Cokenergy, LLC
3210 Watling Street
Mail Code 2-991
East Chicago, Indiana 46312

April 27, 2020

Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
Box 7611, Ben Franklin Station
Washington, DC 20044-7611
Re: DOJ No. 90-5-2-1-08555/1

Air Enforcement Division Director
U.S. Environmental Protection Agency
Office of Civil Enforcement
Air Enforcement Division
U.S. Environmental Protection Agency
1200 Pennsylvania Ave, NW Mail Code: 2242A
Washington, DC 20460

Compliance Tracker
Air Enforcement and Compliance Assurance Branch
U.S. Environmental Protection Agency – Region 5
77 West Jackson Blvd. AE-18J
Chicago, IL 60604-3590

Including an electronic copy to:
R5airenforcement@epa.gov

Susan Tennenbaum
U.S. Environmental Protection Agency
Region 5
C-14J
77 West Jackson Blvd
Chicago, IL 60640

Including an electronic copy to:
tennenbaum.susan@epa.gov

Phil Perry
Indiana Department of Environmental Management
Chief, Air Compliance and Enforcement Branch
100 North Senate Avenue
MC-61-53, IGCN 1003
Indianapolis, IN 46204-2251

Elizabeth A. Zlatos
Indiana Department of Environmental Management
Office of Legal Counsel
100 North Senate Avenue
MC-60-01, IGCN 1307
Indianapolis, IN 46204-2251

Including an electronic copy to:
bzlatos@idem.in.gov

Subject: Consent Decree, United States, et al. v. Indiana Harbor Coke Company, et al.
Cokenergy, LLC (Part 70 Permit No. T089-41033-00383)
Semi-Annual Progress Report – October 1, 2019 through March 31, 2020

To Whom It May Concern:

In accordance with Section VIII (Reporting Requirements), Paragraph 51. of the consent decree (18-cv-35), Cokenergy, LLC has prepared a semi-annual progress report detailing activities from of October 1, 2019 until March 31, 2020. This report provides an update on Cokenergy's activities during the reporting period. Indiana Harbor Coke Company (IHCC) activities will be provided under a separate cover prepared and submitted by IHCC.

Paragraph 51.a. requires details on work performed and progress made towards implementing the requirements of Section IV (Compliance Requirements), including completion of any milestones. The following paragraphs provide an update on our compliance requirements.

Bypass Venting

Paragraph 14.a – *Annual Bypass Venting Limit - From January 1, 2017, through December 31, 2019, a maximum of 12% of the Coke Oven waste gases leaving the common tunnel shall be allowed to be vented to the atmosphere through the Bypass Vent Stacks, as determined on an annual basis.*

- Bypass venting for the period of January 1, 2019 – December 31, 2019 was well within the venting limit of 12% at 5.26%. Venting for 2017 and 2018 was also well within the 12% venting limit at 7.72% and 6.00% respectively.

Paragraph 14.b – *Annual Bypass Venting Limit – Beginning January 1, 2020, a maximum of 13% of the Coke Oven waste gases leaving the common tunnel shall be allowed to be vented to the atmosphere through the Bypass Vent Stack, as determined on an annual basis.*

- Bypass venting for the period of January 1, 2020 – March 31, 2020 was 7.00%.

Paragraph 14.c – *Exception to Paragraph 14.b. – Beginning on January 1, 2020, if Cokenergy undertakes HRSG Retubing, then in that calendar year a maximum of 14% of the Coke Oven waste gases leaving the common tunnel shall be allowed to be vented to the atmosphere through the Bypass Vent Stack, as determined on an annual basis, provided HRSG Retubing accounts for at least 3.25% annual Bypass Venting.*

- Currently we do not anticipate any HRSG retubing to be completed in 2020.

Paragraph 15. – *Daily Bypass Venting Limit – A Maximum of 19% of the Coke Oven waste gases leaving the common tunnel shall be allowed to be vented to the atmosphere through the Bypass Vent Stacks on a twenty-four (24) hour average.*

- During the reporting period of October 1, 2019 through March 31, 2020 there were no incidents of exceedance of the Daily Bypass Venting Limit.

Paragraph 16. – *SO2 Daily Limit – Defendants shall limit SO2 emissions from the Main Stack and Bypass Vent Stacks to 1,656 lbs/hr for a twenty-four (24) hour average.*

- During the reporting period of October 1, 2019 through March 31, 2020 there were no incidents of exceedance of the SO2 Daily Limit.

Paragraph 17. – *Emissions Minimization*

- During the reporting period of October 1, 2019 through March 31, 2020 there were no incidents of exceedance of the Daily Bypass Venting Limit, therefore it was not necessary to implement any Emissions Minimization efforts. (Paragraph 51.f.)

Paragraph 18. – *Bypass Venting Incident Root Cause Failure Analysis*

- During the reporting period of October 1, 2019 through March 31, 2020 there were no incidents of exceedance of the Daily Bypass Venting Limit, therefore there were no Bypass Venting Incident RCFA completed. (Paragraph 51.g. and 51.h.)

Enhanced Monitoring

Paragraph 19. – *Permanent Flow Monitor*

- Milestone complete, see Cokenergy Semiannual report dated April 29, 2019 for details.

Paragraph 21. – *ETS Updates*

- Milestone complete, see Cokenergy Semiannual report dated April 29, 2019 for details.

Paragraph 22. – *Bypass Vent Stack and Main Stack Testing*

- Cokenergy completed lead and VOC testing on the Main Stack in accordance with the applicable requirements of 40 C.F.R Part 60, Appendix A over the period of December 4-6, 2019. Cokenergy submitted a Test Protocol to IDEM on October 8, 2019. Cokenergy also provided IDEM with a 14-day test notification confirming the test dates on November 20, 2019. The final report was submitted on January 16, 2020.

Paragraph 22a. – *Lead Testing*

- Cokenergy completed the first lead stack testing on December 5 and 6, 2019. The results from the lead emission testing averaged **0.014 lbs/hr**, which is well below IHCC's lead emission limit of 0.19 lbs/hr. (Paragraph 51.d.).

Paragraph 22b. – *VOC Testing*

- Milestone Complete. Cokenergy completed the VOC stack testing on December 4, 2019. The results from the VOC emission testing averaged **1.47 lbs/hr**, which is well below IHCC's VOC emission limit of 2.28 lbs/hr. (Paragraph 51.d.).

Preventive Maintenance and Operation Plans

Paragraphs 23 and 23.b. –*Cokenergy PMO Plan for HRSGs and FGD*

- Milestone complete, see Cokenergy Semiannual report dated April 29, 2019 for details. There have been no revisions or modifications of the PMO plan during the current reporting period.

Paragraph 23.c. – *Compliance Assurance*

- The CAP is addressed in Section 9.0 of Cokenergy's PMO Plan. IHCC has not reported production levels in excess of rates included in 23. c. i. during the reporting period of October 1, 2019 – March 31, 2020. (Paragraph 51.j.).

Paragraph 23.d. – *Defendants shall comply with the PMO Plans at all times, including periods of startup, shutdown, and malfunction of the HRSG and FGD.*

- Cokenergy has fully implemented our PMO plan and is following the requirements of the PMO plan.

Mitigation Measures

Paragraph 24 – *Dual SDA Operation*

- Cokenergy has successfully operated the SDAs in dual operation mode prior to the effective date of the CD, except during periods of planned maintenance. SO2 emissions for 2019 were 5,484 tons.

- The emissions of SO2 during the 1st quarter of 2020 are approximately 1,487 tons, which projects to be less than 6,165 tons/year.

Permits

Paragraph 26. - *Permits*

- Milestone complete, see Cokenergy Semiannual report dated October 29, 2019 for details. (Paragraph 51.k.).

Paragraph 27.a. - *Applications for Permits Incorporating the Requirements in Section IV*

- Milestone complete, see Cokenergy Semiannual report dated April 29, 2019 for details. (Paragraph 51.k.).

Paragraph 27.b. – *Application to seek a site-specific revision to the Indiana State Implementation Plan ("SIP") at 326 IAC 7-4.1-7 and 326 IAC 7-4.1-8.*

- Cokenergy formally submitted our request to modify the SIP on December 18, 2018 within the ninety (90) day requirement specified in the CD. IDEM developed the draft rule LSA Document #19-388 which was posted on August 14, 2019 for public comment. The initial public hearing was held on November 13, 2019. There were no public comments during the comment period or initial public hearing. The final public hearing was completed on January 8, 2020. (Paragraph 51.k.).

Paragraph 28. – *Permitting Authority Cooperation*

- Cokenergy has actively worked with IDEM throughout the permitting process.

Paragraph 29. – Submittal of Permit Applications to EPA

- Cokenergy has provided copies of our complete permit application to EPA on the dates specified above in accordance with the requirements specified in Section XV (Notices) of the CD.

Paragraph 51.b. requests details on any significant modifications to previously submitted design specifications of any pollution control system, or to monitoring equipment, required to comply with the Compliance Requirements. Cokenergy has no modifications to report. Dual SDA operation is our normal operating mode and the Permanent Flow Monitor has been fully integrated into our Continuous Emissions Monitoring System (CEMS) and the Emissions Tracking System (ETS).

Cokenergy did not encounter any problems or anticipate any problems in complying with the Compliance Requirements (Paragraph 51.c.).

Paragraph 51.d. requests a summary of the emissions monitoring and testing data collected to demonstrate compliance with any requirement of this CD. Cokenergy completed stack testing for lead and VOC along with an annual RATA on the emissions monitoring equipment over the period of December 4-6, 2019. The lead and VOC results are referenced above in this report and were well below the lead and VOC limits specified in the IHCC Title V operating permit. The RATA results for the SO2 emission monitoring system were within the 40 CFR 60 Appendix B performance specifications. A copy of the RATA report is attached. The lead and VOC stack testing report were previously submitted on January 16, 2020.

Paragraph 51.i. requests any updated PMO Plan required by Paragraph 23. There have been no updates or revisions to the PMO plan during this reporting period.

Cokenergy does not have any noncompliance with the Section VII SEP requirements to report per Paragraph 51.l. The SEP project is in progress and, assuming the impacts of the current stay at home orders as a result of the current COVID-19 pandemic are resolved in the near future, we believe the work will be completed prior to October 2020. If due to COVID-19 issues it becomes apparent that the SEP project will not be complete prior to October 2020, Cokenergy will notify EPA and DOJ to obtain additional time pursuant to EPA's enforcement forbearance policy applicable to delays caused by the pandemic.

Per Paragraph 51.m. there have been no failures to comply with the reporting requirements in Paragraphs 51, through 55.

Per Paragraph 51.n. Cokenergy has provided copies of the following documents

- Revised Deviation and Compliance Monitoring Report for the 3rd quarter of 2019
- Quarterly Deviation and Compliance Monitoring Report for the 4th quarter of 2019
- Quarterly Deviation and Compliance Monitoring Report for the 1st quarter of 2020
- Annual compliance certification for 2019

Pursuant to Paragraph 51.o. the following table is a summary of Lightning Stand-Downs during the October 1, 2019 through March 31, 2020 reporting period.

Start Date/Time	Lightning Warning Detail	End Date/Time	Duration	Compliance response impacted due to lightning stand down
10/2/2019 23:50	Alert: Ltg Warning (west 6)	10/3/2019 1:07	1:17:00	None
10/11/2019 0:18	Alert: Ltg Warning (southwest 9)	10/11/2019 1:33	1:15:00	None
1/10/2020 22:40	Alert: Ltg Warning (northeast 10)	1/10/2020 23:10	0:30:00	None
3/9/2020 5:43	Alert: Ltg Warning (southeast 9.2)	3/9/2020 6:21	0:38:00	None
3/28/2020 1:24	Alert: Ltg Warning (northwest 7.7)	3/28/2020 1:54	0:30:00	None
3/28/2020 6:07	Alert: Ltg Warning (northwest 9.9)	3/28/2020 8:10	2:03:00	None

Per Paragraph 51.p. there were no power outages to report during the October 1, 2019 through March 31, 2020 reporting period.

If you have any questions regarding this semi-annual progress report, please contact me at (219) 397-4626 or email at lford@primaryenergy.com.

I certify under penalty of law that this information was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my directions and my inquiry of the person(s) who manage the system, or the person(s) directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,

Luke E. Ford
Director EH&S
Primary Energy

cc: Seth Acheson (via email)
Thor Ketzback, BCLP (via email)
Nancy Estrada, IHCC (via email)
Katie Batten, Suncoke (via email)

East Chicago Public Library
2401 E. Columbus Drive
East Chicago, Indiana 46312

East Chicago Public Library
1008 W. Chicago Avenue
East Chicago, Indiana 46312

File: X://675

ATTACHMENT 1

Third Quarter 2019 Revised Deviation and Compliance Monitoring Report

Cokenergy LLC
3210 Watling Street MC 2-991
East Chicago, IN 46312

January 27, 2020 Via UPS

Indiana Department of Environmental Management
Compliance and Enforcement Branch
Office of Air Quality
100 N. Senate Avenue
Mail Code 61-50, IGCN 1003
Indianapolis, IN 46204 - 2251

RE: **REVISED** Cokenergy, LLC Quarterly Report – Third Quarter 2019
Part 70 Permit No. T089-41033-00383

To Whom It May Concern:

In accordance with sections C.18 and D.1.14 of the subject permit, 326 IAC 3-5-5 and 326 IAC 3-5-7, we have enclosed the REVISED third quarter 2019 reports for the Cokenergy, LLC facility. This report includes:

- Part 70 Quarterly Report – Certification
- Part 70 Quarterly Deviation and Compliance Report

If you have any questions concerning this data, please call Luke Ford at (219) 397-4626.

Sincerely,

Seth Acheson

Seth Acheson
General Manager
Cokenergy LLC

Enclosure

cc: Luke Ford (scan via email)
Cliff Yukawa IDEM (scan via email)

File: X:\\ 615.4

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR MANAGEMENT
COMPLIANCE AND ENFORCEMENT SECTION
PART 70 OPERATING PERMIT
CERTIFICATION

Source Name: Cokenergy LLC

Source Address: 3210 Watling Street, MC 2-991, East Chicago, Indiana 46312-1610

Part 70 Permit No.: T089-41033-00383

This certification shall be included when submitting monitoring, testing reports/results or other documents as required by this permit.

Please check what document is being certified:

☐ Annual Compliance Certification Letter

☐ Test Result (specify) _____

☒ Report (specify) 3rd Quarter 2019 Deviation and Compliance Monitoring Report

☐ Notification (specify) _____

☐ Affidavit (specify) _____

☐ Other (specify) _____

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

Signature: Seth Acheson

Printed Name: Seth Acheson

Title/Position: General Manager, Cokenergy, LLC

Phone: (219) 397-4521

Date: January 27, 2020

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR QUALITY
COMPLIANCE AND ENFORCEMENT BRANCH
PART 70 OPERATING PERMIT
REVISED - QUARTERLY DEVIATION AND COMPLIANCE MONITORING REPORT

Source Name: Cokenergy LLC
Source Address: 3210 Watling Street, MC 2-991, East Chicago, Indiana 46312-1610
Part 70 Permit No.: T089-41033-00383

Months: July to September **Year:** 2019

This report shall be submitted quarterly based on a calendar year. Any deviation from the requirements, the date(s) of each deviation, the probable cause of the deviation, and the response steps taken must be reported. Deviations that are required to be reported by an applicable requirement shall be reported according to the schedule stated in the applicable requirement and do not need to be included in this report. Additional pages may be attached if necessary. If no deviations occurred, please specify in the box marked "No deviations occurred this reporting period".

☐ NO DEVIATIONS OCCURRED THIS REPORTING PERIOD

☒ THE FOLLOWING DEVIATIONS OCCURRED THIS REPORTING PERIOD

Permit Requirement: (specify permit condition #) D.1.8(d) Method 9 opacity readings during monitor downtime	
Date of Deviation: 9/27/19	**Duration of Deviation:** 42 hours
Number of Deviations: 1	
Probable Cause of Deviation: The Stack 201 continuous opacity monitoring system (COMS) was impacted by a lightning strike during a severe thunderstorm on September 27, 2019 at approximately 19:00. Due to the lightning strike, communication between the data acquisition system and the control room was also impacted and all output values were frozen. There were no alarms generated to indicate that there was a problem. The opacity system remained out of service for a total of 42 hours. During that outage there were no Method 9 readings recorded by a certified visible emissions observer. During daylight hours for the duration of the outage the weather conditions were observed as foggy, cloudy and there were periods of rain.	
Response Steps Taken: The certified visible emission observer will document weather conditions on the opacity form with comments on if readings are possible. Visible emissions observations forms will be included with quarterly reports.	

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Form Completed by: Seth Acheson

Title / Position: General Manager, Cokenergy, LLC

Date: January 27, 2020

Phone: (219) 397-4521

ATTACHMENT 2

Fourth Quarter 2019 Deviation and Compliance Monitoring Report

Cokenergy LLC
3210 Watling Street MC 2-991
East Chicago, IN 46312

January 27, 2020 Via UPS

Indiana Department of Environmental Management
Compliance and Enforcement Branch
Office of Air Quality
100 N. Senate Avenue
Mail Code 61-50, IGCN 1003
Indianapolis, IN 46204 - 2251

RE: Cokenergy, LLC Quarterly Report – Fourth Quarter 2019
Part 70 Permit No. T089-41033-00383

To Whom It May Concern:

In accordance with sections C.18 and D.1.14 of the subject permit, 326 IAC 3-5-5 and 326 IAC 3-5-7, we have enclosed the fourth quarter 2019 reports for the Cokenergy, LLC facility. This report includes:

- Part 70 Quarterly Report – Certification
- Part 70 Quarterly Deviation and Compliance Report
- CEMS Excess Emissions Report
- CEMS Downtime Report
- COMS Fourth Quarter 2019 Opacity Monitor Audit
- COMS 2019 Clear Path Audit

If you have any questions concerning this data, please call Luke Ford at (219) 397-4626.

Sincerely,

Seth Acheson

Seth Acheson
General Manager
Cokenergy LLC

Enclosure
cc: Luke Ford (scan via email)
Cliff Yukawa IDEM (scan via email)

File: X:\\ 615.4

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR MANAGEMENT
COMPLIANCE AND ENFORCEMENT SECTION
PART 70 OPERATING PERMIT
CERTIFICATION

Source Name: Cokenergy LLC

Source Address: 3210 Watling Street, MC 2-991, East Chicago, Indiana 46312-1610

Part 70 Permit No. : T089-41033-00383

This certification shall be included when submitting monitoring, testing reports/results or other documents as required by this permit.

Please check what document is being certified:

☐ Annual Compliance Certification Letter

☒ Test Result (specify) 4th Quarter 2019 COMS Performance Audit and 2019 Clear Stack Audit

☒ Report (specify) 4th Quarter 2019 Deviation and Compliance Monitoring Report

☐ Notification (specify) _____

☐ Affidavit (specify) _____

☐ Other (specify) _____

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

Signature: Seth Acheson

Printed Name: Seth Acheson

Title/Position: General Manager, Cokenergy, LLC

Phone: (219) 397-4521

Date: January 27, 2020

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR QUALITY
COMPLIANCE AND ENFORCEMENT BRANCH
PART 70 OPERATING PERMIT
QUARTERLY DEVIATION AND COMPLIANCE MONITORING REPORT

Source Name: Cokenergy LLC
Source Address: 3210 Watling Street, MC 2-991, East Chicago, Indiana 46312-1610
Part 70 Permit No. : T089-41033-00383

Months: October to December **Year:** 2019

This report shall be submitted quarterly based on a calendar year. Any deviation from the requirements, the date(s) of each deviation, the probable cause of the deviation, and the response steps taken must be reported. Deviations that are required to be reported by an applicable requirement shall be reported according to the schedule stated in the applicable requirement and do not need to be included in this report. Additional pages may be attached if necessary. If no deviations occurred, please specify in the box marked "No deviations occurred this reporting period".

☐ NO DEVIATIONS OCCURRED THIS REPORTING PERIOD

☒ THE FOLLOWING DEVIATIONS OCCURRED THIS REPORTING PERIOD

Permit Requirement: (specify permit condition #) D.1.7(a) PM testing is required at least once every 5 years.	
Date of Deviation: 11/20/19	**Duration of Deviation:**
Number of Deviations: 1	
Probable Cause of Deviation: Indiana Harbor Coke Company (IHCC) initiated an oven rebuild project on B Battery as referenced in paragraph 10.a.i. of the joint consent decree (18-cv-35) effective October 25, 2018. The oven rebuild campaign was scheduled to be completed by November 30, 2018. Cokenergy last completed stack testing on stack 201 for PM on November 20, 2014 and requested an extension to delay the testing until after the rebuild was completed.	
Response Steps Taken: Cokenergy notified IDEM on October 1, 2019 that it would like to delay the PM and PM10 testing until after the coke oven rebuilds were completed. IDEM notified Cokenergy on November 8, 2019 that they could not grant the extension but stated that no enforcement action would be taken provided testing was completed within 90 days of the rebuild project. PM stack testing was completed by Cokenergy on December 6, 2019.	

