URS 40942073

Source Test Report
of the
Coker Steam Vent

Prepared for:

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1.0 Introduction

Hovensa, L.L.C., is a joint venture between a subsidiary of Hess Corporation and a subsidiary of Petroleos de Venezuela, S.A. (PDVSA). Hovensa operates a petroleum refinery in the south-central Estate Hope region of St. Croix, which is located in the United States Virgin Islands (USVI). The facility is one of the most recently constructed refineries in the United States and, with crude oil processing capacity of over 500,000 barrels per day (bpd), is one of the largest in the western hemisphere. The refinery is strategically located to serve gasoline and heating oil markets in both the United States Gulf Coast and along the eastern seaboard, providing a ready market for finished products. The refinery is capable of receiving and processing crudes from all over the world, although a majority of crude is currently supplied from Venezuela.

The refinery operates a Delayed Coker Unit (Coker) that was commissioned in August 2002. The Coker allows for the manufacture of gasoline and heating oil using lower cost heavy crudes.

In September 2007, Hovensa received an emailed communication from the Environmental Protection Agency (EPA), Office of Enforcement and Compliance Assurance, requesting that Hovensa submit a *Source Test Protocol* to conduct source testing of the coke drum steam vents (Coker Steam Vents) which are used to depressurize the coke drums to atmosphere as part of routine Coker operation. EPA specifically requested the following testing methodology:

> *Submit a Protocol for conducting a source test to measure flow, moisture content, particulate matter (PM), non-methane and non-ethane volatile organic compounds, and benzene from the coker drum steam vents for each drum during normal representative operating conditions. The source test shall be conducted as follows:*
>
> *a.* *Test Methods 1,2,3 and 5 of 40 CFR Part 60 Appendix A and Test Method 202 of 40 CFR Part 51 Appendix M (including a nitrogen purge) shall be used to determine the flow, moisture and concentration and mass emission rate of particulate matter;*
> *b.* *The Test Method 5 results shall separately report both front-half and back-half catch results with specific attention paid to collecting and analyzing condensed particulate matter in the sampling train;*
> *c.* *Test Method 18 shall be used to determine the concentration of all major components as determined by a pre-survey that shall include at least methane, ethane, toluene and benzene and the concentration of dissolved VOCs that may be collected in the impinger sampling train or condensate collection device;*

d. Test Method 25A of 40 CFR Part 60 Appendix A shall be used in combination with Methods 1,2,3, and 18 and the dilution methods of Other Test Method 12 (www.epa.gov/ttn/emc/prelim.html) to determine the concentration and mass emission rate of non-methane/non-ethane organic compounds;

e. Four complete venting cycles shall be tested for each pollutant with each cycle being reported as a separate run;

f. Each drum shall be separately tested for each pollutant;

g. All steam vents on a given drum shall be tested simultaneously for a given pollutant (e.g., for Drum A test both vents A-1 and A-2 simultaneously for non-methane/non-ethane organic compounds and then again test both vents A-1 and A-2 simultaneously for particulate matter);

h. Process parameters shall be recorded as frequently as is feasible but in no event less than every 15 minutes for each run and shall include the process parameters described in [Item 1 of the letter referenced above]; and

i. All changes to methodology from the above prescribed methods and requirements shall be specifically reported in a separate section of the protocol and specifically approved in advance. All changes to methodology not planned and approved shall be specifically identified in a separate section of the test report.

As part of the test protocol, provide operating conditions under which measurements shall be made and for which emission measurements shall be representative of normal operation of the coker. Define the ranges of the values of each operating parameter listed in [Item 1 of the letter referenced above] that are representative of normal operation. List all operating parameters that will be monitored and recorded during the test and describe how each parameter will be monitored and recorded. The source test protocol should be organized in accordance with Attachment I.

EPA also requested, in subsequent communication to a similar facility, that SW-846 Method 0010 be performed to measure semi-volatile organic compounds (SVOCs) in the Coker Steam Vent emissions in addition to the testing described above[1].

Testing Project Timeline

HOVENSA engaged URS Corporation (URS) of Austin, Texas to prepare a *Source Test Protocol for the Coker Steam Vent* (*Protocol*) in a manner consistent with EPA's requests. The *Protocol* was submitted to EPA on February 29, 2008, and discussed several necessary deviations from the specifications in the *2007 Section 114 Request* to accomplish this very complex measurement program. The reference test methods requested by EPA to be used as the basis for the quantification of the selected pollutants were primarily developed for use on combustion source gases exiting a stack or vent. The extremely high moisture content (>98%) and high velocity (over 600 ft/sec, or 400 mph) of the vent gas stream, the amount of target analyte present in the vent gas stream, the dynamic nature of the vent stream characteristics,

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[1] EPA letter of January 18, 2008 Re: Citgo Refining and Chemical's Company Response to October 9, 2007 Section 114 Request for Information.

and the batch nature of the coking process made the implementation of the EPA reference test methods, as written, impossible. HOVENSA received EPA's comments on the *Protocol* on March 11, 2008, and information supplemental to the *Protocol* was provided to EPA on March 18, 2008. EPA gave conditional approval of the *Protocol* in a letter dated March 21, 2008. Copies of correspondence related to the source testing of the Coker Steam Vent are provided in Appendix 1-1.

URS conducted two separate test programs according to the *Protocol*. Pre-Survey gas samples were collected from three (3) separate venting cycles of Coker Steam Vent 3 on April 2 through April 5, 2008, to quantify selected VOCs for potential speciation (i.e., the Pre-Survey) during the subsequent source testing. HOVENSA reported Pre-Survey summary results to EPA on May 5, 2008. URS then mobilized to the site on May 28, 2008, and testing was performed on four separate venting cycles of Coker Steam Vent 3 from June 3 through June 8, 2008 (i.e., the Source Test). Test America Laboratories of Knoxville, TN, was contracted for all off-site sample analyses. General information regarding the testing at Coker Steam Vent 3 is summarized in Table 1-1.

1.1 Test Objectives

The EPA Method 18 Pre-Survey of Coker Steam Vent 3 was designed to quantify the emissions of selected VOCs for potential speciation during the Source Test.

The Source Test of Coker Steam Vent 3 was designed to quantify the emissions of the following pollutants per EPA's request:

- Methane, ethane, benzene, and toluene[2];
- Non-methane/non-ethane volatile organic compounds (NMNE VOCs);
- Semivolatile organic compounds (SVOCs); and
- Particulate matter (PM).

The approach for accomplishing the Pre-Survey objective was to complete testing during at least one venting cycle for selected VOCs. The approach for accomplishing the Source Test objectives was to complete testing during four separate and complete venting cycles for each pollutant parameter of interest. A comprehensive description of all test methodology is presented in the *Protocol*.

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[2] As previously described in the HOVENSA letter to EPA of May 5, 2008, the Pre-Survey determined that no VOCs were present in the Coker Steam Vent 3 gas stream in excess of 100 ppmw (i.e., the agreed upon, via *Protocol* approval, trigger for speciation during the Source Test). Therefore, no VOCs were required to be speciated during the Source Test other than methane, ethane, benzene, *and toluene.

Table 1-1. Test Information

Facility Name	HOVENSA, L.L.C Refinery
Contact Person(s)	Kathleen Antoine – Environmental Department Manager Phil May – EPA Liaison (RTP Environmental) Robert Bivens – Field Test Coordinator (RMB Consulting)
Telephone Number	340-692-3774
Facility Address	1 Estate Hope, Christiansted, St. Croix, USVI, 00820-5652
Types of Process Sampled	Coker Steam Vent 3 Gas Stream
Person Responsible for Conducting Test	George Lipinski
Telephone Number	512-454-4797
Testing Company Name	URS Corporation
Testing Company Address	9400 Amberglen Boulevard Austin, Texas 78729
Persons Conducting Pre-Survey	Chris Weber Carl Galloway
Persons Conducting Source Test	George Lipinski Gene Youngerman Chris Weber Kevin McGinn Carl Galloway Meggen DeLollis Derek Ballek Steven Hall Nathan Reichardt
Modified[1] Test Methods Performed	Modified EPA Methods 2, 3, and 4 Modified EPA Methods 5 and 202 Modified EPA Method 18 Modified EPA Method 25A Modified Other Test Method 12 Modified SW-846 Method 0010
Dates of Testing	April 2-5, 2008 and June 3-8, 2008

[1] The *Protocol* described the modified sampling and analytical methodologies used to conduct the Pre-Survey and Source Test of Coker Steam Vent 3. The *Protocol* was submitted to EPA on February 29. 2008 and conditionally approved on March 21, 2008.

Per EPA's request, the Source Test was also designed to record the following process operating parameters while emission's testing was performed:

- Coker feed rate in barrels per day (bpd);
- Coke produced in tons per day from the tested drum (tpd);
- Number of batches per day;
- Coke produced per batch for the tested drum in tons per batch;
- Duration of steam out to fractionator per batch for the tested drum in hours;
- Duration of blowdown to wet gas compressor system;
- Duration of quench water fill time per batch for the tested drum in hours;
- Duration of quench water drain time per batch for the tested drum in hours;

- Duration of venting per batch for the tested drum in hours;
- Duration of coke cutting for the tested drum in hours;
- Duration of drum cycle for the tested drum in hours;
- Number of cycles per day for the tested drum;
- Drum pressure for the tested drum at the moment venting begins in pounds per square inch (psi);
- Drum pressure for the tested drum throughout each test run in pounds per square inch (psi); and
- Coke drum outage (fill distance from top) for the tested drum in feet.

1.2 Summary of Results

The Coker was operated under normal conditions while all source testing was performed. Tables 1-2 and 1-3 present summaries of the Coke Drum 3 process data recorded during the Source Test. Additional process data is discussed in Section 2.1. Tables 1-4 and 1-5 present summaries of the mass emission rates of benzene, toluene, NMNE VOCs, SVOCs and PM quantified during the Source Test for each of the four complete venting cycles of Coker Steam Vent 3. The testing of a complete venting cycle is designated in this report as a "Run." The pollutant mass emission rates are reported in Table 1-4 as units of mass per complete venting cycle (lbs/cycle). This project-specific reporting convention is discussed in Section 2.2. Table 1-5 presents pollutant mass emission rates as tons per year (tpy) based on a nominal frequency of 219 venting cycles per year for Coker Steam Vent 3 (i.e., 40-hour cycles for a given drum over the course of a year). Pre-Survey test results are presented in Section 2.3.

Table 1-2. Coke Drum 3 – Operating Information

	Coke Drum 3
Duration of Batch Process (hours)[1]	40
Duration of Operating Cycle (hours)	20
Batches/Cycles per Day	0.6
Batches/Cycles per Year	219
Average Coke Production (tons per batch)	1,676
Average Coke Production (tons per day)	1,006
Average Coke Production (tons per year)	367,044

[1] The duration of the batch process (40 hours) corresponds to the amount of time between each venting "event" on Coker Steam Vent 3.

Table 1-3. Coke Drum 3 – Process Data Recorded at Venting Cycle Activation

	Date	Overhead Receiver Pressure (psig)	Fractionator Top Pressure (psig)	Coke Drum 3 Pressure[1] (psig)	Coke Drum 3 Pressure[1] (psig)
		PI-1308	PI-1168	PI-3960	PI-3961
Run 1	6/3/2008	4.38	12.0	7.51	7.89
Run 2	6/4-5/2008	4.45	12.4	8.67	8.89
Run 3	6/6/2008	4.64	11.8	7.57	7.25
Run 4	6/8/2008	4.53	11.8	6.86	7.18

[1] Coke Drum 3 pressure was recorded by two separate, redundant instruments.

Table 1-4. Pollutant Mass Emission Rate Results Summary for the Source Test of Coker Steam Vent 3 – Pounds per Cycle[1]

	Date	Benzene Mass Emission Rate[2] (lbs/cycle)	Toluene Mass Emission Rate[2] (lbs/cycle)	NMNE VOC Mass Emission Rate (lbs/cycle)	SVOC Mass Emission Rate (lbs/cycle)	PM Mass Emission Rate (lbs/cycle)
Run 1	6/3/2008	<17.3	<19.8	165	9.27	72.5
Run 2	6/4-5/2008	<10.6	<13.7	354	10.2	95.8
Run 3	6/6/2008	<6.90	<7.89	73.4	2.27	30.7
Run 4	6/8/2008	<9.03	<10.5	120	4.00	47.4
Average	-	**<11.0**	**<13.0**	**178**	**6.44**	**61.6**

[1] Pounds per cycle equals pounds per venting "event". These data include both the measured and any extrapolated data.

[2] All mass emission rate values preceded by a "<" reflect pollutant concentrations measured below the applicable method detection limits.

Table 1-5. Pollutant Mass Emission Rate Results Summary for the Source Test of Coker Steam Vent 3 – Tons per Year

	Date	Benzene Mass Emission Rate[1] (tpy)	Toluene Mass Emission Rate[1] (tpy)	NMNE VOC Mass Emission Rate (tpy)	Total SVOC Mass Emission Rate (tpy)	PM Mass Emission Rate (tpy)
Run 1	6/3/2008	<1.89	<2.17	18.1	1.01	7.94
Run 2	6/4-5/2008	<1.17	<1.50	38.7	1.12	10.5
Run 3	6/6/2008	<0.756	<0.864	8.04	0.248	3.36
Run 4	6/8/2008	<0.989	<1.15	13.2	0.438	5.19
Average	-	**<1.20**	**<1.42**	**19.5**	**0.705**	**6.75**

[1] All mass emission rate values preceded by a "<" reflect pollutant concentrations measured below the applicable method detection limits.

1.3 Coker Unit Description

The HOVENSA Coker became operational in 2002 and underwent a major equipment and process turn-around from May to June 2007. The Coker is equipped with two process heaters (Heater A and Heater B). These units are limited to combusting fuel gas or propane. Each of the two process heaters has two coke drums and each of the four coke drums has a dedicated steam depressurization vent. The Coker's four coke drums are designated in this document as Coker Drums 1-4[3]. The dedicated steam depressurization vents are designated as Coker Steam Vents 1-4.

The Coker converts, via thermal cracking, residual oil (pitch) from Vacuum Units 1 and 3 into gas oil that can be made into light products, weak fuel gases, naphtha, and petroleum (pet) coke. The volatile constituents of the cracked product are driven off by baking at a high temperature (935°F) in a coke drum while the fixed carbon and residual ash are fused together. The coke drum effluent is directed out the top of the drum to a fractionation column. Solid pet coke is deposited in the drum in a porous structure that allows flow through the pores. After a coke drum is full of solidified pet coke, its contents are first steamed to further recover any remaining volatile hydrocarbon content (i.e., products) from the coke, and the coke drum contents are then water-quenched to lower the temperature. The top and bottom heads of the full coke drum are then removed, and the pet coke is subsequently 'cut' from the coke drum with high-pressure water nozzles situated on a rotating cutter, which is inserted into the top of the drum.

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[3] Heater A is associated with Coke Drums 1 and 2. Heater B is associated with Coke Drums 3 and 4.

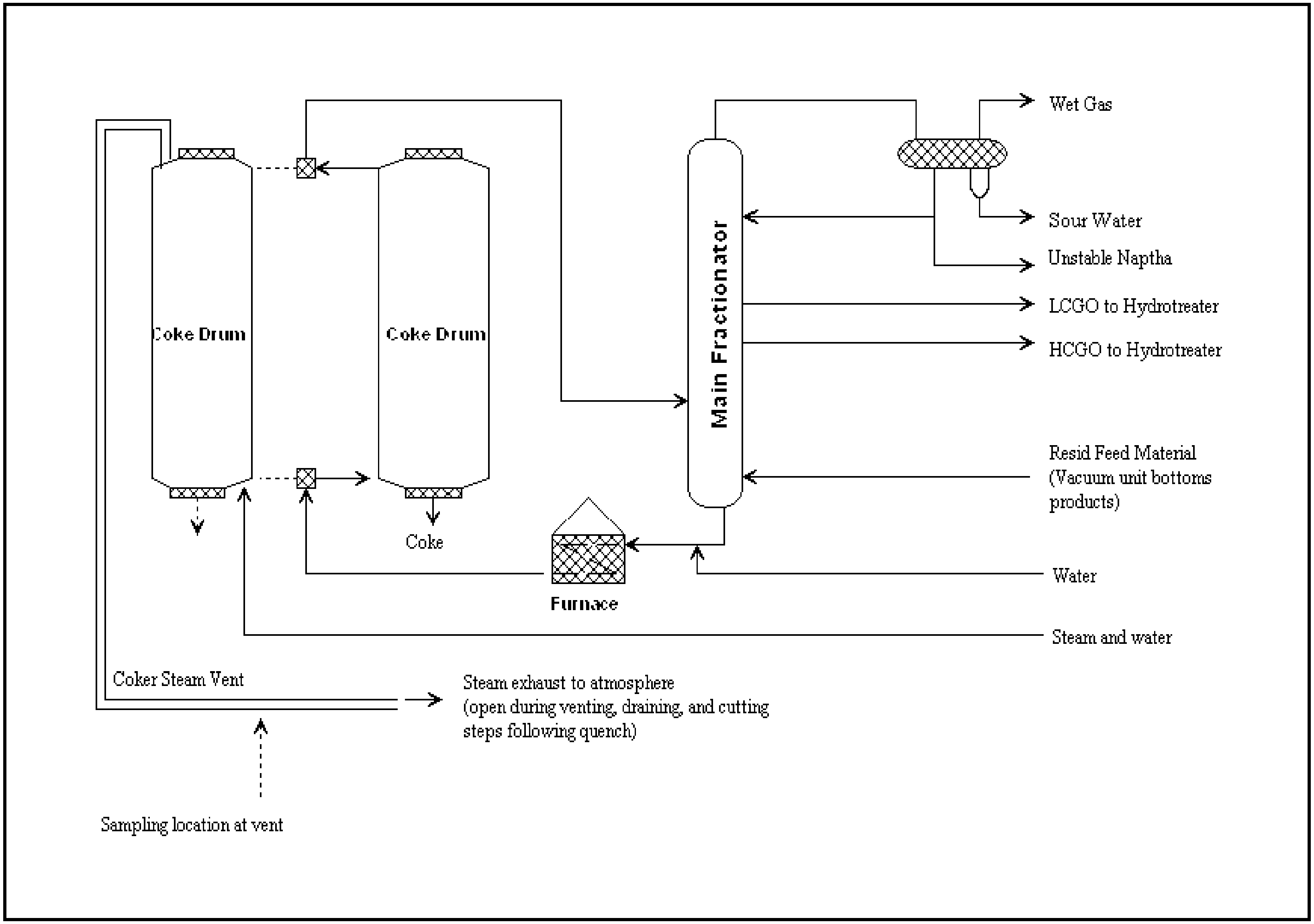
Following the water quench and prior to the removal of the coke drum's top and bottom heads to allow for the removal (i.e., cutting) process, the Coker Steam Vent (a 12-inch pipe) on top of a given coke drum activates and depressurizes the coke drum to atmosphere. The Coker Steam Vent also remains open during coke cutting. The entire Coker operates in a continuous series of cycles where one coke drum on a given process heater is quenched and cut while the second coke drum on the heater is filled, and vice versa. The two process heaters on the Coker operate independently.

All four coke drums are identical and operated in the same manner with the same feedstock. HOVENSA proposed in the *Protocol* that the emissions from all four coke drums are identical. Subsequently, the source testing was performed on Coker Steam Vent 3 only, located on Coke Drum 3, Heater B. A picture of an activated Coker Steam Vent is shown in Figure 1-1. A process flow diagram of the Coker is presented as Figure 1-2.

Figure 1-1. Activated Coker Steam Vent[1]

[1] Coker Steam Vent 2, located on Coke Drum 2, is shown in this photograph.

Figure 1-2. Coker Process Flow Diagram



1.4 Source Test Timing

The Coker Steam Vents are each comprised of a single 12-inch pipe on each of the four coke drums, which vent gas from the coke drum vessel to atmosphere during a typical quench vent release event. A "complete venting cycle" is defined as the period between the activation of the Coker Steam Vent and the "optimal depressurization" of the coke drum that is necessary before the coke-cutting process can begin. The "optimal depressurization" is defined as the operating condition at which the coke drum is considered ready to initiate the coke-cutting procedure (i.e., the point at which a large flange on the top of the coke drum is removed immediately prior to the insertion of the cutting lance into the coke drum), and was contingent upon the following operating parameters:

- Coke bed temperature;
- Coker quench water quota; and
- Coke drum pressure.

This condition of optimal depressurization (i.e., end point) was determined on a test run-by-test run basis to ensure that the data collected would most accurately reflect actual operating conditions. The duration of each venting cycle was dependent upon the batch process operation of the Coker.

For the purposes of the Source Test, the sampling approach was directed at collecting samples during the first 120 minutes after Coker Steam Vent 3 activation, although data was collected over a longer period of time for all four test runs. The project-specific Health and Safety Plan (HASP) dictated that sampling personnel end sampling activities and begin moving off of the Coker prior to the removal of the top head from Coke Drum 3. All of the venting cycles sampled during the Source Test continued beyond 120 minutes, and efforts were made to continue sample collection over an extended time period **for as long as the sampling equipment remained operable within acceptable performance ranges and until health and safety limitations were encountered**. Table 1-6 presents the durations of each of the four venting cycles tested during the Source Test. In all cases, the venting cycle duration was contingent upon the final Coke Drum 3 pressure reaching a measured value of 0.00 psig. This pressure data was recorded by two separate, redundant instruments.

Table 1-6. Source Test Venting Cycle Duration

	Date	Time of Venting Cycle Activation	Initial Coke Drum 3 Pressure[1] (psig)	Final Coke Drum 3 Pressure[2] (psig)	Time of Optimal Drum Depressurization	Venting Cycle Duration (min)
Run 1	6/3/2008	600	7.89	0.00	1018	258
Run 2	6/4-5/2008	2235	8.89	0.00	130	175
Run 3	6/6/2008	1408	7.57	0.00	1615[3]	142
Run 4	6/8/2008	632	7.18	0.00	926	174

[1] The initial Coke Drum 3 pressure data is based upon the highest initial pressure recorded by either of the PI-3960 or PI-3961 redundant pressure indicators at the time of venting cycle activation.

[2] The final Coke Drum 3 pressure data is based upon the time when both redundant pressure indicators recorded values of 0.00 psig.

[3] The sampling of Coker Steam Vent 3 continued until 1630 during Run 3, fifteen (15) minutes past the time of optimal drum depressurization. The venting cycle duration was extended to incorporate this additional sampling duration for the development of all pollutant mass emission rates.

1.5 Pre-Survey and Source Test Chronology

The EPA Method 18 Pre-Survey of Coker Steam Vent 3 was conducted from April 2 to April 5, 2008. Three separate venting cycles, designated as Runs A, B, and C, were tested for the purpose of identifying target VOC analytes for future emissions testing using EPA Method 18. Table 1-7 provides a summary of the dates and times for each test run on the Coker Steam Vent 3 gas stream during the Pre-Survey.

Table 1-7. Pre-Survey Chronology

	Date	Sampling Train	Parameter	Time of Venting Cycle Activation	Sampling Train Interval	Sampling Train Duration (min)
Run A	4/2/2008	Modified EPA Methods 5/TO-14	Speciated VOC	714	715-816	61
Run B	4/3/2008			2305	2338-039	61
Run C	4/5/2008			1532	1532-1636	64

The Source Test of Coker Steam Vent 3 was conducted from June 3 to June 8, 2008. Four separate venting cycles, designated as Runs 1-4, were tested for methane, ethane, benzene, toluene, NMNE VOC, SVOC, and PM emissions. At least three sequential EPA Method 5/202 and three sequential SW-846 0010 sampling trains were performed during each test run. The dilution sampling system used for the performance of EPA Method 18/25A/OTM 12 was operated continuously for as long as possible during each test run. Tables 1-8 through 1-11 provide a summary of the dates and times for the performance of each sampling train during each test run on the Coker Steam Vent 3 gas stream during the Source Test.

Table 1-8. Source Test Chronology – Run 1

	Date	Sampling Train	Parameter	Sampling Train ID	Venting Cycle	Venting Cycle Duration (min)	Sampling Train Interval	Sampling Train Duration (min)
Run 1	6/3/2008	EPA Methods 18/25A/OTM 12	Benzene, Toluene, NMNE VOC	-	600-1018	258	600-910	190
		EPA Methods 5/202	PM	2			607-637	30
		SW-846 Method 0010	SVOC	A			602-632	30
		EPA Methods 5/202	PM	3			638-708	30
		SW-846 Method 0010	SVOC	B			633-703	30
		EPA Methods 5/202	PM	4			708-822[1]	68
		SW-846 Method 0010	SVOC	C			704-734[2]	30
		SW-846 Method 0010	SVOC	D			734-826	52
		EPA Methods 2/4	Volumetric Flow Rate	-			-[3]	-

[1] EPA Method 5/202 sampling train “4” was not operated for six minutes of this sampling train interval due to equipment malfunction.

[2] SW-846 Method 0010 sampling train “C” failed a final leak test, and samples were not recovered from this train for SVOC analysis.

[3] EPA Method 2/4 was not used to collect vent gas moisture concentration and velocity data during Run 1 due to equipment malfunction.

Table 1-9. Source Test Chronology – Run 2

	Date	Sampling Train	Parameter	Sampling Train ID	Venting Cycle	Venting Cycle Duration (min)	Sampling Train Interval	Sampling Train Duration (min)
Run 2	6/4-5/2008	EPA Methods 18/25A/OTM 12	Benzene, Toluene, NMNE VOC	-	2235-130	175	2235-115	160
		EPA Methods 5/202	PM	1			2237-2308	31
		SW-846 Method 0010	SVOC	A			2236-2306	30
		EPA Methods 5/202	PM	2			2309-2339	30
		SW-846 Method 0010	SVOC	B			2307-2337	30
		EPA Methods 5/202	PM	3			2340-040	60
		SW-846 Method 0010	SVOC	C			2338-035	57
		EPA Methods 2/4	Volumetric Flow Rate	-			2236-038	122

Table 1-10. Source Test Chronology – Run 3

	Date	Sampling Train	Parameter	Sampling Train ID	Venting Cycle	Venting Cycle Duration (min)	Sampling Train Interval	Sampling Train Duration (min)
Run 3	6/6/2008	EPA Methods 18/25A/OTM 12	Benzene, Toluene, NMNE VOC	-	1408-1630	142	1408-1630	142
		EPA Methods 5/202	PM	1			1410-1443	33
		SW-846 Method 0010	SVOC	A			1409-1439	30
		EPA Methods 5/202	PM	2			1444-1533	49
		SW-846 Method 0010	SVOC	C			1442-1532	50
		EPA Methods 5/202	PM	3			1538-1622	44
		SW-846 Method 0010	SVOC	D			1533-1621	48
		EPA Methods 2/4	Volumetric Flow Rate	-			1408-1621	135

Table 1-11. Source Test Chronology – Run 4

	Date	Sampling Train	Parameter	Sampling Train ID	Venting Cycle	Venting Cycle Duration (min)	Sampling Train Interval	Sampling Train Duration (min)
Run 4	6/8/2008	EPA Methods 18/25A/OTM 12	Benzene, Toluene, NMNE VOC	-	632-926	174	632-840	128
		EPA Methods 5/202	PM	1			633-705	32
		SW-846 Method 0010	SVOC	A			633-703	30
		EPA Methods 5/202	PM	2			706-736	30
		SW-846 Method 0010	SVOC	B			703-733	30
		EPA Methods 5/202	PM	3			737-834	57
		SW-846 Method 0010	SVOC	C			735-831	56
		EPA Methods 2/4	Volumetric Flow Rate	-			632-834	122

Sampling Train Start Times During the Source Test

HOVENSA commented in a letter to EPA, dated March 18, 2008, that the Source Test would incorporate a one-minute delay between Coker Steam Vent 3 activation and the initiation of emissions sampling. This delay was necessary to avoid capturing condensed material present in the vent pipe from previous venting cycles, for the prevention of sampling train leakage, and for the manual adjustment of specialized gate valves prior to sampling probe insertion. As part of the conditional acceptance of the *Protocol*, EPA expressed that the delay must be minimized to the greatest extent possible.

The significant negative static pressure of the vent at the sampling locations and the manual adjustment of the specialized gate valves contributed to a greater delay than anticipated during the Source Test. URS sampling train operators made every effort to begin sampling for moisture concentration, volumetric flow rate, PM emissions, and SVOC emissions within two minutes of Coker Steam Vent 3 activation during Runs 1-4. EPA Methods 5/202 sampling for PM emissions began within seven minutes of Coker Steam Vent 3 activation during Run 1[4], within two minutes during Run 2, within two minutes during Run 3, and within one minute during Run 4. SW-846 Method 0010 sampling for SVOC emissions began within two minutes of Coker Steam Vent 3 activation for Run 1 and within one minute during Runs 2-4. Sampling using the redundant EPA Method 2/4 sampling train began within one minute of vent activation during Run 2 and immediately with vent activation during Runs 3 and 4. The redundant EPA Method 2/4 sampling train was not used to collect vent gas moisture concentration and velocity data during Run 1 due to equipment malfunction.

URS operators initiated the sampling for benzene, toluene, and NMNE VOC emissions immediately with the venting cycle activation during Runs 1-4 because the EPA Method 18/25A/OTM12 dilution sampling system did not contain leak-prone joints and fittings or components sensitive to negative pressures. The EPA Method 18/25A/OTM12 dilution sampling probe was inserted into the vent before venting cycle activation during all four test runs.

1.6 Report Organization

URS has organized this report in a manner consistent with Attachment II of EPA's request except for two modifications: all raw sampling and analytical data has been included in various appendices of the report and Section 4.0 has been limited to example calculations, and

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[4] The delay between the venting cycle activation and the start of the first EPA Method 5/202 sampling train during Run 1 was attributed to the significant negative static pressure of Coker Steam Vent 3 at the sampling location used by this sampling train, which caused sampling train impinger solutions to "back-flush," or migrate from one sampling train component to another, thereby compromising the effectiveness of the sampling train in quantifying PM emissions. The first sampling train was discarded and a second sampling train was inserted into the sampling location and activated within seven (7) minutes of Coker Steam Vent 3 activation.

Section 5.0 – Quality Assurance Objectives for Measurement Data has been added. The remainder of this report presents the following:

- Section 2.0 – Summary of Results;
- Section 3.0 – Sampling and Analytical Procedures;
- Section 4.0 – Calculations; and
- Section 5.0 – Quality Assurance Objectives for Measurement Data.

The appendices provide raw data, including chain-of-custody forms, sampling logs, laboratory reports, process data, and sampling equipment calibration forms.

1.7 Quality Assurance Summary

In accordance with Item "**i**" of EPA's request, all deviations from the modified sampling and analytical methodologies specified in the *Protocol* are identified in Section 3.0 and discussed in Section 5.0. In addition, any sampling and/or analytical quality assurance/quality control (QA/QC) issues associated with the data obtained through the Pre-Survey and Source Test are described in Section 5.0. Table 1-12 presents the quality assurance summary for the three test runs performed during the Pre-Survey. Tables 1-13 through 1-16 present quality assurance summaries for each of the four test runs performed during the Source Test.

Table 1-12. Quality Assurance Summary – Pre-Survey

	Sampling Train	**Parameter**	**Deviations from *Protocol* and Quality Assurance/Quality Control Issues**
Pre-Survey (Runs A, B, C)	Modified EPA Methods 5/TO-14	Speciated VOCs	1) Methanol rinses were not performed on the connecting glassware between the glass condenser and the filter media; 2) Two sample fractions – the “condensate catch” and the “methanol rinse” – were combined for laboratory analysis; 3) Several compounds were found in the field blank at levels above the detection limit; and 4) Amounts of acetone, 2-butanone, and methylene chloride were found in the condensate field blank sample above detection limits.

Table 1-13. Quality Assurance Summary – Run 1

	Sampling Train	Parameter	Deviations from *Protocol* and Quality Assurance/Quality Control Issues
Run 1	EPA Methods 18/25A/OTM 12	Benzene, Toluene, NMNE VOC	1) A valid Tedlar bag sample was not obtained for second sampling interval (631-701); 2) The THC2 analyzer response for the low-range calibration gas (after dilution) did not meet the EPA Method 25A requirement for calibration error; and 3) The drift between the pre-test run THC2 analyzer responses and the post-test run analyzer responses for the mid-level calibration gas did not meet EPA Method 25A requirements.
	EPA Methods 2/4	Volumetric Flow Rate	1) The sampling probe was not inserted completely into the Coker Steam Vent 3 pipe until approximately 40 minutes after venting cycle activation; 2) Critical data points were not recorded every two minutes during various sampling intervals; and 3) The measured final impinger exit temperature exceeded 68°F during most of the operation of the sampling train.
	EPA Methods 5/202	PM	1) Critical data points were not recorded every two minutes during various sampling intervals; and 2) The measured final impinger exit temperature exceeded 68°F during most of the operation of the sampling trains.
	SW-846 Method 0010	SVOC	1) The analytical fractions recovered during the Source Test and analyzed separately in the laboratory were different than those presented in the *Protocol*; 2) The measured XAD sorbent inlet temperature exceeded 68°F during most of the operation of the sampling trains; 3) The measured final impinger exit temperature exceeded 68°F during most of the operation of the sampling trains; 4) Some XAD sorbent trap and filter samples arrived at the laboratory at temperatures between 3 and 16°C; and 5) 328 of 335 surrogate spike recoveries met the laboratory specification. The 7 outliers were low recoveries of 2-fluorophenol from the XAD/post-XAD condensate sample fractions.

Table 1-14. Quality Assurance Summary – Run 2

	Sampling Train	**Parameter**	**Deviations from *Protocol* and Quality Assurance/Quality Control Issues**
Run 2	EPA Methods 18/25A/OTM 12	Benzene, Toluene, NMNE VOC	1) The third Tedlar bag sample obtained was analyzed in duplicate instead of triplicate; and 2) The THC2 analyzer response for the low-range calibration gas (after dilution) did not meet the EPA Method 25A requirement for calibration error.
	EPA Methods 2/4	Volumetric Flow Rate	1) The measured final impinger exit temperature exceeded 68°F during most of the operation of the sampling train.
	EPA Methods 5/202	PM	1) Sampling train "3" measured 97.8% moisture and operated at an isokinetic sampling rate of 158%; and 2) The measured final impinger exit temperature exceeded 68°F during most of the operation of the sampling trains.
	SW-846 Method 0010	SVOC	1) The analytical fractions recovered during the Source Test and analyzed separately in the laboratory were different than those presented in the *Protocol*; 2) Critical data points were not recorded every two minutes during various sampling intervals; 3) The measured XAD sorbent inlet temperature exceeded 68°F during most of the operation of the sampling trains; 4) The measured final impinger exit temperature exceeded 68°F during most of the operation of the sampling trains; 5) Critical data points were not recorded every two minutes during various sampling intervals; 6) Some XAD sorbent trap and filter samples arrived at the laboratory at temperatures between 3 and 16°C; 7) 328 of 335 surrogate spike recoveries met the laboratory specification. The 7 outliers were low recoveries of 2-fluorophenol from the XAD/post-XAD condensate sample fractions.

Table 1-15. Quality Assurance Summary – Run 3

	Sampling Train	Parameter	Deviations from *Protocol* and Quality Assurance/Quality Control Issues
Run 3	EPA Methods 18/25A/OTM12	Benzene, Toluene, NMNE VOC	1) The THC2 analyzer response for the low-range calibration gas (after dilution) did not meet the EPA Method 25A requirement for calibration error.
	EPA Methods 2/4	Volumetric Flow Rate	1) Critical data points were not recorded every two minutes during various sampling intervals; and 2) The measured final impinger exit temperature exceeded 68°F during most of the operation of the sampling train.
	EPA Methods 5/202	PM	1) Critical data points were not recorded every two minutes during various sampling intervals; and 2) The measured final impinger exit temperature exceeded 68°F during most of the operation of the sampling trains.
	SW-846 Method 0010	SVOC	1) The analytical fractions recovered during the Source Test and analyzed separately in the laboratory were different than those presented in the *Protocol*; 2) Critical data points were not recorded every two minutes during various sampling intervals; 3) The measured XAD sorbent inlet temperature exceeded 68°F during most of the operation of the sampling trains; 4) The measured final impinger exit temperature exceeded 68°F during most of the operation of the sampling trains; 5) Some XAD sorbent trap and filter samples arrived at the laboratory at temperatures between 3 and 16°C; and 6) 328 of 335 surrogate spike recoveries met the laboratory specification. The 7 outliers were low recoveries of 2-fluorophenol from the XAD/post-XAD condensate sample fractions.

Table 1-16. Quality Assurance Summary – Run 4

	Sampling Train	Parameter	Deviations from *Protocol* and Quality Assurance/Quality Control Issues
Run 4	EPA Methods 18/25A/OTM12	Benzene, Toluene, NMNE VOC	1) The THC2 analyzer response for the low-range calibration gas (after dilution) did not meet the EPA Method 25A requirement for calibration error.
	EPA Methods 2/4	Volumetric Flow Rate	1) The measured final impinger exit temperature exceeded 68°F during most of the operation of the sampling train.
	EPA Methods 5/202	PM	1) The measured final impinger exit temperature exceeded 68°F during most of the operation of the sampling trains.
	SW-846 Method 0010	SVOC	1) The analytical fractions recovered during the Source Test and analyzed separately in the laboratory were different than those presented in the *Protocol*; 2) Critical data points were not recorded every two minutes during various sampling intervals; 3) The measured XAD sorbent inlet temperature exceeded 68°F during most of the operation of the sampling trains; 4) The measured final impinger exit temperature exceeded 68°F during most of the operation of the sampling trains; 5) Some XAD sorbent trap and filter samples arrived at the laboratory at temperatures between 3 and 16°C; and 6) 328 of 335 surrogate spike recoveries met the laboratory specification. The 7 outliers were low recoveries of 2-fluorophenol from the XAD/post-XAD condensate sample fractions.

2.0 Summary of Results

This section presents a summary of Coker process operations as well as the results of the emissions testing of Coker Steam Vent 3 for selected VOCs, NMNE VOCs, selected SVOCs, and PM. Both the Pre-Survey and Source Test programs' results are presented and discussed. The modified methods used for sampling and analysis were specified in detail in the *Protocol* and are discussed briefly in Section 3.0. Example calculations are presented in Section 4.0. Quality assurance/quality control objectives for the measurement data are discussed in Section 5.0.

2.1 Process Operations

The Coker was operated under normal conditions during both the Pre-Survey and Source Test programs. In accordance with EPA's request for information, the specific process data outlined in the *Protocol* was recorded during the Source Test. Coke Drum 3 was operated on a 20 hour cycle during the entire Source Test. The batch duration of Coke Drum 3 was 40 hours during the Source Test. The batch duration is defined as the period of time that includes the operating cycle as well as drum post-cutting procedures such as re-heading, pressure-testing, and back-warming. The batch duration was determined by the elapsed time between each venting cycle, which typically corresponded to 40 hours. Table 2-1 presents a production summary of Coker Drum 3 during the Source Test. Table 2-2 presents the durations of various Coker batch processes that constitute an operating cycle. Additional Coke Drum 3 operating data and venting cycle durations for each test run are presented in Tables 1-2, 1-3, and 1-6. Figures 2-1 through 2-4 present plots of Coke Drum 3 pressure data (recorded by instrument PI-3961) versus the elapsed time of the venting cycle for Runs 1 through 4. Printouts of selected process data recorded approximately every minute during the batch operation of Coke Drum 3 are included in Appendix 2-1.

Table 2-1. Coke Drum 3 – Production Summary

	Date	Coke Drum 3 Outage (ft)	Average Coker Feed Rate (mbpd)	Coke Drum 3 Production (tons per batch)	Coke Drum 3 Production (tons per day)
Run 1	6/3/2008	36	62.8	1,671	1,002
Run 2	6/4-5/2008	33	63.7	1,739	1,043
Run 3	6/6/2008	35	56.5	1,693	1,016
Run 4	6/8/2008	39	55.6	1,602	961
Average	-	36	59.7	1,676	1,006

Table 2-2. Coke Drum 3 – Batch Process Durations

Process Parameters	Run 1			Run 2			Run 3			Run 4		
	6/3/2008			6/4-5/2008			6/6/2008			6/8/2008		
	Start	End	Duration (h:min)	Start	End	Duration (h:min)	Start	End	Duration (h:min)	Start	End	Duration (h:min)
Steam Out to Fractionator	100	130	0:30	1650	1705	0:15	654	710	0:16	056	110	0:14
Steam Out to Blowdown	130	215	0:45	1705	1743	0:38	710	836	1:26	110	148	0:38
Quench Water	215	600	3:45	1743	2235	4:52	836	1408	5:32	148	632	4:44
Soak	500	600	1:00	2135	2235	1:00	1308	1408	1:00	532	632	1:00
Vent and Drain	600	1320	7:20	2235	536	7:01	1408	2055	6:47	632	1225	5:53
Coke Cutting	1320	1600	2:40	536	853	3:17	2055	2335	2:40	1225	1545	3:20

