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Consumers Energy

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Hydrogen Chloride Test

EUBOILER3

Consumers Energy Company
J.H. Campbell Plant
17000 Croswell Street
West Olive, Michigan 49460
SRN: B2835
FRS: 110000411108

Test Date: November 29, 2016

January 26, 2017

Test Performed by the Consumers Energy Company
Regulatory Compliance Testing Section – Air Emissions Testing Body
Laboratory Services Section
Work Order No. 26701577

Revision 0

DEQ

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

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RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: Consumers Energy, J.H. Campbell Plant County: Ottawa

Source Address: 17000 Croswell City: West Olive

AQD Source ID (SRN): B2835 ROP No.: MI-ROP-B2835-2013a ROP Section No.: 1

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From October 1, 2016 To December 31, 2016

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Performance test report for hydrogen chloride compliance with the MATS regulation for Unit 3 (EUBOILER3), as required by 40 CFR Part 63.10031(f).

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

Norman J. Kapala	Executive Director of Coal Generation	616-738-3200
Name of Responsible Official (print or type)	Title	Phone Number

Signature of Responsible Official — Date: 1/26/2017

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

EXECUTIVE SUMMARY

Consumers Energy Company (Consumers Energy) Regulatory Compliance Testing Section (RCTS) conducted hydrogen chloride (HCl) testing at the single dedicated exhaust location of coal-fired boiler EUBOILER3 (Unit 3) operating at the J.H. Campbell Generating Station in West Olive, Michigan. The 820-megawatt (MW) net output electric utility steam generating unit (EGU) creates steam to turn a turbine associated with an electricity producing generator.

The HCl test program was performed to satisfy the quarterly performance test requirements in 40 CFR 63, Subpart UUUUU, *National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units* (MATS Rule) as incorporated in the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) MI-ROP-B2835-2013a, and to evaluate compliance with the 2.0E-03 HCl pound per million British thermal unit (lb/mmBtu) MATS Rule limit specified in Table 2, *Emission Limits for Existing EGUs.*

Triplicate minimum 70-minute HCl runs were conducted on November 29, 2016 following the procedures in United States Environmental Protection Agency (USEPA) Reference Methods (RM) 3A, 19, and 26 in 40 CFR 60, Appendix A. A minimum 120 liter sample was collected during each test run. During testing, Unit 3 was operated within the maximum normal operating load requirement range of 90 and 110 percent of design capacity as specified in 40 CFR 63.10007(2).

The Unit 3 HCl results are summarized in the following table.

Run	Boiler Operating Load (MW, Gross)	HCl Emission Rate (lb/mmBtu)	40 CFR 63, Subpart UUUUU HCl Limit, (lb/mmBtu)
1	868	<2.10E-04	-
2	867	<2.14E-04	-
3	868	<1.89E-04	-
Average	**868**	**<2.04E-04**	**2.0E-03**

The individual and 3-run average HCl results are in compliance with the MATS HCl emission rate limit of 2.0E-03 lb/mmBtu. Detailed results are presented in Table 1. Example calculations and field data sheets are presented in Appendices A and B. Laboratory data is presented in

Appendix C. Boiler operating data and supporting information are provided in Appendices D and E.

1.0 INTRODUCTION

Consumers Energy Company (Consumers Energy) Regulatory Compliance Testing Section (RCTS) conducted hydrogen chloride (HCl) testing at the single dedicated exhaust location of coal-fired boiler EUBOILER3 (Unit 3) operating at the J.H. Campbell Generating Station in West Olive, Michigan. The 820-megawatt (MW) net output electric utility steam generating unit (EGU) creates steam to turn a turbine associated with an electricity producing generator.

The HCl test program was performed to satisfy the quarterly performance test requirements in 40 CFR 63, Subpart UUUUU, *National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units* (MATS Rule) as incorporated in the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) MI-ROP-B2835-2013a, and to evaluate compliance with the 2.0E-03 HCl pound per million British thermal unit (lb/mmBtu) MATS Rule limit specified in Table 2, *Emission Limits for Existing EGU's.*

Triplicate minimum 70-minute HCl runs were conducted on November 29, 2016 following the procedures in United States Environmental Protection Agency (USEPA) Reference Methods (RM) 3A, 19, and 26 in 40 CFR 60, Appendix A. A minimum 120 liter sample was collected during each test run. During testing, Unit 3 was operated within the maximum normal operating load requirement range of 90 and 110 percent of design capacity as specified in 40 CFR 63.10007(2).

1.1 CONTACT INFORMATION

Figure 1-1 presents the test program organization, major lines of communication, and names of responsible individuals. Table 1-1 presents contact information for these individuals.

