

EMISSIONS TESTING REPORT 16020
Text and Appendices

PERFORMED FOR:

COVANTA ENERGY GROUP, INC.
Morristown, New Jersey

at the

Kent County Waste to Energy Facility
Grand Rapids, Michigan
Units 1 and 2 SDA Inlets and Stacks
June 2016

by


TESTAR Engineering, P.C.
7424-108 ACC Boulevard
Raleigh, North Carolina 27617
License Number C-3896
919/957-9500

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**PE CERTIFICATION
REPORT 16020**

I hereby certify that I have personally examined and am familiar with the information submitted herein. Based upon my own knowledge and my inquiry of those individuals responsible for obtaining the information presented, the foregoing information is true, accurate and complete. I am aware that this information is being requested for the purpose of determining compliance with local, state, and federal laws and may be submitted to appropriate governmental regulatory agencies for those purposes. I am aware that there are significant penalties for submitting false information to such agencies, including the possibility of fine and imprisonment.

Signature



Date:

7/25/16

Gary L. Williams, PE, QSTI
Director

Professional Engineer, State of Michigan

Seal Number 6201049658

1.0 INTRODUCTION

1.1 General

Covanta Energy Group, Inc. (Covanta) operates the Kent County Waste-to-Energy Facility in Grand Rapids, Michigan. Covanta contracted TESTAR Engineering, P. C. to conduct an air emissions testing program to quantify specific emissions from Units 1 and 2 for determining compliance status. The testing program was conducted between June 14 and 16, 2016 by TESTAR Engineering under the supervision of Mr. Daryll Fickling of Covanta Energy Group, Inc.

1.2 Test Personnel

Table 1-1 presents the personnel that were involved in the testing program.

Table 1-1
Test Personnel

Affiliation	Personnel Responsibility
Covanta Energy Group, Inc.	Daryll Fickling Test Coordinator
Covanta Kent, Inc.	Terry Madden Test Coordinator
Michigan Department of Environmental Quality	Tom Gasloli Test Observer
TESTAR Engineering, P.C.	Chris Wrenn Project Director
	Jeff Aims Field Laboratory Manager
	Will Snipes CEM Test Engineer
	Charles Nahrebecki Test Engineer
	Sean Daley Test Engineer
	Kolbey Inman Test Engineer
	Jorge Vazquez Test Engineer
	Mike Dyson Test Engineer

1.3 Test Parameters and Run Numbers

Tables 1-2 and 1-3 present the test dates, sampling locations, flue gas parameters, sampling methods, and run numbers for reference.

Table 1-2
Ash System and Unit 1 Test Sequence

Test Location	Sampling Method	Flue Gas Parameter	Run Date	Run Time	Run Number	
Ash Handling System	EPA M22	Fugitive Emissions	06/14/16	1050-1200	M22-1	
			06/14/16	1450-1600	M22-2	
			06/15/16	1330-1440	M22-3	
Unit 1 SDA Inlet	EPA MM26	Hydrogen Chloride	06/14/16	1045-1145	1-I-MM26-1	
			06/14/16	1229-1331	1-I-MM26-2	
			06/14/16	1352-1452	1-I-MM26-3	
	EPA M29	Mercury	06/14/16	1044-1258	1-I-M29-1	
			06/14/16	1351-1651	1-I-M29-2	
			06/15/16	0930-1140	1-I-M29-3	
	Unit 1 Stack	EPA MM26	Hydrogen Chloride	06/14/16	1045-1145	1-S-MM26-1
				06/14/16	1229-1329	1-S-MM26-2
				06/14/16	1352-1452	1-S-MM26-3
EPA M29		Particulate and Metals	06/14/16	1044-1258	1-S-M29-1	
			06/14/16	1351-1651	1-S-M29-2	
			06/15/16	0930-1140	1-S-M29-3	
Facility COMS		Opacity	06/14/16	1100-1200	1-S-COM-1	
			06/14/16	1400-1500	1-S-COM-2	
			06/15/16	1000-1100	1-S-COM-3	

Table 1-3
Unit 2 Test Sequence

Test Location	Sampling Method	Flue Gas Parameter	Run Date	Run Time	Run Number
Unit 2 SDA Inlet	EPA MM26	Hydrogen Chloride	06/16/16	0843-0943	2-I-MM26-1
			06/16/16	1013-1121	2-I-MM26-2
			06/16/16	1149-1259	2-I-MM26-3
	EPA M29	Mercury	06/16/16	0842-1055	2-I-M29-1
			06/16/16	1130-1423	2-I-M29-2
			06/16/16	1445-1706	2-I-M29-3
Unit 2 Stack	EPA M23	Dioxins/Furans	06/14/16	1350-1835	2-S-M23-1
			06/14/16	0928-1334	2-S-M23-2
			06/15/16	1403-1828	2-S-M23-3
	EPA MM26	Hydrogen Chloride	06/16/16	0843-0943	2-S-MM26-1
			06/16/16	1013-1121	2-S-MM26-2
			06/16/16	1149-1259	2-S-MM26-3
	EPA M29	Particulate and Metals	06/16/16	0842-1055	2-S-M29-1
			06/16/16	1130-1423	2-S-M29-2
			06/16/16	1445-1707	2-S-M29-3
	EPA M8	Sulfuric Acid Mist	06/15/16	1304-1428	2-S-M8-1
			06/15/16	1542-1658	2-S-M8-2
			06/15/16	1758-1905	2-S-M8-3
	EPA M13B and CARB M425	Total Fluorides and Hexavalent Chromium	06/16/16	0842-1055	2-S-M13B/425-1
			06/16/16	1130-1423	2-S-M13B/425-2
			06/16/16	1445-1707	2-S-M13B/425-3
EPA M25A	Total Hydrocarbons	06/15/16	0928-1106	2-S-M25A-1	
		06/15/16	1119-1259	2-S-M25A-2	
		06/15/16	1312-1450	2-S-M25A-3	
Facility COMS	Opacity	06/16/16	0900-1000	2-S-COM-1	
		06/16/16	1200-1300	2-S-COM-2	
		06/16/16	1500-1600	2-S-COM-3	