Figure 2-1. Coke Drum 3 Pressure Data – Run 1

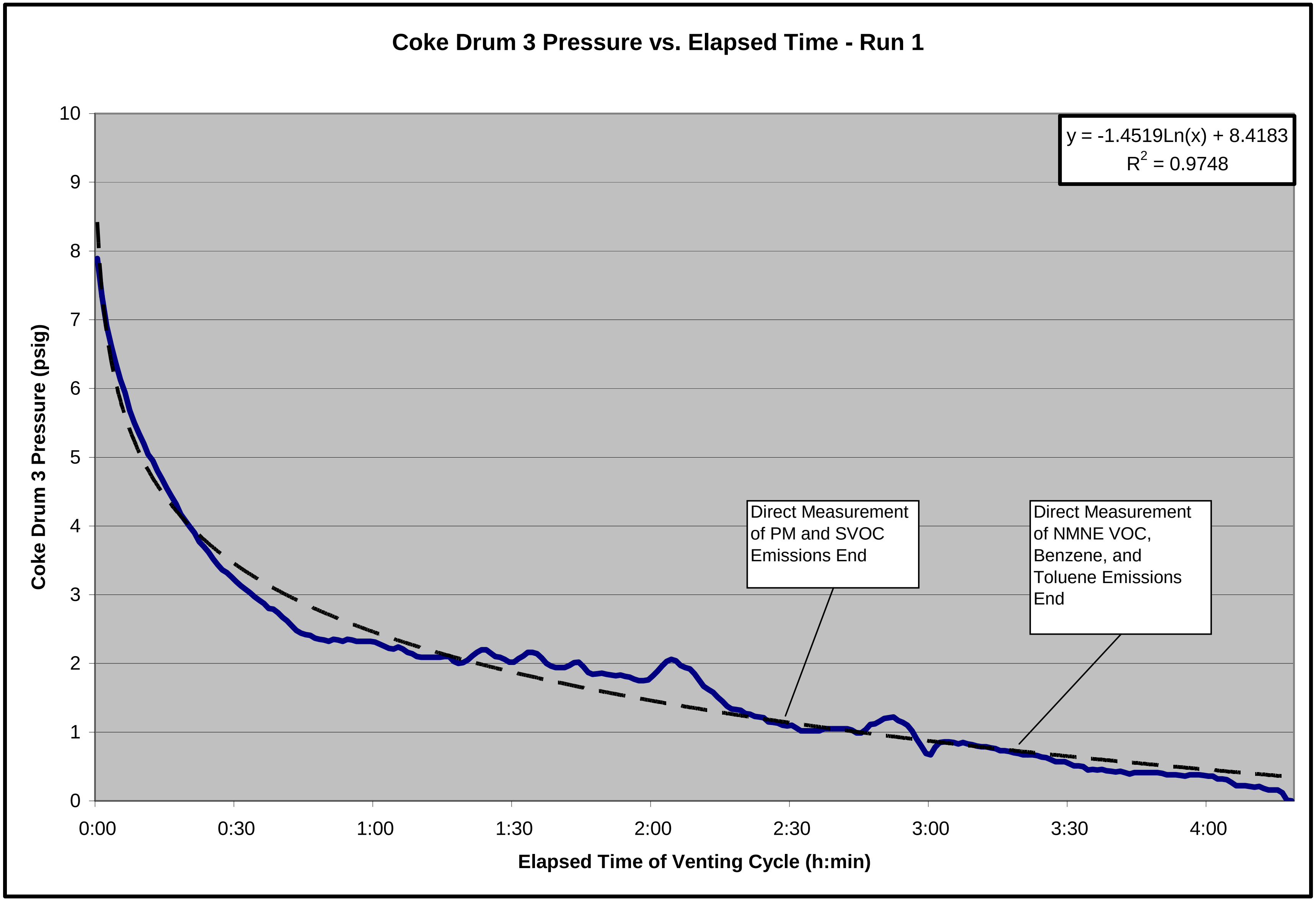


Figure 2-2. Coke Drum 3 Pressure Data – Run 2

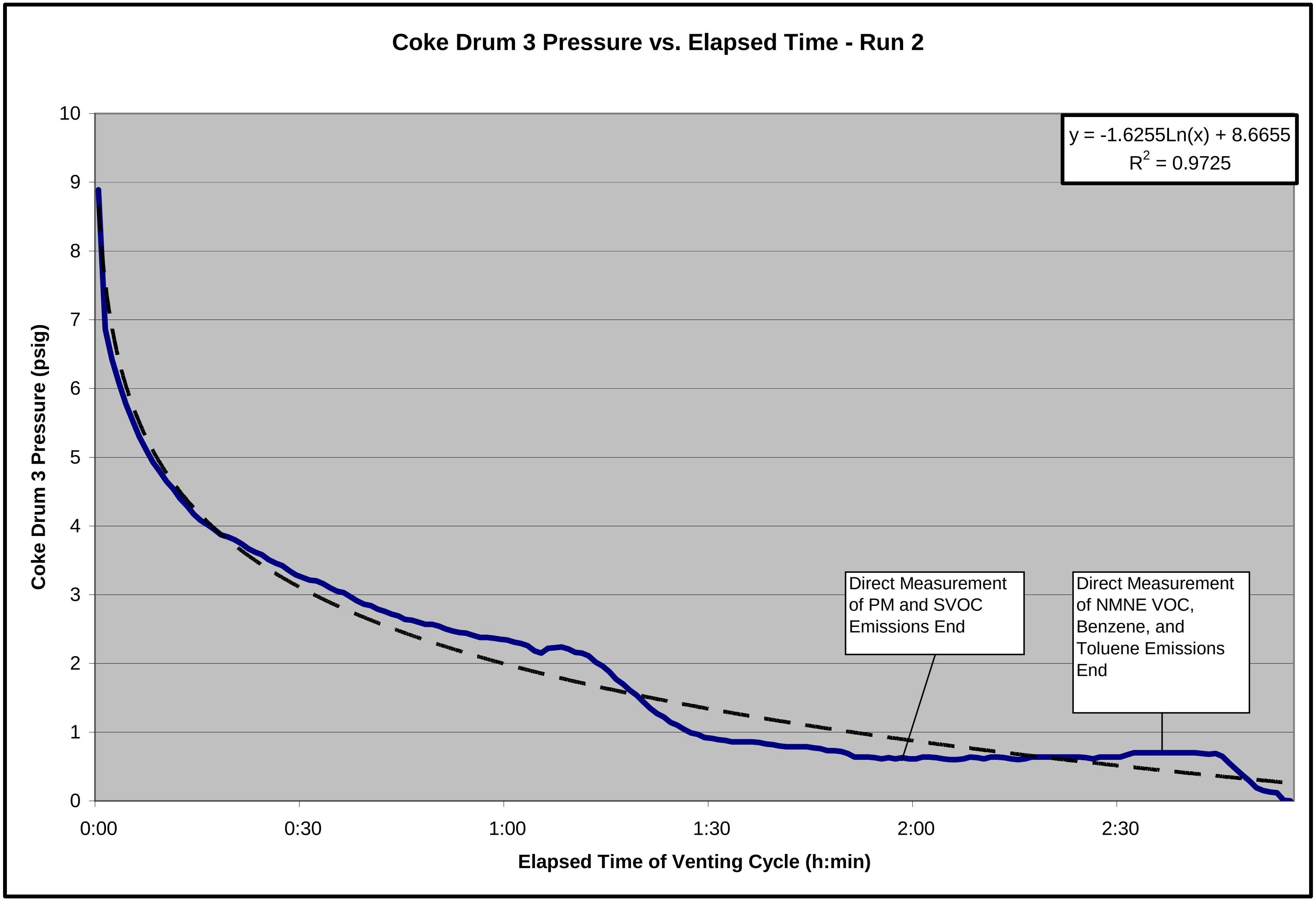


Figure 2-3. Coke Drum 3 Pressure Data – Run 3

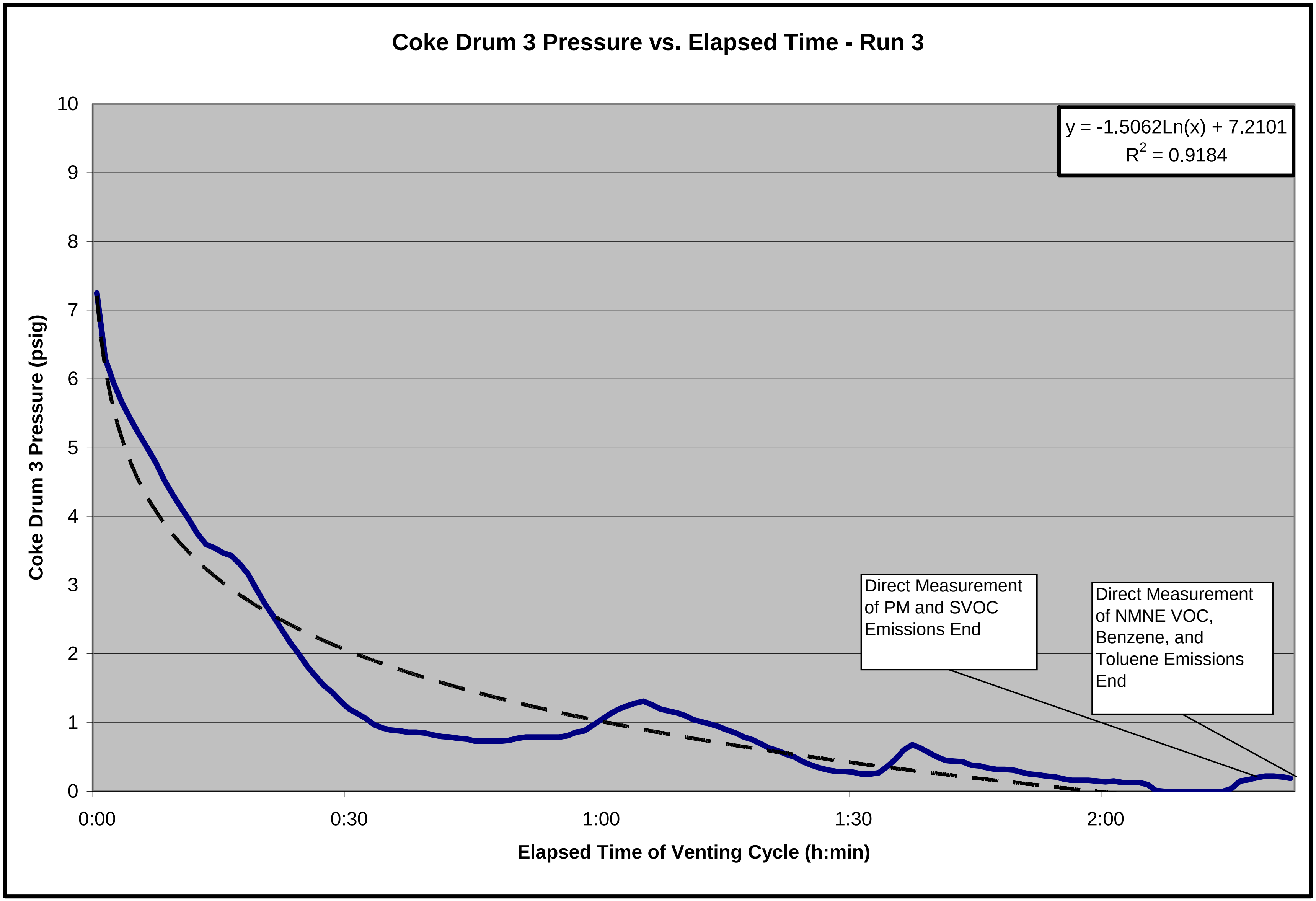
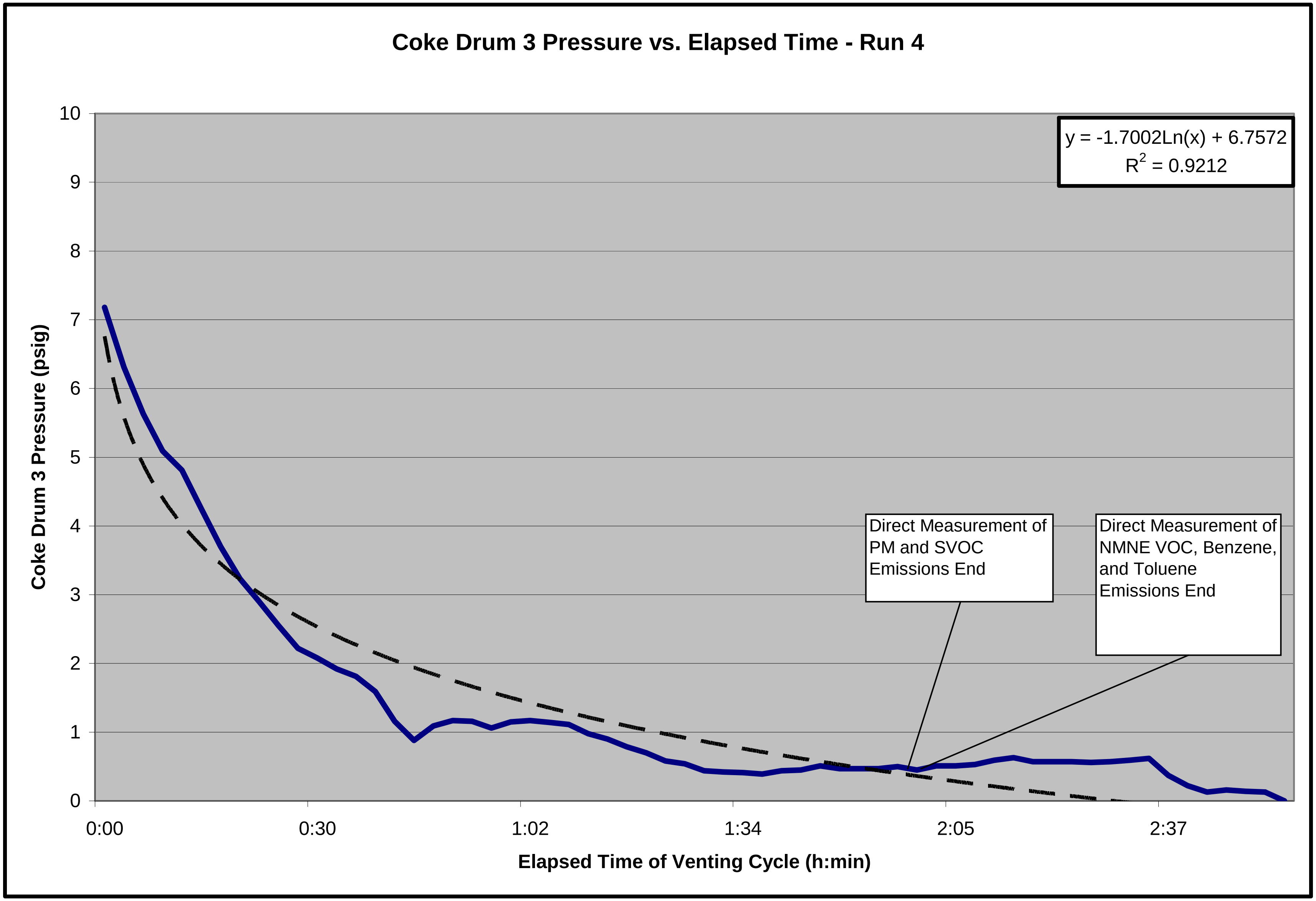


Figure 2-4. Coke Drum 3 Pressure Data – Run 4



2.2 Data Reduction Approach

EPA's request for information communicated interest in developing the mass emission rates for the selected pollutants. Pollutant mass emission rates are typically expressed using an industry standard of mass per unit time, such as lbs/hr, by relating the concentration of a pollutant to the average volumetric flow rate of a gas stream both measured during a distinct unit of time. Due to the atypical, batch nature of the Coker Steam Vent source, HOVENSA proposed that a more comprehensive emissions profile be developed to meet EPA's request. The use of a simple average or time-weighted average is inappropriate for developing an emissions profile for the intermittent, yet dynamic characteristics of the Coker Steam Vent source. Parameters such as gas stream differential pressure and vent static pressure varied greatly during the venting cycle (especially during the first 15 minutes of a given venting event) as the coke drum depressurized and process parameters such as temperature and pressure fluctuated and steadily decreased. Typical combustion sources – for which the EPA Methods were originally developed – do not operate as dynamic batch processes. Instead, they produce effluent gas streams that are more or less static in their profiles. In addition, the duration of each complete venting cycle varied according to the batch process of the Coker. The data reduction approach used in this report integrates pollutant mass emission rates (as lbs/min and lbs/interval) throughout the complete venting cycle, starting at the point of Coker Steam Vent 3 activation and ending at the point of optimal depressurization of Coke Drum 3. A final pollutant mass per complete venting cycle is reported as lbs/cycle for each of the four test runs performed during the Source Test.

2.2.1 Venting Cycle Interval vs. Sampling Train Interval

A distinction is made in this report between a "venting cycle interval" and a "sampling train interval." A "venting cycle interval" is defined as a period of time between when Coker Steam Vent 3 was opened (i.e., activated) and the point of optimal depressurization. A "sampling train interval" is defined as a period of time in which a given sampling train was operational and actively sampling the Coker Steam Vent 3 gas stream. For example, the sampling train interval of EPA Method 5/202 sampling train "2" occurred between 607 and 637 during Run 1. The venting cycle interval corresponding to the measurement of PM concentration by EPA Method 5/202 sampling train "2" was from 600 to 637. The PM concentration measured with EPA Method 5/202 sampling train "2" – operated from 607 to 637 – and the database of instantaneous volumetric flow rate data was used to calculate PM mass emission rates, in both lbs/min and lbs/interval, for the venting cycle interval between 600 and 637.

2.2.2 Volumetric Flow Rate Database

The sequential EPA Method 5/202 and SW-846 Method 0010 sampling trains and the redundant EPA Method 2/4 sampling train were used to quantify instantaneous volumetric flow rates for as long as possible during each venting cycle. A database consisting of instantaneous volumetric flow rates measured by every sampling train operated during a given venting cycle was used to develop average volumetric flow rates for a given venting cycle interval (defined above). The average venting cycle moisture concentration, developed from moisture concentrations quantified by each individual sampling train operated during a given venting cycle, was used to calculate average dry vent gas volumetric flow rates (dscfm) for each venting cycle interval. This approach was used to maintain the highest level of consistency in the development of pollutant mass emission rates, as well as to incorporate the averaging of data as often as possible.

2.2.3 Extrapolated Data

The volumetric flow rate data "gaps" produced through the limited operation of the EPA Method 2/4, EPA Method 5/202, and SW-846 Method 0010 sampling trains during each venting cycle were extrapolated by plotting the instantaneous volumetric flow rates, in scfm, measured by each individual sampling train against the elapsed time of the venting cycle. Either an exponential or logarithmic regression curve was developed for each sampling train's data (depending on which fit produced the largest R^2 value) and used to calculate instantaneous "pro-rated" volumetric flow rates during the time period between the end of direct measurement and the end of the complete venting cycle (the optimal depressurization of Coke Drum 3). The extrapolated instantaneous data from each individual sampling train operated during a given venting cycle was used to calculate average volumetric flow rates for extrapolated venting cycle intervals. URS sampling train operators recorded as many data points as possible for parameters critical to the calculation of vent gas velocity for the purpose of this volumetric flow rate data extrapolation. Printouts and raw data sheets of all data used to extrapolate instantaneous volumetric flow rates with regression curves are included in Appendix 2-2.

2.2.4 Pollutant Mass Emission Rates in Lbs/Cycle

The average dry vent gas volumetric flow rate (dscfm) and pollutant concentration (dry basis) measured for each venting cycle interval were used to develop pollutant mass emission rates for each venting cycle interval in the units of lbs/min and lbs/interval. The pollutant masses quantified as lbs/interval were then totaled to report a final pollutant mass emission rate in the unit of lbs/cycle for each of the four test runs performed during the Source Test.

Section 2.3 presents a summary of average vent gas volumetric flow rate results obtained during the Source Test using EPA Method 2, 3, and 4. Section 2.4 presents speciated VOC emission results measured during both the Pre-Survey and Source Test. Section 2.5 presents a summary of NMNE VOC emission results obtained during the Source Test. Section 2.6 presents a summary of SVOC emission results, and Section 2.7 presents a summary of PM emission results, both obtained during the Source Test.

2.3 Source Test Results for Volumetric Flow Rate

Vent gas sampling to determine the volumetric flow rate was performed during the Source Test according to EPA Methods 2, 3 and 4, modified according to the *Protocol* conditionally approved by EPA. Each EPA Method 2/4, EPA Method 5/202, and SW-846 Method 0010 sampling train was operated to obtain the most accurate velocity and moisture measurements as possible given equipment limitations and the nature of the vent stream. Due to the critical nature of volumetric flow rate measurement in the development of pollutant mass emission rates, as well as the atypical data reduction strategy used for the Source Test results, this section presents a significant amount of data in the form of tables and figures. Printouts of all data used to extrapolate instantaneous and average volumetric flow rates are included in Appendix 2-2.

The dry gas molecular weight fraction of the vent gas was determined by using the average dry gas percentages of methane, ethane, oxygen, and carbon dioxide, with a balance of nitrogen, measured during each test run. The average vent gas molecular weights (wet basis) calculated for Runs 1-4 are presented in Table 2-3.

Table 2-4 presents the average volumetric flow rates of dry gas developed for each venting cycle interval associated with an individual sampling train conducted during Run 1. (Individual sampling train intervals, as opposed to venting cycle intervals, are presented in Table 1-8.) Figures 2-5 and 2-6 present plots of instantaneous wet vent gas volumetric flow rates versus the elapsed time of the 258-minute venting cycle for both measured and extrapolated data. Volumetric flow rate data was not obtained from the separate EPA Method 2/4 sampling train during Run 1 due to equipment malfunction.

Table 2-5 presents the average volumetric flow rates of dry gas developed for each venting cycle interval associated with an individual sampling train conducted during Run 2. (Individual sampling train intervals, as opposed to venting cycle intervals, are presented in Table 1-9.) Figures 2-7 through 2-9 present plots of instantaneous wet vent gas volumetric flow rates versus the elapsed time of the 175-minute venting cycle for both measured and extrapolated data.

Table 2-6 presents the average volumetric flow rates of dry gas developed for each venting cycle interval associated with an individual sampling train conducted during Run 3. (Individual sampling train intervals, as opposed to venting cycle intervals, are presented in Table 1-10.) Figures 2-10 through 2-12 present plots of instantaneous wet vent gas volumetric flow rates versus the elapsed time of the 142-minute venting cycle for both measured and extrapolated data.

Table 2-7 presents the average volumetric flow rates of dry gas developed for each venting cycle interval associated with an individual sampling train conducted during Run 3. (Individual sampling train intervals, as opposed to venting cycle intervals, are presented in Table 1-11.) Figures 2-13 through 2-15 present plots of instantaneous wet vent gas volumetric flow rates versus the elapsed time of the 174-minute venting cycle for both measured and extrapolated data.

Table 2-3. Average Vent Gas (Wet) Molecular Weight Results

	Date	Average Moisture Conc. (%)	Average CH_4 Conc. (ppmw)	Average C_2H_6 Conc. (ppmw)	Average CH_4 Conc. (ppmd)	Average C_2H_6 Conc. (ppmd)	Average CH_4 Conc. (%, dry)	Average C_2H_6 Conc. (%, dry)	Average O_2 Conc. (%, dry)	Average CO_2 Conc. (%, dry)	Average N_2 Conc. (%, dry)	Average Vent Gas Molecular Weight, Wet (g/g-mol)
Run 1	6/3/2008	98.85	8,359	926	728,050	80,658	72.8	8.07	2.00	0	17.1	18.02
Run 2	6/4-5/2008	98.37	12,096	1,423	742,672	87,351	74.3	8.74	2.67	0	14.3	18.02
Run 3	6/6/2008	99.24	4,392	509	579,595	67,140	58.0	6.71	10.5	0	24.8	18.03
Run 4	6/8/2008	98.60	10,003	1,106	715,933	79,152	71.6	7.92	2.33	0	18.2	18.02

Table 2-4. Average Dry Vent Gas Volumetric Flow Rate Results per Venting Cycle Interval – Run 1

	Date	Sampling Train	Sampling Train ID	Venting Cycle	Venting Cycle Interval	Venting Cycle Interval Duration (min)	Average Moisture Conc. (%)	Average Volumetric Flow Rate (scfm)	Average Volumetric Flow Rate (dscfm)
Run 1	6/3/2008	EPA Methods 18/25A/OTM12	N/A	600-1018	600-631	31	98.85	20,594	236
					631-701	30		17,438	200
					701-910	129		13,615	156
			EXT[1]		910-1018	68		10,463	120
		EPA Methods 5/202	2		600-637	37		19,863	228
			3		637-708	31		17,377	200
			4		708-822	74		14,437	166
			EXT		822-1018	116		11,121	128
		SW-846 Method 0010	A		600-632	32		20,594	236
			B		632-703	31		17,391	200
			D		703-826	83		14,431	166
			EXT		826-1018	112		11,062	127

[1] Extrapolated data.

Figure 2-5. EPA Method 5/202 Wet Vent Gas Volumetric Flow Rate vs. Elapsed Time – Run 1

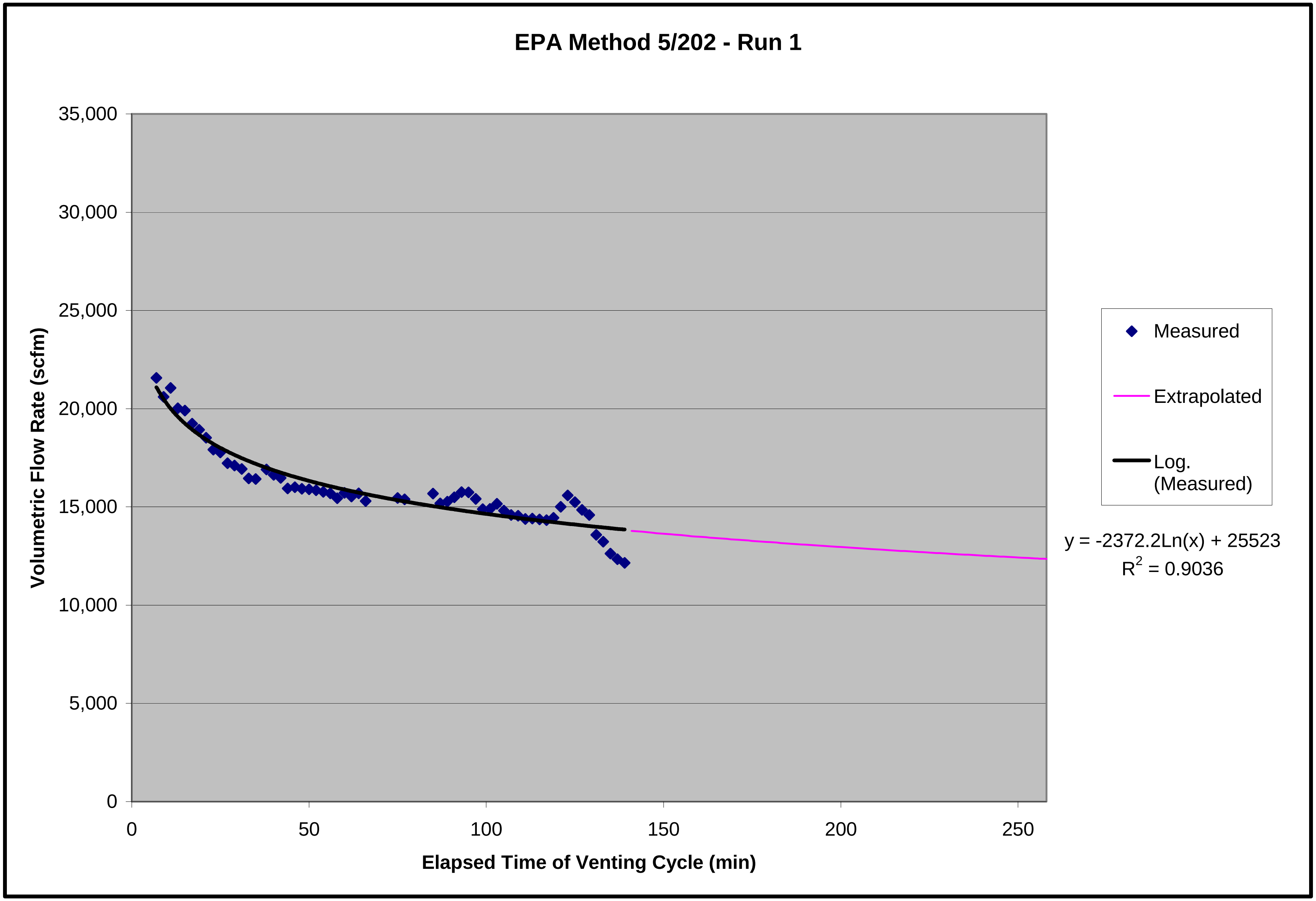


Figure 2-6. SW-846 Method 0010 Wet Vent Gas Volumetric Flow Rate vs. Elapsed Time – Run 1

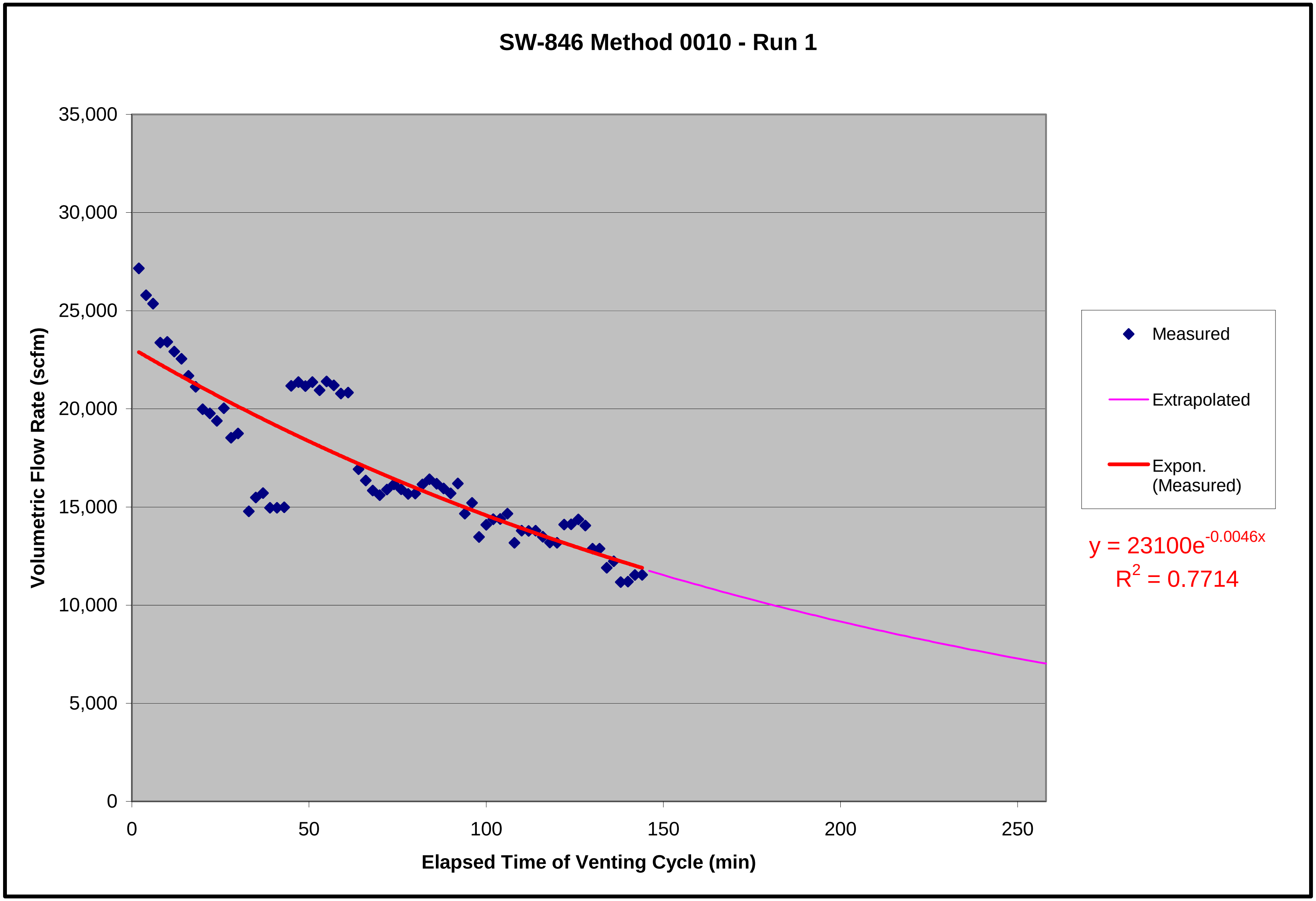


Table 2-5. Average Dry Vent Gas Volumetric Flow Rate Results per Venting Cycle Interval – Run 2

	Date	Sampling Train	Sampling Train ID	Venting Cycle	Venting Cycle Interval	Venting Cycle Interval Duration (min)	Average Moisture Conc. (%)	Average Volumetric Flow Rate (scfm)	Average Volumetric Flow Rate (dscfm)
Run 2	6/4-5/2008	EPA Methods 18/25A/OTM 12	N/A	2235-0130	2235-2305	30	98.37	21,663	353
					2305-2335	30		17,559	286
					2335-0115	100		8,688	142
			EXT[1]		115-130	15		4,181	68.1
		EPA Methods 5/202	1		2235-2308	33		21,540	351
			2		2308-2339	31		17,195	280
			3		2339-040	61		10,032	163
			EXT		040-130	50		5,197	84.6
		SW-846 Method 0010	A		2235-2306	31		21,581	351
			B		2306-2337	31		17,418	284
			C		2337-035	58		10,548	172
			EXT		035-130	55		5,332	86.8

[1] Extrapolated data.

Figure 2-7. EPA Method 5/202 Wet Vent Gas Volumetric Flow Rate vs. Elapsed Time – Run 2

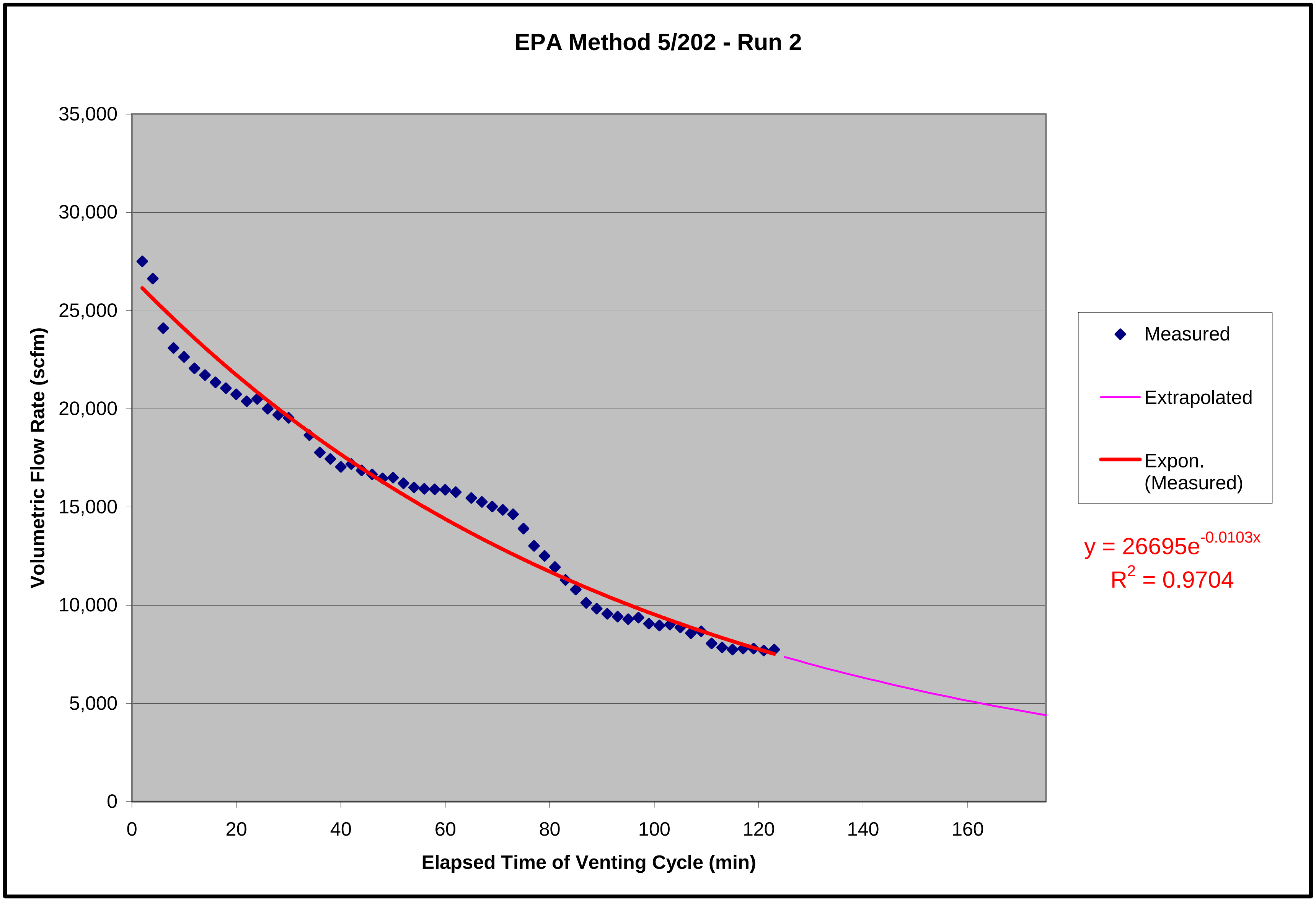


Figure 2-8. SW-846 Method 0010 Wet Vent Gas Volumetric Flow Rate vs. Elapsed Time – Run 2

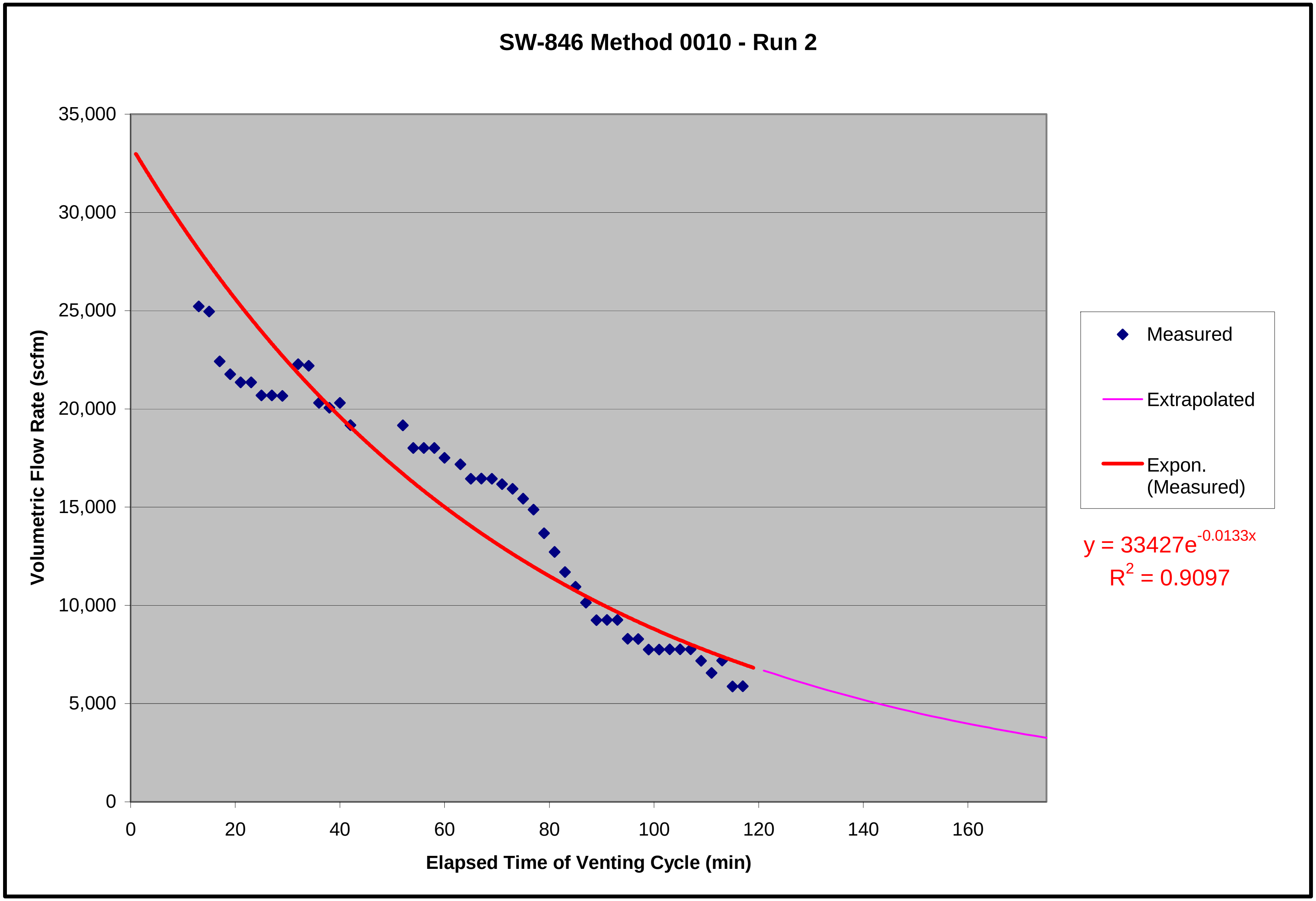


Figure 2-9. EPA Method 2/4 Wet Vent Gas Volumetric Flow Rate vs. Elapsed Time – Run 2

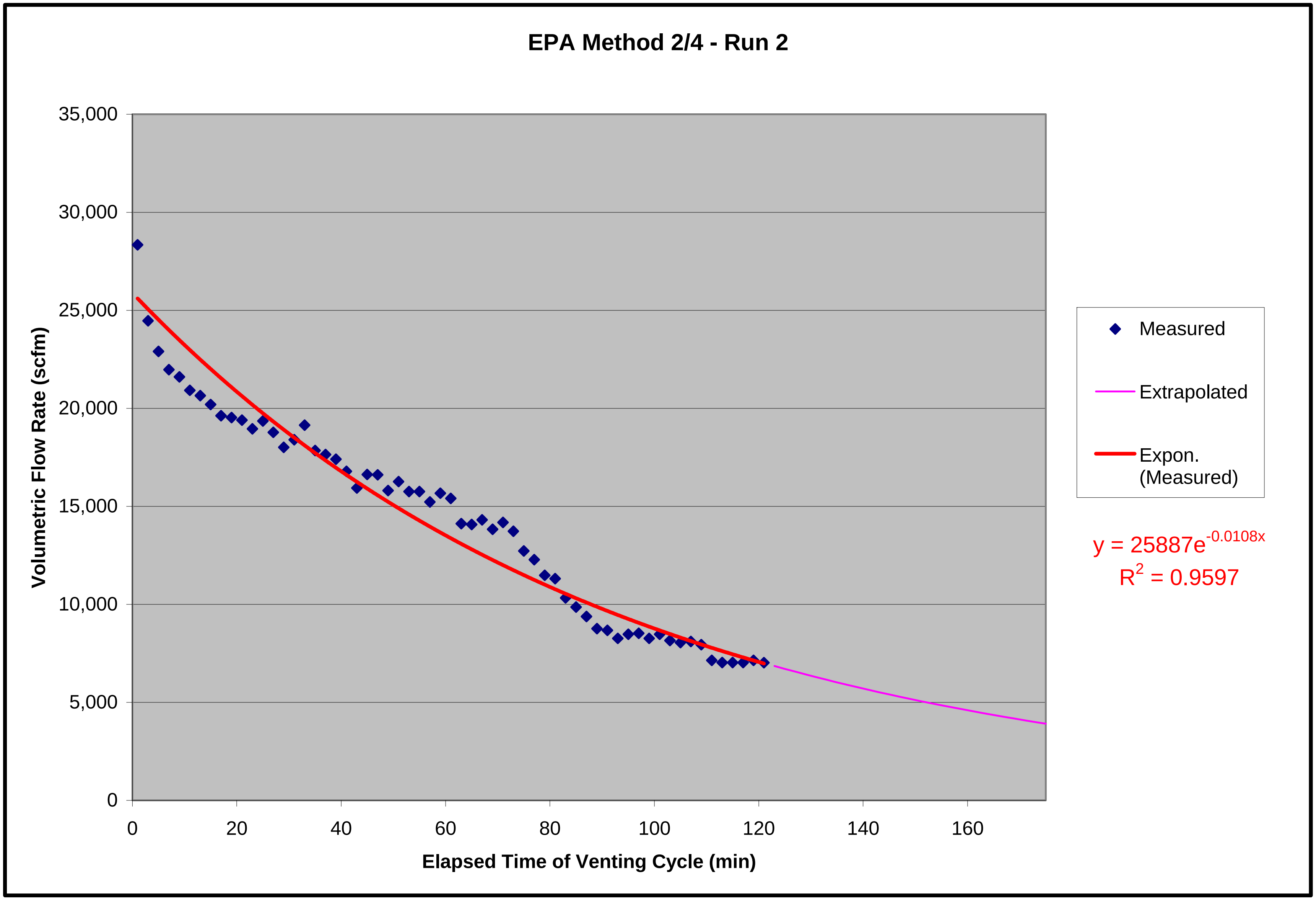


Table 2-6. Average Dry Vent Gas Volumetric Flow Rate Results per Venting Cycle Interval – Run 3

	Date	Sampling Train	Sampling Train ID	Venting Cycle	Venting Cycle Interval	Venting Cycle Interval Duration (min)	Average Moisture Conc. (%)	Average Volumetric Flow Rate (scfm)	Average Volumetric Flow Rate (dscfm)
Run 3	6/6/2008	EPA Methods 18/25A/OTM 12	N/A	1408-1630	1408-1438	30	99.24	19,821	150
					1438-1508	30		9,438	71.5
					1508-1630	82		5,763	43.7
			EXT[1]		1630-1719	49		2,518	19.1
		EPA Methods 5/202	1		1408-1443	35		18,909	143
			2		1443-1533	50		9,298	70.5
			3		1533-1622	49		4,139	31.4
			EXT		1622-1630	8		2,812	21.3
		SW-846 Method 0010	A		1408-1439	31		19,821	150
			C		1439-1532	53		9,400	71.2
			D		1532-1621	49		4,214	31.9
			EXT		1621-1630	9		2,812	21.3

[1] Extrapolated data.

