date	11/16/04	Barometric Pressure (in. H2O)	30.0	DGM Cal. Factor (Y)	1.028
Sampling Location	Mulkey out	Stack Temp. (°F)	275°C	Probe Length & Type	20' TFE
Sample Type	308 Alcohol	Average delta P (in. H2O)		Probe Heater Setting (°F)	NA
Run Number	2	Static Pressure (±) (in. H2O)	2 - 6"	Filter # & Type (if used)	Classified
Operator	WPC	Sample Rate (ppm)	0.5	Filter Temp. (°F)	in stack

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set		4"		
Initial	0.00	2"		
Final	0.01			

[illegible]

Com. rats:

MIDGET SAMPLING TRAIN FIELD DATA

Plant	Ambient Temp. (°F)	Meter Box Number	Test 2
Date	Barometric Pressure (in. H2O)	DGM Cal. Factor (M)	1.028
Sampling Location	Stack Temp. (°F)	Probe Length & Type	20' TFE
Sample Type	Average delta P (in. H2O)	Probe Heater Setting (°F)	NA
Run Number	Static Pressure (±) (in. H2O)	Filter # & Type (if used)	Glass wool
Operator	Sample Rate (ppm)	Filter Temp. (°F)	in stock

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg) <i>30 in</i>	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set				
Initial	0.00	3"		
Final	0.00	2"		

[illegible]

Comments:

21654 ft/m

Plant
Date
Sample Type

CUA - HEPA Outlet
11/16/2004
308 Alcohol

Meter Number
Correction factor
Barometric Pressure

VOST 3
1.027
30

Run Number	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
1	0.00 lpm @4"	1207	0	0.6				97	97	
			5.1	0.7				90	90	
			10	0.6				93.6	93.6	
			15.05	0.6				95	95	
			19.9	0.6				96	96	
			25.05	0.6				96	96	
	0.00 lpm@7"	1307	30.13	0.6				94.6	94.6	
Averages				0.61428571						
Standard Meter Volume			29.58753558					94.6		

Flow 100.15
156pm

ORP-51444, Rev. 0

Run Number	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
2	0.00 lpm @7"	1356	0	0.6				94	94	
			4.95	0.6				98	98	
			9.9	0.6				98	98	
			15.1	0.6				99	99	
			20.05	0.6				101	101	
			24.9	0.6				102	102	
	0.00 lpm @7"	1546	30.04	0.6				98.6666667	98.6666667	
Averages				0.6				98.6666667		
Standard Meter Volume			29.28341862					98.6666667		

Run Number	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature Coil 2	Probe	Meter Temperature Inlet	Meter Temperature Outlet	Vacuum
3	0.00 lpm @7"	1541	0	0.6				97	97	
			5.1	0.6				97	97	
			10.1	0.6				98	98	
			14.95	0.6				99	99	
			20.1	0.6				100	100	
			25.1	0.6				101	101	
	0.00 lpm @6 "	1641	30.07	0.6				98.6666667	98.6666667	
Averages				0.6				98.6666667		
Standard Meter Volume			29.31266305					98.6666667		

Run HEPA OUT 1
Page 1 of 1

Run HEPA OUT 1
Page 1 of 1

50

50

2000

ORP-51444 Rev. 0

Comments:

MIDGET SAMPLING TRAIN FIELD DATA

Plant		Ambient Temp. (°F)	Meter Box Number	VOST #
Date	11/16/04	Barometric Pressure (in. H ₂ O)	DGM Cal. Factor (Y)	1.027
Sampling Location	NEPA Out	Stack Temp. (°F)	Probe Length & Type	15' TFE
Sample Type	308 Alcohol	Average delta P (in. H ₂ O)	Probe Heater Setting (°F)	N/A
Run Number	2	Static Pressure (±) (in. H ₂ O)	Filter # & Type (if used)	N/A
Operator	WPL	Sample Rate (lpm)	Filter Temp. (°F)	N/A

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set				
Tail	0.001 pm	7"		
Field	0.001 pm	7"		

[illegible]

Computats:

MIDGET SAMPLING TRAIN FIELD DATA

Plant	CWA	Ambient Temp. (°F)	75	Meter Box Number	105T 3
Date	11/16/04	Barometric Pressure (in. H2O)	30.0	DGM Cal. Factor (Y)	1.027
Sampling Location	HepA Out	Stack Temp. (°F)		Probe Length & Type	15' TF
Sample Type	308 Alcohol	Average delta P (in.H2O)		Probe Heater Setting (°F)	NA
Run Number	3	Static Pressure (±) (in. H2O)	1.0	Filter # & Type (if used)	NA
Operator	WPC	Sample Rate (lpm)	0.5	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST, Rate (in. Hg) ^{10m}	PRE TEST Vacuum (in. Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in. Hg)
Set				
Initial	0.00	7"		
Final	0.00	6"		

[illegible]

Comments:

$$V_S = 476 \mu A \approx 28126 \mu A \text{ ms}$$

Flow
79.286/10
220-26 dsc/m
-206.34
(181.96 @ 4" B)

Plant CUA - TCO Outlet Meter Number VOST #5
Date 11/16/2004 Correction factor 1.034
Sample Type 308 Alcohol Barometric Pressure 30

Run Number	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature		Probe	Meter Temperature		Vacuum
						Coil 2			Inlet	Outlet	
1	0.01 lpm @5"	1210	441.5	0.7					88	88	
			448.5	0.7					98	98	
			456.2	0.7					100	100	
			463.8	0.6					101	101	
			471.2	0.7					102	102	
			478.7	0.7					103	103	
			486.3	0.6					103	103	
			493.5	0.7					103	103	
			501	0.7					103	103	
			508.5	0.7					102	102	
	0.00 lpm@6"	1350	516.03								
Averages				0.68				100.3	100.3		
Standard Meter Volume			72.455294902					100.3			

Run Number	Leak Rate	Time	Volume	Pressure	Temperature		Probe	Meter Temperature		Vacuum	
					Coil 1	Coil 2		Inlet	Outlet		
2	0.00 lpm @6"	1354	6517	0.7				100	100		
			6524.4	0.6				95	95		
			6531.9	0.7				97	97		
			6539.5	0.6				96	96		
			6546.7	0.7				96	96		
			6554.7	0.7				96	96		
			6561.9	0.7				96	96		
			6569.4	0.7				96	96		
			6577.1	0.7				96	96		
			6584.3	0.6				96	96		
	0.00 lpm @6"	1534	6591.85								
		Averages		0.67				96.4	96.4		
	Standard Meter Volume		73.27463877					96.4			

Run Number	Leak Rate	Time	Volume	Pressure	Coil 1	Temperature		Probe	Meter Temperature		Vacuum	
						Coil 2			Inlet	Outlet		
3	0.00 lpm @6"	1539	6592.32	0.7					93	93		
			6599.7	0.7					95	95		
			6607.1	0.7					96	96		
			6615	0.7					96	96		
			6622.4	0.6					96	96		
			6629.7	0.6					96	96		
			6637.1	0.7					96	96		
			6644.9	0.6					96	96		
			6652.4	0.6					96	96		
			6659.8	0.6					96	96		
	0.00 lpm @6"	1719	6667.18									
		Averages		0.65					95.6	95.6		
	Standard Meter Volume		73.386357788						95.6			

MIDGET SAMPLING TRAIN FIELD DATA

Plant	CWA	Ambient Temp. (°F)	75	Meter Box Number	VOST 5
Date	11/16/04	Barometric Pressure (in. H ₂ O)	30.0	DGM Cal. Factor (Y)	1.034
Sampling Location	TCO Outlet	Stack Temp. (°F)	310000	Probe Length & Type	10' TFE
Sample Type	308 Alcohol	Average delta P (in. H ₂ O)		Probe Heater Setting (°F)	NA
Run Number	1	Static Pressure (±) (in. H ₂ O)	3 - 10"	Filter # & Type (if used)	NA
Operator	WPC	Sample Rate (lpm)	0.75	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in.Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in.Hg)
Set				
Initial	0.01 @ 5"			
Post	0.00 @ 6"			

Sampling Times		Gas Meter Reading Vol In L or ft ³	Rotameter Setting (lpm/ft ³ /min)	Meter Pressure (in.H ₂ O)	Meter Temp. (°F)	Probe Temp. (°F)	Stack Temp. (°F)	Train Vacuum (in.Hg)
Run (min)	Clock (24hr)							
0	12:09:00	448.50	0.75	0.7	68	N/A	N/A	4
10	12:20	448.5	0.80	0.7	98	V	V	4
20	12:30	456.2	0.75	0.7	100	V	V	4
30	12:40	463.8	0.75	0.6	101	V	V	4
40	12:50	471.2	0.75	0.7	102	V	V	4
50	13:00	478.7	0.75	0.7	103	V	V	4
60	13:10	486.3	0.75	0.6	103	V	V	4
70	13:20	493.5	0.75	0.7	103	V	V	4
80	13:30	501.0	0.75	0.7	103	V	V	4
90	13:40	508.5	0.75	0.7	103	V	V	4
100	13:50	516.03	0.75	0.7	102	V	V	4
Total Run Time		Total Volume Metered	Average Flow Rate	Average Pm	Average Tm	Average Ts	Highest Vacuum (in.Hg)	

Comments:

ORP-51444_Rev. 0

Purpose: _____

 Other Data/Notes: _____

[illegible]

MIDGET SAMPLING TRAIN FIELD DATA

Plant		Ambient Temp. (°F)	Meter Box Number	VOST
Date	11/16/04	Barometric Pressure (in. H ₂ O)	DGM Cal. Factor (Y)	1.034
Sampling Location	TCO Outlet	Stack Temp. (°F)	Probe Length & Type	10' TFE
Sample Type	308 Alcohol	Average delta P (in. H ₂ O)	Probe Heater Setting (°F)	NA
Run Number	3	Static Pressure (±) (in. H ₂ O)	Filter # & Type (if used)	NA
Operator	wjw	Sample Rate (lpm)	Filter Temp. (°F)	NA

Purpose:

Other Data/Notes:

LEAK CHECKS:	PRE TEST Rate (in. Hg)	PRE TEST Vacuum (in.Hg)	POST TEST Rate (in. Hg)	POST TEST Vacuum (in.Hg)
Set				
Initial	0.00	6"		
Final	0.00	6"		

[illegible]

Comments:

$O_n = 246$

Appendix C

Chain of Custody

PROJECT		CWA DM1200 MACT TEST		ANALYSES		NO OF CONTAINERS		REMARKS		SAMPLING ID NO.		
SITE		VSL								(for lab use only)		
COLLECTED BY (Signature)		DATE/TIME SAMPLE COLLECTED		SAMPLE MATRIX		DATE/TIME						
Mettler Run 1	↓	Filter	12/10/14	1	✓							
↓	↓	F ¹ HNO ₃	↓	1	1				167.3			
Mettler Run 2	↓	B ¹ HNO ₃	↓	2	↓				5070.8	229.3		
↓	↓	Filter	12/10/14	1	✓				205.2			
↓	↓	F ¹ HNO ₃	↓	1	↓				676.3			
Mettler Run 3	↓	Filter	12/10/14	1	✓				43.5			
↓	↓	B ¹ HNO ₃	↓	1	↓				193.5			
↓	↓	F ¹ HNO ₃	↓	1	↓				561.5			
REMARKS												
* STL Analytes: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn												
RECEIVED BY:		DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME
LAB USE ONLY												
RECEIVED FOR LABORATORY BY:		DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP °C	SEAL #	CONDITION		
[Signature]												
REMARKS												

Chain of Custody Record

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PROJECT CUA DRUGS PILOT TEST		ANALYSES		NO. OF CONTAINERS		REMARKS		SAMPLING ID NO. (for lab use only)		
SITE VSC	DATE/TIME SAMPLE COLLECTED	SAMPLE MATRIX	DATE/TIME SAMPLE COLLECTED	NO. OF CONTAINERS	REMARKS	SAMPLING ID NO. (for lab use only)	DATE	TIME	DATE	TIME
TCO Run 1	12/10/14	FILTER	12/10/14	1						
↓	↓	F 1/2 HNO3	↓	1	171.7					
↓	↓	B 1/2 HNO3	↓	1	458.2					
TCO Run 2	12/10/14	FILTER	12/10/14	1						
↓	↓	F 1/2 HNO3	↓	1	179.2					
↓	↓	B 1/2 HNO3	↓	1	619.1					
TCO Run 3	12/10/14	FILTER	12/10/14	1						
↓	↓	F 1/2 HNO3	↓	1	159.8					
↓	↓	B 1/2 HNO3	↓	1	477.6					
RECEIVED BY: <u>[Signature]</u> DATE: <u>12-10-14</u> TIME: <u>15:30</u> RELINQUISHED BY: <u>[Signature]</u> DATE: <u>12-10-14</u> TIME: <u>15:30</u>										

LAB USE ONLY			
RECEIVED FOR LABORATORY BY:	DATE	TIME	OPENED BY:
<u>[Signature]</u>	12/10/14	15:30	
REMARKS			

TR / TREC Environmental, LLC
P. O. Box 12353
Research Triangle Park, NC 27709-2353

Chain of Custody Record

Page _____ of _____

PROJECT		ANALYSES		NO. OF CONTAINERS		SAMPLING		REMARKS (s)		SAMPLING	
SITE		DATE/TIME		SAMPLE MATRIX		DATE/TIME		REMARKS (s)		SAMPLING	
DM 1200 MAET Testing		12.11.4		Filter							
VSL				F ₁ HNO ₃				156.3			
				B ₁ HNO ₃				731.2			
Collected By (Signature)				Filter							
				F ₁ HNO ₃				173.3			
				D ₁ HNO ₃				721.6			
Melter Run 5				Filter							
				F ₁ HNO ₃				191.4			
				D ₁ HNO ₃				751.0			
REMARKS											
* STL Analytes: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn											
RECEIVED BY:		DATE		TIME		RELINQUISHED BY:		DATE		TIME	
RELINQUISHED BY:		DATE		TIME		RELINQUISHED BY:		DATE		TIME	

LAB USE ONLY		LAB USE ONLY		LAB USE ONLY		LAB USE ONLY	
RECEIVED FOR LABORATORY BY:		DATE		TIME		AIRBILL NO.	
REMARKS		DATE		TIME		TEMP °C	
SEAL #		DATE		TIME		CONDITION	

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P. O. Box 12353
Research Triangle Park, NC 27709-2353

Chain of Custody Record

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PROJECT DM 1200 MACT Testing		ANALYSES		NO. OF CONTAINERS		REMARKS		SAMPLING ID NO. (for lab use only)	
SITE VSC									
COLLECTED BY (Signature) <i>Val D. Dwyer</i>									
FIELD SAMPLE I.D.		SAMPLE MATRIX		DATE/TIME					
TCO Run 4		Filter		12.11.4					
↓		F _{1/2} HNO ₃				105.1			
		B _{1/2} HNO ₃				494.4			
TCO Run 5		Filter							
↓		F _{1/2} HNO ₃				149.8			
		B _{1/2} HNO ₃				482.5			
TCO Run 6		Filter							
↓		F _{1/2} HNO ₃				127.7			
		B _{1/2} HNO ₃				468.2			
REMARKS									
* 67L Analytes: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn									
RECEIVED BY:		DATE		TIME		RELINQUISHED BY:		DATE	
RELINQUISHED BY:		DATE		TIME		RELINQUISHED BY:		DATE	

RECEIVED FOR LABORATORY BY:		DATE		TIME		AIRBILL NO.		OPENED BY:		DATE		TIME		TEMP °C		SEAL #		CONDITION	
<i>Reynolds</i>		12-11-04		15:30															
REMARKS:																			

Chain of Custody Record

Page _____ of _____

PROJECT

DM1200 MACT Tuting

SITE

VSL

COLLECTED BY (Signature)

FIELD SAMPLE I.D.

TCO Run 7

SAMPLE MATRIX

F-116

DATE/TIME

12.11.4

NO. OF CONTAINERS

1*

ANALYSES

Meth/S*

SAM ID NO.

(for lab use only)

REMARKS

125.5

RELINQUISHED BY:

DATE

TIME

RECEIVED BY:

DATE

TIME

RELINQUISHED BY:

DATE

TIME

REMARKS

* STL Analytes: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn

LAB USE ONLY									
RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP °C	SEAL #	CONDITION
<i>Paula Dorman</i>	12-10-00	15:30							
REMARKS									

[illegible]

Chain of Custody Record

AIR/TECH
Environmental, LLC
P. O. Box 12363
Research Triangle Park, NC 27709-2353
AIR-100011

[illegible]

RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP °C	SEAL #	CONDITION
<i>Stephen J. [Signature]</i>	2/20/04	1:53D							
REMARKS									

Chain of Custody Record

Page _____ of _____

PROJECT

CWA DM1200 MACT TEST

SITE

VSL

COLLECTED BY (Signature)

FIELD SAMPLE I.D.

SAMPLE MATRIX

DATE/TIME SAMPLE COLLECTED

NO OF CONTAINERS

ANALYSES

REMARKS

SAM ID NO. (for lab use only)

Melter Run 1	H ₂ SO ₄	12/10/14	1	X						484.1 gm	
Melter Run 1	NaOH	12/10/14	1	X						327.1	
Melter Run 2	H ₂ SO ₄	12/10/14	1	X						488.1	
Melter Run 2	NaOH	12/10/14	1	X						278.2	
Melter Run 3	H ₂ SO ₄	12/10/14	1	X						312.6	
Melter Run 3	NaOH	12/10/14	1	X						385.1	
Tell Run 1	H ₂ SO ₄	12/10/14	1	X						414.1	
Tell Run 1	NaOH	12/10/14	1	X						289.1	
X X X X X											

REMARKS

RELINQUISHED BY:

DATE

TIME

RECEIVED BY:

DATE

TIME

RELINQUISHED BY:

DATE

TIME

Page

of

LAB USE ONLY									
RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP °C	SEAL #	CONDITION
<i>Deputy H. [Signature]</i>	2-13-11	15:30							
REMARKS									

TRC Environmental, LLC
P. O. Box 12353
Research Triangle Park, NC 27709-2353

Chain of Custody Record

PROJECT: **DM 1200 MACT Testing** Page ____ of ____

SITE: **VSL**

COLLECTED BY (Signature): *[Signature]*

FIELD SAMPLE I.D. SAMPLE MATRIX DATE/TIME NO. OF CONTAINERS ANALYSES

FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES	REMARKS	SAM ID NO. (for lab use only)
Melter R4	H ₂ SO ₄	12.11.4	1	✓	767.3	
	NaOH		1	✓	262.4	
R5	H ₂ SO ₄		1	✓	614.7	
	NaOH		1	✓	289.4	
R6	H ₂ SO ₄		1	✓	627.5	
	NaOH		1	✓	307.4	

REMARKS:

RECEIVED BY: DATE TIME RELINQUISHED BY: DATE TIME RECEIVED BY: DATE TIME RELINQUISHED BY: DATE TIME

LAB USE ONLY

RECEIVED FOR LABORATORY BY: DATE TIME AIRBILL NO. OPENED BY: DATE TIME TEMP °C SEAL # CONDITION

REMARKS:

TRC Environmental, LLC
P. O. Box 12353
Research Triangle Park, NC 27709-2353

Chain of Custody Record

PROJECT: _____ Page ____ of ____

SITE: _____

COLLECTED BY (Signature): _____

FIELD SAMPLE I.D. SAMPLE MATRIX DATE/TIME NO. OF CONTAINERS ANALYSES

FIELD SAMPLE I.D.	SAMPLE MATRIX	DATE/TIME	NO. OF CONTAINERS	ANALYSES	REMARKS	SAM ID NO. (for lab use only)
TCO R4	H ₂ SO ₄	12.11.4	1	✓	425.9	
	NaOH		1	✓	265.3	
R5	H ₂ SO ₄		1	✓	401.1	
	NaOH		1	✓	291.4	
R6	H ₂ SO ₄		1	✓	419.6	
	NaOH		1	✓	290.7	

REMARKS:

RECEIVED BY: DATE TIME RELINQUISHED BY: DATE TIME RECEIVED BY: DATE TIME RELINQUISHED BY: DATE TIME

LAB USE ONLY

RECEIVED FOR LABORATORY BY: DATE TIME AIRBILL NO. OPENED BY: DATE TIME TEMP °C SEAL # CONDITION

REMARKS:

Chain of Custody Record

[illegible]

LAB USE ONLY									
RECEIVED FOR LABORATORY BY:	DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP °C	SEAL #	CONDITION
<i>Dr. J. H. Smith</i>	12/17/74	15:30							
REMARKS:									

Chain of Custody Record

Page _____ of _____

PROJECT		NO. OF CONTAINERS		ANALYSES		REMARKS		SAMPLING ID. NO.	
SITE		DATE/TIME		SAMPLE MATRIX		DATE/TIME		SAMPLING ID. NO.	
DM 1200 MACT Testing		12.10.4 - 12.11.4		VOST					
COLLECTED BY (Signature)									
FIELD SAMPLE I.D.		SAMPLE MATRIX		DATE/TIME		NO. OF CONTAINERS		REMARKS	
VOST Melter R4A		VOST Tubes		12.11.4		3			
R4B						3			
R4C						4			
Melter R5A						3			
R5B						3			
R5C						4			
Melter R6A						3			
R6B						3			
R6C						4			
REMARKS									
RECEIVED BY:		DATE		TIME		RELINQUISHED BY:		DATE	
RELINQUISHED BY:		DATE		TIME		RECEIVED BY:		DATE	

RECEIVED FOR LABORATORY BY:		DATE		TIME		AIRBILL NO.		OPENED BY:		DATE		TIME		TEMP °C		SEAL #		CONDITION	
Duke Jensen		12-01-04		15:30															
REMARKS																			

Chain of Custody Record

Page _____ of _____

PROJECT		NO. OF CONTAINERS		ANALYSES		REMARKS		SAMPLING ID. NO.	
FIELD SAMPLE ID.	SAMPLE MATRIX	DATE/TIME	DATE	TIME	DATE	TIME	DATE	TIME	
VOST TCO R4A	VOST TCO	12.11.4	3						
R4B			3						
R4C			4						
R5A			3						
R5B			3						
R5C			4						
R6A			3						
R6B			3						
R6C			4						
REMARKS		VOST TCO METHOD BLANK		4		✓			
RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	

RECEIVED FOR LABORATORY BY:		DATE		TIME		AIRBILL NO.		OPENED BY:		DATE		TIME		TEMP °C		SEAL #		CONDITION	
REMARKS																			

Tech Environmental, LLC
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Research Triangle Park, NC 27709-2353

Chain of Custody Record

Page ____ of ____

PROJECT DM 1200 MACT Testing			NO OF CONTAINERS	ANALYSES									
SITE VSC				Dioxin/Furans									
COLLECTED BY (Signature) <i>[Signature]</i>													
FIELD SAMPLE I.D. TCO Dioxin/Furan R4													
SAMPLE MATRIX Filter			DATE/TIME 12.10.4			REMARKS			SAM ID NO. (for lab use only)				
R5			Ace/MecI			171.3							
			Toluene			60.5							
R6			Filter			202.8							
			Ace/MecI			71.8							
			Toluene			237.7							
			Ace/MecI			57.0							
			Toluene										
REMARKS													
RECEIVED BY:			DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME
LAB USE ONLY													
RECEIVED FOR LABORATORY BY:			DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP °C	SEAL #	CONDITION:		
REMARKS													

4 86-30337

Tech Environmental, LLC
P. O. Box 12353
Research Triangle Park, NC 27709-2353

Chain of Custody Record

Page ____ of ____

PROJECT DM 1200 MACT Testing			NO OF CONTAINERS	ANALYSES									
SITE				Dioxin/Furans									
COLLECTED BY (Signature)													
FIELD SAMPLE I.D. Dioxin/Furan Melter R3													
SAMPLE MATRIX Filter			DATE/TIME			REMARKS			SAM ID NO. (for lab use only)				
			Ace/MecI			254.6							
			Toluene			254.6							
			H ₂ O			89.6							
Melter R4			Filter			236.5							
			Ace/MecI			181.0							
			Toluene			64.0							
			H ₂ O			243.6							
REMARKS Dioxin/Furan Filter Blank													
RECEIVED BY:			DATE	TIME	RELINQUISHED BY:	DATE	TIME	RECEIVED BY:	DATE	TIME	RELINQUISHED BY:	DATE	TIME
LAB USE ONLY													
RECEIVED FOR LABORATORY BY:			DATE	TIME	AIRBILL NO.	OPENED BY:	DATE	TIME	TEMP °C	SEAL #	CONDITION:		
REMARKS													

4 86-30337

Appendix D

Meter Box Calibrations

	γ	Pressure	Rate
VOST / 2	1.028	1.6	.5 lpm
/ 5	1.034	6.8	1 lpm / 0.8 .5 lpm
/ 3	1.027	0.8	1 lpm / 0.8 .75 lpm
/ 1	1.002	2.4	0.75 lpm

	γ	ΔH sampling
? ATC	0.999	1.67 1.74 1.9
✓ ATA	1.0175	.41 .48 .67 .85
✓ ATB	1.068	.41 .40
✓ ATD	1.0248	1.0 .9

PSD { 12/04 Large Apex CUA 1.029
 11/04 ATA 1.0175

Full Post 1/28/05

1.83

ORP-51444, Rev. 0

Subject: CUA Large Box Calibration
From: "Nick D'Angelo" <NickD@vsl.cua.edu>
Date: Tue, 22 Feb 2005 16:19:13 -0500
To: <answers@ipass.net>

Jim,

Here's the calibration spreadsheet I used. I was looking at the wrong graph when I said the gammas were outside the range. However, the deviation from the "pre" calibration I know is outside of regs. The Y before was 1.029 and the dH@ was 1.892

Nick

Sent by The VSL Web Mail System and verified virus free!!!

Full Calibration

Meter # VOST, meter # 1

Barometric Pressure 30

Meter Vacuum 0

Meter Pressure 2.8 (AVERAGE VALUE)

LPM	Meter Vol.	Time	Tbfm	Tm In	Tm Out	Hg	"Yd"
Initial	1	8503	0	68	72	72	0
Final	1	8508	5	67	72	72	0
Result	5	5		67.5		72	1.02
Initial	1.00	8508	0	67	72	72	0
Final	1.00	8513.1	5	68	72	72	0
Result	5.00	5.1		67.5		72	1.00
Initial	1.00	8513.1	0	68	72	72	0
Final	1.00	8518.2	5	68	72	72	0
Result	5.00	5.1		68		72	1.00
Initial							
Final							
Result							8

Initial
Final
ResultInitial
Final
Result

Meter pressure

	5						
Initial	2.00	8520	0	69	72	72	0
Final	2.00	8528.2	4	69	74	73	0
Result	8.00	8.2		69		72.75	0.99
Initial	2.00	8528.2	0	69	74	73	0
Final	2.00	8536.4	4	69	74	74	0
Result	8.00	8.2		69		73.75	1.00
Initial	2.00	8536.4	0	69	74	74	0
Final	2.00	8544.6	4	69	74	74	0
Result	8.00	8.2		69		74	1.00
Initial							
Final							
Result							

Initial
Final
ResultInitial
Final
Result

Meter pressure

	1.7						
Initial	0.50	8545.5	0	69	72	73	0
Final	0.50	8550.5	10	69	72	73	0
Result	5.00	5		69		72.5	1.01
Initial	0.50	8550.5	0	69	72	69	0
Final	0.50	8555.6	10	70	72	73	0
Result	5.00	5.1		69.5		73	0.99
Initial	0.50	8555.6	0	72	71	71	0
Final	0.50	8560.6	10	72	71	71	0
Result	5.00	5		72		71	1.00
Initial							
Final							
Result							

Initial
Final
ResultInitial
Final
ResultInitial
Final
Result

Average 1.001518

Full Calibration

Meter # VOST , meter # 2

Barometric Pressure 29.97

Meter Vacuum 0

Meter Pressure 1.7 (AVERAGE VALUE)

	LPM	Meter Vol.	Time	Tbfm	Tm In	Tm Out	Hg	"Yd"
Initial	0.46511628	2563	0	65	73	71	0	
Final	0.46511628	2572.5	21	64	73	71	0	
Result	9.76744186	9.5		64.5		72		1.04720323
Initial	0.46511628	2572.5	0	64	73	71	0	
Final	0.46511628	2582.1	21	64	73	71	0	
Result	9.76744186	9.6		64		72		1.0372837
Initial	0.46511628	2582.1	0	64	73	73	0	
Final	0.46296296	2591.75	21	64	73	71	0	
Result	9.74483204	9.65		64		71		1.0275853
Initial								
Final								
Result								

Initial
Final
ResultInitial
Final
Result

Meter pressure 2

Initial	0.95	2486.5	0	63	73	71	0	
Final	0.95	2492.2	6	63	73	71	0	
Result	5.71	5.7		63		72		1.02401105
Initial	0.95	2492.2	0	63	73	71	0	
Final	0.95	2497.9	6	63	73	71	0	
Result	5.71	5.7		63		72		1.02401105
Initial	0.95	2497.9	0	63	73	71	0	
Final	0.95	2503.65	6	64	73	71	0	
Result	5.71	5.75		63.5		72		1.01413707
Initial								
Final								
Result								

Initial
Final
ResultInitial
Final
Result

Meter pressure 3.4

Initial	2.00	2523	0	64	73	71	0	
Final	2.00	2530.9	4	63	72	70	0	
Result	8.00	7.9		63.5		71.5		1.0324216
Initial	2.00	2530.9	0	63	72	71	0	
Final	2.00	2538.8	4	63	72	70	0	
Result	8.00	7.9		63		71.25		1.03292254
Initial	2.00	2538.8	0	64	72	71	0	
Final	2.00	2546.8	4	63	72	71	0	
Result	8.00	8		63.5		71.5		1.01951633
Initial								
Final								
Result								

Initial
Final
ResultInitial
Final
ResultInitial
Final
Result

Average 1.02878799

Full Calibration

Meter # VOST , meter # 3

Barometric Pressure 29.97

Meter Vacuum 23

Meter Pressure 0.08 (AVERAGE VALUE)

	LPM	Meter Vol.	Time	Tbfn	Tm	In	Tm Out	Hg	"Yd"
Initial	0.4784689	17.5	0	73		78	78	0	
Final	0.4784689	22.15	10	73		78	78	0	
Result	4.784689	4.65		73			78		1.03882181
Initial	0.48	22.15	0	74		78	78	0	
Final	0.48	26.77	10	74		79	79	0	
Result	4.78	4.62		74			78.5		1.04457932
Initial	0.48	26.77	0	74		79	79	0	
Final	0.48	31.5	10	74		80	80	0	
Result	4.78	4.73		74			79.5		1.02218146
Initial									
Final									
Result									

Initial
Final
ResultInitial
Final
Result

Meter pressure

		1							
Initial	0.98	32.3	0	74		80	80	0	
Final	0.98	42.03	10	74		80	80	0	
Result	9.80	9.73		74			80		1.02
Initial	0.98	42.03	0	74		80	80	0	
Final	0.98	51.65	10	74		81	81	0	
Result	9.80	9.62		74			80.5		1.03
Initial	0.98	51.65	0	74		81	81	0	
Final	0.98	61.4	10	74		81	81	0	
Result	9.80	9.75		74			81		1.02
Initial									
Final									
Result									

Initial
Final
ResultInitial
Final
Result

Meter pressure

		2.2							
Initial	2.00	62.3	0	74		81	81	0	
Final	2.00	82.3	10	74		81	81	0	
Result	20.00	20		74			81		1.02
Initial	2.00	82.3	0	74		81	81	0	
Final	2.00	102.3	10	74		81	81	0	
Result	20.00	20		74			81		1.02
Initial	2.00	102.3	0	74		81	81	0	
Final	2.00	122.29	10	74		81	81	0	
Result	20.00	19.99		74			81		1.02
Initial									
Final									
Result									

Initial
Final
ResultInitial
Final
ResultInitial
Final
Result

Average 1.02640939

Full Calibration

Meter # VOST , meter # 5

Barometric Pressure 30.15

Meter Vacuum 0

Meter Pressure 1 (AVERAGE VALUE)

	LPM	Meter Vol.	Time	Tbfm	Tm	In	Tm Out	Hg	"Yd"
Initial	1.5	3271.5	0	80		84	84	0	
Final	1.5	3278.15	4.5	80		84	84	0	
Result	6.75	6.65		80			84		1.02505019
Initial	1.5	3278.15	0	80		84	84	0	
Final	1.5	3284.7	4.5	80		84	84	0	
Result	6.75	6.55		80			84		1.04069981
Initial	1.5	3284.7	0	80		84	84	0	
Final	1.5	3291.3	4.5	78		85	85	0	
Result	6.75	6.6		79			84.5		1.03568293
Initial									
Final									
Result									

Initial
Final
ResultInitial
Final
Result

Meter pressure		0.8							
Initial	1.00	3221.5	0	75		80	80	0	
Final	1.00	3227.4	6	76		80	80	0	
Result	6.00	5.9		75.5			80		1.02799591
Initial	1.00	3227.4	0	76		80	80	0	
Final	1.00	3233.3	6	78		82	82	0	
Result	6.00	5.9		77			81		1.02702279
Initial	1.00	3233.3	0	78		82	82	0	
Final	1.00	3239.6	6.5	78		82	82	0	
Result	6.50	6.3		78			82		1.04195192
Initial									
Final									
Result									

Initial
Final
ResultInitial
Final
Result

Meter pressure		1							
Initial	2.00	3242	0	74		79	79	0	
Final	2.00	3249.85	4	74		80	80	0	
Result	8.00	7.85		74			79.5		1.0321157
Initial	2.00	3249.85	0	74		80	80	0	
Final	2.00	3257.7	4	75		82	82	0	
Result	8.00	7.85		74.5			81		1.03401716
Initial	2.00	3257.7	0	75		82	82	0	
Final	2.00	3265.52	4	75		82	82	0	
Result	8.00	7.82		75			82		1.03893075
Initial									
Final									
Result									

Initial
Final
ResultInitial
Final
ResultInitial
Final
Result

Average 1.03371857

Method 5 Dry Gas Meter Calibrations For:

"ATA" 11/12/04

**** FULL CALIBRATION ****

- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record readings in outlined boxes below, other columns are automatically calculated.

Air-Tech

DATE: 11/12/04		METER SERIAL #: ATA		METER PART #: 1375		CRITICAL ORIFICE SET SERIAL #: 1375		BAROMETRIC PRESSURE (in Hg): 30.02		INITIAL 30.02		FINAL 30.02		AVG (P _{bar}) 30.02		Pre Test "Y" = AH =	
																IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED	

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT ³)				TEMPERATURES °F				ELAPSED TIME (MIN)	DGM ΔH (in H ₂ O)	V _m (STD)	V _c (STD)	(3)	Y VARI (%)	ΔH@
				INITIAL	FINAL	NET (V _m)	AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL							
56	1	0.2951	23	363.80	369.040	5.240	67	69	69	68	68	68.5	14.00	0.45	5.2593	5.4042	1.0275	1.7050
	2	0.2951	23	369.040	374.280	5.240	70.5	69	70	68	69	69	14.00	0.45	5.2543	5.3863	1.0251	1.7147
	3	0.2951	23	374.080	379.340	5.260	73	70	72	69	70	70.25	14.00	0.45	5.2620	5.3737	1.0212	1.7180
AVG = 1.0246 #DIV/0!																		
54	1	0.426	20	379.50	384.910	5.410	74.5	71	73	67	68	69.75	10.00	0.95	5.4237	5.5331	1.0202	1.7498
	2	0.426	20	384.910	390.320	5.410	75.5	73	74	68	69	71	10.00	0.95	5.4110	5.5280	1.0216	1.7490
	3	0.426	20	390.320	395.730	5.410	76.5	74	75	69	69	71.75	10.00	0.95	5.4033	5.5228	1.0221	1.7498
AVG = 1.0213 #DIV/0!																		
52	1	0.5876	18	396.40	401.660	5.260	77	76	77	74	74	75.25	7.00	1.8	5.230	5.330	1.0191	1.7364
	2	0.5876	18	401.660	406.940	5.280	78	77	78	74	75	76	7.00	1.8	5.2425	5.3251	1.0157	1.7372
	3	0.5876	18	406.940	412.220	5.280	78	78	78	75	76	76.75	7.00	1.8	5.2352	5.3251	1.0172	1.7348
AVG = 1.0173 #DIV/0!																		
51	1	0.6647	17	413.0	418.130	5.130	77	79	79	76	76	77.5	6.00	2.3	5.0856	5.1680	1.0162	1.7287
	2	0.6647	17	418.130	423.280	5.150	77	79	80	76	78	78.25	6.00	2.3	5.0983	5.1680	1.0137	1.7263
	3	0.6647	17	423.280	428.470	5.190	78	80	81	78	77	79	6.00	2.3	5.1307	5.1632	1.0063	1.7271
AVG = 1.0121 #DIV/0!																		
48	1	0.8354	15	429.40	434.80	5.40	78	80	82	77	78	79.25	5.00	3.6	5.3527	5.4077	1.0103	1.7160
	2	0.8354	15	434.80	440.20	5.40	79	82	83	78	78	80.25	5.00	3.6	5.3428	5.4026	1.0112	1.7161
	3	0.8354	15	440.20	445.610	5.410	79	83	83	79	79	81	5.00	3.6	5.3453	5.4026	1.0107	1.7137
AVG = 1.0107 #DIV/0!																		

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 1.0175

Method 5 Dry Gas Meter Calibrations For:

CUA

**** POST CALIBRATION ****

- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record readings in outlined boxes below, other columns are automatically calculated.

Air-Tech

DATE: 3/1/05		METER SERIAL #: 1375		BAROMETRIC PRESSURE (in Hg): 29.4		INITIAL 29.4		FINAL 29.4		AVG (P _{bar}) 29.4		Pre Test "YD" = 1.0175		DH = 1.7282				
METER PART #: ATA		CRITICAL ORIFICE SET SERIAL #: 1375												IF Y VARIATION EXCEEDS 5.00%, ORIFICE SHOULD BE RECALIBRATED				
ORIFICE #	RUN #	K'	TESTED VACUUM (in Hg)	DGM READINGS (FT ³)		TEMPERATURES °F				ELAPSED TIME (MIN)	DGM ΔH (in H ₂ O)	V _m (STD)	V _{cr} (STD)	(3)	Y	VAR (%)		
				INITIAL	FINAL	AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL								DGM OUTLET FINAL	DGM AVG
54	1	0.4485	19	64.0	72.490	8.490	65	69	68	69	68	68.5	15.00	0.96	8.3561	8.6347	1.0333	1.6039
54	2	0.4485	19	72.490	76.462	3.972	66	69	69	68	68	68.5	7.00	0.96	3.9094	4.0257	1.0298	1.6069
54	3	0.4485	19	76.462	82.714	6.252	67	69	69	68	68	68.5	11.00	0.96	6.1534	6.3201	1.0271	1.6100
													AVG = 1.0301		1.23			

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 1.0301

AVERAGE ΔH_g = 1.6069

(1) V_m (std) = K₁ V_m $\frac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions

K₁ = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) V_{cr} (std) = K' $\sqrt{\frac{P_{bar}}{T_{amb}}}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) Y = $\frac{V_{cr} (std)}{V_m (std)}$ = DGM calibration factor

ΔH_g = $\frac{0.75 \Delta H}{V_{cr}(std)}$

Method 5 Dry Gas Meter Calibrations For:

**** FULL CALIBRATION ****

- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record readings in outlined boxes below, other columns are automatically calculated.

Air-Tech

DATE: 7/8/04		METER SERIAL #: 1375		INITIAL 30.1		FINAL 30.1		AVG (P _{bar}) 30.1		Pre Test "Y" =		AH =							
METER PART #: ATB		CRITICAL ORIFICE SET SERIAL #: 1375		BAROMETRIC PRESSURE (in Hg):		ELAPSED TIME (MIN) θ		DGM ΔH (in H ₂ O)		(1) V _m (STD)		(2) V _{cr} (STD)		(3) Y		Y VARI (%)		ΔH ₀	
ORIFICE #		K' FACTOR (AVG)		TESTED VACUUM (in Hg)		AMBIENT		TEMPERATURES °F		DGM INLET		DGM OUTLET		DGM AVG		DGM ΔH (in H ₂ O)		DGM ΔH (in H ₂ O)	
RUN #						INITIAL		FINAL		INITIAL		FINAL		INITIAL		FINAL		INITIAL	
56		1		22		745.50		750.775		5.275		73.25		73.75		73.75		0.4	
56		2		22		750.775		756.055		5.280		73.75		73.75		73.75		0.4	
56		3		22		756.055		761.320		5.265		73.75		73.75		73.75		0.4	
																		AVG = 1.0229 #DIV/0!	
54		1		19		761.40		766.910		5.510		74.5		74.5		74.5		0.91	
54		2		19		766.910		772.430		5.520		75		75		75		0.91	
54		3		19		772.430		777.932		5.502		75.5		75.5		75.5		0.91	
																		AVG = 1.0092 #DIV/0!	
52		1		18		778.10		783.440		5.340		76.25		76.25		76.25		1.8	
52		2		18		783.440		788.805		5.365		77		77		77		1.8	
52		3		18		788.805		794.182		5.377		76.5		76.5		76.5		1.8	
																		AVG = 1.0019 #DIV/0!	
51		1		17		794.30		799.450		5.150		76.5		76.5		76.5		2.3	
51		2		16		799.450		804.670		5.220		76		76		76		2.3	
51		3		16		804.670		809.820		5.150		76.75		76.75		76.75		2.3	
																		AVG = 1.0059 #DIV/0!	
48		1		14		810.010		815.440		5.430		76.25		76.25		76.25		3.8	
48		2		14		815.440		820.850		5.410		77		77		77		3.8	
48		3		14		820.850		826.280		5.430		77.5		77.5		77.5		3.8	
																		AVG = 1.0020 #DIV/0!	

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 1.0081

CUA

**** POST CALIBRATION ****

- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record readings in outlined boxes below, other columns are automatically calculated.

Air-Tech

[illegible]

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_o (std), and the DGM calibration factor, Y . These equations are automatically calculated in the spreadsheet above.

$$\begin{aligned}
 (1) \quad V_m(\text{std}) &= K_1 V_m \frac{P_{\text{bar}} + (\Delta H/13.6)}{T_m} && = \text{Net volume of gas sample passed through DGM, corrected to standard conditions} \\
 &&& K_1 = 17.64 \text{ }^\circ\text{R/in. Hg (English), } 0.3858 \text{ }^\circ\text{K/mm Hg (Metric)} \\
 &&& T_m = \text{Absolute DGM avg. temperature (}^\circ\text{R - English, }^\circ\text{K - Metric)} \\
 (2) \quad V_{cr}(\text{std}) &= K' \sqrt{\frac{P_{\text{bar}}}{T_{\text{amb}}}} && = \text{Volume of gas sample passed through the critical orifice, corrected to standard conditions} \\
 &&& T_{\text{amb}} = \text{Absolute ambient temperature (}^\circ\text{R - English, }^\circ\text{K - Metric)} \\
 &&& K' = \text{Average } K' \text{ factor from Critical Orifice Calibration} \\
 (3) \quad Y &= \frac{V_{cr}(\text{std})}{V_m(\text{std})} && = \text{DGM calibration factor}
 \end{aligned}$$

AVERAGE $\Delta H_{\text{e}} = 1.6549$

$$\Delta H_{\theta} = \frac{0.75 \theta}{V_{cr}(\text{std})} \frac{\Delta H}{V_m(\text{std})} V_m$$

AVERAGE DRY GAS METER CALIBRATION FACTOR. Y = 1.0338

AVERAGE ΔH_{a} = 1.6549

Method 5 Dry Gas Meter Calibrations For:

**** FULL CALIBRATION ****

- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record readings in outlined boxes below, other columns are automatically calculated.

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Pre Test "Y" = AH =

AVG (P_{bar})
30.1

FINAL
30.1

INITIAL
30.1

METER SERIAL #:
1218/03

CRITICAL ORIFICE SET SERIAL #:
ATD

METER PART #:
1375

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT ³)				TEMPERATURES *F				DGM ΔH (in H ₂ O)	ELAPSED TIME (MIN)	V _m (STD)				V _{cr} (STD)	Y	Y	VARI (%)	ΔH _g
				INITIAL	FINAL	INITIAL	FINAL	AMBIENT	DGM INLET	DGM INLET	DGM OUTLET	DGM OUTLET										

56	1	0.2951	22	274.80	280.0	5.20	74	74	74	73	73	73.5	14.00	5.1837	5.3829	1.0384	1.6310	5.1837	1.0384	1.0384	1.6310
56	2	0.2951	22	280.0	285.220	5.220	75	74	74	73	74	73.75	14.00	5.2012	5.3779	1.0340	1.6333	5.2012	1.0340	1.0340	1.6333
56	3	0.2951	22	285.220	290.450	5.230	75	74	74	74	74	74	14.00	5.2088	5.3779	1.0325	1.6325	5.2088	1.0325	1.0325	1.6325

54	1	0.426	20	258.40	263.820	5.420	76	75	75	74	74	74.5	10.00	5.40	5.5401	1.0259	1.7711	5.40	1.0259	1.0259	1.7711
54	2	0.426	20	263.820	269.250	5.430	76	75	74	74	74	74.25	10.00	5.4125	5.5401	1.0236	1.7720	5.4125	1.0236	1.0236	1.7720
54	3	0.426	20	269.250	274.70	5.450	76	74	74	74	74	74	10.00	5.4350	5.5401	1.0193	1.7728	5.4350	1.0193	1.0193	1.7728

52	1	0.5876	18	242.10	247.320	5.220	75	75	75	72	72	73.5	7.00	5.2236	5.3542	1.0250	1.9242	5.2236	1.0250	1.0250	1.9242
52	2	0.5876	18	247.320	252.540	5.220	75	75	76	72	73	74	7.00	5.2187	5.3542	1.0260	1.9224	5.2187	1.0260	1.0260	1.9224
52	3	0.5876	18	252.540	257.780	5.240	75	76	76	73	73	74.5	7.00	5.2338	5.3542	1.0230	1.9206	5.2338	1.0230	1.0230	1.9206

51	1	0.6647	17	225.50	230.540	5.040	73	72	73	70	71	71.5	6.00	5.0674	5.2012	1.0264	1.8063	5.0674	1.0264	1.0264	1.8063
51	2	0.6647	17	230.540	235.590	5.050	73	73	74	71	71	72.25	6.00	5.0703	5.2012	1.0258	1.8037	5.0703	1.0258	1.0258	1.8037
51	3	0.6647	17	235.590	240.650	5.060	73	74	74	71	72	72.75	6.00	5.0756	5.2012	1.0248	1.8020	5.0756	1.0248	1.0248	1.8020

48	1	0.8354	15	209.10	214.380	5.280	71	68	70	67	67	68	5.00	5.3647	5.4577	1.0173	1.9187	5.3647	1.0173	1.0173	1.9187
48	2	0.8354	15	214.380	219.680	5.30	72	70	72	67	68	69.25	5.00	5.3723	5.4526	1.0149	1.9178	5.3723	1.0149	1.0149	1.9178
48	3	0.8354	15	219.680	224.980	5.30	72	72	73	68	69	70.5	5.00	5.3596	5.4526	1.0173	1.9133	5.3596	1.0173	1.0165	1.9133

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 1.0248

AVERAGE ΔH_g = 1.8094

AVERAGE "Y" VARIATION SHOULD NOT EXCEED 2% = #DIV/0!

Method 5 Dry Gas Meter Calibrations For:

CUA

**** POST CALIBRATION ****

Air-Tech

- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 3/1/05 METER PART #: ATD METER SERIAL #: 1375 CRITICAL ORIFICE SET SERIAL #: 1375

INITIAL 29.4 FINAL 29.4 AVG (P_{bar}) 29.4 Pre Test "YD" = 1.0248 DH = 1.809

BAROMETRIC PRESSURE (in Hg): 29.4 IF Y VARIATION EXCEEDS 5.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT ³)				TEMPERATURES °F				ELAPSED TIME (MIN)	DGM ΔH (in H ₂ O)	(1) V _m (STD)	(2) V _{cr} (STD)	(3) Y	VARI (%)	ΔH _g
				INITIAL	FINAL	NET (V _m)	AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL							
54	1	0.4485	18	93.90	99.610	5.710	61.5	58	62	57	59	10.00	0.98	5.7232	5.7758	1.0092		1.6583
54	2	0.4485	18	99.610	107.018	7.408	62.5	62	63	59	62	13.00	0.98	7.3895	7.5013	1.0151		1.6585
54	3	0.4485	18	7.018	12.148	5.130	62.5	62	63	62	64	9.00	0.98	5.1049	5.1932	1.0173		1.6475
														AVG =		1.0139	-1.07	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVG DRY GAS METER CALIBRATION FACTOR, Y = 1.0139

AVERAGE ΔH_g = 1.6517

(1) V_m (std) = K₁ V_m $\frac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions

K₁ = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) V_{cr} (std) = K' $\sqrt{\frac{P_{bar}}{T_{amb}}}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) Y = $\frac{V_{cr} (std)}{V_m (std)}$ = DGM calibration factor

ΔH_g = 0.75 $\frac{\Delta H}{V_{cr} (std)}$ $\frac{V_m (std)}{V_m}$

Method 5 Dry Gas Meter Calibrations For:

ATC - 04/05/2004

**** FULL CALIBRATION ****

- 1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
- 2) Record barometric pressure before and after calibration procedure.
- 3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
- 4) Record readings in outlined boxes below, other columns are automatically calculated.

Air-Tech

DATE: 4/5/04		METER SERIAL #: ATC		METER PART #: 1375		CRITICAL ORIFICE SET SERIAL #: 1375		BAROMETRIC PRESSURE (in Hg):		INITIAL 30		FINAL 30		AVG (P _{bar}) 30		Pre Test "Y" = AH =		
																IF Y VARIATION EXCEEDS 2.00% ORIFICE SHOULD BE RECALIBRATED		
ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT ³)		TEMPERATURES *F				DGM ΔH (in H ₂ O)		(1) V _m (STD)		(2) V _{cr} (STD)		(3) Y VARI (%)		ΔH _g
				INITIAL	FINAL	AMBIENT	DGM INLET	DGM INLET	DGM OUTLET	DGM AVG	ELAPSED TIME (MIN)							
56	1	0.2908	22	334.90	340.170	73	68	67	65	67	14.00	0.4	5.3028	5.2918	0.9979	1.5846		
	2	0.2908	22	340.170	345.440	73	67	72	67	69	14.00	0.4	5.2828	5.2918	1.0017	1.5786		
	3	0.2908	22	345.440	350.70	72	72	73	69	72	14.00	0.4	5.2454	5.2968	1.0098	1.5675		
AVG = 1.0031 #DIV/0!																		
54	1	0.426	20	368.80	374.390	68	73	73	73	73	10.00	0.91	5.5658	5.5634	0.9996	1.6466		
	2	0.426	20	374.390	379.980	68	73	73	73	73	10.00	0.91	5.5658	5.5634	0.9996	1.6466		
	3	0.426	20	379.980	385.860	68	73	73	73	73	10.50	0.91	5.8545	5.8416	0.9978	1.6466		
AVG = 0.9990 #DIV/0!																		
52	1	0.591	18	386.80	392.180	70	73	73	73	74	7.00	1.8	5.3658	5.3926	1.0050	1.7016		
	2	0.591	18	392.180	397.560	71	73	75	74	73	7.00	1.8	5.3608	5.3875	1.0050	1.7032		
	3	0.591	18	397.560	402.960	70	75	76	73	74	7.00	1.8	5.3732	5.3926	1.0036	1.6976		
AVG = 1.0045 #DIV/0!																		
51	1	0.6659	17	405.40	410.650	69	75	75	74	74	6.00	2.3	5.2303	5.2129	0.9967	1.7075		
	2	0.6659	17	410.650	415.920	68	75	75	74	74	6.00	2.3	5.2502	5.2179	0.9938	1.7043		
	3	0.6659	17	415.920	421.190	67	75	75	74	74	6.00	2.3	5.2502	5.2228	0.9948	1.7010		
AVG = 0.9951 #DIV/0!																		
48	1	0.8401	15	421.60	427.150	69	75	76	76	74	5.00	3.7	5.5402	5.4805	0.9892	1.7292		
	2	0.8401	15	427.150	432.690	70	76	77	74	74	5.00	3.7	5.5303	5.4753	0.9901	1.7325		
	3	0.8401	15	432.690	438.250	70	77	78	74	74	5.00	3.7	5.5450	5.4753	0.9874	1.7309		
AVG = 0.9889 #DIV/0!																		

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = **0.9986**
 AVERAGE ΔH_g = **1.6719**
 AVERAGE "Y" VARIATION SHOULD NOT EXCEED 2% = **#DIV/0!**

Air-Tech

4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 3/1/05	METER SERIAL #: 1375	INITIAL 29.4	FINAL 29.4	AVG (P _{bar}) 29.4	Pre Test "YD" = 0.999	DH = 1.6719
METER PART #: ATC	CRITICAL ORIFICE SET SERIAL #: 1375	BAROMETRIC PRESSURE (in Hg):		IF Y VARIATION EXCEEDS 5.00%, ORIFICE SHOULD BE RECALIBRATED		

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	TEMPERATURES °F										ELAPSED TIME (MIN)	DGM ΔH (in H ₂ O)	VARI (%)			ΔH _g
				AMBIENT	DGM INLET		DGM OUTLET	DGM AVG	(1) V _m (STD)	(2) V _{cr} (STD)	(3)	Y							
					INITIAL	FINAL							INITIAL			FINAL			
51	1	0.4485	20	62.5	61	62	59	60	60.5	5.338	7.288	9.00	0.98	5.3349	5.1932	0.9734	1.6576		
	51	0.4485	20	64	60	62	60	62	61	4.751	12.039	8.00	0.98	4.7437	4.6096	0.9717	1.6528		
	51	0.4485	20	65.5	64	66	62	64	64	6.523	18.562	11.00	0.98	6.4756	6.3291	0.9774	1.6530		

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.9742

AVERAGE ΔH_g = 1.6552

$$(1) V_m (std) = K_1 V_m \frac{P_{bar} + (\Delta H / 13.6)}{T_m} = \text{Net volume of gas sample passed through DGM, corrected to standard conditions}$$

$$K_1 = 17.64 \text{ } ^\circ\text{R/in. Hg (English), } 0.3858 \text{ } ^\circ\text{K/mm Hg (Metric)}$$

$$T_m = \text{Absolute DGM avg. temperature (} ^\circ\text{R - English, } ^\circ\text{K - Metric)}$$

$$(2) V_{cr} (std) = K' \sqrt{\frac{P_{bar} \theta}{T_{amb}}} = \text{Volume of gas sample passed through the critical orifice, corrected to standard conditions}$$

$$T_{amb} = \text{Absolute ambient temperature (} ^\circ\text{R - English, } ^\circ\text{K - Metric)}$$

$$K' = \text{Average K' factor from Critical Orifice Calibration}$$

$$(3) Y = \frac{V_{cr} (std)}{V_m (std)} = \text{DGM calibration factor}$$

$$\Delta H_g = \frac{0.75 \beta}{V_{cr} (std)} \Delta H \frac{V_m (std)}{V_m}$$

APEX INSTRUMENTS METHOD 5 PRE-TEST CONSOLE CALIBRATION
USING CALIBRATED CRITICAL ORIFICES
5-POINT ENGLISH UNITS

Meter Console Information	
Console Model Number	511
Console Serial Number	CUA Large Case 511-A-E
DGM Model Number	
DGM Serial Number	

Calibration Conditions			
Date	Time	28-Jan-05	15:00
Barometric Pressure	30.7	in Hg	
Theoretical Critical Vacuum ¹	14.5	in Hg	
Calibration Technician	Nick D'Angelo		

Factors/Conversions		
Std Temp	528	°R
Std Press	29.92	in Hg
K _i	17.647	oR/in Hg

¹For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.

²The Critical Orifice Coefficient, K', must be entered in English units, (ft³•s²/R^{1/2})/(in.Hg•min).

Calibration Data										
Run Time	Metering Console					Critical Orifice				
Elapsed	DGM Orifice ΔH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Serial Number	Coefficient	Amb Temp Initial	Amb Temp Final	Actual Vacuum
(θ)	(P _m)	(V _m)	(V _{mf})	(t _m)	(t _{mf})		K'	(t _{amb})	(t _{amb})	
min	in H ₂ O	cubic feet	cubic feet	°F	°F		see above ²	°F	°F	in Hg
13.0	0.7	718.606	724.760	64	64	DC48	0.3430	64	64	22
13.0	0.7	724.760	730.891	64	64	DC48	0.3430	64	64	22
13.0	0.7	730.891	737.144	64	65	DC48	0.3430	64	64	22
12.0	1.4	737.144	744.597	65	65	DC55	0.4560	64	67	20
12.0	1.4	744.597	752.177	65	65	DC55	0.4560	67	67	20
12.0	1.4	752.177	759.770	61	61	DC55	0.4560	59	60	20
8.0	2.1	759.770	766.267	61	62	DC63	0.5880	60	60	19
8.0	2.2	766.267	772.758	63	63	DC63	0.5880	60	60	19
8.0	2.2	772.758	779.249	63	63	DC63	0.5880	60	60	19
6.0	4.2	779.249	785.933	63	63	DC73	0.8130	60	60	16
6.0	4.2	785.933	792.612	63	63	DC73	0.8130	60	60	17
6.0	4.2	792.612	799.310	63	63	DC73	0.8130	60	60	17
5.0	6.3	799.310	806.138	63	66	DC81	1.0100	60	60	14
5.0	6.3	806.138	812.969	66	66	DC81	1.0100	60	60	14
5.0	5.2	812.969	819.870	65	65	DC81	1.0100	60	60	14

Results								
Standardized Data				Dry Gas Meter				
Dry Gas Meter		Critical Orifice		Calibration Factor		Flowrate	ΔH @	
(V _{m(ΔH)})	(Q _{m(ΔH)})	(V _{cr(ΔH)})	(Q _{cr(ΔH)})	Value	Variation	Std & Corr	0.75 SCFM	Variation
cubic feet	cfm	cubic feet	cfm	(Y)	(ΔY)	(Q _{m(ΔH)(corr)})	(ΔH@)	(ΔΔH@)
						cfm	in H ₂ O	
6.381	0.491	5.988	0.461	0.938	0.001	0.461	1.846	-0.187
6.358	0.489	5.988	0.461	0.942	0.004	0.461	1.929	-0.105
6.478	0.498	5.988	0.461	0.924	-0.013	0.461	1.927	-0.106
7.726	0.644	7.338	0.611	0.950	0.012	0.611	2.114	0.080
7.858	0.655	7.327	0.611	0.933	-0.005	0.611	2.120	0.086
7.931	0.661	7.380	0.615	0.930	-0.007	0.615	2.106	0.072
6.792	0.849	6.341	0.793	0.934	-0.004	0.793	1.977	-0.057
6.768	0.846	6.341	0.793	0.937	-0.001	0.793	2.066	0.032
6.768	0.846	6.341	0.793	0.937	-0.001	0.793	2.066	0.032
7.002	1.167	6.576	1.096	0.939	0.001	1.096	2.083	0.049
6.997	1.166	6.576	1.096	0.940	0.002	1.096	2.083	0.049
7.017	1.170	6.576	1.096	0.937	-0.001	1.096	2.083	0.049
7.168	1.434	6.808	1.362	0.950	0.012	1.362	2.039	0.005
7.151	1.430	6.808	1.362	0.952	0.014	1.362	2.033	-0.001
7.226	1.445	6.808	1.362	0.942	0.004	1.362	1.674	-0.360
				0.938	Y Average		2.034	ΔH@ Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR 40 Part 60, using the Precision Wet Test Meter # 11AE6.

Appendix E

Gravimetric Raw Data

Description: 4"

ORP-51444, Rev. 0

Date:	7-16-04	7-21-04				
Time:	10:00 am	6:40 am				
% RH:	67%	74%				
Temp:	70°	68°				
100 G	100.0004	100.0000				
1G	1.00005	1.00001				
072004-037	0.7010	0.7010	✓			
-038	0.6899	0.6899	✓			
-039	0.7098	0.7097	✓			
-040	0.7124	0.7124	✓			
-041	0.7141	0.7140	✓			
-042	0.7096	0.7095	✓			
-043	0.7132	0.7131	✓			
-044	0.7149	0.7147	✓			
-045	0.6939	0.6938	✓			
-046	0.6899	0.6899	✓			
-047	0.6867	0.6867	✓			
-048	0.7064	0.7063	✓			
-049	0.7010	0.7010	✓			
-050	0.7030	0.7030	✓			
-051	0.7013	0.7013	✓			
-052	0.7162	0.7162	✓			
-053	0.7173	0.7173	✓			
-054	0.7076	0.7077	✓			
-055	0.7102	0.7102	✓			
-056	0.6983	0.6982	✓			
-057	0.7052	0.7052	✓			
-058	0.7031	0.7030	✓			
-059	0.6908	0.6908	✓			
-060	0.7101	0.7101	✓			
-061	0.7075	0.7074	✓			
-062	0.7004	0.7005	✓			
-063	0.6988	0.6987	✓			
-064	0.7157	0.7156	✓			
-065	0.7029	0.7029	✓			
-066	0.7062	0.7060	✓			
-067	0.7018	0.7017	✓			
-068	0.7262	0.7261	✓			
						1521

Description:

[illegible]

DRY DOWN FORM

COA 12/12/04 Tot

DATE: _____

[illegible]

Description:

Date:	09/14/04	09/15/04			
Time:	0845	0950			
% RH:	73	71			
Temp:	70	77			
100 G	100.0000	100.0000			
1G	1.00005	1.0001			
082404-1	0.1321	0.1322 ✓			
2	0.1329	0.1329 ✓			
3	0.1327	0.1327 ✓			
4	0.1317	0.1317 ✓			
5	0.1334	0.1334 ✓			
6	0.1310	0.1310 ✓			
7	0.1327	0.1326 ✓			
8	0.1330	0.1330 ✓			
9	0.1313	0.1313 ✓			
10	0.1339	0.1339 ✓			
11	0.1337	0.1338 ✓			
12	0.1315	0.1315 ✓			
13	0.1325	0.1324 ✓			
14	0.1332	0.1332 ✓			
15	0.1321	0.1321 ✓			
16	0.1323	0.1324 ✓			
17	0.1337	0.1337 ✓			
18	0.1324	0.1325 ✓			
19	0.1325	0.1325 ✓			
20	0.1317	0.1317 ✓			
21	0.1322	0.1324 ✓			
22	0.0989	0.0989 ✓			
23	0.0988	0.0990 ✓			
24	0.0988	0.0988 ✓			
25	0.0985	0.0985 ✓			
26	0.0990	0.0989 ✓			
27	0.0989	0.0989 ✓			
28	0.0985	0.0985 ✓			
29	0.0988	0.0988 ✓			
30	0.0991	0.0991 ✓			

Description:

Date:	2-9-04	2-12-04	2-16-04	2/2/04		
Time:	1030	0800	1030	11.15		
% RH:	55	56	54	75		
Temp:	68	69	70	72		
100 G	100.0004	100.0003	100.0001	100.0000		
1G	1.00010	1.00003	1.00005			
BB 525	111.3456	111.3452	✓	✓		
526	107.0725	107.0713	107.0717	✓	107.0700	
527	109.2563	109.2549	109.2553	✓	109.2539	
528	108.4039	108.4026	108.4029	✓	108.4015	
529	118.7686	118.7673	118.7671	✓		
530	106.3838	106.3825	106.3827	✓	106.3813	
531	108.4243	108.4240	✓	✓	108.4214	
532	119.4255	119.4244	119.4245	✓	119.4229	
533	107.4422	107.4409	107.4409	✓		
534	107.7762	107.7750	107.7750	✓		
535	110.1065	110.1052	110.1053	✓	110.1042	
536	117.1258	117.1242	117.1240	✓	117.1225	
537	108.1232	108.1218	108.1220	✓		
538	109.1965	109.1951	109.1955	✓		
539	109.4226	109.4224	✓	✓		
540	112.7552	112.7539	112.7542	✓		
541	104.4086	104.4072	104.4074	✓		
542	108.0296	108.0281	108.0285	✓		
543	110.1994	110.1980	110.1983	✓		
544	108.8617	108.8605	108.8608	✓		
545	107.8465	107.8462	✓	✓		
546	112.6491	112.6473	112.6477	✓		
547	113.0683	113.0669	113.0673	✓		
548	107.1710	107.1706	✓	✓		

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Description:1526

DAKED

ORP-51444_Rev_0

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Date:		12-16-04	12-17-04	12/20/04	12/21/04	
Time:		6:35 am	6:45 am		0800	
% RH:		64%	65%	58	58	
Temp:		58	62	58 64	62	
100 G		99.9992	100.0000	100.0001	100.0006	
1G		1.00009	1.00012	1.00008	1.00003	
(	82404-27 S-	0.09893	0.09893	✓		
-	82404-12 S-	0.13153	0.13153	✓		
/	82404-28 Finl	0.09915	0.09912	✓		
Tco						
072004 - 055	Rm 1 Tella	0.7113	0.7113	✓		
-057	2 "	0.7059	0.7058	✓		
-060	3 "	0.6919	0.6919	✓		
-063	4 "	0.6988	0.6987	✓		
-053	5 "	0.7175	0.7175	✓		
-058	6 "	0.7032	0.7032	✓		
molt						
072004 - 056		0.8081	0.8086	✓		
-052		0.8124	0.8129	✓		
-059		0.7792	0.7799	0.7788	0.7792 ✓	
-061	Partial R-4	0.7654	0.7657	✓		
102903 - 9	R-4 Quartz	0.9527	0.9533	0.9520	0.9522 ✓	
102903 - 10	R-5 Quartz	0.9893	0.9903	0.9883	0.9888 ✓	
072004 - 075	R-6 Tella ^a	0.8637	0.8644	0.8632	0.8635 ✓	
Glass						
072004 - 054	Blank	0.7084	0.7084	✓		
091604						

CDA 12/2/04 Test

DATE:

[illegible]

1530

1531

*The Catholic University of America
Vitreous State Laboratory*

*Regulatory Off-Gas Emissions Testing on the DM1200
Melter System Using HLW and LAW Simulants
Final Report, VSL-05R5830-1, Rev. 0*

APPENDIX V

Data Validation Reports

Executive Summary

In performing the validation of the Catholic University Vitreous State Laboratory Data Packages, the following steps were followed:

- For any given data package, the Test Plan was reviewed to ensure a correct understanding of the methods to be applied and the analyses to be performed;
- In the actual data package, the Chain of Custody forms were reviewed to verify that the correct analysis was requested and the correct samples were put into the data package.
- The Sample Summary in the data package was checked thoroughly to be sure that the samples included in the data package corresponded to the samples listed on the Chain of Custody forms.
- The Analytical Methods summary and the Narrative of the data package were carefully reviewed to ensure that the correct methods were applied, that appropriate Standard Operating Procedures were used and cited where appropriate, and that the Narrative clearly described any departures from the standard methodology cited. If the results indicated that there was an undocumented departure from the written methodology, the laboratory was questioned to establish clearly what was done.
- Analytical results were examined carefully, assuring that the raw data supplied supported the reported results. Calculations were verified.
- QC data were examined to ensure that all of the correct information was supplied and that all quality control parameters met the appropriate technical specifications.
- Laboratory checklists were examined carefully to ensure that all relevant information from the checklists was discussed in the data package Narrative.
- Instrument logs were examined carefully to ensure that all samples were analyzed within specified hold times.

General Observations

In general, the laboratory was responsive and helpful when questions were asked. The Project Manager, Richard Lafond, was thoroughly knowledgeable about documentation and Mr. Lafond did not hesitate to request information from appropriate QA staff or laboratory managers to answer questions about the data or the analytical methods.

HLW

The HLW data set contained eighteen packages of environmental data. The packages were in general of excellent quality. The laboratory followed the specified methodology, applied the methodology correctly, and reported the results clearly, including all supporting quality control data. In terms of technical difficulty, the VOST analysis for the volatile organic compounds represented the most serious technical challenge. The stationary source matrix was challenging to the analytical methodology. The VOST data packages showed the most difficulty with surrogate recoveries within technical specifications and analytes at levels above the calibration range. Observation of an analyte above the top of the calibration range automatically qualifies that analyte as “estimated” since, in general for the VOST, samples are expended in the analysis and the analysis cannot be repeated at a dilution to bring the analyte within the calibration range. The TOE analysis, a complex analysis with many components, was performed correctly and the data package for this analysis was coherent, well narrated, and well summarized and organized.