Table 1-4
Utilization of EPA Method 2 and 3 Data

Runs Requiring Additional Information	Runs Providing Air Flow Rate Data	Runs Providing Flue Gas Composition Data
1-I-MM26-1	NA	1-I-M29-1
1-I-MM26-2	NA	1-I-M29-1
1-I-MM26-3	NA	1-I-M29-2
1-S-MM26-1	1-S-M29-1	1-S-M29-1
1-S-MM26-2	1-S-M29-1	1-S-M29-1
1-S-MM26-3	1-S-M29-2	1-S-M29-2
2-I-MM26-1	NA	2-I-M29-1
2-I-MM26-2	NA	2-I-M29-1
2-I-MM26-3	NA	2-I-M29-2
2-S-MM26-1	2-S-M29-1	2-S-M29-1
2-S-MM26-2	2-S-M29-1	2-S-M29-1
2-S-MM26-3	2-S-M29-2	2-S-M29-2
2-S-M13B/425-1	2-S-M13B/425-1	2-S-M29-1
2-S-M13B/425-2	2-S-M13B/425-2	2-S-M29-2
2-S-M13B/425-3	2-S-M13B/425-3	2-S-M29-3
2-S-CEM-2,3,4	2-S-M23-2	2-S-M23-2
2-S-CEM-5,6,7	2-S-M23-2	2-S-M23-2
2-S-CEM-8,9,10	2-S-M23-2, 2-S-M8-1, & 2-S-M23-3	2-S-M23-2, 2-S-M8-1, & 2-S-M23-3

2.0 SUMMARY OF RESULTS

2.1 Report Organization

The results of the testing project are summarized in Section 2. The process tested is discussed in Section 3. The sampling and analytical methods utilized are discussed in Section 4 while the Quality Assurance/Quality Control results are presented in Section 5. Appendix A contains detailed results of the testing program. Appendix B contains the field data that was collected and Appendix C contains the analytical results. Appendix D contains all pertinent testing equipment calibration data. Refer to the Table of Contents and the List of Tables and Figures for a complete reference with appropriate page numbers.

2.2 Presentation of Results

Table 2-1 presents the results of the emissions testing project for Unit 1. Table 2-2 presents the results of the emissions testing project for Unit 2. A more detailed summary of the sampling gas parameters is presented in Appendix A.

2.3 Total Hydrocarbon Results

Methane samples were not collected and analyzed because the onsite real-time total hydrocarbon results were significantly below the permitted limit for total non-methane hydrocarbons. This procedure was approved by Mr. Daryll Fickling and Mr. Terry Madden for previous testing programs. This report presents total hydrocarbons as carbon for comparison to the total non-methane hydrocarbons permit limit.

2.4 Opacity and Fugitive Emissions Results

Opacity measurements were taken on each unit utilizing the facility COMS in accordance with 40CFR60.11(e)(5) during each particulate test. Additionally, three EPA Method 22 test runs were performed for fugitive emissions on the ash handling system. No fugitive emissions results are presented in Appendix A because all values were zero. The field data sheets are located in Appendix B.14.

2.5 Dioxins/Furans Results and EMPC Values

In accordance with EPA Method 23, Section 9.9, all dioxins/furans results that were below the minimum detection limit (ND) were treated as zero when averaging or totaling the results. All dioxins/furans results that were an estimated maximum possible concentration (EMPC) are presented using the EMPC value as a positive catch when calculating the results.

Table 2-1
Summary of Emissions
Unit 1 Annual Compliance Testing

Parameter	Rep. 1	Rep. 2	Rep. 3	Average	Permit Limit
Unit 1 SDA Inlet Concentrations @ 7% O₂					
Hydrogen Chloride, ppmvd	667	733	666	689	NA
Mercury, ug/DSCM	75.5	88.0	18.0	60.5	NA
Unit 1 Stack Emissions Rates, lb/hr					
Metals					
Cadmium	9.96E-05	1.15E-04	1.27E-04	1.14E-04	4.17E-03
Lead	0.00183	0.00102	0.00237	0.00174	0.10
Mercury	<0.000045	0.000072	0.000089	<0.000069	0.07
Particulate	0.792	1.34	0.682	0.938	2.6
Unit 1 Stack Concentrations @ 7% O₂					
Hydrogen Chloride, ppmvd	5.35	8.59	11.6	8.52	29
Metals					
Cadmium, ug/DSCM	0.883	0.978	1.09	0.984	37
Lead, mg/DSCM	0.0162	0.00870	0.0204	0.0151	0.87
Mercury, mg/DSCM	<0.000401	0.000617	0.000766	<0.000595	0.61
Opacity by Facility COMS, %	1.3	1.4	0.7	1.1	10
Particulate, gr/DSCF	0.00307	0.00500	0.00257	0.00355	0.010
Unit 1 Removal Efficiency, %					
HCl Removal Efficiency, ppmvd	99.2	98.8	98.3	98.8	≥ 95%