Figure 2-10. EPA Method 5/202 Wet Vent Gas Volumetric Flow Rate vs. Elapsed Time – Run 3

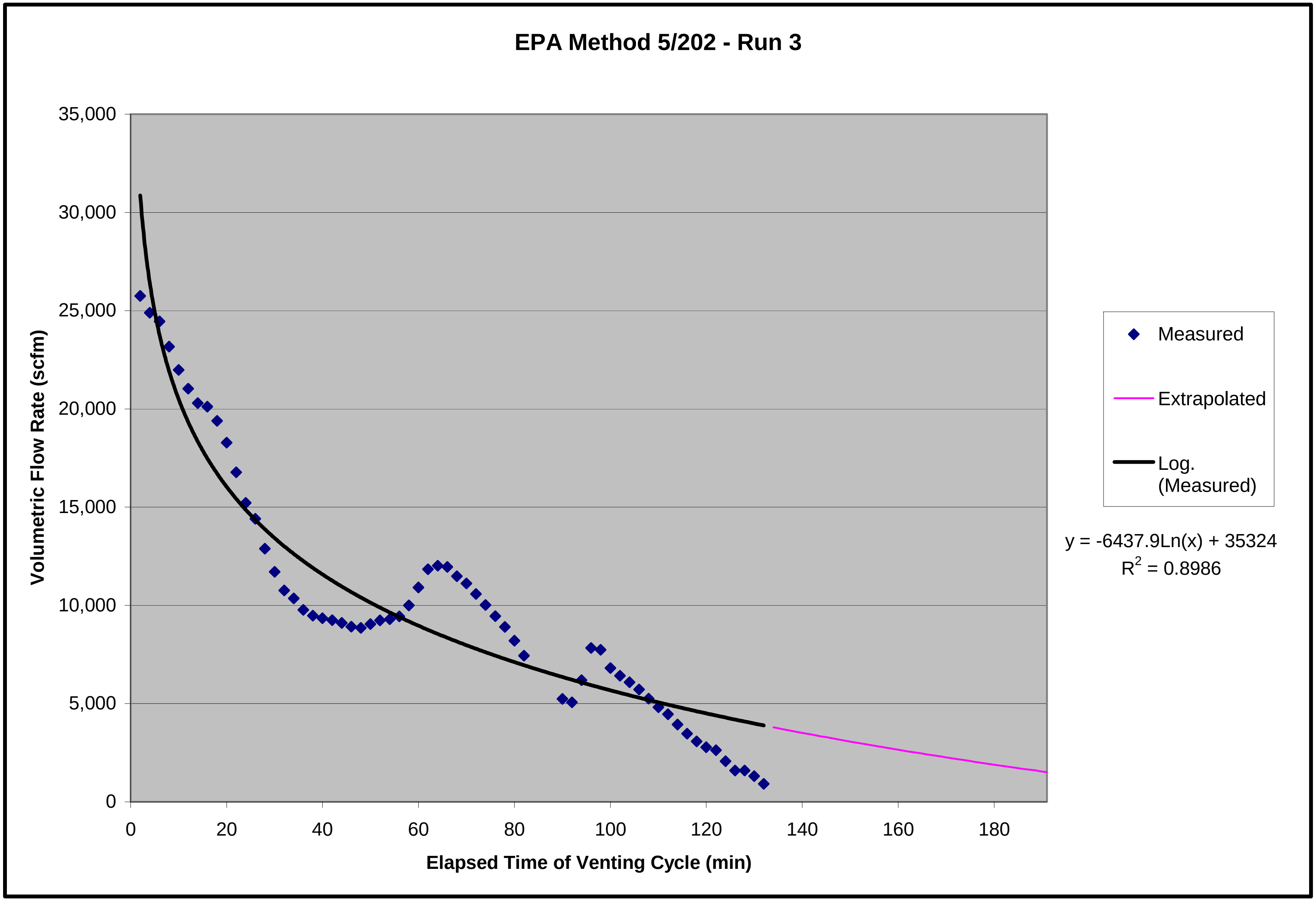


Figure 2-11. SW-846 Method 0010 Wet Vent Gas Volumetric Flow Rate vs. Elapsed Time – Run 3

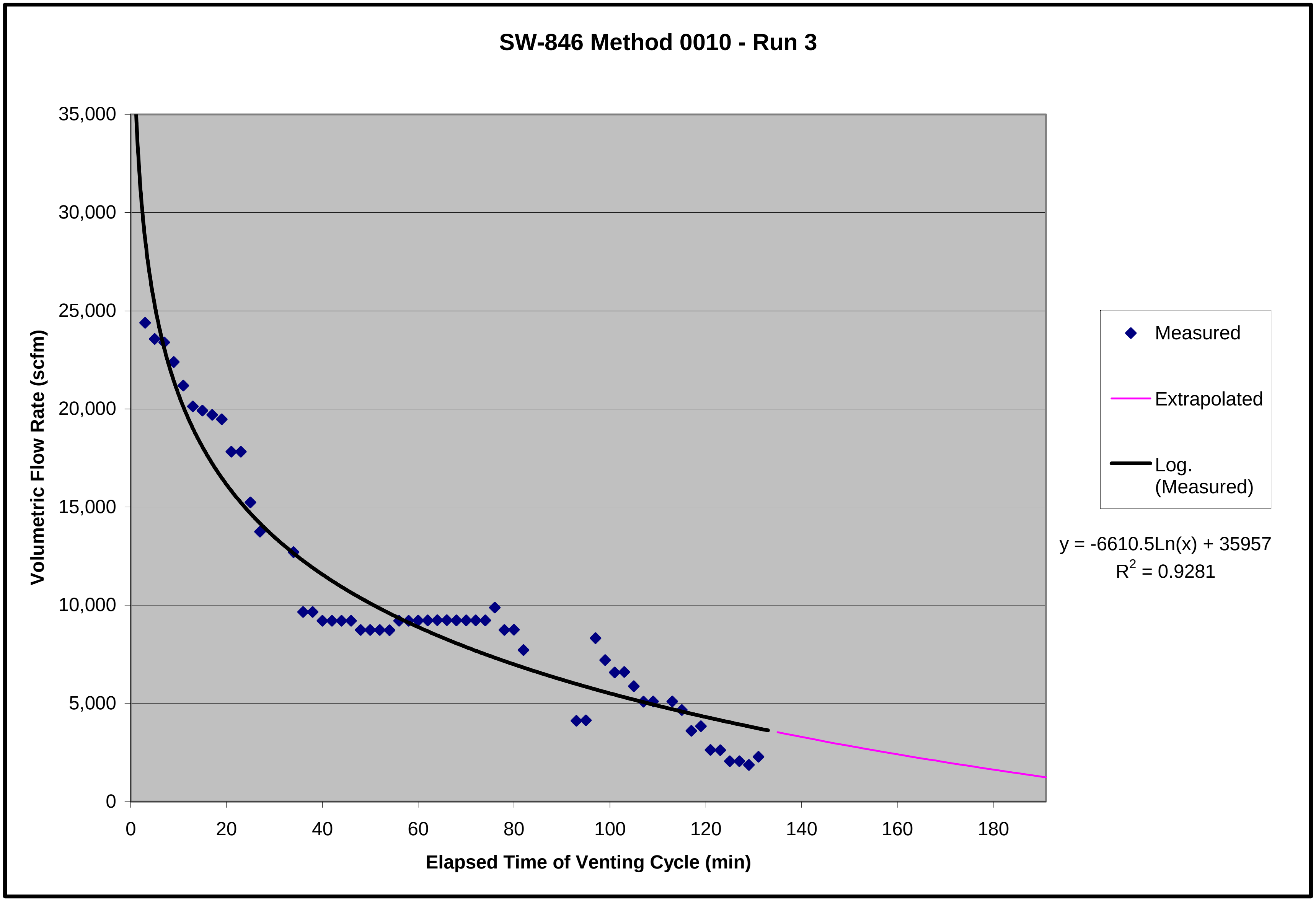


Figure 2-12. EPA Method 2/4 Wet Vent Gas Volumetric Flow Rate vs. Elapsed Time – Run 3

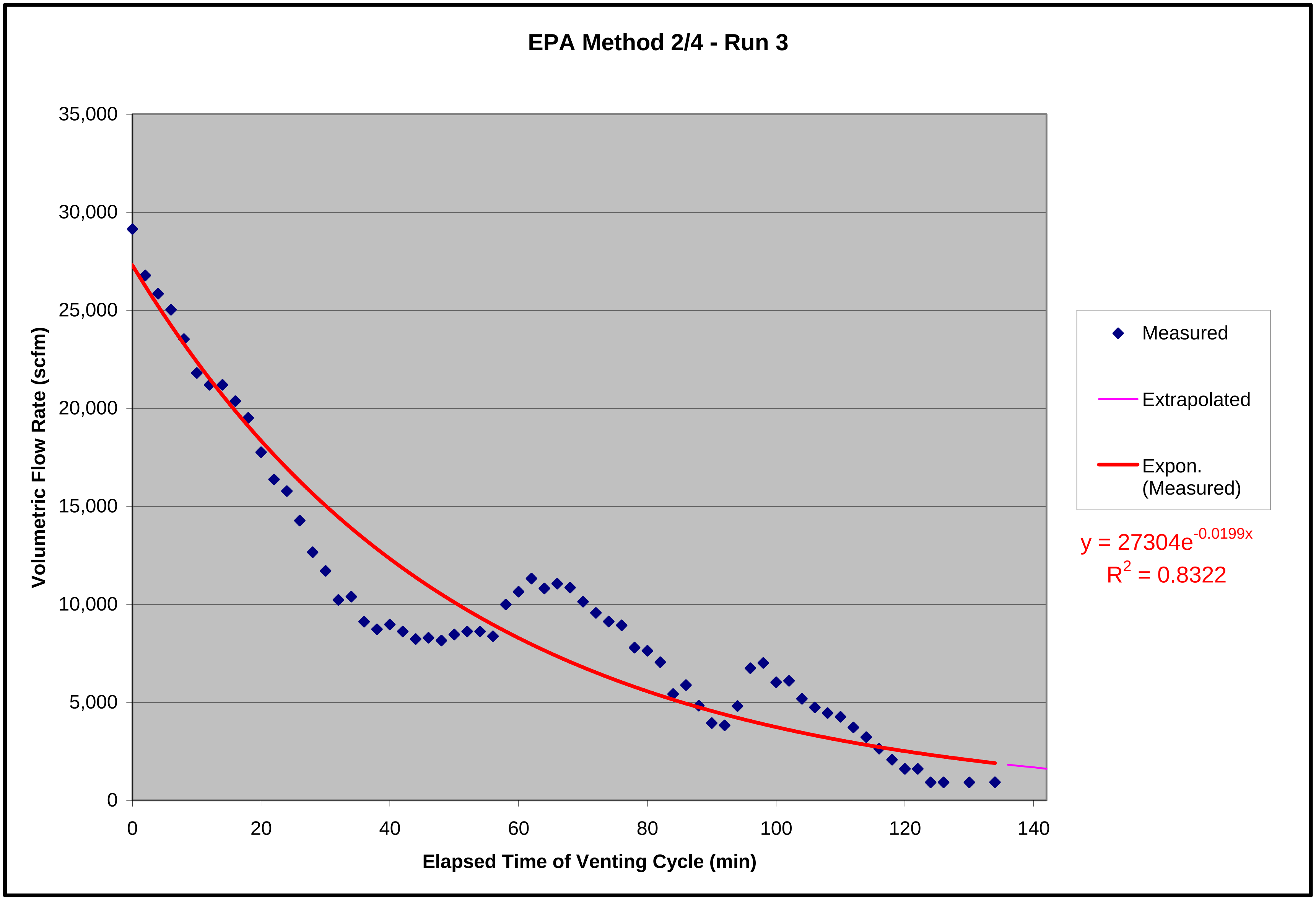


Table 2-7. Average Dry Vent Gas Volumetric Flow Rate Results per Venting Cycle Interval – Run 4

	Date	Sampling Train	Sampling Train ID	Venting Cycle	Venting Cycle Interval	Venting Cycle Interval Duration (min)	Average Moisture Conc. (%)	Average Volumetric Flow Rate (scfm)	Average Volumetric Flow Rate (dscfm)
Run 4	6/8/2008	EPA Methods 18/25A/OTM 12	N/A	632-926	632-702	30	98.60	20,989	293
					702-732	30		11,435	160
					732-840	68		7,630	107
			EXT[1]		840-926	46		4,232	59.1
		EPA Methods 5/202	1		632-705	33		20,743	290
			2		705-736	31		11,149	156
			3		736-834	58		7,708	108
			EXT		834-926	52		4,371	61.1
		SW-846 Method 0010	A		632-703	31		20,863	291
			B		703-733	30		11,333	158
			C		733-831	58		7,846	110
			EXT		831-926	55		4,507	63.0

[1] Extrapolated data.

Figure 2-13. EPA Method 5/202 Wet Vent Gas Volumetric Flow Rate vs. Elapsed Time – Run 4

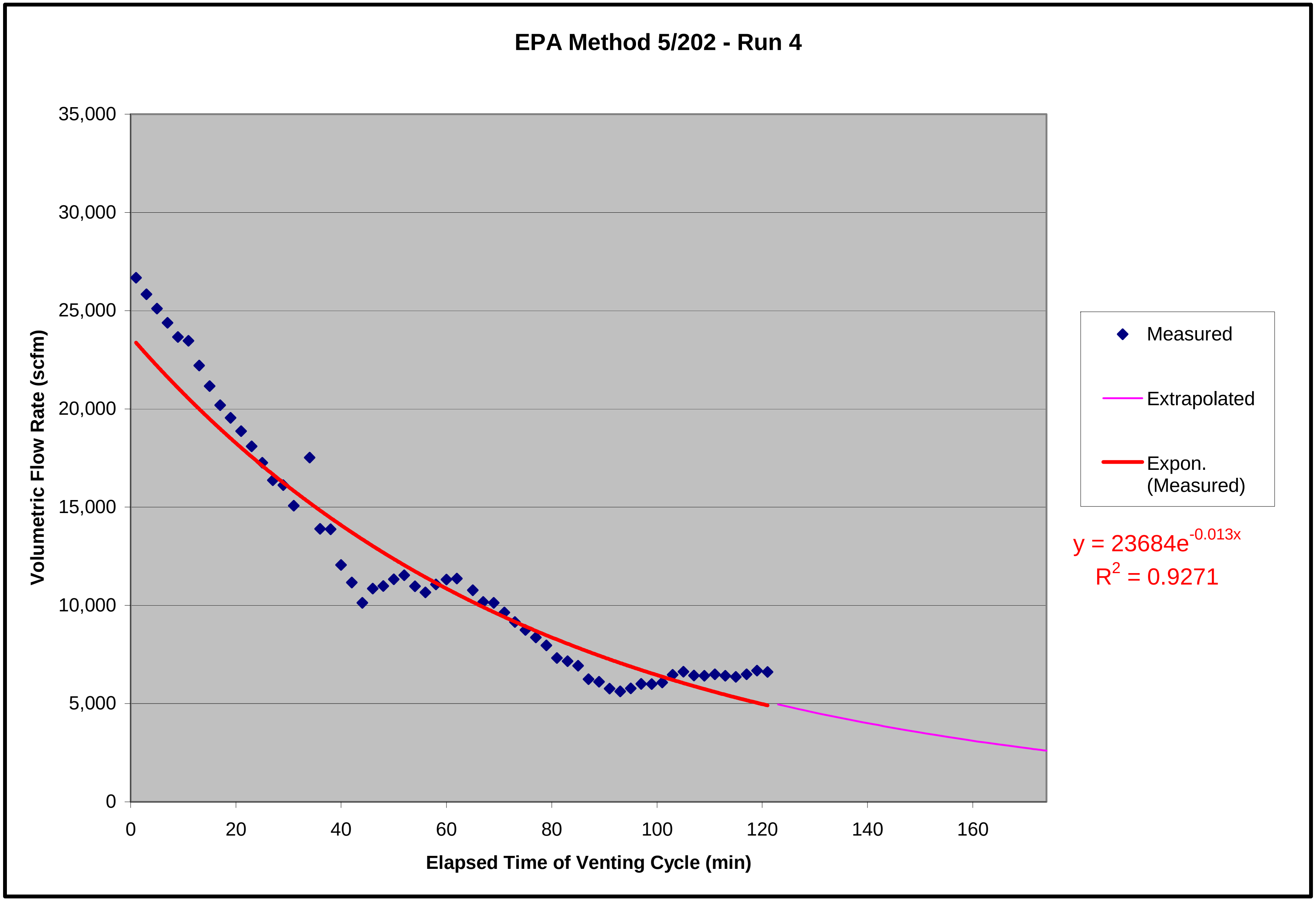


Figure 2-14. SW-846 Method 0010 Wet Vent Gas Volumetric Flow Rate vs. Elapsed Time – Run 4

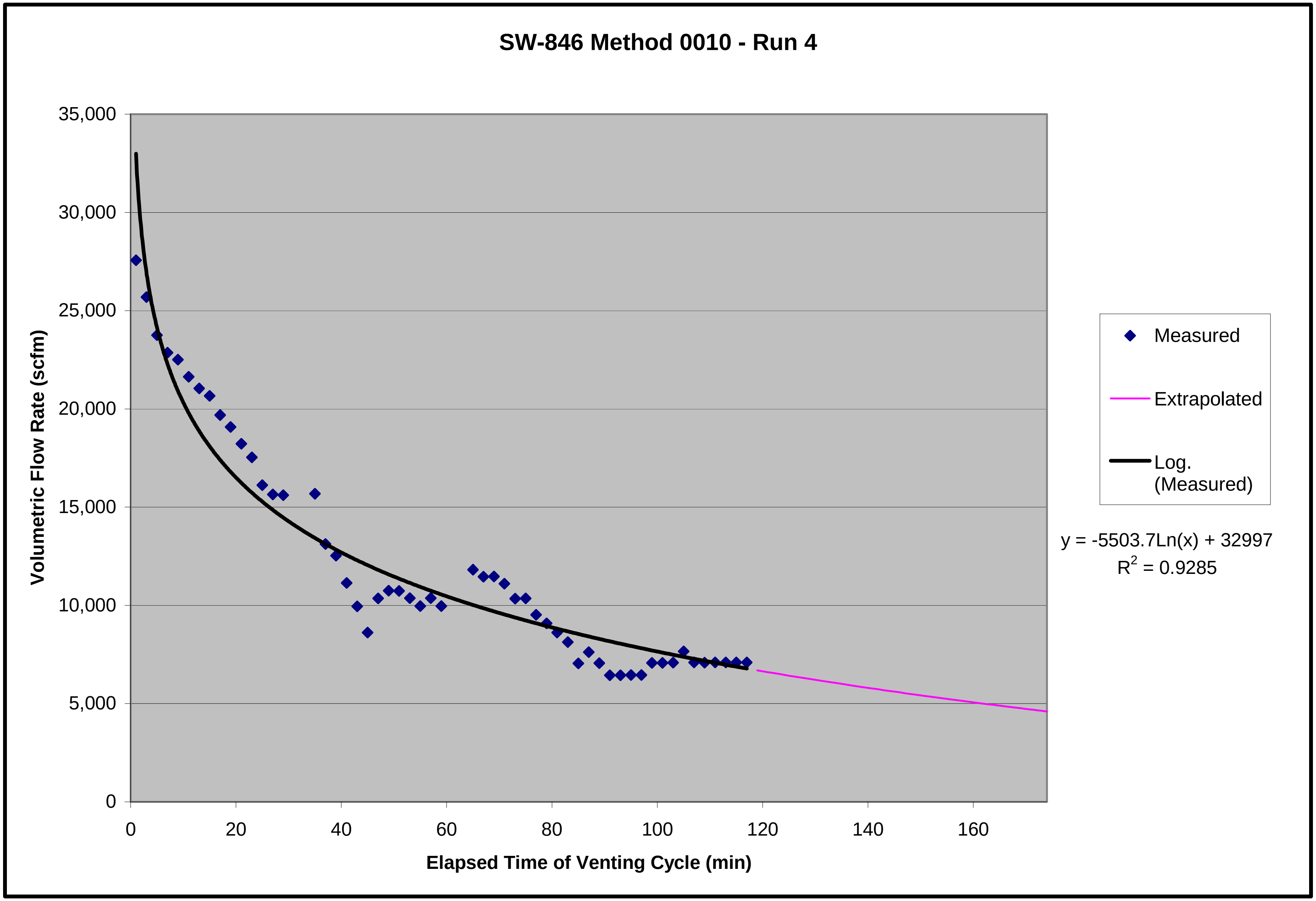
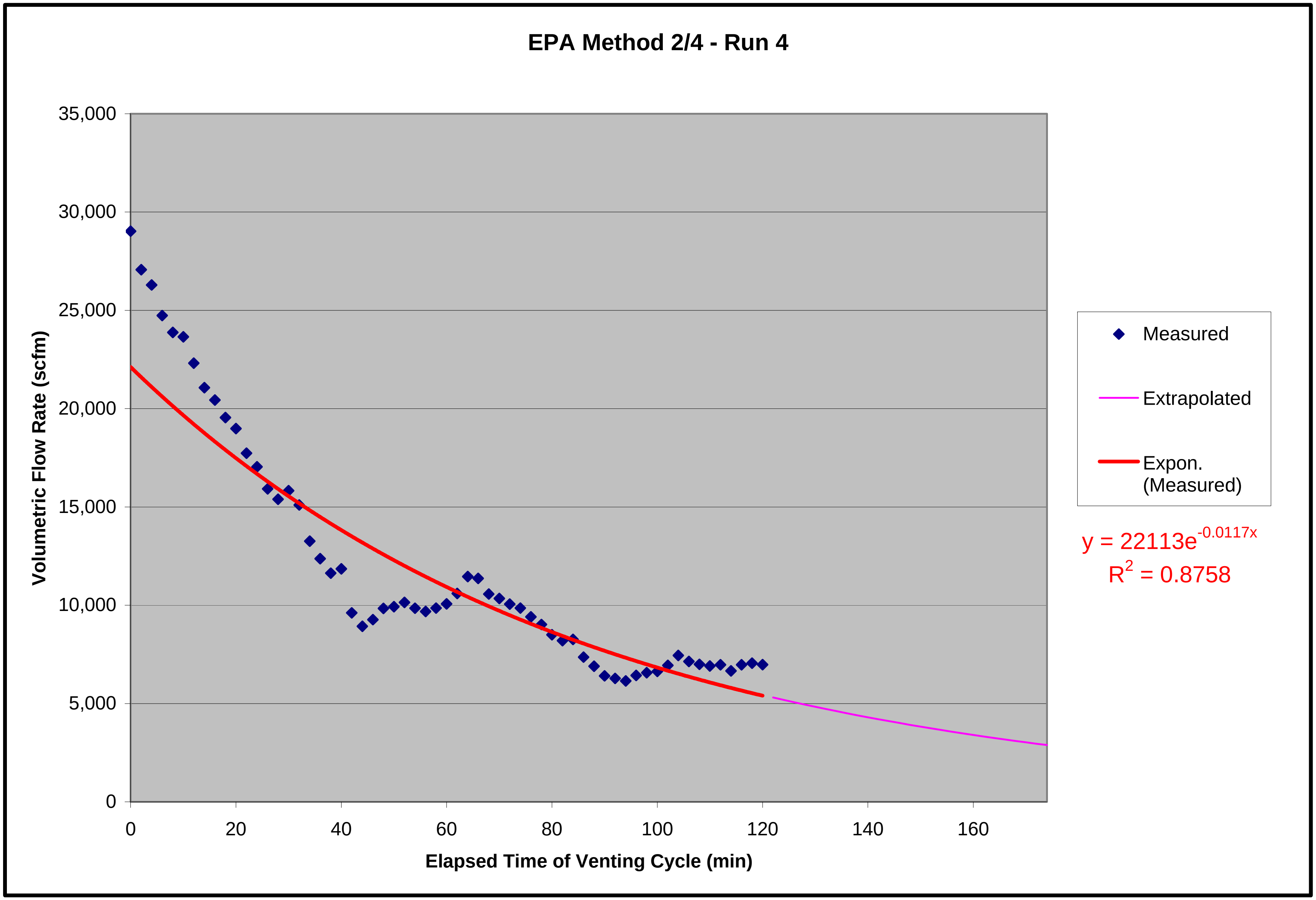


Figure 2-15. EPA Method 2/4 Wet Vent Gas Volumetric Flow Rate vs. Elapsed Time – Run 4



2.4 Results for Speciated Volatile Organic Compound Emissions

Speciated VOC emissions results obtained during both the Pre-Survey and Source Test programs are presented in this section.

2.4.1 Pre-Survey Results for Volatile Organic Compound Concentrations

The Pre-Survey was performed according to Section 5.6 of the *Protocol*. The Pre-Survey was executed for the purpose of identifying target volatile organic analytes for the Source Test of Coker Steam Vent 3 using EPA Method 18. Pre-Survey vent gas samples were collected during three separate venting cycles of Coker Steam Vent 3, designated as Runs A, B, and C, using a modified EPA Method 5/TO-14 sampling train with a slipstream of dry sample gas routed to a Summa canister. The Summa canister sample fractions were analyzed by GC/MS according to EPA Method TO-14, and the condensate sample fractions were analyzed by GC/MS according to SW-846 Method 8260B. Pre-Survey concentration results are presented in Tables 2-8 through 2-10. The development of mass emission rates for speciated volatile organic compounds was not included in the scope of the Pre-Survey program.

Several Summa canister samples were collected over the duration of a test run while only one condensate sample was collected during each test run. As a result, the EPA Method TO-14 concentration results presented in Tables 2-8 through 2-10 for the Summa canister samples represent the average analyte concentrations per run. These average EPA Method TO-14 results were then added to the SW-846 Method 8260B concentration results from the condensate samples obtained for each run (if applicable). In some cases, an organic analyte was not detected in both the Summa canister and condensate sample fractions, or an analyte was not part of the established analytical list for the applicable method. The total concentration results obtained during each test run, in ppmd, were then averaged and corrected to the average moisture concentration (99%) measured from all three test runs in order to present these results on a ppmw basis. The full Pre-Survey laboratory report is included as Appendix 2-3.

The *Protocol* defined that HOVENSA would quantify, during the Source Test, any major organic component (in addition to methane, ethane, benzene, and toluene) measured in excess of 100 ppmw in the Coker Steam Vent 3 gas stream during the Pre-Survey. The Pre-Survey results indicated that no additional organic compounds exceeded this criterion. The organic compound with the highest average concentration was determined to be n-butane at 10 ppmw. The tentatively identified compound (TIC) with the highest average concentration was designated as "Unknown" because the analytical data failed to correspond to the mass spectrometry (MS) library search performed as part of EPA Method TO-14. Based upon technical guidance from the analytical laboratory, the "Unknown" TIC most likely represents a mixture of propane and propene co-eluting from the GC column at an average aggregate concentration of 27 ppmw.

Table 2-8. Pre-Survey Results for Volatile Organic Compound Concentrations

Volatile Organic Compounds[1]	Run A			Run B			Run C			Runs A-C Average	Runs A-C Average
	Average Canister Conc. (ppmd)	Condensate Conc. (ppmd)	Total Conc. (ppmd)	Average Canister Conc. (ppmd)	Condensate Conc. (ppmd)	Total Conc. (ppmd)	Average Canister Conc. (ppmd)	Condensate Conc. (ppmd)	Total Conc. (ppmd)	Total Conc. (ppmd)	Total Conc. Corrected to 99% Moisture (ppmw)
Acetone	ND[2]	94.7	94.7	ND	141	141	ND	147	147	128	1.28
Benzene	173	60.6	233	355	46.3	401	142	44.8	187	274	2.74
n-Butane	690	---[3]	690	1,500	---[3]	1,500	878	---[3]	878	1,023	10.2
n-Heptane	95.0	---[3]	95.0	190	---[3]	190	186	---[3]	186	157	1.57
n-Hexane	128	---[3]	128	270	---[3]	270	280	---[3]	280	226	2.26
n-Octane	47.3	---[3]	47.3	89.0	---[3]	89.0	93.3	---[3]	93.3	76.5	0.765
Pentane	290	---[3]	290	605	---[3]	605	583	---[3]	583	493	4.93
Toluene	347	185	532	720	178	898	254	120	374	601	6.01
m-Xylene and p-Xylene	168	166	334	325	289	614	101	130	231	393	3.93
o-Xylene	21.8	37.8	59.7	48.5	62.3	111	12.8	35.6	48.3	72.9	0.729
Naphthalene	1.87	81.6	83.4	6.15	154	160	0.508	93.4	93.9	113	1.13
1,2,4-Trimethylbenzene	5.27	38.5	43.7	10.3	96.4	107	2.46	44.4	46.9	65.8	0.658

[1] VOCs with average measured total concentrations below 65.8 ppmd (0.658 ppmw) are not shown.

[2] Not detected.

[3] Not quantified per SW-846 Method 8260B.

Table 2-9. Pre-Survey Results for Volatile Organic Compound Concentrations (Tentatively Identified Compounds)

Tentatively Identified Compounds (TIC)[1]	Run A			Run B			Run C			Runs A-C Average	Runs A-C Average
	Average Canister Conc. (ppmd)	Condensate Conc. (ppmd)	Total Conc. (ppmd)	Average Canister Conc. (ppmd)	Condensate Conc. (ppmd)	Total Conc. (ppmd)	Average Canister Conc. (ppmd)	Condensate Conc. (ppmd)	Total Conc. (ppmd)	Total Conc. (ppmd)	Total Conc. Corrected to 99% Moisture (ppmw)
UNKNOWN (Retention Time=3.66)[2]	1,957	---[3]	1,957	4,800	---[3]	4,800	1,465	---[3]	1,465	2,741	27.4
Isobutane	363	---[3]	363	815	---[3]	815	470	---[3]	470	549	5.49
2-Methylpropene	588	---[3]	588	1,390	---[3]	1,390	835	---[3]	835	938	9.38
2-Methylbutane	229	---[3]	229	470	---[3]	470	411	---[3]	411	370	3.70
2-Pentene	83.3	---[3]	83.3	230	---[3]	230	173	---[3]	173	162	1.62

[1] TICs with average measured total concentrations below 162 ppmd (0.162 ppmw) are not shown.

[2] This TIC may represent a mixture of propane and propene co-eluting from the GC column (this information was previously conveyed to EPA during the Pre-Survey results submittal in May 2008).

[3] Not quantified per SW-846 Method 8260B.

Table 2-10. Pre-Survey Results for Methane and Ethane Concentrations

Organic Species	Run A	Run B	Run C	Runs A-C Average	Runs A-C Average
	Average Canister Conc. (ppmd)	Average Canister Conc. (ppmd)	Average Canister Conc. (ppmd)	Total Conc. (ppmd)	Total Conc. Corrected to 99% Moisture (ppmw)
Methane (CH_4)	336,667	490,000	321,750	364,111	3,641
Ethane (C_2H_6)	29,333	51,500	28,250	33,778	338

2.4.2 Source Test Results for Methane, Ethane, Benzene, and Toluene Concentrations

Methane, ethane, benzene, and toluene concentrations were measured during the Source Test according to EPA Method 18 and the *Protocol* conditionally approved by EPA. Tedlar bag samples were collected from the same dilution sampling system used for the measurement of THC concentrations via EPA Method 25A and Other Test Method 12. An integrated sample of vent gas was collected in a Tedlar bag during each of three sampling intervals during a venting cycle and analyzed by GC/FID in triplicate. The sampling data from each test run are presented in Table 2-11. Most of the results for benzene and toluene were below the applicable method detection limits and are reported as a maximum ("<"). In subsequent calculations, for results that are reported with a "<", the "<" is carried through all calculations and reporting (e.g., all emission rates will carry a "<" sign).

EPA's request for information did not require the speciation by GC/FID of all C_1-C_6 hydrocarbons; however, the calibration gas standards used for the performance of EPA Method 18 included a mixture of C_1-C_6 compounds. The analytical results for propane, butane, pentane, and hexane during Runs 1-4 are presented in Table 2-12 as supplementary data.

URS personnel were unable to collect a valid Tedlar bag sample through the EPA Method 18/25A/OTM 12 dilution sampling system during the second sampling interval (6:31-7:01) of Run 1. GC/FID analysis of this second Tedlar bag sample yielded methane and ethane results approximately 600% higher than the results obtained during the first sampling interval (6:00-6:31) of Run 1 and approximately 900% higher than the results obtained during the third sampling interval (7:01-9:10) of Run 1. These extremely high methane and ethane results are also significantly higher than the average THC concentration measured during the corresponding sampling interval. These outlying results were linked to the use of an un-evacuated Tedlar bag previously used to measure oxygen and carbon dioxide concentrations from the undiluted sample gas stream passed through the EPA Method 2/4 sampling train dry gas meter. The methane, ethane, benzene, and toluene results obtained from the invalid Tedlar bag sample are not presented in the following tables and were not used in the calculation of NMNE concentrations; however, they are included in Appendix 2-4 with the printouts of raw GC/FID data. The average of the methane, ethane, benzene, and toluene concentrations measured during the first and third sampling intervals of Run 1 were applied to the second interval for use in further calculations.

2.4.3 Source Test Results for Benzene and Toluene Mass Emission Rates

Benzene and toluene mass emission rates, calculated in lbs/cycle, are presented in Tables 2-13 and 2-14, respectively. Sections 2.2 and 2.3 discuss the development of pollutant mass emission rates from both measured and extrapolated data.

Table 2-11. Source Test Results for Benzene, Toluene, Methane, and Ethane Concentrations

	Date	Venting Cycle	Venting Cycle Duration (min)	Sampling Interval	Sampling Duration (min)	Benzene Conc. (ppmw)	Toluene Conc. (ppmw)	CH_4 Conc. (ppmw)	C_2H_6 Conc. (ppmw)
Run 1	6/3/2008	600-1018	258	600-631	31	<23.5	<26.9	9,624	1,092
				631-701[1]	30	<23.5	<26.9	8,359	926
				701-910	129	<23.5	<26.9	7,093	760
Run 2	6/4-5/2008	2235-130	175	2235-2305	30	<24.9	38.6	15,264	1,829
				2305-2335	30	<24.9	29.9	10,398	1,216
				2335-0115	100	<24.9	<28.5	10,625	1,223
Run 3	6/6/2008	1408-1630	142	1408-1438	30	<25.2	<28.8	4,050	482
				1438-1508	30	<25.2	<28.8	3,767	450
				1508-1630	82	<25.2	<28.8	5,359	594
Run 4	6/8/2008	632-926	174	632-702	30	<26.4	<30.2	8,041	923
				702-732	30	<26.4	<30.2	9,169	1,028
				732-840	68	<26.4	<31.2	12,799	1,367

[1] The average of the benzene, toluene, methane, and ethane concentrations measured during the first and third sampling intervals of Run 1 were applied to the second sampling interval.

Table 2-12. Source Test Results for C_3 through C_6 Concentrations

	Date	Venting Cycle	Venting Cycle Duration (min)	Sampling Interval	Sampling Duration (min)	C_3H_8 Conc. (ppmw)	C_4H_{10} Conc. (ppmw)	C_5H_{12} Conc. (ppmw)	C_6H_{14} Conc. (ppmw)
Run 1	6/3/2008	600-1018	258	600-631	31	<392	<396	<399	<186
				631-701[1]	30	<392	<396	<399	<186
				701-910	129	<392	<396	<399	<186
Run 2	6/4-5/2008	2235-130	175	2235-2305	30	<415	<419	<423	<196
				2305-2335	30	<415	<419	<423	<196
				2335-0115	100	<415	<419	<423	<196
Run 3	6/6/2008	1408-1630	142	1408-1438	30	<420	<425	<428	<199
				1438-1508	30	<420	<425	<428	<199
				1508-1630	82	<420	<425	<428	<199
Run 4	6/8/2008	632-926	174	632-702	30	<440	<445	<448	<208
				702-732	30	<440	<445	<448	<208
				732-840	68	<440	<445	<448	<208

[1] The average of the C_3 through C_6 concentrations measured during the first and third sampling intervals of Run 1 were applied to the second sampling interval.

Table 2-13. Source Test Results for Benzene Mass Emission Rates

	Date	Venting Cycle	Venting Cycle Duration (min)	Venting Cycle Interval	Venting Cycle Interval Duration (min)	Benzene Conc. (ppmw)	Moisture Conc. (%)	Benzene Conc. (ppmd)	Volumetric Flow Rate (dscfm)	Benzene Mass Emission Rate (lb/min)	Benzene Mass Emission Rate (lb/interval)	Benzene Mass Emission Rate (lb/cycle)
Run 1	6/3/2008	600-1018	258	600-631	31	<23.5	98.85	<2,047	236	<0.0982	<3.04	<17.3
				631-701	30	<23.5		<2,047	200	<0.0831	<2.49	
				701-910	129	<23.5		<2,047	156	<0.0649	<8.37	
				910-1018[1]	68	<23.5		<2,047	120	<0.0499	<3.39	
Run 2	6/4-5/2008	2235-130	175	2235-2305	30	<24.9	98.37	<1,529	353	<0.109	<3.28	<10.6
				2305-2335	30	<24.9		<1,529	286	<0.0887	<2.66	
				2335-0115	100	<24.9		<1,529	142	<0.0439	<4.39	
				115-130[1]	15	<24.9		<1,529	68.1	<0.0211	<0.317	
Run 3	6/6/2008	1408-1630	142	1408-1438	30	<25.2	99.24	<3,326	150	<0.101	<3.04	<6.90
				1438-1508	30	<25.2		<3,326	71.5	<0.0482	<1.45	
				1508-1630	82	<25.2		<3,326	43.7	<0.0295	<2.42	
Run 4	6/8/2008	632-926	174	632-702	30	<26.4	98.60	<1,890	293	<0.112	<3.37	<9.03
				702-732	30	<26.4		<1,890	160	<0.0612	<1.84	
				732-840	68	<26.4		<1,890	107	<0.0409	<2.78	
				840-926[1]	46	<26.4		<1,890	59.1	<0.0227	<1.04	

[1] No direct measurements were obtained during this venting cycle interval. These results have been extrapolated.

Table 2-14. Source Test Results for Toluene Mass Emission Rates

	Date	Venting Cycle	Venting Cycle Duration (min)	Venting Cycle Interval	Venting Cycle Interval Duration (min)	Toluene Conc. (ppmw)	Moisture Conc. (%)	Toluene Conc. (ppmd)	Volumetric Flow Rate (dscfm)	Toluene Mass Emission Rate (lb/min)	Toluene Mass Emission Rate (lb/interval)	Toluene Mass Emission Rate (lb/cycle)
Run 1	6/3/2008	600-1018	258	6:00-6:31	31	<26.9	98.85	<2,343	236	<0.112	<3.48	<19.8
				6:31-7:01	30	<26.9		<2,343	200	<0.0952	<2.85	
				7:01-9:10	129	<26.9		<2,343	156	<0.0743	<9.58	
				9:10-10:18[1]	68	<26.9		<2,343	120	<0.0571	<3.88	
Run 2	6/4-5/2008	2235-130	175	2235-2305	30	38.6	98.37	2,369	353	0.200	6.00	<13.7
				2305-2335	30	29.9		1,838	286	0.126	3.77	
				2335-0115	100	<28.5		<1,750	142	<0.0502	<5.02	
				115-130[1]	15	<28.5		<1,750	68.1	<0.0242	<0.363	
Run 3	6/6/2008	1408-1630	142	1408-1438	30	<28.8	99.24	<3,801	150	<0.116	<3.47	<7.89
				1438-1508	30	<28.8		<3,801	71.5	<0.0551	<1.65	
				1508-1630	82	<28.8		<3,801	43.7	<0.0337	<2.76	
Run 4	6/8/2008	632-926	174	632-702	30	<30.2	98.60	<2,161	293	<0.129	<3.86	<10.5
				702-732	30	<30.2		<2,161	160	<0.0701	<2.10	
				732-840	68	<31.2		<2,233	107	<0.0483	<3.28	
				840-926[1]	46	<31.2		<2,233	59.1	<0.0268	<1.23	

[1] No direct measurements were obtained during this venting cycle interval. These results have been extrapolated.

2.5 Source Test Results for Non-Methane/Non-Ethane Volatile Organic Compound Emissions

The precise and accurate quantification of methane and ethane concentrations in the Coker Steam Vent gas stream is related to the measurement of VOC emissions because methane and ethane have been determined by EPA to have negligible atmospheric photochemical reactivity. As such, the concentrations of methane and ethane were subtracted from the measurement of THC prior to the development of VOC mass emission rates. VOC results determined in this manner are referred to as non-methane/non-ethane VOC emissions (NMNE VOC).

2.5.1 Source Test Results for Non-Methane/Non-Ethane Volatile Organic Compound Concentrations

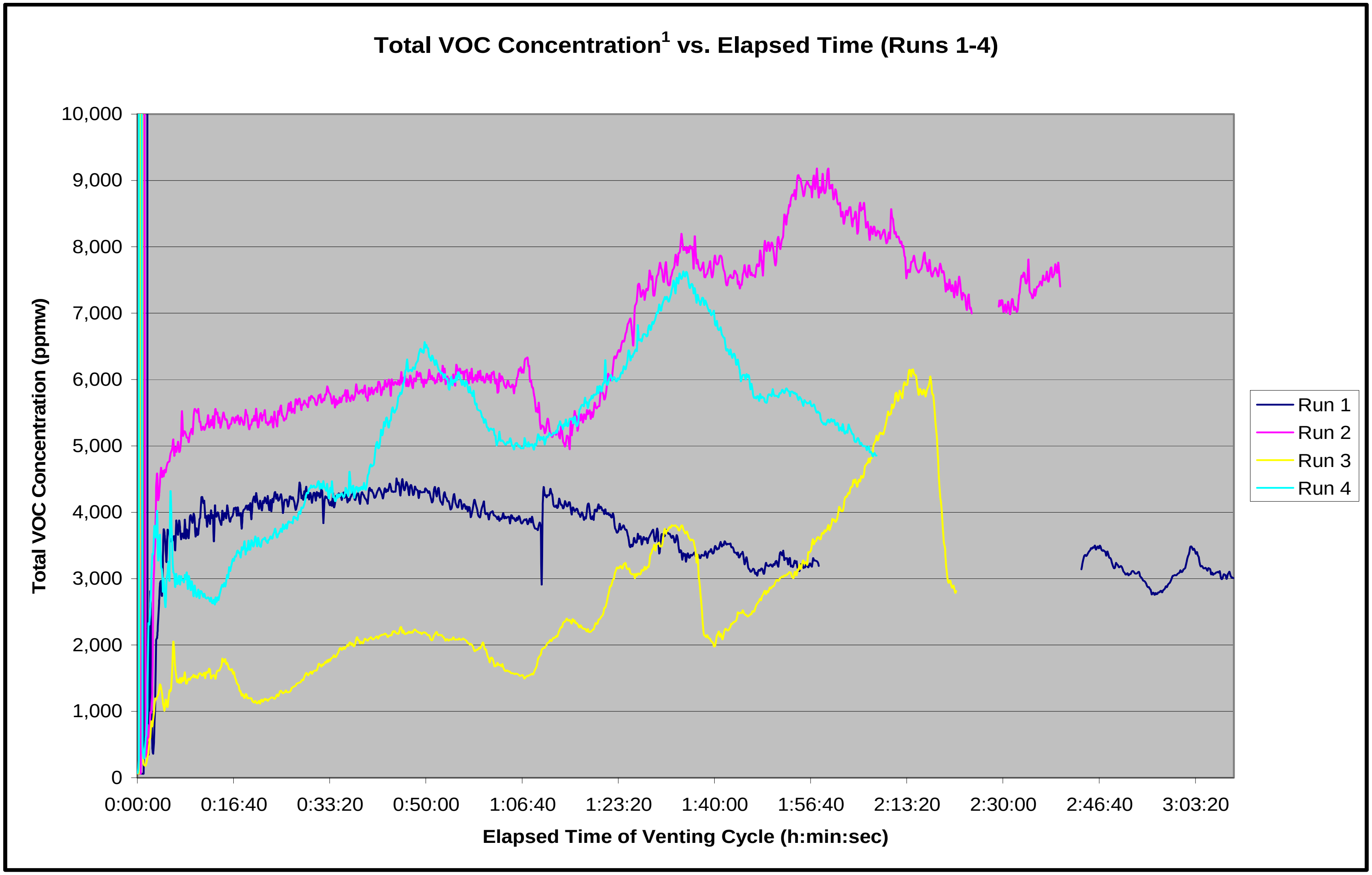
Vent gas sampling for the determination of THC concentration was performed according to EPA Method 25A and the dilution system procedures outlined in Other Test Method 12, significantly modified according to the *Protocol* conditionally approved by EPA. These methods were applied to measure the concentration of total hydrocarbons (THC) on a wet basis, as propane (C_3H_8), using two separate THC analyzers equipped with flame ionization detectors (FID). Standards of propane in a balance of nitrogen were used to calibrate all THC analyzers, and nitrogen was also used as the dilution gas with the dilution sampling system.

The THC results are reported as a conservative estimate of total VOC concentration. The total VOC concentration, in ppmw, was averaged over each of three separate sampling intervals achieved for each venting cycle. NMNE VOC concentration results were obtained by subtracting the methane and ethane concentrations (ppmw), equivalent to propane, from the average total VOC concentration (ppmw) measured during a given sampling interval (see Section 3.6 for details). Figure 2-16 presents the instantaneous total VOC concentration results per elapsed time of the venting cycle for all four test runs performed on the Coker Steam Vent 3 gas stream during the Source Test. A 45-minute gap in instantaneous total VOC data occurred during Run 1 due to a temporary power loss to the THC analyzers. It is important to note that this gap in data begins at the 118th minute of the test run. A 5-minute gap in instantaneous total VOC data occurred during Run 2 due to the temporary loss of dilution gas pressure to the dilution sampling system. Table 2-15 presents the average NMNE VOC concentration results per sampling interval during all four test runs. Appendix 2-5 presents raw data from the THC analyzers.

2.5.2 Source Test Results for Non-Methane/Non-Ethane Volatile Organic Compound Mass Emission Rates

NMNE VOC mass emission rates, calculated in lbs/cycle, are presented in Table 2-16 for all four test runs. Sections 2.2 and 2.3 discuss the development of pollutant mass emission rates from both measured and extrapolated data.

Figure 2-16. EPA Method 25A/OTM12 Total VOC Concentration vs. Elapsed Time



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[1] Total VOC concentrations always peaked during the first two (2) minutes of every test run. This data is an order of magnitude greater than the total VOC concentrations measured during the remaining sampling period of each venting cycle and is not presented in Figure 2-16. The peak VOC values (ppmw), per test run, were: 126,652; 175,926; 97,270; and 100,902.

Table 2-15. Source Test Results for Non-Methane/Non-Ethane Volatile Organic Compound Concentrations

	Date	Venting Cycle	Venting Cycle Duration (min)	Sampling Interval	Sampling Duration (min)	Average Total VOC Conc. (ppmw)	Methane Conc. (ppmw)	Methane (ppmw as propane)	Ethane Conc. (ppmw)	Ethane (ppmw as propane)	Average NMNE VOC Conc. (ppmw)[2]
Run 1	6/3/2008	600-1018	258	600-631	31	4,703	9,624	3,508	1,092	759	436
				631-701[1]	30	4,227	8,359	3,047	926	643	537
				701-910	129	3,470	7,093	2,586	760	528	357
Run 2	6/4-5/2008	2235-130	175	2235-2305	30	6,497	15,264	5,543	1,829	1,280	-326[3]
				2305-2335	30	5,909	10,398	3,776	1,216	851	1,282
				2335-115	100	7,304	10,625	3,859	1,223	856	2,589
Run 3	6/6/2008	1408-1630	142	1408-1438	30	1,982	4,050	1,463	482	339	180
				1438-1508	30	2,037	3,767	1,361	450	317	360
				1508-1630	82	3,246	5,359	1,936	594	396	915
Run 4	6/8/2008	632-926	174	632-702	30	4,282	8,041	2,930	923	653	699
				702-732	30	5,326	9,169	3,341	1,028	728	1,257
				732-840	68	5,883	12,799	4,663	1,367	968	252

[1] No direct measurements for methane and ethane were obtained during this sampling interval (see Section 2.4).

[2] NMNE VOC = Total VOC – Methane (as propane) – Ethane (as propane).

[3] A NMNE VOC concentration of 0 was used in the development of a NMNE VOC mass emission rate for this venting cycle interval.

Table 2-16. Source Test Results for Non-Methane/Non-Ethane Volatile Organic Compound Mass Emission Rates

	Date	Venting Cycle	Venting Cycle Duration (min)	Venting Cycle Interval	Venting Cycle Interval Duration (min)	Average NMNE VOC Conc. (ppmw)	Moisture Conc. (%)	Average NMNE VOC Conc. (ppmd)	Average Volumetric Flow Rate (dscfm)	NMNE VOC Mass Emission Rate (lb/min)	NMNE VOC Mass Emission Rate (lb/interval)	NMNE VOC Mass Emission Rate (lb/cycle)
Run 1	6/3/2008	600-1018	258	600-631	31	436	98.85	38,010	236	1.03	31.9	165
				631-701	30	537		46,747	200	1.07	32.2	
				701-910	129	357		31,122	156	0.557	71.9	
				910-1018[1]	68	357		31,122	120	0.428	29.1	
Run 2	6/4-5/2008	2235-130	175	2235-2305	30	0	98.37	0	353	0	0	354
				2305-2335	30	1,282		78,702	286	2.58	77.3	
				2335-115	100	2,589		158,978	142	2.58	258	
				115-130[1]	15	2,589		158,978	68.1	1.24	18.6	
Run 3	6/6/2008	1408-1630	142	1408-1438	30	180	99.24	23,744	150	0.408	12.3	73.4
				1438-1508	30	360		47,525	71.5	0.389	11.7	
				1508-1630	82	915		120,727	43.7	0.604	49.5	
Run 4	6/8/2008	632-926	174	632-702	30	699	98.60	50,002	293	1.68	50.4	120
				702-732	30	1,257		89,990	160	1.65	49.4	
				732-840	68	252		18,007	107	0.220	15.0	
				840-926[1]	46	252		18,007	59.1	0.122	5.61	

[1] No direct measurements were obtained during this venting cycle interval. These results have been extrapolated.

2.6 Source Test Results for Semivolatile Organic Compound Emissions

This section presents selected semivolatile organic compound (SVOC) emission results obtained during the Source Test of the Coker Steam Vent. Selected SVOC compounds were measured according to modified SW-846 Method 0010 and the *Protocol* conditionally approved by EPA. It is likely that some SVOCs were quantified with the EPA Method 18/25A/OTM12 dilution sampling system and FID analyses and reported as total VOC and NMNE VOC. Therefore, some overlap may exist between the reported NMNE VOC and total SVOC mass emission rates. Total SVOC mass emission rates ranged between 2 and 6% of the NMNE mass emission rates quantified during the Source Test (per test run). A conservative estimate of the degree of overlap between the total SVOC and NMNE mass emission rate data (e.g., the percentage of the NMNE mass emission rate data that is attributed to total SVOCs quantified though the use of the EPA Method 18/25/OTM12 dilution sampling system) is <6%.

Three sampling fractions were extracted separately in accordance with modified SW-846 Method 3542 and the *Protocol*. The three sampling train extracts were analyzed separately using SW-846 Method 8270D. The three sampling train fractions that were extracted and analyzed are:

- The combined filter and probe and nozzle rinses;
- The combined mid-train rinses and pre-XAD sorbent condensate catch; and
- The combined XAD sorbent and post-XAD condensate catch.

Many of the following tables contain results as dry vent gas concentrations that require the application of multiple analytical results. The SVOC analyses resulted in “hits” from some organic compounds (e.g., naphthalene and its derivatives) several orders of magnitude greater than the method detection limits for non-detected analytes. In all cases where multiple measured results are reported for a single sampling train, if one or more individual results of the data set are reported as a non-detect, the results will be treated as zero (0) in the summation of multiple sample fractions for a total dry gas concentration per sampling train. This convention provides the most supportable results and best estimate of actual emissions from the Coker Steam Vent. In addition to the target SVOC analytes defined in the *Protocol*, a MS library search was conducted and the 20 most concentrated tentatively identified compounds (TICs) in the vent gas, per sample fraction, are reported in Appendix 2-6.

The *Protocol* acknowledged that analytical detection limits for selected SVOC dry gas concentrations would be affected by the reduced dry gas sample volumes acquired through the performance of the SW-846 Method 0010 sampling trains on the high-moisture, high-velocity Coker Steam Vent gas stream. In addition, the high concentrations of some selected SVOCs required multiple dilutions prior to laboratory analysis. After comparing the analytical data obtained through this Source Test with professional experience using SW-846 Method 0010 on a variety of combustion sources, URS estimates that the SVOC detection limits achieved through this Source Test are generally at least two orders of magnitude higher than those associated with typical source testing. The full laboratory report detailing the analyses of vent gas samples for SVOC emissions is presented in Appendix 2-7.

