



1 **ANNISTION CHEMICAL AGENT DISPOSAL FACILITY**
2 **FINAL STATIC DETONATION CHAMBER**
3 **EMISSIONS TEST REPORT**
4

5 **CONDITION 4a**

6
7
8 Revision 0, August 2011

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- 24
- 25

ACRONYMS AND ABBREVIATIONS

- 1
- 2 %percent
- 3 @at
- 4 ---.....not applicable
- 5 ±plus or minus
- 6 <less than
- 7 >greater than
- 8 ≤less than or equal to
- 9 ≥greater than or equal to
- 10 °degree
- 11 °Cdegree Celsius
- 12 °F.....degree Fahrenheit
- 13 3X.....3 times
- 14 5X.....5 times
- 15 6X.....6 times
- 16 50X.....50 times
- 17 100X.....100 times
- 18
- 19 AACADEM Administrative Code
- 20 AAHH.....alarm analyzer high-high
- 21 ADEM.....Alabama Department of Environmental Management
- 22 amu.....atomic mass unit
- 23 ANCDF.....Anniston Chemical Agent Disposal Facility
- 24 APCEair pollution control equipment
- 25 ASC.....allowable stack concentration
- 26
- 27 C1Condition 1
- 28 C2.....Condition 2
- 29 C3.....Condition 3
- 30 C4aCondition 4a
- 31 C4b.....Condition 4b
- 32 CAAClean Air Act
- 33 CCC.....calibration check compound
- 34 CCVcontinuing calibration verification
- 35 CDDchlorinated dibenzo-p-dioxin
- 36 CDF.....chlorinated dibenzofuran
- 37 CEMS.....continuous emissions monitoring system
- 38 cfcubic feet
- 39 cfmcubic feet per minute
- 40 CFR.....Code of Federal Regulations
- 41 COcarbon monoxide
- 42 CO₂.....carbon dioxide
- 43 COCchain-of-custody
- 44 CONControl Room
- 45 CVAAS.....cold vapor atomic absorption spectroscopy

ACRONYMS AND ABBREVIATIONS (Continued)

1	
2	DAAMSDepot Area Air Monitoring System
3	DAS.....Data Acquisition System
4	DCLSdetonation chamber lifting system
5	DCRSdetonation chamber rotating system
6	DIdeionized
7	DLdetection limit
8	DRE.....destruction and removal efficiency
9	dscf.....dry standard cubic feet
10	dscf/hrdry standard cubic feet per hour
11	dscfm.....dry standard cubic feet per minute
12	dscmdry standard cubic meter
13	dsL.....dry standard liter
14	EPA.....Environmental Protection Agency
15	
16	FIDflame ionizing detector
17	FIS.....flow indicting sensor
18	FPDflame photometric detector
19	FPI.....feed prohibitive interlock
20	
21	g.....grams
22	GCgas chromatography
23	g/g-molegram per gram-mole
24	gr/dscfgrains per dry standard cubic feet
25	GRAVgravimetric
26	g/s.....grams per second
27	
28	HCl.....hydrogen chloride
29	HEPAhigh efficiency particulate air
30	HNO ₃nitric acid
31	H ₂ Owater
32	H ₂ O ₂hydrogen peroxide
33	HPLChigh pressure liquid chromatography
34	HRAHealth Risk Assessment
35	HRGChigh resolution gas chromatograph
36	HRMShigh resolution mass spectroscopy
37	hrs.....hours
38	H ₂ SO ₄sulfuric acid
39	
40	IAW.....in accordance with
41	IC.....ion chromatography
42	ICALinitial calibration
43	ICPinductively coupled plasma
44	ICSinterference check sample
45	IDidentification
46	IDinduced draft

ACRONYMS AND ABBREVIATIONS (Continued)

- 1
- 2 inHg.....inch of mercury
- 3 inwc.....inch of water column
- 4
- 5 KMnO₄.....potassium permanganate
- 6
- 7 Lliters
- 8 lbspounds
- 9 lb/lb-molepound per pound-mole
- 10 lbs/hrpounds per hour
- 11 LCSlaboratory control sample
- 12 LCSDlaboratory control sample duplicate
- 13 LDC.....lower detonation chamber
- 14 L/min.....liter per minute
- 15 LOPLaboratory Operating Procedure
- 16
- 17 M1US EPA Method 1
- 18 M2US EPA Method 2
- 19 M3BUS EPA Method 3B
- 20 M4US EPA Method 4
- 21 M5US EPA Method 5
- 22 M6CUS EPA Method 6C
- 23 M7E.....US EPA Method 7E
- 24 M26AUS EPA Method 26A
- 25 M29US EPA Method 29
- 26 MM5EUS EPA Modified Method 5
- 27 M0010SW-846 Method 0010
- 28 M0023ASW-846 Method 0023A
- 29 M0030SW-846 Method 0030
- 30 M0040SW-846 Method 0040
- 31 M3510CSW-846 Method 3510C
- 32 M3540CSW-846 Method 3540C
- 33 M3535SW-846 Method 3535
- 34 M3542SW-846 Method 3542
- 35 M5041ASW-846 Method 5041A
- 36 M6020SW-846 Method 6020
- 37 M7470ASW-846 Method 7470A
- 38 M7471ASW-846 Method 7471A
- 39 M8260BSW-846 Method 8260B
- 40 M8270CSW-846 Method 8270C
- 41 M8290SW-846 Method 8290
- 42 M8330SW-846 Method 8330
- 43 MACTMaximum Achievable Control Technologies
- 44 MAXmaximum
- 45 MDL.....method detection limit
- 46 mgmilligram

ACRONYMS AND ABBREVIATIONS (Continued)

- 1
- 2 mg/dscm.....milligrams per dry standard cubic meter
- 3 mg/m³milligrams per cubic meter
- 4 mg/scm.....milligrams per standard cubic meter
- 5 MIN.....minimum
- 6 mL.....milliliter
- 7 mmmillimeter
- 8 mmHgmillimeters mercury
- 9 mun/hrmunitions per hour
- 10 MS.....matrix spike
- 11 MS.....mass spectrometer
- 12 MSD.....mass spectrometer detector
- 13 MSD.....matrix spike duplicate
- 14
- 15 N.....normal
- 16 NaOHsodium hydroxide
- 17 ND.....not detected
- 18 ng.....nanograms
- 19 ng/dscm.....nanograms per dry standard cubic meter
- 20 NO_xnitrogen oxides
- 21
- 22 O₂oxygen
- 23 OGTOff-Gas Treatment System
- 24
- 25 PDARS.....process data acquisition and recording system
- 26 PDSpressure differential sensor
- 27 pg.....picograms
- 28 PICpressure indicating controller
- 29 PICproduct of incomplete combustion
- 30 PISA.....pressure indicating sensing alarm
- 31 PLCprogrammable logic controller
- 32 ppmvparts per million volume
- 33 psi.....pounds per square inch
- 34
- 35 QA.....quality assurance
- 36 QAPPQuality Assurance Project Plan
- 37 QC.....quality control
- 38 QLquality lab
- 39 QPquality plant
- 40
- 41 R1Run 1
- 42 R2.....Run 2
- 43 R3.....Run 3
- 44 R4.....Run 4
- 45 RCRA.....Resources Conservation and Recovery Act
- 46 RF.....response factor

ACRONYMS AND ABBREVIATIONS (Continued)

1	
2	RLreporting limit
3	ROHArolling hourly average
4	RPD.....relative percent difference
5	RSD.....relative standard deviation
6	RTretention time
7	
8	SAPSampling and Analysis Plan
9	scmstandard cubic meters
10	scm/hr.....standard cubic meters per hour
11	SDC.....Static Detonation Chamber
12	SFUSafeguard Filter Unit
13	SICsulfur-impregnated carbon
14	sLpmstandard liters per minute
15	SPCC.....system performance check compounds
16	SO ₂sulfur dioxide
17	
18	TCO.....total chromatographable organic
19	TEFtoxic equivalent factor
20	TEQ.....toxic equivalent quotient
21	TI.....temperature indication
22	TIAtemperature indicating alarm
23	TICtemperature indicating controller
24	TICtentatively identified compound
25	TICSAtemperature indicating sensing alarm
26	TOC.....total organic compound
27	TRM.....temporary reference method
28	
29	UDCupper discharge conveyor
30	ug.....micrograms
31	ug/dscm.....micrograms per dry standard cubic meter
32	ug/L.....micrograms per liter
33	USUnited States
34	
35	VACvacuum
36	
37	WAWestinghouse Anniston
38	WMM.....waste military munition

1 **ES.1 OVERVIEW**

2 Anniston Chemical Agent Disposal Facility (ANCDF) conducted emissions testing for mustard-
3 filled munitions with sulfur-impregnated carbon (SIC) in the Safeguard Filter Unit (SFU)
4 (Condition 4a [C4a]) on the Static Detonation Chamber (SDC) System from July 5 to 8, 2011, as
5 summarized in Table ES-1, with preliminary information collected on July 3, 2011. Emissions
6 testing results for conventional weapons (Condition 1 [C1]) and surrogates (Conditions 2 [C2]
7 and 3 [C3]) were submitted to the Alabama Department of Environmental Management (ADEM)
8 for review in a previous report.

9 The purpose of this final report is to convey to the ADEM data regarding the performance
10 standards and processing parameters that are enumerated in the Resource Conservation and
11 Recovery Act (RCRA) and Clean Air Act (CAA) Permits for the SDC System. The emissions
12 tests were performed to demonstrate the following objectives as outlined in the ANCDF SDC
13 Emissions Test Plan:

- 14 • Demonstrate the destruction and removal efficiency (DRE) of greater than or
15 equal to (\geq) 99.9999 percent (%) for mustard agent at a feed rate of up to
16 72 pounds per hour (lbs/hr) of mustard agent;
- 17 • Demonstrate a rolling hourly average (ROHA) allowable stack concentration
18 (ASC) of less than ($<$) 0.006 milligrams per cubic meter (mg/m^3) and/or
19 instantaneous ASC of $< 0.03 \text{ mg}/\text{m}^3$ for mustard agent; and
- 20 • Demonstrate that emissions are less than the screening levels established in the
21 Health Risk Assessment (HRA).

22 For C4a, a total of four (4) test runs were conducted; however, only Runs 1, 2, and 4 were
23 used to compare emissions to permitted limits. Due to high liquid condensate levels in the
24 duct caused by closed drain valve during sampling for C4a Run 3 (C4aR3, etc), the
25 energetics sampling train was deemed void as condensate was pulled into the sampling train
26 and through the filter housing. In addition, the nitrogen oxide (NO_x) Temporary Reference
27 Method (TRM) Continuous Emissions Monitoring System (CEMS) was also halted for the
28 remainder of the run due to condensate compromising the sample line. With the exception of
29 Depot Area Air Monitoring System (DAAMS), gas chromatography (GC), and volatile
30 organic analyses, samples associated with C4aR3 were archived and not analyzed.

31 All testing and system/analytical data collection planned for C4a were completed with the
32 exception of the completion of the energetic sampling train and NO_x TRM CEMS during
33 C4aR3. ANCDF has reviewed the data to assess their usability and to determine appropriate
34 operating conditions for the SDC System. All data have been determined to be useable for
35 their intended purpose.

36 The operating condition of the SDC System was captured by the Process Data Acquisition
37 and Recording System (PDARS). Data was collected in one (1)-minute averages during
38 actual sampling.

1 **ES.2 SAMPLING METHODS**

2 On-site sampling activities included the equipment staging in the field, sampling operations, data
3 logging, and sample recovery. Exhaust gas samples were collected using the following methods
4 in accordance with (IAW) the approved ANCDF SDC Emissions Test Plan and are as follows:

- 5 • United States (US) Environmental Protection Agency (EPA) Methods 1 (M1) and
6 2 (M2) for traverse sampling locations and flow rates;
- 7 • US EPA Method 3B (M3B) for carbon dioxide (CO₂) and oxygen (O₂) levels;
- 8 • US EPA Method 4 (M4) for moisture;
- 9 • US EPA Method 6C (M6C) for sulfur dioxide (SO₂) emissions;
- 10 • US EPA Method 7E (M7E) for NO_x emissions;
- 11 • US EPA Method 10 (M10) for carbon monoxide (CO) concentrations;
- 12 • SW-846 Method 0010 (M0010) for semivolatile, unspciated, and gravimetric
13 organic emissions [two (2) sampling trains];
- 14 • SW-846 Method 0023A (M0023A) for dioxin/furan emissions;
- 15 • SW-846 Method 0030 (M0030) for volatile organic emissions;
- 16 • SW-846 Method 0040 (M0040) for volatile unspciated organic emissions;
- 17 • US EPA Method 26A (M26A) for the acid gas and particulate emissions;
- 18 • US EPA Method 29 (M29) for trace metal emissions, and
- 19 • US EPA Modified Method 5 (MM5E) for energetic emissions.

20 **ES.3 DAILY RUN SUMMARIES**

21 The following are daily accounts of the on-site test activities. These summaries are presented in
22 sequential order for the entire emissions testing effort and include the preliminary measurements.
23 Table ES-1 presents a summary of the sampling times.

24 **Sunday, July 3, 2011 - C4a Preliminary Measurements:** Preliminary velocity traverses and
25 cyclonic flow checks were conducted at the exhaust blower duct prior to the start of the
26 emissions test for C4a. Moisture runs were also conducted to verify the moisture content of the
27 exhaust gas. The cyclonic flow measurements within the duct at the sampling location yielded
28 results within specified limits. All velocity and moisture measurements were reliable indicators
29 of actual flow and moisture conditions and did not change appreciably from run to run. The
30 M0010, M0010 for total organic compounds (M0010-TOC), M0023A, M26A, and M29 field
31 blank sampling trains were set-up and recovered.

32 **Monday, July 4, 2011 - C4aR1 (Cancelled):** Exhaust gas sampling was cancelled due to
33 mechanical maintenance of the SDC System. However, prior to cancellation of the run, the
34 MM5E field blank sample train was set-up and recovered.

1 **Tuesday, July 5, 2011 - C4aR1:** Exhaust gas sampling commenced at 1625 hours (hrs) and
2 was paused at 1825 hrs for port change. All leak checks were successfully completed. Sampling
3 resumed in the second port at 2015 hrs and concluded at 2215 hrs with all leak checks
4 successfully completed. All samples were recovered, labeled, and custody-sealed.

5 **Wednesday, July 6, 2011 - C4aR2:** Exhaust gas sampling commenced at 1525 hrs and was
6 paused at 1725 hrs for port change. All leak checks were successfully completed. Sampling
7 resumed in the second port at 1950 hrs and concluded at 2150 hrs with all leak checks
8 successfully completed. All samples were recovered, labeled, and custody-sealed.

9 **Thursday, July 7, 2011 - C4aR3:** Exhaust gas sampling commenced at 1450 hrs and was
10 paused at 1650 hrs for port change. All leak checks were successfully completed. Sampling
11 resumed in the second port at 1900 hrs; however, sampling was paused from 2034 to 2044 hrs
12 due to high liquid condensate levels in the duct caused by a closed drain valve. The MM5E
13 sampling train was deemed void as condensate was pulled into the sampling train and through
14 the filter housing. In addition, the NO_x TRM CEMS was also impacted by high condensate
15 levels and sampling was stopped at 2034 hrs. Sampling was resumed for the remainder of the
16 trains at 2044 hrs and was concluded at 2110 hrs with all leak checks successfully completed.
17 All samples, with the exception of the MM5E sampling train, were recovered, labeled, and
18 custody-sealed.

19 **Friday, July 8, 2011 - C4aR4:** Exhaust gas sampling commenced at 1240 hrs and was paused
20 at 1440 hrs for port change. All leak checks were successfully completed. Sampling resumed in
21 the second port at 1545 hrs and concluded at 1745 hrs with all leak checks successfully
22 completed. All samples were recovered, labeled, and custody-sealed.

23 **ES.4 PERFORMANCE STANDARDS**

24 The isokinetic and non-isokinetic sampling summary for all sampling trains required to
25 demonstrate performance standards are summarized in Tables 5-2 and 5-3. The measured
26 performance standards are discussed in the following sections.

27 **ES.4.1 Select Criteria Pollutant Emissions**

28 CO concentrations were measured by the facility CEMS located on the exhaust blower duct.
29 Control of products of incomplete combustion was demonstrated by monitoring the CO
30 concentration (ROHA) to below the RCRA/CAA Permit limit of 100 parts per million by volume
31 (ppmv), dry basis, corrected to 7% O₂. As summarized in Table ES-2, the average CO
32 concentrations (ROHA) were in compliance with the RCRA/CAA Permit limit of 100 ppmv, dry
33 basis, corrected to 7% O₂ using Orsat data. The average instantaneous CO emission rates were
34 also in compliance with the CAA Permit limit of 0.02 lbs/hr.

35 SO₂ and NO_x emissions were measured by the TRM CEMS located on the exhaust blower duct.
36 As summarized in Table ES-2, the average SO₂ and NO_x emission rates were in compliance with
37 the CAA Permit limit of 7.20 and 0.80 lbs/hr, respectively.

1 Composite exhaust gas samples were collected to determine the concentration of O₂ and CO₂ to
2 be used in the calculation of the exhaust gas molecular weight. This calculated molecular weight
3 was used by individual sampling trains to calculate specific parameters associated with gas flow
4 and sampling train isokinetic percentages. In addition, the O₂ data was used to correct emission
5 rates.

6 **ES.4.2 DRE**

7 The DRE results are summarized in Table ES-3. The agent emissions were measured by a
8 DAAMS that was located at the exhaust blower duct near the location where exhaust gas
9 sampling was occurring. The four (4)-hour DAAMS tube set was analyzed for mustard agent
10 concentration by the on-site laboratory. The DRE was calculated per the method specified in
11 ADEM Administrative Code (AAC) 335-14-5-.15(4)(a)1 as follows:

$$12 \quad DRE = \left(\frac{W_{in} - W_{out}}{W_{out}} \right) \times 100$$

13 Where:

14 W_{in} = Feed rate (lbs/hr)
15 W_{out} = Emission rate (lbs/hr)

16 The feed rate was determined based on the amount of agent per hour and feed interval
17 demonstrated as summarized in Table 4-2. Further, the feed rate was purity-adjusted which
18 provides a worst-case or lowest DRE. The mustard agent DRE for all runs was in compliance
19 with the RCRA/CAA Permit limit of 99.9999%.

20 ANCDF has completed analysis and calculations for the determination of the DRE for the
21 operation of the SDC System. These results prove that the required DRE for this system has
22 been clearly demonstrated. However, there have been some concerns raised regarding the
23 presence of mustard agent readings within the ventilation originating from the loading chamber
24 and any potential affect it may have on the determination of DRE for this process.

25 The DAAMS tubes that were used in the DRE determination are capable of detecting mustard
26 agent $\geq 4.03E-01$ nanograms (ng). These DAAMS tubes were allowed to draw a sample from
27 the SDC exhaust for the four (4) hours during which performance testing monitoring occurred
28 for each test run. For the tubes analyzed from the emissions test, mustard was not found to be
29 present \geq the detection limit (DL). During this test, an average feed rate of 33.56 lb/hr was
30 demonstrated which was more than sufficient to meet the minimum required to prove a
31 successful DRE.

32 Given that the DL is 4.03E-01 ng, a reverse calculation shows that the minimum required agent
33 feed rate to demonstrate a 99.9999% DRE would be 0.46 lb/hr. Based upon this information, the
34 agent being detected in the exhaust from the loading chamber does not impact DRE
35 determination as its source is residual contamination from within the loading chamber area. The
36 readings are present based upon this small amount of contamination being present within a
37 confined area and would not be indicative of a failure to demonstrate DRE.

1 ES.4.3 Semivolatile Organic Emissions

2 Table ES-4 summarizes the semivolatile organic emissions results by test run and condition
3 average. No blank corrections have been made to the data. In instances where non-detects
4 (NDs) were incurred, the reporting limit (RL) was used to calculate an emissions rate. No
5 permitted emission limits are associated with semivolatile organic emissions.

6 ES.4.4 Dioxin/Furan Emissions

7 Table ES-5 summarizes the dioxin/furan emissions results by test run and condition average. No
8 blank corrections have been made to the data. In instances where NDs were incurred, the RL
9 was used to calculate an emissions rate. The US EPA toxicity equivalency factors (TEFs) were
10 applied to the detected quantities of each isomer, as well as the total congeners
11 (EPA/100/R-10/005). For the isomer-specific results, the applicable TEF was used to determine
12 the toxicity equivalency quotient (TEQ). The dioxin/furan emission rates for all runs were in
13 compliance with the CAA Permit limit of 0.20 nanograms-TEQ per dry standard cubic meter
14 (ng-TEQ/dscm), corrected to 7% O₂ using Orsat data.

15 ES.4.5 Volatile Organic Emissions

16 Table ES-6 summarizes the volatile organic emissions results by test run and condition average.
17 No blank corrections have been made to the data. In instances where NDs were incurred, the RL
18 was used to calculate an emissions rate. No permitted emission limits are associated with
19 volatile organic emissions.

20 ES.4.6 TOC Emissions

21 Table ES-7 summarizes the TOC emissions results by test run and condition average. Sampling
22 for volatile/semivolatile unspciated and gravimetric organics was conducted using the M0010
23 and M0040 sampling trains. In instances where NDs were incurred, the RL was used to calculate
24 an emissions rate. No permitted emission limits are associated with TOC emissions.

25 ES.4.7 Acid Gases and Particulate Emissions

26 Table ES-8 summarizes the acid gas and particulate emissions results by test run and condition
27 average. No blank corrections have been made to the data. In instances where NDs were
28 incurred, the RL was used to calculate an emissions rate. The chlorine equivalent concentrations
29 for all runs were in compliance with the CAA Permit limit of 21 ppmv, corrected to 7% O₂ using
30 Orsat data. The particulate emission rates for all runs were in compliance with the RCRA/CAA
31 Permit limit of 0.013 grains per dry standard cubic feet (gr/dscf), corrected to 7% O₂ using Orsat
32 data.

33 ES.4.8 Trace Metal Emissions

34 Table ES-9 summarizes the trace metal emissions results by test run and condition average. No
35 blank corrections have been made to the data. In instances where NDs were incurred, the RL
36 was used to calculate an emissions rate. The low-volatile (arsenic, beryllium, and chromium
37 combined), semivolatile (cadmium and lead combined), and high-volatile (mercury) metal

1 emission rates for all runs were in compliance with the CAA Permit limits of 23, 10, and
2 8.1 micrograms per dry standard cubic meter (ug/dscm), corrected to 7% O₂ using Orsat data,
3 respectively.

4 **ES.4.9 Energetic Emissions**

5 Table ES-10 summarizes the energetic emissions results by test run and condition average. No
6 blank corrections have been made to the data. In instances where NDs were incurred, the RL
7 was used to calculate an emissions rate. No permitted emission limits are associated with
8 energetic emissions.

9 **ES.5 FEED PROHIBITIVE INTERLOCK (FPI) LIMITS**

10 The existing FPI limits demonstrate that the current permitted setpoints are protective of human
11 health and the environment. Change to the FPIs will be requested upon submittal of the
12 emissions test report for Condition 4b.

13 **ES.6 PROPOSED FEED RATES**

14 The chemical agent feed rates demonstrated during C4a were 33.41, 30.96, and 36.31 lbs/hr for
15 C4aR1, C4aR2, and C4aR4, respectively, with an average of 33.56 lbs/hr (or 33.6 lbs/hr) as
16 summarized in Table ES-3. ANCDF proposes a 100% feed rate of 33.6 lbs/hr for mustard agent.

17 The metal feed rate was demonstrated during C3. ANCDF proposes a 100% metals feed rate as
18 listed in the ANCDF Final SDC Emissions Test Report (C1/C2/C3).

19 The tray weight, chlorine, sulfur, and explosives (non-mass and mass) feed rates were not
20 intended to be re-established based on emissions testing. ANCDF proposes retaining the
21 manufacturers' specifications as listed in RCRA Permit, Module 5, Table 5-4 for normal
22 operations.

23 **ES.7 DATA FOR USE IN THE HRA**

24 The emissions rates presented in this report are proposed for modeling in the ANCDF HRA,
25 which will be submitted under separate cover. For more discussion on health risk, the current
26 ANCDF Risk Assessment Protocol should be consulted.

27 **ES.8 FINAL CONCLUSIONS**

28 The SDC achieved all compliance objectives specified in the ANCDF SDC Emissions Test Plan
29 and RCRA/CAA Permits while processing mustard-filled munitions with SIC in the SFU.

Table ES-1: Sampling Time Intervals

Run	Date	First Port (hours)		Second Port (hours)	
		Start	Stop	Start	Stop
C4aR1	07/05/11	1625	1825	2015	2215
C4aR2	07/06/11	1525	1725	1950	2150
C4aR3 ⁽¹⁾	07/07/11	1450	1650	1900 ⁽²⁾	2110
C4aR4	07/08/11	1240	1440	1545	1745

Footnotes:

- (1) C4aR3 was archived and has been included for informational purposes only.
- (2) Sampling was paused from 2034 to 2044 hrs because condensate within the duct was aspirated into the energetic sampling train. Condensate was cleared from the duct and sampling resumed.

Table ES-2: Summary of Select Criteria Pollutant Emissions

Parameter	Units	C4aR1	C4aR2	C4aR4	Average	RCRA/CAA Permit Limit
C arbon Monoxide (facility CEMS) ⁽¹⁾	ppmv	0.19	0.99	0.52	0.57	100 ROHA
Carbon Monoxide (facility CEMS) ⁽¹⁾	lbs/hr	0.00064	0.0075	0.0087	0.0056	0.02
Sulfur Dioxide (TRM CEMS)	lbs/hr	0.0046	0.0018	0.0018	0.0027	7.20
Nitrogen Oxides (TRM CEMS)	lbs/hr	0.16	0.13	0.15	0.15	0.80

Footnote:

- (1) Values summarized in table are averages. See Table 4-2 for minimum and maximum values.

Table ES-3: Summary of DRE

Parameter	Units	C4aR1	C4aR2	C4aR4	Average	RCRA/CAA Permit Limit
DAAMS Tube	---	AT001871	AT001868	AT000756	---	---
Sample Collection Time	minutes	240	240	240	240	---
DAAMS Flow Rate ⁽¹⁾	sLpm	0.20	0.19	0.20	0.20	---
Total Gas Sample Volume ⁽²⁾	scm	4.80E-02	4.56E-02	4.80E-02	4.72E-02	---
Dilution Air ⁽³⁾	%	92.0	92.5	92.1	92.2	---
Percent Exhaust Gas Sampled	%	8.0	7.5	7.9	7.8	---
Total Exhaust Gas Sample Volume	scm	3.84E-03	3.42E-03	3.79E-03	3.68E-03	---
Sample Analysis Result	ng	< 4.03E-01 [ND]	< 4.03E-01 [ND]	< 4.03E-01 [ND]	< 4.03E-01 [ND]	---
Exhaust Gas Flow Rate ⁽⁴⁾	scm/hr	1,706	1,613	1,422	1,580.43	---
Agent Concentration	mg/scm	< 1.05E-04 [ND]	< 1.18E-04 [ND]	< 1.06E-04 [ND]	< 1.10E-04 [ND]	---
Emission Rate	lbs/hr	< 3.95E-07 [ND]	< 4.19E-07 [ND]	< 3.33E-07 [ND]	< 3.82E-07 [ND]	---
Average Agent Feed Rate	lbs/hr	33.41	30.96	36.31	33.56	---
Agent Purity ⁽⁵⁾	%	83.9	83.9	83.9	83.9	---
Purity-Adjusted Agent Feed Rate	lbs/hr	28.0	26.0	30.5	28.2	---
DRE	%	> 99.999998 [ND]	> 99.999998 [ND]	> 99.999998 [ND]	> 99.999998 [ND]	99.9999

Footnotes:

- (1) Flow rate is set prior to collection of the 4-hour DAAMS tube set and verified after the tubes have been collected. If the ending flow rate is less than the starting flow rate, then the ending (i.e., lower) flow rate is used to calculate the total exhaust gas flow rate.
- (2) Total gas sample volume represents the exhaust gas sample volume and diluent volume.
- (3) Percent dilution is set prior to collection of the 4-hour tube and verified after the tube has been collected. If the ending percent dilution is greater than the starting percent dilution, the ending (i.e., more dilute) dilution is used to calculate exhaust gas sampled.
- (4) The exhaust gas flow rate was calculated based on the average of all isokinetic sample train for the respective run.
- (5) Based on historical data, the average mustard purity of 83.9% has been used (see ANCDF SDC Emissions Test Plan, Appendix D).

Table ES-4: Summary of Semivolatile Organic Emissions

Parameter	Units	C4aR1			C4aR2			C4aR4			Average		
Acenaphthene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Acenaphthylene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Acetophenone	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2-Acetylaminofluorene	g/s	<	2.44E-05	ND	<	2.44E-05	ND	<	2.39E-05	ND	<	2.42E-05	ND
4-Aminobiphenyl	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
Aniline	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Anthracene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Aramite	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
Benzidine	g/s	<	2.44E-05	ND	<	2.44E-05	ND	<	2.39E-05	ND	<	2.42E-05	ND
Benzoic acid	g/s	<	1.96E-05	<	<	1.87E-05	<	<	1.98E-05	<	<	1.94E-05	<
Benz (a) anthracene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Benzo (b) fluoranthrene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Benzo (j) fluoranthrene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Benzo (k) fluoranthrene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Benzo (g,h,i) perylene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Benzo (a) pyrene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Benzo (e) pyrene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Benzyl alcohol	g/s	<	1.83E-06	<	<	1.83E-06	<	<	1.79E-06	<	<	1.82E-06	<
Benzaldehyde	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Biphenyl	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
bis(2-Chloroethoxy)-methane	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
bis(2-Chloroethyl) ether	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
bis(2-Chloroisopropyl) ether	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
bis(2-Ethylhexyl)-phthalate	g/s	<	4.24E-06	<	<	2.11E-06	<	<	2.47E-06	<	<	2.94E-06	<
4-Bromophenyl phenyl ether	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Butyl benzyl phthalate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2-sec-Butyl-4,6-dinitro-phenol	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
4-Chloroaniline	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Chlorobenzilate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
4-Chloro-3-methylphenol	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
1-Chloronaphthalene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2-Chloronaphthalene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND

Table ES-4: Summary of Semivolatile Organic Emissions (Continued)

Parameter	Units	C4aR1			C4aR2			C4aR4			Average		
2-Chlorophenol	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
4-Chlorophenyl phenyl ether	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Chrysene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Diallate	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
Dibenz(a,j)acridine	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
Dibenz(a,h)anthracene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Dibenzofuran	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Di-n-butyl phthalate	g/s	<	2.22E-06		<	1.98E-06		<	1.95E-06		<	2.05E-06	
1,2-Dichlorobenzene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
1,3-Dichlorobenzene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
1,4-Dichlorobenzene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
3,3'-Dichlorobenzidine	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
2,4-Dichlorophenol	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2,6-Dichlorophenol	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Diethyl phthalate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
p-Dimethylaminoazobenzene	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
7,12-Dimethylbenz(a)-anthracene	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
3,3'-Dimethylbenzidine	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
a,a-Dimethylphenethyl-amine	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
2,4-Dimethylphenol	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Dimethyl phthalate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
1,3-Dinitrobenzene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
4,6-Dinitro-2-methylphenol	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
2,4-Dinitrophenol	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
2,4-Dinitrotoluene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2,6-Dinitrotoluene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Diphenylamine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
1,2-Diphenylhydrazine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Di-n-octyl phthalate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Ethyl methanesulfonate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Ethyl parathion	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
Fluoranthene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND

Table ES-4: Summary of Semivolatile Organic Emissions (Continued)

Parameter	Units	C4aR1			C4aR2			C4aR4			Average		
Fluorene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Hexachlorobenzene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Hexachlorobutadiene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Hexachlorocyclopentadiene	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
Hexachloroethane	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Hexachloropropene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Indeno(1,2,3-cd)pyrene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Isophorone	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Isosafrole	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
Methapyrilene	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
3-Methylcholanthrene	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
Methyl methanesulfonate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2-Methylnaphthalene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2-Methyl-5-nitroaniline	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
2-Methylphenol (o-Cresol)	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
3-Methylphenol (m-cresol)	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
4-Methylphenol (p-cresol)	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Pentachloroethane	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
Naphthalene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
1,4-Naphthoquinone	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
1-Naphthylamine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2-Naphthylamine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2-Nitroaniline	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
3-Nitroaniline	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
4-Nitroaniline	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
Nitrobenzene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2-Nitrophenol	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
4-Nitrophenol	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
4-Nitroquinoline-l-oxide	g/s	<	2.44E-05	ND	<	2.44E-05	ND	<	2.39E-05	ND	<	2.42E-05	ND
N-Nitroso-di-n-butylamine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
N-Nitrosodiethylamine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
N-Nitrosodimethylamine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND

Table ES-4: Summary of Semivolatile Organic Emissions (Continued)

Parameter	Units	C4aR1		C4aR2		C4aR4		Average					
N-Nitrosomethylethylamine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
N-Nitrosodiphenylamine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
N-Nitroso-di-n-propylamine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
N-Nitrosomorpholine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
N-Nitrosopiperidine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
N-Nitrosopyrrolidine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Pentachlorobenzene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Pentachloronitrobenzene	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
Pentachlorophenol	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
Phenacetin	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
Phenanthrene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Phenol	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
1,4-Phenylenediamine	g/s	<	2.44E-05	ND	<	2.44E-05	ND	<	2.39E-05	ND	<	2.42E-05	ND
2-Picoline	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
Pronamide	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
Pyrene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
Pyridine	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
Safrole	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND	<	4.85E-06	ND
1,2,4,5-Tetrachloro-benzene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2,3,4,6-Tetrachlorophenol	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
o-Toluidine	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
1,2,4-Trichlorobenzene	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2,4,5-Trichlorophenol	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND	<	2.42E-06	ND
2,4,6-Trichlorophenol	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND
1,3,5-Trinitrobenzene	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND	<	1.21E-05	ND

Notes:

- (A) Blank corrections have not been made to these data.
- (B) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported.

Table ES-5: Summary of Dioxin/Furan Emissions

Parameter	Units	C4aR1		C4aR2		C4aR4		Average		CAA Permit Limit				
Total 2,3,7,8-TetraCDD	g/s	<	1.33E-13	ND	<	1.01E-13	ND	<	8.00E-14	ND	<	1.05E-13	ND	---
Total 2,3,7,8-PentaCDD	g/s	<	1.85E-13	ND	<	1.21E-13	ND	<	1.43E-13	ND	<	1.50E-13	ND	---
Total 2,3,7,8-HexaCDD	g/s	<	8.09E-13	ND	<	2.82E-13	ND	<	3.25E-13	ND	<	4.72E-13	ND	---
Total 2,3,7,8-HeptaCDD	g/s	<	7.00E-13	ND	<	5.76E-13	ND	<	5.55E-13	ND	<	6.10E-13	ND	---
Total OctaCDD	g/s	<	2.33E-12	ND	<	1.92E-12	ND	<	1.52E-12	ND	<	1.92E-12	ND	---
Total 2,3,7,8-TetraCDF	g/s	<	9.35E-13		<	1.54E-12		<	1.30E-12		<	1.26E-12		---
Total 2,3,7,8-PentaCDF	g/s	<	4.90E-13	ND	<	2.31E-13	ND	<	3.32E-13	ND	<	3.51E-13	ND	---
Total 2,3,7,8-HexaCDF	g/s	<	1.38E-12	ND	<	5.93E-13	ND	<	7.48E-13	ND	<	9.07E-13	ND	---
Total 2,3,7,8-HeptaCDF	g/s	<	2.35E-12	ND	<	1.15E-12	ND	<	9.59E-13	ND	<	1.48E-12	ND	---
Total OctaCDF	g/s	<	4.02E-12	ND	<	1.39E-12	ND	<	8.08E-13	ND	<	2.07E-12	ND	---
Total CDD/CDF	ng-TEQ/dscm @ 7% O ₂	<	0.0052		<	0.0040		<	0.0049		<	0.0048		0.20

Notes:

- (A) Blank corrections have not been made to these data.
- (B) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported.

Table ES-6: Summary of Volatile Organic Emissions

Parameter	Units	C4aR1		C4aR2		C4aR4		Average	
Acetone	g/s	7.63E-06		5.75E-06		4.19E-06		5.85E-06	
Benzene	g/s	< 4.93E-07	<	4.80E-07	<	6.82E-07	<	5.52E-07	<
Bromodichloromethane	g/s	< 1.16E-06	<	1.19E-06	<	7.39E-07	<	1.03E-06	<
Bromoform	g/s	< 1.06E-06	ND	< 1.01E-06	ND	< 9.08E-07	ND	< 9.93E-07	ND
Bromomethane	g/s	< 1.93E-06	<	2.02E-06	ND	< 1.82E-06	ND	< 1.92E-06	<
1,3-Butadiene	g/s	< 3.72E-07	<	3.06E-07	<	3.14E-07	<	3.30E-07	<
2-Butanone (Methyl Ethyl Ketone)	g/s	< 3.77E-06	<	4.22E-06	ND	< 3.79E-06	ND	< 3.93E-06	<
Carbon Disulfide	g/s	< 6.65E-07	<	6.97E-07	<	8.71E-07	<	7.44E-07	<
Carbon Tetrachloride	g/s	< 1.65E-06	<	2.41E-06	<	2.13E-06	<	2.06E-06	<
Chlorobenzene	g/s	< 3.87E-07	<	4.01E-07	<	3.58E-07	<	3.82E-07	<
Chlorodibromomethane	g/s	< 7.04E-07	<	7.44E-07	<	8.10E-07	<	7.53E-07	<
Chloroethane	g/s	< 2.12E-06	ND	< 2.02E-06	ND	< 1.82E-06	ND	< 1.99E-06	ND
Chloroform	g/s	< 6.77E-06	<	5.92E-06	<	5.30E-06	<	6.00E-06	<
Chloromethane	g/s	< 2.39E-06	<	2.28E-06	<	1.46E-06	<	2.05E-06	<
2-Chloropropane	g/s	< 5.33E-07	ND	< 5.09E-07	ND	< 4.57E-07	ND	< 5.00E-07	ND
1,2-Dibromoethane (Ethylene Dibromide)	g/s	< 1.06E-06	ND	< 1.01E-06	ND	< 9.08E-07	ND	< 9.93E-07	ND
Dibromomethane	g/s	< 1.06E-06	ND	< 1.01E-06	ND	< 9.08E-07	ND	< 9.93E-07	ND
cis-1,4-Dichloro-2-butene	g/s	< 2.12E-06	ND	< 2.02E-06	ND	< 1.82E-06	ND	< 1.99E-06	ND
trans-1,4-Dichloro-2-butene	g/s	< 2.12E-06	ND	< 2.02E-06	ND	< 1.82E-06	ND	< 1.99E-06	ND
Dichlorodifluoromethane(Freon 12)	g/s	< 1.04E-06	<	1.01E-06	<	8.79E-07	<	9.76E-07	<
1,1-Dichloroethane	g/s	< 4.23E-07	<	3.70E-07	<	3.34E-07	<	3.76E-07	<
1,2-Dichloroethane	g/s	< 3.93E-07	<	4.07E-07	<	3.43E-07	<	3.81E-07	<
trans-1,2-Dichloroethene	g/s	< 5.33E-07	ND	< 4.43E-07	<	4.12E-07	<	4.63E-07	<
1,1-Dichloroethene	g/s	< 3.81E-07	<	3.68E-07	<	2.86E-07	<	3.45E-07	<
1,2-Dichloropropane (Propylene Dichloride)	g/s	< 5.33E-07	ND	< 5.09E-07	ND	< 3.34E-07	<	4.59E-07	<
cis-1,3-Dichloropropene	g/s	< 5.33E-07	ND	< 5.09E-07	ND	< 3.41E-07	<	4.61E-07	<
trans-1,3-Dichloropropene	g/s	< 5.33E-07	ND	< 5.09E-07	ND	< 4.26E-07	<	4.89E-07	<
Ethyl Benzene	g/s	< 4.94E-07	<	5.09E-07	ND	< 4.57E-07	ND	< 4.87E-07	<
Hexane	g/s	< 8.28E-07	<	8.09E-07	<	9.21E-07	<	8.53E-07	<
2-Hexanone	g/s	< 4.42E-06	ND	< 4.22E-06	ND	< 3.79E-06	ND	< 4.14E-06	ND

Table ES-6: Summary of Volatile Organic Emissions (Continued)

Parameter	Units	C4aR1		C4aR2		C4aR4		Average					
Iodomethane	g/s	<	2.12E-06	ND	<	2.02E-06	ND	<	1.82E-06	ND	<	1.99E-06	ND
Methylene Chloride	g/s		4.82E-06			5.43E-06			4.27E-06			4.84E-06	
4-Methyl-2-pentanone (Methyl Isobutyl Ketone)	g/s	<	4.42E-06	ND	<	4.22E-06	ND	<	3.79E-06	ND	<	4.14E-06	ND
2-Propanol	g/s	<	9.70E-05	ND	<	9.24E-05	ND	<	8.31E-05	ND	<	9.08E-05	ND
Styrene	g/s	<	3.79E-07		<	3.50E-07		<	3.12E-07		<	3.47E-07	
1,1,1,2-Tetrachloroethane	g/s	<	5.33E-07	ND	<	5.09E-07	ND	<	4.57E-07	ND	<	5.00E-07	ND
1,1,2,2-Tetrachloroethane	g/s	<	1.06E-06	ND	<	1.01E-06	ND	<	9.08E-07	ND	<	9.93E-07	ND
Tetrachloroethene (Tetrachloroethylene)	g/s	<	4.89E-07		<	4.30E-07		<	4.12E-07		<	4.44E-07	
Toluene	g/s	<	3.31E-07		<	2.84E-07		<	2.57E-07		<	2.90E-07	
1,1,1-Trichloroethane	g/s	<	7.46E-07		<	8.15E-07		<	8.18E-07		<	7.93E-07	
1,1,2-Trichloroethane (Methyl Chloroform)	g/s	<	1.06E-06	ND	<	1.01E-06	ND	<	9.08E-07	ND	<	9.93E-07	ND
Trichloroethene	g/s	<	4.72E-07		<	4.08E-07		<	4.43E-07		<	4.41E-07	
Trichlorofluoromethane (Freon 11)	g/s	<	5.56E-07		<	5.34E-07		<	4.36E-07		<	5.09E-07	
1,2,3-Trichloropropane	g/s	<	1.06E-06	ND	<	1.01E-06	ND	<	9.08E-07	ND	<	9.93E-07	ND
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	g/s	<	5.01E-07		<	1.44E-06		<	1.10E-06		<	1.01E-06	
Vinyl Acetate	g/s	<	2.12E-06	ND	<	2.02E-06	ND	<	1.82E-06	ND	<	1.99E-06	ND
Vinyl Bromide	g/s	<	2.12E-06	ND	<	2.02E-06	ND	<	1.82E-06	ND	<	1.99E-06	ND
Vinyl Chloride	g/s	<	6.00E-07		<	5.67E-07		<	5.38E-07		<	5.69E-07	
m,p-Xylene	g/s	<	7.71E-07		<	8.03E-07		<	7.79E-07		<	7.84E-07	
o-Xylene	g/s	<	3.92E-07		<	3.99E-07		<	3.59E-07		<	3.84E-07	

Notes:

- (A) No blank corrections have been made to these data.
- (B) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported.

Table ES-7: Summary of TOC Emissions

Parameter	Units	C4aR1		C4aR2		C4aR4		Average	
Concentration	mg/m ³	<	3.44 ¹	<	11.66	<	39.79	<	18.30
Emission Rate	lbs/hr	<	8.93E-03 ¹	<	2.98E-02	<	9.17E-02	<	4.35E-02
Emission Rate	g/s	<	1.12E-03 ¹	<	3.75E-03	<	1.16E-02	<	5.48E-03

Footnote:

(1) Only one injection (Bag 1) was reported for C6 concentration because Bag 2 results were below MDL. Bag 1 is represented as the average for the bags for C4aR1.

Note:

(A) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported.

Table ES-8: Summary of Acid Gases and Particulate Emissions

Parameter	Units	C4aR1		C4aR2		C4aR4		Average		RCRA/CAA Permit Limit	
Hydrogen Chloride	g/s	<	9.00E-05	ND	<	7.76E-05	ND	<	8.11E-05	ND	---
Chlorine	g/s	<	1.88E-05	ND	<	2.09E-05	ND	<	1.94E-05	ND	---
Chloride Equivalents	ppmv @ 7% O ₂	<	0.47	ND	<	0.49	ND	<	0.51	ND	21
Hydrogen Fluoride	g/s	<	9.00E-05	ND	<	7.92E-05	ND	<	8.22E-05	ND	---
Particulates	gr/dscf @ 7% O ₂		0.00048			0.00030			0.00022		0.013

Notes:

(A) Blank corrections have not been made to these data.

(B) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported.

Table ES-9: Summary of Trace Metal Emissions

Parameter	Units	C4aR1		C4aR2		C4aR4		Average		CAA Permit Limit	
Antimony	g/s		7.17E-09		7.89E-09		4.41E-09		6.49E-09	---	
Arsenic	g/s	<	5.48E-08	<	7.38E-08	<	6.54E-08	<	6.47E-08	---	
Barium	g/s		2.79E-07		2.63E-07		2.35E-07		2.59E-07	---	
Beryllium	g/s	<	1.31E-08		4.19E-09		2.60E-09	<	6.62E-09	---	
Boron	g/s		5.92E-06		3.37E-06		5.02E-06		4.77E-06	---	
Cadmium	g/s		9.99E-09		8.98E-09		7.95E-09		8.97E-09	---	
Chromium	g/s		2.36E-07		1.83E-07		1.43E-07		1.87E-07	---	
Cobalt	g/s		1.30E-08		1.28E-08		8.42E-09		1.14E-08	---	
Copper	g/s		1.63E-07		1.43E-07		9.05E-08		1.32E-07	---	
Lead	g/s		5.96E-08		6.21E-08		4.17E-08		5.45E-08	---	
Manganese	g/s		1.61E-04		1.07E-06		4.88E-07		5.41E-05	---	
Mercury	g/s	<	2.91E-07	<	1.10E-07	<	2.64E-07	ND	<	2.22E-07	---
Nickel	g/s		4.27E-07		1.17E-07		9.53E-08		2.13E-07	---	
Phosphorus	g/s	<	2.28E-06	<	2.28E-06	<	2.24E-06		<	2.27E-06	---
Selenium	g/s	<	9.51E-08	<	9.90E-08	<	7.80E-08		<	9.07E-08	---
Silver	g/s		1.48E-07		1.77E-08		4.49E-08		7.03E-08	---	
Thallium	g/s	<	2.50E-08	ND	<	2.60E-08	ND	<	2.44E-08	ND	---
Tin	g/s	<	3.06E-07		<	4.70E-07		<	4.17E-07	---	
Vanadium	g/s	<	1.25E-07	ND	<	1.31E-07	ND	<	1.22E-07	ND	---
Zinc	g/s		2.55E-06		2.17E-06		1.94E-06		2.22E-06	---	
Arsenic, Beryllium, & Chromium	ug/dscm @ 7% O ₂	<	2.12	<	2.03	<	1.92		<	2.02	23
Cadmium and Lead	ug/dscm @ 7% O ₂		0.49		0.55		0.45		0.50	10	
Mercury	ug/dscm @ 7% O ₂	<	2.03	<	0.85		2.41		<	1.76	8.1

Notes:

- (A) Blank corrections have not been made to these data.
- (B) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported.

Table ES-10: Summary of Energetic Emissions

Parameter	Units	C4aR1			C4aR2			C4aR4			Average		
2,4-Dinitrotoluene	g/s	<	1.87E-07	ND	<	1.82E-07	ND	<	1.59E-07	ND	<	1.76E-07	ND
2,6-Dinitrotoluene	g/s	<	1.87E-07	ND	<	1.82E-07	ND	<	1.59E-07	ND	<	1.76E-07	ND
HMX	g/s	<	1.87E-07	ND	<	1.82E-07	ND	<	1.59E-07	ND	<	1.76E-07	ND
Nitroglycerin	g/s	<	7.59E-07	ND	<	7.28E-07	ND	<	6.37E-07	ND	<	7.08E-07	ND
RDX	g/s	<	1.87E-07	ND	<	1.82E-07	ND	<	1.59E-07	ND	<	1.76E-07	ND
2,4,6-Trinitrotoluene	g/s	<	1.87E-07	ND	<	1.82E-07	ND	<	1.59E-07	ND	<	1.76E-07	ND

Notes:

- (A) Blank corrections have not been made to these data.
- (B) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported.

1.0 INTRODUCTION

The US Army has designed and built a hazardous waste disposal facility for the destruction of the chemical munitions stockpile at Anniston Army Depot in Anniston, Alabama. The ANCDF is designed to dispose of chemical nerve agents, mustard agents, munitions containing agent, contaminated refuse, ton containers, liquid wastes, explosive, and propellant components. The ANCDF operates under RCRA Permit, AL3 210 020 027, issued pursuant to the Code of Alabama 1975 §§ 22-30-1-et. seq. Further references to this permit will be termed the RCRA Permit. ANCDF must also comply with its CAA Permit.

It is anticipated that the ANCDF may encounter deteriorated mustard-filled projectiles and mortars that will be armed, fused, and cannot be readily disassembled (separation of the explosives, agent, and munitions bodies to the existing three (3) incinerator systems) and processed at the ANCDF. The SDC System allows ANCDF the ability to process intact explosively configured munitions. Under the requirements of the RCRA Permit and ADEM regulations, the SDC System must demonstrate an ability to effectively treat any hazardous waste such that human health and the environment are protected.

ANCDF proposed five (5) emissions test conditions for the SDC System:

- Condition 1 (C1) - Conventional munitions emissions test without SIC in the SFU;
- Condition 2 (C2) - Surrogate emissions test spiking chlorobenzene, in addition to metal oxides, without SIC in the SFU;
- Condition 3 (C3) - Surrogate emissions test spiking chlorobenzene, in addition to metal oxides, with SIC in the SFU;
- C4a - Mustard-filled munitions emissions test while processing 105-mm projectiles with SIC in the SFU; and
- Condition 4b (C4b) - Mustard-filled munitions emissions test while processing 4.2-inch mortars with SIC in the SFU.

The emissions test results for C1, C2, and C3 has been submitted to ADEM for review and approval. The emissions test results for C4a are contained in this report. Westinghouse Anniston (WA) has the responsibility for operating the SDC System and executing the emissions tests, as required. WA has contracted a third party, URS of Austin, Texas, to provide sampling and analysis support. URS-Austin performed emissions sampling, packaging, transporting samples to the off-site laboratories for analysis, and reporting of the analytical results.

1.1 GENERAL FACILITY INFORMATION

The following general facility information pertains to ANCDF:

Facility Name:	Anniston Chemical Agent Disposal Facility
Mailing Address	3580 Morrisville Road

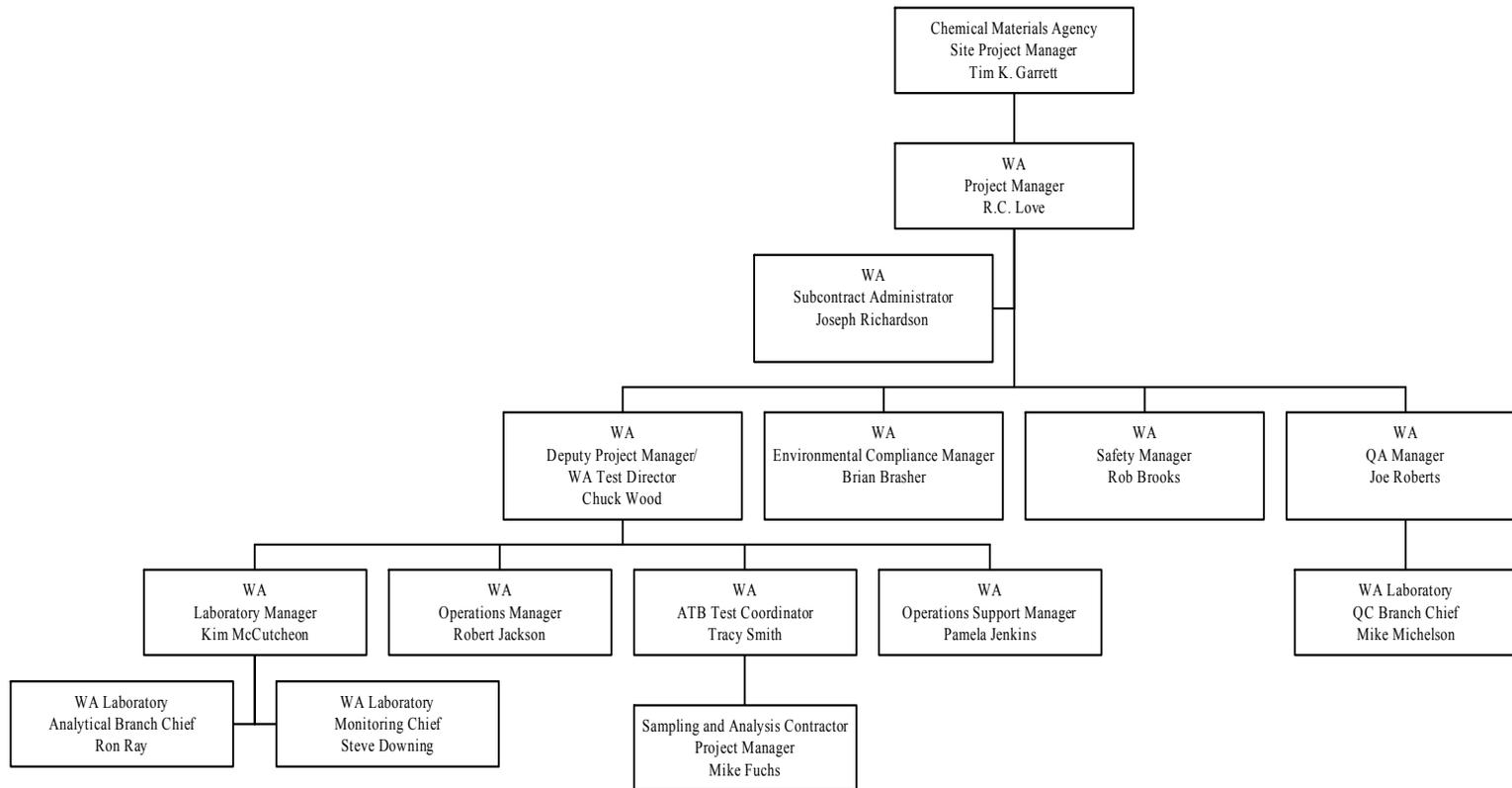


Figure 1-1: Organizational Chart

2.0 PROCESS DESCRIPTION

This section provides a brief process description of the SDC System, design information, process monitors, and monitoring points.