Table 2-2
Summary of Emissions
Unit 1 Subpart Cb Testing

Parameter	Rep. 1	Rep. 2	Rep. 3	Average	Permit Limit
Unit 1 SDA Inlet Concentrations @ 7% O₂					
Hydrogen Chloride, ppmvd	667	733	666	689	NA
Mercury, ug/DSCM	75.5	88.0	18.0	60.5	NA
Unit 1 Stack Concentrations @ 7% O₂					
Cadmium, ug/DSCM	0.883	0.978	1.09	0.984	35
Hydrogen Chloride, ppmvd	5.35	8.59	11.6	8.52	29
Lead, mg/DSCM	0.0162	0.00870	0.0204	0.0151	0.40
Mercury, mg/DSCM	<0.000401	0.000617	0.000766	<0.000595	0.050
Particulate, mg/DSCM	7.02	11.4	5.88	8.11	25
Unit 1 RE%, @ 7% O₂					
HCl Removal Efficiency, ppmvd	99.2	98.8	98.3	98.8	≥ 95%
Hg Removal Efficiency, mg/DSCM	> 99.5	99.3	95.7	> 98.2	≥ 85%

Table 2-3
Summary of Emissions
Unit 2 Annual Compliance Testing

Parameter	Rep. 1	Rep. 2	Rep. 3	Average	Permit Limit
Unit 2 SDA Inlet Concentrations @ 7% O₂					
Hydrogen Chloride, ppmvd	493	612	617	574	NA
Mercury, ug/DSCM	84.2	278	104	155	NA
Unit 2 Stack Emissions Rates, lb/hr					
Carbon Monoxide – 1 hour	1.06	0.529	0.529	0.705	26.05
Carbon Monoxide – 8 hour	0.897	1.08	1.62	1.20	6.51
Dioxins/Furans, 1985 US EPA TEF	3.96E-09	1.48E-08	8.34E-10	6.55E-09	3.38E-07
Hexavalent Chromium	8.27E-05	3.52E-05	< 1.08E-05	< 4.29E-05	4.69E-04
Metals					
Arsenic	2.19E-05	3.00E-05	2.78E-05	2.66E-05	7.0E-04
Beryllium	<3.79E-06	<3.68E-06	<3.69E-06	<3.72E-06	1.83E-05
Cadmium	2.63E-05	1.95E-05	2.13E-05	2.24E-05	4.17E-03
Chromium	1.82E-05	7.61E-05	7.83E-05	5.75E-05	NA
Lead	0.000339	0.000351	0.000468	0.000386	0.10
Mercury	0.0000467	0.000147	0.000292	0.000162	0.07
Nitrogen Oxides – 1 hour	42.0	40.2	39.9	40.7	86
Nitrogen Oxides – 3 hour	39.6	42.3	41.9	41.3	75.25
Particulate	0.114	0.0809	0.148	0.114	2.6
Sulfur Dioxide – 8 hour	2.87	0.410	0.821	1.37	15
Sulfuric Acid Mist (IC)	< 0.00413	< 0.00589	< 0.00630	< 0.00544	4.4
Total Fluorides as HF	< 0.00751	< 0.00749	< 0.00713	< 0.00738	0.28
Total Hydrocarbons as CH ₄	0.0414	0.0080	0.0152	0.0215	0.94
Unit 2 Stack Concentrations @ 7% O₂					
Dioxins/Furans, ng/DSCM (1985 US EPA TEF)	0.0356	0.133	0.00750	0.0588	3.0
Hexavalent Chromium, ug/DSCM	0.730	0.314	< 0.0992	< 0.381	4.2
Hydrogen Chloride, ppmvd	6.08	7.50	8.25	7.28	29
Metals					
Arsenic, ug/DSCM	0.195	0.267	0.249	0.237	6.2
Beryllium, ug/DSCM	< 0.0338	< 0.0328	< 0.0331	< 0.0332	0.16
Cadmium, ug/DSCM	0.235	0.174	0.191	0.200	37
Chromium, ug/DSCM	0.162	0.679	0.701	0.514	NA
Lead, mg/DSCM	0.00302	0.00313	0.00419	0.00345	0.87
Mercury, mg/DSCM	0.000417	0.00132	0.00262	0.00145	0.61
Opacity by Facility COMS, %	1	1	1	1	10
Particulate, gr/DSCF	0.000443	0.000315	0.000578	0.000446	0.010
Sulfuric Acid Mist, mg/DSCM (IC)	< 0.0363	< 0.0523	< 0.0560	< 0.0482	39
Total Fluorides as HF, mg/DSCM	< 0.0664	< 0.0667	< 0.0652	< 0.0661	2.5
Total Hydrocarbons as CH ₄ , mg/DSCM	0.372	0.071	0.137	0.194	8.3
Unit 2 Stack Concentrations, ppmvd @ 7% O₂					
Carbon Monoxide – 1 hour	8	4	4	5	200
Carbon Monoxide – 4 hour	5	11	10	9	100
Carbon Monoxide – 8 hour	6	8	12	9	50
Nitrogen Oxides – 1 hour	192	184	183	186	400
Nitrogen Oxides – 3 hour	184	189	181	185	350
Sulfur Dioxide – 8 hour	9	1	2	4	50
Unit 2 Removal Efficiency, %					
HCl Removal Efficiency, ppmvd	98.8	98.8	98.7	98.7	≥ 95%
Sulfur Dioxide – 8 hour	87.3	97.6	95.6	93.5	≥ 75%