LAW

The Low Activity Waste (LAW) represented a greater technical challenge, since the analytes were present at far lower levels relative to the background matrix. The LAW data set contained eighteen packages of environmental data. The packages were in general of excellent quality, but the editorial quality of the data packages for this data set was significantly lower than for the HLW data set: there were missing pages, extraneous pages, pages turned upside down in the package, etc. Fortunately the STL data packages are sufficiently redundant in many areas (sample receipt information, for example, is found in three places in the data package) so that information missing from one section is readily found in another. However, in this data package, the STL laboratory encountered difficulties with deciphering the sample labels and matching the sample container labels to the Chain of Custody documentation. The Narratives of the data packages accurately reflected what was done to resolve the problem and what experimental procedures were followed in the laboratory. Once again, in terms of technical difficulty, the VOST analysis for the volatile organic compounds represented the most serious technical challenge. The stationary source matrix was challenging to the analytical methodology. The VOST data packages showed the most difficulty with surrogate recoveries within technical specifications and analytes at levels above the calibration range. Observation of an analyte above the top of the calibration range automatically qualifies that analyte as “estimated” since, in general for the VOST, samples are expended in the analysis and the analysis cannot be repeated at a dilution to

bring the analyte within the calibration range. The TOE analytical results were spread among several data packages; the client will be forced to gather the pieces from the four data packages where they are found and match the correct parts.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H4K140110
Test #3 Hot Plenum
Volatile Organic Compounds (VOST)**

Overall Assessment of Data Package H4K140110:

The following observations are relevant to the VOST analysis for Data Package H4K140110:

- Data reported for compounds with boiling points above 100°C should be considered estimates; quantitative sampling in the field cannot be guaranteed for these compounds unless field validation data with dynamic spiking in the field are available to demonstrate that quantitative sampling can occur.
- Values calculated for compounds reported “Above the calibration” should be considered estimated values; these estimated values may well significantly under-report the true value because of chromatographic saturation and the possibility of sorbent breakthrough.
- Since Tenax samples were analyzed as a pair, it is not possible to determine the amount of breakthrough that occurred from Tube #1 to Tube #2. However, according to EPA guidance, observation of 30% or more of the compound of interest relative to the paired Tenax tubes on the Tenax/Anasorb tube is indicative of breakthrough.
- Because of their water solubility, values for the polar compounds (i.e., acetonitrile, 2-hexanone, acetone, 2-butanone) may be significantly under-reported. The general practice for ensuring quantitative purging for these compounds is to heat and salt the purge water, which was not done in this analysis. The original text of Method 0031 does not consider these compounds appropriate VOST compounds under the standard VOST analytical conditions.
- The occurrence of vinyl chloride may be significantly over-reported. Because of the toxicity of this compound, the general practice at STL-Knoxville is to report the compound and calculate a concentration for vinyl chloride given the slightest indication of its presence, rather than requiring the presence of a distinct identifiable mass spectrum.
- The highest values reported for acetonitrile (i.e., >10 µg) may significantly over-report this concentration because of the presence of a coeluting compound with common peaks.
- In order to report some of the observed concentrations, the STL - Knoxville laboratory must be using a split chromatographic injection. The capacity of most

capillary columns is 1000 ng (1 µg) or less. Amounts of compounds in excess of 5-10 µg would cause serious chromatographic and detector saturation; this amount of material therefore cannot be introduced directly into the chromatographic column.

- Analytical parameters for the VOST analysis are within control, and the data package is complete and well organized. The data package would benefit from a more complete Narrative, describing the analysis in more detail and describing the transition of the samples from the Chain of Custody form to the Sample Summary.
- Because benzene was greater than the calibration range for the samples listed below, the concentration of benzene may be over- or under-reported; reported values for benzene should be considered “Estimated” in these samples.
- Trichloroethene, reported as “above the calibration range” in the samples listed below, may also be over- or under-reported and the value of trichloroethene in these samples should be considered “Estimated.”

The following additional observations regarding the data set were reported in the Narrative:

- The result for acetonitrile for method blank G06101AA was greater than the reporting limit. However, data validity is unaffected since acetonitrile was not detected at a level greater than the reporting limit in the associated samples.
- The second tube of the Tenax/Tenax pair for sample VOST TCO Run 6B Tenax was broken and could not be analyzed. The first tube was analyzed alone and reported.
- The concentration of benzene was greater than the calibration range for samples:
VOST Melter Run 4A Tenax
VOST Melter Run 4B Tenax
VOST Melter Run 4C Tenax
VOST Melter Run 5A Tenax
VOST Melter Run 5B Tenax
VOST Melter Run 5C Tenax
VOST Melter Run 6A Tenax
VOST Melter Run 6B Tenax
VOST Melter Run 6C Tenax.
- The concentration of acetone was greater than the calibration range for sample:
VOST TCO Run 4B Anasorb.
- The concentration of trichloroethene was greater than the calibration range for

samples:

VOST TCO Run 5A Tenax
VOST TCO Run 5B Tenax
VOST TCO Run 5C Tenax
VOST TCO Run 6A Tenax
VOST TCO Run 6C Tenax
VOST TCO Run 6B Tenax.

- Reanalysis of tubes containing an analyte at a concentration greater than the calibration range is not possible because the entire sample is consumed during analysis.

Except for the specific samples discussed above, analytical parameters for the VOST analysis are within control, and the data package is complete and well organized. The data package would benefit from a more complete Narrative, describing the analysis in more detail and describing the transition of the samples from the Chain of Custody form to the Sample Summary. Because of the technical limitations discussed above, reported values should be considered “Estimated” for most compounds.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 13, 2004; the analytical data report is dated December 30, 2004, and signed by Richard J. Lafond, Project Manager.

Original Chain of Custody forms are included in the data package. Nineteen samples are listed on the Chain of Custody forms. A typical entry is: VOST Melter R4A, with the Sample Matrix designated as “VOST Tubes”, and the Number of Containers is 3. The samples have either 3 or 4 containers, with no specification as to what the containers are. The total number of containers listed is 64. The Chain of Custody forms were not signed in the space labeled “Collected By.”

The Sample Summary for Data Package H4K140110 has 47 entries, as shown in Table 1, below.

Table 1. Sample Summary for Data Package H4K140110.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G0X64	001	VOST MELTER RUN 4A TENAX	12/11/04	12/17/04
G0X8K	002	VOST MELTER RUN 4A ANASORB	12/11/04	12/20/04
G0X8M	003	VOST MELTER RUN 4B TENAX	12/11/04	12/17/04
G0X9A	004	VOST MELTER RUN 4B ANASORB	12/11/04	12/20/04
G0X9E	005	VOST MELTER RUN 4C TENAX	12/11/04	12/17/04
G0X9K	006	VOST MELTER RUN 4C ANASORB	12/11/04	12/20/04
G0X9X	007	VOST MELTER RUN 5A TENAX	12/11/04	12/17/04
G0X98	008	VOST MELTER RUN 5A ANASORB	12/11/04	12/20/04
G0X99	009	VOST MELTER RUN 5B TENAX	12/11/04	12/17/04
G00AQ	010	VOST MELTER RUN 5B ANASORB	12/11/04	12/20/04
G00AT	011	VOST MELTER RUN 5C TENAX	12/11/04	12/17/04
G00AW	012	VOST MELTER RUN 5C ANASORB	12/11/04	12/20/04
G00A0	013	VOST MELTER RUN 6A TENAX	12/11/04	12/17/04
G00A1	014	VOST MELTER RUN 6A ANASORB	12/11/04	12/20/04
G00A6	015	VOST MELTER RUN 6B TENAX	12/11/04	12/17/04
G00A8	016	VOST MELTER RUN 6B ANASORB	12/11/04	12/20/04
G00CA	017	VOST MELTER RUN 6C TENAX	12/11/04	12/17/04
G00CC	018	VOST MELTER RUN 6C ANASORB	12/11/04	12/20/04
G00CE	019	VOST TCO RUN 4A TENAX	12/11/04	12/17/04
G00CJ	020	VOST TCO RUN 4A ANASORB	12/11/04	12/20/04
G00CK	021	VOST TCO RUN 4B TENAX	12/11/04	12/17/04
G00CN	022	VOST TCO RUN 4B ANASORB	12/11/04	12/20/04
G00CP	023	VOST TCO RUN 4C TENAX	12/11/04	12/17/04
G00CQ	024	VOST TCO RUN 4C ANASORB	12/11/04	12/20/04
G00CR	025	VOST TCO RUN 5A TENAX	12/11/04	12/17/04

G00CT	026	VOST TCO RUN 5A ANASORB	12/11/04	12/20/04
Table 1. Sample Summary for Data Package H4K140111, Continued.				
G00CW	027	VOST TCO RUN 5A ANASORB	12/11/04	12/17/04
G00C1	028	VOST TCO RUN 5B TENAX	12/11/04	12/20/04
G00C4	029	VOST TCO RUN 5B ANASORB	12/11/04	12/17/04
G00C8	030	VOST TCO RUN 5C TENAX	12/11/04	12/16/04
G00DG	031	VOST TCO RUN 5C ANASORB	12/11/04	12/17/04
G00DM	032	VOST TCO RUN 6A TENAX	12/11/04	12/16/04
G00DQ	033	VOST TCO RUN 6A ANASORB	12/11/04	12/17/04
G00D1	034	VOST TCO RUN 6B TENAX	12/11/04	12/16/04
G00D4	035	VOST TCO RUN 6C TENAX	12/11/04	12/17/04
G00D7	036	VOST TCO RUN 6C ANASORB	12/11/04	12/16/04
G00EC	037	A-3900 TENAX MEDIA CHECK	12/11/04	12/16/04
G00EF	038	A-3901 ANASORB MEDIA CHECK	12/11/04	12/16/04
G00EL	039	VOST MELTER RUN 4 CONDENSATE	12/11/04	12/14/04
G00EP	040	VOST MELTER RUN 5 CONDENSATE	12/11/04	12/14/04
G00ET	041	VOST MELTER RUN 6 CONDENSATE	12/11/04	12/14/04
G00EW	042	VOST TCO RUN 4 CONDENSATE	12/11/04	12/14/04
G00EX	043	VOST TCO RUN 5 CONDENSATE	12/11/04	12/14/04
G00E0	044	VOST TCO RUN 6 CONDENSATE	12/11/04	12/14/04
G00E2	045	VOST TCO METHOD BLK TENAX	12/11/04	12/16/04
G00E3	046	VOST TCO METHOD BLK ANASORB	12/11/04	12/16/04
G00E4	047	VOST TCO METHOD BLK CONDENSATE	12/11/04	12/14/04

The Narrative contains the following notes relative to the samples received:

- Condensate samples for all runs were received, but was (sic) not listed on the chain of custody documentation.
- For samples Melter R4B, R5A, R5C, R6A, R6B, and R6C there was no distinction between tube 1 and tube 2. *[Note: In Method 0031, tube 1 and tube 2 are Tenax tubes. The usual practice is for the field samplers to designate which*

tube is the front tube and which tube is the back tube so the tubes can be desorbed in reverse order of collection: i.e., if gas flow is from tube 1 to tube 2 when samples are collected, the gas flow should be from tube 2 to tube 1 when the tubes are desorbed.] The Narrative does not state what was done to resolve this situation, but since quantitative desorption from Tenax is the usual situation when the tubes are desorbed, the order of desorption of the paired Tenax tubes should not be a problem, regardless of the order in which the Tenax tubes are collected or desorbed.

Description of the analytical methodology is provided in the Narrative:

VOST tubes and condensate samples were analyzed for the volatile organic target analytes by purge and trap GCMS using STL Knoxville standard operating procedures KNOX-MS-0011 and KNOX-MS-015, based on the following methods:

- SW-846 5041A, “Analysis for Desorption of Sorbent Cartridges from Volatile Organic Sampling Train (VOST)”
- SW-846 8260B, “Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS).

Samples were received as SW-846 Method 0031 trains. Each Tenax tube pair and each Tenax/Anasorb tube is separately prepared by spiking a known amount of surrogate onto the media using a flash vaporization device. Volatile compounds are introduced into the gas chromatograph by thermal desorption of the analytes from the VOST tube using a clamshell oven and a purge and trap device. VOST condensates are spiked with surrogates and purged directly. The components are separated using the chromatograph and detected using a mass spectrometer, which provides both qualitative and quantitative information.

This descriptive text raised a question, since Method 0031 as written did not contain a mixed-bed sorbent tube: i.e., the third tube of the VOST train was an Anasorb 747 tube, with no Tenax. The following response to the question was received from R. J. Lafond:

Let me provide some information pertaining to the Tenax “plug” that STL has specially included with the Anasorb 747 tubes. I was directly involved with the MDL study on Anasorb; I ran the original MDL study.

Using standard thermal desorption, in order to effectively remove all volatiles captured, the thermal desorber would be needed to be elevated to a very high temperature, >300 degrees C. Since this is not allowed, recovery of spiked surrogates on the Anasorb-only tubes was very low, getting lower in relation to boiling point. Anything eluting off the GC starting in the area of benzene has poor recovery. I spoke with the manufacturer of Anasorb, being SKC, and talked with Linda (can't remember her last name). She told me that Anasorb was designed to be desorbed using solvent and not by thermal means, as it is a microsieve. The theory of Anasorb replacement that was provided to me by Billy Anderson here at the lab was that the purpose of Anasorb was to effectively trap the extremely volatile compounds which tend to migrate off the Tenax during sampling. I don't think this is included in the method, but I might be wrong.

So now the lab was posed with how to report data having low surrogate recoveries, including method blanks. The solution was to include this small amount, and it is about 1/5 of the total tube's total sorbent volume, of Tenax. This is how the modification arose.

I agree that the information in the narrative does not go to the degree of detail specifying the addition of Tenax to the Anasorb tube. There hasn't been a case until now where we have needed this addressed. I hope this does not invalidate the method.

The original intent of the method was to avoid a mixed-bed tube, increasing the capacity of the sorbent by using two full Tenax tubes and using a third carbon-based sorbent tube (Anasorb 747) to collect volatile organic compounds (such as vinyl chloride) that do break through the Tenax. The original supporting laboratory work did indeed use elevated desorption temperatures (~350°C) to make the desorption from the Anasorb tube quantitative. However, even at this elevated desorption temperature, the desorption of the bromofluorobenzene surrogate was erratic and seldom quantitative. The use of a Tenax plug in the third tube of the Method 0031 sampling train for the purpose of spiking the surrogate compounds and obtaining quantitative recovery of the surrogates will not affect the function of the Anasorb in collecting volatile organic compounds that break through the first two Tenax tubes. Also, the MDL study mentioned by STL demonstrates that using the small plug of Tenax does not impair the performance of the Anasorb in the collection and desorption of volatile organic compounds.

Note that the Narrative contains no information on how samples are related between the Chain of Custody forms and the Sample Summary: "3 containers" for a given Run number means that there were three sorbent tubes, two Tenax tubes with the front and back tube designated (except as noted above), and a third Tenax/Anasorb tube. If there were four containers, a fourth container must have been condensate. If condensate samples were received for all runs (but all of the condensates are not listed on the Chain of Custody forms, as noted above), there were undocumented instructions to analyze only one condensate sample for a given Run series. Instructions to R. J. Lafond are not documented, and instructions from R. J. Lafond to Sample Receipt are not documented.

Analytical results for the samples listed in the Sample Summary with Media Checks and Field- and Laboratory-Generated Method Blanks are shown in Table 2 for Data Package H4K140110.

Table 2. Analytical Results for Data Package H4K140110.

Compounds ^d	VOST Melter Run 4 Tenax	VOST Melter Run 4A Anasorb	VOST Melter Run 4B Tenax	VOST Melter Run 4B Anasorb	VOST Melter Run 4C Tenax	VOST Melter Run 4C Anasorb
	µg ^a					
acetone	1.6	0.69	3.0	4.5	2.8	3.0
acetonitrile	3.4	ND	5.7	16	6.6	16
acrylonitrile	0.88	0.24 J	1.6	0.61	1.5	0.61
benzene	2.3 E ^b	0.023 J	2.3 E	0.0084 J	2.8 E	0.022 J
bromomethane	ND ^e	0.017 J	ND	0.012 J	ND	ND
2-butanone	0.13	ND	0.23	0.058 J	0.25	0.037 J
carbon disulfide	0.0093 J ^c	0.0074 J	0.010 J	0.0081 J	0.012 J	0.0071 J
carbon tetrachloride	0.013 J	0.0079 J	0.013 J	ND	0.012 J	ND
chlorobenzene	1.2	ND	0.85	ND	1.4	ND
chloroform	0.042	0.013 J	0.038	0.0046 J	0.040	ND
chloromethane	0.0070 J	0.090	0.011 J	0.10	0.0086 J	0.054
ethylbenzene	0.032	ND	0.023 J	ND	0.039	ND
2-hexanone	0.024 J	ND	0.021 J	ND	ND	ND
iodomethane	0.0060 J	ND	0.0083 J	ND	0.0073 J	ND
methylene chloride	0.38	0.69	0.25	0.30	0.20	0.21
tetrachloroethene	0.0080 J	ND	0.0073 J	ND	0.0083 J	ND
toluene	0.67	0.012 J	0.48	0.0034 J	0.63	ND
trichloroethene	0.010 J	ND	ND	ND	0.0099 J	ND
vinyl chloride	0.0086 J	0.080	0.0095 J	0.095	0.011 J	0.092
xylenes (total)	0.15	ND	0.11	ND	0.18	ND
Surrogates	% Recovery					
dibromofluoromethane	81	95	81	94	82	91
1,2-dichloroethane-d ₄	57	68	58	67	57	60
toluene-d ₈	83	81	82	79	87	82
bromofluorobenzene	77	81	77	80	83	74

^aThe usual reporting units for VOST are nanograms (ng); STL - Knoxville chooses to report their results in micrograms (µg) for compatibility with the SW-846 Method 8260C analysis.

^bEstimated result. Result concentration exceeds the calibration range.

^cEstimated result. The result is less than the Reporting Limit.

^dCompounds with boiling points above 100°C are not appropriate VOST compounds because compounds boiling above 100°C may not be sampled quantitatively in the field. Compounds with boiling points above 100°C include ethylbenzene, 4-methyl-2-pentanone, 2-hexanone, styrene, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethene, toluene, 1,1,2-trichloroethane, and the xylenes. Reported values for these compounds are estimated values because the quantitative nature of the field sample collection cannot be assured. Chlorobenzene, toluene, and tetrachloroethene also have boiling points above 100°C, but field validation data demonstrate that sampling for these compounds is quantitative.

Table 2. Analytical Results for Data Package H4K140110, Continued.

Compounds ^d	VOST Melter Run 5A Tenax	VOST Melter Run 5A Anasorb	VOST Melter Run 5B Tenax	VOST Melter Run 5B Anasorb	VOST Melter Run 5C Tenax	VOST Melter Run 5C Anasorb
	µg ^a					
acetone	2.7	3.2	2.4	2.4	0.88	3.0
acetonitrile	7.0	24	7.1	18	ND	26
acrylonitrile	1.6	0.48 J	1.5	0.73	1.4	0.89
benzene	2.7 E	0.0075 J	2.5 E	0.0071 J	3.1 E	0.017 J
bromomethane	ND	ND	ND	ND	ND	ND
2-butanone	0.27	ND	0.23	ND	0.16	0.045 J
carbon disulfide	0.013 J	0.0065 J	0.012 J	0.0066J	0.0097 J	0.0099 J
carbon tetrachloride	0.014 J	ND	0.013 J	ND	0.013 J	0.0064 J
chlorobenzene	0.89	ND	0.82	0.048 J	1.6	ND
chloroform	0.038	ND	0.036	ND	0.040	ND
chloromethane	0.0094 J	0.040 J	0.0079 J	0.048 J	0.0067 J	0.025 J
ethylbenzene	0.027	ND	0.027	ND	0.045	ND
2-hexanone	ND	ND	ND	ND	0.033 J	ND
iodomethane	0.0086 J	ND	0.0067 J	ND	0.0063 J	ND
methylene chloride	0.18	0.17	0.15	0.086	0.15	0.12
tetrachloroethene	0.0095 J	ND	0.0082 J	ND	0.0086 J	ND
toluene	0.46	0.0033 J	0.40	ND	0.55	ND
trichloroethene	0.012 J	ND	0.011 J	ND	0.013 J	ND
vinyl chloride	0.011 J	0.091	0.0089 J	0.098	0.0083 J	0.091
xylene (total)	0.13	ND	0.12	ND	0.21	ND
Surrogates	% Recovery					
dibromofluoromethane	79	93	79	85	79	92
1,2-dichloroethane-d ₄	58	67	56	60	54	65
toluene-d ₈	84	77	82	78	79	78
bromofluorobenzene	78	75	78	72	73	71

Table 2. Analytical Results for Data Package H4K140110, Continued.

Compounds ^d	VOST Melter Run 6A Tenax	VOST Melter Run 6A Anasorb	VOST Melter Run 6B Tenax	VOST Melter Run 6B Anasorb	VOST Melter Run 6C Tenax	VOST Melter Run 6C Anasorb
	μg^a					
acetone	1.2	3.1	2.4	2.2	0.87	2.0
acetonitrile	2.1	22	8.2	20	1.0	23
acrylonitrile	1.2	1.1	1.7	0.92	1.3	0.75
benzene	2.9 E	0.067	2.8 E	0.075	2.7 E	0.024 J
bromomethane	ND	ND	ND	ND	ND	0.010 J
2-butanone	0.21	0.042 J	0.35	ND	0.077 J	0.063 J
carbon disulfide	0.0081 J	0.0071 J	0.0065 J	0.0092 J	0.014 J	0.0068 J
carbon tetrachloride	0.0096 J	0.0073 J	0.0097 J	0.0075 J	0.012 J	ND
chlorobenzene	1.2	ND	1.3	ND	0.62	ND
chloroform	0.028	0.0052 J	0.032	0.0067 J	0.030	ND
chloromethane	ND	ND	ND	ND	0.013 J	0.090
ethylbenzene	0.038	ND	0.034	ND	0.016 J	ND
2-hexanone	0.031 J	MD	0.041 J	ND	ND	ND
iodomethane	0.0081 J	ND	0.0083 J	ND	0.0098 J	ND
methylene chloride	0.11	0.10	0.11	0.18	0.12	0.058
tetrachloroethene	0.0085 J	ND	0.0077 J	ND	0.0062 J	ND
toluene	0.46	0.0035 J	0.42	ND	0.27	ND
trichloroethene	0.010 J	ND	0.011 J	ND	0.011 J	ND
vinyl chloride	0.0073 J	0.059	0.0076 J	0.066	0.0099 J	0.13
xylene (total)	0.17	ND	0.17	ND	0.075	ND
Surrogates	% Recovery					
dibromofluoromethane	78	92	75	92	85	95
1,2-dichloroethane-d ₄	54	60	51	61	57	65
toluene-d ₈	79	81	74	78	77	79
bromofluorobenzene	74	77	73	77	74	79

Table 2. Analytical Results for Data Package H4K140110, Continued.

Compounds ^d	VOST TCO Run 4A Tenax	VOST TCO Run 4A Anasorb	VOST TCO Run 4B Tenax	VOST TCO Run 4B Anasorb	VOST TCO Run 4C Tenax	VOST TCO Run 4C Anasorb
	μg^a					
acetone	0.58	2.2	0.73	28 E	1.2	0.85
acetonitrile	ND	26	ND	ND	ND	ND
acrylonitrile	ND	0.29 J	ND	ND	ND	ND
benzene	0.44	ND	0.33	ND	0.28	ND
bromomethane	ND	ND	ND	ND	ND	ND
2-butanone	ND	ND	0.040 J	ND	0.065 J	ND
carbon disulfide	0.0042 J	ND	0.0054 J	ND	0.0056 J	ND
carbon tetrachloride	ND	ND	ND	ND	ND	ND
chlorobenzene	0.0045 J	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND	ND
chloromethane	ND	0.21	ND	0.016 J	0.0074 J	0.022 J
ethylbenzene	ND	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND	ND	ND
methylene chloride	1.2	0.18	1.1	0.26	0.74	0.18
tetrachloroethene	0.018 J	ND	0.022 J	ND	0.019 J	ND
toluene	0.011 J	0.0054 J	0.0081 J	ND	0.0073 J	ND
trichloroethene	1.7	ND	1.8	ND	1.9	ND
vinyl chloride	ND	ND	ND	ND	ND	ND
xylene (total)	ND	ND	ND	ND	ND	ND
Surrogates	% Recovery					
dibromofluoromethane	90	87	93	86	92	92
1,2-dichloroethane-d ₄	62	60	70	61	67	61
toluene-d ₈	81	80	78	80	80	82
bromofluorobenzene	73	74	74	71	77	74

Table 2. Analytical Results for Data Package H4K140110, Continued.

Compounds ^d	VOST TCO Run 5A Tenax	VOST TCO Run 5A Anasorb	VOST TCO Run 5B Tenax	VOST TCO Run 5B Anasorb	VOST TCO Run 5C Tenax	VOST TCO Run 5C Anasorb
	μg^a					
acetone	1.2	0.20	0.72	0.21	0.94	0.63
acetonitrile	ND	ND	ND	ND	ND	ND
acrylonitrile	ND	ND	ND	ND	ND	ND
benzene	0.17	ND	0.16	ND	0.15	ND
bromomethane	ND	ND	ND	ND	ND	ND
2-butanone	0.061 J	ND	0.040 J	ND	ND	ND
carbon disulfide	0.0069 J	ND	0.0069 J	ND	0.0067 J	ND
carbon tetrachloride	ND	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND	ND
chloromethane	0.0091 J	0.010 J	0.0093 J	0.023 J	0.0076 J	0.056
ethylbenzene	ND	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND	ND	ND
methylene chloride	0.40	0.15	0.35	0.083	0.23	0.072
tetrachloroethene	0.023 J	ND	0.024 J	ND	0.022 J	ND
toluene	0.0096 J	0.0037 J	0.013 J	ND	0.012 J	ND
trichloroethene	2.2 E	ND	2.1 E	ND	2.1 E	ND
vinyl chloride	ND	ND	ND	ND	ND	ND
xylene (total)	ND	ND	ND	ND	ND	ND
Surrogates	% Recovery					
dibromofluoromethane	86	96	95	100	90	93
1,2-dichloroethane-d ₄	58	73	68	69	66	75
toluene-d ₈	77	80	83	96	78	77
bromofluorobenzene	69	81	74	84	72	74

Table 2. Analytical Results for Data Package H4K140110, Continued.

Compounds ^d	VOST TCO Run 6A Tenax	VOST TCO Run 6A Anasorb	VOST TCO Run 6B Tenax	VOST TCO Run 6B Anasorb	VOST TCO Run 6C Tenax	VOST TCO Run 6C Anasorb
	μg^a					
acetone	0.47	0.41	0.61	0.48	0.11	ND
acetonitrile	ND	ND	ND	ND	ND	ND
acrylonitrile	ND	ND	ND	ND	ND	ND
benzene	0.15	ND	0.096	ND	0.11	0.0048 J
bromomethane	ND	ND	ND	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND	ND
carbon disulfide	ND	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND	ND
chloromethane	0.0080 J	0.078	ND	0.032 J	ND	0.017 J
ethylbenzene	ND	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND	ND	ND
methylene chloride	0.17	0.072	0.11	0.055	0.12	0.10
tetrachloroethene	0.026	ND	0.023 J	ND	0.026	ND
toluene	0.010 J	ND	0.0089 J	ND	0.010 J	ND
trichloroethene	2.3 E	ND	2.1 E	ND	2.4 E	ND
vinyl chloride	ND	0.0050 J	ND	ND	ND	ND
xylene (total)	ND	ND	ND	ND	ND	ND
Surrogates	% Recovery					
dibromofluoromethane	87	91	96	92	102	93
1,2-dichloroethane-d ₄	61	70	72	71	75	74
toluene-d ₈	77	77	80	80	83	81
bromofluorobenzene	70	71	77	75	80	79

Table 2. Analytical Results for Data Package H4K140110, Continued.

Compounds ^d	A-3900 Tenax Media Check	A-3901 Anasorb Media Check	VOST Melter Run 4 Condensate	VOST Melter Run 5 Condensate	VOST Melter Run 6 Condensate	VOST TCO Run 4 Condensate
	µg ^a		µg/L			
acetone	0.33	0.077 J	9.2 J	7.0 J	9.4 J	9.1 J
acetonitrile	ND	ND	90 J	110	75 J	ND
acrylonitrile	ND	ND	ND	ND	ND	ND
benzene	ND	ND	ND	ND	ND	ND
bromomethane	ND	ND	ND	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND	ND
carbon disulfide	ND	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND	ND
chloromethane	ND	0.12	ND	ND	ND	ND
ethylbenzene	ND	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND	ND	ND
methylene chloride	ND	ND	3.3 J	2.5 J	3.2 J	1.3 J
tetrachloroethene	ND	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND	ND
vinyl chloride	0.0049 J	ND	ND	ND	ND	ND
xylene (total)	ND	ND	ND	ND	ND	ND
Surrogates	% Recovery					
dibromofluoromethane	87	87	96	92	95	91
1,2-dichloroethane-d ₄	65	68	98	97	99	95
toluene-d ₈	82	80	100	99	102	101
bromofluorobenzene	73	75	114	115	113	115

Table 2. Analytical Results for Data Package H4K140110, Continued.

Compounds ^d	VOST TCO Run 5 Condensate	VOST TCO Run 6 Condensate	VOST TCO Method Blk Tenax	VOST TCO Method Blk Anasorb	VOST TCO Method Blk Condensate	(Laboratory) Method Blk GC/MS Volatiles
	µg/L		µg		µg/L	
acetone	ND	ND	ND	0.18	ND	ND
acetonitrile	ND	ND	ND	ND	ND	ND
acrylonitrile	ND	ND	ND	ND	ND	ND
benzene	ND	ND	ND	ND	ND	ND
bromomethane	ND	ND	ND	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND	ND
carbon disulfide	ND	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND	ND
chloromethane	ND	ND	ND	0.028 J	ND	ND
ethylbenzene	ND	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND	ND	ND
methylene chloride	1.5 J	1.2 J	0.17	0.012 J	ND	ND
tetrachloroethene	ND	ND	ND	ND	ND	ND
toluene	ND	ND	ND	0.0055 J	ND	ND
trichloroethene	ND	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND	ND
xylenes (total)	ND	ND	ND	ND	ND	ND
Surrogates	% Recovery					
dibromofluoromethane	96	97	95	91	92	94
1,2-dichloroethane-d ₄	101	102	80	68	97	98
toluene-d ₈	100	101	87	82	101	102
bromofluorobenzene	117	116	84	75	113	114

Laboratory Control Samples/Duplicates (LCS/LCSD), Relative Percent Difference (RPD) and associated Method Blanks are shown in Table 3. All recoveries and RPDs are within control limits.

Table 3. LCS/LCSD with Associated Method Blanks for Data Package H4K140110.

Compounds	LCS/LCSD % Recovery	RPD	(Laboratory) Method Blk µg	LCS/LCSD % Recovery	RPD	(Laboratory) Method Blk µg
acetonitrile	NS ^a		1.3	NS		ND ^b
benzene	93/93	0.010	ND	103/103	0.21	ND
chlorobenzene	89/88	0.63	ND	90/96	5.7	ND
1,1-dichloroethene	87/87	0.080	ND	99/97	2.7	ND
toluene	95/94	0.86	ND	87/88	1.5	ND
trichloroethene	87/87	0.14	ND	103/103	0.78	ND
Surrogate Compounds	% Recovery					
dibromofluoromethane	95/95		93	85/91		84
1,2-dichloroethane-d ₄	98/98		72	62/70		56
toluene-d ₈	101/100		85	80/85		77
bromofluorobenzene	109/111		78	70/79		68

^aNS = Not Spiked.

^bND = Not Detected.

Table 3. LCS/LCSD with Associated Method Blanks for Data Package H4K140110, Continued.

Compounds	LCS/LCSD % Recovery	RPD	Method Blank µg	LCS/LCSD % Recovery	RPD
acetonitrile	NS ^a		ND ^b	NS	
benzene	94/95	0.11	ND	102/104	2.5
chlorobenzene	85/83	2.5	ND	85/88	4.4
1,1-dichloroethene	91/94	4.3	ND	97/98	1.7
toluene	80/79	1.6	ND	84/87	3.8
trichloroethene	101/99	1.4	ND	98/104	6.1
Surrogate Compounds	% Recovery				
dibromofluoromethane	81/86		88	86/86	
1,2-dichloroethane-d ₄	59/61		57	58/60	
toluene-d ₈	76/75		80	79/78	
bromofluorobenzene	66/68		69	70/68	

^aNS = Not Spiked.^bND = Not Detected.

Quality control parameters for the VOST analysis for Data Package H4K140110 are shown in Table 4.

Table 4. VOST Quality Control Parameters for Data Package H4K140110.

Parameter	Comments
Initial Calibration (ICAL) (9/22/04)	Acceptable curve.
Initial Calibration (ICAL) (10/04/04)	Acceptable curve.
Bromofluorobenzene Tune Check (9/22/04)	Within specifications
BFB Tune Check (10/04/04)	Within specifications
BFB Tune Check (12/14/04)	Within specifications
BFB Tune Check (12/16/04)	Within specifications
BFB Tune Check (12/17/04)	Within specifications
BFB Tune Check (12/20/04)	Within specifications
Continuing Calibration Check (12/14/04)	Within specifications
Continuing Calibration Check (12/16/04)	Within specifications
Continuing Calibration Check (12/17/04)	Within specifications
Continuing Calibration Check (12/20/04)	Within specifications
Second Source Standard (10/05/04) (Volatiles Analysis)	Recoveries within control limits.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H4K190269
Test #1 Normal Plenum
Allyl Alcohol (Method 308)**

Overall Assessment of Data Package H4K190269:

The overall quality of the data in the data package H4K190269 is excellent. Allyl alcohol should be considered a water-soluble volatile organic compound, rather than a semivolatile compound.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on November 18, 2004; the analytical data report is dated November 24, 2004, and signed by Richard J. Lafond, Project Manager.

Original Chain of Custody forms are included in the data package. Seventeen samples are listed on the Chain of Custody forms “Allyl Alcohol” analysis. The Analytical Methods Summary cites SW-846 Method 8015B, “Nonhalogenated Organics Using GC/FID.”

Data Package H4K190269 contains two Project Narratives, one on page 4 and one on page 5. The Project Narrative on page 5 provides a clearly written description of the modified Method 308 procedures used for the analysis, but does not refer to a STL-Knoxville SOP.

N.B. – Allyl alcohol has a boiling point of 97°C and would therefore be considered a volatile compound, rather than semivolatile.

The Sample Summary for Data Package H4K190269 is shown in Table 1.

Table 1. Sample Summary for Data Package H4K190269

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
GXE VW	001	OHHA1116041 HEPA OUT RUN 1A	11/16/04	11/21/04
GXE V8	002	OHHA1116042 HEPA OUT RUN 2A	11/16/04	11/21/04
GXE WA	003	OHHA1116042 HEPA OUT RUN 2B	11/16/04	11/22/04
GXE WE	004	OHHA1116043 HEPA OUT RUN 3A	11/16/04	11/21/04
GXE WJ	005	OHTA1116041 TCO OUT RUN 1A	11/16/04	11/22/04
GXE WK	006	OHTB1116041 TCO OUT RUN 1B	11/16/04	11/22/04
GXE WP	007	OHTA1116042 TCO OUT RUN 2A	11/16/04	11/22/04
GXE W7	008	OHTA1116043 TCO OUT RUN 3A	11/16/04	11/22/04
GXE XA	009	OHBL1116041 METHOD BLANK	11/16/04	11/22/04
GXE XC	010	OHBLA1116041 METHOD BLANK	11/16/04	11/22/04
GXE XF	011	1Z2-S-73B SCRUBBER BLOWDOWN	11/16/04	11/22/04 11/21/04
GXE XK	012	OHMA1115041 MELTER RUN 1 MATRIX SPIKE	11/15/04	11/22/04
GXE X4	013	OHMB1115041 MELTER RUN 1 MATRIX SPIKE	11/15/04	11/22/04
GXE 0C	014	OHMA1116042 MELTER RUN 2A	11/16/04	11/22/04
GXE 0Q	015	OHMA1116043 MELTER RUN 3A	11/16/04	11/22/04
GXE 01	016	OHMA1116044 MELTER RUN 4A	11/16/04	11/22/04
GXE 05	017	OHMB1116044 MELTER RUN 4B	11/16/04	11/22/04

Analytical results for the 17 allyl alcohol samples in Data Package H4K190269 with Laboratory-Generated Method Blanks, Laboratory Control Sample/Duplicate (LCS/LCSD), and Matrix Spike/Duplicate (MS/MSD) are presented in Table 2.

Table 2. Analytical Results for Modified Method 308 Analysis for Allyl Alcohol in Data Package H4K190269.

Sample	Allyl Alcohol mg/L	Surrogate Recovery, %	RPD
OHHA1116041 HEPA OUT RUN 1A	440, 450	97, 93	1.9 ^a
OHHA1116042 HEPA OUT RUN 2A	700	97	
OHHA1116043 HEPA OUT RUN 3A	770	99	
OHTA1116041 TCO OUT RUN 1A	ND ^b	101	
OHTB1116041 TCO OUT RUN 1B	ND	97	
OHTA1116042 TCO OUT RUN 2A	ND	99	
OHTA1116043 TCO OUT RUN 3A	ND	100	
OHBLB1116041 METHOD BLANK	ND	98	
OHBLA1116041 METHOD BLANK	ND	97	
1Z2-S-73B SCRUBBER BLOWDOWN	2200, 2400	87, 95	9.3
OHMA1115041 MELTER RUN 1 MATRIX SPIKE	3.0	94	
OHMB1115041 MELTER RUN 1 MATRIX SPIKE	ND	100	
OHMA1116042 MELTER RUN 2A	690	84	
OHMA1116043 MELTER RUN 3A	380	83	
OHMA1116044 MELTER RUN 4A	670	79	
OHMB1116044 MELTER RUN 4B	4.8	93	
(LABORATORY) METHOD BLANK (11/21/04)	ND	96	
	% Recovery	% Recovery	RPD
LCS/LCSD	93%/92%	93%/91%	0.62
MS/MSD	98%/108%	95%/96%	2.9

^aRPD is calculated where duplicate analyses were performed.

^bND = Not Detected.

For the Modified Method 308 analyses:

- Initial calibration curves for the GC using the external standard technique at seven levels of concentration showed correlation coefficients ≥ 0.995 ;
- A Method Detection Limit study was performed to demonstrate a statistically derived limit of detection;
- Continuing Calibration Verification (CCV) percent recovery values were within target acceptance limits of 85 to 115%;
- Retention time windows were verified within the correct time intervals (samples were very clean, with no obvious chromatographic interferences);
- Duplicates for samples in this data package were in excellent agreement;
- Surrogate compound recoveries were uniformly very good;
- LCS/LCSD samples showed recoveries within control limits;
- MS/MSD samples showed recoveries within control limits.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

Data Package H4K190288
Test #1 Normal Plenum
Semivolatiles

Overall Assessment of Data Package H4K190288:

The overall quality of the data in the data package H4K190288 is excellent. Because of the high concentrations of naphthalene in two of the samples, surrogate compounds were diluted to a level below the analytical range. However, surrogate recoveries were within the acceptable range on the Laboratory Control Samples, demonstrating that the analysis was in control. The surrogate compound recoveries outside the control limits were attributed to matrix effects arising from the interaction of the XAD-2 sorbent with the combustion matrix.

The only weakness in the data package lies in the supporting documentation. By decision of the client, samples were composited so that all of the components of the Method 0010 sampling train generated a single final sample. This procedure is scientifically valid, but when a modification of the sample preparation procedure is performed but the standard text is included in the Narrative, the combination is misleading.

Analyses of these samples were performed by:

STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on November 18, 2004; the analytical data report is dated December 1, 2004, and signed by Richard J. Lafond, Project Manager.

Original Chain of Custody forms are included in the data package. Two pages of the CoC forms list Front Half, Filter, Back Half, Condensate, and XAD-2 matrix samples, with Naphthalene & SVOC analysis requested. The third page of the CoC forms lists TCO front half, filter, back half, condensate, and TCO-XAD-2 samples, as well as three Blanks. A total number of 18 samples is listed on the Chain of Custody documentation. The Analytical Methods Summary lists SW-846 8270C, "Semivolatile Organic Compounds by GC/MS"; sample preparation methods are not listed.

The Sample Summary for H4K190288 is shown in Table 1; the table has five entries, including a Media Check.

The obvious discrepancy between the number of samples listed on the Chain of Custody forms and the entries in the Sample Summary for SVOC Data Package H4L130145 had prompted a question to STL regarding the analyses of the samples listed on the Chain of Custody forms. The following response was received from STL for Data Package H4L130145; this information is

also relevant to Data Package H4K190288, where SVOC sampling train components were composited:

The samples were logged per the quote generated for Dr. Matlack. He specified that he wanted all train fractions combined. In the past we have done separate fractions but he felt it was not necessary to split them out.

This instruction from the client is not documented in the original data package, and the sample preparation method was not described in the data package Narrative. A Revision of the Narrative for Data Package H4L130145 to describe the actual sample preparation was requested and supplied by STL; this same sample preparation procedure is relevant to Data Package H4K190288. This revised Narrative for Data Package H4L130145 is included below.

Table 1. Sample Summary for Data Package H4K190288.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
GXE5T	001	0010 TCO COMBINED TRAIN	11/17/04	11/24/04
GXE59	002	0010 BLANK COMBINED TRAIN	11/17/04	11/24/04
GXE6P	003	0010 HEPA COMBINED TRAIN	11/17/04	11/24/04
GXE68	004	0010 MELTER COMBINED TRAIN	11/17/04	11/24/04
GXE9M	005	A-3875, A-3876 MEDIA CHECK	11/17/04	11/24/04

**Project Narrative
H4L130145 rev 1
[Also Applicable to Data Package H4K190288]**

Revision notes: This lot was revised to correctly document the preparation of the 0010 sampling trains.

The results reported herein are applicable to the samples submitted for analysis only.

This report shall not be reproduced except in full, without the written approval of the laboratory.

The original chain of custody documentation is included with this report.

Sample Receipt

[There were no problems with the condition of the samples received.] Pertinent only to Data Package H4L130145.

For Data Package H4K190288, the relevant observations are:

The temperature of the cooler was outside of temperature specifications at 7°C (as no temperature blank container was provided). The chain of custody did not list a date/time of collection for sample 50/50 Blank.

Combined Semivolatile Sampling Train Preparation and Analysis

The semivolatile organic sampling train components were, at the direction of the client per quote, extracted and analyzed using STL Knoxville standard operating procedures KNOX-OP-0009 and KNOX-MS-0016, based on the following methods:

- SW-846 3542, "Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train)"
- SW-846 8270C, "Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)."

The sampling trains are prepared as one analytical fraction: The particulate filter and front half of the filter holder, nozzle and probe solvent rinses, XAD-2 resin trap and back half of the filter holder, coil condenser, and connecting glassware solvent rinses are combined as a single sample.

The combined sample components are spiked with the Method 8270C surrogates and Soxhlet extracted with methylene chloride. The extracts are concentrated to 1 mL and analyzed by GC/MS.

Sample results were calculated using the following equation:

$$\text{Result, } \mu\text{g} = (\text{On column concentration, ng}/\mu\text{L}) * \frac{\text{Volume, final extract, } \mu\text{L}}{\text{Sample}} * \frac{1 \mu\text{g}}{1000 \text{ ng}} * \text{DF}$$

DF = Dilution Factor

Quality Control

Unless otherwise noted, all holding times and QC criteria were met and the test results shown in this report meet all applicable NELAC requirements.

The sample media check represents the quality of the media provided to the field. The laboratory sets aside a portion of the media lot sent to the field and prepared and analyzes it along with the samples that were returned to the lab for analysis.

Note: The following sections, shown in brackets [] contain Narrative observations relevant only to Data Package H4L130145.

[The original analyses of samples SV TCO Outlet Run 4 Test 1 and SV TCO Outlet Run 5 Test 1 resulted in surrogate and internal standard recoveries which were outside the laboratory acceptance criteria. Since the samples were bracketed by runs with acceptable internal standards, a sample matrix effect is indicated as the reason for the internal standard criteria not being met. These results are included in the Miscellaneous section of the report, but they were not reported as final sample results.

In order to provide the client with quantitative results, both of these samples were recalculated using the daily standard (rather than the initial calibration) with all analytes referencing internal standard #4, phenanthrene-d₁₀, which exhibited acceptable recovery. Based on this new quantitation, the base/neutral surrogates were within limits. (2-Fluorobiphenyl was slightly high at 119% in sample SV TCO Outlet Run 4 Test 1.) These results further support the conclusion that the internal standards outside lab recovery limits were affected by the extract matrix. These results are included in the Raw Data section of the report and they were reported as the final sample results. The daily standard requantitation against internal

standard phenanthrene-d₁₀ is presented in the Standard section of the report.

In order to provide a quantitation based on the internal standards specified by the method and initial calibration response factors, both samples (SV TCO Outlet Run 4 Test 1 and SV TCO Outlet Run 5 Test 1) were reanalyzed at a dilution. These samples are reported with elevated reporting limits. In these dilutions, the internal standards were within limits except for internal standard #6, perylene-d₁₂, which was not detected. The phenolic surrogate recoveries were within limits, except for 2,4,6-tribromophenol, which was not detected. The base/neutral surrogate recoveries were within limits, except for 2-fluorobiphenyl, which was high, probably due to a suppressed response of its respective internal standard. Running samples at greater dilutions had effectively minimized the matrix effects present in the extract, with the exception of perylene-d₁₂. These results were also reported in the Raw Data section of the report.

Due to the demonstrated matrix effect on the internal standards and surrogates for these two samples, the results should be considered estimated.

Sample SV Carbon Out Run 2 Test 2 was reported with elevated reporting limits for all analytes due to the difficult sample matrix. The sample could not be concentrated to the required final volume of 1 mL. The reporting limits were adjusted accordingly.

All "Melter" and "HEPA" samples were reported with elevated reporting limits for all analytes. Based on screening results, a dilution was necessary prior to analysis; the reporting limits were adjusted accordingly.

The concentration of naphthalene in sample SV HEPA Out Run 3 Test 2 exceeded the calibration level of the instrument. The sample was analyzed at a dilution to bring the concentration of the compound into the instrument calibration range. The reporting limits have been adjusted accordingly.]

The following Narrative observations are relevant to Data Package H4K190288:

Internal standard perylene-d₁₂ recovery for sample 0010 TCO Combined Train was outside QC limits. However, the sample was bracketed by acceptable runs, indicating that a sample matrix effect is responsible for the internal standard criteria not being met. Since the samples were [analyzed] for naphthalene only, there is no impact on the data.

Based on screening results, a dilution was necessary prior to analysis for samples 0010 HEPA Combined Train and 0010 Melter Combined Train; the reporting limits were adjusted accordingly.

The combination of the constituents of the Method 0010 sampling trains to produce a single analytical sample would not satisfy regulatory requirements for this analysis, but the practice is scientifically acceptable if regulatory requirements do not need to be considered. The observed matrix effect arises from the interaction of the combustion matrix with the XAD-2 sorbent used for the collection of semivolatile organic compounds.

Analytical results for this set of samples are presented in Table 2. Analytical results are accurately described in the original Narrative for Data Package H4K190288. The Laboratory-Generated Method Blank and the Laboratory Control Samples are reported in Table 3.

Table 2. Analytical Results Summary for Data Package H4K190288.

Compound	0010 TCO Combined Train	0010 Blank Combined Train	0010 HEPA Combined Train	0010 Melter Combined Train	A-3875, A-3876 Media Check
	µg				
naphthalene	3.8 J ^a	ND ^b	230000 ^c	230000 ^f	ND
Surrogate Compounds	% Recovery				
2-fluorophenol	62	54	NC ^c	NC	71
phenol-d ₅	58	52	NC	NC	68
nitrobenzene-d ₅	83	63	NC	NC	88
2-fluorobiphenyl	94	59	NC	NC	81
2,4,6-tribromophenol	75	75	NC	NC	75
terphenyl-d ₁₄	84	87	NC	NC	90
¹³ C ₆ -naphthalene	92	78	NC	NC	NS ^d

^aEstimated result. Result is less than Reporting Limit.

^bND = Not Detected.

^cThe concentration is not reported due to dilution.

^dNS = Not Spiked.

^eAnalysis performed at 2000-fold dilution; surrogate compounds not reported.

^fAnalysis performed at 1500-fold dilution; surrogate compounds not reported.

Table 3. Method Blank and Laboratory Control Samples, with Percent Recovery and Relative Percent Difference for Data Package H4K190288.

Compounds	(Laboratory) Method Blank	LCS/LCSD	
	µg	% Recovery	RPD
naphthalene	ND ^a	NS ^b	
acenaphthene	ND	90/84	7.4
4-chloro-3-methylphenol	ND	90/80	12
2-chlorophenol	ND	86/87	1.4
1,4-dichlorobenzene	ND	85/86	1.4
2,4-dinitrotoluene	ND	95/87	8.9
4-nitrophenol	ND	84/72	14
N-nitrosodi- <i>n</i> -propylamine	ND	73/72	1.1
pentachlorophenol	ND	82/79	3.5
phenol	ND	88/94	7.7
pyrene	ND	95/91	4.8
1,2,4-trichlorobenzene	ND	86/82	4.4
Surrogate Compounds	% Recovery		
2-fluorophenol	79	85/83	
phenol-d ₅	73	87/81	
nitrobenzene-d ₅	86	90/82	
2-fluorobiphenyl	89	90/86	
2,4,6-tribromophenol	86	94/88	
terphenyl-d ₁₄	93	89/82	

^aND = Not Detected.

^bNS = Not Spiked.

The Initial Calibration for these analyses was performed on October 20, 2004. The following observations are relevant to the Initial Calibration:

- DFTPP tune criteria were met;
- DDT breakdown was < 20% and benzidine tailing <3, and PCP tailing <5;
- Average response factors for the System Performance Check Compounds were >0.050;
- % Relative Standard Deviation (RSD) was <30% for the Calibration Check Compounds;
- The curve cannot be used for benzo(e)pyrene because the standard for this analyte was past its expiration date;
- The y-intercept was not < half the Reporting Limit for *m*-dinitrobenzene.

A second source standard was analyzed to verify the calibration; all recovery values were within the acceptable range.

Continuing calibration checks were performed on November 24, 2004, the date of the analysis of the samples; all parameters were within the acceptable range.

A Method Spike was analyzed on November 24, 2004, as an intra-laboratory check; all parameters were within the acceptable range.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H4L100461
Test #2 & Test #3 VOST
Volatile Organic Compounds (VOST)**

Overall Assessment of Data Package H4L100461:

The following observations are relevant to the VOST analysis for Data Package H4L100461:

- Data reported for compounds with boiling points above 100°C should be considered estimates; quantitative sampling in the field cannot be guaranteed for these compounds unless field validation data with dynamic spiking in the field are available to demonstrate that quantitative sampling can occur.
- Values calculated for compounds reported “Above the calibration” should be considered estimated values; these estimated values may well significantly under-report the true value because of chromatographic saturation and the possibility of sorbent breakthrough.
- Since Tenax samples were analyzed as a pair, it is not possible to determine the amount of breakthrough that occurred from Tube #1 to Tube #2. However, according to EPA guidance, observation of 30% or more of the compound of interest relative to the paired Tenax tubes on the Tenax/Anasorb tube is indicative of breakthrough and raises concerns about quantitative collection of the compounds in question.
- Because of their water solubility, values for the polar compounds (i.e., acetonitrile, 2-hexanone, acetone, 2-butanone) may be significantly under-reported. The general practice for ensuring quantitative purging for these compounds is to heat and salt the purge water, which was not done in this analysis. In the original text of Method 0031, these compounds are not considered appropriate for the VOST analysis. All values reported for these compounds should therefore be considered estimated values.
- The occurrence of vinyl chloride may be significantly over-reported. Because of the toxicity of this compound, the general practice at STL-Knoxville is to report the compound and calculate a concentration for vinyl chloride given the slightest indication of its presence, rather than requiring the presence of a distinct identifiable mass spectrum.
- The highest values reported for acetonitrile (i.e., >10 µg) may significantly over-report this concentration because of the presence of a coeluting compound with common peaks.

- In order to report some of the observed concentrations, the STL - Knoxville laboratory must be using a split chromatographic injection. The capacity of most capillary columns is 1000 ng (1 µg) or less. Amounts of compounds in excess of 5-10 µg would cause serious chromatographic and detector saturation; this amount of material therefore cannot be introduced directly into the chromatographic column.

The following additional observations regarding the data set were reported in the Narrative of Data Package H4L100461:

- The concentration of acetone or chloromethane was greater than the calibration range for samples:
VOST TCO Run 1A Anasorb
VOST TCO Run 1B Anasorb
VOST TCO Run 1C Anasorb
VOST Melter Run 1A Anasorb.
- Reanalysis of tubes containing an analyte at a concentration greater than the calibration range is not possible because the entire sample is consumed during analysis.

Except for the specific samples discussed above, analytical parameters for the VOST analysis are within control, and the data package is complete and well organized. The data package would benefit from a more complete Narrative, describing the analysis in more detail and describing the transition of the samples from the Chain of Custody form to the Sample Summary. Because of the technical limitations discussed above, reported values should be considered “Estimated” for most compounds.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 10, 2004; the analytical data report is dated December 28, 2004, and signed by Richard J. Lafond, Project Manager.

Original Chain of Custody forms are included in the data package. Eighteen samples are listed on the Chain of Custody forms. A typical entry is: VOST TCO RUN 1A, with the Sample Matrix designated as “VOST Tubes”, and the Number of Containers listed for all samples is 3. The total number of containers listed is 54. Both Chain of Custody forms are labeled “Page 1 of 2”; the Chain of Custody forms consist of two pages. A diagram of the STL Test Scheme is included with the Chain of Custody forms, on an un-numbered page in the data package. This scheme is shown in Table 1. No source for the information is cited, but this table must have been prepared from the Test Plan.

Table 1. STL Test Scheme for VSL DM 1200 MACT Testing (12/06/04).

STL Test No.	Sample Type	Runs	Date
2	Mod. 308 (Allyl)	ALL	12/07/04
	Dioxins, Furans & PCBs	Melter Runs 1-2 TCO Runs 1-3	12/07/04 - 12/08/04
	Semivolatiles	Melter Runs 1-3 Hepa Runs 1-3 Carbon Runs 1-3 TCO Runs 1-3	12/08/04
	Total Organics Emissions (TOE)	TCO Run 1	12/09/04
	VOST	Melter Runs 1A - 3C TCO Runs 1A - 3C	12/09/04
	Feed for Metals: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn	Feed Sample: F - 12A - 104A	12/08/04
	SBS Solution: Allyl	SBS Sample: S-12A-49A	12/07/04
	SBS Solution: Semivolatiles	SBS Sample: S-12A-100A	12/08/04
1	Semivolatiles	Melter Runs 4 - 5 Hepa Runs 4 - 5 TCO Runs 4 - 5	12/09/04
	Halides	Melter Runs 1 - 3 TCO Runs 1 - 33	12/09/04 - 12/10/04
	Metals: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn	Melter Runs 1 - 3 TCO Runs 1 - 3 Feed Sample: S - 12A - 142B	12/09/04 - 12/10/04
	SBS Solution: Semivolatiles	SBS Sample: S-12A-142B	12/09/04
3	Dioxins, Furans & PCBs	Melter Runs 3 - 4 TCO Runs 4 - 6 SBS Solution: S-12B-142B	12/10/04
	VOST	Melter Runs 4A - 6C	12/10/04- 12/11/04
	Halides	Melter Runs 4 - 6 TCO Runs 4 - 6	12/11/04
	Metals: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn	Melter Runs 4 - 6 TCO Runs 4 - 7 Feed Sample: F-12B-40A	12/11/04

The Sample Summary for this data package has 44 entries, as shown in Table 2, below.

Table 2. Sample Summary for Data Package H4L100461.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G0TRJ	001	VOST TCO RUN 1A TENAX TEST 2	12/09/04	12/14/04
G0TRK	002	VOST TCO RUN 1A ANASORB TEST 2	12/09/04	12/13/04
G0TRL	003	VOST TCO RUN 1B TENAX TEST 2	12/09/04	12/14/04
G0TRM	004	VOST TCO RUN 1B ANASORB TEST 2	12/09/04	12/13/04
G0TRN	005	VOST TCO RUN 1C TENAX TEST 2	12/09/04	12/14/04
G0TRP	006	VOST TCO RUN 1C ANASORB TEST 2	12/09/04	12/13/04
G0TRR	007	VOST TCO RUN 2A TENAX TEST 2	12/09/04	12/14/04
G0TRT	008	VOST TCO RUN 2A ANASORB TEST 2	12/09/04	12/13/04
G0TRV	009	VOST TCO RUN 2B TENAX TEST 2	12/09/04	12/14/04
G0TRX	010	VOST TCO RUN 2B ANASORB TEST 2	12/09/04	12/13/04
G0TR0	011	VOST TCO RUN 2C TENAX TEST 2	12/09/04	12/14/04
G0TR1	012	VOST TCO RUN 2C ANASORB TEST 2	12/09/04	12/13/04
G0TR5	013	VOST TCO RUN 3A TENAX TEST 2	12/09/04	12/14/04
G0TTA	014	VOST TCO RUN 3A ANASORB TEST 2	12/09/04	12/13/04
G0TTD	015	VOST TCO RUN 3B TENAX TEST 2	12/09/04	12/14/04
G0TTG	016	VOST TCO RUN 3B ANASORB TEST 2	12/09/04	12/13/04
G0TTJ	017	VOST TCO RUN 3C TENAX TEST 2	12/09/04	12/14/04
G0TTL	018	VOST TCO RUN 3C ANASORB TEST 2	12/09/04	12/13/04
G0TT6	019	VOST MELTER RUN 1A TENAX TEST 2	12/09/04	12/14/04
G0TT7	020	VOST MELTER RUN 1A ANASORB TEST 2	12/09/04	12/13/04
G0TT8	021	VOST MELTER RUN 1B TENAX TEST 2	12/09/04	12/14/04
G0TT9	022	VOST MELTER RUN 1B ANASORB TEST 2	12/09/04	12/13/04
G0TVA	023	VOST MELTER RUN 1C TENAX TEST 2	12/09/04	12/14/04
G0TVC	024	VOST MELTER RUN 1C ANASORB TEST 2	12/09/04	12/13/04
G0TVD	025	VOST MELTER RUN 2A TENAX TEST 2	12/09/04	12/14/04
G0TVE	026	VOST MELTER RUN 2A ANASORB TEST 2	12/09/04	12/13/04

Table 2. Sample Summary for Data Package H4L100461, Continued.				
G0TVF	027	VOST MELTER RUN 2B TENAX TEST 2	12/09/04	12/14/04
G0TVG	028	VOST MELTER RUN 2B ANASORB TEST 2	12/09/04	12/13/04
G0TVH	029	VOST MELTER RUN 2C TENAX TEST 2	12/09/04	12/14/04
G0TVJ	030	VOST MELTER RUN 2C ANASORB TEST 2	12/09/04	12/13/04
G0TVK	031	VOST MELTER RUN 3A TENAX TEST 2	12/09/04	12/14/04
G0TVL	032	VOST MELTER RUN 3A ANASORB TEST 2	12/09/04	12/13/04
G0TVM	033	VOST MELTER RUN 3B TENAX TEST 2	12/09/04	12/14/04
G0TVN	034	VOST MELTER RUN 3B ANASORB TEST 2	12/09/04	12/13/04
G0TVP	035	VOST MELTER RUN 3C TENAX TEST 2	12/09/04	12/14/04
G0TVR	036	VOST MELTER RUN 3C ANASORB TEST 2	12/09/04	12/13/04
G0TVV	037	VOST TCO RUN 1 CONDENSATE TEST 2	12/09/04	12/14/04
G0TV3	038	VOST TCO RUN 2 CONDENSATE TEST 2	12/09/04	12/14/04
G0TV5	039	VOST TCO RUN 3 CONDENSATE TEST 2	12/09/04	12/14/04
G0TV8	040	VOST MELTER RUN 1 CONDENSATE TEST 2	12/09/04	12/14/04
G0TV9	041	VOST MELTER RUN 2 CONDENSATE TEST 2	12/09/04	12/14/04
G0TWF	042	VOST MELTER RUN 3 CONDENSATE TEST 2	12/09/04	12/14/04
G0TW0	043	A-3898 TENAX MEDIA CHECK SUPELCO	12/09/04	12/13/04
G0TW1	044	A-3899 ANASORB MEDIA CHECK SUPELCO	12/09/04	12/13/04

The Narrative contains the following note relative to the samples received:

- Condensate samples for Runs 1, 2, and 3 were received, but was (sic) not listed on the chain of custody documentation.

Description of the analytical methodology is provided in the Narrative:

VOST tubes and condensate samples were analyzed for the volatile organic target analytes by purge and trap GCMS using STL Knoxville standard operating procedures KNOX-MS-0011 and KNOX-MS-015, based on the following methods:

- *SW-846 5041A, "Analysis for Desorption of Sorbent Cartridges from Volatile Organic Sampling Train (VOST)"*
- *SW-846 8260B, "Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)."*

Samples were received as SW-846 Method 0031 trains. Each Tenax tube pair and each Tenax/Anasorb tube is separately prepared by spiking a known amount of surrogate onto the media using a flash vaporization device. Volatile compounds are introduced into the gas chromatograph by thermal desorption of the analytes from the VOST tube using a clamshell oven and a purge and trap device. VOST condensates are spiked with surrogates and purged directly. The components are separated using the chromatograph and detected using a mass spectrometer, which provides both qualitative and quantitative information.

This descriptive text raised a question, since Method 0031 as written did not contain a mixed-bed sorbent tube: i.e., the third tube of the VOST train was an Anasorb 747 tube, with no Tenax. The following response to the question was received from R. J. Lafond:

Let me provide some information pertaining to the Tenax "plug" that STL has specially included with the Anasorb 747 tubes. I was directly involved with the MDL study on Anasorb; I ran the original MDL study.

Using standard thermal desorption, in order to effectively remove all volatiles captured, the thermal desorber would be needed to be elevated to a very high temperature, >300 degrees C. Since this is not allowed, recovery of spiked surrogates on the Anasorb-only tubes was very low, getting lower in relation to boiling point. Anything eluting off the GC starting in the area of benzene has poor recovery. I spoke with the manufacturer of Anasorb, being SKC, and talked with Linda (can't remember her last name). She told me that Anasorb was designed to be desorbed using solvent and not by thermal means, as it is a microsieve. The theory of Anasorb replacement that was provided to me by Billy Anderson here at the lab was that the purpose of Anasorb was to effectively trap the extremely volatile compounds which tend to migrate off the Tenax during sampling. I don't think this is included in the method, but I might be wrong.

So now the lab was posed with how to report data having low surrogate recoveries, including method blanks. The solution was to include this small amount, and it is about 1/5 of the total tube's total sorbent volume, of Tenax. This is how the modification arose.

I agree that the information in the narrative does not go to the degree of detail specifying the addition of Tenax to the Anasorb tube. There hasn't been a case until now where we have needed this addressed. I hope this does not invalidate the method.

The original intent of the method was to avoid a mixed-bed tube, increasing the capacity of the sorbent by using two full Tenax tubes and using a third carbon-based sorbent tube (Anasorb 747)

to collect volatile organic compounds (such as vinyl chloride) that do break through the Tenax. The original supporting laboratory work did indeed use elevated desorption temperatures (~350°C) to make the desorption from the Anasorb tube quantitative. However, even at this elevated desorption temperature, the desorption of the bromofluorobenzene surrogate was erratic and seldom quantitative. The use of a Tenax plug in the third tube of the Method 0031 sampling train for the purpose of spiking the surrogate compounds and obtaining quantitative recovery of the surrogates will not affect the function of the Anasorb in collecting volatile organic compounds that break through the first two Tenax tubes. Also, the MDL study mentioned by STL demonstrates that using the small plug of Tenax does not impair the performance of the Anasorb in the collection and desorption of volatile organic compounds.

Note that the Narrative contains no information on how samples are related between the Chain of Custody forms and the Sample Summary: “3 containers” for a given Run number means that there were three sorbent tubes, two Tenax tubes with the front and back tube designated (except as noted above), and a third Tenax/Anasorb tube. If condensate samples were received for all runs (but all of the condensates are not listed on the Chain of Custody forms, as noted above), there were undocumented instructions to analyze only one condensate sample for a given Run series. Instructions to R. J. Lafond are not documented, and instructions from R. J. Lafond to Sample Receipt are not documented.

Analytical results for the samples listed in the Sample Summary with Media Checks and Laboratory-Generated Method Blanks are shown in Table 3 for Data Package H4L100461.

Table 3. Analytical Results for Data Package H4L100461.

Compounds	VOST TCO RUN 1A TENAX TEST 2	VOST TCO RUN 1A ANASORB TEST 2	VOST TCO RUN 1B TENAX TEST 2	VOST TCO RUN 1B ANASORB TEST 2	VOST TCO RUN 1C TENAX TEST 2	VOST TCO RUN 1C ANASORB TEST 2
	μg^a					
acetone	1.4	1.1	0.52	480 E	0.38	25 E
acetonitrile	ND ^c	ND	ND	ND	ND	0.95 J ^d
acrylonitrile	ND	ND	ND	ND	ND	ND
benzene	0.23	ND	ND	ND	0.17	ND
bromomethane	ND	ND	ND	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND	ND
carbon disulfide	ND	ND	0.0057 J	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND	ND
chloromethane	0.0066 J	2.1 E ^b	0.0069 J	2.0	0.0088 J	0.10
ethylbenzene	ND	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND	ND	ND
methylene chloride	0.49	0.11	0.56	0.087	0.58	0.15
tetrachloroethene	0.0070 J	ND	0.0076 J	ND	0.0079 J	ND
toluene	0.0068 J	ND	0.0058 J	ND	0.0064 J	ND
trichloroethene	0.47	ND	0.51	ND	0.58	ND
vinyl chloride	0.0048 J	0.0052 J ^d	ND	0.0048	0.0049 J	0.0051 J
xylene (total)	ND	ND	ND	ND	ND	ND
Surrogates	% Recovery					
dibromofluoromethane	85	83	90	85	85	79
1,2-dichloroethane-d ₄	62	55	68	57	64	57
toluene-d ₈	94	94	95	97	92	93
bromofluorobenzene	80	70	82	77	81	72

^aThe usual reporting units for VOST are nanograms (ng); STL - Knoxville chooses to report their results in micrograms (µg) for compatibility with the SW-846 Method 8260C analysis.

^bEstimated result. Result concentration exceeds the calibration range.

^cND = Not Detected.

^dEstimated result. The result is less than the Reporting Limit.

^eCompounds with boiling points above 100°C are not appropriate VOST compounds because compounds boiling above 100°C may not be sampled quantitatively in the field. Compounds with boiling points above 100°C include ethylbenzene, 4-methyl-2-pentanone, 2-hexanone, styrene, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethene, toluene, 1,1,2-trichloroethane, and the xylenes. Reported values for these compounds are estimated values because the quantitative nature of the field sample collection cannot be assured. Chlorobenzene, toluene, and tetrachloroethene also have boiling points above 100°C, but field validation data demonstrate that sampling for these compounds is quantitative.

Table 3. Analytical Results for Data Package H4L100461, Continued.