2.1 DESCRIPTION OF THE SDC SYSTEM

The SDC System is designed for destruction of munitions and munition components by indirect/conductive heating. The munitions are fed via a conveyor system. The solid scrap material remaining from the munitions is emptied into a scrap-box. The off-gas generated is cleaned and filtered in the Off-Gas Treatment (OGT) System.

The loading area is where munitions are placed in ammunition trays and loaded onto the loading conveyor. The loading conveyor is designed to accept multiple trays prior to any conveyor movement. After the loading conveyor is loaded, the loading operator leaves the area and the loading conveyor moves one (1) tray at a time into the SDC. As each item is conveyed from the loading room to the SDC for destruction the loading conveyor conveys it over to the munitions lift where it is elevated to the level of the first loading chamber. From the lift, the item is then conveyed to the apron of the first loading chamber.

At this point the loading system pauses until the SDC Control Room (CON) operator acknowledges that the tray is ready to load into the SDC. All movements from the loading conveyor to the first loading chamber are automatic. However, the CON operator has full control of all movements and can abort or reverse the movements as required. The loading conveyor and lift are also equipped with guides, interlocks, and sensors that prevent misalignment of trays or other problems and will halt movements automatically if problems arise.

Once at the apron of the first loading chamber and after the operator gives the go-ahead for the loading operation, the first loading chamber gate is opened to admit the tray. The first loading chamber gate is equipped with an inflatable gasket seal which prevents leakage from the first loading chamber. After the gate is opened, the tray containing the munition item is pushed into the munition feed tray located in the first loading chamber by an electrically operated ram equipped with sensors to detect misfeeds and other problems. After the tray is inserted, the ram withdraws and the first loading gate is closed and sealed. Next the second feed gate (which is also fitted with inflatable seals to prevent leakage) opens and a hydraulically operated ram pushes the munition into the second loading chamber. The ram is withdrawn and the second loading gate closes.

To transfer the waste military munition (WMM) from the second loading chamber to the SDC, the cradle and fragment valve rotate 90 degrees (°) as a unit. The fragment valve is a round circular plug shaped device that is positioned above the entrance to the SDC to prevent fragments from impacting the second loading chamber. When rotated, the fragment valve moves out of the opening to the SDC and the cradle is aligned discharging the munitions to the SDC. Once the munitions have been delivered to the SDC, the cradle and fragment valve are rotated in the opposite direction, lining up the fragment valve over the opening to the SDC and the cradle to receive the next load. Once over the SDC, a hydraulic piston presses down on the fragment

1 valve to hold it in position. Loading chamber gates are configured and designed to contain
2 detonations or fragments within them equal to the design limit of the rest of the chamber.

3 After the munitions are fed to the inner detonation chamber the items heat resulting in a
4 detonation and/or deflagration. As there is insufficient air contained within the detonation
5 chamber to support complete combustion of the detonation products, the result is a pyrolysis
6 reaction, which breaks down the detonation gases to simple compounds which are then further
7 treated in the OGT System.

8 A description of key equipment is provided below.

9 **Conveyor System:** The conveyor system is electrically powered and consists of a series of
10 conveyors which transport the ammunition trays to the lift, lift which lifts the trays up to loading
11 chamber 1, and electrical pusher which pushes the tray in to loading chamber 1.

12 **Gate 1:** Gate 1 is the inlet hatch to loading chamber 1. It is a sliding gate and operated
13 hydraulically. The gate is sealed gastight with 1 pneumatic seal. An electric pusher is mounted
14 on gate 1 which pushes the package into loading chamber 2.

15 **Gate 2:** Gate 2 is the inlet gate to loading chamber 2. It is a sliding gate and operated
16 hydraulically. The gate is sealed gastight with 2 pneumatic seals. It is designed to withstand
17 explosions up to 6.6 pounds (lbs) trinitrotoluene equivalent.

18 **Loading Chamber 1/2 and Cradle:** Between loading chamber 1 and 2 there is a gastight gate.
19 Loading chamber 2 has a built in hydraulic powered cradle. The cradle is designed to withstand
20 the pressure and the fragments from the detonation chamber. When the tray has been pushed in
21 loading position the cradle turns 90° in clock wise direction and the package falls down into the
22 detonation chamber. The cradle then turns back and a fragment valve provides a fragment shield
23 by means of a hydraulically operated cone that seals off loading chamber 2 against the SDC.
24 Both positions of the cradle may be monitored by cameras so that both a successful loading of
25 the tray and a successful fall into the SDC can be assured.

26 **Destruction of Munitions in the SDC:** The munition is dumped into the detonation chamber
27 and lands on the hot scrap material at the bottom of the chamber. The munitions are heated until,
28 deflagration or detonation and the explosives in the munitions are destroyed. The destruction
29 process is identified either by the dynamic pressure sensor and/or the static pressure sensor,
30 aided by a sound sensor.

31 The heat is generated by heating elements in the space between the chamber and the shell.
32 During the destruction process, pressure and temperature inside the SDC are monitored and
33 recorded in the CON. Heated sweep air is continuously added to the static kiln during operation.
34 The gases from the destruction process will be transferred into and cleaned by the OGT System.

35 To eliminate potential overpressure peaks coming from the SDC, the off gases shall pass through
36 a buffer tank in order to reduce such pressure peaks before the gases are transferred to the
37 downstream OGT System.

1 **Upper Detonation Chamber (UDC):** The upper part of the SDC is mounted to the outlet flange
2 of loading chamber 2. Connections for incoming process air, outlet exhaust gases, temperature
3 sensors and pressure gauges are placed on the SDCs upper part.

4 **Lower Detonation Chamber (LDC):** The lower part of the SDC has an inner fragment shield
5 and an outer chamber. The space between the chamber and scrap chute is filled with insulation.
6 Electrical resistance heating elements are located in the bottom.

7 **Elevating and Turning System:** When emptying the LDC, it is first lowered by the
8 hydraulically powered mechanical lifting jacks that make up the SDC Lifting System (DCLS).
9 The rotation of the LDC is made by a hydraulic motor, connected to the LDC with a chain which
10 makes up the SDC Rotating System (DCRS).

11 **Locking and Sealing System:** The upper and lower parts of the SDC are locked to each other
12 with a locking ring during destruction. The locking ring is maneuvered by two (2) hydraulic
13 cylinders. For the emptying procedure the locking ring is turned to the open position and lower
14 part of the SDC is lowered and turned. The connection between upper and lower part of the
15 SDC is sealed by three (3) pressurized pneumatic gaskets during destruction.

16 **Hydraulic Power Unit:** The hydraulic power unit provides power to operate the elevating and
17 turning system for the SDC (DCLS), tilting unit, gates 1 and 2, locking ring, and pushers. It has
18 a built in backup pump which is driven by the uninterrupted power supply of the SDC facility.

19 **Scrap Chute and Scrap Conveyor:** When operators determine (based on the material being fed)
20 the SDC should be emptied of treated material, the LDC is lowered and then turned 180° so the
21 scrap material can fall down the scrap chute to the scrap conveyor.

22 **Scrap Conveyor System:** Scrap conveyor 1 transports the scrap material to scrap conveyor 2.
23 Scrap conveyor 2 moves the scrap onto the vibration table. Scrap conveyor 1 and 2 are slow
24 moving and allow the scrap to cool to a temperature where the material may be inspected. The
25 vibration table distributes the scrap evenly and delivers it onto the scrap inspection conveyor. It
26 also separates dust from the scrap which is collected underneath in a basket. The scrap
27 inspection conveyor allows visual inspections of WMM after treatment has occurred in the SDC.

28 **Detonation Chamber Air Heater:** The air heater heats the process air. This hot air is led into
29 the SDC to aid the destruction process.

30 **Reserve Flush Tank:** The reserve tank contains the water based solution which may be used to
31 flush loading chamber 1 as needed after any loading sequence. Process air provides the needed
32 pressure to drive the solution into loading chamber 1. When necessary, the solution can be
33 emptied from loading chamber 1 into the SDC for destruction. Otherwise it will flow back into
34 the reserve flush tank.

35 **OGT System:** The OGT System consists of a buffer or equalization tank which smoothes out
36 pressure pulses caused by detonation within the SDC, followed by an orifice which also helps to
37 smooth the flow going to downstream components of the system. Following the orifice, the gas
38 is heated to approximately 2,000°F for at least two (2) seconds, then cooled by a quench
39 followed by a dry scrubber filter and then remaining contaminants are removed by two (2) wet

1 scrubber stages. The last step is a multistage exhaust filtration system, which acts as a safeguard
2 backing up the OGT System before releasing the off gas to the environment. It should be noted
3 that the entire OGT System from the exit of the SDC to the thermal oxidizer is maintained at
4 adequate temperature to reduce condensation. Descriptions of these items are provided below.

5 **Buffer Tank:** This unit is designed to smooth gas pressure and volume surges from the SDC
6 that occur whenever a munition detonates or deflagrates within the SDC. By smoothing surges
7 the design of downstream equipment is simplified and the equipment is better able to operate
8 near its optimum design flow rate. This allows more consistent removal of contaminants. The
9 buffer tank is comprised of a cone bottom cylindrical tank made of stainless steel. The inlet and
10 outlet of the tank is configured in such a way that the tank also acts as a cyclone, allowing the
11 removal of large particles of ash and small metal fragments from detonations. These materials
12 are collected in the bottom of the conical tank section and are periodically and automatically
13 removed using a lock hopper type rotary valve for recycle to the SDC. The entire tank and all
14 piping are maintained at a temperature using electric heaters and insulation.

15 **Orifice:** The orifice plate also helps to smooth the flow of gases presented to downstream
16 equipment. The orifice plate is comprised of a sharp edged orifice located in a stainless steel
17 metal plate which is in turn sandwiched between two (2) pipe flanges. This plate is replaceable
18 if needed, and is also maintained at temperature using electric heaters and insulation.

19 **Process Ventilation Cyclone, Filter, and Fan:** The fan drives the process ventilation for the
20 SDC. The cyclone and filter remove dust from the process ventilation. The dust is transferred to
21 the air mainly from the scrap emptying sequence and the scrap conveyor system.

22 **Thermal Oxidizer:** The off gases resulting from the pyrolysis process in the SDC are transferred
23 to a thermal oxidizer. The thermal oxidizer is designed to accept all gases resulting from one (1)
24 feed cycle to the SDC. The thermal oxidizer is oversized for this peak flow and is actually able
25 to accommodate twice the flow that is anticipated. The OGT is sufficiently designed to
26 accommodate feed rates greater than the design for the SDC.

27 The thermal oxidizer uses natural gas or propane as a fuel to enable the development of the high
28 temperatures required. The thermal oxidizer design is based on a retention time of two (2)
29 seconds or more at approximately 2,000°F for the peak load expected from the upstream SDC.
30 An additional flow of secondary air is automatically added to ensure an oxidizing environment.
31 The gases to be treated are fed tangentially via a ring system to ensure proper treatment of the
32 contaminated gases.

33 **Spray Dryer:** The off gas coming from the thermal oxidizer exits with a temperature of
34 approximately 2,000°F. This off gas is quickly cooled to approximately 350°F by the injection of
35 water into the gas stream. The injected water will evaporate and the energy needed for the
36 evaporation is taken from the off gas so that the gas will rapidly cool. The water injection or
37 quench takes place in a spray dryer that is positioned at the inlet of the next treatment stage, the
38 acid scrubber. The spray dryer uses spent scrubber liquids for the water feed and subsequently
39 evaporates this water, leaving dry salts and particulates for disposal and removing the need for a
40 water treatment system to process spent scrubber solutions. The dry salts and particulates are

1 automatically removed from the bottom of the spray dryer and collected in a container using a
2 rotary lock hopper type valve for disposal.

3 **Bag House Filter:** A bag house filter is located after the spray dryer. This unit is comprised of
4 a filter system where the bags have a layer of absorbent material added to them which is
5 automatically renewed on a periodic basis. Most of the dust and heavy metals are removed in
6 this unit. The removal occurs in a zone on the inside of the bags where an absorbent sodium
7 bicarbonate is added. The ratio of the material may be adjusted to fit the application. The
8 powdered mixture is fed continuously from a hopper by a screw feeder and pneumatic feed
9 system to the bag house where it adds to the layer of spent material on the inside of the bags.
10 This allows a fresh surface to be presented to the incoming gases at all times. Periodically when
11 the pressure drop across the filter exceeds a set point, the bags are emptied using a pulse jet, and
12 the spent solids with the collected process dust is processed through a rotary lock hopper valve
13 into a drum for disposal.

14 **Quench Venturi:** In the next step the air is cooled from approximately 350 to 170°F. This is
15 done with scrubber solution water from the acid scrubber. The water remaining from this step is
16 cooled and recycled to the acid scrubber sump.

17 **Acid Scrubber:** The off gas in the acid scrubber will be further cooled to the operating
18 temperature of the scrubber, which is approximately 150°F. The acid scrubber is a counter
19 current design where the scrubber liquid flows counter current to the gas flow. The acid
20 scrubber will remove several contaminants from the off gas. Initially, dust is removed by
21 washing out solid particles in the washing tower. Acid gases, volatile and semi-volatile heavy
22 metals will also be removed from the off gas. These components will dissolve in the scrubber
23 liquid making it acidic. The scrubber pH will be controlled by a pH controller that ensures that
24 the liquid has a sufficiently high pH value to obtain the necessary concentration gradient to wash
25 the gases. The resistivity of the scrubber liquid will be monitored. In case of a low resistivity
26 value indicating a high dissolved salt content the scrubber liquid will be partly replaced by fresh
27 water. Excess scrubber liquid is then transferred to the spray dryer for evaporation and salt
28 removal. Scrubber liquid is pumped from the bottom of the scrubber column to the top and is
29 distributed inside the column by spray nozzles. The off gas enters the column from a position
30 located just above the column sump and streams from the bottom to top of the column. In order
31 to ensure an adequate mixing and contact between the liquid and the gas, the columns are filled
32 with a column packing material. As a safeguard, the temperature of the off gas inlet will be
33 monitored. In case of a high temperature off gas, due to a quench malfunction, an emergency
34 water injection will be switched on.

35 **Neutral Scrubber:** After the acid scrubber the off gas is fed to the neutral scrubber. The neutral
36 scrubber removes any residual contaminants that passed through the dry and acid scrubbers. The
37 neutral scrubber has the same dimensions and is built using the same construction principles as
38 the acid scrubber. The neutral scrubber also operates with a counter current gas liquid flow. To
39 obtain a good material exchange between the gas and the liquid, a column packing is used.

40 The scrubber liquid is monitored by a pH controller. Two (2) solutions may be used to maintain
41 the proper neutral pH. One (1) is a sodium hydroxide solution and the other is a hydrogen
42 chloride solution. The amount of scrubber liquid in the neutral scrubber is controlled by a level

1 transmitter in the sump of the scrubber column. To obtain a constant quality in the scrubber a
2 continuous waste stream is taken out through the column sump, which goes into the spray dryer.
3 This stream is replaced by fresh caustic solution as needed.

4 **Induced Draft (ID) Fans:** The ID fans are located downstream after the particle filter. The ID
5 fans ensure that the pressure of the off gas is slightly below atmospheric pressure. The pressure
6 is controlled by pressure transmitters. The speed of the ID fans is adjustable by a frequency
7 controller. The control of the pressure ensures that no contaminated off gas above emissions
8 limitations is released into the environment. The ID fans work continuously during the operation
9 of the plant. Two (2) redundant fans are installed. If one (1) fails, the other will automatically
10 take over.

11 **SFU System:** All gases exiting the OGT System are transferred to a final SFU System. The
12 system provides positive backup capacity to the main OGT in the event of system malfunction.
13 The SFU System is an exhaust filtration unit. The exhaust unit is designed and built IAW the
14 requirements by the US Army's Chemical Demilitarization program. The SFU System is
15 designed as a series of filters - prefilter, high-efficiency particulate air (HEPA), charcoal, space,
16 charcoal HEPA, and charcoal (if applicable).

17 The exhaust filter housings are made of stainless steel and are equipped with differential pressure
18 monitors on all filters to ensure adequate flow and to monitor for when a filter needs to be
19 replaced. Filters within the unit use a bag in / bag out system so that the operator changing the
20 filters never comes in contact with the actual filter media. The systems include an ID fan to
21 provide negative pressure in the system to protect against leakage.

22 **Stack:** The stack for discharge of cleaned gases meets the requirements of the American
23 Conference of Governmental Industrial Hygienist industrial ventilation manual.

24 **2.2 SUMMARY OF PROCESS MONITORS AND FLUE GAS ANALYZERS**

25 **2.2.1 Location and Description of the Process Control System**

26 The proper operation of the process control system is necessary to ensure consistent compliance
27 with all RCRA/CAA Permit conditions and safe, efficient operation of the SDC System. The
28 CON is the remote location where the SDC System is normally operated. The CON houses an
29 operator control console, which includes closed-circuit television monitors for observing
30 operations at various locations, as well as emergency shutdown controls. All remote operations,
31 with exception of emergency shutdown, are performed through an operator keyboard using the
32 equipment controls and indications displayed on advisor screens. Processing and sequencing
33 operations are controlled automatically through the programmable logic controller (PLC), which
34 continuously communicates with the operator console in the CON. The automatic control
35 system provides continuous automatic control of the treatment process.

36 The PLC is also connected to a dedicated alarm concentrator that is programmed to continually
37 scan for alarm conditions and to initiate alarms in the CON, alerting the operator of abnormal
38 conditions. The process control software was designed to provide pre-alarms in the CON. These

1 pre-alarms are used to warn the CON operator in time to take corrective action should a process
2 variable approach a waste feed cutoff or equipment shutdown condition.

3 The PDARS logs and notes the time of all abnormal conditions, as well as the starting and
4 stopping of equipment and operator entries. This system is also used to record process data such
5 as temperature, pressure, and waste feed intervals. PDARS records data at varying intervals.
6 The PDARS takes instantaneous readings at a maximum interval of fifteen seconds and records
7 averages on a one (1)-minute basis. All PDARS data collected for RCRA/CAA instrumentation
8 is included in the ANCDF operating record as required by the CAA/RCRA Permits and
9 applicable regulations.

10 **2.2.2 Flue Gas Monitoring**

11 The SDC System flue gases were monitored for select criteria pollutants by facility and TRM
12 CEMS. The facility CEMS monitors the flue gas for CO in the exhaust blower duct and is
13 programmed into the FPI System (See Table 2-1). The TRM CEMS are provided and operated
14 by URS-Austin and monitor the SDC System for SO₂ and NO_x for the duration of the emissions
15 test.

Table 2-1: FPI Conditions for Mustard and Conventional WMM⁽¹⁾

Item No.	Instrument Tag Number	Process Data Description	Range	Parameter
SDC-01	PI 12007	Detonation Chamber Static Pressure Indication	MAX	362 psi
SDC-02	TI 12021	Detonation Chamber Temperature Indication	MIN	1,000°F
SDC-03	TICS 310 AVG	Thermal Oxidizer Temperature	MIN	1,400° F
SDC-04	PICS 310 AVG	Thermal Oxidizer Pressure	MAX	0.0 psi
SDC-05	TICS 320 AVG	Spray Dryer Temperature	MAX	500°F
SDC-06	PDS 33001	Bag-house Differential Pressure	MAX	0.3 psi
SDC-07	FIA 34204	Acid Scrubber Process Flow	MIN	1.0 cfm
SDC-08	FIS 34203	Quench Tower Flow	MIN	0.5 cfm
SDC-09	TIS 34003, 34004	Quench Tower Temperature	MAX	190°F
SDC-10	TIA 37002	Neutral Scrubber Discharge Temperature	MAX	200°F
SDC-11	SDC 038 A/B/C	Chemical Agent Emissions	MAX	0.03 mg/m ³ (instantaneous)
SDC-12	SDC 038 A/B/C	Chemical Agent Emissions	MAX	0.006 mg/m ³ (ROHA)
SDC-13	AAHH-900	CO Concentration	MAX	100 ppmv, dry basis @ 7% O ₂ (ROHA)

Footnote:

- (1) Operational parameter(s) interlock will prohibit the transfer from loading chamber 1 into chamber 2 until all conditions are met or within range.

3.0 TESTING PROGRAM OVERVIEW

This section summarizes the SDC emissions testing objectives, the planned test program, the actual testing performed, and any deviations from the approved ANCDF SDC Emissions Test Plan which is included as Appendix B.

3.1 SDC EMISSIONS TESTING OBJECTIVES

The emissions tests were performed to demonstrate the following objectives as outlined in the ANCDF SDC Emissions Test Plan:

- Demonstrate DRE of $\geq 99.9999\%$ for mustard agent at a feed rate of up to 72 lbs/hr of mustard agent;
- Demonstrate a ROHA ASC of $< 0.006 \text{ mg/m}^3$ and/or instantaneous ASC of $< 0.03 \text{ mg/m}^3$ for mustard agent; and
- Demonstrate that emissions are less than the screening levels established in the HRA.

3.2 PLANNED EMISSIONS TESTING PROGRAM

The purpose of the SDC emissions testing was to demonstrate the objectives discussed under Section 3.1 by executing a minimum of three (3) test runs. The SDC System was operated at normal conditions to confirm the system operating conditions. Normal system data was collected in addition to the specific sampling and analyses performed to determine the DRE and to confirm the efficiency of the SDC System. The sampling matrix for exhaust gas is found in Table 3-1.

3.3 SUMMARY OF ACTUAL TESTING PERFORMED

The actual testing performed was consistent with the planned program as summarized in Section 3.2 and fully described in the approved ANCDF SDC Emissions Test Plan. Table 3-1 provides a summary of the actual testing that was performed. Table 3-2 summarized deviations from the approved ANCDF SDC Emissions Test Plan. The results of the testing are in Section 8 for the exhaust gas emissions.

Table 3-1: Sampling Matrix for Exhaust Gas

Analyte	Sampling Method	Planned	Performed
Traverse Points	US EPA Method 1	Yes	Yes
Flue Gas Velocity	US EPA Method 2	Yes	Yes
Oxygen and Carbon Dioxide	US EPA Methods 3B	Yes	Yes
Moisture	US EPA Method 4	Yes	Yes
Sulfur Dioxide	US EPA Method 6C	Yes	Yes
Nitrogen Oxides	US EPA Method 7E	Yes	Yes
Semivolatile Organics	SW-846 Method 0010	Yes	Yes
Dioxins/Furans	SW-846 Method 0023A	Yes	Yes
Volatile Organics	SW-846 Method 0030	Yes	Yes
Total Organic Compounds	SW-846 Method 0010 and 0040	Yes	Yes
Acid Gases and Particulates	US EPA Method 26A	Yes	Yes
Trace Metals	US EPA Method 29	Yes	Yes
Energetics	US EPA Modified Method 5	Yes	Yes
Carbon Monoxide	US EPA Method 10	Yes	Yes

Table 3-2: Deviations Summary

Test Element	Deviation	Basis and Impact
ANALYTICAL		
SAP/QAPP, Section 6.1.10	The C4aR1 M29 front-half recovery included a more concentrated reagent than specified in the reference method. Specifically, the initial probe rinse was performed with 10% nitric acid in lieu of 0.1N nitric acid.	C4aR1 metals results may be biased high. Though the probe was recovered IAW method requirements after initial use of the 10% nitric acid, use of the more concentrated nitric acid could introduce metals contamination to the front-half fraction. Results are not blank corrected to provide the most conservative emissions estimates.
SAP/QAPP, Table A-3	During C4aR3, excess condensate accumulated in the exhaust duct. This impacted operation MM5E sampling train such that sampling was interrupted prior to completing the run. The TRM CEMS were also interrupted during C4aR3 due to operational difficulty.	No impact. C4aR1, C4aR2, and C4aR4 were completed and analyzed in their entirety. A minimum of three (3) complete exhaust gas sample sets were collected and analyzed.
SAP/QAPP, Table A-6	Exhaust gas analyses were generally performed within all required QC criteria. However, there were some sample analyses where not all SAP/QAPP QC criteria were met. Specific failures are addressed in Section 7.6.	No impact. All reported exhaust gas data is considered usable. There are some results that should be considered estimated. Usability of each sample analysis is discussed in Section 7.6.
SAP/QAPP, Table A-9	A trip blank (aqueous) for the M0040 sampling train was not included with the sample shipment.	Though any potential contamination from shipment of the sample could not be assessed, the reported sample results are not impacted by this circumstance as they are not corrected for trip blank contamination.
General	During C4aR1, C4aR2, and C4aR3, the NO _x TRM CEMS recorded brief periods where the concentration exceeded that of the high standard. [<i>Note: Operation of the TRM CEMS is not directly addressed in the ANCDF SDC Emissions Test Plan.</i>]	Though the C4aR4 data suggests that the C4aR1, C4aR2, and C4aR3 NO _x results remained within the range of the instrument, results that exceeded the span of the analyzer should be considered estimated.

4.0 FEED PROHIBITIVE INTERLOCKS

FPI for the SDC System were established in the approved ANCDF SDC Emissions Test Plan. These FPI, which are presented in Table 2-1, were identified to ensure emissions do not exceed the performance standards as stated in RCRA Permit Condition V.D.3 and continuously monitored and recorded by the PDARS (see Appendix A). The PDARS data consist of one (1)-minute values calculated from the average of four (4) 15-second readings. Data recorded or calculated by the PDARS includes the average, minimum, and maximum values collected for each FPI parameter and are summarized in Table 4-1.

4.1 FEED RATES

Table 4-2 presents a summary of the chemical agent and energetic feed rates for each test run. The average chemical agent feed rate was 33.41, 30.96, and 36.31 lbs/hr for C4aR1, C4aR2, and C4aR4, respectively, with a condition average of 33.56 lbs/hr using an average destruction timer of 16 minutes.

4.2 EXHAUST GAS PARAMETERS

During the SDC emissions testing, monitoring of all exhaust gas parameters was conducted. These parameters included the exhaust gas parameters listed in Table 3-1 and the key process parameters identified in Table 2-1. Results of the exhaust gas sampling, including emission rates and key process parameter data are presented in Section 8. The following subsections present results for exhaust gas temperature and velocity, air pollution control equipment (APCE) parameters, and CO concentrations and rates.

4.2.1 Exhaust Gas Temperature

The detonation chamber and thermal oxidizer temperatures were continuously measured and recorded using temperature indicating controller as summarized in Table 4-1.

4.2.2 Exhaust Gas Velocity

The detonation chamber flow rate was continuously measured and recorded using a pressure indicating sensor as summarized in Table 4-1.

4.2.3 APCE Control Parameters

The key APCE parameters for the SDC System are listed in Table 2-1. Each of the key APCE parameters was continuously measured and recorded during each test run as summarized in Table 4-1.

4.2.4 CO Concentration

The CO concentration was continuously monitored and recorded using a facility CEMS using an analyzing indication transmitter which provides the data from the monitor of record. As summarized in Table 4-1, all recorded values are expressed as ppmv, dry basis and corrected to 7% O₂.

4.3 FUGITIVE EMISSION SOURCES

The SDC System, excluding the SFU, is housed in a sprung structure. The primary means of controlling fugitive emissions from the SDC System is by maintaining the thermal oxidizer at a pressure that is below the room or structure pressure in which it is located. The average of the

- 1 average thermal oxidizer pressures recorded were approximately -0.064 psi for C4a.
- 2 Additionally, the sprung structure that houses the SDC System is maintained at a negative
- 3 pressure with respect to the atmosphere by regulating the exhaust blower.

Table 4-1: Summary of FPI Conditions

Parameter/Description	Instrument Tag Number	Range	Units	Statistic	C4aR1	C4aR2	C4aR4	Average
SDC-FPI-01 Detonation Chamber Pressure	PISA 12007	< 362	psi	Minimum	4.54	3.25	2.80	3.53
				Maximum	10.81	16.12	9.54	12.15
				Average	6.57	5.64	4.10	5.44
SDC-FPI-02 Detonation Chamber Temperature	TICSA 12021	> 1,000	°F	Minimum	1,449.00	1,449.29	1,449.58	1,449.29
				Maximum	1,450.67	1,450.67	1,450.59	1,450.64
				Average	1,450.05	1,450.01	1,450.01	1,450.02
SDC-FPI-03 Thermal Oxidizer Temperature	TIC 31001, 31002, and 31003	> 1,400	°F	Minimum	1,759.77	1,771.66	1,772.50	1,767.97
				Maximum	1,916.85	1,983.64	1,941.79	1,947.42
				Average	1,806.48	1,805.50	1,809.25	1,807.08
SDC-FPI-04 Thermal Oxidizer Pressure	PIC 31006, 31007, and 31008	< 0.0	psi	Minimum	-0.120	-0.188	-0.098	-0.135
				Maximum	-0.033	0.055 ⁽¹⁾	0.0080 ⁽¹⁾	0.010 ⁽¹⁾
				Average	-0.071	-0.056	-0.065	-0.064
SDC-FPI-05 Spray Dryer Temperature	TIC 32009, 32010, and 32011	< 500	°F	Minimum	314.28	308.38	319.03	313.90
				Maximum	339.09	345.54	344.30	342.98
				Average	330.03	329.98	329.54	329.85
SDC-FPI-06 Bag House Pressure	PDS 33001	< 0.3	psi	Minimum	0.030	0.020	0.030	0.027
				Maximum	0.183	0.180	0.170	0.178
				Average	0.105	0.116	0.100	0.107
SDC-FPI-07 Acid Scrubber Flow Rate	FIS 34204	> 1.0	cfm	Minimum	3.17	3.17	3.16	3.17
				Maximum	3.55	3.56	3.54	3.55
				Average	3.25	3.26	3.24	3.25
SDC-FPI-08 Quench Tower Flow Rate	FIS 34203	> 0.5	cfm	Minimum	2.69	2.69	2.69	2.69
				Maximum	2.89	2.88	2.88	2.89
				Average	2.84	2.84	2.84	2.84

Table 4-1: Summary of FPI Conditions (Continued)

Parameter/Description	Instrument Tag Number	Range	Units	Statistic	C4aR1	C4aR2	C4aR4	Average
SDC-FPI-09 Quench Tower Temperature	TI 34004	< 190	°F	Minimum	158.70	154.17	159.22	157.36
				Maximum	164.43	163.16	165.42	164.34
				Average	160.67	158.98	161.16	160.27
SDC-FPI-09 Quench Tower Temperature	TI 34003	< 190	°F	Minimum	158.57	154.21	159.01	157.26
				Maximum	163.92	162.74	165.04	163.90
				Average	160.41	158.76	160.95	160.04
SDC-FPI-10 Neutral Scrubber Temperature	TIA 37002	< 200	°F	Minimum	174.94	174.65	175.00	174.86
				Maximum	180.85	181.35	182.42	181.54
				Average	178.35	178.19	178.76	178.43
SDC-13 CO Concentration	AAHH-900	< 100 (ROHA)	ppmv (dry basis @ 7% O ₂)	Minimum	0.14	0.14	0.14	0.14
				Maximum	0.64	7.42	9.01	5.69
				Average	0.19	0.99	0.52	0.57

Footnote:

- (1) An FPI(s) occurred; however, activation of FPI SDC-04 did not prevent feeding of the next tray as it occurred during the feed/destruction interval.

Table 4-2: Summary of Tray Weights and Time Intervals

Run	Sampling Time/Port	Tray	105mm HD M57 Mortars			Entered DC (hr:min)	Interval (minutes)	
			Mortars/tray	HD Agent (lbs/tray)	Energetics (lbs/tray)			
C4aR1	Conditioning	1	4	11.88	1.04	13:38	---	
	Conditioning	2	4	11.88	1.04	14:43	65	
	Not Included	3	3	8.91	0.78	15:54	71	
	Port 1	4	4	3	8.91	0.78	16:21	27
		5	5	3	8.91	0.78	16:36	15
		6	6	3	8.91	0.78	16:52	16
		7	7	3	8.91	0.78	17:06	14
		8	8	3	8.91	0.78	17:21	15
		9	9	3	8.91	0.78	17:36	15
		10	10	3	8.91	0.78	17:51	15
		11	11	3	8.91	0.78	18:06	15
		12	12	3	8.91	0.78	18:20	14
	Conditioning	13	3	8.91	0.78	19:59	99	
	Port 2	14	14	3	8.91	0.78	20:14	15
		15	15	3	8.91	0.78	20:29	15
		16	16	3	8.91	0.78	20:44	15
		17	17	3	8.91	0.78	20:59	15
		18	18	3	8.91	0.78	21:14	15
		19	19	3	8.91	0.78	21:29	15
		20	20	3	8.91	0.78	21:43	14
	21	21	3	8.91	0.78	22:05	22	
C4aR1 Average:			3	8.91	0.78	---	16.0	
33.41 lbs/hr HD agent and 2.9 lbs/hr energetics								
C4aR2	Conditioning	1	4	11.88	1.04	13:55	---	
	Conditioning	2	4	11.88	1.04	14:16	21	
	Not Included	3	3	8.91	0.78	15:04	48	
	Port 1	4	4	3	8.91	0.78	15:18	14
		5	5	3	8.91	0.78	15:34	16
		6	6	3	8.91	0.78	15:49	15
		7	7	3	8.91	0.78	16:03	14
		8	8	3	8.91	0.78	16:19	16
		9	9	3	8.91	0.78	16:37	18
		10	10	3	8.91	0.78	17:09	32
	Conditioning	11	3	8.91	0.78	19:31	142	
	Port 2	12	12	3	8.91	0.78	19:46	15
		13	13	3	8.91	0.78	20:05	19
		14	14	3	8.91	0.78	20:21	16
		15	15	3	8.91	0.78	20:38	17
		16	16	3	8.91	0.78	20:53	15
		17	17	3	8.91	0.78	21:08	15
		18	18	3	8.91	0.78	21:24	16
		19	19	3	8.91	0.78	21:45	21
C4aR2 Average:			3	8.91	0.78	---	17.3	
30.96 lbs/hr HD agent and 2.7 lbs/hr energetics								

Table 4-2: Summary of Tray Weights and Time Intervals (Continued)

Run	Sampling Time/Port	Tray	105mm HD M57 Mortars			Entered DC (hr:min)	Interval (minutes)	
			Mortars/tray	HD Agent (lbs/tray)	Energetics (lbs/tray)			
C4aR4	Conditioning	1	4	11.88	1.04	10:25	---	
	Conditioning	2	4	11.88	1.04	11:04	39	
	Conditioning	3	4	11.88	1.04	11:34	30	
	Not Included	4	3	8.91	0.78	12:21	47	
	Port 1		5	3	8.91	0.78	12:38	17
			6	3	8.91	0.78	12:53	15
			7	3	8.91	0.78	13:09	16
			8	3	8.91	0.78	13:23	14
			9	3	8.91	0.78	13:38	15
			10	3	8.91	0.78	13:52	14
			11	3	8.91	0.78	14:06	14
			12	3	8.91	0.78	14:20	14
			13	3	8.91	0.78	14:32	12
	Conditioning	14	3	8.91	0.78	15:24	52	
	Port 2		15	3	8.91	0.78	15:39	15
			16	3	8.91	0.78	15:55	16
			17	3	8.91	0.78	16:10	15
			18	3	8.91	0.78	16:24	14
			19	3	8.91	0.78	16:38	14
			20	3	8.91	0.78	16:53	15
			21	3	8.91	0.78	17:10	17
			22	3	8.91	0.78	17:23	13
			23	3	8.91	0.78	17:38	15
C4aR4 Average:			3	8.91	0.78	---	14.7	
36.31 lbs/hr HD agent and 3.2 lbs/hr energetics								

5.0 EXHAUST GAS SAMPLING

URS-Austin collected all exhaust gas samples during C4a. The sampling locations were selected to yield representative samples for the stream being collected.

The exhaust blower duct sampling location was accessed through flanged ports in the duct between the exhaust blower and stack. The inner diameter of the exhaust blower duct was measured prior to testing and determined to be 12 in at the sampling location. This sampling location was downstream of any online OGT equipment and evaluated prior to testing by M1 and M2 for representativeness. Figure 5-1 presents the traverse point locations for the exhaust blower duct. Eight (8) -point tests were conducted during each isokinetic test run. The M0030 and M0040 sampling trains were collected from the ports that were situated nearest to the stack, with each probe located at a single point within the duct. The TRM CEMS probe was located at the same port set used by the M0030 sampling train.

This section describes the procedures that were followed during the field sampling program. Throughout the overall program, US EPA-approved sampling protocols were utilized. The remainder of this section is divided into three (3) subsections: Field Program Description, Pre-Sampling Activities, and Sampling Methods.

5.1 FIELD PROGRAM DESCRIPTION

C4a consisted of four (4) test runs. C4aR3 was archived and will not be summarized in this report. The exhaust gas test methods that were utilized are as follows:

- M1: “*Sample Velocity Traverse for Stationary Sources*,” 40 Code of Federal Regulations (CFR) Part 60, Appendix A;
- M2: “*Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)*,” 40 CFR Part 60, Appendix A;
- M3B: “*Gas Analysis for the Determination of Emission Rate Correction Factor or Excess Air*,” 40 CFR Part 60, Appendix A;
- M4: “*Determination of Moisture Content in Stack Gases*,” 40 CFR Part 60, Appendix A;
- M6C: “*Determination of Sulfur Dioxide Emissions from Stationary Sources*,” 40 CFR Part 60, Appendix A;
- M7E: “*Determination of Nitrogen Oxide Emissions from Stationary Sources*,” 40 CFR Part 60, Appendix A;
- M10: “*Determination of Carbon Monoxide Emissions from Stationary Sources*,” 40 CFR Part 60, Appendix A;
- M0010: “*Modified Method 5 Sampling Train*,” EPA 600/8-85-003;
- M0010-TOC: “*Guidance for Total Organics*,” EPA 600/R-96-033;

- 1 • M0023A: “*Determination of Polychlorinated Dibenzo-p-Dioxins and*
2 *Polychlorinated Dibenzofurans from Stationary Sources*,” EPA 600/8-85-003;
- 3 • M0030: “*Volatile Organic Sampling Train and the Protocol for the Collection*
4 *and Analysis of Volatile POHCs Using VOST*,” EPA 600/8-85-003;
- 5 • M0040: “*Sampling of Principal Organic Hazardous Constituents from*
6 *Combustion Sources Using Tedlar Bags*,” EPA 600/8-85-003;
- 7 • M26A: “*Determination of Hydrogen Halide and Halogen Emissions from*
8 *Stationary Sources*,” 40 CFR Part 60, Appendix A. [**NOTE:** *Particulates were*
9 *determined from this train as well.*]
- 10 • M29: “*Determination of Metals Emissions from Stationary Sources*,” 40 CFR
11 Part 60, Appendix A; and
- 12 • MM5E: “*Determination of Particulate Emissions from Stationary Sources*,” 40
13 CFR Part 60, Appendix A. [**NOTE:** *This method was modified to determine*
14 *energetic constituents. The modified method, Revision 1.05, was submitted to*
15 *ADEM for review and was approved for use.*]

16 **5.2 PRESAMPLING ACTIVITIES**

17 Presampling activities included equipment calibration, sample media preparation, and
18 precleaning of the sample train glassware. Each of these activities are described or referenced in
19 the following subsections. Other presampling activities included team meetings and
20 conferences, equipment packing, equipment setup, and finalization of all details leading up to the
21 coordinated initiation of the sampling program.

22 **5.2.1 Equipment Calibration**

23 A program of positive actions was followed to prevent the failure of equipment or instruments
24 during use. Maintenance and calibration were employed to ensure accurate measurements from
25 the field and laboratory instruments.

26 Equipment scheduled for field use was cleaned and checked prior to calibration, as appropriate.
27 General readiness of the equipment entailed a visual inspection of the meter boxes, sample hot
28 boxes, probes, and umbilicals for dust, oil, or dirt in lines, and loose fittings and connections. An
29 adequate supply of spare parts was taken to the field to minimize downtime due to equipment
30 failure.

31 Equipment calibration was conducted IAW the procedures outlined in US EPA documents
32 entitled “*Quality Assurance Handbook for Air Pollution Measurement Systems; Volume III -*
33 *Stationary Source Specific Methods*” (EPA 600/4-77-0276). All required calibrations were
34 performed prior to the test program, with post-test calibrations performed as required.
35 Documentation of pretest calibrations was kept in the project file during the field effort and
36 copies provided to the regulatory observers prior to the start of the emissions tests. The
37 calibration procedures for the equipment are summarized in Table 5-1. Copies of the equipment

1 calibration forms for process control equipment, facility CEMS, and exhaust gas sampling
2 equipment can be found in Appendix D.

3 **5.2.2 Glassware Preparation**

4 Prior to field use, sample train glassware was subjected to method-specific cleaning procedures
5 in order to minimize sample contamination. Cleaning and storage procedures for sampling train
6 glassware were IAW the procedures summarized in the Sampling and Analysis Plan
7 (SAP)/Quality Assurance Project Plan (QAPP). Sample bottles were purchased pre-cleaned and
8 sealed to specified US EPA protocols. Sample bottles were fitted with Teflon[®] cap liners.

9 **5.2.3 Sample Media Preparation**

10 Reagents used for the testing program were of sufficient grade or quality to meet or exceed
11 method requirements. This included the use of spectro-grade solvents from the same lot, when
12 possible, and the collection and analysis of the appropriate blanks. Deionized (DI) reagent water
13 used in all organic sampling trains was of a grade and quality that was demonstrated to be
14 “organic-free” as per SW-846 requirements.

15 Resin used in the M0010, M0010-TOC, M0023A, and MM5E sampling trains was prepared and
16 certified clean by TestAmerica. The sorbent traps were loaded with resin at the laboratories with
17 the openings packed with cleaned glass wool to ensure no resin would be lost. Field surrogates
18 were added by the laboratory prior to shipping, as required. The M0030 traps were conditioned
19 by the laboratory IAW procedures specified in M0030.

20 **5.3 SAMPLING METHODS**

21 On-site sampling activities included the equipment staging in the field, sampling operations, data
22 logging (except where noted below), and sample recovery. Copies of field sampling data sheets
23 can be found in Appendix C.

24 Each isokinetic test run had a total sample time of 240 minutes (two (2) ports at
25 120 minutes/port). The M0030 sampling train, which is non-isokinetic, was operated for a total
26 of 160 minutes (40 minutes/set of traps). The non-isokinetic M0040 sampling train was operated
27 to collect two (2) one (1)-hour bag samples. The M3B (non-isokinetic composite sample) was
28 sampled by a separate pumping system operated in conjunction with an isokinetic sampling train.

29 **5.3.1 US EPA Methods 1 and 2**

30 Velocity traverses were conducted at the exhaust blower duct sampling location with an S-type
31 pitot assembly IAW M1 and M2. An S-type pitot tube with an attached inclined manometer was
32 used to measure the gas velocities. An attached Type-K thermocouple with remote digital
33 display was used to determine the exhaust gas temperature.

34 Prior to commencing sampling, a preliminary determination of exhaust gas velocity and
35 volumetric flow rate was performed to assist in selecting the correct nozzle diameter to ensure all
36 isokinetic testing requirements were met. During the actual sampling, exhaust gas velocity, and
37 volumetric flow rate measurements were conducted with each isokinetic sampling train. The

1 required number of sampling traverse points for each sampling location was determined
2 following M1. Pitot tubes were leak-checked before and after each test run.

3 Exhaust duct static pressure measurements, as required by M2, were recorded manually once per
4 run. This static pressure reading was used to calculate stack gas volumetric flow rate for each
5 isokinetic sampling train.

6 A cyclonic flow check was conducted at the sampling location prior to testing IAW Section 11.4
7 of M1. This procedure was used to ensure the flow was not “swirling” at the sampling location.
8 The equipment used consisted of an S-type pitot tube connected to an inclined manometer to
9 measure the duct’s differential pressure, and an angle finding device (i.e., leveled angle finder for
10 horizontal ports or delineated port plate for vertical ports). The pitot tube was positioned at each
11 traverse point so that the face openings of the pitot tube were perpendicular to the exhaust duct
12 cross-sectional plane. This position is called the zero reference. If the velocity pressure reading
13 was zero, the cyclonic angle was recorded as 0°. If the velocity pressure reading was not zero,
14 the pitot tube was rotated clockwise or counterclockwise until the velocity pressure reading
15 became zero. This angle was then measured and reported to the nearest degree. After this
16 technique was applied at each traverse point, the average of the absolute values of the cyclonic
17 angles was calculated. This average was < 20° and the flow conditions in the source were
18 deemed acceptable to test.

19 **5.3.2 US EPA Method 3B**

20 O₂ and CO₂ concentrations were determined during each test run using a bag sampling system
21 IAW M3B. The exhaust gas was collected in an evacuated Tedlar bag. These samples were
22 collected in conjunction with an isokinetic sampling train representing each traverse point within
23 the exhaust duct. One (1) sample was collected for each run.

24 Analysis was conducted using an Orsat combustion gas analyzer. A sample from the Tedlar bag
25 from each run was drawn into the analyzer and analyzed onsite for the concentrations of CO₂ and
26 O₂ on a percentage basis. Analysis and calculation procedures were repeated until the individual
27 dry molecular weights for any three (3) analyses differed from their mean by no more than
28 0.3 gram per gram-mole (g/g-mole) (0.3 pound per pound-mole (lb/lb-mole)). To determine the
29 actual O₂ and CO₂ concentrations for each run, the resulting three (3) acceptable readings for
30 each parameter were averaged. These average results were then used by all isokinetic sampling
31 trains in the determination of the exhaust gas molecular weight. In addition, the O₂
32 concentrations were used for correcting emissions, as applicable, to 7% O₂.

33 **5.3.3 US EPA Method 4**

34 Prior to the test runs, during preliminary measurements, an initial exhaust gas moisture
35 measurement was performed IAW M4. This method is applicable for the determination of the
36 moisture content of stack gas. A gas sample was extracted at a constant rate from the duct, and
37 the moisture removed from the gas stream by a series of chilled impingers. The amount of the
38 collected moisture was then determined gravimetrically and used in the calculation of percent
39 moisture. M4 was used in conjunction with M0010, M0010-TOC, M0023A, M26A, M29, and
40 MM5E for the determination of moisture at the sampling location. The weight gain for each

1 sample train's impinger configuration was recorded and used in the exhaust gas moisture
2 determination calculation.

3 **5.3.4 US EPA Method 6C**

4 SO₂ was determined during each test run using redundant TRM CEMS. A run exceeding four
5 (4) hours was completed for each test run. This allowed for parsing of the data such that it would
6 correspond with the actual times each port was sampled by the isokinetic sampling trains.

7 A logbook was kept and calibrations, quality assurance (QA)/quality control (QC) activities,
8 routine maintenance, and repair activities were documented for the SO₂ testing. Activities
9 related to the pre-test checks (calibration drift/error and response time tests) were also recorded.
10 All data related to SO₂ sampling and the pre-test activities were logged using the Data
11 Acquisition System (DAS).

12 The TRM CEMS was calibrated IAW M6C. In general, the QA/QC measures included the use
13 of US EPA protocol calibration gases, pre- and post-test run calibrations, calibration error, and
14 bias tests. Copies of the certifications for the gas standards, documentation of all TRM CEMS
15 QA/QC procedures, and results summaries of the TRM CEMS QC are provided in Appendix D.

16 **5.3.5 US EPA Method 7E**

17 NO_x was determined during each test run using redundant TRM CEMS. A run exceeding four
18 (4) hours was completed for each test run. This allowed for parsing of the data such that it would
19 correspond with the actual times each port was sampled by the isokinetic sampling trains.

20 A logbook was kept and calibrations, QA/QC activities, routine maintenance, and repair
21 activities were documented for the NO_x testing. Activities related to the pre-test checks
22 (calibration drift/error and response time tests) were also recorded. All data related to NO_x
23 sampling and the pre-test activities were logged using the DAS and/or the digital strip chart
24 recorder.

25 The TRM CEMS was calibrated IAW M7E. In general, the QA/QC measures included the use
26 of US EPA protocol calibration gases, a converter check, pre- and post-test run calibrations,
27 calibration error, and bias tests. Copies of the certifications for the gas standards, documentation
28 of all TRM CEMS QA/QC procedures, and results summaries of the TRM CEMS QC are
29 provided in Appendix D.

30 **5.3.6 SW-846 Method 0010**

31 A sampling train was used to measure and determine the emission rate of the semivolatile
32 product of incomplete combustion (PICs) and tentatively identified compounds (TICs) IAW
33 M0010. Table 5-2 summarizes the exhaust gas characteristics measured by the M0010 sampling
34 train.

35 The sampling train consisted of a heated, glass-lined probe with a glass button-hook nozzle, and
36 a heated Teflon[®] transfer line. A thermocouple and S-type pitot tube with an inclined
37 manometer were attached to the probe for measurement of gas temperature and velocity. The

1 sample gas passed through the probe to a heated, glass fiber filter. The probe and the filter
2 holder were maintained at 248°F plus or minus (\pm) 25°F throughout each test period.
3 Downstream of the heated filter, the gas passed through a heated Teflon[®] transfer line to a water-
4 cooled condenser module, then through a sorbent module containing resin. The heated Teflon[®]
5 transfer line was maintained at 248°F \pm 25°F throughout each test period. The temperature of the
6 exhaust gas entering the resin module was kept below 68°F. The gas then passed through a
7 series of ice-cooled impingers kept below 68°F to enable condensation and collection of
8 entrained moisture.

9 The first impinger, acting as a condensate reservoir (knockout) connected to the outlet of the
10 resin module, was modified with a short stem IAW method requirements. The next two (2)
11 impingers each contained 100-milliliter (mL) of DI water. The second DI water-filled impinger
12 was equipped with a Greenburg-Smith impinger stem. The fourth impinger was empty, and the
13 fifth impinger was loaded with indicating silica gel. All connections within the train were glass
14 or Teflon[®]. No sealant greases were used. A dry gas meter, pump, and calibrated orifice meter
15 followed the impingers. The M0010 sampling train configuration is depicted in Figure 5-2.

16 A M0010 sample was collected over a four (4)-hour sampling period for each test run. Sampling
17 was isokinetic (90 to 110%) with readings of exhaust gas and necessary sampling parameters
18 recorded six (6) times (6X) for each of the eight (8) sampling points.

19 Leak checks of the entire M0010 sampling train were performed prior to the start of sampling,
20 during port changes, and at the completion of sampling. All leak checks and leakage rates were
21 documented on the relevant field test data sheet. The acceptance standard for the M0010
22 sampling train was a leak rate of less than or equal to (\leq) 0.02 cubic feet per minute (cfm)
23 performed at the highest vacuum reached during the period since the previous leak check. Pitot
24 tubes were also successfully leak checked, both prior to and after sampling.

25 Following the completion of each test run (including final leak check), the M0010 sampling train
26 was disassembled at the sampling location, partially recovered, and transported to a recovery
27 trailer onsite. The sample recovery sequence is detailed on the field sampling log for the
28 sampling train found in Appendix C. Each M0010 train resulted in the following sample
29 fractions - front-half (probe, heated Teflon[®] transfer line, nozzle, front-half glassware) recovery
30 rinse, filter, back-half (back-half filter holder and condenser) recovery rinse, resin module,
31 condensate, and first impinger condensate and rinse.

32 **5.3.7 SW-846 Method 0010 for TOCs**

33 A sampling train was used to measure and determine the emission rate of the semi- and
34 nonvolatile TOCs IAW M0010. Table 5-2 summarizes the exhaust gas characteristics measured
35 by the M0010-TOC sampling train.

36 This train was run in conjunction with the M0040 which yielded the volatile portion for the
37 TOC. The methods provide for the sampling and analysis of total organics from stack gas
38 emissions, combining the organics from three (3) specific boiling point/vapor pressure ranges:
39 light hydrocarbons and volatile organics, semivolatile organics, and nonvolatile organics. Two
40 (2) sampling procedures and four (4) analytical techniques were combined to generate a value for

1 total organics. The mass of organics that remain after correction for the identified organics, from
2 SW-846 methodologies, is called residual organic carbon. This mass is used in estimating risk
3 from unidentified organic emissions.

4 The sampling train consisted of a heated, glass-lined probe with a glass button-hook nozzle, and
5 a heated Teflon[®] transfer line. A thermocouple and S-type pitot tube with an inclined
6 manometer were attached to the probe for measurement of gas temperature and velocity. The
7 sample gas passed through the probe to a heated, glass fiber filter. The probe and the filter
8 holder were maintained at 248°F ± 25°F throughout each test period. Downstream of the heated
9 filter, the gas passed through a heated Teflon[®] transfer line to a water-cooled condenser module,
10 then through a sorbent module containing resin. The heated Teflon[®] transfer line was
11 maintained at 248°F ± 25°F throughout each test period. The temperature of the exhaust gas
12 entering the resin module was kept below 68°F. The gas then passed through a series of
13 ice-cooled impingers kept below 68°F to enable condensation and collection of entrained
14 moisture.

15 The first impinger, acting as a condensate reservoir (knockout) connected to the outlet of the
16 resin module, was modified with a short stem IAW method requirements. The next two (2)
17 impingers each contained 100-mL of DI water. The second DI water-filled impinger was
18 equipped with a Greenburg-Smith impinger stem. The fourth impinger was empty, and the fifth
19 impinger was loaded with indicating silica gel. All connections within the train were glass or
20 Teflon[®]. No sealant greases were used. A dry gas meter, pump, and calibrated orifice meter
21 followed the impingers. The M0010-TOC sampling train configuration is depicted in Figure 5-2
22 (the same train configuration as M0010).