2.6.1 Source Test Results for Semivolatile Organic Compound Concentrations

This section discusses selected SVOC concentration results obtained during the Source Test of the Coker Steam Vent. At least three SW-846 Method 0010 sampling trains were performed sequentially during each test run to sample for SVOCs during as much of the complete venting cycle as possible. Each SW-846 Method 0010 sampling train was identified with a unique ID ("A", "B", "C", or "D"). Tables 1-8 through 1-11 presents a summary of SW-846 Method 0010 sampling train sampling intervals during each venting cycle tested during the Source Test. Table 2-17 presents a summary of SW-846 Method 0010 sampling train data such as dry gas volumes collected and isokinetic sampling rates achieved.

SW-846 Method 0100 sampling train "C", operated during Run 1, did not pass a final leak test; therefore, the sample fractions were not recovered from this train for analysis. However, vent gas velocity data obtained from this sampling train was used for the purpose of volumetric flow rate extrapolation, as described in Sections 2.2 and 2.3. SVOC concentrations measured with SW-846 Method 0100 sampling train "D" was applied to the venting cycle interval corresponding to the operation of the failed sampling train "C." Selected SVOC concentrations are presented in Tables 2-18 through 2-29. Note that the dry gas concentrations measured for 2-methylnaphthalene and naphthalene exceeded those measured for other selected SVOCs by one order of magnitude. TIC concentrations are presented in Appendix 2-6.

2.6.2 Source Test Results for Semivolatile Organic Compound Mass Emission Rates

Selected and total SVOC mass emission rates, calculated in lbs/cycle, are presented in Tables 2-30 through 2-49. Only analytes with measured total concentration results above the detection limit are presented in these tables. Note that the individual mass emission rates developed for 2-methylnapthalene and naphthalene contribute to approximately 70% of the total SVOC mass emission rate developed for each test run. Mass emission rates for TICs were also developed for this report and are presented in Appendix 2-6. The total SVOC mass emission rates presented in Tables 1-4, 1-5, 2-34, 2-39, 2-44, and 2-49 do not include the mass emission rates of TICs. Sections 2.2 and 2.3 discuss the development of pollutant mass emission rates from both measured and extrapolated data.

Table 2-17. SW-846 Method 0010 Sampling Train Data

	Date	Sampling Train ID	Venting Cycle	Venting Cycle Duration (min)	Sampling Train Interval	Sampling Train Duration (min)	Moisture Conc. (%)	Dry Gas Sample Volume (dscf)	Isokinetic Sampling Rate (%)
Run 1	6/3/2008	A	600-1018	258	602-632	30	98.98	0.857	93.3
		B			633-703	30	98.64	1.052	94.0
		C			704-734[1]	30	-	-	-
		D			734-826	52	99.07	1.182	136
Run 2	6/4-5/2008	A	2235-130	175	2236-2306	30	98.63	1.112	83.1
		B			2307-2337	30	98.40	1.237	90.2
		C			2338-035	57	98.21	2.395	150
Run 3	6/6/2008	A	1408-1630	142	1409-1439	30	99.35	0.517	98.0
		C			1442-1532	50	99.45	0.694	186
		D			1533-1621	48	98.91	1.221	410
Run 4	6/8/2008	A	632-926	174	633-703	30	98.95	0.857	97.1
		B			703-733	30	98.46	1.110	142
		C			735-831	56	98.29	2.231	194

[1] SW-846 Method 0010 sampling train "C" failed a final leak test, and samples were not recovered from this train for SVOC analysis.

Table 2-18. SW-846 Method 0010 Sampling Train A Concentration Results – Run 1

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 1 - Sampling Train A	6/3/2008	600-1018	602-632	30	0.857
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
Acenaphthene	<0.5	820	30	850	992
Diethyl phthalate	<1.5	6.9	<3.6	6.90	8.06
p-Dimethylaminoazobenzene	<0.5	<9.7	<2.5	0	0
7,12-Dimethylbenz(a)anthracene	<0.94	<7.7	<2.6	0	0
2,4-Dimethylphenol	<2.9	1,300	<32	1,300	1,520
Dimethyl phthalate	<0.63	<5	<2.5	0	0
Aniline	<0.95	820	<36	820	957
Di-n-octyl phthalate	<2.1	<9.6	<2.8	0	0
4,6-Dinitro-2-methylphenol	<5	<5.6	<44	0	0
2,4-Dinitrophenol	<5.9	<15	<110	0	0
2,4-Dinitrotoluene	<1.6	<10	<2.5	0	0
2,6-Dinitrotoluene	<1.3	<7.9	<2.5	0	0
Diphenylamine	<0.5	<11	<2.5	0	0
1,2-Diphenylhydrazine	<0.63	<5.6	<2.5	0	0
Anthracene	2.5	1,800	26	1,830	2,130
Ethyl methanesulfonate	<0.79	<9.8	<2.5	0	0
Fluoranthene	1.4	380	<2.7	381	445
Fluorene	<0.51	3,700	59	3,760	4,390
Hexachlorobenzene	<0.56	<10	<2.5	0	0
Hexachlorobutadiene	<1.4	<7.3	<3.7	0	0
Hexachlorocyclopentadiene	<10	<25	<50	0	0
Hexachloroethane	<2.5	<7.4	<2.7	0	0
Indeno(1,2,3-cd)pyrene	5.6	12	<2.7	17.6	20.5
Isophorone	<0.66	<6.8	<2.5	0	0
3-Methylcholanthrene	<0.5	<6.8	<2.5	0	0
Methyl methanesulfonate	<0.6	<8.6	<2.8	0	0
2-Methylnaphthalene	<0.56	44,000	2,600	46,600	54,400
2-Methylphenol	<2.3	1,800	<15	1,800	2,100
Naphthalene	<0.5	26,000	2,800	28,800	33,600
1-Naphthylamine	<0.93	140	<50	140	163

Table 2-18. SW-846 Method 0010 Sampling Train A Concentration Results - Run 1 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 1 - Sampling Train A	6/3/2008	600-1018	602-632	30	0.857
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
2-Naphthylamine	<0.81	120	<50	120	140
2-Nitroaniline	<0.56	<11	<2.5	0	0
3-Nitroaniline	<3.8	<18	<10	0	0
4-Nitroaniline	<2.3	<15	<10	0	0
Nitrobenzene	<0.73	<6.3	<2.8	0	0
Benzidine	<51	<250	<260	0	0
2-Nitrophenol	<3.2	<10	<2.5	0	0
4-Nitrophenol	<3.3	<15	<16	0	0
N-Nitrosodi-n-butylamine	<0.86	<10	<2.5	0	0
N-Nitrosodimethylamine	<0.72	<8.3	<2.5	0	0
Benzo(a)anthracene	5.5	270	<2.9	276	322
N-Nitrosodi-n-propylamine	<0.73	<8.8	<2.5	0	0
N-Nitrosodiphenylamine	<0.6	<5.2	<4.4	0	0
N-Nitrosopiperidine	<0.62	<7.3	<2.5	0	0
Benzo(b)fluoranthene	2.5	20	<5.5	22.5	26.3
Benzo(k)fluoranthene	2.1	19	<8	21.1	24.6
Benzoic acid	<42	<36	<230	0	0
Benzo(ghi)perylene	17	28	<3.1	45.0	52.5
Pentachlorobenzene	<0.52	<8.7	<2.5	0	0
Benzo(a)pyrene	13	83	<2.5	96.0	112
Pentachloronitrobenzene	<0.76	<10	<2.5	0	0
Pentachlorophenol	<25	<13	<120	0	0
Phenacetin	<0.51	<9	<2.5	0	0
Benzyl alcohol	<35	<7.6	<180	0	0
Phenanthrene	5	9,400	64	9,470	11,100
Phenol	<1.1	2,300	<4.5	2,300	2,690
2-Picoline	<0.98	630	<5.5	630	735
Pyrene	5.5	1,200	4	1,210	1,410
Pyridine	<0.89	210	<3.7	210	245
Acetophenone	<0.77	400	<12	400	467

Table 2-18. SW-846 Method 0010 Sampling Train A Concentration Results - Run 1 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 1 - Sampling Train A	6/3/2008	600-1018	602-632	30	0.857
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
1,2,4,5-Tetrachlorobenzene	<0.87	<8.2	<2.5	0	0
2,3,4,6-Tetrachlorophenol	<1.1	<13	<3.2	0	0
1,2,4-Trichlorobenzene	<0.73	<8.2	<3	0	0
2,4,5-Trichlorophenol	<2.3	<8.1	<6.5	0	0
2,4,6-Trichlorophenol	<1.4	<9.6	<3.8	0	0
Carbazole	1.2	690	<3.2	691	807
3-Methylphenol & 4-Methylphenol	<2.3	1,900	<10	1,900	2,220
bis(2-Chloroethoxy)methane	<0.59	<7.6	<2.5	0	0
bis(2-Chloroethyl) ether	<0.76	<6.4	<2.8	0	0
bis(2-Chloroisopropyl) ether	<1	<6.7	<3.8	0	0
bis(2-Ethylhexyl) phthalate	3.6	<8	<50	3.60	4.20
4-Bromophenyl phenyl ether	<0.53	<5.4	<2.5	0	0
Butyl benzyl phthalate	<1.1	<8.7	<3	0	0
Acenaphthylene	<0.5	63	<2.5	63.0	73.5
4-Chloroaniline	<1.2	<30	<30	0	0
4-Chloro-3-methylphenol	<1	<25	<3.1	0	0
1-Chloronaphthalene	<0.5	<8.9	<2.5	0	0
2-Chloronaphthalene	<0.5	<5.3	<2.5	0	0
2-Chlorophenol	<0.98	<6.3	<2.5	0	0
4-Chlorophenyl phenyl ether	<0.51	<12	<2.5	0	0
Chrysene	6.4	270	<3.2	276	323
Dibenz(a,h)anthracene	7.7	17	<3	24.7	28.8
Dibenzofuran	<0.53	470	16	486	567
Di-n-butyl phthalate	2.1	22	<50	24.1	28.1
1,2-Dichlorobenzene	<0.84	<6.6	<2.6	0	0
1,3-Dichlorobenzene	<1.2	<5.4	<2.8	0	0
1,4-Dichlorobenzene	<1.1	<7.7	<2.6	0	0
3,3'-Dichlorobenzidine	<2.7	<30	<37	0	0
4-Aminobiphenyl	<1.1	<14	<50	0	0
2,4-Dichlorophenol	<1.5	<8.9	<2.5	0	0
2,6-Dichlorophenol	<0.72	<10	<2.5	0	0

Table 2-19. SW-846 Method 0010 Sampling Train B Concentration Results - Run 1

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 1 - Sampling Train B	6/3/2008	600-1018	633-703	30	1.052
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
Acenaphthene	<0.5	310	9.9	320	304
Diethyl phthalate	<1.5	5	<3.6	5.00	4.75
p-Dimethylaminoazobenzene	<0.5	<4.8	<2.5	0	0
7,12-Dimethylbenz(a)anthracene	<0.94	<3.8	<2.6	0	0
2,4-Dimethylphenol	<2.9	630	<32	630	599
Dimethyl phthalate	<0.63	<2.5	<2.5	0	0
Aniline	<0.95	480	<36	480	456
Di-n-octyl phthalate	<2.1	<4.8	<2.8	0	0
4,6-Dinitro-2-methylphenol	<5	<2.8	<44	0	0
2,4-Dinitrophenol	<5.9	<7.6	<110	0	0
2,4-Dinitrotoluene	<1.6	<5.2	<2.5	0	0
2,6-Dinitrotoluene	<1.3	<4	<2.5	0	0
Diphenylamine	<0.5	<5.5	<2.5	0	0
1,2-Diphenylhydrazine	<0.63	<2.8	<2.5	0	0
Anthracene	1.6	700	8.2	710	675
Ethyl methanesulfonate	<0.79	<4.9	<2.5	0	0
Fluoranthene	0.68	120	<2.7	121	115
Fluorene	<0.51	750	18	768	730
Hexachlorobenzene	<0.56	<5	<2.5	0	0
Hexachlorobutadiene	<1.4	<3.6	<3.7	0	0
Hexachlorocyclopentadiene	<10	<12	<50	0	0
Hexachloroethane	<2.5	<3.7	<2.7	0	0
Indeno(1,2,3-cd)pyrene	<2.1	<4.3	<2.7	0	0
Isophorone	<0.66	<3.4	<2.5	0	0
3-Methylcholanthrene	<0.5	<3.4	<2.5	0	0
Methyl methanesulfonate	<0.6	<4.3	<2.8	0	0
2-Methylnaphthalene	<0.56	17,000	880	17,900	17,000
2-Methylphenol	<2.3	910	<15	910	865
Naphthalene	<0.5	12,000	1,200	13,200	12,500
1-Naphthylamine	<0.93	63	<50	63.0	59.9

Table 2-19. SW-846 Method 0010 Sampling Train B Concentration Results - Run 1 (Continued)

	Date	**Venting Cycle**	**Sampling Interval**	**Sampling Duration (min)**	**Sample Volume (dscf)**
Run 1 - Sampling Train B	6/3/2008	600-1018	633-703	30	1.052
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
2-Naphthylamine	<0.81	56	<50	56.0	53.2
2-Nitroaniline	<0.56	<5.3	<2.5	0	0
3-Nitroaniline	<3.8	<9	<10	0	0
4-Nitroaniline	<2.3	<7.3	<10	0	0
Nitrobenzene	<0.73	<3.2	<2.8	0	0
Benzidine	<51	<120	<260	0	0
2-Nitrophenol	<3.2	<5	<2.5	0	0
4-Nitrophenol	<3.3	<7.3	<16	0	0
N-Nitrosodi-n-butylamine	<0.86	<5	<2.5	0	0
N-Nitrosodimethylamine	<0.72	<4.2	<2.5	0	0
Benzo(a)anthracene	2	74	<2.9	76.0	72.2
N-Nitrosodi-n-propylamine	<0.73	<4.4	<2.5	0	0
N-Nitrosodiphenylamine	<0.6	<2.6	<4.4	0	0
N-Nitrosopiperidine	<0.62	<3.6	<2.5	0	0
Benzo(b)fluoranthene	<1.4	<8	<5.5	0	0
Benzo(k)fluoranthene	<2.1	<5.5	<8	0	0
Benzoic acid	<42	<18	<230	0	0
Benzo(ghi)perylene	5.1	7.7	<3.1	12.8	12.2
Pentachlorobenzene	<0.52	<4.4	<2.5	0	0
Benzo(a)pyrene	3.7	18	<2.5	21.7	20.6
Pentachloronitrobenzene	<0.76	<5	<2.5	0	0
Pentachlorophenol	<25	<6.6	<120	0	0
Phenacetin	<0.51	<4.5	<2.5	0	0
Benzyl alcohol	<35	<3.8	<180	0	0
Phenanthrene	3.2	3,000	20	3,020	2,870
Phenol	<1.1	1,200	<4.5	1,200	1,140
2-Picoline	<0.98	480	<5.5	480	456
Pyrene	2.6	420	<2.6	423	402
Pyridine	<0.89	180	<3.7	180	171
Acetophenone	<0.77	210	<12	210	200

Table 2-19. SW-846 Method 0010 Sampling Train B Concentration Results - Run 1 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 1 - Sampling Train B	6/3/2008	600-1018	633-703	30	1.052
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
1,2,4,5-Tetrachlorobenzene	<0.87	<4.1	<2.5	0	0
2,3,4,6-Tetrachlorophenol	<1.1	<6.5	<3.2	0	0
1,2,4-Trichlorobenzene	<0.73	<4.1	<3	0	0
2,4,5-Trichlorophenol	<2.3	<4	<6.5	0	0
2,4,6-Trichlorophenol	<1.4	<4.8	<3.8	0	0
Carbazole	<0.76	270	<3.2	270	257
3-Methylphenol & 4-Methylphenol	<2.3	980	<10	980	931
bis(2-Chloroethoxy)methane	<0.59	<3.8	<2.5	0	0
bis(2-Chloroethyl) ether	<0.76	<3.2	<2.8	0	0
bis(2-Chloroisopropyl) ether	<1	<3.4	<3.8	0	0
bis(2-Ethylhexyl) phthalate	4.2	<4	<50	4.20	3.99
4-Bromophenyl phenyl ether	<0.53	<2.7	<2.5	0	0
Butyl benzyl phthalate	<1.1	<4.4	<3	0	0
Acenaphthylene	<0.5	22	<2.5	22.0	20.9
4-Chloroaniline	<1.2	<15	<30	0	0
4-Chloro-3-methylphenol	<1	<12	<3.1	0	0
1-Chloronaphthalene	<0.5	<4.4	<2.5	0	0
2-Chloronaphthalene	<0.5	<2.6	<2.5	0	0
2-Chlorophenol	<0.98	<3.2	<2.5	0	0
4-Chlorophenyl phenyl ether	<0.51	<6	<2.5	0	0
Chrysene	2.3	69	<3.2	71.3	67.8
Dibenz(a,h)anthracene	2.5	<5.4	<3	2.50	2.38
Dibenzofuran	<0.53	190	5.6	196	186
Di-n-butyl phthalate	1.3	5.8	<50	7.10	6.75
1,2-Dichlorobenzene	<0.84	<3.3	<2.6	0	0
1,3-Dichlorobenzene	<1.2	<2.7	<2.8	0	0
1,4-Dichlorobenzene	<1.1	<3.8	<2.6	0	0
3,3'-Dichlorobenzidine	<2.7	<15	<37	0	0
4-Aminobiphenyl	<1.1	<7	<50	0	0
2,4-Dichlorophenol	<1.5	<4.4	<2.5	0	0
2,6-Dichlorophenol	<0.72	<5	<2.5	0	0

Table 2-20. SW-846 Method 0010 Sampling Train D Concentration Results - Run 1

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 1 - Sampling Train D	6/3/2008	600-1018	704-734	30	1.182
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
Acenaphthene	<0.5	1,000	120	1,120	947
Diethyl phthalate	<1.5	<11	<3.6	0	0
p-Dimethylaminoazobenzene	<0.5	<19	<2.5	0	0
7,12-Dimethylbenz(a)anthracene	<0.94	<15	<2.6	0	0
2,4-Dimethylphenol	<2.9	1,400	<32	1,400	1,180
Dimethyl phthalate	<0.63	<10	<2.5	0	0
Aniline	<0.95	1,100	50	1,150	973
Di-n-octyl phthalate	<2.1	<19	<2.8	0	0
4,6-Dinitro-2-methylphenol	<5	<11	<44	0	0
2,4-Dinitrophenol	<5.9	<30	<110	0	0
2,4-Dinitrotoluene	<1.6	<21	<2.5	0	0
2,6-Dinitrotoluene	<1.3	<16	<2.5	0	0
Diphenylamine	<0.5	<22	<2.5	0	0
1,2-Diphenylhydrazine	<0.63	<11	<2.5	0	0
Anthracene	<0.51	2,400	350	2,750	2,330
Ethyl methanesulfonate	<0.79	<20	<2.5	0	0
Fluoranthene	<0.5	540	52	592	501
Fluorene	<0.51	2,900	360	3,260	2,760
Hexachlorobenzene	<0.56	<20	<2.5	0	0
Hexachlorobutadiene	<1.4	<15	<3.7	0	0
Hexachlorocyclopentadiene	<10	<50	<50	0	0
Hexachloroethane	<2.5	<15	<2.7	0	0
Indeno(1,2,3-cd)pyrene	<2.1	<17	<2.7	0	0
Isophorone	<0.66	<14	<2.5	0	0
3-Methylcholanthrene	<0.5	<14	<2.5	0	0
Methyl methanesulfonate	<0.6	<17	<2.8	0	0
2-Methylnaphthalene	<0.56	49,000	6,800	55,800	47,200
2-Methylphenol	<2.3	2,600	200	2,800	2,370
Naphthalene	<0.5	29,000	5,400	34,400	29,100
1-Naphthylamine	<0.93	160	<50	160	135

Table 2-20. SW-846 Method 0010 Sampling Train D Concentration Results - Run 1 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 1 - Sampling Train D	6/3/2008	600-1018	704-734	30	1.182
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
2-Naphthylamine	<0.81	150	<50	150	127
2-Nitroaniline	<0.56	<21	<2.5	0	0
3-Nitroaniline	<3.8	<36	<10	0	0
4-Nitroaniline	<2.3	<29	<10	0	0
Nitrobenzene	<0.73	<13	<2.8	0	0
Benzidine	<51	<500	<260	0	0
2-Nitrophenol	<3.2	<20	<2.5	0	0
4-Nitrophenol	<3.3	<29	<16	0	0
N-Nitrosodi-n-butylamine	<0.86	<20	<2.5	0	0
N-Nitrosodimethylamine	<0.72	<17	<2.5	0	0
Benzo(a)anthracene	1.4	270	23	294	249
N-Nitrosodi-n-propylamine	<0.73	<18	<2.5	0	0
N-Nitrosodiphenylamine	<0.6	<10	<4.4	0	0
N-Nitrosopiperidine	<0.62	<15	<2.5	0	0
Benzo(b)fluoranthene	<1.4	<32	<5.5	0	0
Benzo(k)fluoranthene	<2.1	<22	<8	0	0
Benzoic acid	<42	<72	<230	0	0
Benzo(ghi)perylene	<2.8	16	<3.1	16.0	13.5
Pentachlorobenzene	<0.52	<17	<2.5	0	0
Benzo(a)pyrene	1.9	42	3.3	47.2	39.9
Pentachloronitrobenzene	<0.76	<20	<2.5	0	0
Pentachlorophenol	<25	<26	<120	0	0
Phenacetin	<0.51	<18	<2.5	0	0
Benzyl alcohol	<35	<15	<180	0	0
Phenanthrene	0.97	12,000	710	12,700	10,800
Phenol	<1.1	3,000	230	3,230	2,730
2-Picoline	<0.98	840	57	897	759
Pyrene	1.2	1,700	150	1,850	1,570
Pyridine	<0.89	270	<3.7	270	228
Acetophenone	<0.77	420	<12	420	355

Table 2-20. SW-846 Method 0010 Sampling Train D Concentration Results - Run 1 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 1 - Sampling Train D	6/3/2008	600-1018	704-734	30	1.182
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
1,2,4,5-Tetrachlorobenzene	<0.87	<16	<2.5	0	0
2,3,4,6-Tetrachlorophenol	<1.1	<26	<3.2	0	0
1,2,4-Trichlorobenzene	<0.73	<16	<3	0	0
2,4,5-Trichlorophenol	<2.3	<16	<6.5	0	0
2,4,6-Trichlorophenol	<1.4	<19	<3.8	0	0
Carbazole	<0.76	820	100	920	778
3-Methylphenol & 4-Methylphenol	<2.3	2,600	210	2,810	2,380
bis(2-Chloroethoxy)methane	<0.59	<15	<2.5	0	0
bis(2-Chloroethyl) ether	<0.76	<13	<2.8	0	0
bis(2-Chloroisopropyl) ether	<1	<13	<3.8	0	0
bis(2-Ethylhexyl) phthalate	<3.3	<16	<50	0	0
4-Bromophenyl phenyl ether	<0.53	<11	<2.5	0	0
Butyl benzyl phthalate	<1.1	<17	<3	0	0
Acenaphthylene	<0.5	54	<2.5	54.0	45.7
4-Chloroaniline	<1.2	<61	<30	0	0
4-Chloro-3-methylphenol	<1	<50	<3.1	0	0
1-Chloronaphthalene	<0.5	<18	<2.5	0	0
2-Chloronaphthalene	<0.5	<11	<2.5	0	0
2-Chlorophenol	<0.98	<13	<2.5	0	0
4-Chlorophenyl phenyl ether	<0.51	<24	<2.5	0	0
Chrysene	1.4	270	22	293	248
Dibenz(a,h)anthracene	<2	<22	<3	0	0
Dibenzofuran	<0.53	660	74	734	621
Di-n-butyl phthalate	0.94	<17	<50	0.940	0.795
1,2-Dichlorobenzene	<0.84	<13	<2.6	0	0
1,3-Dichlorobenzene	<1.2	<11	<2.8	0	0
1,4-Dichlorobenzene	<1.1	<15	<2.6	0	0
3,3'-Dichlorobenzidine	<2.7	<59	<37	0	0
4-Aminobiphenyl	<1.1	<28	<50	0	0
2,4-Dichlorophenol	<1.5	<18	<2.5	0	0
2,6-Dichlorophenol	<0.72	<20	<2.5	0	0

Table 2-21. SW-846 Method 0010 Sampling Train A Concentration Results - Run 2

	Date	**Venting Cycle**	**Sampling Interval**	**Sampling Duration (min)**	**Sample Volume (dscf)**
Run 2 - Sampling Train A	6/4-5/2008	2235-130	2236-2306	30	1.112
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
Acenaphthene	5.6	2,200	59	2,260	2,040
Diethyl phthalate	<15	<13	<3.6	0	0
p-Dimethylaminoazobenzene	<5	<24	<2.5	0	0
7,12-Dimethylbenz(a)anthracene	<9.4	<19	<2.6	0	0
2,4-Dimethylphenol	<29	2,800	<32	2,800	2,520
Dimethyl phthalate	<6.3	<12	<2.5	0	0
Aniline	<9.5	1,700	<36	1,700	1,530
Di-n-octyl phthalate	<21	<24	<2.8	0	0
4,6-Dinitro-2-methylphenol	<50	<14	<44	0	0
2,4-Dinitrophenol	<59	<38	<110	0	0
2,4-Dinitrotoluene	<16	<26	<2.5	0	0
2,6-Dinitrotoluene	<13	<20	<2.5	0	0
Diphenylamine	<5	<28	<2.5	0	0
1,2-Diphenylhydrazine	<6.3	<14	<2.5	0	0
Anthracene	130	3,400	45	3,580	3,210
Ethyl methanesulfonate	<7.9	<24	<2.5	0	0
Fluoranthene	61	460	<2.7	521	468
Fluorene	31	4,100	95	4,230	3,800
Hexachlorobenzene	<5.6	<25	<2.5	0	0
Hexachlorobutadiene	<14	<18	<3.7	0	0
Hexachlorocyclopentadiene	<100	<62	<50	0	0
Hexachloroethane	<25	<18	<2.7	0	0
Indeno(1,2,3-cd)pyrene	310	30	<2.7	340	306
Isophorone	<6.6	<17	<2.5	0	0
3-Methylcholanthrene	<5	<17	<2.5	0	0
Methyl methanesulfonate	<6	<22	<2.8	0	0
2-Methylnaphthalene	37	87,000	3,800	90,800	81,700
2-Methylphenol	<23	3,400	18	3,420	3,070
Naphthalene	8.6	46,000	4,200	50,200	45,100
1-Naphthylamine	<9.3	320	<50	320	288

Table 2-21. SW-846 Method 0010 Sampling Train A Concentration Results - Run 2 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 2 - Sampling Train A	6/4-5/2008	2235-130	2236-2306	30	1.112
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
2-Naphthylamine	<8.1	290	<50	290	261
2-Nitroaniline	<5.6	<26	<2.5	0	0
3-Nitroaniline	<38	<45	<10	0	0
4-Nitroaniline	<23	<36	<10	0	0
Nitrobenzene	<7.3	<16	<2.8	0	0
Benzidine	<510	<620	<260	0	0
2-Nitrophenol	<32	<25	<2.5	0	0
4-Nitrophenol	<33	<36	<16	0	0
N-Nitrosodi-n-butylamine	<8.6	<25	<2.5	0	0
N-Nitrosodimethylamine	<7.2	<21	<2.5	0	0
Benzo(a)anthracene	520	640	<2.9	1,160	1,040
N-Nitrosodi-n-propylamine	<7.3	<22	<2.5	0	0
N-Nitrosodiphenylamine	<6	<13	<4.4	0	0
N-Nitrosopiperidine	<6.2	<18	<2.5	0	0
Benzo(b)fluoranthene	200	110	<5.5	310	279
Benzo(k)fluoranthene	160	86	<8	246	221
Benzoic acid	<420	<90	<230	0	0
Benzo(ghi)perylene	620	61	<3.1	681	612
Pentachlorobenzene	<5.2	<22	<2.5	0	0
Benzo(a)pyrene	900	370	<2.5	1,270	1,140
Pentachloronitrobenzene	<7.6	<25	<2.5	0	0
Pentachlorophenol	<250	<33	<120	0	0
Phenacetin	<5.1	<22	<2.5	0	0
Benzyl alcohol	<350	<19	<180	0	0
Phenanthrene	220	5,000	97	5,320	4,780
Phenol	<11	3,400	<4.5	3,400	3,060
2-Picoline	<9.8	1,300	44	1,340	1,210
Pyrene	270	1,600	6.2	1,880	1,690
Pyridine	<8.9	500	<3.7	500	450
Acetophenone	<7.7	950	<12	950	854

Table 2-21. SW-846 Method 0010 Sampling Train A Concentration Results - Run 2 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 2 - Sampling Train A	6/4-5/2008	2235-130	2236-2306	30	1.112
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
1,2,4,5-Tetrachlorobenzene	<8.7	<20	<2.5	0	0
2,3,4,6-Tetrachlorophenol	<11	<32	<3.2	0	0
1,2,4-Trichlorobenzene	<7.3	<20	<3	0	0
2,4,5-Trichlorophenol	<23	<20	<6.5	0	0
2,4,6-Trichlorophenol	<14	<24	<3.8	0	0
Carbazole	64	980	<3.2	1,040	939
3-Methylphenol & 4-Methylphenol	<23	3,400	<10	3,400	3,060
bis(2-Chloroethoxy)methane	<5.9	<19	<2.5	0	0
bis(2-Chloroethyl) ether	<7.6	<16	<2.8	0	0
bis(2-Chloroisopropyl) ether	<10	<17	<3.8	0	0
bis(2-Ethylhexyl) phthalate	<33	<20	<50	0	0
4-Bromophenyl phenyl ether	<5.3	<14	<2.5	0	0
Butyl benzyl phthalate	<11	<22	<3	0	0
Acenaphthylene	<5	150	<2.5	150	135
4-Chloroaniline	<12	<76	<30	0	0
4-Chloro-3-methylphenol	<10	<62	<3.1	0	0
1-Chloronaphthalene	<5	<22	<2.5	0	0
2-Chloronaphthalene	<5	<13	<2.5	0	0
2-Chlorophenol	<9.8	<16	<2.5	0	0
4-Chlorophenyl phenyl ether	<5.1	<30	<2.5	0	0
Chrysene	530	640	<3.2	1,170	1,050
Dibenz(a,h)anthracene	610	49	<3	659	593
Dibenzofuran	<5.3	980	25	1,010	904
Di-n-butyl phthalate	<7.1	<22	<50	0	0
1,2-Dichlorobenzene	<8.4	<16	<2.6	0	0
1,3-Dichlorobenzene	<12	<14	<2.8	0	0
1,4-Dichlorobenzene	<11	<19	<2.6	0	0
3,3'-Dichlorobenzidine	<27	<74	<37	0	0
4-Aminobiphenyl	<11	<35	<50	0	0
2,4-Dichlorophenol	<15	<22	<2.5	0	0
2,6-Dichlorophenol	<7.2	<25	<2.5	0	0

Table 2-22. SW-846 Method 0010 Sampling Train B Concentration Results - Run 2

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 2 - Sampling Train B	6/4-5/2008	2235-130	2307-2337	30	1.237
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
Acenaphthene	<10	1,700	67	1,770	1,430
Diethyl phthalate	<30	<11	<3.6	0	0
p-Dimethylaminoazobenzene	<10	<19	<2.5	0	0
7,12-Dimethylbenz(a)anthracene	<19	<15	<2.6	0	0
2,4-Dimethylphenol	<58	2,200	<32	2,200	1,780
Dimethyl phthalate	<13	<10	<2.5	0	0
Aniline	<19	1,400	<36	1,400	1,130
Di-n-octyl phthalate	<42	<19	<2.8	0	0
4,6-Dinitro-2-methylphenol	<100	<11	<44	0	0
2,4-Dinitrophenol	<120	<30	<110	0	0
2,4-Dinitrotoluene	<32	<21	<2.5	0	0
2,6-Dinitrotoluene	<26	<16	<2.5	0	0
Diphenylamine	<10	<22	<2.5	0	0
1,2-Diphenylhydrazine	<13	<11	<2.5	0	0
Anthracene	66	2,800	34	2,900	2,340
Ethyl methanesulfonate	<16	<20	<2.5	0	0
Fluoranthene	34	400	<2.7	434	351
Fluorene	15	3,200	96	3,310	2,680
Hexachlorobenzene	<11	<20	<2.5	0	0
Hexachlorobutadiene	<28	<15	<3.7	0	0
Hexachlorocyclopentadiene	<200	<50	<50	0	0
Hexachloroethane	<50	<15	<2.7	0	0
Indeno(1,2,3-cd)pyrene	240	34	<2.7	274	221
Isophorone	<13	<14	<2.5	0	0
3-Methylcholanthrene	55	<14	<2.5	55.0	44.4
Methyl methanesulfonate	<12	<17	<2.8	0	0
2-Methylnaphthalene	18	68,000	4,200	72,200	58,400
2-Methylphenol	<46	2,800	<15	2,800	2,260
Naphthalene	<10	37,000	4,100	41,100	33,200
1-Naphthylamine	<19	280	<50	280	226

Table 2-22. SW-846 Method 0010 Sampling Train B Concentration Results - Run 2 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 2 - Sampling Train B	6/4-5/2008	2235-130	2307-2337	30	1.237
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
2-Naphthylamine	<16	240	<50	240	194
2-Nitroaniline	<11	<21	<2.5	0	0
3-Nitroaniline	<76	<36	<10	0	0
4-Nitroaniline	<46	<29	<10	0	0
Nitrobenzene	<15	<13	<2.8	0	0
Benzidine	<1000	<500	<260	0	0
2-Nitrophenol	<64	<20	<2.5	0	0
4-Nitrophenol	<66	<29	<16	0	0
N-Nitrosodi-n-butylamine	<17	<20	<2.5	0	0
N-Nitrosodimethylamine	<14	<17	<2.5	0	0
Benzo(a)anthracene	330	660	<2.9	990	800
N-Nitrosodi-n-propylamine	<15	<18	<2.5	0	0
N-Nitrosodiphenylamine	<12	<10	<4.4	0	0
N-Nitrosopiperidine	<12	<15	<2.5	0	0
Benzo(b)fluoranthene	170	120	<5.5	290	234
Benzo(k)fluoranthene	120	110	<8	230	186
Benzoic acid	<840	<72	<230	0	0
Benzo(ghi)perylene	580	65	<3.1	645	521
Pentachlorobenzene	<10	<17	<2.5	0	0
Benzo(a)pyrene	740	420	<2.5	1,160	937
Pentachloronitrobenzene	<15	<20	<2.5	0	0
Pentachlorophenol	<500	<26	<120	0	0
Phenacetin	<10	<18	<2.5	0	0
Benzyl alcohol	<700	<15	<180	0	0
Phenanthrene	120	11,000	74	11,200	9,050
Phenol	<22	3,000	<4.5	3,000	2,420
2-Picoline	<20	960	<5.5	960	776
Pyrene	150	1,400	4	1,550	1,260
Pyridine	<18	360	<3.7	360	291
Acetophenone	<15	680	<12	680	550

Table 2-22. SW-846 Method 0010 Sampling Train B Concentration Results - Run 2 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 2 - Sampling Train B	6/4-5/2008	2235-130	2307-2337	30	1.237
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
1,2,4,5-Tetrachlorobenzene	<17	<16	<2.5	0	0
2,3,4,6-Tetrachlorophenol	<22	<26	<3.2	0	0
1,2,4-Trichlorobenzene	<15	<16	<3	0	0
2,4,5-Trichlorophenol	<46	<16	<6.5	0	0
2,4,6-Trichlorophenol	<28	<19	<3.8	0	0
Carbazole	32	860	<3.2	892	721
3-Methylphenol & 4-Methylphenol	<46	2,900	<10	2,900	2,340
bis(2-Chloroethoxy)methane	<12	<15	<2.5	0	0
bis(2-Chloroethyl) ether	<15	<13	<2.8	0	0
bis(2-Chloroisopropyl) ether	<20	<13	<3.8	0	0
bis(2-Ethylhexyl) phthalate	<66	<16	<50	0	0
4-Bromophenyl phenyl ether	<11	<11	<2.5	0	0
Butyl benzyl phthalate	<22	<17	<3	0	0
Acenaphthylene	<10	120	<2.5	120	97.0
4-Chloroaniline	<24	<61	<30	0	0
4-Chloro-3-methylphenol	<20	<50	<3.1	0	0
1-Chloronaphthalene	<10	<18	<2.5	0	0
2-Chloronaphthalene	<10	<11	<2.5	0	0
2-Chlorophenol	<20	<13	<2.5	0	0
4-Chlorophenyl phenyl ether	<10	<24	<2.5	0	0
Chrysene	360	710	<3.2	1,070	865
Dibenz(a,h)anthracene	380	48	<3	428	346
Dibenzofuran	<11	790	27	817	660
Di-n-butyl phthalate	<14	<17	<50	0	0
1,2-Dichlorobenzene	<17	<13	<2.6	0	0
1,3-Dichlorobenzene	<24	<11	<2.8	0	0
1,4-Dichlorobenzene	<22	<15	<2.6	0	0
3,3'-Dichlorobenzidine	<54	<59	<37	0	0
4-Aminobiphenyl	<22	<28	<50	0	0
2,4-Dichlorophenol	<30	<18	<2.5	0	0
2,6-Dichlorophenol	<14	<20	<2.5	0	0

Table 2-23. SW-846 Method 0010 Sampling Train C Concentration Results - Run 2

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 2 - Sampling Train C	6/4-5/2008	2235-130	2338-035	57	2.395

SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
Acenaphthene	<10	2,500	700	3,200	1,340
Diethyl phthalate	<30	<26	<15	0	0
p-Dimethylaminoazobenzene	<10	<48	<10	0	0
7,12-Dimethylbenz(a)anthracene	<19	<38	<10	0	0
2,4-Dimethylphenol	<58	3,400	530	3,930	1,640
Dimethyl phthalate	<13	<25	<10	0	0
Aniline	<19	2,600	240	2,840	1,190
Di-n-octyl phthalate	<42	<48	<11	0	0
4,6-Dinitro-2-methylphenol	<100	<28	<170	0	0
2,4-Dinitrophenol	<120	<76	<440	0	0
2,4-Dinitrotoluene	<32	<52	<10	0	0
2,6-Dinitrotoluene	<26	<40	<10	0	0
Diphenylamine	<10	<55	<10	0	0
1,2-Diphenylhydrazine	<13	<28	<10	0	0
Anthracene	130	4,900	1,400	6,430	2,680
Ethyl methanesulfonate	<16	<49	<10	0	0
Fluoranthene	64	580	150	794	331
Fluorene	32	5,600	1,600	7,230	3,020
Hexachlorobenzene	<11	<50	<10	0	0
Hexachlorobutadiene	<28	<36	<15	0	0
Hexachlorocyclopentadiene	<200	<120	<200	0	0
Hexachloroethane	<50	<37	<11	0	0
Indeno(1,2,3-cd)pyrene	510	76	<11	586	245
Isophorone	<13	<34	<10	0	0
3-Methylcholanthrene	<10	<34	<10	0	0
Methyl methanesulfonate	<12	<43	<11	0	0
2-Methylnaphthalene	46	100,000	28,000	128,000	53,500
2-Methylphenol	<46	4,800	670	5,470	2,280
Naphthalene	11	59,000	18,000	77,000	32,200
1-Naphthylamine	<19	440	<200	440	184

Table 2-23. SW-846 Method 0010 Sampling Train C Concentration Results - Run 2 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 2 - Sampling Train C	6/4-5/2008	2235-130	2338-035	57	2.395
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
2-Naphthylamine	<16	460	<200	460	192
2-Nitroaniline	<11	<53	<10	0	0
3-Nitroaniline	<76	<90	<40	0	0
4-Nitroaniline	<46	<73	<40	0	0
Nitrobenzene	<15	<32	<11	0	0
Benzidine	<1000	<1200	<1000	0	0
2-Nitrophenol	<64	<50	<10	0	0
4-Nitrophenol	<66	<73	<66	0	0
N-Nitrosodi-n-butylamine	<17	<50	<10	0	0
N-Nitrosodimethylamine	<14	<42	<10	0	0
Benzo(a)anthracene	620	1,100	220	1,940	810
N-Nitrosodi-n-propylamine	<15	<44	<10	0	0
N-Nitrosodiphenylamine	<12	<26	<17	0	0
N-Nitrosopiperidine	<12	<36	<10	0	0
Benzo(b)fluoranthene	280	240	25	545	228
Benzo(k)fluoranthene	230	180	<32	410	171
Benzoic acid	<840	<180	<920	0	0
Benzo(ghi)perylene	1,000	140	<12	1,140	476
Pentachlorobenzene	<10	<44	<10	0	0
Benzo(a)pyrene	1,300	850	78	2,230	930
Pentachloronitrobenzene	<15	<50	<10	0	0
Pentachlorophenol	<500	<66	<500	0	0
Phenacetin	<10	<45	<10	0	0
Benzyl alcohol	<700	<38	<700	0	0
Phenanthrene	230	7,600	2,500	10,300	4,310
Phenol	<22	4,800	630	5,430	2,270
2-Picoline	<20	2,000	200	2,200	918
Pyrene	260	2,200	460	2,920	1,220
Pyridine	<18	740	<15	740	309
Acetophenone	<15	1,200	<49	1,200	501

Table 2-23. SW-846 Method 0010 Sampling Train C Concentration Results - Run 2 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 2 - Sampling Train C	6/4-5/2008	2235-130	2338-035	57	2.395
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
1,2,4,5-Tetrachlorobenzene	<17	<41	<10	0	0
2,3,4,6-Tetrachlorophenol	<22	<65	<13	0	0
1,2,4-Trichlorobenzene	<15	<41	<12	0	0
2,4,5-Trichlorophenol	<46	<40	<26	0	0
2,4,6-Trichlorophenol	<28	<48	<15	0	0
Carbazole	62	1,300	340	1,700	711
3-Methylphenol & 4-Methylphenol	<46	4,700	620	5,320	2,220
bis(2-Chloroethoxy)methane	<12	<38	<10	0	0
bis(2-Chloroethyl) ether	<15	<32	<11	0	0
bis(2-Chloroisopropyl) ether	<20	<34	<15	0	0
bis(2-Ethylhexyl) phthalate	<66	<40	<200	0	0
4-Bromophenyl phenyl ether	<11	<27	<10	0	0
Butyl benzyl phthalate	<22	<44	<12	0	0
Acenaphthylene	<10	160	<10	160	66.8
4-Chloroaniline	<24	<150	<120	0	0
4-Chloro-3-methylphenol	<20	<120	<12	0	0
1-Chloronaphthalene	<10	<44	<10	0	0
2-Chloronaphthalene	<10	<26	<10	0	0
2-Chlorophenol	<20	<32	<10	0	0
4-Chlorophenyl phenyl ether	<10	<60	<10	0	0
Chrysene	640	1,200	220	2,060	860
Dibenz(a,h)anthracene	640	110	<12	750	313
Dibenzofuran	<11	1,300	360	1,660	693
Di-n-butyl phthalate	<14	<43	<200	0	0
1,2-Dichlorobenzene	<17	<33	<10	0	0
1,3-Dichlorobenzene	<24	<27	<11	0	0
1,4-Dichlorobenzene	<22	<38	<11	0	0
3,3'-Dichlorobenzidine	<54	<150	<150	0	0
4-Aminobiphenyl	<22	<70	<200	0	0
2,4-Dichlorophenol	<30	<44	<10	0	0
2,6-Dichlorophenol	<14	<50	<10	0	0

Table 2-24. SW-846 Method 0010 Sampling Train A Concentration Results - Run 3

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 3 - Sampling Train A	6/6/2008	1408-1630	1409-1439	30	0.517
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
Acenaphthene	7.8	580	7.9	596	1,150
Diethyl phthalate	<6	<5.3	<3.6	0	0
p-Dimethylaminoazobenzene	<2	<9.7	<2.5	0	0
7,12-Dimethylbenz(a)anthracene	<3.8	<7.7	<2.6	0	0
2,4-Dimethylphenol	<12	830	<32	830	1,610
Dimethyl phthalate	<2.5	<5	<2.5	0	0
Aniline	<3.8	440	<36	440	851
Di-n-octyl phthalate	<8.4	<9.6	<2.8	0	0
4,6-Dinitro-2-methylphenol	<20	<5.6	<44	0	0
2,4-Dinitrophenol	<24	<15	<110	0	0
2,4-Dinitrotoluene	<6.4	<10	<2.5	0	0
2,6-Dinitrotoluene	<5.2	<7.9	<2.5	0	0
Diphenylamine	<2	<11	<2.5	0	0
1,2-Diphenylhydrazine	<2.5	<5.6	<2.5	0	0
Anthracene	18	1,500	8.5	1,530	2,950
Ethyl methanesulfonate	<3.2	<9.8	<2.5	0	0
Fluoranthene	9.5	300	<2.7	310	599
Fluorene	22	1,600	17	1,640	3,170
Hexachlorobenzene	<2.2	<10	<2.5	0	0
Hexachlorobutadiene	<5.6	<7.3	<3.7	0	0
Hexachlorocyclopentadiene	<40	<25	<50	0	0
Hexachloroethane	<10	<7.4	<2.7	0	0
Indeno(1,2,3-cd)pyrene	36	24	<2.7	60.0	116
Isophorone	<2.6	<6.8	<2.5	0	0
3-Methylcholanthrene	<2	<6.8	<2.5	0	0
Methyl methanesulfonate	<2.4	<8.6	<2.8	0	0
2-Methylnaphthalene	580	20,000	550	21,100	40,900
2-Methylphenol	<9.2	760	<15	760	1,470
Naphthalene	480	11,000	600	12,100	23,400
1-Naphthylamine	<3.7	75	<50	75.0	145

Table 2-24. SW-846 Method 0010 Sampling Train A Concentration Results - Run 3 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 3 - Sampling Train A	6/6/2008	1408-1630	1409-1439	30	0.517
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
2-Naphthylamine	<3.2	72	<50	72.0	139
2-Nitroaniline	<2.2	<11	<2.5	0	0
3-Nitroaniline	<15	<18	<10	0	0
4-Nitroaniline	<9.2	<15	<10	0	0
Nitrobenzene	<2.9	<6.3	<2.8	0	0
Benzidine	<200	<250	<260	0	0
2-Nitrophenol	<13	<10	<2.5	0	0
4-Nitrophenol	<13	<15	<16	0	0
N-Nitrosodi-n-butylamine	<3.4	<10	<2.5	0	0
N-Nitrosodimethylamine	<2.9	<8.3	<2.5	0	0
Benzo(a)anthracene	72	320	<2.9	392	758
N-Nitrosodi-n-propylamine	<2.9	<8.8	<2.5	0	0
N-Nitrosodiphenylamine	<2.4	<5.2	<4.4	0	0
N-Nitrosopiperidine	<2.5	<7.3	<2.5	0	0
Benzo(b)fluoranthene	29	44	<5.5	73.0	141
Benzo(k)fluoranthene	23	41	<8	64.0	124
Benzoic acid	<170	<36	<230	0	0
Benzo(ghi)perylene	88	58	<3.1	146	282
Pentachlorobenzene	<2.1	<8.7	<2.5	0	0
Benzo(a)pyrene	130	160	<2.5	290	561
Pentachloronitrobenzene	<3	<10	<2.5	0	0
Pentachlorophenol	<100	<13	<120	0	0
Phenacetin	<2	<9	<2.5	0	0
Benzyl alcohol	<140	<7.6	<180	0	0
Phenanthrene	76	5,400	26	5,500	10,600
Phenol	<4.4	560	<4.5	560	1,080
2-Picoline	<3.9	360	7.8	368	711
Pyrene	42	920	<2.6	962	1,860
Pyridine	<3.6	140	<3.7	140	271
Acetophenone	<3.1	<10	<12	0	0