Compounds	VOST TCO RUN 2A TENAX TEST 2	VOST TCO RUN 2A ANASORB TEST 2	VOST TCO RUN 2B TENAX TEST 2	VOST TCO RUN 2B ANASORB TEST 2	VOST TCO RUN 2C TENAX TEST 2	VOST TCO RUN 2C ANASORB TEST 2
	µg					
acetone	0.41	3.6	0.44	1.5	0.49	1.0
acetonitrile	ND	ND	ND	ND	ND	ND
acrylonitrile	ND	ND	ND	ND	ND	ND
benzene	0.15	ND	0.17	ND	0.15	ND
bromomethane	ND	ND	ND	ND	ND	ND
2-butanone	ND	ND	0.039 J	ND	ND	ND
carbon disulfide	ND	ND	0.0077 J	ND	0.0069 J	ND
carbon tetrachloride	ND	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND	ND
chloromethane	0.0084 J	0.092	0.0064 J	0.064	ND	0.090
ethylbenzene	ND	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND	ND	ND
methylene chloride	0.40	0.21	0.43	0.11	0.47	0.12
tetrachloroethene	0.0079 J	ND	0.0072 J	ND	0.0098 J	ND
toluene	0.0075 J	0.0033 J	0.0065 J	ND	0.0071 J	ND
trichloroethene	0.74	ND	0.92	ND	0.89	ND
vinyl chloride	ND	0.0052 J	0.0048 J	0.0052 J	0.0049 J	0.0053 J
xylenes (total)	ND	ND	ND	ND	ND	ND
Surrogates	% Recovery					
dibromofluoromethane	89	78	94	83	104	81
1,2-dichloroethane-d ₄	65	59	65	57	78	56
toluene-d ₈	91	91	95	96	107	93
bromofluorobenzene	81	72	85	75	100	74

Table 3. Analytical Results for Data Package H4L100461, Continued.

Compounds	VOST TCO RUN 3A TENAX TEST 2	VOST TCO RUN 3A ANASORB TEST 2	VOST TCO RUN 3B TENAX TEST 2	VOST TCO RUN 3B ANASORB TEST 2	VOST TCO RUN 3C TENAX TEST 2	VOST TCO RUN 3C ANASORB TEST 2
	µg					
acetone	0.38	0.70	0.37	0.79	0.093 J	0.71
acetonitrile	ND	ND	ND	ND	ND	ND
acrylonitrile	ND	ND	ND	ND	ND	ND
benzene	0.26	ND	0.18	ND	0.13	ND
bromomethane	ND	ND	ND	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND	ND
carbon disulfide	0.0076 J	ND	0.0092 J	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND	ND
chloromethane	0.0082 J	0.054	0.0094 J	0.070	0.0075 J	0.081
ethylbenzene	ND	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND	ND	ND
methylene chloride	0.32	0.16	0.30	0.37	0.34	0.099
tetrachloroethene	0.015 J	ND	0.0095 J	ND	0.010 J	ND
toluene	0.0082	0.0034 J	0.0070 J	0.022 J	0.0063 J	ND
trichloroethene	1.5	ND	0.96	ND	1.0	ND
vinyl chloride	0.0051 J	0.0055 J	ND	0.0051 J	ND	0.0050 J
xylenes (total)	ND	ND	ND	ND	ND	ND
Surrogates	% Recovery					
dibromofluoromethane	87	81	86	80	89	78
1,2-dichloroethane-d ₄	62	53	64	54	65	55
toluene-d ₈	94	94	92	89	90	90
bromofluorobenzene	84	73	80	71	80	74

Table 3. Analytical Results for Data Package H4L10046 , Continued.

Compounds	VOST MELTER RUN 1A TENAX TEST 2	VOST MELTER RUN 1A ANASORB TEST 2	VOST MELTER RUN 1B TENAX TEST 2	VOST MELTER RUN 1B ANASORB TEST 2	VOST MELTER RUN 1C TENAX TEST 2	VOST MELTER RUN 1C ANASORB TEST 2
	µg					
acetone	1.1	0.78	0.88	1.3	1.4	0.66
acetonitrile	2.8	20	2.4	14	4.4	4.9
acrylonitrile	0.68	ND	0.56	ND	0.70	ND
benzene	1.6	0.0074 J	1.4	0.0056 J	1.3	0.012 J
bromomethane	ND	0.011 J	ND	0.0099 J	ND	ND
2-butanone	0.17	ND	0.17	ND	0.17	ND
carbon disulfide	0.011 J	ND	0.010 J	ND	0.0090 J	ND
carbon tetrachloride	0.014 J	ND	0.012 J	ND	0.013 J	ND
chlorobenzene	1.0	ND	0.98	ND	0.95	ND
chloroform	0.029	ND	0.024 J	ND	0.026	ND
chloromethane	0.0069 J	2.2 E	ND	1.5	0.0091 J	0.049 J
ethylbenzene	0.044	0.0039 J	0.036	ND	0.039	ND
2-hexanone	0.025 J	ND	ND	ND	ND	ND
iodomethane	0.011 J	ND	0.0057 J	ND	0.0053 J	ND
methylene chloride	0.61	0.12	0.42	0.098	0.46	0.17
tetrachloroethene	0.026	0.0046 J	0.019 J	ND	0.014 J	ND
toluene	0.30	0.013 J	0.25	ND	0.23	ND
trichloroethene	ND	ND	ND	ND	ND	ND
vinyl chloride	0.0059 J	0.0061 J	0.0053 J	0.0066 J	0.0053 J	0.012 J
xylene (total)	0.22	0.018 J	0.18	ND	0.19	ND
Surrogates	% Recovery					
dibromofluoromethane	92	110	97	106	98	99
1,2-dichloroethane-d ₄	68	77	71	76	74	68
toluene-d ₈	110	109	114	114	110	117
bromofluorobenzene	100	101	103	101	100	93

Table 3. Analytical Results for Data Package H4L100461, Continued.

Compounds	VOST MELTER RUN 2A TENAX TEST 2	VOST MELTER RUN 2A ANASORB TEST 2	VOST MELTER RUN 2B TENAX TEST 2	VOST MELTER RUN 2B ANASORB TEST 2	VOST MELTER RUN 2C TENAX TEST 2	VOST MELTER RUN 2C ANASORB TEST 2
	µg					
acetone	1.4	0.96	0.97	1.5	1.0	1.4
acetonitrile	4.6	5.9	2.9	11	2.2	9.8
acrylonitrile	0.85	0.10 J	0.89	0.18 J	0.59	0.22 J
benzene	1.7	ND	1.8	0.013 J	1.5	0.0052 J
bromomethane	ND	ND	ND	0.015 J	ND	ND
2-butanone	0.20	ND	0.11	0.057 J	0.15	ND
carbon disulfide	0.011 J	ND	0.010 J	ND	0.010 J	ND
carbon tetrachloride	0.013 J	ND	0.013 J	ND	0.011 J	ND
chlorobenzene	1.1	ND	0.65	ND	0.81	ND
chloroform	0.023 J	ND	0.024 J	ND	0.025	ND
chloromethane	ND	0.24	0.011 J	0.089	0.0066 J	0.024 J
ethylbenzene	0.040	ND	0.028	0.012 J	0.033	ND
iodomethane	ND	ND	0.0066 J	ND	ND	ND
methylene chloride	0.42	ND	0.45	0.20	0.56	0.17
4-methyl-2-pentanone	0.029 J	ND	ND	ND	ND	ND
tetrachloroethene	0.014 J	ND	0.014 J	0.0075 J	0.013 J	ND
toluene	0.31	ND	0.28	0.040	0.23	0.0063 J
trichloroethene	ND	ND	ND	ND	ND	ND
vinyl chloride	0.0062 J	0.0048 J	0.0056 J	0.022 J	0.0054 J	0.012 J
xylene (total)	0.21	ND	0.14	0.059 J	0.17	ND
Surrogates	% Recovery					
dibromofluoromethane	95	98	82	99	85	91
1,2-dichloroethane-d ₄	71	66	60	66	61	63
toluene-d ₈	109	110	98	109	93	103
bromofluorobenzene	103	87	93	92	84	84

Table 3. Analytical Results for Data Package H4L100461, Continued.

Compounds	VOST MELTER RUN 3A TENAX TEST 2	VOST MELTER RUN 3A ANASORB TEST 2	VOST MELTER RUN 3B TENAX TEST 2	VOST MELTER RUN 3B ANASORB TEST 2	VOST MELTER RUN 3C TENAX TEST 2	VOST MELTER RUN 3C ANASORB TEST 2
	µg					
acetone	1.1	2.0	0.90	1.5	6.5	0.51
acetonitrile	2.8	15	2.2	6.8	1.1	ND
acrylonitrile	0.75	0.28 J	0.58	0.30 J	0.57	ND
benzene	1.5	0.0065 J	1.5	0.0064 J	1.5	0.0067 J
bromomethane	ND	ND	ND	ND	ND	ND
2-butanone	0.15	0.060 J	0.17	ND	0.14	ND
carbon disulfide	0.0085 J	ND	0.0086 J	ND	0.0090 J	ND
carbon tetrachloride	0.011 J	ND	0.013 J	ND	0.012 J	ND
chlorobenzene	0.70	ND	1.1	ND	0.95	ND
chloroform	0.036	ND	0.027	ND	0.025	ND
chloromethane	ND	0.076	0.0061 J	0.035 J	ND	0.018 J
ethylbenzene	0.030	ND	0.051	ND	0.039	ND
2-hexanone	ND	ND	ND	ND	ND	ND
iodomethane	0.0058 J	ND	ND	ND	ND	ND
methylene chloride	0.41	0.19	0.38	0.33	0.39	0.18
tetrachloroethene	0.016 J	ND	0.019 J	ND	0.019 J	ND
toluene	0.26	0.0030 J	0.29	ND	0.23	ND
trichloroethene	ND	ND	0.010 J	ND	ND	ND
vinyl chloride	0.0056 J	0.0057 J	0.0057 J	0.015 J	0.0056 J	0.015 J
xylene (total)	0.15	ND	0.26	ND	0.19	ND
Surrogates	% Recovery					
dibromofluoromethane	83	88	95	82	96	84
1,2-dichloroethane-d ₄	61	61	71	59	73	59
toluene-d ₈	93	98	112	92	105	93
bromofluorobenzene	85	81	103	75	97	73

Table 3. Analytical Results for Data Package H4L100461, Continued.

Compounds	VOST TCO RUN 1 CONDENSATE TEST 2	VOST TCO RUN 2 CONDENSATE TEST 2	VOST TCO RUN 3 CONDENSATE TEST 2	VOST MELTER RUN 1 CONDENSATE TEST 2	VOST MELTER RUN 2 CONDENSATE TEST 2
	µg/L				
acetone	21	22	20	ND	ND
acetonitrile	ND	ND	ND	ND	ND
acrylonitrile	ND	ND	ND	ND	ND
benzene	ND	ND	ND	ND	ND
bromomethane	ND	ND	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND
carbon disulfide	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	0.53 J	ND
chloroform	0.50 J	ND	ND	ND	ND
chloromethane	ND	ND	ND	ND	ND
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND	ND
methylene chloride	17	15	16	4.3 J	3.8 J
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	95	95	96	97	90
1,2-dichloroethane-d ₄	99	98	99	100	94
toluene-d ₈	100	103	99	99	101
bromofluorobenzene	114	113	114	114	115

Table 3. Analytical Results for Data Package H4L100461, Continued.

Compounds ^d	VOST MELTER RUN 3 CONDENSATE TEST 2	A-3898 TENAX MEDIA CHECK SUPELCO	A-3898 ANASORB MEDIA CHECK SUPELCO	(Laboratory) METHOD BLANK
	µg/L	µg	µg	µg
acetone	ND	ND	ND	ND
acetonitrile	ND	ND	ND	ND
acrylonitrile	ND	ND	ND	ND
benzene	ND	ND	ND	ND
bromomethane	ND	ND	ND	ND
2-butanone	ND	ND	ND	ND
carbon disulfide	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND
chloroform	ND	ND	ND	ND
chloromethane	ND	ND	ND	ND
ethylbenzene	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND
methylene chloride	3.0 J	ND	ND	ND
tetrachloroethene	ND	ND	ND	ND
toluene	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND
xylenes (total)	ND	ND	ND	ND
Surrogates	% Recovery			
dibromofluoromethane	96	84	78	80
1,2-dichloroethane-d ₄	97	58	56	57
toluene-d ₈	100	97	92	92
bromofluorobenzene	114	74	67	70

Laboratory Control Samples/Duplicates (LCS/LCSD), Relative Percent Difference (RPD) and associated Method Blanks are shown in Table 4. All recoveries and RPDs are within control limits.

Table 4. LCS/LCSD with Associated Method Blanks for Data Package H4L100461.

Compounds	LCS/LCSD % Recovery	RPD	(Laboratory) Method Blank µg	LCS/LCSD % Recovery	RPD	(Laboratory) Method Blank µg
acetonitrile	NS ^a		ND ^b	NS		ND
benzene	98/98	0.11	ND	90/87	3.2	ND
chlorobenzene	88/89	1.7	ND	85/78	8.0	ND
1,1-dichloroethene	118/114	3.9	ND	106/103	2.7	ND
toluene	96/95	0.83	ND	90/87	3.6	ND
trichloroethene	110/112	2.4	ND	98/97	1.7	ND
Surrogate Compounds	% Recovery					
dibromofluoromethane	84/82		79	78/72		94
1,2-dichloroethane-d ₄	57/856		56	54/51		98
toluene-d ₈	93/93		91	89/84		102
bromofluorobenzene	75/76		74	74/63		114

^aNS = Not Spiked.

^bND = Not Detected.

Table 4. LCS/LCSD with RPD for Data Package H4L100461, Continued.

Compounds	LCS/LCSD % Recovery	RPD
acetonitrile	NS ^a	
benzene	93/93	0.010
chlorobenzene	89/88	0.63
1,1-dichloroethene	87/87	0.080
toluene	95/94	0.86
trichloroethene	87/87	0.14
Surrogate Compounds	% Recovery	
dibromofluoromethane	95/98	
1,2-dichloroethane-d ₄	98/98	
toluene-d ₈	101/100	
bromofluorobenzene	109/111	

^aNS = Not Spiked.

Quality control parameters for the VOST analysis for Data Package H4L100461 are shown in Table 5.

Table 5. VOST Quality Control Parameters for Data Package H4L100461.

Parameter	Comments
Initial Calibration (ICAL) (9/22/04)	Acceptable curve.
Initial Calibration (ICAL) (10/04/04)	Acceptable curve.
Bromofluorobenzene Tune Check (9/22/04)	Within specifications
BFB Tune Check (10/04/04)	Within specifications
BFB Tune Check (12/13/04)	Within specifications
BFB Tune Check (12/14/04)	Within specifications
Continuing Calibration Check (12/14/04)	Within specifications
Continuing Calibration Check (12/14/04)	Within specifications
Second Source Standard (9/22/04) (Volatiles Analysis)	Recoveries within control limits.
Second Source Standard (10/04/04) (Volatiles Analysis)	Recoveries within control limits.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H4L100477
Test #2 Cold Plenum
Dioxins/Furans/PCBs

Overall Assessment of Data Package H4L100477:

Data package H4L100477 is of excellent quality, complete and clearly reported. The only weakness of the data package relates to documentation, with two key questions:

- Why were Method 0010 samples composited?
- How were samples prepared so that PCDD/F and PCB analyses could be done on the same sample?

These questions were resolved as indicated in the report. However, the weakness of the documentation has no impact on the quality of the data: the correct analyses were performed correctly to generate data of the indicated quality.

Analyses of these samples were performed by:

STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 10, 2004; the analytical data report is dated January 24, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form, consisting of four pages, is included in the data package. The Chain of Custody form lists 20 samples. For all of the samples, the requested analysis is "Dioxins/Furans;" all of the samples listed on the Chain of Custody forms are highlighted in yellow. Samples are designated variously as "Filter," "MeCl/Ace," "Toluene," and "XAD-2," the components of the Method 0023A sampling train. The sample summary (Table 1) lists 6 samples, including a Media Check sample. Obviously compositing of samples has occurred, but there is no documentation of a reason for compositing or any indication of how the compositing has occurred.

According to additional information requested from/sent by R. Lafond:

The semivolatile organic sampling train components were prepared for field sampling, and were extracted using STL Knoxville Standard Operating Procedure KNOX-ID-0012, based on the following methods:

- *USEPA SW-846 0023A, "Sampling for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofuran Emissions from Stationary Sources;" and*
- *USEPA SW-846 0010, "Modified Method 5 Sampling Train."*

Method 0010 trains for PCDD/Fs and PCBs - all components in one fraction: *The sampling trains were prepared as a combined extract for analysis. The particulate filter and front half of the filter holder, nozzle*

and probe solvent rinses, the XAD-2 resin trap and back half of the filter holder, coil condenser and connecting glassware solvent rinses were combined as one sample. An additional extract was prepared from the condensate, impinger contents and their related glassware solvent rinses. The additional extract was combined with equivalent aliquots of the extract from the other components for PCB analysis. The PCDD/Fs were analyzed in the filter/XAD fraction. PCDD/F analysis of the condensate fraction was not required.

PCDD/Fs and PCBs (combined filter, XAD and condensate): *The combined filter and XAD components were spiked with labeled PCDD/F and labeled PCB internal standards. The components were Soxhlet extracted with dichloromethane (DCM). The DCM extract was retained, while the components were further extracted with toluene. Equal aliquots of the DCM and toluene extracts were combined for PCDD/F analysis. The remaining DCM extract was used for the PCB analysis. The condensate and impinger rinses were combined in a separatory funnel and extracted with DCM. The Soxhlet and separatory funnel extracts were combined in equivalent aliquots for PCBs. The extracts were concentrated and cleaned as needed using column chromatography. Then the extract was further concentrated and recovery standards were added.*

PCDD/Fs: *The PCDD/F extracts were analyzed using STL Knoxville standard operating procedure KNOX-ID-0004, "Analysis of Polychlorinated Dioxins/Furans by High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS) Based on Methods 8290, 1613B, 0023A, and TO-9A." This is an isotope dilution analysis.*

PCBs: *The PCB extracts were analyzed using Knoxville standard operating procedure KNOX-ID-0013, "Analysis of PCB Isomers by Isotope Dilution HRGC/HRMS." This is an isotope dilution analysis.*

A detailed description of the analytical procedures is provided in the Narrative.

The Analytical Methods Summary of Data Package H4L100477 lists SW-846 0023A/8290 (0023A Airtrains 8290) and EPA-22 1668A (PCBs, HRGC/HRMS). The references include:

- SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, November 1986 and its updates;
- "Method 1668, Revision A, Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by HRGC/HRMS."

The Narrative includes a description of quality control parameters associated with the analyses and a detailed description of the HRMS analysis. Preparation of the samples is not addressed, hence the need for the supplemental information supplied by STL, above.

The Test Plan does not discuss compositing of sampling train components, or a combined PCDD/F/PCB analysis. The decision to composite the samples was made jointly by STL and Dr. Matlack in the course of preparation of the quote for the analysis; analysis of PCDD/Fs and PCBs on a single sample was performed by instruction of Dr. Matlack.

The Sample Summary for Data Package H4L100477 is shown in Table 1.

Table 1. Sample Summary for Data Package H4L100477.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G0TXQ	001	D/F MELTER RUN 1 TEST 2	12/08/04	PCB, 1/18/05 D/F, 1/12/05
G0TXR	002	D/F MELTER RUN 2 TEST 2	12/08/04	PCB, 1/18/05 D/F, 1/12/05 1/13/05
G0TXT	003	D/F TCO RUN 1 TEST 2	12/07/04	PCB, 1/18/05 D/F, 1/12/05
G0TXV	004	D/F TCO RUN 2 TEST 2	12/08/04	PCB, 1/20/05 D/F, 1/12/05 1/13/05
G0TXW	005	D/F TCO RUN 3 TEST 2	12/08/04	PCB, 1/20/05 D/F, 1/12/05
G0TXX	006	A-3890, A-3893 MEDIA CHECK	12/07/04	PCB, 1/18/05 D/F, 1/11/05

Analytical results for Method 1668A (PCB Analysis) including Laboratory-Generated Method Blank for Data Package H4L100477 are shown in Table 2.

Table 2. Analytical Results Summary for Method 1668A Analyses for Data Package H4L100477.

Compound	D/F Melter Run 1 Test 2	D/F Melter Run 2 Test 2	D/F TCO Run 1 Test 2
	ng/sample		
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	0.55	0.67	0.11 Q, J
3,4,4',5-tetrachlorobiphenyl (PCB 81)	0.059 Q ^a , J ^b	0.12 Q, J	ND
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	0.84	0.67	1.1
2,3,4,4',5-pentachlorobiphenyl (PCB114)	0.085 Q, J	0.11 J	0.073 Q, J
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	2.2	1.4	2.4
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	ND ^c	ND	ND
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	ND	ND	ND
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	0.16 C ^d , J	0.17 Q, C, J	0.23 C, J
2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	0.16 C156, J	0.17 Q, C156, J	0.23 C156, J
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	0.078	ND	0.078 Q, J
3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	ND	ND	ND
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	ND	ND	ND
Internal Standards	% Recovery		
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	47	51	75
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	66	68	86
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	52	57	57
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB114)	68	72	70
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	65	67	73
¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	62	64	74
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	48	52	56
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	68 C	85 C	90 C
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	68 C	85 C	90 C
¹³ C ₁₂ -2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	72	900	87
¹³ C ₁₂ -3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	62	75	66
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	61	85	64
Surrogate Compounds	% Recovery		
¹³ C ₁₂ -2,2',3,5',6-pentachlorobiphenyl (PCB 95)	119	123	115
¹³ C ₁₂ -2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	109	96	115
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	61	62	71

^aEstimated maximum possible concentration (EMPC).

^aEstimated result. Result is less than Reporting Limit.

^cND = Not Detected.

^dCo-eluting isomer.

Table 2. Analytical Results Summary for Method 1668A Analyses for Data Package H4L100477, Continued.

Compound	D/F TCO Run 2 Test 2	D/F TCO Run 3 Test 2	A-3890, A-3893 Media Check
	ng/sample		
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	0.17 J	0.074 J	ND
3,4,4',5-tetrachlorobiphenyl (PCB 81)	0.076 Q, J	ND	ND
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	0.40 J	0.24 J	ND
2,3,4,4',5-pentachlorobiphenyl (PCB114)	0.050 Q, J	ND	ND
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	0.88	0.45 J	ND
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	0.033 Q, J	ND	ND
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	0.14 Q, J	ND	ND
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	0.13 Q, C, J	0.069 C, J	ND
2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	0.13 Q, C156, J	0.069 C156, J	ND
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	0.089 Q, J	ND	ND
3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	ND	ND	ND
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	0.075 J	ND	ND
Internal Standards	% Recovery		
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	76	80	66
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	77	82	68
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	61	67	73
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB114)	74	81	88
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	71	79	85
¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	75	82	93
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	58	62	66
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	80 C	89 C	84 C
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	80 C	89 C	84 C
¹³ C ₁₂ -2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	74	83	82
¹³ C ₁₂ -3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	62	66	61
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	64	73	79
Surrogate Compounds	% Recovery		
¹³ C ₁₂ -2,4',6-Trichlorobiphenyl (PCB 32)	Not Spiked	Not Spiked	87
¹³ C ₁₂ -2,2',3,5',6-pentachlorobiphenyl (PCB 95)	111	102	Not Spiked
¹³ C ₁₂ -2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	108	105	Not Spiked
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	77	78	69

Table 2. Analytical Results Summary for Method 1668A Analyses for Data Package H4L100477, Continued.

Compound	(Laboratory) Method Blank H4L270000-149
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	ND
3,4,4',5-tetrachlorobiphenyl (PCB 81)	ND
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	ND
2,3,4,4',5-pentachlorobiphenyl (PCB114)	ND
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	ND
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	ND
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	ND
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	ND
2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	ND
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	ND
3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	ND
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	ND
Internal Standards	
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	68
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	77
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	74
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB114)	86
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	51
¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	15*
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	51
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	80 C
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	80 C
¹³ C ₁₂ -2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	85
¹³ C ₁₂ -3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	50
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	43

*Surrogate recovery is outside control limits.

Results for the analysis of a Laboratory Control Sample with Duplicate (LCS/LCSD) for Data Package H4L100477, Percent Recovery, and Relative Percent Difference (RPD) for the Method

1668A analysis are shown in Table 3.

Table 3. LCS/LCSD for Method 1668A Analysis for Data Package H4L100477.

Compound	LCS/LCSD % Recovery	RPD
4-chlorobiphenyl (PCB 3)	93/93	0.71
4,4'-dichlorobiphenyl (PCB 15)	92/96	3.9
3,4,4'-trichlorobiphenyl (PCB 37)	93/93	0.31
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	102/103	0.66
3,4,4',5-tetrachlorobiphenyl (PCB 81)	101/98	2.6
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	105/101	4.2
2,3,4,4',5-pentachlorobiphenyl (PCB 114)	96/93	2.9
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	94/96	1.8
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	91/91	0.42
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	115/115	0.23
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	97/95 C	1.8
2,3,3',4,4',5-hexachlorobiphenyl (PCB 157)	97/95 C156	1.8
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	100/103	3.1
3,3',4,4',5,5'-hexachlorobiphenyl (PCB 169)	103/106	2.7
2,2',3,3',4,4',5-heptachlorobiphenyl (PCB 170)	88/91	2.4
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	92/92	0.090
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	101/102	0.74
2,3,3',4,4',5,5',6-octachlorobiphenyl (PCB 205)	126/107	16
2,2',3,3',4,4',5,5',6-nonachlorobiphenyl (PCB 206)	83/85	2.5
2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl (PCB 209)	105/104	0.87
Internal Standard	% Recovery	
¹³ C ₁₂ -4-chlorobiphenyl (PCB 3)	82/81	
¹³ C ₁₂ -4,4'-dichlorobiphenyl (PCB 15)	79/70	
¹³ C ₁₂ -2,4,4'-trichlorobiphenyl (PCB 28)	89/87	
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	89/66	
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	75/71	
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB 114)	81/84	
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	83/81	

¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	84/85
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	63/60
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	85/83
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	85/83
¹³ C ₁₂ -2,3,4,4',5,5'-hexachlorobiphenyl (PCB 167)	90/89
¹³ C ₁₂ -3,3',4,4',5,6-hexachlorobiphenyl (PCB 169)	65/62
¹³ C ₁₂ -2,2',3,3',4,4',5-heptachlorobiphenyl (PCB 170)	97/105
¹³ C ₁₂ -2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	102/92
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	97/100
¹³ C ₁₂ -2,2',3,3',4,4',5,5'-octachlorobiphenyl (PCB 194)	59/62
¹³ C ₁₂ -2,2',3,3',4,4',5,5',6-nonachlorobiphenyl (PCB 206)	90/114
¹³ C ₁₂ -2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl (PCB 209)	71/101
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	78/61
Surrogate Compounds	% Recovery
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	79/67
¹³ C ₁₂ -2,4',6-trichlorobiphenyl (PCB 32)	88/86

Analytical results for Dioxins/Furans (D/F) for these samples including Laboratory-Generated Method Blank for Data Package H4L100477 are shown in Table 4.

Table 4. Analytical Results Summary for Method 8290 Analyses for Data Package H4L100477.

Compound	D/F Melter Run 1 Test 2	D/F Melter Run 2 Test 2	D/F TCO Run 1 Test 2	D/F TCO Run 1 Test 2	D/F TCO Run 2 Test 2	D/F TCO Run 3 Test 2
	pg/sample					
2,3,7,8-tetrachlorodibenzodioxin	12 Q ^a , J ^b	ND ^c	ND	ND	ND	ND
1,2,3,7,8-pentachlorodibenzodioxin	93 J	98 Q, J	4.0 J	4.0 J	9.9 Q, J	ND
1,2,3,4,7,8-hexachlorodibenzodioxin	94 J	120	ND	ND	9.1 Q, J	ND
1,2,3,6,7,8-hexachlorodibenzodioxin	72 J	75 Q, J	2.9 Q, J	2.9 Q, J	14 Q, J	ND
1,2,3,7,8,9-hexachlorodibenzodioxin	85 J	110	3.4 Q, J	3.4 Q, J	14 Q, J	ND
1,2,3,4,6,7,8-heptachlorodibenzodioxin	220	290	24 J	24 J	64 J	9.8 Q, J
octachlorodibenzodioxin	180 B ^c , J	230 B ^d	180 B, J	180 B, J	90 B, J	68 B, J
2,3,7,8-tetrachlorodibenzofuran	180 Q	210 ^e	ND	ND	35 ^e	ND

1,2,3,7,8-pentachlorodibenzofuran	28 Q, J	40 Q, J	7.1 J	7.1 J	110	ND
2,3,4,7,8-pentachlorodibenzofuran	17 Q, J	32 Q, J	5.7 Q, J	5.7 Q, J	96 Q, J	ND
1,2,3,4,7,8-hexachlorodibenzofuran	94 J	170	21 Q, J	21 Q, J	360 Q	12 Q, J
1,2,3,6,7,8-hexachlorodibenzofuran	8.7 Q, J	34 Q, J	8.2 Q, J	8.2 Q, J	170 Q	4.1 Q, J
2,3,4,6,7,8-hexachlorodibenzofuran	4.7 Q, J	18 Q, J	4.1 Q, J	4.1 Q, J	59 Q, J	ND
1,2,3,7,8,9-hexachlorodibenzofuran	2.3 Q, J	8.3 Q, J	ND	ND	29 J	ND
1,2,3,4,6,7,8-heptachlorodibenzofuran	22 J	140	46 J	46 J	490	19 Q, J
1,2,3,4,7,8,9-heptachlorodibenzofuran	4.6 J	60 J	17 J	17 J	250	9.2 Q, J
octachlorodibenzofuran	14 J	130 Q, J	72 Q, J	72 Q, J	620	25 Q, J
Internal Standards	% Recovery					
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	88	21 ^e	63	63	26 ^e	21 ^e
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	90	52	92	92	57	54
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	83	72	89	89	69	75
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	92	87	103	103	78	102
¹³ C-octachlorodibenzodioxin	105	94	123	123	75	90
¹³ C-2,3,7,8-tetrachlorodibenzofuran	57	8.6 ^e	47	47	16 ^{e,f}	14 ^e
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	86	32 ^e	81	81	45	38 ^e
¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	80	59	87	87	68	64
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	88	77	99	99	75	80
Surrogate Compounds	% Recovery					
³⁷ Cl ₄ -2,3,7,8-tetrachlorodibenzodioxin	92	87	90	90	86	84
¹³ C-1,2,3,4,7,8-heptachlorodibenzodioxin	99	99	100	100	97	90
¹³ C-2,3,4,7,8-pentachlorodibenzofuran	70	105	90	90	100	115
¹³ C-1,2,3,4,7,8-hexachlorodibenzofuran	86	88	87	87	83	82
¹³ C-1,2,3,4,7,8,9-heptachlorodibenzofuran	92	87	100	100	86	93

^aEstimated maximum possible concentration (EMPC).

^bEstimated result. Result is less than Reporting Limit.

^cND = Not Detected.

^dMethod blank contamination. The associated Method Blank contains the target analyte at a reportable level.

^eSurrogate recovery is outside stated control limits.

^f2,3,7,8-Tetrachlorodibenzofuran and ¹³C-2,3,7,8-tetrachlorodibenzofuran reported from confirmation column.

^gNS = Not spiked.

Table 4. Analytical Results Summary for Method 8290 Analyses for Data Package H4L100477, Continued.

Compound	A-3890, A-3893 Media Check	(Laboratory) Method Blank
	pg/sample	
2,3,7,8-tetrachlorodibenzodioxin	ND	ND
1,2,3,7,8-pentachlorodibenzodioxin	ND	ND
1,2,3,4,7,8-hexachlorodibenzodioxin	ND	ND
1,2,3,6,7,8-hexachlorodibenzodioxin	ND	ND
1,2,3,7,8,9-hexachlorodibenzodioxin	ND	ND
1,2,3,4,6,7,8-heptachlorodibenzodioxin	ND	ND
octachlorodibenzodioxin	4.1 Q, B, J	8.3 J
2,3,7,8-tetrachlorodibenzofuran	ND	ND
1,2,3,7,8-pentachlorodibenzofuran	ND	ND
2,3,4,7,8-pentachlorodibenzofuran	ND	ND
1,2,3,4,7,8-hexachlorodibenzofuran	ND	ND
1,2,3,6,7,8-hexachlorodibenzofuran	ND	ND
2,3,4,6,7,8-hexachlorodibenzofuran	ND	ND
1,2,3,7,8,9-hexachlorodibenzofuran	ND	ND
1,2,3,4,6,7,8-heptachlorodibenzofuran	ND	ND
1,2,3,4,7,8,9-heptachlorodibenzofuran	ND	ND
octachlorodibenzofuran	ND	ND
Internal Standards	% Recovery	
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	99	95
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	109	103
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	85	85
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	99	98
¹³ C-octachlorodibenzodioxin	109	102
¹³ C-2,3,7,8-tetrachlorodibenzofuran	94	89
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	100	96
¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	87	84

¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	99	100
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Results for the analysis of a Laboratory Control Sample with Duplicate (LCS/LCSD), Percent Recovery, and Relative Percent Difference (RPD) for the Method 8290 analysis in Data Package H4L100477 are shown in Table 5.

Table 5. LCS/LCSD Results Summary for Method 8290 Analyses for Data Package H4L100477.

Compound	LCS/LCSD % Recovery	RPD
2,3,7,8-tetrachlorodibenzodioxin	112/102	9.5
1,2,3,7,8-pentachlorodibenzodioxin	112/109	3.3
1,2,3,4,7,8-hexachlorodibenzodioxin	108/108	0.44
1,2,3,6,7,8-hexachlorodibenzodioxin	114/115	0.42
1,2,3,7,8,9-hexachlorodibenzodioxin	123/112	9.7
1,2,3,4,6,7,8-heptachlorodibenzodioxin	106/100	6.3
octachlorodibenzodioxin	115 B/113 B ^a	2.4
2,3,7,8-tetrachlorodibenzofuran	103/100	2.4
1,2,3,7,8-pentachlorodibenzofuran	128/122	4.1
2,3,4,7,8-pentachlorodibenzofuran	150 ^a /114	27
1,2,3,4,7,8-hexachlorodibenzofuran	119/116	2.3
1,2,3,6,7,8-hexachlorodibenzofuran	118/111	5.7
2,3,4,6,7,8-hexachlorodibenzofuran	136 ^a /113	19
1,2,3,7,8,9-hexachlorodibenzofuran	142 ^a /118	18
1,2,3,4,6,7,8-heptachlorodibenzofuran	112/109	2.7
1,2,3,4,7,8,9-heptachlorodibenzofuran	114/110	3.3
octachlorodibenzofuran	113/115	1.1
Internal Standards	% Recovery	
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	26 ^a /95	
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	60/99	
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	72/90	
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	90/103	
¹³ C-octachlorodibenzodioxin	106/118	
¹³ C-2,3,7,8-tetrachlorodibenzofuran	22 ^a /84	
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	44/93	

¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	61/88
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	89/102

^aSpiked analyte recovery is outside stated control limits.

^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cSurrogate recovery is outside stated control limits.

Notes from the Narrative for Data Package H4L100477:

On the following samples the recoveries of the listed Internal Standards were below the lower acceptance criterion (40%). The minimum required signal-to-noise ration was present, and the target estimated detection limit for associated analyses was met. The results are reported in accordance with the standard operating procedure. When properly applied, isotope dilution techniques produce results that are independent of internal standard recovery.

D/F Melter Run 2 Test 2

¹³ C-2,3,7,8-tetrachlorodibenzodioxin	21%
¹³ C-2,3,7,8-tetrachlorodibenzofuran	8.6%
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	32%

D/F TCO Run 3 Test 2

¹³ C-2,3,7,8-tetrachlorodibenzofuran	21%
¹³ C-2,3,7,8-tetrachlorodibenzofuran	14%
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	38%

D/F TCO Run 2 Test 2

¹³ C-2,3,7,8-tetrachlorodibenzodioxin	26%
¹³ C-2,3,7,8-tetrachlorodibenzofuran	16%

LCS G1RHC-1AC

¹³ C-2,3,7,8-tetrachlorodibenzodioxin	26%
¹³ C-2,3,7,8-tetrachlorodibenzofuran	22%

The recoveries of 2,3,4,7,8-pentachlorodibenzofuran, 2,3,4,6,7,8-hexachlorodibenzofuran, and 1,2,3,7,8,9-hexachlorodibenzofuran were 150%, 136%, and 142%, respectively. The recoveries on the Laboratory Control Sample Duplicate (LCSD) met the acceptance criteria. The data were reported as is.

Quality control parameters for the PCDD/F and PCB analyses of Data Package H4L100477 are shown in Table 8.

Table 8. Quality Control Summary for Data Package H4L100477.

QC Parameter	Date	All Parameters within Control Limits?
Method 1668A (PCBs)		
PFK Tune Check	8/20/02	Yes; resolution documented before beginning initial calibration (ICAL)
PFK Tune Check	1/17/05	Yes
PFK Tune Check	1/19/05	Yes
ICAL	8/20-21/02	Yes
Second Source Standard Verification	10/28/03	Yes
Calibration Check	1/19/05	Yes
System Blank	1/19/05	Yes
All analytes within SOP retention time criteria and both ions maximized within ± 2 seconds		
Ion abundance ratios for all labeled and unlabeled analytes within the specified control limits.		
Method 8290 (Dioxins/Furans)		
PFK Tune Check	11/08/04	Yes
PFK Tune Check	1/11/05	Yes
PFK Tune Check	12/20/04	Yes
PFK Tune Check	12/21/04	Yes
PFK Tune Check	1/23/05	Yes
PFK Tune Check	2/23/04	Yes
ICAL	11/08/04	Yes
ICAL (DB-225)	2/23/04	Yes
Calibration Check	12/21/04	Yes
Calibration Check	1/11/05	Yes
On 1/12/05, the 12-hour shift closing standard b050112s2 did not meet the 13C-OCDD response factor (RF) acceptance criterion of ± 30 percent difference from the ICAL (%D) The observed value was 36.5%D. The change in the response was due to high boiling sample residue deposited in the GC injector port during the analysis. This was confirmed by installing a clean injector port liner and repeating the closing standard analysis. The second closing standard met the 13C-OCDD RF acceptance criteria. The % recoveries for 13C-OCDD were calculated using the average of the opening and closing standard RFs instead of the ICAL mean RF. The results for the native analog were not similarly affected.		
All 2378 isomers within the RRT limits specified and both ions maximized within ± 2 seconds.		
A; non-2378 isomers were within established RT windows and both ions maximized within ± 2 seconds.		
Ion abundance ratios for all labeled and unlabeled analytes were within the control limits specified.		

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H4L130145
Test #2 & Test #3 0010/SVOC
Semivolatiles**

Overall Assessment of Data Package H4L130145:

The overall quality of the data in the data package H4L130145 is excellent. Because of the high concentrations of naphthalene in several of the samples, surrogate compounds were diluted to a level below the analytical range. However, surrogate recoveries are within the acceptable range on the Laboratory Control Samples, demonstrating that the analysis is in control. Several samples show surrogate compound recoveries outside the acceptable range. However, surrogate recoveries are within the acceptable range on the Laboratory Control Samples, so the analysis is in control. The surrogate compound recoveries outside the control limits are attributed to matrix effects from the interaction of the XAD-2 sorbent with the combustion matrix.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 10, 2004; the analytical data report is dated January 12, 2005, and signed by Richard J. Lafond, Project Manager.

Original Chain of Custody forms are included in the data package. Three pages of the CoC forms list XAD-2 matrix samples, with SVOC analysis requested. Eight pages of CoC forms list filter, condensate, and MeCl/MeOH rinse samples. A total number of 81 samples is listed on the Chain of Custody documentation. One sample is listed as requiring Total Organics analysis (TOE TCO R1 and TOE-1 (Purge and Trap)). This sample is apparently analyzed/reported elsewhere, as the sample is not listed in the Sample Summary supplied by STL. The Analytical Methods Summary lists SW-846 8270C, "Semivolatile Organic Compounds by GC/MS"; sample preparation methods are not listed.

The Sample Summary for H4L130145 is shown in Table 1.

The obvious discrepancy between the 81 samples listed on the Chain of Custody forms and the 20 entries in the Sample Summary prompted a question to STL regarding the analyses of the samples listed on the Chain of Custody forms. The following response was received from STL:

The samples were logged per the quote generated for Dr. Matlack. He specified that he wanted all train fractions combined. In the past we have done separate fractions but he felt it was not necessary to split them out.

This instruction from the client is not documented in the original data package, and the standard preparation method was described in the data package Narrative. A Revision of the Narrative to describe the actual sample preparation was requested and supplied by STL. This revised Narrative is included below.

**Project Narrative
H4L130145 rev 1**

Revision notes: This lot was revised to correctly document the preparation of the 0010 sampling trains.

The results reported herein are applicable to the samples submitted for analysis only.

This report shall not be reproduced except in full, without the written approval of the laboratory.

The original chain of custody documentation is included with this report.

Table 1. Sample Summary for Data Package H4L130145

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G0WWW	001	SV Melter Run 1 Test 2	12/08/04	12/23/04
G0W00	002	SV Melter Run 2 Test 2	12/08/04	12/23/04
G0W02	003	SV Melter Run 3 Test 2	12/08/04	12/23/04
G0W09	004	SV Melter Run 4 Test 1	12/08/04	12/23/04
G0W1D	005	SV Melter Run 5 Test 1	12/08/04	12/23/04
G0W1F	006	SV HEPA Out Run 1 Test 2	12/08/04	12/23/04
G0W1J	007	SV HEPA Out Run 2 Test 2	12/08/04	12/23/04
G0W1L	008	SV HEPA Out Run 3 Test 2	12/08/04	12/23/04
G0W1M	009	SV HEPA Out Run 4 Test 1	12/08/04	12/23/04
G0W1P	010	SV HEPA Out Run 5 Test 1	12/08/04	12/23/04
G0W1V	011	SV Carbon Out Run 1 Test 2	12/08/04	12/18/04
G0W1W	012	SV Carbon Out Run 2 Test 2	12/08/04	12/18/04
G0W11	013	SV Carbon Out Run 3 Test 2	12/08/04	12/18/04
G0W14	014	SV TCO Outlet Run 1 Test 2	12/08/04	12/18/04

G0W2C	015	SV TCO Outlet Run 2 Test 2	12/08/04	12/18/04
G0W2D	016	SV TCO Outlet Run 3 Test 2	12/08/04	12/18/04
G0W2G	017	SV TCO Outlet Run 4 Test 1	12/09/04	12/18/04
G0W2H	018	SV TCO Outlet Run 5 Test 1	12/09/04	12/23/04
G0W2J	019	SV Method Blank Test 1 + 2	12/08/04	12/18/04
G0W2P	020	A-3891, A-3894 Media Check	12/08/04	12/17/04

Sample Receipt

There were no problems with the condition of the samples received.

Combined Semivolatile Sampling Train Preparation and Analysis

The semivolatile organic sampling train components were, at the direction of the client per quote, extracted and analyzed using STL Knoxville standard operating procedures KNOX-OP-0009 and KNOX-MS-0016, based on the following methods:

- SW-846 3542, "Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train)"
- SW-846 8270C, "Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)"

The sampling trains are prepared as one analytical fraction: The particulate filter and front half of the filter holder, nozzle and probe solvent rinses, XAD-2 resin trap and back half of the filter holder, coil condenser, and connecting glassware solvent rinses are combined as a single sample.

The combined sample components are spiked with the Method 8270C surrogates and Soxhlet extracted with methylene chloride. The extracts are concentrated to 1 mL and analyzed by GC/MS.

Sample results were calculated using the following equation:

$$\text{Result, } \mu\text{g} = (\text{On column concentration, ng}/\mu\text{L}) * \frac{\text{Volume, final extract, } \mu\text{L}}{\text{Sample}} * \frac{1 \mu\text{g}}{1000 \text{ ng}} * \text{DF}$$

DF = Dilution Factor

Quality Control

Unless otherwise noted, all holding times and QC criteria were met and the test results shown in this report meet all applicable NELAC requirements.

The sample media check represents the quality of the media provided to the field. The laboratory sets aside a portion of the media lot sent to the field and prepared and analyzes it along with the samples that were returned to the lab for analysis.

The original analyses of samples SV TCO Outlet Run 4 Test 1 and SV TCO Outlet Run 5 Test 1 resulted in surrogate and internal standard recoveries which were outside the laboratory acceptance criteria. Since the samples were bracketed by runs with acceptable internal standards, a sample matrix effect is indicated as the reason for the internal standard criteria not being met. These results are included in the Miscellaneous section of the report, but they were not reported as final sample results.

In order to provide the client with quantitative results, both of these samples were recalculated using the daily standard (rather than the initial calibration) with all analytes referencing internal standard #4, phenanthrene-d₁₀, which exhibited acceptable recovery. Based on this new quantitation, the base/neutral surrogates were within limits. (2-Fluorobiphenyl was slightly high at 119% in sample SV TCO Outlet Run 4 Test 1.) These results further support the conclusion that the internal standards outside lab recovery limits were affected by the extract matrix. These results are included in the Raw Data section of the report and they were reported as the final sample results. The daily standard requantitation against internal standard phenanthrene-d₁₀ is presented in the Standard section of the report.

In order to provide a quantitation based on the internal standards specified by the method and initial calibration response factors, both samples (SV TCO Outlet Run 4 Test 1 and SV TCO Outlet Run 5 Test 1) were reanalyzed at a dilution. These samples are reported with elevated reporting limits. In these dilutions, the internal standards were within limits except for internal standard #6, perylene-d₁₂, which was not detected. The phenolic surrogate recoveries were within limits, except for 2,4,6-tribromophenol, which was not detected. The base/neutral surrogate recoveries were within limits, except for 2-fluorobiphenyl, which was high, probably due to a suppressed response of its respective internal standard. Running samples at greater dilutions had effectively minimized the matrix effects present in the extract, with the exception of perylene-d₁₂. These results were also reported in the Raw Data section of the report.

Due to the demonstrated matrix effect on the internal standards and surrogates for these two samples, the results should be considered estimated.

Sample SV Carbon Out Run 2 Test 2 was reported with elevated reporting limits for all analytes due to the difficult sample matrix. The sample could not be concentrated to the required final volume of 1 mL. The reporting limits were adjusted accordingly.

All "Melter" and "HEPA" samples were reported with elevated reporting limits for all analytes. Based on screening results, a dilution was necessary prior to analysis; the reporting limits were adjusted accordingly.

The concentration of naphthalene in sample SV HEPA Out Run 3 Test 2 exceeded the calibration level of the instrument. The sample was analyzed at a dilution to bring the concentration of the compound into the instrument calibration range. The reporting limits have been adjusted accordingly.

The combination of the constituents of the Method 0010 sampling trains to produce a single analytical sample would not satisfy regulatory requirements for this analysis, but the practice is scientifically acceptable if regulatory requirements do not need to be considered. The observed matrix effect arises from the interaction of the combustion matrix with the XAD-2 sorbent used for the collection of semivolatile organic compounds.

Analytical results for this set of samples are presented in Table 2.

Analytical results are accurately described in the revised Narrative. Two Laboratory-Generated Method Blanks, together with the respective dates of analysis, are reported.

Laboratory Control Samples are reported in Table 3.

Table 2. Analytical Results Summary for Data Package H4L130145.

Compounds	SV Melter Run 1 Test 2	SV Melter Run 2 Test 2	SV Melter Run 3 Test 2	SV Melter Run 4 Test 1	SV Melter Run 5 Test 1	SV HEPA Out Run 1 Test 2
	µg					
naphthalene	110000	120000	120000	120000	120000	170000
Surrogate Compounds	% Recovery					
2-fluorophenol	NC ^a	NC	NC	NC	NC	NC
phenol-d ₅	NC	NC	NC	NC	NC	NC
nitrobenzene-d ₅	NC	NC	NC	NC	NC	NC
2-fluorobiphenyl	NC	NC	NC	NC	NC	NC
2,4,6-tribromophenol	NC	NC	NC	NC	NC	NC
terphenyl-d ₁₄	NC	NC	NC	NC	NC	NC
¹³ C ₆ -naphthalene	NC	NC	NC	NC	NC	NC

^aRecovery was not calculated due to dilution.

Continued

Table 2, Continued

Compounds	SV HEPA Out Run 2 Test 2	SV HEPA Out Run 3 Test 2	SV HEPA Out Run 4 Test 1	SV HEPA Out Run 5 Test 1	SV Carbon Out Run 1 Test 2	SV Carbon Out Run 2 Test 2
	µg					
bis (2-ethylhexyl) phthalate	ND ^c	ND	ND	ND	ND	18 J
butyl benzyl phthalate	ND	ND	ND	ND	2.6 J ^d	3.2J
naphthalene	190000	230000 E ^b	160000	170000	4.4 J	4.5 J
phenol ^c	ND	ND	ND	ND	2.8 J	3.1 J
Surrogate Compounds	% Recovery					
2-fluorophenol	NC ^a	NC	NC	NC	63	58
phenol-d ₅	NC	NC	NC	NC	74	68
nitrobenzene-d ₅	NC	NC	NC	NC	67	62
2-fluorobiphenyl	NC	NC	NC	NC	72	68
2,4,6-tribromophenol	NC	NC	NC	NC	82	88
terphenyl-d ₁₄	NC	NC	NC	NC	74	77
¹³ C ₆ -naphthalene	NC	NC	NC	NC	82	75

^aRecovery was not calculated due to dilution.

Continued

^bEstimated result: concentration exceeds the calibration range.

^cND = Not Detected.

^dEstimated result; value is less than Reporting Limit.

^ePhenol and phenolic compounds at trace levels may be an artifact due to the interaction of the XAD-2 sorbent with the combustion matrix.

Table 2, Continued

Compounds	SV TCO Outlet Run 1 Test 2	SV TCO Outlet Run 2 Test 2	SV TCO Outlet Run 3 Test 2	SV TCO Outlet Run 4 Test 1 DF 1 ^e	SV TCO Outlet Run 4 Test 1 DF 10	SV TCO Outlet Run 5 Test 1 DF 1
	µg					
bis (2-ethylhexyl) phthalate	ND ^a	ND	17 J	ND	ND	17 J
butyl benzyl phthalate	ND	ND	3.0 J	ND	ND	3.2J
diethyl phthalate	ND	ND	ND	ND	ND	3.4 J
2,4-dinitrophenol	ND	ND	ND	67	ND	180
naphthalene	ND	ND	ND	15	120	82
2-nitrophenol	ND	ND	ND	130	94 J	100
4-nitrophenol	ND	ND	ND	23 J	ND	24 J
phenol	5.1 J ^{b,c}	12	5.0 J	ND	30 J	5.8 J
Surrogate Compounds	% Recovery					
2-fluorophenol	71	73	69	1.8 ^d	22	7.8 ^d
phenol-d ₅	77	78	78	0.83 ^d	24	4.8 ^d
nitrobenzene-d ₅	72	79	77	112	86	108
2-fluorobiphenyl	70	77	79	119 ^d	132 ^d	108
2,4,6-tribromophenol	81	59	72	0.0 ^d	0.0 ^d	5.9 ^d
terphenyl-d ₁₄	78	74	77	105	95	104
¹³ C ₆ -naphthalene	88	93	96	115	107	111

^aNot detected.

Continued

^bEstimated result; value is less than Reporting Limit.

^cPhenol and phenolic compounds at trace levels may be an artifact due to the interaction of the XAD-2 sorbent with the combustion matrix.

^dSurrogate recovery is outside stated control limits.

^eDF = Dilution Factor

Table 2, Continued

Compounds	SV TCO Outlet Run 5 Test 1 DF 15 ^c	SV Method Blank Test 1 + 2	A-3891, A-3894 Media Check	(Laboratory) Method Blank 12/23/04	(Laboratory) Method Blank 12/15/04
	µg				
bis (2-ethylhexyl) phthalate	ND ^a	ND	ND	ND	ND
butyl benzyl phthalate	ND	ND	ND	ND	ND
diethyl phthalate	ND	ND	ND	ND	ND
2,4-dinitrophenol	ND	ND	ND	ND	ND
naphthalene	260	9.4 J	ND	ND	ND
2-nitrophenol	91 J ^b	ND	ND	ND	ND
4-nitrophenol	ND	ND	ND	ND	ND
phenol ^c	ND	ND	ND	ND	ND
Surrogate Compounds	% Recovery				
2-fluorophenol	29	60	72	71	72
phenol-d ₅	32	58	79	74	75
nitrobenzene-d ₅	94	66	83	85	79
2-fluorobiphenyl	134 ^d	59	83	87	80
2,4,6-tribromophenol	0.0 ^d	71	86	91	82
terphenyl-d ₁₄	102	77	87	90	88
¹³ C ₆ -naphthalene	126	88	NS ^f	NS	NS

^aNot detected.

^bEstimated result; value is less than Reporting Limit.

^cPhenol and phenolic compounds at trace levels may be an artifact due to the interaction of the XAD-2 sorbent with the combustion matrix.

^dSurrogate recovery is outside stated control limits.

^eDF = Dilution Factor

^fNS = Not Spiked.

Table 3. Laboratory Control Samples, with Percent Recovery and Relative Percent Difference

Compounds	% Recovery		% Recovery	
	LCS1/LCSD1	RPD	LCS2/LCSD2	RPD
acenaphthene	86/86	0.46	86/87	1.4
4-chloro-3-methylphenol	85/88	3.8	98/103	5.3
2-chlorophenol	81/84	3.6	90/76	17
1,4-dichlorobenzene	80/84	4.5	82/57	35
2,4-dinitrotoluene	105/107	1.9	106/113	6.4
4-nitrophenol	98/98	0.40	106/114	7.3
N-nitrosodi- <i>n</i> -propylamine	70/73	3.6	73/70	3.1
pentachlorophenol	85/90	6.0	87/96	9.4
phenol	79/82	3.6	88/79	11
pyrene	88/89	1.2	88/100	13
1,2,4-trichlorobenzene	84/86	2.8	81/71	12
Surrogate Compounds				
2-fluorophenol	73/79		82/62	
phenol-d ₅	74/78		88/77	
nitrobenzene-d ₅	85/89		86/76	
2-fluorobiphenyl	85/88		86/84	
2,4,6-tribromophenol	105/110		97/101	
terphenyl-d ₁₄	81/83		82/92	

The Initial Calibration for these analyses was performed on October 19, 2004. The Continuing Calibration analysis performed for the quantitative analyses performed using Internal Standard #4 (phenanthrene-d₁₀), as recounted in the Narrative, was performed for samples SV TCO Outlet Run 5 Test 1 and SV TCO Outlet Run 4 Test 1 on December 17, 2004. The standard at the 200 level shows several compounds that “exceed the maximum amount” (i.e., the quantitation ion is saturated); these values are not used in the calculation of response factors.

A second source standard was analyzed to verify the calibration; all values were within the acceptable range.

Continuing calibration checks were performed on December 17 and December 21, 2004; all parameters are within the acceptable range.

A second multipoint Initial Calibration was performed on December 22, 2004. The Response Factors are excellent. The standard at the 200 level shows all compounds as “exceeding the maximum amount.” These values were not used in the calculation of the response factors. Analysis of a Second Source standard was performed; all values were within the acceptable range, with the note that the benzo(e)pyrene standard had expired.

Continuing Calibration checks were performed on December 22, 2004 and December 23, 2004; all analytes were within the acceptable range.

A Method Spike was performed as an intra-laboratory check; all parameters were within the acceptable range.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H4L130168
Test #2 Cold Plenum
Total Organics**

Overall Assessment of Data Package H4L130168:

The overall quality of the data in the data package H4L130168 is excellent. For a complex analysis consisting of multiple components, the Data Package was very well explained and documented and the data package was organized in a very logical and clear manner.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 10, 2004; the analytical data report is dated January 11, 2005, and signed by Richard J. Lafond, Project Manager.

Original Chain of Custody forms are included in the data package. One Chain of Custody form is labeled "Page 5 of 5"; on this Chain of Custody form, the following entries are highlighted in yellow:

TOE TCO out R1 Filter
 Condensate
 MeCl/MeOH

TOE-1 Purge and Trap.

For the first three entries, above, "Total Organics" is the requested analysis. For the fourth entry, "0040 Purge & Trap" is the requested analysis.

The note on the Chain of Custody form says:

This sample is separate from the other "train" samples & is analyzed separately.

A second Chain of Custody form is identified as Page 3 of 3; on this Chain of Custody form, the entry highlighted in yellow is:

TOE TCO R1 XAD-2

The analysis requested is "Total Organics."

A third Chain of Custody form, identified as Page 1 of 1, is included after the Receipt anomaly Checklist. There are no yellow-highlighted samples on this Chain of Custody form. There is one sample on this Chain of Custody form for which "Total Organics" analysis is requested. This sample is labeled:

TOB121004A TOE XAD-2.

Under Remarks on the Chain of Custody form, this sample is called "Blank."

This sample must correspond to the sample in the Sample Summary with client identification listed as TCO/GRAV TOE Blank

The Project Narrative contains no explanation of the organization of the samples; this

presentation would be very confusing to someone not intimately familiar with the Total Organics analysis. One complete Total Organics analysis was performed, but the components of the sample were distributed over three different Chain of Custody forms. There is a note on the Chain of Custody Receipt form that the samples were received outside temperature specifications (@ 11°C). However, this circumstance is noted in the Narrative and does not result in any further qualifications of the data.

The Sample Summary for H4L130168 is shown in Table 1.

Table 1. Sample Summary for Data Package H4L130168.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
GOW49	001	TCO/GRAV TOE TCO RUN 1 TEST 2	12/09/04	12/27/04
GOW5D	002	0040 TOE RUN 1 TEST 2	12/08/04	12/22/04
GOW5H	003	A-3892, A-3895 TEST 2	12/08/04	12/22/04
G08J2	004	TCO/GRAV TOE BLANK	12/09/04	12/22/04

The Analytical Methods Summary acknowledges the appropriate methods, as shown in Table 2:

Table 2. Analytical Methods Summary for Data Package H4L130168.

Parameter	Analytical Method ^a	STL Knoxville SOP
Gravimetric Analysis (GRAV)	EPA Method 18 GRAV	KNOX-OP-0009 KNOX-GC-0010
Total Chromatographable Organics (TCO) Analysis	EPA Method 18 TCO	KNOX-OP-0009 KNOX-GC-0010
Unspeciated Volatile Organics	EPA Method 18 0040 COND	KNOX-GC-0016

^aReference: "Guidance for Total Organics," EPA/600/R-96/033, March 1996.

The Project Narrative encompasses five pages and provides a thorough description of the Total

Organics analysis.

Analytical results are reported in Table 3, according to the various components of the analysis.

Table 3. Analytical Results for Total Organics Analysis in Data Package H4L130168.

Sample	Parameter	Result
0040 TOE RUN 1 TEST 2	C ₄ (0 to 30°C) C ₅ (30 to 60 °C) C ₆ (60 to 90 °C) C ₇ (90 to 98°C) Surrogate (C ₈)	3.0 µg/L 2.5 µg/L ND ^a ND 96% Recovery
TCO/GRAV TOE TCO RUN 1 TEST 2	Total Chromatographable Organics Surrogate (<i>n</i> -Heptadecane)	1.9 mg 112% Recovery
A-3892, A-3895 TEST 2	Total Chromatographable Organics Surrogate (<i>n</i> -Heptadecane)	ND 82% Recovery
TCO/GRAV TOE BLANK	Total Chromatographable Organics Surrogate (<i>n</i> -Heptadecane)	0.56 mg 114% Recovery
Method Blank	Total Chromatographable Organics Surrogate (<i>n</i> -Heptadecane)	ND 108% Recovery
LCS/LCSD	Total Chromatographable Organics Surrogate (<i>n</i> -Heptadecane)	Recovery: 88%/88% RPD: 0.50 109%/107%
TCO/GRAV TOE TCO RUN 1 TEST 2	Total Gravimetric Organics	4.1 mg
A-3892, A-3895 TEST 2	Total Gravimetric Organics	ND
TCO/GRAV TOE BLANK	Total Gravimetric Organics	ND
Method Blank	Total Gravimetric Organics	ND
LCS/LCSD	Total Gravimetric Organics	Recovery: 96%/115% RPD: 18

^aND = Not Detected.

The Quality Control data for the TOE analysis are summarized in Table 4.

Table 4. Quality Control Data for Data Package H4L130168.

Parameter	Value
Analysis: 0040 Condensate Analysis (Total Volatile Organics)	
Initial Calibration	Correlation coefficient ≥ 0.995
Continuing Calibration	%D $\leq 15\%$
Method Blank	All analytes < Reporting Limits
LCS/LCSD	All recoveries/RPDs within control limits
Surrogate Recoveries	Within control limits
Analysis: TCO/GRAV	
Initial Calibration	5 levels of standards analyzed Correlation coefficient ≥ 0.995
Balance calibration verified and within limits	Yes
GRAV audit samples within acceptance limits	Yes
Sample surrogates within QC limits	Yes
LCS/LCSD	LCS % Recovery high and affected analytes were ND in associated samples
Method Blank	All analytes < 5x Reporting Limits Surrogate recoveries within QC limits

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H4L130195
Test #2 Cold Plenum
Semivolatiles
Allyl Alcohol (Method 308)**

Overall Assessment of Data Package H4L130195:

The overall quality of the data in the data package H4L130195 is excellent. The Narrative as provided is inadequate and does not supply a clear discussion of the methodology for the Modified Method 308 analyses, and allyl alcohol should be considered a water-soluble volatile organic compound, rather than a semivolatile compound. With a description of the analysis appended from Data Package H4K190269, the overall quality of the data package is excellent.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 10, 2004; the analytical data report is dated December 28, 2004, and signed by Richard J. Lafond, Project Manager.

Original Chain of Custody forms are included in the data package. Twenty-three samples are listed on the Chain of Custody forms: two samples with a request for “Semivolatile” analysis, and the remaining 21 for “Allyl” analysis. The Analytical Methods Summary cites SW-846 Method 8015B, “Nonhalogenated Organics Using GC/FID”, and SW-846 Method 8270C, “Semivolatile Organic Compounds by GC/MS.”

The Project Narrative for Data Package H4L130195 as delivered is completely inadequate. Other than noting that there were no problems with sample condition and that all holding time and QC criteria were met, the Project Narrative provides no description of the sample preparation or analysis for either type of analysis included in this data package. The SW-846 Method 8270C analysis is a standard method and only a minimal description, if any, would be needed. However, “Allyl” and SW-846 Method 8015 are far less common. The “Allyl” sample preparation and analysis is based on EPA Method 308, which has been the subject of method development and method modification by the STL laboratory. A detailed description of this analysis as modified by STL, similar to what the laboratory provides for the Dioxin/Furan analysis, is called for in this Project Narrative.

The Test Plan states:

The melter off-gas will be sampled for allyl alcohol using a modified version of 40 CFR 63 Appendix A, Method 308.

Table 5.2 of the Test Plan refers to 40 CFR 63 **Modified Method 308** as the analytical method.

The minimal description provided in the Test Plan provides the only available written description of the sampling and analytical methodology.

N.B. – Allyl alcohol has a boiling point of 97°C and would therefore be considered a volatile compound, rather than semivolatile.

A concise but thorough description of the Modified Method 308 analysis is presented in Data Package H4K190269. This description is reproduced below.

Project Narrative H4K190269

Calibration

All calibrations were made using an external standard technique. Calibration data were obtained at seven levels of concentration (0.5 mg/L, 1 mg/L, 5 mg/L, 10 mg/L, 20 mg/L, and 100 mg/L - the 7th point is a blank). A method detection limit (MDL) study was performed to demonstrate a statistically derived limit of detection. The reporting limit is established to be 0.5 mg/L for all target analytes. CCV percent recovery values were within target acceptance limits of 85 to 115%.

Analysis

All samples were aqueous, and most of the samples contained dilute sodium hydroxide. The action of the sodium hydroxide forced the laboratory to remove some of the chromatographic column, and reinstall it, because CCVs failed. All samples affected were reanalyzed. The aqueous fraction of each sample was analyzed directly without concentration, but several samples had to be analyzed at elevated dilution. For each sample, 0.10, 1.0, or 10 mL were transferred to a 10 mL vial. Water was added, if necessary, to raise the final volume to 10 mL. The prepared sample was spiked with 10 µL of 1-butanol at a concentration of 20,000 mg/L in acetone, after dilution. The resulting concentration of 1-butanol was 20 mg/L. All injections were made using a 1.0 µL injection volume, followed by a 2.0 µL air gap.

Holding Time and Sample Preservation

The holding time for these samples has not been established. The samples were chilled during shipment and maintained at 4°C while waiting for analysis.

The Sample Summary for H4L130195 is shown in Table 1.

Table 1. Sample Summary for Data Package H4L130195

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G0XGE	001	OHHA1207041 Test 2	12/07/04	12/23/04
G0XHA	002	OHHA1207042 Test 2	12/07/04	12/23/04
G0XHH	003	OHHA1207043 Test 2	12/07/04	12/23/04
GOXHJ	004	OHHA1207043 Test 2	12/07/04	12/23/04
G0XHL	005	S-12A-49A Test 2	12/07/04	12/23/04
GOXHM	006	S-12A-100A Test 2	12/08/04	12/22/04
GOXHN	007	S-12A-142B Test 2	12/09/04	12/22/04
GOXHP	008	OHCA1207041 Test 2	12/07/04	12/23/04
GOXHQ	009	OHCA1207042 Test 2	12/07/04	12/23/04
G0XHR	010	OHCA1207043 Test 2	12/07/04	12/23/04
G0XHT	011	OHCB1207043 Test 2	12/07/04	12/23/04
G0XHV	012	OHMA1207041 Test 2	12/07/04	12/23/04
G0XHW	013	OHMB1207041 Test 2	12/07/04	12/23/04
G0XHX	014	OHMA1207042 Test 2	12/07/04	12/23/04
G0XH3	015	OHMA1207043 Test 2	12/07/04	12/23/04
G0XH4	016	OHBLA120704 Test 2	12/07/04	12/23/04
G0XH5	017	OHBLB120704 Test 2	12/07/04	12/23/04
G0XJA	018	OHTA1206041 Test 2	12/06/04	12/23/04
GOXJF	019	OHTB1206041 Test 2	12/06/04	12/23/04
G0XJH	020	OHTA1207042 Test 2	12/07/04	12/23/04
G0XJL	021	OHTA1207043 Test 2	12/07/04	12/23/04
G0XJM	022	OHTA1207044 Test 2	12/07/04	12/23/04
G0XJN	023	OHTB1207044 Test 2	12/07/04	12/23/04

Analytical results for the pair of semivolatile samples with Laboratory-Generated Method Blank in Data Package H4L130195 are presented in Table 2; the Laboratory Control Sample (LCS) is reported in Table 3.

Table 2. Analytical Results Summary for Semivolatile Samples in Data Package H4L130195.

Compounds	S-12A-100A Test 2	S-12A-142B Test 2	(Laboratory) Method Blank
	µg		
bis(2-ethylhexyl) phthalate	31 J ^a	37 J	ND
naphthalene	1500	1300	ND
nitrobenzene	38 J	56 J	ND
phenol ^b	120 J	160	ND
Surrogate Compounds	% Recovery		
2-fluorophenol	53	46	55
phenol-d ₅	63	55	62
nitrobenzene-d ₅	75	71	64
2-fluorobiphenyl	77	74	73
2,4,6-tribromophenol	87	80	63
terphenyl-d ₁₄	85	79	87

^aJ = Estimated result. Result is less than reporting limit.

^bResults for low levels of phenol and phenolic compounds should be interpreted with caution, since phenol is an oxidation product of XAD-2 when a combustion process is involved.

Table 3. Laboratory Control Sample, with Percent Recovery, for Semivolatile Samples in Data Package H4L130195

Compounds	% Recovery
	LCS
acenaphthene	87
4-chloro-3-methylphenol	89
2-chlorophenol	75
1,4-dichlorobenzene	70
2,4-dinitrotoluene	101
4-nitrophenol	93
N-nitrosodi- <i>n</i> -propylamine	74
pentachlorophenol	85
phenol	78
pyrene	94
1,2,4-trichlorobenzene	76
Surrogate Compounds	
2-fluorophenol	64
phenol-d ₅	73
nitrobenzene-d ₅	75
2-fluorobiphenyl	87
2,4,6-tribromophenol	100
terphenyl-d ₁₄	89

Quality control parameters for the semivolatile samples were within control limits:

- DFTPP met tune criteria on 12/21/04, 12/22/04, and 12/23/04;
- DDT breakdown was $\leq 20\%$, benzidine tailing was ≤ 3 , and PCP tailing ≤ 5 .
- Initial Calibration was performed on 12/21/04; all parameters were within control limits.
- Continuing Calibration checks were performed on 12/22/04 and 12/23/04; all parameters were within control limits.
- A Second Source standard was analyzed, with appropriate parameters within control limits.