Figure 1-1. Test Program Organization

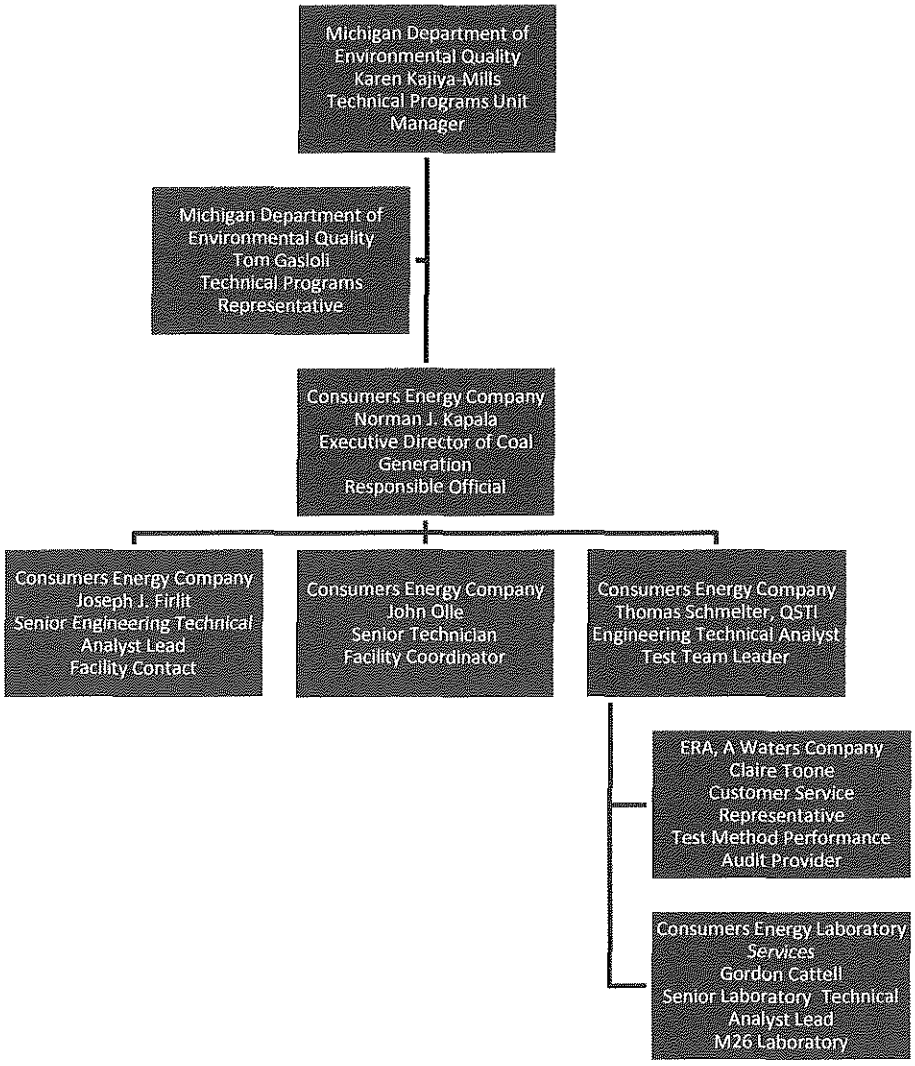


Table 1-1
Contact Information

Program Role	Contact	Address
State Regulatory Administrator	Ms. Karen Kajiya-Mills Technical Programs Unit Manager 517-335-4874 kajiya-millsk@michigan.gov	Michigan Department of Environmental Quality Technical Programs Unit 525 W. Allegan, Constitution Hall, 2nd Floor S Lansing, Michigan 48933
Regulatory Agency Representative	Mr. Tom Gasloli Technical Programs Unit Manager 517-284-6778 gaslolit@michigan.gov	Michigan Department of Environmental Quality Technical Programs Unit 525 W. Allegan, Constitution Hall, 2nd Floor S Lansing, Michigan 48933
Responsible Official	Mr. Norman J. Kapala 616-738-3200 Executive Director of Coal Generation Norman.Kapala@cmsenergy.com	Consumers Energy Company J. H. Campbell Power Plant 17000 Croswell Street West Olive, Michigan 49460
Test Facility	Mr. Joseph J. Firlit 616-738-3260 Sr. Engineering Tech Analyst Lead Joseph.Firlit@cmsenergy.com	Consumers Energy Company J. H. Campbell Power Plant 17000 Croswell Street West Olive, Michigan 49460
Test Facility	Mr. John Olle 616-738-3278 Senior Technician John.Olle@cmsenergy.com	Consumers Energy Company J. H. Campbell Power Plant 17000 Croswell Street West Olive, Michigan 49460
Test Team Representative	Mr. Thomas Schmelter, QSTI 616-738-3334 Engineering Technical Analyst Thomas.Schmelter@cmsenergy.com	Consumers Energy Company L&D Training Center 17010 Croswell Street West Olive, Michigan 49460
Laboratory	Mr. Gordon Cattell 517-788-2334 Senior Laboratory Technical Analyst Lead Gordon.Cattell@cmsenergy.com	Consumers Energy Company Laboratory Services 135 W Trail Street Jackson, Michigan 49201
Test Method Performance Audit Provider	Ms. Claire Toon 800-372-0122 Customer Service Representative Claire_Toon@waters.com	ERA, A Waters Company 16341 Table Mountain Parkway Golden, Colorado 80403

2.0 SUMMARY OF RESULTS

2.1 OPERATING DATA

Unit 3 is a dry bottom, wall-fired boiler with a nominal heat input capacity rating of 8,240 mmBtu/hr generating approximately 820 MW net and 900 MW gross electricity output. During the HCl test program, the boiler was operated at maximum normal operating load conditions, which was between 90 and 110 percent of design capacity and representative of normal Unit 3 operations. The average load across the three test runs was 868 MW gross, or about 96% of the rated capacity. Refer to Attachment D for detailed operating data.

2.2 APPLICABLE PERMIT INFORMATION

The J.H. Campbell Generating Station, State of Michigan Registration Number (SRN) B2835, operates in accordance with Renewable Operating Permit (ROP) Number MI-ROP-B2835-2013a, in which EUBOILER3 is identified as an emission unit. The applicable Unit 3 MATS Rule requirements are described in the ROP under *EUBOILER3 Emission Unit Conditions*, § IX, *Other Requirement(s)*. The J.H. Campbell facility is also associated with the comprehensive USEPA Facility Registration Service (FRS) database, FRS number 110000411108.

2.3 RESULTS

The individual and 3-run average HCl results presented in Table 2-2 are in compliance with the MATS HCl emission rate limit of 2.0E-03 lb/mmBtu. Please note that each of the HCl samples collected and submitted for analysis were reported by the laboratory as "not detected" or below the quantitation limit. The HCl results provided in this report are therefore based upon the reported quantitation limit (QL), as required by §63.10007(e)(1). However, the actual HCl concentrations reported were less than the QL. Detailed HCl Results are presented in Table 1 at the end of this report with the laboratory data in Appendix B. Example calculations and field data sheets are presented in Appendices A and B.