Table 2-24. SW-846 Method 0010 Sampling Train A Concentration Results - Run 3 (Continued)

	Date	**Venting Cycle**	**Sampling Interval**	**Sampling Duration (min)**	**Sample Volume (dscf)**
Run 3 - Sampling Train A	6/6/2008	1408-1630	1409-1439	30	0.517
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
1,2,4,5-Tetrachlorobenzene	<3.5	<8.2	<2.5	0	0
2,3,4,6-Tetrachlorophenol	<4.4	<13	<3.2	0	0
1,2,4-Trichlorobenzene	<2.9	<8.2	<3	0	0
2,4,5-Trichlorophenol	<9.2	<8.1	<6.5	0	0
2,4,6-Trichlorophenol	<5.6	<9.6	<3.8	0	0
Carbazole	8.4	480	<3.2	488	945
3-Methylphenol & 4-Methylphenol	<9.2	660	<10	660	1,280
bis(2-Chloroethoxy)methane	<2.4	<7.6	<2.5	0	0
bis(2-Chloroethyl) ether	<3	<6.4	<2.8	0	0
bis(2-Chloroisopropyl) ether	<4	<6.7	<3.8	0	0
bis(2-Ethylhexyl) phthalate	<13	<8	<50	0	0
4-Bromophenyl phenyl ether	<2.1	<5.4	<2.5	0	0
Butyl benzyl phthalate	<4.4	<8.7	<3	0	0
Acenaphthylene	<2	36	<2.5	36.0	69.6
4-Chloroaniline	<4.8	<30	<30	0	0
4-Chloro-3-methylphenol	<4	<25	<3.1	0	0
1-Chloronaphthalene	<2	<8.9	<2.5	0	0
2-Chloronaphthalene	<2	<5.3	<2.5	0	0
2-Chlorophenol	<3.9	<6.3	<2.5	0	0
4-Chlorophenyl phenyl ether	<2	<12	<2.5	0	0
Chrysene	79	340	<3.2	419	810
Dibenz(a,h)anthracene	52	36	<3	88.0	170
Dibenzofuran	4.9	330	3.8	339	655
Di-n-butyl phthalate	<2.8	<8.6	<50	0	0
1,2-Dichlorobenzene	<3.4	<6.6	<2.6	0	0
1,3-Dichlorobenzene	<4.8	<5.4	<2.8	0	0
1,4-Dichlorobenzene	<4.4	<7.7	<2.6	0	0
3,3'-Dichlorobenzidine	<11	<30	<37	0	0
4-Aminobiphenyl	<4.4	<14	<50	0	0
2,4-Dichlorophenol	<6	<8.9	<2.5	0	0
2,6-Dichlorophenol	<2.9	<10	<2.5	0	0

Table 2-25. SW-846 Method 0010 Sampling Train C Concentration Results - Run 3

	Date	**Venting Cycle**	**Sampling Interval**	**Sampling Duration (min)**	**Sample Volume (dscf)**
Run 3 - Sampling Train C	6/6/2008	1408-1630	1442-1532	50	0.694
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
Acenaphthene	<5	740	140	880	1,270
Diethyl phthalate	<15	<5.3	<3.6	0	0
p-Dimethylaminoazobenzene	<5	<9.7	<2.5	0	0
7,12-Dimethylbenz(a)anthracene	<9.4	<7.7	<2.6	0	0
2,4-Dimethylphenol	<29	1,100	77	1,180	1,700
Dimethyl phthalate	<6.3	<5	<2.5	0	0
Aniline	<9.5	660	<36	660	951
Di-n-octyl phthalate	<21	<9.6	<2.8	0	0
4,6-Dinitro-2-methylphenol	<50	<5.6	<44	0	0
2,4-Dinitrophenol	<59	<15	<110	0	0
2,4-Dinitrotoluene	<16	<10	<2.5	0	0
2,6-Dinitrotoluene	<13	<7.9	<2.5	0	0
Diphenylamine	<5	<11	<2.5	0	0
1,2-Diphenylhydrazine	<6.3	<5.6	<2.5	0	0
Anthracene	40	1,800	390	2,230	3,210
Ethyl methanesulfonate	<7.9	<9.8	<2.5	0	0
Fluoranthene	28	360	54	442	637
Fluorene	8.2	1,900	380	2,290	3,300
Hexachlorobenzene	<5.6	<10	<2.5	0	0
Hexachlorobutadiene	<14	<7.3	<3.7	0	0
Hexachlorocyclopentadiene	<100	<25	<50	0	0
Hexachloroethane	<25	<7.4	<2.7	0	0
Indeno(1,2,3-cd)pyrene	240	18	2.9	261	376
Isophorone	<6.6	<6.8	<2.5	0	0
3-Methylcholanthrene	<5	<6.8	<2.5	0	0
Methyl methanesulfonate	<6	<8.6	<2.8	0	0
2-Methylnaphthalene	10	32,000	5,600	37,600	54,200
2-Methylphenol	<23	1,000	99	1,100	1,580
Naphthalene	<5	18,000	4,100	22,100	31,800
1-Naphthylamine	<9.3	110	<50	110	159

Table 2-25. SW-846 Method 0010 Sampling Train C Concentration Results - Run 3 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 3 - Sampling Train C	6/6/2008	1408-1630	1442-1532	50	0.694
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
2-Naphthylamine	<8.1	98	<50	98.0	141
2-Nitroaniline	<5.6	<11	<2.5	0	0
3-Nitroaniline	<38	<18	<10	0	0
4-Nitroaniline	<23	<15	<10	0	0
Nitrobenzene	<7.3	<6.3	<2.8	0	0
Benzidine	<510	<250	<260	0	0
2-Nitrophenol	<32	<10	<2.5	0	0
4-Nitrophenol	<33	<15	<16	0	0
N-Nitrosodi-n-butylamine	<8.6	<10	<2.5	0	0
N-Nitrosodimethylamine	<7.2	<8.3	<2.5	0	0
Benzo(a)anthracene	320	460	54	834	1,200
N-Nitrosodi-n-propylamine	<7.3	<8.8	<2.5	0	0
N-Nitrosodiphenylamine	<6	<5.2	<4.4	0	0
N-Nitrosopiperidine	<6.2	<7.3	<2.5	0	0
Benzo(b)fluoranthene	150	66	7.1	223	322
Benzo(k)fluoranthene	130	57	<8	187	269
Benzoic acid	<420	<36	<230	0	0
Benzo(ghi)perylene	490	32	5	527	759
Pentachlorobenzene	<5.2	<8.7	<2.5	0	0
Benzo(a)pyrene	680	220	27	927	1,340
Pentachloronitrobenzene	<7.6	<10	<2.5	0	0
Pentachlorophenol	<250	<13	<120	0	0
Phenacetin	<5.1	<9	<2.5	0	0
Benzyl alcohol	<350	<7.6	<180	0	0
Phenanthrene	77	6,800	740	7,620	11,000
Phenol	<11	900	93	993	1,430
2-Picoline	<9.8	530	79	609	878
Pyrene	120	1,100	170	1,390	2,000
Pyridine	<8.9	210	<3.7	210	303
Acetophenone	<7.7	350	<12	350	504

Table 2-25. SW-846 Method 0010 Sampling Train C Concentration Results - Run 3 (Continued)

	Date	**Venting Cycle**	**Sampling Interval**	**Sampling Duration (min)**	**Sample Volume (dscf)**
Run 3 - Sampling Train C	6/6/2008	1408-1630	1442-1532	50	0.694
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
1,2,4,5-Tetrachlorobenzene	<8.7	<8.2	<2.5	0	0
2,3,4,6-Tetrachlorophenol	<11	<13	<3.2	0	0
1,2,4-Trichlorobenzene	<7.3	<8.2	<3	0	0
2,4,5-Trichlorophenol	<23	<8.1	<6.5	0	0
2,4,6-Trichlorophenol	<14	<9.6	<3.8	0	0
Carbazole	19	600	92	711	1,020
3-Methylphenol & 4-Methylphenol	<23	970	91	1,060	1,530
bis(2-Chloroethoxy)methane	<5.9	<7.6	<2.5	0	0
bis(2-Chloroethyl) ether	<7.6	<6.4	<2.8	0	0
bis(2-Chloroisopropyl) ether	<10	<6.7	<3.8	0	0
bis(2-Ethylhexyl) phthalate	<33	<8	<50	0	0
4-Bromophenyl phenyl ether	<5.3	<5.4	<2.5	0	0
Butyl benzyl phthalate	<11	<8.7	<3	0	0
Acenaphthylene	<5	66	11	77.0	111
4-Chloroaniline	<12	<30	<30	0	0
4-Chloro-3-methylphenol	<10	<25	<3.1	0	0
1-Chloronaphthalene	<5	<8.9	<2.5	0	0
2-Chloronaphthalene	<5	<5.3	<2.5	0	0
2-Chlorophenol	<9.8	<6.3	<2.5	0	0
4-Chlorophenyl phenyl ether	<5.1	<12	<2.5	0	0
Chrysene	350	450	55	855	1,230
Dibenz(a,h)anthracene	290	25	3.4	318	459
Dibenzofuran	<5.3	430	78	508	732
Di-n-butyl phthalate	<7.1	<8.6	<50	0	0
1,2-Dichlorobenzene	<8.4	<6.6	<2.6	0	0
1,3-Dichlorobenzene	<12	<5.4	<2.8	0	0
1,4-Dichlorobenzene	<11	<7.7	<2.6	0	0
3,3'-Dichlorobenzidine	<27	<30	<37	0	0
4-Aminobiphenyl	<11	<14	<50	0	0
2,4-Dichlorophenol	<15	<8.9	<2.5	0	0
2,6-Dichlorophenol	<7.2	<10	<2.5	0	0

Table 2-26. SW-846 Method 0010 Sampling Train D
Concentration Results - Run 3

	Date	**Venting Cycle**	**Sampling Interval**	**Sampling Duration (min)**	**Sample Volume (dscf)**
Run 3 - Sampling Train D	6/6/2008	1408-1630	1533-1621	48	1.221
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
Acenaphthene	<0.5	680	19	699	572
Diethyl phthalate	<1.5	<5.3	<3.6	0	0
p-Dimethylaminoazobenzene	<0.5	<9.7	<2.5	0	0
7,12-Dimethylbenz(a)anthracene	<0.94	<7.7	<2.6	0	0
2,4-Dimethylphenol	<2.9	630	<32	630	516
Dimethyl phthalate	<0.63	<5	<2.5	0	0
Aniline	<0.95	360	<36	360	295
Di-n-octyl phthalate	<2.1	<9.6	<2.8	0	0
4,6-Dinitro-2-methylphenol	<5	<5.6	<44	0	0
2,4-Dinitrophenol	<5.9	<15	<110	0	0
2,4-Dinitrotoluene	<1.6	<10	<2.5	0	0
2,6-Dinitrotoluene	<1.3	<7.9	<2.5	0	0
Diphenylamine	<0.5	<11	<2.5	0	0
1,2-Diphenylhydrazine	<0.63	<5.6	<2.5	0	0
Anthracene	2.6	1,600	11	1,610	1,320
Ethyl methanesulfonate	<0.79	<9.8	<2.5	0	0
Fluoranthene	1	330	<2.7	331	271
Fluorene	0.65	1,700	31	1,730	1,420
Hexachlorobenzene	<0.56	<10	<2.5	0	0
Hexachlorobutadiene	<1.4	<7.3	<3.7	0	0
Hexachlorocyclopentadiene	<10	<25	<50	0	0
Hexachloroethane	<2.5	<7.4	<2.7	0	0
Indeno(1,2,3-cd)pyrene	13	39	<2.7	52.0	42.6
Isophorone	<0.66	<6.8	<2.5	0	0
3-Methylcholanthrene	<0.5	<6.8	<2.5	0	0
Methyl methanesulfonate	<0.6	<8.6	<2.8	0	0
2-Methylnaphthalene	1.8	33,000	2,100	35,100	28,700
2-Methylphenol	<2.3	570	<15	570	467
Naphthalene	0.9	20,000	3,000	23,000	18,800
1-Naphthylamine	<0.93	65	<50	65.0	53.2

Table 2-26. SW-846 Method 0010 Sampling Train D Concentration Results - Run 3 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 3 - Sampling Train D	6/6/2008	1408-1630	1533-1621	48	1.221
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
2-Naphthylamine	<0.81	58	<50	58.0	47.5
2-Nitroaniline	<0.56	<11	<2.5	0	0
3-Nitroaniline	<3.8	<18	<10	0	0
4-Nitroaniline	<2.3	<15	<10	0	0
Nitrobenzene	<0.73	<6.3	<2.8	0	0
Benzidine	<51	<250	<260	0	0
2-Nitrophenol	<3.2	<10	<2.5	0	0
4-Nitrophenol	<3.3	<15	<16	0	0
N-Nitrosodi-n-butylamine	<0.86	<10	<2.5	0	0
N-Nitrosodimethylamine	<0.72	<8.3	<2.5	0	0
Benzo(a)anthracene	8	350	<2.9	358	293
N-Nitrosodi-n-propylamine	<0.73	<8.8	<2.5	0	0
N-Nitrosodiphenylamine	<0.6	<5.2	<4.4	0	0
N-Nitrosopiperidine	<0.62	<7.3	<2.5	0	0
Benzo(b)fluoranthene	5.4	52	<5.5	57.4	47.0
Benzo(k)fluoranthene	4.3	49	<8	53.3	43.6
Benzoic acid	<42	<36	<230	0	0
Benzo(ghi)perylene	36	96	<3.1	132	108
Pentachlorobenzene	<0.52	<8.7	<2.5	0	0
Benzo(a)pyrene	28	220	<2.5	248	203
Pentachloronitrobenzene	<0.76	<10	<2.5	0	0
Pentachlorophenol	<25	<13	<120	0	0
Phenacetin	<0.51	<9	<2.5	0	0
Benzyl alcohol	<35	<7.6	<180	0	0
Phenanthrene	5.2	6,000	39	6,040	4,950
Phenol	<1.1	510	11	521	427
2-Picoline	<0.98	380	<5.5	380	311
Pyrene	4.2	1,000	2.8	1,010	824
Pyridine	<0.89	160	<3.7	160	131
Acetophenone	<0.77	<10	<12	0	0

Table 2-26. SW-846 Method 0010 Sampling Train D Concentration Results - Run 3 (Continued)

	Date	**Venting Cycle**	**Sampling Interval**	**Sampling Duration (min)**	**Sample Volume (dscf)**
Run 3 - Sampling Train D	6/6/2008	1408-1630	1533-1621	48	1.221
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
1,2,4,5-Tetrachlorobenzene	<0.87	<8.2	<2.5	0	0
2,3,4,6-Tetrachlorophenol	<1.1	<13	<3.2	0	0
1,2,4-Trichlorobenzene	<0.73	<8.2	<3	0	0
2,4,5-Trichlorophenol	<2.3	<8.1	<6.5	0	0
2,4,6-Trichlorophenol	<1.4	<9.6	<3.8	0	0
Carbazole	<0.76	450	<3.2	450	368
3-Methylphenol & 4-Methylphenol	<2.3	500	<10	500	409
bis(2-Chloroethoxy)methane	<0.59	<7.6	<2.5	0	0
bis(2-Chloroethyl) ether	<0.76	<6.4	<2.8	0	0
bis(2-Chloroisopropyl) ether	<1	<6.7	<3.8	0	0
bis(2-Ethylhexyl) phthalate	<3.3	11	<50	11.0	9.01
4-Bromophenyl phenyl ether	<0.53	<5.4	<2.5	0	0
Butyl benzyl phthalate	<1.1	<8.7	<3	0	0
Acenaphthylene	<0.5	65	<2.5	65.0	53.2
4-Chloroaniline	<1.2	<30	<30	0	0
4-Chloro-3-methylphenol	<1	<25	<3.1	0	0
1-Chloronaphthalene	<0.5	<8.9	<2.5	0	0
2-Chloronaphthalene	<0.5	<5.3	<2.5	0	0
2-Chlorophenol	<0.98	<6.3	<2.5	0	0
4-Chlorophenyl phenyl ether	<0.51	<12	<2.5	0	0
Chrysene	9.4	340	<3.2	349	286
Dibenz(a,h)anthracene	18	56	<3	74.0	60.6
Dibenzofuran	<0.53	380	9.4	389	319
Di-n-butyl phthalate	1.3	<8.6	<50	1.30	1.06
1,2-Dichlorobenzene	<0.84	<6.6	<2.6	0	0
1,3-Dichlorobenzene	<1.2	<5.4	<2.8	0	0
1,4-Dichlorobenzene	<1.1	<7.7	<2.6	0	0
3,3'-Dichlorobenzidine	<2.7	<30	<37	0	0
4-Aminobiphenyl	<1.1	<14	<50	0	0
2,4-Dichlorophenol	<1.5	<8.9	<2.5	0	0
2,6-Dichlorophenol	<0.72	<10	<2.5	0	0

Table 2-27. SW-846 Method 0010 Sampling Train A Concentration Results - Run 4

	Date	**Venting Cycle**	**Sampling Interval**	**Sampling Duration (min)**	**Sample Volume (dscf)**
Run 4 - Sampling Train A	6/8/2008	632-926	633-703	30	0.857
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
Acenaphthene	<1.5	1,200	31	1,230	1,440
Diethyl phthalate	<4.5	<5.3	<3.6	0	0
p-Dimethylaminoazobenzene	<1.5	<9.7	<2.5	0	0
7,12-Dimethylbenz(a)anthracene	<2.8	<7.7	<2.6	0	0
2,4-Dimethylphenol	<8.7	1,400	<32	1,400	1,630
Dimethyl phthalate	<1.9	<5	<2.5	0	0
Aniline	<2.8	720	<36	720	841
Di-n-octyl phthalate	<6.3	<9.6	<2.8	0	0
4,6-Dinitro-2-methylphenol	<15	<5.6	<44	0	0
2,4-Dinitrophenol	<18	<15	<110	0	0
2,4-Dinitrotoluene	<4.8	<10	<2.5	0	0
2,6-Dinitrotoluene	<3.9	<7.9	<2.5	0	0
Diphenylamine	<1.5	<11	<2.5	0	0
1,2-Diphenylhydrazine	<1.9	<5.6	<2.5	0	0
Anthracene	20	3,100	21	3,140	3,670
Ethyl methanesulfonate	<2.4	<9.8	<2.5	0	0
Fluoranthene	12	360	<2.7	372	434
Fluorene	3.2	4,400	50	4,450	5,200
Hexachlorobenzene	<1.7	<10	<2.5	0	0
Hexachlorobutadiene	<4.2	<7.3	<3.7	0	0
Hexachlorocyclopentadiene	<30	<25	<50	0	0
Hexachloroethane	<7.5	<7.4	<2.7	0	0
Indeno(1,2,3-cd)pyrene	44	20	<2.7	64.0	74.7
Isophorone	<2	<6.8	<2.5	0	0
3-Methylcholanthrene	<1.5	<6.8	<2.5	0	0
Methyl methanesulfonate	<1.8	<8.6	<2.8	0	0
2-Methylnaphthalene	3.9	48,000	2,400	50,400	58,800
2-Methylphenol	<6.9	1,100	<15	1,100	1,280
Naphthalene	<1.5	25,000	2,700	27,700	32,300
1-Naphthylamine	<2.8	110	<50	110	128

Table 2-27. SW-846 Method 0010 Sampling Train A Concentration Results - Run 4 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 4 - Sampling Train A	6/8/2008	632-926	633-703	30	0.857
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
2-Naphthylamine	<2.4	100	<50	100	117
2-Nitroaniline	<1.7	<11	<2.5	0	0
3-Nitroaniline	<11	<18	<10	0	0
4-Nitroaniline	<6.9	<15	<10	0	0
Nitrobenzene	<2.2	<6.3	<2.8	0	0
Benzidine	<150	<250	<260	0	0
2-Nitrophenol	<9.6	<10	<2.5	0	0
4-Nitrophenol	<9.9	<15	<16	0	0
N-Nitrosodi-n-butylamine	<2.6	<10	<2.5	0	0
N-Nitrosodimethylamine	<2.2	<8.3	<2.5	0	0
Benzo(a)anthracene	110	290	<2.9	400	467
N-Nitrosodi-n-propylamine	<2.2	<8.8	<2.5	0	0
N-Nitrosodiphenylamine	<1.8	<5.2	<4.4	0	0
N-Nitrosopiperidine	<1.9	<7.3	<2.5	0	0
Benzo(b)fluoranthene	40	36	<5.5	76.0	88.7
Benzo(k)fluoranthene	35	33	<8	68.0	79.4
Benzoic acid	<130	<36	<230	0	0
Benzo(ghi)perylene	110	44	<3.1	154	180
Pentachlorobenzene	<1.6	<8.7	<2.5	0	0
Benzo(a)pyrene	170	120	<2.5	290	339
Pentachloronitrobenzene	<2.3	<10	<2.5	0	0
Pentachlorophenol	<75	<13	<120	0	0
Phenacetin	<1.5	<9	<2.5	0	0
Benzyl alcohol	<100	<7.6	<180	0	0
Phenanthrene	36	8,800	52	8,890	10,400
Phenol	<3.3	820	6	826	964
2-Picoline	<2.9	790	<5.5	790	922
Pyrene	54	1,100	4	1,160	1,350
Pyridine	<2.7	270	<3.7	270	315
Acetophenone	<2.3	510	<12	510	595

Table 2-27. SW-846 Method 0010 Sampling Train A Concentration Results - Run 4 (Continued)

	Date	**Venting Cycle**	**Sampling Interval**	**Sampling Duration (min)**	**Sample Volume (dscf)**
Run 4 - Sampling Train A	6/8/2008	632-926	633-703	30	0.857
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
1,2,4,5-Tetrachlorobenzene	<2.6	<8.2	<2.5	0	0
2,3,4,6-Tetrachlorophenol	<3.3	<13	<3.2	0	0
1,2,4-Trichlorobenzene	<2.2	<8.2	<3	0	0
2,4,5-Trichlorophenol	<6.9	<8.1	<6.5	0	0
2,4,6-Trichlorophenol	<4.2	<9.6	<3.8	0	0
Carbazole	10	700	<3.2	710	829
3-Methylphenol & 4-Methylphenol	<6.9	980	<10	980	1,140
bis(2-Chloroethoxy)methane	<1.8	<7.6	<2.5	0	0
bis(2-Chloroethyl) ether	<2.3	<6.4	<2.8	0	0
bis(2-Chloroisopropyl) ether	<3	<6.7	<3.8	0	0
bis(2-Ethylhexyl) phthalate	<9.9	<8	<50	0	0
4-Bromophenyl phenyl ether	<1.6	<5.4	<2.5	0	0
Butyl benzyl phthalate	<3.3	<8.7	<3	0	0
Acenaphthylene	<1.5	77	<2.5	77.0	89.9
4-Chloroaniline	<3.6	<30	<30	0	0
4-Chloro-3-methylphenol	<3	<25	<3.1	0	0
1-Chloronaphthalene	<1.5	<8.9	<2.5	0	0
2-Chloronaphthalene	<1.5	<5.3	<2.5	0	0
2-Chlorophenol	<2.9	<6.3	<2.5	0	0
4-Chlorophenyl phenyl ether	<1.5	<12	<2.5	0	0
Chrysene	110	300	<3.2	410	479
Dibenz(a,h)anthracene	64	30	<3	94.0	110
Dibenzofuran	<1.6	580	14	594	693
Di-n-butyl phthalate	2.6	<8.6	<50	2.60	3.04
1,2-Dichlorobenzene	<2.5	<6.6	<2.6	0	0
1,3-Dichlorobenzene	<3.6	<5.4	<2.8	0	0
1,4-Dichlorobenzene	<3.3	<7.7	<2.6	0	0
3,3'-Dichlorobenzidine	<8.1	<30	<37	0	0
4-Aminobiphenyl	<3.3	<14	<50	0	0
2,4-Dichlorophenol	<4.5	<8.9	<2.5	0	0
2,6-Dichlorophenol	<2.2	<10	<2.5	0	0

Table 2-28. SW-846 Method 0010 Sampling Train B Concentration Results - Run 4

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 4 - Sampling Train B	6/8/2008	632-926	703-733	30	1.110
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
Acenaphthene	<1.5	1,000	33	1,030	931
Diethyl phthalate	<4.5	<5.3	<3.6	0	0
p-Dimethylaminoazobenzene	<1.5	<9.7	<2.5	0	0
7,12-Dimethylbenz(a)anthracene	<2.8	<7.7	<2.6	0	0
2,4-Dimethylphenol	<8.7	1,200	<32	1,200	1,080
Dimethyl phthalate	<1.9	<5	<2.5	0	0
Aniline	<2.8	620	<36	620	559
Di-n-octyl phthalate	<6.3	<9.6	<2.8	0	0
4,6-Dinitro-2-methylphenol	<15	<5.6	<44	0	0
2,4-Dinitrophenol	<18	<15	<110	0	0
2,4-Dinitrotoluene	<4.8	<10	<2.5	0	0
2,6-Dinitrotoluene	<3.9	<7.9	<2.5	0	0
Diphenylamine	<1.5	<11	<2.5	0	0
1,2-Diphenylhydrazine	<1.9	<5.6	<2.5	0	0
Anthracene	8.1	2,000	22	2,030	1,830
Ethyl methanesulfonate	<2.4	<9.8	<2.5	0	0
Fluoranthene	3.9	310	<2.7	314	283
Fluorene	<1.5	2,300	56	2,360	2,120
Hexachlorobenzene	<1.7	<10	<2.5	0	0
Hexachlorobutadiene	<4.2	<7.3	<3.7	0	0
Hexachlorocyclopentadiene	<30	<25	<50	0	0
Hexachloroethane	<7.5	<7.4	<2.7	0	0
Indeno(1,2,3-cd)pyrene	20	22	<2.7	42.0	37.9
Isophorone	<2	<6.8	<2.5	0	0
3-Methylcholanthrene	<1.5	<6.8	<2.5	0	0
Methyl methanesulfonate	<1.8	<8.6	<2.8	0	0
2-Methylnaphthalene	<1.7	18,000	2,500	20,500	18,500
2-Methylphenol	<6.9	1,000	<15	1,000	901
Naphthalene	<1.5	12,000	2,800	14,800	13,300
1-Naphthylamine	<2.8	99	<50	99.0	89.2

Table 2-28. SW-846 Method 0010 Sampling Train B Concentration Results - Run 4 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 4 - Sampling Train B	6/8/2008	632-926	703-733	30	1.110
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
2-Naphthylamine	<2.4	95	<50	95.0	85.6
2-Nitroaniline	<1.7	<11	<2.5	0	0
3-Nitroaniline	<11	<18	<10	0	0
4-Nitroaniline	<6.9	<15	<10	0	0
Nitrobenzene	<2.2	<6.3	<2.8	0	0
Benzidine	<150	<250	<260	0	0
2-Nitrophenol	<9.6	<10	<2.5	0	0
4-Nitrophenol	<9.9	<15	<16	0	0
N-Nitrosodi-n-butylamine	<2.6	<10	<2.5	0	0
N-Nitrosodimethylamine	<2.2	<8.3	<2.5	0	0
Benzo(a)anthracene	44	260	<2.9	304	274
N-Nitrosodi-n-propylamine	<2.2	<8.8	<2.5	0	0
N-Nitrosodiphenylamine	<1.8	<5.2	<4.4	0	0
N-Nitrosopiperidine	<1.9	<7.3	<2.5	0	0
Benzo(b)fluoranthene	17	36	<5.5	53.0	47.8
Benzo(k)fluoranthene	15	34	<8	49.0	44.2
Benzoic acid	<130	<36	<230	0	0
Benzo(ghi)perylene	47	49	<3.1	96.0	86.5
Pentachlorobenzene	<1.6	<8.7	<2.5	0	0
Benzo(a)pyrene	75	130	<2.5	205	185
Pentachloronitrobenzene	<2.3	<10	<2.5	0	0
Pentachlorophenol	<75	<13	<120	0	0
Phenacetin	<1.5	<9	<2.5	0	0
Benzyl alcohol	<100	<7.6	<180	0	0
Phenanthrene	14	3,100	56	3,170	2,860
Phenol	<3.3	730	7.4	737	665
2-Picoline	<2.9	570	<5.5	570	514
Pyrene	17	920	3.4	940	848
Pyridine	<2.7	180	<3.7	180	162
Acetophenone	<2.3	510	<12	510	460

Table 2-28. SW-846 Method 0010 Sampling Train B Concentration Results - Run 4 (Continued)

	Date	**Venting Cycle**	**Sampling Interval**	**Sampling Duration (min)**	**Sample Volume (dscf)**
Run 4 - Sampling Train B	6/8/2008	632-926	703-733	30	1.110
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
1,2,4,5-Tetrachlorobenzene	<2.6	<8.2	<2.5	0	0
2,3,4,6-Tetrachlorophenol	<3.3	<13	<3.2	0	0
1,2,4-Trichlorobenzene	<2.2	<8.2	<3	0	0
2,4,5-Trichlorophenol	<6.9	<8.1	<6.5	0	0
2,4,6-Trichlorophenol	<4.2	<9.6	<3.8	0	0
Carbazole	3.5	620	<3.2	624	562
3-Methylphenol & 4-Methylphenol	<6.9	880	<10	880	793
bis(2-Chloroethoxy)methane	<1.8	<7.6	<2.5	0	0
bis(2-Chloroethyl) ether	<2.3	<6.4	<2.8	0	0
bis(2-Chloroisopropyl) ether	<3	<6.7	<3.8	0	0
bis(2-Ethylhexyl) phthalate	<9.9	<8	<50	0	0
4-Bromophenyl phenyl ether	<1.6	<5.4	<2.5	0	0
Butyl benzyl phthalate	<3.3	<8.7	<3	0	0
Acenaphthylene	<1.5	76	4.4	80.4	72.5
4-Chloroaniline	<3.6	<30	<30	0	0
4-Chloro-3-methylphenol	<3	<25	<3.1	0	0
1-Chloronaphthalene	<1.5	<8.9	<2.5	0	0
2-Chloronaphthalene	<1.5	<5.3	<2.5	0	0
2-Chlorophenol	<2.9	<6.3	<2.5	0	0
4-Chlorophenyl phenyl ether	<1.5	<12	<2.5	0	0
Chrysene	46	260	<3.2	306	276
Dibenz(a,h)anthracene	29	30	<3	59.0	53.2
Dibenzofuran	<1.6	510	15	525	473
Di-n-butyl phthalate	<2.1	<8.6	<50	0	0
1,2-Dichlorobenzene	<2.5	<6.6	<2.6	0	0
1,3-Dichlorobenzene	<3.6	<5.4	<2.8	0	0
1,4-Dichlorobenzene	<3.3	<7.7	<2.6	0	0
3,3'-Dichlorobenzidine	<8.1	<30	<37	0	0
4-Aminobiphenyl	<3.3	<14	<50	0	0
2,4-Dichlorophenol	<4.5	<8.9	<2.5	0	0
2,6-Dichlorophenol	<2.2	<10	<2.5	0	0

Table 2-29. SW-846 Method 0010 Sampling Train C Concentration Results - Run 4

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 4 - Sampling Train C	6/8/2008	632-926	735-831	56	2.231
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
Acenaphthene	<1	1,400	380	1,780	798
Diethyl phthalate	<3	<11	<3.6	0	0
p-Dimethylaminoazobenzene	<1	<19	<2.5	0	0
7,12-Dimethylbenz(a)anthracene	<1.9	<15	<2.6	0	0
2,4-Dimethylphenol	<5.8	1,400	<32	1,400	628
Dimethyl phthalate	<1.3	<10	<2.5	0	0
Aniline	<1.9	750	<36	750	336
Di-n-octyl phthalate	<4.2	<19	<2.8	0	0
4,6-Dinitro-2-methylphenol	<10	<11	<44	0	0
2,4-Dinitrophenol	<12	<30	<110	0	0
2,4-Dinitrotoluene	<3.2	<21	<2.5	0	0
2,6-Dinitrotoluene	<2.6	<16	<2.5	0	0
Diphenylamine	<1	<22	<2.5	0	0
1,2-Diphenylhydrazine	<1.3	<11	<2.5	0	0
Anthracene	5	2,600	840	3,450	1,540
Ethyl methanesulfonate	<1.6	<20	<2.5	0	0
Fluoranthene	2.6	400	99	502	225
Fluorene	1.6	3,400	850	4,250	1,910
Hexachlorobenzene	<1.1	<20	<2.5	0	0
Hexachlorobutadiene	<2.8	<15	<3.7	0	0
Hexachlorocyclopentadiene	<20	<50	<50	0	0
Hexachloroethane	<5	<15	<2.7	0	0
Indeno(1,2,3-cd)pyrene	24	40	<2.7	64.0	28.7
Isophorone	<1.3	<14	<2.5	0	0
3-Methylcholanthrene	<1	<14	<2.5	0	0
Methyl methanesulfonate	<1.2	<17	<2.8	0	0
2-Methylnaphthalene	1.7	26,000	18,000	44,000	19,700
2-Methylphenol	<4.6	1,200	130	1,330	596
Naphthalene	<1	19,000	11,000	30,000	13,400
1-Naphthylamine	<1.9	120	<50	120	53.8

Table 2-29. SW-846 Method 0010 Sampling Train C Concentration Results - Run 4 (Continued)

	Date	**Venting Cycle**	**Sampling Interval**	**Sampling Duration (min)**	**Sample Volume (dscf)**
Run 4 - Sampling Train C	6/8/2008	632-926	735-831	56	2.231
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
2-Naphthylamine	<1.6	130	<50	130	58.3
2-Nitroaniline	<1.1	<21	<2.5	0	0
3-Nitroaniline	<7.6	<36	<10	0	0
4-Nitroaniline	<4.6	<29	<10	0	0
Nitrobenzene	<1.5	<13	<2.8	0	0
Benzidine	<100	<500	<260	0	0
2-Nitrophenol	<6.4	<20	<2.5	0	0
4-Nitrophenol	<6.6	<29	<16	0	0
N-Nitrosodi-n-butylamine	<1.7	<20	<2.5	0	0
N-Nitrosodimethylamine	<1.4	<17	<2.5	0	0
Benzo(a)anthracene	34	340	65	439	197
N-Nitrosodi-n-propylamine	<1.5	<18	<2.5	0	0
N-Nitrosodiphenylamine	<1.2	<10	<4.4	0	0
N-Nitrosopiperidine	<1.2	<15	<2.5	0	0
Benzo(b)fluoranthene	18	65	<5.5	83.0	37.2
Benzo(k)fluoranthene	14	50	<8	64.0	28.7
Benzoic acid	<84	<72	<230	0	0
Benzo(ghi)perylene	53	95	<3.1	148	66.3
Pentachlorobenzene	<1	<17	<2.5	0	0
Benzo(a)pyrene	77	210	16	303	136
Pentachloronitrobenzene	<1.5	<20	<2.5	0	0
Pentachlorophenol	<50	<26	<120	0	0
Phenacetin	<1	<18	<2.5	0	0
Benzyl alcohol	<70	<15	<180	0	0
Phenanthrene	9.6	4,900	2,500	7,410	3,320
Phenol	<2.2	870	87	957	429
2-Picoline	<2	900	70	970	435
Pyrene	11	1,300	310	1,620	727
Pyridine	<1.8	330	<3.7	330	148
Acetophenone	<1.5	<20	<12	0	0

Table 2-29. SW-846 Method 0010 Sampling Train C Concentration Results - Run 4 (Continued)

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Sample Volume (dscf)
Run 4 - Sampling Train C	6/8/2008	632-926	735-831	56	2.231
SVOC Analyte	**Probe and Nozzle Rinses/ Filter Mass (µg)**	**Pre-XAD Condensate/ Mid-Train Rinses Mass (µg)**	**XAD/ Post-XAD Condensate Mass (µg)**	**Total Mass (µg)**	**Total Conc. (µg/dscf)**
1,2,4,5-Tetrachlorobenzene	<1.7	<16	<2.5	0	0
2,3,4,6-Tetrachlorophenol	<2.2	<26	<3.2	0	0
1,2,4-Trichlorobenzene	<1.5	<16	<3	0	0
2,4,5-Trichlorophenol	<4.6	<16	<6.5	0	0
2,4,6-Trichlorophenol	<2.8	<19	<3.8	0	0
Carbazole	2.3	720	170	892	400
3-Methylphenol & 4-Methylphenol	<4.6	1,000	110	1,110	498
bis(2-Chloroethoxy)methane	<1.2	<15	<2.5	0	0
bis(2-Chloroethyl) ether	<1.5	<13	<2.8	0	0
bis(2-Chloroisopropyl) ether	<2	<13	<3.8	0	0
bis(2-Ethylhexyl) phthalate	<6.6	<16	<50	0	0
4-Bromophenyl phenyl ether	<1.1	<11	<2.5	0	0
Butyl benzyl phthalate	<2.2	<17	<3	0	0
Acenaphthylene	<1	76	35	111	49.8
4-Chloroaniline	<2.4	<61	<30	0	0
4-Chloro-3-methylphenol	<2	<50	<3.1	0	0
1-Chloronaphthalene	<1	<18	<2.5	0	0
2-Chloronaphthalene	<1	<11	<2.5	0	0
2-Chlorophenol	<2	<13	<2.5	0	0
4-Chlorophenyl phenyl ether	<1	<24	<2.5	0	0
Chrysene	36	370	64	470	211
Dibenz(a,h)anthracene	31	57	<3	88.0	39.5
Dibenzofuran	<1.1	780	200	980	439
Di-n-butyl phthalate	<1.4	<17	<50	0	0
1,2-Dichlorobenzene	<1.7	<13	<2.6	0	0
1,3-Dichlorobenzene	<2.4	<11	<2.8	0	0
1,4-Dichlorobenzene	<2.2	<15	<2.6	0	0
3,3'-Dichlorobenzidine	<5.4	<59	<37	0	0
4-Aminobiphenyl	<2.2	<28	<50	0	0
2,4-Dichlorophenol	<3	<18	<2.5	0	0
2,6-Dichlorophenol	<1.4	<20	<2.5	0	0

Table 2-30. SW-846 Method 0010 Sampling Train A Mass Emission Rate Results - Run 1

	Date	**Venting Cycle**	**Venting Cycle Interval**	**Venting Cycle Duration (min)**	**Volumetric Flow Rate (dscfm)**
Run 1 - Sampling Train A	6/3/2008	600-1018	600-632	32	236
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	992	154.2	534	5.17E-04	1.66E-02
Diethyl phthalate	8.06	222.2	568	4.20E-06	1.34E-04
2,4-Dimethylphenol	1,520	122.2	412	7.91E-04	2.53E-02
Aniline	957	93.1	363	4.99E-04	1.60E-02
Anthracene	2,130	178.2	644	1.11E-03	3.56E-02
Fluoranthene	445	202.3	707	2.32E-04	7.43E-03
Fluorene	4,390	166.2	563	2.29E-03	7.32E-02
Indeno(1,2,3-cd)pyrene	20.5	276.3	997	1.07E-05	3.43E-04
2-Methylnaphthalene	54,400	142.2	466	2.84E-02	9.07E-01
2-Methylphenol	2,100	108.1	376	1.10E-03	3.51E-02
Naphthalene	33,600	128.2	424	1.75E-02	5.61E-01
1-Naphthylamine	163	143.2	572	8.52E-05	2.73E-03
2-Naphthylamine	140	143.2	583	7.30E-05	2.34E-03
Benzo(a)anthracene	322	228.3	820	1.68E-04	5.36E-03
Benzo(b)fluoranthene	26.3	252.3	675	1.37E-05	4.38E-04
Benzo(k)fluoranthene	24.6	252.3	896	1.28E-05	4.11E-04
Benzo(ghi)perylene	52.5	276.3	932	2.74E-05	8.76E-04
Benzo(a)pyrene	112	252.3	923	5.84E-05	1.87E-03
Phenanthrene	11,100	178.2	644	5.76E-03	1.84E-01
Phenol	2,690	94.1	359	1.40E-03	4.48E-02
2-Picoline	735	93.1	265	3.83E-04	1.23E-02
Pyrene	1,410	202.3	759	7.36E-04	2.36E-02
Pyridine	245	79.1	239	1.28E-04	4.09E-03
Acetophenone	467	120.2	395	2.43E-04	7.79E-03
Carbazole	807	167.2	677	4.21E-04	1.35E-02
3-Methylphenol & 4-Methylphenol	2,220	108.1	396	1.16E-03	3.70E-02
bis(2-Ethylhexyl) phthalate	4.20	390.6	728	2.19E-06	7.01E-05
Acenaphthylene	73.5	152.2	509	3.83E-05	1.23E-03
Chrysene	323	228.3	838	1.68E-04	5.38E-03
Dibenz(a,h)anthracene	28.8	278.4	975	1.50E-05	4.81E-04
Dibenzofuran	567	168.2	545	2.96E-04	9.46E-03
Di-n-butyl phthalate	28.1	278.3	644	1.47E-05	4.69E-04

Table 2-31. SW-846 Method 0010 Sampling Train B
Mass Emission Rate Results - Run 1

	Date	**Venting Cycle**	**Venting Cycle Interval**	**Venting Cycle Duration (min)**	**Volumetric Flow Rate (dscfm)**
Run 1 - Sampling Train B	6/3/2008	600-1018	632-703	31	200
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	304	154.2	534	1.34E-04	4.15E-03
Diethyl phthalate	4.75	222.2	568	2.09E-06	6.48E-05
2,4-Dimethylphenol	599	122.2	412	2.64E-04	8.17E-03
Aniline	456	93.1	363	2.01E-04	6.23E-03
Anthracene	675	178.2	644	2.97E-04	9.21E-03
Fluoranthene	115	202.3	707	5.05E-05	1.57E-03
Fluorene	730	166.2	563	3.21E-04	9.96E-03
2-Methylnaphthalene	17,000	142.2	466	7.48E-03	2.32E-01
2-Methylphenol	865	108.1	376	3.81E-04	1.18E-02
Naphthalene	12,500	128.2	424	5.52E-03	1.71E-01
1-Naphthylamine	59.9	143.2	572	2.64E-05	8.17E-04
2-Naphthylamine	53.2	143.2	583	2.34E-05	7.26E-04
Benzo(a)anthracene	72.2	228.3	820	3.18E-05	9.86E-04
Benzo(ghi)perylene	12.2	276.3	932	5.35E-06	1.66E-04
Benzo(a)pyrene	20.6	252.3	923	9.08E-06	2.81E-04
Phenanthrene	2,870	178.2	644	1.26E-03	3.92E-02
Phenol	1,140	94.1	359	5.02E-04	1.56E-02
2-Picoline	456	93.1	265	2.01E-04	6.23E-03
Pyrene	402	202.3	759	1.77E-04	5.48E-03
Pyridine	171	79.1	239	7.53E-05	2.33E-03
Acetophenone	200	120.2	395	8.79E-05	2.72E-03
Carbazole	257	167.2	677	1.13E-04	3.50E-03
3-Methylphenol & 4-Methylphenol	931	108.1	396	4.10E-04	1.27E-02
bis(2-Ethylhexyl) phthalate	3.99	390.6	728	1.76E-06	5.45E-05
Acenaphthylene	20.9	152.2	509	9.20E-06	2.85E-04
Chrysene	67.8	228.3	838	2.98E-05	9.25E-04
Dibenz(a,h)anthracene	2.38	278.4	975	1.05E-06	3.24E-05
Dibenzofuran	186	168.2	545	8.18E-05	2.54E-03
Di-n-butyl phthalate	6.75	278.3	644	2.97E-06	9.21E-05

Table 2-32. SW-846 Method 0010 Sampling Train D
Mass Emission Rate Results - Run 1

	Date	**Venting Cycle**	**Venting Cycle Interval**	**Venting Cycle Duration (min)**	**Volumetric Flow Rate (dscfm)**
Run 1 - Sampling Train D	6/3/2008	600-1018	703-826	83	166
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	947	154.2	534	3.46E-04	2.87E-02
2,4-Dimethylphenol	1,180	122.2	412	4.32E-04	3.59E-02
Aniline	973	93.1	363	3.55E-04	2.95E-02
Anthracene	2,330	178.2	644	8.50E-04	7.05E-02
Fluoranthene	501	202.3	707	1.83E-04	1.52E-02
Fluorene	2,760	166.2	563	1.01E-03	8.36E-02
2-Methylnaphthalene	47,200	142.2	466	1.72E-02	1.43E00
2-Methylphenol	2,370	108.1	376	8.65E-04	7.18E-02
Naphthalene	29,100	128.2	424	1.06E-02	8.82E-01
1-Naphthylamine	135	143.2	572	4.94E-05	4.10E-03
2-Naphthylamine	127	143.2	583	4.63E-05	3.85E-03
Benzo(a)anthracene	249	228.3	820	9.09E-05	7.55E-03
Benzo(ghi)perylene	13.5	276.3	932	4.94E-06	4.10E-04
Benzo(a)pyrene	39.9	252.3	923	1.46E-05	1.21E-03
Phenanthrene	10,800	178.2	644	3.93E-03	3.26E-01
Phenol	2,730	94.1	359	9.98E-04	8.28E-02
2-Picoline	759	93.1	265	2.77E-04	2.30E-02
Pyrene	1,570	202.3	759	5.72E-04	4.75E-02
Pyridine	228	79.1	239	8.34E-05	6.92E-03
Acetophenone	355	120.2	395	1.30E-04	1.08E-02
Carbazole	778	167.2	677	2.84E-04	2.36E-02
3-Methylphenol & 4-Methylphenol	2,380	108.1	396	8.68E-04	7.21E-02
Acenaphthylene	45.7	152.2	509	1.67E-05	1.38E-03
Chrysene	248	228.3	838	9.06E-05	7.52E-03
Dibenzofuran	621	168.2	545	2.27E-04	1.88E-02
Di-n-butyl phthalate	0.795	278.3	644	2.90E-07	2.41E-05

Table 2-33. SW-846 Method 0010 Extrapolated Mass Emission Rate Results - Run 1

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Duration (min)	Volumetric Flow Rate (dscfm)
Run 1 - Extrapolated[1]	6/3/2008	600-1018	826-1018	112	127
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	947	154.2	534	2.65E-04	2.97E-02
2,4-Dimethylphenol	1,180	122.2	412	3.32E-04	3.71E-02
Aniline	973	93.1	363	2.72E-04	3.05E-02
Anthracene	2,330	178.2	644	6.51E-04	7.29E-02
Fluoranthene	501	202.3	707	1.40E-04	1.57E-02
Fluorene	2,760	166.2	563	7.72E-04	8.65E-02
2-Methylnaphthalene	47,200	142.2	466	1.32E-02	1.48E00
2-Methylphenol	2,370	108.1	376	6.63E-04	7.43E-02
Naphthalene	29,100	128.2	424	8.15E-03	9.12E-01
1-Naphthylamine	135	143.2	572	3.79E-05	4.24E-03
2-Naphthylamine	127	143.2	583	3.55E-05	3.98E-03
Benzo(a)anthracene	249	228.3	820	6.97E-05	7.81E-03
Benzo(ghi)perylene	13.5	276.3	932	3.79E-06	4.24E-04
Benzo(a)pyrene	39.9	252.3	923	1.12E-05	1.25E-03
Phenanthrene	10,800	178.2	644	3.01E-03	3.37E-01
Phenol	2,730	94.1	359	7.65E-04	8.57E-02
2-Picoline	759	93.1	265	2.12E-04	2.38E-02
Pyrene	1,570	202.3	759	4.38E-04	4.91E-02
Pyridine	228	79.1	239	6.39E-05	7.16E-03
Acetophenone	355	120.2	395	9.95E-05	1.11E-02
Carbazole	778	167.2	677	2.18E-04	2.44E-02
3-Methylphenol & 4-Methylphenol	2,380	108.1	396	6.65E-04	7.45E-02
Acenaphthylene	45.7	152.2	509	1.28E-05	1.43E-03
Chrysene	248	228.3	838	6.95E-05	7.78E-03
Dibenzofuran	621	168.2	545	1.74E-04	1.95E-02
Di-n-butyl phthalate	0.795	278.3	644	2.23E-07	2.49E-05

[1] No direct measurements were obtained during this venting cycle interval.