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Form Completed by: Seth Acheson

Title / Position: General Manager, Cokenergy, LLC

Date: January 27, 2020

Phone: (219) 397-4521

Excess Emissions and Downtime Report

COKENERGY, LLC, East Chicago, IN

Plant ID: 089-00383

Emissions Unit ID: Stack 201

Emissions Unit: Heat Recovery Coke Carbonization Waste Heat Stack

PLANT OPERATIONS DOWNTIME SUMMARY

Reporting Period: 4th Quarter of 2019

Commencement of Emission Unit Downtime	Completion of Emission Unit Downtime	Emission Unit Downtime Duration (hours)	Reasons for Emission Unit Downtime
12/6/2019 9:17	12/6/2019 10:12	1	ID fan trip due to loss of Modicon remote I/O rack power loss
Total Emission Unit Downtime for the quarter =		1	hours

COKENERGY, LLC, East Chicago, IN
Plant ID: 089-00383
Emissions Unit ID: Stack 201
Emissions Unit: Heat Recovery Coke Carbonization Waste Heat Stack

EXCESS EMISSIONS SUMMARY

Reporting Period: 4th Quarter of 2019

SO_2 Exceedances

Emission Standard: 1,656 lb/hr on a 24-hr average basis
(Note that this limit is for the combined emissions from Cokenergy Stack 201 and 16 IHCC Vent Stacks)

Date/Time of Commencement	Date/Time of Completion	Magnitude of Emissions (lb/hr)			Reasons for Excess Emissions	Corrective Actions Taken
		Main Stack Avg	Vent Stack Avg	Plant Avg		
None						

COKENERGY, LLC, East Chicago, IN

Plant ID: 089-00383

Emissions Unit ID: Stack 201

Emissions Unit: Heat Recovery Coke Carbonization Waste Heat Stack

EXCESS EMISSIONS SUMMARY

Reporting Period: 4th Quarter of 2019

Opacity Exceedances

Emission Standard: 20% opacity

Date/Time of Commencement	Date/Time of Completion	Magnitude of Emissions	Reasons for Excess Emissions	Corrective Actions Taken
		None		
Total Duration	0 minutes			

COKENERGY, LLC, East Chicago, IN
Plant ID: 089-00383
Emissions Unit ID: Stack 201
Emissions Unit: Heat Recovery Coke Carbonization Waste Heat Stack

CONTINUOUS MONITORING SYSTEM DOWNTIME SUMMARY

Reporting Period: 4th Quarter of 2019

SO_2 CEMS Downtime

Date/Time of Commencement	Duration of Downtime (hours)	Reasons for Instrument Downtime	System Repairs and Adjustments
None			
Total Downtime	0 hours		

Note: Daily zero and span checks of the instrument have been excluded from the downtime summary per 326 IAC 3-5-7.

COKENERGY, LLC, East Chicago, IN

Plant ID: 089-00383

Emissions Unit ID: Stack 201

Emissions Unit: Heat Recovery Coke Carbonization Waste Heat Stack

CONTINUOUS MONITORING SYSTEM DOWNTIME SUMMARY

Reporting Period: 4th Quarter of 2019

Opacity Monitor Downtime

Date/Time of Commencement	Duration of Downtime (minutes)	Reasons for Instrument Downtime	System Repairs and Adjustments
12/4/19 7:00	60	Quarterly PMs and Clear Path	Completed PMs and clear path audit
12/19/19 9:00	60	Quarterly Opacity Performance Audit	Completed audit
Total Downtime	120 minutes		

Note: Daily zero and span checks of the instrument have been excluded from the downtime summary per 326 IAC 3-5-7.

COKENERGY, LLC, East Chicago, IN

Plant ID: 089-00383

Emissions Unit ID: Stack 201

Emissions Unit: Heat Recovery Coke Carbonization Waste Heat Stack

CONTINUOUS MONITORING SYSTEM DOWNTIME SUMMARY

Reporting Period: 4th Quarter of 2019

Flow Monitor Downtime

Date/Time of Commencement	Duration of Downtime (hours)	Reasons for Instrument Downtime	System Repairs and Adjustments
12/19/19 9:00	1	Quaterly PM & Leak Check	Completed PMs
Total Downtime	1 hours		

Note: Daily zero and span checks of the instrument have been excluded from the downtime summary per 326 IAC 3-5-7.

OPACITY PERFORMANCE AUDIT

FOR

Primary Energy

E. Chicago, IN

Unit: Stack 201

MONITORING SOLUTIONS, INC.
MODEL: DURAG D-R 290 COMS

Fourth (4th) Quarter Results
2019

Audit Completed On: 12/19/2019

PREPARED BY:

Monitoring | Solutions

Leaders in Environmental Monitoring Systems & Services

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Appendix A - COMS Audit Data Forms for the Durag Model D-R 290

Appendix B - Audit Filter Certification Sheet(s)

I. Introduction

Monitoring Solutions, Inc. was contracted to conduct an opacity performance audit on a Durag Model D-R 290 opacity system.

Client: Primary Energy
City, State: E. Chicago, IN
Auditor: Dan Bowles
Audit Date: 12/19/2019

The performance testing consists of:

1 Zero and Span Check
2 Zero Compensation Check
3 Optical Alignment Check
4 Calibration Error Check
5 Annual Zero Alignment (When required)

All raw data, calculated data and final summary are presented. The results indicate compliance for all specifications. Testing was performed as per 40CFR60 Appendix F and 40CFR60 Appendix B, PS1 (Where Applicable).

Annual "Zero Alignment" check performed this quarter:

YES: X NO: _____ ERROR: 0.1

Summary of Calibration Error Check

Filter :	Low	Mid	High
Percent of Error:	0.20	0.50	0.20
	PASS	PASS	PASS

Reviewed by: _____

Date: 1/22/2020

Revision: March 2016

PERFORMANCE AUDIT PROCEDURES FOR THE MONITORING SOLUTIONS, INC. OPACITY MONITOR

II. Monitoring Solutions, Inc. Durag Model D-R 290

The instrument is manufactured by the Durag Corporation and distributed and serviced by Monitoring Solutions, Inc.

A. COMS Description

The Monitoring Solutions, Inc. D-R 290 opacity monitoring system consists of four major components: the Transmissometer, the terminal control box, the air-purging system and the remote control unit and data acquisition equipment. The Transmissometer component consists of an optical transmitter/receiver (transceiver) unit mounted on one side of a stack or duct and a retro reflector unit mounted on the opposite side. The transceiver unit contains the light source, the photodiode detector, and the associated electronics. The transceiver uses a single-lamp, single detector system to determine effluent opacity. A LED light source is modulated electronically at 2 KHz to eliminate any ambient light interference. The modulated beam is configured to alternately produce reference and measurement signals so that the effects of variations in the optical and electronic components of the COMS are minimized.

In a single display configuration, an AW unit is mounted in a blue housing next to the transceiver location. In a dual display configuration, an AZ unit is mounted in the blue housing next to the transceiver location and an AW is mounted in a remote location, typically, a control room. The AZ and the AW communicate via an RS 422 cable. The AZ unit provides an on stack readout and can be used as a diagnostic tool. In either configuration, only the AW provides the signals to the final recording device.

The air purging system serves a threefold purpose: 1) it provides an air window to keep exposed optical surfaces clean; 2) it protects the optical surfaces from condensation of stack gas moisture; and 3) it minimizes thermal conduction from the stack to the instrument. A standard installation has one air-purging system for each the transceiver and the retro reflector units.

The opacity monitor measures the amount of light transmitted through the effluent from the transceiver to the retro reflector and back again. The control unit uses the effluent transmittance to calculate the optical density of the effluent at the monitor location, or the "path" optical density. In order to provide stack exit opacity data, the path optical density must be corrected. The correction factor is expressed as the ratio of the stack exit inside diameter to the inside diameter of the stack at the Transmissometer location. This ratio is called the "stack correction factor" (SCF) by Monitoring Solutions, Inc. The following equations illustrate the relationship between this ratio, path optical density, and stack exit opacity.

Calculation of "Stack Correction Factor"

L_x / L_t = stack correction factor

where:

L_x = stack exit inside diameter (in)

L_t = the stack inside diameter (or the duct width) at the monitor location (in).

$OP_x = 1 - (1 - \frac{Opacity}{100})^{correction\ factor}$

OP_x = stack exit opacity (%)

B. Performance Audit Procedures

1. Preliminary Data

a. Obtain the stack exit inside diameter (in feet) and the stack inside diameter at the monitor location (in feet). Record these values in Blanks 1 and 2 of the Monitoring Solutions, Inc. D-R 290 Performance Audit Data Sheet.

Note: Effluent handling system dimensions may be acquired from the following sources listed in descending order of reliability: 1) physical measurements, 2) construction drawings, 3) opacity monitor installation/certification documents, and 4) source personnel recollections.

b. Calculate the stack correction factor (SCF) by dividing the value in Blank 1 by the value in Blank 2. Record the result in Blank 3.

c. Record the source-cited Stack Correction Factor (SCF) in Blank 4.

Note: The stack correction factor (SCF) is preset by the manufacturer using information supplied by the source. The value recorded in Blank 4 should be the value source personnel agree should be set inside the monitor.

d. Obtain the reference zero and span calibration values. Record these values in Blank 5 and Blank 6, respectively.

Note: The reference zero and span calibration values may not be the same as the values recorded during instrument installation and/or certification. The zero and span values recorded in Blank 5 and Blank 6 should be the reference values recorded during the most recent clear-path calibration of the CEMS.

2. Error Checks

The following steps describe the error codes for the Monitoring Solutions, Inc. D-R 290 remote control unit. The audit can continue with the error codes shown below being present, provided the source has been informed of the fault conditions. All other error codes must be corrected prior to audit.

Error code 100 = Transceiver blower fault
Error code 200 = Transceiver filter plugged
Error code 300 = Reflector blower fault
Error code 400 = Reflector filter plugged

Note: If a fault is active, an error code will be displayed on the stack mounted display and on the remote display. An explanation of the error codes can be found in the manual.

3. Instrument Range Check

a. Check the COMS measurement range by pressing the MOD button (the LED on the button will light up) and using the PLUS button to cycle through the displays.

b. Record the instrument range in Blank 11.

4. Reference Signal, Zero and Span Checks

a. Initiate the calibration cycle by pressing the arrow and plus buttons simultaneously and holding for approximately 5 seconds.

Note: The opacity monitor will automatically cycle through the internal zero (zero point check), external zero (window check), span and stack taper ratio modes. Approximately 6 minutes for a complete cycle.

b. Record the milliamp value shown for the internal zero (zero point check) displayed on the control panel display in Blank 12.

Note: The internal zero checks the instrument reference signal (Zero Point Check). Since the instrument provides a full scale output of 4 to 20 milliamps, a value of 4 milliamps displayed on the control unit display represents a zero condition. After 1 ½ minutes in the internal zero mode, the monitor will automatically switch to the external zero mode (Window Check).

c. Record the milliamp value shown for the external zero (window check) displayed on the control panel in Blank 13. Also record the external zero value (in percent opacity) displayed on the opacity data recorder in Blank 14.
(Continued on next page)

Note: During the zero calibration check, the zero mirror is moved into the path of the measurement beam by a servomotor. The zero mechanism is designed to present the transceiver with a simulated clear-path condition. The daily zero check does not test the actual clear-path zero, nor does it provide a check of cross-stack parameters such as the optical alignment of the Transmissometer or drift in the reflectance of the retro reflector. The actual clear-path zero can only be checked during clear-stack or off-stack calibration of the CEMS. In addition to simulating the instrument clear-path zero, the zero mechanism allows the amount of dust on the transceiver optics (primary lens and zero mirror) to be quantified. After 1 ½ minutes in the external zero mode, the CEMS will automatically enter the span mode.

d. Record in Blank 15 the span value (in milliamps) displayed on the control panel display. Also record the span value (in percent opacity) displayed on the data recorder in Blank 16. Go to the Transmissometer location.

Note: During the span calibration check, a servomotor moves an internal span filter into the path of the measurement beam while the zero mirror is in place. The span mechanism is designed to provide an indication of the upscale accuracy of the CEMS relative to the simulated clear-path zero. Note: The opacity monitor display will output its stack correction factor (SCF) for 1 ½ minutes when the span portion of the calibration cycle is completed. The CEMS automatically returns to the measurement mode when the SCF portion of the calibration cycle is complete.

5. Reflector Dust Accumulation Check.

a. Record the effluent opacity prior to cleaning the retroreflector optics in Blank 17.

b. Open the reflector housing, inspect and clean the retroreflector optics, and close the housing.

c. Record the post-cleaning effluent opacity in Blank 18. Go to the transceiver location.

6. Transceiver Dust Accumulation Check.

a. Record the pre-cleaning effluent opacity in Blank 19.

b. Open the transceiver, clean the optics (primary window and zero mirror) and close the transceiver.

c. Record the post-cleaning effluent opacity in Blank 20.

7. Alignment Check

a. Determine the monitor alignment by looking through the alignment port of the side of the transceiver.

b. Observe whether the image is centered in the cross hairs and record this information (YES or NO) in Blank 21.

8. Zero Compensation Check

The Durag 290 provides internal compensation for window contamination. This compensation value can be determined by performing the Window Check. This compensation cannot be disabled for testing. Remove internal compensation as follows: Clean the transceiver window and the zero mirror lens. Verify the window check value is at zero so no compensation is applied to the quarterly audit. Enter the Filter Audit Mode and verify the starting Durag opacity value is zero percent. **NOTE:** This process must be completed prior to the Calibration Error Check.

9. Zero Alignment Error Check

The Zero Alignment Error Check is performed one time each year. This check utilizes Durag's Clear Path Procedure. This procedure verifies the "measuring" zero point of the unit in a known clear path setup. The Transceiver and reflector are removed from their installation and set up on stands in a clean, dust free environment. The stands are set at the same distance as the installation location. Without performing any adjustments, the measuring zero is compared to the simulated zero - or - Window Check. The difference between the measuring zero and the simulated zero, must NOT exceed 2% opacity.

Verify the Zero Compensation Check has been performed. Since the zero compensation function cannot be disabled for the zero alignment check, the optics must be cleaned and a manual calibration performed. This will set the internal compensation value to 0.0%. This MUST be accomplished prior to the Zero Alignment Check.

Perform the following to document the "Zero Alignment Error":

a) Remove the Transceiver & Reflector from its current installation and setup on stands at the exact distance as their original location.

b) Perform the Zero Compensation Check and perform a manual calibration.

c) Record the Durag's response to the clear path zero in % opacity without any adjustment.

d) Activate the simulated zero (Window Check) and record the reading in % opacity without any adjustment.
(continued on next page)

e) The response difference between these two readings are recorded as the "zero alignment error". The maximum allowable zero alignment error is 2%.

f) Adjust the simulated zero (window check) to read the same value in % opacity as the clear path zero.

10. Calibration Error Check

The calibration error check is performed using three neutral density filters. Performing the calibration error check on-stack using the filters determines the linearity of the instrument response relative to the current clear-path zero setting. This calibration error check does not determine the accuracy of the actual instrument clear-path zero or the status of any cross-stack parameters. A true calibration check is performed by moving the on-stack components to a location with minimal ambient opacity, making sure that the proper path length and alignments are attained, and then placing the calibration filters in the measurement path.

a. Put the monitor in Filter Audit mode.

b. Wait approximately three minutes or until a clear "zero" value has been recorded and displayed on the data recorder.

c. Record the audit filter serial numbers and opacity values in Blanks 22, 23, and 24.

d. Remove the filters from their protective covers, inspect and if necessary, clean them.

e. Insert the low range neutral density filter into the filter audit slot located in front of the heated lens.

f. Wait approximately three minutes or until a clear value has been recorded and displayed on the data recorder.

Note: The audit data should be taken from a data recording/reporting device that presents instantaneous opacity (or opacity data with the shortest available integration period).

g. Record the COMS response to the low range neutral density filter.

h. Remove the low range filter and insert the mid range neutral density filter.

i. Wait approximately three minutes and record the COMS response to the mid range neutral density filter.

j. Remove the mid range filter and insert the high range filter.

k. Wait approximately three minutes and record the COMS response to the high range neutral density filter.

(continued on next page)

l. Remove the high range filter.

m. * If applicable, wait approximately three minutes, and record the zero value.

n. Repeat steps (e) through (m) until a minimum of <u>three</u> opacity readings are obtained for each neutral density filter.

o. If six-minute integrated opacity data is required, repeat steps (e) through (m) once more, changing the waiting periods to 13 minutes.

p. Record the six-minute integrated data.

Note: In order to acquire valid six-minute averaged opacity data, each filter must remain in for at least two consecutive six-minute periods; the first period will be invalid because it was in progress when the filter was inserted. A waiting period of 13 minutes is recommended. You should have a "starting zero" reading and an "ending zero" reading.

q. When the calibration error check is complete, return the monitor to measuring mode. Close the transceiver head and the weather cover, and return to the COMS control unit.

11. Test Conclusion

a. Obtain a copy of the audit data from the data recorder.

b. Transcribe the calibration error response from the data recorder to Blanks 25 through 50 of the audit form and complete the audit data calculations.

C. Interpretation of Audit Results

This section is designed to help the auditor interpret the D-R 290 performance audit results.

Error codes / fault analysis

Error codes are typically associated with parameters that the monitor manufacturer feels are critical to COMS function, and to the collection of valid opacity data. The parameters associated with each of the error codes are found in the manufacturer's manual. With the exception of alarms that warn of elevated opacity levels (alarm or warning lamps), the error codes indicate that the COMS is not functioning properly. An error or failure indication will be represented by a "YES" in Blanks 7 - 10.

(continued on next page)

Stack Exit Correlation Error Check

The path length correction error in Blank 51 should be within +2%. This error exponentially affects the opacity readings, resulting in over - or - underestimation of the stack exit opacity. The most common error in computing the optical path length correction factor is the use of the flange-to-flange distance in place of the stack/duct inside diameter at the monitor location. This error will result in underestimation of the stack exit opacity and can be identified by comparing the monitor optical path length to the flange-to-flange distance; the flange-to-flange distance should be greater by approximately two to four feet

Control Panel Meter Error (Optional)

The accuracy of the control panel meter (AW) is important at sources using the meter during monitor adjustment and calibration. The accuracy of the control panel meter (Blank 52 and Blank 54) is determined by comparing the zero and span reference values to the panel meter output recorded during the COMS calibration check.

Note: Some installations utilize a different "Instrument Range Setting" than the normal 100% range. The panel meter span error must be corrected for the different range in order to provide an accurate error result. Use the following equation to calculate the span error corrected for "Instrument Range" (Blank 11):

Panel Meter span error in % opacity =

$$(((\text{Blank 15} - 4) \div 16) \times \text{Blank 11}) - \text{Blank 6}$$

Zero and Span Checks

The D-R 290 internal zero or "zero point check" (Blank 12 should be set to indicate 0% opacity (equivalent to 3.7 - 4.3 mA). An external zero error or "window check" (Blank 53) greater than 4% opacity is usually due to excessive dust accumulation on the optical surfaces, electronic drift or an electronic/mechanical offset of the data recorder. Excessive dust on the optical surfaces sufficient to cause a significant zero error would be indicated by the difference in the internal and external zero values and/or window alarm. Instrument span error (Blank 55) may be caused by the same problem(s) that cause zero errors and may be identified in a similar fashion.

If the zero and span errors are due to a data recorder offset, both errors will be in the same direction and will be of the same magnitude

(continued on next page)

The external zero displayed on the control unit panel meter (AW) also indicates the level of dust accumulation on the zero retroreflector and transceiver measurement window. The difference between the internal and external zero responses should equal the amount of dust found on the transceiver optics (Blank 57). To convert the zero responses to a value that represents lens dusting in percent opacity, use the following equation.

Meter response in % opacity = 6.25 [(Blank 13) - (Blank 12)]

Optical Alignment Check

When the transceiver and retroreflector are misaligned, a portion of the measurement beam that should be returned to the measurement detector is misdirected, resulting in a positive bias in the data reported by the COMS. One of the most common causes of misalignment is vibration which may cause the on-stack components to shift slightly on the instrument mounting flanges. Another common cause of misalignment is thermal expansion and contraction of the structure on which the transmissometer is mounted. If the COMS is being audited while the unit is off-line (cold stack), the results of the alignment analysis may not be representative of the alignment of the instrument when the stack or duct is at normal operating temperature. When checking the alignment, the reflected light beam should be centered.

Zero Compensation Check

The Zero Compensation Check should be performed and documented as such in (Blank 21a).

Annual Zero Alignment Error Check

The Zero Alignment Error Check is performed once each year. It verifies that the enegy output from the simulated zero device (Window Check) is within 2% of the Clear Path reading. The values required for this check are documented in (Blank 21b). If the difference between the Clear Path Value and the Simulated Zero (Window Check) value differ by more than 2%, then the COMS unit is considered Out Of Control. If the difference is 2% or less, then the Window Check Value is adjusted to match the Clear Path value.

Optical Surface Dust Accumulation Check

The results of the dust accumulation check (Blank 58) should not exceed 4%. A dust accumulation value of more than 4% opacity indicates that the air flow of the purge system and/or the cleaning frequency of the optical surfaces are inadequate. When determining the optical surface dust accumulation, the auditor should note whether the effluent opacity is relatively stable (within +2% opacity) before and after cleaning the optical surfaces. If the effluent opacity is fluctuating by more that +2%, the dust accumulation analysis should be omitted.

(continued on next page)

Calibration Error

Calibration error results (Blanks 68, 69 and 70) in excess of +3% are indicative of a non-linear or miss calibrated instrument. However, the absolute calibration accuracy of the monitor can be determined only when the instrument clear-path zero value is known. If the zero and span data are out-of-specification, the calibration error data will often be biased in the direction of the zero and span errors. Even if the zero and span data indicate that the COMS is calibrated properly, the monitor may still be inaccurate due to error in the clear-path zero adjustment. The optimum calibration procedure involves using neutral density filters during clear-stack or off-stack COMS calibration. This procedure would establish both the absolute calibration accuracy and linearity of the COMS. If this procedure is impractical, and it is reasonable to assume that the clear-path zero is set correctly, the monitor's calibration can be set using either the neutral density filters or the internal zero and span values.