Table 2-4
Summary of Emissions
Unit 2 Subpart Cb Testing

Parameter	Rep. 1	Rep. 2	Rep. 3	Average	Permit Limit
Unit 2 SDA Inlet Concentrations @ 7% O₂					
Hydrogen Chloride, ppmvd	493	612	617	574	NA
Mercury, ug/DSCM	84.2	278	104	155	NA
Unit 2 Stack Concentrations @ 7% O₂					
Cadmium, ug/DSCM	0.235	0.174	0.191	0.200	35
Dioxins/Furans, ng/DSCM	5.55	19.6	0.849	8.66	30
Hydrogen Chloride, ppmvd	6.08	7.50	8.25	7.28	29
Lead, mg/DSCM	0.00302	0.00313	0.00419	0.00345	0.40
Mercury, mg/DSCM	0.000417	0.00132	0.00262	0.00145	0.050
Particulate, mg/DSCM	1.01	0.722	1.32	1.02	25
Unit 2 RE%, @ 7% O₂					
HCl Removal Efficiency, ppmvd	98.8	98.8	98.7	98.7	≥ 95%
Hg Removal Efficiency, mg/DSCM	99.5	99.5	97.5	98.8	≥ 85%

2.6 CEM Parameters

The facility CEMS were utilized for the sulfur dioxide, nitrogen oxides, and carbon monoxide concentrations. The facility data was provided in 1, 3, 4, 8, and 24 hour averages as necessary.

The facility CEMS were utilized for sulfur dioxide, nitrogen oxides, and carbon monoxide along with the air flow rate results from the three EPA Method 29 test runs to calculate 1, 3, and 8 hour emission rates averages in pounds per hour (lb/hr). This data is contained in Appendix B.

2.7 Metals Reagent Blank Corrections

Chromium and lead were detected at low levels in the reagent blank. In accordance with EPA Method 29, Sections 12.6 and 12.7, the test run catch weights were corrected for the lead blank values.

2.8 Sulfuric Acid Mist Results

The EPA Method 8 samples for sulfuric acid mist were analyzed using the Thorin titration as specified in EPA Method 8 and by Ion Chromatography techniques. Ion chromatography is more accurate because it avoids interferences that are inherent in the titration procedure. Mr. Gary McAlister of the USEPA has stated his "technical opinion that analyzing EPA Method 8 samples for sulfuric acid mist by IC is as accurate as analyzing the samples by the Thorin titrations as specified in EPA Method 8". Ion chromatography results were utilized for subsequent calculations in this report. The results of both analytical techniques are presented in Appendix C.

2.9 Non-detected Values

The results are presented using a worst-case scenario. All non-detected results were used as values for calculation purposes and the result is preceded by a "<" symbol. All non-detected results were used as a zero when calculating total catch weights for samples that had both a positive catch weight for one or more fractions and also non-detected fraction(s). When averaging across a set of three test runs, non-detected results were treated as values. Any average result that includes a non-detected value includes a "<" symbol in front of the result.

2.10 Duplicate Analyses

Run 2 for each unit was analyzed in duplicate for the metals of interest. All runs for mercury were analyzed in duplicate. All runs for HCl were analyzed in duplicate. The average of the duplicate analyses were used for reporting purposes.

2.11 Performance Audit Samples

Two metals (As, Be, Cd, Cr, Pb) audits (060716K, Cat No. 1425 and 060716K, Cat No. 1426), two mercury audits (060716K, Cat No. 1427 and 060716K, Cat No. 1428), one fluoride audit (060716K, Cat No. 1441), one sulfate audit (060716L, Cat No. 1444), and one hydrogen chloride audit (060716L, Cat No. 1440) were obtained from ERA. The results are summarized in Table 5-2 in Section 5 and complete results can be found in Appendix C.6.

3.0 PROCESS DESCRIPTION AND OPERATION

The Kent County Waste-to-Energy Facility processes up to 625 tons of solid waste each day, generating up to 18 megawatts of electricity or up to 116,000 lbs per hour exported steam. The facility was designed and built and is operated by Covanta of Kent, Inc. Each of the two (2) Martin GmbH waterwall furnaces processes up to 312.5 tons of waste per day. Waste is combusted at furnace temperatures exceeding 1,800 degrees Fahrenheit and reduced to an inert ash residue. Before leaving the facility, combustion air is directed through technologically advanced air pollution control equipment consisting of spray dryer absorbers (SDA) and fabric filter baghouses. The effluent entering the equipment is treated by the carbon and ammonia injection systems.

4.0 SAMPLING AND ANALYTICAL METHODS

This section briefly describes the sampling and analytical procedures that were used and any deviations from the methods. Figure 4-1 depicts a cross-section of the SDA Inlet test locations.

Figure 4-2 depicts a cross-section of the Stack test locations.

4.1 EPA Methods 1-4 – Air Flow Rate and Moisture

EPA Methods 1 through 4 were utilized in conjunction with each isokinetic test method. EPA Method 1 was used to determine the location of the sampling points. EPA Method 2 was used to measure the flue gas flow rate. EPA Method 3 was used to determine the flue gas molecular weight. EPA Method 4 was used to determine the flue gas moisture content. The information provided by these methods was used in determining isokinetics, parameter concentrations, and parameter emission rates.

4.2 EPA Method 8 – Sulfuric Acid Mist

Sulfuric acid mist concentrations and emission rates were determined utilizing EPA Method 8. The EPA Method 8 sampling train consisted of a glass nozzle, a heated glass probe, a heated glass mat filter, one chilled impinger with 100mL of 80% IPA, an unheated glass mat filter, two chilled impingers each with 100mL of 3% H₂O₂, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 8 with no exceptions.