Table 2-34. SW-846 Method 0010 Total SVOC Mass Emission Rate Results - Run 1

SVOC Analyte	Sampling Train A Mass Emission Rate (lbs/interval)	Sampling Train B Mass Emission Rate (lbs/interval)	Sampling Train D Mass Emission Rate (lbs/interval)	Extrapolated[1] Mass Emission Rate (lbs/interval)	Run 1 Total Mass Emission Rate (lbs/cycle)
Acenaphthene	1.66E-02	4.15E-03	2.87E-02	2.97E-02	7.91E-02
Diethyl phthalate	1.34E-04	6.48E-05	0	0	1.99E-04
2,4-Dimethylphenol	2.53E-02	8.17E-03	3.59E-02	3.71E-02	1.07E-01
Aniline	1.60E-02	6.23E-03	2.95E-02	3.05E-02	8.22E-02
Anthracene	3.56E-02	9.21E-03	7.05E-02	7.29E-02	1.88E-01
Fluoranthene	7.43E-03	1.57E-03	1.52E-02	1.57E-02	3.99E-02
Fluorene	7.32E-02	9.96E-03	8.36E-02	8.65E-02	2.53E-01
Indeno(1,2,3-cd)pyrene	3.43E-04	0	0	0	3.43E-04
2-Methylnaphthalene	9.07E-01	2.32E-01	1.43E00	1.48E00	4.05E00
2-Methylphenol	3.51E-02	1.18E-02	7.18E-02	7.43E-02	1.93E-01
Naphthalene	5.61E-01	1.71E-01	8.82E-01	9.12E-01	2.53E00
1-Naphthylamine	2.73E-03	8.17E-04	4.10E-03	4.24E-03	1.19E-02
2-Naphthylamine	2.34E-03	7.26E-04	3.85E-03	3.98E-03	1.09E-02
Benzo(a)anthracene	5.36E-03	9.86E-04	7.55E-03	7.81E-03	2.17E-02
Benzo(b)fluoranthene	4.38E-04	0	0	0	4.38E-04
Benzo(k)fluoranthene	4.11E-04	0	0	0	4.11E-04
Benzo(ghi)perylene	8.76E-04	1.66E-04	4.10E-04	4.24E-04	1.88E-03
Benzo(a)pyrene	1.87E-03	2.81E-04	1.21E-03	1.25E-03	4.61E-03
Phenanthrene	1.84E-01	3.92E-02	3.26E-01	3.37E-01	8.87E-01
Phenol	4.48E-02	1.56E-02	8.28E-02	8.57E-02	2.29E-01
2-Picoline	1.23E-02	6.23E-03	2.30E-02	2.38E-02	6.53E-02
Pyrene	2.36E-02	5.48E-03	4.75E-02	4.91E-02	1.26E-01
Pyridine	4.09E-03	2.33E-03	6.92E-03	7.16E-03	2.05E-02
Acetophenone	7.79E-03	2.72E-03	1.08E-02	1.11E-02	3.24E-02
Carbazole	1.35E-02	3.50E-03	2.36E-02	2.44E-02	6.50E-02
3-Methylphenol & 4-Methylphenol	3.70E-02	1.27E-02	7.21E-02	7.45E-02	1.96E-01
bis(2-Ethylhexyl) phthalate	7.01E-05	5.45E-05	0	0	1.25E-04
Acenaphthylene	1.23E-03	2.85E-04	1.38E-03	1.43E-03	4.33E-03
Chrysene	5.38E-03	9.25E-04	7.52E-03	7.78E-03	2.16E-02
Dibenz(a,h)anthracene	4.81E-04	3.24E-05	0	0	5.13E-04
Dibenzofuran	9.46E-03	2.54E-03	1.88E-02	1.95E-02	5.03E-02
Di-n-butyl phthalate	4.69E-04	9.21E-05	2.41E-05	2.49E-05	6.10E-04
Total SVOC	**2.04**	**0.549**	**3.29**	**3.40**	**9.27**

[1] No direct measurements were obtained during this venting cycle interval.

Table 2-35. SW-846 Method 0010 Sampling Train A Mass Emission Rate Results - Run 2

	Date	**Venting Cycle**	**Venting Cycle Interval**	**Venting Cycle Duration (min)**	**Volumetric Flow Rate (dscfm)**
Run 2 - Sampling Train A	6/4-5/2008	2235-130	2235-2306	31	351
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	2,040	154.2	534	1.58E-03	4.89E-02
2,4-Dimethylphenol	2,520	122.2	412	1.95E-03	6.05E-02
Aniline	1,530	93.1	363	1.18E-03	3.67E-02
Anthracene	3,210	178.2	644	2.49E-03	7.72E-02
Fluoranthene	468	202.3	707	3.63E-04	1.13E-02
Fluorene	3,800	166.2	563	2.94E-03	9.13E-02
Indeno(1,2,3-cd)pyrene	306	276.3	997	2.37E-04	7.34E-03
2-Methylnaphthalene	81,700	142.2	466	6.33E-02	1.96E00
2-Methylphenol	3,070	108.1	376	2.38E-03	7.38E-02
Naphthalene	45,100	128.2	424	3.50E-02	1.08E00
1-Naphthylamine	288	143.2	572	2.23E-04	6.91E-03
2-Naphthylamine	261	143.2	583	2.02E-04	6.26E-03
Benzo(a)anthracene	1,040	228.3	820	8.08E-04	2.51E-02
Benzo(b)fluoranthene	279	252.3	675	2.16E-04	6.70E-03
Benzo(k)fluoranthene	221	252.3	896	1.71E-04	5.31E-03
Benzo(ghi)perylene	612	276.3	932	4.75E-04	1.47E-02
Benzo(a)pyrene	1,140	252.3	923	8.85E-04	2.74E-02
Phenanthrene	4,780	178.2	644	3.70E-03	1.15E-01
Phenol	3,060	94.1	359	2.37E-03	7.34E-02
2-Picoline	1,210	93.1	265	9.37E-04	2.90E-02
Pyrene	1,690	202.3	759	1.31E-03	4.05E-02
Pyridine	450	79.1	239	3.48E-04	1.08E-02
Acetophenone	854	120.2	395	6.62E-04	2.05E-02
Carbazole	939	167.2	677	7.27E-04	2.26E-02
3-Methylphenol & 4-Methylphenol	3,060	108.1	396	2.37E-03	7.34E-02
Acenaphthylene	135	152.2	509	1.05E-04	3.24E-03
Chrysene	1,050	228.3	838	8.15E-04	2.53E-02
Dibenz(a,h)anthracene	593	278.4	975	4.59E-04	1.42E-02
Dibenzofuran	904	168.2	545	7.00E-04	2.17E-02

Table 2-36. SW-846 Method 0010 Sampling Train B
Mass Emission Rate Results - Run 2

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Duration (min)	Volumetric Flow Rate (dscfm)
Run 2 - Sampling Train B	6/4-5/2008	2235-130	2306-2337	31	284
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	1,430	154.2	534	8.93E-04	2.77E-02
2,4-Dimethylphenol	1,780	122.2	412	1.11E-03	3.45E-02
Aniline	1,130	93.1	363	7.08E-04	2.19E-02
Anthracene	2,340	178.2	644	1.47E-03	4.54E-02
Fluoranthene	351	202.3	707	2.19E-04	6.80E-03
Fluorene	2,680	166.2	563	1.67E-03	5.19E-02
Indeno(1,2,3-cd)pyrene	221	276.3	997	1.38E-04	4.29E-03
3-Methylcholanthrene	44.4	268.4	536	2.78E-05	8.62E-04
2-Methylnaphthalene	58,400	142.2	466	3.65E-02	1.13E00
2-Methylphenol	2,260	108.1	376	1.42E-03	4.39E-02
Naphthalene	33,200	128.2	424	2.08E-02	6.44E-01
1-Naphthylamine	226	143.2	572	1.42E-04	4.39E-03
2-Naphthylamine	194	143.2	583	1.21E-04	3.76E-03
Benzo(a)anthracene	800	228.3	820	5.00E-04	1.55E-02
Benzo(b)fluoranthene	234	252.3	675	1.47E-04	4.54E-03
Benzo(k)fluoranthene	186	252.3	896	1.16E-04	3.60E-03
Benzo(ghi)perylene	521	276.3	932	3.26E-04	1.01E-02
Benzo(a)pyrene	937	252.3	923	5.86E-04	1.82E-02
Phenanthrene	9,050	178.2	644	5.66E-03	1.75E-01
Phenol	2,420	94.1	359	1.52E-03	4.70E-02
2-Picoline	776	93.1	265	4.85E-04	1.50E-02
Pyrene	1,260	202.3	759	7.85E-04	2.43E-02
Pyridine	291	79.1	239	1.82E-04	5.64E-03
Acetophenone	550	120.2	395	3.44E-04	1.07E-02
Carbazole	721	167.2	677	4.51E-04	1.40E-02
3-Methylphenol & 4-Methylphenol	2,340	108.1	396	1.47E-03	4.54E-02
Acenaphthylene	97.0	152.2	509	6.06E-05	1.88E-03
Chrysene	865	228.3	838	5.41E-04	1.68E-02
Dibenz(a,h)anthracene	346	278.4	975	2.16E-04	6.71E-03
Dibenzofuran	660	168.2	545	4.13E-04	1.28E-02

Table 2-37. SW-846 Method 0010 Sampling Train C
Mass Emission Rate Results - Run 2

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Duration (min)	Volumetric Flow Rate (dscfm)
Run 2 - Sampling Train C	6/4-5/2008	2235-130	2337-0035	58	172
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	1,340	154.2	534	5.06E-04	2.93E-02
2,4-Dimethylphenol	1,640	122.2	412	6.21E-04	3.60E-02
Aniline	1,190	93.1	363	4.49E-04	2.60E-02
Anthracene	2,680	178.2	644	1.02E-03	5.90E-02
Fluoranthene	331	202.3	707	1.26E-04	7.28E-03
Fluorene	3,020	166.2	563	1.14E-03	6.63E-02
Indeno(1,2,3-cd)pyrene	245	276.3	997	9.27E-05	5.37E-03
2-Methylnaphthalene	53,500	142.2	466	2.02E-02	1.17E00
2-Methylphenol	2,280	108.1	376	8.65E-04	5.02E-02
Naphthalene	32,200	128.2	424	1.22E-02	7.06E-01
1-Naphthylamine	184	143.2	572	6.96E-05	4.04E-03
2-Naphthylamine	192	143.2	583	7.27E-05	4.22E-03
Benzo(a)anthracene	810	228.3	820	3.07E-04	1.78E-02
Benzo(b)fluoranthene	228	252.3	675	8.62E-05	5.00E-03
Benzo(k)fluoranthene	171	252.3	896	6.48E-05	3.76E-03
Benzo(ghi)perylene	476	276.3	932	1.80E-04	1.05E-02
Benzo(a)pyrene	930	252.3	923	3.52E-04	2.04E-02
Phenanthrene	4,310	178.2	644	1.63E-03	9.47E-02
Phenol	2,270	94.1	359	8.59E-04	4.98E-02
2-Picoline	918	93.1	265	3.48E-04	2.02E-02
Pyrene	1,220	202.3	759	4.62E-04	2.68E-02
Pyridine	309	79.1	239	1.17E-04	6.79E-03
Acetophenone	501	120.2	395	1.90E-04	1.10E-02
Carbazole	711	167.2	677	2.69E-04	1.56E-02
3-Methylphenol & 4-Methylphenol	2,220	108.1	396	8.41E-04	4.88E-02
Acenaphthylene	66.8	152.2	509	2.53E-05	1.47E-03
Chrysene	860	228.3	838	3.26E-04	1.89E-02
Dibenz(a,h)anthracene	313	278.4	975	1.19E-04	6.88E-03
Dibenzofuran	693	168.2	545	2.62E-04	1.52E-02

Table 2-38. SW-846 Method 0010 Extrapolated Mass Emission Rate Results - Run 2

	Date	**Venting Cycle**	**Venting Cycle Interval**	**Venting Cycle Duration (min)**	**Volumetric Flow Rate (dscfm)**
Run 2 - Extrapolated[1]	6/4-5/2008	2235-130	0035-130	55	86.8
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	1,340	154.2	534	2.56E-04	1.41E-02
2,4-Dimethylphenol	1,640	122.2	412	3.14E-04	1.73E-02
Aniline	1,190	93.1	363	2.27E-04	1.25E-02
Anthracene	2,680	178.2	644	5.14E-04	2.83E-02
Fluoranthene	331	202.3	707	6.35E-05	3.49E-03
Fluorene	3,020	166.2	563	5.78E-04	3.18E-02
Indeno(1,2,3-cd)pyrene	245	276.3	997	4.68E-05	2.58E-03
2-Methylnaphthalene	53,500	142.2	466	1.02E-02	5.63E-01
2-Methylphenol	2,280	108.1	376	4.37E-04	2.40E-02
Naphthalene	32,200	128.2	424	6.16E-03	3.39E-01
1-Naphthylamine	184	143.2	572	3.52E-05	1.93E-03
2-Naphthylamine	192	143.2	583	3.68E-05	2.02E-03
Benzo(a)anthracene	810	228.3	820	1.55E-04	8.53E-03
Benzo(b)fluoranthene	228	252.3	675	4.36E-05	2.40E-03
Benzo(k)fluoranthene	171	252.3	896	3.28E-05	1.80E-03
Benzo(ghi)perylene	476	276.3	932	9.11E-05	5.01E-03
Benzo(a)pyrene	930	252.3	923	1.78E-04	9.79E-03
Phenanthrene	4,310	178.2	644	8.26E-04	4.54E-02
Phenol	2,270	94.1	359	4.34E-04	2.39E-02
2-Picoline	918	93.1	265	1.76E-04	9.67E-03
Pyrene	1,220	202.3	759	2.33E-04	1.28E-02
Pyridine	309	79.1	239	5.91E-05	3.25E-03
Acetophenone	501	120.2	395	9.59E-05	5.28E-03
Carbazole	711	167.2	677	1.36E-04	7.48E-03
3-Methylphenol & 4-Methylphenol	2,220	108.1	396	4.25E-04	2.34E-02
Acenaphthylene	66.8	152.2	509	1.28E-05	7.03E-04
Chrysene	860	228.3	838	1.65E-04	9.06E-03
Dibenz(a,h)anthracene	313	278.4	975	5.99E-05	3.30E-03
Dibenzofuran	693	168.2	545	1.33E-04	7.30E-03

[1] No direct measurements were obtained during this venting cycle interval.

Table 2-39. SW-846 Method 0010 Total SVOC Mass Emission Rate Results - Run 2

SVOC Analyte	**Sampling Train A Mass Emission Rate (lbs/interval)**	**Sampling Train B Mass Emission Rate (lbs/interval)**	**Sampling Train C Mass Emission Rate (lbs/interval)**	**Extrapolated[1] Mass Emission Rate (lbs/interval)**	**Run 2 Total Mass Emission Rate (lbs/cycle)**
Acenaphthene	4.89E-02	2.77E-02	2.93E-02	1.41E-02	1.20E-01
2,4-Dimethylphenol	6.05E-02	3.45E-02	3.60E-02	1.73E-02	1.48E-01
Aniline	3.67E-02	2.19E-02	2.60E-02	1.25E-02	9.72E-02
Anthracene	7.72E-02	4.54E-02	5.90E-02	2.83E-02	2.10E-01
Fluoranthene	1.13E-02	6.80E-03	7.28E-03	3.49E-03	2.88E-02
Fluorene	9.13E-02	5.19E-02	6.63E-02	3.18E-02	2.41E-01
Indeno(1,2,3-cd)pyrene	7.34E-03	4.29E-03	5.37E-03	2.58E-03	1.96E-02
3-Methylcholanthrene	0	8.62E-04	0	0	8.62E-04
2-Methylnaphthalene	1.96E00	1.13E00	1.17E00	5.63E-01	4.83E00
2-Methylphenol	7.38E-02	4.39E-02	5.02E-02	2.40E-02	1.92E-01
Naphthalene	1.08E00	6.44E-01	7.06E-01	3.39E-01	2.77E00
1-Naphthylamine	6.91E-03	4.39E-03	4.04E-03	1.93E-03	1.73E-02
2-Naphthylamine	6.26E-03	3.76E-03	4.22E-03	2.02E-03	1.63E-02
Benzo(a)anthracene	2.51E-02	1.55E-02	1.78E-02	8.53E-03	6.69E-02
Benzo(b)fluoranthene	6.70E-03	4.54E-03	5.00E-03	2.40E-03	1.86E-02
Benzo(k)fluoranthene	5.31E-03	3.60E-03	3.76E-03	1.80E-03	1.45E-02
Benzo(ghi)perylene	1.47E-02	1.01E-02	1.05E-02	5.01E-03	4.03E-02
Benzo(a)pyrene	2.74E-02	1.82E-02	2.04E-02	9.79E-03	7.58E-02
Phenanthrene	1.15E-01	1.75E-01	9.47E-02	4.54E-02	4.30E-01
Phenol	7.34E-02	4.70E-02	4.98E-02	2.39E-02	1.94E-01
2-Picoline	2.90E-02	1.50E-02	2.02E-02	9.67E-03	7.39E-02
Pyrene	4.05E-02	2.43E-02	2.68E-02	1.28E-02	1.04E-01
Pyridine	1.08E-02	5.64E-03	6.79E-03	3.25E-03	2.65E-02
Acetophenone	2.05E-02	1.07E-02	1.10E-02	5.28E-03	4.75E-02
Carbazole	2.26E-02	1.40E-02	1.56E-02	7.48E-03	5.96E-02
3-Methylphenol & 4-Methylphenol	7.34E-02	4.54E-02	4.88E-02	2.34E-02	1.91E-01
Acenaphthylene	3.24E-03	1.88E-03	1.47E-03	7.03E-04	7.29E-03
Chrysene	2.53E-02	1.68E-02	1.89E-02	9.06E-03	7.00E-02
Dibenz(a,h)anthracene	1.42E-02	6.71E-03	6.88E-03	3.30E-03	3.11E-02
Dibenzofuran	2.17E-02	1.28E-02	1.52E-02	7.30E-03	5.70E-02
Total SVOC	**4.00**	**2.45**	**2.54**	**1.22**	**10.2**

[1] No direct measurements were obtained during this venting cycle interval.

Table 2-40. SW-846 Method 0010 Sampling Train A Mass Emission Rate Results - Run 3

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Duration (min)	Volumetric Flow Rate (dscfm)
Run 3 - Sampling Train A	6/6/2008	1408-1630	1408-1439	31	150
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	1,150	154.2	534	3.81E-04	1.18E-02
2,4-Dimethylphenol	1,610	122.2	412	5.31E-04	1.65E-02
Aniline	851	93.1	363	2.82E-04	8.73E-03
Anthracene	2,950	178.2	644	9.77E-04	3.03E-02
Fluoranthene	599	202.3	707	1.98E-04	6.14E-03
Fluorene	3,170	166.2	563	1.05E-03	3.25E-02
Indeno(1,2,3-cd)pyrene	116	276.3	997	3.84E-05	1.19E-03
2-Methylnaphthalene	40,900	142.2	466	1.35E-02	4.19E-01
2-Methylphenol	1,470	108.1	376	4.87E-04	1.51E-02
Naphthalene	23,400	128.2	424	7.74E-03	2.40E-01
1-Naphthylamine	145	143.2	572	4.80E-05	1.49E-03
2-Naphthylamine	139	143.2	583	4.61E-05	1.43E-03
Benzo(a)anthracene	758	228.3	820	2.51E-04	7.78E-03
Benzo(b)fluoranthene	141	252.3	675	4.67E-05	1.45E-03
Benzo(k)fluoranthene	124	252.3	896	4.10E-05	1.27E-03
Benzo(ghi)perylene	282	276.3	932	9.35E-05	2.90E-03
Benzo(a)pyrene	561	252.3	923	1.86E-04	5.76E-03
Phenanthrene	10,600	178.2	644	3.52E-03	1.09E-01
Phenol	1,080	94.1	359	3.59E-04	1.11E-02
2-Picoline	711	93.1	265	2.36E-04	7.30E-03
Pyrene	1,860	202.3	759	6.16E-04	1.91E-02
Pyridine	271	79.1	239	8.96E-05	2.78E-03
Carbazole	945	167.2	677	3.13E-04	9.69E-03
3-Methylphenol & 4-Methylphenol	1,280	108.1	396	4.23E-04	1.31E-02
Acenaphthylene	69.6	152.2	509	2.31E-05	7.15E-04
Chrysene	810	228.3	838	2.68E-04	8.32E-03
Dibenz(a,h)anthracene	170	278.4	975	5.63E-05	1.75E-03
Dibenzofuran	655	168.2	545	2.17E-04	6.72E-03

Table 2-41. SW-846 Method 0010 Sampling Train C
Mass Emission Rate Results - Run 3

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Duration (min)	Volumetric Flow Rate (dscfm)
Run 3 - Sampling Train C	6/6/2008	1408-1630	1439-1532	53	71.2
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	1,270	154.2	534	1.99E-04	1.06E-02
2,4-Dimethylphenol	1,700	122.2	412	2.66E-04	1.41E-02
Aniline	951	93.1	363	1.49E-04	7.92E-03
Anthracene	3,210	178.2	644	5.05E-04	2.67E-02
Fluoranthene	637	202.3	707	1.00E-04	5.30E-03
Fluorene	3,300	166.2	563	5.18E-04	2.74E-02
Indeno(1,2,3-cd)pyrene	376	276.3	997	5.90E-05	3.13E-03
2-Methylnaphthalene	54,200	142.2	466	8.51E-03	4.51E-01
2-Methylphenol	1,580	108.1	376	2.49E-04	1.32E-02
Naphthalene	31,800	128.2	424	5.00E-03	2.65E-01
1-Naphthylamine	159	143.2	572	2.49E-05	1.32E-03
2-Naphthylamine	141	143.2	583	2.22E-05	1.18E-03
Benzo(a)anthracene	1,200	228.3	820	1.89E-04	1.00E-02
Benzo(b)fluoranthene	322	252.3	675	5.05E-05	2.68E-03
Benzo(k)fluoranthene	269	252.3	896	4.23E-05	2.24E-03
Benzo(ghi)perylene	759	276.3	932	1.19E-04	6.32E-03
Benzo(a)pyrene	1,340	252.3	923	2.10E-04	1.11E-02
Phenanthrene	11,000	178.2	644	1.72E-03	9.14E-02
Phenol	1,430	94.1	359	2.25E-04	1.19E-02
2-Picoline	878	93.1	265	1.38E-04	7.30E-03
Pyrene	2,000	202.3	759	3.15E-04	1.67E-02
Pyridine	303	79.1	239	4.75E-05	2.52E-03
Acetophenone	504	120.2	395	7.92E-05	4.20E-03
Carbazole	1,020	167.2	677	1.61E-04	8.53E-03
3-Methylphenol & 4-Methylphenol	1,530	108.1	396	2.40E-04	1.27E-02
Acenaphthylene	111	152.2	509	1.74E-05	9.24E-04
Chrysene	1,230	228.3	838	1.93E-04	1.03E-02
Dibenz(a,h)anthracene	459	278.4	975	7.21E-05	3.82E-03
Dibenzofuran	732	168.2	545	1.15E-04	6.09E-03

Table 2-42. SW-846 Method 0010 Sampling Train D Mass Emission Rate Results - Run 3

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Duration (min)	Volumetric Flow Rate (dscfm)
Run 3 - Sampling Train D	6/6/2008	1408-1630	1532-1621	49	31.9
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	572	154.2	534	4.03E-05	1.97E-03
2,4-Dimethylphenol	516	122.2	412	3.63E-05	1.78E-03
Aniline	295	93.1	363	2.08E-05	1.02E-03
Anthracene	1,320	178.2	644	9.30E-05	4.56E-03
Fluoranthene	271	202.3	707	1.91E-05	9.35E-04
Fluorene	1,420	166.2	563	9.98E-05	4.89E-03
Indeno(1,2,3-cd)pyrene	42.6	276.3	997	3.00E-06	1.47E-04
2-Methylnaphthalene	28,700	142.2	466	2.02E-03	9.91E-02
2-Methylphenol	467	108.1	376	3.29E-05	1.61E-03
Naphthalene	18,800	128.2	424	1.33E-03	6.50E-02
1-Naphthylamine	53.2	143.2	572	3.75E-06	1.84E-04
2-Naphthylamine	47.5	143.2	583	3.34E-06	1.64E-04
Benzo(a)anthracene	293	228.3	820	2.06E-05	1.01E-03
Benzo(b)fluoranthene	47.0	252.3	675	3.31E-06	1.62E-04
Benzo(k)fluoranthene	43.6	252.3	896	3.07E-06	1.51E-04
Benzo(ghi)perylene	108	276.3	932	7.61E-06	3.73E-04
Benzo(a)pyrene	203	252.3	923	1.43E-05	7.00E-04
Phenanthrene	4,950	178.2	644	3.48E-04	1.71E-02
Phenol	427	94.1	359	3.00E-05	1.47E-03
2-Picoline	311	93.1	265	2.19E-05	1.07E-03
Pyrene	824	202.3	759	5.80E-05	2.84E-03
Pyridine	131	79.1	239	9.22E-06	4.52E-04
Carbazole	368	167.2	677	2.59E-05	1.27E-03
3-Methylphenol & 4-Methylphenol	409	108.1	396	2.88E-05	1.41E-03
bis(2-Ethylhexyl) phthalate	9.01	390.6	728	6.34E-07	3.11E-05
Acenaphthylene	53.2	152.2	509	3.75E-06	1.84E-04
Chrysene	286	228.3	838	2.01E-05	9.87E-04
Dibenz(a,h)anthracene	60.6	278.4	975	4.27E-06	2.09E-04
Dibenzofuran	319	168.2	545	2.24E-05	1.10E-03
Di-n-butyl phthalate	1.06	278.3	644	7.49E-08	3.67E-06

Table 2-43. SW-846 Method 0010 Extrapolated Mass Emission Rate Results - Run 3

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Duration (min)	Volumetric Flow Rate (dscfm)
Run 3 - Extrapolated[1]	6/6/2008	1408-1630	1621-1630	9	21.3
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	572	154.2	534	2.69E-05	2.42E-04
2,4-Dimethylphenol	516	122.2	412	2.42E-05	2.18E-04
Aniline	295	93.1	363	1.38E-05	1.25E-04
Anthracene	1,320	178.2	644	6.21E-05	5.59E-04
Fluoranthene	271	202.3	707	1.27E-05	1.15E-04
Fluorene	1,420	166.2	563	6.66E-05	5.99E-04
Indeno(1,2,3-cd)pyrene	42.6	276.3	997	2.00E-06	1.80E-05
2-Methylnaphthalene	28,700	142.2	466	1.35E-03	1.22E-02
2-Methylphenol	467	108.1	376	2.19E-05	1.97E-04
Naphthalene	18,800	128.2	424	8.85E-04	7.96E-03
1-Naphthylamine	53.2	143.2	572	2.50E-06	2.25E-05
2-Naphthylamine	47.5	143.2	583	2.23E-06	2.01E-05
Benzo(a)anthracene	293	228.3	820	1.38E-05	1.24E-04
Benzo(b)fluoranthene	47.0	252.3	675	2.21E-06	1.99E-05
Benzo(k)fluoranthene	43.6	252.3	896	2.05E-06	1.84E-05
Benzo(ghi)perylene	108	276.3	932	5.08E-06	4.57E-05
Benzo(a)pyrene	203	252.3	923	9.54E-06	8.58E-05
Phenanthrene	4,950	178.2	644	2.32E-04	2.09E-03
Phenol	427	94.1	359	2.00E-05	1.80E-04
2-Picoline	311	93.1	265	1.46E-05	1.32E-04
Pyrene	824	202.3	759	3.87E-05	3.49E-04
Pyridine	131	79.1	239	6.15E-06	5.54E-05
Carbazole	368	167.2	677	1.73E-05	1.56E-04
3-Methylphenol & 4-Methylphenol	409	108.1	396	1.92E-05	1.73E-04
bis(2-Ethylhexyl) phthalate	9.01	390.6	728	4.23E-07	3.81E-06
Acenaphthylene	53.2	152.2	509	2.50E-06	2.25E-05
Chrysene	286	228.3	838	1.34E-05	1.21E-04
Dibenz(a,h)anthracene	60.6	278.4	975	2.85E-06	2.56E-05
Dibenzofuran	319	168.2	545	1.50E-05	1.35E-04
Di-n-butyl phthalate	1.06	278.3	644	5.00E-08	4.50E-07

[1] No direct measurements were obtained during this venting cycle interval.

Table 2-44. SW-846 Method 0010 Total SVOC Mass Emission Rate Results - Run 3

SVOC Analyte	Sampling Train A Mass Emission Rate (lbs/interval)	Sampling Train C Mass Emission Rate (lbs/interval)	Sampling Train D Mass Emission Rate (lbs/interval)	Extrapolated Mass Emission[1] Rate (lbs/interval)	Run 3 Total Mass Emission Rate (lbs/cycle)
Acenaphthene	1.18E-02	1.06E-02	1.97E-03	2.42E-04	2.46E-02
2,4-Dimethylphenol	1.65E-02	1.41E-02	1.78E-03	2.18E-04	3.26E-02
Aniline	8.73E-03	7.92E-03	1.02E-03	1.25E-04	1.78E-02
Anthracene	3.03E-02	2.67E-02	4.56E-03	5.59E-04	6.22E-02
Fluoranthene	6.14E-03	5.30E-03	9.35E-04	1.15E-04	1.25E-02
Fluorene	3.25E-02	2.74E-02	4.89E-03	5.99E-04	6.55E-02
Indeno(1,2,3-cd)pyrene	1.19E-03	3.13E-03	1.47E-04	1.80E-05	4.49E-03
2-Methylnaphthalene	4.19E-01	4.51E-01	9.91E-02	1.22E-02	9.82E-01
2-Methylphenol	1.51E-02	1.32E-02	1.61E-03	1.97E-04	3.01E-02
Naphthalene	2.40E-01	2.65E-01	6.50E-02	7.96E-03	5.78E-01
1-Naphthylamine	1.49E-03	1.32E-03	1.84E-04	2.25E-05	3.01E-03
2-Naphthylamine	1.43E-03	1.18E-03	1.64E-04	2.01E-05	2.79E-03
Benzo(a)anthracene	7.78E-03	1.00E-02	1.01E-03	1.24E-04	1.89E-02
Benzo(b)fluoranthene	1.45E-03	2.68E-03	1.62E-04	1.99E-05	4.31E-03
Benzo(k)fluoranthene	1.27E-03	2.24E-03	1.51E-04	1.84E-05	3.68E-03
Benzo(ghi)perylene	2.90E-03	6.32E-03	3.73E-04	4.57E-05	9.64E-03
Benzo(a)pyrene	5.76E-03	1.11E-02	7.00E-04	8.58E-05	1.77E-02
Phenanthrene	1.09E-01	9.14E-02	1.71E-02	2.09E-03	2.20E-01
Phenol	1.11E-02	1.19E-02	1.47E-03	1.80E-04	2.47E-02
2-Picoline	7.30E-03	7.30E-03	1.07E-03	1.32E-04	1.58E-02
Pyrene	1.91E-02	1.67E-02	2.84E-03	3.49E-04	3.90E-02
Pyridine	2.78E-03	2.52E-03	4.52E-04	5.54E-05	5.81E-03
Acetophenone	0	4.20E-03	0	0	4.20E-03
Carbazole	9.69E-03	8.53E-03	1.27E-03	1.56E-04	1.96E-02
3-Methylphenol & 4-Methylphenol	1.31E-02	1.27E-02	1.41E-03	1.73E-04	2.74E-02
bis(2-Ethylhexyl) phthalate	0	0	3.11E-05	3.81E-06	3.49E-05
Acenaphthylene	7.15E-04	9.24E-04	1.84E-04	2.25E-05	1.84E-03
Chrysene	8.32E-03	1.03E-02	9.87E-04	1.21E-04	1.97E-02
Dibenz(a,h)anthracene	1.75E-03	3.82E-03	2.09E-04	2.56E-05	5.80E-03
Dibenzofuran	6.72E-03	6.09E-03	1.10E-03	1.35E-04	1.41E-02
Di-n-butyl phthalate	0	0	3.67E-06	4.50E-07	4.12E-06
Total SVOC	**0.993**	**1.04**	**0.212**	**0.0260**	**2.27**

[1] No direct measurements were obtained during this venting cycle interval.

Table 2-45. SW-846 Method 0010 Sampling Train A Mass Emission Rate Results - Run 4

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Duration (min)	Volumetric Flow Rate (dscfm)
Run 4 - Sampling Train A	6/8/2008	632-926	632-703	31	291
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	1,440	154.2	534	9.24E-04	2.86E-02
2,4-Dimethylphenol	1,630	122.2	412	1.05E-03	3.26E-02
Aniline	841	93.1	363	5.40E-04	1.67E-02
Anthracene	3,670	178.2	644	2.36E-03	7.31E-02
Fluoranthene	434	202.3	707	2.79E-04	8.65E-03
Fluorene	5,200	166.2	563	3.34E-03	1.04E-01
Indeno(1,2,3-cd)pyrene	74.7	276.3	997	4.80E-05	1.49E-03
2-Methylnaphthalene	58,800	142.2	466	3.78E-02	1.17E00
2-Methylphenol	1,280	108.1	376	8.25E-04	2.56E-02
Naphthalene	32,300	128.2	424	2.08E-02	6.44E-01
1-Naphthylamine	128	143.2	572	8.25E-05	2.56E-03
2-Naphthylamine	117	143.2	583	7.50E-05	2.33E-03
Benzo(a)anthracene	467	228.3	820	3.00E-04	9.30E-03
Benzo(b)fluoranthene	88.7	252.3	675	5.70E-05	1.77E-03
Benzo(k)fluoranthene	79.4	252.3	896	5.10E-05	1.58E-03
Benzo(ghi)perylene	180	276.3	932	1.16E-04	3.58E-03
Benzo(a)pyrene	339	252.3	923	2.18E-04	6.74E-03
Phenanthrene	10,400	178.2	644	6.67E-03	2.07E-01
Phenol	964	94.1	359	6.19E-04	1.92E-02
2-Picoline	922	93.1	265	5.93E-04	1.84E-02
Pyrene	1,350	202.3	759	8.69E-04	2.69E-02
Pyridine	315	79.1	239	2.03E-04	6.28E-03
Acetophenone	595	120.2	395	3.83E-04	1.19E-02
Carbazole	829	167.2	677	5.33E-04	1.65E-02
3-Methylphenol & 4-Methylphenol	1,140	108.1	396	7.35E-04	2.28E-02
Acenaphthylene	89.9	152.2	509	5.78E-05	1.79E-03
Chrysene	479	228.3	838	3.08E-04	9.54E-03
Dibenz(a,h)anthracene	110	278.4	975	7.05E-05	2.19E-03
Dibenzofuran	693	168.2	545	4.46E-04	1.38E-02
Di-n-butyl phthalate	3.04	278.3	644	1.95E-06	6.05E-05

Table 2-46. SW-846 Method 0010 Sampling Train B
Mass Emission Rate Results - Run 4

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Duration (min)	Volumetric Flow Rate (dscfm)
Run 4 - Sampling Train B	6/8/2008	632-926	703-733	30	158
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	931	154.2	534	3.25E-04	9.75E-03
2,4-Dimethylphenol	1,080	122.2	412	3.78E-04	1.13E-02
Aniline	559	93.1	363	1.95E-04	5.85E-03
Anthracene	1,830	178.2	644	6.39E-04	1.92E-02
Fluoranthene	283	202.3	707	9.88E-05	2.96E-03
Fluorene	2,120	166.2	563	7.41E-04	2.22E-02
Indeno(1,2,3-cd)pyrene	37.9	276.3	997	1.32E-05	3.96E-04
2-Methylnaphthalene	18,500	142.2	466	6.45E-03	1.93E-01
2-Methylphenol	901	108.1	376	3.15E-04	9.44E-03
Naphthalene	13,300	128.2	424	4.66E-03	1.40E-01
1-Naphthylamine	89.2	143.2	572	3.11E-05	9.34E-04
2-Naphthylamine	85.6	143.2	583	2.99E-05	8.97E-04
Benzo(a)anthracene	274	228.3	820	9.56E-05	2.87E-03
Benzo(b)fluoranthene	47.8	252.3	675	1.67E-05	5.00E-04
Benzo(k)fluoranthene	44.2	252.3	896	1.54E-05	4.62E-04
Benzo(ghi)perylene	86.5	276.3	932	3.02E-05	9.06E-04
Benzo(a)pyrene	185	252.3	923	6.45E-05	1.93E-03
Phenanthrene	2,860	178.2	644	9.97E-04	2.99E-02
Phenol	665	94.1	359	2.32E-04	6.96E-03
2-Picoline	514	93.1	265	1.79E-04	5.38E-03
Pyrene	848	202.3	759	2.96E-04	8.88E-03
Pyridine	162	79.1	239	5.66E-05	1.70E-03
Acetophenone	460	120.2	395	1.60E-04	4.81E-03
Carbazole	562	167.2	677	1.96E-04	5.89E-03
3-Methylphenol & 4-Methylphenol	793	108.1	396	2.77E-04	8.31E-03
Acenaphthylene	72.5	152.2	509	2.53E-05	7.59E-04
Chrysene	276	228.3	838	9.63E-05	2.89E-03
Dibenz(a,h)anthracene	53.2	278.4	975	1.86E-05	5.57E-04
Dibenzofuran	473	168.2	545	1.65E-04	4.96E-03

Table 2-47. SW-846 Method 0010 Sampling Train C
Mass Emission Rate Results - Run 4

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Duration (min)	Volumetric Flow Rate (dscfm)
Run 4 - Sampling Train C	6/8/2008	632-926	733-831	58	110

SVOC Analyte	Total Conc. (µg/dscf)	Molecular Weight (g/g-mol)	Boiling Point (°F)	Total Mass Emission Rate (lbs/min)	Total Mass Emission Rate (lbs/interval)
Acenaphthene	798	154.2	534	1.93E-04	1.12E-02
2,4-Dimethylphenol	628	122.2	412	1.52E-04	8.80E-03
Aniline	336	93.1	363	8.13E-05	4.71E-03
Anthracene	1,540	178.2	644	3.73E-04	2.16E-02
Fluoranthene	225	202.3	707	5.43E-05	3.15E-03
Fluorene	1,910	166.2	563	4.61E-04	2.67E-02
Indeno(1,2,3-cd)pyrene	28.7	276.3	997	6.93E-06	4.02E-04
2-Methylnaphthalene	19,700	142.2	466	4.77E-03	2.77E-01
2-Methylphenol	596	108.1	376	1.44E-04	8.36E-03
Naphthalene	13,400	128.2	424	3.25E-03	1.89E-01
1-Naphthylamine	53.8	143.2	572	1.30E-05	7.54E-04
2-Naphthylamine	58.3	143.2	583	1.41E-05	8.17E-04
Benzo(a)anthracene	197	228.3	820	4.76E-05	2.76E-03
Benzo(b)fluoranthene	37.2	252.3	675	8.99E-06	5.22E-04
Benzo(k)fluoranthene	28.7	252.3	896	6.93E-06	4.02E-04
Benzo(ghi)perylene	66.3	276.3	932	1.60E-05	9.30E-04
Benzo(a)pyrene	136	252.3	923	3.28E-05	1.90E-03
Phenanthrene	3,320	178.2	644	8.03E-04	4.66E-02
Phenol	429	94.1	359	1.04E-04	6.01E-03
2-Picoline	435	93.1	265	1.05E-04	6.10E-03
Pyrene	727	202.3	759	1.76E-04	1.02E-02
Pyridine	148	79.1	239	3.58E-05	2.07E-03
Carbazole	400	167.2	677	9.67E-05	5.61E-03
3-Methylphenol & 4-Methylphenol	498	108.1	396	1.20E-04	6.98E-03
Acenaphthylene	49.8	152.2	509	1.20E-05	6.98E-04
Chrysene	211	228.3	838	5.09E-05	2.95E-03
Dibenz(a,h)anthracene	39.5	278.4	975	9.53E-06	5.53E-04
Dibenzofuran	439	168.2	545	1.06E-04	6.16E-03

Table 2-48. SW-846 Method 0010 Extrapolated Mass Emission Rate Results - Run 4

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Duration (min)	Volumetric Flow Rate (dscfm)
Run 4 - Extrapolated[1]	6/8/2008	632-926	831-926	55	63.0
SVOC Analyte	**Total Conc. (µg/dscf)**	**Molecular Weight (g/g-mol)**	**Boiling Point (°F)**	**Total Mass Emission Rate (lbs/min)**	**Total Mass Emission Rate (lbs/interval)**
Acenaphthene	798	154.2	534	1.11E-04	6.09E-03
2,4-Dimethylphenol	628	122.2	412	8.71E-05	4.79E-03
Aniline	336	93.1	363	4.67E-05	2.57E-03
Anthracene	1,540	178.2	644	2.14E-04	1.18E-02
Fluoranthene	225	202.3	707	3.12E-05	1.72E-03
Fluorene	1,910	166.2	563	2.65E-04	1.46E-02
Indeno(1,2,3-cd)pyrene	28.7	276.3	997	3.98E-06	2.19E-04
2-Methylnaphthalene	19,700	142.2	466	2.74E-03	1.51E-01
2-Methylphenol	596	108.1	376	8.28E-05	4.55E-03
Naphthalene	13,400	128.2	424	1.87E-03	1.03E-01
1-Naphthylamine	53.8	143.2	572	7.47E-06	4.11E-04
2-Naphthylamine	58.3	143.2	583	8.09E-06	4.45E-04
Benzo(a)anthracene	197	228.3	820	2.73E-05	1.50E-03
Benzo(b)fluoranthene	37.2	252.3	675	5.17E-06	2.84E-04
Benzo(k)fluoranthene	28.7	252.3	896	3.98E-06	2.19E-04
Benzo(ghi)perylene	66.3	276.3	932	9.21E-06	5.07E-04
Benzo(a)pyrene	136	252.3	923	1.89E-05	1.04E-03
Phenanthrene	3,320	178.2	644	4.61E-04	2.54E-02
Phenol	429	94.1	359	5.96E-05	3.28E-03
2-Picoline	435	93.1	265	6.04E-05	3.32E-03
Pyrene	727	202.3	759	1.01E-04	5.55E-03
Pyridine	148	79.1	239	2.05E-05	1.13E-03
Carbazole	400	167.2	677	5.55E-05	3.05E-03
3-Methylphenol & 4-Methylphenol	498	108.1	396	6.91E-05	3.80E-03
Acenaphthylene	49.8	152.2	509	6.91E-06	3.80E-04
Chrysene	211	228.3	838	2.93E-05	1.61E-03
Dibenz(a,h)anthracene	39.5	278.4	975	5.48E-06	3.01E-04
Dibenzofuran	439	168.2	545	6.10E-05	3.35E-03

[1] No direct measurements were obtained during this venting cycle interval.

Table 2-49. SW-846 Method 0010 Total SVOC Mass Emission Rate Results - Run 4

SVOC Analyte	Sampling Train A Mass Emission Rate (lbs/interval)	Sampling Train B Mass Emission Rate (lbs/interval)	Sampling Train C Mass Emission Rate (lbs/interval)	Extrapolated Mass Emission[1] Rate (lbs/interval)	Run 4 Total Mass Emission Rate (lbs/cycle)
Acenaphthene	2.86E-02	9.75E-03	1.12E-02	6.09E-03	5.57E-02
2,4-Dimethylphenol	3.26E-02	1.13E-02	8.80E-03	4.79E-03	5.75E-02
Aniline	1.67E-02	5.85E-03	4.71E-03	2.57E-03	2.99E-02
Anthracene	7.31E-02	1.92E-02	2.16E-02	1.18E-02	1.26E-01
Fluoranthene	8.65E-03	2.96E-03	3.15E-03	1.72E-03	1.65E-02
Fluorene	1.04E-01	2.22E-02	2.67E-02	1.46E-02	1.67E-01
Indeno(1,2,3-cd)pyrene	1.49E-03	3.96E-04	4.02E-04	2.19E-04	2.51E-03
2-Methylnaphthalene	1.17E00	1.93E-01	2.77E-01	1.51E-01	1.79E00
2-Methylphenol	2.56E-02	9.44E-03	8.36E-03	4.55E-03	4.79E-02
Naphthalene	6.44E-01	1.40E-01	1.89E-01	1.03E-01	1.08E00
1-Naphthylamine	2.56E-03	9.34E-04	7.54E-04	4.11E-04	4.66E-03
2-Naphthylamine	2.33E-03	8.97E-04	8.17E-04	4.45E-04	4.48E-03
Benzo(a)anthracene	9.30E-03	2.87E-03	2.76E-03	1.50E-03	1.64E-02
Benzo(b)fluoranthene	1.77E-03	5.00E-04	5.22E-04	2.84E-04	3.07E-03
Benzo(k)fluoranthene	1.58E-03	4.62E-04	4.02E-04	2.19E-04	2.67E-03
Benzo(ghi)perylene	3.58E-03	9.06E-04	9.30E-04	5.07E-04	5.92E-03
Benzo(a)pyrene	6.74E-03	1.93E-03	1.90E-03	1.04E-03	1.16E-02
Phenanthrene	2.07E-01	2.99E-02	4.66E-02	2.54E-02	3.09E-01
Phenol	1.92E-02	6.96E-03	6.01E-03	3.28E-03	3.54E-02
2-Picoline	1.84E-02	5.38E-03	6.10E-03	3.32E-03	3.32E-02
Pyrene	2.69E-02	8.88E-03	1.02E-02	5.55E-03	5.15E-02
Pyridine	6.28E-03	1.70E-03	2.07E-03	1.13E-03	1.12E-02
Acetophenone	1.19E-02	4.81E-03	0	0	1.67E-02
Carbazole	1.65E-02	5.89E-03	5.61E-03	3.05E-03	3.11E-02
3-Methylphenol & 4-Methylphenol	2.28E-02	8.31E-03	6.98E-03	3.80E-03	4.19E-02
Acenaphthylene	1.79E-03	7.59E-04	6.98E-04	3.80E-04	3.63E-03
Chrysene	9.54E-03	2.89E-03	2.95E-03	1.61E-03	1.70E-02
Dibenz(a,h)anthracene	2.19E-03	5.57E-04	5.53E-04	3.01E-04	3.60E-03
Dibenzofuran	1.38E-02	4.96E-03	6.16E-03	3.35E-03	2.83E-02
Di-n-butyl phthalate	6.05E-05	0	0	0	6.05E-05
Total SVOC	**2.49**	**0.504**	**0.652**	**0.355**	**4.00**

[1] No direct measurements were obtained during this venting cycle interval.