Analytical results for the 21 allyl alcohol samples in Data Package H4L130195, with Laboratory-Generated Method Blanks, LCS, and Matrix Spike/Matrix Spike Duplicate (MS/MSD), are presented in Table 4.

Table 4. Analytical Results for Modified Method 308 Analysis for Allyl Alcohol in Data Package H4L130195.

Sample	Allyl Alcohol, mg/L	Surrogate Recovery, %	RPD
OHHA1207041 TEST2	910/890	98/102	1.9 ^c
OHHA1207042 TEST 2	1300	101	
OHHB1207042 TEST 2	2.5	99	
OHHA1207043 TEST 2	1500	98	
S-12A-49A TEST 2	3200	100	
OHCA1207041 TEST 2	16	94	
OHCA1207042 TEST 2	230	104	
OHCA1207043 TEST 2	860	96	
OHCB1207043 TEST 2	11/10	98/95	3.4
OHMA1207041 TEST 2	3000	102	
OHMB1207041 TEST 2	4.4	100	
OHMA1207042 TEST 2	1400	101	
OHMA1207043 TEST 2	1700	97	
OHBLA120704 TEST 2	8.7	100	
OHBLB120704 TEST 2	0.20 J ^a	96	
OHTA1206041 TEST 2	303	93	
OHTB1206041 TEST 2	0.15 J	111	
OHTA1207042 TEST 2	ND ^b	106	
OHTA1207043 TEST 2	ND	104	
OHTA1207044 TEST 2	ND	100	
OHTB12070044 TEST 2	ND	97	
METHOD BLANK (Laboratory) (12/23/04)	ND	99	
LCS	93% recovery	97	
MS/MSD	96/88 % recovery	95/95	2.4

^aEstimated result. Result is less than Reporting Limit.

^bND = Not Detected.

^cTests showing an RPD were performed in duplicate.

For the Modified Method 308 analyses:

- Initial calibration curves for the GC showed correlation coefficients ≥ 0.995 ;
- Retention time windows were verified within the correct time intervals (samples were very clean, with no obvious chromatographic interferences);
- Duplicates for samples in this data package were in excellent agreement;
- Surrogate compound recoveries were uniformly very good.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H4L140203
Test #3 Hot Plenum HALIDES
Halide Ions

Overall Assessment of Data Package H4L140203:

Data package H4L140203 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. Samples were analyzed at very high dilutions because of matrix effects, according to standard laboratory practice.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 13, 2004; the analytical data report is dated January 12, 2005, and signed by Richard J. Lafond, Project Manager.

The Chain of Custody records list 12 samples, with “Halogens” analysis requested for all samples. All samples listed on the Chain of Custody forms are included in the Sample Summary and reported in Data Package H4L140203. The samples were received (hand-delivered) at ambient temperature, with no custody seals. The Analytical Methods Summary lists SW-846 9056, “Determination of Inorganic Anions by Ion Chromatography.” The samples were analyzed for chloride and fluoride (per Test Plan) by ion chromatography using Standard Operating Procedure KNOX-WC-005 (based on SW-846 Methods 9056 and 9057).

The Sample Summary for Data Package H4L140203 is shown in Table 1.

Table 1. Sample Summary for Data Package H4L140203.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G0079	001	MELTER RUN 4 H ₂ SO ₄	12/11/04	1/4/05
G008J	002	MELTER RUN 4 NaOH	12/11/04	1/4/05
G008M	003	MELTER RUN 5 H ₂ SO ₄	12/11/04	1/4/05
G008P	004	MELTER RUN 5 NaOH	12/11/04	Cl, 1/6/05 F, 1/4/05
G008Q	005	MELTER RUN 6 H ₂ SO ₄	12/11/04	1/4/05
G008T	006	MELTER RUN 6 NaOH	12/11/04	Cl, 1/6/05 F, 1/4/05
G008W	007	TCO RUN 4 H ₂ SO ₄	12/11/04	1/4/05
G0080	008	TCO RUN 4 NaOH	12/11/04	Cl, 1/6/05 F, 1/4/05
G0082	009	TCO RUN 5 H ₂ SO ₄	12/11/04	1/4/05
G0083	010	TCO RUN 5 NaOH	12/11/04	Cl, 1/6/05 F, 1/4/05
G0084	011	TCO RUN 6 H ₂ SO ₄	12/11/04	1/4/05
G0086	012	TCO RUN 6 NaOH	12/11/04	Cl, 1/6/05 F, 1/4/05

Analytical results for these samples and the Laboratory-Generated Method Blanks are shown in Table 2. Sample results are reported as total μg . The dilution factor (DF) reported on the sample result form is actually the combination of factors required by the method to convert the anion reporting limit and method detection limit from $\mu\text{g/mL}$ to total μg .

The explanation for the high dilution factors, according to the data package Narrative, is: *Note also that impinger samples containing 0.1 N H_2SO_4 and 0.1 N NaOH typically display suppressed conductivity detector responses. This suppression is attributed to a matrix effect causing poor method performance and possibly giving unreliable data unless it is removed. Therefore, samples are progressively diluted in the laboratory to modify the matrix for an enhanced anion response. The samples are analyzed at increasing dilutions along with matrix spikes until matrix spikes are recovered from the sample within laboratory control limits.*

The final dilution factor is reported in with the analytical data in Table 2.

Table 2. Analytical Results Summary for Data Package H4L140203.

Sample	Chloride, μg	DF	Fluoride, μg	DF
Melter Run 4 H_2SO_4	39700	7700	22200	7700
Melter Run 4 NaOH	1110 J ^a	2520	ND ^b	2520
Melter Run 5 H_2SO_4	47300	6100	24900	6100
Melter Run 5 NaOH	ND	580	ND	2900
Melter Run 6 H_2SO_4	35400	6250	25600	6250
Melter Run 6 NaOH	ND	616	ND	3080
TCO Run 4 H_2SO_4	2930 B	4250	ND	2125
TCO Run 4 NaOH	ND	530	ND	2650
TCO Run 5 H_2SO_4	2920 B	4000	ND	2000
TCO Run 5 NaOH	ND	580	ND	2900
TCO Run 6 H_2SO_4	3010 B	4150	ND	2075
TCO Run 6 NaOH	ND	580	ND	2900
(Laboratory) Method Blank (1/4/05)	ND	100	ND	100
(Laboratory) Method Blank2 (1/4/05)	ND	100	ND	100
(Laboratory) Method Blank (Cl, 1/6/05)	ND	100	NA ^c	NA

^aEstimated result. Result is less than Reporting Limit.

^bND = Not Detected.

^cNA = Not Analyzed.

Samples reported as “ND” with high dilution levels were not re-analyzed at a lower dilution. Since matrix spikes/matrix spike duplicates (MS/MSDs) were within control limits, the MS/MSDs are not reported on standard report forms by prior agreement of STL with Dr. Matlack. A MS was performed for sample Melter Run 4 H₂SO₄ and TCO Run 4 H₂SO₄; recoveries were calculated manually. Concentrations and % Recovery for the MS/MSD are shown in Table 3.

Table 3. MS/MSD Data for Data Package H4L140203.

Sample	Chloride: µg % Recovery	Fluoride: µg % Recovery
Melter Run 4 H ₂ SO ₄	77400/77700 97.9%/98.8%	45600/45800 101.2%/102.1%
TCO Run 4 H ₂ SO ₄	9790/10000 80.7%/83.1%	3820/3740 89.9%/87.9%

Laboratory Control Samples/Duplicates associated with data package H4L140203 are shown in Table 4, with Relative Percent Difference (RPD). All parameters (% Recovery and RPD) are within control limits.

Table 4. Laboratory Control Samples/Duplicates Associated with Data Package H4L140203.

LCS/LCSD (1/6/05)			
Chloride, % Recovery	RPD	Fluoride, % Recovery	RPD
105/105	0.50	109/108	0.92
LCS/LCSD (1/4/05)			
104/104	0.76	101/103	1.6
LCS/LCSD (1/4/05)			
99/100	0.66	NA ^a	NA

^aNA = Not Analyzed.

Quality control results are shown in Table 5; all QC parameters were within control limits. Method Blanks are shown in Table 2; no analytes were detected in the Method Blanks on any of the days when analysis was performed. The LCS/LCSD show all recoveries and RPDs within control limits.

Table 5. Quality Control Summary for Data Package H4L140203.

QC Parameter	Date	All Parameters within Control Limits
Instrument ICS_1500		
Initial Calibration	12/27/04	5 levels of each analyte analyzed
Initial Calibration Verification	(2) 1/4/05	Yes
Initial Calibration Blank	1/4/05	Yes
Continuing Calibration Verification	(4) 1/4/05	Yes
Continuing Calibration Blank	(6) 1/3/05	Yes
Instrument Aragorn		
Initial Calibration	1/3/05	5 levels of each analyte analyzed
Initial Calibration Verification	(2) 1/4/05	Yes
Initial Calibration Blank	1/4/05	Yes
Continuing Calibration Verification	(2) 1/4/05	Yes
Continuing Calibration Blank	(2) 1/4/05	Yes
Instrument Aragorn		
Initial Calibration	1/3/05	5 levels of each analyte analyzed
Initial Calibration Verification	(2) 1/6/05	Yes
Initial Calibration Blank	1/6/05	Yes
Continuing Calibration Verification	(2) 1/6/05	Yes
Continuing Calibration Blank	(2) 1/6/05	Yes

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H4L140205
Test #1 Normal Plenum
Halide Ions

Overall Assessment of Data Package H4L140205:

Data package H4L140205 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 13, 2004; the analytical data report is dated January 12, 2005, and signed by Richard J. Lafond, Project Manager.

The Chain of Custody record lists 14 samples, with Halide analysis requested for all samples. All samples listed on the Chain of Custody forms are included in the Sample Summary and reported in Data Package H4L140205. The samples were received (hand-delivered) at ambient temperature, with no custody seals. The Analytical Methods Summary lists SW-846 9056, "Determination of Inorganic Anions by Ion Chromatography." The samples were analyzed for chloride and fluoride (per Test Plan) by ion chromatography using Standard Operating Procedure KNOX-WC-005 (based on SW-846 Methods 9056 and 9057).

The Sample Summary for Data Package H4L140205 is shown in Table 1.

Table 1. Sample Summary for Data Package H4L140205.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G009L	001	Melter Run 1 H ₂ SO ₄	12/10/04	1/3/05
G009V	002	Melter Run 1 NaOH	12/10/04	Cl, 1/6/05 Fl, 1/5/05
G009X	003	Melter Run 2 H ₂ SO ₄	12/10/04	1/3/05
G0090	004	Melter Run 2 NaOH	12/10/04	1/5/05
G0092	005	Melter Run 3 H ₂ SO ₄	12/10/04	1/3/05
G0093	006	Melter Run 3 NaOH	12/10/04	Cl, 1/6/05 Fl, 1/5/05
G0094	007	TCO Run 1 H ₂ SO ₄	12/10/04	1/3/05
G0095	008	TCO Run 1 NaOH	12/10/04	1/5/05
G0096	009	TCO Run 2 H ₂ SO ₄	12/10/04	1/3/05
G0097	010	TCO Run 2 NaOH	12/10/04	1/5/05
G0098	011	TCO Run 3 H ₂ SO ₄	12/10/04	1/3/05
G01AA	012	TCO Run 3 NaOH	12/10/04	1/5/05
G01AC	013	Melter Blank H ₂ SO ₄	12/10/04	1/3/05
G01AD	014	Melter Blank NaOH	12/10/04	Cl, 1/5/05 Fl, 1/6/05

Analytical results for these samples and the Method Blanks are shown in Table 2. Sample results are reported as total μg . The dilution factor (DF) reported on the sample result form is actually the combination of factors required by the method to convert the anion reporting limit and method detection limit from $\mu\text{g/mL}$ to total μg .

The high dilution factors are explained in the data package Narrative:

Note also that impinger samples containing 0.1 N H₂SO₄ and 0.1 N NaOH typically display suppressed conductivity detector responses. This suppression is attributed to a matrix effect causing poor method performance and possibly giving unreliable data unless it is removed. Therefore samples are progressively diluted in the laboratory to modify the matrix for an enhanced anion response. The samples are analyzed at increasing dilutions along with matrix spikes until matrix spikes are recovered from the sample within laboratory control limits.

The final dilution factor is reported in Table 2.

Table 2. Analytical Results Summary for Data Package H4L140205.

Sample	Chloride, µg	DF	Fluoride, µg	DF
Melter Run 1 H ₂ SO ₄	16300	9680	9960	4840
Melter Run 1 NaOH	167 B ^a	327	ND	654
Melter Run 2 H ₂ SO ₄	11900	9760	8250	4880
Melter Run 2 NaOH	258 B	596	ND	596
Melter Run 3 H ₂ SO ₄	1890	630	ND	630
Melter Run 3 NaOH	ND ^b	385	ND	770
TCO Run 1 H ₂ SO ₄	2040	830	ND	830
TCO Run 1 NaOH	196 B	580	ND	580
TCO Run 2 H ₂ SO ₄	2480	770	ND	770
TCO Run 2 NaOH	ND	610	ND	610
TCO Run 3 H ₂ SO ₄	12400	9000	6800	4500
TCO Run 3 NaOH	871	610	ND	610
Melter Blank H ₂ SO ₄	ND	100	ND	100
Melter Blank NaOH	342	100	ND	100
(Laboratory) Method Blank (1/3/05)	ND	100	ND	100
(Laboratory) Method Blank (1/5/05)	ND	100	ND	100
(Laboratory) Method Blank (1/6/05)	ND	100	ND	100

^aMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^bND = Not Detected.

Since matrix spikes/matrix spike duplicates (MS/MSD) were within control limits, the MS/MSDs are not reported on standard report forms by prior agreement of STL with Dr. Matlack. A MS was performed for sample Melter Blank H₂SO₄. Chloride and fluoride were not detected in the unspiked sample. A recovery of 98.6% for chloride and 61.9% for fluoride was observed for this sample, with a dilution factor of 100. Other MS/MSD pairs were analyzed using samples Melter Run 1 H₂SO₄, TCO Run 1 H₂SO₄, Melter Run 3 H₂SO₄, Melter Run 1 NaOH, and TCO Run 1 NaOH. % Recovery values were calculated manually within the data package, but report pages were not prepared. Concentrations and % Recovery for the MS/MSD are shown in Table 3 where they were calculated; not all recoveries were calculated. Recoveries for fluoride tend to be lower than recoveries for chloride.

Table 3. MS/MSD Data for Data Package H4L140205.

Sample	Chloride: µg, % Recovery	Fluoride: µg, % Recovery
Melter Run 1 H ₂ SO ₄	32600/33000 84.6%/86.3%	18900/19000 NC ^a
TCO Run 1 H ₂ SO ₄	5790/5760 89.5%/89.6%	798/751 48.1%/45.2%
Melter Run 3 H ₂ SO ₄	620/616 93.6%/93.0%	837/868 53.3%/55.8%
Melter Run 1 NaOH	1871/1405 93.6%/70.3%	722/708 81.5%/79.9%
TCO Run 1 NaOH	1580/1560 119.1%/117.9%	599/599 51.7%/51.7%

^aNot calculated.

Laboratory Control Samples/Duplicates associated with Data Package H4L140205 are shown in Table 4, with Relative Percent Difference (RPD). All parameters (% Recovery and RPD) are within control limits.

Table 4. Laboratory Control Samples/Duplicates Associated with Data Package H4L140205.

LCS/LCSD (1/3/05)			
Chloride, % Recovery	RPD	Fluoride, % Recovery	RPD
101/100	1.3	102/102	0.39
LCS/LCSD (1/5/05)			
104/104	0.0	108/108	0.0
LCS/LCSD (1/6/05)			
105/105	0.50	110/107	2.0

Quality control results for Data Package H4L140205 are shown in Table 5; all QC parameters were within control limits. Method Blanks are shown in Table 2; no analytes were detected in the Method Blanks on any of the days when analysis was performed. The LCS/LCSD show all recoveries and RPDs within control limits.

Table 5. Quality Control Summary for Data Package H4L140205.

QC Parameter	Date	All Parameters within Control Limits
Initial Calibration	1/3/05	5 levels of each analyte analyzed
Initial Calibration Verification	(2) 1/3/05	Yes
Initial Calibration Blank	1/3/05	Yes
Continuing Calibration Verification	(3) 1/3/05	Yes
Continuing Calibration Blank	(3) 1/3/05	Yes
Initial Calibration	1/5/05	5 levels of each analyte analyzed
Initial Calibration Verification	(2) 1/5/05	Yes
Initial Calibration Blank	1/5/05	Yes
Continuing Calibration Verification	(2) 1/5/05	Yes
Continuing Calibration Blank	(2) 1/5/05	Yes
Initial Calibration	1/6/05	5 levels of each analyte analyzed
Initial Calibration Verification	(2) 1/6/05	Yes
Initial Calibration Blank	1/6/05	Yes
Continuing Calibration Verification	(2) 1/6/05	Yes
Continuing Calibration Blank	(2) 1/6/05	Yes

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H4L140261
Test #3 Hot Plenum
Metals

Overall Assessment of Data Package H4L140261:

Data package H4L140261 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. Laboratory blanks analyzed with the samples show a slight commonly observed level of metal contamination on the “clean” filters. The field blank shows additional background metals contamination.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 13, 2004; the analytical data report is dated January 12, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form, consisting of four pages, is included in the data package; the pages of the Chain of Custody form are not numbered. The Chain of Custody form lists twenty-four samples, with “Metals” analysis requested for all samples; sixteen of these samples appear in the Sample Summary Table. The following analytes are specified:

Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn.

The measurement of the total mass of particulate matter trapped by the filter and the probe rinse of a Modified Method 5 (Method 0010) sampling train was performed according to STL-Knoxville Standard Operating Procedure KNOX-WC-0006, based on EPA Methods 0050 and 5. The filters of the sampling train are carefully reweighed to constant weight after being dried, and the acetone probe rinse solution is evaporated to dryness to determine the total particulate matter trapped by the rinse. The total particulate for a Method 0010 train is the sum of the particulate filter and the acetone probe rinse residue weights. Note that STL - Knoxville did not pre-weigh the filters for this field test. Tared weights for the filters were provided by the sampling organization, AirTech.

The Sample Summary for Data Package H4L140261 is shown in Table 1.

Table 1. Sample Summary for Data Package H4L140261.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G01XW	001	METALS TCO RUN 4 FH 072004-036	12/11/04	1/04/05
G01X9	002	METALS TCO RUN 4 BH	12/11/04	1/04/05
G010E	003	METALS TCO RUN 5 FH 072004-035	12/11/04	1/04/05
G010N	004	METALS TCO RUN 5 BH	12/11/04	1/04/05
G010R	005	METALS TCO RUN 6 FH	12/11/04	1/04/05
G0108	006	METALS TCO RUN 6 BH	12/11/04	1/04/05
G011H	007	METALS TCO RUN 7 FH	12/11/04	1/04/05
G011K	008	METALS TCO RUN 7 BH	12/11/04	1/04/05
G011V	009	METALS MELTER RUN 4 FH 072004-029	12/11/04	1/04-06/05
G0113	010	METALS MELTER RUN 4 BH	12/11/04	1/04-05/05
G0117	011	METALS MELTER RUN 5 FH 072004-027	12/11/04	1/04-06/05
G012C	012	METALS MELTER RUN 5 BH	12/11/04	1/04/05
G012E	013	METALS MELTER RUN 6 FH 072004-028	12/11/04	1/04-06/05
G012K	014	METALS MELTER RUN 6 BH	12/11/04	1/04-05/05
G012P	015	METALS TCO METHOD BLK FH 072004-032	12/11/04	1/04-05/05
G0122	016	METALS TCO METHOD BLK BH	12/11/04	1/04-05/05

These samples were prepared and analyzed using STL Knoxville standard operating procedure KNOX-MT-0006 which is based on EPA SW-846 Method 0060, "Determination of Metals in Stack Emissions" and Method 29, "Determination of Metals Emissions from Stationary Sources." The SW-846 Method 6010B as incorporated in STL Knoxville standard operating procedure KNOX-MT-0007 is used to perform the final instrument analysis.

Analytical results for the samples of Data Package H4L140261 are shown in Table 2; the Method Blanks are shown in Table 3.

Table 2. Analytical Results Summary for Data Package H4L140261.

Element	METALS TCO Run 4 FH 072004-036	METALS TCO Run 4 BH	METALS TCO Run 5 FH 072004-035	METALS TCO Run 5 BH	METALS TCO Run 6 FH
	µg				
antimony (Sb)	9.0 J ^a	0.67 B,J	9.1 J	ND	2.6 B,J
arsenic (As)	1.0	ND	0.91 B	ND	0.51 B
barium (Ba)	6.2 B ^b	0.68 B	5.5 B	0.44 B	0.94 B
cadmium (Cd)	0.91 J	0.19 B	0.39 B,J	0.086 B	0.50 J
chromium (Cr)	2.2	0.72 B	2.5	0.76 B	3.0
copper (Cu)	4.5	2.5 J	5.2	1.3 B,J	3.1
lead (Pb)	5.1	1.1	4.0	0.63 B	1.4
manganese (Mn)	3.4	0.45 B	3.6	0.38 B	1.8
nickel (Ni)	7.3	0.76 B	7.3	0.53 B	2.5 B
selenium (Se)	24.2	10.9 J	19.2	12.4 J	11.0
silver (Ag)	ND ^c	ND	ND	ND	ND
zinc (Zn)	22.2	7.8	13.8	39.9	11.31

Continued

^aEstimated result. Result is less than Reporting Limit.

^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cND = Not Detected.

Table 2. Analytical Results Summary for Data Package H4L140261, Continued.

Element	METALS TCO Run 6 BH	METALS TCO Run 7 FH	METALS TCO Run 7 BH	METALS MELTER Run 4 FH 072004-029	METALS MELTER Run 4 BH
			µg		
antimony (Sb)	1.2 B,J	3.0 B,J	ND	2460 J	28.8 J
arsenic (As)	ND	ND	ND	4660	ND
barium (Ba)	0.34 B	ND	ND	101	1.1 B
cadmium (Cd)	0.11 B	0.36 B,J	0.052 B	1650 J	0.27 B
chromium (Cr)	0.59 B	1.6	0.34 B	2030	3.3
copper (Cu)	2.0 B,J	0.60 B	1.4 B,J	204	1.6 B,J
lead (Pb)	0.53 B	0.33 B	0.48 B	1780	0.79 B
manganese (Mn)	0.19 B	0.77 B	0.19 B	3310	1.1 B
nickel (Ni)	0.42 B	0.79 B	ND	590	0.76 B
selenium (Se)	16.3 J	3.1	5.2 J	124000	6240 J
silver (Ag)	0.66 B	ND	0.29 B	2.4	0.46 B
zinc (Zn)	8.3	2.7	11.8	7780	12.6

Table 2. Analytical Results Summary for Data Package H4L140261, Continued.

Element	METALS MELTER Run 5 FH 072004-027	METALS MELTER Run 5 BH	METALS MELTER Run 6 FH 072004-028	METALS MELTER Run 6 BH
	µg			
antimony (Sb)	2550 J	3.2 B,J	2290 J	11.8 J
arsenic (As)	4860	8.2	4780	16.4
barium (Ba)	107	1.5 B	75.5	1.6 B
cadmium (Cd)	1720 J	1.7	1610 J	3.6
chromium (Cr)	2400	4.5	1950	8.7
copper (Cu)	219	1.8 B,J	170	1.4 B,J
lead (Pb)	1930	2.8	1650	3.6
manganese (Mn)	3520	1.5	2660	1.5
nickel (Ni)	686	1.0 B	489	0.76 B
selenium (Se)	130000	15600 J	126000	7780 J
silver (Ag)	2.3	1.0 B	1.7 B	0.84 B
zinc (Zn)	8670	29.5	6250	33.0

Four blanks were analyzed in conjunction with Data Package H4L140261. Samples labeled “Method Blank” are laboratory blanks generated by digestion of clean filters from the same batch as the filters used in the field. Consistent with results obtained in multiple laboratories, the “clean” filters show background levels of antimony, cadmium, copper, and selenium. The samples labeled “Metals TCO Method Blank BH” and “Metals TCO Method Blk FH 072004-032” were generated in the field using a sampling train with no stationary source matrix pulled through the filter. In this process, a number of additional metals at concentrations higher than the laboratory method blanks are observed, presumably due to contamination arising from handling in the field.

Table 3. Analytical Results Summary for Blanks in Data Package H4L140261.

Element	METALS TCO METHOD BLK FH 072004-032	METALS TCO METHOD BLK BH	(Laboratory) METHOD BLANK 1/04/05	(Laboratory) METHOD BLANK2 1/04/05
	µg			
antimony (Sb)	8.9 J ^a , B ^b	ND ^c	1.7 B	0.74 B
arsenic (As)	3.4	ND	ND	ND
barium (Ba)	4.7	ND	ND	ND
cadmium (Cd)	0.27 J, B	0.084 B	ND	0.052 B
chromium (Cr)	1.7	ND	ND	ND
copper (Cu)	1.2 B	3.0 J, B	0.29 B	ND
lead (Pb)	3.6	0.66	ND	ND
manganese (Mn)	2.2	0.27	ND	ND
nickel (Ni)	5.4	0.51	ND	ND
selenium (Se)	32.2 B	26.5 B, J	0.48 B	ND
silver (Ag)	ND	ND	ND	ND
zinc (Zn)	6.0	59.0	ND	ND

^aEstimated result. Result is less than Reporting Limit.

^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cND = Not Detected.

Filters were also weighed for particulate matter; results are reported in Table 4.

Table 4. Particulate Matter from Filters in Data Package H4L140261.

Sample	Weight of Particulate, mg
METALS TCO RUN 4 FH 072004-036	ND
METALS TCO RUN 5 FH 072004-035	ND
METALS MELTER RUN 4 FH 072004-029	279
METALS MELTER RUN 5 FH 072004-027	335
METALS MELTER RUN 6 FH 072004-028	341
METALS TCO METHOD BLK FH 072004-032	ND

Laboratory Control Samples/Duplicates associated with data package H4L140261 are shown in Table 5, with Relative Percent Difference (RPD). All parameters are within control limits.

Table 5. Laboratory Control Samples/Duplicates Associated with Data Package H4L140261.

Element	LCS/LCSD (1) % Recovery	RPD	LCS/LCSD (2) % Recovery	RPD
antimony (Sb)	97/99	1.5	101/102	0.89
arsenic (As)	96/99	3.6	99/100	0.69
barium (Ba)	96/99	2.8	99/99	0.41
cadmium (Cd)	101/105	3.8	105/106	0.66
chromium (Cr)	101/104	2.9	103/102	0.42
copper (Cu)	93/96	3.0	96/95	0.60
lead (Pb)	99/103	3.7	102/103	1.4
manganese (Mn)	101/104	3.1	103/103	0.24
nickel (Ni)	101/104	3.2	103/104	0.70
selenium (Se)	92/95	3.7	95/96	1.2
silver (Ag)	92/97	5.7	94/96	2.6
zinc (Zn)	103/107	3.3	107/107	0.35

Quality control procedures are shown in Table 6; all QC parameters were within control limits.

Table 6. Quality Control Summary for Data Package H4L140261.

QC Parameter	Date	All Parameters within Control Limits
Initial Calibration	1/04/05 1/05/05 1/06/05	Yes
Initial Calibration Verification	1/04/05 1/05/05 1/06/05	Yes
Initial Calibration Blank (2 performed)	1/04/05 1/05/05 1/06/05	Yes
Continuing Calibration Verification (9 CCVs performed)	1/04/05 1/05/05 1/06/05	Yes
Detection Limit Standard	1/04/05 1/05/05 1/06/05	Yes
Continuing Calibration Blank (9 CCBs performed)	1/04/05 1/05/05 1/06/05	Yes
Interference Check Standards A, AB	1/04/05 1/05/05 1/06/05	Yes
Serial Dilutions (Samples NBLK012705, HBLK012705)	1/04/05 1/05/05 1/06/05	Yes

A matrix spike and a matrix spike duplicate were performed; all parameters were within control limits. By prior agreement with Dr. Matlack, the MS/MSD is not reported since all parameters are within control limits.

As previous data validation reports have shown, the Laboratory Information Management System (LIMS) in use at STL Knoxville shows problems with consistency in rounding: at times a numerical value that ends in 6666 is truncated, at other times the value is rounded correctly. Likewise, a value that ends in 3333 is occasionally rounded up. Since three instrumental values are averaged to produce a final quantitative value, these occurrences are relatively common and are shown in Table 6. These instances of erratic rounding occur only in a last decimal place; the effect on reported values is minimal.

Table 6. Examples of Erratic LIMS Rounding for Data Package H4L140261.

Element	Calculated	Reported	Element	Calculated	Reported
G01X9 1/4/05 14:18			G0122 1/4/05 15:03		
Cd	0.00187666	0.00187	Ba	0.002656666	0.00265
G010N 1/4/05 14:24			Cd	0.084666666	0.084
Sb	0.00049666	0.00049	Cu	0.0323033	0.03231
Cr	0.00761666	0.00761	Ni	0.0311966	0.03119
Mn	0.00383333	0.00384	G010E 1/4/05 16:10		
G0108 1/4/05 14:35			Mn	0.035786666	0.03578
Se	0.162976666	0.16297	Ni	0.073493333	0.07350
G011K 1/4/05 14:41			Zn	0.137823333	0.13783
Sb	0.00383333	0.00384	G010R 1/4/05 16:38		
Cd	0.053	0.052	Ba	0.009393333	0.00940
Zn	0.118016666	0.11801	G011H 1/4/05 16:44		
G0113 1/4/05 14:46			Ba	0.00243333	0.00244
Ba	0.010596666	0.01059	Ni	0.007903333	0.00791
Ni	0.00763666	0.00763	G011V 1/4/05 16:49		
G012C 1/4/05 14:52			Pb	17.772666	17.772
Sb	0.031703333	0.03171	G012P 1/4/05 17:08		
Ni	0.010426666	0.01042	Ag	0.001656666	0.00165
Zn	0.294993333	0.29500	G010R 1/5/05 18:25		
G012P 1/5/05 18:37			Cu	0.031303333	0.03131
Cu	0.012216666	0.01221			

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H4L140288
Test #1 Normal Plenum
Metals

Overall Assessment of Data Package H4L140288:

Data package H4L140288 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. No field blanks were reported with this Data Package. The laboratory-generated Method Blanks show background filter contamination with antimony, cadmium, copper, and selenium.

Analyses of these samples were performed by:

STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 13, 2004; the analytical data report is dated January 12, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form, consisting of two pages, is included in the data package; the pages of the Chain of Custody form are not numbered. The Chain of Custody form lists eighteen samples, with "Metals" analysis requested for all samples. The following analytes are specified on the Chain of Custody form:

Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn.

Twelve of these samples are listed in the Sample Summary.

The Analytical Methods Summary lists SW-846 6010B, "Inductively Coupled Plasma (ICP) Metals." These samples were prepared and analyzed using STL Knoxville standard operating procedure KNOX-MT-0006 which is based on EPA SW-846 Method 0060, "Determination of Metals in Stack Emissions" and Method 29, "Determination of Metals Emissions from Stationary Sources." The SW-846 Method 6010B as incorporated in STL Knoxville standard operating procedure KNOX-MT-0007 is used to perform the final instrument analysis.

The measurement of the total mass of particulate matter trapped by the filter and the probe rinse of a Modified Method 5 (Method 0010) sampling train was performed according to STL-Knoxville Standard Operating Procedure KNOX-WC-0006, based on EPA Methods 0050 and 5. The filters of the sampling train are carefully reweighed to constant weight after being dried, and the acetone probe rinse solution is evaporated to dryness to determine the total particulate matter trapped by the rinse. The total particulate for a Method 0010 train is the sum of the particulate filter and the acetone probe rinse residue weights. Note that STL - Knoxville did not pre-weigh the filters for this field test. Tared weights for the filters were provided by the sampling organization, AirTech.

The Sample Summary for Data Package H4L140288 is shown in Table 1.

Table 1. Sample Summary for Data Package H4L140288.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G0189	001	METALS TCO RUN 1 FH 072004-031	12/10/04	1/4-5/05
G02A8	002	METALS TCO RUN 1 BH	12/10/04	1/4-5/05
G02CC	003	METALS TCO RUN 2 FH 072004-023	12/10/04	1/4-5/05
G02CX	004	METALS TCO RUN 2 BH	12/10/04	1/4-5/05
G02DF	005	METALS TCO RUN 3 FH 072004-034	12/10/04	1/4-5/05
G02DL	006	METALS TCO RUN 3 BH	12/10/04	1/4-5/05
G02D2	007	METALS MELTER RUN 1 FH 072004-030	12/10/04	1/4-5/05
G02D8	008	METALS MELTER RUN 1 BH	12/10/04	1/4-5/05
G02ED	009	METALS MELTER RUN 2 FH 072004-022	12/10/04	1/4-6/05
G02EH	010	METALS MELTER RUN 2 BH	12/10/04	1/4-5/05
G02EK	011	METALS MELTER RUN 3 FH 072004-033	12/10/04	1/4-6/05
G02EN	012	METALS MELTER RUN 3 BH	12/10/04	1/4-5/05

Analytical results for the metals analysis for the samples of Data Package H4L140288 and the Laboratory-Generated Method Blanks are shown in Table 2. No field blank was included with this set of samples. The Laboratory-Generated Method Blanks show background contamination of antimony, cadmium, copper, and selenium.

Table 2. Analytical Results Summary for Metals Analysis for Data Package H4L140288.

Element	METALS TCO Run 1 FH 072004-031	METALS TCO Run 1 BH	METALS TCO Run 2 FH 072004-023	METALS TCO Run 2 BH	METALS TCO Run 3 FH 072004-034
			µg		
antimony (Sb)	10.0 J ^a	ND ^c	10.2 J	5.1 B,J	8.7 J
arsenic (As)	2.3	ND	2.6	ND	0.68 B
barium (Ba)	7.4 B ^b	0.71 B	6.0 B	1.0 B	5.4 B
cadmium (Cd)	0.78 J	1.0	1.5 J	0.49 B	0.082 B,J
chromium (Cr)	2.7	0.84 B	1.8	0.35 B	1.4
copper (Cu)	5.9	4.1 J	2.8	3.8 J	2.1 B
lead (Pb)	8.7	1.9	5.3	1.5	3.4
manganese (Mn)	3.4	1.3 B	3.8	0.92 B	1.8
nickel (Ni)	8.3	1.4 B	7.2	1.3 B	6.1
selenium (Se)	22.5	4.7 J	96.6	2.3 J	12.2
silver (Ag)	ND ^c	0.44 B	ND	0.50 B	ND
zinc (Zn)	27.1	34.8	24.3	34.2	8.2

Continued

^aEstimated result. Result is less than Reporting Limit.

^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cND = Not Detected.

Table 2. Analytical Results Summary for Data Package H4L140288, Continued.

Element	METALS TCO Run 3 BH	METALS MELTER RUN 1 FH 0723004-030	METALS MELTER RUN 1 BH	METALS MELTER RUN 2 FH 0723004-022	METALS MELTER RUN 2 BH
			µg		
antimony (Sb)	1.6 B,J	946 J	12.5 J	549 J	1.6 B,J
arsenic (As)	ND	1910	14.0	1810	ND
barium (Ba)	1.1 B	76.7	1.9 B	16.0 B	0.61 B
cadmium (Cd)	1.2	813 J	7.8	517 J	0.24 B
chromium (Cr)	0.39 B	1160	7.0	1030	0.84 B
copper (Cu)	2.9 J	88.3	3.5 J	32.9	4.8 J
lead (Pb)	0.74 B	900	9.0	537	0.81 B
manganese (Mn)	0.50 B	1040	31.8	137	0.93 B
nickel (Ni)	1.9 B	405	4.5	54.8	1.2 B
selenium (Se)	2.8 J	56600	2410 J	40400	2810 J
silver (Ag)	0.46 B	1.4 B	0.51 B	0.86 B	0.80 B
zinc (Zn)	69.0	3030	57.4	619	47.7

Continued

Table 2. Analytical Results Summary for Data Package H4L140288, Continued.

Element	METALS MELTER Run 3 FH 072004-033	METALS MELTER Run 3 BH	(Laboratory) METHOD BLANK 1/4/05	(Laboratory) METHOD BLANK 1/4/05
	µg			
antimony (Sb)	809 J, B	4.9 J, B	1.7 B	0.74 B
arsenic (As)	1650	18.4	ND	ND
barium (Ba)	46.2	1.2	ND	ND
cadmium (Cd)	655 J, B	7.9 B	ND	0.052 B
chromium (Cr)	1050	11.1	ND	ND
copper (Cu)	62.2 B	3.1 J, B	0.29 B	ND
lead (Pb)	717	7.7	ND	N
manganese (Mn)	677	1.7	ND	ND
nickel (Ni)	180	1.6 B	ND	ND
selenium (Se)	55700 B	2180 J, B	0.48 B	ND
silver (Ag)	ND	0.30	ND	ND
zinc (Zn)	2090	85.1	ND	ND

Filters and acetone rinse residuals were also weighed for particulate matter for Data Package H4L140288; results are reported in Table 3.

Table 3. Particulate Matter from Filters in Data Package H4L140288.

Sample	Weight of Particulate, mg
METALS TCO RUN 1 FH 072004-031	ND
METALS TCO RUN 2 FH 072004-023	ND
METALS TCO RUN 3 FH 072004-034	ND
METALS MELTER RUN 1 FH 072004-030	105 (total particulate)
METALS MELTER RUN 2 FH 072004-022	84.7 (total particulate)
METALS MELTER RUN 3 FH 072004-023	104 (total particulate)

Laboratory Control Samples/Duplicates associated with Data Package H4L140288 are shown in Table 4, with Relative Percent Difference (RPD). All parameters are within control limits.

Table 4. Laboratory Control Samples/Duplicates Associated with Data Package H4L140261.

Element	LCS/LCSD (1) % Recovery	RPD	LCS/LCSD (2) % Recovery	RPD
antimony (Sb)	97/99	1.5	101/102	0.89
arsenic (As)	96/99	3.6	99/100	0.69
barium (Ba)	96/99	2.8	99/99	0.41
cadmium (Cd)	101/105	3.8	105/106	0.66
chromium (Cr)	101/104	2.9	103/102	0.42
copper (Cu)	93/96	3.0	96/95	0.60
lead (Pb)	99/103	3.7	102/103	1.4
manganese (Mn)	101/104	3.1	103/103	0.24
nickel (Ni)	101/104	3.2	103/104	0.70
selenium (Se)	92/95	3.7	95/96	1.2
silver (Ag)	92/97	5.7	94/96	2.6
zinc (Zn)	103/107	3.3	107/107	0.35

Quality control data for Data Package H4L140288 are shown in Table 5; all QC parameters were within control limits, with the exceptions noted.

Table 5. Quality Control Summary for Data Package H4L140288.

QC Parameter	Date	All Parameters within Control Limits?
Initial Calibration	1/04/05 1/05/05 1/06/05	Yes
Initial Calibration Verification	1/04/05 1/05/05 1/06/05	Yes Yes Yes
Initial Calibration Blank (2 performed)	1/04/05 1/05/05 1/06/05	Yes Yes Yes
Continuing Calibration Verification (8 CCVs performed)	1/04/05 1/05/05 1/06/05 ^a	Yes Yes No
Detection Limit Standard	1/04/05 1/05/05 1/06/05	Yes Yes Yes
Continuing Calibration Blank (8 CCBs performed)	1/04/05 1/05/05 1/06/05 ^b	Yes Yes No
Interference Check Standards A, AB	1/04/05 1/05/05 1/06/05	Yes Yes Yes
Serial Dilutions (Samples G010E, G010EP)	1/04/05	Yes

^aCCV4, -5, -6, and -7 failed for Cu. CCV8 failed for Ba, Cu, K, Ni, and Tl.

^bCCB6, -7 failed for Se. CCB8 failed for Ag and Se.

All samples analyzed for Ba, Cu, Ni, Ag, and Se were re-analyzed – i.e., samples analyzed before and after the failed CCVs and CCBs were re-done.

A matrix spike and a matrix spike duplicate were performed; all parameters were within control limits. By prior agreement with Dr. Matlack, the MS/MSD is not reported since all parameters are within control limits.

As previous data validation reports have shown, the Laboratory Information Management System (LIMS) in use at STL Knoxville shows problems with consistency in rounding: at times a numerical value that ends in 6666 is truncated, at other times the value is rounded correctly. Likewise, a value that ends in 3333 is occasionally rounded up. Since three instrumental values are averaged to produce a final quantitative value, these occurrences are relatively common and are shown in Table 6. These instances of erratic rounding occur only in a last decimal place; the effect on reported values is minimal.

Table 6. Examples of Erratic LIMS Rounding for Data Package H4L140261.

Element	Calculated	Reported	Element	Calculated	Reported
G02A8			G02D2		
Sb	-0.00964333	-0.00965	Sb	9.4559666	9.4559
Se	0.04690333	0.04691	Pb	8.9954333	8.9955
G02CX			G02EK		
Ag	0.00495333	0.00496	Pb	7.17056666	7.1705
G02D8			Ni	1.8019333	1.8020
Cd	0.07837666	0.07837	G02DF 1/05/05 19:18		
G02EH			Se	0.1248633	0.12487
Mn	0.00927333	0.00928	G02D2Z20		
G02EN			Zn	1.6518333	1.6519
Zn	0.85125666	0.85125	G02EDZ20		
G0189			Cu	0.01755666	0.01755
Cr	0.02730666	0.02730	G02ED 1/05/05 21:05		
G02CC			Cu	0.32881333	0.32882
Pb	0.0526666	0.05266	G02DF 1/06/05 16:21		
			Se	0.12225333	0.012226

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H4L140306
Test #1 Normal Plenum
Metals (Feed)

Overall Assessment of Data Package H4L140306:

Data package H4L140306 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent considering the difficulty of dealing with a Feed matrix.

Analyses of these samples were performed by:

STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 13, 2004; the analytical data report is dated January 7, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form is included in the data package. The Chain of Custody form lists four samples. Three of the listed samples are designated as “Feed” Samples, with Metals analysis requested with the specified analytes: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn. The fourth listed sample is designated as “SBS Solution”, and the analysis requested for this sample is Dioxins, Furans, PCBs. The second sample listed is highlighted in yellow, and only the second sample listed on the Chain of Custody form (F-12B-8A) is listed in the Sample Summary.

The Sample Summary for H4L140306 is shown in Table 1. Note that the Sample Summary includes only one of the four samples listed on the Chain of Custody form.

Table 1. Sample Summary for Data Package H4L140306.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G02HJ	001	F-12B-8A	12/09/05	12/22/04

This feed sample was prepared for analysis by digestion and dilution (see Note below). A dilution factor of 200 was used for analysis of Sb, As, Ba, Cd, Cr, Cu, Pb, Ni, Se, and Ag; a dilution factor of 1000 was used for analysis of Mn and Zn. The SW-846 Method 6010B as incorporated in STL Knoxville standard operating procedure KNOX-MT-0007 was used to perform the final instrumental analysis.

Note on Metals Prep Log/Batch Summary:

Per PM Rich Lafond samples to be digested at 1:5 dilution due to low sample volume and matrix. Samples have sediment on the bottom of their containers. Samples are thoroughly mixed and 10 mL taken for digestion. Samples reacted vigorously (foam) with addition of 1 mL Conc. HNO₃. Samples bubbled with addition of 2.5 mL conc. HCl. After digestion, samples have layer of muddy sediment on the bottom.

Analytical results for this sample, the associated Method Blank, and the associated Laboratory Control Sample (LCS) are shown in Table 2. The Method Blank shows background contamination of arsenic, manganese, and zinc. However, the levels of these analytes in the Feed sample are so high that the amount in the Method Blank is insignificant.

Table 2. Analytical Results Summary for Data Package H4L140306.

Element	F-12B-8A	(Laboratory) METHOD BLANK	LABORATORY CONTROL SAMPLE	SPIKE AMOUNT µg/L
	µg		% Recovery	
antimony (Sb)	90200	ND ^c	98	500
arsenic (As)	202000 J ^a , B ^b	4.6 B	98	2000
barium (Ba)	46000	ND	102	2000
cadmium (Cd)	650000	ND	100	50.0
chromium (Cr)	3580	ND	99	200
copper (Cu)	186000	ND	100	250
lead (Pb)	1080000	ND	97	500
manganese (Mn)	12400000 J, B	2.0 B	100	500
nickel (Ni)	604000	ND	99	500
selenium (Se)	311000	ND	100	2000
silver (Ag)	ND	ND	99	50.0
zinc (Zn)	6920000 J, B	7.6 B	106	500

^aEstimated result. Result is less than Reporting Limit.

^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cND = Not Detected.

The Project Narrative notes that the sample, F-12B-8A, was reported with elevated Reporting Limits for all analytes because of the dilution required due to the difficult sample matrix [Feed].

A batch matrix spike and a matrix spike duplicate were performed in association with this sample using a sample from this lot. The recoveries were outside control limits for chromium and zinc. However, the Laboratory Control Sample (LCS, Table 2) showed acceptable recoveries for these elements, indicating that the analysis was in control. The recoveries of chromium and zinc in the MS/MSD are therefore attributed to matrix effects; a native analyte was present at a concentration > 4 times the spike level. By prior agreement with Dr. Matlack, the MS/MSD is not reported.

Quality control data are shown in Table 3; all QC parameters were within control, with exceptions as stated.

Table 3. Quality Control Summary for Data Package H4L140306.

QC Parameter	Date	All Parameters within Control Limits?
Initial Calibration	12/20/04	Yes
Initial Calibration Verification	12/20/04 12/22/04	Yes Yes
Initial Calibration Blank	12/20/04 12/22/04	Yes Yes
Continuing Calibration Verification (7 CCVs performed)	12/20/04 12/22/04	Yes Yes
Detection Limit Standard	2/17/04 12/22/04	Yes Yes
Continuing Calibration Blanks (7 CCBs performed)	12/20/04 12/22/04	Yes Yes
Interference Check Standards A, AB	12/20/04 12/22/04	Yes Yes
Serial Dilutions (Samples G02HJZ200, G02HJPZ1000)	1/3/05	No. Zn, at 14.6% difference, was out of control due to physical or chemical matrix interference.

As previous data validation reports have shown, the Laboratory Information Management System (LIMS) in use at STL Knoxville shows problems with consistency in rounding: at times a numerical value that ends in 6666 is truncated, at other times the value is rounded correctly. Likewise, a value that ends in 3333 is occasionally rounded up. Since three instrumental values are averaged to produce a final quantitative value, these occurrences are relatively common and are shown in Table 4. These instances of erratic rounding occur only in a last decimal place; the effect on reported values is minimal.

Table 4. Examples of Erratic LIMS Rounding for Data Package H4L140306.

Element	Calculated	Reported	Element	Calculated	Reported
G02HJZ40 12/22/04					
Cr	0.01789666	0.01789			

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H4L140309
Test #2 Cold Plenum
Metals (Feed)

Overall Assessment of Data Package H4L140309:

Data package H4L140309 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. Low levels of arsenic, manganese, and zinc are observed in the Method (reagent) Blank, but the levels of these analytes in the FEED sample are so high that the small amount observed in the Method Blank is insignificant. Analysis of a number of Feed samples with high levels of these analytes may result in some cross-contamination with Blanks or other samples with low levels of these analytes.

Analyses of these samples were performed by:

STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 13, 2004; the analytical data report is dated January 7, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form is included in the data package. The Chain of Custody form lists four samples. Three of the listed samples are designated as "Feed Samples," with Metals analysis requested with the specified analytes: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn. The fourth listed sample is designated as "SBS Solution", and the analysis requested for this sample is Dioxins, Furans, PCBs. The first sample listed is highlighted in yellow, and only the first sample listed on the Chain of Custody form (F-12A-104A) is listed in the Sample Summary.

The Sample Summary for Data Package H4L140309 is shown in Table 1.

Table 1. Sample Summary for Data Package H4L140309.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G02J9	001	F-12A-104A	12/08/05	2/8/04

Note that the Sample Summary includes only one of the four samples listed on the Chain of Custody form.

This feed sample was prepared for analysis by digestion and dilution (see Note below). A dilution factor of 200 was used for Sb, As, Ba, Cd, Cr, Cu, Pb, Ni, Se, and Ag; a dilution factor

of 1000 was used for Mn and Zn. The SW-846 Method 6010B as incorporated in STL Knoxville standard operating procedure KNOX-MT-0007 was used to perform the final instrumental analysis.

Note on Metals Prep Log/Batch Summary:

Per PM Rich Lafond samples to be digested at 1:5 dilution due to low sample volume and matrix. Samples have sediment on the bottom of their containers. Samples are thoroughly mixed and 10 mL taken for digestion. Samples reacted vigorously (foam) with addition of 1 mL Conc. HNO₃. Samples bubbled with addition of 2.5 mL conc. HCl. After digestion, samples have layer of muddy sediment on the bottom.

Analytical results for this sample, the associated Laboratory-Generated Method Blank, and the associated Laboratory Control Sample (LCS) are shown in Table 2.

Table 2. Analytical Results Summary for Data Package H4L140309.

Element	F-12A-104A	(Laboratory) METHOD BLANK	LABORATORY CONTROL SAMPLE
	µg		% Recovery
antimony (Sb)	50000	ND ^c	98
arsenic (As)	175000 J ^a , B ^b	4.6 B	98
barium (Ba)	35400	ND	102
cadmium (Cd)	596000	ND	100
chromium (Cr)	3400	ND	99
copper (Cu)	177000	ND	100
lead (Pb)	1020000	ND	97
manganese (Mn)	11600000 J,B	2.0 B	100
nickel (Ni)	572000	ND	99
selenium (Se)	342000	ND	100
silver (Ag)	ND ^c	ND	99
zinc (Zn)	6660000 J, B	7.6 B	106

^aEstimated result. Result is less than Reporting Limit.

^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cND = Not Detected.

The Project Narrative notes that the sample, F-12A-104A, was reported with elevated Reporting Limits for all analytes because of the dilution required due to the difficult sample matrix [Feed].

A matrix spike and a matrix spike duplicate were performed in association with this sample; all parameters were within control limits. By prior agreement with Dr. Matlack, the MS/MSD is not reported since all parameters are within control limits.

Quality control procedures are shown in Table 3; all QC parameters were within control, with exceptions as stated.

Table 3. Quality Control Summary for Data Package H4L140309.

QC Parameter	Date	All Parameters within Control Limits?
Initial Calibration	12/20/04	Yes
Initial Calibration Verification	12/22/04	Yes
Initial Calibration Blank	12/22/04	Yes
Continuing Calibration Verification (7 CCVs performed)	12/22/04	Yes
Detection Limit Standard	12/22/04	Yes
Continuing Calibration Blank (7 CCBs performed)	12/22/04	Yes
Interference Check Standards A, AB	12/22/04	Yes
Serial Dilutions (Samples G02HJZ200, G02HJPZ1000)	1/3/05	No. Zn, at 14.6% difference, was out of control due to physical or chemical matrix interference.

As previous data validation reports have shown, the Laboratory Information Management System (LIMS) in use at STL Knoxville shows problems with consistency in rounding: at times a numerical value that ends in 6666 is truncated, at other times the value is rounded correctly. Likewise, a value that ends in 3333 is occasionally rounded up. Since three instrumental values are averaged to produce a final quantitative value, these occurrences are relatively common and are shown in Table 4. These instances of erratic rounding occur only in a last decimal place; the effect on reported values is minimal.

Table 4. Examples of Erratic LIMS Rounding for Data Package H4L140309.

Element	Calculated	Reported
G029J9Z40		
Cu	0.8857633	0.88577
Pb	5.1044666	5.1045

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H4L140311
Test #3 Hot Plenum
Metals
Dioxins/Furans/PCBs

Overall Assessment of Data Package H4L140311:

The data package is of excellent quality, complete and clearly organized. The Narrative describes the analytical methods and procedures for all of the sample analyses. The question of performing Dioxin/Furan and PCB analysis on the same sample was resolved by R. Lafond. The only weakness associated with the data package is in documentation; observations related to the documentation have no impact on the quality of the data. The metals Method Blank shows the presence of arsenic, manganese, and zinc, but these metals are present in the sample at such high levels that the level observed in the Blank are insignificant. The levels of these metals observed in the Method Blank may be the result of cross-contamination with high level samples.

Analyses of these samples were performed by:

STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 13, 2004; the analytical data report is dated January 17, 2005, and signed by Richard J. Lafond, Project Manager. The original Chain of Custody Form is included in the data package; the Form does not have a number. The Chain of Custody form lists four samples. Three of the listed samples are designated as "Feed Samples," with Metals analysis requested with the specified analytes: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn. The fourth listed sample is designated as "SBS Solution", and the analysis requested for this sample is Dioxins, Furans, PCBs. The last two samples listed on the Chain of Custody Form are highlighted in yellow, and only the last two samples listed on the Chain of Custody form (F-12B-40A, S-12B-76A) are listed in the Sample Summary for Data Package H4L140311.

The Sample Summary for Data Package H4L140311 is shown in Table 1.

Table 1. Sample Summary for Data Package H4L140311.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G02KM	001	F-12B-40A	12/11/04	Metals, 12/22/04
G02KN	002	S-12B-76A	12/11/04	PCBs, 1/12/05 D/F, 12/21/04

Note that the Sample Summary includes only two of the four samples listed on the Chain of Custody form.

The Feed sample was prepared for Metals analysis by digestion and dilution (see Note below). A dilution factor of 200 was used for Sb, As, Ba, Cd, Cr, Cu, Pb, Ni, Se, and Ag; a dilution factor of 1000 was used for Mn and Zn. The SW-846 Method 6010B as incorporated in STL Knoxville standard operating procedure KNOX-MT-0007 was used to perform the final instrumental analysis.

The Analytical Methods Summary includes the following methods:

- SW-846 Method 8290 (Dibenzodioxins and Dibenzofurans, HRGC/HRMS);
- EPA - 22 1668A (PCBs, HRGC/HRMS);
- SW-846 Method 6010B (Trace Inductively Coupled Plasma (ICP) Metals).

The following references are included:

- “Method 1668, Revision A: Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by HRGC/HRMS;”
- SW-846, “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,” Third Edition, November 1986 and its updates.

Note on Metals Prep Log/Batch Summary:

Per PM Rich Lafond samples to be digested at 1:5 dilution due to low sample volume and matrix. Samples have sediment on the bottom of their containers. Samples are thoroughly mixed and 10 mL taken for digestion. Samples reacted vigorously (foam) with addition of 1 mL Conc. HNO₃. Samples bubbled with addition of 2.5 mL conc. HCl. After digestion, samples have layer of muddy sediment on the bottom.

Analytical results for metals analysis in this sample, the associated Laboratory-Generated Method Blank, and the associated Laboratory Control Sample (LCS) are shown in Table 2.

Table 2. Analytical Results Summary for Data Package H4L140311, Metals Analysis.

Element	F-12B-40A	(Laboratory) METHOD BLANK	LABORATORY CONTROL SAMPLE
	μg		% Recovery
antimony (Sb)	59600	ND ^c	98
arsenic (As)	183000 J ^a , B ^b	4.6 B	98
barium (Ba)	29500	ND	102
cadmium (Cd)	622000	ND	100
chromium (Cr)	3060	ND	99
copper (Cu)	165000	ND	100
lead (Pb)	975000	ND	97
manganese (Mn)	11300000 J, B	2.0 B	100
nickel (Ni)	524000	ND	99
selenium (Se)	344000	ND	100
silver (Ag)	ND	ND	99
zinc (Zn)	6280000 J, B	7.6 B	106

^aEstimated result. Result is less than Reporting Limits.

^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cND = Not Detected.

The Project Narrative notes that the sample, F-12B-40A, was reported with elevated Reporting Limits for all analytes because of the dilution required due to the difficult sample matrix [Feed].

A matrix spike and a matrix spike duplicate were performed in association with this sample; all parameters were within control limits. By prior agreement with Dr. Matlack, the MS/MSD is not reported since all parameters are within control limits.

Quality control procedures are shown in Table 3 for all of the analyses included in Data Package H4L140311 (the Dioxin/Furan and PCB analyses are discussed subsequently); all QC parameters were within control, with exceptions as stated.

Table 3. Quality Control Summary for Data Package H4L140311.

QC Parameter	Date	All Parameters within Control Limits?
Metals		
Initial Calibration (ICAL)	12/22/04	Yes
Initial Calibration Verification	12/22/04	Yes
Initial Calibration Blank	12/22/04	Yes
Continuing Calibration Verification (7 CCVs performed)	12/22/04	Yes
Detection Limit Standard	12/22/04	Yes
Continuing Calibration Blank (7 CCBs performed)	12/22/04	Yes
Interference Check Standards A, AB	12/22/04	Yes
Serial Dilutions (Sample 4350527)	1/3/05	No. Zn, at 14.6% difference, was out of control due to physical or chemical matrix interference.
Method 1668A (PCBs)		
PFK Tune Check	8/20/02	Yes; resolution documented before beginning initial calibration (ICAL)
PFK Tune Check	1/12/05	Yes
ICAL	8/20-21/02	Yes
Second Source Standard Verification	10/28/03	Yes
Calibration Check	1/12/05	Yes
System Blank	1/12/05	Yes
Dioxins/Furans (Method 8290)		
PFK Tune Check	12/16/04	Yes
PFK Tune Check	12/20/04	Yes
PFK Tune Check	12/21/04	Yes
ICAL	12/16-17/04	Yes
Calibration Check	12/21/04	Yes

As previous data validation reports have shown, the Laboratory Information Management System (LIMS) in use at STL Knoxville shows problems with consistency in rounding: at times a numerical value that ends in 6666 is truncated, at other times the value is rounded correctly. Likewise, a value that ends in 3333 is occasionally rounded up. Since three instrumental values are averaged to produce a final quantitative value for the Metals analysis, these occurrences are relatively common and are shown in Table 4. These instances of erratic rounding occur only in a last decimal place; the effect on reported values is minimal.

Table 4. Examples of Erratic LIMS Rounding for Data Package H4L140311.

Element	Calculated	Reported
G0KMZ40		
Pb	4.87483333	4.8749

Sample S-12B-76A was also analyzed for PCBs according to EPA Method 1668A. Results are reported for sample S-12B-76A and Method Blank in Table 5; the Quality Control Summary is presented in Table 3.

Sample preparation note: Sample S-12B-76A was spiked with labeled PCDD/F and labeled PCB internal standards and extracted with methylene chloride. The methylene chloride extract was retained and the solution was further extracted with toluene. Equal aliquots of the methylene chloride and toluene extracts were combined for PCDD/F analysis. The remaining methylene chloride extract was used for the PCB analysis. The extracts were concentrated and cleaned as needed using column chromatography.

Table 5. Analytical Results Summary for Method 1668A Analyses for Data Package H4L140311.

Compound	S-12B-76A	(Laboratory) Method Blank
	ng/sample	ng/sample
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	ND ^a	ND
3,4,4',5-tetrachlorobiphenyl (PCB 81)	ND	ND
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	ND	ND
2,3,4,4',5-pentachlorobiphenyl (PCB114)	ND	ND
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	ND	0.014 J ^b
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	ND	ND
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	ND	ND
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	ND	ND
2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	ND	ND
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	ND	ND
3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	ND	ND
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	ND	ND
Internal Standards	% Recovery	
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	72	78
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	70	73
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	59	73
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB114)	73	81
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	72	80
¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	73	81
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	54	60
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	82	86
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	82	86
¹³ C ₁₂ -2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	77	79
¹³ C ₁₂ -3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	57	54
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	66	77
Surrogate Compounds	% Recovery	
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	81	85

^aND = Not Detected.

^bEstimated result. Result is less than Reporting Limit.

Results for the Method 1668A analysis of a Laboratory Control Sample with Percent Recovery are shown in Table 6.

Table 6. Analytical Results for LCS for Method 1668A in Data Package H4L140311.

Compound	LCS H4L170000-279 % Recovery
4-chlorobiphenyl (PCB 3)	93
4,4'-dichlorobiphenyl (PCB 15)	89 B ^a
3,4,4'-trichlorobiphenyl (PCB 37)	93
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	99
3,4,4',5-tetrachlorobiphenyl (PCB 81)	98
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	103
2,3,4,4',5-pentachlorobiphenyl (PCB 114)	89
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	91
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	88
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	110
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	90 C ^b
2,3,3',4,4',5-hexachlorobiphenyl (PCB 157)	90 C156
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	94
3,3',4,4',5,5'-hexachlorobiphenyl (PCB 169)	98
2,2',3,3',4,4',5-heptachlorobiphenyl (PCB 170)	83
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	82
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	98
2,3,3',4,4',5,5',6-octachlorobiphenyl (PCB 205)	117
2,2',3,3',4,4',5,5',6-nonachlorobiphenyl (PCB 206)	77
2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl (PCB 209)	90
Internal Standard	% Recovery
¹³ C ₁₂ -4-chlorobiphenyl (PCB 3)	79
¹³ C ₁₂ -4,4'-dichlorobiphenyl (PCB 15)	81
¹³ C ₁₂ -2,4,4'-trichlorobiphenyl (PCB 28)	85
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	74
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	66
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB 114)	74
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	74

¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	76
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	51
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	82
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	82
¹³ C ₁₂ -2,3,4,4',5,5'-hexachlorobiphenyl (PCB 167)	78
¹³ C ₁₂ -3,3',4,4',5,6-hexachlorobiphenyl (PCB 169)	44
¹³ C ₁₂ -2,2',3,3',4,4',5-heptachlorobiphenyl (PCB 170)	85
¹³ C ₁₂ -2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	93
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	73
¹³ C ₁₂ -2,2',3,3',4,4',5,5'-octachlorobiphenyl (PCB 194)	63
¹³ C ₁₂ -2,2',3,3',4,4',5,5',6-nonachlorobiphenyl (PCB 206)	90
¹³ C ₁₂ -2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl (PCB 209)	86
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	71
Surrogate Compounds	% Recovery
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	84
¹³ C ₁₂ -2,4',6-trichlorobiphenyl (PCB 32)	96

^aMethod Blank contamination. The associated Method Blank contains the target analyte at a reportable level.

^bCo-eluting isomer.

Analytical results for Dioxins/Furans (D/F) (Method 8290) for sample S-12B-76A including Method Blank for Data Package H4L140311 are shown in Table 7.

Table 7. Analytical Results Summary for Method 8290 Analyses for Data Package H4L140311.

Compound	S-12B-76A	(Laboratory) Method Blank
	pg/sample	
2,3,7,8-tetrachlorodibenzodioxin	ND ^a	ND
1,2,3,7,8-pentachlorodibenzodioxin	160 Q ^b , J ^c	ND
1,2,3,4,7,8-hexachlorodibenzodioxin	220 J	ND
1,2,3,6,7,8-hexachlorodibenzodioxin	120 Q, J	ND
1,2,3,7,8,9-hexachlorodibenzodioxin	160 J	ND
1,2,3,4,6,7,8-heptachlorodibenzodioxin	470 J	ND
octachlorodibenzodioxin	540 B ^d , J	2.9 Q, J
2,3,7,8-tetrachlorodibenzofuran	180 Q, J	ND
1,2,3,7,8-pentachlorodibenzofuran	38 Q, J	ND
2,3,4,7,8-pentachlorodibenzofuran	33 B, J	0.34 Q, J
1,2,3,4,7,8-hexachlorodibenzofuran	180 Q, B, J	0.52 Q, J
1,2,3,6,7,8-hexachlorodibenzofuran	26 Q, J	ND
2,3,4,6,7,8-hexachlorodibenzofuran	ND	ND
1,2,3,7,8,9-hexachlorodibenzofuran	ND	0.44 Q, J
1,2,3,4,6,7,8-heptachlorodibenzofuran	ND	ND
1,2,3,4,7,8,9-heptachlorodibenzofuran	ND	ND
octachlorodibenzofuran	59 Q, B, J	1.6 Q, J
Internal Standards	% Recovery	
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	96	85
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	98	87
¹³ C-1,2,3,4,7,8-hexachlorodibenzodioxin	93	89
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	97	89
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	101	103
¹³ C-octachlorodibenzodioxin	85	84
¹³ C-2,3,7,8-tetrachlorodibenzofuran	89	87
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	91	86
¹³ C-2,3,4,7,8-pentachlorodibenzofuran	94	90

¹³ C-1,2,3,4,7,8-hexachlorodibenzofuran	93	89
¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	91	87
¹³ C-2,3,4,6,7,8-hexachlorodibenzofuran	95	88
¹³ C-1,2,3,7,8,9-hexachlorodibenzofuran	95	91
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	101	95
¹³ C-1,2,3,4,7,8,9-heptachlorodibenzofuran	100	95

^aND = Not Detected.

^bEstimated maximum possible concentration (EMPC).

^cEstimated result. Result is less than Reporting Limit.

^dMethod blank contamination. The associated Method Blank contains the target analyte at a reportable level.

Results for the analysis of a Laboratory Control Sample with Duplicate (LCS/LCSD), Percent Recovery, and Relative Percent Difference (RPD) for the Method 8290 analysis are shown in Table 8.

Table 8. Analytical Results Summary for Method 8290 LCS/LCSD Analyses for Data Package H4L140311.

Compound	LCS/LCSD % Recovery	RPD
2,3,7,8-tetrachlorodibenzodioxin	97/93	4.1
1,2,3,7,8-pentachlorodibenzodioxin	104/101	2.5
1,2,3,4,7,8-hexachlorodibenzodioxin	103/100	3.3
1,2,3,6,7,8-hexachlorodibenzodioxin	99/106	7.5
1,2,3,7,8,9-hexachlorodibenzodioxin	108/108	0.66
1,2,3,4,6,7,8-heptachlorodibenzodioxin	99/98	1.3
octachlorodibenzodioxin	107 B ^a /104 B	2.8
2,3,7,8-tetrachlorodibenzofuran	102/103	1.3
1,2,3,7,8-pentachlorodibenzofuran	105/105	0.56
2,3,4,7,8-pentachlorodibenzofuran	97 B/94 B	3.2
1,2,3,4,7,8-hexachlorodibenzofuran	103 B/105 B	2.2
1,2,3,6,7,8-hexachlorodibenzofuran	104/102	1.9
2,3,4,6,7,8-hexachlorodibenzofuran	105/104	1.2
1,2,3,7,8,9-hexachlorodibenzofuran	104 B/101 B	2.9
1,2,3,4,6,7,8-heptachlorodibenzofuran	94/92	1.7
1,2,3,4,7,8,9-heptachlorodibenzofuran	102/101	1.2
octachlorodibenzofuran	113 B/109 B	3.5
Internal Standards	% Recovery	
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	88/71	
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	91/86	
¹³ C-1,2,3,4,7,8-hexachlorodibenzodioxin	86/85	
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	90/82	
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	118/105	
¹³ C-octachlorodibenzodioxin	100/86	
¹³ C-2,3,7,8-tetrachlorodibenzofuran	87/63	
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	91/79	
¹³ C-2,3,4,7,8-pentachlorodibenzofuran	99/87	
¹³ C-1,2,3,4,7,8-hexachlorodibenzofuran	87/80	
¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	85/82	

¹³ C-2,3,4,6,7,8-hexachlorodibenzofuran	90/86
¹³ C-1,2,3,7,8,9-hexachlorodibenzofuran	91/86
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	95/93
¹³ C-1,2,3,4,7,8,9-heptachlorodibenzofuran	104/94

^aMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H4L160264
Test #3 Hot Plenum
Dioxins/Furans
PCBs

Overall assessment of Data Package H4L160264:

Data package H4L160264 is of excellent quality, complete and clearly reported. The only weakness of the data package relates to documentation, with two key questions:

- Why were Method 0010 samples composited?
- How were samples prepared so that PCDD/F and PCB analyses could be done on the same sample?

These questions were resolved as indicated in the report. However, the weakness of the documentation has no impact on the quality of the data: the correct analyses were performed correctly to generate data of the indicated quality.