Table 2-2
Summary of Unit 3 Hydrogen Chloride Emission Rates

Run	HCl Emission Rate (lb/mmBtu)	40 CFR 63, Subpart UUUUU HCl Limit (lb/mmBtu)
1	<2.10E-04	
2	<2.14E-04	
3	<1.89E-04	
Average	**<2.04E-04**	**2.0E-03**

3.0 SOURCE DESCRIPTION

The approximate 900 megawatt (MW) gross output Unit 3 electric utility steam generating unit (EGU) is a coal-fired boiler that generates steam to turn a turbine connected to an electricity producing generator.

3.1 PROCESS

EUBOILER3 is a pulverized coal-fired 8,240 mmBtu per hour dry bottom, wall-fired boiler with fuel oil startup capability. The boiler was manufactured by Foster Wheeler and constructed in 1974. The high pressure steam from the boiler turns a turbine connected to a generator that is used to produce electricity. The boiler is fired with low sulfur western sub-bituminous pulverized coal and is rated to produce an electricity output of approximately 820 megawatts (MW) net and 900 MW gross. The source classification code (SCC) is 10100222.

The basic operating parameters used to regulate boiler operations consist of ambient air temperature and humidity, fuel consistency and feed rate, and electrical or steam output. The following parameters were recorded during testing and are included in Appendix D.

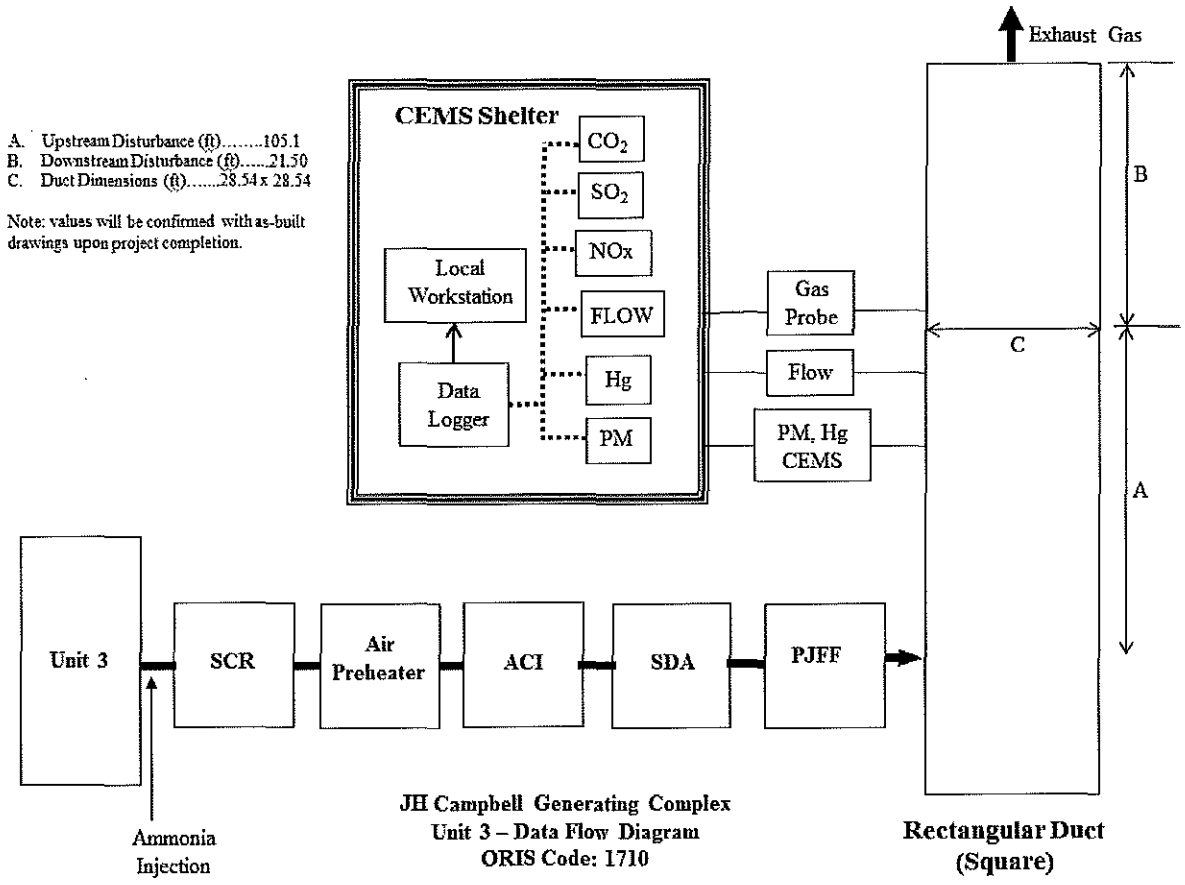
- Exhaust Gas CO_2 Concentration (Vol-%, Wet)
- Total heat input (mmBtu/hr)
- Fuel factor (scf/mmBtu)
- Gross electric output (MWg)

3.2 PROCESS FLOW

The flue gas generated through coal combustion is controlled by multiple pollution control devices. Unit 3 emissions are minimized or controlled through the use of low-NO_x burners (LNB), over-fire air (OFA) and selective catalytic reduction (SCR) for NO_x, activated carbon injection (ACI) for mercury (Hg), spray dryer absorbers (SDAs) for acid gases [e.g., sulfur oxides (SO_x), HCl], and a low pressure/high volume pulse jet fabric filter (PJFF) system for particulate matter control. The SDA control system was not operational during the testing. Once the SDA is fully commissioned, Consumers Energy intends to use the installed sulfur dioxide (SO_2) continuous emissions monitoring system and the MATS SO_2 surrogate emission limit in

lieu of demonstrating compliance with the MATS HCl emission limit through the use of quarterly testing. Refer to Figure 3-1 for the Unit 3 Data Flow Diagram.