At the end of each test run, the contents of the IPA impinger were poured back into the original IPA reagent jar. The contents of the H₂O₂ impingers were poured back into the original H₂O₂ reagent jar. The silica gel was returned to its original container. The moisture catch in the components was then determined gravimetrically. The nozzle, probe, and filter fronthalf were rinsed with IPA into a sample jar. The heated filter was placed into this sample jar. The filter backhalf, IPA impinger, fronthalf of the second filter, connecting glassware, and the second filter itself were rinsed with DI water into the IPA reagent jar. The backhalf of the second filter, the H₂O₂ impingers, and connecting glassware were rinsed with DI water into the H₂O₂ reagent jar.

The fronthalf portion of the samples was analyzed in accordance with EPA Method 8 for sulfate as sulfuric acid mist using the Thorin titration as specified in EPA Method 8 and by Ion Chromatography techniques. Ion chromatography results were utilized for subsequent calculations in this report.

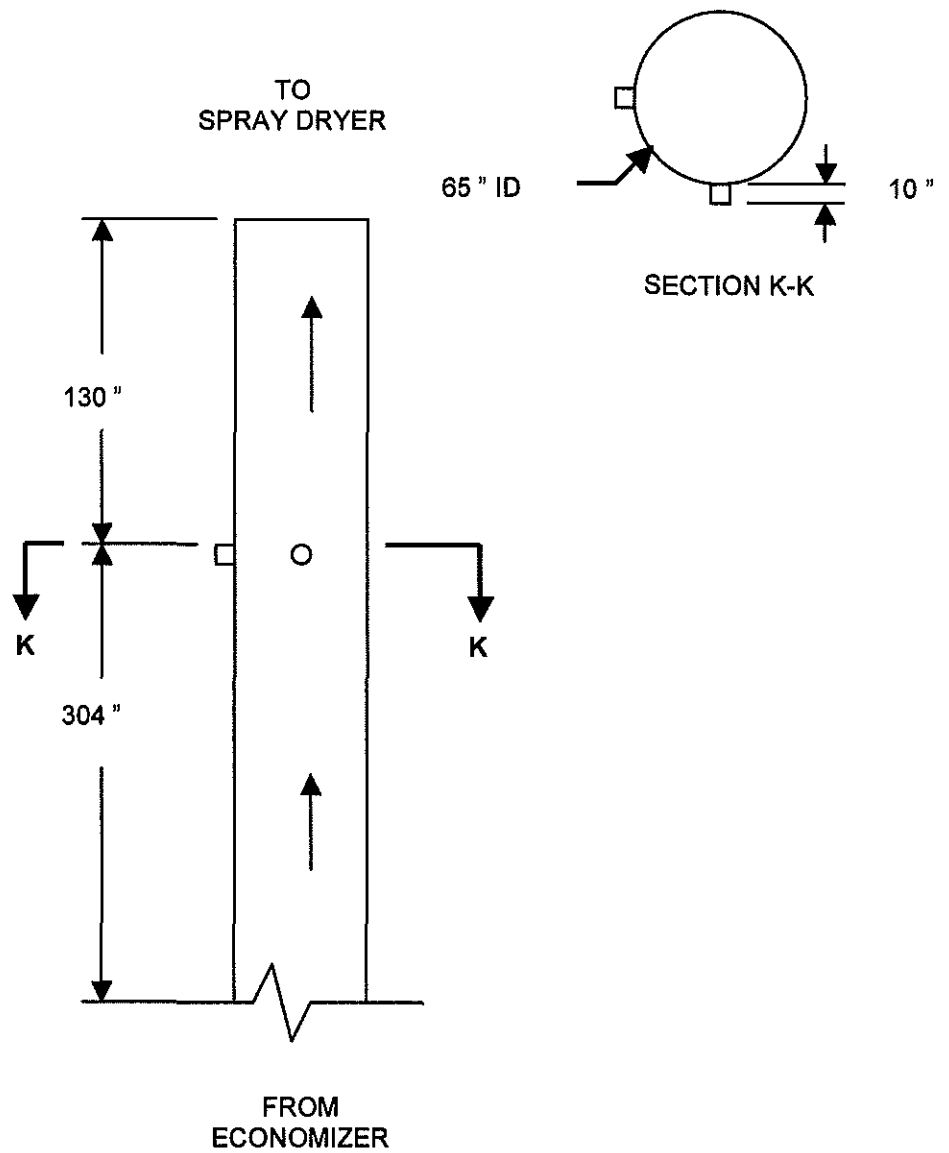


Figure 4-1. SDA Inlet Sampling Location
(Units 1 & 2 are identical)