Analyses of these samples were performed by:

STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on December 13 and 14, 2004; the analytical data report is dated January 24, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form, consisting of two pages, is included in the data package; one page of the Chain of Custody form is not numbered, a second page is numbered "Page 1 of 1." The Chain of Custody form lists 24 samples. For 17 of the samples, the requested analysis is "Dioxins/Furans." For 6 samples, the requested analysis is "Dioxin/Furans + PCBs." For one sample, the requested analysis is "Total Organics." Samples are listed as "Filter, Ace/MeCl, Toluene", with two "H₂O" samples listed. The Chain of Custody form numbered as "Page 1 of 1" includes six samples listed as "D/F XAD-2." In the column labeled "Remarks," remarks for the XAD-2 samples include, e.g., "Melter R3", "TCO Run 4," etc., which designate how the XAD-2 modules are to be related to the other media. The sample summary (Table 1) lists 7 samples. Obviously compositing of samples has occurred, but there is no documentation of a reason for compositing or any indication of how the compositing has occurred.

According to additional information requested from/sent by R. Lafond:

The semivolatile organic sampling train components were prepared for field sampling, and were extracted using STL Knoxville Standard Operating Procedure KNOX-ID-0012, based on the following methods:

- USEPA SW-846 0023A, "Sampling for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofuran Emissions from Stationary Sources;" and
- USEPA SW-846 0010, "Modified Method 5 Sampling Train."

Method 0010 trains for PCDD/Fs and PCBs - all components in one fraction: The sampling trains were prepared as a combined extract for analysis. The particulate filter and front half of the filter holder, nozzle and probe solvent rinses, the XAD-2 resin trap and back half of the filter holder, coil condenser and connecting glassware solvent rinses were combined as one sample. An additional extract was prepared from the condensate, impinger contents and their related glassware solvent rinses. The additional extract was combined with equivalent aliquots of the extract from the other components for PCB analysis. The PCDD/Fs were analyzed in the filter/XAD fraction. PCDD/F analysis of the condensate fraction was not required.

PCDD/Fs and PCBs (combined filter, XAD and condensate): The combined filter and XAD components were spiked with labeled PCDD/F and labeled PCB internal standards. The components were Soxhlet extracted with dichloromethane (DCM). The DCM extract was retained, while the components were further extracted with toluene. Equal aliquots of the DCM and toluene extracts were combined for PCDD/F analysis. The remaining DCM extract was used for the PCB analysis. The condensate and impinger rinses were combined in a separatory funnel and extracted with DCM. The Soxhlet and separatory funnel extracts were combined in equivalent aliquots for PCBs. The extracts were concentrated and cleaned as needed using column chromatography. Then the extract was further concentrated and recovery standards were added.

PCDD/Fs: The PCDD/F extracts were analyzed using STL Knoxville standard operating procedure KNOX-ID-0004, "Analysis of Polychlorinated Dioxins/Furans by High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS) Based on Methods 8290, 1613B, 0023A, and TO-9A." This is an isotope dilution analysis.

PCBs: The PCB extracts were analyzed using Knoxville standard operating procedure KNOX-ID-0013, "Analysis of PCB Isomers by Isotope Dilution HRGC/HRMS." This is an isotope dilution analysis.

A detailed description of the analytical procedures is provided in the Narrative.

The Analytical Methods Summary lists SW-846 0023A/8290 (0023A Airtrains 8290) and EPA-22 1668A (PCBs, HRGC/HRMS). The references include:

- SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, November 1986 and its updates;
- "Method 1668, Revision A, Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by HRGC/HRMS."

The Narrative includes a description of quality control parameters associated with the analyses and a detailed description of the HRMS analysis. Preparation of the samples is not addressed in the existing Narrative for Data Package H4L160264; information on the preparation of the samples was elicited by question to R. Lafond (STL), as shown above.

The Sample Summary for Data Package H4L160264 is shown in Table 1.

Table 1. Sample Summary for Data Package H4L160264.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G08AV	001	D/F TCO RUN 4	12/10/04	PCB, 1/20/05 D/F, 1/12/05
G08DH	002	D/F TCO RUN 5	12/10/04	PCB, 1/20/05 D/F, 1/12/05
G08DK	003	D/F TCO RUN 6	12/10/04	PCB, 1/20/05 D/F, 1/12/05
G08DP	004	D/F MELTER RUN 3	12/10/04	PCB, 1/20/05 D/F, 1/12/05
G08DT	005	D/F MELTER RUN 4	12/10/04	PCB, 1/20/05 D/F, 1/12/05
G08D0	006	D/F BLANK	12/10/04	PCB, 1/20/05 D/F, 1/11/05
G08D4	007	A-3896, A-3897 MEDIA CHECK	12/10/04	PCB, 1/18/05 D/F, 1/11/05

Analytical results for Method 1668A analysis including Method Blank for Data Package H4L160264 are shown in Table 2.

Table 2. Analytical Results Summary for Method 1668A Analyses for Data Package H4L160264.

Compound	D/F TCO Run 4	D/F TCO Run 5	D/F TCO Run 6
	ng/sample		
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	0.059 J ^a	0.049 Q, J	0.088 J
3,4,4',5-tetrachlorobiphenyl (PCB 81)	ND ^b	ND	ND
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	0.15 Q ^c , J	0.38 J	0.28 J
2,3,4,4',5-pentachlorobiphenyl (PCB114)	ND	ND	ND
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	0.34 J	1.0	0.74
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	ND	ND	ND
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	ND	ND	ND
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	0.066 C ^d , J	0.083 C, J	0.076 C, J
2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	0.066 C156, J	0.083 C156, J	0.076 C156, J
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	ND	ND	ND
3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	ND	ND	ND
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	ND	ND	ND
Internal Standards	% Recovery		
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	79	79	83
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	84	82	86
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	68	68	92
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB114)	84	86	112
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	81	82	110
¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	85	83	115
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	63	67	88
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	88	86	88
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	88	86	88
¹³ C ₁₂ -2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	82	80	81
¹³ C ₁₂ -3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	65	69	67
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	69	69	85
Surrogate Compounds	% Recovery		
¹³ C ₁₂ -2,2',3,5',6-pentachlorobiphenyl (PCB 95)	106	103	80
¹³ C ₁₂ -2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	109	111	108
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	76	76	79

^aEstimated result. Result is less than Reporting Limit.

^bND = Not Detected.

^cEstimated maximum possible concentration (EMPC).

^dCo-eluting isomer.

Table 2. Analytical Results Summary for Method 1668A Analyses for Data Package H4L160264, Continued.

Compound	D/F Melter Run 3	D/F Melter Run 4	D/F Blank
	ng/sample		
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	0.97	0.90	ND
3,4,4',5-tetrachlorobiphenyl (PCB 81)	0.11 J	0.14 Q, J	ND
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	0.60	0.94	ND
2,3,4,4',5-pentachlorobiphenyl (PCB114)	0.13 J	0.11 J	ND
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	1.2	2.1	0.019 Q, J
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	0.074 Q, J	ND	ND
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	0.076 J	ND	ND
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	0.16 C, J	0.24 Q, C, J	ND
2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	0.16 C156, J	0.24 Q, C156, J	ND
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	ND	0.088 Q, J	ND
3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	ND	ND	ND
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	ND	ND	ND
Internal Standards	% Recovery		
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	69	69	69
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	76	75	65
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	61	62	81
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB114)	75	75	96
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	73	73	96
¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	75	75	103
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	58	59	74
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	81	82	87
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	81	82	87
¹³ C ₁₂ -2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	77	79	83
¹³ C ₁₂ -3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	68	72	68
¹³ C ₁₂ -2,2',3,3',4,4',5-heptachlorobiphenyl (PCB 170)	Not spiked	85	Not spiked
¹³ C ₁₂ -2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	Not spiked	90	Not spiked
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	64	65	84
Surrogate Compounds	% Recovery		
¹³ C ₁₂ -2,2',3,5',6-pentachlorobiphenyl (PCB 95)	110	109	90
¹³ C ₁₂ -2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	108	106	102
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	72	75	72

Table 2. Analytical Results Summary for Method 1668A Analyses for Data Package H4L160264, Continued.

Compound	A-3896, A-3897 Media Check	(Laboratory) Method Blank
	ng/sample	
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	ND	ND
3,4,4',5-tetrachlorobiphenyl (PCB 81)	ND	ND
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	ND	ND
2,3,4,4',5-pentachlorobiphenyl (PCB114)	ND	ND
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	ND	ND
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	ND	ND
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	ND	ND
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	ND	ND
2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	ND	ND
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	ND	ND
3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	ND	ND
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	ND	ND
Internal Standards	% Recovery	
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	67	68
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	67	77
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	79	74
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB114)	90	86
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	93	51
¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	99	15*
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	66	51
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	85	80
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	85	80
¹³ C ₁₂ -2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	79	85
¹³ C ₁₂ -3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	63	50
¹³ C ₁₂ -2,2',3,3',4,4',5-heptachlorobiphenyl (PCB 170)	Not spiked	92
¹³ C ₁₂ -2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	Not spiked	92
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	87	43
Surrogate Compounds	% Recovery	
¹³ C ₁₂ -2,2',3,5',6-pentachlorobiphenyl (PCB 95)	Not reported	Not reported

¹³ C ₁₂ -2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	Not reported	Not reported
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	69	56

*Surrogate recovery is outside control limits.

Results for the analysis of a Laboratory Control Sample with Duplicate (LCS/LCSD), Percent Recovery, and Relative Percent Difference (RPD) for the Method 1668A analysis are shown in Table 3.

Table 3. LCS/LCSD for Method 1668A Analysis for Data Package H4L160264.

Compound	LCS/LCSD % Recovery	RPD
4-chlorobiphenyl (PCB 3)	93/93	0.71
4,4'-dichlorobiphenyl (PCB 15)	92/96	3.9
3,4,4'-trichlorobiphenyl (PCB 37)	93/93	0.31
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	102/103	0.66
3,4,4',5-tetrachlorobiphenyl (PCB 81)	101/98	2.6
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	105/101	4.2
2,3,4,4',5-pentachlorobiphenyl (PCB 114)	96/93	2.9
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	94/96	1.8
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	91/91	0.42
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	115/115	0.23
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	97/95 C	1.8
2,3,3',4,4',5-hexachlorobiphenyl (PCB 157)	97/95 C156	1.8
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	100/103	3.1
3,3',4,4',5,5'-hexachlorobiphenyl (PCB 169)	103/106	2.7
2,2',3,3',4,4',5-heptachlorobiphenyl (PCB 170)	88/91	2.4
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	92/92	0.090
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	101/102	0.74
2,3,3',4,4',5,5',6-octachlorobiphenyl (PCB 205)	126/107	16
2,2',3,3',4,4',5,5',6-nonachlorobiphenyl (PCB 206)	83/85	2.5
2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl (PCB 209)	105/104	0.87
Internal Standard	% Recovery	
¹³ C ₁₂ -4-chlorobiphenyl (PCB 3)	82/81	
¹³ C ₁₂ -4,4'-dichlorobiphenyl (PCB 15)	79/70	

¹³ C ₁₂ -2,4,4'-trichlorobiphenyl (PCB 28)	89/87
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	89/66
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	75/71
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB 114)	81/84
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	83/81
¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	84/85
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	63/60
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	85/83
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	85/83
¹³ C ₁₂ -2,3,4,4',5,5'-hexachlorobiphenyl (PCB 167)	90/89
¹³ C ₁₂ -3,3',4,4',5,6-hexachlorobiphenyl (PCB 169)	65/62
¹³ C ₁₂ -2,2',3,3',4,4',5-heptachlorobiphenyl (PCB 170)	97/105
¹³ C ₁₂ -2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	102/92
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	97/100
¹³ C ₁₂ -2,2',3,3',4,4',5,5'-octachlorobiphenyl (PCB 194)	59/62
¹³ C ₁₂ -2,2',3,3',4,4',5,5',6-nonachlorobiphenyl (PCB 206)	90/114
¹³ C ₁₂ -2,2',3,3',4,4',5,5',6,6'-decachlorobiphenyl (PCB 209)	71/101
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	78/61
Surrogate Compounds	% Recovery
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	79/67
¹³ C ₁₂ -2,4',6-trichlorobiphenyl (PCB 32)	88/86

Analytical results for Dioxins/Furans (D/F) for these samples including Laboratory-Generated Method Blank for Data Package H4L160264 are shown in Table 4.

Table 4. Analytical Results Summary for Method 8290 Analyses for Data Package H4L160264.

Compound	D/F TCO Run 4	D/F TCO Run 5	D/F TCO Run 6	D/F Melter Run 3	D/F Melter Run 4	D/F Blank	A-3896 A-3897 Media Check
	pg/sample						
2,3,7,8-tetrachlorodibenzodioxin	ND ^a	ND	ND	22 Q	16 Q, J	ND	ND
1,2,3,7,8-pentachlorodibenzodioxin	ND	ND	ND	160	170	ND	ND
1,2,3,4,7,8-hexachlorodibenzodioxin	ND	ND	ND	180	200	ND	ND
1,2,3,6,7,8-hexachlorodibenzodioxin	ND	ND	ND	130	130	ND	ND
1,2,3,7,8,9-hexachlorodibenzodioxin	ND	ND	ND	160	160	ND	ND
1,2,3,4,6,7,8-heptachlorodibenzodioxin	7.3 Q ^b , J ^c	7.6 Q, J	6.54 Q, J	480	460	ND	ND
octachlorodibenzodioxin	70 B ^d , J	35 B, J	45 B, J	530 B	390 B	5.9 B, J	4.9 B, J
2,3,7,8-tetrachlorodibenzofuran	ND	ND	ND	370 ^f	340 ^f	ND	ND
1,2,3,7,8-pentachlorodibenzofuran	ND	ND	ND	66 J	91 J	ND	ND
2,3,4,7,8-pentachlorodibenzofuran	ND	ND	ND	31 J	36 J	ND	ND
1,2,3,4,7,8-hexachlorodibenzofuran	2.5 Q, J	2.1 Q, J	2.9 Q, J	190	210	ND	ND
1,2,3,6,7,8-hexachlorodibenzofuran	1.7 Q, J	2.1 Q, J	ND	25 J	24 Q, J	ND	ND
2,3,4,6,7,8-hexachlorodibenzofuran	ND	2.2 J	ND	8.6 J	12 Q, J	ND	ND
1,2,3,7,8,9-hexachlorodibenzofuran	ND	ND	ND	3.2 Q, J	4.7 J	ND	ND
1,2,3,4,6,7,8-heptachlorodibenzofuran	9.1 Q, J	11 Q, J	7.0 Q, J	57 Q, J	57 J	ND	ND
1,2,3,4,7,8,9-heptachlorodibenzofuran	2.4 Q, J	4.7 J	ND	12 Q, J	15 J	ND	ND
octachlorodibenzofuran	21 Q, J	17 Q, J	17 Q, J	82 J	38 J	ND	ND
Internal Standards	% Recovery						
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	28 ^e	39 ^e	61	51	53	24 ^e	93
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	61	77	9.	75	82	68	96
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	80	80	85	80	78	79	85
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	96	96	97	99	96	91	98
¹³ C-octachlorodibenzodioxin	115	85	84	74	79	105	110
¹³ C-2,3,7,8-tetrachlorodibenzofuran	18 ^e	28 ^e	52	17 ^e	27 ^{e,f}	19 ^e	81
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	46	65	85	67	73	47	89
¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	66	75	82	77	76	69	80

¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	90	93	94	87	86	86	99
Surrogate Compounds	% Recovery						
³⁷ Cl ₄ -2,3,7,8-tetrachlorodibenzodioxin	89	88	92	89	93	89	NS ^g
¹³ C-1,2,3,4,7,8-heptachlorodibenzodioxin	95	100	97	97	96	92	NS
¹³ C-2,3,4,7,8-pentachlorodibenzofuran	101	94	95	63 ^e	71	123	NS
¹³ C-1,2,3,4,7,8-hexachlorodibenzofuran	89	89	88	85	89	83	NS
¹³ C-1,2,3,4,7,8,9-heptachlorodibenzofuran	94	97	94	90	95	95	NS

^aND = Not Detected.

^bEstimated maximum possible concentration (EMPC).

^cEstimated result. Result is less than Reporting Limit.

^dMethod blank contamination. The associated Method Blank contains the target analyte at a reportable level.

^eSurrogate recovery is outside stated control limits.

^f2,3,7,8-Tetrachlorodibenzofuran and ¹³C-2,3,7,8-tetrachlorodibenzofuran reported from confirmation column.

^gNS = Not spiked.

Table 4. Analytical Results Summary for Method 8290 Analyses for Data Package H4L160264, Continued.

Compound	(Laboratory) Method Blank
	pg/sample
2,3,7,8-tetrachlorodibenzodioxin	ND
1,2,3,7,8-pentachlorodibenzodioxin	ND
1,2,3,4,7,8-hexachlorodibenzodioxin	ND
1,2,3,6,7,8-hexachlorodibenzodioxin	ND
1,2,3,7,8,9-hexachlorodibenzodioxin	ND
1,2,3,4,6,7,8-heptachlorodibenzodioxin	ND
octachlorodibenzodioxin	8.3 J
2,3,7,8-tetrachlorodibenzofuran	ND
1,2,3,7,8-pentachlorodibenzofuran	ND
2,3,4,7,8-pentachlorodibenzofuran	ND
1,2,3,4,7,8-hexachlorodibenzofuran	ND
1,2,3,6,7,8-hexachlorodibenzofuran	ND
2,3,4,6,7,8-hexachlorodibenzofuran	ND
1,2,3,7,8,9-hexachlorodibenzofuran	ND
1,2,3,4,6,7,8-heptachlorodibenzofuran	ND
1,2,3,4,7,8,9-heptachlorodibenzofuran	ND
octachlorodibenzofuran	ND
Internal Standards	% Recovery
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	95
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	103
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	85
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	98
¹³ C-octachlorodibenzodioxin	102
¹³ C-2,3,7,8-tetrachlorodibenzofuran	89
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	96
¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	84
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	100

Results for the analysis of a Laboratory Control Sample with Duplicate (LCS/LCSD), Percent Recovery, and Relative Percent Difference (RPD) for the Method 8290 analysis are shown in Table 5.

Table 5. Analytical Results Summary for Method 8290 Analyses for Data Package H4L160264.

Compound	LCS/LCSD % Recovery	RPD
2,3,7,8-tetrachlorodibenzodioxin	112/102	9.5
1,2,3,7,8-pentachlorodibenzodioxin	112/109	3.3
1,2,3,4,7,8-hexachlorodibenzodioxin	108/108	0.44
1,2,3,6,7,8-hexachlorodibenzodioxin	114/115	0.42
1,2,3,7,8,9-hexachlorodibenzodioxin	123/112	9.7
1,2,3,4,6,7,8-heptachlorodibenzodioxin	106/100	6.3
octachlorodibenzodioxin	115 B/113 B ^a	2.4
2,3,7,8-tetrachlorodibenzofuran	103/100	2.4
1,2,3,7,8-pentachlorodibenzofuran	128/122	4.1
2,3,4,7,8-pentachlorodibenzofuran	150 ^a /114	27
1,2,3,4,7,8-hexachlorodibenzofuran	119/116	2.3
1,2,3,6,7,8-hexachlorodibenzofuran	118/111	5.7
2,3,4,6,7,8-hexachlorodibenzofuran	136 ^a /113	19
1,2,3,7,8,9-hexachlorodibenzofuran	142 ^a /118	18
1,2,3,4,6,7,8-heptachlorodibenzofuran	112/109	2.7
1,2,3,4,7,8,9-heptachlorodibenzofuran	114/110	3.3
octachlorodibenzofuran	113/115	1.1
Internal Standards	% Recovery	
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	26 ^c /95	
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	60/99	
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	72/90	
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	90/103	
¹³ C-octachlorodibenzodioxin	106/118	
¹³ C-2,3,7,8-tetrachlorodibenzofuran	22 ^c /84	
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	44/93	
¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	61/88	

¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	89/102
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*Spiked analyte recovery is outside stated control limits.

*Method blank contamination. The associated method blank contains the target analyte at a reportable level.

*Surrogate recovery is outside stated control limits.

Quality control parameters for the PCDD/F and PCB analyses of Data Package H4L160264 are shown in Table 6.

Table 6. Quality Control Summary for Data Package H4L160264.

QC Parameter	Date	All Parameters within Control Limits?
Method 1668A (PCBs)		
PFK Tune Check	8/20/02	Yes; resolution documented before beginning initial calibration (ICAL)
PFK Tune Check	1/17/05	Yes
PFK Tune Check	1/19/05	Yes
ICAL	8/20-21/02	Yes
Second Source Standard Verification	10/28/03	Yes
Calibration Check	1/19/05	Yes
System Blank	1/19/05	Yes
All analytes within SOP retention time criteria and both ions maximized within ± 2 seconds		
Ion abundance ratios for all labeled and unlabeled analytes within the specified control limits.		
Method 8290 (Dioxins/Furans)		
PFK Tune Check	11/08/04	Yes
PFK Tune Check	1/11/05	Yes
PFK Tune Check	12/20/04	Yes
PFK Tune Check	12/21/04	Yes
PFK Tune Check	1/23/05	Yes
PFK Tune Check	2/23/04	Yes
ICAL	11/08/04	Yes
ICAL (DB-225)	2/23/04	Yes
Calibration Check	12/21/04	Yes
Calibration Check	1/11/05	Yes

On 1/12/05, the 12-hour shift closing standard b050112s2 did not meet the 13C-OCDD response factor (RF) acceptance criterion of ± 30 percent difference from the ICAL (%D) The observed value was 36.5%D. The change in the response was due to high boiling sample residue deposited in the GC injector port during the analysis. This was confirmed by installing a clean injector port liner and repeating the closing standard analysis. The second closing standard met the 13C-OCDD RF acceptance criteria. The % recoveries for 13C-OCDD were calculated using the average of the opening and closing standard RFs instead of the ICAL mean RF. The results for the native analog were not similarly affected.

All 2378 isomers within the RRT limits specified and both ions maximized within ± 2 seconds.

A; non-2378 isomers were within established RT windows and both ions maximized within ± 2 seconds.

Ion abundance ratios for all labeled and unlabeled analytes were within the control limits specified.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H5B020275
Test #3 Hot Plenum
Metals

Overall Assessment of Data Package H5B020275:

Data package H5B020275 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. There is no discussion of the fourth sample on the Chain of Custody form; if this sample was analyzed and reported, it is included in another data package. The Method Blanks reported with this data package show background levels of antimony, barium, copper, and silver; antimony is the only element observed in both Method Blanks.

Analyses of these samples were performed by:

STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on February 1, 2005; the analytical data report is dated February 11, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form is included in the data package. The Chain of Custody form lists four samples. Three of the listed samples are designated as “Reagent Blanks - Metals”; the fourth listed sample shows “Allyl” as the requested analysis. One sample, the sample requesting “Allyl” analysis, on the Chain of Custody form is yellow-highlighted, but there is no explanation in the data package of this highlighting; this highlighted sample does not show a request for metals analysis on the Chain of Custody form. Project Manager instructions on the Sample Receipt/Condition Upon Receipt Anomaly Checklist show the following:
 Allyl Alcohol → Test 1, all else is Test 3. The date shown on this checklist is February 1, 2005. The Analytical Methods Summary lists SW-846 6010B, “Inductively Coupled Plasma (ICP) Metals.”

The Sample Summary for Data Package H5B020275 is shown in Table 1.

Table 1. Sample Summary for Data Package H5B020275.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G3MET	001	29BLK012705	1/27/05	2/8/05
G3ME2	002	NBLK012705	1/27/05	2/8/05
G3ME4	003	HBLK012705	1/27/05	2/8/05

Note that the Sample Summary includes only three of the four samples listed on the Chain of Custody form.

These samples were prepared and analyzed using STL Knoxville standard operating procedure KNOX-MT-0006 which is based on EPA SW-846 Method 0060, “Determination of Metals in Stack Emissions” and Method 29, “Determination of Metals Emissions from Stationary Sources.” The SW-846 Method 6010B as incorporated in STL Knoxville standard operating procedure KNOX-MT-0007 is used to perform the final instrument analysis. Analytical results for metals analysis of these three samples are shown in Table 2.

Table 2. Analytical Results Summary for Data Package H5B020275.

Element	29BLK012705	NBLK012705	HBLK012705
	µg		
antimony (Sb)	20.3 J ^a , B ^b	ND ^c	0.093 B,J
arsenic (As)	960	ND	0.32 B
barium (Ba)	249 B	ND	ND
cadmium (Cd)	0.094 B, J	ND	ND
chromium (Cr)	4.3 B	ND	0.25 B
copper (Cu)	3.2	ND	ND
lead (Pb)	16.9	ND	ND
manganese (Mn)	48.0	ND	ND
nickel (Ni)	3.1 B	ND	ND
selenium (Se)	ND	ND	ND
silver (Ag)	ND	ND	0.46 B,J
zinc (Zn)	72.2	ND	17.5

^aEstimated result. Result is less than Reporting Limit.

^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cND = Not Detected.

Laboratory-Generated Method Blanks associated with these analyses are reported in Table 3.

Table 3. Analytical Results Summary for Method Blanks associated with Data Package H5B020275.

Element	(Laboratory) Method Blank H5B040000-092	(Laboratory) Method Blank H5B040000-095
	µg	
antimony (Sb)	1.1 B ^a	0.73 B
arsenic (As)	ND ^b	ND
barium (Ba)	0.84 B	ND
cadmium (Cd)	ND	ND
chromium (Cr)	ND	ND
copper (Cu)	ND	0.36 B
lead (Pb)	ND	ND
manganese (Mn)	ND	ND
nickel (Ni)	ND	ND
selenium (Se)	ND	ND
silver (Ag)	ND	0.55 B
zinc (Zn)	ND	ND

^aMethod Blank contamination. The associated Method Blank contains the analyte at reportable levels.^bNot detected.

Laboratory Control Samples/Duplicates associated with Data Package H5B020275 are shown in Table 4, with Relative Percent Difference (RPD). All parameters are within control limits.

Table 4. Laboratory Control Samples/Duplicates Associated with Data Package H5B020275.

Element	LCS/LCSD (1) % Recovery	RPD	LCS/LCSD (2) % Recovery	RPD
antimony (Sb)	103/100	2.4	99/101	2.3
arsenic (As)	98/97	0.96	96/98	2.2
barium (Ba)	104/104	0.50	101/104	2.5
cadmium (Cd)	105/103	1.7	101/103	2.3
chromium (Cr)	108/106	2.4	105/108	2.7
copper (Cu)	105/104	0.96	102/104	2.3
lead (Pb)	102/101	1.8	101/102	1.7
manganese (Mn)	107/105	1.1	104/106	2.3
nickel (Ni)	104/103	1.2	101/103	2.1
selenium (Se)	93/92	2.0	92/94	2.2
silver (Ag)	108/103	5.6	107/107	0.03
zinc (Zn)	107/106	0.98	105/108	2.4

Quality control procedures are shown in Table 5; all QC parameters were within control limits.

Table 5. Quality Control Summary for Data Package H5B020275.

QC Parameter	Date	All Parameters within Control Limits
Initial Calibration Verification	2/8/05	Yes
Initial Calibration Blank (2 performed)	2/8/05	Yes
Continuing Calibration Verification (9 CCVs performed)	2/8/05	Yes
Detection Limit Standard	2/8/05	Yes
Continuing Calibration Blank (9 CCBs performed)	2/8/05	Yes
Interference Check Standards A, AB	2/8/05	Yes
Serial Dilutions (Samples NBLK012705, HBLK012705)	2/8/05	Yes

A matrix spike and a matrix spike duplicate were performed; all parameters were within control limits. By prior agreement with Dr. Matlack, the MS/MSD is not reported since all parameters are within control limits.

As previous data validation reports have shown, the Laboratory Information Management System (LIMS) in use at STL Knoxville shows problems with consistency in rounding: at times a numerical value that ends in 6666 is truncated, at other times the value is rounded correctly. Likewise, a value that ends in 3333 is occasionally rounded up. Since three instrumental values are averaged to produce a final quantitative value, these occurrences are relatively common and are shown in Table 6. These instances of erratic rounding occur only in a last decimal place; the effect on reported values is minimal.

Table 6. Examples of Erratic LIMS Rounding for Data Package H5B020275.

Element	Calculated	Reported	Element	Calculated	Reported
HBLK012705			29BLK012705		
Pb	0.0016666	0.00166	Ba	2.4852666	2.4852
Zn	0.1752533	0.17526	Cd	0.0946666	0.094
NBLK012705			Cu	0.0323033	0.03231
Ba	0.0000733	0.00008	Ni	0.0311966	0.03119
Cu	-0.0003733	-0.00038			
Mn	-0.0000633	-0.00007			
Se	0.0008966	0.00089			
Ag	0.0019733	0.00198			

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H5B150129
Test #1 Normal Plenum
Metals

Overall Assessment of Data Package H5B150129:

Data package H5B150129 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. The laboratory-generated Method Blank shows the presence of antimony and cadmium, contaminants regularly observed in “clean” quartz filters. The sample labeled “Low Metals Quartz RB Filter” shows the presence of at least trace levels of all of the analytes except cadmium, copper, and silver.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on February 15, 2005; the analytical data report is dated February 21, 2005, and signed by Richard J. Lafond, Project Manager.

The document labeled as the “Original Chain of Custody” is a handwritten note from Jim McGaughey (AirTech) dated February 14, 2005:

Rich:

It appears that a glass fiber filter [was sent to STL - Knoxville] instead of low metals quartz for Metals Reagent Blank analyses. Here are two low metals quartz (1 + spare) filters for analysis. Can we get a quick TAT?

The samples consisted of one box, with no Chain of Custody form. The Analytical Methods Summary lists SW-846 6010B, “Inductively Coupled Plasma (ICP) Metals.” This sample was prepared and analyzed using STL Knoxville standard operating procedure KNOX-MT-0006 which is based on EPA SW-846 Method 0060, “Determination of Metals in Stack Emissions” and Method 29, “Determination of Metals Emissions from Stationary Sources.” The SW-846 Method 6010B as incorporated in STL Knoxville standard operating procedure KNOX-MT-0007 is used to perform the final instrument analysis.

The Sample Summary for Data Package H5B020275 is shown in Table 1.

Table 1. Sample Summary for Data Package H5B150

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G4E88	001	Low Metals Quartz RB Filter	2/14/05	2/15/05

Analytical results for this sample and the Method Blank are shown in Table 2.

Table 2. Analytical Results Summary for Data Package H5B020275.

Element	Low Metals Quartz RB Filter	(Laboratory) Method Blank
	μg	
antimony (Sb)	8.9 J ^a , B ^b	1.2 B
arsenic (As)	0.37	ND
barium (Ba)	4.2	ND
cadmium (Cd)	ND ^c	0.064 B
chromium (Cr)	0.45	ND
copper (Cu)	ND	ND
lead (Pb)	2.2	ND
manganese (Mn)	0.98	ND
nickel (Ni)	5.2	ND
selenium (Se)	0.60	ND
silver (Ag)	ND	ND
zinc (Zn)	1.2	ND

^aEstimated result. Result is less than Reporting Limit.

^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cNot detected.

A Laboratory Control Sample/Duplicate associated with Data Package H5B150129 is shown in Table 3, with Relative Percent Difference (RPD).

Table 3. Laboratory Control Sample/Duplicate Associated with Data Package H5B150129.

Element	LCS/LCSD % Recovery	RPD
antimony (Sb)	97/95	2.1
arsenic (As)	98/98	0.50
barium (Ba)	94/94	0.37
cadmium (Cd)	98/98	0.69
chromium (Cr)	102/101	1.0
copper (Cu)	88/88	0.32
lead (Pb)	100/99	0.87
manganese (Mn)	103/102	0.87
nickel (Ni)	103/102	0.88
selenium (Se)	92/92	0.51
silver (Ag)	98/94	3.8
zinc (Zn)	98/97	1.2

Quality control procedures are shown in Table 4; all QC parameters were within control except for zinc in the serial dilution due to physical or chemical matrix interferences.

Table 4. Quality Control Summary for Data Package H5B150129.

QC Parameter	Date	All Parameters within Control Limits
Initial Calibration Verification	2/15/05	Yes
Initial Calibration Blank	2/15/05	Yes
Continuing Calibration Verification (5 CCVs performed)	2/15/05	Yes
Detection Limit Standard	2/15/05	Yes
Continuing Calibration Blank (5 CCBs performed)	2/15/05	Yes
Interference Check Standards A, AB	2/15/05	Yes
Serial Dilutions ^a	2/15/05	Yes

^aZinc outside control limits due to physical or chemical matrix interferences.

As previous data validation reports have shown, the Laboratory Information Management System (LIMS) in use at STL Knoxville shows problems with consistency in rounding: at times a numerical value that ends in 6666 is truncated, at other times the value is rounded correctly. Likewise, a value that ends in 3333 is occasionally rounded up. Since three instrumental values are averaged to produce a final quantitative value, these occurrences are relatively common and are shown in Table 5. These instances of erratic rounding occur only in a last decimal place; the effect on reported values is minimal.

Table 5. Examples of Erratic LIMS Rounding for Data Package H5B150129.

Element	Calculated	Reported
Low Metals Quartz RB Filter		
Se	0.605	0.60

Metals Blanks

Element	Low Metals Quartz RB Filter H5B150129	(Laboratory) Method Blank H5B150129	NBLK012705 Nitric Acid	HBLK012705 5% HNO₃ 10% H₂O₂
	µg			
antimony (Sb)	8.9 J ^a , B ^b	1.2 B	ND ^c	0.093 B,J
arsenic (As)	0.37	ND	ND	0.32 B
barium (Ba)	4.2	ND	ND	ND
cadmium (Cd)	ND ^c	0.064 B	ND	ND
chromium (Cr)	0.45	ND	ND	0.25 B
copper (Cu)	ND	ND	ND	ND
lead (Pb)	2.2	ND	ND	ND
manganese (Mn)	0.98	ND	ND	ND
nickel (Ni)	5.2	ND	ND	ND
selenium (Se)	0.60	ND	ND	ND
silver (Ag)	ND	ND	ND	0.46 B,J
zinc (Zn)	1.2	ND	ND	17.5

^aEstimated result. Result is less than Reporting Limit.^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.^cNot detected.

Element	(Laboratory) Method Blank H5B040000- 092	(Laboratory) Method Blank H5B040000- 095	(Laboratory) METHOD BLANK (FEED) H4L140309	(Laboratory) METHOD BLANK 1/4/05 H4L140288	(Laboratory) METHOD BLANK 1/4/05 H4L140288
	µg				
antimony (Sb)	1.1 B ^a	0.73 B	ND ^c	1.7 B	0.74 B
arsenic (As)	ND ^b	ND	4.6 B	ND	ND
barium (Ba)	0.84 B	ND	ND	ND	ND
cadmium (Cd)	ND	ND	ND	ND	0.052 B
chromium (Cr)	ND	ND	ND	ND	ND
copper (Cu)	ND	0.36 B	ND	0.29 B	ND
lead (Pb)	ND	ND	ND	ND	N
manganese (Mn)	ND	ND	2.0 B	ND	ND
nickel (Ni)	ND	ND	ND	ND	ND
selenium (Se)	ND	ND	ND	0.48 B	ND
silver (Ag)	ND	0.55 B	ND	ND	ND
zinc (Zn)	ND	ND	7.6 B	ND	ND

^aEstimated result. Result is less than Reporting Limit.

^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cNot detected.

Element	METALS TCO METHOD BLK FH 072004-032	METALS TCO METHOD BLK BH
	µg	
antimony (Sb)	8.9 J ^a , B ^b	ND ^c
arsenic (As)	3.4	ND
barium (Ba)	4.7	ND
cadmium (Cd)	0.27 J, B	0.084 B
chromium (Cr)	1.7	ND
copper (Cu)	1.2 B	3.0 J, B
lead (Pb)	3.6	0.66
manganese (Mn)	2.2	0.27
nickel (Ni)	5.4	0.51
selenium (Se)	32.2 B	26.5 B, J
silver (Ag)	ND	ND
zinc (Zn)	6.0	59.0

^aEstimated result. Result is less than Reporting Limit.

^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cND = Not Detected.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

Data Package H5C110117
Test #1 Normal Plenum308 ALLYL
Allyl Alcohol (Method 308)

Overall Assessment of Data Package H5C110117:

The overall quality of the data in the data package H5C110117 is excellent. Allyl alcohol should be considered a water-soluble volatile organic compound, rather than a semivolatile compound.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 10, 2005; the analytical data report is dated March 21, 2005, and signed by Richard J. Lafond, Project Manager.

Original Chain of Custody forms are included in the data package. Twenty-three samples are listed on the Chain of Custody forms with “Mod. 308 (Allyl)” requested as the analysis. The Analytical Methods Summary cites SW-846 Method 8015B, “Nonhalogenated Organics Using GC/FID.”

The Project Narrative on pages 4-5 of Data Package H5C110117 provides a clearly written description of the modified Method 308 procedures used for the analysis, but does not refer to a STL-Knoxville SOP.

N.B. – Allyl alcohol has a boiling point of 97°C and would therefore be considered a volatile compound, rather than semivolatile.

The Sample Summary for Data Package H5C110117 is shown in Table 1.

Table 1. Sample Summary for Data Package H5C110117.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G52W4	001	OHTA037051	3/07/05	3/17/05
G52D2	002	OHTB0071051	3/07/05	3/17/05
G52D3	003	OHMA0308051	3/08/05	3/18/05
G52D4	004	OHMB0308051	3/08/05	3/17/05
G52D9	005	OHHA0081051	3/08/05	3/17/05
G52EC	006	OHCA0308051	3/08/05	3/17/05
G52EE	007	OHTA0308051	3/08/05	3/17/05
G52EF	008	OHMA0308052	3/08/05	3/18/05
G52EJ	009	OHHA0308052	3/08/05	3/17/05
G52EL	010	OHCA0308052	3/08/05	3/17/05
G52E0N	011	OHTA0308052	3/08/05	3/17/05
G52EP	012	OHTB0308052	3/08/05	3/17/05
G52EQ	013	OHMA0308053	3/08/05	3/17/05
G52ER	014	OHHA0308053	3/08/05	3/17/05
G52T	015	OHHB0308053	3/08/05	3/18/05
G52EV	016	OHCA0308053	3/08/05	3/18/05
G52EW	017	OHCB0308053	3/08/05	3/18/05
G52EX	018	OHTA0308053	3/08/05	3/18/05
G52E0	019	OHHA0309053	3/09/05	3/18/05
G52E1	020	OHCA0309053	3/09/05	3/18/05
G52E3	021	S-12D-126A4	3/09/05	3/18/05
G52E6	022	OHTA030905MB	3/09/05	3/18/05
G52E9	023	OHTB030905MB	3/09/05	3/18/05

Analytical results for the allyl alcohol samples in Data Package H5C110117 with Laboratory-Generated Method Blanks, Laboratory Control Sample/Duplicate (LCS/LCSD), and Matrix Spike/Duplicate (MS/MSD) are presented in Table 2.

Table 2. Analytical Results for Modified Method 308 Analysis for Allyl Alcohol in Data Package H5C110117.

Sample	Allyl Alcohol mg/L	Surrogate Recovery, %	RPD
OHTA0307051	27	87	
OHTA0307051 (DUP)	26	86	1.2 ^a
OHTB0307051	0.76	92	
OHMA0308051 (DF = 2)	110	93	
OHMB0308051	29	87	
OHHA0308051	29	94	
OHCA0308051	2.0	80	
OHTA0308051	ND ^a	93	
OHMA0308052 (DF = 3)	150	102	
OHHA0308052	37	97	
OHCA0308052	1.8	86	
OHTA0308052	ND	90	
OHTB0308052	ND	100	
OHMA0308053	110	104	
OHHA0308053	27	96	
OHHA0308053 (DUP)	28	96	3.6
OHHB0308053	24	92	
OHCA0308053	0.90	97	
OHCB0308053	0.64	93	
OHTA0308053	ND	93	
OHHA0309053	13	97	
OHCA0309054	14	91	
S-12D-126A4 (DF = 20) ^d	1200	91	
OHTA030905MB	0.12 J ^b	96	

Table 2. Analytical Results for Modified Method 308 Analysis for Allyl Alcohol in Data Package H5C110117, Continued.			
OHTB030905MB	ND	91	
(Laboratory) METHOD BLANK1	ND	95	
(Laboratory) METHOD BLANK2	ND	95	
LCS1	98% Recovery	87	
LCS2	100% Recovery	88	
MS/MSD1	88/102 % Recovery	82/88	6.0
MS/MSD2	105/86 % Recovery	93/100	8.5

^a ND = Not Detected. RPD is calculated where duplicate analyses were performed.

^b Estimated result. Result is less than Reporting Limit.

^c RPD is calculated where duplicate analyses were performed.

^d Sample S-12D-126A4 was very caustic, caused column degradation, and required a 1/20 dilution to bring allyl alcohol within the calibration range. This diluted out the surrogate response. The surrogate response from a 1/5 dilution is reported to provide recovery assessment for the sample matrix.

For the Modified Method 308 analyses:

- The initial calibration curve for the GC (3/17/05), using the external standard technique at seven levels of concentration, showed correlation coefficients ≥ 0.995 ;
- A Method Detection Limit study was performed to demonstrate a statistically derived limit of detection (0.081 mg/L);
- The Continuing Calibration Verification (CCV) percent recovery value (3/18/05) was within target acceptance limits of 85 to 115%;
- Retention time windows were verified within the correct time intervals (samples were very clean, with no obvious chromatographic interferences), except for Sample S-12D-126A4;
- Duplicates for samples in this data package were in excellent agreement;
- Surrogate compound recoveries were uniformly very good;
- LCS samples showed recoveries within control limits;
- MS/MSD samples showed recoveries within control limits.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H5C110190
Test #1 Normal Plenum HALIDES
Halide Ions

Overall Assessment of Data Package H5C110190:

Data package H5C110190 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. Samples were analyzed at very high dilutions because of matrix effects, according to standard laboratory practice.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 10, 2005; the analytical data report is dated March 30, 2005, and signed by Richard J. Lafond, Project Manager.

The Chain of Custody records list 12 samples, with “Halides (Cl, F)” analysis requested for all samples. All samples listed on the Chain of Custody forms are included in the Sample Summary and reported in Data Package H5C110190. The samples were received (hand-delivered) at ambient temperature, with no custody seals. The Analytical Methods Summary lists SW-846 9056, “Determination of Inorganic Anions by Ion Chromatography.” The samples were analyzed for chloride and fluoride (per Test Plan) by ion chromatography using Standard Operating Procedure KNOX-WC-005 (based on SW-846 Methods 9056 and 9057).

The Sample Summary for Data Package H5C110190 is shown in Table 1.

Table 1. Sample Summary for Data Package H5C110190.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G52G0	001	FM0309051	3/09/05	3/18/05
G52G1	002	FT0309051	3/09/05	3/18/05
G52G4	003	FM0309052	3/09/05	3/18/05
G52G6	004	FT0309052	3/09/05	3/18/05
G52G7	005	FM0309053	3/09/05	3/18/05
G52G8	006	FT0309053	3/09/05	3/18/05
G52G9	007	BM0309051	3/09/05	Cl, 3/22/05 F, 3/21/05
G52HH	008	BT0309051	3/09/05	Cl, 3/23/05 F, 3/21/05
G52HJ	009	BM0309052	3/09/05	Cl, 3/22/05 F, 3/21/05
G52HK	010	BT0309052	3/09/05	Cl, 3/23/05 F, 3/21/05
G52HP	011	BM0309053	3/09/05	Cl, 3/22/05 F, 3/21/05
G52HQ	012	BT0309053	3/09/05	Cl, 3/23/05 F, 3/21/05

Analytical results for these samples and the Laboratory-Generated Method Blanks are shown in Table 2. Sample results are reported as total μg . The dilution factor (DF) reported on the sample result form is actually the combination of factors required by the method to convert the anion reporting limit and method detection limit from $\mu\text{g/mL}$ to total μg .

The explanation for the high dilution factors, according to the data package Narrative, is:

Note also that impinger samples containing 0.1 N H_2SO_4 and 0.1 N NaOH typically display suppressed conductivity detector responses. This suppression is attributed to a matrix effect causing poor method performance and possibly giving unreliable data unless it is removed. Therefore, samples are progressively diluted in the laboratory to modify the matrix for an enhanced anion response. The samples are analyzed at increasing dilutions along with matrix spikes until matrix spikes are recovered from the sample within laboratory control limits.

The final dilution factor is reported with the analytical data in Table 2.

Table 2. Analytical Results Summary for Data Package H5C110190.

Sample	Chloride, μg	DF	Fluoride, μg	DF
FM0309051	ND ^a	512	1840	1536
FT0309051	2070	1320	ND	1320
FM0309052	ND	522	2080	1570
FT0309052	2300	1380	ND	1380
FM0309053	ND	520	1870	1560
FT0309053	2050	1455	ND	1455
BM0309051	ND	3000	ND	3000
BT0309051	ND	6660	ND	3330
BM0309052	ND	3270	ND	3270
BT0309052	ND	5900	ND	2950
BM0309053	ND	3450	ND	3450
BT0309053	ND	6460	ND	3230
(Laboratory) Method Blank (3/18/05)	ND	100	ND	100
(Laboratory) Method Blank2 (3/22/05)	ND	100	ND	100
(Laboratory) Method Blank (Cl, 3/23/05)	ND	100	NA ^c	NA

^a ND = Not Detected.

^b Estimated result. Result is less than Reporting Limit.

^c NA = Not Analyzed.

Samples reported as “ND” with high dilution levels were not re-analyzed at a lower dilution.

Matrix spikes/matrix spike duplicates (MS/MSDs) were within control limits except as designated, and are reported on standard report forms. Concentrations and % Recovery for the MS/MSD are shown in Table 3.

Table 3. MS/MSD Data for Data Package H5C110190.

Sample	Chloride % Recovery	RPD	Fluoride % Recovery	RPD
MS/MSD1 (3/18/05)	96/97	1.0	90/90	0.16
MS/MSD2 (3/18/05)	92/91	0.70	99/98	0.76
MS/MSD1 (3/21/05)	NR ^a	NR	82/84	2.6
MS/MSD2 (3/21/05)	NR	NR	73 N ^b /74 N	1.0
MS/MSD (3/22/05)	78/77	0.64	NR	NR
MS/MSD (3/23/05)	89/91	1.7	NR	NR

^aNot reported.

^b Spiked analyte recovery is outside control limits.

Laboratory Control Samples/Duplicates associated with data package H5C110190 are shown in Table 4, with Relative Percent Difference (RPD). All parameters (% Recovery and RPD) are within control limits.

Table 4. Laboratory Control Samples/Duplicates Associated with Data Package H5C110190.

LCS/LCSD (3/18/05)			
Chloride, % Recovery	RPD	Fluoride, % Recovery	RPD
100/100	0.53	102/102	0.0
LCS/LCSD (3/21/05)			
NR ^a	NR	97/100	3.0
LCS/LCSD (3/22/05)			
98/101	3.1	NR	NR
LCS/LCSD (3/23/05)			
99/105	6.0	NR	NR

^aNR = Not Reported.

Quality control results are shown in Table 5; all QC parameters were within control limits. Method Blanks are shown in Table 2; no analytes were detected in the Method Blanks on any of the days when analysis was performed. The LCS/LCSD show all recoveries and RPDs within control limits.

Table 5. Quality Control Summary for Data Package H5C110190.

QC Parameter	Date	All Parameters within Control Limits
Instrument ICS_1500		
Initial Calibration	2/10/05	6 levels of each analyte analyzed
	3/18/05	6 levels of each analyte analyzed
Initial Calibration Verification	(2) 3/18/05	Yes
	(2) 3/21/05	Yes
	(2) 3/22/05	Yes
	(2) 3/23/05	Yes
Initial Calibration Blank	3/18/05	Yes
	3/21/05	Yes
	3/22/05	Yes
	3/23/05	Yes
Continuing Calibration Verification	(2) 3/18/05	Yes
	(3) 3/21/05	Yes
	(3) 3/22/05	Yes
	(2) 3/23/05	Yes
Continuing Calibration Blank	(2) 3/18/05	Yes
	(3) 3/21/05	Yes
	(3) 3/22/05	Yes
	(2) 3/23/05	Yes

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H5C110203
Test #1 Normal Plenum 0060
Metals

Overall Assessment of Data Package H5C110203:

Data package H5C110203 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. Laboratory blanks analyzed with the samples show a slight commonly observed level of metal contamination on the “clean” filters. The field blank shows additional background metals contamination.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 10, 2005; the analytical data report is dated March 30, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form, consisting of three pages, is included in the data package. The Chain of Custody form lists nineteen samples highlighted in yellow, with “Metals” analysis (SW-846 0060) requested for all samples; thirteen of these samples appear in the Sample Summary Table. The following analytes are specified:
Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn.

The Sample Summary for Data Package H5C110203 is shown in Table 1.

Table 1. Sample Summary for Data Package H5C110203.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G52LX	001	NM0308051/5M0308051	3/08/05	3/16/05
G52L4	002	NT0308051/5T0308051	3/08/05	3/16/05
G52L6	003	NM0308052/5M0308052	3/08/05	3/16/05
G52L8	004	NT0308052/5T0308052	3/08/05	3/16/05
G52L9	005	NM0308053/5M0308053	3/08/05	3/16/05
G52MC	006	NT0308053/5T0308053	3/08/05	3/16/05
G52MG	007	HM0308051	3/08/05	3/16/05
G52MM	008	HT0308051	3/08/05	3/16/05
G52MN	009	HM0308052	3/08/05	3/16/05
G52MP	010	HT0308052	3/08/05	3/16/05
G52MV	011	HM0308053	3/08/05	3/16/05
G52M3	012	HT0309053	3/08/05	3/16/05
G52NA	013	F-12D-129A	3/08/05	3/21/05

These samples were prepared and analyzed using STL Knoxville Standard Operating Procedure KNOX-MT-0006 which is based on EPA SW-846 Method 0060, “Determination of Metals in Stack Emissions” and Method 29, “Determination of Metals Emissions from Stationary Sources.” The SW-846 Method 6010B as incorporated in STL Knoxville Standard Operating Procedure KNOX-MT-0007 is used to perform the final instrument analysis. Analytical results for the samples of Data Package H5C110203 are shown in Table 2; the Laboratory-Generated Method Blanks are shown in Table 3.

Table 2. Analytical Results Summary for Data Package H5C11203.

Element	NM0308051/ 5M0308051	NT0308051/ 5T0308051	NM030802/ 5M0308052	NT0308052/ 5T0308052	NM0308053/ 5M0308053
	µg				
antimony (Sb)	33.7	5.0 B	21.0	4.3 B	11.3
arsenic (As)	22.9	1.7	16.2	1.3	4.9
barium (Ba)	12.2 B ^a	7.0 B	9.1 B	5.4 B	7.8 B
cadmium (Cd)	810 J ^b	1.9 J	701 J	1.3 J	128 J
chromium (Cr)	7850	2.8	6730	2.6	1540
copper (Cu)	34.2	6.2	27.5	4.7	7.9
lead (Pb)	38.2 J	ND ^c	27.4 J	ND G ^d	3.2 J
manganese (Mn)	23.8	3.3	7.8	2.7	6.4
nickel (Ni)	24.1	19.9	21.2	21.7	19.8
selenium (Se)	12100	48.8	11500	46.5	1530
silver (Ag)	2.5	ND	2.1	ND	1.3 B
zinc (Zn)	2130	30.4	1630	20.6	904

Continued

^a Method blank contamination. The associated method blank contains the target analyte at a reportable level.

^b Estimated result. Result is less than Reporting Limit.

^cND = Not Detected.

^dElevated reporting limit. The reporting limit is elevated due to matrix interference.

Table 2. Analytical Results Summary for Data Package H5C110203, Continued.

Element	NT0308053/ 5T0308053	HM0308051	HT0308051	HM0308052	HT0308052
	µg				
antimony (Sb)	15.4	ND	ND	ND	0.89 B
arsenic (As)	11.3	ND	ND	ND	ND
barium (Ba)	7.5 B	0.40 B	0.35 B	0.45 B	0.49 B
cadmium (Cd)	558 J	3.4	2.2	3.0	2.1
chromium (Cr)	4600	2.0	0.42 B	1.0	0.70 B
copper (Cu)	18.4	1.9 B	0.67 B	1.8 B	2.0 B
lead (Pb)	16.6 J	44.2	29.2	39.1	26.6
manganese (Mn)	5.8	23.9	10.7	1.9	2.6
nickel (Ni)	19.3	0.82 B	0.48 B	1.4 B	0.76 B
selenium (Se)	8180	25.5	42.0	19.3	39.9
silver (Ag)	ND	ND	ND	ND	ND
zinc (Zn)	572	79.0	37.9	42.3	47.5

Continued

Table 2. Analytical Results Summary for Data Package H5C110203, Continued.

Element	HM0308053	HT0308053	F-12D-129A
	µg		
antimony (Sb)	ND	ND	ND
arsenic (As)	ND	ND	0.83 B
barium (Ba)	0.32 B	0.32 B	23.1
cadmium (Cd)	0.80	0.54	709
chromium (Cr)	2.2	0.31 B	2380
copper (Cu)	2.4 B	1.8 B	23.7
lead (Pb)	6.9	5.3	7.1
manganese (Mn)	3.5	0.62 B	64.4
nickel (Ni)	0.60 B	0.55 B	34.4
selenium (Se)	43.1	2.9	74.8
silver (Ag)	ND	ND	ND
zinc (Zn)	49.6	29.4	13900 J

Three Method Blanks were analyzed in conjunction with Data Package H5C110203. Samples labeled “Method Blank” are laboratory blanks generated by digestion of clean filters from the same batch as the filters used in the field. Consistent with results obtained in multiple laboratories, the “clean” filters show background levels of antimony, cadmium, copper, and selenium.

Table 3. Analytical Results Summary for Blanks in Data Package H4L140261.

Element	(Laboratory) Method Blank1 3/16/05	(Laboratory) Method Blank2 3/16/05	(Laboratory) Method Blank 3 3/21/05
antimony (Sb)	ND	ND	ND
arsenic (As)	ND	ND	ND
barium (Ba)	ND	ND	ND
cadmium (Cd)	ND	0.11 B ^a	ND
chromium (Cr)	ND	ND	ND
copper (Cu)	ND	ND	ND
lead (Pb)	ND	0.21 B	ND
manganese (Mn)	ND	ND	ND
nickel (Ni)	ND	ND	ND
selenium (Se)	ND	ND	ND
silver (Ag)	ND	ND	ND
zinc (Zn)	ND	ND	0.50 B

^aMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cND = Not Detected.

Laboratory Control Samples/Duplicates associated with data package H5C110203 are shown in Table 4, with Relative Percent Difference (RPD). All parameters are within control limits.

Table 4. Laboratory Control Samples/Duplicates Associated with Data Package H5C110203.

Element	LCS/LCSD #1 % Recovery 3/16/05	RPD	LCS/LCSD#2 % Recovery 3/16/05	RPD	LCS % Recovery 3/21/05
antimony (Sb)	95/96	0.89	96/96	0.66	99
arsenic (As)	95/96	0.81	97/98	0.70	98
barium (Ba)	99/100	0.22	101/102	0.77	100
cadmium (Cd)	97/98	1.2	100/101	0.71	101
chromium (Cr)	99/100	0.53	99/100	0.99	98
copper (Cu)	97/97	0.82	98/98	0.15	95
lead (Pb)	98/98	0.53	98/98	0.02	98
manganese (Mn)	100/100	0.60	101/101	0.61	99
nickel (Ni)	97/98	1.0	99/99	0.37	99
selenium (Se)	92/92	0.88	93/94	0.78	97
silver (Ag)	93/94	0.61	92/93	0.81	97
zinc (Zn)	102/102	0.78	103/104	0.64	106

Quality control procedures are shown in Table 5; all QC parameters were within control limits, with exceptions as indicated.

Table 5. Quality Control Summary for Data Package H5C110203.

QC Parameter	Date	All Parameters within Control Limits
Initial Calibration	3/06/05 3/21/05	Yes Yes
Initial Calibration Verification	3/06/05 3/21/05 3/22/05	Yes Yes Yes
Initial Calibration Blank (3 performed)	3/06/05 3/21/05 3/22/05	Yes Yes Yes
Continuing Calibration Verification (5 CCVs performed) (10 CCVs performed) (13 CCVs performed)	3/16/05 3/21/05 3/22/05	Yes Yes Yes
Detection Limit Standard	3/16/05 3/21/05 3/22/05	Yes Yes Yes
Continuing Calibration Blank (5 CCBs performed) (10 CCBs performed) (13 CCBs performed)	3/16/05 3/21/05 3/22/05 3/23/05, CCB13	Yes Yes Yes
Interference Check Standards A, AB	1/04/05 1/05/05 1/06/05	Yes
Serial Dilutions (Samples G52MG, G52MGP) (Samples G52LX, G52LXP) (Samples G52NA, G52NAP) (Samples G52LXZ5, G52LXPZ25) (Samples G52NAZ20, G52NAPZ100)	3/16/05 3/16/05 3/21/05 3/22/05 3/22/05	Yes No; Pb outside limits ^a No; Cu outside limits Yes No; Zn outside limits

^aObservation of analytes outside control limits on serial dilution was attributed to matrix effects.

A matrix spike and a matrix spike duplicate were performed; all parameters were within control limits. By prior agreement with Dr. Matlack, the MS/MSD is not reported since all parameters are within control limits.

As previous data validation reports have shown, the Laboratory Information Management System (LIMS) in use at STL Knoxville shows problems with consistency in rounding: at times a numerical value that ends in 6666 is truncated, at other times the value is rounded correctly. Likewise, a value that ends in 3333 is occasionally rounded up. Since three instrumental values are averaged to produce a final quantitative value, these occurrences are relatively common and are shown in Table 6. These instances of erratic rounding occur only in a last decimal place; the effect on reported values is minimal.

Table 6. Examples of Erratic LIMS Rounding for Data Package H5C11203.

Element	Calculated	Reported	Element	Calculated	Reported
G52MG H5C110203-007			G52MC H5C110203-006		
Ni	0.0082666	0.0082	Pb	0.1655666	0.1655
	0.83	0.82	Mn	0.0579666	0.0579
G52MN H5C110203-009			Se	16.355633	16.3557
Cu	0.0176333	0.0177	G52L4 H5C110203-002		
Se	0.1929333	0.1930	Cd	0.0188333	0.0189
G52MP H5C110203-010			Cr	0.0283666	0.0283
Cr	0.0069333	0.0070	Ag	0.0018666	0.0018
	0.69	0.70	G52L6 H5C110203-003		
G52MV H5C110203-011			Se	23.0171666	23.0171
Sb	-0.0027333	-0.0028	Zn	3.2675333	3.2676
Pb	0.0689666	0.0688	G52L8 H5C110203-004		
			Cu	0.0472333	0.0473

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H5C110227
Test #1 Normal Plenum 0010
Semivolatiles**

Overall Assessment of Data Package H5C110227:

The overall quality of the data in the data package H5C110227 is very good. Because of the high concentrations of naphthalene in several of the samples, surrogate compounds were diluted to a level below the analytical range. However, surrogate recoveries were within the acceptable range on the Laboratory Control Samples, demonstrating that the analysis was in control. The surrogate compound recoveries outside the control limits were attributed to matrix effects arising from the interaction of the XAD-2 sorbent with the combustion matrix. Because of the matrix, most of the samples were analyzed at a high level of dilution. Extraneous peaks (non-target compounds) were observed in several of the chromatograms. In at least one sample, the extraneous peak was chromatographically saturated and suppressed signal level in portions of the chromatogram.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 10, 2005; the analytical data report is dated August 3, 2005, and signed by Richard J. Lafond, Project Manager.

A complete set of the original Chain of Custody forms is included in the data package. The Chain of Custody forms list 65 samples for Semivolatile Analysis; the samples are listed as:

- XAD-2;
- Filter;
- F¹/₂ 50/50; and
- B¹/₂ 50/50.

These samples were composited, producing 15 samples for the final analysis, according to the scheme described in the Narrative:

The sampling trains are prepared as two analytical fractions and the extracts from these fractions are combined into a single sample for analysis. The first fraction consists of the particulate filter and front half of the filter holder, nozzle and probe solvent rinses, XAD-2 resin trap and back half of the filter holder, coil condenser and connecting glassware solvent rinses. The second fraction includes the condensate, iminger contents and their related glassware solvent rinses.

The samples as received presented significant problems with identification, i.e., relating the labels on the containers to the list on the Chain of Custody forms.

According to the Data Package Narrative:

Many of the back 50/50 rinses had the labels smeared such that the sample identification could not be read. For all samples except for two, the identification number was determined by matching the weights appearing on the sample labels to the samples as listed on the COCs, which listed these weights as well. However, two remaining unidentified samples, SVMB0309051 and SVTB0309051 as determined by default, had no identification markings present on the container label.

After consultation with the samplers, it was believed that these samples could be identified by the discoloration of the solvent. The remaining rinses were from the TCO Outlet and the Melter. It was known that the Melter samples contained a yellow discoloration. The lab took aliquots of the rinses and placed them in clean 12 mL screw cap vials for visual inspection. The vials were placed on a white sheet of paper, to provide a blank background, and evaluated for difference. One of the rinses had a noticeable yellowing and this was determined to be the rinse from the Melter.

The Sample Summary for Data Package H5C110227 is shown in Table 1; the table has fifteen entries, including a Media Check.

Table 1. Sample Summary for Data Package H5C110227.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G52W2	001	SVMX/SVMP/SVMF/SVMB/SVMC0309051	3/09/05	3/16/05
G52XF	002	SVHX/SVHP/SVHF/SVHB/SVHC0309051	3/09/05	3/16/05
G52XM	003	SVCX/SVCP/SVCF/SVCC/SVCC0309051	3/09/05	3/16/05
G52XQ	004	SVTX/SVTP/SVTF/SVTB/SVTC0309051	3/09/05	3/16/05
G52X0	005	SVMX/SVMP/SVMF/SVMB/SVMC0309052	3//09/05	3/16/05
G52X2	006	SVHX/SVHP/SVHF/SVHB/SVHC0309052	3/09/05	3/16/05
G52X7	007	SVCX/SVCP/SVCF/SVCC/SVCC0309052	3/09/05	3/16/05
G520C	008	SVTX/SVTP/SVTF/SVTB/SVTC0309052	3/09/05	3/16/05
G520G	009	SVMX/SVMP/SVMF/SVMB/SVMC0309053	3/09/05	3/16/05
G520M	010	SVHX/SVHP/SVHF/SVHB/SVHC0309053	3/09/05	3/16/05
G5201	011	SVCX/SVCP/SVCF/SVCC/SVCC0309053	3/09/05	3/16/05
G5205	012	SVTX/SVTP/SVTF/SVTB/SVTC0309053	3/09/05	3/16/05
G521D	013	SVMX/SVMP/SVMF/SVMB/SVMC030905MB	3/09/05	3/16/05
G521J	014	S-12E-20A	3/09/05	3/16/05
G522E	015	A-3989, A-3990 MEDIA CHECK	3/09/05	3/16/05

The semivolatile organic sampling train components were, at the direction of the client per quote, extracted and analyzed using STL Knoxville standard operating procedures KNOX-OP-0009 and KNOX-MS-0016, based on the following methods:

- SW-846 3542, “Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train)”
- SW-846 8270C, “Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS).”

The sampling trains are prepared as one analytical fraction: The particulate filter and front half of the filter holder, nozzle and probe solvent rinses, XAD-2 resin trap and back half of the filter holder, coil condenser, and connecting glassware solvent rinses are combined as a single sample. The combined sample components are spiked with the Method 8270C surrogates and Soxhlet extracted with methylene chloride. The extracts are concentrated to 1 mL and analyzed by GC/MS.

Analytical results for this set of samples are presented in Table 2. Analytical results are accurately described in the original Narrative for Data Package H5C110227. The Laboratory-Generated Method Blanks are reported in Table 3 and the Laboratory Control Samples are reported in Table 4.

Table 2. Analytical Results Summary for Data Package H5C110227.

Compound	SVMX/SVMP/ SVMF/SVMB 0309051 DF = 1000	SVHX/SVHP/ SVHF/SVHB 0309051 DF = 1000	SVCX/SVCP/ SVCF/SVCB 0309051 DF = 250	SVTX/SVTP/ SVTF/SVTB 0309051 ^d DF = 1
	µg			
diethyl phthalate	ND ^a	ND	ND	3.6 J ^c
naphthalene	140000	120000	11000	
Surrogate Compounds	% Recovery			
2-fluorophenol	DIL ^b	DIL	DIL	NC
phenol-d ₅	DIL	DIL	DIL	NC
nitrobenzene-d ₅	DIL	DIL	DIL	NC
2-fluorobiphenyl	DIL	DIL	DIL	NC
2,4,6-tribromophenol	DIL	DIL	DIL	NC
terphenyl-d ₁₄	DIL	DIL	DIL	
¹³ C ₆ -naphthalene	DIL	DIL	DIL	NC

^aND = Not Detected.

^bThe concentration is estimated or not reported due to dilution.

^cEstimated result. Result is less than reporting limit.

^dSeveral compounds in this sample could not be reported because of the interfering sample matrix.

Table 2. Analytical Results Summary for Data Package H5C110227, Continued.

Compound	SVMX/SVMP/ SVMF/SVMB 0309052 DF = 1000	SVHX/SVHP/ SVHF/SVHB 0309052 DF = 1000	SVCX/SVCP/ SVCF/SVCB 0309052 ^d DF = 100	SVTX/SVTP/ SVTF/SVTB 0309052 DF = 1
	µg			
diethyl phthalate	ND ^a	ND	ND	3.6 J ^c
phenol	ND	ND	ND	11
naphthalene	170000	130000	4000	13
Surrogate Compounds	% Recovery			
2-fluorophenol	DIL ^b	DIL	DIL	72
phenol-d ₅	DIL	DIL	DIL	70
nitrobenzene-d ₅	DIL	DIL	DIL	75
2-fluorobiphenyl	DIL	DIL	DIL	84
2,4,6-tribromophenol	DIL	DIL	DIL	91
terphenyl-d ₁₄	DIL	DIL	DIL	80
¹³ C ₆ -naphthalene	DIL	DIL	DIL	91

^aND = Not Detected.

^bThe concentration is estimated or not reported due to dilution.

^cEstimated result. Result is less than reporting limit.

^dSeveral compounds in this sample could not be reported because of the interfering sample matrix.

Table 2. Analytical Results Summary for Data Package H5C110227, Continued.

Compound	SVMX/SVMP/ SVMF/SVMB 0309053 DF = 1000	SVHX/SVHP/ SVHF/SVHB 0309053 DF = 1000	SVCX/SVCP/ SVCF/SVCB 0309053 ^d DF = 20	SVTX/SVTP/ SVTF/SVTB 0309053 DF = 1
	µg			
diethyl phthalate	ND ^a	ND	ND	ND
nitrobenzene	ND	ND	42 J ^c	ND
phenol	ND	ND	ND	6.0 J
naphthalene	150000	100000	560	20
Surrogate Compounds	% Recovery			
2-fluorophenol	DIL ^b	DIL	DIL	68
phenol-d ₅	DIL	DIL	DIL	70
nitrobenzene-d ₅	DIL	DIL	DIL	65
2-fluorobiphenyl	DIL	DIL	DIL	76
2,4,6-tribromophenol	DIL	DIL	DIL	88
terphenyl-d ₁₄	DIL	DIL	DIL	77
¹³ C ₆ -naphthalene	DIL	DIL	DIL	82

^aND = Not Detected.

^bThe concentration is estimated or not reported due to dilution.

^cEstimated result. Result is less than reporting limit.

^dSeveral compounds in this sample could not be reported because of the interfering sample matrix.

Table 2. Analytical Results Summary for Data Package H5C110227, Continued.

Compound	SVMX/SVMP/ SVMF/SVMB 0309055MB DF = 1	S-12E-20A ^c DF = 1	A-3989, A-3990 MEDIA CHECK
	µg		
diethyl phthalate	ND ^a	ND	ND
4,6-dinitro-2-methylphenol	ND	30 J ^b	ND
2,4-dinitrophenol	ND	190	ND
di- <i>n</i> -octyl phthalate	3.9 J	ND	ND
nitrobenzene	ND	4.6 J	ND
2-nitrophenol	ND	18	ND
4-nitrophenol	ND	67	ND
phenol	ND	ND	ND
naphthalene	12	180	ND
Surrogate Compounds	% Recovery		
2-fluorophenol	71	2.0 ^d	74
phenol-d ₅	71	9.9 ^d	78
nitrobenzene-d ₅	65	80	76
2-fluorobiphenyl	78	83	86
2,4,6-tribromophenol	88	4.1 ^d	92
terphenyl-d ₁₄	77	80	77
¹³ C ₆ -naphthalene	84	1.7 ^d	NS ^e

^aND = Not Detected.^bEstimated result. Result is less than reporting limit.^cIn this sample, note the absence of detectable levels of phenol, with the appearance of nitrated compounds. This observation, coupled with the failure to recover the acid surrogates and the pre-spiked compound, suggest that the matrix was highly oxidizing, with high levels of NO_x.^dSurrogate recovery is outside stated control limits.^eNS = Not Spiked.