Figure 3-1. Unit 3 Data Flow Diagram



3.3 RATED CAPACITY

During the performance tests, the boiler was operated at maximum normal operating load conditions. 40 CFR 63.10007(2) states the maximum normal operating load is generally between 90 and 110 percent of design capacity but should be representative of site specific normal operations. The performance testing was performed while the boiler was operating within the range of 861 MWg to 874 MWg. Refer to Appendix D for the recorded operational data, including gross load.

3.4 PROCESS INSTRUMENTATION

The process was continuously monitored by boiler operators and environmental technicians. The control equipment process instrumentation is recorded on Eastern Daylight Time (EDT), whereas the continuous emissions monitoring systems records data on Eastern Standard Time (EST). During the November 29, 2016 testing EDT and EST were the same. Refer to Appendix D for detailed operating data.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

Consumers Energy tested for HCl emissions using the USEPA test methods presented in Table 4-1. The sampling and analytical procedures associated with each parameter are described in the following sections.

Table 4-1
Test Methods

Parameter	USEPA	
	Method	Title
Molecular weight (O_2 and CO_2)	3A	Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)
Pollutant emission rate	19	Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates
Hydrogen Chloride	26	Determination of Hydrogen Chloride Emissions from Stationary Sources

4.1 DESCRIPTION OF SAMPLING TRAIN AND FIELD PROCEDURES

The test matrix presented in Table 4-2 summarizes the sampling and analytical methods performed for the specified parameters during this test program.

Table 4-2
Test Matrix

No. of Runs	Sample/Type Pollutant	Sampling Method	Sampling Organization	Sample Run Time (minutes)	Analytical Method	Analytical Laboratory
3	Oxygen and Carbon dioxide	M3A	Consumers Energy	70 to 75	Instrumental	NA
3	Pollutant Emission rate	M19	Consumers Energy	-	Stoichiometric calculation	NA

Table 4-2
Test Matrix

No. of Runs	Sample/Type Pollutant	Sampling Method	Sampling Organization	Sample Run Time (minutes)	Analytical Method	Analytical Laboratory
3	Hydrogen Chloride	M26	Consumers Energy	70 to 75	Ion Chromatography	Consumers Energy; Laboratory Services

4.1.1 Sample Location and Traverse Points

Method 26 is a non-isokinetic test procedure where an integrated sample is collected from a single sample point, rather than multiple traverse points within the duct or stack. HCl emission rates are calculated using stoichiometric equations presented in Method 19 and other than diluent concentrations do not require ancillary flue gas measurements, such as, exhaust gas velocity, temperature, or moisture content. Therefore, the sample probe was positioned within the bottom of the five eastern-facing vertically oriented sample ports. During each minimum seventy-minute HCl run, the sample was collected from a single point located no closer to the Unit 3 common exhaust duct wall than 1.0 meter (3.3 feet) as described in 40 CFR 60, Appendix A, Method 3, Section 8.1.1. A drawing of the Unit 3 exhaust duct and existing test port locations is shown in Figures 4-1 and 4-2.

Figure 4-1. Unit 3 Upstream and Downstream Disturbances

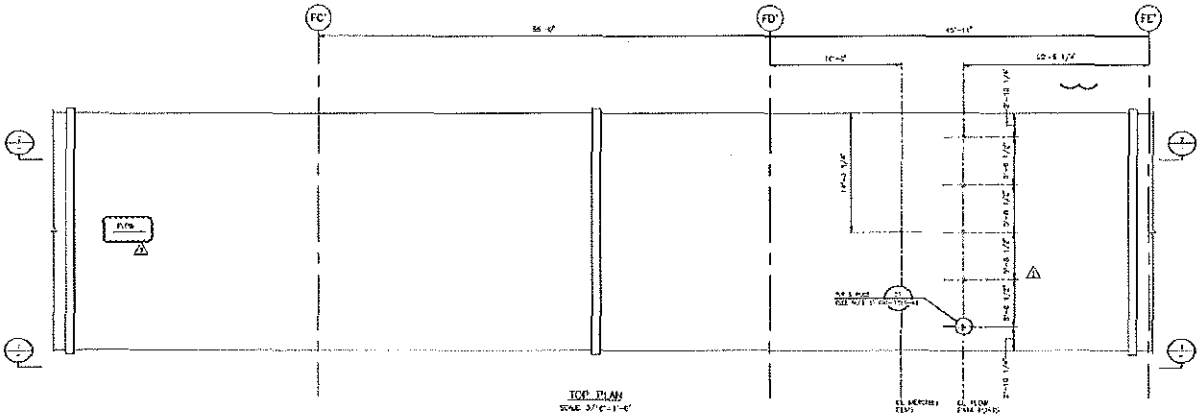
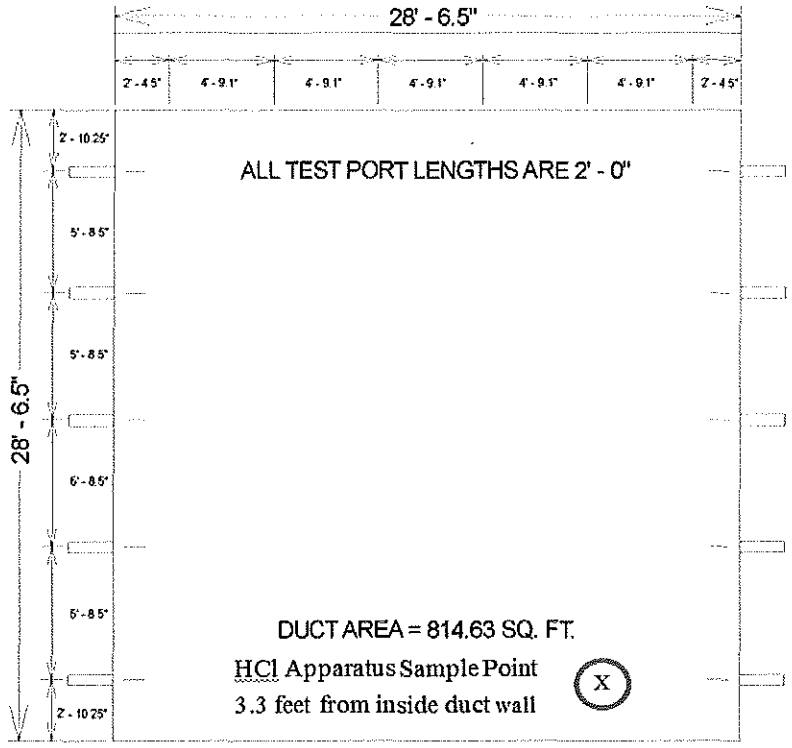