Appendix A
COMS Audit Data Forms for the Durag Model D-R 290

AUDIT DATA SHEET
MONITORING SOLUTIONS DURAG D-R 290 COMS

Company: Primary Energy
City, ST: E. Chicago, IN
Unit ID: Stack 201
Auditor: Dan Bowles
Representing: Monitoring Solutions
Attendees: N/A
Representing:
Transceiver serial number: 1248342
Reflector serial number: 1248145
Remote serial number 1248283
COMS Flange to Flange distance (Feet / Inches): 226.125"
Date: 12/19/2019

Preliminary Data

1	Inside diameter at Stack Exit = Lx	216.000 inches
2	Inside diameter at the Transmissometer location = Lt	216.000 inches
3	Calculated Stack Correction Factor (SCF) = Lx/Lt	1.000
4	Source-cited Stack Correction Factor (SCF)	1.000
5	Source-cited zero automatic calibration value (% opacity)	0.00 %
6	Source-cited span automatic calibration value (% opacity)	40.00 %

[START AT CONTROL UNIT / DATA RECORDER LOCATION]

(If required) [INSPECT DATA RECORDING SYSTEM AND MARK WITH "OPACITY AUDIT," AUDITOR'S NAME, AFFILIATION, DATE, SOURCE, PROCESS UNIT/STACK IDENTIFICATION, AND THE TIME OF DAY.]

Error codes / faults	YES - or - NO
7 Blower [Loss of purge air from blower - Error 100, 300]	NO
8 Filter [Air filter restriction - Error 200, 400]	NO
9 Window [Excessive dirt on transceiver window - Error 001]	NO
10 Fault [Additional CEMS fault has occurred. Note fault code on Opacity display and consult the instrument manual.]	NO

Instrument Range Check

11	Instrument range setting	100 %

Zero Check

12	Opacity Display - Internal zero value in "milliamps" (Zero Point Check) [Wait for 1½ minutes for automatic change to external zero mode.]	4.00 mA
13	Opacity Display - Zero calibration value in "milliamps" (Window Check)	4.00 mA
14	Opacity data recorder zero calibration value in "% Op" (Window Check) [Wait 1½ minutes for automatic change to span mode.]	0.00 mA

Span Check

15	Opacity Display - Span calibration value in "milliamps" (Span Check)	10.40 mA
16	Opacity data recorder span calibration value in "% Op" (Span Check)	40.00 %

[Go to reflector location.]

AUDIT DATA SHEET
MONITORING SOLUTIONS DURAG D-R 290 COMS

Reflector Dust Accumulation Check

17 Pre-cleaning effluent opacity (% Op) 3.6 %
[Inspect and clean optical surface.]
18 Post-cleaning effluent opacity (% Op) 3.5 %
[Go to transceiver location.]

Transceiver Dust Accumulation Check and Zero Compensation Check

19 Pre-cleaning effluent opacity (% Op) 3.5 %
[Inspect and clean optical window and zero mirror.]
20 Post-cleaning effluent opacity (% Op) 2.9 %

Optical Alignment Check

[LOOK THROUGH ALIGNMENT SIGHT AND DETERMINE IF BEAM IMAGE IS CENTERED.]
21 Is the image centered? YES - or - NO: YES

Zero Compensation Check

21a Did you comply with the Zero Compensation Check? YES - or - NO: YES

Annual Zero Alignment Error Check

21b Did you comply with the Annual Zero Alignment Error Check? YES - or - NO: YES

Zero Alignment Error Check results (if applicable):

Clear Path Value % = 0.1 Window Check Value % = 0.2 Zero Alignment Error % = 0.1

[Record audit filter data.]

Filter	Serial NO.	% Opacity	SCF%
22 LOW	YC61	18.20	18.20 %
23 MID	YC62	27.30	27.30 %
24 HIGH	YC63	46.40	46.40 %

[Remove the audit filters from the protective covers, inspect, and clean each filter]

[Set the unit up to display the initial zero. Wait 3 minutes to allow opacity data recorder to record initial zero]

[Insert a filter, wait approximately 3 minutes, and record the opacity value reported by the opacity data recorder. Repeat the process 5 times for each filter.]

[Read and transcribe final calibration error data from the opacity data recorder on the next page]

25 ZERO 0.00

	LOW		MID		HIGH		(If Required) ZERO
26	18.40	27	27.80	28	46.60	29	N/A
30	18.40	31	27.80	32	46.60	33	N/A
34	18.40	35	27.80	36	46.60	37	N/A
38	18.40	39	27.80	40	46.60	41	N/A
42	18.40	43	27.80	44	46.60	45	0.00

[Six-minute average data, if applicable.]

	ZERO		LOW		MID		HIGH		(If Required) ZERO
46	0.00	47	18.40	48	27.80	49	46.60	50	0.00

Reserved Area

Calculation of Audit Results

Stack Correction Factor correlation error (%):

51 $$\left[\frac{Blank\ 4\ (1.000) - Blank\ 3\ (1.000)}{Blank\ 3\ (1.000)}\right] \times 100 = 0.00$$

Zero Error (% Op.):

52 Opacity Display: 6.25 * (Blank 13 (4.00) - 4.0) - Blank 5 (0.00) = 0.00 %

53 Opacity Data Recorder: Blank 14 (0.00) - Blank 5 (0.00) = 0.00

AUDIT DATA SHEET
MONITORING SOLUTIONS DURAG D-R 290 COMS

Span Error (% Op.):

54 Opacity Display: (((Blank 15 - 4.0) ÷ 16) × Blank 11) - Blank 6 (10.40, 100, 40.00) = 0.00 %

55 Opacity Data Recorder: Blank 16 (40) - Blank 6 (40) = 0.00

Optical Surface Dust Accumulation (% OP):

56 Retroreflector: Blank 17 (3.6) - Blank 18 (3.5) = 0.10 %

57 Transceiver: Blank 19 (3.5) - Blank 20 (2.9) = 0.60 %

58 Total: Blank 56 (0.1) + Blank 57 (0.6) = 0.70 %

Optical Path Length Correction (SCF)
Audit Filters Corrected for Path Length:

59 LOW: 18.20, 1.000

$$1 - (1 - (\frac{Blank\ 22}{100})^{Blank\ 4}) \times 100$$

= 18.20 %

60 MID: 27.30, 1.000

$$1 - (1 - (\frac{Blank\ 23}{100})^{Blank\ 4}) \times 100$$

= 27.30 %

61 HIGH: 46.40, 1.000

$$1 - (1 - (\frac{Blank\ 24}{100})^{Blank\ 4}) \times 100$$

= 46.40 %

AUDIT DATA SHEET
MONITORING SOLUTIONS DURAG D-R 290 COMS

Auditor: Dan Bowles Date: 12/19/19

Source: Primary Energy Unit: Stack 201

PARAMETER		Blank No.	Audit Results	Specifications
Error Codes/Faults				
Blower failure		7	NO	NO
Filter Blockage		8	NO	NO
Window		9	NO	NO
Fault		10	NO	NO
SCF Correlation Error		51	0.00	+/- 2% Op
Internal Zero Error	Display	52	0.00	+/- 4% Op
	Data	53	0.00	+/- 4% Op
Internal Span Error	Display	54	0.00	+/- 4% Op
	Data	55	0.00	+/- 4% Op
Optical Alignment Analysis		21	YES	YES = Centered
Zero Compensation Check		21a	YES	YES = Complied With
Zero Alignment Error		21b	0.10	≤ 2% Op
Optical Surface Dust Accumulation				
Retroreflector		56	0.10	≤ 2% Op
Transceiver		57	0.60	≤ 2% Op
Total		58	0.70	≤ 4% Op
Calibration Error Analysis				
Arithmetic Mean Difference				
	LOW	62	0.20	
		71a	0.20	
	MID	63	0.50	
		72a	0.50	
	HIGH	64	0.20	
		73a	0.20	
Confidence Coeffecient				
		65	0.00	
		66	0.00	
		67	0.00	
Calibration Error				
		68	0.20	≤ 3% Op
		69	0.50	≤ 3% Op
		70	0.20	≤ 3% Op

Revision: March, 2016

OPACITY LOW FILTER AUDIT

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 12/19/2019

LOW FILTER RUN	Opacity Output from Recording Device	Audit Filter Value Corrected for Path Length (SCF)	(FILTER-MONITOR) Difference	Difference^2
		RM	**(X_i)**	**X_i^2**
1	18.40	18.20	0.20	0.0400
2	18.40	18.20	0.20	0.0400
3	18.40	18.20	0.20	0.0400
4	18.40	18.20	0.20	0.0400
5	18.40	18.20	0.20	0.0400

n = 5

t(0.975) = 2.776

Mean Ref. Method Value	**18.2000**	***RM***
Sum of Differences	**1.0000**	***Xi***
Arithmetic Mean Difference	**0.2000**	***Xi ave***
Sum of Differences Squared	**0.2000**	***Xi^2***
Standard Deviation	**0.0000**	***sd***
2.5% Error Conf.Coef	**0.0000**	***CC***
Calibration Error	**0.2000**	***percent***

OPACITY MID FILTER AUDIT

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 12/19/2019

MID FILTER RUN	Opacity Output from Recording Device	Audit Filter Value Corrected for Path Length (SCF)	(FILTER-MONITOR) Difference	Difference^2
		RM	**(X_i)**	**X_i^2**
1	27.80	27.30	0.50	0.2500
2	27.80	27.30	0.50	0.2500
3	27.80	27.30	0.50	0.2500
4	27.80	27.30	0.50	0.2500
5	27.80	27.30	0.50	0.2500

n = 5

t(0.975) = 2.776

Mean Ref. Method Value	**27.3000**	***RM***
Sum of Differences	**2.5000**	***Xi***
Arithmetic Mean Difference	**0.5000**	***Xi ave***
Sum of Differences Squared	**1.2500**	***Xi^2***
Standard Deviation	**0.0000**	***sd***
2.5% Error Conf.Coef	**0.0000**	***CC***
Calibration Error	**0.5000**	***percent***

OPACITY HIGH FILTER AUDIT

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 12/19/2019

HIGH FILTER RUN	Opacity Output from Recording Device	Audit Filter Value Corrected for Path Length (SCF)	(FILTER-MONITOR) Difference	Difference^2
		RM	**(X_i)**	**X_i^2**
1	46.60	46.40	0.20	0.0400
2	46.60	46.40	0.20	0.0400
3	46.60	46.40	0.20	0.0400
4	46.60	46.40	0.20	0.0400
5	46.60	46.40	0.20	0.0400

n = 5

t(0.975) = 2.776

Mean Ref. Method Value	**46.4000**	***RM***
Sum of Differences	**1.0000**	***Xi***
Arithmetic Mean Difference	**0.2000**	***Xi ave***
Sum of Differences Squared	**0.2000**	***Xi^2***
Standard Deviation	**0.0000**	***sd***
2.5% Error Conf.Coef	**0.0000**	***CC***
Calibration Error	**0.2000**	***percent***

Scans Report

12/19/2019	OPACITY, %
09:14	
09:14:01	0.0 MOS
09:14:03	0.0 MOS
09:14:05	0.0 MOS
09:14:07	0.0 MOS
09:14:09	0.0 MOS
09:14:11	0.0 MOS
09:14:13	0.0 MOS
09:14:15	0.0 MOS
09:14:17	5.4 MOS
09:14:19	9.2 MOS
09:14:21	13.5 MOS
09:14:23	18.1 MOS
09:14:25	18.4 MOS
09:14:27	18.4 MOS
09:14:29	18.4 MOS
09:14:31	18.4 MOS
09:14:33	18.4 MOS
09:14:35	18.4 MOS
09:14:37	18.4 MOS
09:14:39	18.4 MOS
09:14:41	18.4 MOS
09:14:43	18.4 MOS
09:14:45	18.4 MOS
09:14:47	18.4 MOS
09:14:49	18.4 MOS
09:14:51	18.4 MOS
09:14:53	15.2 MOS
09:14:55	13.7 MOS
09:14:57	15.8 MOS
09:14:59	18.8 MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

12/19/2019	OPACITY, %
09:15	
09:15:01	24.3 MOS
09:15:03	27.8 MOS
09:15:05	27.8 MOS
09:15:07	27.8 MOS
09:15:09	27.8 MOS
09:15:11	27.8 MOS
09:15:13	27.8 MOS
09:15:15	27.8 MOS
09:15:17	27.8 MOS
09:15:19	27.8 MOS
09:15:21	27.8 MOS
09:15:23	27.8 MOS
09:15:25	27.8 MOS
09:15:27	25.8 MOS
09:15:29	27.5 MOS
09:15:31	32.2 MOS
09:15:33	36.9 MOS
09:15:35	43.4 MOS
09:15:37	46.6 MOS
09:15:39	46.6 MOS
09:15:41	46.6 MOS
09:15:43	46.6 MOS
09:15:45	46.6 MOS
09:15:47	46.6 MOS
09:15:49	46.6 MOS
09:15:51	46.6 MOS
09:15:54	46.6 MOS
09:15:56	46.6 MOS
09:15:58	46.6 MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

12/19/2019	OPACITY, %	
09:16		
09:16:00	46.6	MOS
09:16:02	46.6	MOS
09:16:04	46.6	MOS
09:16:06	46.6	MOS
09:16:08	46.6	MOS
09:16:10	46.6	MOS
09:16:12	43.8	MOS
09:16:14	34.6	MOS
09:16:16	27.6	MOS
09:16:18	20.5	MOS
09:16:20	16.3	MOS
09:16:22	18.4	MOS
09:16:24	18.4	MOS
09:16:26	18.4	MOS
09:16:28	18.4	MOS
09:16:30	18.4	MOS
09:16:32	18.4	MOS
09:16:34	18.4	MOS
09:16:36	18.4	MOS
09:16:38	18.4	MOS
09:16:40	18.4	MOS
09:16:42	18.4	MOS
09:16:44	18.4	MOS
09:16:46	18.4	MOS
09:16:48	18.4	MOS
09:16:50	18.4	MOS
09:16:52	20.7	MOS
09:16:54	22.5	MOS
09:16:56	24.9	MOS
09:16:58	27.2	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

12/19/2019	OPACITY, %
09:17	
09:17:00	27.8 MOS
09:17:02	27.8 MOS
09:17:04	27.8 MOS
09:17:06	27.8 MOS
09:17:08	27.8 MOS
09:17:10	27.8 MOS
09:17:12	27.8 MOS
09:17:14	27.8 MOS
09:17:16	27.8 MOS
09:17:18	27.8 MOS
09:17:20	27.8 MOS
09:17:22	27.8 MOS
09:17:24	27.8 MOS
09:17:26	27.8 MOS
09:17:28	27.8 MOS
09:17:30	27.8 MOS
09:17:32	26.2 MOS
09:17:34	25.4 MOS
09:17:36	31.2 MOS
09:17:38	35.9 MOS
09:17:40	44.0 MOS
09:17:42	46.6 MOS
09:17:44	46.6 MOS
09:17:46	46.6 MOS
09:17:48	46.6 MOS
09:17:50	46.6 MOS
09:17:52	46.6 MOS
09:17:54	46.6 MOS
09:17:56	46.6 MOS
09:17:58	46.6 MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

12/19/2019	OPACITY, %
09:18	
09:18:00	46.6 MOS
09:18:02	46.6 MOS
09:18:04	46.6 MOS
09:18:06	46.6 MOS
09:18:08	46.6 MOS
09:18:10	46.6 MOS
09:18:12	40.9 MOS
09:18:14	32.6 MOS
09:18:16	25.6 MOS
09:18:18	17.0 MOS
09:18:20	17.2 MOS
09:18:22	18.4 MOS
09:18:24	18.4 MOS
09:18:26	18.4 MOS
09:18:28	18.4 MOS
09:18:30	18.4 MOS
09:18:32	18.4 MOS
09:18:35	18.4 MOS
09:18:37	18.4 MOS
09:18:39	18.4 MOS
09:18:41	18.4 MOS
09:18:43	18.4 MOS
09:18:45	18.4 MOS
09:18:47	18.4 MOS
09:18:49	18.4 MOS
09:18:51	19.0 MOS
09:18:53	21.4 MOS
09:18:55	23.7 MOS
09:18:57	25.5 MOS
09:18:59	27.8 MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

Scans Report

12/19/2019	OPACITY, %
09:19	
09:19:01	27.8 MOS
09:19:03	27.8 MOS
09:19:05	27.8 MOS
09:19:07	27.8 MOS
09:19:09	27.8 MOS
09:19:11	27.8 MOS
09:19:13	27.8 MOS
09:19:15	27.8 MOS
09:19:17	27.8 MOS
09:19:19	27.8 MOS
09:19:21	27.8 MOS
09:19:23	27.8 MOS
09:19:25	27.8 MOS
09:19:27	27.8 MOS
09:19:29	27.8 MOS
09:19:31	27.8 MOS
09:19:33	27.8 MOS
09:19:35	27.0 MOS
09:19:37	25.7 MOS
09:19:39	30.4 MOS
09:19:41	35.1 MOS
09:19:43	43.5 MOS
09:19:45	46.6 MOS
09:19:47	46.6 MOS
09:19:49	46.6 MOS
09:19:51	46.6 MOS
09:19:53	46.6 MOS
09:19:55	46.6 MOS
09:19:57	46.6 MOS
09:19:59	46.6 MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

12/19/2019	OPACITY, %
09:20	
09:20:01	46.6 MOS
09:20:03	46.6 MOS
09:20:05	46.6 MOS
09:20:07	46.6 MOS
09:20:09	46.6 MOS
09:20:11	46.6 MOS
09:20:13	46.6 MOS
09:20:15	46.6 MOS
09:20:17	46.6 MOS
09:20:19	37.5 MOS
09:20:21	30.6 MOS
09:20:23	25.1 MOS
09:20:25	16.4 MOS
09:20:27	18.4 MOS
09:20:29	18.4 MOS
09:20:31	18.4 MOS
09:20:33	18.4 MOS
09:20:35	18.4 MOS
09:20:37	18.4 MOS
09:20:39	18.4 MOS
09:20:41	18.4 MOS
09:20:43	18.4 MOS
09:20:45	18.4 MOS
09:20:47	18.4 MOS
09:20:49	18.4 MOS
09:20:51	18.4 MOS
09:20:53	16.5 MOS
09:20:55	16.9 MOS
09:20:57	19.2 MOS
09:20:59	21.6 MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

12/19/2019	OPACITY, %
09:21	
09:21:01	25.0 MOS
09:21:03	27.8 MOS
09:21:05	27.8 MOS
09:21:07	27.8 MOS
09:21:09	27.8 MOS
09:21:11	27.8 MOS
09:21:13	27.8 MOS
09:21:15	27.8 MOS
09:21:18	27.8 MOS
09:21:20	27.8 MOS
09:21:22	27.8 MOS
09:21:24	27.8 MOS
09:21:26	27.8 MOS
09:21:28	27.8 MOS
09:21:30	27.8 MOS
09:21:32	27.8 MOS
09:21:34	27.8 MOS
09:21:36	27.8 MOS
09:21:38	25.3 MOS
09:21:40	30.0 MOS
09:21:42	34.7 MOS
09:21:44	39.3 MOS
09:21:46	46.6 MOS
09:21:48	46.6 MOS
09:21:50	46.6 MOS
09:21:52	46.6 MOS
09:21:54	46.6 MOS
09:21:56	46.6 MOS
09:21:58	46.6 MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

12/19/2019	OPACITY, %
09:22	
09:22:00	46.6 MOS
09:22:02	46.6 MOS
09:22:04	46.6 MOS
09:22:06	46.6 MOS
09:22:08	46.6 MOS
09:22:10	46.6 MOS
09:22:12	46.6 MOS
09:22:14	46.6 MOS
09:22:16	38.9 MOS
09:22:18	30.1 MOS
09:22:20	24.0 MOS
09:22:22	17.8 MOS
09:22:24	18.4 MOS
09:22:26	18.4 MOS
09:22:28	18.4 MOS
09:22:30	18.4 MOS
09:22:32	18.4 MOS
09:22:34	18.4 MOS
09:22:36	18.4 MOS
09:22:38	18.4 MOS
09:22:40	18.4 MOS
09:22:42	18.4 MOS
09:22:44	18.4 MOS
09:22:46	18.4 MOS
09:22:48	18.4 MOS
09:22:50	18.4 MOS
09:22:52	18.4 MOS
09:22:54	15.8 MOS
09:22:56	17.9 MOS
09:22:58	19.8 MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

12/19/2019	OPACITY, %
09:23	
09:23:00	22.7 MOS
09:23:02	27.7 MOS
09:23:04	27.8 MOS
09:23:06	27.8 MOS
09:23:08	27.8 MOS
09:23:10	27.8 MOS
09:23:12	27.8 MOS
09:23:14	27.8 MOS
09:23:16	27.8 MOS
09:23:18	27.8 MOS
09:23:20	27.8 MOS
09:23:22	27.8 MOS
09:23:24	27.8 MOS
09:23:26	27.8 MOS
09:23:28	27.8 MOS
09:23:30	27.8 MOS
09:23:32	27.8 MOS
09:23:34	24.4 MOS
09:23:36	28.3 MOS
09:23:38	32.9 MOS
09:23:40	37.6 MOS
09:23:42	46.6 MOS
09:23:44	46.6 MOS
09:23:46	46.6 MOS
09:23:48	46.6 MOS
09:23:50	46.6 MOS
09:23:52	46.6 MOS
09:23:54	46.6 MOS
09:23:56	46.6 MOS
09:23:59	46.6 MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