23 A M0010-TOC sample was collected over a four (4)-hour sampling period during each
24 emissions test. Sampling was isokinetic (90 to 110%) with readings of exhaust gas and
25 necessary sampling parameters recorded 6X for each of the eight (8) sampling points.

26 Leak checks of the entire M0010-TOC sampling train were performed prior to the start of
27 sampling, during port changes, and at the completion of sampling. All leak checks and leakage
28 rates were documented on the relevant field test data sheet. The acceptance standard for the
29 M0010-TOC sampling train was a leak rate of ≤ 0.02 cfm performed at the highest vacuum
30 reached during the period since the previous leak check. Pitot tubes were also successfully leak
31 checked, both prior to and after sampling.

32 Following the completion of each test run (including final leak check), the M0010-TOC
33 sampling train was disassembled at the sampling location, partially recovered, and transported to
34 a recovery trailer onsite. The sample recovery sequence is detailed on the field sampling log for
35 the sampling train found in Appendix C. Each M0010-TOC train resulted in the following
36 sample fractions -front-half (probe, heated Teflon[®] transfer line, nozzle, front-half glassware)
37 recovery rinse, filter, resin module, condensate, and back-half rinse.

1 **5.3.8 SW-846 Method 0023A**

2 A sampling train was used to measure and determine the emission rate of the dioxins/furans IAW
3 M0023A. Table 5-2 summarizes the exhaust gas characteristics for dioxins/furans measured by
4 the M0023A sampling trains.

5 The sampling train consisted of a heated, glass-lined probe with a glass button-hook nozzle, and
6 a heated Teflon[®] transfer line. A thermocouple and S-type pitot tube with an inclined
7 manometer were attached to the probe for measurement of gas temperature and velocity. The
8 sample gas passed through the probe to a heated, glass fiber filter. The probe and the filter
9 holder were maintained at 248°F ± 25°F throughout each test period. Downstream of the heated
10 filter, the gas passed through a heated Teflon[®] transfer line to a water-cooled condenser module,
11 then through a sorbent module containing resin. The heated Teflon[®] transfer line was
12 maintained at 248°F ± 25°F throughout each test period. The temperature of the exhaust gas
13 entering the resin module was kept below 68°F. The gas then passed through a series of
14 ice-cooled impingers kept below 68°F to enable condensation and collection of entrained
15 moisture.

16 The first impinger, acting as a condensate reservoir (knockout) connected to the outlet of the
17 resin module, was modified with a short stem IAW method requirements. The next two (2)
18 impingers each contained 100-mL of DI water. The second DI water-filled impinger was
19 equipped with a Greenburg-Smith impinger stem. The fourth impinger was empty, and the fifth
20 impinger was loaded with indicating silica gel. All connections within the train were glass or
21 Teflon[®]. No sealant greases were used. A dry gas meter, pump, and calibrated orifice meter
22 followed the impingers. The M0023A sampling train configuration is depicted in Figure 5-2 (the
23 same train configuration as M0010).

24 A M0023A sample was collected over a four (4)-hour sampling period during each emissions
25 test. Sampling was isokinetic (90 to 110%) with readings of exhaust gas and necessary sampling
26 parameters recorded 6X for each of the eight (8) sampling points.

27 Leak checks of the entire M0023A sampling train were performed prior to the start of sampling,
28 during port changes, and at the completion of sampling. All leak checks and leakage rates were
29 documented on the relevant field test data sheet. The acceptance standard for the M0023A
30 sampling train was a leak rate of ≤ 0.02 cfm performed at the highest vacuum reached during the
31 period since the previous leak check. Pitot tubes were also successfully leak checked, both prior
32 to and after sampling.

33 Following the completion of each test run (including final leak check), the M0023A sampling
34 train was disassembled at the sampling location, partially recovered, and transported to a
35 recovery trailer onsite. The sample recovery sequence is detailed on the field sampling log for
36 the sampling train found in Appendix C. Each M0023A train resulted in the following sample
37 fractions: -front-half (probe, heated Teflon[®] transfer line, nozzle, front-half glassware) recovery
38 rinse, filter, back-half rinse, and resin module.

1 **5.3.9 SW-846 Method 0030**

2 The M0030 was used to determine emission rates of the volatile PICs and TICs in the exhaust
3 gas. M0030 procedures and QA/QC requirements as described in M0030 were followed. The
4 M0030 sampling system is a non-isokinetic sampling train, and sampling rates are predetermined
5 based on desired run times.

6 Table 5-3 summarizes the exhaust gas characteristics measured by the M0030 sampling train.
7 Approximately twenty liters were collected through each set of traps at a sampling rate of
8 approximately 0.5 liters per minute (L/min). Four (4) sets of traps were collected for each test
9 run. The condensate was collected at the end of the run. A diagram of the sampling train is
10 presented in Figure 5-3.

11 Handling precautions were followed to reduce the potential for contamination of the resin.
12 Tenax resin is susceptible to contamination. The resin stock was thermally desorbed under
13 helium and stored either sealed in the collection traps or under helium. A packed trap was
14 desorbed to serve as a laboratory blank prior to placing the batch of Tenax traps in the field. The
15 laboratory prepared sufficient sealed blank traps in sealed containers for the M0030 sampling.
16 Four (4) pairs of traps and a condensate sample were collected during each test run. One (1) pair
17 of field blanks were collected for each test run, and one (1) pair of trip blanks were provided for
18 each shipping container containing M0030 samples being shipped to the laboratory. M0030 data
19 is reported in Section 8, uncorrected for any field blank contamination.

20 **5.3.10 SW-846 Method 0040**

21 A M0040 sampling train was used to measure and determine the emission rates of volatile TOCs
22 IAW M0040. Table 5-3 summarizes the exhaust gas characteristics measured by the M0040
23 sampling train.

24 The methods provide for the sampling and analysis of total organics from stack gas emissions,
25 combining the organics from three (3) specific boiling point/vapor pressure ranges: light
26 hydrocarbons and volatile organics, semi-volatile organics, and nonvolatile organics. Two (2)
27 sampling procedures and four (4) analytical techniques were combined to generate a value for
28 total organics. The mass of organics that remain after correction for the identified organics, from
29 SW-846 methodologies, is called residual organic carbon. This mass will be used in estimating
30 risk from unidentified organic emissions.

31 The M0040 sampling train consisted of a glass-lined probe, a heated glass or Teflon[®] filter
32 holder and quartz filter attached to one (1) of two (2) inlets of a glass and Teflon[®] three (3)-way
33 isolation valve. The second valve inlet was connected to a charcoal trap to filter incoming air
34 when releasing system pressure after leak checks. The outlet of the isolation valve was
35 connected to a glass, water-cooled, coil-type condenser and a glass condensate trap for the
36 removal and collection of condensable liquids present in the gas stream. A Teflon[®] transfer line
37 connected the condensate trap to a second three (3)-way isolation valve and the isolation valve to
38 a Tedlar bag contained in a rigid, air-tight container for sampling, storage and transport. The bag
39 container was connected to a control console with a Teflon[®] vacuum line between the bag
40 container and the control console to protect the console and sampling personnel from hazardous

1 emissions in case of a bag rupture during sampling. The M0040 sampling train configuration is
2 depicted in Figure 5-4.

3 Leak checks of the entire M0040 train were performed before and after each sampling run. In
4 the event any portion of the train was disassembled and reassembled, leak checks were
5 performed prior to disassembling the train and again upon reassembly. All leak checks and
6 leakage rates were documented on the relevant field test data sheets.

7 Two (2) Tedlar bag gas samples were collected per run with approximately 40 liters of sample
8 collected into each Tedlar bag at a flow rate of approximately 0.65 L/min. A daily field blank
9 was also collected. Each run produced the following samples - Tedlar bag sample 1, condensate
10 sample 1, Tedlar bag sample 2, condensate sample 2, Tedlar bag field blank (only one (1) per
11 day), and condensate field blank (only one (1) per day).

12 A field control spike was conducted using one (1) bag during one (1) of the sampling runs for
13 each condition. The field control spikes consisted of a known concentration of a target
14 compound (propane) injected directly into the Tedlar bag of a field sample.

15 **5.3.11 US EPA Method 26A**

16 A sampling train was used to measure and determine the emission rate of the acid gases IAW
17 M26A. Table 5-2 summarizes the exhaust gas characteristics measured by the M26A sampling
18 train.

19 The sampling train consisted of a heated, glass-lined probe with a glass button-hook nozzle, and
20 a Teflon[®] transfer line. A thermocouple and S-type pitot tube with an inclined manometer were
21 attached to the probe for measurement of gas temperature and velocity. The sample gas passed
22 through the probe to a heated filter. The probe and the filter holder were maintained at greater
23 than or equal to 248°F throughout each test period. The gas then passed through a series of six
24 (6) ice-cooled impingers kept below 68°F to enable condensation and collection of entrained
25 moisture.

26 The first impinger served as a moisture knockout and contained 50 mL of 0.1 normal (N) sulfuric
27 acid (H₂SO₄). The next two (2) impingers contained 100 mL of 0.1N H₂SO₄. The fourth and
28 fifth impingers contained 100 mL of 0.1N sodium hydroxide (NaOH). The sixth impinger
29 contained a pre-weighed amount of silica gel. The impingers were followed by a dry gas meter
30 pump and calibrated orifice meter. The M26A sampling train configuration is depicted in
31 Figure 5-5.

32 A M26A sample was collected over a four (4)-hour sampling period for each emissions test.
33 Sampling was isokinetic (90 to 110%) with readings of exhaust gas and necessary sampling
34 parameters recorded 6X for each of the eight (8) sampling points.

35 Leak checks of the entire M26A sampling train were performed prior to the start of sampling,
36 during port changes, and at the completion of sampling. All leak checks and leakage rates were
37 documented on the relevant field test data sheet. The acceptance standard for the M26A
38 sampling train was a leak rate of ≤ 0.02 cfm performed at the highest vacuum reached during the

1 period since the previous leak check. Pitot tubes were also successfully leak checked, both prior
2 to and after sampling.

3 Following the completion of each test run (including the final leak check), the filter and filter
4 housing was visually inspected to verify that there was no moisture present and that a purge with
5 filtered air was not required. The sample recovery sequence is detailed on the field sampling log
6 for the sampling train found in Appendix C. Each M26A train resulted in the following sample
7 fractions - filter, front-half solvent rinse, 0.1N H₂SO₄ impinger catches, and 0.1N NaOH
8 impinger catches.

9 **5.3.12 US EPA Method 29**

10 A sampling train was used to measure and determine the emission rate of the trace metals IAW
11 M29. Table 5-2 summarizes the exhaust gas characteristics measured by the M29 sampling
12 train.

13 The sampling train consisted of a heated glass-lined probe with a glass button-hook nozzle, and a
14 Teflon[®] transfer line. A thermocouple and S-type pitot tube with an inclined manometer were
15 attached to the probe for measurement of gas temperature and velocity. The sample gas passed
16 through the probe to a heated filter. The probe and the filter holder were maintained at 248°F ±
17 25°F throughout each test period. Downstream of the heated filter, the gas passed through a
18 series of seven (7) ice-cooled impingers kept below 68°F to enable condensation and collection
19 of entrained moisture.

20 The first impinger was empty and served as a moisture knockout. The second and third
21 impingers contained 100 mL of a 5% nitric acid (HNO₃)/10% hydrogen peroxide (H₂O₂)
22 solution. The fourth impinger was empty. The fifth and sixth impingers contained 100 mL of a
23 4% potassium permanganate (KMnO₄)/10% H₂SO₄ solution. The seventh impinger contained a
24 pre-weighed amount of silica gel. The impingers were followed by a dry gas meter, pump, and
25 calibrated orifice meter. The M29 sampling train configuration is depicted in Figure 5-6.

26 A M29 sample was collected over a four (4)-hour sampling period for each emissions test.
27 Sampling was isokinetic (90 to 110%) with readings of exhaust gas and necessary sampling
28 parameters recorded 6X for each of the eight (8) sampling points.

29 Leak checks of the entire M29 sampling train were performed prior to the start of sampling,
30 during port changes, and at the completion of sampling. All leak checks and leakage rates were
31 documented on the relevant field test data sheet. The acceptance standard for the M29 sampling
32 train was a leak rate of ≤ 0.02 cfm performed at the highest vacuum reached during the period
33 since the previous leak check. Pitot tubes were also successfully leak checked, both prior to and
34 after sampling.

35 Following the completion of each test run (including final leak check), the M29 sampling train
36 was disassembled at the sampling location, partially recovered, and transported to a recovery
37 trailer onsite. The sample recovery sequence is detailed on the field sampling log for the
38 sampling train found in Appendix C. Each M29 train resulted in the following sample fractions -
39 filter, probe nozzle and front-half filter housing 0.1N HNO₃ rinse, back-half filter housing and

1 0.1N HNO₃ impinger catch (impingers 1, 2, and 3), impinger 4 - 0.1N HNO₃ rinse (empty),
2 impingers 5 and 6 - acidified KMnO₄ impinger catch, and impingers 5 and 6 hydrogen chloride
3 (HCl) rinse.

4 **5.3.13 US EPA Modified Method 5**

5 A sampling train was used to measure and determine the emission rate of target energetic
6 compounds IAW MM5E. Table 5-2 summarizes the exhaust gas characteristics measured by the
7 MM5E sampling train.

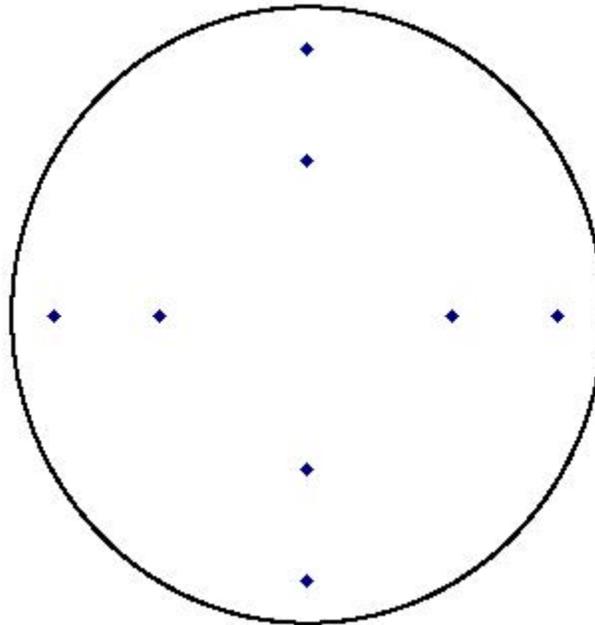
8 The sampling train consisted of a heated, glass-lined probe with a glass button-hook nozzle and a
9 heated sample line. A thermocouple and S-type pitot tube attached to an inclined manometer
10 were attached to the probe for measurement of gas temperature and velocity measurement. The
11 sample gas passed through the probe assembly to a heated filter. The probe, filter holder, and
12 transfer line were maintained at 248°F ± 25°F throughout each test period. Downstream of the
13 heated filter, the gas passed through a heated sample line and then through a series of three (3)
14 ice-cooled impingers kept below 68°F to enable condensation of entrained moisture. The first
15 impinger had a short stem and was charged with 50 mL of DI water to serve as the primary
16 condensate knockout. The second and third impingers were empty. After passing through the
17 first three (3) impingers, the sample gas passed through a two (2) section sorbent module. Each
18 section of the module contained approximately 10 grams of resin separated by a glass wool plug.
19 The gas then passed through a fourth ice-cooled impinger (empty) and finally through a fifth
20 impinger containing a preweighed amount of silica gel. All connections within the train were
21 glass or Teflon[®]. No sealant greases were used. The impingers were followed by a dry gas
22 meter, pump, and calibrated orifice meter. The MM5E sampling train configuration is depicted
23 in Figure 5-7.

24 A MM5E sample was collected over a four (4)-hour sampling period for each emissions test.
25 Sampling was isokinetic (90 to 110%) with readings of exhaust gas and necessary sampling
26 parameters recorded 6X for each of the eight (8) sampling points.

27 Leak checks of the entire MM5E sampling train were performed prior to the start of sampling,
28 during port changes, and at the completion of sampling. All leak checks and leakage rates were
29 documented on the relevant field test data sheet. The acceptance standard for the MM5E
30 sampling train was a leak rate of ≤ 0.02 cfm performed at the highest vacuum reached during the
31 period since the previous leak check. Pitot tubes were also successfully leak checked, both prior
32 to and after sampling.

33 Following the completion of each test run (including final leak check), the MM5E sampling train
34 was disassembled at the sampling location, partially recovered, and transported to a recovery
35 trailer onsite. The sample recovery sequence is detailed on the field sampling log for the
36 sampling train found in Appendix C. Each MM5E train resulted in the following sample
37 fractions - front-half rinse and filter, impingers 1, 2, 3, and 4 condensate and rinsate, and resin
38 module.

Figure 5-1: Traverse Point Locations for the SDC Exhaust Duct



Traverse Point	Fraction of Diameter	Distance From Wall (inches)
1	6.7	0.804
2	25	3.0
3	75	9.0
4	93.3	11.2

Note: Traverse point locations are recorded on a field log sheet provided in Appendix C.

Figure 5-2: SW-846 Methods 0010 and 0023A Sampling Train

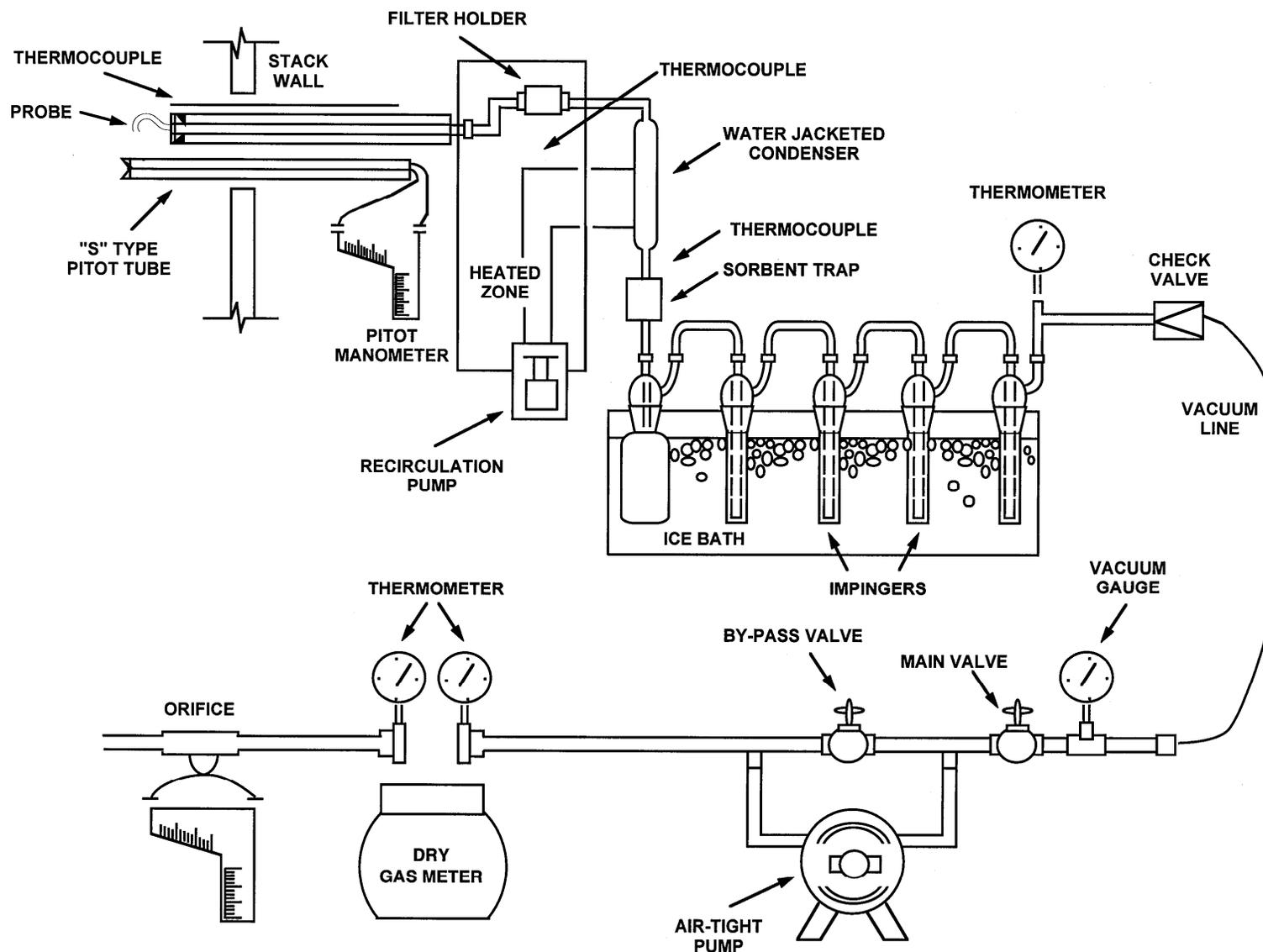


Figure 5-3: SW-846 Method 0030 Sampling Train

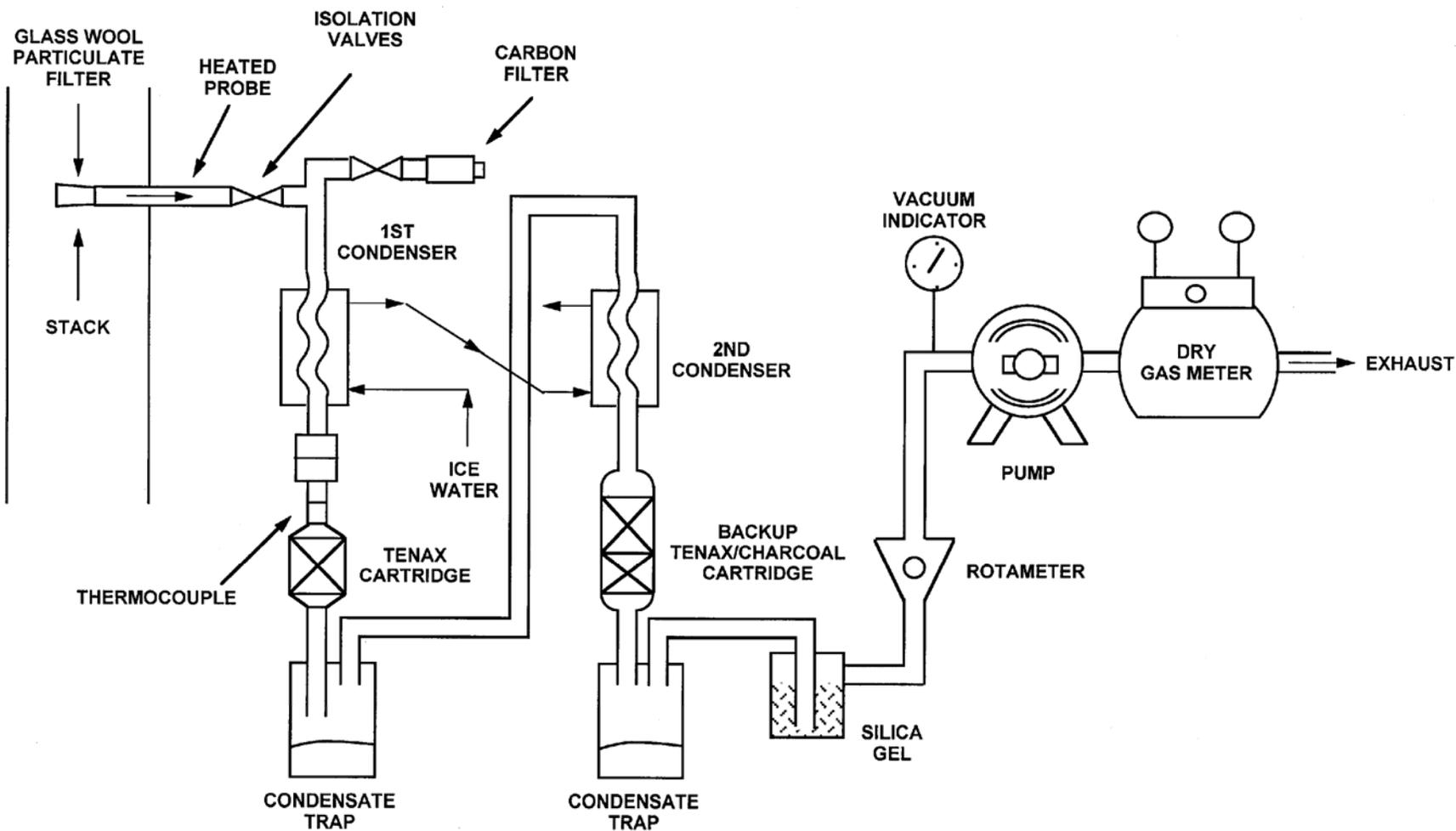


Figure 5-4: SW-846 Method 0040 Sampling Train

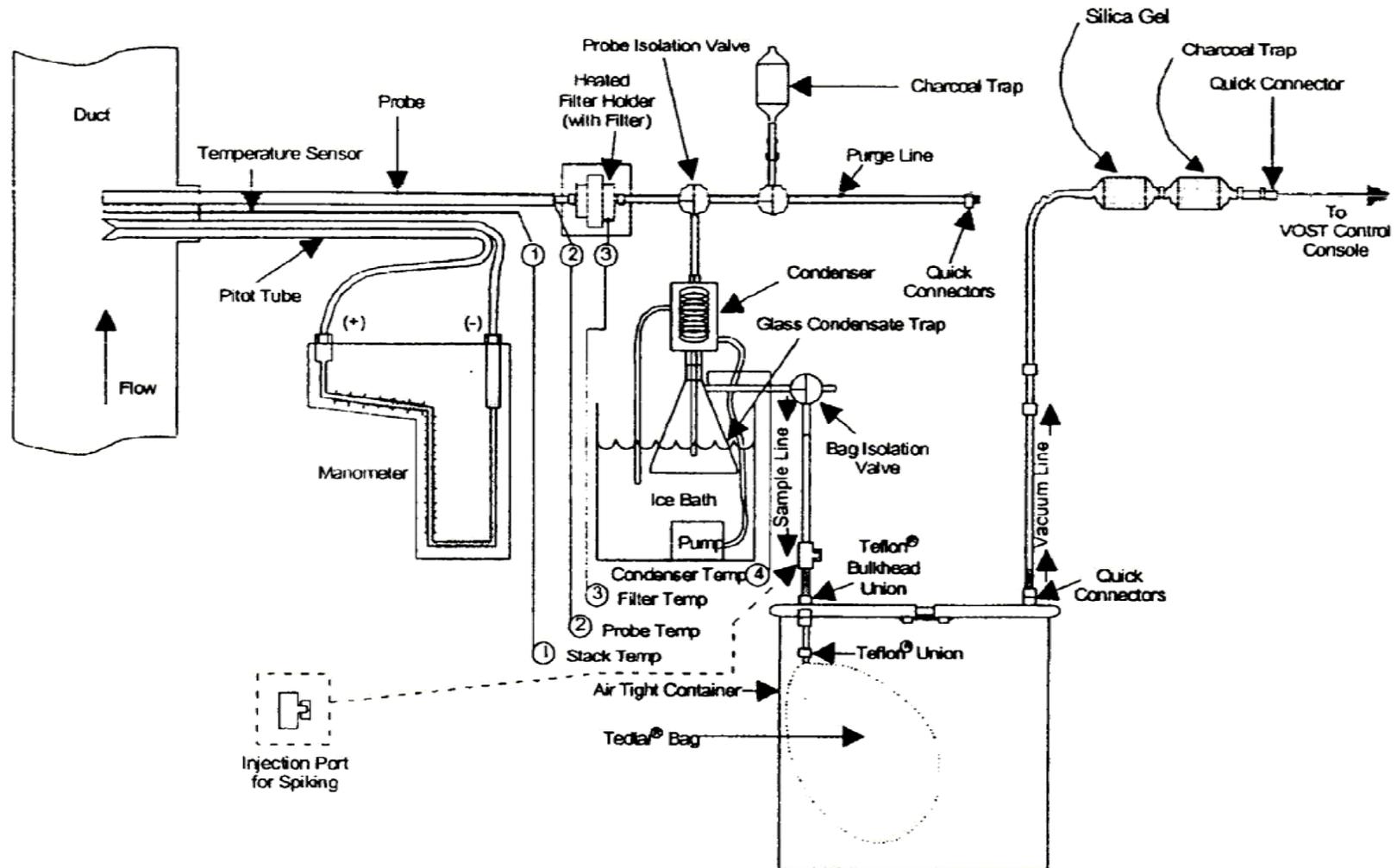


Figure 5-5: US EPA Method 26A Sampling Train

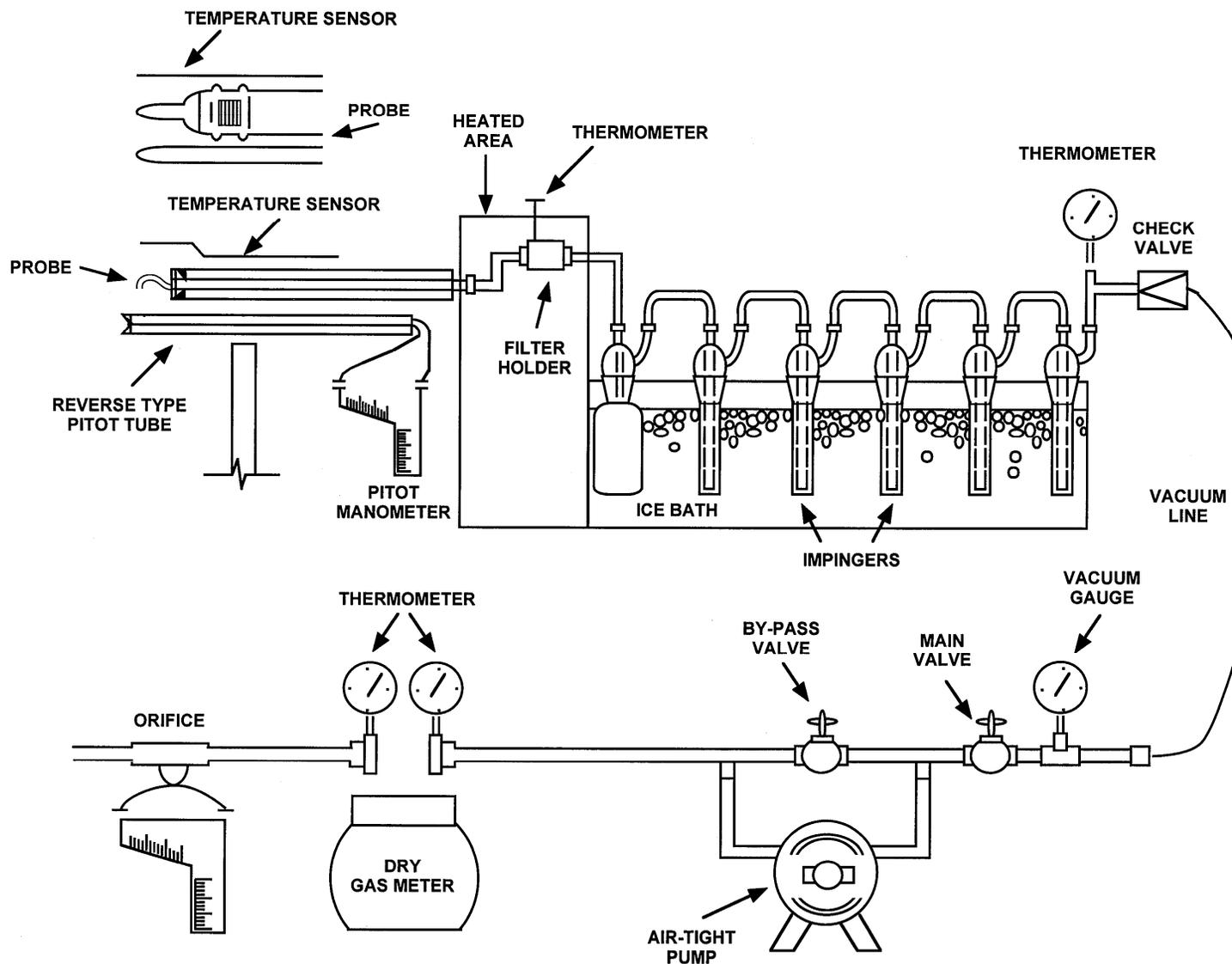


Figure 5-6: US EPA Method 29 Sampling Train

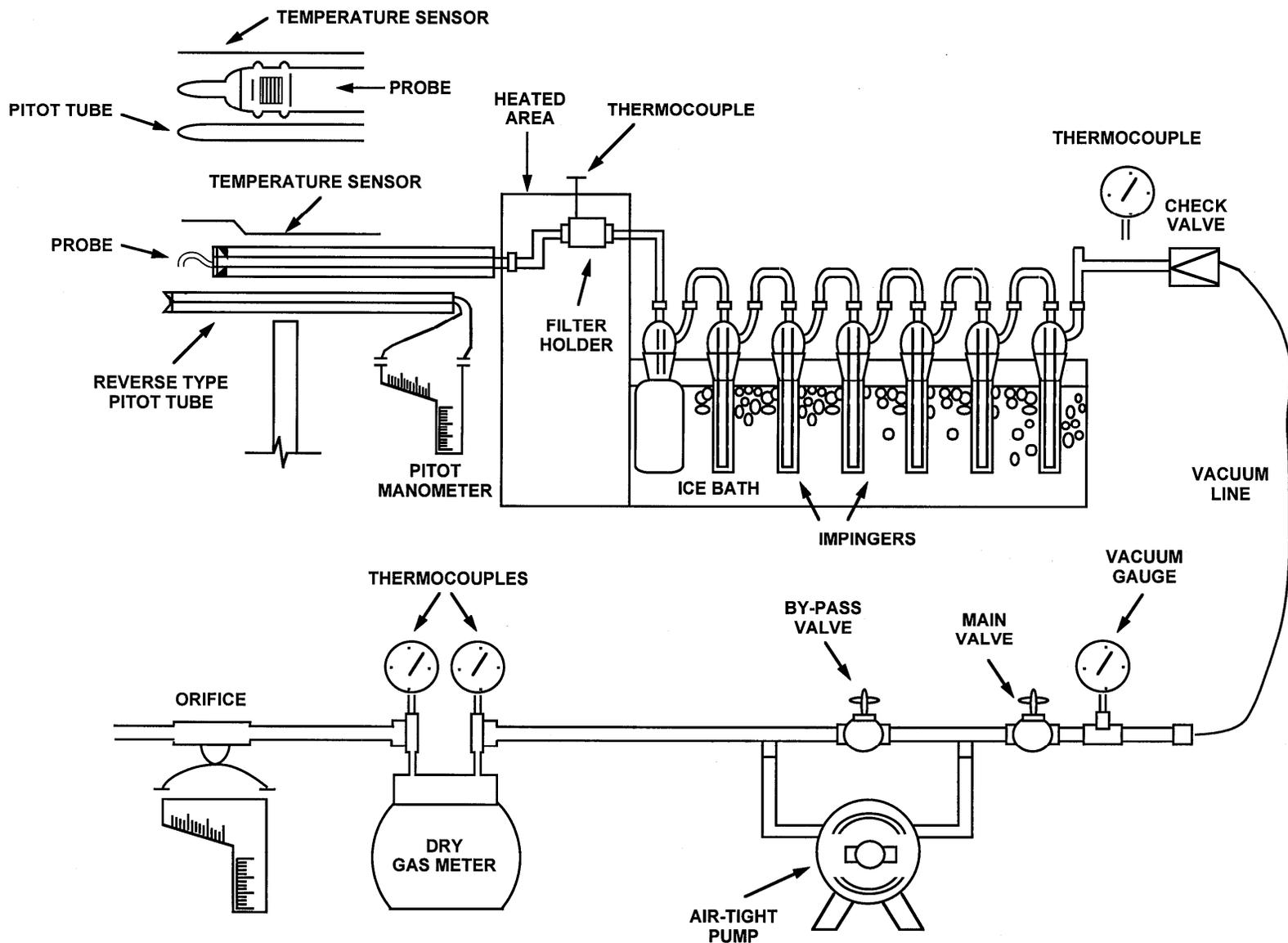


Figure 5-7: US EPA Modified Method 5 for Energetics Sampling Train

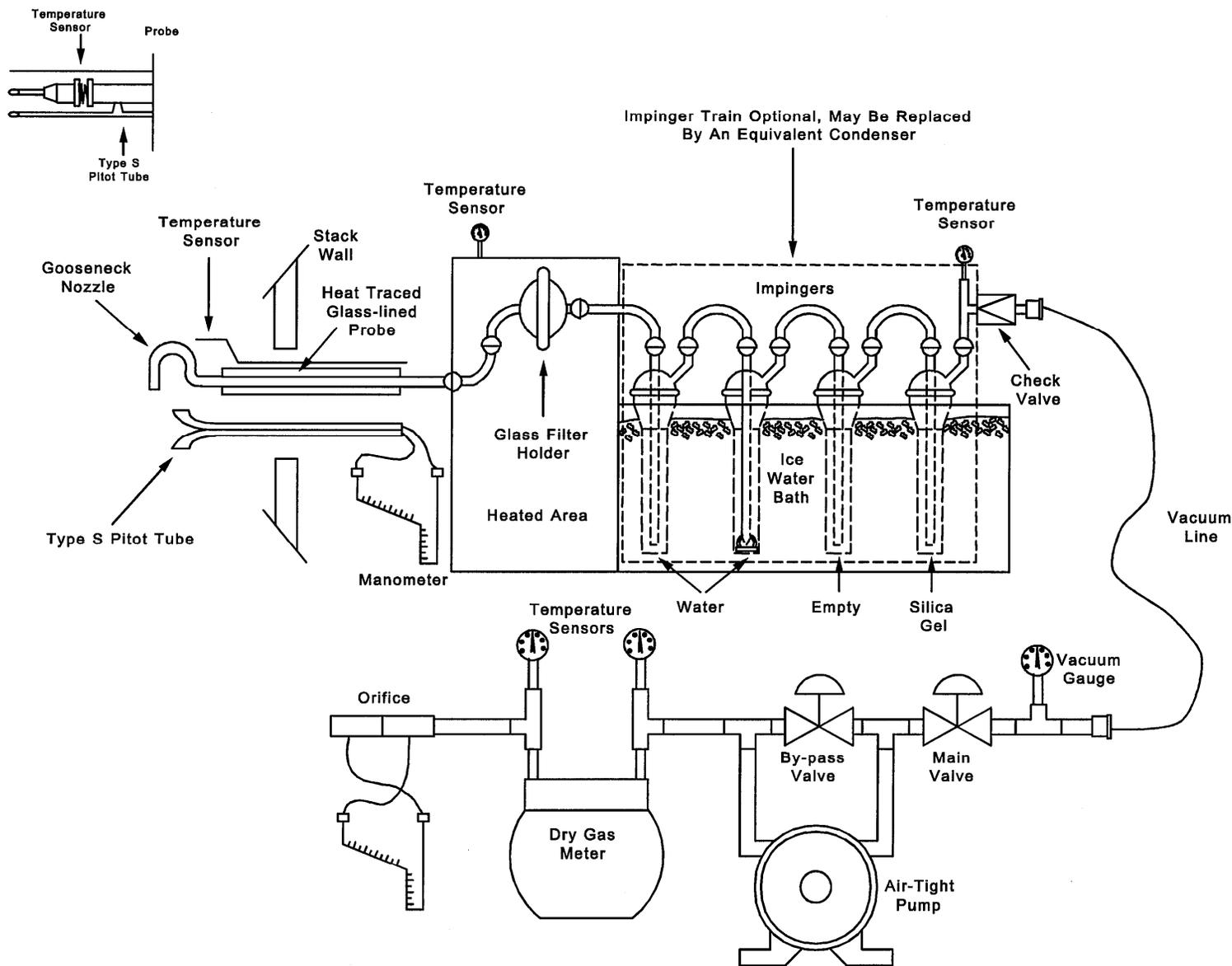


Table 5-1: Calibration Procedures for Equipment

Equipment	Reference	Procedure	Frequency
Probe Nozzles	QA Handbook, Volume III, Section 3.4.2, page 19	Measured three (3) internal diameters of the nozzle to 0.001 inches and averaged. Acceptance criteria: the difference between high and low values ≤ 0.004 inches.	Every nozzle prior to use and post-test physical inspection.
Pitot tubes	QA Handbook Volume III, Section 3.1.2, pages 1 to 13	Initial calibration in a wind tunnel. Measured for appropriate spacing and dimensions when utilized in probe configuration. Rejection criteria given on the calibration sheet.	Post-test inspection for damage to the sensing heads. Calibration verification performed using geometric configuration prior to subsequent test events.
Thermocouples	QA Handbook, Volume III, Section 3.4.2, pages 12 to 18 and ALT Method 011	Verified against a mercury-in-glass thermometer at three (3) points including the anticipated measurement range. Acceptance criteria: <ul style="list-style-type: none"> • impinger $\pm 2^\circ\text{F}$ • dry gas meter $\pm 5.4^\circ\text{F}$ • stack $\pm 1.5\%$ of stack temperature 	Initial calibration conducted using three (3) temperature points. Calibration verification performed using a single temperature point prior to subsequent test events.
Dry gas meters, Isokinetic sampling consoles	US EPA 40 CFR Part 60, Method 5, Section 10.3.1	Calibrated against a secondary standard dry gas meter or using a critical orifice set. Acceptance criteria: <ul style="list-style-type: none"> • pre-test: $Y_i = Y \pm 0.02$ • post-test: $Y_i = Y \pm 0.05$ 	Initial calibration performed using a secondary standard dry test meter. Post calibration and initial calibration of subsequent test events performed with a secondary standard dry test meter or critical orifice set.
Dry gas meters, Non-isokinetic sampling consoles		Calibrated against a standard bubble meter. Acceptance criteria: <ul style="list-style-type: none"> • pre-test: $Y_i = Y \pm 0.02$ • post-test: $Y_i = Y \pm 0.05$ 	
Analytical balances	QA Handbook, Volume III, Section 3.4.2, page 19	Calibrated with Standard Class-S weights within ± 0.001 gram of stated value. Corrective action: have manufacturer re-calibrate or adjust.	Calibrated yearly by manufacturer. Calibration verification performed using Class-S weights daily prior to using the balance.
Field Top Loader Balance	QA Handbook, Volume III, Section 3.4.2, page 19	Calibrated with Standard Class-S weights within ± 1 gram of stated value. Corrective action: have manufacturer re-calibrate or adjust.	Calibrated yearly by manufacturer. Calibration verification performed using Class-S weights daily prior to using the balance.
Probe Heating System	US EPA 40 CFR Part 60, Method 5, Section 10.4	Capable of maintaining $120 \pm 14^\circ\text{C}$ ($248 \pm 25^\circ\text{F}$)	Periodic checks of calibrated thermocouple readout during sampling.
	SW-846 Method 0031	Capable of maintaining $>131^\circ\text{C}$	
	SW-846 Method 0040	Capable of maintaining between 130 and 140°C	

Table 5-2: Isokinetic Sampling Train Summary

Parameter	Units	C4aR1	C4aR2	C4aR4	Average
SW-846 Method 0010					
Sample Volume	dscf	145.206	141.197	127.291	137.90
Exhaust Gas Flow Rate	dscfm	710	689	608	669.00
Exhaust Gas Temperature	°F	181.9	179.0	179.0	179.97
Exhaust Gas Moisture	%	30.82	28.99	30.56	30.12
Isokinetics	%	99.61	99.21	102.58	100.47
SW-846 Method 0010 for Total Organic Compounds					
Sample Volume	dscf	137.899	134.549	125.910	132.79
Exhaust Gas Flow Rate	dscfm	692	682	615	663.00
Exhaust Gas Temperature	°F	180.9	178.8	178.1	179.27
Exhaust Gas Moisture	%	30.49	28.78	30.43	29.90
Isokinetics	%	98.67	97.79	101.39	99.28
SW-846 Method 0023A					
Sample Volume	dscf	141.902	135.831	120.966	132.90
Exhaust Gas Flow Rate	dscfm	685	671	575	643.67
Exhaust Gas Temperature	°F	181.7	179.5	179.3	180.17
Exhaust Gas Moisture	%	30.98	29.20	31.25	30.48
Isokinetics	%	100.25	98.65	102.42	100.44
US EPA Method 26A					
Sample Volume	dscf	144.980	134.088	122.149	133.74
Exhaust Gas Flow Rate	dscfm	712	671	590	657.67
Exhaust Gas Temperature	°F	181.1	178.3	178.1	179.17
Exhaust Gas Moisture	%	30.82	29.00	30.72	30.18
Isokinetics	%	99.76	97.81	101.36	99.64
US EPA Method 29					
Sample Volume	dscf	136.283	129.737	121.925	129.32
Exhaust Gas Flow Rate	dscfm	659	653	576	629.33
Exhaust Gas Temperature	°F	179.1	176.7	175.6	177.13
Exhaust Gas Moisture	%	30.82	28.51	30.74	30.02
Isokinetics	%	101.32	97.28	102.57	100.39
US EPA Modified Method 5					
Sample Volume	dscf	143.190	130.379	126.312	133.29
Exhaust Gas Flow Rate	dscfm	709	655	589	651.00
Exhaust Gas Temperature	°F	182.8	179.9	179.9	180.87
Exhaust Gas Moisture	%	30.97	29.23	30.91	30.37
Isokinetics	%	98.92	97.56	104.97	100.48

Table 5-3: Non-Isokinetic Sampling Train Summary

Parameter	C4aR1			C4aR2			C4aR4		
Barometric Pressure (inHg)	29.16			29.20			29.12		
M0030 Meter Calibration Factor	1.004			1.004			1.004		
M0030 Collection Time (hours)	Tube A: 1625-1705 hrs Tube B: 1712-1752 hrs Tube C: 2015-2055 hrs Tube D: 2102-2142 hrs			Tube A: 1525-1605 hrs Tube B: 1612-1652 hrs Tube C: 1950-2030 hrs Tube D: 2037-2117 hrs			Tube A: 1240-1320 hrs Tube B: 1327-1407 hrs Tube C: 1545-1625 hrs Tube D: 1632-1712 hrs		
Tube Pairs	Sample Volume (L, dry)	Temp. (°F)	Corrected Volume (dsL)	Sample Volume (L, dry)	Temp. (°F)	Corrected Volume (dsL)	Sample Volume (L, dry)	Temp. (°F)	Corrected Volume (dsL)
Tube A	20.08	96.00	18.66	19.76	95.13	18.42	20.18	96.63	18.71
Tube B	19.81	102.50	18.20	21.32	100.88	19.67	20.34	103.00	18.64
Tube C	19.70	84.75	18.69	20.18	89.38	19.00	20.60	99.38	19.00
Tube D	20.29	90.50	19.04	19.81	94.75	18.48	19.56	103.63	17.91
Totals	---	---	74.59	---	---	75.56	---	---	74.25
Barometric Pressure (inHg)	29.16			29.20			29.12		
Average Delta H (inwc)	1.3			1.3			1.3		
M0040 Meter Calibration Factor	1.001			1.001			1.001		
M0040 Collection Time (hours)	Bag A: 1638-1738 hrs Bag B: 2015-2115 hrs Field Blank: 2213-2313 hrs			Bag A: 1540-1640 hrs Bag B: 1959-2059 hrs Field Blank: 1203-1303 hrs			Bag A: 1350-1450 hrs Bag B: 1559-1659 hrs Field Blank: 1147-1247 hrs		
Tube Pairs	Sample Volume (L, dry)	Temp. (°F)	Corrected Volume (dsL)	Sample Volume (L, dry)	Temp. (°F)	Corrected Volume (dsL)	Sample Volume (L, dry)	Temp. (°F)	Corrected Volume (dsL)
Bag A	27.22	102.2	25.021	29.23	107.8	26.639	28.75	108.5	26.099
Bag B	29.43	88.0	27.754	27.24	95.2	25.392	29.56	104.4	27.031
Field Blank	30.14	90.7	28.284	27.14	97.5	25.195	28.71	98.3	26.540

6.0 ANALYTICAL PROCEDURES

The analytical program that was performed in support of C4a of the SDC Emissions Test consisted of the analysis of exhaust gas samples. The program used US EPA analytical methods, project-specific procedures, and laboratory-specific procedures as specified in the SAP/QAPP. A complete copy of all the analytical laboratory deliverables is located in Appendix F.

6.1 SUMMARY OF ON-SITE ANALYTICAL PROCEDURES

6.1.1 O₂ and CO₂

M3B sampling was performed to determine O₂ and CO₂ concentrations by collecting an integrated bag sample that was analyzed using an Orsat analyzer. One (1) integrated bag sample was collected during each run in conjunction with an isokinetic sampling train. Each sample was analyzed and the resulting O₂ and CO₂ values were used for all sampling trains. Each sample was collected at a constant rate resulting in a total sample volume. All Tedlar bags were leak checked prior to use.

The Orsat analyzer was successfully leak-checked prior to analysis of each sample IAW the procedures in M3B. The Orsat accuracy was checked with ambient air on a daily basis and with cylinder audits once during each condition. Two (2) cylinders, each containing different CO₂ and O₂ concentrations were used to conduct each audit. Results of the cylinder audits are recorded on the field data sheets provided in Appendix C.

6.1.2 SO₂

SO₂ concentration was determined during each test run using a TRM CEMS operated IAW M6C. The quality of data generated by this TRM CEMS was evaluated by conducting system performance checks before testing began, by conducting calibration checks during each test run, and reviewing all data records obtained during the initial instrument performance evaluation.

During each test run, the zero and span checks of the monitors were considered verification of the quality of data received. Data was reported on one (1)-minute intervals and was archived in the TRM CEMS data acquisition system. The calibration gas used to calibrate the instrument conformed to the US EPA *Traceability Protocol for Assay and Certification of Gaseous Calibration Standards* (RTI/6960/208-01F).

6.1.3 NO_x

NO_x concentration was determined during each test run using a TRM CEMS operated IAW M7E. The quality of data generated by this TRM CEMS was evaluated by conducting system performance checks before testing began (i.e., stratification check, interference check, and NO₂ to NO conversion efficiency), by conducting calibration checks during each test run, and reviewing all data records obtained during the initial instrument performance evaluation.

During each test run, the zero and span checks of the monitors were considered verification of the quality of data received. Data was reported on one (1)-minute intervals and was archived in the TRM CEMS data acquisition system. The calibration gas used to calibrate the instrument

1 conformed to the US EPA *Traceability Protocol for Assay and Certification of Gaseous*
2 *Calibration Standards* (RTI/6960/208-01F).

3 **6.1.4 Volatile TOCs**

4 TOC sampling and analysis was accomplished by following the procedures identified and
5 referenced in “*Guidance for Total Organics, Final Report*” (EPA/600/R-96/033). Two (2)
6 separate sampling trains were employed to collect the samples necessary to make the TOC
7 determination. A M0040 sampling train was used to collect exhaust gas samples for the
8 determination of total volatile unspciated organics and a M0010 sampling train was used to
9 collect exhaust gas samples for total unspciated semivolatile and non-volatile organics.

10 For the volatile TOCs, two (2) bag samples per run were collected and analyzed on-site for C₁-C₇
11 compounds via GC/flame ionizing detector (FID). The condensate collected ahead of the Tedlar
12 bag during each run was analyzed for C₄-C₇ compounds off-site, as were the samples collected
13 with the M0010-TOC.

14 The exhaust gas samples collected into the Tedlar bags were analyzed in the field by GC/FID.
15 The GC was set up in the field with column and conditions appropriate for the analysis of C₁
16 through C₇ n-alkanes. Retention times were determined and a calibration was performed with
17 certified gas standards of C₁ through C₇ alkanes in air or nitrogen. Compounds of interest were
18 identified by retention times or retention time ranges and quantitative analysis was performed.
19 Results of the Tedlar bag analyses were added to the volatile organics from the condensate to
20 yield the volatile organics portion of the TOC number.

21 **6.1.5 Mustard Agent in Exhaust Gas**

22 Exhaust gas samples were collected on DAAMS and analyzed IAW ANCDF Laboratory
23 Operating Procedures (LOPs) to determine the exhaust gas concentration of mustard for use in
24 determining DRE. This analysis was conducted by collecting exhaust gas samples IAW
25 AN-LOP-200. This procedure provides for non-isokinetic sampling with a 240 minute sampling
26 time. Each sample was then analyzed by GC-flame photometric detector (FPD) IAW
27 AN-LOP-120 and by mass spectrometer detector (MSD) IAW AN-LOP-130, if applicable.

28 AN-LOP-120 and -130 are GC-FPD and MSD site-specific procedures where a DAAMS tube
29 sample is desorbed to introduce the sample into a GC. The GC is equipped with a fused-silica
30 capillary column. The GC oven is temperature-programmed to allow separation of the target
31 analyte, which is then detected by a FPD that is interfaced to the GC. GC-FPD quantitation is
32 accomplished using the FPD analyte response and a pre-established calibration curve.

33

6.2 SUMMARY OF OFF-SITE ANALYTICAL PROCEDURES

With the exception of agent, Orsat, and M0040 (bag samples), all exhaust gas samples were analyzed by off-site laboratories. The analytical methods employed for exhaust gas samples are listed below.

<u>Parameter</u>	<u>Analysis Method</u>
Semivolatile Organics	SW-846 Method 8270C (M8270C)
Dioxins/Furans	SW-846 Methods 8290 (M8290)
Volatile Organics	SW-846 Method 8260B (M8260B)
Total Volatile, Semivolatile, and Nonvolatile Unspeciated Organics	“Guidance for Total Organics” EPA/600/R-96/033
Acid Gases	M26A
Particulate Matter	US EPA Method 5 (M5)
Metals	SW-846 Methods 6020 (M6020), 7470A (M7470A), and 7471A (M7471A)
Energetics	SW-846 Method 8330 (M8330)

6.2.1 Semivolatile Organics

Sampling for semivolatile organics was accomplished by M0010. Preparation of the sampling train was performed IAW SW-846 Method 3542 (M3542). Analysis of the three (3) analytical fractions of the M0010 sampling train was performed IAW M8270C by GC/MS.