Figure 4-2. Unit 3 Outlet Duct Test Port Detail



4.1.2 Velocity and Temperature

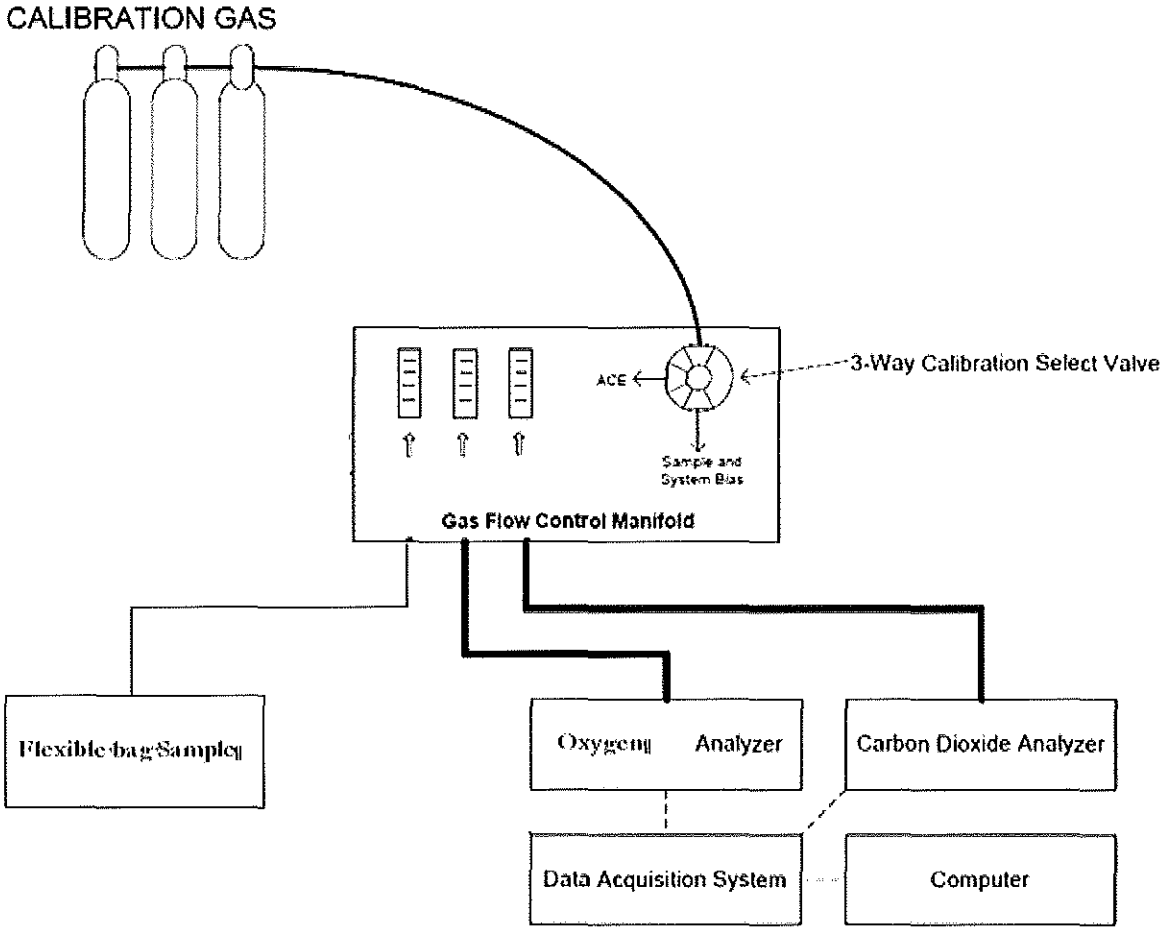
The Method 26 HCl emission rate was calculated using stoichiometric equations within Method 19. The calculation does not require exhaust gas velocity and temperature measurements; therefore, a velocity and temperature profile measurement was not performed.

4.1.3 Molecular Weight

The exhaust gas composition and molecular weight was measured using the sampling and analytical procedures of USEPA Method 3A, *Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure).* The flue gas oxygen and carbon dioxide concentrations were used to calculate molecular weight and emissions in lb/mmBtu.

Flue gas was extracted from the stack through a heated stainless steel lined probe and Teflon® sample line through a gas conditioning system that removes water vapor and into a flexible sample bag. The gas sample was withdrawn from the flexible bag and conveyed into paramagnetic and infrared gas analyzers that measured the oxygen and carbon dioxide concentrations. Figure 4-3 depicts the Method 3A sampling system.

Figure 4-3. Method 3A Sampling System



Prior to analyzing the flexible bag flue gas sample, the analyzers were calibrated by performing a calibration error test where zero-, mid-, and high-level calibration gases were introduced to the back of the analyzers. The calibration error check was performed to evaluate if the analyzers response was within ±2.0% of the calibration gas span. A system-bias and drift test was performed where the zero- and mid- or high- calibration gases were introduced at the inlet of the sampling system to measure the ability of the system to respond to within ±5.0% of span.

At the conclusion of the bag sample analysis for each of the three test runs, and as allowed by Section 8.5 of RM 7E, an additional system bias check was performed to evaluate the drift from the pre- and post-test system bias checks. The system-bias check evaluated if the analyzers drift was within the allowable criterion of ±3.0% of span from pre- to post-test system bias checks. The measured oxygen and carbon dioxide concentrations were corrected for analyzer drift.