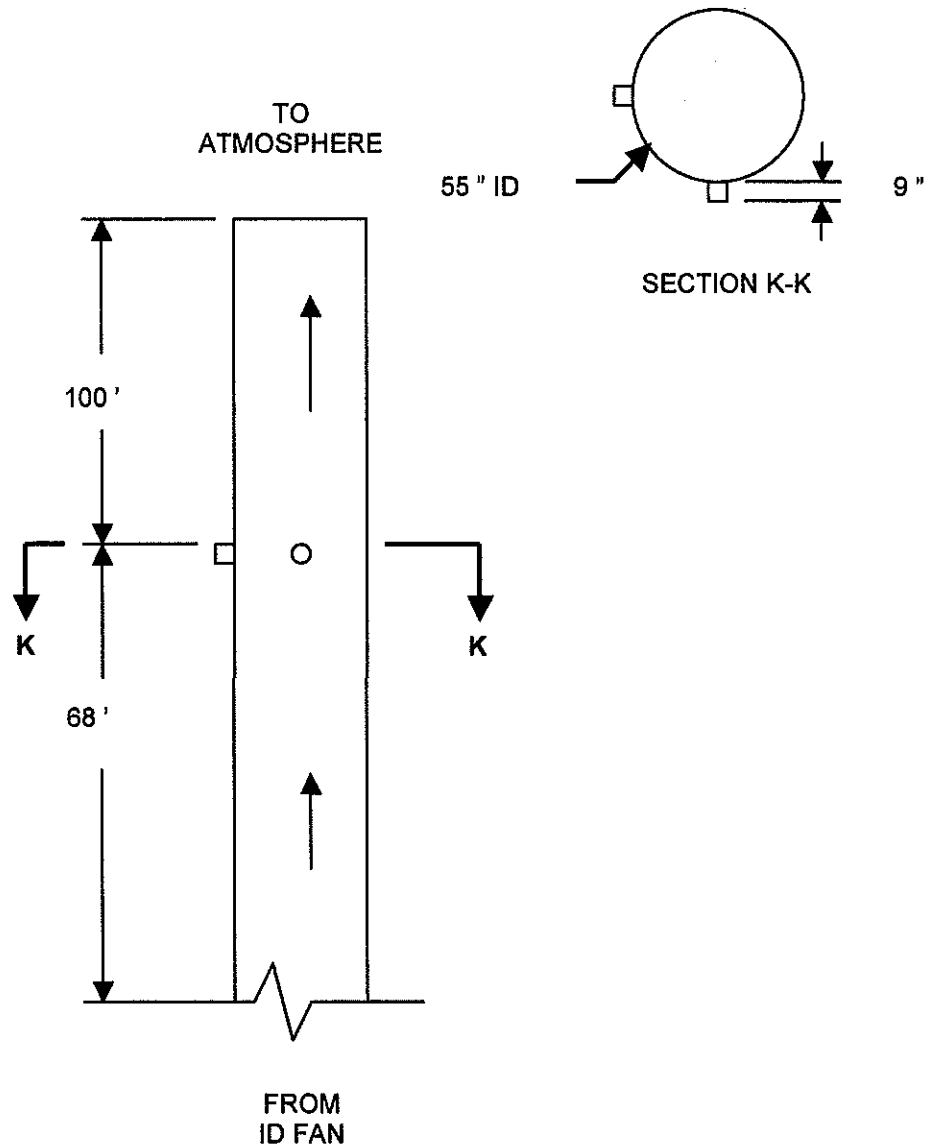


Figure 4-2. Stack Sampling Location
(Units 1 & 2 are identical)

4.3 EPA Method 13B and CARB Method 425 – Total Fluorides and Hexavalent Chromium

Total fluorides as hydrogen fluoride and hexavalent chromium concentrations and emission rates were determined utilizing a combined EPA Method 13B and CARB Method 425 sampling train. The sampling train consisted of a glass nozzle, a heated glass probe, a heated Whatman 541 filter, two chilled impingers each with 100mL of 0.5N NaOH, an empty impinger, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 13B and CARB Method 425 with no exceptions.

At the end of each test run, the contents of the first three impingers were poured back into the original reagent jar. The moisture catch was then determined gravimetrically. The nozzle, probe, filter holder, impingers, and connecting glassware were rinsed with DI into the sample jar. The filter was placed into the sample jar.

The samples were analyzed in accordance with EPA Method 13B for total fluorides as hydrogen fluoride. The samples were analyzed in accordance with CARB Method 425 for hexavalent chromium.

4.4 EPA Method 22 – Fugitive Emissions

The accumulated emissions time of fugitive emissions was determined by observing the process area(s) during normal operations for a pre-determined observation period (one hour). This method does not require that the opacity of emissions be determined, but rather the length of time that any fugitive emissions are visible. Fugitive emissions include emissions that escape capture by exhaust hoods, that are emitted during material transfer, that are emitted from buildings housing material processing or handling equipment, or that are emitted directly from process equipment. If any fugitive emissions are observed during the observation period, the length of time that the emissions are visible is quantified using a stopwatch. This total accumulated time of fugitive emissions is then used to determine compliance with the subpart or permit.

4.5 EPA Method 23/Alternate Method 052 – Dioxins/Furans

The concentrations and emissions rates of polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans (PCDD/PCDF or dioxins/furans) were determined utilizing EPA Method 23. The EPA Method 23 sampling train consisted of a glass nozzle, a heated glass probe, a heated glassmat filter, a condenser, an XAD resin trap, an empty impinger, two chilled impingers each with 100mL of DI water, an empty impinger, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 23 with no exceptions.

At the end of each test run, the nozzle, probe, and filter fronthalf were rinsed with acetone into a sample jar. The filter was recovered dry into a glass petri dish. The filter backhalf, and condenser were rinsed with acetone into a sample jar. All of the components listed above up to the XAD resin trap were rinsed again with toluene into a sample jar. The XAD resin trap was sealed and placed into a chilled ice chest. The contents of the first three impingers were poured back into the original reagent jar. The silica gel was poured back into its original container. The moisture catch was then determined gravimetrically.

The samples were analyzed in accordance with EPA Method 23 for dioxins/furans.

4.6 EPA Method 26 (Modified) –Hydrogen Chloride

Hydrogen chloride concentrations and emission rates were determined utilizing EPA Method 26 modified to use large impingers. The EPA Method 26 sampling train consisted of a heated glass probe, a heated quartz filter, two chilled impingers each with 100mL of 0.1N H₂SO₄, one empty impinger, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 26 except that large impingers were used for sample collection.