Sample fractions were prepared for analysis IAW M3542. This method provides procedures by which the samples generated by the M0010 sampling train are separated and solvent extracted IAW SW-846 Method 3540C (M3540C) (filter and XAD/back-half rinse fractions) and SW-846 Method 3510C (M3510C) (front-half rinse and condensate/condensate rinse fractions) with method exceptions as noted in M3542. Extracts are concentrated to final volume IAW M3540C. In total, the sample fractions recovered from the M0010 sampling train prepared for analysis by M3542 yielded three (3) extracts for analysis by M8270C.

M8270C is a GC/MS method where samples that have been prepared for analysis using one (1) or more of the aforementioned sample preparation procedures are introduced into a GC by injecting an aliquot of the concentrated sample extract. The GC is equipped with a fused-silica capillary column. The GC oven is temperature-programmed to allow separation of the analytes, which are then detected by a MS interfaced to the GC. Analytes eluted from the capillary column are introduced into the MS whereby identification of target analytes is accomplished by comparing their mass spectra with the electron impact spectra of authentic standards. Quantitation is accomplished by comparing the response of a major (quantitation) ion relative to an internal standard using a multi-point calibration curve.

6.2.2 Dioxins/Furans

Sampling for dioxins/furans was accomplished by M0023A. Samples were extracted and concentrated as described in the method. Analysis of the sample extracts was performed by high resolution gas chromatograph (HRGC)/high resolution mass spectrometer (HRMS) IAW M8290.

1 Samples were solvent extracted IAW the matrix-specific technique described in M8290 after the
2 addition of internal standards and surrogates, as required (surrogate standards are added to the
3 sorbent/back-half prior to sampling). Sample extracts are solvent exchanged and concentrated
4 using a nitrogen evaporative concentrator to reduce the volume of the extract. After the
5 concentrated samples are subject to a clean-up step, fractionated, and subject to additional
6 clean-up steps, they are ready for analysis by M8290.

7 M8290 employs a HRGC column coupled to a HRMS. An aliquot of each concentrated sample
8 extract is injected into the HRGC/HRMS system. The system is capable of performing selected
9 ion monitoring at resolving powers of at least 10,000 (10% valley definition). Identification of
10 the target analytes for which a C₁₃-labeled standard is available in the sample fortification and
11 recovery standard solutions (added prior to sample analysis) is based on their elution at their
12 exact retention time (-1 to +3 seconds from the respective internal or recovery standard signal)
13 and simultaneous detection of the two (2) most abundant ions in the molecular ion region. All
14 other target analytes are identified when their relative retention times fall within their respective
15 dioxins/furans retention time windows, as established using a column performance evaluation
16 solution, and the simultaneous detection of the two (2) most abundant ions in the molecular ion
17 region. The identification of octachlorodibenzofuran is based on its retention time relative to
18 ¹³C₁₂- octachlorinated dibenzo-p-dioxin (CDD) and the simultaneous detection of the two (2)
19 most abundant ions in the molecular ion region. Confirmation is based on a comparison of the
20 ratio of the integrated ion abundance of the molecular ion species to their theoretical abundance
21 ratio. Quantitation of the individual congeners, total dioxins, and total furans is achieved in
22 conjunction with the establishment of a multi-point calibration curve for each homologue, during
23 which each calibration solution is analyzed once.

24 **6.2.3 Volatile Organics**

25 Sampling for selected volatile organics was accomplished by M0030. Analysis of the M0030
26 samples was performed IAW SW-846 Methods 5041A (M5041A) and M8260B. The sample
27 fraction analyzed included the Tenax tubes, the Tenax/charcoal tubes, and the condensate from
28 each run.

29 M5041A is a method in which the sorbent tubes are thermally desorbed by heating and purging
30 with organic-free helium. The gaseous effluent from the tubes is bubbled through pre-purged
31 organic-free reagent water and trapped on an analytical sorbent trap in a purge-and-trap unit. For
32 condensate samples, a sample aliquot is placed directly into the purging chamber of the
33 purge-and-trap unit where volatile organic constituents are purged onto the analytical sorbent
34 trap. After desorption, the analytical sorbent trap is heated rapidly and the gas flow from the
35 analytical trap is directed to the head of a fused-silica capillary column. The volatile organic
36 compounds desorbed from the analytical trap are determined by M8260B.

37 M8260B is a GC/MS method where volatile compounds are introduced into a GC using
38 appropriate purge-and-trap methods. The GC is equipped with a fused-silica capillary column.
39 The GC oven is temperature-programmed to allow separation of the analytes, which are then
40 detected by a MS interfaced to the GC. Analytes eluted from the capillary column are
41 introduced into the MS whereby identification of target analytes is accomplished by comparing
42 their mass spectra with the electron impact spectra of authentic standards. Quantitation is

1 accomplished by comparing the response of a major (quantitation) ion relative to an internal
2 standard using a multi-point calibration curve.

3 **6.2.4 Total Volatile, Semivolatile, and Nonvolatile Organics**

4 TOC sampling and analysis was accomplished by following the procedures identified and
5 referenced in "*Guidance for Total Organics, Final Report*" (EPA/600/R-96/033). Two (2)
6 separate sampling trains were employed to collect the samples necessary to make the TOC
7 determination. A M0040 sampling train was used to collect samples for the determination of the
8 volatile fraction of the TOC and a M0010 sampling train was used to collect exhaust gas samples
9 for the determination of the semivolatile and nonvolatile fractions of the TOC.

10 For the volatile fraction of the TOC, two (2) bag samples per run were collected and analyzed
11 on-site for C₁ through C₇ compounds via field GC/FID as described in Section 6.1.2. The
12 condensate collected ahead of the Tedlar bag during each run was analyzed for C₄ through C₇
13 compounds by an off-site laboratory IAW the method described in "*Guidance for Total*
14 *Organics, Final Report*" (EPA/600/R-96/033). This is GC/FID method where samples are
15 purged onto a sorbent trap and the sorbent trap is then desorbed into a GC. The GC is equipped
16 with a fused-silica capillary column. The GC oven is temperature-programmed to allow
17 separation of the analytes, which are then detected by a FID. Uniform FID response for varying
18 compound classes is assumed in this methodology. Compounds found with retention times prior
19 to the C₄ retention time are quantified with an appropriate response factor and reported as C₄
20 with the other results quantitated against a multi-point calibration curve prepared using C₅
21 through C₇ standards. Results of the condensate are added to the field determined volatile
22 organics values to yield the total volatile fraction of the TOC.

23 For the total semivolatile and nonvolatile fractions of the TOC, samples are prepared IAW
24 M0010, Appendix B. Specifically, two (2) standards were added to each sample prior to
25 extraction to bracket the quantitation range. One (1) of the standards serves as a surrogate to
26 provide an additional QC measure for the analysis. The three (3) extracts from the total
27 sampling train are combined prior to analysis, and the combined extract is split to allow separate
28 analysis.

29 The total chromatographable organic (TCO) method is a capillary GC/FID method quantifying
30 chromatographable material in the 100 to 300 degrees Celsius (°C) boiling point range. An
31 aliquot of the prepared extract is injected onto a capillary GC column with a FID detector, and
32 the peak areas are summed over the retention time window that encompasses the TCO boiling
33 point range. The TCO value is determined from the multipoint calibration curve, generated with
34 hydrocarbon standards that fall within the TCO range, specifically decane, dodecane, and
35 tetradecane. The organics identified in the prescribed boiling point range are quantified and
36 summed (totaled) to obtain the TCO portion of the TOC.

37 The gravimetric (GRAV) method quantifies nonvolatile organic material with a boiling point
38 greater than 300°C. A carefully measured aliquot of the prepared extract is placed in a pre-
39 cleaned weighing pan and allowed to dry in air at room temperature, then comes to complete
40 dryness in a room temperature desiccator, while exposure to dust and contaminants are

1 minimized. The residue in the pan is weighed and the mass is recorded to determine the GRAV
2 value.

3 The TOC value is reported as the sum of the volatile, semivolatile, and nonvolatile unspciated
4 organics results.

5 **6.2.5 Acid Gases**

6 Acid gas sampling and analysis were accomplished by following the procedures in M26A. A
7 small volume of each M26A sample is injected into an ion chromatograph (IC) to flush and fill a
8 constant volume sample loop. The sample is then injected into a stream of
9 carbonate-bicarbonate eluent of the same strength as the impinger solutions. The sample is
10 pumped through three (3) different ion exchange columns and into a conductivity detector. The
11 first two (2) columns, a precolumn or guard column and a separator column, are packed with
12 low-capacity, strongly basic anion exchanger. Ions are separated into discrete bands based on
13 their affinity for the exchange sites of the resin. The last column is a suppressor column that
14 reduces the background conductivity of the eluent to a low or negligible level and converts the
15 anions in the sample to their corresponding acids. The separated anions in their acid form are
16 measured using an electrical-conductivity cell. Anions are identified based on their retention
17 times compared to known standards. Quantitation is accomplished by measuring the peak height
18 or area and comparing it to a calibration curve generated from known standards.

19 **6.2.6 Particulates**

20 Particulate analyses were accomplished following the procedures in M5. The sampling for
21 particulate emissions was done with the M26A isokinetic sampling train. Particulate
22 determination was performed during all runs.

23 Prior to use in the field, each filter used was desiccated to a constant weight, placed in glass petri
24 dishes, and sealed with Teflon[®] tape. An identification label was placed on each dish, and the
25 weight of each filter was recorded. The beakers used for the dry-down of the acetone rinse were
26 cleaned and dried in a drying oven. The beakers were desiccated to a constant weight.

27 Analysis of the particulate matter samples was accomplished by: drying the front-half acetone
28 rinses in a tared beaker, desiccating, and weighing to a constant weight. The filters were
29 desiccated and weighed to a constant weight. The net weight for the front-half acetone rinse and
30 filter was determined by calculating the difference in weight. The sum of the net weights for the
31 probe wash and filter catch was used to calculate the particulate matter concentrations in the
32 exhaust gas.

33 **6.2.7 Trace Metals**

34 Metals sampling and preparation of the sampling trains for analysis were accomplished by
35 following the procedures in M29. The M29 sample preparation procedures employ acid
36 digestion using acid/reagent combinations specified in the method for each sample fraction
37 collected from the sampling train.

1 Analysis of the prepared and combined sample fractions, as specified by M29, was conducted by
2 cold vapor atomic absorption spectroscopy (CVAAS) for mercury, M7470A/M7471A, and by
3 inductively coupled plasma (ICP)/MS, M6020, for the remaining metals.

4 In the CVAAS technique used for mercury analysis (M7470A/M7471A), analysis is based on the
5 absorption of radiation at 253.7-nanometer by mercury vapor. The mercury is reduced to the
6 elemental state and aerated from solution in a closed system. The mercury vapor passes through
7 a cell positioned in the light path of an atomic absorption spectrophotometer. Absorbance is
8 measured as a function of mercury concentration.

9 M6020, used to analyze M29 samples for all target metal concentrations except mercury, is a
10 multi-element procedure that uses ICP/MS. The method measures ions produced by a radio
11 frequency ICP. Analyte species originating in the liquid sample digestate are nebulized and the
12 resulting aerosol transported by argon gas into the plasma torch of the instrument. The ions
13 produced are entrained in the plasma gas and introduced, by means of an interface, into a MS.
14 The ions produced in the plasma are sorted according to their mass-to-charge ratios and
15 quantified with a channel electron multiplier. Interferences are assessed by the analytical system
16 and valid corrections are applied. Interference correction includes compensation for background
17 ions contributed by the plasma gas, reagents, and constituents of the sample matrix.

18 **6.2.8 Energetics**

19 Sampling of energetic compounds was accomplished using a modified M5 sampling train. Each
20 sampling train yielded three (3) fractions for preparation and four (4) fractions for analysis: the
21 front-half rinse and filter, the condensate and impinger rinsate, and the two (2)-section resin
22 module. The front-half rinse and filter fraction was prepared for analysis by decanting the
23 solvent phase. The condensate and condensate rinse fraction was prepared for analysis IAW
24 SW-846 Method 3535 (M3535). Each resin section was prepared for analysis by serial
25 extraction with acetonitrile. Analysis of the analytical fractions of the modified M5 train was
26 done IAW M8330 (modified) by high-performance liquid chromatography (HPLC) with
27 ultra-violet detection. The second resin section results are only included in train totals when
28 analytes are detected in the first resin section analysis IAW the approved energetics procedure.

7.0 QA/QC RESULTS

7.1 OVERVIEW

QA/QC measures for this program were based on the methods employed and the specific measures outlined in the ANCDF SDC Emissions Test Plan (See Appendix B). Results of the QA/QC activities employed during the testing program are summarized in this section. All calculations were performed using standardized equations.

Field data was reduced using a personal computer with software containing validated equations. Isokinetic ratios were determined after each test run. Reduced data shown in Appendix C-3 were generated after each test run with the exception of pollutant concentrations and emission rates, which were determined after sample analyses were completed. All sampling trains were leak checked prior to, and immediately after, sampling in each port.

Exhaust gas samples were collected by URS-Austin. Sample collection, documentation, and management procedures were performed IAW the SAP/QAPP. Table 7-1 provides a summary of laboratory and field samples collected and analyzed in support of the emissions tests.

7.2 LABORATORY QUALIFICATIONS AND ANALYTICAL STANDARDS

The off-site analytical laboratories used to perform sample analysis were TestAmerica in Knoxville, Tennessee, and TestAmerica in Sacramento, California. Both laboratories have extensive experience in these methods and have conducted emissions testing at ANCDF and other chemical demilitarization facilities.

7.2.1 Data Validation

Analytical data were initially verified by the subcontractor laboratory QC and/or supervisory personnel and then subjected to validation by ANCDF-designated personnel. The field and laboratory blanks, replicate samples, and internal QC sample results were used to assess the analytical results. Designated personnel reviewed subcontractor laboratory raw analytical data to verify the calculated results. The criteria used to evaluate the analytical data includes use of approved analytical procedures, use of properly operating and calibrated instrumentation, and acceptable results from analyses of QC samples.

7.2.2 Data Reporting

All data were reported in standard units depending on the measurement and the ultimate use of the data.

7.3 FIELD QC SUMMARY

7.3.1 Calibration Procedures

Prior to the field sampling effort, the field sampling equipment was calibrated. Copies of the calibration documentation were on-site during the emissions test and are included in Appendix D. Calibrations were performed as described in the US EPA publications “*Quality*

1 *Assurance Handbook for Air Pollution Measurement Systems; Volume III - Stationary Source*
2 *Specific Methods,*” (EPA-600/4-77-027b) and US EPA 40 CFR Part 60, Appendix A. Field
3 sampling equipment that required calibration included the sample metering system, nozzles,
4 thermocouples, pitot tubes, and the barometer. Calibration documentation for process control
5 equipment and facility CEMS are also included in Appendix D.

6 **7.3.2 Equipment Leak Checks**

7 Prior to sampling, each isokinetic sampling train was leak checked IAW the procedures outlined
8 in M5 and/or the applicable sampling method. During the course of each test run, a leak check
9 was conducted before and after sampling in each port. Leakage rates for each isokinetic
10 sampling train were recorded on the appropriate field data sheets (See Appendix C-2). Table 7-2
11 summarizes the leak check results recorded for each isokinetic sampling train.

12 The M0030 sampling train leak checks were performed between the three (3)-way valve
13 downstream of the probe and the pump. The acceptance criteria used for each M0030 leak check
14 was a leakage rate of < 0.1 inches of mercury (inHg) as shown on the vacuum gauge after one (1)
15 minute. All M0030 leak checks met acceptance criteria and were recorded on the appropriate
16 field data sheets.

17 The M0040 sampling train initial and final leak check for each bag sample collected was
18 performed between the probe and the vacuum pump. The acceptance criteria used for each
19 M0040 leak check was a leakage rate of < 0.1 inHg as shown on the vacuum gauge after one (1)
20 minute. All M0040 leak checks for each bag sample submitted for analysis from each run met
21 acceptance criteria and were recorded on the appropriate field data sheets.

22 **7.3.3 Field Blanks**

23 Field blanks for exhaust gas sampling methods were collected during the field sampling program
24 IAW the ANCDF SDC Emissions Test Plan.

25 **7.4 SAMPLE MANAGEMENT**

26 This section presents the sample preservation, transportation and receiving, holding times,
27 traceability, and chain-of-custody (COC) documentation.

28 **7.4.1 Sample Preservation**

29 The exhaust gas samples were preserved by storing them on ice, as required, until packaged for
30 shipment to the off-site laboratories. Samples requiring cooling were packed with ice to
31 maintain temperatures within the required range for shipment to the laboratory. All shipments
32 arrived at the laboratories at temperatures prescribed in the SAP/QAPP.

33 **7.4.2 Sample Traceability**

34 Sample traceability procedures were employed IAW the ANCDF SDC Emissions Test Plan to
35 document the identity of each sample and its handling from its first existence as a sample until
36 analysis and data reduction was completed. Custody records traced a sample from its collection

1 through all transfers of custody until it was transferred to the analytical laboratory. Internal
2 laboratory records then documented the custody of the sample through its final disposition.

3 Sample integrity was maintained throughout all sampling and analysis programs. IAW SW-846
4 guidance, a sample was considered to be under a person's custody if the sample was:

- 5 • In that person's physical possession,
- 6 • In view of that person after acquiring possession,
- 7 • Secured by that person so that no one could tamper with the sample, and/or
- 8 • Secured by that person in an area that was restricted to authorized personnel.

9 These criteria were used to define the meaning of “custody” and to ensure the integrity of the test
10 program samples from collection to data reporting. Restricted access to the samples was an
11 integral part of the COC procedure. Samples were held within sight of the samplers or sample
12 custodian or kept in sealed and secured containers at all times. Custody seals were applied to
13 each sample container and/or the shipping container used to ship the samples to the off-site
14 laboratories.

15 **7.4.3 Sample Transportation and Receiving**

16 The exhaust gas samples were stored on-site until they were transported via chartered aircraft or
17 delivered by URS-Austin personnel to the respective TestAmerica laboratories. For chartered
18 aircraft deliveries, a laboratory representative met the aircraft or URS-Austin sample custodian
19 and secured custody of the samples directly from the URS-Austin sample custodian that
20 accompanied the samples during transport. Upon receipt at the laboratories, the samples were
21 logged into the laboratory sample tracking system with a unique laboratory sample number.

22 **7.4.4 Sample Shipping**

23 Samples were packaged, transported, and shipped IAW applicable US Department of
24 Transportation, International Air Transportation Authority, and US EPA regulations. A COC
25 form accompanied the samples. The COC form listed the parameters to be analyzed by the
26 laboratory for each sample and the total number and type of samples shipped for analysis.
27 Authorized laboratory personnel acknowledged receipt of shipment by signing and dating the
28 COC form and returning a copy to URS-Austin.

29 **7.4.5 Sample Holding Times**

30 The sample preservation requirements and holding times are presented in Table A-10 of the
31 SAP/QAPP. The sampling personnel preserved the samples by keeping them in a cooler packed
32 with ice, during the transport, as required. Sample temperatures were monitored upon receipt at
33 the laboratory. Holding times were monitored by keeping track of the day(s) from the time the
34 samples were collected to the time that they were prepared, extracted, and/or analyzed. All
35 samples met the holding time requirements as specified in Table A-10 of the SAP/QAPP.

1 **7.4.6 COC Documentation**

2 **7.4.6.1 Labeling**

3 Sample identification labels were used to ensure the required information was entered in the
4 field. Exhaust gas sample labels were affixed to the appropriate container at the time of sample
5 recovery. All samples collected were labeled with a preprinted sample label. There were some
6 instances where the laboratory reported minor discrepancies between the sample name listed on
7 the label and the name listed on the COC. The laboratories were able to resolve all such
8 discrepancies and the required analyses were performed.

9 **7.4.6.2 Field Logbook**

10 Information pertinent to the sampling was recorded in a sampling log. Entries were made in
11 indelible ink and corrections generally followed the error correction protocol of one (1) line
12 through the error, initial of the person performing the correction, and the date of the correction.
13 Sampling personnel also recorded required information using the appropriate field data sheets. A
14 copy of the field logbook and field data sheets is provided in Appendix C.

15 **7.4.6.3 COC Forms**

16 To establish the documentation necessary to trace sample possession from the time of collection,
17 a COC form was filled out and accompanied every sample or group of individually identified
18 samples. Each person who had custody signed the COC form.

19 **7.5 SAMPLE COLLECTION**

20 Exhaust gas sampling procedures were performed using the methods listed in Section 5.3.
21 Isokinetic samples (M0010, M0010-TOC, M0023A, MM5E, M26A, and M29) and
22 non-isokinetic samples (M0030 and M0040) were collected from ports located in the exhaust
23 duct that extends between the induced draft fan and stack. The number and location of exhaust
24 gas sampling points were determined IAW the procedures specified in M1. The sampling port
25 locations met the requirements for acceptable distances from flow disturbances as specified in
26 M1, and all traverse points were at least one-half ($\frac{1}{2}$) inch from the inner wall of the duct.

27 Verification of the absence of cyclonic flow in the sampling duct was performed on 12/04/10,
28 with no cyclonic flow present. Cyclonic flow data sheets can be found in Appendix C-2.
29 Calibration of the pitot tubes used for flow testing was performed IAW 40 CFR 60, Appendix A.
30 Calibration data are presented in Appendix D.

31 Prior to sampling, all sampling train glassware was cleaned as required by each respective
32 sampling method. All reagents used during sampling met the specifications of each respective
33 sampling method. All sample containers were received in sealed boxes from the vendor with
34 certificates of QA compliance IAW US EPA specifications.

35 Each sampling train was operated IAW the applicable method and SAP/QAPP requirements.
36 For the isokinetic sampling trains the time, velocity pressure, orifice pressure, stack gas
37 temperature, probe temperature, transfer line temperature (as applicable), sorbent trap inlet

1 temperature (as applicable), silica gel impinger outlet temperature, dry gas meter inlet and outlet
2 temperatures, dry gas meter volume, and sample vacuum were recorded every five (5) minutes at
3 each traverse point.

4 **7.5.1 Isokinetic Sampling**

5 For each isokinetic sampling train (i.e., M0010, M0010toe, M0023A, M26A, M29, and MM5E)
6 the following key sampling procedures were performed to comply with US EPA requirements
7 and the ANCDF SDC Emissions Test Plan:

- 8 • A minimum of three (3) dry standard cubic meters (dscm) total sample volume
9 was collected over a 240-minute sampling period for each run. The sample
10 volume collected for each run is presented in Appendix C.
- 11 • One (1) field blank sample was collected by assembling a complete sampling train
12 at the sampling area. The filter housing and probe on the blank train were heated
13 to the appropriate temperature and the train was leak checked the same number of
14 times as an actual sample train. The sample was then recovered in the same
15 manner as an actual sample.
- 16 • Sample recovery was conducted both at the sampling location and in a controlled
17 laboratory setting IAW the procedures specified in the reference method.
- 18 • For M0010, M0010toe, M0023A, and MM5E, the resin was packed in air-tight
19 glass traps. The resin was purchased pre-cleaned and packed by the laboratory
20 IAW the procedures specified in the reference method.
- 21 • For M0010, M0010toe, and M0023A the temperature of the sample gas stream
22 between the outlet of the condenser and the inlet to the resin trap was maintained
23 below 68°F (20°C).
- 24 • For M0010, M0010-TOC, M0023A, and MM5E, the temperatures of the probe,
25 transfer line, and filter were maintained between 223 and 273°F. For the M29,
26 the temperatures of the probe and filter were maintained between 223 and 273°F.
27 For the M26A, the temperatures of the probe and filter were maintained between
28 248 and 273°F. These temperatures were monitored and recorded on field data
29 sheets during each run. The field data sheets are included in Appendix C-2.
- 30 • An initial and final leak check was conducted on each sampling train for each
31 traverse with a maximum allowable leak rate of 0.02 cfm over a one (1)-minute
32 time period. The initial pre-test leak check for each run was conducted at a
33 minimum vacuum of approximately 10 to 15 inHg. The leak checks performed
34 during the sampling run, at port change, and at the completion of the test were
35 conducted at a vacuum greater than or equal to the maximum value reached
36 during the sampling run. Passing leak check results were obtained in all
37 instances. The leak check results are presented in Table 7-2 and Appendix C.
- 38 • An initial and final leak check was conducted for each test run on the Type S pitot
39 tube at a minimum velocity pressure reading of 3.0 inches of water column
40 (inwc). Both the pitot impact opening and the static pressure opening on the pitot
41 tube passed the leak check.

- Isokinetic sampling rates were maintained during each of the sampling runs. Percent isokinetic data for each run is presented in Appendix C.

It is noted that at the conclusion of C4aR1 the M0023A nozzle was observed to have a small chip after withdrawing the probe from the duct. A successful leak check was performed with the chipped nozzle in place, the nozzle was recovered without incident, and the chipped nozzle was replaced prior to C4aR2. This circumstance does not impact the validity of the C4aR1 M0023A sample.

During recovery of the C4aR1 M29 probe, the initial rinse was performed with 10% HNO₃ in lieu of 0.1 N HNO₃ (10% HNO₃ is more concentrated, or stronger, than 0.1 N HNO₃). After this anomaly was identified, the volume of 10% HNO₃ was determined gravimetrically (the tare weight of the empty container was recorded prior to recovery) and the probe was recovered with 100 ml of 0.1 N HNO₃ as required by the method. As use of a more concentrated acid in addition to the method specified concentration is expected to provide greater “recoverability” of the target metals, this anomaly is not believed to have impacted the usability of the C4aR1 sample.

During C4aR3 the MM5E sampling train experienced operational difficulties near the end of the run. After stopping all sampling trains (at 2034 hrs) it was determined that the MM5E had collected free liquid (condensate) from the exhaust duct and completing the run would not be possible. After verifying that none of the other sampling trains had collected free liquid, sampling was resumed at 2044 hrs and the run was completed. C4aR3 results are not used and this circumstance does not impact the usability of the reported results from C4aR1, C4aR2, and C4aR4.

During C4aR4 the M0023A nozzle was observed to have a small chip after first port sampling was completed. A successful leak check was performed with the chipped nozzle in place and the chipped nozzle was replaced with an identically sized nozzle (0.351 inches) to complete the run. Both nozzles were recovered with the front-half of the sampling train. This circumstance does not impact the validity of the C4aR4 M0023A sample.

At the conclusion of C4aR4 the MM5E nozzle was observed to have a small chip after withdrawing the probe from the duct. A successful leak check was performed with the chipped nozzle in place and the nozzle was recovered without incident. This circumstance does not impact the validity of the C4aR4 MM5E sample.

7.5.2 Non-Isokinetic Sampling

7.5.2.1 Volatile Organics

The following key sampling procedures were performed to comply with US EPA requirements and the ANCDF SDC Emissions Test Plan for M0030 sampling:

- Four (4) sets of sorbent traps and one (1) condensate sample were collected for each run. Each sorbent trap set consisted of one (1) Tenax tube and one (1) Tenax/charcoal tube.
- A field blank sample was collected during each run at the sampling location. The end caps on the blank set of traps were removed for the period of time required to

1 exchange each pair of traps. After collection, the field blank sample was handled
2 and analyzed in the same manner as the actual sample.

- 3 • A trip blank sample set was included with the actual sample traps during shipment
4 to the site, sampling, and shipment to the laboratory. The end caps were not
5 removed from the trip blank.
- 6 • A trip blank consisting of organic-free water was included with the actual sample
7 condensates during shipment to the laboratory.
- 8 • The samples were delivered to the laboratory in a sealed cooler packed with ice.
9 Documentation of analysis and a COC form relinquishing custody of the samples
10 accompanied the samples.
- 11 • The samples were maintained at 0 to 6°C at all times, before and after sampling,
12 prior to analysis.
- 13 • Each sample was collected by drawing the exhaust gas through the train at a rate
14 of approximately 0.5 L/min for 40 minutes. Approximately 20 dry standard liters
15 (dsL) of exhaust gas sample volume were pulled through each set of traps. The
16 sample volume collected and field data sheets for each run are presented in
17 Appendix C-2.
- 18 • The cooling water used for circulating through the condensers came from an ice
19 water bath. The temperature of the sample gas stream between the outlet of the
20 first condenser and the Tenax sorbent trap and between the outlet of the second
21 condenser and the Tenax/charcoal trap was maintained below 68°F (20°C).
- 22 • An initial leak check was conducted for each sample collected, with a maximum
23 allowable leak rate of 2.5 millimeters mercury (mmHg) over a one (1)-minute
24 time period while pulling a vacuum greater than (>) 10 inHg (this value exceeds
25 the normal operating pressure). A final leak check was conducted for each
26 sample collected, with a maximum allowable leak rate of 2.5 mmHg over a one
27 (1)-minute time period while pulling a vacuum of greater than or equal to the
28 highest vacuum encountered during collection of the sample. The M0030
29 sampling train passed all leak checks. The leak check results are presented in
30 Appendix C-2.

31 **7.5.2.2 Volatile TOCs**

32 The following key sampling procedures were performed to comply with US EPA requirements
33 and the ANCDF SDC Emissions Test Plan for M0040 sampling:

- 34 • Approximately 30 liters of exhaust gas was collected per bag sample collected.
35 The sample volume collected and field data sheets for each run are presented in
36 Appendix C.
- 37 • All bag samples were collected into Tedlar bags.
- 38 • One (1) condensate sample was collected per bag sample collected. Amber glass
39 septum cap vials were used to collect the condensate.

- 1 • Two (2) bag samples were collected during each run.
- 2 • A daily field blank sample was collected.
- 3 • The temperatures of the probe, filter, and valve were maintained between 130 and
- 4 140°C (266 and 284°F) during collection of each sample.
- 5 • The condenser temperature was maintained at a temperature of < 20°C (68°F).
- 6 Temperatures were recorded every five (5) minutes. Field data sheets
- 7 documenting the temperatures are found in Appendix C.

8 **7.5.2.3 O₂ and CO₂**

9 M3B sampling was performed to determine O₂ and CO₂ concentrations by collecting an
10 integrated bag sample that was analyzed using an Orsat analyzer.

- 11 • Integrated bag samples were collected during each run in conjunction with one (1)
- 12 of the isokinetic sampling trains.
- 13 • Each sample was collected at a constant rate during each traverse into a Tedlar
- 14 bag and leak checked prior to sampling.
- 15 • The Orsat analyzer was successfully leak checked prior to analysis of each sample
- 16 according to the procedures in M3B.
- 17 • Each Orsat bag sample was analyzed three times (3X) and the average was
- 18 calculated and used for reporting O₂ and CO₂ concentration. Orsat analysis
- 19 readings are recorded on field data sheets included in Appendix C-2.

20 **7.5.2.4 Sulfur Dioxide**

21 SO₂ was determined during each run IAW M6C. A single SO₂ run was completed for each run
22 that encompassed the sampling times of the isokinetic sampling trains.

23 A logbook was kept and calibrations, QC activities, routine maintenance, and repair activities
24 were documented for the SO₂ testing. Activities related to the pre-test checks (calibration
25 drift/error and response time tests) were also recorded. All data related to SO₂ sampling and the
26 pre-test activities were logged using the Data Acquisition System (DAS).

27 The analyzer was calibrated IAW M6C. The QC measures included the use of US EPA protocol
28 calibration gases, pre- and post-test run calibrations, calibration error, and bias tests. Copies of
29 the certifications for the gas standards are provided in Appendix D and the results are provided in
30 Appendix F-10.

31 During C4aR3 the TRM CEMS system experienced operational difficulties such that results are
32 only available through 2030 hrs. The end time for C4aR3 was 2110 hrs. C4aR3 was not used
33 and this circumstance has no impact on the usability of the C4aR1, C4aR2, and C4aR4 results.

7.5.2.5 Nitrogen Oxides

NO_x was determined during each run IAW M7E. A single NO_x run was completed for each run that encompassed the sampling times of the isokinetic sampling trains.

A logbook was kept and calibrations, QC activities, routine maintenance, and repair activities were documented for the NO_x testing. Activities related to the pre-test checks (calibration drift/error and response time tests) were also recorded. All data related to NO_x sampling and the pre-test activities were logged using the DAS.

The analyzer was calibrated IAW M7E. The QC measures included the use of US EPA protocol calibration gases, conversion efficiency, pre- and post-test run calibrations, calibration error, and bias tests. Copies of the certifications for the gas standards are provided in Appendix D and the results are provided in Appendix F-10.

It is noted that the range of the NO_x analyzer was set at 100 ppm, with a high standard of nominally 50 ppm, based on the NO_x concentrations measured during preliminary testing performed on 07/03/11. During C4aR1, C4aR2, and C4aR3 NO_x concentrations were recorded that exceeded the nominal 50 ppm concentration of the high NO_x standard but were less than the range of the instrument. For C4aR4, the range of the NO_x CEMS was set at 200 ppm with the concentration of the high standard being 198 ppm. All readings of NO_x were below the range of the CEMS, and below the highest standard. NO_x results from C4aR1, C4aR2, and C4aR3 should be considered estimated.

During C4aR3 the TRM CEMS system experienced operational difficulties such that results are only available through 2030 hrs. The end time for C4aR3 was 2110 hrs. C4aR3 was not used and this circumstance has no impact on the usability of the C4aR1, C4aR2, and C4aR4 results.

7.5.2.6 Mustard

During each run a DRE DAAMS was used to collect a sample for the determination of emission levels of mustard agent IAW with a site specific procedure. The flow through each tube was verified prior to and after collection of each set of tubes IAW site-specific procedures.

7.6 DATA VALIDATION RESULTS

Blank and spiked samples were analyzed IAW the QA/QC requirements specified in the ANCDF SDC Emissions Test Plan. Blank samples included reagent blanks, field blanks, trip blanks, and method blanks. Method blanks were used to measure any contaminants that may have been introduced to the sample during sample preparation and analysis in the laboratory. Reagent blanks were used to assess the cleanliness of the reagents used in the field. Field blanks were used to measure any contaminants that may have been introduced to the samples from the sampling equipment and sampling technique.

Trip blanks provide a measure of any sample contamination that may be introduced during shipping of the samples from the site to the laboratory. The spike samples consisted of matrix spike and matrix spike duplicates (MS/MSD), laboratory control samples and laboratory control sample duplicates (LCS/LCSD, blank spikes), and surrogate spikes. These samples were used to

1 assess method performance and the recovery efficiency of the various analytical methods used in
2 this work. Exhaust gas samples are generally consumed in their entirety during the initial
3 preparation and analysis of each sample. In instances where re-extraction and/or analysis are
4 indicated in response to poor spike recovery, such action cannot be taken, as there is no
5 additional sample aliquot available.

6 Analytical precision was assessed by performing spikes and spike duplicates with the analytes of
7 interest and measuring the relative percent difference (RPD) between the duplicate analyses.
8 The recovery of the spiked samples was used to assess the bias (accuracy) of the analysis. The
9 surrogate spikes, which are authentic standards (not likely to be found in the matrix) added to
10 every organic sample prior to preparation and/or analysis, were used to provide an additional
11 measure of QC for each sample. Surrogate spikes provide data that allows items such as matrix
12 effects, gross sample-processing errors, and extraction efficiency to be assessed.

13 The following subsections summarize the QA/QC assessment for the exhaust gas samples
14 collected and analyzed.

15 **7.6.1 Semivolatile Organics**

16 During each run, a M0010 sampling train was used to collect samples for the determination of
17 emission levels of the semivolatile PICs and TICs as specified in the SAP/QAPP. M0010
18 samples collected during each run were extracted IAW M3542 and analyzed IAW M8270C. QC
19 protocols included the use of a field surrogate, which was spiked onto the XAD trap prior to
20 sampling, additional surrogates added to the samples in the laboratory prior to extraction, and
21 internal standards added prior to analysis. The preparation of the M0010 sampling train yields
22 three (3) fractions for analysis by M8270C. Table 7-3 provides a summary of the dates each
23 sample was prepared and analyzed and demonstrates all holding time requirements were
24 satisfied.

25 **GC/MS Tuning**

26 GC/MS instruments were tuned to ensure mass resolution, identification, and sensitivity. For
27 semivolatile sample analysis, instruments were tuned by analyzing decafluorotriphenylphosphine
28 at the beginning of each 12-hour period during which samples or standards are analyzed and
29 comparing the ion abundance for selected mass to electron ratios to the ion abundance criteria
30 specified in M8270C. All GC/MS instrument tunings met the criteria during analysis of the
31 samples.

32 An additional part of the M8270C tune is the system performance check on the injection port
33 inertness and column performance. These additional items were evaluated with each instrument.
34 The criteria for injection port inertness and peak tailing were met for each tune check.

35 **Instrument Calibration**

36 Requirements for instrument calibration are established to ensure the instrument is capable of
37 producing acceptable qualitative and quantitative data. Initial calibration (ICAL) demonstrates
38 the instrument is capable of producing a linear calibration curve, and continuing calibration
39 demonstrates maintenance of the linear curve on a daily basis. System performance check

1 compounds (SPCCs) and calibration check compounds (CCCs) must meet criteria specified in
2 the method for the calibration to be valid.

3 Instruments were initially calibrated by analyzing standards containing compounds of interest at
4 a minimum of five (5) concentrations. Because of the extensive target analyte list, there are two
5 (2) ICALs associated with each instrument with each ICAL containing a subset of the entire
6 target analyte list. These two (2) calibrations are referred to in the raw data as the "HSL" and
7 "AP9" lists. The concentrations of each compound were quantitated relative to the closest
8 eluting internal standard and a response factor (RF) was determined. The average RFs for each
9 compound were calculated. The four (4) SPCC compounds were checked for a minimum
10 average RF. The minimum acceptable average RF is 0.05. If the minimum RF criteria are not
11 met, all detects should be considered estimated and NDs should be flagged as "rejected"
12 (unusable).

13 The relative standard deviation (RSD) for the CCCs was calculated using the RF from the ICAL.
14 The RSD for each CCC should be < 30% for the calibration to be valid. The RSD for each
15 non-CCC should be < 15% if the average RF was used by the laboratory for quantitation. If the
16 RSD for any target analyte is > 15%, an alternate means of quantitation should be employed
17 (e.g., use of a quadratic curve). When the RSD is > 15% but < 90% all detects and NDs should
18 be considered estimated. When the RSD is > 90% all detects should be considered estimated and
19 NDs should be flagged as "rejected" (unusable).

20 The ICAL curve was checked and verified once every 12 hrs of analysis time for each target
21 compound. This verification was accomplished by analyzing a calibration standard and checking
22 the SPCCs and CCCs. The RFs for the SPCCs and target compounds were evaluated similarly
23 for both the continuing and initial calibration.

24 The CCCs were evaluated by comparing the % drift between the CCC standard concentrations
25 with the measured concentrations. The % drift for each CCC should be < 20% for the continuing
26 calibration to be valid. When the % drift is > 20% but < 90% all detects and NDs should be
27 considered estimated. When the % drift is > 90% all detects should be considered estimated and
28 NDs should be flagged as "rejected" (unusable).

29 All samples were quantitated against the same initial calibration (i.e., instrument SV5 on
30 07/07/11 [HSL] and 07/08/11 [AP9]) and all criteria were met without exception and
31 qualification of the data is not indicated. All continuing calibration criteria were met without
32 exception and qualification of the data is not indicated.

33 **Surrogate Standard Results**

34 Laboratory performance on individual samples was established by means of spiking activities.
35 All samples were spiked with six (6) surrogate compounds prior to sample analysis. Each XAD
36 trap was spiked with a field surrogate, 1,2-dichlorobenzene-d₄, to provide an indication of
37 possible breakthrough or loss due to sampling handling procedures.

38 Evaluation criteria for surrogates include estimating sample results when any one (1) of the
39 surrogates has recoveries outside the acceptance limits provided the recovery is $\geq 10\%$. If any
40 surrogate has < 10% recovery, sample results for that fraction may be rejected. Surrogate

1 recoveries for all field samples were within SAP/QAPP QC limits. Surrogate recoveries are
2 presented in Table 7-4.

3 **Internal Standard Performance**

4 Internal standards are monitored to ensure GC/MS sensitivity and response is stable during every
5 instrument run. Six (6) internal standards were added to each sample prior to analysis:

6 1,4-dichlorobenzene-d₄, naphthalene-d₈, acenaphthene-d₁₀, phenanthrene-d₁₀, chrysene-d₁₂, and
7 perylene-d₁₂.

8 M8270C specifies that internal standard area counts for the continuing calibration standard must
9 not vary by more than a factor of two (2) (-50% to + 100%) from the associated ICAL standards
10 and the retention time (RT) must not vary by > 30 seconds. Internal standard acceptance criteria
11 for samples and blanks are not specified by M8270C. For validation purposes, samples and
12 blanks were evaluated to verify internal standard area counts did not vary by more than a factor
13 of two (2) (-50% to + 100%) from the associated continuing calibration standard and the RT did
14 not vary by > 30 seconds. Should the area response be outside the criteria, professional
15 judgment is used to assess the impact on the reported results. All internal standard area and RTs
16 were found to have met acceptance criteria for all continuing calibrations, samples, and blanks.

17 **Method Blank Results**

18 Laboratory (method) blank samples are analyzed to determine the existence and magnitude of
19 contamination resulting from laboratory activities.

20 No target analytes were found in the laboratory blank associated with the front-half or
21 condensate fractions and qualification of the reported sample results is not indicated. The
22 laboratory blank associated with the back-half train fractions had benzoic acid (17 micrograms
23 [ug]), benzyl alcohol (2.0 ug), bis(2-ethyl hexyl)phthalate (19 ug), and di-n-butyl phthalate
24 (7.9 ug) detected. These analytes were found in all back-half fractions at concentrations that
25 were ≤ five times (5X) the method blank concentration. All reported results for these analytes
26 should be considered ND at the reported concentration. No other target analytes were found in
27 the back-half fraction method blank above the RL.

28 **Field Blank Results**

29 Field blanks are indicators of ambient and sample handling contamination. A field blank was
30 collected by setting up a sampling train at the sampling location, heating the train, and
31 performing leak checks. The field blank is recovered in the same manner as the field samples.

32 No target analytes were detected in the condensate fractions of the field blank. Bis(2-ethyl
33 hexyl) phthalate (3.2 ug) and di-n-butyl phthalate (3.4 ug) were found in the front-half field
34 blank fraction. Benzoic acid (64 ug), benzyl alcohol (3.3 ug), bis(2-ethyl hexyl) phthalate
35 (20 ug) and di-n-butyl phthalate (57 ug) were found in the back-half field blank fraction. The
36 sample results are not corrected for field blank contamination. However, all associated sample
37 results for these analytes should be considered estimated.

1 **Reagent Blank Results**

2 Reagent blanks are indicators of the cleanliness of the reagents and materials used in the field.
3 Reagent blanks were collected that included the filter, solvent, resin, and organic-free water.

4 No compounds were reported at or above the RL in any of the reagent blanks with the exception
5 of benzoic acid (56 ug), benzyl alcohol (2.6 ug), bis(2-ethyl hexyl) phthalate (22 ug), and
6 di-n-butyl phthalate (7.1 ug) found in the in the resin blank. These analytes were also found in
7 the associated laboratory blank. The sample results are not corrected for reagent blank
8 contamination. However, all associated sample results for this analyte should be considered
9 estimated.

10 **Trip Blank Results**

11 Trip blanks are indicators of ambient and sample handling contamination introduced during
12 shipping of the samples. A trip blank consisting of a resin trap was shipped with the samples to
13 the laboratory and analyzed.

14 Benzoic acid (48 ug), benzyl alcohol (2.5 ug), bis(2-ethyl hexyl) phthalate (22 ug), and
15 di-n-butyl phthalate (6.7 ug) found in the in the trip blank. These analytes were also found in the
16 associated laboratory blank. The sample results are not corrected for trip blank contamination.
17 However, all associated sample results for this analyte should be considered estimated.

18 **LCS Results**

19 LCS/LCSDs were analyzed to provide information on the accuracy of the analytical method and
20 on laboratory performance. All LCS/LCSD recoveries and RPD were within SAP/QAPP QC
21 limits. The results of the LCS/LCSD analyses are presented in Table 7-5.

22 **7.6.2 Semivolatile and Nonvolatile TOCs**

23 Exhaust gases were collected for semivolatile and nonvolatile total organics IAW M0010-TOC.
24 The following subsections discuss the semivolatile and nonvolatile total organic analysis. The
25 preparation of the M0010-TOC sampling train yields one (1) fraction that is split and analyzed
26 by for semivolatile and nonvolatile TOCs. Table 7-6 provides a summary of the dates each
27 sample was prepared and analyzed and demonstrates all holding time requirements were
28 satisfied.

29 **Instrument Calibration**

30 Requirements for instrument calibration are established to ensure the instrument is capable of
31 producing acceptable qualitative and quantitative data. ICAL demonstrates the instrument is
32 capable of acceptable performance prior to sample analysis, and continuing calibration sample
33 analyses verify that the ICAL is still valid. A multi-point calibration curve was prepared to
34 determine an average RF for the C₈-C₁₇ range. Instrument calibration met all acceptance criteria.

1 For the nonvolatile total organics the analytical balance was calibrated using three (3) different
2 weights and a zero before and after sample analysis. These performance checks demonstrate that
3 the analytical balance was in control and capable of producing valid results.

4 **Surrogate Standard Results**

5 For the semivolatile total organics analysis, laboratory performance on individual samples is
6 established by means of spiking samples with known concentrations of selected compounds. All
7 samples were spiked with n-heptadecane as a surrogate compound prior to sample analysis.
8 Surrogates are not used with the nonvolatile total organics analysis.

9 Evaluation criteria for the surrogate include estimating sample results when any surrogate has a
10 recovery $\geq 10\%$, but below the lower SAP/QAPP QC limit. If any surrogate has $< 10\%$
11 recovery, concentrations of detected compounds are qualified as estimated and compounds with
12 concentrations less than method detection limit (MDL) are rejected. All surrogate recoveries
13 were within acceptance limits. Qualification of the results based on surrogate recovery is not
14 indicated. Surrogate recoveries are shown in Table 7-6.

15 **Method Blank Results**

16 A method blank was prepared and analyzed along with the field samples to determine the
17 existence and magnitude of contamination resulting from laboratory activities. The method
18 blank results also reflect the background level of artifacts present in resin.

19 The semivolatile fraction method blank showed that there was contamination below the RL of
20 0.15 milligrams (mg) at a reported concentration of 0.12 mg. The nonvolatile method blank
21 showed contamination at the RL of 1.5 mg. All semivolatile and nonvolatile total organic
22 sample results should be considered estimated and biased high.

23 **Field Blank Results**

24 Field blanks are indicators of ambient and sample handling contamination. A field blank was
25 collected by setting up a sampling train, bringing the train to the sampling location, heating the
26 train, and performing leak checks. The field blank is recovered in the same manner as the field
27 samples.

28 The semivolatile fraction of the field blank showed contamination at 0.63 mg. The sample
29 results are not corrected for field blank contamination. The nonvolatile fraction of the field
30 blank showed contamination at 2.0 mg. The sample results are not corrected for field blank
31 contamination. However, all semivolatile and nonvolatile total organic sample results should be
32 considered estimated and biased high considering the contamination present in the field blank.

33 **Reagent Blank Results**

34 Reagent blanks are indicators of the cleanliness of the reagents and materials used in the field.
35 Reagent blanks were collected that included the filter, solvent, and organic-free water.

1 The semivolatile fraction of the reagent blank showed contamination at 0.39 mg. No nonvolatile
2 total organics were found above the RL. The sample results are not corrected for reagent blank
3 contamination. However, all semivolatile total organic sample results should be considered
4 estimated and biased high considering the contamination present in the field blank.

5 **Trip Blank Results**

6 Trip blanks are indicators of ambient and sample handling contamination introduced during
7 shipping of the samples. A trip blank consisting of a resin trap was shipped with the samples to
8 the laboratory.

9 The semivolatile fraction of the trip blank showed contamination at 0.23 mg. No nonvolatile
10 organics were found above the RL. The sample results are not corrected for trip blank
11 contamination. However, all semivolatile total organic sample results should be considered
12 estimated and biased high considering the contamination present in the trip blank.

13 **LCS Results**

14 LCSs are samples of known concentration that are prepared and analyzed along with the
15 samples. The LCS is used to monitor the overall performance of the preparation and analysis
16 process. The LCSs are presented in Table 7-7. All LCS results were within SAP/QAPP QC
17 limits.

18 **7.6.3 Dioxins/Furans**

19 During each run, a M0023A sampling train was used to collect samples for the determination of
20 emission levels of dioxins/furans as specified in the SAP/QAPP.

21 M0023A samples collected during each run were extracted IAW M0023A and analyzed IAW
22 M8290 for dioxins/furans. QC protocols included the use of field surrogates, which were spiked
23 onto the XAD trap prior to sampling, additional surrogates, and internal standards added to the
24 samples in the laboratory prior to extraction and analysis. The preparation of the M0023A
25 sampling train for dioxin/furan analysis yields two (2) fractions for analysis: the front-half
26 which includes the front-half rinse and particulate filter and the back-half which includes the
27 XAD trap and solvent rinse from the XAD trap forward to the back-half of the filter housing.
28 Table 7-8 provides a summary of the dates each sample was prepared and analyzed and
29 demonstrates all holding time requirements were satisfied.

30 **GC/MS Tuning**

31 GC/MS instruments were tuned to ensure mass resolution, identification, and sensitivity. For
32 dioxin/furan sample analysis, instruments were tuned by analyzing perfluorokerosene prior to
33 each 12-hour period during which samples or standards were analyzed and comparing the mass
34 resolution for selected mass to electron ratios to the mass resolution criteria of 10,000 (10%
35 valley definition). All GC/MS instrument tunes met the criteria during analysis of the samples.

1 **Instrument Calibration**

2 Requirements for instrument calibration are established to ensure the instrument is capable of
3 producing acceptable qualitative and quantitative data for target compounds. ICAL demonstrates
4 that the instrument is capable of producing a linear curve, and continuing calibration
5 demonstrates maintenance of the linear curve on a daily basis.

6 Instruments were initially calibrated by analyzing standards containing compounds of interest at
7 five (5) concentrations. The concentrations of each compound were quantitated relative to the
8 closest eluting internal standard, and RFs and average RFs for each compound were calculated.

9 The RSD for labeled and unlabeled dioxin/furan standards should be $\leq 30\%$ and $\leq 20\%$,
10 respectively, for the calibration to be valid. The ICAL curve was checked and verified once
11 every 12 hours of analysis time for each target compound. This verification was accomplished
12 by analyzing a calibration standard and checking target analytes and internal standards. The RFs
13 for the target compounds were evaluated similarly for both the continuing and the initial
14 calibration.

15 The target analytes were evaluated by comparing the % drift between the standard concentrations
16 with the measured concentrations. The % drift for labeled and unlabeled dioxin/furan standards
17 should be $\leq 30\%$ and $\leq 20\%$, respectively, for the beginning continuing calibration to be valid
18 and $\leq 35\%$ and $\leq 25\%$, respectively, for the ending continuing calibration to be valid.

19 All ICAL criteria were met for both the primary instrument and the confirmation instrument
20 (confirmation using a second column IAW method requirements was required for one (1) or
21 more samples). All continuing calibration criteria were met for both the primary instrument and
22 the confirmation instrument

23 **Internal and Surrogate Standard Results**

24 Laboratory performance on individual samples was established by means of spiking activities.
25 All samples were spiked with nine (9) internal standard compounds prior to sample analysis.
26 Evaluation criteria for internal standards include estimating sample results when any one (1) of
27 the internal standards have recoveries outside the acceptance limits provided the recovery is
28 $\geq 10\%$. If any internal standard has $< 10\%$ recovery, associated sample results for that fraction
29 may be rejected.

30 Sampling efficiencies on individual samples are established by means of spiking activities. Prior
31 to sampling, the resin traps of all samples were spiked with five (5) labeled compounds. The
32 surrogates are used to monitor efficiency and are not used in the quantitation of unlabeled
33 analytes. Prior to extraction, the same five (5) standards were spiked onto the particulate filter to
34 monitor the extraction efficiency of the front-half fraction of the sampling train. Low recoveries,
35 $< 70\%$, could be indicative of breakthrough taking place during sampling. Table 7-9 presents the
36 internal and surrogate standard recoveries for all samples.

37 All internal and surrogate standard results were within acceptance limits with the exception of
38 the reagent blank resin fraction (SDC-M4ARB-M0023A-XAD). One (1) internal standard
39 recovery was less than the lower control limit but $> 10\%$. Results for this reagent blank should

1 be considered estimated. Qualification of the field sample results based on this circumstance is
2 not indicated.

3 **Method Blank Results**

4 Laboratory (method) blank samples were analyzed to determine the existence and magnitude of
5 contamination resulting from laboratory activities. No target analytes were reported at or above
6 the RL in laboratory blanks associated with the front- and back-half fractions and qualification of
7 the results was not indicated.

8 **Field Blank Results**

9 Field blanks are indicators of ambient and sample handling contamination. A field blank was
10 collected by setting up a sampling train, bringing the train to the sampling location, heating the
11 train, and performing leak checks. The field blank is recovered in the same manner as the field
12 samples. The front-half fraction of the field blank showed contamination with
13 1,2,3,4,6,7,8-heptaCDF (52 picograms [pg]), total heptaCDF (52 pg), and octaCDF (300 pg).
14 These analytes were not found in any of the field samples and qualification of the sample results
15 is not indicated. No target analytes were reported at or above the RL in back-half fraction of the
16 field blank.

17 **Reagent Blank Results**

18 Reagent blanks are indicators of the cleanliness of the reagents and materials used in the field.
19 Reagent blanks were collected that included the filter and solvents. No target analytes were
20 reported at or above the RL in any of the reagent blanks samples.

21 **Trip Blank Results**

22 Trip blanks are indicators of ambient and sample handling contamination introduced during
23 shipping of the samples. A trip blank consisting of a resin trap was shipped with the samples to
24 the laboratory and analyzed. No target analytes were reported at or above the RL in the trip
25 blank.