Scans Report

12/19/2019	OPACITY, %
09:24	
09:24:01	46.6 MOS
09:24:03	46.6 MOS
09:24:05	46.6 MOS
09:24:07	46.6 MOS
09:24:09	40.9 MOS
09:24:11	26.4 MOS
09:24:13	14.7 MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

12/19/2019	OPACITY, %	
09:24		
09:24:01	46.6	MOS
09:24:03	46.6	MOS
09:24:05	46.6	MOS
09:24:07	46.6	MOS
09:24:09	40.9	MOS
09:24:11	26.4	MOS
09:24:13	14.7	MOS
09:24:15	3.1	MOS
09:24:17	0.0	MOS
09:24:19	0.0	MOS
09:24:21	0.0	MOS
09:24:23	0.0	MOS
09:24:25	0.0	MOS
09:24:27	0.0	MOS
09:24:29	0.0	MOS
09:24:31	0.0	MOS
09:24:33	0.0	MOS
09:24:35	0.0	MOS
09:24:37	0.0	MOS
09:24:39	0.0	MOS
09:24:41	0.0	MOS
09:24:43	0.0	MOS
09:24:45	0.0	MOS
09:24:47	0.0	MOS
09:24:49	0.0	MOS
09:24:51	0.0	MOS
09:24:53	0.0	MOS
09:24:55	0.0	MOS
09:24:57	0.0	MOS
09:24:59	0.0	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

OPACITY FILTER AUDIT

*** 6-minute Averages ***

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 12/19/2019

6 Minute Averages	Opacity Output from Recording Device	Audit Filter Value Corrected for Path Length (SCF)	(FILTER-MONITOR) Difference	Opacity Error
		RM	(Xi)	
ZERO	0.00	0.00	0.00	**0.00**
LOW	18.40	18.20	0.20	**0.20**
MID	27.80	27.30	0.50	**0.50**
HIGH	46.60	46.40	0.20	**0.20**
ZERO	0.00	0.00	0.00	**0.00**

Primary Energy Coke

East Chicago, IN

Opacity Report

12/19/2019 - 12/19/2019

12/19/2019

Created on : Dec 19, 2019 10:41:29

STACK 201

Hour	Opac, % Minutes 0 - 5	Opac, % Minutes 6 - 11	Opac, % Minutes 12 - 17	Opac, % Minutes 18 - 23	Opac, % Minutes 24 - 29	Opac, % Minutes 30 - 35	Opac, % Minutes 36 - 41	Opac, % Minutes 42 - 47	Opac, % Minutes 48 - 53	Opac, % Minutes 54 - 59
0	2.7 SVC	2.9 SVC	2.9 SVC	2.8 SVC	2.6 SVC	2.8 SVC	2.8 SVC	2.7 SVC	2.8 SVC	3.0 SVC
1	2.9 SVC	2.8 SVC	2.7 SVC	2.8 SVC	2.6 SVC	2.6 SVC	2.8 SVC	2.9 SVC	3.1 SVC	2.9 SVC
2	2.7 SVC	2.8 SVC	2.7 SVC	2.7 SVC	2.8 SVC	2.8 SVC	3.2 SVC	3.1 SVC	2.9 SVC	2.8 SVC
3	2.8 SVC	2.6 SVC	2.7 SVC	2.8 SVC	3.1 SVC	2.9 SVC	2.8 SVC	2.8 SVC	2.9 SVC	2.8 SVC
4	2.8 SVC	3.0 SVC	3.3 SVC	3.3 SVC	3.0 SVC	3.0 SVC	3.0 SVC	2.9 SVC	2.9 SVC	2.9 SVC
5	3.0 SVC	3.1 SVC	3.0 SVC	3.0 SVC	2.9 SVC	2.8 SVC	2.7 SVC	2.9 SVC	3.0 SVC	3.1 SVC
6	3.1 SVC	3.0 SVC	2.9 SVC	2.8 SVC	2.9 SVC	2.9 SVC	3.0 SVC	3.1 SVC	3.1 SVC	3.0 SVC
7	2.9 SVC	2.7 SVC	2.8 SVC	2.9 SVC	3.0 SVC	3.0 SVC	3.1 SVC	3.1 SVC	2.9 SVC	2.9 SVC
8	2.9 SVC	2.9 SVC	3.1 SVC	3.1 SVC	3.0 SVC	3.1 SVC	3.0 SVC	2.8 SVC	2.9 SVC	2.9 MOS
9	3.0 MOS	12.3 MOS	20.3 MOS	30.1 MOS	1.6 MOS	0.0 MOS	4.4 MOS	18.4 MOS	18.7 MOS	27.8 MOS
10	27.9 MOS	42.6 MOS	46.6 MOS	18.8 MOS	0.0 MOS	1.0 MOS				

Status Code Definitions

MOS = MONITOR OUT OF SERVICE SVC = MONITOR IN SERVICE

The average opacity period average for the day was 2.9 % for 89 periods of valid data.

The Fan was in operation for 106 periods

The maximum opacity period average for the day was 3.3 %

There were 17 periods of invalid data

APPENDIX B
AUDIT FILTER CERTIFICATION SHEETS

Monitoring Solutions
Leaders in Environmental Monitoring Systems & Services
4404 Guion Rd., Indianapolis, Indiana 46254 Tel: 317.856.9400

REPORT OF CERTIFICATION OF NEUTRAL DENSITY AUDIT FILTERS

Date of Filter Certification: **August 31, 2019**
Date of Filter Expiration: **February 29, 2020** **Filter Set - K**

Audit Device / Filter Slot Angle of Incidence **10** Degrees
Path-Length Correction **1.000** (Straight Stack)

Table 1: Individual Filter Certification Data

Serial Number	Opacity Value (%)	Transmittance (%)	Previous Opacity (%)	Change in Opacity (%)
YC60	8.5	91.5	8.5	0.0
YC61	18.2	81.8	18.2	0.0
YC62	27.3	72.7	27.3	0.0
YC63	46.4	53.6	46.4	0.0
YG00	57.8	42.2	57.8	0.0
YG02	86.5	13.5	86.4	0.1

J T Lephardt

Laboratory-Based Transmissometer
Operator

See second page for Instrument Information and Details of Certification

ZERO ALIGNMENT CHECK

FOR

Primary Energy

East Chicago

Unit(s): Stack 201

MONITORING SOLUTIONS, INC.
MODEL: DURAG D-R 290 COMS

2019

Testing Completed On: 12/4/2019

PREPARED BY:

Monitoring | Solutions

Leaders in Environmental Monitoring Systems & Services

Monitoring Solutions, Inc. was contracted to conduct a Zero Alignment Check on a Durag Model D-R 290 opacity system. Testing was performed as per 40CFR60 Appendix F - Procedure 3.

Client: Primary Energy
City, State: East Chicago
Unit(s): Stack 201
Auditor: Dan
Test Date: 12/4/2019

Stack Correction Factor (SCF): 1.000

Durag Flange to Flange distance: 226.125

Test results are as follows:

Unit ID :	Stack
Transceiver S/N :	1248342
Reflector S/N :	1248145
Remote S/N :	1248283
Clear Path Reading % :	0.1
Window Check Value % :	0.2
Zero Alignment Error % :	0.1

PASS

* Zero Alignment Error must be ≤ 2% to pass

Reviewed by: _____

Date: 1/22/2020

Revision: May 2015

Zero Alignment Error Check Procedure

The Zero Alignment Error Check is performed one time each year. This check utilizes the setup section of Durag's Clear Path procedure and verifies the "measuring" zero point of the unit in a known clear path setup. The transceiver and reflector are removed from their installation and set up on stands in a clean, dust free environment. The stands are set at the same distance as the installation location, referred to as the "Durag flange to flange distance". The optics on the unit are cleaned and the alignment is verified / adjusted as required. Without performing any electrical and/or mechanical adjustments to the transceiver, the measuring zero is compared to the simulated zero - or - Window Check. The difference between the measuring zero and the simulated zero, must NOT exceed 2% opacity.

Perform the following to document the "Zero Alignment Error":

a) Remove the Transceiver & Reflector from its current installation and setup on stands at the exact distance as their original location.

b) Connect and power up the remote (AW) unit and allow the system to complete a calibration check.

c) Check that the transceiver and reflector are properly aligned using the sighting window on the side of the transceiver. Adjust alignment as necessary.

d) Clean the transceiver's window & zero mirror; and the reflector. Perform a manual calibration to verify the internal compensation is at zero.

e) After unit has stabilized, record the Durag's response to the clear path zero in % opacity without any adjustment.

f) Activate the simulated zero (Window Check) and record the reading in % opacity without any adjustment.

g) The response difference between these two readings are recorded as the "zero alignment error". The maximum allowable zero alignment error is 2%.

h) If the zero alignment error is 2% or less, then adjust the simulated zero (window check) to read the same value in % opacity as the clear path zero value. Continue to step k).

i) If the zero alignment error is greater than 2%, then perform the Durag Clear Path setup procedure.

j) After completion of the the Durag Clear Path procedure, document the final values in the second results box.

k) Power down the system and return the components to their original location and power up the system.

l) Verify alignment is correct and perform a manual Daily Calibration check and verify it passes.

ATTACHMENT 3

First Quarter 2020 Deviation and Compliance Monitoring Report

Cokenergy LLC
3210 Watling Street MC 2-991
East Chicago, IN 46312

April 20, 2020 Via UPS

Indiana Department of Environmental Management
Compliance and Enforcement Branch
Office of Air Quality
100 N. Senate Avenue
Mail Code 61-50, IGCN 1003
Indianapolis, IN 46204 - 2251

RE: Cokenergy, LLC Quarterly Report – First Quarter 2020
Part 70 Permit No. T089-41033-00383

To Whom It May Concern:

In accordance with sections C.18 and D.1.14 of the subject permit, 326 IAC 3-5-5 and 326 IAC 3-5-7, we have enclosed the first quarter 2020 reports for the Cokenergy, LLC facility. This report includes:

- Part 70 Quarterly Report – Certification
- Part 70 Quarterly Deviation and Compliance Report
- CEMS Excess Emissions Report
- CEMS Downtime Report
- COMS First Quarter 2020 Opacity Monitor Audit
- CEMS First Quarter 2020 Cylinder Gas Audit

If you have any questions concerning this data, please call Luke Ford at (219) 397-4626.

Sincerely,

Seth Acheson

Seth Acheson
General Manager
Cokenergy LLC

Enclosure
cc: Luke Ford (scan via email)
Cliff Yukawa IDEM (scan via email)

File: X:\\ 615.4

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR MANAGEMENT
COMPLIANCE AND ENFORCEMENT SECTION
PART 70 OPERATING PERMIT
CERTIFICATION

Source Name: Cokenergy LLC

Source Address: 3210 Watling Street, MC 2-991, East Chicago, Indiana 46312-1610

Part 70 Permit No.: T089-41033-00383

This certification shall be included when submitting monitoring, testing reports/results or other documents as required by this permit.

Please check what document is being certified:

☐ Annual Compliance Certification Letter

☒ Test Result (specify) 1st Quarter 2020 COMS Performance Audit and Cylinder Gas Audit

☒ Report (specify) 1st Quarter 2020 Deviation and Compliance Monitoring Report

☐ Notification (specify) _____

☐ Affidavit (specify) _____

☐ Other (specify) _____

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

Signature: Seth Acheson

Printed Name: Seth Acheson

Title/Position: General Manager, Cokenergy, LLC

Phone: (219) 397-4521

Date: April 20, 2020

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR QUALITY
COMPLIANCE AND ENFORCEMENT BRANCH
PART 70 OPERATING PERMIT
QUARTERLY DEVIATION AND COMPLIANCE MONITORING REPORT

Source Name: Cokenergy LLC
Source Address: 3210 Watling Street, MC 2-991, East Chicago, Indiana 46312-1610
Part 70 Permit No. T089-41033-00383

Months: January to March **Year:** 2020

This report shall be submitted quarterly based on a calendar year. Any deviation from the requirements, the date(s) of each deviation, the probable cause of the deviation, and the response steps taken must be reported. Deviations that are required to be reported by an applicable requirement shall be reported according to the schedule stated in the applicable requirement and do not need to be included in this report. Additional pages may be attached if necessary. If no deviations occurred, please specify in the box marked "No deviations occurred this reporting period".

☒ NO DEVIATIONS OCCURRED THIS REPORTING PERIOD

☐ THE FOLLOWING DEVIATIONS OCCURRED THIS REPORTING PERIOD

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Permit Requirement: (specify permit condition #)	
Date of Deviation:	**Duration of Deviation:**
Number of Deviations:	
Probable Cause of Deviation:	
Response Steps Taken:	

Form Completed by: Seth Acheson

Title / Position: General Manager, Cokenergy, LLC

Date: April 20, 2020

Phone: (219) 397-4521

Excess Emissions and Downtime Report

COKENERGY, LLC, East Chicago, IN

Plant ID: 089-00383

Emissions Unit ID: Stack 201

Emissions Unit: Heat Recovery Coke Carbonization Waste Heat Stack

PLANT OPERATIONS DOWNTIME SUMMARY

Reporting Period: 1st Quarter of 2020

Commencement of Emission Unit Downtime	Completion of Emission Unit Downtime	Emission Unit Downtime Duration (hours)	Reasons for Emission Unit Downtime
NONE			
Total Emission Unit Downtime for the quarter =		0	hours

COKENERGY, LLC, East Chicago, IN
Plant ID: 089-00383
Emissions Unit ID: Stack 201
Emissions Unit: Heat Recovery Coke Carbonization Waste Heat Stack

EXCESS EMISSIONS SUMMARY

Reporting Period: 1st Quarter of 2020

SO_2 Exceedances

Emission Standard: 1,656 lb/hr on a 24-hr average basis
(Note that this limit is for the combined emissions from Cokenergy Stack 201 and 16 IHCC Vent Stacks)

Date/Time of Commencement	Date/Time of Completion	Magnitude of Emissions (lb/hr)			Reasons for Excess Emissions	Corrective Actions Taken
		Main Stack Avg	Vent Stack Avg	Plant Avg		
None						

COKENERGY, LLC, East Chicago, IN
Plant ID: 089-00383
Emissions Unit ID: Stack 201
Emissions Unit: Heat Recovery Coke Carbonization Waste Heat Stack

EXCESS EMISSIONS SUMMARY

Reporting Period: 1st Quarter of 2020

Opacity Exceedances

Emission Standard: 20% opacity

Date/Time of Commencement	Date/Time of Completion	Magnitude of Emissions	Reasons for Excess Emissions	Corrective Actions Taken
None				
Total Duration	0 minutes			

COKENERGY, LLC, East Chicago, IN
Plant ID: 089-00383
Emissions Unit ID: Stack 201
Emissions Unit: Heat Recovery Coke Carbonization Waste Heat Stack

CONTINUOUS MONITORING SYSTEM DOWNTIME SUMMARY

Reporting Period: 1st Quarter of 2020

Opacity Monitor Downtime

Date/Time of Commencement	Duration of Downtime (minutes)	Reasons for Instrument Downtime	System Repairs and Adjustments
2/5/20 8:35	16	Purge air blower maintenance	Moved purge air blowers to a new circuit.
3/3/20 9:00	120	Quarterly PMs and Opacity Performance Audit	Completed PMs and audit
Total Downtime	136 minutes		

Note: Daily zero and span checks of the instrument have been excluded from the downtime summary per 326 IAC 3-5-7.

COKENERGY, LLC, East Chicago, IN
Plant ID: 089-00383
Emissions Unit ID: Stack 201
Emissions Unit: Heat Recovery Coke Carbonization Waste Heat Stack

CONTINUOUS MONITORING SYSTEM DOWNTIME SUMMARY

Reporting Period: 1st Quarter of 2020

SO_2 CEMS Downtime

Date/Time of Commencement	Duration of Downtime (hours)	Reasons for Instrument Downtime	System Repairs and Adjustments
3/3/20 9:00	2	Quarterly PMs.	Completed PMs
Total Downtime	2 hours		

Note: Daily zero and span checks of the instrument have been excluded from the downtime summary per 326 IAC 3-5-7.

COKENERGY, LLC, East Chicago, IN
Plant ID: 089-00383
Emissions Unit ID: Stack 201
Emissions Unit: Heat Recovery Coke Carbonization Waste Heat Stack

CONTINUOUS MONITORING SYSTEM DOWNTIME SUMMARY

Reporting Period: 1st Quarter of 2020

Flow Monitor Downtime

Date/Time of Commencement	Duration of Downtime (hours)	Reasons for Instrument Downtime	System Repairs and Adjustments
3/3/20 9:00	2	Quarterly PMs and leak check.	Completed PMs and leak check
Total Downtime	2 hours		

Note: Daily zero and span checks of the instrument have been excluded from the downtime summary per 326 IAC 3-5-7.

OPACITY PERFORMANCE AUDIT

FOR

Primary Energy

E. Chicago, IN

Unit: Stack 201

MONITORING SOLUTIONS, INC.
MODEL: DURAG D-R 290 COMS

First (1st) Quarter Results
2020

Audit Completed On: 3/3/2020

PREPARED BY:

Monitoring | Solutions

Leaders in Environmental Monitoring Systems & Services

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Appendix A - COMS Audit Data Forms for the Durag Model D-R 290

Appendix B - Audit Filter Certification Sheet(s)

I. Introduction

Monitoring Solutions, Inc. was contracted to conduct an opacity performance audit on a Durag Model D-R 290 opacity system.

Client: Primary Energy
City, State: E. Chicago, IN
Auditor: Dan Bowles
Audit Date: 3/3/2020

The performance testing consists of:

1 Zero and Span Check
2 Zero Compensation Check
3 Optical Alignment Check
4 Calibration Error Check
5 Annual Zero Alignment (When required)

All raw data, calculated data and final summary are presented. The results indicate compliance for all specifications. Testing was performed as per 40CFR60 Appendix F and 40CFR60 Appendix B, PS1 (Where Applicable).

Annual "Zero Alignment" check performed this quarter:

YES: _____ NO: X ERROR: N/A

Summary of Calibration Error Check

Filter :	Low	Mid	High
Percent of Error:	0.34	0.40	0.21
	PASS	PASS	PASS

Reviewed by: _____

Date: 3/9/2020

Revision: March 2016

PERFORMANCE AUDIT PROCEDURES FOR THE MONITORING SOLUTIONS, INC. OPACITY MONITOR

II. Monitoring Solutions, Inc. Durag Model D-R 290

The instrument is manufactured by the Durag Corporation and distributed and serviced by Monitoring Solutions, Inc.

A. COMS Description

The Monitoring Solutions, Inc. D-R 290 opacity monitoring system consists of four major components: the Transmissometer, the terminal control box, the air-purging system and the remote control unit and data acquisition equipment. The Transmissometer component consists of an optical transmitter/receiver (transceiver) unit mounted on one side of a stack or duct and a retro reflector unit mounted on the opposite side. The transceiver unit contains the light source, the photodiode detector, and the associated electronics. The transceiver uses a single-lamp, single detector system to determine effluent opacity. A LED light source is modulated electronically at 2 KHz to eliminate any ambient light interference. The modulated beam is configured to alternately produce reference and measurement signals so that the effects of variations in the optical and electronic components of the COMS are minimized.

In a single display configuration, an AW unit is mounted in a blue housing next to the transceiver location. In a dual display configuration, an AZ unit is mounted in the blue housing next to the transceiver location and an AW is mounted in a remote location, typically, a control room. The AZ and the AW communicate via an RS 422 cable. The AZ unit provides an on stack readout and can be used as a diagnostic tool. In either configuration, only the AW provides the signals to the final recording device.

The air purging system serves a threefold purpose: 1) it provides an air window to keep exposed optical surfaces clean; 2) it protects the optical surfaces from condensation of stack gas moisture; and 3) it minimizes thermal conduction from the stack to the instrument. A standard installation has one air-purging system for each the transceiver and the retro reflector units.

The opacity monitor measures the amount of light transmitted through the effluent from the transceiver to the retro reflector and back again. The control unit uses the effluent transmittance to calculate the optical density of the effluent at the monitor location, or the “path” optical density. In order to provide stack exit opacity data, the path optical density must be corrected. The correction factor is expressed as the ratio of the stack exit inside diameter to the inside diameter of the stack at the Transmissometer location. This ratio is called the “stack correction factor” (SCF) by Monitoring Solutions, Inc. The following equations illustrate the relationship between this ratio, path optical density, and stack exit opacity.

Calculation of "Stack Correction Factor"

L_x / L_t = stack correction factor

where:

L_x = stack exit inside diameter (in)

L_t = the stack inside diameter (or the duct width) at the monitor location (in).

$OP_x = 1 - (1 - \frac{Opacity}{100})^{correction\ factor}$

OP_x = stack exit opacity (%)

B. Performance Audit Procedures

1. Preliminary Data

a. Obtain the stack exit inside diameter (in feet) and the stack inside diameter at the monitor location (in feet). Record these values in Blanks 1 and 2 of the Monitoring Solutions, Inc. D-R 290 Performance Audit Data Sheet.

Note: Effluent handling system dimensions may be acquired from the following sources listed in descending order of reliability: 1) physical measurements, 2) construction drawings, 3) opacity monitor installation/certification documents, and 4) source personnel recollections.

b. Calculate the stack correction factor (SCF) by dividing the value in Blank 1 by the value in Blank 2. Record the result in Blank 3.

c. Record the source-cited Stack Correction Factor (SCF) in Blank 4.

Note: The stack correction factor (SCF) is preset by the manufacturer using information supplied by the source. The value recorded in Blank 4 should be the value source personnel agree should be set inside the monitor.

d. Obtain the reference zero and span calibration values. Record these values in Blank 5 and Blank 6, respectively.