4.1.4 Moisture Content

When calculating HCl emission rates in units of lb/mmBtu using the stoichiometric equations of Method 19 as required by the MATS Rule, measurement of flue gas moisture content is not a requirement. However, as a quality control measure, the impinger condensate catch was measured and the flue gas moisture content was calculated. This data was compared to expected flue gas water content and evaluated for run to run variation for information purposes only.

4.1.5 Emission Rates (USEPA Method 19)

USEPA Method 19, *Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates,* was referenced to calculate HCl emission rates in units of lb/mmBtu. Measured carbon dioxide concentrations and F factors (ratios of combustion gas volumes to heat inputs) were used to calculate emission rates using equation 19-6 from Method 19:

Figure 4-4. USEPA Method 19 Equation 19-6

$$E = C_d F_c \frac{100}{(\%CO_{2d})}$$

Where:

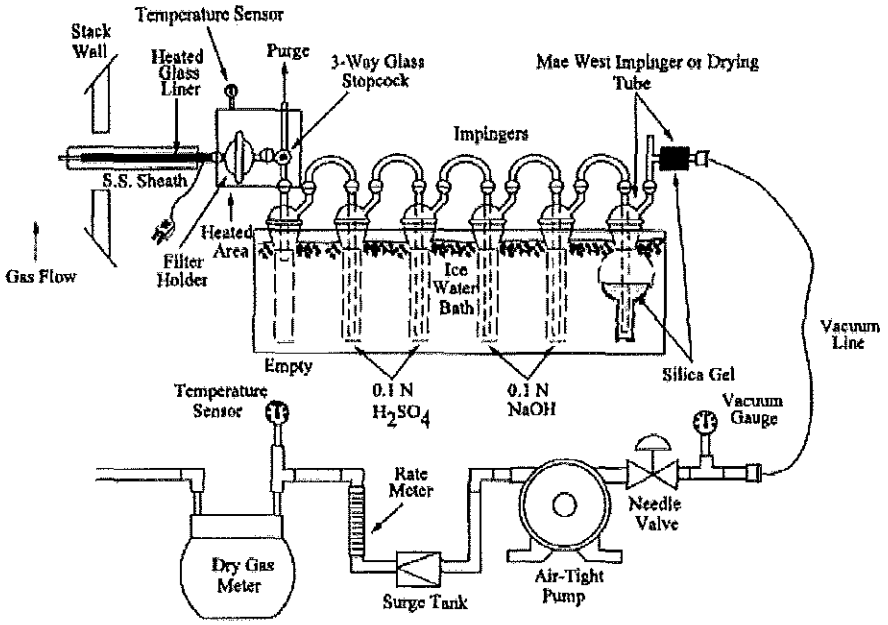
E	=	Pollutant emission rate (lb/mmBtu)
C_d	=	Pollutant concentration, dry basis (lb/dscf)
F_c	=	Volumes of combustion components per unit of heat content (scf/mmBtu) 1,840 scf/mmBtu for subbituminous coal from 40 CFR 75, Appendix F, Table 1
$\%CO_{2d}$	=	Concentration of carbon dioxide on a dry basis (%, dry)

Refer to Appendix A for example calculations.

4.1.6 Hydrogen Chloride

HCl was measured by collecting an integrated sample of the flue gas following the procedures of USEPA Method 26, *Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources.* Triplicate minimum 70-minute test runs were performed at the EUBOILER3 sampling location by sampling flue gas through a heated glass-lined probe, Teflon filter, and into a series of impingers containing absorbing solutions. The filter collects particulate matter and halide salts, and the acidic and alkaline absorbing solutions collect the gaseous hydrogen halides (HCl) and halogens, respectively. Figure 4-5 depicts the USEPA Method 26 sample apparatus.

Figure 4-5. USEPA Method 26 Sample Apparatus



After charging the impingers, assembling the apparatus, and completing a leak check, the sample probe was inserted into the sampling port. Ice was placed around the impingers and upon achieving probe and filter temperatures between 248°F and 273°F, the probe and filter of sampling apparatus was purged with flue gas for a minimum of 10-minutes prior to initiating the test run. During the run, the probe and filter temperatures were maintained and dry gas meter (DGM) volume, temperatures, and sample apparatus vacuum were recorded at 5-minute intervals. After a minimum 120 liters sample volume was collected, sampling was stopped, and a post-test leak check was performed. Refer to Appendix B for the field test data sheets.

The impingers were removed from the sample apparatus and transported to the recovery area. The acidic and alkaline impinger contents were transferred to separate, labeled polyethylene sample containers, while the alkaline impinger contents were submitted to the laboratory they were not analyzed, as halogens were not being assessed as part of the test program. Each impinger was rinsed with deionized water and the rinsate collected in the appropriate sample container. Approximately 0.5 milligrams of sodium thiosulfate was added to the sample storage bottle containing the 0.1 N NaOH impinger catch to assure a complete reaction with the hypohalous acid to form a second chlorine ion.

The sample containers, including reagent and water blanks, were transported via courier to the Consumers Energy Laboratory Services facility in Jackson, Michigan under chain-of-custody for hydrogen chloride analysis. The chain of custody was prepared in accordance with ASTM D4840-99(2010) procedures and included the sample date, collection time, identification, and requested analysis. Included with the samples was an HCl performance audit sample with associated documentation. Refer to Appendix C for the laboratory data sheets and Section 5.4.2 for further discussion of the audit sample results.

5.0 TEST RESULTS AND DISCUSSION

The HCl test program was performed to satisfy the quarterly performance test requirements in 40 CFR 63, Subpart UUUUU, *National Emission Standards for Hazardous Air Pollutants: Coal- and Oil-Fired Electric Utility Steam Generating Units* (MATS Rule) as incorporated in the MDEQ ROP MI-ROP-B2835-2013a, and to evaluate compliance with the 2.0E-03 lb HCl/mmBtu MATS Rule limit specified in Table 2, *Emission Limits for Existing EGU's.* The individual and 3-run average HCl results are presented in Table 2-2 and indicate compliance with the MATS HCl emission rate limit of 2.0E-03 lb/mmBtu.