26 **LCS Results**

27 LCSs were analyzed to provide information on the accuracy of the analytical method and on
28 laboratory performance. The LCSs associated with the preparation and analysis of the field
29 samples are presented in Table 7-10. All LCS results were within SAP/QAPP QC limits.

30 **7.6.4 Volatile Organics**

31 During each run, a M0030 sampling train was used to collect samples for the determination of
32 emission levels of volatile PICs and TICs as specified in the SAP/QAPP. M0030 samples
33 collected during each run were analyzed IAW M5041A and M8260B. Four (4) Tenax tube
34 samples, four (4) Tenax/charcoal tube samples, and a single (1) condensate sample were
35 collected during each run. Prior to analysis, each sample was spiked with surrogate standards.
36 Each tube was prepared and analyzed separately, allowing breakthrough to be assessed.

1 Table 7-11 provides a summary of the date each sample was analyzed and demonstrates all
2 holding time requirements were satisfied.

3 **GC/MS Tuning**

4 Samples were analyzed by a GC/MS tuned to ensure mass resolution, identification, and
5 sensitivity. For volatile organic sample analyses, instruments were tuned by analyzing
6 4-bromofluorobenzene at the beginning of each 12-hour period during which samples or
7 standards were analyzed and comparing the ion abundance for selected mass to electron ratios to
8 the ion abundance criteria specified in M8260B. All associated GC/MS instrument tunings met
9 requirements prior to sample analysis.

10 **Instrument Calibration**

11 Requirements for instrument calibration were established to ensure the instrument was capable of
12 producing acceptable qualitative and quantitative data for target compounds. ICAL demonstrates
13 that the instrument is capable of producing a linear curve, and continuing calibration
14 demonstrates maintenance of the linear curve on a daily basis. SPCCs and CCCs must meet
15 criteria in the method for the calibration to be valid.

16 Instruments were initially calibrated by analyzing standards containing compounds of interest at
17 five (5) concentrations. The concentrations of each compound were quantitated relative to the
18 closest eluting internal standard and RFs. The average RFs for each compound were calculated.
19 The five (5) SPCC compounds were checked for a minimum average RF. The minimum
20 acceptable average RF was 0.10 for chloromethane, 1,1-dichloroethane, and bromoform. The
21 minimum acceptance average RF was 0.30 for 1,1,2,2-tetrachloroethane and chlorobenzene. If
22 the minimum RF criteria are not met, all detects should be considered estimated and NDs should
23 be flagged as “rejected” (unusable).

24 The RSD for the CCCs was calculated using the RF from the ICAL. The RSD for each CCC
25 must be < 30% for the calibration to be valid. The RSD for each non-CCC should be < 15% if
26 the average RF was used by the laboratory for quantitation. If the RSD for any target analyte is
27 > 15%, an alternate means of quantitation should be employed (e.g., use of a quadratic curve).
28 When the RSD is > 15% but < 90% all detects and NDs should be considered estimated. When
29 the RSD is > 90% all detects should be considered estimated and NDs should be flagged as
30 “rejected” (unusable).

31 The ICAL curve was checked and verified once every 12 hours of analysis time for each target
32 compound. This verification was accomplished by analyzing a calibration standard and checking
33 the SPCCs and CCCs. The RFs for the SPCCs and target compounds were evaluated similarly
34 for both the continuing and initial calibration.

35 The CCCs were evaluated by comparing the % drift between the CCC standard concentrations
36 with the measured concentrations. The % drift for each CCC should be < 20% for the continuing
37 calibration to be valid. When the % drift is > 20% but < 90% all detects and NDs should be
38 considered estimated. When the % drift is > 90% all detects should be considered estimated and
39 NDs should be flagged as “rejected” (unusable).

1 All ICAL criteria were met with the following exceptions:

- 2 • For the ICAL associated with samples SDC-M4A1-M0030-COND BK,
3 SDC-M4A1-M0030-COND, SDC-M4A2-M0030-COND, and
4 SDC-M4A4-M0030-COND (i.e., instrument “R” on 04/15/11), the RSD for target
5 analytes was < 15% with the exception of 2-propanol (15.1%). All associated
6 sample results for 2-propanol should be considered estimated.

7 All continuing calibrations were met with the following exceptions:

- 8 • For the continuing calibration associated with samples
9 SDC-M4A1-M0030-COND BK, SDC-M4A1-M0030-COND,
10 SDC-M4A2-M0030-COND, and SDC-M4A4-M0030-COND (i.e., instrument
11 “R” on 07/13/11), the RSD for target analytes was < 20% with the exception of
12 dichlorodifluoromethane (31.2%). All associated sample results for
13 dichlorodifluoromethane should be considered estimated.
- 14 • For the continuing calibration associated with samples SDC-M4A1-M0030-T BK,
15 SDC-M4A1-M0030-TC BK, SDC-M4A2-M0030-T BK,
16 SDC-M4A2-M0030-TC BK, SDC-M4A4-M0030-T1, SDC-M4A4-M0030-TC1,
17 SDC-M4A4-M0030-T2, SDC-M4A4-M0030-TC2, SDC-M4A4-M0030-T3,
18 SDC-M4A4-M0030-TC3, SDC-M4A4-M0030-T4, SDC-M4A4-M0030-TC4,
19 SDC-M4A4-M0030-T BK, SDC-M4A4-M0030-T BK, SDC-M4ATB-M0030-T,
20 and SDC-M4ATB-M0030-TC1, (i.e., instrument “Z” on 07/12/11), the RSD for
21 target analytes was < 20% with the exception of dichlorodifluoromethane
22 (45.9%), chloromethane (41.0%), 1,3-butadiene (42.8%), 2-chloropropane
23 (33.7%), 1,1,2-trichloro-1,2,2-trifluoroethane (24.3%), acetone (27.6%), carbon
24 disulfide (30.7%), 2-propanol (-36.7%), and 2-butanone (30.2%). All associated
25 sample results for these compounds should be considered estimated.
- 26 • For the continuing calibration associated with samples SDC-M4A2-M0030-T1,
27 SDC-M4A2-M0030-TC1, SDC-M4A2-M0030-T2, SDC-M4A2-M0030-TC2,
28 SDC-M4A2-M0030-T3, SDC-M4A2-M0030-TC3, SDC-M4A2-M0030-T4, and
29 SDC-M4A2-M0030-TC4, (i.e., instrument “Z” on 07/13/11), the RSD for target
30 analytes was < 20% with the exception of dichlorodifluoromethane (42.8%),
31 chloromethane (32.9%), 1,3-butadiene (33.2%), 2-chloropropane (31.4%),
32 1,1,2-trichloro-1,2,2-trifluoroethane (20.2%), acetone (40.5%), carbon disulfide
33 (29.2%), 2-propanol (48.9%), 2-butanone (36.1%), and 4-methyl-2-pentanone
34 (26.7%). All associated sample results for these compounds should be considered
35 estimated.
- 36 • For the continuing calibration associated with samples SDC-M4A1-M0030-T1,
37 SDC-M4A1-M0030-TC1, SDC-M4A1-M0030-T2, SDC-M4A1-M0030-TC2,
38 SDC-M4A1-M0030-T3, SDC-M4A1-M0030-TC3, SDC-M4A1-M0030-T4, and
39 SDC-M4A1-M0030-TC4, (i.e., instrument “Z” on 07/14/11), the RSD for target
40 analytes was < 20% with the exception of dichlorodifluoromethane (33.6%),
41 1,3-butadiene (24.9%), 1,1,2-trichloro-1,2,2-trifluoroethane (30.7%),
42 iodomethane (21.9%), carbon disulfide (38.7%), and trans-1,4-dichloro-2-butene

1 (-24.3%). All associated sample results for these compounds should be
2 considered estimated.

3 The ICAL establishes a linear range with an upper limit determined by the highest ICAL
4 standard. When the initial analysis of a sample has a concentration of any analyte that exceeds
5 the ICAL range, the sample should be diluted and reanalyzed if possible. For M0030, neither
6 dilution nor reanalysis is possible as the sample is used in its entirety during the initial analysis.
7 For M0030, analyte concentrations that exceed the linear range but do not saturate the detector
8 should be considered estimated and those that do saturate the detector should be rejected. All
9 reported results were within the linear range of the instrument on which they were analyzed.

10 **Surrogate Standard Results**

11 Laboratory performance on individual samples was established by means of spiking activities.
12 four (4) surrogate compounds prior to sample analysis – dibromofluoromethane,
13 1,2-dichloroethane-d₄, toluene-d₈, and 4-bromofluorobenzene.

14 Evaluation criteria for surrogates include estimating sample results when any one (1) of the
15 surrogates has recoveries outside the acceptance limits provided the recovery is $\geq 10\%$. If any
16 surrogate has $< 10\%$ recovery, sample results for that fraction may be rejected. Surrogate
17 recoveries are presented in Table 7-11. All surrogate recoveries were within acceptance limits
18 and qualification of the data is not indicated.

19 It is noted that the laboratory evaluated the surrogate recoveries using statistically derived limits
20 that were more stringent than those indicated in the SAP/QAPP. The laboratory developed limits
21 for both sorbent tubes and condensate. When the sorbent tube surrogate recoveries are evaluated
22 using the laboratory derived limits there is no change in the assessment. Table 7-11 lists the
23 acceptance limits specified in the SAP/QAPP.

24 **Internal Standard Results**

25 Internal standards are monitored to ensure GC/MS sensitivity and response is stable during every
26 instrument run. Three (3) internal standards were added to each sample prior to analysis:
27 fluorobenzene, chlorobenzene-d₅, and 1,4-dichlorobenzene-d₄.

28 M8260B specifies that internal standard area counts for the continuing calibration standard must
29 not vary by more than a factor of two (2) (-50% to + 100%) from the associated ICAL standards
30 and the RT must not vary by > 30 seconds. Internal standard acceptance criteria for samples and
31 blanks are not specified by M8260B. For validation purposes, samples and blanks were
32 evaluated to verify that internal standard area counts did not vary by a factor of two (2) (-50% to
33 + 100%) from the associated continuing calibration standard and the RT did not vary
34 by > 30 seconds. Should the area response be outside the criteria, professional judgment is used
35 to assess the impact on the reported results. Internal standard area and RT were found to have
36 met acceptance criteria for all samples.

1 **Method Blank Results**

2 Laboratory (method) blank samples were analyzed to determine the existence and magnitude of
3 contamination resulting from laboratory activities.

4 Acetone, methylene chloride, and toluene were found in one (1) or more of the method blanks.
5 Field samples have not been corrected for method blank contamination, thus providing the most
6 conservative emissions results. However, all associated sample results for the aforementioned
7 analytes should be considered estimated.

8 **Field Blank Results**

9 Field blanks are indicators of ambient and sample handling contamination. A field blank was
10 collected with each run.

11 Chloromethane, acetone, methylene chloride, and toluene were detected in one (1) or more field
12 blanks. Field samples have not been corrected for field blank contamination, thus providing the
13 most conservative emissions results. However, all associated sample results for the
14 aforementioned analytes should be considered estimated.

15 **Trip Blank Results**

16 A trip blank is an indicator of ambient and sample handling contamination introduced during
17 shipping of media and samples. A trip blank consists of a Tenax tube, a Tenax/charcoal tube,
18 and reagent water in a septum cap vial that were shipped with the samples to the laboratory and
19 analyzed.

20 Acetone, methylene chloride, and toluene were detected in the Tenax and Tenax/charcoal trip
21 blank samples. Field samples have not been corrected for trip blank contamination, thus
22 providing the most conservative emissions results. However, all associated results for the
23 aforementioned analytes should be considered estimated.

24 Acetone, 2-butanone, 1,2-dichloropropane, cis-1,3-dichloropropene, methylene chloride, styrene,
25 tetrachloroethene, and toluene were detected in the condensate trip blank sample. Field samples
26 have not been corrected for trip blank contamination, thus providing the most conservative
27 emissions results. However, all associated results for the aforementioned analytes should be
28 considered estimated.

29 **LCS/LCSD Results**

30 For the Tenax and Tenax/charcoal tubes, the entire sample is consumed with each analysis and it
31 is not possible to provide MS/MSDs. For the condensate fraction, a single sample container is
32 provided to the laboratory and though the entire sample is not consumed, the laboratory
33 procedure does not provide for replicate analyses from the same container. For these samples,
34 LCS/LCSDs were prepared in the laboratory by spiking blanks with known concentrations of
35 selected compounds provided by an independent vendor. The LCS/LCSD results are
36 summarized in Table 7-12. QC objectives were met in all instances and qualification of the data
37 is not indicated.

1 It is noted that the SAP/QAPP requires five (5) compounds to be spiked and evaluated for
2 LCS/LCSD pairs. The laboratory spiking solution contains more than the five (5) required
3 compounds. Only the five (5) compounds indicated in the SAP/QAPP were considered when
4 evaluating the useability of the data with respect to LCS/LCSD performance.

5 **Breakthrough**

6 The results of compounds detected on the front and back tubes of each M0030 pair were
7 evaluated for breakthrough to determine if a compound may have exceeded the absorbing
8 capacity of the tube pair. According to EPA/625/6-89/023, breakthrough is indicated when
9 > 30% of a compound detected on the front tube is present in the back tube. The breakthrough
10 analysis does not apply when < 75 ng is detected on the back tube. With the exceptions noted
11 below, breakthrough determination was not required as no target analytes were detected on both
12 the front and back tube when a compound was present on the back tube at a concentration of
13 ≥ 75 ng for any sample.

14 The chloromethane results from C4aR1-Sets 1/2/3/4, C4aR2-Sets 1/2/3/4, and C4aR4-Set 4,
15 meet the US EPA's definition of breakthrough as reportable concentrations were found on the
16 corresponding Tenax tube and > 75 ng was detected on each Tenax/charcoal tube.
17 Chloromethane is a common analysis artifact and is often detected in laboratory, field, and trip
18 blanks. Considering the actual concentrations detected on the Tenax tubes and typical blank
19 results, it is not believed that these results are indicative of actual breakthrough. However, all
20 associated sample results for chloromethane should be considered estimated.

21 The acetone results from C4aR1-Sets 1/2/3/4, C4aR2-Sets 1/2/3/4, and C4aR4-Sets 2/3, meet the
22 US EPA's definition of breakthrough as reportable concentrations were found on the
23 corresponding Tenax tube and > 75 ng was detected on each Tenax/charcoal tube. Acetone is a
24 common analysis contaminant and is often detected in laboratory, field, and trip blanks.
25 Considering the actual concentrations detected on the Tenax tubes and typical blank results, it is
26 not believed that these results are indicative of actual breakthrough. However, all associated
27 sample results for acetone should be considered estimated.

28 The methylene chloride results from C4aR4-Sets 2/3/4 meet the US EPA's definition of
29 breakthrough as reportable concentrations were found on the corresponding Tenax tube and > 75
30 ng was detected on each Tenax/charcoal tube. Methylene chloride is a common field and
31 laboratory contaminant and was detected in associated laboratory, field, and trip blanks.
32 Considering the actual concentrations detected on the Tenax tubes and the associated blank
33 results, it is not believed that these results are indicative of actual breakthrough. However, all
34 associated sample results for methylene chloride should be considered estimated.

35 **7.6.5 Volatile TOCs**

36 Exhaust gases were sampled for volatile total organics IAW M0040. The following subsections
37 discuss the volatile total organic analysis.

1 **Instrument Calibration (Bag Analysis)**

2 Requirements for instrument calibration were established to ensure the instrument was capable of
3 producing acceptable qualitative and quantitative data for target compounds. ICAL demonstrates
4 that the instrument is capable of producing a linear curve and continuing calibration
5 demonstrates maintenance of the linear curve on a daily basis.

6 The field GC was calibrated on 07/04/11 and all ICAL acceptance criteria of 5% RSD for RT and
7 area responses were satisfied. A continuing calibration verification (CCV) was analyzed at the
8 beginning of each analytical sequence. The acceptance criterion for CCV analysis is $\pm 10\%$ for
9 RT and area responses. All CCV analyses were within acceptance limits with the exception of
10 C4aR4 propane (21.5%). All C4aR4 propane results should be considered estimated.

11 **LCS Results (Bag Analysis)**

12 LCSs were analyzed to provide information on the accuracy of the analytical method and on
13 laboratory performance. The CCV conducted at the beginning of each analytical sequence
14 served as the LCS for each day. The results of the LCSs are presented in Table 7-14. All LCS
15 recoveries were within the acceptance limits and qualification of the sample results is not
16 indicated.

17 **Field Spike Results (Bag Analysis)**

18 A field spike is a field-collected sample that is spiked with a known quantity of one (1) or more
19 target analytes. The field spike provides information about the effect of each sample matrix on
20 the analysis procedure. The results of the field spike are presented in Table 7-15. The field
21 spike recovery was within the acceptance limits and qualification of the sample results is not
22 indicated.

23 **Field Blank Results (Bag Analysis)**

24 Field blanks are Tedlar bags filled with nitrogen that are sampled in the same manner as a field
25 sample. The blanks act as an indicator of contamination that may occur during field sampling.
26 A daily field blank was collected IAW SAP/QAPP requirements.

27 For C4a, contamination was observed in each of the four (4) field blanks that were collected.
28 Ethane (C_2) was found in the C4aR4 field blank, butane (C_4) was found in the C4aR3 field blank,
29 and hexane (C_6) was found in all four (4) field blanks. For C4aR4, the sample results for C_2
30 were "ND" and are not impacted by this circumstance. For C4aR3, C_4 was detected in both the
31 "A" and "B" samples at concentrations that were $< 5X$ the amount detected in the field blank.
32 These results should be considered "ND" at the reported concentrations. For all runs, C_6 was
33 observed or detected. Though C_6 is reported to be a system contaminant, field sample results are
34 not corrected for field blank contamination. However, all reported C_6 sample results should be
35 considered estimated.

1 **Trip Blank Results (Bag Analysis)**

2 A trip blank is a Tedlar bag that is filled with nitrogen in the field laboratory, carried to the
3 sampling location, and returned to the field laboratory for analysis. Trip blanks were collected
4 during each test condition and used to assess the existence and magnitude of contamination
5 resulting from ambient conditions. C₄ and C₆ were detected in the trip blank collected on
6 07/07/11. Field sample results are not corrected for trip blank contamination. However, all
7 reported C₄ and C₆ sample results should be considered estimated.

8 **Compound Identification (Bag Analysis)**

9 Identification and quantitation of C₆ for both analyses of C4aR1 Bag B was impacted by the loss
10 of the raw data files as reported by URS-Austin. Specifically, the C₆ peak present on both
11 analyses is not identified by the data system and has no retention time, area, or concentration. C₆
12 results have been reported as “not quantitated” (NQ) to indicate that a C₆ peak is present but a
13 corresponding area and concentration is not available. Though no other C4aR1 Bag B results are
14 impacted by this circumstance, it is recommended that results from C4aR1 Bag A be used to
15 determine emission rates as the C4aR1 Bag B total cannot account for the C₆.

16 **Instrument Calibration (Condensate Analysis)**

17 A multi-point calibration curve of pentane (C₅) through heptane (C₇) was prepared to determine
18 an average RF factor for each carbon range. IAW the method requirements, C₄ is reported using
19 the C₅ RF. A CCV and blank are analyzed every 10 samples. The CCV must be within 15% for
20 the calibration to be valid. The continuing calibration and RT window criteria were met for the
21 method.

22 **Method Blank Results (Condensate Analysis)**

23 A method blank was analyzed to determine the existence and magnitude of contamination
24 resulting from laboratory activities. All method blank results were < RL and qualification of the
25 results is not indicated.

26 **Surrogate Standard Results (Condensate Analysis)**

27 Laboratory performance on individual samples was established by means of spiking samples
28 with known concentrations of selected compounds. All samples were spiked with n-octane as a
29 surrogate compound prior to sample analysis.

30 Evaluation criteria for the surrogate include estimating sample results if the surrogate recovery is
31 outside the acceptance limits provided the recovery is $\geq 10\%$. If the surrogate has < 10%
32 recovery, sample results may be rejected. Surrogate recoveries are presented in Table 7-13. All
33 objectives were met, and qualification of the data is not indicated.

34 **LCS Results (Condensate Analysis)**

35 LCSs were prepared in the laboratory by filling sample containers with reagent water spiked with
36 known concentrations of selected compounds. A LCS was analyzed in duplicate to provide

1 information on the accuracy of the analytical method and on laboratory performance. The results
 2 of the LCS are presented in Table 7-16. All objectives were met and qualification of the data is
 3 not indicated.

4 **Field Blank Results (Condensate Analysis)**

5 Condensate field blanks represent the collected reagent water rinse during recovery of each field
 6 blank. The blanks act as an indicator of contamination that may occur during field sampling. A
 7 daily field blank was collected resulting in one (1) field blank for each run of the performance
 8 test.

9 Contamination was observed in the C4aR2 and C4aR3 field blanks as summarized below:

<u>Boiling Point Range</u>	<u>Field Blank 07/06/11(total ug)</u>	<u>Field Blank 07/07/11(total ug)</u>
C ₅ (30-60°C)	0.011	0.012

10 Field samples are not corrected for field blank contamination. However, all reported C4a sample
 11 results for the C₅ (30 to 60°C) boiling point range should be considered estimated.

12 **Trip Blank Results (Condensate Analysis)**

13 Trip blanks are sample vials filled with reagent water that are packaged with the field samples
 14 for shipment to the off-site laboratory. Trip blanks may be used to determine the existence and
 15 magnitude of contamination resulting from ambient conditions. For C4a, a condensate trip blank
 16 was not provided to the laboratory for analysis. Reported sample results are not impacted by this
 17 circumstance.

18 **7.6.6 Acid Gases**

19 During each run, a M26A sampling train was used to collect samples for the determination of
 20 acid gas emission levels. The samples were analyzed IAW procedures identified in the sampling
 21 and analysis method, M26A. Table 7-17 provides a summary of the dates each sample was
 22 collected and analyzed and demonstrates all holding time requirements were satisfied.

23 **Instrument Calibration**

24 Requirements for instrument calibration are established to ensure the instrument is capable of
 25 producing acceptable qualitative and quantitative data. ICAL demonstrates the instrument is
 26 capable of acceptable performance prior to sample analysis, and continuing calibration sample
 27 analyses verify that the ICAL is still valid.

28 The IC was calibrated IAW M26A, using a minimum of five (5) points for the ICAL. The
 29 correlation coefficient for chloride and fluoride were > 0.995 for each ICAL curve. Initial and
 30 continuing calibration verification sample results were within the acceptable control limits of 90
 31 to 110% recovery.

1 **Duplicate Injections**

2 Duplicate injections of the samples were performed to ensure the precision of the reported result.
3 The duplicate injections of each sample should be within 5% RPD when sample results are > 5X
4 the RL. No field sample results were > 5X the RL and RPD was not evaluated.

5 **Method Blank Results**

6 Laboratory (method) blank samples were analyzed to determine the existence and magnitude of
7 contamination resulting from laboratory activities. No target analytes were detected at or above
8 the MDL in any of the laboratory blanks. No qualification of samples was performed based on
9 laboratory blank results.

10 **Field and Reagent Blank Results**

11 Reagent blanks are indicators of reagent contamination. Field blanks are indicators of reagent
12 and ambient contamination that may have contaminated the sample. No target analytes were
13 detected at or above the MDL in the field and reagent blanks.

14 **LCS Results**

15 LCSs were samples of known concentration that are prepared and analyzed along with the field
16 samples. The LCSs were used to monitor the overall performance of the analysis process. The
17 results of the LCS analyses are summarized in Table 7-18. All objectives were met, and
18 qualification of the data was not necessary.

19 **MS/MSD Results**

20 The MS/MSD sample results provide information about the effect of each sample matrix on the
21 analysis procedure. The MS/MSD results are summarized in Table 7-19. All objectives were
22 met, and qualification of the data was not necessary.

23 **7.6.7 Particulates**

24 A M26A sampling train was used to collect samples for the determination of emission levels of
25 particulates. The samples were analyzed for particulates gravimetrically IAW M5. QC
26 measures included the use of Class-S weights to verify the accuracy of the analytical balance, the
27 collection and analysis of blank samples, and replicate weighings of each sample collected.

28 All sample analyses were completed within the holding times specified in the SAP/QAPP. The
29 balance calibration was verified prior to each use as required and replicate weighings were
30 performed and meet QC requirements.

31 There was field blank contamination observed that would have biased the reported results.
32 Particulate was present in both the field blank filter (0.0003 grams [g]) and solvent rinses
33 (0.0008 g). Particulate was also present in the reagent blank filter (0.0003 g). All sample results
34 should be considered estimated and may be biased high.

1 **7.6.8 Trace Metals**

2 During each run, a M29 sampling train was used to collect samples for the determination of
3 emission levels of metals as indicated in the SAP. The analysis of the samples for mercury was
4 performed IAW M7470A. All other metals analysis was performed IAW M6020. Instrument
5 calibration and calibration verification for each method employed was performed IAW method
6 requirements.

7 **Instrument Tune**

8 The ICP/MS instrument was tuned prior to each analytical sequence to ensure mass resolution,
9 identification, and sensitivity. The results of each tune show that the ICP/MS achieved a mass
10 resolution of < 1.0 atomic mass units (amu) at 10% peak height and met the mass calibration of
11 < 0.1 amu from the expected value.

12 **Instrument Calibration**

13 Instrument calibration was performed to ensure the instrument was capable of producing
14 acceptable quantitative data. ICAL demonstrated that the instrument was capable of acceptable
15 performance prior to sample analysis and continuing calibration sample analyses verified that the
16 ICAL was still valid. As allowed by M6020, the instrument was periodically recalibrated during
17 the run to ensure accurate quantitation of target analytes.

18 M6020, ICP/MS, was used for the analysis of aluminum, antimony, arsenic, barium, beryllium,
19 boron, cadmium, chromium, cobalt, copper, lead, manganese, nickel, potassium, selenium,
20 silver, thallium, tin, uranium, vanadium, and zinc. M7470A, CVAAS, was used for the
21 determination of mercury. The ICP/MS and CVAAS were calibrated IAW M6020 and M7470A,
22 respectively. Initial and continuing calibration verification sample results were within the
23 acceptable control limits of 90 to 110% recovery for ICP/MS and 80 to 120% for CVAAS
24 throughout the analysis of all exhaust gas samples.

25 **Internal Standard Results**

26 M6020 requires the use of internal standards. Internal standards were added to each sample
27 analyzed by M6020. Internal standard intensities fell between 30 and 130% of the internal
28 standard intensities in the first standard used during calibration. As the method allows the
29 instrumented to be re-sloped during the course of a sequence, internal standard recoveries are
30 calculated using the standard used for re-sloping, as applicable. Internal standard recoveries for
31 each field sample met the recovery objectives.

32 **Interference Check Samples**

33 M6020 requires interference check samples (ICSs) to be analyzed at the beginning of each
34 analytical sequence. Two (2) check sample solutions are run, an "A" solution (i.e., ICSA)
35 containing only interfering elements at high concentrations and an "AB" solution (i.e., ICSAB),
36 containing all analytes of interest including the interfering elements. The EPA's validation
37 guidelines are written for a modified procedure that requires an additional ICS at the end of each
38 analytical sequence. M6020 does not require an ending ICS analysis and the review criteria

1 applied only considered the required ICS. The ICS results were within $\pm 20\%$ of the true value
2 for all analytes in the ICS solutions for each run analyzed.

3 M7470A has no interference check sample requirements.

4 **Method Blank Results**

5 Method blanks were analyzed to determine the existence and magnitude of contamination
6 resulting from laboratory handling of the samples. Method blank results for are summarized in
7 Table 7-20.

8 The laboratory method blanks associated with the preparation and analysis of the exhaust gas
9 samples are blanks G1G130000-154 and G1G130000-157 for all ICP/MS elements. The method
10 blanks associated with the mercury preparation and analysis are G1G120000-106,
11 G1G120000-107, G1G120000-108, G1G120000-109, and G1G150000-117. No target elements
12 were detected above the RL (note that the laboratory blank associated with the back-half fraction
13 had a reported arsenic concentration that was equal to the RL). There were instances where
14 target metals were found between the RL and MDL.

15 **Field and Reagent Blank Results**

16 Reagent blanks are indicators of the quality of the reagents used in the preparation and recovery
17 of the sampling trains. Field blanks are indicators of reagent and ambient contamination that
18 may have occurred in the field. The results of reagent and field blank are presented in
19 Table 7-20.

20 M29 allows for correction of the field sample results for reagent blank contribution. However,
21 the field sample results were not corrected for reagent blank metals content, which allows for
22 reporting the most conservative metals emissions data. Reported “total catch” results should be
23 considered biased high for those metals identified in Table 7-20 that were found in the field and
24 reagent blanks.

25 **LCS/LCSD Results**

26 LCSs are samples of known concentration that were prepared and analyzed along with the field
27 samples. The LCSs were used to monitor the overall performance of the preparation and
28 analysis process. The results of the LCSs are summarized in Table 7-21. All objectives were
29 met and qualification of the data was not necessary.

30 **MS/MSD Results**

31 The MS/MSD sample results provide information about the effect of each sample matrix on the
32 preparation and analysis procedure. For the M29 sampling train, the MS/MSDs are
33 post-digestion spike/post-digestion spike duplicates for the front- and back-half fractions of the
34 sampling train as the sample cannot be split and separate aliquots spiked prior to sample
35 preparation. Only the back-half mercury fraction has an MS/MSD that is prepared by spiking
36 sample aliquots prior to digestion. The MS/MSD results are summarized in Table 7-22.

1 All MS/MSD recoveries were within acceptance limits with the exception of beryllium and
2 manganese MS/MSD recoveries associated with the back-half fraction. Though the beryllium
3 MS/MSD recoveries (both 74%) are only marginally below the lower acceptance limit, the
4 back-half fraction beryllium results should be considered estimated. For manganese, the sample
5 concentration was substantially greater than the spike amount and meaningful recovery data was
6 not obtainable. The back-half fraction manganese results should be considered estimated.

7 **Serial Dilution Results**

8 Serial dilution, or dilution test, is required by M6020 and is used to determine whether
9 significant physical or chemical interferences exist attributable to sample matrix. If the analyte
10 concentration is 100 times (100X) greater than the concentration in the MDL the serial dilution
11 results should be within 10% of the original determination. The laboratory conducted serial
12 dilution analysis with each analytical batch per instrument as required.

13 All serial dilution results were within acceptance limits with the exception of copper (14.6%) and
14 zinc (17.7%) in the front-half fraction serial dilution and aluminum (26.3%), nickel (11.9%), and
15 silver (12.3%) in the back-half fraction serial dilution. All front-half fraction copper and zinc
16 results are > 50 times (50X) the MDL and should be considered estimated. The C4aR1 back-half
17 fraction aluminum, nickel, and silver results are > 50X the MDL and should be considered
18 estimated. The C4aR2 back-half fraction aluminum, nickel, and silver results are < 50X the
19 MDL and qualification of these results is not indicated. The C4aR4 back-half fraction aluminum
20 result is > 50X the MDL and should be considered estimated. The C4aR2 back-half fraction
21 nickel and silver results are < 50X the MDL and qualification of these results is not indicated.

22 **7.6.9 Energetics**

23 Exhaust gases were sampled for energetic compounds using the MM5-E. The laboratory
24 provided preloaded and surrogate spiked (3,4-dinitrotoluene) XAD traps, and the impinger
25 fraction of the sampling train was spiked by URS-Austin prior to sampling with surrogate.
26 Following any necessary extraction, the sampling train components were analyzed for energetic
27 compounds using M8330, HPLC. Table 7-23 provides a summary of the dates each sample was
28 prepared and analyzed and demonstrates all holding time requirements were satisfied. The
29 following subsections discuss the energetic analysis.

30 **Instrument Calibration**

31 Instrument calibration was performed to ensure that the instrument was capable of producing
32 acceptable quantitative data. ICAL demonstrates that the instrument is capable of acceptable
33 performance prior to sample analysis, and continuing calibration sample analyses verify that the
34 ICAL is still valid. Instrument calibration met all acceptance criteria.

35 **Surrogate Standard Results**

36 Laboratory performance on individual samples was established by field spiking impinger and
37 XAD samples with known concentrations of 3,4-dinitrotoluene. No further surrogate spiking
38 was performed in the laboratory for the field samples. The method blanks, LCSs, and LCSsDs

1 associated with the impinger and XAD fractions were spiked with equivalent concentrations of
2 3,4-dinitrotoluene prior to extraction at the laboratory.

3 Evaluation criteria for the surrogate include estimating sample results when any surrogate has a
4 recovery $\geq 10\%$, but below the lower QC limit. If any surrogate has $< 10\%$ recovery reported,
5 concentrations may be rejected. Surrogate recoveries are presented in Table 7-23. The reported
6 surrogate recoveries for the XAD fraction represent the combined recovery from all extractions
7 performed. All recovery objectives were met, and qualification of the data is not indicated.

8 It is noted that the aqueous reagent blank (SDC-M4ARB-MM5E-COND) was not spiked with
9 surrogate in the field. As the laboratory does not add surrogate to the condensate fractions (they
10 are field spiked), no surrogate was added to the reagent blank either. Field sample results are not
11 impacted by this circumstance.

12 **Method Blank Results**

13 A method blank was prepared and analyzed along with the field samples to determine the
14 existence and magnitude of contamination resulting from laboratory activities. The method
15 blank results also reflect the background level of artifacts present in the resin. No target analytes
16 were detected in any of the method blanks and qualification of the data is not indicated.

17 **Field Blank Results**

18 Field blanks are indicators of ambient and sample handling contamination. A field blank was
19 collected by setting up a sampling train, bringing the train to the sampling location, heating the
20 train, and performing leak checks. The field blank is recovered in the same manner as the field
21 samples. No target analytes were detected in any field blank fraction.

22 **Reagent Blank Results**

23 Reagent blanks are indicators of the cleanliness of the reagents and materials used in the field.
24 Reagent blanks were collected that included the filter, solvent, and reagent water. No target
25 analytes were detected in any of the reagent blanks samples.

26 **Trip Blank Results**

27 Trip blanks are indicators of ambient and sample handling contamination introduced during
28 shipping of the samples. A trip blank consisting of a resin trap was shipped with the samples to
29 the laboratory and analyzed. No target analytes were detected in the trip blank samples.

30 **LCS Results**

31 LCSs were analyzed to provide information on the accuracy of the analytical method and on
32 laboratory performance. The results of the LCSs are presented in Table 7-24. All objectives
33 were met for all fractions and qualification of the data is not indicated.

1 **7.6.10 Mustard**

2 A DRE DAAMS was used to collect a sample for the determination of emission levels of HD
3 agent. The DRE DAAMS samples collected during each run of C4a were analyzed IAW a site-
4 specific procedures.

5 QC measures included the use of quality laboratory (QL) and quality plant (QP) samples. QL
6 samples are sample tubes that are spiked with a known quantity of mustard and used to verify the
7 initial calibration on a daily basis. QP samples are sample tubes that are spiked with the mustard
8 prior to sampling, loaded into the sampling array, and aspirated for the same amount of time as
9 the DRE sample tube. The results were reported, reviewed, and validated in accordance with the
10 approved ANCDF SDC Emissions Test Plan requirements. The mustard DRE DAAMS data
11 report is provided in Appendix G.

12 The sampling data and laboratory reports have been reviewed and validated by designated
13 ANCDF personnel. All sample analyses were completed within the required holding time.

14 The QL samples analyzed at the beginning and end of each analytical sequence meet the site
15 specific procedure requirements.

16 The QP samples aspirated with C4aR2 and C4aR4 yielded percent recoveries that were within
17 acceptance limits. The C4aR1 QP recovery of 145.5% was above the upper QC limit (65 to
18 135%). No HD agent was found in the C4aR1 samples and the usability of the sample result is
19 not impacted by the high bias indicated by the associated QP result. A summary table presented
20 in Appendix G lists QP recoveries by sample as reported by the laboratory.

21 **7.7 CONCLUSIONS**

22 **7.7.1 Comparability of Analytical Data**

23 IAW the ANCDF SDC Emissions Test Plan, standardized methodologies (e.g., approved US
24 EPA sample collection procedures and site specific procedures) were employed to collect
25 samples and generate data in common units. Samples were analyzed using the US EPA
26 approved procedures described in the ANCDF SDC Emissions Test Plan. For this reason,
27 ANCDF considers the results generated during this test to be comparable to other results
28 collected using the same methodologies and procedures.

29 **7.7.2 Representativeness of Analytical Data**

30 Based on a review of the sampling and analysis results, ANCDF considers the exhaust gas
31 sample results to be representative. The exhaust gas sampling locations met US EPA
32 specifications for distance from flow disturbances and absence of cyclonic flow was
33 demonstrated at the isokinetic sampling locations. Approved US EPA sampling methods were
34 used to collect all exhaust gas samples and the analytical procedures specified in the ANCDF
35 SDC Emissions Test Plan were employed in their analysis.

1 **7.7.3 Completeness of Analytical Data**

2 The ANCDF SDC Emissions Test Plan identified obtaining a minimum of three (3) complete
3 exhaust gas sample sets the critical measurement. Based on a review of the sampling and
4 analysis results ANCDF considers the exhaust gas sample results to be complete. Exhaust gas
5 samples from a minimum of three (3) test runs were collected and analyzed. No field samples
6 were wholly rejected or flagged as unusable during the data validation process.

7 On an individual analyte basis, there were a total of 3,078 individual analytes planned to be
8 reported for the field samples collected. None of the 3,078 individual analytes were reported to
9 be unusable. With 3,078 of the 3,078 individual analytes reported to be useable, this represents a
10 completeness of 100%.

11 **7.7.4 Analytical Data Usability**

12 The analytical data generated from the C4a field samples is valid and considered useable for
13 their intended purposes. Results qualified as estimated can be used as long as the limitations of
14 the results are understood.

Table 7-1: Field and Laboratory Sample Identification Cross Reference Guide

Laboratory Sample No.	Field Sample No.	Test Run No.	Sampling Date	Analytical Testing Parameters										
				Semivolatile Organics	Semivolatile Unspeciated and Gravimetric Organics	Dioxins/Furans	Volatile Organics	Volatile Unspeciated Organics	Hydrogen Chloride/Fluoride	Total Chlorine	Particulates	Trace Metals	Energetics	
G1G090420-001	SDC-M4A1-M0010-SEMIS-FH	C4aR1	07/05/11	X										
G1G090420-002	SDC-M4A1-M0010- SEMIS-BH	C4aR1	07/05/11	X										
G1G090420-003	SDC-M4A1-M0010- SEMIS-COND	C4aR1	07/05/11	X										
G1G090420-004	SDC-M4A2-M0010- SEMIS-FH	C4aR2	07/06/11	X										
G1G090420-005	SDC-M4A2-M0010- SEMIS-BH	C4aR2	07/06/11	X										
G1G090420-006	SDC-M4A2-M0010- SEMIS-COND	C4aR2	07/06/11	X										
G1G090420-010	SDC-M4A4-M0010- SEMIS-FH	C4aR4	07/08/11	X										
G1G090420-011	SDC-M4A4-M0010- SEMIS-BH	C4aR4	07/08/11	X										
G1G090420-012	SDC-M4A4-M0010- SEMIS-COND	C4aR4	07/08/11	X										
G1G090420-013	SDC-M4AFB-M0010- SEMIS-FH	---	07/03/11	X										
G1G090420-014	SDC-M4AFB-M0010- SEMIS-BH	---	07/03/11	X										
G1G090420-015	SDC-M4AFB-M0010- SEMIS-IMPINGER RINSE	---	07/03/11	X										
G1G090420-016	SDC-M4ARB-M0010- SEMIS-FILTER	---	07/07/11	X										
G1G090420-017	SDC-M4ARB-M0010- SEMIS-XAD	---	07/07/11	X										
G1G090420-018	SDC-M4ARB-M0010- SEMIS-WATER	---	07/07/11	X										
G1G090420-019	SDC-M4ARB-M0010- SEMIS-MECL/MEOH	---	07/07/11	X										
G1G090420-020	SDC-M4ATB-M0010-SEMIS-XAD	---	07/07/11	X										
H1G110415-001	SDC-M4A1-M0010-TOE-COMBINED	C4AR1	07/05/11		X									
H1G110415-002	SDC-M4A2-M0010-TOE-COMBINED	C4AR2	07/06/11		X									
H1G110415-004	SDC-M4A4-M0010-TOE-COMBINED	C4AR4	07/08/11		X									
H1G110415-005	SDC-M4AFB-M0010-TOE-COMBINED	---	07/03/11		X									
H1G110415-006	SDC-M4ARB-M0010-TOE-COMBINED	---	07/07/11		X									

Table 7-1: Field and Laboratory Sample Identification Cross Reference Guide (Continued)

Laboratory Sample No.	Field Sample No.	Test Run No.	Sampling Date	Analytical Testing Parameters										
				Semivolatile Organics	Semivolatile Unspeciated and Gravimetric Organics	Dioxins/Furans	Volatile Organics	Volatile Unspeciated Organics	Hydrogen Chloride/Fluoride	Total Chlorine	Particulates	Trace Metals	Energetics	
H1G110415-007	SDC-M4ATB-M0010-TOE-XAD	---	07/07/11		X									
G1G090416-001	SDC-M4A1-M0023A-FH	C4aR1	07/05/11			X								
G1G090416-002	SDC-M4A1-M0023A-BH	C4aR1	07/05/11			X								
G1G090416-003	SDC-M4A2-M0023A-FH	C4aR2	07/06/11			X								
G1G090416-004	SDC-M4A2-M0023A-BH	C4aR2	07/06/11			X								
G1G090416-007	SDC-M4A4-M0023A-FH	C4aR4	07/08/11			X								
G1G090416-008	SDC-M4A4-M0023A-BH	C4aR4	07/08/11			X								
G1G090416-009	SDC-M4AFB-M0023A-FH	---	07/03/11			X								
G1G090416-010	SDC-M4AFB-M0023A-BH	---	07/03/11			X								
G1G090416-011	SDC-M4ARB-M0023A-FILTER	---	07/07/11			X								
G1G090416-012	SDC-M4ARB-M0023A-XAD	---	07/07/11			X								
G1G090416-013	SDC-M4ARB-M0023A-MECL,TOL,ACE	---	07/07/11			X								
G1G090416-014	SDC-M4ATB-M0023A-XAD	---	07/08/11			X								
H1G110424-001	SDC-M4A1-M0030-T1	C4aR1	07/05/11				X							
H1G110424-002	SDC-M4A1-M0030-TC1	C4aR1	07/05/11				X							
H1G110424-003	SDC-M4A1-M0030-T2	C4aR1	07/05/11				X							
H1G110424-004	SDC-M4A1-M0030-TC2	C4aR1	07/05/11				X							
H1G110424-005	SDC-M4A1-M0030-T3	C4aR1	07/05/11				X							
H1G110424-006	SDC-M4A1-M0030-TC3	C4aR1	07/05/11				X							
H1G110424-007	SDC-M4A1-M0030-T4	C4aR1	07/05/11				X							
H1G110424-008	SDC-M4A1-M0030-TC4	C4aR1	07/05/11				X							
H1G110424-009	SDC-M4A1-M0030-T BK	---	07/05/11				X							

Table 7-1: Field and Laboratory Sample Identification Cross Reference Guide (Continued)

Laboratory Sample No.	Field Sample No.	Test Run No.	Sampling Date	Analytical Testing Parameters										
				Semivolatile Organics	Semivolatile Unspeciated and Gravimetric Organics	Dioxins/Furans	Volatile Organics	Volatile Unspeciated Organics	Hydrogen Chloride/Fluoride	Total Chlorine	Particulates	Trace Metals	Energetics	
H1G110424-010	SDC-M4A1-M0030-TC BK	---	07/05/11				X							
H1G110424-011	SDC-M4A1-M0030-COND	C4aR1	07/05/11				X							
H1G110424-012	SDC-M4A1-M0030-COND BK	---	07/05/11				X							
H1G110424-013	SDC-M4A2-M0030-T1	C4aR2	07/06/11				X							
H1G110424-014	SDC-M4A2-M0030-TC1	C4aR2	07/06/11				X							
H1G110424-015	SDC-M4A2-M0030-T2	C4aR2	07/06/11				X							
H1G110424-016	SDC-M4A2-M0030-TC2	C4aR2	07/06/11				X							
H1G110424-017	SDC-M4A2-M0030-T3	C4aR2	07/06/11				X							
H1G110424-018	SDC-M4A2-M0030-TC3	C4aR2	07/06/11				X							
H1G110424-019	SDC-M4A2-M0030-T4	C4aR2	07/06/11				X							
H1G110424-020	SDC-M4A2-M0030-TC4	C4aR2	07/06/11				X							
H1G110424-021	SDC-M4A2-M0030-T BK	---	07/06/11				X							
H1G110424-022	SDC-M4A2-M0030-TC BK	---	07/06/11				X							
H1G110424-023	SDC-M4A2-M0030-COND	C4aR2	07/06/11				X							
H1G110424-035	SDC-M4A4-M0030-T1	C4aR4	07/08/11				X							
H1G110424-036	SDC-M4A4-M0030-TC1	C4aR4	07/08/11				X							
H1G110424-037	SDC-M4A4-M0030-T2	C4aR4	07/08/11				X							
H1G110424-038	SDC-M4A4-M0030-TC2	C4aR4	07/08/11				X							
H1G110424-039	SDC-M4A4-M0030-T3	C4aR4	07/08/11				X							
H1G110424-040	SDC-M4A4-M0030-TC3	C4aR4	07/08/11				X							
H1G110424-041	SDC-M4A4-M0030-T4	C4aR4	07/08/11				X							
H1G110424-042	SDC-M4A4-M0030-TC4	C4aR4	07/08/11				X							

Table 7-1: Field and Laboratory Sample Identification Cross Reference Guide (Continued)

Laboratory Sample No.	Field Sample No.	Test Run No.	Sampling Date	Analytical Testing Parameters										
				Semivolatile Organics	Semivolatile Unspecified and Gravimetric Organics	Dioxins/Furans	Volatile Organics	Volatile Unspecified Organics	Hydrogen Chloride/Fluoride	Total Chlorine	Particulates	Trace Metals	Energetics	
H1G110424-043	SDC-M4A4-M0030-T BK	---	07/08/11				X							
H1G110424-044	SDC-M4A4-M0030-TC BK	---	07/08/11				X							
H1G110424-045	SDC-M4A4-M0030-COND	C4aR4	07/08/11				X							
H1G110424-046	SDC-M4ATB-M0030-T1	---	07/08/11				X							
H1G110424-047	SDC-M4ATB-M0030-TC1	---	07/08/11				X							
H1G110422-001	SDC-M4A1A-M0040-TOE-COND	C4aR1	07/05/11					X						
H1G110422-002	SDC-M4A1B-M0040-TOE-COND	C4aR1	07/05/11					X						
H1G110422-003	SDC-M4A1BK-M0040-TOE-COND	C4aR1	07/05/11					X						
H1G110422-004	SDC-M4A2A-M0040-TOE-COND	C4aR2	07/06/11					X						
H1G110422-005	SDC-M4A2B-M0040-TOE-COND	C4aR2	07/06/11					X						
H1G110422-006	SDC-M4A2BK-M0040-TOE-COND	C4aR2	07/06/11					X						
H1G110422-010	SDC-M4A4A-M0040-TOE-COND	C4aR4	07/08/11					X						
H1G110422-011	SDC-M4A4B-M0040-TOE-COND	C4aR4	07/08/11					X						
H1G110422-012	SDC-M4A4BK-M0040-TOE-COND	C4aR4	07/08/11					X						
H1G110422-001	SDC-M4AFB-1-M0040-TOE-COND BLK	---						X						
H1G110422-001	SDC-M4ARB-M0040-TOE-COND	---						X						
H1G110422-001	SDC-M4AFB-2-M0040-TOE-COND BLK	---						X						
H1G110422-001	SDC-M4AFB-3-M0040-TOE-COND BLK	---						X						
G1G090432-001	SDC-M4A1-M5/26A-PNR	C4aR1	07/05/11									X		
G1G090432-002	SDC-M4A1-M5/M26A-FILT	C4aR1	07/05/11									X		
G1G090432-003	SDC-M4A1-M5/26A-ACDIMPA,B	C4aR1	07/05/11						X					
G1G090432-004	SDC-M4A1-M5/26A-ALKIMP	C4aR1	07/05/11							X				

Table 7-1: Field and Laboratory Sample Identification Cross Reference Guide (Continued)

Laboratory Sample No.	Field Sample No.	Test Run No.	Sampling Date	Analytical Testing Parameters										
				Semivolatile Organics	Semivolatile Unspeciated and Gravimetric Organics	Dioxins/Furans	Volatile Organics	Volatile Unspeciated Organics	Hydrogen Chloride/Fluoride	Total Chlorine	Particulates	Trace Metals	Energetics	
G1G090432-005	SDC-M4A2-M5/26A-PNR	C4aR2	07/06/11									X		
G1G090432-006	SDC-M4A2-M5/26A-FILT	C4aR2	07/06/11									X		
G1G090432-007	SDC-M4A2-M5/26A-ACDIMPA,B	C4aR2	07/06/11						X					
G1G090432-008	SDC-M4A2-M5/26A-ALKIMP	C4aR2	07/06/11							X				
G1G090432-013	SDC-M4A4-M5/26A-PNR	C4aR4	07/08/11									X		
G1G090432-014	SDC-M4A4-M5/26A-FILT	C4aR4	07/08/11									X		
G1G090432-015	SDC-M4A4-M5/26A-ACDIMPA,B	C4aR4	07/08/11						X					
G1G090432-016	SDC-M4A4-M5/26A-ALKIMP	C4aR4	07/08/11							X				
G1G090432-017	SDC-M4AFB-M5/26A-PNR	---	07/03/11									X		
G1G090432-018	SDC-M4AFB-M5/26A-FILT	---	07/03/11									X		
G1G090432-019	SDC-M4AFB-M5/26A-ACDIMPA	---	07/03/11						X					
G1G090432-020	SDC-M4AFB-M5/26A-ALKIMP	---	07/03/11							X				
G1G090432-021	SDC-M4ARB-M5/26A-ACE	---	07/07/11									X		
G1G090432-022	SDC-M4ARB-M5/26A-FILT	---	07/07/11									X		
G1G090432-023	SDC-M4ARB-M5/26A-ACDIMPA	---	07/07/11						X					
G1G090432-024	SDC-M4ARB-M5/26A-ALKIMP	---	07/07/11							X				
G1G090432-025	SDC-M4ARB-M5/26A-WATER	---	07/07/11						X					
G1G090413-001	SDC-M4A1-M29-FH	C4aR1	07/05/11										X	
G1G090413-002	SDC-M4A1-M29-BH	C4aR1	07/05/11										X	
G1G090413-003	SDC-M4A2-M29-FH	C4aR2	07/06/11										X	
G1G090413-004	SDC-M4A2-M29-BH	C4aR2	07/06/11										X	
G1G090413-007	SDC-M4A4-M29-FH	C4aR4	07/08/11										X	

Table 7-1: Field and Laboratory Sample Identification Cross Reference Guide (Continued)

Laboratory Sample No.	Field Sample No.	Test Run No.	Sampling Date	Analytical Testing Parameters										
				Semivolatile Organics	Semivolatile Unspeciated and Gravimetric Organics	Dioxins/Furans	Volatile Organics	Volatile Unspeciated Organics	Hydrogen Chloride/Fluoride	Total Chlorine	Particulates	Trace Metals	Energetics	
G1G090413-008	SDC-M4A4-M29-BH	C4aR4	07/08/11										X	
G1G090413-009	SDC-M4AFB-M29-FH	---	07/03/11										X	
G1G090413-010	SDC-M4AFB-M29-BH	---	07/03/11										X	
G1G090413-011	SDC-M4ARB-M29-FH	---	07/07/11										X	
G1G090413-12	SDC-M4ARB-M29-BH	---	07/07/11										X	
G1G090424-001	SDC-M4A1-MM5E-PNR/FILT	C4aR1	07/05/11											X
G1G090424-002	SDC-M4A1-MM5E-COND	C4aR1	07/05/11											X
G1G090424-003	SDC-M4A1-MM5E-XAD-TOP	C4aR1	07/05/11											X
G1G090424-005	SDC-M4A2-MM5E-PNR/FILT	C4aR2	07/06/11											X
G1G090424-006	SDC-M4A2-MM5E-COND	C4aR2	07/06/11											X
G1G090424-007	SDC-M4A2-MM5E-XAD-TOP	C4aR2	07/06/11											X
G1G090424-013	SDC-M4A4-MM5E-PNR/FILT	C4aR4	07/08/11											X
G1G090424-014	SDC-M4A4-MM5E-COND	C4aR4	07/08/11											X
G1G090424-015	SDC-M4A4-MM5E-XAD-TOP	C4aR4	07/08/11											X
G1G090424-017	SDC-M4AFB-MM5E-PNR/FILT	---	07/04/11											X
G1G090424-018	SDC-M4AFB-MM5E-COND	---	07/04/11											X
G1G090424-019	SDC-M4AFB-MM5E-XAD-TOP	---	07/04/11											X
G1G090424-021	SDC-M4ARB-MM5E-PNR/FILT	---	07/07/11											X
G1G090424-022	SDC-M4ARB-MM5E-COND	---	07/07/11											X
G1G090424-023	SDC-M4ARB-MM5E-XAD-TOP	---	07/07/11											X
G1G090424-024	SDC-M4ATB-MM5E-XAD-TOP	---	07/07/11											X

Table 7-2: Leak Checks

Run	Sample Train	Initial		Port Change				Final	
		VAC (inHg)	Rate (cf)	VAC (inHg)	Rate (cf)	VAC (in Hg)	Rate (cf)	VAC (inHg)	Rate (cf)
C4aR1	M0010	0.003	15	0.003	11	0.005	15	0.003	14
	M0010-TOC	0.006	15	0.003	15	0.004	15	0.006	13
	M0023A	0.005	21	0.005	12	0.004	15	0.005	10
	M26A	0.004	18	0.003	15	0.003	15	0.005	6
	M29	0.003	15	0.004	16	0.004	17	0.003	14
	MM5E	0.004	15	0.002	15	0.002	15	0.003	8
C4aR2	M0010	0.004	15	0.000	12	0.003	12	0.002	11
	M0010-TOC	0.005	15	0.006	13	0.004	13	0.007	12.5
	M0023A	0.005	17	0.001	18	0.004	13	0.006	14
	M26A	0.004	16	0.002	8	0.002	12.5	0.002	12
	M29	0.005	13	0.003	13	0.003	13	0.005	15
	MM5E	0.006	11	0.003	7	0.004	16	0.004	15
C4aR4	M0010	0.003	11	0.002	7	0.002	7	0.003	10
	M0010-TOC	0.003	12	0.003	12	0.005	12	0.005	12
	M0023A	0.004	15	0.005	8	0.002	8	0.002	13
	M26A	0.004	12	0.004	6.5	0.004	9	0.002	7
	M29	0.001	15	0.002	15	0.003	12	0.003	12
	MM5E	0.004	13	0.004	18	0.002	15	0.004	5.5

Table 7-3: Semivolatile Organic Sample Holding Time Summary

Sample Name	Sample Date	Preparation Date	Analysis Date	Collection to Extraction (Days)	Extraction to Analysis (Days)
SDC-M4A1-M0010-SEMIS-FH	07/05/11	07/10/11	07/13/11	5	3
SDC-M4A1-M0010-SEMIS-BH	07/05/11	07/10/11	07/13/11	5	3
SDC-M4A1-M0010-SEMIS-COND.	07/05/11	07/10/11	07/13/11	5	3
SDC-M4A2-M0010-SEMIS-FH	07/06/11	07/10/11	07/13/11	4	3
SDC-M4A2-M0010-SEMIS-BH	07/06/11	07/10/11	07/13/11	4	3
SDC-M4A2-M0010-SEMIS-COND	07/06/11	07/10/11	07/13/11	4	3
SDC-M4A4-M0010-SEMIS-FH	07/08/11	07/10/11	07/13/11	2	3
SDC-M4A4-M0010-SEMIS-BH	07/08/11	07/10/11	07/13/11	2	3
SDC-M4A4-M0010-SEMIS-COND	07/08/11	07/10/11	07/13/11	2	3
SDC-M4AFB-M0010-SEMIS-FH	07/03/11	07/10/11	07/13/11	7	3
SDC-M4AFB-M0010-SEMIS-BH	07/03/11	07/10/11	07/13/11	7	3
SDC-M4AFB-M0010-SEMIS-Impinger Rinse	07/03/11	07/10/11	07/13/11	7	3
SDC-M4ARB-M0010-SEMIS-Filter	07/07/11	07/10/11	07/13/11	3	3
SDC-M4ARB-M0010-SEMIS-XAD	07/07/11	07/10/11	07/13/11	3	3
SDC-M4ARB-M0010-SEMIS-WATER	07/07/11	07/10/11	07/13/11	3	3
SDC-M4ARB-M0010-SEMIS-MECL/MEOH	07/07/11	07/10/11	07/13/11	3	3
SDC-M4ATB-M0010-SEMIS-XAD	07/07/11	07/10/11	07/13/11	3	3
INTRA-LAB BLANK (MKRR81AA)	---	07/10/11	07/13/11	---	3
INTRA-LAB BLANK (MKRR81AE)	---	07/10/11	07/13/11	---	3
INTRA-LAB BLANK (MKRR91AA)	---	07/10/11	07/12/11	---	2
CHECK SAMPLE (MKRR81AC)	---	07/10/11	07/13/11	---	3
DUPLICATE CHECK (MKRR81AD)	---	07/10/11	07/13/11	---	3
CHECK SAMPLE (MKRR91AC)	---	07/10/11	07/14/11	---	4
DUPLICATE CHECK (MKRR91AD)	---	07/10/11	07/14/11	---	4

SAP/QAPP Limit: 14 days from collection to extraction and 40 days from extraction to analysis

Table 7-4: Semivolatile Surrogate Standard Results

Sample Name	1,2-DichlorobenzeneD-d ₄	2-Fluorobiphenyl	2-Fluorophenol	NitrobenzeneD-d ₅	Phenol-d ₅	Terphenyl-d ₁₄	2,4,6-Tribromophenol
	SAP/QAPP Limit (%)						
	10-136	35-122	10-108	15-118	10-121	35-120	10-154
SDC-M4A1-M0010-SEMIS-FH	---	91	82	82	85	90	92
SDC-M4A1-M0010-SEMIS-BH	49	66	52	55	59	94	102
SDC-M4A1-M0010-SEMIS-COND.	---	65	39	62	23	86	84
SDC-M4A2-M0010-SEMIS-FH	---	84	73	77	80	89	100
SDC-M4A2-M0010-SEMIS-BH	52	67	58	56	63	90	99
SDC-M4A2-M0010-SEMIS-COND	---	71	40	68	29	89	88
SDC-M4A4-M0010-SEMIS-FH	---	73	71	72	74	92	82
SDC-M4A4-M0010-SEMIS-BH	58	78	63	62	71	79	82
SDC-M4A4-M0010-SEMIS-COND	---	74	48	72	31	88	88
SDC-M4AFB-M0010-SEMIS-FH	---	84	68	70	80	89	97
SDC-M4AFB-M0010-SEMIS-BH	42	70	42	48	59	81	97
SDC-M4AFB-M0010-SEMIS-Impinger Rinse	---	83	57	79	37	93	87
SDC-M4ARB-M0010-SEMIS-Filter	---	60	61	57	63	88	83
SDC-M4ARB-M0010-SEMIS-XAD	62	74	61	64	70	88	91
SDC-M4ARB-M0010-SEMIS-WATER	---	72	53	68	33	77	72
SDC-M4ARB-M0010-SEMIS-MECL/MEOH	---	90	67	82	48	94	86
SDC-M4ATB-M0010-SEMIS-XAD	54	73	58	62	65	89	96
INTRA-LAB BLANK (MKRR81AA)	69	70	65	62	69	87	93
INTRA-LAB BLANK (MKRR81AE)	---	60	61	57	63	91	78
INTRA-LAB BLANK (MKRR91AA)	---	74	53	72	36	85	85
CHECK SAMPLE (MKRR81AC)	---	80	68	70	73	85	104
DUPLICATE CHECK (MKRR81AD)	---	82	70	72	75	89	99
CHECK SAMPLE (MKRR91AC)	---	87	59	83	39	78	89
DUPLICATE CHECK (MKRR91AD)	---	94	69	91	48	87	99

Note: 1,2-Dichlorobenzene-d₄ is a field surrogate that is only added to the resin trap. As such, only back-half sample fractions have a recovery reported for this surrogate.