Note: The reference zero and span calibration values may not be the same as the values recorded during instrument installation and/or certification. The zero and span values recorded in Blank 5 and Blank 6 should be the reference values recorded during the most recent clear-path calibration of the CEMS.

2. Error Checks

The following steps describe the error codes for the Monitoring Solutions, Inc. D-R 290 remote control unit. The audit can continue with the error codes shown below being present, provided the source has been informed of the fault conditions. All other error codes must be corrected prior to audit.

Error code 100 = Transceiver blower fault
Error code 200 = Transceiver filter plugged
Error code 300 = Reflector blower fault
Error code 400 = Reflector filter plugged

Note: If a fault is active, an error code will be displayed on the stack mounted display and on the remote display. An explanation of the error codes can be found in the manual.

3. Instrument Range Check

a. Check the COMS measurement range by pressing the MOD button (the LED on the button will light up) and using the PLUS button to cycle through the displays.

b. Record the instrument range in Blank 11.

4. Reference Signal, Zero and Span Checks

a. Initiate the calibration cycle by pressing the arrow and plus buttons simultaneously and holding for approximately 5 seconds.

Note: The opacity monitor will automatically cycle through the internal zero (zero point check), external zero (window check), span and stack taper ratio modes. Approximately 6 minutes for a complete cycle.

b. Record the milliamp value shown for the internal zero (zero point check) displayed on the control panel display in Blank 12.

Note: The internal zero checks the instrument reference signal (Zero Point Check). Since the instrument provides a full scale output of 4 to 20 milliamps, a value of 4 milliamps displayed on the control unit display represents a zero condition. After 1 ½ minutes in the internal zero mode, the monitor will automatically switch to the external zero mode (Window Check).

c. Record the milliamp value shown for the external zero (window check) displayed on the control panel in Blank 13. Also record the external zero value (in percent opacity) displayed on the opacity data recorder in Blank 14.

(Continued on next page)

Note: During the zero calibration check, the zero mirror is moved into the path of the measurement beam by a servomotor. The zero mechanism is designed to present the transceiver with a simulated clear-path condition. The daily zero check does not test the actual clear-path zero, nor does it provide a check of cross-stack parameters such as the optical alignment of the Transmissometer or drift in the reflectance of the retro reflector. The actual clear-path zero can only be checked during clear-stack or off-stack calibration of the CEMS. In addition to simulating the instrument clear-path zero, the zero mechanism allows the amount of dust on the transceiver optics (primary lens and zero mirror) to be quantified. After 1 ½ minutes in the external zero mode, the CEMS will automatically enter the span mode.

d. Record in Blank 15 the span value (in milliamps) displayed on the control panel display. Also record the span value (in percent opacity) displayed on the data recorder in Blank 16. Go to the Transmissometer location.

Note: During the span calibration check, a servomotor moves an internal span filter into the path of the measurement beam while the zero mirror is in place. The span mechanism is designed to provide an indication of the upscale accuracy of the CEMS relative to the simulated clear-path zero. Note: The opacity monitor display will output its stack correction factor (SCF) for 1 ½ minutes when the span portion of the calibration cycle is completed. The CEMS automatically returns to the measurement mode when the SCF portion of the calibration cycle is complete.

5. Reflector Dust Accumulation Check.

a. Record the effluent opacity prior to cleaning the retroreflector optics in Blank 17.

b. Open the reflector housing, inspect and clean the retroreflector optics, and close the housing.

c. Record the post-cleaning effluent opacity in Blank 18. Go to the transceiver location.

6. Transceiver Dust Accumulation Check.

a. Record the pre-cleaning effluent opacity in Blank 19.

b. Open the transceiver, clean the optics (primary window and zero mirror) and close the transceiver.

c. Record the post-cleaning effluent opacity in Blank 20.

7. Alignment Check

a. Determine the monitor alignment by looking through the alignment port of the side of the transceiver.

b. Observe whether the image is centered in the cross hairs and record this information (YES or NO) in Blank 21.

8. Zero Compensation Check

The Durag 290 provides internal compensation for window contamination. This compensation value can be determined by performing the Window Check. This compensation cannot be disabled for testing. Remove internal compensation as follows: Clean the transceiver window and the zero mirror lens. Verify the window check value is at zero so no compensation is applied to the quarterly audit. Enter the Filter Audit Mode and verify the starting Durag opacity value is zero percent. **NOTE:** This process must be completed prior to the Calibration Error Check.

9. Zero Alignment Error Check

The Zero Alignment Error Check is performed one time each year. This check utilizes Durag's Clear Path Procedure. This procedure verifies the "measuring" zero point of the unit in a known clear path setup. The Transceiver and reflector are removed from their installation and set up on stands in a clean, dust free environment. The stands are set at the same distance as the installation location. Without performing any adjustments, the measuring zero is compared to the simulated zero - or - Window Check. The difference between the measuring zero and the simulated zero, must NOT exceed 2% opacity.

Verify the Zero Compensation Check has been performed. Since the zero compensation function cannot be disabled for the zero alignment check, the optics must be cleaned and a manual calibration performed. This will set the internal compensation value to 0.0%. This MUST be accomplished prior to the Zero Alignment Check.

Perform the following to document the "Zero Alignment Error":

a) Remove the Transceiver & Reflector from its current installation and setup on stands at the exact distance as their original location.

b) Perform the Zero Compensation Check and perform a manual calibration.

c) Record the Durag's response to the clear path zero in % opacity without any adjustment.

d) Activate the simulated zero (Window Check) and record the reading in % opacity without any adjustment.

(continued on next page)

e) The response difference between these two readings are recorded as the "zero alignment error". The maximum allowable zero alignment error is 2%.

f) Adjust the simulated zero (window check) to read the same value in % opacity as the clear path zero.

10. Calibration Error Check

The calibration error check is performed using three neutral density filters. Performing the calibration error check on-stack using the filters determines the linearity of the instrument response relative to the current clear-path zero setting. This calibration error check does not determine the accuracy of the actual instrument clear-path zero or the status of any cross-stack parameters. A true calibration check is performed by moving the on-stack components to a location with minimal ambient opacity, making sure that the proper path length and alignments are attained, and then placing the calibration filters in the measurement path.

a. Put the monitor in Filter Audit mode.

b. Wait approximately three minutes or until a clear "zero" value has been recorded and displayed on the data recorder.

c. Record the audit filter serial numbers and opacity values in Blanks 22, 23, and 24.

d. Remove the filters from their protective covers, inspect and if necessary, clean them.

e. Insert the low range neutral density filter into the filter audit slot located in front of the heated lens.

f. Wait approximately three minutes or until a clear value has been recorded and displayed on the data recorder.

Note: The audit data should be taken from a data recording/reporting device that presents instantaneous opacity (or opacity data with the shortest available integration period).

g. Record the COMS response to the low range neutral density filter.

h. Remove the low range filter and insert the mid range neutral density filter.

i. Wait approximately three minutes and record the COMS response to the mid range neutral density filter.

j. Remove the mid range filter and insert the high range filter.

k. Wait approximately three minutes and record the COMS response to the high range neutral density filter.

(continued on next page)

l. Remove the high range filter.

m. * If applicable, wait approximately three minutes, and record the zero value.

n. Repeat steps (e) through (m) until a minimum of three opacity readings are obtained for each neutral density filter.

o. If six-minute integrated opacity data is required, repeat steps (e) through (m) once more, changing the waiting periods to 13 minutes.

p. Record the six-minute integrated data.

Note: In order to acquire valid six-minute averaged opacity data, each filter must remain in for at least two consecutive six-minute periods; the first period will be invalid because it was in progress when the filter was inserted. A waiting period of 13 minutes is recommended. You should have a "starting zero" reading and an "ending zero" reading.

q. When the calibration error check is complete, return the monitor to measuring mode. Close the transceiver head and the weather cover, and return to the COMS control unit.

11. Test Conclusion

a. Obtain a copy of the audit data from the data recorder.

b. Transcribe the calibration error response from the data recorder to Blanks 25 through 50 of the audit form and complete the audit data calculations.

C. Interpretation of Audit Results

This section is designed to help the auditor interpret the D-R 290 performance audit results.

Error codes / fault analysis

Error codes are typically associated with parameters that the monitor manufacturer feels are critical to COMS function, and to the collection of valid opacity data. The parameters associated with each of the error codes are found in the manufacturer's manual. With the exception of alarms that warn of elevated opacity levels (alarm or warning lamps), the error codes indicate that the COMS is not functioning properly. An error or failure indication will be represented by a "YES" in Blanks 7 - 10.

(continued on next page)

Stack Exit Correlation Error Check

The path length correction error in Blank 51 should be within +2%. This error exponentially affects the opacity readings, resulting in over - or - underestimation of the stack exit opacity. The most common error in computing the optical path length correction factor is the use of the flange-to-flange distance in place of the stack/duct inside diameter at the monitor location. This error will result in underestimation of the stack exit opacity and can be identified by comparing the monitor optical path length to the flange-to-flange distance; the flange-to-flange distance should be greater by approximately two to four feet

Control Panel Meter Error (Optional)

The accuracy of the control panel meter (AW) is important at sources using the meter during monitor adjustment and calibration. The accuracy of the control panel meter (Blank 52 and Blank 54) is determined by comparing the zero and span reference values to the panel meter output recorded during the COMS calibration check.

Note: Some installations utilize a different "Instrument Range Setting" than the normal 100% range. The panel meter span error must be corrected for the different range in order to provide an accurate error result. Use the following equation to calculate the span error corrected for "Instrument Range" (Blank 11):

Panel Meter span error in % opacity =

$$(((\text{Blank 15} - 4) \div 16) \times \text{Blank 11}) - \text{Blank 6}$$

Zero and Span Checks

The D-R 290 internal zero or "zero point check" (Blank 12 should be set to indicate 0% opacity (equivalent to 3.7 - 4.3 mA). An external zero error or "window check" (Blank 53) greater than 4% opacity is usually due to excessive dust accumulation on the optical surfaces, electronic drift or an electronic/mechanical offset of the data recorder. Excessive dust on the optical surfaces sufficient to cause a significant zero error would be indicated by the difference in the internal and external zero values and/or window alarm. Instrument span error (Blank 55) may be caused by the same problem(s) that cause zero errors and may be identified in a similar fashion.

If the zero and span errors are due to a data recorder offset, both errors will be in the same direction and will be of the same magnitude

(continued on next page)

The external zero displayed on the control unit panel meter (AW) also indicates the level of dust accumulation on the zero retroreflector and transceiver measurement window. The difference between the internal and external zero responses should equal the amount of dust found on the transceiver optics (Blank 57). To convert the zero responses to a value that represents lens dusting in percent opacity, use the following equation.

Meter response in % opacity = 6.25 [(Blank 13) - (Blank 12)]

Optical Alignment Check

When the transceiver and retroreflector are misaligned, a portion of the measurement beam that should be returned to the measurement detector is misdirected, resulting in a positive bias in the data reported by the COMS. One of the most common causes of misalignment is vibration which may cause the on-stack components to shift slightly on the instrument mounting flanges. Another common cause of misalignment is thermal expansion and contraction of the structure on which the transmissometer is mounted. If the COMS is being audited while the unit is off-line (cold stack), the results of the alignment analysis may not be representative of the alignment of the instrument when the stack or duct is at normal operating temperature. When checking the alignment, the reflected light beam should be centered.

Zero Compensation Check

The Zero Compensation Check should be performed and documented as such in (Blank 21a).

Annual Zero Alignment Error Check

The Zero Alignment Error Check is performed once each year. It verifies that the enegy output from the simulated zero device (Window Check) is within 2% of the Clear Path reading. The values required for this check are documented in (Blank 21b). If the difference between the Clear Path Value and the Simulated Zero (Window Check) value differ by more than 2%, then the COMS unit is considered Out Of Control. If the difference is 2% or less, then the Window Check Value is adjusted to match the Clear Path value.

Optical Surface Dust Accumulation Check

The results of the dust accumulation check (Blank 58) should not exceed 4%. A dust accumulation value of more than 4% opacity indicates that the air flow of the purge system and/or the cleaning frequency of the optical surfaces are inadequate. When determining the optical surface dust accumulation, the auditor should note whether the effluent opacity is relatively stable (within +2% opacity) before and after cleaning the optical surfaces. If the effluent opacity is fluctuating by more that +2%, the dust accumulation analysis should be omitted.

(continued on next page)

Calibration Error

Calibration error results (Blanks 68, 69 and 70) in excess of +3% are indicative of a non-linear or miss calibrated instrument. However, the absolute calibration accuracy of the monitor can be determined only when the instrument clear-path zero value is known. If the zero and span data are out-of-specification, the calibration error data will often be biased in the direction of the zero and span errors. Even if the zero and span data indicate that the COMS is calibrated properly, the monitor may still be inaccurate due to error in the clear-path zero adjustment. The optimum calibration procedure involves using neutral density filters during clear-stack or off-stack COMS calibration. This procedure would establish both the absolute calibration accuracy and linearity of the COMS. If this procedure is impractical, and it is reasonable to assume that the clear-path zero is set correctly, the monitor's calibration can be set using either the neutral density filters or the internal zero and span values.

Appendix A
COMS Audit Data Forms for the Durag Model D-R 290

AUDIT DATA SHEET
MONITORING SOLUTIONS DURAG D-R 290 COMS

Company: Primary Energy
Unit ID: Stack 201
Auditor: Dan Bowles
Attendees: N/A
Transceiver serial number: 1248342
Reflector serial number: 1248145
Remote serial number 1248283
Date: 3/3/2020

City, ST: E. Chicago, IN
Representing: Monitoring Solutions
Representing:

COMS Flange to Flange distance (Feet / Inches): 226.125"

Preliminary Data

1	Inside diameter at Stack Exit = Lx	216.000 inches
2	Inside diameter at the Transmissometer location = Lt	216.000 inches
3	Calculated Stack Correction Factor (SCF) = Lx/Lt	1.000
4	Source-cited Stack Correction Factor (SCF)	1.000
5	Source-cited zero automatic calibration value (% opacity)	0.00 %
6	Source-cited span automatic calibration value (% opacity)	40.00 %

[START AT CONTROL UNIT / DATA RECORDER LOCATION]

(If required) [INSPECT DATA RECORDING SYSTEM AND MARK WITH "OPACITY AUDIT," AUDITOR'S NAME, AFFILIATION, DATE, SOURCE, PROCESS UNIT/STACK IDENTIFICATION, AND THE TIME OF DAY.]

Error codes / faults	YES - or - NO
7 Blower [Loss of purge air from blower - Error 100, 300]	NO
8 Filter [Air filter restriction - Error 200, 400]	NO
9 Window [Excessive dirt on transceiver window - Error 001]	NO
10 Fault [Additional CEMS fault has occurred. Note fault code on Opacity display and consult the instrument manual.]	NO

Instrument Range Check

11	Instrument range setting	100 %

Zero Check

12	Opacity Display - Internal zero value in "milliamps" (Zero Point Check) [Wait for 1½ minutes for automatic change to external zero mode.]	4.00 mA
13	Opacity Display - Zero calibration value in "milliamps" (Window Check)	4.00 mA
14	Opacity data recorder zero calibration value in "% Op" (Window Check) [Wait 1½ minutes for automatic change to span mode.]	0.00 mA

Span Check

15	Opacity Display - Span calibration value in "milliamps" (Span Check)	10.40 mA
16	Opacity data recorder span calibration value in "% Op" (Span Check)	40.00 %

[Go to reflector location.]

AUDIT DATA SHEET
MONITORING SOLUTIONS DURAG D-R 290 COMS

Reflector Dust Accumulation Check

17 Pre-cleaning effluent opacity (% Op) 3.6 %

[Inspect and clean optical surface.]

18 Post-cleaning effluent opacity (% Op) 3.5 %

[Go to transceiver location.]

Transceiver Dust Accumulation Check and Zero Compensation Check

19 Pre-cleaning effluent opacity (% Op) 3.5 %

[Inspect and clean optical window and zero mirror.]

20 Post-cleaning effluent opacity (% Op) 2.9 %

Optical Alignment Check

[LOOK THROUGH ALIGNMENT SIGHT AND DETERMINE IF BEAM IMAGE IS CENTERED.]

21 Is the image centered?

YES - or - NO
YES

Zero Compensation Check

21a Did you comply with the Zero Compensation Check?

YES - or - NO
YES

Annual Zero Alignment Error Check

21b Did you comply with the Annual Zero Alignment Error Check?

YES - or - NO
NO

Zero Alignment Check results (if applicable):

Clear Path Value % = N/A Window Check Value % = N/A Zero Alignment Error % = N/A

[Record audit filter data.]

Filter	Serial NO.	% Opacity	SCF%
22 LOW	YB11	15.80	15.80 %
23 MID	YB12	26.00	26.00 %
24 HIGH	ZA44	49.30	49.30 %

[Remove the audit filters from the protective covers, inspect, and clean each filter]

[Set the unit up to display the initial zero. Wait 3 minutes to allow opacity data recorder to record initial zero]

[Insert a filter, wait approximately 3 minutes, and record the opacity value reported by the opacity data recorder. Repeat the process 5 times for each filter.]

[Read and transcribe final calibration error data from the opacity data recorder on the next page]

AUDIT DATA SHEET
MONITORING SOLUTIONS DURAG D-R 290 COMS

25 ZERO 0.00

	LOW		MID		HIGH		(If Required) ZERO
26	16.00	27	26.40	28	49.40	29	N/A
30	16.10	31	26.40	32	49.40	33	N/A
34	16.10	35	26.40	36	49.50	37	N/A
38	16.10	39	26.40	40	49.40	41	N/A
42	16.10	43	26.40	44	49.50	45	0.00

[Six-minute average data, if applicable.]

	ZERO		LOW		MID		HIGH		(If Required) ZERO
46	0.00	47	16.10	48	26.40	49	49.50	50	0.00

Reserved Area

Calculation of Audit Results

Stack Correction Factor correlation error (%):

51 $$\left[\frac{Blank\ 4^{1.000} - Blank\ 3^{1.000}}{Blank\ 3^{1.000}}\right] \times 100 = 0.00$$

Zero Error (% Op.):

52 Opacity Display $6.25 * (Blank\ 13^{4.00} - 4.0) - Blank\ 5^{0.00} = 0.00\ \%$

		0.00		0.00			
53	Opacity Data Recorder	Blank 14	-	Blank 5	=	0.00	

AUDIT DATA SHEET
MONITORING SOLUTIONS DURAG D-R 290 COMS

Span Error (% Op.):

		10.40		100	40.00		
54	Opacity Display	(((Blank 15 - 4.0) ÷ 16) ×	Blank 11) -		Blank 6	=	0.00 %
		40		40			
55	Opacity Data Recorder	Blank 16	-	Blank 6		=	0.00

Optical Surface Dust Accumulation (% OP):

	3.6		3.5			
56	Retroreflector	Blank 17	-	Blank 18	=	0.10 %
	3.5		2.9			
57	Transceiver	Blank 19	-	Blank 20	=	0.60 %
	0.1		0.6			
58	Total	Blank 56	+	Blank 57	=	0.70 %

Optical Path Length Correction (SCF)
Audit Filters Corrected for Path Length:

59	LOW:	15.80 1.000		
		$1 - (1 - (\frac{Blank\ 22}{100})^{Blank\ 4})\ x\ 100$	=	15.80 %
60	MID:	26.00 1.000		
		$1 - (1 - (\frac{Blank\ 23}{100})^{Blank\ 4})\ x\ 100$	=	26.00 %
61	HIGH	49.30 1.000		
		$1 - (1 - (\frac{Blank\ 24}{100})^{Blank\ 4})\ x\ 100$	=	49.30 %

AUDIT DATA SHEET
MONITORING SOLUTIONS DURAG D-R 290 COMS

Auditor: Dan Bowles Date: 03/03/20
Source: Primary Energy Unit: Stack 201

PARAMETER		Blank No.	Audit Results	Specifications
Error Codes/Faults				
Blower failure		7	NO	NO
Filter Blockage		8	NO	NO
Window		9	NO	NO
Fault		10	NO	NO
SCF Correlation Error		51	0.00	+/- 2% Op
Internal Zero Error	Display	52	0.00	+/- 4% Op
	Data	53	0.00	+/- 4% Op
Internal Span Error	Display	54	0.00	+/- 4% Op
	Data	55	0.00	+/- 4% Op
Optical Alignment Analysis		21	YES	YES = Centered
Zero Compensation Check		21a	YES	YES = Complied With
Zero Alignment Error		21b	N/A	≤ 2% Op
Optical Surface Dust Accumulation				
Retroreflector		56	0.10	≤ 2% Op
Transceiver		57	0.60	≤ 2% Op
Total		58	0.70	≤ 4% Op
Calibration Error Analysis				
Arithmetic Mean Difference				
	LOW	62	0.28	
		71a	0.30	
	MID	63	0.40	
		72a	0.40	
	HIGH	64	0.14	
		73a	0.20	
Confidence Coeffecient				
		65	0.06	
		66	0.00	
		67	0.07	
Calibration Error				
		68	0.34	≤ 3% Op
		69	0.40	≤ 3% Op
		70	0.21	≤ 3% Op