5.1 Variations and Upset Conditions

No sampling procedure or results affecting boiler operating condition variations were encountered during the test program. The process and control equipment were operating under routine conditions and no upsets were encountered.

5.2 Air Pollution Control Device Maintenance

Other than normal control device optimization and operating requirements, no significant pollution control device maintenance occurred during the three months prior to the test. Optimization of the air pollution control devices is a continuous process to ensure compliance with regulatory emission limits. As noted in Section 3.2, the SDA control system was in the final stages of construction and not operational during the testing.

5.3 Field Quality Assurance / Quality Control Procedures

The USEPA reference methods performed state reliable results are obtained by persons equipped with a thorough knowledge of the techniques associated with each method. To that end, factors with the potential to cause measurement errors are minimized by implementing quality control (QC) and assurance (QA) programs into the applicable components of field testing. QA/QC components were included in this test program. Table 5-1 summarizes the primary field quality assurance and quality control activities that were performed. Refer to Appendix E for supporting documentation.

Table 5-1
Quality Control Procedures

QC Specification	Purpose	Procedure	Frequency	Acceptance Criteria
M1: Sampling Location	Evaluate if the sampling location is suitable for sampling	Measure distance from ports to downstream and upstream disturbance	Pre-test	≤2 diameters downstream; ≤0.5 diameter upstream.
M1: Duct diameter	Verify area of stack is accurately measured	Review as-built drawings and field measurement	Pre-test	Field measurement agreement with as-built drawings
M3A: Calibration gas standards	Ensure accurate calibration standards	Traceability protocol of calibration gases	Pre-test	Calibration gas uncertainty ≤2.0%
M3A: Calibration Error	Evaluates operation of analyzers	Calibration gases introduces directly into analyzers	Pre-test	±2% of the calibration span
M3A: System Bias and Analyzer Drift	Evaluates ability of sampling system to delivery stack gas to analyzers	Cal gases introduced at inlet of sampling system and into analyzers	Pre-test and Post-test	±5% of the analyzer calibration span for bias and ±3% of analyzer calibration span for drift
M3: Single point grab sample	Ensure representative sample collection	Insert probe into stack and purge sample system	Pre-test	Collect sample no closer to the stack walls then 1.0 meter
M26: Apparatus Temperature	Ensures purge of acid gases in glass probe liner and Teflon filter	Set probe & filter heat controller to ≥248°F	Verify prior to and during each run	Apparatus temperature must be ≥248°F and ≤ 273°F
M26: sample rate	Ensure representative sample collection	Calculate rate based on volume collected	During and post-test	Target sample rate is ~ 2 liters/minute
M26: sample volume	Ensure sufficient sample volume is collected	Record pre- and post-test DGM volume reading	Post test	120 liters minimum requirement
M26: post-test leak check	Evaluate if the collected sample was affected by leak	Cap sample train; monitor DGM	Pre-test optional, post-test mandatory	Leak rate ≤ 2% of the average sample rate
M26: post-test meter audit	Evaluates accurate measurement equipment for sample volume	Calibrate DGM pre- and post-test; compare calibration factors (Y)	Pre-test Post-test	±5 %

5.3.1 Dry Gas Meter QA/QC Checks

Table 5-2 summarizes the dry-gas meter calibration checks in comparison to the acceptable USEPA tolerance. Refer to Appendix E for complete DGM calibrations.

5.3.2 Thermocouple QA/QC Checks

Thermocouple temperature calibrations were conducted following *Alternative Method 2 Thermocouple Calibration Procedure ALT-011*. ALT-011 describes the inherent accuracy and precision of the thermocouple within ±1.3°F in the range of -32°F and 2500°F and states that a system that performs accurately at one temperature is expected to behave similarly at other temperatures. Therefore, the two-point calibration described in Method 2 may be replaced with a single point calibration procedure that verifies the thermocouple and reference thermometers shall agree to within ±2.0°F, while taking into account the presence of disconnected wire junctions, other loose connections or a potential mis-calibrated temperature display. Thermocouple calibration data is presented with the Dry Gas Meter Calibration Data in Appendix E of this report, and thermocouples met the required calibration criteria.

5.3.3 Oxygen and Carbon Dioxide Analyzer QA/QC Checks

The Method 3A sampling apparatus described in Section 4.1.3 were audited for measurement accuracy and data reliability. The analyzers passed the applicable calibration criteria. Refer to Appendix E for additional calibration data.

5.4 Laboratory Quality Assurance / Quality Control Procedures

Laboratory quality assurance and quality control procedures were performed in accordance with USEPA Method 26 guidelines. Specific QA/QC procedures include evaluation of reagent and filter blanks and the application of blank corrections. Refer to Appendix C for the laboratory data sheets.

5.4.1 QA/QC Blanks

Reagent and media blanks were analyzed for the parameters of interest. The results of the blanks are presented in the Table 5-2.

Table 5-2
QA/QC Blanks

Sample Identification	HCl mass (µg)	Comment
0.1 N H_2SO_4 Reagent Blank	<31.2	Sample volume was 54 milliliters. Blank corrections were not applied.
Water Blank	<31.2	Sample volume was 31 milliliters. Blank corrections were not applied.

The reagent and water blanks do not suggest contamination or bias as HCl was not detected.

5.4.2 Audit Samples

A performance audit (PA) sample (if available) for each test method employed is required for regulatory compliance purposes as described in 40 CFR 63.7(c)(2)(iii). The PA sample consist of blind audit sample(s), as supplied by an accredited audit sample provider (AASP), which are analyzed during the performance test in order to provide a measure of test data bias. After estimating the HCl concentration in the flue gas at the compliant emission limit using The NELAC Institute (TNI) Stationary Source Audit Sample (SSAS) Program audit sample calculation tool, the HCl PA was requested from Environmental Resource Associates (ERA) and obtained prior to the test event.