Table 3. Method Blanks for Data Package H5C110227.

Compounds	(Laboratory) Method Blank1	(Laboratory) Method Blank2
	µg	
naphthalene	ND ^a	ND
acenaphthene	ND	ND
4-chloro-3-methylphenol	ND	ND
2-chlorophenol	ND	ND
1,4-dichlorobenzene	ND	ND
2,4-dinitrotoluene	ND	ND
4-nitrophenol	ND	ND
N-nitrosodi- <i>n</i> -propylamine	ND	ND
pentachlorophenol	ND	ND
phenol	ND	ND
pyrene	ND	ND
1,2,4-trichlorobenzene	ND	ND
Surrogate Compounds	% Recovery	
2-fluorophenol	67	72
phenol-d ₅	71	80
nitrobenzene-d ₅	69	76
2-fluorobiphenyl	83	94
2,4,6-tribromophenol	86	83
terphenyl-d ₁₄	81	86

^aND = Not Detected.

Table 4. Laboratory Control Samples/Laboratory Control Sample Duplicates (LCS/LCSD) for Data Package H5C110227 with RPD

Compounds	LCS/LCSD1 % Recovery	RPD	LCS/LCSD2 % Recovery	RPD
acenaphthene	86/79	8.0	85/87	2.9
4-chloro-3-methylphenol	92/86	7.2	94/99	4.3
2-chlorophenol	87/83	4.9	90/91	1.2
1,4-dichlorobenzene	84/81	4.0	86/86	0.81
2,4-dinitrotoluene	95/89	6.4	96/101	4.8
4-nitrophenol	93/87	6.6	81/89	9.6
N-nitrosodi- <i>n</i> -propylamine	75/72	4.4	78/80	2.5
pentachlorophenol	88/83	5.6	82/88	7.0
phenol	87/83	4.8	89/90	1.2
pyrene	87/80	7.9	85/85	0.23
1,2,4-trichlorobenzene	79/76	4.1	81/81	0.0
Surrogate Compounds	% Recovery			
2-fluorophenol	80/76		81/82	
phenol-d ₅	80/77		83/86	
nitrobenzene-d ₅	81/76		79/82	
2-fluorobiphenyl	95/88		94/95	
2,4,6-tribromophenol	100/90		94/96	
terphenyl-d ₁₄	83/77		82/82	

Quality Control

The Initial Calibration for these analyses was performed on February 1, 2005, in quadruplicate. The following observations are relevant to the Initial Calibration:

- DFTPP tune criteria were met;
- DDT breakdown was < 20% and benzidine tailing <3, and PCP tailing <5;
- Average response factors for the System Performance Check Compounds were >0.050;
- % Relative Standard Deviation (RSD) was <30% for the Calibration Check Compounds.

A second source standard was analyzed in quadruplicate on 2/01/05 to verify the calibration; all recovery values were within the acceptable range.

A Continuing Calibration Checks was performed on March 16, 2005, the date of the analysis of the samples; all parameters were within the acceptable range.

A Second Source Standard was analyzed in quadruplicate on February 1, 2005; all parameters of interest were within control limits.

Additional quality control observations are shown in Table 5.

Table 5. Additional Quality Control Observations for Data package H5C110227.

Sample	Observation	Comment
SVCX/SVCP/SVCF/SVCB0309051	Internal standard perylene-d ₁₂ has %DIFF = -81 The chromatogram shows a “humpogram” at long retention time.	Low signal level
SVTX/SVTP/SVTF/SVTB0309051	The surrogate 2-fluorobiphenyl is outside control limits. Internal standard perylene-d ₁₂ has %DIFF = -81 The chromatogram shows many non-target compounds.	Low signal level
SVCX/SVCP/SVCF/SVCB0309052	Internal standard acenaphthene-d ₁₀ has %DIFF = -60. Internal standard perylene-d ₁₂ has %DIFF = -100	
SVTX/SVTP/SVTF/SVTB0309052	Internal standard perylene-d ₁₂ has %DIFF = -63	Low signal level
SVCX/SVCP/SVCF/SVCB0309053	Internal standards acenaphthene-d ₁₀ chrysene-d ₁₂ perylene-d ₁₂ were not observed (%DIFF = -100) A HUGE chromatographically saturated non-target peak was observed in the chromatogram at ~6.40 min. Many compounds were “not reportable” due to the matrix.	
S-12E-20A	Several surrogates were outside control limits: 2-fluorophenol, phenol-d ₅ , and 2,4,6-tribromophenol. The ¹³ C ₆ -naphthalene pre-spike recovery was also outside control limits. Nitrated target compounds (phenolics) were observed.	The oxidizing matrix with high levels of NO _x was responsible for very low recoveries and nitration of phenolic compounds.
Method Blank #2	A huge peak was observed eluting near perylene-d ₁₂ .	This peak could be due to carryover from another sample.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H5C150247
Test #1 Normal Plenum 0060
Metals

Overall Assessment of Data Package H5C150247:

Data package H4L140261 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. Laboratory-generated Method Blanks analyzed with the samples show a slight commonly observed level of metal contamination on the “clean” filters.

Analyses of these samples were performed by:

STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 15, 2005; the analytical data report is dated April 5, 2005, and is signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form, consisting of one page, is included in the data package; the Chain of Custody form is numbered “Page 1 of 1.” The Chain of Custody form lists six samples, with “Metals” analysis requested for all samples; four of these samples appear in the Sample Summary Table.

The following analytes are specified: Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn.

The samples as listed on the Chain of Custody form are:

NT031005MB	0.1M NHO3 (sic)
5T031005MB	Low metals quartz
HT031005MB	H2O2/HNO3
NT031005RB	0.1M NHO3 (sic)
5TO31005RB	Low metals quartz
HT031005RB	H2O2/HNO3

The Sample Summary for Data Package H5C150247 is shown in Table 1. Samples labeled “5T031005MB” and “Low metals quartz” are identified on the Chain of Custody form as filters that have been prepared and analyzed together with the corresponding “MB” and “RB” samples.

Table 1. Sample Summary for Data Package H5C150247.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G5836	001	NT031005MB/5T031005MB	3/10/05	3/24/05
G584K	002	HT031005MB	3/10/05	3/24/05
G584R	003	NT031005RB/5T031005RB	3/10/05	3/24/05
G584W	004	HT031005RB	3/10/05	3/24/05

These samples were prepared and analyzed using STL Knoxville standard operating procedure KNOX-MT-0006 which is based on EPA SW-846 Method 0060, “Determination of Metals in Stack Emissions” and Method 29, “Determination of Metals Emissions from Stationary Sources.” The SW-846 Method 6010B as incorporated in STL Knoxville standard operating procedure KNOX-MT-0007 is used to perform the final instrumental analysis.

Analytical results for the samples of Data Package H5C150247 are shown in Table 2; the Laboratory-generated Method Blanks are shown in Table 3.

Table 2. Analytical Results Summary for Data Package H5C150247.

Element	NT031005MB/ 5T031005MB	HT031005MB	NT031005RB/ 5T031005RB	HT031 005RB
	µg			
antimony (Sb)	1.4 J ^a	ND	1.6 J	ND
arsenic (As)	0.89 J	ND	0.76 J	ND
barium (Ba)	5.3 J	ND	4.8 J	ND
cadmium (Cd)	1.2 B ^b	0.067 B	ND	ND
chromium (Cr)	6.2	0.30 J	0.74 J	ND
copper (Cu)	1.7 J	0.27 J	ND	ND
lead (Pb)	ND ^c G ^d	0.52 B,J	ND G	0.40 B,J
manganese (Mn)	2.4	0.58 J	1.3 J	ND
nickel (Ni)	12.4	ND	9.0	ND
selenium (Se)	10.9 B	0.78 B,J	5.1 B	ND
silver (Ag)	ND	0.92 J	ND	1.6 J
zinc (Zn)	13.4	19.3	1.7 J	5.1

^aEstimated result. Result is less than Reporting Limit.

^bMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^cND = Not Detected.

^dElevated reporting limit. The reporting limit is elevated due to matrix interference.

Two laboratory-generated Method Blanks were analyzed in conjunction with Data Package H5C150247. Samples labeled “Method Blank” are laboratory blanks generated by digestion of clean filters from the same batch as the filters used in the field. Consistent with results obtained in multiple laboratories, the “clean” filters show background levels of cadmium, lead, and selenium.

Table 3. Analytical Results Summary for Laboratory-Generated Method Blanks in Data Package H5C150247.

Element	(Laboratory) METHOD BLANK1 3/24/05	(Laboratory) METHOD BLANK2 3/24/05
	µg	
antimony (Sb)	ND ^a	ND
arsenic (As)	ND	ND
barium (Ba)	ND	ND
cadmium (Cd)	ND	0.065 J
chromium (Cr)	ND	ND
copper (Cu)	ND	ND
lead (Pb)	0.30 J ^b	ND
manganese (Mn)	ND	ND
nickel (Ni)	ND	ND
selenium (Se)	0.22 J	ND
silver (Ag)	ND	ND
zinc (Zn)	2.0	ND

^a ND = Not Detected.

^b Estimated result. Result is less than Reporting Limit.

Laboratory Control Samples/Duplicates associated with data package H5C150247 are shown in Table 4, with Relative Percent Difference (RPD). All parameters are within control limits.

Table 4. Laboratory Control Samples/Duplicates Associated with Data Package H5C150247.

Element	LCS/LCSD (1) % Recovery	RPD	LCS/LCSD (2) % Recovery	RPD
antimony (Sb)	94/93	1.3	102/101	0.62
arsenic (As)	93/92	1.8	101/100	0.35
barium (Ba)	97/96	0.83	103/103	0.03
cadmium (Cd)	98/95	3.2	106/105	0.87
chromium (Cr)	98/96	2.8	105/104	1.1
copper (Cu)	96/95	1.2	100/100	0.07
lead (Pb)	96/94	2.3	102/102	0.54
manganese (Mn)	98/95	2.6	105/104	0.69
nickel (Ni)	95/93	2.7	103/102	0.70
selenium (Se)	91/90	0.80	98/98	0.34
silver (Ag)	94/93	0.57	99/98	0.93
zinc (Zn)	101/99	2.2	109/108	0.77

Quality control procedures associated with Data Package H5C150247 are shown in Table 5; all parameters were within control limits, with exceptions as noted.

Table 5. Quality Control Summary for Data Package H5C150247.

QC Parameter	Date	All Parameters within Control Limits
Initial Calibration	3/24/05	Yes
Initial Calibration Verification	3/24/05	Yes
Initial Calibration Blank	3/24/05	Yes
Continuing Calibration Verification (14 CCVs performed)	1-12, 3/24/05 13-14, 3/25/05	Yes
Detection Limit Standard	3/24/05	Yes
Continuing Calibration Blank (14 CCBs performed)	1-12, 3/24/05 13-14, 3/25/05	Yes
Interference Check Standards A, AB	3/24/05	Yes
Serial Dilutions (Samples G570A, G57X9)	3/24/05	G570A, in control G57X9, out of control limits for Ag

A matrix spike and a matrix spike duplicate were performed; all parameters were within control limits. By prior agreement with Dr. Matlack, the MS/MSD is not reported since all parameters are within control limits.

As previous data validation reports have shown, the Laboratory Information Management System (LIMS) in use at STL Knoxville shows problems with consistency in rounding: at times a numerical value that ends in 6666 is truncated, at other times the value is rounded correctly. Likewise, a value that ends in 3333 is occasionally rounded up. Since three instrumental values are averaged to produce a final quantitative value, these occurrences are relatively common and are shown in Table 6. These instances of erratic rounding occur only in a last decimal place; the effect on reported values is minimal.

Table 6. Examples of Erratic LIMS Rounding for Data Package H5C150247.

Element	Calculated	Reported	Element	Calculated	Reported
G584W H5C150247-004			G5836 H5C150247-001		
Cu	-0.00255666	-0.00255	Sb	0.0149333	0.01450
Se	-0.0001833	-0.00020	G584R H5C150247-003		
			As	0.00755666	0.00755

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H5C240121
VSL DM1200 LAW MACT 2A+2B VOST
Volatile Organic Compounds (VOST)**

Overall Assessment of Data Package H5C240121:

The following observations are relevant to the VOST analysis for Data Package H5C240121:

- Some of the VOST samples were analyzed by the standard thermal desorption/purge and trap GC/MS VOST methodology (samples VM032005MB Tenax and VM032005MB Anasorb); the remaining samples were prepared by methanol desorption and analyzed by purge and trap GC/MS according to Knoxville Standard Operating Procedure KNOX-MS-0018, a special SOP created to deal with VOST samples expected to contain analytes above the upper calibration level.
- Data reported for compounds with boiling points above 100°C should be considered estimates; quantitative sampling in the field cannot be guaranteed for these compounds unless field validation data with dynamic spiking in the field are available to demonstrate that quantitative sampling can occur.
- Values calculated for compounds reported “Above the calibration” should be considered estimated values; these estimated values may well significantly under-report the true value because of chromatographic saturation and the possibility of sorbent breakthrough.
- Since Tenax samples were analyzed as a pair, it is not possible to determine the amount of breakthrough that occurred from Tube #1 to Tube #2. However, according to EPA guidance, observation of 30% or more of the compound of interest relative to the paired Tenax tubes on the Tenax/Anasorb tube is indicative of breakthrough.
- Because of their water solubility, values for the polar compounds (i.e., acetonitrile, 2-hexanone, acetone, 2-butanone) may be significantly under-reported. The general practice for ensuring quantitative purging for these compounds is to heat and salt the purge water, which was not done in this analysis. The original text of Method 0031 does not consider these compounds appropriate VOST compounds under the standard VOST analytical conditions.
- The occurrence of vinyl chloride may be significantly over-reported. Because of the toxicity of this compound, the general practice at STL-Knoxville is to report the compound and calculate a concentration for vinyl chloride given the slightest indication of its presence, rather than requiring the presence of a distinct

identifiable mass spectrum.

- In order to report some of the observed concentrations, the STL - Knoxville laboratory must be using a split chromatographic injection. The capacity of most capillary columns is 1000 ng (1 µg) or less. Amounts of compounds in excess of 5-10 µg would cause serious chromatographic and detector saturation; this amount of material therefore cannot be introduced directly into the chromatographic column.
- Analytical parameters for the VOST analysis are within control, and the data package is complete and well organized. The data package would benefit from a more complete Narrative, describing the analysis in more detail and describing the transition of the samples from the Chain of Custody form to the Sample Summary.
- Trichloroethene, reported as “above the calibration range” in the samples listed below, may also be over- or under-reported and the value of trichloroethene in these samples should be considered “Estimated.”

The following additional observations regarding this data set were reported in the Narrative:

- Samples VM0320051A-D Cond, VM0320052A-D Cond, VM0320053A-D Cond, VM0320054A-D Cond, VM0320055A-D Cond, and VM0320056A-D Cond were reported with elevated reporting limits for all analytes. Based on screening results, a dilution was necessary prior to analysis; the reporting limits were adjusted accordingly.
- The result for acetone for Method Blank G67F01AA was greater than the reporting limit, but less than 5 times the reporting limit. Acetone is considered a common laboratory contaminant.
- Reanalysis of tubes containing an analyte at a concentration greater than the calibration range is not possible because the entire sample is consumed during analysis.

Except for the specific samples discussed above, analytical parameters for the VOST analysis are within control, and the data package is complete and well organized. The data package would benefit from a more complete Narrative, describing the transition of the samples from the Chain of Custody form to the Sample Summary. Because of the technical limitations discussed above, reported values should be considered “Estimated” for most compounds.

Analyses of these samples were performed by:
 STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 23, 2005; the analytical data report is dated April 11, 2005, and signed by Richard J. Lafond, Project Manager.

Original Chain of Custody forms are included in the data package. Twenty-five multi-container samples are listed on the Chain of Custody forms. The samples have either 3 or 4 containers, with no specification as to what the containers are.

The Sample Summary for Data Package H5C240121 has 56 entries, as shown in Table 1, below.

Table 1. Sample Summary for Data Package H5C240121.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G6WTF	001	VM0320051A TENAX	3/20/05	3/30/05
G6WT0	002	VM0320051A ANASORB	3/20/05	3/30/05
G6WT2	003	VM0320051B TENAX	3/20/05	3/30/05
G6WT3	004	VM0320051B ANASORB	3/20/05	3/31/05
G6WT5	005	VM0320051C TENAX	3/20/05	3/30/05
G6WT6	006	VM0320051C ANASORB	3/20/05	3/31/05
G6WT7	007	VM0320051D TENAX	3/20/05	3/29/05
G6WT9	008	VM0320051D ANASORB	3/20/05	3/29/05
G6WVA	009	VM0320051A-D COOND (sic)	3/20/05	3/30/05
G6WVE	010	VM0320052A TENAX	3/20/05	3/30/05
G6WVJ	011	VM0320052A ANASORB	3/20/05	3/31/05
G6WVK	012	VM0320052B TENAX	3/20/05	3/30/05
G6WVT	013	VM0320052B ANASORB	3/20/05	3/31/05
G6WVW	014	VM0320052C TENAX	3/20/05	3/30/05
G6WV1	015	VM0320052C ANASORB	3/20/05	3/31/05
G6WV3	016	VM0320052D TENAX	3/20/05	3/29/05
G6WV6	017	VM0320052D ANASORB	3/20/05	3/29/05

Table 1. Sample Summary for Data Package H5C240121, Continued.				
Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G6WWA	018	VM0320052A-D COND	3/20/05	3/30/05
G6WWF	019	VM0320053A TENAX	3/20/05	3/30/05
G6WWJ	020	VM0320053A ANASORB	3/20/05	3/31/05
G6WWK	021	VM0320053B TENAX	3/20/05	3/30/05
G6WWN	022	VM0320053B ANASORB	3/20/05	3/31/05
G6WWP	023	VM0320053C TENAX	3/20/05	3/30/05
G6WWR	024	VM0320053C ANASORB	3/20/05	3/31/05
G6WWV	025	VM0320053D TENAX	3/20/05	3/29/05
G6WWW	026	VM0320053D ANASORB	3/20/05	3/29/05
G6WWD	027	VM0320053A-D COND	3/20/05	3/30/05
G6WW5	028	VM0320054A TENAX	3/20/05	3/30/05
G6WXC	029	VM0320054A ANASORB	3/20/05	3/31/05
G6WXJ	030	VM0320054B TENAX	3/20/05	3/30/05
G6WXL	031	VM0320054B ANASORB	3/20/05	3/31/05
G6WXM	032	VM0320054C TENAX	3/20/05	3/30/05
G6WXN	033	VM0320054C ANASORB	3/20/05	4/01/05
G6WXX	034	VM0320054D TENAX	3/20/05	3/29/05
G6WX5	035	VM0320054D ANASORB	3/20/05	3/29/05
G6W0C	036	VM0320054A-D COND	3/20/05	3/30/05
G6W0K	037	VM0320055A TENAX	3/20/05	3/30/05
G6W0N	038	VM0320055A ANASORB	3/20/05	4/01/05
G6W0P	039	VM0320055B TENAX	3/20/05	3/30/05
G6W0R	040	VM0320055B ANASORB	3/20/05	4/01/05
G6W0T	041	VM0320055C TENAX	3/20/05	3/31/05
G6W0W	042	VM0320055C ANASORB	3/20/05	4/01/05
G6W0X	043	VM0320055D TENAX	3/20/05	3/29/05
G6W02	044	VM0320055D ANASORB	3/20/05	3/29/05

Table 1. Sample Summary for Data Package H5C240121, Continued.				
Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G6W04	045	VM0320055A-D COND	3/20/05	3/30/05
G6W06	046	VM0320056A TENAX	3/20/05	4/01/05
G6W08	047	VM0320056A ANASORB	3/20/05	4/01/05
G6W09	048	VM0320056B TENAX	3/20/05	3/30/05
G6W1C	049	VM0320056B ANASORB	3/20/05	4/01/05
G6W1D	050	VM0320056C TENAX	3/20/05	3/30/05
G6W1H	051	VM0320056C ANASORB	3/20/05	4/01/05
G6W1J	052	VM0320056D TENAX	3/20/05	3/29/05
G6W1L	053	VM0320056D ANASORB	3/20/05	3/29/05
G6W1N	054	VM0320056A-D COND	3/20/05	3/30/05
G6W58	055	VM032005MB TENAX	3/20/05	3/29/05
G6W6D	056	VM032005MB ANASORB	3/20/05	3/29/05

Description of the analytical methodology is provided in the Narrative:

VOST tubes and condensate samples were analyzed for the volatile organic target analytes by purge and trap GC/MS using STL Knoxville standard operating procedures KNOX-MS-0011 and KNOX-MS-015, based on the following methods:

- SW-846 5041A, "Analysis for Desorption of Sorbent Cartridges from Volatile Organic Sampling Train (VOST)"
- SW-846 8260B, "Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS).

Samples were received as SW-846 Method 0031 trains. Each Tenax tube pair and each Tenax/Anasorb tube is separately prepared by spiking a known amount of surrogate onto the media using a flash vaporization device. Volatile compounds are introduced into the gas chromatograph by thermal desorption of the analytes from the VOST tube using a clamshell oven and a purge and trap device. VOST condensates are spiked with surrogates and purged directly. The components are separated using the chromatograph and detected using a mass spectrometer, which provides both qualitative and quantitative information.

This descriptive text raised a question, since Method 0031 as written did not contain a mixed-bed sorbent tube: i.e., the third tube of the VOST train was an Anasorb 747 tube, with no Tenax. The following response to the question was received from R. J. Lafond:

Let me provide some information pertaining to the Tenax "plug" that STL has specially included with the Anasorb 747 tubes. I was directly involved with the MDL study on Anasorb; I ran the original MDL study.

Using standard thermal desorption, in order to effectively remove all volatiles captured, the thermal desorber would be needed to be elevated to a very high temperature, >300 degrees C. Since this is not allowed, recovery of spiked surrogates on the Anasorb-only tubes was very low, getting lower in relation to boiling point. Anything eluting off the GC starting in the area of benzene has poor recovery. I spoke with the manufacturer of Anasorb, being SKC, and talked with Linda (can't remember her last name). She told me that Anasorb was designed to be desorbed using solvent and not by thermal means, as it is a microsieve. The theory of Anasorb replacement that was provided to me by Billy Anderson here at the lab was that the purpose of Anasorb was to effectively trap the extremely volatile compounds which tend to migrate off the Tenax during sampling. I don't think this is included in the method, but I might be wrong.

So now the lab was posed with how to report data having low surrogate recoveries, including method blanks. The solution was to include this small amount, and it is about 1/5 of the total tube's total sorbent volume, of Tenax. This is how the modification arose.

I agree that the information in the narrative does not go to the degree of detail specifying the addition of Tenax to the Anasorb tube. There hasn't been a case until now where we have needed this addressed. I hope this does not invalidate the method.

The original intent of the method was to avoid a mixed-bed tube, increasing the capacity of the sorbent by using two full Tenax tubes and using a third carbon-based sorbent tube (Anasorb 747) to collect volatile organic compounds (such as vinyl chloride) that do break through the Tenax. The original supporting laboratory work did indeed use elevated desorption temperatures (~350°C) to make the desorption from the Anasorb tube quantitative. However, even at this elevated desorption temperature, the desorption of the bromofluorobenzene surrogate was erratic and seldom quantitative. The use of a Tenax plug in the third tube of the Method 0031 sampling train for the purpose of spiking the surrogate compounds and obtaining quantitative recovery of the surrogates will not affect the function of the Anasorb in collecting volatile organic compounds that break through the first two Tenax tubes. Also, the MDL study mentioned by STL demonstrates that using the small plug of Tenax does not impair the performance of the Anasorb in the collection and desorption of volatile organic compounds.

Note that the Narrative contains no information on how samples are related between the Chain of Custody forms and the Sample Summary: "3 containers" for a given Run number means that there were three sorbent tubes, two Tenax tubes with the front and back tube designated (except as noted above), and a third Tenax/Anasorb tube. If there were four containers, a fourth container must have been condensate. If condensate samples were received for all runs (but all of the condensates are not listed on the Chain of Custody forms, as noted above), there were undocumented instructions to analyze only one condensate sample for a given Run series. Instructions to R. J. Lafond are not documented, and instructions from R. J. Lafond to Sample Receipt are not documented.

Analytical results for the samples listed in the Sample Summary with Media Checks are shown in Table 2 for Data Package H5C240121.

Table 2. Analytical Results for Data Package H5C240121.

Compounds ^c	VM0320051A Tenax DF = 200	VM0320051A Anasorb DF = 200	VM0320051B Tenax DF = 200	VM0320051B Anasorb DF = 200	VM0320051C Tenax DF = 200
	µg ^a				
acetone	50	ND	45	ND	44
acetonitrile	480	ND	470	ND	430
acrylonitrile	27 J ^b	ND	25 J	ND	28 J
benzene	1.7 J	ND	1.5 J	ND	2.1 J
bromomethane	ND ^e	1.7 J, B	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	ND	2.5 J,B	ND	1.3 J,B	1.2 J
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	N D	ND	ND	ND	ND
iodomethane	5.8 J, B ^d	7.4 J,B	6.2 J,B	7.1 J,B	5.9 J,B
methylene chloride	ND	ND	ND	ND	ND
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	0.59 J
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylenes (total)	ND	ND	ND	ND	ND

Table 2. Analytical Results for Data Package H5C240121, Continued.					
Surrogates	% Recovery				
dibromofluoromethane	93	86	79	83	61
1,2-dichloroethane-d ₄	102	100	85	96	70
toluene-d ₈	79	79	58	76	62
bromofluorobenzene	81	92	60	89	65

^aThe usual reporting units for VOST are nanograms (ng); STL - Knoxville chooses to report their results in micrograms (µg) for compatibility with the SW-846 Method 8260C analysis.

^bEstimated result. The result is less than the Reporting Limit.

^cCompounds with boiling points above 100°C are not appropriate VOST compounds because compounds boiling above 100°C may not be sampled quantitatively in the field. Compounds with boiling points above 100°C include ethylbenzene, 4-methyl-2-pentanone, 2-hexanone, styrene, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethene, toluene, 1,1,2-trichloroethane, and the xylenes. Reported values for these compounds are estimated values because the quantitative nature of the field sample collection cannot be assured. Chlorobenzene, toluene, and tetrachloroethene also have boiling points above 100°C, but field validation data demonstrate that sampling for these compounds is quantitative.

^dMethod Blank contamination. The associated Method Blank contains the target analyte at a reportable level.

^eND = Not Detected.

Table 2. Analytical Results for Data Package H5C240121, Continued.

Compounds ^c	VM0320051C Anasorb DF = 200	VM0320051D Tenax DF = 200	VM0320051D Anasorb DF = 200	VM0320051 A-D Cond DF = 33.33	VM0320052A Tenax DF = 200
	µg ^a				
acetone	ND	40	ND	310 J	47
acetonitrile	ND	440	ND	5900	480
acrylonitrile	ND	31 J	ND	ND	36 J
benzene	ND	2.1 J	ND	ND	2.8 J
bromomethane	ND	2.1 J,B	1.6 J,B	64 J	ND
2-butanone	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	ND	2.9 J,B	2.0 J,B	ND	ND
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	6.5 J,B	10 B	7.7 J,B	36 J,B	6.0 J,B
methylene chloride	ND	ND	ND	12000	ND
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	0.63 J	ND	ND	0.66 J
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylene (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	90	94	84	95	113
1,2-dichloroethane-d ₄	105	101	95	96	121
toluene-d ₈	84	74	70	93	91
bromofluorobenzene	98	72	75	109	94

Table 2. Analytical Results for Data Package H5C240121, Continued.

Compounds ^c	VM0320052A Anasorb DF = 200	VM0320052B Tenax DF = 200	VM0320052B Anasorb DF = 200	VM0320052C Tenax DF = 200	VM0320052C Anasorb DF = 200
	µg ^a				
acetone	ND	40	ND	62	ND
acetonitrile	ND	420	ND	620	ND
acrylonitrile	ND	27 J	ND	37 J	ND
benzene	ND	1.3 J	ND	2.0 J	ND
bromomethane	ND	ND	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	1.2 J,B	ND	1.4 J,B	ND	ND
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	5.9 J,B	5.5 J,B	6.1 J,B	5.3 J,B	5.8 J,B
methylene chloride	14	ND	ND	ND	ND
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylene (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	90	84	89	92	92
1,2-dichloroethane-d ₄	107	93	101	98	108
toluene-d ₈	82	67	77	72	80
bromofluorobenzene	96	68	85	75	91

Table 2. Analytical Results for Data Package H5C240121, Continued.

Compounds ^c	VM0320052D Tenax DF = 200	VM0320052D Anasorb DF = 200	VM0320052 A-D Cond DF = 100	VM0320053A Tenax DF = 200	VM0320053A Anasorb DF = 200
	µg ^a				
acetone	40	ND	790 J	46	ND
acetonitrile	410	ND	ND	450	ND
acrylonitrile	25 J	ND	ND	31 J	ND
benzene	1.5 J	ND	ND	2.0 J	ND
bromomethane	1.6 J,B	ND	200 J	ND	ND
2-butanone	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	ND	1.6 J,B	ND	1.4 J	ND
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	7.2 J,B	6.6 J,B	110 J,B	5.6 J,B	5.7 J,B
methylene chloride	ND	ND	18000	7.2	18
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	79	92	95	89	60
1,2-dichloroethane-d ₄	88	101	96	97	68
toluene-d ₈	69	80	98	72	49 OCL [*]
bromofluorobenzene	69	81	107	75	58

^{*}OCL = Out of Control Limits

Table 2. Analytical Results for Data Package H5C240121, Continued.

Compounds ^c	VM0320053A Anasorb DF = 200	VM0320053B Tenax DF = 200	VM0320053B Anasorb DF = 200	VM0320053C Tenax DF = 200	VM0320053C Anasorb DF = 200
	µg ^a				
acetone	ND	74	ND	53	ND
acetonitrile	ND	750	ND	610	ND
acrylonitrile	ND	48 J	ND	35 J	ND
benzene	ND	2.7 J	ND	1.9 J	ND
bromomethane	ND	ND	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	ND	ND	1.9 J	ND	ND
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	6.4 J,B	537 J,B	5.7 J,B	5.8 J,B	5.6 J,B
methylene chloride	18	ND	ND	ND	ND
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	0.64 J	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylene (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	60	85	71	85	94
1,2-dichloroethane-d ₄	69	92	85	95	109
toluene-d ₈	48 OCL [*]	64	65	69	88
bromofluorobenzene	59	63	77	67	100

^{*}OCL = Out of Control Limits

Table 2. Analytical Results for Data Package H5C240121, Continued.

Compounds ^c	VM0320053D Tenax DF = 200	VM0320053D Anasorb DF = 200	VM0320053A -D Cond DF = 200	VM0320054A Tenax DF = 200	VM0320054A Anasorb DF = 200
	µg ^a				
acetone	37	ND	ND	36	ND
acetonitrile	380	ND	ND	310	ND
acrylonitrile	24 J	ND	ND	27 J	ND
benzene	2.0 J	ND	ND	ND	ND
bromomethane	ND	ND	380 J	ND	ND
2-butanone	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	1.2 J,B	ND	ND	ND	ND
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	6.7 J,B	6.2 J,B	270 J,B	5.6 J,B	5.8 J,B
methylene chloride	ND	ND	45000	130	6.8
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	86	85	97	87	87
1,2-dichloroethane-d ₄	95	94	95	95	102
toluene-d ₈	74	72	96	68	74
bromofluorobenzene	75	73	110	68	85

Table 2. Analytical Results for Data Package H5C240121, Continued.

Compounds ^c	VM0320054B Tenax DF = 200	VM0320054B Anasorb DF = 200	VM0320054C Tenax DF = 200	VM0320054C Anasorb DF = 200	VM0320054D Tenax DF = 200
	µg ^a				
acetone	43	ND	52	ND	37
acetonitrile	420	ND	590	ND	320
acrylonitrile	28 J	ND	40 J	ND	ND
benzene	0.89 J	ND	1.6 J	ND	ND
bromomethane	ND	ND	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	ND	ND	1.4 J	ND	1.9 J,B
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	5.4 J,B	5.4 J,B	5.4 J,B	5.2 J,B	6.4 J,B
methylene chloride	ND	ND	ND	ND	ND
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylene (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	86	90	87	90	91
1,2-dichloroethane-d ₄	95	108	95	105	100
toluene-d ₈	70	82	67	80	73
bromofluorobenzene	72	93	68	90	73

Table 2. Analytical Results for Data Package H5C240121, Continued.

Compounds ^c	VM0320054D Anasorb DF = 200	VM0320054 A-D Cond DF = 200	VM0320055A Tenax DF = 200	VM0320055A Anasorb DF = 200	VM0320055B Tenax DF = 200
	µg ^a				
acetone	ND	ND	ND	ND	25
acetonitrile	ND	ND	ND	ND	200
acrylonitrile	ND	ND	ND	ND	ND
benzene	ND	ND	ND	ND	ND
bromomethane	ND	590 J	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	1.7 J,B	ND	ND	ND	ND
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	6.0 J,B	370 J,B	5.5 J,B	5.2 J,B	5.4 J,B
methylene chloride	ND	73000	25	52	4.1 J
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	88	95	90	87	89
1,2-dichloroethane-d ₄	96	97	100	101	97
toluene-d ₈	74	87	66	79	72
bromofluorobenzene	76	107	62	90	72

Table 2. Analytical Results for Data Package H5C240121, Continued.

Compounds ^c	VM0320055B Anasorb DF = 200	VM0320055C Tenax DF = 200	VM0320055C Anasorb DF = 200	VM0320055C Tenax DF = 200	VM0320055C Anasorb DF = 200
	µg ^a				
acetone	ND	59	ND	ND	ND
acetonitrile	ND	550	ND	ND	ND
acrylonitrile	ND	38 J	ND	ND	ND
benzene	ND	0.93 J	ND	ND	ND
bromomethane	ND	2.0 J	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	ND	1.8 J	ND	ND	1.2 J,B
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	5.2 J,B	8.1 J,B	5.2 J,B	5.2 J,B	7.3 J,B
methylene chloride	ND	ND	ND	52	ND
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylene (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	89	92	51	87	48 OCL [*]
1,2-dichloroethane-d ₄	106	108	60	101	59
toluene-d ₈	83	84	47 OCL [*]	79	46 OCL [*]
bromofluorobenzene	95	93	53	90	54

^aOCL = Out of Control Limits.

Table 2. Analytical Results for Data Package H5C240121, Continued.

Compounds ^c	VM0320055D Tenax DF = 200	VM0320055D Anasorb DF = 200	VM0320055 A-D Cond DF = 250	VM0320056A Tenax DF = 200	VM0320056A Anasorb DF = 200
	µg ^a				
acetone	39	ND	ND	36	ND
acetonitrile	400	ND	ND	350	ND
acrylonitrile	ND	ND	ND	24 J	ND
benzene	ND	ND	ND	1.1 J	ND
bromomethane	ND	ND	510 J	1.6 J	ND
2-butanone	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	ND	ND	ND	ND	1.4 J,B
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	5.7 J,B	5.6 J,B	450 J,B	7.6 J,B	6.9 J,B
methylene chloride	ND	ND	71000	27	47
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	86	93	97	80	130
1,2-dichloroethane-d ₄	93	103	96	90	150 OCL *
toluene-d ₈	69	77	101	59	117
bromofluorobenzene	69	79	109	63	133 OCL *

^aOCL = Out of Control Limits.

Table 2. Analytical Results for Data Package H5C240121, Continued.

Compounds ^c	VM0320056A Anasorb DF = 200	VM0320056B Tenax DF = 200	VM0320056B Anasorb DF = 250	VM0320056C Tenax DF = 200	VM0320056C Anasorb DF = 200
	µg ^a				
acetone	ND	50	ND	32	ND
acetonitrile	ND	490	ND	360	ND
acrylonitrile	ND	28 J	ND	22 J	ND
benzene	ND	1.1 J	ND	0.93 J	ND
bromomethane	1.6 J,B	ND	ND	ND	ND
2-butanone	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	2.1 J,B	ND	ND	ND	1.5 J,B
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	5.5 J,B	5.3 J,B	5.3 J,B	5.2 J,B	5.1 J,B
methylene chloride	45	ND	ND	ND	ND
tetrachloroethene	ND	ND	ND	ND	ND
toluene	2.9 J	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylene (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	128	89	89	84	85
1,2-dichloroethane-d ₄	148 OCL [*]	97	104	96	100
toluene-d ₈	118	71	78	66	76
bromofluorobenzene	134 OCL [*]	70	86	62	84

^aOCL = Out of Control Limits.

Table 2. Analytical Results for Data Package H5C240121, Continued.

Compounds ^c	VM0320056D Tenax DF = 200	VM0320056D Anasorb DF = 200	VM0320056 A-D Cond DF = 250	VM032005MB Tenax DF = 1	VM032005MB Anasorb DF = 1
	µg ^a				
acetone	39	ND	ND	0.94 B	0.22 B
acetonitrile	370	ND	ND	12	4.6
acrylonitrile	24 J	ND	ND	0.30 J	ND
benzene	1.1 J	ND	ND	0.020 J,B	ND
bromomethane	ND	ND	650 J	ND	ND
2-butanone	ND	ND	ND	0.040 J	ND
carbon disulfide	ND	ND	ND	0.0061 J	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	ND	ND	ND	ND	ND
ethylbenzene	ND	ND	ND	ND	0.087
2-hexanone	ND	ND	ND	ND	ND
iodomethane	5.6 J,B	5.5 J,B	550 J,B	ND	ND
methylene chloride	ND	ND	84000	0.20	ND
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND	ND
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	85	86	97	80	79
1,2-dichloroethane-d ₄	92	95	96	72	72
toluene-d ₈	65	69	96	92	82
bromofluorobenzene	64	72	110	87	91

Results for Laboratory-Generated Method Blanks are shown in Table 3.

Table 3. Laboratory-Generated Method Blanks for Data Package H5C240121.

Compound	Method Blank1 3/29/05	Method Blank2 3/29/05	Method Blank3 3/30/05	Method Blank4 3/30/05	Method Blank5 3/31/05
	µg				
acetone	ND ^a	0.11	ND	ND	ND
benzene	ND	0.0073 J	ND	ND	ND
bromoform	3.0 J ^b	ND	ND	ND	ND
bromomethane	1.9 J	ND	ND	ND	2.0 J
chloromethane	1.3 J	ND	ND	ND	3.5 J
iodomethane	9.7 J	ND	0.60 J	9.8 J	9.4 J
toluene	ND	0.0031 J	ND	ND	ND
Surrogate Compounds	% Recovery				
dibromofluoromethane	95	85	94	89	89
1,2-dichloroethane-d ₄	99	77	92	97	102
toluene-d ₈	81	88	99	78	80
bromofluorobenzene	83	91	110	79	86

^aND = Not Detected.

^b Estimated result. Result is less than Reporting Limit.

Laboratory Control Samples/Duplicates (LCS/LCSD) and Relative Percent Difference (RPD) are shown in Table 4. All recoveries and RPDs are within control limits.

Table 4. LCS/LCSD with Associated Method Blanks for Data Package H5C240121.

Compounds	LCS/LCSD % Recovery	RPD	LCS/LCSD % Recovery	RPD	LCS/LCSD % Recovery	RPD
benzene	96/96	0.22	106/103	3.5	103/106	2.6
chlorobenzene	95/95	0.35	94/89	5.8	105/105	0.020
1,1-dichloroethene	101/107	5.8	89/92	3.6	92/93	0.15
toluene	90/91	1.1	97/93	4.9	100/100	0.16
trichloroethene	99/99	0.20	113/114	0.39	99/103	3.4
Surrogate Compounds	% Recovery					
dibromofluoromethane	102/94		85/82		94/91	
1,2-dichloroethane-d ₄	105/98		73/71		89/89	
toluene-d ₈	88/82		93/93		105/101	
bromofluorobenzene	90/84		83/81		105/104	

Table 4. LCS/LCSD with Associated Method Blanks for Data Package H5C240121, Continued.

Compounds	LCS/LCSD % Recovery	RPD	LCS/LCSD % Recovery	RPD
benzene	100/92	7.9	101/95	5.6
chlorobenzene	98/90	8.7	100/91	9.8
1,1-dichloroethene	115/108	6.4	84/101	18
toluene	92/85	7.8	99/90	9.9
trichloroethene	109/97	12	90/84	7.5
Surrogate Compounds	% Recovery			
dibromofluoromethane	107/98		94/93	
1,2-dichloroethane-d ₄	110/97		107/102	
toluene-d ₈	87/77		90/81	
bromofluorobenzene	91/81		102/89	

Quality control parameters for the VOST analysis for Data Package H5C240121 are shown in Table 5.

Table 5. VOST Quality Control Parameters for Data Package H5C240121.

Parameter	Comments
Initial Calibration (ICAL) (1/03/05)	Acceptable curve.
Initial Calibration (ICAL) (3/20/05)	Acceptable curve.
Bromofluorobenzene Tune Check (1/03/05)	Within specifications
BFB Tune Check (3/29/05)	Within specifications
BFB Tune Check (3/30/05)	Within specifications
BFB Tune Check (3/31/05)	Within specifications
BFB Tune Check (4/01/05)	Within specifications
BFB Tune Check (12/20/04)	Within specifications
Continuing Calibration Check (3/29/05)	Within specifications
Continuing Calibration Check (3/30/05)	Within specifications
Continuing Calibration Check (3/31/05)	Within specifications
Continuing Calibration Check (4/01/05)	Within specifications
Second Source Standard (1/03/05) (Volatiles Analysis)	Recoveries within control limits.
Second Source Standard (3/21/05) (Volatiles Analysis)	Recoveries within control limits

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H5C240202
VSL DM1200 LAW MACT 2A+2B VOST
Volatile Organic Compounds (VOST)**

Overall Assessment of Data Package H5C240202:

The following observations are relevant to the VOST analysis for Data Package H5C240202:

- All of the VOST samples were analyzed by the standard thermal desorption/purge and trap GC/MS VOST methodology (samples VM032005MB Tenax and VM032005MB Anasorb) according to Knoxville Standard Operating Procedure KNOX-MS-0011 and KNOX-MS-0015.
- Data reported for compounds with boiling points above 100°C should be considered estimates; quantitative sampling in the field cannot be guaranteed for these compounds unless field validation data with dynamic spiking in the field are available to demonstrate that quantitative sampling can occur.
- Values calculated for compounds reported “Above the calibration” should be considered estimated values; these estimated values may well significantly under-report the true value because of chromatographic saturation and the possibility of sorbent breakthrough.
- Since Tenax samples were analyzed as a pair, it is not possible to determine the amount of breakthrough that occurred from Tube #1 to Tube #2. However, according to EPA guidance, observation of 30% or more of the compound of interest relative to the paired Tenax tubes on the Tenax/Anasorb tube is indicative of breakthrough.
- Because of their water solubility, values for the polar compounds (i.e., acetonitrile, 2-hexanone, acetone, 2-butanone) may be significantly under-reported. The general practice for ensuring quantitative purging for these compounds is to heat and salt the purge water, which was not done in this analysis. The original text of Method 0031 does not consider these compounds appropriate VOST compounds under the standard VOST analytical conditions.
- The occurrence of vinyl chloride may be significantly over-reported. Because of the toxicity of this compound, the general practice at STL-Knoxville is to report the compound and calculate a concentration for vinyl chloride given the slightest indication of its presence, rather than requiring the presence of a distinct identifiable mass spectrum.

- In order to report some of the observed concentrations, the STL - Knoxville laboratory must be using a split chromatographic injection. The capacity of most capillary columns is 1000 ng (1 µg) or less. Amounts of compounds in excess of 5-10 µg would cause serious chromatographic and detector saturation; this amount of material therefore cannot be introduced directly into the chromatographic column.
- Analytical parameters for the VOST analysis are within control, and the data package is complete and well organized. The data package includes a Narrative, that describes the analysis thoroughly and discusses the transition of the samples from the Chain of Custody form to the Sample Summary at some length because of the difficulties encountered in the laboratory..
- Because of the matrix, difficulties were encountered with the analysis for many of the samples: see additional observations below.

The following additional observations regarding this data set were reported in the Narrative:

- Samples VT0320051A-D Cond, VT0320052A-D Cond, VT0320053A-D Cond, VT0320054A-D Cond, VT0320055A-D Cond, VT032005MB Cond, and VT0320056A-D Cond were reported with elevated reporting limits for all analytes. Based on screening results, a dilution was necessary prior to analysis; the reporting limits were adjusted accordingly.
- The result for acetone for Method Blank G67F01AA was greater than the reporting limit, but less than 5 times the reporting limit. Acetone is considered a common laboratory contaminant.
- One or more surrogate recoveries for samples VT0320051A Tenax, VT0320053C Tenax, VT0320055B Tenax, VT0320056B Tenax, and VT0320056B Anasorb were outside QC limits. However, reanalysis of the associated samples was not possible since the entire sample was consumed during analysis. Since the recoveries were low, the results for the samples may be biased low.
- Sample VT0320051C Tenax was broken by the analyst in the process of tightening the fittings just before analysis. The analysis was not performed and no data were reported for this sample.
- Internal standard and surrogate recoveries for samples VT0320053B Tenax, VT0320054B Tenax, and VT0320055A Tenax were outside QC limits. However, the samples were bracketed by acceptable runs, indicating that a sample matrix effect is responsible for the internal standard criteria not being met. The surrogates were quantitated against the internal standards that were outside QC

limits.

- The concentration of several analytes was greater than the calibration range for all the samples except for those samples analyzed by methanol extraction, the media checks and samples VT032005B Tenax, VT0320054C Tenax, VT0320055C Tenax, and VT0320056C Tenax. Reanalysis at a dilution was not possible because the entire sample was consumed during analysis. Results for compounds that exceed the calibration may be biased low.
- Reanalysis of tubes containing an analyte at a concentration greater than the calibration range is not possible because the entire sample is consumed during analysis.

Except for the specific samples discussed above, analytical parameters for the VOST analysis are within control, and the data package is complete and well organized. The data package includes a more complete Narrative than the usual STL Knoxville data package describing the transition of the samples from the Chain of Custody form to the Sample Summary because of the difficulties encountered in this process. Because of the technical limitations discussed above, reported values should be considered “Estimated” for most compounds.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 23, 2005; the analytical data report is dated April 8, 2005, and signed by Richard J. Lafond, Project Manager.

Original Chain of Custody forms are included in the data package. Twenty-four multi-container samples are listed on the Chain of Custody forms. The samples have either 3 or 4 containers, with no specification as to what the containers are.

Additional notes regarding the Chain of Custody forms/sample receipt from the Data Package H5C240202 Narrative:

The Chains of Custody contained sample identifications that were incomplete and did not match the labels on the containers directly. The VOST Tenax, Anasorb, and condensates were not clearly identified on the Chains of Custody. The condensates were apparently included on the Chains of Custody with the “D” set of tubes as determined by the container amounts. No tubes were indicated to be archived and all tubes were logged for analysis. The client was emailed a sample confirmation report to show how tubes were

logged in for review and any necessary changes. The laboratory processed the samples using the information on the container label.

The Sample Summary for Data Package H5C240202 has 55 entries, as shown in Table 1, below.

Table 1. Sample Summary for Data Package H5C240202.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G6XFC	001	VT0320051A TENAX	3/20/05	4/01/05
G6XFE	002	VT0320051A ANASORB	3/20/05	3/31/05
G6XFG	003	VT0320051B TENAX	3/20/05	4/01/05
G6XFJ	004	VT0320051B ANASORB	3/20/05	3/31/05
G6XFL	006	VT0320051C ANASORB	3/20/05	3/31/05
G6XFN	007	VT0320051D TENAX	3/20/05	3/30/05
G6XFP	008	VT0320051D ANASORB	3/20/05	3/30/05
G6XFQ	009	VT0320051A-D COND	3/20/05	3/30/05
G6XFR	010	VT0320052A TENAX	3/20/05	4/01/05
G6XFT	011	VT0320052A ANASORB	3/20/05	3/31/05
G6XFV	012	VT0320052B TENAX	3/20/05	4/01/05
G6AFX	013	VT0320052B ANASORB	3/20/05	3/31/05
G6XF0	014	VT0320052C TENAX	3/20/05	4/01/05
G6XF2	015	VT0320052C ANASORB	3/20/05	3/31/05
G6XF3	016	VT0320052A-C COND	3/20/05	3/30/05
G6XF5	017	VT0320053A TENAX	3/20/05	4/01/05
G6XF6	018	VT0320053A ANASORB	3/20/05	3/31/05
G6XF7	019	VT0320053B TENAX	3/20/05	4/01/05
G6XF8	020	VT0320053B ANASORB	3/20/05	3/31/05
G6XGA	021	VT0320053C TENAX	3/20/05	4/01/05
G6XGD	022	VT0320053C ANASORB	3/20/05	3/31/05

Table 1. Sample Summary for Data Package H5C240202, Continued.				
Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G6XGF	023	VT0320053D TENAX	3/20/05	3/30/05
G6XGJ	024	VT0320053D ANASORB	3/20/05	3/30/05
G6XGL	025	VT0320053A-D COND	3/20/05	3/30/05
G6XLD	026	VT0320054A TENAX	3/20/05	4/01/05
G6XLF	027	VT0320054A ANASORB	3/20/05	3/31/05
G6XLJ	028	VT0320054B TENAX	3/20/05	4/01/05
G6XLM	029	VT0320054B ANASORB	3/20/05	3/31/05
G6XLQ	030	VT0320054C TENAX	3/20/05	4/01/05
G6XLR	031	VT0320054C ANASORB	3/20/05	3/31/05
G6XLV	032	VT0320054D TENAX	3/20/05	3/30/05
G6XL0	033	VT0320054D ANASORB	3/20/05	3/30/05
G6XL1	034	VT0320054A-D COND	3/20/05	3/30/05
G6XL3	035	VT0320055A TENAX	3/20/05	4/01/05
G6XL6	036	VT0320055A ANASORB	3/20/05	3/31/05
G6LX9	037	VT0320055B TENAX	3/20/05	4/01/05
G6XMA	038	VT0320055B ANASORB	3/20/05	3/31/05
G6XMG	039	VT0320055C TENAX	3/20/05	4/01/05
G6XML	040	VT0320055C ANASORB	3/20/05	3/31/05
G6XMX	041	VT0320055A-C COND	3/20/05	3/30/05
G6XM7	042	VT0320056A TENAX	3/20/05	4/01/05
G6XNA	043	VT0320056A ANASORB	3/20/05	3/31/05
G6XND	044	VT0320056B TENAX	3/20/05	4/01/05
G6XNL	045	VT0320056B ANASORB	3/20/05	3/31/05
G6XNN	046	VT0320056C TENAX	3/20/05	4/01/05

Table 1. Sample Summary for Data Package H5C240202, Continued				
Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G6XNP	047	VT0320056C ANASORB	3/20/05	3/31/05
G6XNR	048	VT0320056D TENAX	3/20/05	3/30/05
G6XNV	049	VT0320056D ANASORB	3/20/05	3/29/05
G6XNX	050	VT0320056A-D COND	3/20/05	3/30/05
G6XN2	051	VT032005MB TENAX	3/20/05	3/29/05
G6XN8	052	VT032005MB ANASORB	3/20/05	3/29/05
G6XPG	053	A-3997 MEDIA CHECK TENAX	3/20/05	3/29/05
G6XPT	054	A-3999 MEDIA CHECK ANASORB	3/20/05	3/29/05
G6XV1	055	VT032005MB COND	3/20/05	3/30/05

Description of the analytical methodology is provided in the Narrative:

VOST tubes and condensate samples were analyzed for the volatile organic target analytes by purge and trap GC/MS using STL Knoxville standard operating procedures KNOX-MS-0011 and KNOX-MS-015, based on the following methods:

- SW-846 5041A, "Analysis for Desorption of Sorbent Cartridges from Volatile Organic Sampling Train (VOST)"
- SW-846 8260B, "Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS).

Samples were received as SW-846 Method 0031 trains. Each Tenax tube pair and each Tenax/Anasorb tube is separately prepared by spiking a known amount of surrogate onto the media using a flash vaporization device. Volatile compounds are introduced into the gas chromatograph by thermal desorption of the analytes from the VOST tube using a clamshell oven and a purge and trap device. VOST condensates are spiked with surrogates and purged directly. The components are separated using the chromatograph and detected using a mass spectrometer, which provides both qualitative and quantitative information.

This descriptive text raised a question, since Method 0031 as written did not contain a mixed-bed sorbent tube: i.e., the third tube of the VOST train was an Anasorb 747 tube, with no Tenax. The following response to the question was received from R. J. Lafond:

Let me provide some information pertaining to the Tenax “plug” that STL has specially included with the Anasorb 747 tubes. I was directly involved with the MDL study on Anasorb; I ran the original MDL study.

Using standard thermal desorption, in order to effectively remove all volatiles captured, the thermal desorber would be needed to be elevated to a very high temperature, >300 degrees C. Since this is not allowed, recovery of spiked surrogates on the Anasorb-only tubes was very low, getting lower in relation to boiling point. Anything eluting off the GC starting in the area of benzene has poor recovery. I spoke with the manufacturer of Anasorb, being SKC, and talked with Linda (can't remember her last name). She told me that Anasorb was designed to be desorbed using solvent and not by thermal means, as it is a microsieve. The theory of Anasorb replacement that was provided to me by Billy Anderson here at the lab was that the purpose of Anasorb was to effectively trap the extremely volatile compounds which tend to migrate off the Tenax during sampling. I don't think this is included in the method, but I might be wrong.

So now the lab was posed with how to report data having low surrogate recoveries, including method blanks. The solution was to include this small amount, and it is about 1/5 of the total tube's total sorbent volume, of Tenax. This is how the modification arose.

I agree that the information in the narrative does not go to the degree of detail specifying the addition of Tenax to the Anasorb tube. There hasn't been a case until now where we have needed this addressed. I hope this does not invalidate the method.

The original intent of the method was to avoid a mixed-bed tube, increasing the capacity of the sorbent by using two full Tenax tubes and using a third carbon-based sorbent tube (Anasorb 747) to collect volatile organic compounds (such as vinyl chloride) that do break through the Tenax. The original supporting laboratory work did indeed use elevated desorption temperatures (~350°C) to make the desorption from the Anasorb tube quantitative. However, even at this elevated desorption temperature, the desorption of the bromofluorobenzene surrogate was erratic and seldom quantitative. The use of a Tenax plug in the third tube of the Method 0031 sampling train for the purpose of spiking the surrogate compounds and obtaining quantitative recovery of the surrogates will not affect the function of the Anasorb in collecting volatile organic compounds that break through the first two Tenax tubes. Also, the MDL study mentioned by STL demonstrates that using the small plug of Tenax does not impair the performance of the Anasorb in the collection and desorption of volatile organic compounds.

Note that the Narrative contains no information on how samples are related between the Chain of Custody forms and the Sample Summary: “3 containers” for a given Run number means that there were three sorbent tubes, two Tenax tubes with the front and back tube designated (except as noted above), and a third Tenax/Anasorb tube. If there were four containers, a fourth container must have been condensate. If condensate samples were received for all runs (but all of the condensates are not listed on the Chain of Custody forms, as noted above), there were undocumented instructions to analyze only one condensate sample for a given Run series. Instructions to R. J. Lafond are not documented, and instructions from R. J. Lafond to Sample Receipt are not documented.

Analytical results for the samples listed in the Sample Summary with Media Checks are shown in Table 2 for Data Package H5C240202

Table 2. Analytical Results for Data Package H5C240202.

Compounds ^f	VT0320051A Tenax DF = 1	VT0320051A Anasorb DF = 1	VT0320051B Tenax DF = 1	VT0320051B Anasorb DF = 200	VT0320051C Anasorb DF = 1
	µg ^e				
acetone	0.075 J ^a	0.11	0.50	0.75	0.18
acetonitrile	ND ^b	ND	ND	0.95 J	1.1
acrylonitrile	ND	ND	ND	ND	ND
benzene	0.091	ND	0.087	ND	ND
bromomethane	0.093 B ^c	0.20 B	0.075 B	0.055 B	0.034 J,B
2-butanone	0.047 J	ND	ND	0.080 J	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	0.0098 J	ND	0.0088 J	ND	ND
chloroform	0.0051 J	ND	ND	ND	ND
chloromethane	2.5 E ^d	12 E	2.9 E	9.2 E	8.5 E
1,2-dichloroethene (total)	0.075	ND	0.089	0.011 J	0.0099 J
ethylbenzene	0.010 J	0.016 J	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	0.011 J	0.057	0.0073 J	0.024 J	0.011 J
methylene chloride	0.10	0.10	0.12	0.074	0.051
tetrachloroethene	ND	ND	ND	ND	ND
toluene	0.0087 J	0.0074 J	0.0035 J	ND	0.59 J
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	0.0081 J	0.055	0.0071 J	0.024 J	0.016 J
xylenes (total)	0.055 J	0.092	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	44*	73	58	78	80
1,2-dichloroethane-d ₄	44*	70	58	74	75
toluene-d ₈	80	89	87	87	89
bromofluorobenzene	70	80	76	80	81

^aEstimated result. The result is less than the Reporting Limit.

^bND = Not Detected.

^cMethod Blank contamination. The associated Method Blank contains the target analyte at a reportable level.

^dEstimated result. Result concentration exceeds the reporting range.

Compounds with boiling points above 100°C are not appropriate VOST compounds because compounds boiling above 100°C may not be sampled quantitatively in the field. Compounds with boiling points above 100°C include ethylbenzene, 4-methyl-2-pentanone, 2-hexanone, styrene, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethene, toluene, 1,1,2-trichloroethane, and the xylenes. Reported values for these compounds are estimated values because the quantitative nature of the field sample collection cannot be assured. Chlorobenzene, toluene, and tetrachloroethene also have boiling points above 100°C, but field validation data demonstrate that sampling for these compounds is quantitative.

^fThe usual reporting units for VOST are nanograms (ng); STL - Knoxville chooses to report their results in micrograms (µg) for compatibility with the SW-846 Method 8260C analysis.

Table 2. Analytical Results for Data Package H5C240202, Continued.

Compounds	VT0320051D Tenax DF = 200	VT0320051D Anasorb DF = 200	VT0320051 A-D Cond DF = 200	VT0320052A Tenax DF = 1	VM0320052A Anasorb DF = 1
	µg		µg/L	µg	
acetone	ND	ND	ND	0.48	0.15
acetonitrile	ND	ND	ND	ND	0.97 J
acrylonitrile	ND	ND	ND	ND	ND
benzene	ND	ND	ND	0.075	ND
bromomethane	1.6 J,B	ND	ND	0.047 J,B	0.026 J,B
2-butanone	ND	ND	ND	0.068 J	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	0.0077 J	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	4.8 J,B	2.9 J,B	ND	2.5 E	8.1 E
1,2-dichloroethene (total)	0.089	ND	0.089	0.011 J	0.0094 J
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	0.0052 J	6.0 J,B	ND	36 J,B	0.0094 J
methylene chloride	0.59	150	260 J	12000	7.9 E
tetrachloroethene	ND	ND	ND	ND	ND
toluene	0.0033 J	ND	ND	ND	0.0036 J
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	0.0083 J	ND	ND	ND	0.012 J
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	63	87	97	95	77
1,2-dichloroethane-d ₄	62	98	93	96	72
toluene-d ₈	84	70	99	93	90
bromofluorobenzene	73	72	107	109	81

Table 2. Analytical Results for Data Package H5C240202, Continued.

Compounds	VT0320052B Tenax DF = 1	VT0320052B Anasorb DF = 1	VT0320052B Tenax DF = 1	VT0320052C Anasorb DF = 1	VT0320052C A-C Cond DF = 200
	µg				µg/L
acetone	0.62	0.20	0.52	0.16	ND
acetonitrile	ND	1.2	ND	1.3	ND
acrylonitrile	ND	ND	ND	ND	ND
benzene	0.088	ND	0.071	ND	ND
bromomethane	0.029 J,B	0.028 J,B	0.035 J,B	0.018 J,B	470 J
2-butanone	0.041 J	ND	0.079 J	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	0.0089 J	ND	0.0069 J	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	1.6	13 E	2.5 E	8.4 E	ND
1,2-dichloroethene (total)	0.088	0.012 J	0.067	ND	ND
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	ND	0.018 J	ND	0.0069 J	480 J,B
methylene chloride	0.15	1.0	0.098	0.057	52000
tetrachloroethene	ND	ND	ND	ND	ND
toluene	0.0027 J	ND	0.0034 J	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	0.0048 J	0.039	0.0080 J	0.011 J	ND
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	69	75	63	71	95
1,2-dichloroethane-d ₄	70	70	64	69	94
toluene-d ₈	85	89	84	87	96
bromofluorobenzene	79	86	77	82	108

Table 2. Analytical Results for Data Package H5C240202, Continued.

Compounds	VT0320053A Tenax DF = 1	VT0320053A Anasorb DF = 200	VMT0320053B Tenax DF = 1	VT0320053B Anasorb DF = 1	VT0320053C Tenax DF = 1
	µg				
acetone	0.94	0.16	0.93	0.25	0.13
acetonitrile	ND	1.0	1.3	1.0	ND
acrylonitrile	ND	ND	ND	ND	ND
benzene	0.059	ND	0.081	ND	0.055
bromomethane	0.034 J,B	0.018 J,B	0.026 J,B	0.020 J,B	0.031 J,B
2-butanone	0.10	0.036 J	0.17	0.064 J	0.081 J
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	0.0057 J	ND	0.0046 J	ND	0.0050 J
chloroform	ND	ND	ND	ND	ND
chloromethane	2.6 E	9.7 E	2.8 E	12 E	2.7 E
1,2-dichloroethene (total)	0.060	ND	0.033	ND	0.061
ethylbenzene	ND	ND	ND	ND	0.013 J
2-hexanone	ND	ND	ND	ND	ND
iodomethane	ND	0.0064 J	ND	0.0060 J	0.086
methylene chloride	0.12	16 E	0.99	0.79	ND
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	0.0052 J	0.0095 J	ND	0.0035 J
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	0.0069 J	0.018 J	0.012 J	0.040	0.0078 J
xylenes (total)	ND	ND	ND	ND	0.066 J
Surrogates	% Recovery				
dibromofluoromethane	64	84	39 OCL *	83	47 OCL
1,2-dichloroethane-d ₄	64	80	40 OCL	81	47 OCL
toluene-d ₈	96	89	74	91	80
bromofluorobenzene	93	83	75	84	73

* OCL = Out of Control Limits

Table 2. Analytical Results for Data Package H5C240202, Continued.

Compounds	VT0320053C Anasorb DF = 1	VT0320053D Tenax DF = 200	VT0320053D Anasorb DF = 200	VT0320053 A-D Cond DF = 200	VT0320054A Tenax DF = 1
	µg			µg/L	µg
acetone	0.27	ND	ND	ND	0.68
acetonitrile	1.7	ND	ND	ND	ND
acrylonitrile	ND	ND	ND	ND	ND
benzene	ND	ND	ND	ND	0.059
bromoform	ND	ND	3.1 J,B	ND	ND
bromomethane	0.019 J,B	ND	ND	700 J	0.019 J,B
2-butanone	ND	ND	ND	ND	0.082 J
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	0.0046 J
chloroform	ND	ND	ND	ND	0.0075 J
chloromethane	11 E	3.2 J,B	2.4 J,B	ND	1.5
1,2-dichloroethene (total)	ND	ND	ND	ND	0.018 J
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	0.0054 J	7.2 J,B	7.2 J,B	720 J,B	ND
methylene chloride	0.077	ND	ND	64000	2.1 E
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	0.0033 J
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	0.036	ND	ND	ND	ND
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	70	91	81	96	67
1,2-dichloroethane-d ₄	69	100	90	96	66
toluene-d ₈	87	77	66	91	84
bromofluorobenzene	83	79	68	108	73

Table 2. Analytical Results for Data Package H5C240202, Continued.

Compounds	VT0320054A Anasorb DF = 1	VT0320054B Tenax DF = 1	VT03200534B Anasorb DF = 1	VT0320054C Tenax DF = 1	VT0320054C Anasorb DF = 1
	µg				
acetone	0.38	0.65	0.15	0.73	0.19
acetonitrile	1.1	1.6	4.8	1.4	ND
acrylonitrile	ND	ND	ND	ND	ND
benzene	ND	0.026	ND	0.089	ND
bromomethane	ND	0.059 B	0.014 J,B	0.022 J,B	0.013 J,B
2-butanone	ND	0.12	0.044 J	0.16	0.061 J
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	0.015 J	ND
chloroform	ND	ND	ND	0.0080 J	ND
chloromethane	6.3 E	5.0 E	7.1 E	1.8	4.7 E
1,2-dichloroethene (total)	ND	0.013 J	ND	0.014 J	ND
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	ND	0.0081 J	ND	0.0095 J	ND
methylene chloride	10 E	0.15	0.29	0.20	0.16
tetrachloroethene	ND	ND	ND	ND	ND
toluene	0.0052 J	ND	0.0048 J	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	0.013 J	0.010 J	0.012 J	0.0088 J	0.0076 J
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	79	32 OCL	80	81	82
1,2-dichloroethane-d ₄	79	34 OCL	77	80	81
toluene-d ₈	88	74	92	99	93
bromofluorobenzene	86	74	84	91	90

Table 2. Analytical Results for Data Package H5C240202, Continued.

Compounds	VT0320054D Tenax DF = 200	VT0320054D Anasorb DF = 200	VT0320054 A-D Cond DF = 1000	VT0320055A Tenax DF = 0	VT0320055A Anasorb DF = 1
	µg		µg/L	µg	
acetone	ND	ND	ND	1.2	0.14
acetonitrile	ND	ND	ND	37	7.3
acrylonitrile	ND	ND	ND	ND	ND
benzene	ND	ND	ND	0.015 J	ND
bromomethane	ND	ND	3300 J	0.27 B	0.014 J,B
2-butanone	ND	ND	ND	0.39	0.072 J
carbon disulfide	ND	ND	ND	ND	0.0070 J
carbon tetrachloride	ND	ND	ND	0.0044 J	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	3.3 J,B	2.0 J,B	ND	18 E	4.9 E
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	6.6 J,B	6.5 J,B	2700 J,B	0.054	ND
methylene chloride	ND	ND	140000	0.60	4.8 E
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	0.0040 J	0.010 J
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	0.023 J	0.0069 J
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	94	90	95	25 OCL	93
1,2-dichloroethane-d ₄	103	99	96	29 OCL	91
toluene-d ₈	76	76	97	64	100
bromofluorobenzene	77	77	111	87	98

Table 2. Analytical Results for Data Package H5C240202, Continued.

Compounds	VT0320055B Tenax DF = 1	VT0320055B Anasorb DF =	VT0320055C Tenax DF = 1	VT0320055C Anasorb DF = 1	VT0320055 A-C Cond DF = 1000
	µg				µg/L
acetone	0.52	0.23	0.67	0.20	ND
acetonitrile	ND	ND	ND	ND	ND
acrylonitrile	ND	ND	ND	ND	ND
benzene	0.028	ND	0.049	ND	ND
bromomethane	0.024 J,B	0.013 J,B	0.016 J,B	0.014 J,B	3500 J
2-butanone	0.34	0.12	0.13	0.13	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	ND
chloromethane	2.3 E	4.0 E	0.96	4.8 E	ND
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND	2800 J,B
methylene chloride	0.11	0.18	0.13	0.070	91000
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	0.0058 J	0.0029 J	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	0.0060 J	0.0054 J	0.0036 J	0.0056 J	ND
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	48 OCL	81	60	94	95
1,2-dichloroethane-d ₄	51	80	62	92	96
toluene-d ₈	95	94	90	106	98
bromofluorobenzene	86	87	80	100	108

Table 2. Analytical Results for Data Package H5C240202, Continued.