Revision: March, 2016

OPACITY LOW FILTER AUDIT

Accuracy Determination

Primary Energy E. Chicago, IN Stack 201 3/3/2020

LOW FILTER RUN	Opacity Output from Recording Device	Audit Filter Value Corrected for Path Length (SCF)	(FILTER-MONITOR) Difference	Difference^2
		RM	(X_i)	X_i^2
1	16.00	15.80	0.20	0.0400
2	16.10	15.80	0.30	0.0900
3	16.10	15.80	0.30	0.0900
4	16.10	15.80	0.30	0.0900
5	16.10	15.80	0.30	0.0900

n = 5

t(0.975) = 2.776

Mean Ref. Method Value	**15.8000**	***RM***
Sum of Differences	**1.4000**	***Xi***
Arithmetic Mean Difference	**0.2800**	***Xi ave***
Sum of Differences Squared	**0.4000**	***Xi^2***
Standard Deviation	**0.0447**	***sd***
2.5% Error Conf.Coef	**0.0555**	***CC***
Calibration Error	**0.3355**	***percent***

OPACITY MID FILTER AUDIT

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 3/3/2020

MID FILTER RUN	Opacity Output from Recording Device	Audit Filter Value Corrected for Path Length (SCF)	(FILTER-MONITOR) Difference	Difference^2
		RM	**(X_i)**	**X_i^2**
1	26.40	26.00	0.40	0.1600
2	26.40	26.00	0.40	0.1600
3	26.40	26.00	0.40	0.1600
4	26.40	26.00	0.40	0.1600
5	26.40	26.00	0.40	0.1600

n = 5

t(0.975) = 2.776

Mean Ref. Method Value	**26.0000**	***RM***
Sum of Differences	**2.0000**	***Xi***
Arithmetic Mean Difference	**0.4000**	***Xi ave***
Sum of Differences Squared	**0.8000**	***Xi^2***
Standard Deviation	**0.0000**	***sd***
2.5% Error Conf.Coef	**0.0000**	***CC***
Calibration Error	**0.4000**	***percent***

OPACITY HIGH FILTER AUDIT

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 3/3/2020

HIGH FILTER RUN	Opacity Output from Recording Device	Audit Filter Value Corrected for Path Length (SCF)	(FILTER-MONITOR) Difference	Difference^2
		RM	**(X_i)**	**X_i^2**
1	49.40	49.30	0.10	0.0100
2	49.40	49.30	0.10	0.0100
3	49.50	49.30	0.20	0.0400
4	49.40	49.30	0.10	0.0100
5	49.50	49.30	0.20	0.0400

n = 5

t(0.975) = 2.776

Mean Ref. Method Value	**49.3000**	***RM***
Sum of Differences	**0.7000**	***Xi***
Arithmetic Mean Difference	**0.1400**	***Xi ave***
Sum of Differences Squared	**0.1100**	***Xi^2***
Standard Deviation	**0.0548**	***sd***
2.5% Error Conf.Coef	**0.0680**	***CC***
Calibration Error	**0.2080**	***percent***

03/03/2020	OPACITY, %	
09:37		
09:37:01	0.0	MOS
09:37:03	0.0	MOS
09:37:05	0.0	MOS
09:37:07	0.0	MOS
09:37:09	0.0	MOS
09:37:11	0.0	MOS
09:37:13	0.0	MOS
09:37:15	0.0	MOS
09:37:17	0.0	MOS
09:37:19	0.0	MOS
09:37:21	0.0	MOS
09:37:23	0.0	MOS
09:37:25	0.0	MOS
09:37:27	0.0	MOS
09:37:29	2.5	MOS
09:37:31	7.5	MOS
09:37:33	11.5	MOS
09:37:35	15.5	MOS
09:37:37	16.1	MOS
09:37:39	16.0	MOS
09:37:41	16.0	MOS
09:37:43	16.0	MOS
09:37:45	16.0	MOS
09:37:47	16.0	MOS
09:37:49	16.0	MOS
09:37:51	16.0	MOS
09:37:53	16.0	MOS
09:37:56	16.1	MOS
09:37:58	16.1	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

03/03/2020	OPACITY, %	
09:38		
09:38:00	16.1	MOS
09:38:02	16.1	MOS
09:38:04	16.1	MOS
09:38:06	16.1	MOS
09:38:08	15.1	MOS
09:38:10	15.7	MOS
09:38:12	18.3	MOS
09:38:14	21.1	MOS
09:38:16	24.4	MOS
09:38:18	26.4	MOS
09:38:20	26.4	MOS
09:38:22	26.4	MOS
09:38:24	26.4	MOS
09:38:26	26.4	MOS
09:38:28	26.4	MOS
09:38:30	26.4	MOS
09:38:32	26.4	MOS
09:38:34	26.4	MOS
09:38:36	26.4	MOS
09:38:38	26.4	MOS
09:38:40	26.4	MOS
09:38:42	21.7	MOS
09:38:44	27.4	MOS
09:38:46	33.2	MOS
09:38:48	39.0	MOS
09:38:50	48.2	MOS
09:38:52	49.4	MOS
09:38:54	49.4	MOS
09:38:56	49.4	MOS
09:38:58	49.5	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

03/03/2020	OPACITY, %	
09:39		
09:39:00	49.4	MOS
09:39:02	49.4	MOS
09:39:04	49.4	MOS
09:39:06	49.5	MOS
09:39:08	49.4	MOS
09:39:10	49.5	MOS
09:39:12	49.5	MOS
09:39:14	49.5	MOS
09:39:16	49.5	MOS
09:39:18	49.5	MOS
09:39:20	46.4	MOS
09:39:22	35.9	MOS
09:39:24	27.6	MOS
09:39:26	19.3	MOS
09:39:28	13.9	MOS
09:39:30	16.1	MOS
09:39:32	16.1	MOS
09:39:34	16.1	MOS
09:39:36	16.1	MOS
09:39:38	16.1	MOS
09:39:40	16.1	MOS
09:39:42	16.1	MOS
09:39:44	16.1	MOS
09:39:46	16.1	MOS
09:39:48	16.1	MOS
09:39:50	16.1	MOS
09:39:52	16.1	MOS
09:39:54	16.1	MOS
09:39:56	16.1	MOS
09:39:58	16.1	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

03/03/2020	OPACITY, %	
09:40		
09:40:00	16.1	MOS
09:40:02	18.0	MOS
09:40:04	20.6	MOS
09:40:06	23.8	MOS
09:40:08	26.4	MOS
09:40:10	26.4	MOS
09:40:12	26.4	MOS
09:40:14	26.4	MOS
09:40:16	26.4	MOS
09:40:18	26.4	MOS
09:40:20	26.4	MOS
09:40:22	26.4	MOS
09:40:24	26.4	MOS
09:40:26	26.4	MOS
09:40:28	26.4	MOS
09:40:30	26.4	MOS
09:40:32	26.4	MOS
09:40:34	26.4	MOS
09:40:37	26.4	MOS
09:40:39	26.4	MOS
09:40:41	23.2	MOS
09:40:43	29.0	MOS
09:40:45	34.7	MOS
09:40:47	40.5	MOS
09:40:49	49.4	MOS
09:40:51	49.4	MOS
09:40:53	49.4	MOS
09:40:55	49.4	MOS
09:40:57	49.4	MOS
09:40:59	49.4	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

03/03/2020	OPACITY, %	
09:41		
09:41:01	49.4	MOS
09:41:03	49.4	MOS
09:41:05	49.4	MOS
09:41:07	49.4	MOS
09:41:09	49.4	MOS
09:41:11	49.4	MOS
09:41:13	49.4	MOS
09:41:15	49.4	MOS
09:41:17	49.5	MOS
09:41:19	49.4	MOS
09:41:21	38.9	MOS
09:41:23	30.6	MOS
09:41:25	23.9	MOS
09:41:27	16.0	MOS
09:41:29	16.1	MOS
09:41:31	16.1	MOS
09:41:33	16.1	MOS
09:41:35	16.1	MOS
09:41:37	16.1	MOS
09:41:39	16.1	MOS
09:41:41	16.1	MOS
09:41:43	16.1	MOS
09:41:45	16.1	MOS
09:41:47	16.1	MOS
09:41:49	16.1	MOS
09:41:51	16.1	MOS
09:41:53	16.1	MOS
09:41:55	16.1	MOS
09:41:57	16.1	MOS
09:41:59	16.1	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

03/03/2020	OPACITY, %	
09:42		
09:42:01	16.7	MOS
09:42:03	19.3	MOS
09:42:05	21.9	MOS
09:42:07	24.5	MOS
09:42:09	26.4	MOS
09:42:11	26.4	MOS
09:42:13	26.4	MOS
09:42:15	26.4	MOS
09:42:17	26.4	MOS
09:42:19	26.4	MOS
09:42:21	26.4	MOS
09:42:23	26.4	MOS
09:42:25	26.4	MOS
09:42:27	26.4	MOS
09:42:29	26.4	MOS
09:42:31	26.4	MOS
09:42:33	26.4	MOS
09:42:35	26.4	MOS
09:42:37	24.8	MOS
09:42:39	25.2	MOS
09:42:41	32.5	MOS
09:42:43	38.2	MOS
09:42:45	47.2	MOS
09:42:47	49.4	MOS
09:42:49	49.4	MOS
09:42:51	49.4	MOS
09:42:53	49.5	MOS
09:42:55	49.5	MOS
09:42:57	49.4	MOS
09:42:59	49.4	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

03/03/2020	OPACITY, %	
09:43		
09:43:01	49.4	MOS
09:43:03	49.4	MOS
09:43:05	49.4	MOS
09:43:07	49.4	MOS
09:43:09	49.4	MOS
09:43:11	49.4	MOS
09:43:13	49.4	MOS
09:43:15	43.3	MOS
09:43:17	34.7	MOS
09:43:20	26.4	MOS
09:43:22	18.1	MOS
09:43:24	15.9	MOS
09:43:26	16.1	MOS
09:43:28	16.1	MOS
09:43:30	16.1	MOS
09:43:32	16.1	MOS
09:43:34	16.1	MOS
09:43:36	16.1	MOS
09:43:38	16.1	MOS
09:43:40	16.1	MOS
09:43:42	16.1	MOS
09:43:44	16.1	MOS
09:43:46	16.1	MOS
09:43:48	16.1	MOS
09:43:50	12.7	MOS
09:43:52	14.6	MOS
09:43:54	17.2	MOS
09:43:56	20.2	MOS
09:43:58	26.3	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

03/03/2020	OPACITY, %	
09:44		
09:44:00	26.4	MOS
09:44:02	26.4	MOS
09:44:04	26.4	MOS
09:44:06	26.4	MOS
09:44:08	26.4	MOS
09:44:10	26.4	MOS
09:44:12	26.4	MOS
09:44:14	26.4	MOS
09:44:16	26.4	MOS
09:44:18	26.4	MOS
09:44:20	26.4	MOS
09:44:22	26.4	MOS
09:44:24	26.4	MOS
09:44:26	26.4	MOS
09:44:28	26.4	MOS
09:44:30	21.3	MOS
09:44:32	25.7	MOS
09:44:34	31.5	MOS
09:44:36	37.2	MOS
09:44:38	48.1	MOS
09:44:40	49.4	MOS
09:44:42	49.4	MOS
09:44:44	49.4	MOS
09:44:46	49.4	MOS
09:44:48	49.4	MOS
09:44:50	49.4	MOS
09:44:52	49.4	MOS
09:44:54	49.4	MOS
09:44:56	49.4	MOS
09:44:58	49.4	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

03/03/2020	OPACITY, %	
09:45		
09:45:00	49.4	MOS
09:45:02	49.5	MOS
09:45:04	49.4	MOS
09:45:06	49.4	MOS
09:45:08	49.4	MOS
09:45:10	49.4	MOS
09:45:12	38.9	MOS
09:45:14	30.5	MOS
09:45:16	22.2	MOS
09:45:18	14.9	MOS
09:45:20	16.1	MOS
09:45:22	16.1	MOS
09:45:24	16.1	MOS
09:45:26	16.1	MOS
09:45:28	16.1	MOS
09:45:30	16.1	MOS
09:45:32	16.1	MOS
09:45:34	16.1	MOS
09:45:36	16.1	MOS
09:45:38	16.1	MOS
09:45:40	16.1	MOS
09:45:42	16.1	MOS
09:45:44	16.1	MOS
09:45:46	16.1	MOS
09:45:48	15.9	MOS
09:45:50	15.1	MOS
09:45:52	17.7	MOS
09:45:54	20.2	MOS
09:45:56	22.9	MOS
09:45:58	26.4	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

03/03/2020	OPACITY, %	
09:46		
09:46:01	26.4	MOS
09:46:03	26.4	MOS
09:46:05	26.4	MOS
09:46:07	26.4	MOS
09:46:09	26.4	MOS
09:46:11	26.4	MOS
09:46:13	26.4	MOS
09:46:15	26.4	MOS
09:46:17	26.4	MOS
09:46:19	26.4	MOS
09:46:21	26.4	MOS
09:46:23	26.4	MOS
09:46:25	26.4	MOS
09:46:27	24.8	MOS
09:46:29	23.0	MOS
09:46:31	28.8	MOS
09:46:33	34.3	MOS
09:46:35	40.4	MOS
09:46:37	49.4	MOS
09:46:39	49.4	MOS
09:46:41	49.4	MOS
09:46:43	49.5	MOS
09:46:45	49.5	MOS
09:46:47	49.5	MOS
09:46:49	49.5	MOS
09:46:51	49.4	MOS
09:46:53	49.4	MOS
09:46:55	49.4	MOS
09:46:57	49.5	MOS
09:46:59	49.5	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

03/03/2020	OPACITY, %	
09:47		
09:47:01	49.4	MOS
09:47:03	49.4	MOS
09:47:05	40.4	MOS
09:47:07	32.1	MOS
09:47:09	24.1	MOS
09:47:11	15.4	MOS
09:47:13	16.1	MOS
09:47:15	16.1	MOS
09:47:17	16.1	MOS
09:47:19	16.1	MOS
09:47:21	16.1	MOS
09:47:23	16.1	MOS
09:47:25	16.1	MOS
09:47:27	16.1	MOS
09:47:29	16.1	MOS
09:47:31	16.1	MOS
09:47:33	15.4	MOS
09:47:35	14.6	MOS
09:47:37	17.2	MOS
09:47:39	20.4	MOS
09:47:41	23.9	MOS
09:47:43	26.4	MOS
09:47:45	26.4	MOS
09:47:47	26.4	MOS
09:47:49	26.4	MOS
09:47:51	26.4	MOS
09:47:53	26.4	MOS
09:47:55	26.4	MOS
09:47:57	26.4	MOS
09:47:59	26.4	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

03/03/2020	OPACITY, %	
09:48		
09:48:01	26.4	MOS
09:48:03	26.4	MOS
09:48:05	26.4	MOS
09:48:07	26.4	MOS
09:48:09	23.1	MOS
09:48:11	22.0	MOS
09:48:13	27.8	MOS
09:48:15	33.5	MOS
09:48:17	41.8	MOS
09:48:19	49.4	MOS
09:48:21	49.4	MOS
09:48:23	49.4	MOS
09:48:25	49.4	MOS
09:48:27	49.4	MOS
09:48:29	49.4	MOS
09:48:31	49.4	MOS
09:48:33	49.4	MOS
09:48:35	49.4	MOS
09:48:37	49.4	MOS
09:48:39	49.4	MOS
09:48:41	49.4	MOS
09:48:44	49.4	MOS
09:48:46	49.4	MOS
09:48:48	49.4	MOS
09:48:50	43.7	MOS
09:48:52	32.2	MOS
09:48:54	19.9	MOS
09:48:56	7.5	MOS
09:48:58	0.0	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

03/03/2020	OPACITY, %	
09:49		
09:49:00	0.0	MOS
09:49:02	0.0	MOS
09:49:04	0.0	MOS
09:49:06	0.0	MOS
09:49:08	0.0	MOS
09:49:10	0.0	MOS
09:49:12	0.0	MOS
09:49:14	0.0	MOS
09:49:16	0.0	MOS
09:49:18	0.0	MOS
09:49:20	0.0	MOS
09:49:22	0.0	MOS
09:49:24	0.0	MOS
09:49:26	0.0	MOS
09:49:28	0.0	MOS
09:49:30	0.0	MOS
09:49:32	0.0	MOS
09:49:34	0.0	MOS
09:49:36	0.0	MOS
09:49:38	0.0	MOS
09:49:40	0.0	MOS
09:49:42	0.0	MOS
09:49:44	0.0	MOS
09:49:46	0.0	MOS
09:49:48	0.0	MOS
09:49:50	0.0	MOS
09:49:52	0.0	MOS
09:49:54	0.0	MOS
09:49:56	0.0	MOS
09:49:58	0.0	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

OPACITY FILTER AUDIT

*** 6-minute Averages ***

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 3/3/2020

6 Minute Averages	Opacity Output from Recording Device	Audit Filter Value Corrected for Path Length (SCF)	(FILTER-MONITOR) Difference	Opacity Error
		RM	(Xi)	
ZERO	0.00	0.00	0.00	**0.00**
LOW	16.10	15.80	0.30	**0.30**
MID	26.40	26.00	0.40	**0.40**
HIGH	49.50	49.30	0.20	**0.20**
ZERO	0.00	0.00	0.00	**0.00**

Primary Energy Coke

Opacity Report

Created on : Mar 06, 2020 12:58:16

East Chicago, IN

03/03/2020 - 03/03/2020

03/03/2020

STACK 201

Hour	Opac, % Minutes 0 - 5	Opac, % Minutes 6 - 11	Opac, % Minutes 12 - 17	Opac, % Minutes 18 - 23	Opac, % Minutes 24 - 29	Opac, % Minutes 30 - 35	Opac, % Minutes 36 - 41	Opac, % Minutes 42 - 47	Opac, % Minutes 48 - 53	Opac, % Minutes 54 - 59
0	3.1 SVC	2.9 SVC	2.9 SVC	3.0 SVC	2.6 SVC	2.7 SVC	2.5 SVC	2.9 SVC	2.9 SVC	2.7 SVC
1	2.6 SVC	2.7 SVC	2.4 SVC	2.5 SVC	2.5 SVC	2.8 SVC	2.9 SVC	2.6 SVC	2.4 SVC	2.8 SVC
2	2.4 SVC	2.3 SVC	2.5 SVC	2.7 SVC	2.9 SVC	2.8 SVC	2.7 SVC	3.0 SVC	2.8 SVC	2.8 SVC
3	2.8 SVC	2.7 SVC	3.0 SVC	3.1 SVC	2.9 SVC	3.0 SVC	3.1 SVC	2.6 SVC	2.8 SVC	2.9 SVC
4	3.2 SVC	3.2 SVC	3.1 SVC	3.1 SVC	3.5 SVC	2.8 SVC	2.8 SVC	3.0 SVC	3.2 SVC	3.3 SVC
5	3.6 SVC	3.0 SVC	3.4 SVC	3.1 SVC	2.9 SVC	3.0 SVC	2.7 SVC	2.9 SVC	3.2 SVC	3.3 NSA
6	4.4 SVC	3.4 SVC	2.8 SVC	3.0 SVC	3.4 SVC	3.2 SVC	3.3 SVC	3.6 SVC	3.3 SVC	3.1 SVC
7	2.9 SVC	3.0 SVC	3.5 SVC	3.3 SVC	3.5 SVC	4.0 SVC	3.4 SVC	3.0 SVC	3.1 SVC	3.1 SVC
8	3.6 SVC	3.4 SVC	3.5 SVC	3.8 SVC	3.5 SVC	3.1 SVC	3.3 SVC	3.3 SVC	3.6 SVC	3.5 NSA
9	3.5 MOS	3.9 MOS	3.7 MOS	3.1 MOS	3.0 MOS	10.9 MOS	23.7 MOS	29.5 MOS	6.3 MOS	0.0 MOS
10	7.4 MOS	16.1 MOS	17.0 MOS	26.4 MOS	26.4 MOS	46.3 MOS	49.5 MOS	17.2 MOS	0.0 MOS	1.7 MOS
11	3.0 NSA	2.9 SVC	3.3 SVC	3.5 SVC	3.8 SVC	4.1 SVC	4.1 SVC	4.3 SVC	4.2 SVC	4.0 SVC
12	4.4 SVC	4.2 SVC	4.4 SVC	4.8 SVC	4.6 SVC	4.2 SVC	4.2 SVC	4.0 SVC	4.3 SVC	4.2 SVC
13	4.1 SVC	4.7 SVC	5.0 SVC	4.3 SVC	4.4 SVC	4.0 SVC	4.4 SVC	4.2 SVC	4.1 SVC	4.1 SVC
14	5.0 SVC	4.4 SVC	4.1 SVC	4.2 SVC	4.2 SVC	4.1 SVC	4.3 SVC	4.5 SVC	5.2 SVC	4.8 SVC
15	4.3 SVC	4.3 SVC	4.2 SVC	3.9 SVC	4.0 SVC	4.1 SVC	4.9 SVC	5.0 SVC	4.1 SVC	4.0 SVC
16	4.0 SVC	3.9 SVC	3.7 SVC	4.0 SVC	4.5 SVC	4.8 SVC	4.1 SVC	3.8 SVC	3.9 SVC	4.2 SVC
17	3.9 SVC	3.9 SVC	4.0 SVC	4.4 SVC	4.0 SVC	3.8 SVC	4.0 SVC	4.1 SVC	4.2 SVC	4.2 SVC
18	4.4 SVC	4.1 SVC	4.0 SVC	4.2 SVC	4.1 SVC	4.0 SVC	3.7 SVC	3.6 SVC	3.7 SVC	3.7 SVC
19	3.9 SVC	4.2 SVC	4.1 SVC	4.3 SVC	4.0 SVC	3.9 SVC	4.1 SVC	4.4 SVC	3.9 SVC	3.9 SVC
20	3.8 SVC	3.7 SVC	3.7 SVC	3.7 SVC	3.8 SVC	4.0 SVC	3.9 SVC	3.8 SVC	4.0 SVC	3.9 SVC
21	3.8 SVC	4.1 SVC	3.8 SVC	3.6 SVC	3.7 SVC	3.6 SVC	3.5 SVC	3.7 SVC	3.6 SVC	3.9 SVC
22	4.1 SVC	3.8 SVC	4.0 SVC	3.7 SVC	3.6 SVC	3.7 SVC	4.1 SVC	3.6 SVC	3.6 SVC	3.4 SVC
23	3.5 SVC	3.5 SVC	3.5 SVC	3.7 SVC	3.7 SVC	4.0 SVC	4.3 SVC	4.0 SVC	4.0 SVC	3.9 SVC

Status Code Definitions

MOS = MONITOR OUT OF SERVICE NSA = NO SAMPLE AVAILABLE SVC = MONITOR IN SERVICE

The average opacity period average for the day was 3.6 % for 217 periods of valid data.