At the end of each test run, the contents of the impingers were poured back into the original H₂SO₄ reagent jar. The silica gel was returned to its original container. The moisture catch in the components was determined gravimetrically. The filter backhalf and impingers were rinsed with DI water into the H₂SO₄ reagent jar.

The H₂SO₄ portion of the samples were analyzed in accordance with EPA Method 26 for hydrogen chloride.

4.7 EPA Method 29 – Particulate and Metals

Particulate, mercury, and metals concentrations and emission rates were determined utilizing EPA Method 29. The EPA Method 29 sampling train consisted of a glass nozzle, a heated glass probe, a heated tared quartz filter, an empty impinger, two chilled impingers each with 100mL of 5%HNO₃/10%H₂O₂, an empty impinger, two chilled impingers each with 100mL of 4%KMnO₄/10%H₂SO₄, an impinger with 200 grams of silica gel, and a dry gas metering console. The equipment was operated in accordance with EPA Method 29 with no exceptions.

At the end of each test run, the nozzle, probe, and filter fronthalf were rinsed with acetone into a sample bottle. The nozzle, probe, and filter fronthalf were rinsed again with 100 mL of 0.1N nitric acid into a sample jar. The filter was recovered dry into another sample bottle. The contents of the first three impingers were poured back into the original reagent jar. Any condensate in the fourth impinger was poured into a sample bottle. The 4%KMnO₄/10%H₂SO₄ impingers were recovered into another sample jar.

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The moisture catch was then determined gravimetrically. The filter backhalf and first three impingers were rinsed with 100 mL of 0.1N nitric acid into the reagent jar. The empty impinger was rinsed with 100 mL of 0.1N nitric acid into a sample jar. The 4%KMnO₄/10%H₂SO₄ impingers were rinsed with 100 mL of 4%KMnO₄/10%H₂SO₄ and 100 mL of DI water into the jar containing the 4%KMnO₄/10%H₂SO₄ reagent. The 4%KMnO₄/10%H₂SO₄ impingers and connecting glassware were rinsed with 25mL of 8N HCl if any brown residue remained. This HCl rinse was added to a jar containing 200mL of DI water.

The filter and acetone rinses were desiccated and analyzed gravimetrically following EPA Method 5 techniques. The samples were analyzed in accordance with EPA Method 29 for metals.

5.0 QA/QC RESULTS

5.1 QA/QC Policy Procedures

TESTAR Engineering, P. C. is committed to adhering to Quality Assurance/Quality Control (QA/QC) procedures and objectives that meet or exceed the relevant EPA guidance. Our procedures include calibration of equipment as appropriate, proper glassware pre-cleaning to prevent contamination of samples, proper sample recovery, documented sample custody, blank samples, duplicate analyses, matrix spike recovery, and validated computer generated results. We also adhere to other method specific criteria such as maintaining isokinetic conditions during particulate type testing and posttest leak checks.

TESTAR Engineering uses oil manometers to determine velocity differential pressures thus eliminating potential errors from magnehelic gauges. The manometers are leveled and zeroed prior to taking any measurements. All equipment used onsite undergoes a pretest audit and operational check for accuracy. Dry gas meters are checked by using an orifice to determine the meter gamma. The audit gamma must be within 3% of the full test gamma for the meter to be acceptable. Likewise, all thermocouples are checked at ambient temperature versus an ASTM reference thermometer or a thermometer that has been checked against an ASTM reference thermometer. The reading must agree within 2°F. Additionally, the barometer is checked against a reference barometer prior to each project and must agree within 0.1" Hg.

After each testing project, the dry gas meter undergoes a posttest audit following the guidelines of Alternate Method 009. Alternate Method 009 utilizes a mathematical calculation to check the dry gas meter calibration factor (gamma) versus the full test calibration factor. The gamma must agree within ±5% of the full test gamma.

5.2 Sample Custody and Preservation

Proper sample custody and preservation techniques ensure that the samples collected and analyzed are the same, that the sample did not change in concentration prior to analysis, and that the sample was not tampered with prior to analysis. To ensure accurate results, TESTAR Engineering collects and transports samples in clean containers that are inert to the matrix enclosed, that will not contaminate the sample, and that prevent photochemical reactions when appropriate. All samples contain unique identifiers that include the client name, facility name, project number, collection date, unique run number, sample fraction, and matrix. Liquid levels are marked in order to determine if any leakage occurred during transport. Samples are accompanied by sample custody forms identifying the client, facility, project number, sample, fractions, collection date, etc. When custody is relinquished to the laboratory, the receiving sample custodian signs the form.

5.3 Sample Blanks, Duplicates, and Matrix Spikes

Several types of blanks are utilized depending upon the project QA objectives. Typical blanks include field blanks, reagent blanks, and trip blanks. Blanks help to identify the source of contamination if contamination is suspected based upon the result validation procedure. Trip blanks are typically not analyzed unless the field blank shows significant contamination. Field blanks and reagent blanks are analyzed during most testing programs involving metals unless requested not to do so by the client. Field blanks are analyzed during most programs involving organics such as dioxins/furans.

Duplicates and matrix spikes are analyzed for projects involving metals testing. At least 10% of the samples are analyzed in duplicate for metals and at least one matrix spike is performed. All mercury analyses are performed in duplicate.

Breakthrough analyses are performed for projects involving organics utilizing adsorbent tubes. Adsorbent tubes are desorbed and analyzed separately to determine if any breakthrough occurred. Breakthrough is said to have occurred if the organic catch weight on the last fraction (generally the backhalf of the last adsorbent tube) is more than 10% of the total train organic catch.