Compounds	VT0320056A Tenax DF = 1	VT0320056A Anasorb DF = 1	VT0320056B Tenax DF = 1	VT0320056B Anasorb DF = 1	VT0320056C Tenax DF = 1
	µg				
acetone	0.74	0.25	0.63	0.21	0.58
acetonitrile	ND	ND	ND	ND	ND
acrylonitrile	ND	ND	ND	ND	ND
benzene	0.042	ND	0.038	ND	0.051
bromomethane	0.016 J,B	0.012 J,B	0.020 J,B	0.013 J,B	0.018 J,B
2-butanone	0.099 J	ND	0.095 J	ND	0.077 J
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	0.0055 J	ND	ND	ND	ND
chloromethane	1.9	3.6 E	2.3 E	5.1 E	1.4
1,2-dichloroethene (total)	0.012 J	ND	ND	ND	ND
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	ND	ND	ND	ND	ND
methylene chloride	4.8 E	24 E	0.21	1.4	0.12
tetrachloroethene	ND	0.0064 J	ND	ND	ND
toluene	ND	ND	ND	ND	0.0028 J
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	0.0048 J	0.0055 J	0.0058 J	0.0053 J	0.0036 J
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	76	100	45 OCL	111	53
1,2-dichloroethane-d ₄	77	101	47 OCL	113	55
toluene-d ₈	94	108	82	130 OCL	84
bromofluorobenzene	82	105	76	122	76

Table 2. Analytical Results for Data Package H5C240202, Continued.

Compounds	VT0320056C Anasorb DF = 1	VT0320056D Tenax DF = 200	VT0320056D Anasorb DF = 200	VT0320056 A-D Cond DF = 1000	VT032005MB Tenax DF = 1
	µg			µg/L	µg
acetone	0.16	ND	ND	ND	0.12 B
acetonitrile	ND	ND	ND	ND	ND
acrylonitrile	ND	ND	ND	ND	ND
benzene	ND	ND	ND	ND	ND
bromomethane	0.013 J,B	ND	ND	3800 J	ND
2-butanone	ND	ND	ND	ND	ND
carbon tetrachloride	ND	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND	ND
chloroform	ND	ND	ND	ND	0.0071 J
chloromethane	5.6 E	2.8 J,B	1.2 J,B	ND	ND
ethylbenzene	ND	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND	ND
iodomethane	ND	6.2 J,B	7.2 J,B	3400 J,B	ND
methylene chloride	0.079	ND	ND	160000	19 E
tetrachloroethene	ND	ND	ND	ND	ND
toluene	ND	ND	ND	ND	ND
trichloroethene	ND	ND	ND	ND	ND
vinyl chloride	0.0083 J	ND	ND	ND	ND
xylenes (total)	ND	ND	ND	ND	ND
Surrogates	% Recovery				
dibromofluoromethane	86	93	92	96	76
1,2-dichloroethane-d ₄	86	103	101	94	74
toluene-d ₈	108	77	78	98	93
bromofluorobenzene	99	80	81	108	88

Table 2. Analytical Results for Data Package H5C240202, Continued.

Compounds	VT032005MB Anasorb DF = 1	A-3397 MEDIA CHECK TENAX	A-3999 MEDIA CHECK ANASORB	VT032005MB Cond
	µg			µg/L
acetone	0.10 B	0.098 J,B	0.089 J,B	ND
acetonitrile	ND	ND	ND	ND
acrylonitrile	ND	ND	ND	ND
benzene	ND	ND	ND	ND
bromodichloromethane	0.0045 J	ND	ND	ND
bromomethane	ND	ND	ND	4600 J
2-butanone	ND	0.037 J	ND	ND
carbon disulfide	ND	ND	ND	520 J
carbon tetrachloride	ND	ND	ND	ND
chlorobenzene	ND	ND	ND	ND
chloroform	0.012 J	ND	ND	ND
chloromethane	ND	ND	ND	ND
ethylbenzene	ND	ND	ND	ND
2-hexanone	ND	ND	ND	ND
iodomethane	ND	ND	ND	3300 J,B
methylene chloride	32 E	0.047	0.028	320000
tetrachloroethene	ND	ND	ND	ND
toluene	0.0029 J,B	ND	ND	ND
trichloroethene	ND	ND	ND	ND
vinyl chloride	ND	ND	ND	ND
xylenes (total)	ND	ND	ND	ND
Surrogates	% Recovery			
dibromofluoromethane	90	83	89	95
1,2-dichloroethane-d ₄	80	76	81	93
toluene-d ₈	104	97	94	97
bromofluorobenzene	99	91	99	108

NOTE: With due consideration to the difficulties of the sample identification, there is every reason to question whether condensates are matched with the correct tube samples. When a high level of methylene chloride is observed in a condensate (i.e., a concentration >100000 µg/L), it would seem logical to find that condensate paired with Tenax tubes that show a high level of methylene chloride. Methylene chloride could be found in the condensate only after it had passed through and broken through paired Tenax tubes in the Method 0031 sampling train. The likelihood that methylene chloride would break through paired Tenax tubes and leave nothing on the sorbent is very small. Therefore, I find it questionable that condensate samples containing high levels of methylene chloride are correctly matched with sets of tubes that show NO methylene chloride on the Tenax tubes. The analyses are performed correctly, compounds are identified and quantitated correctly, but the pairing of tubes and condensates in the final data interpretation is questionable.

Results for Laboratory-Generated Method Blanks are shown in Table 3.

Table 3. Laboratory-Generated Method Blanks for Data Package H5C240202

Compound	Method Blank1 3/29/05	Method Blank2 3/29/05	Method Blank3 3/30/05	Method Blank4 3/30/05	Method Blank5 3/31/05
	µg				
acetone	ND ^a	0.11	ND	ND	ND
benzene	ND	0.0073 J	ND	ND	ND
bromoform	3.0 J ^b	ND	ND	ND	ND
bromomethane	1.9 J	ND	ND	ND	0.011 J
chloromethane	1.3 J	ND	ND	ND	ND
iodomethane	9.7 J	ND	0.60 J	9.8 J	ND
toluene	ND	0.0031 J	ND	ND	ND
Surrogate Compounds	% Recovery				
dibromofluoromethane	95	85	94	89	92
1,2-dichloroethane-d ₄	99	77	92	97	85
toluene-d ₈	81	88	99	78	93
bromofluorobenzene	83	91	110	79	80

^aND = Not Detected.

^b Estimated result. Result is less than Reporting Limit.

Laboratory Control Samples/Duplicates (LCS/LCSD) and Relative Percent Difference (RPD) are shown in Table 4. All recoveries and RPDs are within control limits.

Table 4. LCS/LCSD with Associated Method Blanks for Data Package H5C240202.

Compounds	LCS/LCSD % Recovery 3/09/05	RPD	LCS/LCSD % Recovery 3/29/05	RPD	LCS/LCSD % Recovery\3/ 30/05	RPD
benzene	96/96	0.22	106/103	3.5	103/106	2.6
chlorobenzene	95/95	0.35	94/89	5.8	105/105	0.020
1,1-dichloroethene	101/107	5.8	89/92	3.6	92/93	0.15
toluene	90/91	1.1	97/93	4.9	100/100	0.16
trichloroethene	99/99	0.20	113/114	0.39	99/103	3.4
Surrogate Compounds	% Recovery					
dibromofluoromethane	102/94		85/82		94/91	
1,2-dichloroethane-d ₄	105/98		73/71		89/89	
toluene-d ₈	88/82		93/93		105/101	
bromofluorobenzene	90/84		83/81		105/104	

Table 4. LCS/LCSD for Data Package H5C240202, Continued.

Compounds	LCS/LCSD % Recovery 3/31/05	RPD
benzene	86/87	1.3
chlorobenzene	75/76	0.94
1,1-dichloroethene	85/86	2.0
toluene	80/82	1.8
trichloroethene	90/95	5.2
Surrogate Compounds	% Recovery	
dibromofluoromethane	89/84	
1,2-dichloroethane-d ₄	81/76	
toluene-d ₈	87/84	
bromofluorobenzene	78/72	

Quality control parameters for the VOST analysis for Data Package H5C240202 are shown in Table 5.

Table 5. VOST Quality Control Parameters for Data Package H5C240202

Parameter	Comments
Initial Calibration (ICAL) (1/03/05)	Acceptable curve.
Initial Calibration (ICAL) (3/20/05)	Acceptable curve.
BFB Tune Check (12/20/04)	Within specifications
Bromofluorobenzene Tune Check (1/03/05)	Within specifications
BFB Tune Check (3/29/05)	Within specifications
BFB Tune Check (3/30/05)	Within specifications
BFB Tune Check (3/31/05)	Within specifications
BFB Tune Check (4/01/05)	Within specifications
Continuing Calibration Check (3/29/05)	Within specifications
Continuing Calibration Check (3/30/05)	Within specifications
Continuing Calibration Check (3/31/05)	Within specifications
Continuing Calibration Check (4/01/05)	Within specifications
Second Source Standard (1/03/05) (Volatiles Analysis)	Recoveries within control limits.
Second Source Standard (3/21/05) (Volatiles Analysis)	Recoveries within control limits

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H5C240363
VSL DM1200 LAW MACT 2A+2B M308
Allyl Alcohol (Method 308)**

Overall Assessment of Data Package H5C240363:

The overall quality of the data in the data package H5C240363 is excellent. Allyl alcohol should be considered a water-soluble volatile organic compound, rather than a semivolatile compound.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 23, 2005; the analytical data report is dated April 19, 2005, and signed by Richard J. Lafond, Project Manager.

Original Chain of Custody forms are included in the data package. Twenty-eight samples are listed on the Chain of Custody forms with “Mod. 308 (Allyl)” requested as the analysis. The Analytical Methods Summary cites SW-846 Method 8015B, “Nonhalogenated Organics Using GC/FID.”

The Project Narrative on pages 4-5 of Data Package H5C240363 provides a clearly written description of the modified Method 308 procedures used for the analysis, but does not refer to a STL-Knoxville SOP.

N.B. – Allyl alcohol has a boiling point of 97°C and would therefore be considered a volatile compound, rather than semivolatile.

The Sample Summary for Data Package H5C240363 is shown in Table 1.

Table 1. Sample Summary for Data Package H5C240363.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G60W0	001	OHMA0321051	3/21/05	3/30/05
G60W1	002	OHHA0321051	3/21/05	3/30/05
G60W2	003	OHHB0321051	3/21/05	3/30/05
G60W3	004	OHCA0321051	3/21/05	3/30/05
G60W4	005	OHCB0321051	3/21/05	3/31/05
G60W5	006	OHTA0321051	3/21/05	3/31/05
G60W6	007	OHTB0321051	3/21/05	3/31/05
G60W7	008	OHMA0317051	3/17/05	3/30/05
G60W8	009	OHMB0317051	3/17/05	3/30/05
G60W9	010	OHMA0321052	3/21/05	3/31/05
G60XA	011	OHMB0321052	3/21/05	4/03/05
G60XC	012	OHHA0321052	3/21/05	4/03/05
G60XD	013	OHHB0321052	3/21/05	4/03/05
G60XE	014	OHCA0321052	3/21/05	4/03/05
G60XF	015	OHCB0321052	3/21/05	4/03/05
G60XG	016	OHTA0321052	3/21/05	4/03/05
G60XH	017	OHTB0321052	3/21/05	4/03/05
G60XJ	018	OH032105RB	3/21/05	4/03/05
G60XL	019	OHMA0321053	3/21/05	4/04/05
G60XM	020	OHHA0321053	3/21/05	4/03/05
G60XN	021	OHHB0321053	3/21/05	4/03/05
G60XP	022	OHCA0321053	3/21/05	4/03/05
G60XQ	023	OHCB0321053	3/21/05	4/03/05
G60XR	024	OHTA0321053	3/21/05	4/04/05
G60XT	025	OHTB0321053	3/21/05	4/03/05
G60XV	026	OHTA032105MB	3/21/05	4/04/05
G60XW	027	OHTB032105MB	3/21/05	4/04/05
G60X2	028	S-12F-102A	3/22/05	4/04/05

Analytical results for the allyl alcohol samples in Data Package H5C240363 with Laboratory-Generated Method Blanks, Laboratory Control Sample/Duplicate (LCS/LCSD), and Matrix Spike/Duplicate (MS/MSD) are presented in Table 2.

Table 2. Analytical Results for Modified Method 308 Analysis for Allyl Alcohol in Data Package H5C240363.

Sample	Allyl Alcohol mg/L	Surrogate Recovery, %	RPD
OHMA0321051	69	98	
OHMA0321051 (DUP)	68	95	2.0 ^a
OHHA0321051	39	97	
OHHB0321051	56	87	
OHCA0321051	3.4	99	
OHCB0321051	3.0	102	
OHTA0321051	ND ^b	95	
OHTB0321051	ND	100	
OHMA0317051	13	90	
OHMB0318051	ND	96	
OHMA0321052	92	97	
OHMB0321052	39	93	
OHHA0321052	35	103	
OHHA0321052 (DUP)	33	99	6.1
OHHB0321052	41	106	
OHCA0321052	3.0	100	
OHCB0321052	1.8	92	
OHTA0321052	ND	99	
OHTB0321052	ND	100	
OH032105RB	ND	101	
OHMA0321053	64	95	
OHHA0321053	49	98	
OHHB0321053	34	102	
OHCA0321053	5.1	105	

Table 2. Analytical Results for Modified Method 308 Analysis for Allyl Alcohol in Data Package H5C240363, Continued.			
OHC0321053	2.1	92	
OHTA0321053	ND	103	
OHTB0321053	ND	99	
OHTA032105MB	ND	98	
OHTB032105MB	ND	112	
S-12F-102A	1200	97	
METHOD BLANK (LABORATORY)	ND	92	
LCS (3/30/05)	102% RECOVERY	92	
MS/MSD	123/114 % RECOVERY	101/96	
METHOD BLANK (LABORATORY)	ND	104	
LCS (4/03/05)	104 % RECOVERY	99	
MS/MSD	87/97 % RECOVERY	95/99	

^a RPD is calculated where duplicate analyses were performed.

^b ND = Not Detected.

For the Modified Method 308 analyses:

- The initial calibration curve for the GC (3/30/05), using the external standard technique at seven levels of concentration, showed correlation coefficients ≥ 0.995 ;
- A Method Detection Limit study was performed to demonstrate a statistically derived limit of detection (0.081 mg/L);
- The Continuing Calibration VerificationS (CCV) percent recovery value (3/31/05, 4/03/05, 4/04/05) were within target acceptance limits of 85 to 115%;
- Retention time windows were verified within the correct time intervals (samples were very clean, with no obvious chromatographic interferences);
- Duplicates for samples in this data package were in excellent agreement;
- Surrogate compound recoveries were uniformly very good;
- LCS/LCSD samples showed recoveries within control limits;
- MS/MSD samples showed recoveries within control limits.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H5C240366
VSL DM1200 LAW MACT 2A+2B 9056
Halide Ions

Overall Assessment of Data Package H5C240366:

Data package H5C240366 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. Samples were analyzed at very high dilutions because of matrix effects, according to standard laboratory practice.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 23, 2005; the analytical data report is dated April 15, 2005, and signed by Richard J. Lafond, Project Manager.

The Chain of Custody records list 14 samples highlighted with yellow, with “Halogens – Cl, F” analysis requested for all samples. All samples listed and highlighted on the Chain of Custody forms are included in the Sample Summary and reported in Data Package H5C240366. The samples were received (hand-delivered) at ambient temperature, with no custody seals. The Analytical Methods Summary lists SW-846 9056, “Determination of Inorganic Anions by Ion Chromatography.” The samples were analyzed for chloride and fluoride (per Test Plan) by ion chromatography using Standard Operating Procedure KNOX-WC-005 (based on SW-846 Methods 9056 and 9057).

The Sample Summary for Data Package H5C240366 is shown in Table 1.

Table 1. Sample Summary for Data Package H5C240366.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G60X7	001	FM0319051	3/19/05	4/01/05
G60X8	002	BM0319051	3/19/05	Cl, 4/06/05 F, 4/04/05
G600A	003	FT0319051	3/19/05	4/01/05
G600D	004	BT0319051	3/19/05	4/06/05
G600E	005	FM0319052	3/19/05	4/01/05
G600F	006	BM0319052	3/19/05	Cl, 4/06/05 F, 4/04/05
G600H	007	FT0319052	3/19/05	4/01/05
G600J	008	BT0319052	3/19/05	4/06/05
G600L	009	FM0319053	3/19/05	4/01/05
G600M	010	BM0319053	3/19/05	Cl, 4/06/05 F, 4/04/05
G600P	011	FT0319053	3/19/05	4/01/05
G600Q	012	BT0319053	3/19/05	4/06/05
G600R	013	BT032305MB	3/23/05	Cl, 4/04/05 F, 4/06/05
G600V	014	FT032305MB	3/23/05	4/01/05

Analytical results for these samples and the Laboratory-Generated Method Blanks are shown in Table 2. Sample results are reported as total μg . The dilution factor (DF) reported on the sample result form is actually the combination of factors required by the method to convert the anion reporting limit and method detection limit from $\mu\text{g/mL}$ to total μg .

The explanation for the high dilution factors, according to the data package Narrative, is:

Note also that impinger samples containing 0.1 N H_2SO_4 and 0.1 N NaOH typically display suppressed conductivity detector responses. This suppression is attributed to a matrix effect causing poor method performance and possibly giving unreliable data unless it is removed. Therefore, samples are progressively diluted in the laboratory to modify the matrix for an enhanced anion response. The samples are analyzed at increasing dilutions along with matrix spikes until matrix spikes are recovered from the sample within laboratory control limits.

The final dilution factor is reported with the analytical data in Table 2.

Table 2. Analytical Results Summary for Data Package H5C 240366.

Sample	Chloride, µg	DF	Fluoride, µg	DF
FM0319051	8340 J ^a	10940	13500	5470
BM0319051	ND ^b	6300	ND	3150
FT0319051	33900	10820	ND	5410
BT0319051	ND	7000	ND	3500
FM039052	ND	10360	15600	5180
BM0319052	ND	6800	ND	3400
FT0319052	65100	11200	ND	5600
BT0319052	6700	6700	ND	3350
FM0319053	10300 J	10380	12300	5190
BM0319053	ND	5800	ND	2900
FT0319053	48300	10760	ND	5380
BT0319053	ND	5500	ND	2750
BT032305MB	ND	100	ND	100
FT032305MB	ND	200	ND	200
(Laboratory) Method Blank (4/01/05)	ND	100	ND	100
(Laboratory) Method Blank (4/04/05)	ND	100	ND	100
(Laboratory) Method Blank (4/06/05)	ND	100	ND	100
LCS/LCSD (4/01/05)	99/102 % Recovery RPD = 2.4		94/98 % Recovery RPD = 3.3	
LCS/LCSD (4/04/05)	96/99 % Recovery RPD = 3.1		94/97 % Recovery RPD = 2.9	
LCS/LCSD (4/06/05)	94/100 % Recovery RPD = 5.6		92/96 % Recovery RPD = 4.4	
MS/MSD (4/01/05)	81/80 % Recovery RPD = 0.81		91/89 % Recovery RPD = 0.85	
MS/MSD (4/04/05)	77/77 % Recovery RPD = 0.20		98/99 % Recovery RPD = 0.64	
MS/MSD (4/06/05)	71 N ^c /71 N % Recovery RPD = 0.20		88/89 % Recovery RPD = 0.81	

^aEstimated result. Result is less than Reporting Limit.

^bND = Not Detected.

^cSpiked analyte recovery is outside stated control limits.

Samples reported as “ND” with high dilution levels were not re-analyzed at a lower dilution. Quality control results are shown in Table 3; all QC parameters were within control limits.

Table 5. Quality Control Summary for Data Package H5C240366.

QC Parameter	Date	All Parameters within Control Limits
Instrument ICS_1500		
Initial Calibration	2/10/05	6 levels of each analyte analyzed
Initial Calibration Verification	(2) 4/01/05 (2) 4/04/05 (2) 4/06/05	Yes Yes Yes
Initial Calibration Blank	4/01/05 4/04/05 4/06/05	Yes Yes Yes
Continuing Calibration Verification	(3) 4/01/05 (4) 4/04/05 (3) 4/06/05	Yes Yes Yes
Continuing Calibration Blank	(3) 4/01/05 (4) 4/04/05 (3) 4/06/05	Yes Yes Yes

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H5C240373
VSL DM1200 LAW MACT 2A+2B 0060
Metals

Overall Assessment of Data Package H5C240373:

Data package H5C240373 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. Laboratory blanks analyzed with the samples show a slight commonly observed level of metal contamination on the “clean” filters. The field blank shows additional background metals contamination.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 23, 2005; the analytical data report is dated April 25, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form, consisting of four pages, is included in the data package. The Chain of Custody form lists twenty-three samples highlighted in yellow, with “Metals” analysis (SW-846 0060) requested for 21 samples; two of the samples appear on the Chain of Custody forms with no analysis requested. Eighteen of these samples appear in the Sample Summary Table. The following analytes are specified:
Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn.

The Sample Summary for Data Package H5C240373 is shown in Table 1.

Table 1. Sample Summary for Data Package H5C240373.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G601P	001	NM0318051/5M0318051	3/18/05	4/15/05
G601Q	002	HM0318051	3/18/05	4/15/05
G601R	003	NM0318052/5M0318052	3/18/05	4/15/05
G601V	004	HM0318052	3/18/05	4/15/05
G601W	005	NM0318053/5M0318053	3/18/05	4/15/05
G601X	006	HM0318053	3/18/05	4/15/05
G6013	007	NT0318051/5T0318051	3/18/05	4/15/05
G6014	008	HT0318051	3/18/05	4/15/05
G6016	009	NT0318052/5T0318052	3/18/05	4/15/05
G6019	010	HT0318052	3/18/05	4/15/05
G602A	011	NT0318053/5T0318053	3/18/05	4/15/05
G602F	012	F-12F-21A	3/22/05	4/01/05
G602H	013	F-12F-104A	3/22/05	4/01/05
G602K	014	HT031205MB	3/23/05	4/15/05
G602P	015	NRB032205	3/23/05	4/15/05
G602W	016	HBLK032205RB	3/23/05	4/15/05
G602W	017	HT0318053	3/18/05	4/15/05
G63FL	018	NT032205MB	3/22/05	4/15/05

These samples were prepared and analyzed using STL Knoxville Standard Operating Procedure KNOX-MT-0006 which is based on EPA SW-846 Method 0060, "Determination of Metals in Stack Emissions" and Method 29, "Determination of Metals Emissions from Stationary Sources." The SW-846 Method 6010B as incorporated in STL Knoxville Standard Operating Procedure KNOX-MT-0007 is used to perform the final instrument analysis.

Analytical results for the samples of Data Package H5C240373 are shown in Table 2; the

Laboratory-Generated Method Blanks are shown in Table 3.

Table 2. Analytical Results Summary for Data Package H5C240373.

Element	NM0318051/ 5M031851	HM0318051	NM0318052/ 5M0318052	HM0318052	NM0318053/ 5M0318053
	µg				
antimony (Sb)	ND ^a G ^b	ND	ND G	ND	ND G
arsenic (As)	18.3	ND	11.2	ND	14.3
barium (Ba)	11.5 J ^c	ND	7.3 J	ND	11.7 J
cadmium (Cd)	2360 B ^d	0.56	1790 B	0.71	1830 B
chromium (Cr)	13100	0.93 J	10200	2.8	14600
copper (Cu)	96.3	ND	76.6	1.1 J	94.1
lead (Pb)	48.0	0.59 J	37.2	1.3	41.0
manganese (Mn)	10.8	0.34 J	7.1	0.45	11.5
nickel (Ni)	11.6	ND	8.7	0.49 J	10.7
selenium (Se)	13100 B	18.7 B	9980 B	19.1 B	13700 B
silver (Ag)	0.88 J	ND	ND	ND	ND
zinc (Zn)	3980 B	21.9 B	3330 B	35.6 B	4970 B

Continued

^a ND = Not Detected.

^b Elevated reporting limit. The reporting limit is elevated due to matrix interference.

^c Estimated result. Result is less than Reporting Limit.

^d Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Table 2. Analytical Results Summary for Data Package H5C240373, Continued.

Element	HM0318053	NT0318051/ 5T0318051	HT0318051	NT0318052/ 5T0318052	HT0318052
	µg				
antimony (Sb)	1.0 J	1.7 J	ND	1.5 J	ND
arsenic (As)	ND	1.2	ND	1.1	ND
barium (Ba)	0.32 J	5.5 J	ND	6.1 J	ND
cadmium (Cd)	0.56	1.6 B	0.40 B	2.3 B	0.25 B
chromium (Cr)	2.3	6.3	1.1	13.3	0.89 J
copper (Cu)	0.71 J	2.1 J	0.79 J	4.0	0.81 J
lead (Pb)	0.69 J	ND	0.76 J	ND	0.86 J
manganese (Mn)	0.82 J	2.5	0.94 J	2.9	0.61 J
nickel (Ni)	ND	11.3	ND	10.6	ND
selenium (Se)	19.4 B	37.0 B	10.6 B	31.2 B	40.3 B
silver (Ag)	ND	ND	ND	ND	ND
zinc (Zn)	21.2 B	24.7 B	27.6 B	34.0 B	44.6 B

Continued

Table 2. Analytical Results Summary for Data Package H5C240373, Continued.

Element	NT0318053/ 5T0318053	F-12F-21A	F-12F-104A	HT031205MB	NRB032205
	µg				
antimony (Sb)	1.3 J	ND G	ND G	ND	ND
arsenic (As)	0.88 J	ND G	ND G	ND	ND
barium (Ba)	5.5 J	20.5	23.0	ND	ND
cadmium (Cd)	1.8 B	566 B	559 B	0.079 B,J	0.12 B,J
chromium (Cr)	9.6	2750	2140	ND	ND
copper (Cu)	2.9	24.2	20.6	ND	ND
lead (Pb)	ND	6.2	5.5	ND	ND
manganese (Mn)	2.8	58.8	49.1	78.8	ND
nickel (Ni)	9.2	26.2	16.6	ND	ND
selenium (Se)	22.2 B	87.1 B	70.4 B	0.64 B,J	ND
silver (Ag)	ND	0.85 J	0.72 J	ND	ND
zinc (Zn)	29.3 B	14200 B	12600 B	11.9 B	ND

Table 2. Analytical Results Summary for Data Package H5C240373, Continued.

Element	HBLK032205RB	HT0318053	NT032205MB
	µg		
antimony (Sb)	ND	ND	ND
arsenic (As)	ND	ND	ND
barium (Ba)	ND	0.70 J	0.45 J
cadmium (Cd)	ND	0.082 J	0.30 B,J
chromium (Cr)	ND	0.55 J	1.1
copper (Cu)	ND	0.67 J	0.82 J
lead (Pb)	0.26 J	0.87 J	ND
manganese (Mn)	ND	0.69 J	1.4 J
nickel (Ni)	ND	0.50 J	1.4 J
selenium (Se)	ND	38.0 B	2.5 B
silver (Ag)	ND	ND	ND
zinc (Zn)	ND	31.3 B	4.4 B

Three Method Blanks were analyzed in conjunction with Data Package H5C240373. Samples labeled “Method Blank” are laboratory blanks generated by digestion of clean filters from the same batch as the filters used in the field. Consistent with results obtained in multiple laboratories, the “clean” filters show background levels of zinc, cadmium, and selenium.

Table 3. Analytical Results Summary for Blanks in Data Package H5C240373.

Element	(Laboratory) Method Blank1 4/01/05	(Laboratory) Method Blank2 4/15/05	(Laboratory) Method Blank 3 4/15/05
antimony (Sb)	ND ^a	ND	ND
arsenic (As)	ND	ND	ND
barium (Ba)	ND	ND	ND
cadmium (Cd)	ND	ND	0.055 B
chromium (Cr)	ND	ND	ND
copper (Cu)	ND	ND	ND
lead (Pb)	ND	ND	ND
manganese (Mn)	ND	ND	ND
nickel (Ni)	ND	ND	ND
selenium (Se)	ND	0.24 B	0.44 B
silver (Ag)	ND	ND	ND
zinc (Zn)	0.55 B ^b	ND	ND

^aND = Not Detected.

^b Method blank contamination. The associated method blank contains the target analyte at a reportable level.

A Laboratory Control Sample and Laboratory Control Samples/Duplicates associated with data package H5C240373 are shown in Table 4, with Relative Percent Difference (RPD). All parameters are within control limits.

Table 4. Laboratory Control Samples/Duplicates Associated with Data Package H5C240373.

Element	LCS % Recovery 4/1/05	LCS/LCSD#1 % Recovery 4/15/05	RPD	LCS/LCSD#2 % Recovery 4/15/05	RPD
antimony (Sb)	101	95/96	0.42	97/96	0.86
arsenic (As)	101	94/95	1.3	96/96	0.38
barium (Ba)	103	98/97	0.40	97/98	0.86
cadmium (Cd)	108	98/100	1.9	99/101	1.2
chromium (Cr)	106	98/100	1.6	99/99	0.58
copper (Cu)	101	97/97	0.55	96/97	0.09
lead (Pb)	103	96/97	1.7	97/97	0.66
manganese (Mn)	104	98/100	1.4	99/100	0.72
nickel (Ni)	101	95/97	1.8	97/94	0.27
selenium (Se)	99	91/92	1.2	93/93	0.03
silver (Ag)	101	95/95	0.10	96/94	2.6
zinc (Zn)	106	102/104	1.3	104/104	0.20

Quality control procedures are shown in Table 5; all QC parameters were within control limits, with exceptions as indicated.

Table 5. Quality Control Summary for Data Package H5C110203.

QC Parameter	Date	All Parameters within Control Limits
Initial Calibration	4/01/05 4/15/05	Yes Yes
Initial Calibration Verification	4/01/05 4/15/05	Yes Yes
Initial Calibration Blank (2 performed)	4/01/05 4/15/05	Yes Yes
Continuing Calibration Verification (7 CCVs performed) (11 CCVs performed)	4/01/05 4/15/05	Yes Yes
Detection Limit Standard	4/01/05 4/15/05	Yes Yes
Continuing Calibration Blank (7 CCBs performed) (11 CCBs performed)	4/01/05 4/15/05	Yes Yes
Interference Check Standards A, AB	4/01/05 4/15/05	Yes Yes
Serial Dilutions	4/01/05 4/15/05	Yes Yes

A matrix spike and a matrix spike duplicate were performed; all parameters were within control limits. By prior agreement with Dr. Matlack, the MS/MSD is not reported since all parameters are within control limits.

As previous data validation reports have shown, the Laboratory Information Management System (LIMS) in use at STL Knoxville shows problems with consistency in rounding: at times a numerical value that ends in 6666 is truncated, at other times the value is rounded correctly. Likewise, a value that ends in 3333 is occasionally rounded up. Since three instrumental values are averaged to produce a final quantitative value, these occurrences are relatively common and are shown in Table 6. These instances of erratic rounding occur only in a last decimal place; the effect on reported values is minimal.

Table 6. Examples of Erratic LIMS Rounding for Data Package H5C240373.

Element	Calculated	Reported	Element	Calculated	Reported
G601Q H5C240373-002			G601V H5C240373-004		
As	-0.00078666	-0.00078	Zn	0.35644333	0.35645
Se	0.18702666	0.18702	G6019 H5C240373-010		
Zn	0.21855333	0.21856	Se	0.40346333	0.40347
G6014 H5C240373-008			G602Q H5C240373-016		
Cr	0.01104333	0.01105	Ba	0.00204333	0.00205
Mn	0.00942333	0.00943	Mn	0.00118666	0.00118
Ag	-0.00008666	-0.00008	G601P H5C240373-001		
G602W H5C240373-017			Sb	-0.00151333	-0.00152
Zn	0.31262666	0.31262	G602A H5C240373-011		
G6016 H5C240373-009			Sb	0.01322666	0.01322
Se	0.31179333	0.31180	G602K H5C240373-014		
Ag	0.00150666	0.00150	Cd	0.079666	0.079
Zn	0.33973666	0.33973	Zn	0.11905333	0.11906
G602P H5C240373-015			G63FL H5C240373-018		
Sb	-0.00339666	-0.00339	Cd	0.305	0.30
As	0.0004666	0.00046	Ag	-0.00070333	-0.00071
G601R H5C240373-003			Zn	0.04362333	0.04363
Ba	0.07328666	0.07328	G601W H5C240373-005		
Ag	0.00625333	0.00626	Pb	0.41007666	0.41007

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H5C250320
VSL DM1200 LAW MACT TEST #2A+2B
Dioxins/Furans/PCBs

Overall Assessment of Data Package H5C250320:

Data package H5C250320 is of excellent quality, complete and clearly reported. The only weakness of the data package relates to documentation, with two key questions:

- Why were Method 0010 samples composited?
- How were samples prepared so that PCDD/F and PCB analyses could be done on the same sample?

These questions were resolved as indicated in the report. However, the weakness of the documentation has no impact on the quality of the data: the correct analyses were performed correctly to generate data of the indicated quality.

Analyses of these samples were performed by:

STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 23, 2005; the analytical data report is dated April 29, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form, consisting of ten pages, is included in the data package. The Chain of Custody form lists 52 samples for which the analysis requested is “Dioxins, Furans, PCBs.” Samples requesting the “Dioxins, Furans, PCBs” analysis on the Chain of Custody forms are highlighted in yellow. Samples are designated variously as “Filter,” “MeCl/Ace,” “Toluene,” and “XAD-2,” the components of the Method 0023A sampling train. The sample summary (Table 1) lists 11 samples, including a Media Check sample. Obviously compositing of samples has occurred, but there is no documentation of a reason for compositing or any indication of how the compositing has occurred.

According to additional information requested from/sent by R. Lafond:

The semivolatile organic sampling train components were prepared for field sampling, and were extracted using STL Knoxville Standard Operating Procedure KNOX-ID-0012, based on the following methods:

- *USEPA SW-846 0023A, “Sampling for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofuran Emissions from Stationary Sources;” and*
- *USEPA SW-846 0010, “Modified Method 5 Sampling Train.”*

Method 0010 trains for PCDD/Fs and PCBs - all components in one fraction: *The sampling trains were prepared as a combined extract for analysis. The particulate filter and front half of the filter holder, nozzle*

and probe solvent rinses, the XAD-2 resin trap and back half of the filter holder, coil condenser and connecting glassware solvent rinses were combined as one sample. An additional extract was prepared from the condensate, impinger contents and their related glassware solvent rinses. The additional extract was combined with equivalent aliquots of the extract from the other components for PCB analysis. The PCDD/Fs were analyzed in the filter/XAD fraction. PCDD/F analysis of the condensate fraction was not required.

PCDD/Fs and PCBs (combined filter, XAD and condensate): *The combined filter and XAD components were spiked with labeled PCDD/F and labeled PCB internal standards. The components were Soxhlet extracted with dichloromethane (DCM). The DCM extract was retained, while the components were further extracted with toluene. Equal aliquots of the DCM and toluene extracts were combined for PCDD/F analysis. The remaining DCM extract was used for the PCB analysis. The condensate and impinger rinses were combined in a separatory funnel and extracted with DCM. The Soxhlet and separatory funnel extracts were combined in equivalent aliquots for PCBs. The extracts were concentrated and cleaned as needed using column chromatography. Then the extract was further concentrated and recovery standards were added.*

PCDD/Fs: *The PCDD/F extracts were analyzed using STL Knoxville standard operating procedure KNOX-ID-0004, "Analysis of Polychlorinated Dioxins/Furans by High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS) Based on Methods 8290, 1613B, 0023A, and TO-9A." This is an isotope dilution analysis.*

PCBs: *The PCB extracts were analyzed using Knoxville standard operating procedure KNOX-ID-0013, "Analysis of PCB Isomers by Isotope Dilution HRGC/HRMS." This is an isotope dilution analysis.*

A detailed description of the analytical procedures is provided in the Narrative.

The Analytical Methods Summary of Data Package H5C250320 lists SW-846 0023A/8290 (0023A Airtrains 8290) and EPA-22 1668A (PCBs, HRGC/HRMS). The references include:

- SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, November 1986 and its updates;
- "Method 1668, Revision A, Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by HRGC/HRMS."

The Narrative includes a description of quality control parameters associated with the analyses and a detailed description of the HRMS analysis. Preparation of the samples is not addressed, hence the need for the supplemental information supplied by STL, above.

The Test Plan does not discuss compositing of sampling train components, or a combined PCDD/F/PCB analysis. The decision to composite the samples was made jointly by STL and Dr. Matlack in the course of preparation of the quote for the analysis; analysis of PCDD/Fs and PCBs on a single sample was performed by instruction of Dr. Matlack.

The Sample Summary for Data Package H5C250320, including a Media Check sample, is shown in Table 1.

Table 1. Sample Summary for Data Package H5C250320.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G63N7	001	DFT 031805 R1	3/18/05	PCB, 4/21/05 4/22/05 D/F, 4/19/05
G63PL	002	DFM 031905 R2	3/18/05	PCB, 4/22/05 D/F, 4/19/05 4/20/05
G63PQ	003	DFT 032205 R5	3/22/05	PCB, 4/21/05 4/22/05 D/F, 4/19/05 4/20/05
G63PW	004	DFT 032205 MB	3/22/05	PCB, 4/21/05 D/F, 4/18/05
G63PX	005	DFM 031805 R1	3/18/05	PCB, 4/22/05 D/F, 4/19/05 4/20/05
G63P4	006	DFT 031905 R2	3/18/05	PCB, 4/22/05 D/F, 4/19/05
G63P5	007	DFT 031905 R3	3/18/05	PCB, 4/22/05 D/F, 4/19/05
G63QD	008	MEDIA CHECK A-5000, A-5003	3/18/05	PCB, 4/21/05 D/F, 4/18/05
G68XV	009	DFB 032205RB	3/22/05	PCB, 4/21/05 D/F, 1/11/05
G6825	010	DFM 032205 R3	3/22/05	PCB, 4/22/05 D/F, 4/22/05
G683C	011	DFT 032205 R4	3/22/05	PCB, 4/22/05 D/F, 4/22/05

Analytical results for Method 1668A (PCB Analysis) including Laboratory-Generated Method Blank and LCS for Data Package H5C250320 are shown in Table 2.

Table 2. Analytical Results Summary for Method 1668A Analyses for Data Package H5C250320.

Compound	DFT 031805 R1	DFM 031905 R2	DFT 032205 R5	DFT 032205 MB	DFM 031805 R1
	ng/sample				
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	0.070 Q ^a ,J ^b	0.45 Q,J	1.1	0.055 J	0.57
3,4,4',5-tetrachlorobiphenyl (PCB 81)	ND ^c	ND	0.10 J	ND	0.12 J
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	0.41 J	0.77 Q,S ^d ,J	1.1	0.33 Q,J	0.62 Q,J
2,3,4,4',5-pentachlorobiphenyl (PCB114)	ND	ND	ND	ND	ND
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	0.86 J	1.7 J	2.8 J	0.79 Q	2.2 J
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	ND	ND	ND	ND	ND
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	ND	ND	ND	ND	ND
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	ND	ND	ND	0.057 Q,C,J	ND
2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	ND	ND	ND	0.057 Q,C,J	ND
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	ND	ND	ND	ND	ND
3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	ND	ND	ND	ND	ND
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	ND	ND	ND	ND	ND
Internal Standards	% Recovery				
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	80	77	79	84	75
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	85	78	83	86	80
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	72	46	72	74	72
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB114)	90	90	89	87	82
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	87	88	87	90	80
¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	83	69	84	94	78
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	75	81	72	68	70
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	88 C ^c	152 C ^{c*}	93 C	96 C	99 C
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	88 C	152 C [*]	93 C	96 C	99 C
¹³ C ₁₂ -2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	82	146	88	86	95
¹³ C ₁₂ -3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	80	125	73	76	87
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	67	70	68	79	73

Surrogate Compounds	% Recovery				
¹³ C ₁₂ -2,2',3,5',6-pentachlorobiphenyl (PCB 95)	103	121	98	98	108
¹³ C ₁₂ -2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	106	74	102	106	102
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	80	86	80	86	78

*Estimated maximum possible concentration (EMPC).

*Estimated result. Result is less than Reporting Limit.

*ND = Not Detected.

*Co-eluting isomer.

*S = Ion suppression.

*Surrogate recovery is outside stated control limits.

Table 2. Analytical Results Summary for Method 1668A Analyses for Data Package H5C250320, Continued.

Compound	DFT 031905 R2	DFT 031905 R3	Media Check A-5000, A-5003	DFB 032205 RB	DFM 032205 R3
	ng/sample				
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	0.10 J	0.64 Q,J	ND	ND	0.20 J
3,4,4',5-tetrachlorobiphenyl (PCB 81)	ND	ND	ND	ND	ND
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	ND	1.5 Q,,J	ND	ND	ND
2,3,4,4',5-pentachlorobiphenyl (PCB114)	ND	ND	ND	ND	ND
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	0.79 Q,J	ND	ND	ND	0.66 J
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	ND	ND	ND	ND	ND
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	ND	ND	ND	ND	ND
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	ND	ND	ND	ND	ND
2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	ND	ND	ND	ND	ND
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	ND	ND	ND	ND	ND
3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	ND	ND	ND	ND	ND
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	ND	Not Reported	ND	ND	ND
Internal Standards	% Recovery				
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	56	Not Reported	89	88	72
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	77	Not Reported	90	87	82
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	62	77	83	83	74
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB114)	82	94	96	96	87
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	81	90	82	95	83
¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	78	90	96	97	83
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	70	73	77	79	71
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	140 C	107 C	96 C	94 C	127 C
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	140 C	107 C	96 C	94 C	127 C
¹³ C ₁₂ -2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	130	98	90	88	123
¹³ C ₁₂ -3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	111	88	80	81	103
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	118	Not Reported	83	86	83

Surrogate Compounds	% Recovery				
¹³ C ₁₂ -2,2',3,5',6-pentachlorobiphenyl (PCB 95)	81	108	Not Reported	Not Reported	102
¹³ C ₁₂ -2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	89	108	Not Reported	Not Reported	100
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	63	89	96	95	82

Table 2. Analytical Results Summary for Method 1668A Analyses for Data Package H5C250320, Continued.

Compound	DFT 032205 R4	(Laboratory) Method Blank	LCS/LCSD	
	ng/sample		% Recovery	RPD
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	0.34 Q,J	ND	108/107	1.3
3,4,4',5-tetrachlorobiphenyl (PCB 81)	0.13 J	ND	101/102	0.73
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	0.47 J	ND	113/111	2.3
2,3,4,4',5-pentachlorobiphenyl (PCB114)	ND	ND	94/94	0.31
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	0.77 Q,J	ND	99/99	0.57
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	ND	ND	94/92	1.5
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	0.70 Q,J	ND	116/112	3.2
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	ND	ND	98/98	0.25
2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	ND	ND	98/98	0.25
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	ND	ND	105/105	0.020
3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	0.41 J	ND	112/107	4.6
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	0.14 J	ND	109/107	1.6
Internal Standards	% Recovery			
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	73	84	89/95	
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	78	85	88/91	
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	69	79	98/102	
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB114)	82	90	94/97	
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	77	87	98/103	
¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	77	92	74/82	
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	65	72	98/102	
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	85 C	97 C	98/102	
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	85 C	97 C	91/95	
¹³ C ₁₂ -2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	75	90	71/83	
¹³ C ₁₂ -3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	70	77	90/92	
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	57	86	91/95	
Surrogate Compounds	% Recovery			
¹³ C ₁₂ -2,4',6-Trichlorobiphenyl (PCB 32)	104	Not Spiked	Not Spiked	
¹³ C ₁₂ -2,2',3,5',6-pentachlorobiphenyl (PCB 95)	117	Not Spiked	Not Spiked	
¹³ C ₁₂ -2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	85	Not Spiked	Not Spiked	
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	77	82	95/95	

Analytical results for Dioxins/Furans (D/F) for these samples including Laboratory-Generated Method Blank for Data Package H5C250320 are shown in Table 3.

Table 3. Analytical Results Summary for Method 8290 Analyses for Data Package H5C250320.

Compound	DFT 031805 R1	DFM 031905 R2	DFT 032205 R5	DFT 032205 MB	DFM 031805 R1	DFT 031805 R2
	pg/sample					
2,3,7,8-tetrachlorodibenzodioxin	1.9 Q ^a , J ^b	ND	ND	2.5 Q,J	8.3 Q,J	ND
1,2,3,7,8-pentachlorodibenzodioxin	ND ^c	5.5 Q, J	2.9 Q, J	ND	7.4 Q, J	ND
1,2,3,4,7,8-hexachlorodibenzodioxin	ND	2.3 Q,J	5.1 Q,J	ND	5.5 J	ND
1,2,3,6,7,8-hexachlorodibenzodioxin	ND	6.7 Q, J	4.4 Q, J	ND	6.6 Q, J	1.7 J
1,2,3,7,8,9-hexachlorodibenzodioxin	2.3 Q, J	ND	7.4 J	ND	8.7 J	ND
1,2,3,4,6,7,8-heptachlorodibenzodioxin	9.9 Q,J	32 B,J	32 B, J	4.0 Q,B,J	28 B, J	9.5 Q,B, J
octachlorodibenzodioxin	36 Q, B ^d , J	99 B,J	50 B, J	19 B, J	76 B,J	52 B, J
2,3,7,8-tetrachlorodibenzofuran ^f	12 Q,J	30 Q	9.0 J	1.3 Q,J	37	3.1 Q,J
1,2,3,7,8-pentachlorodibenzofuran	6.7 Q, J	8.8 J	31 Q,J	1.1 Q,J	9.9 Q,J	2.9 Q,J
2,3,4,7,8-pentachlorodibenzofuran	4.8 Q,B, J	17 Q,B, J	49 Q,B,J	0.98 Q,B,J	17 B, J	ND
1,2,3,4,7,8-hexachlorodibenzofuran	18 J	8.5 Q, J	210	2.4 Q, J	11 J	4.0 Q, J
1,2,3,6,7,8-hexachlorodibenzofuran	9.7 Q, J	5.9 J	88 J	0.85 Q, J	5.3 Q,J	1.8 Q, J
2,3,4,6,7,8-hexachlorodibenzofuran	2.9 Q,B, J	3.2 Q,B, J	36 Q,B, J	ND	3.9 B,J	ND
1,2,3,7,8,9-hexachlorodibenzofuran	4.5 J	ND	11 Q,J	ND	ND	3.8 Q,J
1,2,3,4,6,7,8-heptachlorodibenzofuran	26 Q,B, J	10 Q,B, J	300 Q,B	3.3 Q,B,J	16 Q,B,J	8.2 Q,B, J
1,2,3,4,7,8,9-heptachlorodibenzofuran	15 J	ND	120	ND	9.3 J	3.3 Q, J
octachlorodibenzofuran	50 Q,B, J	12 B,J	230 Q, B	301 Q,B, J	28 B,J	18 Q,B, J
Internal Standards	% Recovery					
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	84	63	106	93	99	94
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	91	95	111	96	104	102
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	92	88	103	97	93	94
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	94	102	106	111	105	98
¹³ C-octachlorodibenzodioxin	81	102	94	106	99	94
¹³ C-2,3,7,8-tetrachlorodibenzofuran ^f	84	56	101	86	91	90
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	82	77	100	83	94	96

¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	86	78	97	89	91	87
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	89	79	99	100	97	92
Surrogate Compounds	% Recovery					
³⁷ Cl ₄ -2,3,7,8-tetrachlorodibenzodioxin	90	92	92	91	95	93
¹³ C-1,2,3,4,7,8-heptachlorodibenzodioxin	92	92	93	93	101	92
¹³ C-2,3,4,7,8-pentachlorodibenzofuran	96	103	95	98	98	92
¹³ C-1,2,3,4,7,8-hexachlorodibenzofuran	92	91	92	92	93	92
¹³ C-1,2,3,4,7,8,9-heptachlorodibenzofuran	89	61*	97	96	101	8

^aEstimated maximum possible concentration (EMPC).

^bEstimated result. Result is less than Reporting Limit.

^cND = Not Detected.

^dMethod blank contamination. The associated Method Blank contains the target analyte at a reportable level.

^e2,3,7,8-Tetrachlorodibenzofuran and ¹³C-2,3,7,8-tetrachlorodibenzofuran reported from confirmation column.

*Surrogate recovery is outside stated control limits.

Table 4. Analytical Results Summary for Method 8290 Analyses for Data Package H5C250320, Continued.

Compound	DFT 031905 R3	Media Check A-5000, A-5003	DFB 032205 RB	DFM 032205 R3	DFT 032205 R4	(Laboratory) Method Blank
	pg/sample					
2,3,7,8-tetrachlorodibenzodioxin	ND	ND	ND	6.2 Q,J	2.5 Q,J	ND
1,2,3,7,8-pentachlorodibenzodioxin	ND	ND	ND	7.3 J	ND	ND
1,2,3,4,7,8-hexachlorodibenzodioxin	ND	ND	ND	2.0 Q,J	ND	ND
1,2,3,6,7,8-hexachlorodibenzodioxin	ND	ND	ND	3.7 Q,J	ND	ND
1,2,3,7,8,9-hexachlorodibenzodioxin	ND	ND	ND	4.9 J	ND	ND
1,2,3,4,6,7,8-heptachlorodibenzodioxin	ND	ND	ND	15 Q,B,J	3.3 Q,B, J	0.85 Q,J
octachlorodibenzodioxin	36 B, J	6.6 B,J	ND	40 Q,B, J	16 Q,B,J	7.1 J
2,3,7,8-tetrachlorodibenzofuran ^F	14 Q,J	ND	ND	12 J	7.3 Q,J	ND
1,2,3,7,8-pentachlorodibenzofuran	5.2 Q, J	ND	ND	5.3 Q,J	2.4 Q,J	ND
2,3,4,7,8-pentachlorodibenzofuran	6.1 Q,B, J	1.2 Q,B, J	ND	7.6 Q,B,J	2.2 Q,B, J	1.4 Q,J
1,2,3,4,7,8-hexachlorodibenzofuran	15 J	ND	ND	10 Q,J	6.8 Q,J	ND
1,2,3,6,7,8-hexachlorodibenzofuran	6.4 Q, J	ND	ND	5.9 J	3.1 J	ND
2,3,4,6,7,8-hexachlorodibenzofuran	5.6 B, J	ND	ND	3.3 Q,B,J	ND	1.2 J
1,2,3,7,8,9-hexachlorodibenzofuran	ND	ND	ND	ND	2.4 Q,J	ND
1,2,3,4,6,7,8-heptachlorodibenzofuran	29 Q,B, J	ND	ND	18 Q,B,J	8.8 Q,B,J	1.4 Q,J
1,2,3,4,7,8,9-heptachlorodibenzofuran	13 J	ND	ND	3.9 J	2.3 Q,J	ND
octachlorodibenzofuran	20 Q,B, J	ND	ND	22 B,J	10 Q,B,J	3.4 Q,J
Internal Standards	% Recovery					
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	62	95	85	95	106	80
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	90	101	82	101	113	80
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	92	95	90	97	101	83
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	80	98	92	100	116	96
¹³ C-octachlorodibenzodioxin	63	81	80	89	109	91
¹³ C-2,3,7,8-tetrachlorodibenzofuran ^F	53	94	83	88	98	77
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	73	87	77	89	101	71
¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	90	85	85	88	97	77
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	77	92	88	92	105	86

Surrogate Compounds	% Recovery					
³⁷ Cl ₄ -2,3,7,8-tetrachlorodibenzodioxin	89	Not Spiked	Not Spiked	91	93	Not Spiked
¹³ C-1,2,3,4,7,8-heptachlorodibenzodioxin	91	Not Spiked	Not Spiked	93	97	Not Spiked
¹³ C-2,3,4,7,8-pentachlorodibenzofuran	100	Not Spiked	Not Spiked	98	95	Not Spiked
¹³ C-1,2,3,4,7,8-hexachlorodibenzofuran	86	Not Spiked	Not Spiked	92	93	Not Spiked
¹³ C-1,2,3,4,7,8,9-heptachlorodibenzofuran	79	Not Spiked	Not Spiked	96	101	Not Spiked

Results for the analysis of a Laboratory Control Sample with Duplicate (LCS/LCSD), Percent Recovery, and Relative Percent Difference (RPD) for the Method 8290 analysis in Data Package H4L100477 are shown in Table 5.

Table 5. LCS/LCSD Results Summary for Method 8290 Analyses for Data Package H5C250320.

Compound	LCS/LCSD % Recovery	RPD
2,3,7,8-tetrachlorodibenzodioxin	94/96	2.2
1,2,3,7,8-pentachlorodibenzodioxin	98/90	8.7
1,2,3,4,7,8-hexachlorodibenzodioxin	91/92	1.0
1,2,3,6,7,8-hexachlorodibenzodioxin	96/97	0.81
1,2,3,7,8,9-hexachlorodibenzodioxin	96/94	2.6
1,2,3,4,6,7,8-heptachlorodibenzodioxin	87 B ^a /88 B	1.0
octachlorodibenzodioxin	88 B/91 B	4.1
2,3,7,8-tetrachlorodibenzofuran	93/91	2.5
1,2,3,7,8-pentachlorodibenzofuran	98/100	2.0
2,3,4,7,8-pentachlorodibenzofuran	105 B/106 B	0.72
1,2,3,4,7,8-hexachlorodibenzofuran	103/100	2.9
1,2,3,6,7,8-hexachlorodibenzofuran	99/98	1.0
2,3,4,6,7,8-hexachlorodibenzofuran	109 B/110 B	0.90
1,2,3,7,8,9-hexachlorodibenzofuran	93/89	4.9
1,2,3,4,6,7,8-heptachlorodibenzofuran	89 B/87 B	1.6
1,2,3,4,7,8,9-heptachlorodibenzofuran	65 A ^b /66 A	2.4
octachlorodibenzofuran	33 A,B/34 A,B	5.1

Internal Standards	% Recovery
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	74/79
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	84/91
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	86/85
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	89/102
¹³ C-octachlorodibenzodioxin	73/93
¹³ C-2,3,7,8-tetrachlorodibenzofuran	72/80
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	74/78
¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	78/77
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	80/86

^aMethod blank contamination. The associated Method Blank contains the target analyte at a reportable level.

^bSpiked analyte recovery is outside stated control limits.

Notes from the Narrative for Data package H5C250320;

EPA Method 1668A

The recoveries of internal standards ¹³C-PCB-156 and ¹³C-PCB-157 were outside quality control limits (25 - 150%) at 152% for sample DFM 031905 R2. The high recovery was due to ion suppression on the associated recovery standard. The results are reported in accordance with the standard operating procedure. When properly applied, isotope dilution techniques produce results that are independent of internal standard recovery.

Due to severe ion suppression, sample DFM 031905 R2 was analyzed at a dilution of 1/10 for all congeners.

Due to severe ion suppression, the following samples were analyzed at a dilution of 1/10 for congeners in the penta and hexa groups:

DFT 031805 R1
 DFT 032205 R5
 DFM 031805 R1
 DFT 031805 R2
 DFT 031805 R3
 DFM 032205 R3
 DFT 032205 R4

Method 8290

The percent recoveries in the LCS/LCSD for the following analytes were outside QC limits of 70-130. The associated samples are air samples and re-extraction is not possible. Root cause is

unknown. Efforts are ongoing to determine the cause.

LCS	1,2,3,4,7,8,9-heptachlorodibenzofuran	65%
	Octachlorodibenzofuran	33%
LCSD	1,2,3,4,7,8,9-heptachlorodibenzofuran	66%
	Octachlorodibenzofuran	34%

The recovery of surrogate standard ^{13}C -1,2,3,4,7,8,9-heptachlorodibenzofuran in sample DFM 031905 R2 was 61%, below the lower acceptance criterion.

Quality control parameters for the PCDD/F and PCB analyses of Data Package H5C250320 are shown in Table 8.

Table 8. Quality Control Summary for Data Package H5C250320.

QC Parameter	Date	All Parameters within Control Limits?
Method 1668A (PCBs)		
PFK Tune Check	8/20/02	Yes; resolution documented before beginning initial calibration (ICAL)
PFK Tune Check	4/21/05	Yes
PFK Tune Check	4/22/05	Yes
ICAL	8/20-21/02	Yes
Second Source Standard Verification	10/28/03	Yes
Continuing Calibration Check	4/21/05	Yes
	4/22/05	Yes
System Blank	4/21/05	Yes
	4/22/05	Yes
	1/19/05	Yes
All analytes within SOP retention time criteria and both ions maximized within ± 2 seconds		
Ion abundance ratios for all labeled and unlabeled analytes within the specified control limits.		

Method 8290 (Dioxins/Furans)		
PFK Tune Check	11/08/04	Yes
PFK Tune Check	1/11/05	Yes
PFK Tune Check	4/18/05	Yes
PFK Tune Check	4/19/05	Yes
PFK Tune Check	4/20/05	Yes
PFK Tune Check	4/22/05	Yes
ICAL	11/08/04	Yes
ICAL (DB-225)	2/23/04	Yes
Continuing Calibration Check	4/18/05	Yes
Continuing Calibration Check	4/19/05	Yes
	4/20/05	Yes
	4/22/05	Yes
Continuing Calibration Check (Confirmation Column)	4/20/05	Yes
All 2378 isomers within the RRT limits specified and both ions maximized within ± 2 seconds.		
All non-2378 isomers were within established RT windows and both ions maximized within ± 2 seconds.		
Ion abundance ratios for all labeled and unlabeled analytes were within the control limits specified.		

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

Data Package H5C250330
VSL DM1200 LAW MACT TEST #2A+2B
Semivolatiles

Overall Assessment of Data Package H5C250330:

The overall quality of the data in the data package H5C250330 is very good. Because of the high concentrations of naphthalene in several of the samples, surrogate compounds were diluted to a level below the analytical range. However, surrogate recoveries were within the acceptable range on the Laboratory Control Samples, demonstrating that the analysis was in control. The surrogate compound recoveries outside the control limits were attributed to matrix effects arising from the interaction of the XAD-2 sorbent with the combustion matrix. Because of the matrix, most of the samples were analyzed at a high level of dilution. Extraneous peaks (non-target compounds) were observed in several of the chromatograms. In at least one sample, the extraneous peak was chromatographically saturated and suppressed signal level in portions of the chromatogram.

Analyses of these samples were performed by:

STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 23, 2005; the analytical data report is dated May 18, 2005, and signed by Richard J. Lafond, Project Manager.

A complete set of the original Chain of Custody forms is included in the data package. The Chain of Custody forms list 50 samples for Semivolatile Analysis; the samples are listed as:

- XAD-2;
- Filter;
- F¹/₂ 50/50; and
- B¹/₂ 50/50.

These samples were composited, producing 14 samples for the final analysis, according to the scheme described in the Narrative:

The sampling trains are prepared as two analytical fractions and the extracts from these fractions are combined into a single sample for analysis. The first fraction consists of the particulate filter and front half of the filter holder, nozzle and probe solvent rinses, XAD-2 resin trap and back half of the filter holder, coil condenser and connecting glassware solvent rinses. The second fraction includes the condensate, iminger contents and their related glassware solvent rinses.

The Sample Summary for Data Package H5C250330 is shown in Table 1; the table has fourteen entries, including a Media Check.

Table 1. Sample Summary for Data Package H5C250330.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G63TM	001	SVH 032205 R4	3/22/05	4/14/05
G63TW	002	SVC 032205 R4	3/22/05	4/14/05
G63TX	003	SVH 032205 R6	3/22/05	5/03/05
G63T0	004	SVC 032205 R6	3/22/05	5/09/05
G63T1	005	SVH 032205 R5	3/22/05	5/03/05
G63T5	006	SVC 032205 R5	3/22/05	5/03/05
G63T6	007	SVM 032205 R5	3/22/05	5/03/05
G63T7	008	SVT 032205 R5	3/22/05	5/09/05
G63T8	009	SVT 032205 MB	3/22/05	5/03/05
G63VH	010	S-12F-141A	3/22/05	4/04/05
G63VL	011	MEDIA A-3999, A-5002	3/22/05	5/03/05
G63XK	012	SVM 032205 R4	3/22/05	4/07/05
G68X1	013	SVB032205RB	3/22/05	5/09/05
G7AV6	014	SVT0322054	3/22/05	5/09/05

The semivolatile organic sampling train components were, at the direction of the client per quote, extracted and analyzed using STL Knoxville standard operating procedures KNOX-OP-0009 and KNOX-MS-0016, based on the following methods:

- SW-846 3542, “Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train)”
- SW-846 8270C, “Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS).”

The sampling trains are prepared as one analytical fraction: The particulate filter and front half of the filter holder, nozzle and probe solvent rinses, XAD-2 resin trap and back half of the filter holder, coil condenser, and connecting glassware solvent rinses are combined as a single sample. The combined sample components are spiked with the Method 8270C surrogates and Soxhlet extracted with methylene chloride. The extracts are concentrated to 1 mL and analyzed by

GC/MS.

Analytical results for this set of samples are presented in Table 2. Analytical results are accurately described in the original Narrative for Data Package H5C250330. The Laboratory-Generated Method Blanks are reported in Table 3 and the Laboratory Control Samples are reported in Table 4.

Table 2. Analytical Results Summary for Data Package H5C250330.

Compound	SVH 032205 R4 ^a DF = 1000	SVC 032205 R4 ^a DF = 5000	SVH 032205 R6 DF = 2000	SVC 032205 R6 DF = 40	SVH 032205 R5 DF = 2000	SVC 032205 R5 DF = 4000
	µg					
diethyl phthalate	ND ^b	ND	ND	ND	ND	ND
naphthalene	2900 J ^c	13000 J	59000	6100	54000	ND
nitrobenzene	ND	ND	ND	89 J	ND	ND
Surrogate Compounds	% Recovery					
2-fluorophenol	DIL ^d	DIL	DIL	DIL	DIL	DIL
phenol-d ₅	DIL	DIL	DIL	DIL	DIL	DIL
nitrobenzene-d ₅	DIL	DIL	DIL	DIL	DIL	DIL
2-fluorobiphenyl	DIL	DIL	DIL	DIL	DIL	DIL
2,4,6-tribromophenol	DIL	DIL	DIL	DIL	DIL	DIL
terphenyl-d ₁₄	DIL	DIL	DIL	DIL	DIL	DIL
¹³ C ₆ -naphthalene	DIL	DIL	DIL	DIL	DIL	DIL

^aSeveral analytes in this sample were not reportable because of interference from the sample matrix.

^bND = Not Detected.

^cEstimated result. Result is less than reporting limit.

^d The concentration is estimated or not reported due to dilution.

Table 2. Analytical Results Summary for Data Package H5C250330, Continued.

Compound	SVM 032205 R5 DF = 100	SVM 032205 R5 DF = 1000	SVT 032205 R5 DF = 5	SVT 032205 MB DF = 1	S-12F- 141A ^g DF = 15.2	S-12F- 141A DF = 152
	µg					
diethyl phthalate	ND	ND	ND	ND	ND	ND
4,6-dinitro-4-methylphenol	ND	ND	76 J	ND	410 J	ND
2,4-dinitrophenol	ND	ND	ND	ND	2000	ND
naphthalene	75000 E ^e	ND	ND	3.5 J	1500	ND
nitrobenzene	170000	170000 D ^f	4000	ND	32 J	ND
2-nitrophenol	ND	ND	40 J	ND	150	ND
4-nitrophenol	ND	ND	ND	ND	1500	ND
phenol	ND	ND	32 J	ND	ND	ND
Surrogate Compounds	% Recovery					
2-fluorophenol	DIL	DIL	77	64	DIL	DIL
phenol-d ₅	DIL	DIL	64	56	DIL	DIL
nitrobenzene-d ₅	DIL	DIL	122	71	DIL	DIL
2-fluorobiphenyl	DIL	DIL	146*	75	DIL	DIL
2,4,6-tribromophenol	DIL	DIL	81	86	DIL	DIL
terphenyl-d ₁₄	DIL	DIL	134*	85	DIL	DIL
¹³ C ₆ -naphthalene	DIL	DIL	130	81	DIL	DIL

^eEstimated concentration. Result concentration exceeds the calibration range.

^fResult was obtained from analysis of a dilution.

^{*}Surrogate recovery is outside stated control limits.

^gIn this sample, note the absence of detectable levels of phenol, with the appearance of nitrated compounds. This observation, coupled with the failure to recover the acid surrogates and the pre-spiked compound, suggest that the matrix was highly oxidizing, with high levels of NO_x.

Table 2. Analytical Results Summary for Data Package H5C250330, Continued.

Compound	MEDIA A-3999, A-5002 DF = 1	SVM 032205 R4 DF = 1000	SVM 032205 R4 DF = 2000	SVB 032205 RB DF = 2	SVT 0322054 DF = 1	SVT 0322054 DF = 100
	µg					
bis(2-ethylhexyl) phthalate	ND	ND		ND	150	ND
butyl benzyl phthalate	ND	ND		ND	16	ND
diethyl phthalate	ND	ND		ND	ND	ND
4,6-dinitro-4-methylphenol	ND	ND		ND	17 J	ND
2,4-dinitrophenol	ND	ND		ND	ND	ND
naphthalene	ND	250000 E	160000 D	14 J	2.0 J	ND
nitrobenzene	ND	ND		ND	11	ND
2-nitrophenol	ND	ND		ND	50	ND
4-nitrophenol	ND	ND		ND	ND	ND
phenol	ND	ND		ND	ND	ND
Surrogate Compounds	% Recovery					
2-fluorophenol	62	DIL	DIL	65	1.7*	DIL
phenol-d ₅	59	DIL	DIL	52	1.0*	DIL
nitrobenzene-d ₅	87	DIL	DIL	80	138*	DIL
2-fluorobiphenyl	72	DIL	DIL	62	ND	DIL
2,4,6-tribromophenol	80	DIL	DIL	58	0.0*	DIL
terphenyl-d ₁₄	78	DIL	DIL	98	1600*	DIL
¹³ C ₆ -naphthalene	NS ^g	DIL	DIL	NS	92	DIL

^gNS = Not Spiked.

Table 3. Method Blanks for Data Package H5C250330.

Compounds	(Laboratory) Method Blank1	(Laboratory) Method Blank2	(Laboratory) Method Blank3
	µg		
bis(2-ethylhexyl) phthalate	ND ^a	ND	ND
butyl benzyl phthalate	ND	ND	ND
diethyl phthalate	ND	ND	ND
4,6-dinitro-4-methylphenol	ND	ND	ND
2,4-dinitrophenol	ND	ND	ND
naphthalene	ND	ND	ND
nitrobenzene	ND	ND	ND
2-nitrophenol	ND	ND	ND
4-nitrophenol	ND	ND	ND
phenol	ND	ND	ND
Surrogate Compounds	% Recovery		
2-fluorophenol	56	80	73
phenol-d ₅	62	83	79
nitrobenzene-d ₅	63	93	84
2-fluorobiphenyl	67	92	84
2,4,6-tribromophenol	61	105	90
terphenyl-d ₁₄	76	95	82

^aND = Not Detected.

Table 4. Laboratory Control Samples/Laboratory Control Sample Duplicates (LCS/LCSD) for Data Package H5C250330 with RPD

Compounds	LCS/LCSD1 % Recovery	RPD	LCS/LCSD2 % Recovery	RPD	LCS/LCSD3 % Recovery	RPD
acenaphthene	82/84	2.4	84/86	205	79/85	7.3
4-chloro-3-methylphenol	91/45*	68*	92/94	1.9	88/95	7.2
2-chlorophenol	80/55*	37*	87/89	2.4	83/92	10
1,4-dichlorobenzene	82/80	1.6	85/88	2.8	80/86	7.0
2,4-dinitrotoluene	101/106	4.8	103/105	1.9	98/107	8.3
4-nitrophenol	76/19*	120*	97/102	5.0	89/98	10
N-nitrosodi- <i>n</i> -propylamine	81/83	2.4	84/85	1.9	85/93	9.0
pentachlorophenol	94/49*	64*	93/93	0.43	90/98	8.5
phenol	82/38*	75*	85/86	0.93	84/90	7.0
pyrene	93/96	3.2	92/94	2.5	88/94	6.6
1,2,4-trichlorobenzene	86/83	3.6	90/90	0.55	80/86	7.6
Surrogate Compounds	% Recovery					
2-fluorophenol	68/29*		83/81		77/81	
phenol-d ₅	75/35*		82/82		80/85	
nitrobenzene-d ₅	91/87		92/93		89/96	
2-fluorobiphenyl	88/87		89/91		86/89	
2,4,6-tribromophenol	101/89		98/97		97/105	
terphenyl-d ₁₄	90/94		89/90		89/94	

Notes from the Project narrative for Data Package H5C250330

The laboratory control sample duplicate results for LCS/LCSD1 were outside control limits for several analytes. However, re-extraction and reanalysis of the associated samples were not possible since the entire sample was consumed during extraction. The associated laboratory control sample and the blank had acceptable recoveries.