Table 7-5: Semivolatile LCS Results

Laboratory ID:	G1G100000016C/G1G100000016L									
Spiked Compound	Concentration (ug)			Recovery (%)		RPD (%)	SAP/QAPP Limits (%)			
	True	LCS	LCSD	LCS	LCSD		Recovery		RPD	
Acenaphthene	100	84.7	84.5	85	85	0.18	57	-	113	35
4-Chloro-3-methylphenol	100	95.2	92.8	95	93	2.5	42	-	126	35
2-Chlorophenol	100	67.5	67.9	68	68	0.60	52	-	110	35
1,4-Dichlorobenzene	100	66.2	67.4	66	67	1.8	50	-	108	35
2,4-Dinitrotoluene	100	106	103	106	103	2.4	62	-	113	35
4-Nitrophenol	100	98.8	96.4	99	96	2.4	10	-	145	35
N-Nitrosodi-n-propylamine	100	72.5	73.7	73	74	1.7	46	-	123	35
Pentachlorophenol	100	106	101	106	101	4.8	11	-	135	35
Phenol	100	77.6	77.8	78	78	0.25	20	-	119	35
Pyrene	100	95.3	94.3	95	94	1.0	47	-	155	35
1,2,4-Trichlorobenzene	100	68.9	67.4	69	67	2.2	49	-	112	35

Laboratory ID:	G1G100000017C/G1G100000017L									
Spiked Compound	Concentration (ug)			Recovery (%)		RPD (%)	SAP/QAPP Limits (%)			
	True	LCS	LCSD	LCS	LCSD		Recovery		RPD	
Acenaphthene	100	82.4	91.2	82	91	10	57	-	113	35
4-Chloro-3-methylphenol	100	87.9	94.3	88	94	7.0	42	-	126	35
2-Chlorophenol	100	78.4	81.2	78	81	3.5	52	-	110	35
1,4-Dichlorobenzene	100	75.4	76.4	75	76	1.3	50	-	108	35
2,4-Dinitrotoluene	100	93.7	101	94	101	7.5	62	-	113	35
4-Nitrophenol	100	38.3	50.4	38	50	27	10	-	145	35
N-Nitrosodi-n-propylamine	100	81.9	84.8	82	85	3.4	46	-	123	35
Pentachlorophenol	100	93.4	100	93	100	7.2	11	-	135	35
Phenol	100	40.4	48.7	40	49	19	20	-	119	35
Pyrene	100	86.3	97.1	86	97	12	47	-	155	35
1,2,4-Trichlorobenzene	100	78.1	81.6	78	82	4.4	49	-	112	35

Table 7-6: Semivolatile TOC Holding Time and Surrogate Standard Results

Sample	Sample Date	Preparation Date	Analysis Date	Collection to Extraction (Days)	Extraction to Analysis (Days)	n-Heptadecane (%)
SDC-M4A1-M0010-TOE-COMBINED	07/05/11	07/11/11	07/14/11	6	3	100
SDC-M4A2-M0010-TOE-COMBINED	07/06/11	07/11/11	07/14/11	5	3	105
SDC-M4A4-M0010-TOE-COMBINED	07/08/11	07/11/11	07/14/11	3	3	102
SDC-M4AFB-M0010-TOE-COMBINED	07/03/11	07/11/11	07/14/11	8	3	118
SDC-M4ARB-M0010-TOE-COMBINED	07/07/11	07/11/11	07/14/11	4	3	124
SDC-M4ATB-M0010-TOE-XAD	07/07/11	07/11/11	07/14/11	4	3	103
H1G110000-099 (MB)	---	07/11/11	07/15/11	---	4	111
H1G110000-099 (LCS)	---	07/11/11	07/14/11	---	3	116
H1G110000-099 (LCSD)	---	07/11/11	07/14/11	---	3	121

SAP/QAPP Limit: 14 days from collection to extraction
 40 days from extraction to analysis
 Recovery = 50 to 150%;

Table 7-7: Semivolatile TOC LCS Results

Sample ID	Concentration (mg)			Recovery (%)		RPD (%)
	True	LCS	LCSD	LCS	LCSD	
Total Chromatographic Organics						
H1G110000-099	0.225	0.214	0.235	95	105	9.3
Total Gravimetric Organics						
H1G110000-100	2.50	2.67	3.07	107	123	14

SAP/QAPP Limits: Recovery = TCO: 40 to 120%, GRAV: 50 to 150%
 RPD = TCO: ≤ 50%, GRAV: ≤ 35%

Table 7-8: Dioxin/Furan Sample Holding Time Summary

Sample Name	Sample Date	Preparation Date	Analysis Date	Collection to Extraction (Days)	Extraction to Analysis (Days)
SDC-M4A1-M0023A-FH	07/05/11	07/10/11	07/12/11	5	2
SDC-M4A1-M0023A-BH	07/05/11	07/10/11	07/12/11	5	2
SDC-M4A2-M0023A-FH	07/06/11	07/10/11	07/12/11	4	2
SDC-M4A2-M0023A-BH	07/06/11	07/10/11	07/12/11	4	2
SDC-M4A4-M0023A-FH	07/08/11	07/10/11	07/12/11	2	2
SDC-M4A4-M0023A-BH	07/08/11	07/10/11	07/12/11	2	2
SDC-M4AFB-M0023A-FH	07/03/11	07/10/11	07/12/11	7	2
SDC-M4AFB-M0023A-BH	07/03/11	07/10/11	07/12/11	7	2
SDC-M4ARB-M0023A-Filter	07/07/11	07/10/11	07/12/11	3	2
SDC-M4ARB-M0023A-XAD	07/07/11	07/10/11	07/12/11	3	2
SDC-M4ARB-M0023A-BH-MECL,TOL,ACE	07/07/11	07/10/11	07/12/11	3	2
SDC-M4ATB-M0023A-XAD	07/08/11	07/10/11	07/12/11	2	2
INTRA-LAB BLANK(MKRR51AA)	---	07/10/11	07/12/11	---	2
INTRA-LAB BLANK(MKRR51AE)	---	07/10/11	07/12/11	---	2
CHECK SAMPLE(MKRR51AC)	---	07/10/11	07/12/11	---	2
DUPLICATE CHECK(MKRR51AD)	---	07/10/11	07/12/11	---	2

SAP/QAPP Limits: 30 days from collection to extraction
 45 days from extraction to analysis

Table 7-9: Dioxin/Furan Internal and Surrogate Standard Results

Sample Name	Internal Standards								Surrogates					
	¹³ C-2,3,7,8-TetraCDD	¹³ C-1,2,3,7,8-PentaCDD	¹³ C-1,2,3,6,7,8-HexaCDD	¹³ C-1,2,3,4,6,7,8-HeptaCDD	¹³ C-OctaCDD	¹³ C-2,3,7,8-TetraCDF	¹³ C-1,2,3,7,8-PentaCDF	¹³ C-1,2,3,6,7,8-HexaCDF	¹³ C-1,2,3,4,6,7,8-HeptaCDF	³⁷ Cl ₄ -2,3,7,8-TetraCDD	¹³ C-2,3,4,7,8-PentaCDF	¹³ C-1,2,3,4,7,8-HexaCDF	¹³ C-1,2,3,4,7,8-HexaCDD	¹³ C-1,2,3,4,7,8,9-HeptaCDF
	SAP/QAPP Limit (%)													
	40-135		25-150		40-135		25-150		70-130					
SDC-M4A1-M0023A-FH	92	98	88	81	79	102	102	91	90	103	99	112	101	97
SDC-M4A1-M0023A-BH	97	97	92	80	81	102	103	91	90	97	95	111	93	96
SDC-M4A2-M0023A-FH	98	106	89	83	77	107	112	91	92	109	103	120	108	104
SDC-M4A2-M0023A-BH	95	97	89	79	71	102	104	91	89	104	98	118	106	102
SDC-M4A4-M0023A-FH	97	105	92	85	78	105	109	94	94	102	97	114	100	98
SDC-M4A4-M0023A-BH	93	98	92	85	75	100	105	92	96	104	98	115	100	101
SDC-M4AFB-M0023A-FH	89	95	91	80	73	93	98	90	91	101	98	118	97	96
SDC-M4AFB-M0023A-BH	84	97	95	82	80	91	98	92	93	106	103	116	92	98
SDC-M4ARB-M0023A-Filter	83	77	86	84	88	93	86	91	83	87	104	107	99	103
SDC-M4ARB-M0023A-XAD	93	82	89	92	98	102	94	92	94	65	78	82	79	74
SDC-M4ARB-M0023A-BH-MECL,TOL,ACE	81	76	83	88	99	91	88	89	84	---	---	---	---	---
SDC-M4ATB-M0023A-XAD	85	73	91	91	100	95	93	94	91	88	95	105	94	105
INTRA-LAB BLANK(MKRR51AA)	86	90	85	71	61	93	98	81	80	98	91	110	86	92
INTRA-LAB BLANK(MKRR51AE)	78	83	73	68	61	83	88	75	77	102	96	117	100	95
CHECK SAMPLE(MKRR51AC)	96	101	86	82	76	102	108	91	94	---	---	---	---	---
DUPLICATE CHECK(MKRR51AD)	100	101	90	87	80	105	108	91	99	---	---	---	---	---

Note: **Shading** indicates a result that is outside the acceptable SAP/QAPP limit.

Table 7-10: Dioxin/Furan LCS Results

Laboratory ID:	G1G100000013C/G1G100000013L					
Spiked Compound	Concentration (pg)			Recovery (%)		RPD (%)
	True	LCS	LCSD	LCS	LCSD	
2,3,7,8-TCDD	400	450	446	112	111	0.87
1,2,3,7,8-PeCDD	2,000	2,260	2,240	113	112	0.91
1,2,3,4,7,8-HxCDD	2,000	2,620	2,520	131	126	3.9
1,2,3,6,7,8-HxCDD	2,000	2,430	2,360	121	118	3.0
1,2,3,7,8,9-HxCDD	2,000	2,570	2,550	128	127	0.65
1,2,3,4,6,7,8-HpCDD	2,000	2,290	2,250	115	112	2.0
OCDD	4,000	4,310	4,070	108	102	5.7
2,3,7,8-TCDF	400	461	458	115	114	0.69
1,2,3,7,8-PeCDF	2,000	2,310	2,280	116	114	1.5
2,3,4,7,8-PeCDF	2,000	2,290	2,240	114	112	2.2
1,2,3,4,7,8-HxCDF	2,000	2,540	2,580	127	129	1.5
1,2,3,6,7,8-HxCDF	2,000	2,370	2,380	119	119	0.24
2,3,4,6,7,8-HxCDF	2,000	2,610	2,580	131	129	1.2
1,2,3,7,8,9-HxCDF	2,000	2,620	2,690	131	134	2.6
1,2,3,4,6,7,8-HpCDF	2,000	2,320	2,270	116	114	2.2
1,2,3,4,7,8,9-HpCDF	2,000	2,200	2,180	110	109	0.94
OCDF	4,000	4,450	4,370	111	109	1.7

SAP/QAPP Limits: Recovery = 50 to 150% with the following exceptions - 1,2,3,7,8,9-HexaCDD/1,2,3,4,7,8-HexaCDF (50 to 154%),
 2,3,4,6,7,8-HexaCDF (50 to 160%), and 1,2,3,7,8,9-HexaCDF (50 to 159%)
 RPD = ≤ 20%

Table 7-11: Volatile Holding Time Summary and Surrogate Standard Results

Sample Name	Sample Date	Analysis Date	Collection to Analysis (Days)	Surrogate			
				Dibromofluoromethane	1,2-Dichloroethane-d ₄	Toluene-d ₈	4-Bromofluorobenzene
				QC Limit (%)			
				50-150	50-150	50-150	50-150
SDC-M4A1-M0030-T1	07/05/11	07/14/11	9	95	93	93	80
SDC-M4A1-M0030-TC1	07/05/11	07/14/11	9	97	98	92	88
SDC-M4A1-M0030-T2	07/05/11	07/14/11	9	95	98	94	85
SDC-M4A1-M0030-TC2	07/05/11	07/14/11	9	88	90	93	80
SDC-M4A1-M0030-T3	07/05/11	07/14/11	9	95	95	97	80
SDC-M4A1-M0030-TC3	07/05/11	07/14/11	9	91	88	92	75
SDC-M4A1-M0030-T4	07/05/11	07/14/11	9	95	96	99	82
SDC-M4A1-M0030-TC4	07/05/11	07/14/11	9	89	88	94	76
SDC-M4A2-M0030-T1	07/06/11	07/13/11	7	89	102	95	85
SDC-M4A2-M0030-TC1	07/06/11	07/13/11	7	91	99	93	80
SDC-M4A2-M0030-T2	07/06/11	07/13/11	7	93	99	93	84
SDC-M4A2-M0030-TC2	07/06/11	07/13/11	7	89	91	92	76
SDC-M4A2-M0030-T3	07/06/11	07/13/11	7	96	105	96	89
SDC-M4A2-M0030-TC3	07/06/11	07/13/11	7	91	96	89	76
SDC-M4A2-M0030-T4	07/06/11	07/13/11	7	89	102	88	84
SDC-M4A2-M0030-TC4	07/06/11	07/13/11	7	90	96	93	84
SDC-M4A4-M0030-T1	07/08/11	07/12/11	4	90	84	93	82
SDC-M4A4-M0030-TC1	07/08/11	07/12/11	4	88	81	93	82
SDC-M4A4-M0030-T2	07/08/11	07/12/11	4	88	84	95	82
SDC-M4A4-M0030-TC2	07/08/11	07/12/11	4	90	82	97	85
SDC-M4A4-M0030-T3	07/08/11	07/12/11	4	92	84	96	91
SDC-M4A4-M0030-TC3	07/08/11	07/12/11	4	87	77	91	77
SDC-M4A4-M0030-T4	07/08/11	07/12/11	4	87	79	94	74
SDC-M4A4-M0030-TC4	07/08/11	07/12/11	4	88	80	93	81
SDC-M4A1-M0030-T BK	07/05/11	07/12/11	7	86	77	95	77
SDC-M4A1-M0030-TC BK	07/05/11	07/12/11	7	86	77	92	82
SDC-M4A2-M0030-T BK	07/06/11	07/12/11	6	89	76	98	77
SDC-M4A2-M0030-TC BK	07/06/11	07/12/11	6	86	76	95	75
SDC-M4A4-M0030-T BK	07/08/11	07/12/11	4	85	77	97	82
SDC-M4A4-M0030-TC BK	07/08/11	07/12/11	4	86	77	97	81
SDC-M4ATB-M0030-T1	07/08/11	07/12/11	4	87	76	94	80
SDC-M4ATB-M0030-TC1	07/08/11	07/12/11	4	84	74	94	79
INTRA-LAB BLANK (MKR771AA)	---	07/12/11	---	85	76	91	73
INTRA-LAB BLANK (MKVF11AA)	---	07/13/11	---	93	94	92	74
INTRA-LAB BLANK (MKWCF1AA)	---	07/14/11	---	89	89	88	68

Table 7-11: Volatile Holding Time Summary and Surrogate Standard Results (Continued)

Sample Name	Sample Date	Analysis Date	Collection to Analysis (Days)	Surrogate			
				Dibromofluoromethane	1,2-Dichloroethane-d ₄	Toluene-d ₈	4-Bromofluorobenzene
				QC Limit (%)			
				50-150	50-150	50-150	50-150
CHECK SAMPLE (MKR771AC)	---	07/12/11	---	83	70	94	72
DUPLICATE CHECK (MKR771AD)	---	07/12/11	---	83	74	94	76
CHECK SAMPLE (MKVF11AC)	---	07/13/11	---	88	87	96	70
DUPLICATE CHECK (MKVF11AD)	---	07/13/11	---	84	87	91	70
CHECK SAMPLE (MKWCF1AC)	---	07/14/11	---	89	86	92	74
DUPLICATE CHECK (MKWCF1AD)	---	07/14/11	---	91	91	95	71
Condensate Samples				QC Limit (%)			
				50-150	50-150	50-150	50-150
SDC-M4A1-M0030-COND	07/05/11	07/13/11	8	102	95	107	98
SDC-M4A2-M0030-COND	07/06/11	07/13/11	7	106	100	105	99
SDC-M4A4-M0030-COND	07/08/11	07/13/11	5	104	101	106	99
SDC-M4A1-M0030-COND BK	07/05/11	07/13/11	8	104	97	105	99
INTRA-LAB BLANK (MKVD91AA)	---	07/13/11	---	104	99	106	99
CHECK SAMPLE (MKVD91AC)	---	07/13/11	---	104	94	105	102
DUPLICATE CHECK (MKVD91AD)	---	07/13/11	---	104	95	109	102

SAP/QAPP Limit: 14 days from sample collection to analysis

Table 7-12: Volatile LCS Results

Laboratory ID:	HIG110000143C/HIG110000143L									
Date Analyzed:	07/12/11									
Spiked Compound	Concentration (ug)			Recovery (%)		RPD (%)	QC Limits (%)			
	True	LCS	LCSD	LCS	LCSD		Recovery	RPD		
Benzene	0.250	0.227	0.235	91	94	3.6	50	-	150	25
1,1-Dichloroethene	0.250	0.246	0.253	98	101	2.7	50	-	150	25
Trichloroethene	0.250	0.254	0.284	102	114	11	50	-	150	25
Toluene	0.250	0.237	0.239	95	96	0.86	50	-	150	25
Chlorobenzene	0.250	0.223	0.220	89	88	1.5	50	-	150	25
Laboratory ID:	HIG120000119C/HIG120000119L									
Date Analyzed:	07/13/11									
Spiked Compound	Concentration (ug)			Recovery (%)		RPD (%)	QC Limits (%)			
	True	LCS	LCSD	LCS	LCSD		Recovery	RPD		
Benzene	10.0	11.6	11.3	116	113	2.8	50	-	150	25
1,1-Dichloroethene	10.0	11.9	11.8	119	118	0.77	50	-	150	25
Trichloroethene	10.0	12.1	12.1	121	121	0.23	50	-	150	25
Toluene	10.0	11.6	11.8	116	118	1.8	50	-	150	25
Chlorobenzene	10.0	11.2	11.1	112	111	0.52	50	-	150	25
Laboratory ID:	HIG120000125C/HIG120000125L									
Date Analyzed:	07/13/11									
Spiked Compound	Concentration (ug/L)			Recovery (%)		RPD (%)	QC Limits (%)			
	True	LCS	LCSD	LCS	LCSD		Recovery	RPD		
Benzene	0.250	0.232	0.235	93	94	1.6	50	-	150	25
1,1-Dichloroethene	0.250	0.245	0.244	98	98	0.22	50	-	150	25
Trichloroethene	0.250	0.264	0.274	106	109	3.6	50	-	150	25
Toluene	0.250	0.239	0.227	96	91	5.4	50	-	150	25
Chlorobenzene	0.250	0.214	0.208	86	83	2.8	50	-	150	25
Laboratory ID:	HIG130000105C/HIG130000105L									
Date Analyzed:	07/14/11									
Spiked Compound	Concentration (ug/L)			Recovery (%)		RPD (%)	QC Limits (%)			
	True	LCS	LCSD	LCS	LCSD		Recovery	RPD		
Benzene	0.250	0.236	0.241	94	97	2.2	50	-	150	25
1,1-Dichloroethene	0.250	0.257	0.261	103	104	1.4	50	-	150	25
Trichloroethene	0.250	0.272	0.262	109	105	3.8	50	-	150	25
Toluene	0.250	0.236	0.241	94	96	2.3	50	-	150	25
Chlorobenzene	0.250	0.219	0.226	88	90	3.1	50	-	150	25

Notes: Only the five (5) spiking compounds identified in the SAP/QAPP are included in the summary tables.
Recovery limits from Table A-9 of the SAP/QAPP.

Table 7-13: Volatile TOC Condensate Holding Time Summary and Surrogate Standard Results

Sample	Sample Date	Preparation Date	Analysis Date	Collection to Analysis (Days)	n-Octane Recovery (%)
SDC-M4A1A-M0040-TOE-COND	07/05/11	07/13/11	07/13/11	8	108
SDC-M4A1B-M0040-TOE-COND	07/05/11	07/13/11	07/13/11	8	101
SDC-M4A1BK-M0040-TOE-COND	07/05/11	07/13/11	07/13/11	8	100
SDC-M4A2A-M0040-TOE-COND	07/06/11	07/13/11	07/13/11	7	98
SDC-M4A2B-M0040-TOE-COND	07/06/11	07/13/11	07/13/11	7	96
SDC-M4A2BK-M0040-TOE-COND	07/06/11	07/13/11	07/13/11	7	98
SDC-M4A4A-M0040-TOE-COND	07/08/11	07/13/11	07/13/11	5	101
SDC-M4A4B-M0040-TOE-COND	07/08/11	07/13/11	07/13/11	5	102
SDC-M4A4BK-M0040-TOE-COND	07/08/11	07/13/11	07/13/11	5	104
Method Blank (H1G120000-142)	---	07/13/11	07/13/11	---	105
LCS (H1G120000-142)	---	07/13/11	07/13/11	---	108
LCSD (H1G120000-142)	---	07/13/11	07/13/11	---	106

SAP/QAPP Limit: Recovery = 50 to 150%

Table 7-14: Volatile TOC Field Spike Results

Spike Sample:		Run 3 Bag "B"			
Compounds	Sample (ppmv)	Spike (ppmv)	Field Spike (ppmv)	Recovery (%)	
C ₁ -Methane	1.28	---	1.23	---	
C ₂ -Ethane	0.1063	---	0.0428	---	
C ₃ -Propane	ND	1.07	0.976	91.2	
C ₄ -Butane	0.0159	---	0.0181	---	
C ₅ -Pentane	ND	---	ND	---	
C ₆ -Hexane	0.325	---	0.883	---	
C ₇ -Heptane	ND	---	ND	---	

SAP/QAPP Limit: Recovery = 80 to 120%

Table 7-15: Volatile TOC LCS Results

Run Number:		Run 1		Run 2		Run 4	
Date:		07/05/11		07/06/11		07/08/11	
Analyte	True (ppmv)	LCS (ppmv)	Recovery (%)	LCS (ppmv)	Recovery (%)	LCS (ppmv)	Recovery (%)
Methane (C ₁)	1.152	1.125	97.7	1.191	103.4	1.125	97.6
Ethane (C ₂)	1.100	1.035	94.1	1.108	100.7	0.967	87.9
Propane (C ₃)	1.100	1.072	97.5	1.150	104.6	1.317	119.8
Butane (C ₄)	1.100	1.072	97.5	1.147	104.3	1.034	94.0
Pentane (C ₅)	1.100	1.075	97.7	1.138	103.4	1.046	95.1
Hexane (C ₆)	1.100	1.073	97.6	1.136	103.2	1.056	96.0
Heptane (C ₇)	1.152	1.117	96.9	1.206	104.7	1.174	101.9

SAP/QAPP Limit: Recovery = 75 to 125%

Table 7-16: Volatile TOC Condensate LCS/LCSD Results

Sample ID:		H1G120000-142				
Analysis Date:		07/13/11				
Element	Concentration (ug/sample)			Recovery (%)		RPD (%)
	True	LCS	LCSD	LCS	LCSD	
C ₅ -Pentane	0.250	0.293	0.292	117	117	0.53
C ₆ -Hexane	0.250	0.291	0.286	116	114	1.6
C ₇ -Heptane	0.250	0.268	0.264	107	106	1.6

SAP/QAPP Limit: Recovery = 50 to 150%
 RPD = 0 to 35%

Table 7-17: Acid Gas Sample Holding Time Summary

Sample Name	Sample Date	Preparation Date	Analysis Date	Collection to Analysis (Days)
SDC-M4A1-M5/26A-ACIDIMPA,B	07/05/11	07/12/11	07/12/11	7
SDC-M4A1-M5/26A-ALKIMP	07/05/11	07/13/11	07/13/11	8
SDC-M4A2-M5/26A-ACIDIMPA,B	07/06/11	07/12/11	07/12/11	6
SDC-M4A2-M5/26A-ALKIMP	07/06/11	07/13/11	07/13/11	7
SDC-M4A4-M5/26A-ACIDIMPA,B	07/08/11	07/12/11	07/12/11	4
SDC-M4A4-M5/26A-ALKIMP	07/08/11	07/13/11	07/13/11	5
SDC-M4AFB-M5/26A-ACIDIMP	07/03/11	07/12/11	07/12/11	9
SDC-M4AFB-M5/26A-ALKIMP	07/03/11	07/13/11	07/13/11	10
SDC-M4ARB-M5/26A-ACIDIMP	07/07/11	07/12/11	07/12/11	5
SDC-M4ARB-M5/26A-ALKIMP	07/07/11	07/13/11	07/13/11	6
SDC-M4ARB-M5/26A-WATER	07/07/11	07/12/11	07/12/11	5
Method Blank (G1G140000-073)	---	07/13/11	07/13/11	---
Method Blank (G1G130000-076)	---	07/12/11	07/12/11	---
Method Blank (G1G130000-078)	---	07/12/11	07/12/11	---
LCS (G1G140000-073)	---	07/13/11	07/13/11	---
LCS (G1G130000-076)	---	07/12/11	07/12/11	---
LCS (G1G130000-078)	---	07/12/11	07/12/11	---
MS (G1G090432-004)	---	07/13/11	07/13/11	---
MSD (G1G090432-004)	---	07/13/11	07/13/11	---
MS (G1G090432-003)	---	07/12/11	07/12/11	---
MSD (G1G090432-003)	---	07/12/11	07/12/11	---
MSD (G1G090432-003)	---	07/12/11	07/12/11	---

SAP/QAPP Limit: 28 days from collection to analysis

Table 7-18: Acid Gas LCS Results

Sample ID	Analysis Date	Parameter	Units	Concentration		Recovery (%)
				True	LCS	
G1G140000-073	07/13/11	Chlorine	mg	25.0	25.1	101
G1G130000-076	07/12/11	Hydrochloric Acid	mg	25.7	25.9	101
G1G130000-078	07/12/11	Hydrogen Fluoride	mg	26.3	26.2	100

SAP/QAPP Limit: Recovery = 90 to 110%

Table 7-19: Acid Gas MS/MSD Results

Sample ID	Analysis Date	Parameter	Units	Concentration				Recovery (%)		RPD (%)
				Spike	Sample	MS	MSD	MS	MSD	
G1G090432-004	07/13/11	Chlorine	mg	4.50	ND	4.41	4.42	98	98	0.27
G1G090432-003	07/12/11	Hydrochloric Acid	mg	21.3	ND	20.6	21.0	97	99	1.6
G1G090432-003	07/12/11	Hydrogen Fluoride	mg	21.8	ND	20.9	20.9	96	96	0.07

SAP/QAPP Limit: Recovery = 85 to 125%
 RPD = 0 to 25%

Table 7-20: Trace Metal Blank Results

Parameter	Method Blank (ug)		Field Blank (ug)		Reagent Blank (ug)	
	Front-Half	Back-Half	Front-Half	Back-Half	Front-Half	Back-Half
Antimony	ND	ND	0.016	0.061	0.021	0.083
Arsenic	0.15	0.32	ND	0.61	ND	0.71
Barium	ND	ND	3.1	0.50	2.6	0.29
Beryllium	ND	0.028	0.013	0.081	0.032	0.11
Boron	ND	ND	6.4	10.9	1.5	2.5
Cadmium	ND	0.020	0.069	0.093	0.059	0.12
Chromium	ND	0.15	1.2	0.30	1.1	0.26
Cobalt	0.016	0.028	0.055	0.16	0.051	0.16
Copper	0.012	0.024	0.66	0.43	0.45	0.19
Lead	0.012	0.051	0.28	0.24	0.18	0.15
Manganese	0.018	0.047	0.73	0.40	0.80	0.098
Mercury (Front-Half)	ND	---	ND	---	ND	---
Mercury (HNO ₃ /H ₂ O ₂)	---	ND	---	ND	---	ND
Mercury (KMnO ₄)	---	ND	---	ND	---	ND
Mercury (Empty Impinger)	---	ND	---	ND	---	ND
Mercury (HCl)	---	ND	---	0.036	---	ND
Nickel	0.017	0.029	1.5	0.52	0.38	0.21
Phosphorus	ND	ND	ND	12.9	ND	11.6
Selenium	ND	ND	0.64	ND	0.48	ND
Silver	ND	0.012	0.037	0.088	0.018	0.059
Thallium	ND	ND	ND	ND	ND	ND
Tin	0.65	0.82	ND	2.5	ND	1.6
Vanadium	ND	ND	ND	ND	ND	ND
Zinc	ND	0.27	10.1	6.1	8.4	0.47

Table 7-21: Trace Metal LCS/LCSD Results

Sample ID: G1G130000154C						
Element	Concentration (ug)			Recovery (%)		RPD (%)
	True	LCS	LCSD	LCS	LCSD	
Antimony	30.0	26.9	---	90	---	---
Arsenic	30.0	27.8	---	93	---	---
Barium	30.0	27.1	---	90	---	---
Beryllium	30.0	27.0	---	90	---	---
Boron	150	140	---	93	---	---
Cadmium	30.0	27.3	---	91	---	---
Chromium	30.0	26.2	---	87	---	---
Cobalt	30.0	26.3	---	88	---	---
Copper	30.0	27.3	---	91	---	---
Lead	30.0	27.6	---	92	---	---
Manganese	30.0	26.6	---	89	---	---
Nickel	30.0	26.6	---	89	---	---
Phosphorus	150	149	---	99	---	---
Selenium	30.0	28.4	---	95	---	---
Silver	7.50	6.72	---	90	---	---
Thallium	7.50	6.85	---	91	---	---
Tin	30.0	27.4	---	92	---	---
Vanadium	30.0	26.3	---	88	---	---
Zinc	30.0	28.4	---	95	---	---
Sample ID: G1G130000157C						
Element	Concentration (ug)			Recovery (%)		RPD (%)
	True	LCS	LCSD	LCS	LCSD	
Antimony	32.0	27.3	---	85	---	---
Arsenic	32.0	27.4	---	85	---	---
Barium	32.0	30.8	---	96	---	---
Beryllium	32.0	27.0	---	84	---	---
Boron	160	149	---	93	---	---
Cadmium	32.0	27.5	---	86	---	---
Chromium	32.0	31.8	---	99	---	---
Cobalt	32.0	32.9	---	103	---	---
Copper	32.0	31.6	---	99	---	---
Lead	32.0	30.9	---	97	---	---
Manganese	32.0	32.3	---	101	---	---
Nickel	32.0	31.9	---	100	---	---
Phosphorus	160	145	---	91	---	---
Selenium	32.0	28.2	---	88	---	---
Silver	8.00	7.47	---	93	---	---
Thallium	8.00	7.76	---	97	---	---
Tin	32.0	31.7	---	99	---	---
Vanadium	32.0	32.2	---	101	---	---
Zinc	32.0	27.1	---	85	---	---
Sample ID: G1G150000117C, G1G120000106C/G1G120000106L, G1G120000107C/G1G120000107L, G1G120000108C/G1G120000108L, G1G120000109C/G1G120000109L						
Mercury	Concentration (ug)			Recovery (%)		RPD (%)
	True	LCS	LCSD	LCS	LCSD	
Front-Half	1.00	0.999	---	100	---	---
HNO ₃ /H ₂ O	1.00	0.930	0.980	93	98	5.2
KMnO ₄	1.00	1.22	1.02	122	102	18
Empty	1.00	0.930	0.980	93	98	5.2
HCl	1.00	1.22	1.02	122	102	18

SAP/QAPP Limit: Recovery = 75 to 125%
 RPD = 0 to 25%

Table 7-22: Trace Metal MS/MSD Results

Sample ID:	G1G090413-001, G1G090413-001S, G1G090413-001D						
	Concentration (ug)				Recovery (%)		RPD (%)
	True	Sample	MS	MSD	MS	MSD	
Antimony	30.0	0.052	31.1	31.6	104	105	1.4
Arsenic	30.0	ND	25.1	25.5	84	85	1.6
Barium	30.0	2.6	32.7	32.8	100	101	0.42
Beryllium	30.0	ND	25.5	25.6	85	85	0.49
Boron	150	3.7	134	135	87	87	0.23
Cadmium	30.0	0.073	26.5	26.8	88	89	1.1
Chromium	30.0	2.3	31.7	31.7	98	98	0.04
Cobalt	30.0	0.090	28.7	28.5	95	95	0.75
Copper	30.0	1.3	29.0	29.1	93	93	0.06
Lead	30.0	0.51	30.8	31.0	101	101	0.36
Manganese	30.0	3.3	32.2	32.1	96	96	0.27
Nickel	30.0	2.1	30.2	30.0	94	93	0.40
Phosphorus	150	ND	121	122	78	78	0.64
Selenium	30.0	0.86	23.9	24.1	77	77	0.54
Silver	7.50	0.14	8.45	8.48	111	111	0.33
Thallium	7.50	ND	7.58	7.63	101	102	0.59
Tin	30.0	ND	28.8	29.2	96	97	1.2
Vanadium	30.0	ND	29.2	29.3	97	97	0.08
Zinc	30.0	23.8	48.2	48.2	82	82	0.01

Sample ID:	G1G090413-002, G1G090413-002S, G1G090413-002D						
	Concentration (ug)				Recovery (%)		RPD (%)
	True	Sample	MS	MSD	MS	MSD	
Antimony	32.0	0.037	25.8	26.0	81	81	0.76
Arsenic	32.0	0.38	26.3	26.3	81	81	0.15
Barium	32.0	0.86	32.1	32.4	98	98	0.89
Beryllium	32.0	0.012	23.7	23.5	74	74	0.44
Boron	160	69.8	211	214	88	90	1.1
Cadmium	32.0	0.051	26.1	26.1	81	81	0.16
Chromium	32.0	0.63	34.2	34.4	105	106	0.76
Cobalt	32.0	0.071	33.2	32.6	103	102	1.8
Copper	32.0	0.72	32.8	33.0	100	101	0.55
Lead	32.0	0.23	31.8	32.0	99	99	0.62
Manganese	32.0	1,990	1,940	2,010	0	45	Not Calculated
Nickel	32.0	3.20	35.2	35.4	100	101	0.68
Phosphorus	160	13.3	151	143	86	81	4.9
Selenium	32.0	ND	24.7	24.4	77	76	1.3
Silver	8.00	1.7	10.1	10.1	106	106	0.19
Thallium	8.00	ND	7.84	7.86	98	98	0.26
Tin	32.0	2.3	32.5	32.7	94	95	0.67
Vanadium	32.0	ND	34.7	35.1	108	109	1.1
Zinc	32.0	7.9	33.9	34.3	82	83	1.0
Mercury (HNO ₃ /H ₂ O ₂)	16.0	ND	15.7	14.8	99	93	6.0

Note: **Shading** indicates a result that is not within the QC limits.

SAP/QAPP Limit: Recovery = 75 to 125%
 RPD = 0 to 25%

Table 7-23: Energetic Holding Time Summary and Surrogate Standard Results

Sample Name	Sample Date	Preparation Date	Analysis Date	Collection to Extraction (Days)	Extraction to Analysis (Days)	3,4-Dinitrotoluene
						QC Limit (%)
						70-130
SDC-M4A1-MM5E-PNR/FILT	07/05/11	07/11/11	07/14/11	6	3	---
SDC-M4A1-MM5E-COND.	07/05/11	07/11/11	07/13/11	6	2	98
SDC-M4A1-MM5E-XAD-Top	07/05/11	07/10/11	07/13/11	5	3	78
SDC-M4A2-MM5E-PNR/FILT	07/06/11	07/11/11	07/14/11	5	3	---
SDC-M4A2-MM5E-COND.	07/06/11	07/11/11	07/13/11	5	2	98
SDC-M4A2-MM5E-XAD-Top	07/06/11	07/10/11	07/13/11	4	3	79
SDC-M4A4-MM5E-PNR/FILT	07/08/11	07/11/11	07/14/11	3	3	---
SDC-M4A4-MM5E-COND.	07/08/11	07/11/11	07/13/11	3	2	97
SDC-M4A4-MM5E-XAD-Top	07/08/11	07/10/11	07/13/11	2	3	83
SDC-M4A4FB-MM5E-PNR/FILT-FH	07/04/11	07/11/11	07/14/11	7	3	---
SDC-M4A4FB-MM5E-COND	07/04/11	07/11/11	07/13/11	7	2	98
SDC-M4A4FB-MM5E-XAD-Top	07/04/11	07/10/11	07/14/11	6	4	77
SDC-M4A4RB-MM5E-PNR/FILT	07/07/11	07/11/11	07/14/11	4	3	---
SDC-M4A4RB-MM5E-COND	07/07/11	07/11/11	07/13/11	4	2	---
SDC-M4A4RB-MM5E-XAD-Top	07/07/11	07/10/11	07/14/11	3	4	81
SDC-M4A4TB-MM5E-XAD-Top	07/07/11	07/10/11	07/14/11	3	4	80
INTRA-LAB BLANK (MKRTA1AA)	---	07/10/11	07/13/11	---	3	77
INTRA-LAB BLANK (MKR2L1AA)	---	07/11/11	07/14/11	---	3	91
INTRA-LAB BLANK (MKTN61AA)	---	07/11/11	07/13/11	---	2	88
CHECK SAMPLE (MKRTA1AC)	---	07/10/11	07/13/11	---	3	78
DUPLICATE CHECK (MKRTA1AD)	---	07/10/11	07/13/11	---	3	77
CHECK SAMPLE (MKR2L1AC)	---	07/11/11	07/14/11	---	3	95
DUPLICATE CHECK (MKR2L1AD)	---	07/11/11	07/14/11	---	3	97
CHECK SAMPLE (MKTN61AC)	---	07/11/11	07/13/11	---	2	100
DUPLICATE CHECK (MKTN61AD)	---	07/11/11	07/13/11	---	2	100

Note: For resin and condensate fractions a seven (7) day holding time to extraction is applied. For the front-half fraction a fourteen (14) day holding time to extraction is applied. For all fractions a fourteen (14) day holding time from extraction to analysis is applied. Surrogate is not added to the front-half rinse and filter fraction. As such, no recoveries are reported.

Table 7-24: Energetic LCS Results

Sample ID:	G1G10000018C/G1G10000018L					
Date Extracted:	07/10/11					
Date Analyzed:	07/13/11					
Compound	Concentration (ug)			Recovery (%)		RPD (%)
	True	LCS	LCS D	LCS	LCS D	
2,4-Dinitrotoluene	50.0	44.3	43.8	89	88	1.2
2,6-Dinitrotoluene	50.0	45.0	44.3	90	89	1.6
Nitroglycerin	50.0	41.6	41.9	83	84	0.83
2,4,6-Trinitrotoluene	50.0	38.7	38.3	77	77	0.96
HMX	50.0	45.9	45.6	92	91	0.52
RDX	50.0	48.6	48.4	97	97	0.47
Sample ID:	G1G110000085C/G1G110000085L					
Date Extracted:	07/11/11					
Date Analyzed:	07/14/11					
Compound	Concentration (ug)			Recovery (%)		RPD (%)
	True	LCS	LCS D	LCS	LCS D	
2,4-Dinitrotoluene	2.00	1.87	1.89	94	95	1.1
2,6-Dinitrotoluene	2.00	1.87	1.88	93	94	0.85
Nitroglycerin	2.00	1.64	1.72	82	86	4.9
2,4,6-Trinitrotoluene	2.00	1.63	1.65	82	83	1.3
HMX	2.00	1.92	1.96	96	98	1.7
RDX	2.00	2.06	2.07	103	103	0.67
Sample ID:	G1G110000086C/G1G110000086L					
Date Extracted:	07/11/11					
Date Analyzed:	07/13/11					
Compound	Concentration (ug)			Recovery (%)		RPD (%)
	True	LCS	LCS D	LCS	LCS D	
2,4-Dinitrotoluene	2.00	1.93	2.01	96	100	3.9
2,6-Dinitrotoluene	2.00	1.91	1.99	96	100	4.0
Nitroglycerin	2.00	1.76	1.82	88	91	3.0
2,4,6-Trinitrotoluene	2.00	1.67	1.74	83	87	3.9
HMX	2.00	1.84	1.91	92	95	3.7
RDX	2.00	2.09	2.17	105	108	3.5

SAP/QAPP Limit: Recovery = 75 to 125%
 RPD = Not specified, 50% applied

8.0 EMISSIONS TEST RESULTS SUMMARY

This section presents a summary of the results of the SDC emissions test for C4a. All supporting data are presented in the report appendices.

8.1 DAILY RUN SUMMARIES

The following are daily accounts of the on-site test activities. These summaries are presented in sequential order for the entire emissions testing effort and include the preliminary measurements. Table 8-1 presents a summary of the sampling times.

Sunday, July 3, 2011 - C4a Preliminary Measurements: Preliminary velocity traverses and cyclonic flow checks were conducted at the exhaust blower duct prior to the start of the emissions test for C4a. Moisture runs were also conducted to verify the moisture content of the exhaust gas. The cyclonic flow measurements within the duct at the sampling location yielded results within specified limits. All velocity and moisture measurements were reliable indicators of actual flow and moisture conditions and did not change appreciably from run to run. The M0010, M0010-TOC, M0023A, M26A, and M29 field blank sampling trains were set-up and recovered.

Monday, July 4, 2011 - C4aR1 (Cancelled): Exhaust gas sampling was cancelled due to mechanical maintenance of the SDC System. However, prior to cancellation of the run, the MM5E field blank sample train was set-up and recovered.

Tuesday, July 5, 2011 - C4aR1: Exhaust gas sampling commenced at 1625 hrs and was paused at 1825 hrs for port change. All leak checks were successfully completed. Sampling resumed in the second port at 2015 hrs and concluded at 2215 hrs with all leak checks successfully completed. All samples were recovered, labeled, and custody-sealed.

Wednesday, July 6, 2011 - C4aR2: Exhaust gas sampling commenced at 1525 hrs and was paused at 1725 hrs for port change. All leak checks were successfully completed. Sampling resumed in the second port at 1950 hrs and concluded at 2150 hrs with all leak checks successfully completed. All samples were recovered, labeled, and custody-sealed.

Thursday, July 7, 2011 - C4aR3: Exhaust gas sampling commenced at 1450 hrs and was paused at 1650 hrs for port change. All leak checks were successfully completed. Sampling resumed in the second port at 1900 hrs; however, sampling was paused from 2034 to 2044 hrs due to high liquid condensate levels in the duct caused by a closed drain valve. The MM5E sampling train was deemed void as condensate was pulled into the sampling train and through the filter housing. In addition, the NO_x CEMS was also impacted by high condensate levels and sampling was stopped at 2034 hrs. Sampling was resumed for the remainder of the trains at 2044 hrs and was concluded at 2110 hrs with all leak checks successfully completed. All samples, with the exception of the MM5E sampling train, were recovered, labeled, and custody-sealed.

Friday, July 8, 2011 - C4aR4: Exhaust gas sampling commenced at 1240 hrs and was paused at 1440 hrs for port change. All leak checks were successfully completed. Sampling resumed in the second port at 1545 hrs and concluded at 1745 hrs with all leak checks successfully completed. All samples were recovered, labeled, and custody-sealed.

8.2 CYCLONIC FLOW CHECK

A cyclonic flow check was conducted in two (2) ports of the exhaust blower duct on December 4, 2010, prior to the start of the Condition 1 emissions test. The ports were found to be free of cyclonic flow ($< 20^\circ$) with a mean cyclonic of $\sim 11^\circ$. The individual measurements are presented in Appendix C-2.

8.3 PERFORMANCE STANDARD RESULTS

The isokinetic and non-isokinetic sampling summary for all sampling trains required to demonstrate performance standards are summarized in Tables 5-2 and 5-3. The measured performance standards are discussed in the following sections.

8.3.1 Select Criteria Pollutant Emissions

CO concentrations were measured by the facility CEMS located on the exhaust blower duct. Control of products of incomplete combustion was demonstrated by monitoring the CO concentration (ROHA) to below the RCRA/CAA Permit limit of 100 ppmv, dry basis, corrected to 7% O₂ using Orsat data. As summarized in Table 8-2, the average CO concentrations (ROHA) were in compliance with the RCRA/CAA Permit limit of 100 ppmv, dry basis, corrected to 7% O₂. The average instantaneous CO emission rates were also in compliance with the CAA Permit limit of 0.02 lbs/hr.

SO₂ and NO_x emissions were measured by the TRM CEMS located on the exhaust blower duct. As summarized in Table 8-2, the average SO₂ and NO_x emission rates were in compliance with the CAA Permit limit of 7.20 and 0.80 lbs/hr, respectively. A summary CEMS report for SO₂ and NO_x can be found in Appendix F-10.

Composite exhaust gas samples were collected to determine the concentration of O₂ and CO₂ to be used in the calculation of the exhaust gas molecular weight. This calculated molecular weight was used by individual sampling trains to calculate specific parameters associated with gas flow and sampling train isokinetic percentages (see Table 5-2). In addition, the O₂ data was used to correct emission rates.

8.3.2 DRE

The DRE results are summarized in Table 8-3. The agent emissions were measured by a DAAMS that was located at the exhaust blower duct near the location where exhaust gas sampling was occurring. The four (4)-hour DAAMS tube set was analyzed for mustard agent concentration by the on-site laboratory. The DRE was calculated per the method specified in AAC 335-14-5-.15(4)(a)1 as follows:

$$DRE = \left(\frac{W_{in} - W_{out}}{W_{out}} \right) \times 100$$

Where:

W_{in} = Feed rate (lbs/hr)

W_{out} = Emission rate (lbs/hr)

The feed rate was determined based on the amount of agent per hour and feed interval demonstrated (see Table 4-2 and Appendices E and G). Further, the feed rate was purity-adjusted which provides a worst-case or lowest DRE. The mustard agent DRE for all runs was

1 in compliance with the RCRA/CAA Permit limit of 99.9999%. Supporting information is
2 included in Appendix G.

3 ANCDF has completed analysis and calculations for the determination of the DRE for the
4 operation of the SDC System. These results prove that the required DRE for this system has
5 been clearly demonstrated. However, there have been some concerns raised regarding the
6 presence of mustard agent readings within the ventilation originating from the loading chamber
7 and any potential affect it may have on the determination of DRE for this process.

8 The DAAMS tubes that were used in the DRE determination are capable of detecting mustard
9 agent $\geq 4.03\text{E-}01$ ng. These DAAMS tubes were allowed to draw a sample from the SDC
10 exhaust for the four (4) hours during which performance testing monitoring occurred for each
11 test run. For the tubes analyzed from the emissions test, mustard was not found to be present
12 \geq DL. During this test, an average feed rate of 33.56 lb/hr was demonstrated which was more
13 than sufficient to meet the minimum required to prove a successful DRE.

14 Given that the DL is $4.03\text{E-}01$ ng, a reverse calculation shows that the minimum required agent
15 feed rate to demonstrate a 99.9999% DRE would be 0.46 lb/hr. Based upon this information, the
16 agent being detected in the exhaust from the loading chamber does not impact DRE
17 determination as its source is residual contamination from within the loading chamber area. The
18 readings are present based upon this small amount of contamination being present within a
19 confined area and would not be indicative of a failure to demonstrate DRE.

20 **8.3.3 Semivolatile Organic Emissions**

21 Table 8-4 summarizes the semivolatile organic emissions results by test run and condition
22 average. No blank corrections have been made to the data. In instances where NDs were
23 incurred, the RL was used to calculate an emissions rate. No permitted emission limits are
24 associated with semivolatile organic emissions. A summary analytical report for semivolatile
25 organics can be found in Appendix F-1.