The Fan was in operation for 240 periods

The maximum opacity period average for the day was 5.2 %

There were 23 periods of invalid data

APPENDIX B
AUDIT FILTER CERTIFICATION SHEETS

CYLINDER GAS AUDIT

FOR

Primary Energy

E. Chicago, IN

Unit: Stack 201

MONITORING SOLUTIONS, INC.
FULL EXTRACTIVE

First (1st) Quarter Results
2020

CGA Completed On: 3/4/2020

PREPARED BY:

Monitoring | Solutions

Leaders in Environmental Monitoring Systems & Services

Monitoring | Solutions
Leaders in Environmental Monitoring Systems & Services

4404 Guion Rd., Indianapolis, Indiana 46254 Tel: 317.856.9400

REPORT OF CERTIFICATION OF NEUTRAL DENSITY AUDIT FILTERS

Date of Filter Certification: **December 31, 2019**
Date of Filter Expiration: **June 30, 2020** **Filter Set - LRG**

Audit Device / Filter Slot Angle of Incidence **10** Degrees
Path-Length Correction **1.000** (Straight Stack)

Table 1: Individual Filter Certification Data

Serial Number	Opacity Value (%)	Transmittance (%)	Previous Opacity (%)	Change in Opacity (%)
JK20	7.6	92.4	7.6	0.0
YB11	15.8	84.2	15.7	0.1
YB12	26.0	74.0	25.9	0.1
ZA44	49.3	50.7	49.3	0.0

Laboratory-Based Transmissometer
Operator

See second page for Instrument Information and Details of Certification

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I. Introduction ….……..…….……1
II. Cylinder Gas Audit Procedures …… 3
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Table **Page**

Table 1-1: Summary of Cylinder Gas Audit Results ***2***
Table 1-2: Measurement Points for Cylinder Gas Audit ***3***

I. Introduction

Monitoring Solutions, Inc. was contracted to conduct a Cylinder Gas Audit on a Continuous Emission Monitoring System (CEMS). This audit was performed:

Client: Primary Energy
City, State: E. Chicago, IN
Unit: Stack 201
Auditor: Dan Bowles
Audit Date: 3/4/2020

The audit of the Continuous Emission Monitoring System was conducted for the following gases:

Gas #1：SO2
Gas #2：O2 Dry & O2 Wet

Our assessment of this quarter's CGA results indicates that all of the analyzers evaluated during this test program meet the accuracy requirements as outlined in 40 CFR 60, Appendix F.
NOTE: Table 1-1 summarizes the results for the cylinder gas audit.

Reviewed by: _____

Date: 3/6/2020

Summary of Cylinder Gas Audit Results

Parameter	Low Gas Error	Mid Gas Error
SO2	1.38	1.61
O2 Dry	2.00	3.31
O2 Wet	2.00	2.31
	Pass	Pass

Table 1-1

40 CFR 60, Appendix F Performance Test requirements: <15%

II. CYLINDER GAS AUDIT PROCEDURES

Each Continuous Emission Monitor (CEM) must be audited three out of four calendar quarters of each year. As part of the Quality Control (QC) and Quality Assurance (QA) procedures, the quality of data produced is evaluated by response accuracy compared to known standards,

The Cylinder Gas Audit (CGA) for this quarter was conducted in accordance with the QA/QC procedure outlined in 40 CFR 60, Appendix F.

All applicable audit gases are connected to the sampling system. Each gas is introduced into the sampling and analysis system. The gases flow through as much of the sampling path as possible.

The gases are actuated on and off by utilizing a computer and/or PLC controlled solenoids at designated time intervals.

a) Challenge each monitor (both pollutant and diluent, if applicable) with cylinder gases of known concentrations at two measurement points listed in Table 1-2.

b) Use a separate cylinder gas for measurement points 1 and 2. Challenge the CEMS three times at each measurement point and record the responses.

c) Use cylinder gases that have been certified by comparison to National Institute of Standards and Technology (NIST) gaseous standard reference material (SRM) or NIST/EPA approved gas manufacturer's certified reference material (CRM) following ''Traceability Protocol for Establishing True Concentrations of Gases Used for Calibration and Audits of Continuous Source Emission Monitors. (Protocol Number 1).''

NOTE: In rare cases, some operators may have pollutant cylinder gases that are not "Protocol 1". Pollutant cylinder gases in high concentrations may not be certifiable to the "Protocol 1 Standard" and are only available as a "Certified Standard" (e.g. Sulfur Dioxide [SO2] in a concentration of 3.0% - or - 30,000 ppm).

Gas	*Measurement point #1*	*Measurement point #2*
Pollutants -	20-30% of span value	50-60% of span value
Diluent - O2	4-6% by volume	8-12% by volume
Diluent - CO2	5-8% by volume	10-14% by volume

Table 1-2

NOTE: Some operators may have cylinder gas values that fall outside of these parameters. This may be a result of previous agreements with their state or local EPA authority.

d) Determine the Relative Accuracy of each measurement point using the formula below. The RA error must not exceed 15%.

$$RA = \left|\left(\frac{\bar{d}}{AC}\right)100\right| \qquad \leq 15 \text{ percent}$$

Where:

RA = Relative Accuracy

$\bar{d}$ = Average of the three responses (Arithmetic Mean)

AC = The certified concentration of the cylinder gas.

III. Cylinder Gas Audit Data Sheets

CYLINDER GAS AUDIT (CGA) ERROR DETERMINATION

CLIENT: Primary Energy
PLANT / SITE: E. Chicago, IN
UNIT ID: Stack 201

CONDUCTED BY : Dan Bowles
ATTENDEE : N/A
AUDIT DATE: 3/4/2020

MONITOR TESTED: SO2
RANGE : 0 - 700 PPM

ANALYZER SERIAL NUMBER: 1152150034

	Run	Time	Reference value	Monitor value	Difference	Error %
Low-level	1	8:52	176.50	174.10	-2.40	-1.36 %
	2	9:10	176.50	173.60	-2.90	-1.64 %
	3	9:28	176.50	174.50	-2.00	-1.13 %
Mid-level	1	8:46	399.90	392.70	-7.20	-1.80 %
	2	9:04	399.90	393.90	-6.00	-1.50 %
	3	9:22	399.90	393.80	-6.10	-1.53 %

Low-level

Arithmetic Mean: 174.07

Tank S/N CC14789

Tank Expiration Date 7/25/2025

CGA Error: 1.38 %

Mid-Level

Arithmetic Mean: 393.47

Tank S/N CC31822

Tank Expiration Date 9/16/2027

CGA Error: 1.61 %

Date	Parameter	Run#	Timestamp	Type	Expected	Measured	Low Diff	-------	Mid Diff	-------
03/04/2020										
	SO2, PPM	1	08:46:19	QTR_MID	399.9	392.7			7.2	
	SO2, PPM	1	08:52:19	QTR_LOW	176.5	174.1	2.4			
	SO2, PPM	2	09:04:19	QTR_MID	399.9	393.9			6.0	
	SO2, PPM	2	09:10:20	QTR_LOW	176.5	173.6	2.9			
	SO2, PPM	3	09:22:18	QTR_MID	399.9	393.8			6.1	
	SO2, PPM	3	09:28:18	QTR_LOW	176.5	174.5	2.0			

Arithmetic Mean of Quarterly Low : 174.1
Linearity Error of Quarterly Low : 1.4
Calibration Tolerance: 15.0

Arithmetic Mean of Quarterly Mid : 393.5
Linearity Error of Quarterly Mid : 1.6
Calibration Tolerance: 15.0

Calibration Result : Pass

CEMS Type : Full Extractive
Manufacturer: Thermo
Model Number : 43i-HL
Serial Number: 1152150034
Monitor Certification Date:

Tested By : _____

Date: _____

CYLINDER GAS AUDIT (CGA) ERROR DETERMINATION

CLIENT: Primary Energy
PLANT / SITE: E. Chicago, IN
UNIT ID: Stack 201

CONDUCTED BY : Dan Bowles
ATTENDEE : N/A
AUDIT DATE: 3/4/2020

MONITOR TESTED: O2 Dry
RANGE : 0 - 25 %

ANALYZER SERIAL NUMBER: 11400

	Run	Time	Reference value	Monitor value	Difference	Error %
Low-level	1	8:52	5.00	5.10	0.10	2.00 %
	2	9:10	5.00	5.10	0.10	2.00 %
	3	9:28	5.00	5.10	0.10	2.00 %
Mid-level	1	8:58	9.97	10.30	0.33	3.31 %
	2	9:16	9.97	10.30	0.33	3.31 %
	3	9:34	9.97	10.30	0.33	3.31 %

Low-level

Arithmetic Mean: 5.10

Tank S/N CC14789

Tank Expiration Date 7/25/2025

CGA Error: 2.00 %

Mid-Level

Arithmetic Mean: 10.30

Tank S/N CC400438

Tank Expiration Date 8/16/2025

CGA Error: 3.31 %

Date	Parameter	Run#	Timestamp	Type	Expected	Measured	Low Diff	-------	Mid Diff	-------
03/04/2020										
	O2 DRY, %	1	08:52:19	QTR_LOW	5.0	5.1	0.1			
	O2 DRY, %	1	08:58:19	QTR_MID	10.0	10.3			0.3	
	O2 DRY, %	2	09:10:20	QTR_LOW	5.0	5.1	0.1			
	O2 DRY, %	2	09:16:20	QTR_MID	10.0	10.3			0.3	
	O2 DRY, %	3	09:28:18	QTR_LOW	5.0	5.1	0.1			
	O2 DRY, %	3	09:34:19	QTR_MID	10.0	10.3			0.3	

Arithmetic Mean of Quarterly Low : 5.1
Linearity Error of Quarterly Low : 1.8
Calibration Tolerance: 15.0

Arithmetic Mean of Quarterly Mid : 10.3
Linearity Error of Quarterly Mid : 3.3
Calibration Tolerance: 15.0

Calibration Result : Pass

CEMS Type : Full Extractive
Manufacturer: Brand Gaus
Model Number : 4705
Serial Number: 11400
Monitor Certification Date:

Tested By : _____

Date: _____

CYLINDER GAS AUDIT (CGA) ERROR DETERMINATION

CLIENT: Primary Energy
PLANT / SITE: E. Chicago, IN
UNIT ID: Stack 201

CONDUCTED BY : Dan Bowles
ATTENDEE : N/A
AUDIT DATE: 3/4/2020

MONITOR TESTED: O2 Wet
RANGE : 0 - 25 %

ANALYZER SERIAL NUMBER: 11401

	Run	Time	Reference value	Monitor value	Difference	Error %
Low-level	1	8:52	5.00	5.10	0.10	2.00 %
	2	9:10	5.00	5.10	0.10	2.00 %
	3	9:28	5.00	5.10	0.10	2.00 %
Mid-level	1	8:58	9.97	10.20	0.23	2.31 %
	2	9:16	9.97	10.20	0.23	2.31 %
	3	9:34	9.97	10.20	0.23	2.31 %

Low-level

Arithmetic Mean: 5.10

Tank S/N CC14789

Tank Expiration Date 7/25/2025

CGA Error: 2.00 %

Mid-Level

Arithmetic Mean: 10.20

Tank S/N CC400438

Tank Expiration Date 8/16/2025

CGA Error: 2.31 %

Date	Parameter	Run#	Timestamp	Type	Expected	Measured	Low Diff	-------	Mid Diff	-------
03/04/2020										
	O2 WET, %	1	08:52:19	QTR_LOW	5.0	5.1	0.1			
	O2 WET, %	1	08:58:19	QTR_MID	10.0	10.2			0.2	
	O2 WET, %	2	09:10:20	QTR_LOW	5.0	5.1	0.1			
	O2 WET, %	2	09:16:20	QTR_MID	10.0	10.2			0.2	
	O2 WET, %	3	09:28:18	QTR_LOW	5.0	5.1	0.1			
	O2 WET, %	3	09:34:19	QTR_MID	10.0	10.2			0.2	

Arithmetic Mean of Quarterly Low : 5.1
Linearity Error of Quarterly Low : 1.8
Calibration Tolerance: 15.0

Arithmetic Mean of Quarterly Mid : 10.2
Linearity Error of Quarterly Mid : 2.3
Calibration Tolerance: 15.0

Calibration Result : Pass

CEMS Type : Full Extractive
Manufacturer: Brand Gaus
Model Number : 4705
Serial Number: 11401
Monitor Certification Date:

Tested By : _____

Date: _____

IV. Cylinder Gas Certification Sheets

Airgas
an Air Liquide company

In Service 9/29/17

Airgas USA, LLC
12722 S. Wentworth Ave.
Chicago, IL 60628
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI84E15A0007	Reference Number:	54-124629354-1
Cylinder Number:	CC14789	Cylinder Volume:	150.4 CF
Laboratory:	124 - Chicago - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12017	Valve Outlet:	660
Gas Code:	CO2,O2,SO2,BALN	Certification Date:	Jul 25, 2017

Expiration Date: Jul 25, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
[redacted]	175.0 PPM	[redacted]	G1	+/- 1.0% NIST Traceable	07/17/2017, 07/25/2017
[redacted]	5.000 %	[redacted]	G1	+/- 1.0% NIST Traceable	07/18/2017
CARBON DIOXIDE	10.00 %	10.00 %	G1	+/- 0.9% NIST Traceable	07/17/2017
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	16060140	CC437515	515.2 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 16, 2021
NTRM	11060719	CC338460	4.861 % OXYGEN/NITROGEN	+/- 0.4%	Dec 13, 2022
NTRM	13060635	CC413759	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 09, 2019

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801332	FTIR	Jun 21, 2017
O2-1 HORIBA MPA-510 3VUYL9NR	Paramagnetic	Jul 17, 2017
Nicolet 6700 AHR0801332	FTIR	Jul 21, 2017

Triad Data Available Upon Request

Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
12722 S. Wentworth Ave.
Chicago, IL 60628
Airgas.com

In Service
2/6/20

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E03NI89E15A0052	Reference Number:	54-401594677-1
Cylinder Number:	CC31822	Cylinder Volume:	149.9 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12019	Valve Outlet:	660
Gas Code:	CO2,SO2,BALN	Certification Date:	Sep 16, 2019

Expiration Date: Sep 16, 2027

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
SULFUR DIOXIDE	385.0 PPM	399.9 PPM	G1	+/- 1.1% NIST Traceable	09/09/2019, 09/16/2019
CARBON DIOXIDE	10.00 %	9.808 %	G1	+/- 1.0% NIST Traceable	09/09/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	10010726	AAL072978	491.9 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jul 06, 2022
NTRM	12061517	CC354769	19.87 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801332	FTIR	Aug 27, 2019
Nicolet 6700 AHR0801332	FTIR	Aug 27, 2019

Triad Data Available Upon Request

Approved for Release

Airgas Specialty Gases
Airgas USA, LLC
12722 S. Wentworth Ave.
Chicago, IL 60628
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI90E15A0228	Reference Number:	54-400967311-1
Cylinder Number:	CC400438	Cylinder Volume:	145.2 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12017	Valve Outlet:	590
Gas Code:	O2,BALN	Certification Date:	Aug 16, 2017

Expiration Date: Aug 16, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	10.00 %	9.970 %	G1	+/- 1% NIST Traceable	08/16/2017
NITROGEN	Balance			-	

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	06120102	CC195613	9.898 % OXYGEN/NITROGEN	+/- 0.7%	Jul 26, 2018

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
O2-1 HORIBA MPA-510 3VUYL9NR	Paramagnetic	Jul 17, 2017

Triad Data Available Upon Request

Signature on file
Approved for Release

ATTACHMENT 4

2020 Annual Compliance Certification

Cokenergy LLC
3210 Watling Street MC 2-991
East Chicago, IN 46312

April 9, 2020 Via UPS

Indiana Department of Environmental Management
Compliance and Enforcement Branch
Office of Air Quality
100 N. Senate Avenue
Mail Code 61-53, IGCN 1003
Indianapolis, IN 46204 - 2251

RE: Cokenergy, LLC – 2019 Annual Compliance Certification
Part 70 Permit No. T089-36965-00383, T089-40905-00383 and T089-41033-00383

To Whom It May Concern:

In accordance with section B.9 of the subject permit and 326 IAC 2-7-6(5), we have enclosed the revised Annual Compliance Certification for the Cokenergy, LLC facility to include the permit number for the significant source modification permit issued on April 18, 2019.

If you have any questions concerning this report, please contact me at (219) 397-4626.

Sincerely,

Luke E. Ford
Director EH&S
Primary Energy

Enclosure

File: X:\\ 615.1

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR QUALITY
COMPLIANCE BRANCH
100 North Senate Avenue
MC 61-53 IGCN 1003
Indianapolis, IN 46204-2251

Cokenergy, LLC

PART 70 / FESOP PERMIT- ANNUAL COMPLIANCE CERTIFICATION

This form can be used to satisfy the annual compliance certification requirements for Part 70 sources under 326 IAC 2-7-5, 326 IAC 2-7-6(5)(C) and FESOP sources under 326 IAC 2-8-5(a)(1)(C).

SOURCE INFORMATION					
(1) Source name:	Cokenergy, LLC				
(2) Source address:	3210 Watling Street MC 2-991				
(3) City:	East Chicago	(4) State:	IN	(5) Zip code:	46312
(6) Mailing address (if different from above):					
(7) Mailing City:		(8) State:	IN	(9) Zip code:	46312
(10) Permit numbers:	089-36965-00383, 089-40905-00383 and 089-41033-00383	(11) Reporting Period:		1/1/2019 – 12/31/2019	
(12) Contact person:	Luke Ford	(13) Email Address:		lford@primaryenergy.com	
(14) Phone number:	219-397-4626	(15) Fax number:		219-397-8313	
(16) Comments:					

SOURCE COMPLIANCE INFORMATION	
(17) CHECK THE BOX NEXT TO EITHER (A) OR (B) BELOW. (The terms "continuous compliance" and "intermittent compliance" are defined on the Definitions page).	
(A) This source was in **CONTINUOUS COMPLIANCE** with **all of the permit terms and conditions** that impose a work practice or emission standard or requires performance testing, monitoring, record keeping or reporting based on the monitoring methods in the permit.	
(B) This source was in **CONTINUOUS COMPLIANCE** with **all of the permit terms and conditions** that impose a work practice or emission standard or requires performance testing, monitoring, record keeping or reporting based on the monitoring methods in the permit, **except** for the terms and conditions listed in the following table for which the source reported intermittent compliance.	X

IMPORTANT: If you select option (B), you must complete the following table in which you list any permit terms for which compliance was intermittent during the permit for the reporting period covered by this Compliance Certification.

(18) PERMIT TERMS FOR WHICH COMPLIANCE WAS INTERMITTENT

Source Name: Cokenergy, LLC		**Source Permit Number:** 089-36965-00383, 089-40905-00383 and 089-41033-00383	
Permit Term/ Condition	**Description of Permit Condition**	***Method Codes**	**Report Date/Comments**
C.1(a)	Opacity shall not exceed an average of twenty percent (20%) in any one (1) six (6) minute averaging period.	COMS	May 30, 2019 – At 1:42 AM the Indiana Harbor Coke Company (IHCC) facility experienced a loss of power to the A/C substation when the 3A1 main breaker tripped. This caused a power interruption to the A/C substation and subsequently all A/C battery HRSGs. This sudden disruption caused both ID fans to trip offline along with the Cokenergy steam turbine and generator. As the fans were being restarted at approximately 2:30 AM a second trip of the 3A1 main breaker occurred and the No. 1 ID fan tripped. The No. 2 ID fan was restarted at approximately 3:03 AM and there were three (3), six (6) minute opacity exceedances due to dust which settled in the duct work after the second ID fan trip. ID fan No.1 was left offline while IHCC identified the cause of the fault to prevent motor damage. ID fan No. 1 was restarted at 11:41 AM.
D.1.8(d)	Method 9 opacity readings during COMS down time	RR	September 27, 2019 – The Stack 201 continuous opacity monitoring system (COMS) was impacted by a lightning strike during a severe thunderstorm on September 27, 2019 at approximately 19:00. Due to the lightning strike, communication between the data acquisition system and the control room was also impacted and all output values were frozen. There were no alarms generated to indicate that there was a problem. The opacity system remained out of service for a total of 42 hours. During that outage there were no Method 9 readings recorded by a certified visible emissions observer. During daylight hours for the duration of the outage the weather conditions were observed as foggy, cloudy and there were periods of rain.
D.1.7(a)	PM and PM_{10} stack testing is required at least once every five (5) years.	RR	November 20, 2019 Indiana Harbor Coke Company (IHCC) initiated an oven rebuild project on B Battery as referenced in paragraph 10.a.i. of the joint consent decree (18-cv-35) effective October 25, 2018. The oven rebuild campaign was scheduled to be completed by November 30, 2018. Cokenergy last completed stack testing on stack 201 for PM on November 20, 2014 and requested an extension from IDEM on October 1, 2019 to delay the testing until after the rebuild was completed. IDEM notified Cokenergy on November 8, 2019 that they could not grant the extension but stated that no enforcement action would be taken provided testing was completed within 90 days of the rebuild project. PM stack testing was completed by Cokenergy on December 6, 2019.