The audit sample was brought to the field sampling location, handled, and submitted in the same manner as the collected samples. The samples were analyzed at Consumers Energy Laboratory Services facility in Jackson, Michigan. At the laboratory, the audit sample was analyzed by the

same analyst using the same analytical reagents and analytical system and at the same time as the compliance samples.

The audit sample result met the ± 10% fixed acceptance limit criterion for the specific HCl audit concentration requested. Refer to Table 5-3 for a summary of the audit sample results in comparison the acceptable criterion. ERA's Audit Evaluation Report is included in Appendix E.

Table 5-3
Stationary Source Audit Program QA/QC Audit Sample Results

Sample Catalog Number	Analyte	Units	Consumers Energy Reported Value	ERA Assigned Value	Difference	Acceptable Limits	Performance Evaluation
1770	Hydrogen chloride in impinger solution	mg/L	6.45	7.10	-0.65	6.39-7.81	Acceptable

6.0 CERTIFICATION

I hereby certify the statements and information in this test report and supporting enclosures are true, accurate, and complete, and the test program was performed in accordance with test methods specified in this report.

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Table

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Table 1 - HCl Results

Facility and Source Information				
Facility:	J.H. Campbell			
Source:	Unit 3		Unit Load:	High
Work Order:	26701577			
Date:	11/29/2016	11/29/2016	11/29/2016	
Run Number:	Run 1	Run 2	Run 3	
Run Start Time:	8:35	12:50	14:10	
Run Stop Time:	12:40	14:00	15:25	
Dry Gas Meter Calibration Factor, Y, dimensionless:	1.003	1.003	1.003	
Stack Length, L, inches:	342.5	342.5	342.5	
Stack Width, W, inches:	342.5	342.5	342.5	
Stack Area, A, ft^2:	814.63	814.63	814.63	
Unit Operating Conditions During Test Period	**Run 1**	**Run 2**	**Run 3**	**Average**
Heat Input Rate, mmBtu/hr:	7,039.1	7,076.7	7,054.3	7,056.7
Sub-Bituminous Coal F-Factor, F_c, scf CO_2/mmBtu:	1,840	1,840	1,840	1,840
Sub-Bituminous Coal F-Factor, F_d, dscf/mmBtu:	9,820	9,820	9,820	9,820
Unit Load, MW_g:	868	867	868	868
Source Test Data	**Run 1**	**Run 2**	**Run 3**	**Average**
Barometric Pressure, P_{bar}, in Hg:	28.90	28.95	28.95	28.93
Stack Static Pressure, P_g, in H_2O:	0.20	0.20	0.20	0.20
Duration of Sample, θ, minutes:	70	70	75	72
Meter Leak Rate, ft^3/min:	0.000	0.000	0.000	0.000
Meter Start Volume, ft^3:	261.645	270.424	274.728	
Meter Final Volume, ft^3:	270.415	274.695	279.21	
Sampling Rate, l/min:	1.733	1.728	1.813	1.758
Average Meter Orifice Pressure, in. H_2O:	0.013	0.013	0.013	0.013
Average Meter Temperature, T_m, °F:	50.4	53.9	54.8	53.0
Sample Volume Data	**Run 1**	**Run 2**	**Run 3**	**Average**
Liquid Volume Collected, milliliters:	10.2	11.1	7.7	9.65
Liquid Volume Collected, grams:	2.6	0.7	5.0	2.77
Water Vapor Volume at STP, $V_{w(std)}$, scf:	0.602	0.554	0.597	0.58
Meter Volume, V_m, dcf:	4.285	4.271	4.482	4.346
Meter Volume, $V_{m(std)}$, dscf	4.293	4.257	4.460	4.337
Meter Volume, V_m, dl:	121.34	120.94	126.92	123.07
Meter Volume, $V_{m(std)}$, dsl:	121.56	120.56	126.28	122.80
Meter Volume, $V_{m(std)}$, dscm:	0.122	0.121	0.126	0.123
Total Gas Sampled, scf:	4.895	4.812	5.057	4.921
Stack Gas Moisture, %:	12.29	11.52	11.81	11.88
Gas Analysis Data	**Run 1**	**Run 2**	**Run 3**	**Average**
Carbon Dioxide, % dry:	14.01	13.82	14.93	14.25
Oxygen, % dry:	5.67	5.69	4.74	5.37
Carbon Monoxide, % dry:	0	0	0	0
Nitrogen, % dry:	80.32	80.49	80.33	80.38
Dry Molecular Weight, M_d, lb/lb-mole:	30.468	30.439	30.578	30.495
Molecular Weight, at Stack Condition, M_s, lb/lb-mole:	28.936	29.006	29.092	29.011
Calculated Fuel Factor, F_o, dimensionless:	1.087	1.101	1.082	1.090
Percent Excess Air, %EA:	36.50	36.57	28.78	33.95
Acid Gas Calculations [1]	**Run 1**	**Run 2**	**Run 3**	**Average**
Hydrogen Choride (HCl) Molecular Weight:	36.46	36.46	36.46	
HCl Mass, mg:	<0.0312	<0.0312	<0.0312	<0.0312
HCl Concentration, mg/dscm:	<0.2566	<0.2588	<0.2470	<0.2541
HCl Concentration, mg/dscf:	<0.0073	<0.0073	<0.0070	<0.0072
HCl Concentration, ppmv:	<0.1693	<0.1707	<0.1629	<0.1676
HCl Conversion Factor, ppm to lb/scf:	9.43E-08	9.43E-08	9.43E-08	
HCl Emission Rate, lb/mmBtu:	**2.10E-04**	**2.14E-04**	**1.89E-04**	**2.04E-04**

[1] HCl was not detected at the quantitation method; therefore the reported quantitation limit for each run was inputted to calculate the emission rate