26 **8.3.4 Dioxin/Furan Emissions**

27 Table 8-5 summarizes the dioxin/furan emissions results by test run and condition average. No
28 blank corrections have been made to the data. In instances where NDs were incurred, the RL
29 was used to calculate an emissions rate. The US EPA TEFs were applied to the detected
30 quantities of each isomer, as well as the total congeners (EPA/100/R-10/005). For the isomer-
31 specific results, the applicable TEF was used to determine the TEQ. The dioxin/furan emission
32 rates for all runs were in compliance with the CAA Permit limit of 0.20 ng-TEQ/dscm, corrected
33 to 7% O₂ using Orsat data. A summary analytical report for dioxins/furans can be found in
34 Appendix F-2.

35 **8.3.5 Volatile Organic Emissions**

36 Table 8-6 summarizes the volatile organic emissions results by test run and condition average.
37 No blank corrections have been made to the data. In instances where NDs were incurred, the RL
38 was used to calculate an emissions rate. No permitted emission limits are associated with
39 volatile organic emissions. A summary analytical report for volatile organics can be found in
40 Appendix F-3.

1 **8.3.6 TOC Emissions**

2 Tables 8-7, 8-8, and 8-9 summarize the TOC emissions results by test run and condition average.
3 Sampling for volatile/semivolatile unspciated and gravimetric organics was conducted using the
4 M0010 and M0040 sampling trains. In instances where NDs were incurred, the RL was used to
5 calculate an emissions rate. No permitted emission limits are associated with TOC emissions. A
6 summary analytical report for volatile/semivolatile unspciated and gravimetric organics can be
7 found in Appendices F-4, F-5, and F-6.

8 **8.3.7 Acid Gases and Particulate Emissions**

9 Table 8-10 summarizes the acid gas and particulate emissions results by test run and condition
10 average. No blank corrections have been made to the data. In instances where NDs were
11 incurred, the RL was used to calculate an emissions rate. The chlorine equivalent concentrations
12 for all runs were in compliance with the CAA Permit limit of 21 ppmv, corrected to 7% O₂ using
13 Orsat data. The particulate emission rates for all runs were in compliance with the RCRA/CAA
14 Permit limit of 0.013 gr/dscf, corrected to 7% O₂ using Orsat data. A summary analytical report
15 for acid gases and particulates can be found in Appendix F-7.

16 **8.3.8 Trace Metal Emissions**

17 Table 8-11 summarizes the trace metal emissions results by test run and condition average. No
18 blank corrections have been made to the data. In instances where NDs were incurred, the RL
19 was used to calculate an emissions rate. The low-volatile (arsenic, beryllium, and chromium
20 combined), semivolatile (cadmium and lead combined), and high-volatile (mercury) metal
21 emission rates for all runs were in compliance with the CAA Permit limits of 23, 10, and
22 8.1 ug/dscm, corrected to 7% O₂ using Orsat data, respectively. A summary analytical report for
23 trace metals can be found in Appendix F-8.

24 **8.3.9 Energetic Emissions**

25 Table 8-12 summarizes the energetic emissions results by test run and condition average. No
26 blank corrections have been made to the data. In instances where NDs were incurred, the RL
27 was used to calculate an emissions rate. No permitted emission limits are associated with
28 energetic emissions. A summary analytical report for energetics can be found in Appendix F-9.

29 **8.4 FEED PROHIBITIVE INTERLOCK (FPI) LIMITS**

30 The existing FPI limits demonstrate that the current permitted setpoints are protective of human
31 health and the environment. Change to the FPIs will be requested upon submittal of the
32 emissions test report for Condition 4b.

33 **8.5 PROPOSED FEED RATES**

34 The chemical agent feed rates demonstrated during C4a were 33.41, 30.96, and 36.31 lbs/hr for
35 C4aR1, C4aR2, and C4aR4, respectively, with an average of 33.56 lbs/hr (or 33.6 lbs/hr) as
36 summarized in Table 8-3. ANCDF proposes a 100% feed rate of 33.6 lbs/hr for mustard agent.

37 The metal feed rate was demonstrated during C3. ANCDF proposes a 100% metals feed rate as
38 listed in the ANCDF Final SDC Emissions Test Report (C1/C2/C3).

39 The tray weight, chlorine, sulfur, and explosives (non-mass and mass) feed rates were not
40 intended to be re-established based on emissions testing. ANCDF proposes retaining the

1 manufacturers' specifications as listed in RCRA Permit, Module 5, Table 5-4 for normal
2 operations.

3 **8.6 DATA FOR USE IN THE HRA**

4 The emissions rates presented in this report are proposed for modeling in the ANCDF HRA,
5 which will be submitted under separate cover. For more discussion on health risk, the current
6 ANCDF Risk Assessment Protocol should be consulted.

7 **8.7 FINAL CONCLUSIONS**

8 The SDC achieved all compliance objectives specified in the ANCDF SDC Emissions Test Plan
9 and RCRA/CAA Permits while processing mustard-filled munitions with SIC in the SFU.

Table 8-1: Sampling Time Intervals

Run	Date	First Port (hours)		Second Port (hours)	
		Start	Stop	Start	Stop
C4aR1	07/05/11	1625	1825	2015	2215
C4aR2	07/06/11	1525	1725	1950	2150
C4aR3 ⁽¹⁾	07/07/11	1450	1650	1900 ⁽²⁾	2110
C4aR4	07/08/11	1240	1440	1545	1745

Footnotes:

- (1) C4aR3 was archived and has been included for informational purposes only.
- (2) Sampling was paused from 2034 to 2044 hrs because condensate within the duct was aspirated into the energetic sampling train. Condensate was cleared from the duct and sampling resumed.

Table 8-2: Summary of Select Criteria Pollutant Emissions

Parameter	Units	C4aR1	C4aR2	C4aR4	Average	RCRA/CAA Permit Limit
C carbon Monoxide (facility CEMS) ⁽¹⁾	ppmv	0.19	0.99	0.52	0.57	100 ROHA
Carbon Monoxide (facility CEMS) ⁽¹⁾	lbs/hr	0.00064	0.0075	0.0087	0.0056	0.02
Sulfur Dioxide (TRM CEMS)	lbs/hr	0.0046	0.0018	0.0018	0.0027	7.20
Nitrogen Oxides (TRM CEMS)	lbs/hr	0.16	0.13	0.15	0.15	0.80

Footnote:

- (1) Values summarized in table are averages. See Table 4-2 for minimum and maximum values.

Table 8-3: DRE Summary

Parameter	Units	C4aR1	C4aR2	C4aR4	Average	RCRA/CAA Permit Limit
DAAMS Tube	---	AT001871	AT001868	AT000756	---	---
Sample Collection Time	minutes	240	240	240	240	---
DAAMS Flow Rate ⁽¹⁾	sLpm	0.20	0.19	0.20	0.20	---
Total Gas Sample Volume ⁽²⁾	scm	4.80E-02	4.56E-02	4.80E-02	4.72E-02	---
Dilution Air ⁽³⁾	%	92.0	92.5	92.1	92.2	---
Percent Exhaust Gas Sampled	%	8.0	7.5	7.9	7.8	---
Total Exhaust Gas Sample Volume	scm	3.84E-03	3.42E-03	3.79E-03	3.68E-03	---
Sample Analysis Result	ng	< 4.03E-01 [ND]	< 4.03E-01 [ND]	< 4.03E-01 [ND]	< 4.03E-01 [ND]	---
Exhaust Gas Flow Rate ⁽⁴⁾	scm/hr	1,706	1,613	1,422	1,580.43	---
Agent Concentration	mg/scm	< 1.05E-04 [ND]	< 1.18E-04 [ND]	< 1.06E-04 [ND]	< 1.10E-04 [ND]	---
Emission Rate	lbs/hr	< 3.95E-07 [ND]	< 4.19E-07 [ND]	< 3.33E-07 [ND]	< 3.82E-07 [ND]	---
Average Agent Feed Rate	lbs/hr	33.41	30.96	36.31	33.56	---
Agent Purity ⁽⁵⁾	%	83.9	83.9	83.9	83.9	---
Purity-Adjusted Agent Feed Rate	lbs/hr	28.0	26.0	30.5	28.2	---
DRE	%	> 99.999998 [ND]	> 99.999998 [ND]	> 99.999998 [ND]	> 99.999998 [ND]	99.9999

Footnotes:

- (1) Flow rate is set prior to collection of the 4-hour DAAMS tube set and verified after the tubes have been collected. If the ending flow rate is less than the starting flow rate, then the ending (i.e., lower) flow rate is used to calculate the total exhaust gas flow rate.
- (2) Total gas sample volume represents the exhaust gas sample volume and diluent volume.
- (3) Percent dilution is set prior to collection of the 4-hour tube and verified after the tube has been collected. If the ending percent dilution is greater than the starting percent dilution, the ending (i.e., more dilute) dilution is used to calculate exhaust gas sampled.
- (4) The exhaust gas flow rate was calculated based on the average of all isokinetic sample train for the respective run.
- (5) Based on historical data, the average mustard purity of 83.9% has been used (see ANCDF SDC Emissions Test Plan, Appendix D).

Table 8-4: Semivolatile Organic Emissions Summary

Parameter		Units	C4aR1		C4aR2		C4aR4		Average	
Sample Volume		dscf	145.206		141.197		127.291		137.90	
Gas Flow Rate		dscfm	710		689		608		669.00	
Acenaphthene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Acenaphthylene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Acetophenone	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
2-Acetylaminofluorene	Total Catch	ug	< 300	ND						
	Concentration	ug/dscm	< 72.95	ND	< 75.02	ND	< 83.22	ND	< 77.06	ND
	Emission Rate	lbs/hr	< 1.94E-04	ND	< 1.94E-04	ND	< 1.90E-04	ND	< 1.92E-04	ND
	Emission Rate	g/s	< 2.44E-05	ND	< 2.44E-05	ND	< 2.39E-05	ND	< 2.42E-05	ND
4-Aminobiphenyl	Total Catch	ug	< 150	ND						
	Concentration	ug/dscm	< 36.48	ND	< 37.51	ND	< 41.61	ND	< 38.53	ND
	Emission Rate	lbs/hr	< 9.70E-05	ND	< 9.68E-05	ND	< 9.48E-05	ND	< 9.62E-05	ND
	Emission Rate	g/s	< 1.22E-05	ND	< 1.22E-05	ND	< 1.19E-05	ND	< 1.21E-05	ND
3-Amino-9-ethycarbazole	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
Aniline	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Anthracene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Aramite	Total Catch	ug	< 60	ND						
	Concentration	ug/dscm	< 14.59	ND	< 15.00	ND	< 16.64	ND	< 15.41	ND
	Emission Rate	lbs/hr	< 3.88E-05	ND	< 3.87E-05	ND	< 3.79E-05	ND	< 3.85E-05	ND
	Emission Rate	g/s	< 4.89E-06	ND	< 4.88E-06	ND	< 4.78E-06	ND	< 4.85E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		
Benzidine	Total Catch	ug	<	300	ND	<	300	ND	<	300	ND
	Concentration	ug/dscm	<	72.95	ND	<	75.02	ND	<	77.06	ND
	Emission Rate	lbs/hr	<	1.94E-04	ND	<	1.94E-04	ND	<	1.92E-04	ND
	Emission Rate	g/s	<	2.44E-05	ND	<	2.44E-05	ND	<	2.42E-05	ND
Benzoic acid	Total Catch	ug	<	241	<	230	<	249	<	240	
	Concentration	ug/dscm	<	58.60	<	57.52	<	69.07	<	61.73	
	Emission Rate	lbs/hr	<	1.56E-04	<	1.48E-04	<	1.57E-04	<	1.54E-04	
	Emission Rate	g/s	<	1.96E-05	<	1.87E-05	<	1.98E-05	<	1.94E-05	
Benz (a) anthracene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
Benzo (b) fluoranthrene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
Benzo (j) fluoranthrene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
Benzo (k) fluoranthrene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
Benzo (g,h,i) perylene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
Benzo (a) pyrene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
Benzo (e) pyrene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		
Benzyl alcohol	Total Catch	ug	<	22.5	<	22.5	<	22.5	<	22.5	
	Concentration	ug/dscm	<	5.47	<	5.63	<	6.24	<	5.78	
	Emission Rate	lbs/hr	<	1.46E-05	<	1.45E-05	<	1.42E-05	<	1.44E-05	
	Emission Rate	g/s	<	1.83E-06	<	1.83E-06	<	1.79E-06	<	1.82E-06	
Benzaldehyde	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
Benzenethiol	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
Biphenyl	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
bis(2-Chloroethoxy)-methane	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
bis(2-Chloroethyl) ether	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
bis(2-Chloroisopropyl) ether	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
bis(2-Ethylhexyl)-phthalate	Total Catch	ug	<	52		<	25.9	<	31	<	36.3
	Concentration	ug/dscm	<	12.64		<	6.48	<	8.60	<	9.24
	Emission Rate	lbs/hr	<	3.36E-05		<	1.67E-05	<	1.96E-05	<	2.33E-05
	Emission Rate	g/s	<	4.24E-06		<	2.11E-06	<	2.47E-06	<	2.94E-06
4-Bromophenyl phenyl ether	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		
Butyl benzyl phthalate	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
2-sec-Butyl-4,6-dinitro-phenol	Total Catch	ug	<	60	ND	<	60	ND	<	60	ND
	Concentration	ug/dscm	<	14.59	ND	<	15.00	ND	<	16.64	ND
	Emission Rate	lbs/hr	<	3.88E-05	ND	<	3.87E-05	ND	<	3.79E-05	ND
	Emission Rate	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.78E-06	ND
4-Chloroaniline	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
Chlorobenzilate	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
4-Chloro-3-methylphenol	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	41.61	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.48E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND
1-Chloronaphthalene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
2-Chloronaphthalene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
2-Chlorophenol	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
4-Chlorophenyl phenyl ether	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average	
Chrysene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
4,4'-DDE	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
Diallate	Total Catch	ug	< 60	ND						
	Concentration	ug/dscm	< 14.59	ND	< 15.00	ND	< 16.64	ND	< 15.41	ND
	Emission Rate	lbs/hr	< 3.88E-05	ND	< 3.87E-05	ND	< 3.79E-05	ND	< 3.85E-05	ND
	Emission Rate	g/s	< 4.89E-06	ND	< 4.88E-06	ND	< 4.78E-06	ND	< 4.85E-06	ND
Dibenz(a,j)acridine	Total Catch	ug	< 60	ND						
	Concentration	ug/dscm	< 14.59	ND	< 15.00	ND	< 16.64	ND	< 15.41	ND
	Emission Rate	lbs/hr	< 3.88E-05	ND	< 3.87E-05	ND	< 3.79E-05	ND	< 3.85E-05	ND
	Emission Rate	g/s	< 4.89E-06	ND	< 4.88E-06	ND	< 4.78E-06	ND	< 4.85E-06	ND
Dibenz(a,h)anthracene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Dibenzofuran	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
1,2-Dibromo-3-chloropropane	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
Di-n-butyl phthalate	Total Catch	ug	< 27.3		< 24.4		< 24.5		< 25.4	
	Concentration	ug/dscm	< 6.64		< 6.10		< 6.80		< 6.51	
	Emission Rate	lbs/hr	< 1.77E-05		< 1.57E-05		< 1.55E-05		< 1.63E-05	
	Emission Rate	g/s	< 2.22E-06		< 1.98E-06		< 1.95E-06		< 2.05E-06	
1,2-Dichlorobenzene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average	
N,N'-Diisopropylcarbodiimide	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Concentration	ug/dscm								
	Emission Rate	lbs/hr								
	Emission Rate	g/s								
1,3-Dichlorobenzene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
1,4-Dichlorobenzene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
3,3'-Dichlorobenzidine	Total Catch	ug	< 60	ND						
	Concentration	ug/dscm	< 14.59	ND	< 15.00	ND	< 16.64	ND	< 15.41	ND
	Emission Rate	lbs/hr	< 3.88E-05	ND	< 3.87E-05	ND	< 3.79E-05	ND	< 3.85E-05	ND
	Emission Rate	g/s	< 4.89E-06	ND	< 4.88E-06	ND	< 4.78E-06	ND	< 4.85E-06	ND
2,4-Dichlorophenol	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
2,6-Dichlorophenol	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Diethyl phthalate	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Dihydrosafrole	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Concentration	ug/dscm								
	Emission Rate	lbs/hr								
	Emission Rate	g/s								
p-Dimethylaminoazobenzene	Total Catch	ug	< 60	ND						
	Concentration	ug/dscm	< 14.59	ND	< 15.00	ND	< 16.64	ND	< 15.41	ND
	Emission Rate	lbs/hr	< 3.88E-05	ND	< 3.87E-05	ND	< 3.79E-05	ND	< 3.85E-05	ND
	Emission Rate	g/s	< 4.89E-06	ND	< 4.88E-06	ND	< 4.78E-06	ND	< 4.85E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average	
7,12-Dimethylbenz(a)-anthracene	Total Catch	ug	< 60	ND						
	Concentration	ug/dscm	< 14.59	ND	< 15.00	ND	< 16.64	ND	< 15.41	ND
	Emission Rate	lbs/hr	< 3.88E-05	ND	< 3.87E-05	ND	< 3.79E-05	ND	< 3.85E-05	ND
	Emission Rate	g/s	< 4.89E-06	ND	< 4.88E-06	ND	< 4.78E-06	ND	< 4.85E-06	ND
3,3'-Dimethylbenzidine	Total Catch	ug	< 150	ND						
	Concentration	ug/dscm	< 36.48	ND	< 37.51	ND	< 41.61	ND	< 38.53	ND
	Emission Rate	lbs/hr	< 9.70E-05	ND	< 9.68E-05	ND	< 9.48E-05	ND	< 9.62E-05	ND
	Emission Rate	g/s	< 1.22E-05	ND	< 1.22E-05	ND	< 1.19E-05	ND	< 1.21E-05	ND
a,a-Dimethylphenethyl-amine	Total Catch	ug	< 150	ND						
	Concentration	ug/dscm	< 36.48	ND	< 37.51	ND	< 41.61	ND	< 38.53	ND
	Emission Rate	lbs/hr	< 9.70E-05	ND	< 9.68E-05	ND	< 9.48E-05	ND	< 9.62E-05	ND
	Emission Rate	g/s	< 1.22E-05	ND	< 1.22E-05	ND	< 1.19E-05	ND	< 1.21E-05	ND
2,4-Dimethylphenol	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Dimethyl phthalate	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
1,3-Dinitrobenzene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
4,6-Dinitro-2-methylphenol	Total Catch	ug	< 150	ND						
	Concentration	ug/dscm	< 36.48	ND	< 37.51	ND	< 41.61	ND	< 38.53	ND
	Emission Rate	lbs/hr	< 9.70E-05	ND	< 9.68E-05	ND	< 9.48E-05	ND	< 9.62E-05	ND
	Emission Rate	g/s	< 1.22E-05	ND	< 1.22E-05	ND	< 1.19E-05	ND	< 1.21E-05	ND
2,4-Dinitrophenol	Total Catch	ug	< 150	ND						
	Concentration	ug/dscm	< 36.48	ND	< 37.51	ND	< 41.61	ND	< 38.53	ND
	Emission Rate	lbs/hr	< 9.70E-05	ND	< 9.68E-05	ND	< 9.48E-05	ND	< 9.62E-05	ND
	Emission Rate	g/s	< 1.22E-05	ND	< 1.22E-05	ND	< 1.19E-05	ND	< 1.21E-05	ND
2,4-Dinitrotoluene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		
2,6-Dinitrotoluene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
Dioxathion	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
Diphenylamine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
1,2-Diphenylhydrazine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
Di-n-octyl phthalate	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
Ethyl methanesulfonate	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
Ethyl parathion	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	38.53	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.62E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.21E-05	ND
Fluoranthene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
Fluorene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average	
Heptachlor	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Concentration	ug/dscm								
	Emission Rate	lbs/hr								
	Emission Rate	g/s								
Hexachlorobenzene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Hexachlorobutadiene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Hexachlorocyclopentadiene	Total Catch	ug	< 150	ND						
	Concentration	ug/dscm	< 36.48	ND	< 37.51	ND	< 41.61	ND	< 38.53	ND
	Emission Rate	lbs/hr	< 9.70E-05	ND	< 9.68E-05	ND	< 9.48E-05	ND	< 9.62E-05	ND
	Emission Rate	g/s	< 1.22E-05	ND	< 1.22E-05	ND	< 1.19E-05	ND	< 1.21E-05	ND
Hexachloroethane	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Hexachlorophene	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Concentration	ug/dscm								
	Emission Rate	lbs/hr								
	Emission Rate	g/s								
Hexachloropropene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Indeno(1,2,3-cd)pyrene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
Isophorone	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		
Isosafrole	Total Catch	ug	<	60	ND	<	60	ND	<	60	ND
	Concentration	ug/dscm	<	14.59	ND	<	15.00	ND	<	15.41	ND
	Emission Rate	lbs/hr	<	3.88E-05	ND	<	3.87E-05	ND	<	3.85E-05	ND
	Emission Rate	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.85E-06	ND
Methapyrilene	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	38.53	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.62E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.21E-05	ND
Methoxychlor	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
Methylcyclohexane	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
3-Methylcholanthrene	Total Catch	ug	<	60	ND	<	60	ND	<	60	ND
	Concentration	ug/dscm	<	14.59	ND	<	15.00	ND	<	15.41	ND
	Emission Rate	lbs/hr	<	3.88E-05	ND	<	3.87E-05	ND	<	3.85E-05	ND
	Emission Rate	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.85E-06	ND
Methyl methanesulfonate	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
2-Methylnapthalene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
2-Methyl-5-nitroaniline	Total Catch	ug	<	60	ND	<	60	ND	<	60	ND
	Concentration	ug/dscm	<	14.59	ND	<	15.00	ND	<	15.41	ND
	Emission Rate	lbs/hr	<	3.88E-05	ND	<	3.87E-05	ND	<	3.85E-05	ND
	Emission Rate	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.85E-06	ND
2-Methylphenol (o-Cresol)	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		
3-Methylphenol (m-Cresol)	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	38.53	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.62E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.21E-05	ND
Diisopropylmethylphosphonate	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
4-Methylphenol (p-Cresol)	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
Pentachloroethane	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	38.53	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.62E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.21E-05	ND
Naphthalene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
1,4-Naphthoquinone	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	38.53	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.62E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.21E-05	ND
1-Naphthylamine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
2-Naphthylamine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
5-Nitroacenaphthene	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		
2-Nitroaniline	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	41.61	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.48E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND
3-Nitroaniline	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	41.61	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.48E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND
4-Nitroaniline	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	41.61	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.48E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND
Nitrobenzene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
2-Nitrophenol	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
4-Nitrophenol	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	41.61	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.48E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND
4-Nitroquinoline-l-oxide	Total Catch	ug	<	300	ND	<	300	ND	<	300	ND
	Concentration	ug/dscm	<	72.95	ND	<	75.02	ND	<	83.22	ND
	Emission Rate	lbs/hr	<	1.94E-04	ND	<	1.94E-04	ND	<	1.90E-04	ND
	Emission Rate	g/s	<	2.44E-05	ND	<	2.44E-05	ND	<	2.39E-05	ND
N-Nitroso-di-n-butylamine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND
N-Nitrosodiethylamine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	8.32	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.90E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.39E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		
N-Nitrosodimethylamine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
N-Nitrosomethylethylamine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
N-Nitrosodiphenylamine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
N-Nitroso-di-n-propylamine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
N-Nitrosomorpholine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
N-Nitrosopiperidine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
N-Nitrosopyrrolidine	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
Pentachlorobenzene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
Pentachloronitrobenzene	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	38.53	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.62E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.21E-05	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		
Pentachlorophenol	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	38.53	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.62E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.21E-05	ND
Perylene	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
Phenacetin	Total Catch	ug	<	60	ND	<	60	ND	<	60	ND
	Concentration	ug/dscm	<	14.59	ND	<	15.00	ND	<	15.41	ND
	Emission Rate	lbs/hr	<	3.88E-05	ND	<	3.87E-05	ND	<	3.85E-05	ND
	Emission Rate	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.85E-06	ND
Phenanthrene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND
Phenol	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	38.53	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.62E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.21E-05	ND
1,4-Phenylenediamine	Total Catch	ug	<	300	ND	<	300	ND	<	300	ND
	Concentration	ug/dscm	<	72.95	ND	<	75.02	ND	<	77.06	ND
	Emission Rate	lbs/hr	<	1.94E-04	ND	<	1.94E-04	ND	<	1.92E-04	ND
	Emission Rate	g/s	<	2.44E-05	ND	<	2.44E-05	ND	<	2.42E-05	ND
2-Picoline	Total Catch	ug	<	60	ND	<	60	ND	<	60	ND
	Concentration	ug/dscm	<	14.59	ND	<	15.00	ND	<	15.41	ND
	Emission Rate	lbs/hr	<	3.88E-05	ND	<	3.87E-05	ND	<	3.85E-05	ND
	Emission Rate	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.85E-06	ND
Pronamide	Total Catch	ug	<	60	ND	<	60	ND	<	60	ND
	Concentration	ug/dscm	<	14.59	ND	<	15.00	ND	<	15.41	ND
	Emission Rate	lbs/hr	<	3.88E-05	ND	<	3.87E-05	ND	<	3.85E-05	ND
	Emission Rate	g/s	<	4.89E-06	ND	<	4.88E-06	ND	<	4.85E-06	ND
Pyrene	Total Catch	ug	<	30	ND	<	30	ND	<	30	ND
	Concentration	ug/dscm	<	7.30	ND	<	7.50	ND	<	7.71	ND
	Emission Rate	lbs/hr	<	1.94E-05	ND	<	1.94E-05	ND	<	1.92E-05	ND
	Emission Rate	g/s	<	2.44E-06	ND	<	2.44E-06	ND	<	2.42E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average	
Pyridine	Total Catch	ug	< 60	ND						
	Concentration	ug/dscm	< 14.59	ND	< 15.00	ND	< 16.64	ND	< 15.41	ND
	Emission Rate	lbs/hr	< 3.88E-05	ND	< 3.87E-05	ND	< 3.79E-05	ND	< 3.85E-05	ND
	Emission Rate	g/s	< 4.89E-06	ND	< 4.88E-06	ND	< 4.78E-06	ND	< 4.85E-06	ND
Quinoline	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
Safrole	Total Catch	ug	< 60	ND						
	Concentration	ug/dscm	< 14.59	ND	< 15.00	ND	< 16.64	ND	< 15.41	ND
	Emission Rate	lbs/hr	< 3.88E-05	ND	< 3.87E-05	ND	< 3.79E-05	ND	< 3.85E-05	ND
	Emission Rate	g/s	< 4.89E-06	ND	< 4.88E-06	ND	< 4.78E-06	ND	< 4.85E-06	ND
1,2,4,5-Tetrachloro-benzene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
2,3,4,6-Tetrachlorophenol	Total Catch	ug	< 150	ND						
	Concentration	ug/dscm	< 36.48	ND	< 37.51	ND	< 41.61	ND	< 38.53	ND
	Emission Rate	lbs/hr	< 9.70E-05	ND	< 9.68E-05	ND	< 9.48E-05	ND	< 9.62E-05	ND
	Emission Rate	g/s	< 1.22E-05	ND	< 1.22E-05	ND	< 1.19E-05	ND	< 1.21E-05	ND
o-Toluidine	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
p-Toluidine	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND	
1,2,4-Trichlorobenzene	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND
2,4,5-Trichlorophenol	Total Catch	ug	< 30	ND						
	Concentration	ug/dscm	< 7.30	ND	< 7.50	ND	< 8.32	ND	< 7.71	ND
	Emission Rate	lbs/hr	< 1.94E-05	ND	< 1.94E-05	ND	< 1.90E-05	ND	< 1.92E-05	ND
	Emission Rate	g/s	< 2.44E-06	ND	< 2.44E-06	ND	< 2.39E-06	ND	< 2.42E-06	ND

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		
2,4,6-Trichlorophenol	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	41.61	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.48E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND
1,3,5-Trinitrobenzene	Total Catch	ug	<	150	ND	<	150	ND	<	150	ND
	Concentration	ug/dscm	<	36.48	ND	<	37.51	ND	<	41.61	ND
	Emission Rate	lbs/hr	<	9.70E-05	ND	<	9.68E-05	ND	<	9.48E-05	ND
	Emission Rate	g/s	<	1.22E-05	ND	<	1.22E-05	ND	<	1.19E-05	ND
Tributylamine	Total Catch	ug	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Concentration	ug/dscm	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	lbs/hr	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
	Emission Rate	g/s	NOT FOUND		NOT FOUND		NOT FOUND		NOT FOUND		
Decane (TIC: 124-18-5)	Total Catch	ug	19.8		17		22.9		19.90		
	Concentration	ug/dscm	4.81		4.25		6.35		5.14		
	Emission Rate	lbs/hr	1.28E-05		1.10E-05		1.45E-05		1.27E-05		
	Emission Rate	g/s	1.61E-06		1.38E-06		1.82E-06		1.61E-06		
Octadecanoic acid, methyl este (TIC: 112-61-8)	Total Catch	ug	10		9.6		NO TIC		9.80		
	Concentration	ug/dscm	2.43		2.40		NO TIC		2.42		
	Emission Rate	lbs/hr	6.47E-06		6.20E-06		NO TIC		6.33E-06		
	Emission Rate	g/s	8.15E-07		7.81E-07		NO TIC		7.98E-07		
9-Octadecenamide, (z)- (TIC: 301-02-0)	Total Catch	ug	67		81		34		60.67		
	Concentration	ug/dscm	16.29		20.26		9.43		15.33		
	Emission Rate	lbs/hr	4.33E-05		5.23E-05		2.15E-05		3.90E-05		
	Emission Rate	g/s	5.46E-06		6.59E-06		2.71E-06		4.92E-06		
Phosphine imide, p,p,p,-triphen (TIC: 2240-47-3)	Total Catch	ug	9.1		NO TIC		NO TIC		9.1		
	Concentration	ug/dscm	2.21		NO TIC		NO TIC		2.21		
	Emission Rate	lbs/hr	5.89E-06		NO TIC		NO TIC		5.89E-06		
	Emission Rate	g/s	7.42E-07		NO TIC		NO TIC		7.42E-07		
2-Hexanol (TIC: 626-93-7)	Total Catch	ug	25		27		37		29.67		
	Concentration	ug/dscm	6.08		6.75		10.26		7.70		
	Emission Rate	lbs/hr	1.62E-05		1.74E-05		2.34E-05		1.90E-05		
	Emission Rate	g/s	2.04E-06		2.20E-06		2.95E-06		2.39E-06		
Toluene (TIC: 108-88-3)	Total Catch	ug	30		48.5		19		32.50		
	Concentration	ug/dscm	7.30		12.13		5.27		8.23		
	Emission Rate	lbs/hr	1.94E-05		3.13E-05		1.20E-05		2.09E-05		
	Emission Rate	g/s	2.44E-06		3.94E-06		1.51E-06		2.63E-06		

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1	C4aR2	C4aR4	Average
Sulfur (TIC: 13798-23-7)	Total Catch	ug	37	34	21	30.67
	Concentration	ug/dscm	9.00	8.50	5.83	7.78
	Emission Rate	lbs/hr	2.39E-05	2.19E-05	1.33E-05	1.97E-05
	Emission Rate	g/s	3.02E-06	2.77E-06	1.67E-06	2.48E-06
Undecane, 3-methyl- (TIC: 1002-43-3)	Total Catch	ug	7.0	NO TIC	NO TIC	7.0
	Concentration	ug/dscm	1.70			1.70
	Emission Rate	lbs/hr	4.53E-06			4.53E-06
	Emission Rate	g/s	5.70E-07			5.70E-07
1,2-Benzenedicarboxylic acid, (TIC: 84-69-5)	Total Catch	ug	29	25	20	24.67
	Concentration	ug/dscm	7.05	6.25	5.55	6.28
	Emission Rate	lbs/hr	1.88E-05	1.61E-05	1.26E-05	1.58E-05
	Emission Rate	g/s	2.36E-06	2.03E-06	1.59E-06	2.00E-06
N-hexadecanoic acid (TIC: 57-10-3)	Total Catch	ug	16	22.1	10	16.03
	Concentration	ug/dscm	3.89	5.53	2.77	4.06
	Emission Rate	lbs/hr	1.03E-05	1.43E-05	6.32E-06	1.03E-05
	Emission Rate	g/s	1.30E-06	1.80E-06	7.96E-07	1.30E-06
Cyclic octaatomic sulfur (TIC: 10544-50-0)	Total Catch	ug	220	180	140	180
	Concentration	ug/dscm	53.50	45.01	38.84	45.78
	Emission Rate	lbs/hr	1.42E-04	1.16E-04	8.85E-05	1.16E-04
	Emission Rate	g/s	1.79E-05	1.46E-05	1.11E-05	1.46E-05
Octadecanoic acid (TIC: 57-11-4)	Total Catch	ug	11	16.3	6.7	11.33
	Concentration	ug/dscm	2.67	4.08	1.86	2.87
	Emission Rate	lbs/hr	7.11E-06	1.05E-05	4.23E-06	7.29E-06
	Emission Rate	g/s	8.96E-07	1.33E-06	5.33E-07	9.18E-07
1-Docosene (TIC: 1599-67-3)	Total Catch	ug	96	NO TIC	71	83.50
	Concentration	ug/dscm	23.34		19.70	21.52
	Emission Rate	lbs/hr	6.21E-05		4.49E-05	5.35E-05
	Emission Rate	g/s	7.82E-06		5.65E-06	6.74E-06
Cyclooctacosane (TIC: 297-24-5)	Total Catch	ug	26	NO TIC	NO TIC	26
	Concentration	ug/dscm	6.32			6.32
	Emission Rate	lbs/hr	1.68E-05			1.68E-05
	Emission Rate	g/s	2.12E-06			2.12E-06
Butanoic acid, methyl ester (TIC: 623-42-7)	Total Catch	ug	4.8	12	8.2	8.33
	Concentration	ug/dscm	1.17	3.00	2.27	2.15
	Emission Rate	lbs/hr	3.10E-06	7.75E-06	5.18E-06	5.34E-06
	Emission Rate	g/s	3.91E-07	9.76E-07	6.53E-07	6.73E-07

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1	C4aR2	C4aR4	Average
Decane, 2-methyl- (TIC: 6975-98-0)	Total Catch	ug	NO TIC	5.9	NO TIC	5.9
	Concentration	ug/dscm		1.48		1.48
	Emission Rate	lbs/hr		3.81E-06		3.81E-06
	Emission Rate	g/s		4.80E-07		4.80E-07
Benzene, 1,1'-(1,2-ethanediylb (TIC: 104-66-5)	Total Catch	ug	NO TIC	4.2	NO TIC	4.2
	Concentration	ug/dscm		1.05		1.05
	Emission Rate	lbs/hr		2.71E-06		2.71E-06
	Emission Rate	g/s		3.42E-07		3.42E-07
Heptadecane (TIC: 629-78-7)	Total Catch	ug	NO TIC	5.0	NO TIC	5.0
	Concentration	ug/dscm		1.25		1.25
	Emission Rate	lbs/hr		3.23E-06		3.23E-06
	Emission Rate	g/s		4.07E-07		4.07E-07
2,6-Diisopropylnaphthalene (TIC: 24157-81-1)	Total Catch	ug	NO TIC	5.6	6.5	6.05
	Concentration	ug/dscm		1.40	1.80	1.60
	Emission Rate	lbs/hr		3.61E-06	4.11E-06	3.86E-06
	Emission Rate	g/s		4.55E-07	5.17E-07	4.86E-07
Cyclohexadecane (TIC: 295-65-8)	Total Catch	ug	NO TIC	30	NO TIC	30
	Concentration	ug/dscm		7.50		7.50
	Emission Rate	lbs/hr		1.94E-05		1.94E-05
	Emission Rate	g/s		2.44E-06		2.44E-06
1-Octadecanol (TIC: 112-92-5)	Total Catch	ug	NO TIC	89	NO TIC	89
	Concentration	ug/dscm		22.26		22.26
	Emission Rate	lbs/hr		5.74E-05		5.74E-05
	Emission Rate	g/s		7.24E-06		7.24E-06
Pentafluoropropionic acid, hep (TIC: 100028-30-4)	Total Catch	ug	NO TIC	7.6	NO TIC	7.6
	Concentration	ug/dscm		1.90		1.90
	Emission Rate	lbs/hr		4.91E-06		4.91E-06
	Emission Rate	g/s		6.18E-07		6.18E-07
1-Hexacosanol (TIC: 506-52-5)	Total Catch	ug	NO TIC	24	NO TIC	24
	Concentration	ug/dscm		6.00		6.00
	Emission Rate	lbs/hr		1.55E-05		1.55E-05
	Emission Rate	g/s		1.95E-06		1.95E-06
Benzaldehyde, 3-ethyl- (TIC: 34246-54-3)	Total Catch	ug	NO TIC	NO TIC	7.1	7.1
	Concentration	ug/dscm			1.97	1.97
	Emission Rate	lbs/hr			4.49E-06	4.49E-06
	Emission Rate	g/s			5.65E-07	5.65E-07

Table 8-4: Semivolatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1	C4aR2	C4aR4	Average
Eicosane (TIC: 112-95-8)	Total Catch	ug	NO TIC	NO TIC	4.9	4.9
	Concentration	ug/dscm			1.36	1.36
	Emission Rate	lbs/hr			3.10E-06	3.10E-06
	Emission Rate	g/s			3.90E-07	3.90E-07
Cyclotridecane (TIC: 295-02-3)	Total Catch	ug	NO TIC	NO TIC	17	17
	Concentration	ug/dscm			4.72	4.72
	Emission Rate	lbs/hr			1.07E-05	1.07E-05
	Emission Rate	g/s			1.35E-06	1.35E-06
1-Hexadecanesulfonyl chloride (TIC: 38775-38-1)	Total Catch	ug	NO TIC	NO TIC	13	13
	Concentration	ug/dscm			3.61	3.61
	Emission Rate	lbs/hr			8.21E-06	8.21E-06
	Emission Rate	g/s			1.03E-06	1.03E-06

- Notes:
- (A) Blank corrections have not been made to these data.
 - (B) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported. When identified, TICs are reported at the reported estimated concentrations.
 - (C) "NOT FOUND" indicates that a non-calibrated target compound was not found using an ion-specific forward library search. An estimated RL or DL is not available for these compounds.
 - (D) Note that only TICs detected in multiple runs are averaged. If detected in only a single run, that value is reported in the "Average" column. "NO TIC" is reported for the runs in which the TIC was not found. In instances where a TIC was identified more than once in one (1) or more sample fractions, the reported value represents the sum of all reported values.

Table 8-5: Dioxin/Furan Emissions Summary

Parameter	Units	C4aR1			CAA Permit Limit
Sample Volume	dscf	141.902			
Gas Flow Rate	dscfm	685			
O ₂ Level	%	14.5			
Congeners	TEF [EPA/100/R-10/005]	Measured Catch (pg)	Weighted Catch (pg)	Emission Rate (g/s)	
2,3,7,8-TetraCDD	1.0	< 1.65	ND	1.65	---
Total 2,3,7,8-TetraCDD	---	< 1.65	ND	---	1.33E-13
Total TetraCDD	---	< 3.85	ND	---	---
1,2,3,7,8-PentaCDD	1.0	< 2.3	ND	2.3	---
Total 2,3,7,8-PentaCDD	---	< 2.3	ND	---	1.85E-13
Total PentaCDD	---	< 2.3	ND	---	---
1,2,3,4,7,8-HexaCDD	0.1	< 2.18	ND	0.218	---
1,2,3,6,7,8-HexaCDD	0.1	< 2.97	ND	0.297	---
1,2,3,7,8,9-HexaCDD	0.1	< 4.9	ND	0.49	---
Total 2,3,7,8-HexaCDD	---	< 10.05	ND	---	8.09E-13
Total HexaCDD	---	< 5.9	ND	---	---
1,2,3,4,6,7,8-HeptaCDD	0.01	< 8.7	ND	0.087	---
Total 2,3,7,8-HeptaCDD	---	< 8.7	ND	---	7.00E-13
Total HeptaCDD	---	< 8.8	ND	---	---
Total OctaCDD	0.0003	< 28.9	ND	0.00867	2.33E-12
Sum Concentration	pg ng-TEQ/dscm @ 7% O ₂			5.05067 0.0027	
2,3,7,8-TetraCDF	0.1	< 11.62		1.162	---
Total 2,3,7,8-TetraCDF	---	< 11.62		---	9.35E-13
Total TetraCDF	---	< 47.70		---	---
1,2,3,7,8-PentaCDF	0.03	< 1.29	ND	0.0387	---
2,3,4,7,8-PentaCDF	0.3	< 4.8	ND	1.44	---
Total 2,3,7,8-PentaCDF	---	< 6.09	ND	---	4.90E-13
Total PentaCDF	---	< 5.2	ND	---	---
1,2,3,4,7,8-HexaCDF	0.1	< 5.8	ND	0.58	---
1,2,3,6,7,8-HexaCDF	0.1	< 4.4	ND	0.44	---
2,3,4,6,7,8-HexaCDF	0.1	< 4.0	ND	0.40	---
1,2,3,7,8,9-HexaCDF	0.1	< 2.94	ND	0.294	---
Total 2,3,7,8-HexaCDF	---	< 17.14	ND	---	1.38E-12
Total HexaCDF	---	< 6.2	ND	---	---
1,2,3,4,6,7,8-HeptaCDF	0.01	< 22.2	ND	0.222	---
1,2,3,4,7,8,9-HeptaCDF	0.01	< 7.0	ND	0.070	---
Total 2,3,7,8-HeptaCDF	---	< 29.2	ND	---	2.35E-12
Total HeptaCDF	---	< 22.2	ND	---	---
Total OctaCDF	0.0003	< 50	ND	0.015	4.02E-12
Sum Concentration	pg ng-TEQ/dscm @ 7% O ₂			4.6617 0.0025	
Total Dioxins/Furans	ng-TEQ/dscm @ 7% O ₂			0.0052	0.20

Table 8-5: Dioxin/Furan Emissions Summary (Continued)

Parameter	Units	C4aR2			CAA Permit Limit
Sample Volume	dscf	135.831			
Gas Flow Rate	dscfm	671			
O ₂ Level	%	15.1			
Congeners	TEF [EPA/100/R-10/005]	Measured Catch (pg)	Weighted Catch (pg)	Emission Rate (g/s)	CAA Permit Limit
2,3,7,8-TetraCDD	1.0	< 1.23	ND	1.23	---
Total 2,3,7,8-TetraCDD	---	< 1.23	ND	---	1.01E-13
Total TetraCDD	---	< 2.15	ND	---	---
1,2,3,7,8-PentaCDD	1.0	< 1.47	ND	1.47	---
Total 2,3,7,8-PentaCDD	---	< 1.47	ND	---	1.21E-13
Total PentaCDD	---	< 1.47	ND	---	---
1,2,3,4,7,8-HexaCDD	0.1	< 1.28	ND	0.128	---
1,2,3,6,7,8-HexaCDD	0.1	< 0.92	ND	0.092	---
1,2,3,7,8,9-HexaCDD	0.1	< 1.23	ND	0.123	---
Total 2,3,7,8-HexaCDD	---	< 3.43	ND	---	2.82E-13
Total HexaCDD	---	< 1.62	ND	---	---
1,2,3,4,6,7,8-HeptaCDD	0.01	< 7.0	ND	0.070	---
Total 2,3,7,8-HeptaCDD	---	< 7.0	ND	---	5.76E-13
Total HeptaCDD	---	< 7.1	ND	---	---
Total OctaCDD	0.0003	< 23.3	ND	0.00699	1.92E-12
Sum Concentration	pg ng-TEQ/dscm @ 7% O ₂			3.11999 0.0019	
2,3,7,8-TetraCDF	0.1	< 18.65		1.865	---
Total 2,3,7,8-TetraCDF	---	< 18.65		---	1.54E-12
Total TetraCDF	---	< 18.65		---	---
1,2,3,7,8-PentaCDF	0.03	< 0.77	ND	0.0231	---
2,3,4,7,8-PentaCDF	0.3	< 2.04	ND	0.612	---
Total 2,3,7,8-PentaCDF	---	< 2.81	ND	---	2.31E-13
Total PentaCDF	---	< 3.95	ND	---	---
1,2,3,4,7,8-HexaCDF	0.1	< 2.40	ND	0.24	---
1,2,3,6,7,8-HexaCDF	0.1	< 1.86	ND	0.186	---
2,3,4,6,7,8-HexaCDF	0.1	< 1.99	ND	0.199	---
1,2,3,7,8,9-HexaCDF	0.1	< 0.95	ND	0.095	---
Total 2,3,7,8-HexaCDF	---	< 7.20	ND	---	5.93E-13
Total HexaCDF	---	< 2.84	ND	---	---
1,2,3,4,6,7,8-HeptaCDF	0.01	< 11.6	ND	0.116	---
1,2,3,4,7,8,9-HeptaCDF	0.01	< 2.32	ND	0.0232	---
Total 2,3,7,8-HeptaCDF	---	< 13.9	ND	---	1.15E-12
Total HeptaCDF	---	< 11.6	ND	---	---
Total OctaCDF	0.0003	< 16.9	ND	0.00507	1.39E-12
Sum Concentration	pg ng-TEQ/dscm @ 7% O ₂			3.36437 0.0021	
Total Dioxins/Furans	ng-TEQ/dscm @ 7% O ₂			0.0040	0.20

Table 8-5: Dioxin/Furan Emissions Summary (Continued)

Parameter	Units	C4aR4			CAA Permit Limit
Sample Volume	dscf	120.966			
Gas Flow Rate	dscfm	575			
O ₂ Level	%	15.3			
Congeners	TEF [EPA/100/R-10/005]	Measured Catch (pg)	Weighted Catch (pg)	Emission Rate (g/s)	CAA Permit Limit
2,3,7,8-TetraCDD	1.0	< 1.01	ND 1.01		---
Total 2,3,7,8-TetraCDD	---	< 1.01	ND ---	8.00E-14	---
Total TetraCDD	---	< 3.20	ND ---		---
1,2,3,7,8-PentaCDD	1.0	< 1.81	ND 1.81		---
Total 2,3,7,8-PentaCDD	---	< 1.81	ND ---	1.43E-13	---
Total PentaCDD	---	< 2.22	ND ---		---
1,2,3,4,7,8-HexaCDD	0.1	< 0.93	ND 0.093		---
1,2,3,6,7,8-HexaCDD	0.1	< 0.97	ND 0.097		---
1,2,3,7,8,9-HexaCDD	0.1	< 2.20	ND 0.220		---
Total 2,3,7,8-HexaCDD	---	< 4.1	ND ---	3.25E-13	---
Total HexaCDD	---	< 2.5	ND ---		---
1,2,3,4,6,7,8-HeptaCDD	0.01	< 7.0	ND 0.070		---
Total 2,3,7,8-HeptaCDD	---	< 7.0	ND ---	5.55E-13	---
Total HeptaCDD	---	< 8.2	ND ---		---
Total OctaCDD	0.0003	< 19.2	ND 0.00576	1.52E-12	---
Sum Concentration	pg ng-TEQ/dscm @ 7% O ₂		3.30576 0.0024		
2,3,7,8-TetraCDF	0.1	< 16.35	ND 1.635		---
Total 2,3,7,8-TetraCDF	---	< 16.35	ND ---	1.30E-12	---
Total TetraCDF	---	< 16.35	ND ---		---
1,2,3,7,8-PentaCDF	0.03	< 1.86	ND 0.0558		---
2,3,4,7,8-PentaCDF	0.3	< 2.33	ND 0.699		---
Total 2,3,7,8-PentaCDF	---	< 4.19	ND ---	3.32E-13	---
Total PentaCDF	---	< 5.16	ND ---		---
1,2,3,4,7,8-HexaCDF	0.1	< 2.43	ND 0.243		---
1,2,3,6,7,8-HexaCDF	0.1	< 2.65	ND 0.265		---
2,3,4,6,7,8-HexaCDF	0.1	< 2.66	ND 0.266		---
1,2,3,7,8,9-HexaCDF	0.1	< 1.70	ND 0.170		---
Total 2,3,7,8-HexaCDF	---	< 9.44	ND ---	7.48E-13	---
Total HexaCDF	---	< 3.0	ND ---		---
1,2,3,4,6,7,8-HeptaCDF	0.01	< 9.2	ND 0.092		---
1,2,3,4,7,8,9-HeptaCDF	0.01	< 2.9	ND 0.029		---
Total 2,3,7,8-HeptaCDF	---	< 12.1	ND ---	9.59E-13	---
Total HeptaCDF	---	< 9.2	ND ---		---
Total OctaCDF	0.0003	< 10.2	ND 0.00306	8.08E-13	---
Sum Concentration	pg ng-TEQ/dscm @ 7% O ₂		3.45786 0.0025		
Total Dioxins/Furans	ng-TEQ/dscm @ 7% O ₂		0.0049		0.20

Table 8-5: Dioxin/Furan Emissions Summary (Continued)

Parameter	Units	Average			CAA Permit Limit
Sample Volume	dscf	132.90			
Gas Flow Rate	dscfm	643.67			
O ₂ Level	%	14.97			
Congeners	TEF [EPA/100/R-10/005]	Measured Catch (pg)	Weighted Catch (pg)	Emission Rate (g/s)	CAA Permit Limit
2,3,7,8-TetraCDD	1.0	< 1.30	ND	1.30	---
Total 2,3,7,8-TetraCDD	---	< 1.30	ND	---	1.05E-13
Total TetraCDD	---	< 3.07	ND	---	---
1,2,3,7,8-PentaCDD	1.0	< 1.86	ND	1.86	---
Total 2,3,7,8-PentaCDD	---	< 1.86	ND	---	1.50E-13
Total PentaCDD	---	< 2.00	ND	---	---
1,2,3,4,7,8-HexaCDD	0.1	< 1.46	ND	0.146	---
1,2,3,6,7,8-HexaCDD	0.1	< 1.62	ND	0.162	---
1,2,3,7,8,9-HexaCDD	0.1	< 2.78	ND	0.278	---
Total 2,3,7,8-HexaCDD	---	< 5.86	ND	---	4.72E-13
Total HexaCDD	---	< 3.34	ND	---	---
1,2,3,4,6,7,8-HeptaCDD	0.01	< 7.57	ND	0.0757	---
Total 2,3,7,8-HeptaCDD	---	< 7.57	ND	---	6.10E-13
Total HeptaCDD	---	< 8.03	ND	---	---
Total OctaCDD	0.0003	< 23.80	ND	0.00714	1.92E-12
Sum Concentration	pg ng-TEQ/dscm @ 7% O ₂			3.82547 0.0024	
2,3,7,8-TetraCDF	0.1	< 15.54		1.554	---
Total 2,3,7,8-TetraCDF	---	< 15.54		---	1.26E-12
Total TetraCDF	---	< 27.57		---	---
1,2,3,7,8-PentaCDF	0.03	< 1.31	ND	0.0392	---
2,3,4,7,8-PentaCDF	0.3	< 3.06	ND	0.917	---
Total 2,3,7,8-PentaCDF	---	< 4.36	ND	---	3.51E-13
Total PentaCDF	---	< 4.77	ND	---	---
1,2,3,4,7,8-HexaCDF	0.1	< 3.54	ND	0.354	---
1,2,3,6,7,8-HexaCDF	0.1	< 2.97	ND	0.297	---
2,3,4,6,7,8-HexaCDF	0.1	< 2.88	ND	0.288	---
1,2,3,7,8,9-HexaCDF	0.1	< 1.86	ND	0.186	---
Total 2,3,7,8-HexaCDF	---	< 11.26	ND	---	9.07E-13
Total HexaCDF	---	< 4.01	ND	---	---
1,2,3,4,6,7,8-HeptaCDF	0.01	< 14.33	ND	0.1433	---
1,2,3,4,7,8,9-HeptaCDF	0.01	< 4.07	ND	0.0407	---
Total 2,3,7,8-HeptaCDF	---	< 18.41	ND	---	1.48E-12
Total HeptaCDF	---	< 14.33	ND	---	---
Total OctaCDF	0.0003	< 25.70	ND	0.00771	2.07E-12
Sum Concentration	pg ng-TEQ/dscm @ 7% O ₂			3.82798 0.0024	
Total Dioxins/Furans	ng-TEQ/dscm @ 7% O ₂			0.0048	0.20

Notes:

- (A) Blank corrections have not been made to these data.
- (B) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported.