2.7 Source Test Results for Particulate Matter Emissions

This section presents particulate matter (PM) emissions results obtained during the Source Test of the Coker Steam Vent. PM was measured according to modified EPA Methods 5 and 202 and the *Protocol* conditionally approved by EPA. Four sampling fractions were analyzed gravimetrically, after desiccation, for total PM:

- Front-half (nozzle, probe liner, cyclone with knockout flask, and front-half of the filter holder) rinse with acetone;
- The pre-weighed quartz-fiber filter;
- Contents of the impingers, including a water rinse of the impingers, the back-half of the filter holder, the glass coiled condenser, and the Teflon transfer line between the back-half of the filter holder and the inlet to the condenser; and
- Methylene chloride rinse of the impingers, the back half of the filter holder, the glass coiled condenser, and the Teflon transfer line between the back half of the filter holder and the inlet to the condenser.

The full laboratory report detailing the analyses of vent gas samples for PM emissions is presented in Appendix 2-8.

2.7.1 Source Test Results for Particulate Matter Concentrations

This section discusses PM concentration results obtained during the Source Test of the Coker Steam Vent. Three EPA Method 5/202 sampling trains were performed sequentially during each test run to sample for total PM during as much of the complete venting cycle as possible. Each EPA Method 5/202 sampling train was identified with a unique ID (“1”, “2”, “3”, or “4”). Tables 1-8 through 1-11 presents a summary of EPA Method 5/202 sampling train sampling intervals during each venting cycle tested during the Source Test. Table 2-50 presents a summary of EPA Method 5/202 sampling train data such as dry gas volume collected and isokinetic sampling rate achieved. PM concentrations are presented in Tables 2-51 through 2-54. Condensible PM, recovered in the “back-half” fractions of the EPA Method 5/202 sampling trains, contributed to the majority of total measured PM.

2.7.2 Source Test Results for Particulate Matter Mass Emission Rates

Total PM mass emission rates, calculated in lbs/cycle, are presented in Tables 2-55 through 2-58, and Sections 2.2 and 2.3 discuss the development of pollutant mass emission rates from both measured and extrapolated data.

Table 2-50. EPA Method 5/202 Sampling Train Data

	Date	Sampling Train ID	Venting Cycle	Venting Cycle Duration (min)	Sampling Train Interval	Sampling Train Duration (min)	Moisture Conc. (%)	Dry Gas Sample Volume (dscf)	Isokinetic Sampling Rate (%)
Run 1	6/3/2008	2	600-1018	258	607-637	30	98.80	0.905	92.1
		3			638-708	30	98.63	0.977	122
		4			708-822	68[1]	99.00	1.735	111
Run 2	6/4-5/2008	1	2235-130	175	2237-2308	31	98.56	1.184	94.9
		2			2309-2339	30	98.41	1.181	102
		3			2340-040	60	97.83	2.649	158
Run 3	6/6/2008	1	1408-1630	142	1410-1443	33	99.58	0.367	114
		2			1444-1533	49	99.36	0.778	176
		3			1538-1622	44	98.81	1.254	451
Run 4	6/8/2008	1	632-926	174	633-705	32	99.17	0.703	100
		2			706-736	30	98.40	1.096	131
		3			737-834	57	98.25	2.254	255

[1] EPA Method 5/202 sampling train “4” was not operated for six (6) minutes of this sampling train interval due to equipment malfunction.

Table 2-51. Source Test Results for Particulate Matter Concentrations – Run 1

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Front-Half Fraction		Back-Half Fraction: Condensible PM		Total PM Mass (mg)	Sample Volume (dscf)	Total PM Conc. (mg/dscm)	Total PM Conc. (gr/dscf)
					Probe and Nozzle Rinse PM Mass (mg)	Filter PM Mass (mg)	Condensate PM Mass (mg)	MeCl2 Rinse PM Mass (mg)				
Run 1	6/3/2008	600-1018	607-637	30	19.8	7.0	218	512	757	0.905	29,544	12.9
			638-708	30	5.3	3.4	215	483	707	0.977	25,543	11.2
			708-822	68[1]	7.0	2.4	519	839	1,367	1.735	27,839	12.2

[1] EPA Method 5/202 sampling train "4" was not operated for six minutes of this sampling train interval due to equipment malfunction.

Table 2-52. Source Test Results for Particulate Matter Concentrations – Run 2

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Front-Half Fraction		Back-Half Fraction: Condensible PM		Total PM Mass (mg)	Sample Volume (dscf)	Total PM Conc. (mg/dscm)	Total PM Conc. (gr/dscf)
					Probe and Nozzle Rinse PM Mass (mg)	Filter PM Mass (mg)	Condensate PM Mass (mg)	MeCl2 Rinse PM Mass (mg)				
Run 2	6/4-5/2008	2235-130	2237-2308	31	150.0	114.0	186	1,360	1,810	1.184	53,978	23.6
			2309-2339	30	148.0	138.0	142	1,020	1,448	1.181	43,301	18.9
			2340-040	60	501.0	183.0	425	1,710	2,819	2.649	37,580	16.4

Table 2-53. Source Test Results for Particulate Matter Concentrations – Run 3

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Front-Half Fraction		Back-Half Fraction: Condensible PM		Total PM Mass (mg)	Sample Volume (dscf)	Total PM Conc. (mg/dscm)	Total PM Conc. (gr/dscf)
					Probe and Nozzle Rinse PM Mass (mg)	Filter PM Mass (mg)	Condensate PM Mass (mg)	MeCl2 Rinse PM Mass (mg)				
Run 3	6/6/2008	1408-1630	1410-1443	33	114.0	19.6	136	387	657	0.367	63,160	27.6
			1444-1533	49	110.0	50.9	136	569	866	0.778	39,280	17.2
			1538-1622	44	73.8	11.2	206	478	769	1.254	21,662	9.46

Table 2-54. Source Test Results for Particulate Matter Concentrations – Run 4

	Date	Venting Cycle	Sampling Interval	Sampling Duration (min)	Front-Half Fraction		Back-Half Fraction: Condensible PM		Total PM Mass (mg)	Sample Volume (dscf)	Total PM Conc. (mg/dscm)	Total PM Conc. (gr/dscf)
					Probe and Nozzle Rinse PM Mass (mg)	Filter PM Mass (mg)	Condensate PM Mass (mg)	MeCl2 Rinse PM Mass (mg)				
Run 4	6/8/2008	632-926	633-705	32	47.8	10.7	261	695	1,015	0.703	50,956	22.3
			706-736	30	18.7	8.8	291	464	783	1.096	25,211	11.0
			737-834	57	46.5	12.6	362	580	1,001	2.254	15,688	6.85

Table 2-55. Source Test Results for Particulate Matter Mass Emission Rates – Run 1

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Interval Duration (min)	Total PM Conc. (mg/dscm)	Volumetric Flow Rate (dscfm)	Total PM Mass Emission Rate (lbs/min)	Total PM Mass Emission Rate (lbs/interval)	Total PM Mass Emission Rate (lbs/cycle)
Run 1	6/3/2008	600-1018	600-637	37	29,544	228	0.421	15.6	72.5
			637-708	31	25,543	200	0.318	9.9	
			708-822	74	27,839	166	0.288	21.3	
			822-1018[1]	116	27,839	128	0.222	25.7	

[1] No direct measurements were obtained during this venting cycle interval. These results have been extrapolated.

Table 2-56. Source Test Results for Particulate Matter Mass Emission Rates – Run 2

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Interval Duration (min)	Total PM Conc. (mg/dscm)	Volumetric Flow Rate (dscfm)	Total PM Mass Emission Rate (lbs/min)	Total PM Mass Emission Rate (lbs/interval)	Total PM Mass Emission Rate (lbs/cycle)
Run 2	6/4-5/2008	2235-130	2235-2308	33	53,978	351	1.18	39.0	95.8
			2308-2339	31	43,301	280	0.757	23.5	
			2339-040	61	37,580	163	0.383	23.4	
			040-130[1]	50	37,580	84.6	0.199	9.93	

[1] No direct measurements were obtained during this venting cycle interval. These results have been extrapolated.

Table 2-57. Source Test Results for Particulate Matter Mass Emission Rates – Run 3

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Interval Duration (min)	Total PM Conc. (mg/dscm)	Volumetric Flow Rate (dscfm)	Total PM Mass Emission Rate (lbs/min)	Total PM Mass Emission Rate (lbs/interval)	Total PM Mass Emission Rate (lbs/cycle)
Run 3	6/6/2008	1408-1630	1408-1443	35	63,160	143	0.565	19.8	30.7
			1443-1533	50	39,280	70.5	0.173	8.64	
			1533-1622	49	21,662	31.4	0.0424	2.08	
			1622-1630[1]	8	21,662	21.3	0.0288	0.231	

[1] No direct measurements were obtained during this venting cycle interval. These results have been extrapolated.

Table 2-58. Source Test Results for Particulate Matter Mass Emission Rates – Run 4

	Date	Venting Cycle	Venting Cycle Interval	Venting Cycle Interval Duration (min)	Total PM Conc. (mg/dscm)	Volumetric Flow Rate (dscfm)	Total PM Mass Emission Rate (lbs/min)	Total PM Mass Emission Rate (lbs/interval)	Total PM Mass Emission Rate (lbs/cycle)
Run 4	6/8/2008	632-926	632-705	33	50,956	290	0.922	30.4	47.4
			705-736	31	25,211	156	0.245	7.60	
			736-834	58	15,688	108	0.105	6.12	
			834-926[1]	55	15,688	61.1	0.0598	3.29	

[1] No direct measurements were obtained during this venting cycle interval. These results have been extrapolated.

3.0 Sampling and Analytical Procedures

The Pre-Survey was conducted during three separate venting cycles of Coker Steam Vent 3, where one valid sampling run was performed during each venting cycle. The Source Test was conducted during four separate venting cycles of Coker Steam Vent 3, where one valid sampling run (comprised by several individual sampling trains) was performed during each venting cycle. During the Source Test, all sampling began as soon as possible (see Section 1.4) after Coker Steam Vent 3 activation and continued for as long as sampling equipment remained operable within acceptable performance ranges and until health and safety limitations were encountered.

The source testing of the Coker Steam Vent 3 gas stream for all of the parameters requested by EPA was a challenging project that required much more than the simple performance of standard source testing methodologies for pollutants in a matrix of air. The accurate and precise measurement of the mass emission rates of benzene, toluene, NMNE VOCs, SVOCs, and PM from the Coker Steam Vent could not be performed without significantly modifying the methods prescribed in EPA's request. The modified sampling and analytical procedures that are described in the *Protocol* and conditionally approved by EPA are briefly discussed in this section. Any deviations from the EPA-approved modified test methods during the source testing are also identified in this section and discussed in Section 5.0. Table 3-1 provides a summary of the sampling and analytical methods used in the measurement of the target pollutant emissions as well as vent gas volumetric flow rates from the Coker Steam Vent. Appendix 3-1 presents the field sample logbook. Appendices 3-2 through 3-5 present the vent gas sampling data sheets and the isokinetic and volumetric flow rate calculations.

3.1 Coker Steam Vent 3 Sampling Locations

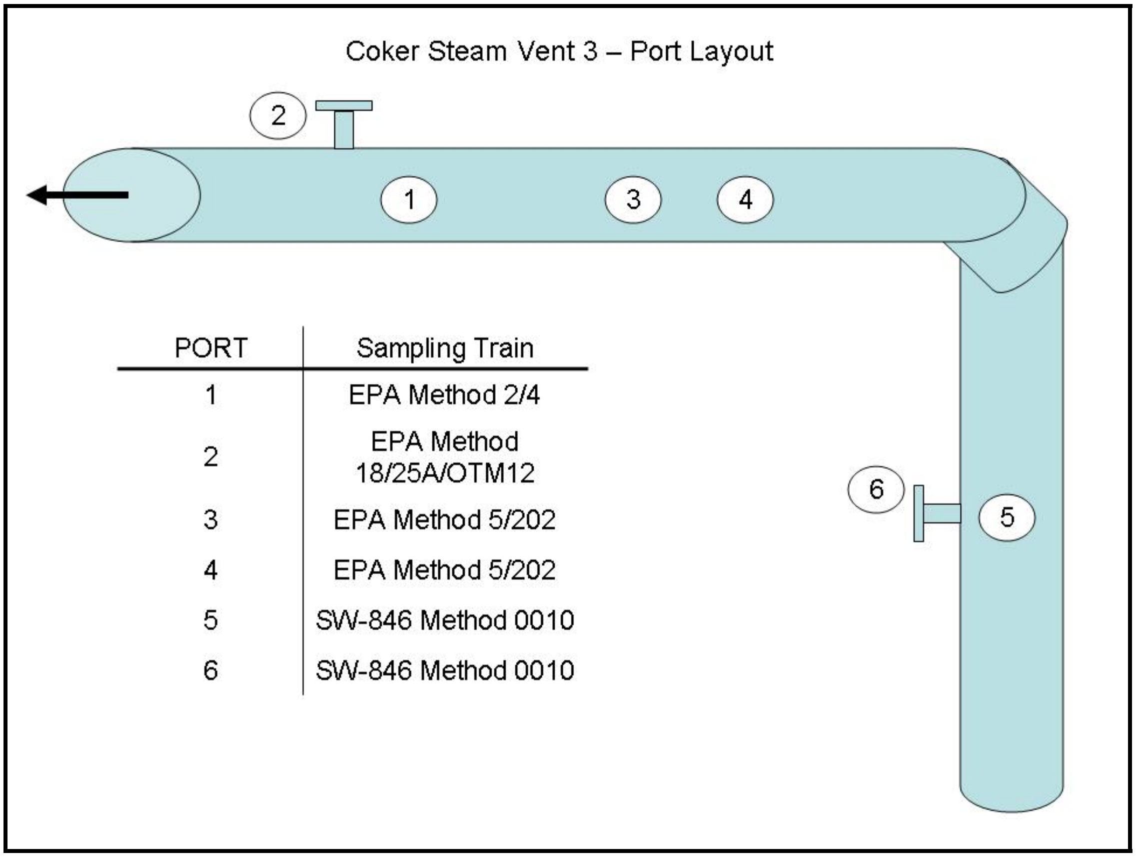
HOVENSA installed six sampling ports on the Coker Steam Vent 3 pipe to facilitate the simultaneous sampling of methane, ethane, benzene, toluene, NMNE VOC, SVOC, and PM emissions during the Source Test. Figure 3-1 presents a schematic of the Coker Steam Vent 3 sampling ports. Each sampling port was located at least two pipe diameters downstream and at least ½ pipe diameters upstream from any outlet, disturbance, or adjacent sampling port that was actively used for EPA Method 2/4, EPA Method 5/202, or SW-846 Method 0010 sampling. The Coker Steam Vent 3 pipe has a diameter of 12 inches. Of the six sampling ports, two adjacent ports ("3" and "4") were dedicated for the operation of sequential EPA Method 5/202 sampling trains and two adjacent ports ("5" and "6") were dedicated for the operation of sequential SW-846 Method 0010 sampling trains during the Source Test. The EPA Method 2/4 sampling train and the EPA Method 18/25A/OTM12 sampling system were operated on the remaining two sampling ports ("1" and "2", respectively) during the Source Test. The EPA Method 5/TO-14 sampling train was operated on Port "3" during the Pre-Survey.

Table 3-1. Summary of Sampling and Analytical Methods

Test Program	**Parameter**	**Modified[1] Sampling Methodology**	**Modified[1] Analytical Methodology**
Pre-Survey	Speciated VOCs	EPA Methods 5 and TO-14	GC/MS by EPA Method TO-14 and SW-846 Method 8260B
Pre-Survey and Source Test	Moisture	EPA Method 4	Gravimetric by EPA Method 4
Source Test	Volumetric Flow Rate	EPA Methods 2, 3, and 4	N/A
Source Test	Methane, Ethane, Benzene, and Toluene	EPA Methods 18 and Other Test Method 12	GC/FID by EPA Method 18
Source Test	NMNE VOCs	EPA Methods 18, 25A, and Other Test Method 12	GC/FID by EPA Methods 18 and 25A
Source Test	SVOCs	SW-846 Method 0010	GC/MS by SW-846 Methods 3542 and 8270C
Source Test	PM	EPA Methods 5 and 202	Gravimetric by EPA Methods 5 and 202

[1] The *Protocol* described the modified sampling and analytical methodologies used to conduct the Pre-Survey and Source Test of Coker Steam Vent 3. The *Protocol* was submitted to EPA on February 29. 2008 and conditionally approved on March 21, 2008.

Figure 3-1. Coker Steam Vent 3 Sampling Location Diagram



PORT	Sampling Train
1	EPA Method 2/4
2	EPA Method 18/25A/OTM12
3	EPA Method 5/202
4	EPA Method 5/202
5	SW-846 Method 0010
6	SW-846 Method 0010

3.2 Speciated Volatile Organic Compound Concentrations by EPA Methods 5 and TO-14

The Pre-Survey was conducted to determine the target analytes for emissions testing using EPA Method 18. The Pre-Survey results were previously provided to EPA in a letter report dated May 5, 2008. EPA Method 18 recommends the performance of optional pre-survey screening on sources where the target pollutants are not generally known. As such, the primary intent of the Pre-Survey was to identify any organic analytes (in addition to methane, ethane, benzene, and toluene) measured in excess of 100 ppmw in the Coker Steam Vent 3 gas stream. Section 16.1.3 of EPA Method 18 presents sampling procedures for conducting an optional pre-survey using either glass flasks or flexible bags; however, neither of these sampling procedures is suitable for testing the high-moisture, high-velocity Coker Steam Vent source. Selected VOC concentrations were speciated during the Pre-Survey according to sampling procedures based upon EPA Methods 5, 25, TO-14 and the *Protocol*. The analytical procedures were based upon EPA Method TO-14 and SW-846 Method 8260B.

The modified EPA Method 5/TO-14 sampling train consisted of the following components:

- Stainless steel nozzle;
- Sampling probe with stainless steel liner (the probe was also equipped with a Type-S pitot tube);
- Heated quartz fiber filter;
- Teflon transfer line;
- Glass coiled condenser;
- Large glass impinger (3-liter), with knockout stem, empty;
- Large glass impinger (3-liter), with modified Greenburg-Smith stem, containing 100 ml D.I. H_2O;
- Large glass impinger (3-liter), with Greenburg-Smith stem, containing 100 ml D.I. H_2O;
- Two standard impingers, with knockout stems, empty;
- Two standard glass impingers, with Greenburg-Smith stems, each containing 100 ml 5% zinc acetate solution;
- One standard glass impinger, with modified Greenburg-Smith stem, containing 100 ml 1.0N potassium hydroxide;
- Teflon union to allow a sample gas slipstream to a:
  - — Teflon valve;
  - — Mass flow meter;
  - — Stainless steel valve; and
  - — Evacuated Summa canister;

- One standard glass impinger, with modified Greenburg-Smith stem, containing approximately 300 g of silica gel desiccant;
- Air-tight sample pump;
- Dry gas meter; and
- Orifice.

Sample gas was collected in up to three 1-liter Summa canisters per test run once a sufficient amount of dry sample gas had passed through the entire sampling train. A precision vacuum gauge was used to measure the initial vacuum of the evacuated Summa canister prior to sampling. Mass flow meter and canister vacuum readings were recorded every two minutes during Summa canister sampling. Sampling train operators ensured that the canister vacuum remained higher than the total sampling system vacuum during the entire canister-sampling period. Once a sufficient amount of sample gas had been collected in a given canister, a precision vacuum gauge was used to measure the final vacuum of the canister.

Upon completion of a given sampling period a final leak check of the sampling system was performed. In the event that any leak rates exceeded 4% of the average sampling rate, the dry gas sample volume was corrected according to the applicable calculations presented in EPA Method 5. The total dry gas sample volume collected in the Summa canister was added to the dry gas sample volume recorded by the dry gas meter prior to performing calculations for the dry gas concentrations of VOCs captured in the sampling train upstream of the Summa canister sampling manifold.

Several Summa canister samples were collected over the duration of a given test run while only one condensate sample was collected during each test run. The 1-liter Summa canisters were analyzed according to EPA Method TO-14. The moisture content of the vent gas was determined from the total weight gain of the sampling train impingers. After the gravimetric determination of moisture concentration, the contents of the first three large glass impingers were recovered as a “condensate catch” sample fraction. The condenser, the first three impingers, and all connecting glassware between the impingers were then rinsed three times with D.I. H_2O into the “condensate catch” sample bottles. The condenser, the first three impingers, and all connecting glassware between the impingers were then rinsed three times with methanol into the “methanol rinse” sample bottles. The “condensate catch” and “methanol rinse” samples were combined in the laboratory into one fraction for single analysis according to SW-846 Method 8260B. The entire list of Pre-Survey VOC analytes was drawn from EPA Method TO-14 and SW-846 Method 8260B and is presented in Tables 3-2 and 3-3.

Table 3-2. List of Pre-Survey Volatile Organic Compound Analytes for EPA Method TO-14

EPA Method TO-14 Analytes			
Methane	Benzene	n-Decane	Chloromethane
Ethane	Acetonitrile	n-Dodecane	3-Chloropropene
Butane, 2-methyl-	n-Octane	n-Undecane	Cyclohexane
Butane, 2,3-dimethyl-	Pentane	Chlorodifluoromethane	Dibromomethane
Cyclopropane, 1,2-dimethyl-, trans-	Benzyl chloride	Nonane	1,2-Dichlorobenzene
Isobutane	n-Propylbenzene	m-Xylene & p-Xylene	1,3-Dichlorobenzene
cis-1,3-Dichloropropene	Styrene	Bromodichloromethane	1,4-Dichlorobenzene
1-Propene, 2-methyl-	1,1,2,2-Tetrachloroethane	1,2-Dibromoethane (EDB)	Dichlorodifluoromethane
1-Propene, 2-methyl-	Tetrachloroethene	2-Butanone (MEK)	1,1-Dichloroethane
trans-1,3-Dichloropropene	Toluene	4-Methyl-2-pentanone (MIBK)	1,2-Dichloroethane
1,2-Dichloro-1,1,2,2-tetrafluoroethane	1,2,4-Trichlorobenzene	cis-1,2-Dichloroethene	1,1-Dichloroethene
Acetone	1,1,1-Trichloroethane	n-Butane	
Ethylbenzene	1,1,2-Trichloroethane	Bromoform	
Ethyl ether	Trichloroethene	Bromomethane	
Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,3-Butadiene	
n-Heptane	1,2,4-Trimethylbenzene	1-Butanol	
Hexachlorobutadiene	1,3,5-Trimethylbenzene	Acrolein	
n-Hexane	Vinyl acetate	Carbon disulfide	
2-Hexanone	Vinyl chloride	Acrylonitrile	
Cumene	o-Xylene	Carbon tetrachloride	
Methanol	trans-1,2-Dichloroethene	Chlorobenzene	
Methylene chloride	1,2-Dichloropropane	Dibromochloromethane	
Naphthalene	Methyl tert-butyl ether	Chloroethane	
Benzene	alpha-Methylstyrene	Chloroform	

Table 3-3. List of Pre-Survey Volatile Organic Compound Analytes for SW-846 Method 8260B

SW-846 Method 8260B Analytes			
Benzene, 1-ethyl-3-methyl-	1,2,3-Trichlorobenzene	Carbon disulfide	trans-1,2-Dichloroethene
Naphthalene, 2-methyl-	1,2,4-Trichlorobenzene	Carbon tetrachloride	1,2-Dichloropropane
trans-1,3-Dichloropropene	1,1,1-Trichloroethane	Chlorobenzene	1,3-Dichloropropane
Acetone	1,1,2-Trichloroethane	Chlorodibromomethane	2,2-Dichloropropane
Ethylbenzene	Trichloroethene	1,2-Dibromo-3-chloropropane	1,1-Dichloropropene
Trichlorofluoromethane	1,2,3-Trichloropropane	Chloroethane	cis-1,3-Dichloropropene
Hexachlorobutadiene	1,2,4-Trimethylbenzene	Chloroform	
2-Hexanone	1,3,5-Trimethylbenzene	Chloromethane	
Isopropylbenzene	Vinyl chloride	2-Chlorotoluene	
p-Isopropyltoluene	o-Xylene	4-Chlorotoluene	
Methylene chloride	m-Xylene & p-Xylene	1,2-Dibromoethane	
4-Methyl-2-pentanone	Bromobenzene	Dibromomethane	
Naphthalene	Bromochloromethane	1,2-Dichlorobenzene	
Benzene	Bromodichloromethane	1,3-Dichlorobenzene	
n-Propylbenzene	Bromoform	1,4-Dichlorobenzene	
Styrene	Bromomethane	Dichlorodifluoromethane	
1,1,1,2-Tetrachloroethane	2-Butanone	1,1-Dichloroethane	
1,1,2,2-Tetrachloroethane	n-Butylbenzene	1,2-Dichloroethane	
Tetrachloroethene	sec-Butylbenzene	1,1-Dichloroethene	
Toluene	tert-Butylbenzene	cis-1,2-Dichloroethene	

Speciated VOC concentrations obtained for both the canister and condensate/rinse fractions were corrected from a dry basis to a wet basis using the average of the moisture concentrations (99%) measured from all three Pre-Survey test runs.

3.2.1 Deviations from the *Protocol*

Two deviations from the *Protocol* occurred during the Pre-Survey sampling, and their respective impacts on quality control/quality assurance are discussed further in Section 5.0:

- Methanol rinses were not performed on the connecting glassware between the glass condenser and the filter media; and
- Two sample fractions recovered from each EPA Method 5/TO-14 sampling train – the "condensate catch" and the "methanol rinse" – were not analyzed separately; they were combined for single analysis in the laboratory.

3.3 Volumetric Flow Rate by EPA Methods 2, 3, and 4

The vent gas volumetric flow rate was determined during the Source Test according to procedures based upon EPA Methods 2, 3, and 4. The sequential EPA Method 5/202 and SW-846 Method 0010 sampling trains and the redundant EPA Method 2/4 sampling train were used to quantify instantaneous volumetric flow rates for as long as possible during each venting cycle. The modified procedures by which volumetric flow rate data was obtained on the high-moisture, high velocity Coker Steam Vent gas stream have already been described in detail in the *Protocol*. Any deviations from those modified procedures are discussed in this section.

The EPA Method 2/4 sampling train consisted of the following components:

- Stainless steel nozzle;
- Sampling probe with stainless steel liner (the probe was also equipped with a Type-S pitot tube);
- Heated quartz fiber filter;
- Teflon transfer line;
- Glass coiled condenser;
- Two large glass impingers (3-liter), with knockout stem, empty;
- Two large glass impingers (3-liter), with modified Greenburg-Smith stem, each containing 200 ml D.I. H_2O;
- Two standard glass impingers, with Greenburg-Smith stems, each containing 200 ml 5% zinc acetate solution;
- One standard glass impinger, with modified Greenburg-Smith stem, containing 200 ml 5% zinc acetate solution;

- One standard glass impinger, with knockout stem, empty (optional);
- One standard glass impinger, with modified Greenburg-Smith stem, containing approximately 300 g of silica gel desiccant;
- Air-tight sample pump;
- Dry gas meter; and
- Orifice.

The configurations of the SW-846 Method 0010 and EPA Method 5/202 sampling trains are described in Sections 3.7 and 3.8, respectively.

During the EPA Method 2 sampling, differential pressure measurements across a Type-S pitot tube were recorded to determine the vent gas velocity. These measurements were made with digital manometers rather than a gauge-oil manometer due to the high vent gas differential pressure (>100 inches of H_2O) encountered in Coker Steam Vent 3. A calibration check was performed on the digital manometers according to EPA Method 2, Section 6.2.1. This calibration check data as well as other calibration information associated with equipment used in the EPA Method 2/4 sampling train is included in Appendix 3-6.

The differential pressure readings, vent temperature readings, dry gas meter readings, and other applicable sampling system operating parameters were generally recorded every two minutes during the operation of each EPA Method 2/4, EPA Method 5/202, and SW-846 Method 0010 sampling train. Some deviations to this criterion occurred during the Source Test and are discussed in Section 5.0. Static pressure measurements for use in the determination of vent gas velocity were obtained with a magnehelic gauge and stainless steel sampling probe attached to each EPA Method 2/4, EPA Method 5/202, and SW-846 Method 0010 sampling train.

EPA Method 3 was used to determine the dry gas molecular weight of the Coker Steam Vent 3 gas stream. Three single-point grab samples were collected during each test run in Tedlar bags attached to the dry gas meter outlet of the EPA Method 2/4 sampling train, except during Run 3, where only one grab sample was collected due to the lower dry gas content of the vent gas stream during that venting cycle. A Fyrite combustion analyzer was used to measure the oxygen and carbon dioxide concentrations (in %) of the Tedlar bag samples. Average oxygen and carbon dioxide concentrations were developed from all of the samples collected during a test run. In addition, speciated VOC data obtained with the EPA Method 18 analysis of vent gas samples, averaged throughout the test run, were used to quantify major contributors (>1%) to dry gas molecular weight. The remaining balance in the dry gas fraction of the vent gas was designated as nitrogen. Average vent gas molecular weights are presented in Table 2-3 for each test run.

Upon completion of a sampling period a final leak check was performed. In the event that any leak rates exceeded 4% of the average sampling rate, the dry gas sample volume was corrected according to the applicable calculations presented in EPA Method 5. One of the consequences of low sampling rates acquired with sampling trains composed of several large knockout impingers, joints, and unions is the possibility of a post-test leak check rate exceeding 4% of the average sampling rate achieved during the test run. In such a case, EPA Method 5 requires dry gas volume correction according to EPA Equation 5-1(a) Case I. During the Source Test, most of the EPA Method 2/4, EPA Method 5/202, and SW-846 Method 0010 sampling trains performed on Coker Steam Vent 3 required dry gas volume correction according to this equation.

The moisture content of the gas stream was determined from the total weight gain of the sampling train impingers according to EPA Method 4. A significant organic layer was not present in the condensate catch upon visual inspection of the impingers, and a separatory funnel was not used after any of the test runs to remove the organic layer prior to the gravimetric determination of condensed water.

A database consisting of the instantaneous volumetric flow rates and moisture concentrations measured by each individual sampling train operated during a given venting cycle was used to develop average volumetric flow rates (in dscfm) for a given venting cycle interval (defined in Section 2.2). This approach was used to maintain the highest level of consistency in the development of pollutant mass emission rates, as well as to incorporate the averaging of data as often as possible.

3.3.1 Deviations from the *Protocol*

Two deviations from the *Protocol* occurred during the sampling for vent gas volumetric flow rate, and their respective impacts on quality control/quality assurance are discussed further in Section 5.0.

- The redundant EPA Method 2/4 sampling train conducted during Run 1 was not inserted completely into the Coker Steam Vent 3 pipe until approximately 40 minutes after venting cycle activation, therefore moisture and volumetric flow rate data obtained with this sampling train was not used in any calculations. However, Tedlar bag samples for the determination of oxygen and carbon dioxide concentrations were collected from this sampling train after the sampling probe nozzle had been appropriately positioned in the center of the pipe.
- Data points critical to the development of vent gas volumetric flow rates were not recorded every two minutes during various sampling intervals of EPA Method 2/4, EPA Method 5/202, and SW-846 Method 0010 sampling train operation during all four test runs. This deviation occurred because sampling train operators were

preoccupied with other sampling train quality assurance/quality control activities, such as the application of ice to maintain acceptable sampling train operating temperatures.

3.4 Methane, Ethane, Benzene, and Toluene Concentrations by EPA Method 18 and Other Test Method 12

The concentrations of methane, ethane, benzene, and toluene in the Coker Steam Vent 3 gas stream were measured during the Source Test using a gas chromatograph (GC) and FID. A diluted sample of the Coker Steam Vent 3 gas stream was extracted via the EPA Method 18/25A/OTM12 dilution sampling system to a Tedlar bag. An integrated bag sample was collected during each of three sampling intervals achieved during each venting cycle. The Tedlar bag samples were then transported to a laboratory until analysis by GC/FID.

Methane, ethane, benzene, and toluene concentrations in the diluted Tedlar bag samples were measured on a wet basis by the GC/FID. EPA's request for information did not require the speciation by GC/FID of all C_1-C_6 hydrocarbons; however, the calibration gas standards used for the performance of EPA Method 18 included a mixture of C_1-C_6 compounds. The concentrations of propane, butane, pentane, and hexane were measured during the Source Test and reported as supplementary data.

It is important to note that with an average EPA Method 18/25/OTM12 sampling system dilution ratio (DR) of approximately 30:1 during each test run, the moisture concentrations in the Tedlar bag samples were approximately 3%. Each Tedlar bag sample was analyzed at least in triplicate and the final speciated VOC concentration result was calculated as the average of all separate analyses of the sample. The average dilution ratios developed on a run-by-run basis through the operation of the EPA Method 18/25A/OTM dilution sampling system (see Section 3.5) were incorporated into the EPA Method 18 analyses.

Prior to the start of sampling, the GC/FID analyzer was calibrated using Master Class (+/- 2% accuracy) calibration gas standards containing the target analytes in a balance of nitrogen. The analyte-specific method detection limits established through the calibration of the GC/FID are presented in Table 3-4. The following calibration and QA procedures presented in EPA Method 18 were followed:

- The instrument was calibrated at three points before sample analysis and at one point after analysis; and
- A recovery study showed 90-110% recovery of a gas sample introduced as close to the probe as possible.

Table 3-4. EPA Method 18 Analyte Detection Limits

		Methane	Ethane	Propane	Butane	Pentane	Hexane	Benzene	Toluene
Result (ppm)	Injection 1	526	521	522	522	523	233	25.6	25.6
	Injection 2	522	517	518	518	518	231	25.6	25.4
	Injection 3	520	516	517	517	517	230	25.5	25.3
	Injection 4	522	518	519	519	519	231	25.3	25.1
	Injection 5	522	518	519	518	519	231	25.7	25.8
	Injection 6	523	519	519	519	519	232	25.7	25.7
	Injection 7	532	528	529	529	529	236	26.1	25.9
	Average	524	520	520	520	520	232	25.7	25.5
Standard Deviation (ppm)		3.97	4.10	4.10	4.15	4.18	1.94	0.246	0.282
Method Detection Limit (ppm)		**12.5**	**12.9**	**12.9**	**13.0**	**13.1**	**6.10**	**0.774**	**0.885**

The recovery study was not performed exactly as described in EPA Method 18 because this method does not specify a procedure for performing a recovery study using both a dilution sampling system and bag sampling. Elements of both Sections 8.4.1 and 8.4.2 of EPA Method 18 were followed to perform the recovery study during the Source Test. Calibration gas was introduced upstream of the dilution sampling system and subsequently collected in Tedlar bag samples for GC/FID analyses. Raw data and calibration information associated with the performance of EPA Method 18 is included in Appendices 2-4 and 3-7.

Detection limits were developed using the approach described in 40 CFR 136, Appendix B. According to this methodology, each calibration standard is analyzed multiple times, and the method detection limit is defined as the standard deviation times the student's T value at the 99% confidence limit. The student's T value for 7 replicates is 3.143. This method detection limit was developed at the instrument, using direct injection of calibration gas.

3.4.1 Deviations from the *Protocol*

Two deviations from the *Protocol* occurred during the sampling for methane, ethane, benzene and toluene concentrations in the vent gas, and their respective impacts on quality control/quality assurance are discussed further in Section 5.0:

- The Tedlar bag sample obtained during Run 2, sampling interval 2335-0115, was analyzed in duplicate; and
- A valid Tedlar bag sample was not obtained during the second sampling interval of Run 1 (631-701).

3.5 Total Volatile Organic Compound Concentration by EPA Method 25A and Other Test Method 12

The total VOC concentration in the Coker Steam Vent 3 gas stream was measured during the Source Test as total hydrocarbons (THC) using two THC analyzers that were calibrated at different yet complementary ranges. One of these THC analyzers was operated in a dual-range mode, producing a total of three separate measurement ranges for the quantification of THC concentrations. A sample of the Coker Steam Vent 3 gas stream was extracted from Coker Steam Vent 3 using a dilution sampling probe equipped with a glass critical orifice and immediately diluted with high-purity nitrogen at a known dilution factor (approximately 30:1). The diluted sample gas passed from the dilution sampling probe to the two Thermo-Electron 51C-HT THC analyzers via a single 100-foot heated Teflon sample line. Both THC analyzers were operated in accordance with EPA Method 25A and Other Test Method 12 for as long as possible during the complete venting cycle.

An EPM Dilution Probe and CAE Exemplar Flow Panel were used as part of the dilution sampling system. A stable dilution air pressure was maintained through all calibrations as well as the sampling period for all test runs. A critical orifice vacuum greater than 14.7” Hg (manufacturer’s specification) was also maintained through all calibrations as well as the sampling period for all test runs.

THC concentrations in the diluted sample gas were measured on a wet basis by two THC analyzers using FIDs. An FID operates by ionizing organic compounds in the sample stream using the energy of a hydrogen/helium flame. The flame oxidizes organic compounds to generate carbon dioxide and water, and in the process, ions are formed in an electrical field between a polarized jet and collector electrode. When negative ions migrate to the collector electrode, a current is produced proportional to the concentration of carbon atoms in the sample gas. The analog voltage output reading from each THC analyzer was recorded by a data acquisition system every ten seconds.

When instantaneous THC concentrations were within the scale of a defined measurement range (THC1, THC2, or THC4), the results were used in the calculation of the average THC concentration per sampling interval. Though not specifically required by EPA Method 25A, a conservative lower detection limit of 2% of a given actual THC measurement range was calculated by multiplying 2% X the instrument operating range X the DR. This conservative approach for determining minimum detection limits for each THC analyzer was developed exclusively for the testing of the Coker Steam Vent source. Dilution ratios, detection limits, and measurement ranges established for each THC analyzer during each test run are described in Section 3.5.4 and presented in Table 3-5.

Table 3-5. THC Analyzer Calibration Summary

	Analyzer ID	Actual Analyzer Operating Range (ppmw)	Dilution Ratio	Effective Analyzer Measurement Range (with Dilution)	
				Lower Detection Limit (ppmw)	Upper Detection Limit (ppmw)
Run 1	THC1	0-100	30.25	60.5	3,025
	THC2	0-1,000	30.53	611	30,535
	THC4	0-10,000	30.39	6,079	303,934
Run 2	THC1	0-100	32.93	65.9	3,293
	THC2	0-1,000	31.41	628	31,412
	THC4	0-10,000	32.17	6,434	321,703
Run 3	THC1	0-100	32.78	65.6	3,278
	THC2	0-1,000	32.36	647	32,357
	THC4	0-10,000	32.57	6,514	325,688
Run 4	THC1	0-100	34.90	69.8	3,490
	THC2	0-1,000	33.38	668	33,383
	THC4	0-10,000	34.14	6,828	341,403

Each measurement range (THC1, THC2, and THC4) was calibrated as a separate analyzer. The low-range THC analyzer (0-100 ppmw, THC1) was calibrated according to EPA Method 25A and the dilution system procedures described in Other Method 12. In accordance with these requirements, EPA Protocol calibration gases of propane in nitrogen were introduced to THC1 through the tip of the dilution probe (upstream of the dilution system). The mid-range THC analyzer (0-1,000 ppmw, THC2) was calibrated in an identical manner, upstream of the dilution system. However, unlike THC1, THC2 was operated in a dual-range mode and calibrated at an additional high-range (0-10,000 ppmw, THC4). THC4 was calibrated according to EPA Method 25A and calibration gases were only introduced downstream of the dilution system.

EPA Method 25A requires that a THC analyzer be calibrated using four calibration gases:

- A zero gas, such as high-purity nitrogen;
- A low-level calibration gas, containing propane at a concentration of 25-35% of the span concentration (the range of the analyzer);
- A mid-level calibration gas, containing propane at a concentration of 45-55% of the span concentration (the range of the analyzer); and

- A high-level calibration gas, containing propane at a concentration of 80-90% of the span concentration (the range of the analyzer).

EPA Method 25A requires that initial calibration error testing be performed on a THC analyzer within two hours of the beginning of a test run. Due to the atypical time constraints involved with the calibration of three THC analyzers using a single dilution sampling system, calibration error tests were performed on each THC analyzer within four hours of Run 1and within three hours of Runs 2-4.

3.5.1 Low-Range THC Analyzer Calibration (THC1)

The calibration error test was performed upstream of the dilution probe according to Other Test Method 12. High-, mid-, and low-range pressurized calibration gases were introduced at the dilution probe tip to establish linearity for an effective measurement span of approximately 3,000 ppmw. An average DR for the dilution sampling system using THC1 was determined following the calibration error test through the dilution system. The instrument responses for each of these gases (after dilution) met method requirements and were no more than ±5% of the respective calibration gas value divided by the average DR during all test runs. Zero gas was introduced to the THC1 analyzer upstream of the dilution probe as high-purity nitrogen. There is no analyzer response criteria for zero gas specified in EPA Method 25A.

Following the completion of a test run, a zero gas and mid-level was reintroduced to the sampling system upstream of the dilution probe to check the calibration drift over the test period according to the procedures specified in EPA Method 25A and Other Test Method 12. The drift between the pre-run THC1 analyzer responses and the post-run analyzer responses for the mid-level calibration gas met method requirements and was ≤3% of the instrument span (with dilution) during all test runs. The drift between the pre-run analyzer responses and the post-run analyzer responses for the zero calibration gas was also ≤3% of the instrument span (with dilution) during all test runs. All supporting documentation regarding the calibration of THC1 is documented in Appendix 3-8.

3.5.2 Mid-Range THC Analyzer Calibration (THC2)

The calibration error test was performed upstream of the dilution probe according to Other Test Method 12. High-, mid-, and low-range pressurized calibration gases were introduced at the dilution probe tip to establish linearity for an effective measurement span of approximately 30,000 ppmw. An average DR for the dilution sampling system using THC2 was determined following the calibration error test through the dilution system. The instrument responses for the mid- and high-range gases (after dilution) met method requirements and were no more than ±5% of the respective calibration gas value divided by the average DR during all test runs. Zero gas was introduced to the THC2 analyzer upstream of the dilution probe as high-purity nitrogen. There is no analyzer response criteria for zero gas specified in EPA Method 25A.

The instrument response for the low-range gas (after dilution) did not meet the method requirement for calibration error during all test runs. This deviation from EPA Method 25A performance criteria occurred because the high- and mid-range gases used prior to each test run for THC2 calibration were classified as "Primary Standard," rather than "EPA Protocol," and were subjected to different analytical criteria during the vendor's NIST-certification. A limited number of Primary Standards (+/- 1% accuracy) were used during the Source Test because EPA Protocol calibration gases of propane in a balance of nitrogen at concentrations >15,000 ppm were not commercially available due to the health and safety issues involved with their preparation and certification (i.e., flammability and risk of explosion). The low-range gas was certified as an "EPA Protocol" gas, however, and the use of two different types of standards during the calibration error procedure demonstrated the instrument linearity out of EPA Method 25A specifications. The calibration error responses for the low-range gas standard were between 5 and 6% of the respective calibration gas value (as opposed to the EPA Method 25A criterion of ≤5% of the calibration gas value) divided by the average DR during all test runs.

Following the completion of a test run, a zero and mid-level calibration gas was reintroduced to the sampling system upstream of the dilution probe to check the calibration drift over the test period according to the procedures specified in EPA Method 25A and Other Test Method 12. The drift between the pre-run THC2 analyzer responses and the post-run analyzer responses for the mid-level calibration gas met method requirements and was ≤3% of the instrument span (with dilution) during Runs 2-4. The analyzer drift during Run 1 was 4.3%. This deviation from EPA Method 25A performance criteria probably occurred because of a temporary power loss to the THC2 analyzer between 758 and 843 during Run 1. The loss of power to a FID can detrimentally affect the instrument's linearity, established during the calibration error procedure. The drift between the pre-run analyzer responses and the post-run analyzer responses for the zero calibration gas were ≤3% of the instrument span (with dilution) during all test runs. All supporting documentation regarding the calibration of THC2 is documented in Appendix 3-8.

3.5.3 High-Range THC Analyzer Calibration (THC4)

The calibration error test was performed downstream of the dilution probe according to EPA Method 25A because an acceptable THC analyzer with an operating range over 10,000 ppmw was not readily available. High-, mid-, and low-range pressurized calibration gases were introduced at a calibration valve assembly downstream of the dilution probe to establish linearity for the instrument operating range of 10,000 ppmw. The instrument responses for each of these gases (without dilution) met method requirements and were no more than ±5% of the respective calibration gas value during all test runs. Zero gas was introduced to the THC4 analyzer downstream of the dilution probe as high-purity nitrogen. There is no analyzer response criteria for zero gas specified in EPA Method 25A.

Following the completion of a test run, a zero gas and mid-level was reintroduced to the sampling system downstream of the dilution probe to check the calibration drift over the test period according to the procedures specified in EPA Method 25A. The drift between the pre-run THC4 analyzer responses and the post-run analyzer responses for the mid-level calibration gas met method requirements and was ≤3% of the instrument span (without dilution) during all test runs. The drift between the pre-run analyzer responses and the post-run analyzer responses for the zero calibration gas was also ≤3% of the instrument span (without dilution) during all test runs. All supporting documentation regarding the calibration of THC4 is documented in Appendix 3-8.