5.4 Data Validation and Presentation

The field test engineer is responsible for reviewing and validating data as it is obtained. Additionally the onsite project manager reviews data for consistency, completeness, and accuracy prior to leaving the site. This validation procedure is based upon their knowledge of the process being tested and/or similar sources as well as checks built into the software being utilized. This allows for error correction or for the testing to be repeated immediately rather than at a later undetermined date. The data undergoes another review by a Project Director upon return to headquarters. Analytical data is reviewed by the QA Director upon submittal by the analytical laboratory to resolve any conflicts or concerns as soon as possible rather than after the results have been calculated.

Data is collected using computerized spreadsheets in the field and the results are calculated using validated computer programs to prevent erroneous calculations.

5.5 QA/QC Results

This section presents QA/QC results from measures taken during the testing program. The results are summarized in the following tables for easy reference.

Table 5-1
Summary of QA/QC Procedures

Test Method	QA/QC Procedure	QA/QC Objective	QA/QC Results	Status of QA/QC
EPA M8	Reagent Blank	NA	< 0.041 mg	Acceptable
	H2SO4 In-House Audit	≤ 10 %	2.39 %	Acceptable
	H2SO4 Matrix Spike	90 – 110 %	97.2 %	Acceptable
EPA M13B	NaOH Blank – HF	ND	< 0.1 ug	Acceptable
	DI Blank – HF	ND	< 0.1 ug	Acceptable
	Duplicate RPD	≤ 10 %	0.0 %	Acceptable
	Spike Recovery	90 – 110 %	93 %	Acceptable
CARB M425	NaOH Blank – Cr+6	ND	0.692 ug	Acceptable
	DI Blank – Cr+6	ND	< 0.016 ug	Acceptable
	Duplicate RPD	≤ 10 %	3.6 %	Acceptable
	Spike Recovery	90 – 110 %	102 %	Acceptable
EPA M23	Internal Standard Recoveries (4-6)	40 – 130 %	81.2 – 106 %	Acceptable
	Internal Standard Recoveries (7-8)	25 – 130 %	71.3 – 104 %	Acceptable
	Surrogate Standard Recoveries	70 – 130 %	83.4 – 104 %	Acceptable
EPA MM26	HCl Reagent Blank	ND	< 0.084 mg	Acceptable
	HCl In-House Audit	< 10%	- 5.29 %	Acceptable
	HCl Matrix Spike	90 – 110 %	100.1 %	Acceptable
EPA M29	Acetone Blank	< 1.0E-05 mg/mg	0.00E-06 mg/mg	Acceptable
EPA M29	Duplicate RPD	≤ 20 %	0 – 5.7 %	Acceptable
Arsenic	Reagent Blank	NA	< 0.2 ug	Acceptable
Beryllium	Reagent Blank	NA	< 0.05 ug	Acceptable
Cadmium	Reagent Blank	NA	< 0.2 ug	Acceptable
Chromium	Reagent Blank	NA	1.73 ug	Acceptable, blank correction
Lead	Reagent Blank	NA	0.493 ug	Acceptable
Metals	Spike Recoveries	75 – 125 %	59 – 122 %	Acceptable ¹
Mercury	Reagent Blank	NA	< 0.5 ug	Acceptable
Mercury	Duplicate RPD	≤ 20 %	0 – 2.6 %	Acceptable
Mercury	Spike Recoveries	75 – 125 %	77 – 111 %	Acceptable

¹ Refer to Appendix C.3 for further discussion.

Table 5-2
Performance Audit Results

Test Method	Audit ID	QA/QC Objective	QA/QC Results	Status of QA/QC
EPA M8 – Sulfate (IC)	Audit 060716L, Cat No. 1444, Solution	± 15 %	22.1 mg/dscm	Acceptable
EPA M13B - Fluoride	Audit 060716K, Cat No. 1441, Solution	± 15 %	1.14 mg/dscm	Acceptable
EPA M26 – Hydrogen Chloride	Audit 060716L, Cat No. 1440, Solution	± 10 %	34.3 mg/L	Acceptable
EPA M29 - Arsenic	Audit 060716K, Cat No. 1425, Filter	± 25 %	26.5 ug/filter	Acceptable
EPA M29 - Beryllium	Audit 060716K, Cat No. 1425, Filter	± 25 %	13.4 ug/filter	Acceptable
EPA M29 - Cadmium	Audit 060716K, Cat No. 1425, Filter	± 20 %	13.5 ug/filter	Acceptable
EPA M29 - Chromium	Audit 060716K, Cat No. 1425, Filter	± 20 %	20.9 ug/filter	Acceptable
EPA M29 - Lead	Audit 060716K, Cat No. 1425, Filter	± 20 %	25.1 ug/filter	Acceptable
EPA M29 - Arsenic	Audit 060716K, Cat No. 1426, Solution	± 25 %	0.959 ug/mL	Acceptable
EPA M29 - Beryllium	Audit 060716K, Cat No. 1426, Solution	± 30 %	0.146 ug/mL	Acceptable
EPA M29 - Cadmium	Audit 060716K, Cat No. 1426, Solution	± 20 %	0.628 ug/mL	Acceptable
EPA M29 - Chromium	Audit 060716K, Cat No. 1426, Solution	± 20 %	0.852 ug/mL	Acceptable
EPA M29 - Lead	Audit 060716K, Cat No. 1426, Solution	± 25 %	4.40 ug/mL	Acceptable
EPA M29 - Mercury	Audit 060716K, Cat No. 1427, Filter	± 25 %	1.94 ug/filter	Acceptable
EPA M29 - Mercury	Audit 060716K, Cat No. 1428, Solution	± 25 %	2.31 ng/mL	Acceptable