Sample SVC 032205 R5 built up pressure after being extracted. Most of the extract for the sample was lost when the high pressure caused the sample vial to break. One internal standard recovery for this sample was outside control limits. However, the sample was bracketed by acceptable runs, indicating that a sample matrix effect is likely to be responsible for the internal standard criteria not being met.

The concentration of naphthalene in samples SVM 032205 R5 and SVM 032205 R4 exceeded the calibration range of the instrument. The sample was analyzed at a dilution to bring the concentration of the compound into the instrument calibration range. The results for both analyses are reported in order to provide the lowest possible reporting limits.

All the other samples except SVT 032205 MB, MEDIA A-3999, A-5002 and SVT0322054 were reported with elevated reporting limits for all analytes due to the difficult sample matrix. A dilution was necessary prior to analysis, and the reporting limits were adjusted accordingly.

Sample S-12F-141A was reported with elevated reporting limits for all analytes due to the limited amount of sample received.

Sample SVT 032205 R5 was reported with elevated reporting limits for all analytes to reflect the sample split between 8270C and TCO/GRAV analyses.

The last internal standard, perylene- d_5 , was not found in samples SVH 032205 R4 and SVC 032205 R4. Both samples were analyzed at a 1:1000 dilution due to concern regarding sample matrix.

Internal standard perylene- d_5 was not found in sample S-12F-141A for the original analysis. The sample was reanalyzed at a 1:10 dilution and the internal standards were all within limits. Both sets of data were reported.

Internal standard and surrogate recoveries for the original analyses of sample SVT0322054 were outside QC limits. Internal standards acenaphthene- d_{10} and perylene- d_5 were not found. The sample was re-analyzed at a 1:100 dilution and all the internal standards were within limits with the exception of perylene- d_5 which was low. This sample was bracketed by acceptable runs, indicating that a sample matrix effect is responsible for the internal standard criteria not being met. The surrogates were quantitated against the internal standards that were outside QC limits. Both sets of data were reported.

Sample SVC 032205 R6 was analyzed at a 1:40 dilution. The last internal standard, perylene- d_5 , was not found in the sample. This sample was also analyzed at 1/5000 to report analytes associated with the last internal standard.

One internal standard recovery for sample SVT 032205 R5 was outside QC limits. However, the sample was bracketed by acceptable runs, indicating that a sample matrix effect is responsible for the internal standard criteria not being met. Surrogate recoveries for this sample were outside QC limits. However, re-extraction and reanalysis were not possible since the entire sample was consumed during extraction.

Quality Control

The Initial Calibration for these analyses was performed on April 6, 2005, in quadruplicate. The following observations are relevant to the Initial Calibration:

- DFTPP tune criteria were met;
- DDT breakdown was < 20% and benzidine tailing <3, and PCP tailing <5;
- Average response factors for the System Performance Check Compounds were >0.050;
- % Relative Standard Deviation (RSD) was <30% for the Calibration Check Compounds;
- Benz(a)anthracene had a %RSD of 15.3%;
- Indeno(1,2,3-cd)pyrene had a %RSD of 15.0%.

Additional ICALs were performed on 3/1/05, 4/13/05, 4/14/05, 4/18/05, and 4/20/05.

A second source standard was analyzed on 2/05/05, 3/02/05, 4/13/05, 4/14/05, 4/15/05, 4/18/05, 4/19/05, and 4/21/05 to verify the calibration; all recovery values were within the acceptable range.

Continuing Calibration Checks were performed on 4/04/05, 4/07/05, 4/27/05, 5/03/05, and 5/09/05.

Additional quality control observations are shown in Table 5.

Table 5. Additional Quality Control Observations for Data package H5C110227.

Sample	Observation	Comment
SVCX/SVCP/SVCF/SVCB0309051	Internal standard perylene-d ₁₂ has %DIFF = -81 The chromatogram shows a “humpogram” at long retention time.	Low signal level
SVTX/SVTP/SVTF/SVTB0309051	The surrogate 2-fluorobiphenyl is outside control limits. Internal standard perylene-d ₁₂ has %DIFF = -81 The chromatogram shows many non-target compounds.	Low signal level
SVCX/SVCP/SVCF/SVCB0309052	Internal standard acenaphthene-d ₁₀ has %DIFF = -60. Internal standard perylene-d ₁₂ has %DIFF = -100	
SVTX/SVTP/SVTF/SVTB0309052	Internal standard perylene-d ₁₂ has %DIFF = -63	Low signal level
SVCX/SVCP/SVCF/SVCB0309053	Internal standards acenaphthene-d ₁₀ chrysene-d ₁₂ perylene-d ₁₂ were not observed (%DIFF = -100) A HUGE chromatographically saturated non-target peak was observed in the chromatogram at ~6.40 min. Many compounds were “not reportable” due to the matrix.	
S-12E-20A	Several surrogates were outside control limits: 2-fluorophenol, phenol-d ₅ , and 2,4,6-tribromophenol. The ¹³ C ₆ -naphthalene pre-spike recovery was also outside control limits. Nitrated target compounds (phenolics) were observed.	The oxidizing matrix with high levels of NO _x was responsible for very low recoveries and nitration of phenolic compounds.
Method Blank #2	A huge peak was observed eluting near perylene-d ₁₂ .	This peak could be due to carryover from another sample.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H5C250349
VSL DM1200 LAW MACT TEST #2A+2B
Semivolatiles, Dioxins/Furans**

Overall Assessment of Data Package H5C250349:

The overall quality of the data in Data Package H5C250349 is very good. Because of the high concentrations of naphthalene in some of the samples, surrogate compounds were diluted to a level below the analytical range. However, surrogate recoveries were within the acceptable range on the Laboratory Control Samples, demonstrating that the analysis was in control. The surrogate compound recoveries outside the control limits were attributed to matrix effects arising from the interaction of the XAD-2 sorbent with the combustion matrix. Because of the matrix, most of the samples were analyzed at a high level of dilution. Dioxin/Furan analysis was also performed on several of the samples at a high level of quality, although the usual complete descriptive material for the Dioxin/Furan analysis was not included in the data package, nor was the documentation describing the preparation of a single Method 0010 train sample for both semivolatiles and dioxin/furan analysis.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 23, 2005; the analytical data report is dated May 23, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form is included in the data package. The Chain of Custody forms list 12 samples for Semivolatile Analysis; the samples are listed as:

- 50/50;
- Filter;
- Toluene; and
- Condensate.

These samples were composited, producing 3 samples for the final analysis, according to the scheme described in the Narrative:

The sampling trains are prepared as one analytical fraction: The particulate filter and front half of the filter holder, nozzle and probe solvent rinses, XAD-2 resin trap and back half of the filter holder, coil condenser and connecting glassware solvent rinses are combined as a single sample.

The Chain of Custody forms provided do not list the XAD-2 components of the Method 0010 sampling trains. These components appear on another Chain of Custody form, not provided with Data Package H5C250349. A note on the receipt anomaly checklist says:

3/29/05

Revised COCs included two XAD samples listed. These XADs were not assigned to any lot because they originally did not have a COC listing.

The Sample Summary for Data Package H5C250349 is shown in Table 1; the table has three entries, including a Media Check.

Table 1. Sample Summary for Data Package H5C250349.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G63X4	001	SVM 032205 R6	3/22/05	SVOC, 4/28/05 D/F, 4/14/05
G63X7	002	SVT 032205 R6	3/22/05	SVOC, 5/09/05 D/F, 4/14/05
G63X8	003	MEDIA CHECK A-5001, A-5004	3/22/05	SVOC, 5/03/05 D/F, 4/13/05

The semivolatile organic sampling train components were, at the direction of the client per quote, extracted and analyzed using STL Knoxville standard operating procedures KNOX-OP-0009 and KNOX-MS-0016, based on the following methods:

- SW-846 3542, “Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train)”
- SW-846 8270C, “Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS).”
- 0023A Airtrains 8290.

The sampling trains are prepared as one analytical fraction: The particulate filter and front half of the filter holder, nozzle and probe solvent rinses, XAD-2 resin trap and back half of the filter holder, coil condenser, and connecting glassware solvent rinses are combined as a single sample. The combined sample components are spiked with the Method 8270C surrogates and Soxhlet extracted with methylene chloride. The extracts are concentrated to 1 mL and analyzed by GC/MS.

The additional information was supplied by STL:

Method 0010 trains for PCDD/Fs – all components in one fraction: The sampling trains were prepared as a combined extract for analysis. The particulate filter and front half of the filter holder, nozzle and probe

solvent rinses, the XAD-2 resin trap and back half of the filter holder, coil condenser and connecting glassware solvent rinses were combined as one sample. An additional extract was prepared from the condensate, impinger contents and their related glassware solvent rinses. The additional extract was combined with equivalent aliquots of the extract from the other components for semivolatile analysis. The PCDD/Fs were analyzed in the filter/XAD fraction. PCDD/F analysis of the condensate fraction was not required.

Analytical results for the semivolatile component of this set of samples, including the laboratory-generated Method Blank, are presented in Table 2. Analytical results for the PCDD/PCDF component of this set of samples, including the Laboratory-Generated Method Blank, are presented in Table 3. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) results are reported in Table 4 for semivolatiles and Table 5 for PCDD/PCDFs.

Table 2. Analytical Results Summary for Semivolatiles, Including Laboratory-Generated Method Blank, in Data Package H5C250349.

Compound	SVM 032205 R6 DF = 10	SVM032205 R6 DF = 1000	SVT 032205 R6 DF = 5	MEDIA CHECK A-5001, A-5004	(Laboratory) Method Blank 4/28/05
	µg				
4,6-dinitro-2-methylphenol	160 J ^a		150 J	ND	ND
di- <i>n</i> -octyl phthalate	48 J		ND	ND	ND
2-methylphenol	ND ^b		120	ND	ND
naphthalene	63000 E ^c	140000 D ^c	ND	ND	ND
nitrobenzene	240		ND	ND	ND
2-nitrophenol	350		ND	ND	ND
4-nitrophenol	180 J		ND	ND	ND
phenol	62 J		29 J	ND	ND
Surrogate Compounds	% Recovery				
2-fluorophenol	74	DIL ^f	91	65	55
phenol-d ₅	74	DIL	75	62	45
nitrobenzene-d ₅	151 ^d	DIL	90	90	64
2-fluorobiphenyl	70	DIL	108	83	68
2,4,6-tribromophenol	63	DIL	70	72	73
terphenyl-d ₁₄	82	DIL	90	78	68
¹³ C ₆ -naphthalene	52	DIL	86	NS ^g	NS

^aEstimated result. Result is less than Reporting Limit.

^bND = Not Detected.

^cEstimated result. Result concentration exceeds the calibration range.

^dSurrogate recovery is outside stated control limits.

^eResult was obtained from the analysis of a dilution.

^fThe concentration is estimated or not reported due to dilution.

^gNS = Not Spiked.

Table 3. Analytical Results Summary for Method 8290 Analyses, Including Laboratory-Generated Method Blank, for Data Package H5C250349.

Compound	SVM 032205 R6	SVT 032205 R6	Media Check A-5001, A-5004	(Laboratory) Method Blank
	pg/sample			
2,3,7,8-tetrachlorodibenzodioxin	5.4 Q ^a , J ^b	4.0 Q,J	ND	ND
1,2,3,7,8-pentachlorodibenzodioxin	7.8 J	ND ^c	43.8 Q, J	ND
1,2,3,4,7,8-hexachlorodibenzodioxin	3.1 Q, J	2.4 Q,J	ND	ND
1,2,3,6,7,8-hexachlorodibenzodioxin	5.5 Q, J	ND	ND	ND
1,2,3,7,8,9-hexachlorodibenzodioxin	4.6 Q, J	2.8 Q,J	10 J	4.3 J
1,2,3,4,6,7,8-heptachlorodibenzodioxin	17 B ^c , J	7.8 Q,B, J	12 Q,B,J	12 Q, J
octachlorodibenzodioxin	45 B, J	49 Q,B, J	37 B, J	ND
2,3,7,8-tetrachlorodibenzofuran	15 Q,J	5.2 Q,J	4.0 Q,J	ND
1,2,3,7,8-pentachlorodibenzofuran	6.5 Q, J	4.4 Q,J	2.9 Q, J	ND
2,3,4,7,8-pentachlorodibenzofuran	5.8 Q, J	2.9 Q,J	3.4 Q, J	ND
1,2,3,4,7,8-hexachlorodibenzofuran	6.3 Q, J	3.9 Q,J	4.0 Q, J	ND
1,2,3,6,7,8-hexachlorodibenzofuran	4.8 J	3.6 Q,J	4.2 J	ND
2,3,4,6,7,8-hexachlorodibenzofuran	2.5 Q,S ^d , J	2.9 Q,J	5.0 Q, J	ND
1,2,3,7,8,9-hexachlorodibenzofuran	3.4 Q, J	7.6 Q,J	7.5 Q,J	ND
1,2,3,4,6,7,8-heptachlorodibenzofuran	13 Q,B, J	14 Q,B, J	6.8 Q,B, J	2.4 Q,J
1,2,3,4,7,8,9-heptachlorodibenzofuran	3.5 Q, J	5.0 Q,J	6.7 Q,J	ND
octachlorodibenzofuran	13 Q,B,J	21 Q,B, J	23 B, J	5.4 Q, J
Internal Standards	% Recovery			
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	76	74	57	71
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	77	75	52	72
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	88	103	144 ^f	120
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	93	99	104	112
¹³ C-octachlorodibenzodioxin	71	92	65	83

Table 3. Analytical Results Summary for Method 8290 Analyses, Including Laboratory-Generated Method Blank, for Data Package H5C250349, Continued.				
¹³ C-2,3,7,8-tetrachlorodibenzofuran	57	67	56	67
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	65	66	45	58
¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	74	92	126	104
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	69	88	118	108
Surrogate Compounds	% Recovery			
³⁷ Cl ₄ -2,3,7,8-tetrachlorodibenzodioxin	89	84	NS ^g	NS
¹³ C-1,2,3,4,7,8-heptachlorodibenzodioxin	98	89	NS	NS
¹³ C-2,3,4,7,8-pentachlorodibenzofuran	100	98	NS	NS
¹³ C-1,2,3,4,7,8-hexachlorodibenzofuran	85	84	NS	NS
¹³ C-1,2,3,4,7,8,9-heptachlorodibenzofuran	84	82	NS	NS

^aQ = Estimated maximum possible concentration (EMPC).

^bEstimated result. Result is less than Reporting Limit.

^cMethod blank contamination. The associated Method Blank contains the target analyte at a reportable level.

^dIon suppression.

^eND = Not Detected.

^fSurrogate recovery is outside stated control limits.

^gNS = Not Spiked.

Table 4. Laboratory Control Samples/Laboratory Control Sample Duplicates (LCS/LCSD) for Data Package H5C250349 with RPD.

Compounds	LCS/LCSD % Recovery	RPD
acenaphthene	74/70	4.8
4-chloro-3-methylphenol	80/76	5.1
2-chlorophenol	74/72	2.8
1,4-dichlorobenzene	73/72	0.68
2,4-dinitrotoluene	91/86	6.2
4-nitrophenol	83/78	6.8
N-nitrosodi- <i>n</i> -propylamine	70/68	2.9
pentachlorophenol	84/78	6.8
phenol	72/70	2.1
pyrene	79/75	5.2
1,2,4-trichlorobenzene	75/73	2.7
Surrogate Compounds	% Recovery	
2-fluorophenol	70/68	
phenol-d ₅	70/67	
nitrobenzene-d ₅	82/78	
2-fluorobiphenyl	82/76	
2,4,6-tribromophenol	100/91	
terphenyl-d ₁₄	79/75	

Table 5. Analytical Results Summary for Method 8290 LCS/LCSD Analyses for Data Package H5C250349.

Compound	LCS/LCSD % Recovery	RPD
2,3,7,8-tetrachlorodibenzodioxin	90/87	3.7
1,2,3,7,8-pentachlorodibenzodioxin	92/93	0.97
1,2,3,4,7,8-hexachlorodibenzodioxin	90/87	3.3
1,2,3,6,7,8-hexachlorodibenzodioxin	98/95	2.6
1,2,3,7,8,9-hexachlorodibenzodioxin	73/75	2.5
1,2,3,4,6,7,8-heptachlorodibenzodioxin	85 B ^a /83 B	2.7
octachlorodibenzodioxin	94 B/91 B	3.3
2,3,7,8-tetrachlorodibenzofuran	88/89	0.68
1,2,3,7,8-pentachlorodibenzofuran	99/101	2.4
2,3,4,7,8-pentachlorodibenzofuran	108/105	3.1
1,2,3,4,7,8-hexachlorodibenzofuran	100/102	2.3
1,2,3,6,7,8-hexachlorodibenzofuran	99/99	0.69
2,3,4,6,7,8-hexachlorodibenzofuran	97/105	7.6
1,2,3,7,8,9-hexachlorodibenzofuran	71/77	8.7
1,2,3,4,6,7,8-heptachlorodibenzofuran	94 B/92 B	2.0
1,2,3,4,7,8,9-heptachlorodibenzofuran	80/81	0.55
octachlorodibenzofuran	90 B/87 B	3.8
Internal Standards	% Recovery	
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	76/86	
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	77/85	
¹³ C-1,2,3,6,7,8-hexachlorodibenzodioxin	113/111	
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	103/107	
¹³ C-octachlorodibenzodioxin	73/91	
¹³ C-2,3,7,8-tetrachlorodibenzofuran	69/77	
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	67/76	
¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	98/92	
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	98/99	

^aMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

Quality Control

Semivolatiles

Initial Calibrations for these analyses were performed on April 11, 2005, and April 14, 2005, in quadruplicate. The following observations are relevant to the Initial Calibrations:

- DFTPP tune criteria were met;
- DDT breakdown was < 20% and benzidine tailing <3, and PCP tailing <5;
- Average response factors for the System Performance Check Compounds were >0.050;
- % Relative Standard Deviation (RSD) was <30% for the Calibration Check Compounds.

Continuing Calibration (CCAL) checks were performed on 4/28/05, 5/02/05, 5/03/05, and 5/09/05. The following observations are relevant to the Continuing Calibration Checks:

- Continuing Calibration Checks were compared to the correct Initial Calibration;
- DFTPP tune criteria were met;
- DDT breakdown was < 20% and benzidine tailing <3, and PCP tailing <5;
- Average response factors for the System Performance Check Compounds were >0.050;
- % Relative Standard Deviation (RSD) was <30% for the Calibration Check Compounds

A second source standard was analyzed on 4/11/05, 4/14/05, 4/15/05 and 4/20/05 to verify the calibration; all recovery values were within the acceptable range.

Dioxins/Furans

Initial Calibration was performed on 11/08/04 and met all technical specifications.

The Continuing Calibrations on 4/12/05, 4/13/05 and 4/14/05 met all technical specifications.

Additional quality control observations are shown in Table 5.

Table 5. Additional Quality Control Observations for Data package H5C110227.

Sample	Observation	Comment
SVCX/SVCP/SVCF/SVCB0309051	Internal standard perylene-d ₁₂ has %DIFF = -81 The chromatogram shows a “humpogram” at long retention time.	Low signal level
SVTX/SVTP/SVTF/SVTB0309051	The surrogate 2-fluorobiphenyl is outside control limits. Internal standard perylene-d ₁₂ has %DIFF = -81 The chromatogram shows many non-target compounds.	Low signal level
SVCX/SVCP/SVCF/SVCB0309052	Internal standard acenaphthene-d ₁₀ has %DIFF = -60. Internal standard perylene-d ₁₂ has %DIFF = -100	
SVTX/SVTP/SVTF/SVTB0309052	Internal standard perylene-d ₁₂ has %DIFF = -63	Low signal level
SVCX/SVCP/SVCF/SVCB0309053	Internal standards acenaphthene-d ₁₀ chrysene-d ₁₂ perylene-d ₁₂ were not observed (%DIFF = -100) A HUGE chromatographically saturated non-target peak was observed in the chromatogram at ~6.40 min. Many compounds were “not reportable” due to the matrix.	

S-12E-20A	Several surrogates were outside control limits: 2-fluorophenol, phenol-d ₅ , and 2,4,6-tribromophenol. The ¹³ C ₆ -naphthalene pre-spike recovery was also outside control limits. Nitrated target compounds (phenolics) were observed.	The oxidizing matrix with high levels of NO _x was responsible for very low recoveries and nitration of phenolic compounds.
Method Blank #2	A huge peak was observed eluting near perylene-d ₁₂ .	This peak could be due to carryover from another sample.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H5C290299
VSL DM1200 LAW MACT TEST #2A+2B
TOE

Overall Assessment of Data Package H5C290299:

Data Package H5C290299 was narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. Although the data package is labeled as “TOE”, the contents include only a portion of the overall TOE analysis, namely Total Chromatographable Organics (TCO) and Gravimetric (GRAV) analysis. Other portions of the TOE analysis are reported in other data packages.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 23, 2005; the analytical data report is dated April 13, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form, consisting of three pages, is included in the data package. The Chain of Custody form lists nine samples highlighted in yellow, with “TOE - EPA 0040” analysis requested for three samples; the other six highlighted samples do not show any analysis requested.

The samples are identified on the Chain of Custody forms as:

- TOE XAD-2 RB;
- TOE filter RB;
- XAD-2;
- Filter;
- 50/50; and
- Condensate.

A note on the Receipt Anomaly Checklist states:

3/29/05

Additional COCs received by e-mail.

Per client instruction, analysis of TOX032205RB is not required; it is a duplicate of TOTX032205RB.

From Lot H5C250330 split sample TOTX032205RB for SVOC and TCO/GRAV, 50% each.

The Sample Summary lists three samples for analysis, plus a Media Check.

The Sample Summary for Data Package H5C290299 is shown in Table 1.

Table 1. Sample Summary for Data Package H5C290299.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G6806	001	TOT 0322105 R1	3/21/05	TCO, 4/11/05 GRAV, 4/12/05
G681H	002	TOTX032205RB	3/22/05	TCO, 4/11/05 GRAV, 4/12/05
G681P	003	TOTP032105 RB	3/21/05	TCO, 4/11/05 GRAV, 4/12/05
G6813	005 (sic)	MEDIA CHECK, A-5025, A-5027	3/22/05	TCO, 4/11/05 GRAV, 4/12/05

The semivolatile organic sampling train components were extracted and analyzed for Total Chromatographable Organics (TCO) and Total Gravimetric Organics (GRAV) using STL Knoxville Standard Operating Procedures KNOX-OP-0009 and KNOX-GC-0010, based on the following methods:

- SW-846 3542, “Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train)”;
- SW-846 8015B, “Nonhalogenated Organics Using GC/FID”;
- U.S. EPA “Guidance for Total Organics” (1966).

Analytical results for the TCO/GRAV samples of Data Package H5C110203 are shown in Table 2, with laboratory-generated Method Blanks and LCS/LCSD.

Table 2. Analytical Results Summary for TCO/GRAV in Data Package H5C290299.

Sample	TCO (mg)	Surrogate Recovery (%)	GRAV (mg)
TOT 032105 R1	3.7 B ^a	105	9.5
TOTX032205RB	0.46 B	79	ND
TOTP032105 RB	ND ^b	95	ND
MEDIA CHECK A-5026, A-5027	0.018 J ^c , B	88	ND
METHOD BLANK 4/03/05	0.043 J	70	ND
LCS/LCSD 4/11/05	86%/89% Recovery RPD = 4.1	92/88	101%/107% Recovery RPD = 5.4

Quality control procedures are shown in Table 3; all QC parameters were within control limits, with exceptions as indicated.

Table 4. Quality Control Summary for Metals/TCO/GRAV Data Package H5C290299.

QC Parameter	Date	All Parameters within Control Limits
TCO/GRAV		
TCO Initial Calibration (triplicate)	3/07/05	Yes
CCV1-9	3/08/05	Yes
CCV1-4	3/15/05	Yes
CCV1-7	3/16/05	Yes
CCV1-2	4/01/05	Yes
CCV1-2	4/08/05	Yes
CCV1-2	4/11/05	Yes
GRAV Balance Calibration	4/12/05	Yes
GRAV Audit Sample Analysis (triplicate)	4/12/05	Yes

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H5C290304
VSL DM1200 LAW MACT TEST#2A+2B
Unspeciated Volatile Organics**

Overall Assessment of Data Package H5C290304:

The overall quality of the data in the data package H5C290304 is excellent. The Total Organics (TOE) analysis consists of multiple components. Data Package H5C290304 consists of the Unspeciated Volatile Organics portion reported for one sample.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 23, 2005; the analytical data report is dated April 11, 2005, and signed by Richard J. Lafond, Project Manager.

Original Chain of Custody forms are included in the data package. The Chain of Custody form lists six samples. One sample is highlighted in yellow and marked with an asterisk, with the note: *This is the only sample logged with this lot. Sample label indicates 0040 analysis.* The Chain of Custody form shows that no analysis is requested for this sample.

The Sample Summary for H5C290304 is shown in Table 1.

Table 1. Sample Summary for Data Package H4L130168.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G682L	001	TOTC20321051	3/21/05	3/30/05

The Analytical Methods Summary acknowledges the appropriate portion of the Total Organics methods, as shown in Table 2:

Table 2. Analytical Methods Summary for Data Package H5C290304.

Parameter	Analytical Method ^a	STL Knoxville SOP
Unspeciated Volatile Organics	EPA Method 18 0040 COND	KNOX-GC-0016

^aReference: "Guidance for Total Organics," EPA/600/R-96/033, March 1996.

The Project Narrative provides a thorough description of the Unspeciated Volatile Organics portion of the Total Organics analysis.

Analytical results are reported in Table 3.

Table 3. Analytical Results for Total Organics Analysis in Data Package H5C290304.

Sample	Parameter	Result
TOTC20321051	Unspeciated Volatile Organics Surrogate (C ₈)	C ₄ : 56 µg/L C ₅ : 19 µg/L C ₆ : 1.9 µg/L C ₇ : ND ^a 101% Recovery

^aND = Not Detected.

The Quality Control data for the TOE analysis are summarized in Table 4.

Table 4. Quality Control Data for Data Package H4L130168.

Parameter	Value
Analysis: 0040 Condensate Analysis (Total Volatile Organics)	
Initial Calibration 12/9/04	Correlation coefficient ≥ 0.9995
Continuing Calibration 3/30/05	%D $\leq 15\%$
Method Blank	All analytes < Reporting Limits; surrogate recovery 100%
LCS/LCSD	All recoveries/RPDs within control limits 97/100, RPD 6.5 108/107, RPD 0.74 104/10, RPD 0.49
Surrogate Recoveries	Within control limits

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing includes both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

**Data Package H5C310196
VSL DM1200 MACT TESTING M308
Allyl Alcohol (Method 308)**

Overall Assessment of Data Package H5C310196:

The overall quality of the data in the data package H5C310196 is excellent. Allyl alcohol should be considered a water-soluble volatile organic compound, rather than a semivolatile compound.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 31, 2005; the analytical data report is dated April 19, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form is included in the data package. Ten samples are listed on the Chain of Custody forms with “Mod. 308 (Allyl)” requested as the analysis. The Analytical Methods Summary cites SW-846 Method 8015B, “Nonhalogenated Organics Using GC/FID.”

The Project Narrative on page 5 of Data Package H5C110117 provides a clearly written description of the modified Method 308 procedures used for the analysis, but does not refer to a STL-Knoxville SOP.

N.B. – Allyl alcohol has a boiling point of 97°C and would therefore be considered a volatile compound, rather than semivolatile.

The Sample Summary for Data Package H5C310196 is shown in Table 1.

Table 1. Sample Summary for Data Package H5C310196.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G7EG8	001	OHHB0308051	3/08/05	4/04/05
G7EHR	002	OHCB0308051	3/08/05	4/04/05
G7EH0	003	OHTB0308051	3/08/05	4/04/05
G7EH3	004	OHMB0308052	3/08/05	4/04/05
G7EJ4	005	OHCB0308052	3/08/05	4/04/05
G7EJ5	006	OHMB0308053	3/08/05	4/04/05
G7EJ6	007	OHTB0308053	3/08/05	4/04/05
G7EJ7	008	OHHB0309054	3/09/05	4/04/05
G7EJ8	009	OHCB0309054	3/09/05	4/04/05
G7EJ9	010	OHSPK033005A	3/30/05	4/04/05

Analytical results for the allyl alcohol samples in Data Package H5C310196 with Laboratory-Generated Method Blanks, Laboratory Control Sample/Duplicate (LCS/LCSD), and Matrix Spike/Duplicate (MS/MSD) are presented in Table 2.

Table 2. Analytical Results for Modified Method 308 Analysis for Allyl Alcohol in Data Package H5C310196.

Sample	Allyl Alcohol mg/L	Surrogate Recovery, %	RPD
OHHB0308051	33	98	
OHCB0308051	1.3	93	
OHTB0308051	ND ^a	99	
OHMB0308052	17	93	
OHCB0308052	1.2	90	
OHMB0308053	36	93	
OHMB0308053 (DUP)	34	87	4.6 ^b
OHTB0308053	ND	98	
OHHB0309054	0.084 J ^c	87	
OHCB0309054	1.3	106	
OHSPK033005A	13	86	
METHOD BLANK (LABORATORY)	ND	93	
LCS	91% RECOVERY	87	
MS/MSD	71/95 % RECOVERY	82/88	

^aND = Not Detected.

^bRPD is calculated where duplicate analyses were performed.

^cEstimated result. Result is less than Reporting Limit.

For the Modified Method 308 analyses:

- The initial calibration curve for the GC (4/04/05), using the external standard technique at seven levels of concentration, showed correlation coefficient ≥ 0.995 ;
- A Method Detection Limit study was performed to demonstrate a statistically derived limit of detection (0.081 mg/L);
- The Continuing Calibration Verification (CCV) percent recovery value (4/04/05) was within target acceptance limits of 85 to 115%;
- Retention time windows were verified within the correct time intervals (samples were very clean, with no obvious chromatographic interferences);
- Duplicates for samples in this data package were in excellent agreement;
- Surrogate compound recoveries were uniformly very good;
- LCS sample showed recoveries within control limits;
- MS/MSD samples showed recoveries within control limits.

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H5C310225
VSL DM1200 MACT TESTING
Dioxins/Furans/PCBs

Overall Assessment of Data Package H5C310225:

Data package H5C310225 is of excellent quality, complete and clearly reported. The only weakness of the data package relates to documentation, with two key questions:

- Why were Method 0010 samples composited?
- How were samples prepared so that PCDD/F and PCB analyses could be done on the same sample?

These questions were resolved as indicated in the report. However, the weakness of the documentation has no impact on the quality of the data: the correct analyses were performed correctly to generate data of the indicated quality.

Analyses of these samples were performed by:

STL Knoxville
 5815 Middlebrook Pike
 Knoxville, TN 37921

Samples were received at the STL laboratory facility on ; the analytical data report is dated January 24, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form, consisting of one page, is included in the data package. The Chain of Custody form lists 10 samples, with “Dioxins, Furans, PCBs” as the requested analysis for one sample. The sample summary (Table 1) lists 1 sample.

According to additional information requested from/sent by R. Lafond:

The semivolatile organic sampling train components were prepared for field sampling, and were extracted using STL Knoxville Standard Operating Procedure KNOX-ID-0012, based on the following methods:

- *USEPA SW-846 0023A, “Sampling for Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofuran Emissions from Stationary Sources;” and*
- *USEPA SW-846 0010, “Modified Method 5 Sampling Train.”*

Method 0010 trains for PCDD/Fs and PCBs - all components in one fraction: *The sampling trains were prepared as a combined extract for analysis. The particulate filter and front half of the filter holder, nozzle and probe solvent rinses, the XAD-2 resin trap and back half of the filter holder, coil condenser and connecting glassware solvent rinses were combined as one sample. An additional extract was prepared from the condensate, impinger contents and their related glassware solvent rinses. The additional extract was combined with equivalent aliquots of the extract from the other components for PCB analysis. The PCDD/Fs were analyzed in the filter/XAD fraction. PCDD/F analysis of the condensate fraction was not required.*

PCDD/Fs and PCBs (combined filter, XAD and condensate): The combined filter and XAD components were spiked with labeled PCDD/F and labeled PCB internal standards. The components were Soxhlet extracted with dichloromethane (DCM). The DCM extract was retained, while the components were further extracted with toluene. Equal aliquots of the DCM and toluene extracts were combined for PCDD/F analysis. The remaining DCM extract was used for the PCB analysis. The condensate and impinger rinses were combined in a separatory funnel and extracted with DCM. The Soxhlet and separatory funnel extracts were combined in equivalent aliquots for PCBs. The extracts were concentrated and cleaned as needed using column chromatography. Then the extract was further concentrated and recovery standards were added.

PCDD/Fs: The PCDD/F extracts were analyzed using STL Knoxville standard operating procedure KNOX-ID-0004, "Analysis of Polychlorinated Dioxins/Furans by High Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS) Based on Methods 8290, 1613B, 0023A, and TO-9A." This is an isotope dilution analysis.

PCBs: The PCB extracts were analyzed using Knoxville standard operating procedure KNOX-ID-0013, "Analysis of PCB Isomers by Isotope Dilution HRGC/HRMS." This is an isotope dilution analysis.

A detailed description of the analytical procedures is provided in the Narrative.

The Analytical Methods Summary of Data Package H5C310225 lists SW-846 0023A/8290 (0023A Airtrains 8290) and EPA-22 1668A (PCBs, HRGC/HRMS). The references include:

- SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," Third Edition, November 1986 and its updates;
- "Method 1668, Revision A, Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by HRGC/HRMS."

The Narrative includes a description of quality control parameters associated with the analyses and a detailed description of the HRMS analysis. Preparation of the samples is not addressed, hence the need for the supplemental information supplied by STL, above.

The Test Plan does not discuss compositing of sampling train components, or a combined PCDD/F/PCB analysis. The decision to composite the samples was made jointly by STL and Dr. Matlack in the course of preparation of the quote for the analysis; analysis of PCDD/Fs and PCBs on a single sample was performed by instruction of Dr. Matlack.

The Sample Summary for Data Package H5C310225 is shown in Table 1.

Table 1. Sample Summary for Data Package H5C310225.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G7EKW	001	S-12E-123A	3/18/05	PCB, 4/20/05 D/F, 4/14/05

Analytical results for Method 1668A (PCB Analysis) including Laboratory-Generated Method Blank and the LCS sample for Data Package H5C310225 are shown in Table 2.

Table 2. Analytical Results Summary for Method 1668A Analyses for Data Package H5C310225.

Compound	S-12E-123A	(Laboratory) Method Blank ^e	LCS1 ^e % Recovery
	ng/sample		
3,3',4,4'-tetrachlorobiphenyl (PCB 77)	ND ^a	ND	108
3,4,4',5-tetrachlorobiphenyl (PCB 81)	ND	ND	105
2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	ND	ND	108
2,3,4,4',5-pentachlorobiphenyl (PCB114)	ND	ND	94
2,3',4,4',5-pentachlorobiphenyl (PCB 118)	0.66 Q ^b , B ^c , J ^d	0.020 Q,J	95 B
2',3,4,4',5-pentachlorobiphenyl (PCB 123)	ND	ND	94
3,3',4,4',5-pentachlorobiphenyl (PCB 126)	ND	ND	109
2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	ND	ND	92 C
2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	ND	ND	92 C
2,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	ND	ND	98
3,3',4,4',5,5'-hexachlorobiphenyl (PCB169)	ND	ND	103
2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	ND	ND	96
Internal Standards	% Recovery		
¹³ C ₁₂ -3,3',4,4'-tetrachlorobiphenyl (PCB 77)	113	55	79
¹³ C ₁₂ -3,4,4',5-tetrachlorobiphenyl (PCB 81)	111	53	NS ^f
¹³ C ₁₂ -2,3,3',4,4'-pentachlorobiphenyl (PCB 105)	103	60	76
¹³ C ₁₂ -2,3,4,4',5-pentachlorobiphenyl (PCB114)	115	60	84
¹³ C ₁₂ -2,3',4,4',5-pentachlorobiphenyl (PCB 118)	112	60	81

¹³ C ₁₂ -2',3,4,4',5-pentachlorobiphenyl (PCB 123)	120	72	83
¹³ C ₁₂ -3,3',4,4',5-pentachlorobiphenyl (PCB 126)	93	77	71
¹³ C ₁₂ -2,3,3',4,4',5-hexachlorobiphenyl (PCB 156)	80 C ^c	44 C	92 C
¹³ C ₁₂ -2,3,3',4,4',5'-hexachlorobiphenyl (PCB 157)	80 C	44 C	92 C
¹³ C ₁₂ -2,3,3',4,4',5,5'-hexachlorobiphenyl (PCB 167)	76	40	83
¹³ C ₁₂ -3,3',4,4',5,5'-hexachlorobiphenyl (PCB 169)	64	37	70
¹³ C ₁₂ -2,3,3',4,4',5,5'-heptachlorobiphenyl (PCB 189)	83	56	86
Surrogate Compound	% Recovery		
¹³ C ₁₂ -2,3,3',5,5'-pentachlorobiphenyl (PCB 111)	102	64	NS

^aND = Not Detected.

^bEstimated maximum possible concentration (EMPC).

^cMethod Blank contamination. The associated Method Blank contains the target analyte at a reportable level.

^dEstimated result. Result is less than Reporting Limit.

^eCo-eluting isomer.

^fDue to samples in the QC batch unrelated to Data Package H5C310255, the Method Blank and the LCS were analyzed for internal standards and cleanup standards not on the target list; the compounds extraneous to this analysis are not reported in Table 2.

^gNS = Not Spiked.

Analytical results for Dioxins/Furans (D/F) for these samples including Laboratory-Generated Method Blank and LCS/LCSD for Data Package H5C310225 are shown in Table 3.

Table 3. Analytical Results Summary for Method 8290 Analyses for Data Package H5C310225.

Compound	S-12E-123A	(Laboratory) Method Blank	LCS/LCSD B% Recovery	RPD
	pg/sample			
2,3,7,8-tetrachlorodibenzodioxin	ND ^a	ND	96/101	4.6
1,2,3,7,8-pentachlorodibenzodioxin	ND	ND	99/100	1.6
1,2,3,4,7,8-hexachlorodibenzodioxin	ND	ND	94/99	5.4
1,2,3,6,7,8-hexachlorodibenzodioxin	ND	ND	91/93	2.3
1,2,3,7,8,9-hexachlorodibenzodioxin	ND	ND	90/96	5.5
1,2,3,4,6,7,8-heptachlorodibenzodioxin	48 Q ^b , J ^c	ND	92/94	1.6
octachlorodibenzodioxin	140 Q, B ^d , J	4.1 Q,J	93 B/99 B	6.6
2,3,7,8-tetrachlorodibenzofuran	ND	3.3 Q,J	103 B/97 B	6.1
1,2,3,7,8-pentachlorodibenzofuran	ND	ND	91/92	1.3
2,3,4,7,8-pentachlorodibenzofuran	ND	ND	95/97	2.4
1,2,3,4,7,8-hexachlorodibenzofuran	ND	ND	93/97	4.4
1,2,3,6,7,8-hexachlorodibenzofuran	ND	ND	90/93	3.8

2,3,4,6,7,8-hexachlorodibenzofuran	ND	ND	91/93	2.5
1,2,3,7,8,9-hexachlorodibenzofuran	ND	ND	91/93	2.0
1,2,3,4,6,7,8-heptachlorodibenzofuran	ND	ND	79/86	7.8
1,2,3,4,7,8,9-heptachlorodibenzofuran	ND	ND	91/97	6.4
octachlorodibenzofuran	72 B, J	2.3 Q, J	88 B/97 B	9.1
Internal Standards	% Recovery			
¹³ C-2,3,7,8-tetrachlorodibenzodioxin	74	51	44/65	
¹³ C-1,2,3,7,8-pentachlorodibenzodioxin	90	51	66/72	
¹³ C-1,2,3,4,7,8-hexachlorodibenzodioxin	88	61	84/87	
¹³ C-1,2,3,,6,7,8-hexachlorodibenzodioxin	98	70	93/94	
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzodioxin	87	63	81/84	
¹³ C-octachlorodibenzodioxin	73	57	60/64	
¹³ C-2,3,7,8-tetrachlorodibenzofuran	76	49	41/66	
¹³ C-1,2,3,7,8-pentachlorodibenzofuran	90	55	64/77	
¹³ C-2,3,4,7,8-pentachlorodibenzofuran	86	52	68/74	
¹³ C-1,2,3,4,7,8-hexachlorodibenzofuran	88	60	83/87	
¹³ C-1,2,3,6,7,8-hexachlorodibenzofuran	85	59	83/99	
¹³ C-2,3,4,6,7,8-hexachlorodibenzofuran	85	60	85/88	
¹³ C-1,2,3,7,8,9-hexachlorodibenzofuran	83	57	80/80	
¹³ C-1,2,3,4,6,7,8-heptachlorodibenzofuran	88	58	84/85	
¹³ C-1,2,3,4,7,8,9-heptachlorodibenzofuran	85	58	74/79	

^aND = Not Detected.

^bEstimated maximum possible concentration (EMPC)..

^cEstimated result. Result is less than Reporting Limit

^dMethod blank contamination. The associated Method Blank contains the target analyte at a reportable level.

Quality control parameters for the PCDD/F and PCB analyses of Data Package H5C310225 are shown in Table 4.

Table 4. Quality Control Summary for Data Package H5C310225.

QC Parameter	Date	All Parameters within Control Limits?
Method 1668A (PCBs)		
PFK Tune Check	8/20/02	Yes; resolution documented before beginning initial calibration (ICAL)
PFK Tune Check	4/19/05	Yes
PFK Tune Check	4/20/05	Yes

ICAL	8/20-21/02	Yes
Second Source Standard Verification	10/28/03	Yes
Continuing Calibration Check	4/20/05	Yes
System Blank	14/20/05	Yes
All analytes within SOP retention time criteria and both ions maximized within ± 2 seconds		
Ion abundance ratios for all labeled and unlabeled analytes within the specified control limits.		
Method 8290 (Dioxins/Furans)		
PFK Tune Check	12/16/04	Yes
PFK Tune Check	1/11/05	Yes
PFK Tune Check	12/20/04	Yes
PFK Tune Check	12/21/04	Yes
PFK Tune Check	1/23/05	Yes
PFK Tune Check	2/23/04	Yes
ICAL	12/16/04	Yes
ICAL (DB-225)	2/23/04	Yes
Continuing Calibration Check	4/14/05	Yes
Continuing Calibration Check	4/14/05	Yes
All 2378 isomers within the RRT limits specified and both ions maximized within ± 2 seconds.		
All non-2378 isomers were within established RT windows and both ions maximized within ± 2 seconds.		
Ion abundance ratios for all labeled and unlabeled analytes were within the control limits specified.		

Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants

The operational requirements for the River Protection Project – Waste Treatment Plant (RPP - WTP) Low Activity Waste (LAW) and High Level Waste (HLW) melter systems and the feed constituents impose a number of challenges to the off-gas treatment system. The system must be robust from the standpoints of operational reliability and minimization of maintenance. The system must effectively control and remove a wide range of solid particulate matter, acid mists and gases, and organic constituents arising from products of incomplete combustion of sugar and organics in the feed, to concentration levels below those imposed by regulatory requirements. The one-third scale HLW DM1200 Pilot Melter installed at the Vitreous State Laboratory (VSL) was equipped with a prototypical off-gas train to meet the needs for testing and confirmation of the performance of the baseline off-gas system design. The modified DM-1200 system can be reconfigured to enable tests to be performed using either the baseline HLW or LAW off-gas trains and will be used to perform off-gas emissions testing with both LAW and HLW simulants in the present work. Emissions testing include both “normal” and “challenge” WTP melter conditions in order to obtain data for the potential range of operating conditions for the WTP melters and off-gas components. Naphthalene was used for testing to represent semivolatile organics and allyl alcohol was used to represent volatile organics. Testing was performed to determine emissions of:

- Halides
- Metals
- Products of incomplete combustion (PICs)
- Dioxins/Furans
- Coplanar polychlorinated biphenyls (PCBs)
- CO_x and NO_x (monitored by Continuous Emission Monitors)
- Particle size distribution (PSD) of particulate matter discharged at the end of the off-gas train (samples not analyzed by STL).

This series of data validation reports addresses the High Level Waste (HLW) series of emissions tests.

H5D010175
CVA LOW LEVEL WASTE MACT TEST
Metals, TOE 0010

Overall Assessment of Data Package H5D010175:

Data package H5D010175 was complete, narrated clearly and completely, reviewed thoroughly, and the overall quality of this data package is excellent. Laboratory blanks analyzed with the samples show a slight commonly observed level of metal contamination on the “clean” filters. The field blank shows additional background metals contamination. The TOE analysis as reported does not represent the complete suite of TOE analyses; only the Total Chromatographable Organics portion of the TOE analysis was performed.

Analyses of these samples were performed by:

STL Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921

Samples were received at the STL laboratory facility on March 28, 2005; the analytical data report is dated April 29, 2005, and signed by Richard J. Lafond, Project Manager.

The original Chain of Custody form, consisting of one page, is included in the data package. The Chain of Custody form lists three samples highlighted in yellow, with “Metals” analysis (SW-846 0060) requested for one sample; three of these samples appear in the Sample Summary Table. The following analytes are specified for metals:

Sb, As, Ba, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, Zn.

“TCO” analysis is requested for two of the samples.

The Sample Summary for Data Package H5D010175 is shown in Table 1.

Table 1. Sample Summary for Data Package H5D010175.

Work Order Number	Sample Number	Client Sample Identification	Sampled Date	Analyzed Date
G7G1V	001	5RB032205 (R.BLK.)	3/22/05	Metals, 4/15/05
G7G10	002	5RB032205 (M. BLK.)	3/22/05	Metals, 4/15/05
G7G11	003	TOE (RUN 1 OF 1)	3/21/05	TCO, 4/11/05 GRAV, 4/12/05

These samples were prepared and analyzed for Metals using STL Knoxville Standard Operating Procedure KNOX-MT-0006 which is based on EPA SW-846 Method 0060, “Determination of Metals in Stack Emissions” and Method 29, “Determination of Metals Emissions from Stationary Sources.” The SW-846 Method 6010B as incorporated in STL Knoxville Standard Operating Procedure KNOX-MT-0007 is used to perform the final instrument analysis.

Analytical results for the samples of Data Package H5C110203 with the laboratory-generated Method Blank and the Laboratory Control sample are shown in Table 2. The semivolatile organic sampling train components were extracted and analyzed for Total Chromatographable Organics (TCO) and Total Gravimetric Organics (GRAV) using STL Knoxville Standard Operating Procedures KNOX-OP-0009 and KNOX-GC-0010, based on the following methods:

- SW-846 3542, “Extraction of Semivolatile Analytes Collected Using Method 0010 (Modified Method 5 Sampling Train)”;
- SW-846 8015B, “Nonhalogenated Organics Using GC/FID”;
- U.S. EPA “Guidance for Total Organics” (1966).

Analytical results for the TCO/GRAV samples of Data Package H5C110203 are shown in Table 3; the Laboratory-Generated Method Blanks are shown in Table 4.

Table 2. Analytical Results Summary for Data Package H5D010175.

Element	5RB032205 (Reagent Blank)	5RB032205 (Method Blank)	(Laboratory) Method Blank	LCS/LCSD % Recovery	RPD
	µg				
antimony (Sb)	0.72 B ^a	1.1 B	ND	97/97	0.08
arsenic (As)	0.72 B	0.81 B	ND	97/96	0.09
barium (Ba)	4.7 B	4.7 B	ND	98/98	0.54
cadmium (Cd)	ND	ND	ND	100/100	0.34
chromium (Cr)	0.69 B	0.58 B	ND	98/98	0.19
copper (Cu)	0.35 B	ND	ND	96/96	0.37
lead (Pb)	ND G ^b	ND G	ND	97/97	0.0
manganese (Mn)	1.2 B	1.0 B	ND	99/99	0.04
nickel (Ni)	6.5	7.6	ND	97/97	0.12
selenium (Se)	3.8	4.2	ND	95/95	0.03
silver (Ag)	ND ^c	ND	ND	94/94	0.04
zinc (Zn)	2.4	4.0	ND	104/104	0.01

^a Method blank contamination. The associated method blank contains the target analyte at a reportable level.

^b Elevated reporting limit. The reporting limit is elevated due to matrix interference.

^c ND = Not Detected.

Table 3. Analytical Results Summary for TCO/GRAV in Data Package H5D010175.

Sample	TCO (mg)	Surrogate Recovery (%)	GRAV (mg)
TOE (Run 1 of 1)	ND ^a	90	ND
Method Blank GC Semivolatiles	0.043 J ^b	70	ND
LCS/LCSD GC Semivolatiles	86/89 RPD = 4.1	92/88	101/107 RPD = 5.4

Quality control procedures are shown in Table 4; all QC parameters were within control limits, with exceptions as indicated.

Table 4. Quality Control Summary for Metals/TCO/GRAV Data Package H5D010175.

QC Parameter	Date	All Parameters within Control Limits
Metals		
Initial Calibration	4/15/05	Yes
Initial Calibration Verification ICV (Zn only)	4/15/05 4/18/05	Yes Yes
Initial Calibration Blank (3 performed)	3/06/05 3/21/05 3/22/05	Yes Yes Yes
Initial Calibration Blank (Zn only)	4/18/05	
Continuing Calibration Verification (12 CCVs performed)	4/15/05	Yes
Continuing Calibration Verification (Zn only) (9 CCVs performed)	4/16/05, CCV12 4/18/05	Yes Yes.
Detection Limit Standard	4/15/05	Yes
Detection Limit Standard (Zn only)	4/18/05	Yes
Continuing Calibration Blank (12 CCBs performed)	4/15/05 4/16/05, CCB12	Yes Yes
Continuing Calibration Blank (Zn only) (9 CCBs performed)	4/18/05	Yes
Interference Check Standards A, AB	4/15/05 4/18/05	Yes Yes
Serial Dilution	4/15/05	No; Zn outside limits.
Serial Dilution (Zn only)	4/18/05	No; Zn outside limits. ^a

^aObservation of analytes outside control limits on serial dilution was attributed to matrix effects.

TCO calibration was performed on 3/08/05; all parameters were within control limits. The analytical balance was calibrated on 4/12/05.

A matrix spike and a matrix spike duplicate were performed; all parameters were within control limits. By prior agreement with Dr. Matlack, the MS/MSD is not reported since all parameters are within control limits.

As previous data validation reports have shown, the Laboratory Information Management System (LIMS) in use at STL Knoxville shows problems with consistency in rounding: at times a numerical value that ends in 6666 is truncated, at other times the value is rounded correctly. Likewise, a value that ends in 3333 is occasionally rounded up. Since three instrumental values are averaged to produce a final quantitative value, these occurrences are relatively common and are shown in Table 6. These instances of erratic rounding occur only in a last decimal place; the effect on reported values is minimal.

Table 5. Examples of Erratic LIMS Rounding for Data Package H5D010175.

Element	Calculated	Reported
G7G10 H5D010175-002		
Sb	0.01137666	0.01137
As	0.00810333	0.0081
Zn	0.03954333	0.03955
G7G1V H5D010175-001		
Cu	0.00352333	0.00353

**Metals Blanks
Laboratory and Field Blanks
LAW Data**

Element	(Laboratory) Method Blank1 3/16/05	(Laboratory) Method Blank2 3/16/05	(Laboratory) Method Blank 3 3/21/05	(Laboratory) METHOD BLANK1 3/24/05	(Laboratory) METHOD BLANK2 3/24/05
				µg	
antimony (Sb)	ND ^b	ND	ND	ND ^a	ND
arsenic (As)	ND	ND	ND	ND	ND
barium (Ba)	ND	ND	ND	ND	ND
cadmium (Cd)	ND	0.11 B ^a	ND	ND	0.065 J
chromium (Cr)	ND	ND	ND	ND	ND
copper (Cu)	ND	ND	ND	ND	ND
lead (Pb)	ND	0.21 B	ND	0.30 J ^b	ND
manganese (Mn)	ND	ND	ND	ND	ND
nickel (Ni)	ND	ND	ND	ND	ND
selenium (Se)	ND	ND	ND	0.22 J	ND
silver (Ag)	ND	ND	ND	ND	ND
zinc (Zn)	ND	ND	0.50 B	2.0	ND

^aMethod blank contamination. The associated method blank contains the target analyte at a reportable level.

^bND = Not Detected.

Element	NT031005MB/ 5T031005MB	HT031005MB	NT031005RB/ 5T031005RB	HT031 005RB
	µg			
antimony (Sb)	1.4 J ^a	ND	1.6 J	ND
arsenic (As)	0.89 J	ND	0.76 J	ND
barium (Ba)	5.3 J	ND	4.8 J	ND
cadmium (Cd)	1.2 B ^b	0.067 B	ND	ND
chromium (Cr)	6.2	0.30 J	0.74 J	ND
copper (Cu)	1.7 J	0.27 J	ND	ND
lead (Pb)	ND ^c G ^d	0.52 B,J	ND G	0.40 B,J
manganese (Mn)	2.4	0.58 J	1.3 J	ND
nickel (Ni)	12.4	ND	9.0	ND
selenium (Se)	10.9 B	0.78 B,J	5.1 B	ND
silver (Ag)	ND	0.92 J	ND	1.6 J
zinc (Zn)	13.4	19.3	1.7 J	5.1

^aEstimated result. Result is less than Reporting Limit.

^b Method blank contamination. The associated method blank contains the target analyte at a reportable level.

^cND = Not Detected.

^dElevated reporting limit. The reporting limit is elevated due to matrix interference.

Element	HT031205MB	NRB032205	HBLK032205 RB	NT032205 MB	(Laboratory) Method Blank1 4/01/05
	µg				
antimony (Sb)	ND ^c	ND	ND	ND	ND ^a
arsenic (As)	ND	ND	ND	ND	ND
barium (Ba)	ND	ND	ND	0.45 J	ND
cadmium (Cd)	0.079 B ^b ,J ^a	0.12 B,J	ND	0.30 B,J	ND
chromium (Cr)	ND	ND	ND	1.1	ND
copper (Cu)	ND	ND	ND	0.82 J	ND
lead (Pb)	ND	ND	0.26 J	ND	ND
manganese (Mn)	78.8	ND	ND	1.4 J	ND
nickel (Ni)	ND	ND	ND	1.4 J	ND
selenium (Se)	0.64 B,J	ND	ND	2.5 B	ND
silver (Ag)	ND	ND	ND	ND	ND
zinc (Zn)	11.9 B	ND	ND	4.4 B	0.55 B

^aEstimated result. Result is less than Reporting Limit.

^b Method blank contamination. The associated method blank contains the target analyte at a reportable level.

^cND = Not Detected.

Element	(Laboratory) Method Blank2 4/15/05	(Laboratory) Method Blank 3 4/15/05	5RB032205 (Reagent Blank)	5RB032205 (Method Blank)	(Laboratory) Method Blank
	µg				
antimony (Sb)	ND	ND	0.72 B ^a	1.1 B	ND
arsenic (As)	ND	ND	0.72 B	0.81 B	ND
barium (Ba)	ND	ND	4.7 B	4.7 B	ND
cadmium (Cd)	ND	0.055 B	ND	ND	ND
chromium (Cr)	ND	ND	0.69 B	0.58 B	ND
copper (Cu)	ND	ND	0.35 B	ND	ND
lead (Pb)	ND	ND	ND G ^c	ND G	ND
manganese (Mn)	ND	ND	1.2 B	1.0 B	ND
nickel (Ni)	ND	ND	6.5	7.6	ND
selenium (Se)	0.24 B	0.44 B	3.8	4.2	ND
silver (Ag)	ND	ND	ND	ND	ND
zinc (Zn)	ND	ND	2.4	4.0	ND

^a Method blank contamination. The associated method blank contains the target analyte at a reportable level.

^bND = Not Detected.

^cElevated reporting limit. The reporting limit is elevated due to matrix interference.

R&T Subcontractor Document Review Record

Page 1 of 1

1) To Be Completed by Cognizant R&T Personnel			
Document Number VSL-05R5830-1	Revision A	Document Title Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants	
Test Spec: 24590-WTP-TSP-RT-04-0001, Rev. 1		Scoping Statement(s): VH-4, VHO-3, VHO-2, VH-5	
R&T Contact: Lawrence Petkus Name (Print)		MS6-N1 MSIN	371-4557 Telephone Number
		August 17, 2005 Date	

Review Distribution			
Organization	Contact	MSIN	Required?
Process Operations	D McLaughlin	MS4-B2	Yes ☒ No ☐
Quality Assurance	M Mitchell	MS14-4B	Yes ☐ No ☒
Environmental and Nuclear Safety	E Saucedo	MS4-C1	Yes ☒ No ☐
Commissioning and Training	K Vacca	MS12-B	Yes ☐ No ☒
Engineering	M Ongpin	MS4-A2	Yes ☒ No ☐
R&T Functional Manager	S. Barnes	MS5-L	Yes ☒ No ☐
			Yes ☐ No ☐
			Yes ☐ No ☐
			Yes ☐ No ☐
			Yes ☐ No ☐

Comments Due By: September 8, 2005

Required Reviewers are required to respond to the R&T Contact.

2) To be Completed by Reviewer			
Reviewer _____			
Name (Print)	Organization	Date	
☐	☐	☐	☐
Accepted, No Comments	Accepted, Comments Not Significant	Significant Comments, Form 24590-MGT-F00006 Attached	Significant Comments, Comments Marked on Document

3) To be Completed by Reviewer*		
My significant comments have been addressed.		
Acceptance: _____		
Print/Type Name	Signature	Date
<p><i>* An e-mail to the R&T contact stating that significant comments are addressed can substitute for this acceptance.</i></p>		

Petkus, Lawrence

From: Perez, Joseph [jimperez2@bechtel.com]
Sent: Monday, October 10, 2005 9:04 AM
To: Petkus, Lawrence
Subject: RE: MACT test report - comment responses

Larry, I accept the proposed comment dispositions

Thanks,

Joe Perez
R&T/WTP, ETC-1, Rm# N-118
Ph.: 509.371.5975
Fax: 509.371.5754
Mail Stop: 6-N1

-----Original Message-----

From: Innocent Joseph [mailto:IJOSEPH@duratekinc.com]
Sent: Friday, October 07, 2005 2:35 PM
To: Petkus, Lawrence
Cc: Perez, Joseph; Abel, Keith H.
Subject: MACT test report - comment responses

Please see attached comment responses.

thank you
Innocent

ijoseph@duratekinc.com
Phone: (410) 312-5120
Fax: (410) 290-9070

Petkus, Lawrence

From: Bostic, Lee
Sent: Monday, October 17, 2005 2:13 PM
To: Petkus, Lawrence
Subject: RE: MACT Report Responses

The responses and word changes to the document are acceptable.

Lee Bostic

-----Original Message-----

From: Petkus, Lawrence
Sent: Monday, October 17, 2005 1:50 PM
To: Valenti, Thomas; Bostic, Lee
Subject: MACT Report Responses

Tom, Lee

Please look at these responses to the last few items. Lee, I think you have already agreed with the new words, but please check.

Larry Petkus

R&T, ETC-1

MS6-N1

Ph. 371-4557

<< File: MACTresponses to Project response 2.doc >>

Petkus, Lawrence

From: Valenti, Thomas
Sent: Tuesday, November 08, 2005 8:59 AM
To: Petkus, Lawrence
Cc: Mclaughlin, Doris; Ongpin, Maria
Subject: RE: Review or draft report VSL-05R5830-1, the DM1200 MACT Report

Process Engineering has reviewed and concurs that comments have been resolved. Copy of the SDDR is attached.

MACT SDDR.doc

Thomas J. Valenti

Process Engineering Group
 MPF C120A
 509/ 371-3760

INCLUDES PROCESS OPERATIONS

-----Original Message-----

From: Petkus, Lawrence
Sent: Wednesday, August 17, 2005 10:02 AM
To: Mclaughlin, Doris; Mitchell, Michelle; Saucedo, Ermelinda; Vacca, Karen; Ongpin, Maria; Barnes, Steven M
Cc: Perez, Joseph; Kelly, Sam; Carl, Daniel; Valenti, Thomas; Hanson, Robert L; Gimpel, Rod; Damerow, Frederick; Knighton, David; Rouse, James; Bostic, Lee; Eager, Kevin; Roth, Janet; Schneider, John; Deckers, Janice
Subject: Review or draft report VSL-05R5830-1, the DM1200 MACT Report

All,
 VSL has submitted a draft of the final report VSL-05R5830-1 "Regulatory Off-Gas Emissions Testing on the DM1200 Melter System Using HLW and LAW Simulants" Melter tests were conducted on the DM1200 to determine system performance relative to the MACT standards at normal and challenge conditions for both HLW and LAW flow sheets. Please have the appropriate staff review this document and return comments to Larry Petkus by September 8, 2005. (Three week review cycle)

The document, the Subcontractor Document Review Record, and Comment Resolution Form are located at the following link

<\\Wtps0166\R&t\Vitrification\Permitting\MACT work\Test Report\Draft MACT Rpt VSL-05R5830-1 Rev A\>

Larry Petkus
 R&T, ETC-1
 MS6-N1
 Ph. 371-4557

R&T Technology Issues Summary

Page 1 of 4

Test Report Title: Regulatory Off-Gas Emission Testing on the DM1200 Melter System Using HLW and LAW Simulants

Test Report Number: VSL-05R5830-1

Prepared By: Lawrence Petkus **Date:** November 10, 2005

Signature: Lawrence Petkus 11/10/05 LP

Does the Testing or Report reveal any new discoveries, technology issues, or suggest potential follow-on work?	Yes	No
	☒	☐

If yes, describe the suggested activity.

See attached sheets

If appropriate, is a Request for Technology Development attached.	Yes	No
	☐	☒

Additional comments (include researcher recommendations):

See attached sheets

Technology Issues from the report

w/ additional R&T comments

The modified SBS design appeared to show less tendency for accumulation of solids in the down-comer than did the previous design, but longer test durations are needed to confirm this. Net accumulation of solids in the SBS bowl over the course of several tests contributed to the clogging of the wand that is used to remove solids from the bottom of the SBS bowl.

Although longer testing periods would be better, the accumulation time for the SBS down comer and the bed have been long enough to show that the plugging mechanisms have been disrupted. Down comer clogging would occur within a week to 10 days of run time in the old configuration. No plugging has occurred through several equivalent periods. Plugging of the removal wand in the LAW test occurred after solids had been allowed to accumulate, and then settle during a long (~2.5 month) shut down period. This shut down period would not be typical for plant operations. SBS clean out is recommended prior to long idle periods.

Film cooler clogging was less of an operational problem during these tests. However, post-test inspection showed corrosion, cracking, and filling of the air holes with glass over the course of this and previous tests. Although the damage had likely prevented airflow through the air holes in the leading edge of the film cooler, air flow through the film cooler as a whole, presumably through the louvers, was maintained throughout its service life.

This comment pertains to HLW only. Improved design of the plant film cooler, together with a mechanical cleanout device and a conservative bubbler operation will mitigate film cooler problems.

Electrical malfunctions of the WESP, which have been reported in previous DM1200 tests with LAW simulants, continued to be a problem during the present tests with LAW simulants. No such problems were encountered during the HLW tests.

Design of the plant WESP has included features to avoid problems experienced in the VSL WESP. Physical isolation and air purging will prevent migration of process fluids back to the electrical isolation features. Virtually every malfunction was traced to the failure or an electrical cable or arcing in the area the cable is attached to the metal structure that carries the current to the tubes or rods. The wet NOx and alkali environment leads to the condensation of acidic and conductive solutions that attack these vulnerable areas. Through testing it has been learned that stopping the gas inlet water spray just prior to restarting power after a deluge permits a faster restart. However, since this problem has only occurred with LAW feeds, the mechanism causing these problems may not be fully understood.

Maintaining a cold-cap-limited feed rate during DM1200 tests is dependent on frequent visual monitoring of conditions in the melter plenum. This is particularly true when establishing and maintaining low temperature challenge plenum conditions. The planned

operation of the WTP melter, based on only non-visual data such as plenum temperature, could lead to either under feeding of the melter resulting in lower than attainable production rates or over feeding of the melter resulting in excessive cold-cap buildup as well as other operational difficulties. Testing under prototypic conditions is therefore recommended to determine whether the required glass production rates can be achieved without the visual data.

The testing program has demanded tight control of the DM1200 to attain test objectives. Experienced operators have observed melter conditions and adjusted melter parameters to maintain the required operating conditions. Operation of the production melter will be different than the testing protocols. R&T has already recommended that cameras be employed during commissioning. Melter features are in place to accommodate cameras during commissioning and later if necessary. Additional testing under prototypical conditions would serve to mitigate risks to the commissioning period.

Analysis and recovery of off-gas samples at detection level concentrations of naphthalene in the presence of samples with very high concentrations of naphthalene can easily lead to cross contamination. A miniscule amount of cross contamination drastically affects calculated DRE values. Sampling and analysis of the two sample types should be carefully isolated. Another possibility would be to sample only stack exhaust for naphthalene and to use a total hydrocarbon monitor to evaluate relative organic destruction in other off-gas system locations.

Sampling results showed a high variability, especially for organic constituents in a high NO_x environment. Sampling techniques, analytical methods, and vendor performance during plant testing should be thoroughly demonstrated prior to regulatory testing.

Commercially available filters and reagents contain trace levels of metals making DF determination across the off-gas system difficult. The problem can be addressed by taking multiple samples of long duration (24 hour samples were used successfully at the WESP outlet in previous tests) as well as provide a series of blanks for analysis to improve blank correction when permissible. Increasing the feed concentration would also improve DF calculations.

Vendor demonstration of required metals analysis, including adequate blank analysis, should also be required prior to regulatory testing.

The low particulate concentrations at the catalyst outlet cause difficulties in determining particle emission rates and size distribution. The problem can be addressed by taking multiple samples of long duration as well as by using microscopic analysis of filters to estimate size distributions.

Recommend that particulate sampling durations and methods be addressed in the Demonstration Test Plan. Sampling results must address regulatory limits.

Measurable gaseous chlorine emissions at the catalyst outlet are higher than at the melter outlet indicating that gaseous chlorine is generated within the off gas system. Potential sources of the HCl monitored at the catalyst outlet include HCl desorption from the

carbon media or generation of HCl in the SBS or WESP sumps as a result of collection of particulate NaCl in the acidic sump solutions. Gaseous HCl may have deleterious effects on the catalyst. Quantification of total chloride emissions (gaseous and particulate) at various locations in the off-gas system would identify the mechanism for the gaseous chlorine generation and therefore facilitate strategies for limiting the emissions.

Plant design includes "Guard Beds" between the HEPA filters and the Mercury absorbers to remove acid gases, including HCl and HF. The guard beds should mitigate problems with chlorides and fluorides in down stream equipment. However, engineering should verify their source-term assumptions account for acid gases that may be generated or liberated from the POG devices.

Sulfur dioxide emissions from the carbon column indicate that sulfur is being stripped off the column. The loss of sulfur from the carbon media would compromise its effectiveness for mercury removal, which is one of its principal functions in the off-gas train. Gaseous sulfur also has the potential to poison the catalyst and/or to react with ammonia to form ammonium sulfate particulate, which can clog the catalyst. Consequently, the integrity of the carbon media in the presence of high nitrogen oxide exhaust needs to be understood.

Additional testing of the sulfur impregnated activated carbon media for the mercury absorber will take place as part of vendor qualification activities. Integrity of the carbon media in a high NO_x exhaust will be demonstrated as well as organic and mercury capacities and any interference between one and the other in absorption on the carbon media.

Additional R&T Comments

Two samples from the naphthalene testing failed to meet the 99.99% DRE requirement. The report suggests than sample contamination may be the cause. An additional contributor may be the analytical variability in the results. Although melter off gas is variable, one hour or three hour long sampling periods should be expected to smooth the results to a relatively constant value. However, the test results show that emissions can vary by a factor of 2 or more between sampling periods. It is recommended that sampling techniques, analytical methods, and vendor performance during plant testing should be thoroughly demonstrated prior to regulatory testing to reduce the effect of the apparent inherent variability.