A DR for the dilution sampling system using THC4 was determined by averaging the DRs developed during the calibration error procedure for THC1 and THC2. The use of an average DR with the THC concentration results measured with THC4 established an effective measurement span of approximately 300,000 ppmw.

3.5.4 Dilution Ratios and Method Detection Limits

DRs for the dilution sampling system were developed using data obtained during the calibration error procedures performed on both THC1 and THC2. The DR obtained with a given THC analyzer was applied as a multiplier to all of the measurements obtained with that analyzer, except for THC4, where the average of the DRs obtained using THC1 and THC2 was applied.

The three effective measurement ranges and average DRs were determined on a per run basis. Lower detection limits were calculated for all THC analyzers by multiplying the run-specific DR by a conservative instrument sensitivity of 2% of the instrument operating ranges (0-100 ppmw, 0-1,000, and 0-10,000 ppmw, respectively). Upper detection limits were calculated for all THC analyzers by multiplying the run-specific DR by the instrument span. All three measurement ranges overlapped during each test run, and the only data substitution applied during the Source Test involved the conservative rounding up of a limited amount of measured THC concentrations to the lower detection limits calculated for THC1. When instantaneous THC concentration results were within the scale of a defined measurement range (THC1, THC2, or THC4), the results were used in the calculation of average THC concentration. Table 3-5 presents a summary of the actual and effective THC analyzer measurement ranges, DRs, and detection limits for established for each test run.

3.5.5 Methane and Ethane Response Factors

The response factor (RF) per carbon in an FID is usually higher for methane and ethane than propane per carbon. Since the FIDs in the two THC analyzers were calibrated with standards of propane in nitrogen, average RFs for methane (RF_M) and ethane (RF_E) were determined experimentally by directly introducing both a methane and ethane calibration standard (with a balance of nitrogen) to each THC analyzer (and all 3 measurement ranges) prior to sampling the Coker Steam Vent 3 gas stream. The methane and ethane RFs for each THC analyzer's measurement range were calculated according to Equation 25Aap-1 in Other Test Method 12. Methane and ethane RFs were obtained for THC1 and THC2 by introducing the gas standards upstream of the dilution system. An ethane RF for THC1 was not obtained because the response for the ethane gas standard used during the Source Test was outside the instrument's operating range. A methane and ethane RF for THC4 was obtained by introducing the gas standards downstream of the dilution system. Individual and average RFs for methane and ethane are presented in Table 3-6.

Table 3-6. Methane and Ethane Response Factors

	Response Factor	**Analyzer Response**			**Average**
		THC1	**THC2**	**THC4**	
Run 1	**RF_M**	1.079	1.107	1.095	1.094
	RF_E	-	1.050	1.034	1.042
Run 2	**RF_M**	1.090	1.097	1.082	1.089
	RF_E	-	1.045	1.055	1.050
Run 3	**RF_M**	1.048	1.105	1.098	1.084
	RF_E	-	1.057	1.051	1.054
Run 4	**RF_M**	1.061	1.107	1.111	1.093
	RF_E	-	1.060	1.064	1.062

3.5.6 Deviations from the *Protocol*

Several deviations from methodology specified in the *Protocol* and/or Other Test Method 12 and EPA Method 25A were encountered during the Source Test. The relative impacts of these deviations on data quality are discussed in Section 5.0. The deviations are as follows:

- The THC2 analyzer response for the low-range gas (after dilution) did not meet the method requirement for calibration error during all test runs; and
- The drift between the pre-run THC2 analyzer responses and the post-run analyzer responses for the mid-level calibration gas did not meet method requirements during Run 1.

3.6 Non-Methane/Non-Ethane Volatile Organic Compound Concentration by EPA Methods 18, 25A, and Other Test Method 12

The precise and accurate quantification of methane and ethane concentrations in the Coker Steam Vent gas stream is related to the measurement of VOC emissions because methane and ethane have been determined by EPA to have negligible atmospheric photochemical reactivity. As such, the concentrations of methane and ethane can be subtracted from the measurement of total VOCs, quantified through the use of a THC analyzer(s), prior to the development of VOC mass emission rates. VOC results determined in this matter are referred to as non-methane/non-ethane VOC emissions (NMNE VOC).

Methane (as propane) and ethane (as propane) equivalencies for use in the development of NMNE VOC concentrations were calculated using the methane and ethane concentrations measured by GC/FID using EPA Method 18 and the appropriate average RFs. The concentration of NMNE VOCs in the Coker Steam Vent 3 gas stream during the Source Test was calculated by subtracting the propane-equivalent concentrations of methane and ethane from the average concentration of total VOCs measured with the THC analyzers during each sampling interval of the venting cycle.

3.6.1 Deviations from the *Protocol*

Two deviations from the *Protocol* occurred during the sampling for NMNE VOC concentrations in the vent gas, and their respective impacts on quality control/quality assurance are discussed further in Section 5.0.

- The Tedlar bag sample obtained during Run 2, sampling interval 2335-0115, was analyzed in duplicate.
- A valid Tedlar bag sample was not obtained during the second sampling interval of Run 1 (631-701).

3.7 Semivolatile Organic Compound Concentrations by SW-846 Method 0010

Samples for the determination of selected SVOCs in stack gas were collected during the Source Test using an isokinetic sampling train meeting the requirements of SW-846 Method 0010 with modifications addressed in the *Protocol*.

The SW-846 Method 0010 sampling train consisted of the following components:

- Stainless steel nozzle;
- Sampling probe with stainless steel liner (the probe was also equipped with a Type-S pitot tube);
- Heated quartz fiber filter;

- Heated Teflon transfer line;
- Glass coiled condenser;
- One large glass impinger (3-liter), with knockout stem, empty;
- XAD sorbent trap;
- One large glass impinger (3-liter), with modified Greenburg-Smith stem, containing 200 ml D.I. H_2O;
- Two large glass impingers (3-liter), with knockout stems, empty;
- Two standard glass impingers, with Greenburg-Smith stems, each containing 200 ml 5% zinc acetate solution;
- One standard glass impinger, with modified Greenburg-Smith stem, containing 200 ml 5% zinc acetate solution;
- One standard glass impinger, with knockout stem, empty (optional);
- One standard glass impinger, with modified Greenburg-Smith stem, containing approximately 300 g of silica gel desiccant;
- Air-tight sample pump;
- Dry gas meter; and
- Orifice.

SVOC samples were prepared in the laboratory for analysis using SW-846 Method 3542. The three analytical fractions analyzed separately in the laboratory by GC/MS were:

- Combined filter, cyclone, and probe and nozzle rinses;
- Combined mid-train rinses and pre-XAD sorbent condensate catch; and
- Combined XAD sorbent and post-XAD condensate catch.

3.7.1 Deviations from the *Protocol*

Two deviations from the *Protocol* occurred during the sampling for selected SVOC concentrations in the vent gas, and their respective impacts on quality control/quality assurance are discussed further in Section 5.0.

- The analytical fractions recovered during the Source Test and analyzed separately in the laboratory were different than those presented in the *Protocol*.
- Data points critical to the development of vent gas volumetric flow rates were not recorded every two minutes during various sampling intervals of SW-846 Method 0010 sampling train operation during all four test runs. This deviation occurred because sampling train operators were preoccupied with other sampling train quality assurance/quality control activities, such as the application of ice to maintain acceptable sampling train operating temperatures.

3.8 Particulate Matter Concentrations by EPA Methods 5 and 202

Samples for the determination of PM in stack gas were collected during the Source Test using an isokinetic sampling train meeting the requirements of EPA Methods 5 and 202 with modifications addressed in the *Protocol*.

The EPA Method 5/202 sampling train consisted of the following components:

- Stainless steel nozzle;
- Sampling probe with stainless steel liner (the probe was also equipped with a Type-S pitot tube);
- Heated quartz fiber filter;
- Teflon transfer line;
- Glass coiled condenser;
- One large glass impinger (3-liter), with knockout stem, empty;
- One large glass impinger (3-liter), with modified Greenburg-Smith stem, containing 200 ml D.I. H_2O;
- Two large glass impingers (3-liter), with knockout stems or modified Greenburg-Smith stems, empty;
- Two standard glass impingers, with Greenburg-Smith stems, each containing 200 ml 5% zinc acetate solution;
- One standard glass impinger, with modified Greenburg-Smith stem, containing 200 ml 5% zinc acetate solution;
- One standard glass impinger, with knockout stem, empty (optional);
- One standard glass impinger, with modified Greenburg-Smith stem, containing approximately 300 g of silica gel desiccant;
- Air-tight sample pump;
- Dry gas meter; and
- Orifice.

After the completion of each test run, the impinger contents of the sampling trains were immediately purged with nitrogen according the EPA Method 202. Following the purge, the PM samples from each of the EPA Method 5/202 sampling trains utilized during the venting cycle were recovered separately into the following components:

- Front-half (nozzle, probe liner, cyclone with knockout flask, and front-half filter holder) rinse with acetone;
- Quartz-fiber filter;

- Contents of the first two impingers, including a water rinse of the impingers, the back-half of filter holder, the Teflon transfer line, and the coiled condenser; and
- A methylene chloride rinse of the first two impingers, the back-half of the filter holder, the Teflon transfer line, and the coiled condensers.

Front-half PM determinations were performed according to EPA Method 5. After submittal to the laboratory, the filter and the front-half sampling train rinse fractions were dried to constant weight. The weight gains from the filter and front-half rinse fractions were related to the dry gas volume collected and are reported as front-half particulate loading. The amount of condensible material found in the impingers was determined according to EPA Method 202. According to EPA Method 202, the impinger solutions were extracted with methylene chloride, and the methylene chloride extract was combined with the methylene chloride rinse in the field. Both fractions (water and methylene chloride) were reduced to dryness, and the weight gain determined. These masses were related to the dry gas volume sampled and were reported as "back-half" particulate loading. A total PM (front-half plus back-half) concentration was quantified for each EPA Method 5/202 sampling train performed during a given venting cycle.

3.8.1 Deviations from the *Protocol*

Two deviations from the *Protocol* occurred during the sampling for PM concentrations in the vent gas, and the impact on quality control/quality assurance are discussed further in Section 5.0:

- Data points critical to the development of vent gas volumetric flow rates were not recorded every two minutes during various sampling intervals of EPA Method 5/202 sampling train operation during all four test runs. This deviation occurred because sampling train operators were preoccupied with other sampling train quality assurance/quality control activities, such as the application of ice to maintain acceptable sampling train operating temperatures.
- Sampling train "3", performed during Run 2, measured a moisture concentration of 97.8% and was operated at an isokinetic sampling rate of 158%. The *Protocol* specifies that the isokinetic sampling acceptance criterion for the Source Test program is 50-150% if the measured moisture is <98%.

4.0 Calculations

This section presents calculations used in the determination of speciated VOC, NMNE VOC, SVOC, and PM concentrations in the Coker Steam Vent 3 gas stream during the Pre-Survey and Source Test. This section also presents calculations used in the determination of vent gas volumetric flow rates and benzene, toluene, NMNE VOC, SVOC, and PM mass emission rates during the Source Test. The calculation of pollutant mass emission rates in a measurement unit of lbs/cycle rather than the typical lbs/hour is an approach developed specifically for this project and the Coker Steam Vent 3 source. Each complete venting cycle that was sampled was separated into four distinct time intervals (see Section 2.2) for the calculation of pollutant mass emission rates to most accurately characterize the emissions from the batch process of the Coker. Pollutant mass emission rates from the last venting cycle interval during each test run were extrapolated using a project-specific data reduction strategy. Example calculations are presented in Appendix 4-1.

A database consisting of the instantaneous volumetric flow rates and moisture concentrations measured by every sampling train operated during a given venting cycle was used to develop average velocity and associated volumetric flow rates (in dscfm) for a given venting cycle interval. This approach was used to achieve the highest level of consistency in the development of pollutant mass emission rates, as well as to incorporate the averaging of data as often as possible.

4.1 Vent Gas Dry Molecular Weight

The average molecular weight of the dry gas fraction of the vent gas exiting Coker Steam Vent 3 was calculated per test run according to the following equation, based upon EPA Equation 3-1:

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.30(\%C_2H_6) + 0.16(\%CH_4) + 0.28(\%N_2)$$

Where:

M_d = Dry gas molecular weight, lb/lb-mol;
$\%CO_2$ = Average percent carbon dioxide by volume, dry basis, per test run;
$\%O_2$ = Average percent oxygen by volume, dry basis, per test run;
$\%C_2H_6$ = Average percent ethane by volume, dry basis, per test run;
$\%CH_4$ = Average percent methane by volume, dry basis, per test run;
$\%N_2$ = Average percent nitrogen by volume, dry basis, per test run;
0.44 = Molecular weight of carbon dioxide, divided by 100, lb/lb-mol;
0.32 = Molecular weight of oxygen, divided by 100, lb/lb-mol;
0.30 = Molecular weight of ethane, divided by 100, lb/lb-mol;
0.16 = Molecular weight of methane, divided by 100, lb/lb-mol; and
0.28 = Molecular weight of nitrogen (balance), divided by 100, lb/lb-mol.

4.2 Vent Gas Velocity

The velocity of the vent gas exiting Coker Steam Vent 3 was calculated according to EPA Equation 2-7. Instantaneous vent gas velocity was calculated nominally every two minutes during the venting cycle as:

$$V_S = 85.49\ C_P\ \sqrt{\Delta P}\ \sqrt{\frac{(T_S)}{(P_S)(M_W)}}$$

Where:

V_S = Instantaneous velocity of the vent gas (ft/sec);
ΔP = Instantaneous differential pressure measured by Type S pitot (inches H_2O);
T_s = Instantaneous vent gas temperature (°R);
P_s = Absolute vent pressure, per interval (inches Hg);
M_w = Wet gas molecular weight, per venting cycle (lb/lb-mole);
C_p = Type-S pitot correction factor (0.84); and
85.49 = Conversion constant, per Equation 2-7 of EPA Method 2.

Average vent gas velocity was calculated from data measured by a single EPA Method 5/202 or SW-846 Method 0010 sampling train to determine that train's specific isokinetic sampling rate according to EPA Equation 5-8.

4.3 Vent Gas Volumetric Flow Rate - Standard Conditions

The volumetric flow rate of the Coker Steam Vent 3 gas, corrected to standard conditions, was calculated according to procedures based upon EPA Method 2. Instantaneous vent gas volumetric flow rate was calculated nominally every two minutes during the venting cycle as:

$$Q_s = (60 \times V_s \times A)\left(\frac{528}{T_S}\right)\left(\frac{P_S}{29.92}\right)$$

Where:

Q_s = Instantaneous volumetric flow rate, corrected to standard conditions (scfm);
V_s = Instantaneous velocity of the vent gas (ft/sec);
A = Cross-sectional area of the vent (ft^2);
60 = Conversion from second to minutes;
528 = Standard temperature (°R);
T_s = Instantaneous vent gas temperature (°R);
29.92 = Standard pressure (inches Hg); and
P_s = Instantaneous absolute vent pressure (inches Hg).

4.4 Vent Gas Volumetric Flow Rate - Dry Standard Conditions

The average volumetric flow rate of the Coker Steam Vent 3 gas, corrected to dry standard conditions, was calculated according to procedures based upon EPA Method 2. The average venting cycle moisture concentration, developed from moisture concentrations quantified by each individual sampling train operated during a given venting cycle, and the average volumetric flow rate (corrected to standard conditions) were used to calculate average dry vent gas volumetric flow rates (dscfm) for each venting cycle interval as:

$$Q_{sd} = (1 - B_W)(Q_s)$$

Where:

Q_{sd} = Average dry volumetric flow rate at standard conditions, per venting cycle interval (dscfm);

Q_s = Average actual volumetric flow rate, per venting cycle interval (acfm); and

B_w = Average moisture fraction of vent gas, per complete venting cycle.

4.5 Standard Dry Gas Meter Sample Volume

The dry gas meter volume at standard conditions was calculated as:

$$V_{sd} = (V_{ac})\left(\frac{528}{T_m}\right)\left(\frac{BP + \left(\frac{P_m}{13.6}\right)}{29.92}\right)$$

Where:

V_{sd} = Dry gas meter volume at standard conditions (dscf);

V_{ac} = Actual dry gas meter volume (dcf);

13.6 = Conversion from inches H_2O to inches Hg (inches H_2O/inches Hg);

528 = Standard temperature (°R);

T_m = Average dry gas meter temperature (°R);

29.92 = Standard pressure (inches Hg);

P_m = Dry gas meter pressure (inches H_2O); and

BP = Barometric pressure at the dry gas meter location (inches Hg).

As previously explained, the amount of dry gas that passed through the EPA Method 2/4, EPA Method 5/202, and SW-846 Method 0010 sampling trains to the dry gas meters were very small, and average dry gas sampling rates were on the order of 0.5 to 2 liters per minute.

Because of the relatively small dry gas sample volumes acquired, the leak rates exceeded 4% of the average sampling rate for most of the sampling trains performed during the Pre-Survey and Source Test, and corrections to the dry gas volume were made according to EPA Equation 5-1(a), Case I:

$$V'_{ac} = V_{ac} - [(L_p - L_a) \times T]$$

Where:

V'_{ac} = Actual dry gas meter sample volume, corrected (dcf);
V_{ac} = Actual dry gas meter sample volume, uncorrected (dcf);
L_p = Leakage rate observed during the post-test leak check (cfm);
L_a = 4% of the average sampling rate (cfm); and
T = Operating duration of sampling train (min).

The volume of dry gas sampled with the EPA Method 5/TO-14 sampling train used during the Pre-Survey was also corrected by adding the volume of dry gas collected in the evacuated Summa canisters to the volume of dry gas recorded with the dry gas meter. For each canister, the sample volume collected was calculated by multiplying the known volume of the canister (1 liter) by the vacuum of the sample in the canister according to the equation:

$$\mathrm{Vol}_{ac} = \mathrm{Vol}_{can} \times \frac{\mathrm{Vac}_{init} - \mathrm{Vac}_{final}}{\mathrm{Vac}_{itit}}$$

Where:

Vol_{ac} = Actual canister sample volume (liters);
Vol_{can} = Volume of canister (liters);
Vac_{init} = Initial vacuum of canister, before sampling (inches Hg); and
Vac_{final} = Final vacuum of canister, after sampling (inches Hg).

The actual canister sample volume (liters) was corrected to standard temperature conditions by using the average temperature recorded during the sampling interval with a thermocouple placed near the Teflon valve assembly in the EPA Method 5/TO-14 sampling train.

4.6 Concentration of Non-Methane/Non-Ethane Volatile Organic Compounds in the Vent Gas (Per Venting Cycle Interval)

The concentration of THC (as propane) in the Coker Steam Vent 3 gas was continuously measured throughout the venting cycle in units of parts per million volume, on a wet basis (ppmvw). The NMNE VOC concentration was calculated by subtracting the concentrations of methane and ethane (as determined by EPA Method 18) from the concentration of THC (as determined by EPA Method 25A). The average concentration of NMNE VOC was calculated during each of the four venting cycle intervals as:

$$[C]_{VOC} = [C]_{THC} - \frac{[C]_M \times RF_M}{3} - \frac{2[C]_E \times RF_E}{3}$$

Where:

$[C]_{VOC}$ = Average concentration of NMNE VOC, as propane, per venting cycle interval (ppmw);
$[C]_{THC}$ = Average concentration of THC measured, per venting cycle interval (ppmw);
$[C]_M$ = Concentration of methane, per venting cycle interval (ppmw);
RF_M = Average FID response factor for methane, determined directly from THC1, THC2, and THC4 (unit-less);
$[C]_E$ = Concentration of ethane, per venting cycle interval (ppmw); and
RF_E = Average FID response factor for ethane, determined directly from THC2 and THC4 (unit-less).

All average NMNE VOC concentrations calculated per venting cycle interval were corrected to a dry basis (ppmd) using the average of the moisture concentrations quantified by each individual sampling train operated during a given venting cycle. Conversion of NMNE VOC concentration results from ppmd to grams per dry standard cubic foot were calculated using this equation:

$$[C]_{g/dscf} = \frac{([C]_{VOC})(44.1)(453.59)}{(10^6)(385)}$$

Where:

$[C]_{g/dscf}$ = Concentration of NMNE VOCs as propane, per venting cycle interval (g/dscf);
$[C]_{VOC}$ = Concentration of NMNE VOCs as propane, per venting cycle interval (ppmd, expressed as scf/10^6 scf for the purposes of this calculation);
44.1 = Molecular weight of propane (lb/lb-mol);
453.59 = Conversion from pounds to grams (g/lb);
10^6 = Conversion from ppmd to scf/scf (unit-less); and
385 = Ideal gas law constant (scf/lb-mol).

The measured concentrations of benzene and toluene were also converted from ppmd to g/dscf using the equation presented above and the appropriate molecular weight.

4.7 Concentration of Particulate Matter and Selected Semivolatile Organic Compounds in the Vent Gas (Per Venting Cycle Interval)

The concentration of PM or selected SVOCs were calculated for each EPA Method 5/202 or SW-846 Method 0010 sampling train conducted during the complete venting cycle as:

$$[\mathrm{C}]_{\mathrm{g/dscf}} = \frac{\mathrm{M}}{\mathrm{V_{sd}}}$$

Where:

$[\mathrm{C}]_{\mathrm{g/dscf}}$ = Concentration of PM or selected SVOCs, per venting cycle interval (g/dscf);

M = Mass of PM collected in the EPA Method 5/202 sampling train (g) or mass of selected SVOC collected in the SW-846 Method 0010 sampling train (g); and

$\mathrm{V_{sd}}$ = Dry gas meter volume collected with the EPA Method 5/202 or SW-846 Method 0010 sampling train, at standard conditions (dscf).

4.8 Mass Emission Rate of Pollutant (Per Venting Cycle Interval)

The mass emissions rate for benzene, toluene, NMNE VOCs, selected SVOCs, and PM, in lbs/min, were calculated during four venting cycle intervals of each test run as:

$$\mathrm{MER_i} = [\mathrm{C}_{\mathrm{g/dscf}}] \left(\frac{\mathrm{Q_{sd}}}{453.59} \right)$$

Where:

$\mathrm{MER_i}$ = Mass emission rate of pollutant, per venting cycle interval (lbs/min);

$[\mathrm{C}]_{\mathrm{g/dscf}}$ = Concentration of pollutant, per venting cycle interval (g/dscf);

453.59 = Conversion from grams to pounds (g/lb); and

$\mathrm{Q_{sd}}$ = Average dry volumetric flow rate at standard conditions (dscfm), per venting cycle interval.

4.9 Mass Emission Rate of Pollutant (Per Cycle)

The total mass emission rates for benzene, toluene, NMNE VOCs, selected SVOCs, and PM, in lbs/cycle, were calculated as follows:

$$\mathrm{MER_{cycle}} = \frac{\sum_{1} \mathrm{MER_i} \times \mathrm{T_i}}{\mathrm{cycle}}$$

Where:

$\mathrm{MER_{cycle}}$ = Mass emission rate of pollutant, per complete venting cycle (lbs/cycle);
$\mathrm{MER_i}$ = Mass emission rate of pollutant, per venting cycle interval (lbs/min);
$\mathrm{T_i}$ = Total time of venting cycle interval (minutes); and
cycle = 1 -- one complete venting cycle event.

5.0 Quality Assurance Objectives for Measurement Data

The Pre-Survey and Source Test programs conducted on HOVENSA's Coker Steam Vent 3 are part of ongoing research of the potential emissions associated with delayed coker depressurization vent sources, which is currently being performed at similar, select sources around the United States. Quality assurance/quality control (QA/QC) activities were performed as an integral part of these sampling and analysis measurement programs to ensure that results are of known quality. The emissions tests were conducted in accordance with the *Protocol* conditionally approved by EPA. Any deviations from the *Protocol* were previously presented in Section 3.0 and summarized in Tables 1-12 through 1-16. The potential impact of these deviations on the test results is discussed in this section.

The results of the QA/QC activities demonstrate that the quality of the Coker Steam Vent 3 project measurement data is well documented and that the data are reliable, defensible, and meet project objectives.

The primary objectives of the QA/QC effort were to control, assess, and document data quality. To accomplish these objectives, the QA/QC approach consisted of the following key elements:

- Definition of data quality objectives that reflect the overall technical objectives of the measurement program;
- Design of a sampling, analytical, QA/QC and data analysis system to meet those objectives;
- Evaluation of the performance of the measurement system; and
- Initiation of corrective action when measurement system performance does not meet the specifications.

The QA procedures described in the *Protocol* include the use of sampling and analytical procedures, along with specified calibration requirements, QC checks, data reduction and validation procedures, and sample tracking. A review of analytical results for QA/QC samples and assessment of overall data quality is presented in this section. Detailed QC information is presented in Appendices 5-1 through 5-7 of this report. Sample Chain-of-Custody forms are included in Appendix 5-8.

The following subsections present discussions of the QA/QC activities associated with each of the following project tasks:

- Collection and analysis of vent gas samples for speciated VOC concentrations (Pre-Survey);
- Collection and analysis of vent gas samples for methane, ethane, benzene, and toluene concentrations;
- Collection and analysis of vent gas samples for THC concentration;
- Collection of vent gas samples for EPA Method 2/4, EPA Method 5/202, and SW-846 analyses;
- Analysis of vent gas samples for selected SVOC concentrations; and
- Analysis of vent gas samples for PM concentrations.

Several minor issues associated with sampling and analysis are identified and discussed below. Due to the difficulty associated with sampling this type of atypical source, the non-traditional use and application of the sampling methodology and equipment, and the "unknowns" of any given research project, these issues were not entirely unexpected. Nevertheless, the overall conclusion of the data quality assessment is that the results of the Pre-Survey and Source Test are valid, and are appropriate for their intended use.

5.1 Expected Deviations from the *Protocol*

Some deviations from the *Protocol* were expected prior to the performance of the Source Test and were previously conveyed to EPA in HOVENSA's Pre-Survey results letter dated May 5, 2008. These deviations, reproduced below, are not discussed in detail in this report.

- Section 2.3 of the *Protocol* mistakenly represents that the venting cycle on a given coke drum occurs nominally every 20 hours. The typical frequency of a venting cycle on a given coke drum is 40 hours.
- Section 3.0 of the *Protocol* specifies that EPA Method 5/202 and SW-846 Method 0010 sampling trains would begin at approximately the 1st, 15th, and 30th minute of the venting cycle and that a 4th set of sampling trains would be utilized if time permits. After verifying that the actual duration of a typical venting cycle is in excess of an hour, HOVENSA proposed to collect two 15-minute samples, followed by a 30-minute sample, followed by a 4th sample to be collected throughout as much of the venting cycle as possible with the EPA Method 5/202 and SW-846 Method 0010 sampling trains (for at total sampling time of at least one hour).

  During the Source Test, URS typically collected two 30-minute samples followed by a 3rd sample collected throughout as much of the remainder of the venting cycle as possible (for a total sampling time of approximately two hours). Through the Pre-Survey and Practice Run testing efforts, URS determined that a minimum duration of 30 minutes was required to collect an acceptable dry gas sample volume from the Coker Steam Vent 3 with the EPA Method 5/202 and SW-846 Method 0010 sampling trains. URS and HOVENSA anticipated that these modifications to the sampling strategy would occur as part of an ongoing research effort and communicated to EPA that all sampling train durations were nominal and subject to adjustment on a run-by-run basis.

- Hourly calibration drift determinations were not performed according to EPA Method 25A. Instead, URS performed THC analyzer calibration drift determinations before and after each test run to acquire the most "complete" set of VOC emissions data. This deviation had a minimal impact on overall data quality associated with the measurement of THC concentrations, as described in Section 5.4.
- Glass impingers containing solutions of 5% zinc acetate were used with the EPA Method 2/4, EPA Method 5/202, and SW-846 Method 0010 sampling trains to protect sensitive sampling equipment as well as URS testing personnel from any pollutants exhausting out of the dry gas meters.

5.1.2 Isokinetic Sampling Criteria

Section 3.1.3 of the *Protocol* describes the difficulty involved in achieving 90-110% isokinetic sampling rates on the Coker Steam Vent source and prescribes an isokinetic sampling acceptance criterion for the Source Test of 50-150% if the measured moisture is <98%, and abandons a specific criterion if the measured moisture is ≥98%. In addition, the *Protocol* specifies that an isokinetic sampling percentage outside the 50-150% range will not invalidate a test run.

Isokinetic sampling train operating parameters such as the sampling nozzle orifice size were determined during preliminary project activities to achieve isokinetic sampling percentages as close to 100% as possible during the Source Test. Out of a total of 24 isokinetic EPA Method 5/202 and SW-846 Method 0010 sampling trains performed during Source Test, only EPA Method 5/202 sampling train "3", performed during Run 2, failed the isokinetic sampling criteria presented in the *Protocol* (see Section 5.5).

It is important to note that the isokinetic sampling percentages achieved with the first EPA Method 5/202 sampling trains performed at the beginning of Runs 1-4, and operated for approximately 30 minutes, were 92.1, 94.9, 114, and 100%, respectively (see Table 2-50). In addition, the isokinetic sampling percentages achieved with the first SW-846 Method 0010 sampling trains performed at the beginning of Runs 1-4, also operated for approximately 30 minutes, were 93.3, 83.1, 98.0, and 97.1, respectively (see Table 2-17).

It is difficult to estimate the degree of bias associated with the measurement of PM and selected SVOC concentrations when achieving isokinetic sampling rates outside the traditional criteria of 90-110%, or the project-specific criteria described above, without conducting further research and testing on high-moisture, high-velocity Coker Steam Vent sources. Generally, isokinetic sampling rates >100% have been demonstrated to bias pollutant concentration results low because the gas velocity at the sampling train nozzle orifice exceeds the velocity of the vent gas stream and a greater than representative number of small particles, aerosols, or droplets, which follow the gas flow pattern into the nozzle orifice, are collected in the sampling train.

5.2 Collection and Analysis of Vent Gas Samples for Speciated Volatile Organic Compound Concentrations (Pre-Survey)

QA/QC activities associated with the collection of vent gas samples using modified EPA Method 5/TO-14 sampling trains include:

- Use of pre-printed sampling data sheets;
- Use of calibrated sampling equipment;
- Collection of samples at appropriate operating conditions;
- Collection of acceptable sample volumes;
- Performance of sampling system leak checks; and
- Collection of samples per the *Protocol* and applicable EPA methods.

QA/QC activities associated with the analysis of vent gas samples for speciated VOC concentrations include:

- Use of pre-printed recovery data sheets;
- Calibration of the analytical instrumentation;
- Use of documented calibration standards;
- Sample handling and preservation;
- Preparation and analysis of samples within specified holding times;
- Preparation and analysis of laboratory blanks;
- Collection and analysis of field blanks;
- Preparation and analysis of media check samples;
- Preparation and analysis of laboratory control samples (LCS) and laboratory control sample duplicates (LCSD);
- Addition of surrogate spikes to every sample; and
- Analyses of samples per the *Protocol* and applicable EPA methods.

A review of the data quality associated with these measurements indicates that these data are supportable and usable for the purpose intended. Refer to the detailed quality assessments in Appendices 5-1 and 5-2. The issues identified during the data quality review are detailed below.

- For the canister analyses, several compounds were observed in the field blank at levels above the detection limit: These included n-dodecane, ethylbenzene, n-heptane, n-hexane, methanol, methylene chloride, naphthalene, nonane, n-octane, pentane, n-propylbenzene, toluene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, n-undecane, o-xylene, m xylene and p-xylene. The field blank results and range of field sample results are presented in Table 5-1 for only the compounds which were detected in the field blank. The field blank results are negligible compared to the field samples and have no impact on the interpretation of the Pre-Survey VOC emissions data for the use intended.

- For the condensate analyses, several compounds were observed in the field blank above the detection limit. These included acetone, 2-butanone, and methylene chloride. The laboratory blank had detected amounts of methylene chloride. All other results for the field and laboratory blanks were below or near the detection limit. The field blank results and range of field sample results are presented in Table 5-2 for only the compounds which were detected in the field blank. The field blank results for acetone and methylene chloride were well below the amounts found in the field samples and have no impact on the results. The field blank result for 2-butanone is below the amount in the field sample and may indicate a positive bias.
- Methanol rinses were not performed on the connecting glassware between the large glass condenser and the filter media according to the *Protocol*. The vast majority of condensate was collected in the first two impingers used in the modified EPA Method 5/TO-14 sampling train, and the moisture concentrations measured during the Pre-Survey are comparable to those measured during the Source Test. Upon visual inspection of the Teflon transfer line and back-half of the filter holder during each test run, URS operators did not observe evidence of significant moisture condensation inside these sampling train components. Based upon the range of boiling points of the target analytes, the operating temperature of the sampling train components, and the temperature of the vent gas, the amount of material potentially caught in the back-half of the filter holder and the Teflon transfer line is negligible compared with the masses found in the condensate and Summa canister sample fractions.
- Two sample fractions recovered from each modified EPA Method 5/TO-14 sampling train – the “condensate catch” and the “methanol rinse” – were not analyzed separately according to the *Protocol*; they were combined for single analysis in the laboratory. However, the collection of data related to the deposition of various VOCs within specific fractions of the modified sampling train was not a primary objective of the Pre-Survey, and the combination of these analytical fractions provides acceptable and meaningful data for the composition of the vent gas stream.

Table 5-1. Pre-Survey Field Blank Results – Canister Samples

*	Field Blank Result (ppb)	Range of Field Sample Results (ppb)
Acetone	250	<1,400-<72,000
Benzene	300	39,000-390,000
n-Butane	2,700	240,000-1,600,000
2-Butanone (MEK)	14	700-<10,000
Carbon disulfide	1.1	110-<1,600
Cumene	2.5	160-<3,100
Cyclohexane	91	5,800-61,000
n-Decane	15	340-3,100
n-Dodecane	17	210-28,000
Ethylbenzene	52	4,700-49,000
n-Heptane	500	35,000-330,000
n-Hexane	760	54,000-460,000
Methanol	480	4,300-<170,000
Methylene chloride	6.9	540-5,800
Naphthalene	4.6	<89-8,100
Nonane	110	4,100-44,000
n-Octane	290	17,000-160,000
Pentane	1,500	120,000-920,000
n-Propylbenzene	3.4	160-<2,900
Toluene	640	76,000-780,000
1,2,4-Trimethylbenzene	20	570-11,000
1,3,5-Trimethylbenzene	26	920-14,000
n-Undecane	3.1	100-5,500
o-Xylene	50	3,500-49,000
m-Xylene & p-Xylene	370	28,000-330,000

Table 5-2. Pre-Survey Field Blank Results – Condensate Samples

	Field Blank Results (ug/sample)	Range of Field Sample Results (ug/sample)
Acetone	460	9,300-12,000
2-Butanone	1,200	1,900-5,400
Chloromethane	13	<25-<37
Methylene Chloride	52	160-210

5.3 Collection and Analysis of Vent Gas Samples for Methane, Ethane, Benzene, and Toluene Concentrations

QA/QC activities associated with the collection of the vent gas samples using the EPA Method 18/25A/OTM12 sampling system include:

- Use of calibrated sampling equipment;
- Use of calibration and dilution gas of appropriate and documented quality;
- Collection of samples at appropriate operating conditions;
- Proper operation of the dilution sampling system;
- Performance of sampling system leak checks; and
- Collection of samples per the *Protocol* and applicable EPA methods.

QA/QC activities associated with the analysis of vent gas samples for methane, ethane, benzene, and toluene concentrations include:

- Calibration of the analytical instrumentation;
- Use of documented calibration standards;
- Replicate analyses; and
- Analyses of samples per the *Protocol* and applicable EPA methods.

A review of the data quality associated with these measurements indicates that these data are supportable and usable for the purpose intended for all test runs. Refer to the detailed quality assessment in Appendix 5-3. The issues identified during the data quality review are detailed below.

- The Tedlar bag sample obtained during Run 2, sampling interval 2335-0115, was analyzed in duplicate instead of triplicate. These results are consistent with the results for all other samples, and the relative standard deviations (RSD) (indicating precision) for the duplicate sample analyses are acceptable (2.23 and 2.67 for methane and ethane, respectively). Benzene and toluene were not detected over the method detection limits for either analysis of this sample. This deviation has no impact on the usability of this data.
- A valid Tedlar bag sample was not obtained during the second sampling interval of Run 1 (631-701). The average of the concentration results for methane, ethane, benzene, and toluene measured during the first and third sampling intervals of Run 1 were applied to the second sampling interval for use in further calculations of average dry vent gas molecular weight, benzene and toluene mass emission rates, and NMNE mass emission rates. The results for Run 1 are consistent with the results from Runs 2, 3, and 4, and the results for the first and third Tedlar bag sample represent data before and after the missing data point. This data-substitution approach using averages provides a reasonable estimate of the concentration for the missing data.

5.4 Collection and Analysis of Vent Gas Samples for Total Hydrocarbon Concentration

QA/QC activities associated with the collection of vent gas samples using the EPA Method 18/25A/OTM12 sampling system include:

- Use of pre-printed data sheets;
- Use of dilution gas of appropriate and documented quality;
- Collection of samples at appropriate operating conditions;
- Proper operation of the dilution sampling system;
- Collection of samples per the *Protocol* and applicable EPA methods.

QA/QC activities associated with the analysis of vent gas samples for THC concentration include:

- Use of calibrated sampling equipment;
- Performance of calibration error checks;
- Performance of drift checks;
- Use of documented calibration standards; and
- Analyses of samples per the *Protocol* and applicable EPA methods

A review of the data quality associated with these measurements indicates that these data are supportable and usable for the purpose intended for all test runs. The use of the detection limit strategy developed exclusively for this project also provides a conservative estimate of total VOC concentrations in the vent gas. Refer to the detailed quality assessment in Appendix 5-4. The issues identified during the data quality review are detailed below.

- The THC2 analyzer response for the low-range calibration gas standard (after dilution) did not meet the EPA Method 25A performance requirement for calibration error during all test runs. The systematic recovery of the one calibration standard on THC2 may be associated with an inconsistency in the preparation of gas standards. Since the response was greater than the quoted value for the calibration gas, the error indicates a potential positive bias in the field results, which is conservative, relative to estimating emissions. Since the calibration error was consistently 5-6%, the magnitude for this bias is no greater than 5-6%, which is insignificant.
- The drift between the pre-run THC2 analyzer responses and the post-run analyzer responses for the mid-level calibration gas did not meet method performance requirements during Run 1. This deviation occurred because power was lost to the THC2 analyzer between 758 and 843. Power losses may have a detrimental effect on FID-based analyzers, because instrument temperatures may drop below operating specifications and the internal flame must be “re-lit.” As a consequence, the

established calibration curve may shift. In this case, the calibration drift was outside method specifications. However, the calibration drift was -4.3%, indicating that any bias would be no greater than 4.3% low. This amount of bias is insignificant.

5.5 Collection of Vent Gas Samples for EPA Method 2/4, EPA Method 5/202, and SW-846 Method 0010 Analyses

QA/QC activities associated with the collection of vent gas samples using modified EPA Method 2/4, EPA Method 5/202, and SW-846 Method 0010 sampling trains include:

- Use of pre-printed sampling data sheets;
- Use of calibrated sampling equipment;
- Collection of samples at appropriate operating conditions;
- Collection of acceptable sample volumes;
- Performance of sampling system leak checks; and
- Collection of samples per the *Protocol* and applicable EPA methods.

QA/QC activities associated with the analysis of vent gas samples for moisture concentration, velocity, temperature, differential pressure, and static pressure include:

- Use of pre-printed recovery data sheets;
- Calibration of the analytical instrumentation;
- Use of documented calibration standards; and
- Analyses of samples per the *Protocol* and applicable EPA methods.

A review of the data quality associated with these measurements indicates that these data are supportable and usable for the purpose intended. Refer to the detailed quality assessment in Appendix 5-5. The issues identified during the data quality review are detailed below.

- The measured XAD sorbent inlet temperature exceeded 68°F during most of the operation of the SW-846 Method 0010 sampling trains. These operating temperatures are attributed to the very slow rate of dry gas passing through the sampling train. As the condenser exit temperature (upstream of the inlet of the XAD sorbent) met the method performance specification, this is considered to be a project-specific measurement anomaly.

- The measured final impinger exit temperature exceeded 68°F during most of the operation of the EPA Method 2/4, EPA Method 5/202, and SW-846 Method 0010 sampling trains. These temperatures are attributed to the very slow rate of dry gas passing through the sampling train, which the applicable test methods are not designed to address. Every effort was made to keep the sampling trains fully immersed in an ice bath continuously and throughout each test run, rendering these final impinger exit temperatures unavoidable. As the condenser exit temperature (upstream of the final impinger exit) met the method performance specification, this is considered to be a project-specific measurement anomaly.

- The XAD sorbent and final impinger exit temperature deviations above the specifications may indicate that the target analytes condensed or were otherwise deposited in fractions of the sampling train where they are not usually collected. However, since the applicable sampling train components were recovered in their entirety, the overall results are unaffected. The interpretation of results for separate fractions may require additional scrutiny.
- The redundant EPA Method 2/4 sampling train conducted during Run 1 was not inserted completely into the Coker Steam Vent 3 pipe until approximately 40 minutes after venting cycle activation, therefore moisture and volumetric flow rate data obtained with this sampling train was not used in any calculations. Redundant volumetric flow rate data was already obtained with the use of both the EPA Method 5/202 and SW-846 Method 0010 sampling trains. As volumetric flow rate data was collected for the whole program and shown to have consistency, the loss of one piece of redundant data does not impact the usability of the results.
- Data points critical to the development of vent gas volumetric flow rates were not recorded every two minutes during various sampling intervals of EPA Method 2/4, EPA Method 5/202, and SW-846 Method 0010 sampling train operation during all four test runs. This deviation occurred because sampling train operators were preoccupied with other sampling train quality assurance/quality control activities, such as the application of ice to maintain acceptable sampling train operating temperatures. However, upon review of the proportion of valid 2-minute data points recorded per sampling train, any unrecorded data points represented only a loss in redundancy for the database and not in the overall data itself, and the impact on the data quality associated with the overall volumetric flow rate results is negligible. The proportion of valid 2-minute data points per sampling train per test run is presented in Table 5-3. The loss of an occasional data point for sampling parameters not critical to the development of instantaneous volumetric flow rate, such as sampling system operating temperatures and vacuum, is also negligible. In these cases, any data used in further calculations is interpreted from nearby sampling points.
- The SW-846 Method 0010 sampling train “C” operated during Run 1 failed its final leak check and was not recovered for analysis. However, the measurements for vent gas velocity made with this sampling train are used in further calculations. The failed final leak check rendered the sample unusable, but the measurements made during the test run; temperature, differential pressure, etc. are valid.
- EPA Method 5/202 sampling train “3”, performed during for Run 2, measured 97.8% moisture concentration and was operated with an isokinetic sampling rate of 158%. Per the *Protocol*, the PM concentration results obtained with this sampling train are not invalidated. As these data are consistent with all other data from the source test, the results for this sampling train are usable and are reported.

Table 5-3. Proportion of Valid Data Points for the Volumetric Flow Rate Database

	Sampling Train	Sampling Train ID	Sampling Train Interval (h:min)	Proportion of Valid Data Points (%)
Run 1	EPA Methods 5/202	2	607-637	100
		3	638-708	100
		4	708-822	87.9
	SW-846 Method 0010	A	602-632	100
		B	633-703	100
		C	704-734	100
		D	734-826	100
Run 2	EPA Methods 2/4	-	2236-0038	100
	EPA Methods 5/202	1	2237-2308	100
		2	2309-2339	100
		3	2340-040	100
	SW-846 Method 0010	A	2236-2306	62.5
		B	2307-2337	75.0
		C	2338-035	96.6
Run 3	EPA Methods 2/4	-	1408-1621	97.1
	EPA Methods 5/202	1	1410-1443	100
		2	1444-1533	96.0
		3	1538-1622	100
	SW-846 Method 0010	A	1409-1439	87.5
		C	1442-1532	100
		D	1533-1621	76.0
Run 4	EPA Methods 2/4	-	632-834	100
	EPA Methods 5/202	1	633-705	100
		2	706-736	100
		3	737-834	100
	SW-846 Method 0010	A	633-703	100
		B	703-733	87.5
		C	735-831	96.4

5.6 Analysis of Vent Gas Samples for Selected Semivolatile Organic Compound Concentrations

QA/QC activities associated with the analysis of vent gas samples for selected SVOC concentrations include:

- Sample handling and preservation;
- Preparation and analysis of samples within specified holding times;
- Preparation and analysis of laboratory blanks;
- Collection and analysis of field blanks;
- Preparation and analysis of media check samples;
- Preparation and analysis of laboratory control samples (LCS) and laboratory control sample duplicates (LCSD);
- Addition of surrogate spikes to every sample; and
- Analyses of samples per the *Protocol* and applicable EPA methods.

A review of the data quality associated with these measurements indicates that these data are supportable and usable for the purpose intended for all test runs. Refer to the detailed quality assessment in Appendix 5-6. The issues identified during the data quality review are detailed below.

- All samples were received intact by the laboratory. Some XAD sorbent trap and filter samples arrived at temperatures between 3 and 16°C. All other samples arrived at temperatures below 4°C. However, the XAD sorbent traps are spiked with a surrogate compound before sampling. Recovery of that surrogate compound met specification in all cases, indicating that there was no loss from these samples during any aspect of the program, including sample collection and shipping.
- 328 of 335 surrogate spike recoveries met the laboratory specification. The 7 outliers were low recoveries of 2-fluorophenol from the XAD/post-XAD condensate sample fractions. The laboratory has noted that these were spectral interferences associated with co-eluting target analytes. The few surrogate recoveries outside laboratory specification have negligible impact, considering the overwhelming number of surrogate recoveries met all specifications, and the identification of interferences with target analytes.
- The analytical fractions recovered during the Source Test and analyzed separately in the laboratory were different than those presented in the *Protocol*. All of the applicable components of the SW-846 Method 0010 sampling train were recovered for analysis, and the results of these analyses present a supportable and usable measurement of the target analytes collected in the SW-846 Method 0010 sampling trains. There is no impact on the usability of these results by the use of alternative sample fractions.

5.7 Analysis of Vent Gas Samples for Particulate Matter Concentrations

QA/QC activities associated with the analysis of vent gas samples for PM concentrations include:

- Sample handling and preservation;
- Preparation and analysis of samples within specified holding times;
- Collection and analysis of field blanks;
- Preparation and analysis of media check samples; and
- Analyses of samples per the *Protocol* and applicable EPA methods.

A review of the data quality associated with these measurements indicates that these data are supportable and usable for the purpose intended for all test runs. Refer to the detailed quality assessment in Appendix 5-7. The issues identified during the data quality review are detailed below.

- In some cases, data was not collected at the identified data points. As data was being collected at 2-minute intervals, the loss of an occasional data point is negligible. In all cases, the data used in further calculations was interpolated from nearby sampling points. This is discussed in Section 5.4, above.