Table 8-6: Volatile Organic Emissions Summary

Parameter	Units	C4aR1	C4aR2	C4aR4	Average			
Sample Volume	liters	74.59	75.56	74.25	74.80			
Gas Flow Rate	dscfm	694.50	670.17	592.17	652.28			
Acetone	Total Catch	ug	1.735	1.373	1.113	1.41		
	Concentration	ug/dscm	23.26	18.17	14.99	18.81		
	Emission Rate	lbs/hr	6.05E-05	4.56E-05	3.33E-05	4.65E-05		
	Emission Rate	g/s	7.63E-06	5.75E-06	4.19E-06	5.85E-06		
Benzene	Total Catch	ug	< 0.112	< 0.115	< 0.181	< 0.14		
	Concentration	ug/dscm	< 1.50	< 1.52	< 2.44	< 1.82		
	Emission Rate	lbs/hr	< 3.91E-06	< 3.81E-06	< 5.42E-06	< 4.38E-06		
	Emission Rate	g/s	< 4.93E-07	< 4.80E-07	< 6.82E-07	< 5.52E-07		
Bromodichloromethane	Total Catch	ug	< 0.264	< 0.284	< 0.196	< 0.25		
	Concentration	ug/dscm	< 3.54	< 3.75	< 2.64	< 3.32		
	Emission Rate	lbs/hr	< 9.22E-06	< 9.42E-06	< 5.86E-06	< 8.17E-06		
	Emission Rate	g/s	< 1.16E-06	< 1.19E-06	< 7.39E-07	< 1.03E-06		
Bromoform	Total Catch	ug	< 0.24	ND	< 0.24	ND	< 0.24	ND
	Concentration	ug/dscm	< 3.24	ND	< 3.20	ND	< 3.25	ND
	Emission Rate	lbs/hr	< 8.42E-06	ND	< 8.03E-06	ND	< 7.21E-06	ND
	Emission Rate	g/s	< 1.06E-06	ND	< 1.01E-06	ND	< 9.08E-07	ND
Bromomethane	Total Catch	ug	< 0.440	< 0.48	ND	< 0.483	ND	< 0.47
	Concentration	ug/dscm	< 5.89	< 6.39	ND	< 6.50	ND	< 6.26
	Emission Rate	lbs/hr	< 1.53E-05	< 1.61E-05	ND	< 1.44E-05	ND	< 1.53E-05
	Emission Rate	g/s	< 1.93E-06	< 2.02E-06	ND	< 1.82E-06	ND	< 1.92E-06
1,3-Butadiene	Total Catch	ug	< 0.085	< 0.073	< 0.083	< 0.080		
	Concentration	ug/dscm	< 1.13	< 0.97	< 1.12	< 1.07		
	Emission Rate	lbs/hr	< 2.95E-06	< 2.43E-06	< 2.49E-06	< 2.62E-06		
	Emission Rate	g/s	< 3.72E-07	< 3.06E-07	< 3.14E-07	< 3.30E-07		
2-Butanone (Methyl Ethyl Ketone)	Total Catch	ug	< 0.858	< 1.01	ND	< 1.01	ND	< 0.96
	Concentration	ug/dscm	< 11.50	< 13.34	ND	< 13.55	ND	< 12.80
	Emission Rate	lbs/hr	< 2.99E-05	< 3.35E-05	ND	< 3.01E-05	ND	< 3.12E-05
	Emission Rate	g/s	< 3.77E-06	< 4.22E-06	ND	< 3.79E-06	ND	< 3.93E-06
Carbon Disulfide	Total Catch	ug	< 0.151	< 0.167	< 0.231	< 0.18		
	Concentration	ug/dscm	< 2.03	< 2.20	< 3.11	< 2.45		
	Emission Rate	lbs/hr	< 5.27E-06	< 5.54E-06	< 6.91E-06	< 5.91E-06		
	Emission Rate	g/s	< 6.65E-07	< 6.97E-07	< 8.71E-07	< 7.44E-07		
Carbon Tetrachloride	Total Catch	ug	< 0.375	< 0.575	< 0.566	< 0.51		
	Concentration	ug/dscm	< 5.03	< 7.61	< 7.63	< 6.76		
	Emission Rate	lbs/hr	< 1.31E-05	< 1.91E-05	< 1.69E-05	< 1.64E-05		
	Emission Rate	g/s	< 1.65E-06	< 2.41E-06	< 2.13E-06	< 2.06E-06		

Table 8-6: Volatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average	
Chlorobenzene	Total Catch	ug	< 0.088	<	0.096	<	0.095	<	0.093	
	Concentration	ug/dscm	< 1.18	<	1.27	<	1.28	<	1.24	
	Emission Rate	lbs/hr	< 3.07E-06	<	3.18E-06	<	2.84E-06	<	3.03E-06	
	Emission Rate	g/s	< 3.87E-07	<	4.01E-07	<	3.58E-07	<	3.82E-07	
Chlorodibromomethane	Total Catch	ug	< 0.160	<	0.178	<	0.215	<	0.18	
	Concentration	ug/dscm	< 2.15	<	2.35	<	2.90	<	2.46	
	Emission Rate	lbs/hr	< 5.59E-06	<	5.90E-06	<	6.43E-06	<	5.97E-06	
	Emission Rate	g/s	< 7.04E-07	<	7.44E-07	<	8.10E-07	<	7.53E-07	
Chloroethane	Total Catch	ug	< 0.48	ND	< 0.48	ND	< 0.483	ND	< 0.48	ND
	Concentration	ug/dscm	< 6.47	ND	< 6.39	ND	< 6.50	ND	< 6.45	ND
	Emission Rate	lbs/hr	< 1.68E-05	ND	< 1.61E-05	ND	< 1.44E-05	ND	< 1.58E-05	ND
	Emission Rate	g/s	< 2.12E-06	ND	< 2.02E-06	ND	< 1.82E-06	ND	< 1.99E-06	ND
Chloroform	Total Catch	ug	< 1.542	<	1.415	<	1.407	<	1.45	
	Concentration	ug/dscm	< 20.67	<	18.72	<	18.95	<	19.44	
	Emission Rate	lbs/hr	< 5.38E-05	<	4.70E-05	<	4.20E-05	<	4.76E-05	
	Emission Rate	g/s	< 6.77E-06	<	5.92E-06	<	5.30E-06	<	6.00E-06	
Chloromethane	Total Catch	ug	< 0.545	<	0.545	<	0.388	<	0.49	
	Concentration	ug/dscm	< 7.30	<	7.22	<	5.23	<	6.59	
	Emission Rate	lbs/hr	< 1.90E-05	<	1.81E-05	<	1.16E-05	<	1.62E-05	
	Emission Rate	g/s	< 2.39E-06	<	2.28E-06	<	1.46E-06	<	2.05E-06	
2-Chloropropane	Total Catch	ug	< 0.12	ND						
	Concentration	ug/dscm	< 1.63	ND	< 1.61	ND	< 1.63	ND	< 1.62	ND
	Emission Rate	lbs/hr	< 4.23E-06	ND	< 4.04E-06	ND	< 3.62E-06	ND	< 3.97E-06	ND
	Emission Rate	g/s	< 5.33E-07	ND	< 5.09E-07	ND	< 4.57E-07	ND	< 5.00E-07	ND
1,2-Dibromoethane (Ethylene Dibromide)	Total Catch	ug	< 0.24	ND						
	Concentration	ug/dscm	< 3.24	ND	< 3.20	ND	< 3.25	ND	< 3.23	ND
	Emission Rate	lbs/hr	< 8.42E-06	ND	< 8.03E-06	ND	< 7.21E-06	ND	< 7.88E-06	ND
	Emission Rate	g/s	< 1.06E-06	ND	< 1.01E-06	ND	< 9.08E-07	ND	< 9.93E-07	ND
Dibromomethane	Total Catch	ug	< 0.24	ND						
	Concentration	ug/dscm	< 3.24	ND	< 3.20	ND	< 3.25	ND	< 3.23	ND
	Emission Rate	lbs/hr	< 8.42E-06	ND	< 8.03E-06	ND	< 7.21E-06	ND	< 7.88E-06	ND
	Emission Rate	g/s	< 1.06E-06	ND	< 1.01E-06	ND	< 9.08E-07	ND	< 9.93E-07	ND
cis-1,4-Dichloro-2-butene	Total Catch	ug	< 0.48	ND						
	Concentration	ug/dscm	< 6.47	ND	< 6.39	ND	< 6.50	ND	< 6.45	ND
	Emission Rate	lbs/hr	< 1.68E-05	ND	< 1.61E-05	ND	< 1.44E-05	ND	< 1.58E-05	ND
	Emission Rate	g/s	< 2.12E-06	ND	< 2.02E-06	ND	< 1.82E-06	ND	< 1.99E-06	ND

Table 8-6: Volatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		
trans-1,4-Dichloro-2-butene	Total Catch	ug	<	0.48	ND	<	0.48	ND	<	0.48	ND
	Concentration	ug/dscm	<	6.47	ND	<	6.39	ND	<	6.45	ND
	Emission Rate	lbs/hr	<	1.68E-05	ND	<	1.61E-05	ND	<	1.58E-05	ND
	Emission Rate	g/s	<	2.12E-06	ND	<	2.02E-06	ND	<	1.99E-06	ND
Dichlorodifluoromethane (Freon 12)	Total Catch	ug	<	0.237		<	0.241		<	0.234	
	Concentration	ug/dscm	<	3.17		<	3.19		<	3.15	
	Emission Rate	lbs/hr	<	8.25E-06		<	8.01E-06		<	6.98E-06	
	Emission Rate	g/s	<	1.04E-06		<	1.01E-06		<	8.79E-07	
1,1-Dichloroethane	Total Catch	ug	<	0.096		<	0.088		<	0.089	
	Concentration	ug/dscm	<	1.29		<	1.17		<	1.19	
	Emission Rate	lbs/hr	<	3.36E-06		<	2.94E-06		<	2.65E-06	
	Emission Rate	g/s	<	4.23E-07		<	3.70E-07		<	3.34E-07	
1,2-Dichloroethane	Total Catch	ug	<	0.089		<	0.097		<	0.091	
	Concentration	ug/dscm	<	1.20		<	1.29		<	1.23	
	Emission Rate	lbs/hr	<	3.12E-06		<	3.23E-06		<	2.72E-06	
	Emission Rate	g/s	<	3.93E-07		<	4.07E-07		<	3.43E-07	
trans-1,2-Dichloroethene	Total Catch	ug	<	0.121	ND	<	0.106		<	0.110	
	Concentration	ug/dscm	<	1.63	ND	<	1.40		<	1.47	
	Emission Rate	lbs/hr	<	4.23E-06	ND	<	3.52E-06		<	3.27E-06	
	Emission Rate	g/s	<	5.33E-07	ND	<	4.43E-07		<	4.12E-07	
1,1-Dichloroethene	Total Catch	ug	<	0.087		<	0.088		<	0.076	
	Concentration	ug/dscm	<	1.16		<	1.16		<	1.02	
	Emission Rate	lbs/hr	<	3.02E-06		<	2.92E-06		<	2.27E-06	
	Emission Rate	g/s	<	3.81E-07		<	3.68E-07		<	2.86E-07	
1,2-Dichloropropane (Propylene Dichloride)	Total Catch	ug	<	0.12	ND	<	0.12	ND	<	0.089	
	Concentration	ug/dscm	<	1.63	ND	<	1.61	ND	<	1.20	
	Emission Rate	lbs/hr	<	4.23E-06	ND	<	4.04E-06	ND	<	2.65E-06	
	Emission Rate	g/s	<	5.33E-07	ND	<	5.09E-07	ND	<	3.34E-07	
cis-1,3-Dichloropropene	Total Catch	ug	<	0.12	ND	<	0.12	ND	<	0.091	
	Concentration	ug/dscm	<	1.63	ND	<	1.61	ND	<	1.22	
	Emission Rate	lbs/hr	<	4.23E-06	ND	<	4.04E-06	ND	<	2.71E-06	
	Emission Rate	g/s	<	5.33E-07	ND	<	5.09E-07	ND	<	3.41E-07	
trans-1,3-Dichloropropene	Total Catch	ug	<	0.12	ND	<	0.12	ND	<	0.113	
	Concentration	ug/dscm	<	1.63	ND	<	1.61	ND	<	1.52	
	Emission Rate	lbs/hr	<	4.23E-06	ND	<	4.04E-06	ND	<	3.38E-06	
	Emission Rate	g/s	<	5.33E-07	ND	<	5.09E-07	ND	<	4.26E-07	

Table 8-6: Volatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average	
Ethyl Benzene	Total Catch	ug	< 0.112	<	0.12	ND	< 0.12	ND	< 0.12	
	Concentration	ug/dscm	< 1.51	<	1.61	ND	< 1.63	ND	< 1.58	
	Emission Rate	lbs/hr	< 3.92E-06	<	4.04E-06	ND	< 3.62E-06	ND	< 3.86E-06	
	Emission Rate	g/s	< 4.94E-07	<	5.09E-07	ND	< 4.57E-07	ND	< 4.87E-07	
Hexane	Total Catch	ug	< 0.188	<	0.193	<	0.245	<	0.21	
	Concentration	ug/dscm	< 2.53	<	2.56	<	3.29	<	2.79	
	Emission Rate	lbs/hr	< 6.57E-06	<	6.42E-06	<	7.31E-06	<	6.77E-06	
	Emission Rate	g/s	< 8.28E-07	<	8.09E-07	<	9.21E-07	<	8.53E-07	
2-Hexanone	Total Catch	ug	< 1.01	ND						
	Concentration	ug/dscm	< 13.49	ND	< 13.34	ND	< 13.55	ND	< 13.46	ND
	Emission Rate	lbs/hr	< 3.51E-05	ND	< 3.35E-05	ND	< 3.01E-05	ND	< 3.29E-05	ND
	Emission Rate	g/s	< 4.42E-06	ND	< 4.22E-06	ND	< 3.79E-06	ND	< 4.14E-06	ND
Iodomethane	Total Catch	ug	< 0.48	ND						
	Concentration	ug/dscm	< 6.47	ND	< 6.39	ND	< 6.50	ND	< 6.45	ND
	Emission Rate	lbs/hr	< 1.68E-05	ND	< 1.61E-05	ND	< 1.44E-05	ND	< 1.58E-05	ND
	Emission Rate	g/s	< 2.12E-06	ND	< 2.02E-06	ND	< 1.82E-06	ND	< 1.99E-06	ND
Methylene Chloride	Total Catch	ug	1.097		1.298		1.134		1.18	
	Concentration	ug/dscm	14.71		17.17		15.28		15.73	
	Emission Rate	lbs/hr	3.83E-05		4.31E-05		3.39E-05		3.84E-05	
	Emission Rate	g/s	4.82E-06		5.43E-06		4.27E-06		4.84E-06	
4-Methyl-2-pentanone (Methyl Isobutyl Ketone)	Total Catch	ug	< 1.01	ND						
	Concentration	ug/dscm	< 13.49	ND	< 13.34	ND	< 13.55	ND	< 13.46	ND
	Emission Rate	lbs/hr	< 3.51E-05	ND	< 3.35E-05	ND	< 3.01E-05	ND	< 3.29E-05	ND
	Emission Rate	g/s	< 4.42E-06	ND	< 4.22E-06	ND	< 3.79E-06	ND	< 4.14E-06	ND
2-Propanol	Total Catch	ug	< 22.07	ND	< 22.08	ND	< 22.07	ND	< 22.07	ND
	Concentration	ug/dscm	< 295.82	ND	< 292.22	ND	< 297.16	ND	< 295.05	ND
	Emission Rate	lbs/hr	< 7.70E-04	ND	< 7.34E-04	ND	< 6.59E-04	ND	< 7.21E-04	ND
	Emission Rate	g/s	< 9.70E-05	ND	< 9.24E-05	ND	< 8.31E-05	ND	< 9.08E-05	ND
Styrene	Total Catch	ug	< 0.086	<	0.084	<	0.083	<	0.084	
	Concentration	ug/dscm	< 1.16	<	1.11	<	1.12	<	1.13	
	Emission Rate	lbs/hr	< 3.01E-06	<	2.78E-06	<	2.48E-06	<	2.75E-06	
	Emission Rate	g/s	< 3.79E-07	<	3.50E-07	<	3.12E-07	<	3.47E-07	
1,1,1,2-Tetrachloroethane	Total Catch	ug	< 0.12	ND						
	Concentration	ug/dscm	< 1.63	ND	< 1.61	ND	< 1.63	ND	< 1.62	ND
	Emission Rate	lbs/hr	< 4.23E-06	ND	< 4.04E-06	ND	< 3.62E-06	ND	< 3.97E-06	ND
	Emission Rate	g/s	< 5.33E-07	ND	< 5.09E-07	ND	< 4.57E-07	ND	< 5.00E-07	ND

Table 8-6: Volatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average	
1,1,2,2-Tetrachloroethane	Total Catch	ug	< 0.24	ND						
	Concentration	ug/dscm	< 3.24	ND	< 3.20	ND	< 3.25	ND	< 3.23	ND
	Emission Rate	lbs/hr	< 8.42E-06	ND	< 8.03E-06	ND	< 7.21E-06	ND	< 7.88E-06	ND
	Emission Rate	g/s	< 1.06E-06	ND	< 1.01E-06	ND	< 9.08E-07	ND	< 9.93E-07	ND
Tetrachloroethene (Tetrachloroethylene)	Total Catch	ug	< 0.111		< 0.103		< 0.110		< 0.11	
	Concentration	ug/dscm	< 1.49		< 1.36		< 1.47		< 1.44	
	Emission Rate	lbs/hr	< 3.88E-06		< 3.41E-06		< 3.27E-06		< 3.52E-06	
	Emission Rate	g/s	< 4.89E-07		< 4.30E-07		< 4.12E-07		< 4.44E-07	
Toluene	Total Catch	ug	< 0.075		< 0.068		< 0.068		< 0.070	
	Concentration	ug/dscm	< 1.01		< 0.90		< 0.92		< 0.94	
	Emission Rate	lbs/hr	< 2.62E-06		< 2.25E-06		< 2.04E-06		< 2.30E-06	
	Emission Rate	g/s	< 3.31E-07		< 2.84E-07		< 2.57E-07		< 2.90E-07	
1,1,1-Trichloroethane	Total Catch	ug	< 0.170		< 0.195		< 0.217		< 0.19	
	Concentration	ug/dscm	< 2.28		< 2.58		< 2.93		< 2.59	
	Emission Rate	lbs/hr	< 5.92E-06		< 6.47E-06		< 6.49E-06		< 6.29E-06	
	Emission Rate	g/s	< 7.46E-07		< 8.15E-07		< 8.18E-07		< 7.93E-07	
1,1,2-Trichloroethane (Methyl Chloroform)	Total Catch	ug	< 0.24	ND						
	Concentration	ug/dscm	< 3.24	ND	< 3.20	ND	< 3.25	ND	< 3.23	ND
	Emission Rate	lbs/hr	< 8.42E-06	ND	< 8.03E-06	ND	< 7.21E-06	ND	< 7.88E-06	ND
	Emission Rate	g/s	< 1.06E-06	ND	< 1.01E-06	ND	< 9.08E-07	ND	< 9.93E-07	ND
Trichloroethene	Total Catch	ug	< 0.107		< 0.097		< 0.118		< 0.11	
	Concentration	ug/dscm	< 1.44		< 1.29		< 1.58		< 1.44	
	Emission Rate	lbs/hr	< 3.74E-06		< 3.24E-06		< 3.51E-06		< 3.50E-06	
	Emission Rate	g/s	< 4.72E-07		< 4.08E-07		< 4.43E-07		< 4.41E-07	
Trichlorofluoromethane (Freon 11)	Total Catch	ug	< 0.127		< 0.128		< 0.116		< 0.12	
	Concentration	ug/dscm	< 1.70		< 1.69		< 1.56		< 1.65	
	Emission Rate	lbs/hr	< 4.41E-06		< 4.24E-06		< 3.46E-06		< 4.04E-06	
	Emission Rate	g/s	< 5.56E-07		< 5.34E-07		< 4.36E-07		< 5.09E-07	
1,2,3-Trichloropropane	Total Catch	ug	< 0.24	ND						
	Concentration	ug/dscm	< 3.24	ND	< 3.20	ND	< 3.25	ND	< 3.23	ND
	Emission Rate	lbs/hr	< 8.42E-06	ND	< 8.03E-06	ND	< 7.21E-06	ND	< 7.88E-06	ND
	Emission Rate	g/s	< 1.06E-06	ND	< 1.01E-06	ND	< 9.08E-07	ND	< 9.93E-07	ND
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	Total Catch	ug	< 0.114		< 0.344		< 0.292		< 0.25	
	Concentration	ug/dscm	< 1.53		< 4.55		< 3.94		< 3.34	
	Emission Rate	lbs/hr	< 3.98E-06		< 1.14E-05		< 8.73E-06		< 8.04E-06	
	Emission Rate	g/s	< 5.01E-07		< 1.44E-06		< 1.10E-06		< 1.01E-06	

Table 8-6: Volatile Organic Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		
Vinyl Acetate	Total Catch	ug	<	0.48	ND	<	0.48	ND	<	0.48	ND
	Concentration	ug/dscm	<	6.47	ND	<	6.39	ND	<	6.45	ND
	Emission Rate	lbs/hr	<	1.68E-05	ND	<	1.61E-05	ND	<	1.58E-05	ND
	Emission Rate	g/s	<	2.12E-06	ND	<	2.02E-06	ND	<	1.99E-06	ND
Vinyl Bromide	Total Catch	ug	<	0.48	ND	<	0.48	ND	<	0.48	ND
	Concentration	ug/dscm	<	6.47	ND	<	6.39	ND	<	6.45	ND
	Emission Rate	lbs/hr	<	1.68E-05	ND	<	1.61E-05	ND	<	1.58E-05	ND
	Emission Rate	g/s	<	2.12E-06	ND	<	2.02E-06	ND	<	1.99E-06	ND
Vinyl Chloride	Total Catch	ug	<	0.137		<	0.136		<	0.143	
	Concentration	ug/dscm	<	1.83		<	1.79		<	1.93	
	Emission Rate	lbs/hr	<	4.76E-06		<	4.50E-06		<	4.27E-06	
	Emission Rate	g/s	<	6.00E-07		<	5.67E-07		<	5.38E-07	
m,p-Xylene	Total Catch	ug	<	0.176		<	0.192		<	0.207	
	Concentration	ug/dscm	<	2.35		<	2.54		<	2.79	
	Emission Rate	lbs/hr	<	6.12E-06		<	6.37E-06		<	6.18E-06	
	Emission Rate	g/s	<	7.71E-07		<	8.03E-07		<	7.79E-07	
o-Xylene	Total Catch	ug	<	0.089		<	0.095		<	0.096	
	Concentration	ug/dscm	<	1.20		<	1.26		<	1.29	
	Emission Rate	lbs/hr	<	3.11E-06		<	3.17E-06		<	2.85E-06	
	Emission Rate	g/s	<	3.92E-07		<	3.99E-07		<	3.59E-07	
Ethane, 2,2-dichloro-1,1,1-tri (TIC: 306-83-2)	Total Catch	ug		0.776			0.18			NO TIC	0.48
	Concentration	ug/dscm		10.40			2.38				6.39
	Emission Rate	lbs/hr		2.71E-05			5.98E-06				1.65E-05
	Emission Rate	g/s		3.41E-06			7.54E-07				2.08E-06
Heptane, 2,4-dimethyl- (TIC: 2213-23-2)	Total Catch	ug		0.029			NO TIC			NO TIC	0.029
	Concentration	ug/dscm		0.39							0.39
	Emission Rate	lbs/hr		1.01E-06							1.01E-06
	Emission Rate	g/s		1.27E-07							1.27E-07
1-Pentene (TIC: 109-67-1)	Total Catch	ug		NO TIC			NO TIC			0.031	0.031
	Concentration	ug/dscm								0.42	0.42
	Emission Rate	lbs/hr								9.26E-07	9.26E-07
	Emission Rate	g/s								1.17E-07	1.17E-07

Notes:

- (A) No blank corrections have been made to these data. If undetected in the analysis, the DL is reported.
- (B) Results have been reported considering both the reporting and MDLs as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the reporting and MDLs are incorporated into the emission estimate as reported.
- (C) Note that only TICs detected in multiple runs are averaged. If detected in only a single run, that value is reported in the "Average" column. "NO TIC" is reported for the runs in which the TIC was not found. In instances where a TIC was identified more than once in one (1) or more sample fractions, the reported value represents the sum of all reported values.

Table 8-7: TOC Emissions Summary

Parameter	Units	C4aR1	C4aR2	C4aR4	Average
Concentration	mg/m ³	< 3.44 ¹	< 11.66	< 39.79	< 18.30
Emission Rate	lbs/hr	< 8.93E-03 ¹	< 2.98E-02	< 9.17E-02	< 4.35E-02
Emission Rate	g/s	< 1.12E-03 ¹	< 3.75E-03	< 1.16E-02	< 5.48E-03

Footnote:

(1) Only one injection (Bag 1) was reported for C6 concentration because Bag 2 results were below MDL. Bag 1 is represented as the average for the bags for C4aR1.

Note:

(A) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported.

Table 8-8: Semivolatile Unspeciated Organic Emissions Summary

Parameter	Units	C4aR1	C4aR2	C4aR4	Average
Sample Volume	dscf	137.899	134.549	125.910	132.79
Gas Flow Rate	dscfm	692	682	615	663.00
Gas Flow Rate	dscf/hr	41,520	40,920	36,900	39,780
Total Chromatographable Organics (C₈ through C₁₇)					
Total Catch	mg	0.57	0.54	0.49	0.53
Concentration	mg/m ³	0.15	0.14	0.14	0.14
Emission Rate	lbs/hr	3.78E-04	3.62E-04	3.17E-04	3.52E-04
Emission Rate	g/s	4.77E-05	4.56E-05	3.99E-05	4.44E-05
Total Gravimetric Organics					
Total Catch	mg	2.6	2.8	2.3	2.6
Concentration	mg/m ³	0.67	0.73	0.65	0.68
Emission Rate	lbs/hr	1.73E-03	1.88E-03	1.49E-03	1.70E-03
Emission Rate	g/s	2.17E-04	2.37E-04	1.87E-04	2.14E-04

Table 8-9: Volatile Unspeciated Organic Emissions Summary

Parameter	Units	C4aR1								Average					
		Bag 1		Condensate 1		Bag 2		Condensate 2		Bags		Condensates			
Gas Volume	dsL	25.02				27.75				26.39					
Flow Rate	dscf/hr	41,547				41,547				41,547					
C ₁ Concentration	ppm	1.14		---		1.14		---		1.14		---			
C ₁ Concentration	ug/m ³	760.60		---		760.60		---		760.60		---			
C ₁ Emission Rate	lbs/hr	1.97E-03		---		1.97E-03		---		1.97E-03		---			
C ₂ Concentration	ppm	0.029		---		0.0295		---		0.0293		---			
C ₂ Concentration	ug/m ³	36.27		---		36.89		---		36.58		---			
C ₂ Emission Rate	lbs/hr	9.41E-05		---		9.57E-05		---		9.49E-05		---			
C ₃ Concentration	ppm	<	0.072	ND	---	<	0.072	ND	---	<	0.072	ND	---		
C ₃ Concentration	ug/m ³	<	132.04	ND	---	<	132.04	ND	---	<	132.04	ND	---		
C ₃ Emission Rate	lbs/hr	<	3.43E-04	ND	---	<	3.43E-04	ND	---	<	3.43E-04	ND	---		
C ₄ Total Catch	ug	---		<	0.085	ND	---		<	0.083	ND	---			
C ₄ Concentration	ppm	<	0.011	ND	---	<	0.011	ND	---	<	0.011	ND	---		
C ₄ Concentration	ug/m ³	<	26.59	ND	<	3.40	ND	<	26.59	ND	<	2.99	ND		
C ₄ Emission Rate	lbs/hr	<	6.90E-05	ND	<	8.81E-06	ND	<	6.90E-05	ND	<	7.76E-06	ND		
C ₅ Total Catch	ug	---		0.160		---		<	0.041	ND	---		<	0.101	
C ₅ Concentration	ppm	<	0.011	ND	---	<	0.011	ND	---	<	0.011	ND	---		
C ₅ Concentration	ug/m ³	<	33.01	ND	6.39		<	33.01	ND	<	1.48	ND	<	3.94	
C ₅ Emission Rate	lbs/hr	<	8.56E-05	ND	1.66E-05		<	8.56E-05	ND	<	3.83E-06	ND	<	1.02E-05	
C ₆ Total Catch	ug	---		<	0.042	ND	---		<	0.041	ND	---		<	0.042
C ₆ Concentration	ppm	0.431		---		NQ ⁽¹⁾		---		0.431 ⁽¹⁾		---			
C ₆ Concentration	ug/m ³	1,544.70		<		1.68	ND	NQ ⁽¹⁾		<	1.48	ND	<	1,544.70 ⁽¹⁾	
C ₆ Emission Rate	lbs/hr	4.01E-03		<		4.35E-06	ND	NQ ⁽¹⁾		<	3.83E-06	ND	<	4.01E-03 ⁽¹⁾	
C ₇ Total Catch	ug	---		<	0.042	ND	---		<	0.041	ND	---		<	0.042
C ₇ Concentration	ppm	<	0.020	ND	---	<	0.020	ND	---	<	0.020	ND	---		
C ₇ Concentration	ug/m ³	<	83.35	ND	<	1.68	ND	<	83.35	ND	<	1.48	ND	<	83.35
C ₇ Emission Rate	lbs/hr	<	2.16E-04	ND	<	4.35E-06	ND	<	2.16E-04	ND	<	3.83E-06	ND	<	4.09E-06
Total C₁ through C₇ Compounds															
Concentration	ug/m ³	<	2,616.56	<	13.15	NQ ¹		<	7.42	ND	<	2,616.56 ¹	<	10.29	
Concentration	ug/m ³	<	2,629.71	---		NQ ¹		---		<	2,629.71 ¹	---			
Emission Rate	lbs/hr	<	6.82E-03	---		NQ ¹		---		<	6.82E-03 ¹	---			
Emission Rate	g/s	<	8.60E-04	---		NQ ¹		---		<	8.60E-04 ¹	---			

Table 8-9: Volatile Unspeciated Organics Emission Summary (Continued)

Parameter	Units	C4aR2								Average											
		Bag 1				Condensate 1				Bag 2				Condensate 2				Bags		Condensates	
Gas Volume	dsL	26.64								25.39				26.02							
Flow Rate	dscf/hr	40,903								40,903				40,903							
C ₁ Concentration	ppm	1.32				---				2.40				---				1.86		---	
C ₁ Concentration	ug/m ³	880.70				---				1,601.27				---				1,240.99		---	
C ₁ Emission Rate	lbs/hr	2.25E-03				---				4.09E-03				---				3.17E-03		---	
C ₂ Concentration	ppm	< 0.010	ND	---		---		0.0306		---		---		< 0.0203		---		---			
C ₂ Concentration	ug/m ³	< 12.51	ND	---		---		38.27		---		---		< 25.39		---		---			
C ₂ Emission Rate	lbs/hr	< 3.19E-05	ND	---		---		9.77E-05		---		---		< 6.48E-05		---		---			
C ₃ Concentration	ppm	< 0.072	ND	---		---		< 0.072	ND	---		---		< 0.072	ND	---		---			
C ₃ Concentration	ug/m ³	< 132.04	ND	---		---		< 132.04	ND	---		---		< 132.04	ND	---		---			
C ₃ Emission Rate	lbs/hr	< 3.37E-04	ND	---		---		< 3.37E-04	ND	---		---		< 3.37E-04	ND	---		---			
C ₄ Total Catch	ug	---		< 0.082	ND	---		---		< 0.084	ND	---		---		< 0.083	ND	---			
C ₄ Concentration	ppm	< 0.011	ND	---		---		< 0.011	ND	---		---		< 0.011	ND	---		---			
C ₄ Concentration	ug/m ³	< 26.59	ND	< 3.08	ND	---		< 26.59	ND	< 3.31	ND	---		< 26.59	ND	< 3.19	ND	---			
C ₄ Emission Rate	lbs/hr	< 6.79E-05	ND	< 7.86E-06	ND	---		< 6.79E-05	ND	< 8.45E-06	ND	---		< 6.79E-05	ND	< 8.15E-06	ND	---			
C ₅ Total Catch	ug	---		0.10		---		---		0.10		---		---		0.10		---			
C ₅ Concentration	ppm	< 0.011	ND	---		---		< 0.011	ND	---		---		< 0.011	ND	---		---			
C ₅ Concentration	ug/m ³	< 33.01	ND	3.75		---		< 33.01	ND	3.94		---		< 33.01	ND	3.85		---			
C ₅ Emission Rate	lbs/hr	< 8.43E-05	ND	9.59E-06		---		< 8.43E-05	ND	1.01E-05		---		< 8.43E-05	ND	9.82E-06		---			
C ₆ Total Catch	ug	---		< 0.041	ND	---		---		< 0.042	ND	---		---		< 0.042	ND	---			
C ₆ Concentration	ppm	3.91		---		---		1.24		---		---		2.58		---		---			
C ₆ Concentration	ug/m ³	14,013.42		< 1.54		ND		4,444.15		< 1.65		ND		9,228.79		< 1.60		ND			
C ₆ Emission Rate	lbs/hr	3.58E-02		< 3.93E-06		ND		1.13E-02		< 4.22E-06		ND		2.36E-02		< 4.08E-06		ND			
C ₇ Total Catch	ug	---		< 0.041		ND		---		< 0.042		ND		---		< 0.042		ND			
C ₇ Concentration	ppm	< 0.020	ND	---		---		< 0.020	ND	---		---		< 0.020	ND	---		---			
C ₇ Concentration	ug/m ³	< 83.35	ND	< 1.54	ND	---		< 83.35	ND	< 1.65	ND	---		< 83.35	ND	< 1.60	ND	---			
C ₇ Emission Rate	lbs/hr	< 2.13E-04	ND	< 3.93E-06	ND	---		< 2.13E-04	ND	< 4.22E-06	ND	---		< 2.13E-04	ND	< 4.08E-06	ND	---			
Total C₁ through C₇ Compounds																					
Concentration	ug/m ³	< 15,181.61	< 9.91		---		< 6,358.68		< 10.55		---		< 10,770.15		< 10.23		---				
Concentration	ug/m ³	< 15,191.52	---		---		< 6,369.24		---		---		< 10,780.38		---		---				
Emission Rate	lbs/hr	< 3.88E-02	---		---		< 1.63E-02		---		---		< 2.75E-02		---		---				
Emission Rate	g/s	< 4.89E-03	---		---		< 2.05E-03		---		---		< 3.47E-03		---		---				

Table 8-9: Volatile Unspeciated Organics Emission Summary (Continued)

Parameter	Units	C4aR4								Average							
		Bag 1				Condensate 1				Bag 2				Condensate 2		Bags	Condensates
Gas Volume	dsL	26.10								27.03		26.56					
Flow Rate	dscf/hr	36,916								36,916		36,916					
C ₁ Concentration	ppm	1.1532				---				1.13		---		1.14		---	
C ₁ Concentration	ug/m ³	769.41				---				753.93		---		761.67		---	
C ₁ Emission Rate	lbs/hr	1.77E-03				---				1.74E-03		---		1.76E-03		---	
C ₂ Concentration	ppm	< 0.010	ND	---		< 0.010	ND	---		< 0.010	ND	---		< 0.010	ND	---	
C ₂ Concentration	ug/m ³	< 12.51	ND	---		< 12.51	ND	---		< 12.51	ND	---		< 12.51	ND	---	
C ₂ Emission Rate	lbs/hr	< 2.88E-05	ND	---		< 2.88E-05	ND	---		< 2.88E-05	ND	---		< 2.88E-05	ND	---	
C ₃ Concentration	ppm	< 0.072	ND	---		< 0.072	ND	---		< 0.072	ND	---		< 0.072	ND	---	
C ₃ Concentration	ug/m ³	< 132.04	ND	---		< 132.04	ND	---		< 132.04	ND	---		< 132.04	ND	---	
C ₃ Emission Rate	lbs/hr	< 3.04E-04	ND	---		< 3.04E-04	ND	---		< 3.04E-04	ND	---		< 3.04E-04	ND	---	
C ₄ Total Catch	ug	---		< 0.082	ND	---		< 0.083	ND	---		< 0.083	ND	---		< 0.083	ND
C ₄ Concentration	ppm	< 0.011	ND	---		< 0.011	ND	---		< 0.011	ND	---		< 0.011	ND	---	
C ₄ Concentration	ug/m ³	< 26.59	ND	< 3.14	ND	< 26.59	ND	< 3.07	ND	< 26.59	ND	< 3.11	ND	< 26.59	ND	< 3.11	ND
C ₄ Emission Rate	lbs/hr	< 6.13E-05	ND	< 7.24E-06	ND	< 6.13E-05	ND	< 7.08E-06	ND	< 6.13E-05	ND	< 7.16E-06	ND	< 6.13E-05	ND	< 7.16E-06	ND
C ₅ Total Catch	ug	---		< 0.041	ND	---		< 0.041	ND	---		< 0.041	ND	---		< 0.041	ND
C ₅ Concentration	ppm	< 0.011	ND	---		< 0.011	ND	---		< 0.011	ND	---		< 0.011	ND	---	
C ₅ Concentration	ug/m ³	< 33.01	ND	< 1.57	ND	< 33.01	ND	< 1.52	ND	< 33.01	ND	< 1.54	ND	< 33.01	ND	< 1.54	ND
C ₅ Emission Rate	lbs/hr	< 7.61E-05	ND	< 3.62E-06	ND	< 7.61E-05	ND	< 3.50E-06	ND	< 7.61E-05	ND	< 3.56E-06	ND	< 7.61E-05	ND	< 3.56E-06	ND
C ₆ Total Catch	ug	---		< 0.041	ND	---		< 0.041	ND	---		< 0.041	ND	---		< 0.041	ND
C ₆ Concentration	ppm	16.5		---		4.68		---		10.59		---		10.59		---	
C ₆ Concentration	ug/m ³	59,135.92		< 1.57 ND		16,773.10		< 1.52 ND		37,954.51		< 1.54 ND		37,954.51		< 1.54 ND	
C ₆ Emission Rate	lbs/hr	1.36E-01		< 3.62E-06 ND		3.87E-02		< 3.50E-06 ND		8.75E-02		< 3.56E-06 ND		8.75E-02		< 3.56E-06 ND	
C ₇ Total Catch	ug	---		< 0.041	ND	---		< 0.041	ND	---		< 0.041	ND	---		< 0.041	ND
C ₇ Concentration	ppm	< 0.020	ND	---		< 0.020	ND	---		< 0.020	ND	---		< 0.020	ND	---	
C ₇ Concentration	ug/m ³	< 83.35	ND	< 1.57	ND	< 83.35	ND	< 1.52	ND	< 83.35	ND	< 1.54	ND	< 83.35	ND	< 1.54	ND
C ₇ Emission Rate	lbs/hr	< 1.92E-04	ND	< 3.62E-06	ND	< 1.92E-04	ND	< 3.50E-06	ND	< 1.92E-04	ND	< 3.56E-06	ND	< 1.92E-04	ND	< 3.56E-06	ND
Total C₁ through C₇ Compounds																	
Concentration	ug/m ³	< 60,192.82	< 7.85 ND		< 17,814.52	< 7.62 ND		< 39,003.67	< 7.74 ND								
Concentration	ug/m ³	< 60,200.68	---		< 17,822.14	---		< 39,011.41	---								
Emission Rate	lbs/hr	< 1.39E-01	---		< 4.11E-02	---		< 8.99E-02	---								
Emission Rate	g/s	< 1.75E-02	---		< 5.18E-03	---		< 1.13E-02	---								

Footnote:

(1) Only one (1) injection, Bag 1, was reported for the C₆ concentration because Bag 2 results < MDL.

Table 8-10: Acid Gas and Particulate Emissions Summary

Parameter	Units	C4aR1		C4aR2		C4aR4		Average		RCRA/CAA Permit Limit
Sample Volume	dscf	144.980		134.088		122.149		133.74		
Gas Flow Rate	dscfm	712		671		590		657.67		
O ₂ Level	%	14.5		15.1		15.3		14.97		
Hydrogen Chloride										
Catch	mg	< 1.1	ND	< 0.93	ND	< 0.94	ND	< 0.99	ND	---
Concentration	mg/dscm	< 0.27	ND	< 0.24	ND	< 0.27	ND	< 0.26	ND	---
Concentration	ppmv @ 7% O ₂	< 0.38	ND	< 0.39	ND	< 0.44	ND	< 0.40	ND	---
Emission Rate	lbs/hr	< 7.15E-04	ND	< 6.16E-04	ND	< 6.01E-04	ND	< 6.44E-04	ND	---
Emission Rate	g/s	< 9.00E-05	ND	< 7.76E-05	ND	< 7.57E-05	ND	< 8.11E-05	ND	---
Chlorine										
Catch	mg	< 0.23	ND	< 0.25	ND	< 0.23	ND	< 0.24	ND	---
Concentration	mg/dscm	< 0.056	ND	< 0.066	ND	< 0.066	ND	< 0.063	ND	---
Concentration	ppmv @ 7% O ₂	< 0.082	ND	< 0.11	ND	< 0.11	ND	< 0.100	ND	---
Emission Rate	lbs/hr	< 1.49E-04	ND	< 1.65E-04	ND	< 1.47E-04	ND	< 1.54E-04	ND	---
Emission Rate	g/s	< 1.88E-05	ND	< 2.09E-05	ND	< 1.85E-05	ND	< 1.94E-05	ND	---
Chloride Equivalents										
Concentration	ppmv @ 7% O ₂	< 0.47	ND	< 0.49	ND	< 0.56	ND	< 0.51	ND	21
Hydrogen Fluoride										
Catch	mg	< 1.1	ND	< 0.95	ND	< 0.96	ND	< 1.00	ND	---
Concentration	mg/dscm	< 0.27	ND	< 0.25	ND	< 0.28	ND	< 0.27	ND	---
Emission Rate	lbs/hr	< 7.15E-04	ND	< 6.29E-04	ND	< 6.13E-04	ND	< 6.52E-04	ND	---
Emission Rate	g/s	< 9.00E-05	ND	< 7.92E-05	ND	< 7.73E-05	ND	< 8.22E-05	ND	---
Particulates										
Catch, Total	mg	2.1		1.1		0.7		1.30		---
Concentration	mg/dscm	0.51		0.29		0.20		0.33		---
Concentration	mg/dscm @ 7% O ₂	1.11		0.69		0.50		0.77		---
Concentration	gr/dscf @ 7% O ₂	0.00048		0.00030		0.00022		0.00034		0.013
Emission Rate	lbs/hr	1.36E-03		7.28E-04		4.47E-04		8.47E-04		---
Emission Rate	g/s	1.72E-04		9.17E-05		5.64E-05		1.07E-04		---

Notes:

- (A) Blank corrections have not been made to these data.
- (B) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported.

Table 8-11: Trace Metal Emissions Summary

Parameter		Units	C4aR1	C4aR2	C4aR4	Average	CAA Permit Limit
Sample Volume		dscf	136.283	129.737	121.925	129.32	
Gas Flow Rate		dscfm	659	653	576	629.33	
O ₂ Level		%	14.5	15.1	15.3	14.97	
Antimony	Total Catch	ug	0.089	0.094	0.056	0.080	---
	Concentration	ug/dscm	0.0231	0.026	0.016	0.022	---
	Emission Rate	lbs/hr	5.69E-08	6.26E-08	3.50E-08	5.15E-08	---
	Emission Rate	g/s	7.17E-09	7.89E-09	4.41E-09	6.49E-09	---
Arsenic	Total Catch	ug	< 0.68	< 0.88	< 0.83	< 0.80	---
	Concentration	ug/dscm	< 0.18	< 0.24	< 0.24	< 0.22	---
	Emission Rate	lbs/hr	< 4.35E-07	< 5.86E-07	< 5.19E-07	< 5.13E-07	---
	Emission Rate	g/s	< 5.48E-08	< 7.38E-08	< 6.54E-08	< 6.47E-08	---
Barium	Total Catch	ug	3.46	3.14	2.98	3.19	---
	Concentration	ug/dscm	0.90	0.85	0.86	0.87	---
	Emission Rate	lbs/hr	2.21E-06	2.09E-06	1.86E-06	2.06E-06	---
	Emission Rate	g/s	2.79E-07	2.63E-07	2.35E-07	2.59E-07	---
Beryllium	Total Catch	ug	< 0.162	0.050	0.033	< 0.082	---
	Concentration	ug/dscm	< 0.042	0.014	0.010	< 0.022	---
	Emission Rate	lbs/hr	< 1.04E-07	3.33E-08	2.06E-08	< 5.25E-08	---
	Emission Rate	g/s	< 1.31E-08	4.19E-09	2.60E-09	< 6.62E-09	---
Boron	Total Catch	ug	73.5	40.2	63.7	59.13	---
	Concentration	ug/dscm	19.04	10.94	18.45	16.14	---
	Emission Rate	lbs/hr	4.70E-05	2.68E-05	3.98E-05	3.79E-05	---
	Emission Rate	g/s	5.92E-06	3.37E-06	5.02E-06	4.77E-06	---
Cadmium	Total Catch	ug	0.124	0.107	0.101	0.11	---
	Concentration	ug/dscm	0.032	0.029	0.029	0.030	---
	Emission Rate	lbs/hr	7.93E-08	7.12E-08	6.31E-08	7.12E-08	---
	Emission Rate	g/s	9.99E-09	8.98E-09	7.95E-09	8.97E-09	---
Chromium	Total Catch	ug	2.93	2.18	1.81	2.31	---
	Concentration	ug/dscm	0.76	0.59	0.52	0.63	---
	Emission Rate	lbs/hr	1.87E-06	1.45E-06	1.13E-06	1.49E-06	---
	Emission Rate	g/s	2.36E-07	1.83E-07	1.43E-07	1.87E-07	---
Cobalt	Total Catch	ug	0.161	0.152	0.107	0.14	---
	Concentration	ug/dscm	0.042	0.041	0.031	0.038	---
	Emission Rate	lbs/hr	1.03E-07	1.01E-07	6.69E-08	9.03E-08	---
	Emission Rate	g/s	1.30E-08	1.28E-08	8.42E-09	1.14E-08	---
Copper	Total Catch	ug	2.02	1.70	1.15	1.62	---
	Concentration	ug/dscm	0.52	0.46	0.33	0.44	---
	Emission Rate	lbs/hr	1.29E-06	1.13E-06	7.19E-07	1.05E-06	---
	Emission Rate	g/s	1.63E-07	1.43E-07	9.05E-08	1.32E-07	---

Table 8-11: Trace Metal Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average	CAA Permit Limit
Lead	Total Catch	ug	0.74		0.74		0.53		0.67	---
	Concentration	ug/dscm	0.19		0.20		0.15		0.18	---
	Emission Rate	lbs/hr	4.73E-07		4.93E-07		3.31E-07		4.32E-07	---
	Emission Rate	g/s	5.96E-08		6.21E-08		4.17E-08		5.45E-08	---
Manganese	Total Catch	ug	1,993.3		12.7		6.2		670.73	---
	Concentration	ug/dscm	516.45		3.46		1.80		173.90	---
	Emission Rate	lbs/hr	1.27E-03		8.46E-06		3.87E-06		4.29E-04	---
	Emission Rate	g/s	1.61E-04		1.07E-06		4.88E-07		5.41E-05	---
Mercury	Total Catch	ug	< 3.615	<	1.307	<	3.35	ND	< 2.76	---
	Concentration	ug/dscm	< 0.94	<	0.36	<	0.97	ND	< 0.75	---
	Emission Rate	lbs/hr	< 2.31E-06	<	8.70E-07	<	2.09E-06	ND	< 1.76E-06	---
	Emission Rate	g/s	< 2.91E-07	<	1.10E-07	<	2.64E-07	ND	< 2.22E-07	---
Nickel	Total Catch	ug	5.30		1.39		1.21		2.63	---
	Concentration	ug/dscm	1.37		0.38		0.35		0.70	---
	Emission Rate	lbs/hr	3.39E-06		9.25E-07		7.56E-07		1.69E-06	---
	Emission Rate	g/s	4.27E-07		1.17E-07		9.53E-08		2.13E-07	---
Phosphorus	Total Catch	ug	< 28.3	<	27.2	<	28.5		< 28.00	---
	Concentration	ug/dscm	< 7.33	<	7.40	<	8.25		< 7.66	---
	Emission Rate	lbs/hr	< 1.81E-05	<	1.81E-05	<	1.78E-05		< 1.80E-05	---
	Emission Rate	g/s	< 2.28E-06	<	2.28E-06	<	2.24E-06		< 2.27E-06	---
Selenium	Total Catch	ug	< 1.18	<	1.18	<	0.99		< 1.12	---
	Concentration	ug/dscm	< 0.31	<	0.32	<	0.29		< 0.30	---
	Emission Rate	lbs/hr	< 7.55E-07	<	7.86E-07	<	6.19E-07		< 7.20E-07	---
	Emission Rate	g/s	< 9.51E-08	<	9.90E-08	<	7.80E-08		< 9.07E-08	---
Silver	Total Catch	ug	1.84		0.211		0.57		0.87	---
	Concentration	ug/dscm	0.48		0.057		0.17		0.23	---
	Emission Rate	lbs/hr	1.18E-06		1.40E-07		3.56E-07		5.58E-07	---
	Emission Rate	g/s	1.48E-07		1.77E-08		4.49E-08		7.03E-08	---
Thallium	Total Catch	ug	< 0.31	ND						
	Concentration	ug/dscm	< 0.080	ND	< 0.084	ND	< 0.090	ND	< 0.085	ND
	Emission Rate	lbs/hr	< 1.98E-07	ND	< 2.06E-07	ND	< 1.94E-07	ND	< 1.99E-07	ND
	Emission Rate	g/s	< 2.50E-08	ND	< 2.60E-08	ND	< 2.44E-08	ND	< 2.51E-08	ND
Tin	Total Catch	ug	< 3.8	<	5.6	<	5.3		< 4.90	---
	Concentration	ug/dscm	< 0.98	<	1.52	<	1.53		< 1.35	---
	Emission Rate	lbs/hr	< 2.43E-06	<	3.73E-06	<	3.31E-06		< 3.16E-06	---
	Emission Rate	g/s	< 3.06E-07	<	4.70E-07	<	4.17E-07		< 3.98E-07	---

Table 8-11: Trace Metal Emissions Summary (Continued)

Parameter		Units	C4aR1		C4aR2		C4aR4		Average		CAA Permit Limit	
Vanadium	Total Catch	ug	<	1.55	ND	<	1.56	ND	<	1.55	ND	<
	Concentration	ug/dscm	<	0.40	ND	<	0.42	ND	<	0.43	ND	<
	Emission Rate	lbs/hr	<	9.91E-07	ND	<	1.04E-06	ND	<	1.00E-06	ND	<
	Emission Rate	g/s	<	1.25E-07	ND	<	1.31E-07	ND	<	1.22E-07	ND	<
Zinc	Total Catch	ug		31.7		25.9		24.7		27.43		
	Concentration	ug/dscm		8.21		7.05		7.15		7.47		
	Emission Rate	lbs/hr		2.03E-05		1.72E-05		1.54E-05		1.77E-05		
	Emission Rate	g/s		2.55E-06		2.17E-06		1.94E-06		2.22E-06		
Arsenic	Concentration	ug/dscm @ 7% O ₂	<	0.38	<	0.57	<	0.60	<	0.52	---	
Beryllium	Concentration	ug/dscm @ 7% O ₂	<	0.091	<	0.033	<	0.024	<	0.049	---	
Chromium	Concentration	ug/dscm @ 7% O ₂		1.65		1.42		1.30		1.46	---	
Combined Total	Concentration	ug/dscm @ 7% O ₂	<	2.12	<	2.03	<	1.92	<	2.02	23	
Cadmium	Concentration	ug/dscm @ 7% O ₂		0.070		0.070		0.073		0.071	---	
Lead	Concentration	ug/dscm @ 7% O ₂		0.42		0.48		0.38		0.43	---	
Combined Total	Concentration	ug/dscm @ 7% O ₂		0.49		0.55		0.45		0.50	10	
Mercury	Concentration	ug/dscm @ 7% O ₂	<	2.03	<	0.85		2.41	<	1.76	8.1	

Notes:

- (A) Blank corrections have not been made to these data.
- (B) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported.

Table 8-12: Energetic Emissions Summary

Parameter	Units	C4aR1		C4aR2		C4aR4		Average					
Sample Volume	liters	143.190		130.379		126.312		133.29					
Stack Gas Flow Rate	dscfm	709		655		589		651.00					
2,4-Dinitrotoluene	ug	<	2.27	ND	<	2.17	ND	<	2.04	ND	<	2.16	ND
	ug/dscm	<	0.56	ND	<	0.59	ND	<	0.57	ND	<	0.57	ND
	lbs/hr	<	1.49E-06	ND	<	1.44E-06	ND	<	1.26E-06	ND	<	1.40E-06	ND
	g/s	<	1.87E-07	ND	<	1.82E-07	ND	<	1.59E-07	ND	<	1.76E-07	ND
2,6-Dinitrotoluene	ug	<	2.27	ND	<	2.17	ND	<	2.04	ND	<	2.16	ND
	ug/dscm	<	0.56	ND	<	0.59	ND	<	0.57	ND	<	0.57	ND
	lbs/hr	<	1.49E-06	ND	<	1.44E-06	ND	<	1.26E-06	ND	<	1.40E-06	ND
	g/s	<	1.87E-07	ND	<	1.82E-07	ND	<	1.59E-07	ND	<	1.76E-07	ND
HMX	ug	<	2.27	ND	<	2.17	ND	<	2.04	ND	<	2.16	ND
	ug/dscm	<	0.56	ND	<	0.59	ND	<	0.57	ND	<	0.57	ND
	lbs/hr	<	1.49E-06	ND	<	1.44E-06	ND	<	1.26E-06	ND	<	1.40E-06	ND
	g/s	<	1.87E-07	ND	<	1.82E-07	ND	<	1.59E-07	ND	<	1.76E-07	ND
Nitroglycerin	ug	<	9.2	ND	<	8.7	ND	<	8.2	ND	<	8.7	ND
	ug/dscm	<	2.27	ND	<	2.36	ND	<	2.29	ND	<	2.31	ND
	lbs/hr	<	6.03E-06	ND	<	5.78E-06	ND	<	5.06E-06	ND	<	5.62E-06	ND
	g/s	<	7.59E-07	ND	<	7.28E-07	ND	<	6.37E-07	ND	<	7.08E-07	ND
RDX	ug	<	2.27	ND	<	2.17	ND	<	2.04	ND	<	2.16	ND
	ug/dscm	<	0.56	ND	<	0.59	ND	<	0.57	ND	<	0.57	ND
	lbs/hr	<	1.49E-06	ND	<	1.44E-06	ND	<	1.26E-06	ND	<	1.40E-06	ND
	g/s	<	1.87E-07	ND	<	1.82E-07	ND	<	1.59E-07	ND	<	1.76E-07	ND
2,4,6-Trinitrotoluene	ug	<	2.27	ND	<	2.17	ND	<	2.04	ND	<	2.16	ND
	ug/dscm	<	0.56	ND	<	0.59	ND	<	0.57	ND	<	0.57	ND
	lbs/hr	<	1.49E-06	ND	<	1.44E-06	ND	<	1.26E-06	ND	<	1.40E-06	ND
	g/s	<	1.87E-07	ND	<	1.82E-07	ND	<	1.59E-07	ND	<	1.76E-07	ND

Notes:

- (A) Blank corrections have not been made to these data.
- (B) Results have been reported considering both the RL and DL as reported on the laboratory results page for each fraction. To provide the most conservative emission estimates, calibrated target compounds that are not detected are reported at the RL. Values reported between the RL and MDL are incorporated into the emission estimate as reported.