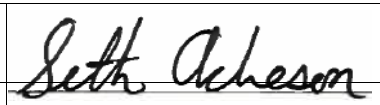
(18) PERMIT TERMS FOR WHICH COMPLIANCE WAS INTERMITTENT (Continued)

Source Name: Cokenergy, LLC		**Source Permit Number:** 089-36965-00383, 089-40905-00383 and 089-41033-00383	
Permit Term/ Condition	**Description of Permit Condition**	***Method Codes**	**Report Date/Comments**

*Method Codes:

Monitoring methods: CEMS = continuous emissions monitoring system; COMS = continuous opacity monitoring system; ST = stack test; VE = visible emissions; RK = record keeping; RR = review of records; MB = mass balance; EF = emissions factor; Insp = inspections; FA = fuel analysis; WP = work practice; PM = parametric monitoring; Calc = calculations; O = other (specify in Comments)

For Part 70 sources: The submittal by the Permittee requires the certification by the "responsible official" as defined by 326 IAC 2-7-1(34).
For FESOP sources: The notification which shall be submitted by the Permittee requires the certification by the "authorized individual" as defined by 326 IAC 2-1.1-1(1).

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.			
Signature:		Title/Position:	General Manager
Printed Name:	Seth Acheson	Date:	March 31, 2020
Phone number:	219-397-4521	Email Address:	sacheson@primaryenergy.com

PLEASE NOTE: YOU MUST EITHER SIGN THIS FORM OR ATTACH THE CERTIFICATION FORM INCLUDED IN YOUR PERMIT.

ATTACHMENT 5

2019 Relative Accuracy Test Audit Report

Cokenergy LLC
3210 Watling Street MC 2-991
East Chicago, IN 46312

January 16, 2020 via UPS

Indiana Department of Environmental Management
Compliance and Enforcement Branch
Office of Air Quality
100 N. Senate Avenue
Mail Code 61-50, IGCN 1003
Indianapolis, IN 46204 - 2251

RE: Cokenergy, LLC Stack 201 – 2019 Relative Accuracy Test Audit Report
Part 70 Permit No. T089-41033-00383

To Whom It May Concern:

In accordance with the sulfur dioxide monitoring requirements of permit condition D.1.8 and the Continuous Monitoring of Emissions requirements referenced in 326 IAC 3-5 a relative accuracy test audit (RATA) was completed on the HRCC waste gas main stack (stack ID 201) on December 4, 2019 by AECOM Technical Services, Inc. In accordance with 326 IAC 3-6-4(b) the final report is attached.

If you have any questions, please contact me at (219) 397-4626.

Sincerely,

Luke E. Ford
Director EH&S

Enclosure

File: X:\\ 613.2

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR MANAGEMENT
COMPLIANCE DATA SECTION
PART 70 OPERATING PERMIT
CERTIFICATION

Source Name: Cokenergy LLC

Source Address: 3210 Watling Street, MC 2-991, East Chicago, Indiana 46312-1610

Part 70 Permit No.: T089-41033-00383

This certification shall be included when submitting monitoring, testing reports/results or other documents as required by this permit.

Please check what document is being certified:

☐ Annual Compliance Certification Letter

☐ Test Result (specify) _____

☒ Report (specify) 2019 RATA Report

☐ Notification (specify) _____

☐ Affidavit (specify) _____

☐ Other (specify) _____

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

Signature: Seth Acheson

Printed Name: Seth Acheson

Title/Position: General Manager Cokenergy, LLC

Phone: (219) 397-4521

Date: January 16, 2020

RATA Report for Stack 201 CEMS

Prepared for:
Cokenergy LLC
3210 Watling Street
East Chicago, IN 46312

Prepared by:
AECOM Technical Services, Inc.
701 Scarboro Road, Suite 202
Oak Ridge, TN 37830

AECOM

January 2020

RATA REPORT FOR
STACK 201 CEMS

Prepared for:

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January 2020

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LIST OF ACRONYMS

AECOM	AECOM Technical Services, Inc.
CCVS	Continuing Calibration Verification Standard
CEMS	Continuous Emissions Monitoring System
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
DAS	Data Acquisition System
dscm	dry standard cubic meter
EPA	Environmental Protection Agency
ESC	Environmental Systems Corporation
FGD	Flue Gas Desulfurization
N_2	Nitrogen
O_2	Oxygen
PM	Particulate Matter
ppm	parts per million
QA	Quality Assurance
QC	Quality Control
RATA	Relative Accuracy Test Audit
SDA	Spray Dryer Absorber
SO_2	Sulfur Dioxide

1. INTRODUCTION

Cokenergy operates a facility that recovers waste heat from a heat recovery coke plant and provides electricity and process steam to an adjacent steel-making operation. The coke plant produces flue gas that must be controlled to meet the limitations for sulfur dioxide (SO_2) and particulate matter (PM) in Cokenergy's operating permit. Cokenergy operates 16 heat recovery steam generators that produce steam from the coke plant flue gas and control SO_2 levels with a flue gas desulfurization (FGD) system that consists of two lime spray dry absorbers (SDA) in parallel followed by a baghouse. The exhaust from the baghouse exits through stack 201.

Cokenergy contracted AECOM Technical Services, Inc. (AECOM) to perform the annual Relative Accuracy Test Audit (RATA) on the SO_2 continuous emissions monitoring system (CEMS) installed on stack 201. A RATA Notification Protocol was submitted to the Indiana Department of Environmental Management (IDEM) on October 8, 2019. The RATA testing was successfully completed on December 4, 2019. IDEM's Mr. Steve Friend was present during the RATA testing.

This test report presents the results of the annual RATA. Section 2.0 summarizes the test results. Section 3.0 describes the methods and techniques that were used to conduct the testing. Section 4.0 discusses the quality assurance (QA)/quality control (QC) procedures that were followed in the performance of the testing. Detailed data supporting the RATA testing are presented in Appendices A and B.

2. TEST RESULTS

The results of the RATA testing are presented in this section. During the RATA testing, the facility was operated at a main steam flow of approximately 730,000 lb/hr or over 75% of its maximum main steam flow rate. The RATA consisted of at least nine valid sampling runs. Each sample run was at least 21 minutes in duration. Table 2-1 summarizes the results of the RATA for the SO_2 CEMS. As indicated in the table, the relative accuracy requirement of ±20% of the average reference method results was met.

The reference method sample data, calibration data, calibration gas certification sheets, equipment calibration sheets, and field data sheets for the volumetric flow rate measurements and moisture determinations are included in Appendix A. The installed CEMS sample data results are included in Appendix B.

Table 2-1. SO_2 CEMS RATA Results

Plant Name: Cokenergy		**Analyzers:**	SO_2: Thermo 43i-HL; S/N 1152150034		
			Dry O_2: Brand Gaus 4705; S/N 11400		
Location: Main Stack			Wet O_2: Brand Gaus 4705; S/N 11401		
			Flow Monitor: Monitoring Solutions CEMFLOW; S/N 031518-000-1118-UMCR		
			SO2, lb/hour		
Date	**Time**	**Run #**	**RM Data**	**CEMS Data**	**Delta**
Note: Times shown are EST					
4-Dec-19	1130 - 1150	1	1466	1277	189
4-Dec-19	1151 - 1211	2	1489	1267	222
4-Dec-19	1212 - 1232	3	1474	1255	219
4-Dec-19	1310 - 1330	4	1498	1229	269
4-Dec-19	1331 - 1351	5	1491	1215	276
4-Dec-19	1352 - 1412	6	1503	1209	294
4-Dec-19	1435 - 1455	7	1539	1249	290
4-Dec-19	1456 - 1516	8	1538	1243	295
4-Dec-19	1517 - 1537	9	~~1540~~	~~1245~~	~~295~~
4-Dec-19	1538 - 1558	10	1406	1247	160
		11			
		12			
	Average:		1489	1243	246
Standard Deviation (Sd)					49.9
t-value					2.306
Confidence Coefficient (CC)					38.4
Relative Accuracy, % (Reference Method)					19.1
Emission Standard, lb/hour					NA
Relative Accuracy, % (Rel to Standard)					NA
					PASS

3. RELATIVE ACCURACY TEST AUDIT TECHNICAL APPROACH

The following sections describe the methods and techniques that were used to complete the RATA testing. Section 3.1 is a brief description of the installed SO_2 CEMS. Section 3.2 describes the RATA testing. Descriptions of the EPA Reference Methods used to perform the RATA are presented in Section 3.3, while Section 3.4 describes the calculations used.

3.1 Installed Sulfur Dioxide CEMS Description

The Cokenergy CEMS is an extractive system with a Thermo Model 43 SO_2 and Brand-Gaus Model 4705 O_2 monitors which measure O_2 on both a wet and a dry basis. The stack volumetric flow rate is measured by a Monitoring Solutions CEMFLOW continuous flow monitoring systems. The CEMS and flow system outputs are monitored by a Monitoring Solutions CEMDAS PLC based controller equipped with a CEMDAS controlled polling computer. The serial numbers for the major components of the SO_2 CEMS are provided in Table 3-1.

Table 3-1. Continuous Emissions Monitoring System Components

Instrument	Manufacturer and Model Number	Serial Number
SO_2 analyzer (dry)	Thermo, Model 43i-HL	1152150034
O_2 analyzer (dry)	Brand Gaus, Model 4705	11400
O_2 analyzer (wet)	Brand Gaus, Model 4705	11401
Flow Rate Monitor	Monitoring Solutions CEMFLOW	031518-000-1118-UMCR

3.2 Relative Accuracy Test Audit Testing

The RATA is a direct comparison of the permanently installed measurement system and concurrently measured results gathered by EPA reference methods. The SO_2 RATA was performed according to the applicable procedures cited in 40 CFR 60, Appendix B, as indicated in Table 3-2. For the EPA reference method analyzers, a gas sample was continuously extracted and analyzed. The average observed concentration during each test run was determined using an arithmetic average of the data logger's 1-minute sub-averages. The gas volumetric flow rate was determined in accordance with Method 2. A velocity traverse was conducted during each test

run. The molecular weight of the gas was determined using Method 3A. The average observed concentration of O_2 and carbon dioxide (CO_2) during each test run was determined using an arithmetic average of the data logger's 1 minute sub-averages. The moisture content of the gas was determined using Method 4. A moisture determination was performed approximately once per hour (once per three test runs).

Table 3-2. Test Procedures for RATA Testing

Parameter	Reference Procedures for RATA Testing
SO_2	• 40 CFR 60, Appendix F, QA Procedures, Section 5.1.1 – RATA • 40 CFR 60, Appendix B, Performance Specification 2 – Specifications and Test Procedures for SO_2 and NO_X CEMS in Stationary Sources • 40 CFR 60, Appendix A, Method 6C – SO_2 Concentration Determination
Volumetric Flow Rate	• 40 CFR 60, Appendix F, QA Procedures, Section 5.1.1 – RATA • 40 CFR 60, Appendix B, Performance Specification 6 – Specifications and Test Procedures for Continuous Emission Rate Monitoring Systems in Stationary Sources • 40 CFR 60, Appendix A, Method 2 – Volumetric Flow Rate Determination • 40 CFR 60, Appendix A, Method 3A – Dry Molecular Weight Determination • 40 CFR 60, Appendix A, Method 4 – Moisture Determination

3.3 U.S. Environmental Protection Agency Reference Methods

The following sections summarize the sampling procedures that were followed to complete the RATA testing program.

3.3.1 Method 2, Volumetric Flow Rate Determination

The gas volumetric flow rate was determined using EPA Reference Method 2. An S-type Pitot tube and an inclined manometer were used to measure the velocity pressure at each of 12 traverse points (3 points per each of 4 test ports) in the main stack. The traverse points were located in accordance with the requirements of EPA Reference Method 1. A calibrated type "K" thermocouple was used to measure the gas temperature at each traverse point. The velocity pressures and gas temperatures were used in accordance with EPA Reference Method 2 to calculate the volumetric gas flow rate for each test run. The molecular weight and moisture content derived from EPA Reference Methods 3A and 4, respectively, were incorporated into the volumetric flow rate calculations.

3.3.2 Method 3A, Dry Molecular Weight Determination

The dry molecular weight of the gas [O_2, CO_2, and nitrogen (N_2) by difference] was determined using procedures contained in EPA Reference Method 3A. A heated, stainless steel probe was used to extract the gas sample from the main stack. A 3/8-in., heated Teflon line transported the gas sample from the point of extraction to a gas conditioner and then to the O_2 and CO_2 analyzers.

The average observed concentration, Cobs, for each test run was determined using an arithmetic average of a data logger's 1-minute sub-averages. QC procedures implemented during the EPA reference method testing included three-point calibrations, bias checks, and a response time test. The analyzers were calibrated before each series of test runs. The calibration consisted of introducing ultra-high purity N_2 as a zero gas and two known concentrations of O_2 and CO_2 directly to the analyzers. Bias checks were performed after each set of 3 test runs. The bias check consisted of introducing a zero gas and one known concentration of O_2 and CO_2 to the sampling system at a point directly following the sampling probe. The measurement system response time was determined during the bias check by noting the times required to achieve a stable response for both the zero and upscale gases. EPA Protocol 1 calibration gases were used to perform the calibrations and bias checks.

3.3.3 Method 4, Moisture Determination

The sample gas moisture content was determined by gravimetrically measuring the weight gain of chilled impingers using procedures contained in EPA Reference Method 4. A moisture determination was made approximately once per hour. The samples were collected from a single point within the stack. The moisture content of the gas was used in calculating the wet gas molecular weight and determining the dry gas flow rate.

3.3.4 Method 6C, Sulfur Dioxide Concentration Determination

The SO_2 sampling and calibrations conformed to procedures outlined in EPA Reference Method 6C. The sample extraction, transport, and conditioning system described in Section 3.3.2 for the Method 3A sampling was used to supply sample gas to the Method 6C analyzer.

The average observed SO_2 concentration for each test run was determined using an arithmetic average of a data logger's 1-minute sub-averages. QC procedures implemented during the EPA reference method testing for SO_2 included three-point calibrations, bias checks, and a response time test. The SO_2 analyzer was calibrated before each series of test runs. The calibrations consisted of introducing mid-level O_2/CO_2 calibration gas as a zero gas and two known concentrations of SO_2 directly to the analyzer. Bias checks were performed after each set of 3 test runs. The bias check consisted of introducing a zero gas and one known concentration of SO_2 to the sampling system at a point directly following the sampling probe. EPA Protocol 1 calibration gases were used to perform the calibrations and bias checks. The measurement system response time was determined during the bias check by noting the times required to achieve a stable response for both the zero and upscale gases.

3.4 Relative Accuracy Test Calculations

The following sections detail the calculations that were performed during data reduction and relative accuracy determination activities.

3.4.1 Calibration Error Corrections

For each test run of the CEMS RATA, the mean of the reference method observed concentrations was calculated. The mean values for SO_2, CO_2, and O_2 were corrected for calibration error (drift/bias) using the following equation:

$$C_{corr} = (C_{obs} - C_o) \times \left(\frac{C_{MA}}{(C_M - C_o)} \right)$$

where:

C_{corr} = C_{obs} corrected for drift/bias, parts per million (ppm) or vol%
C_{obs} = Average observed analyzer concentration during test, ppm or vol%
C_o = (Pretest system zero response + post test system zero response)/2, ppm or vol%
C_{MA} = Actual concentration of calibration gas used, ppm or vol%
C_M = (Pretest system calibration response + post test calibration response)/2, ppm or vol%

3.4.2 Sulfur Dioxide Mass Emission Rate Calculations

For each test run of the CEMS RATA, the mass emission rate for SO_2 in pounds per hour (lb/hour) was calculated using the following equation:

$$E_h = K \times C_{corr} \times Q_h \times 60 \times [1 - (B_{wo}/100)]$$

where:

E_h = Mass emission rate, lb/hour;
K = 1.66×10^{-7} for SO_2 (lb/standard cubic foot)/ppm;
C_{corr} = C_{obs} corrected for drift/bias, dry basis, ppm;
Q_h = Volumetric flow rate, wet basis, standard cubic feet per minute;
60 = 60 minutes/hour;
B_{wo} = Gas moisture, %.

3.4.3 Relative Accuracy Calculations

The relative accuracy test is a direct comparison of the permanently installed monitoring system and concurrently measured results gathered by EPA reference method. The arithmetic difference between the reference method and the installed system output was calculated for each test run. These arithmetic differences were then used to calculate the mean of the difference, standard deviation, confidence coefficient, and relative accuracy, using the following equations.

a) Arithmetic mean equation:

$$\overline{d} = \frac{1}{n} \sum_{i=1}^{n} d_i$$

where:

n = number of data points,

$\sum_{i=1}^{n} d_i$ = Algebraic sum of the individual difference d_i.

b) Standard deviation equation:

$$S_d = \left[\frac{\sum_{i=1}^{n} d_i^{\,2} - \frac{\left(\sum_{i=1}^{n} d_i \right)^2}{n}}{n-1} \right]^{1/2}$$

c) Confidence coefficient equation:

$$CC = t_{0.975} \frac{S_d}{\sqrt{n}}$$

where:

$t_{0.975}$ = t-value (see table below).

t-values					
n[a]	**$t_{0.975}$**	**n[a]**	**$t_{0.975}$**	**n[a]**	**$t_{0.975}$**
2	12.706	7	2.947	12	2.201
3	4.303	8	2.365	13	2.179
4	3.182	9	2.306	14	2.160
5	2.776	10	2.262	15	2.145
6	2.571	11	2.228	16	2.131

[a] The t-values are already corrected for n-1 degrees of freedom.
Use n equal to the number of individual values.

d) Relative accuracy equation:

$$RA = \frac{\left|\bar{d}\right| + \left|CC\right|}{\overline{RM}} \times 100$$

where:

RA = Relative accuracy,
$|\bar{d}|$ = Absolute value of the mean of differences,
$|CC|$ = Absolute value of the confidence coefficient,
$\overline{RM}$ = Average reference method value or applicable standard.

4. QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

The objective of AECOM's QA Program is to ensure the accuracy and precision, as well as the reliability, of the data collected and generated for AECOM's clients and to meet the data quality objectives of the regulatory or accrediting bodies. Management, administrative, statistical, investigative, preventive, and corrective techniques were employed to maximize the reliability of data.

During the RATA testing, a strict QA/QC program was adhered to. Before actual sampling on-site, sampling equipment was thoroughly checked to ensure that each component was clean and operable. Equipment calibration data forms were compiled and reviewed for completeness and accuracy to ensure the acceptability of the equipment. Upon arrival on-site, the equipment was unloaded, inspected for possible damage, and then assembled for use. Any damaged or faulty equipment was tagged and removed from service until it could be repaired.

4.1 U.S. Environmental Protection Agency Reference Method Analyzer Calibrations

The reference method analyzer calibrations conformed to the procedures outlined in EPA Reference Methods 3A and 6C. EPA Protocol 1 gas standards were utilized for all reference method calibrations.

4.1.1 Analyzer Calibration Error Checks

Zero and two upscale concentration gases were introduced to each analyzer and the responses recorded. The calibration error checks were considered successful if the difference between each of the certified concentrations (obtained from certificates of analysis) and the analyzer responses was within ±2% of the analyzer range for each of the calibration gases.

4.1.2 System Bias Checks

To determine the impact of the sample lines, pump, and sample cooler on the analyzer readings, a tee was used to introduce calibration gases (zero and upscale concentrations) to the sampling system at a point directly following the sampling probe. The analyzer responses were recorded and compared to the responses recorded when calibration gases were introduced directly to the analyzers for the analyzer calibration checks. The system bias checks were considered successful if the difference between the readings was within ±5% of the analyzer range for each of the calibration gases.

4.1.3 System Drift

During the field test, system drift was also determined. The system drift checks were considered successful if the difference between initial and final system bias readings was within ±3% of the analyzer range for calibration gases.

4.2 Sampling Equipment Quality Control Procedures

The sampling equipment used was calibrated before and after each field effort according to manufacturers' specifications; *EPA Quality Assurance Handbook for Air Pollution Measurement Systems*, Volume III (EPA-600/4-7-027b); and 40 CFR 60. Calibrations were performed with standards that are National Institute of Standards and Technology traceable when applicable. The standards include multipoint dry gas meter calibration, standard Pitot tubes, thermocouples, and EPA Protocol I certified gases.

Appendix A
REFERENCE METHOD SUPPORTING DOCUMENTATION

- Reference Method Sample Data
- Reference Method Calibration Data
- Calibration Gas Certification Sheets
- Sampling Equipment Calibration Data
- Field Data Sheets

Reference Method Sample Data

Plant Name	Cokenergy
Sampling Location	Main Stack
Date	4-Dec-19
CEM Operator	Bill Thomas
Project Number	60616835

Note: Times shown are EST

Run No.	Start Time	Stop Time	Start - Stop Time	Reference Method Obs. Value				
				O_2	CO_2	SO_2	Moisture	Flow Rate
1	1130	1150	1130 - 1150	12.6	5.1	169.50	0.1248	937476
2	1151	1211	1151 - 1211	12.8	5.2	171.10	0.1248	942938
3	1212	1232	1212 - 1232	12.9	5.1	172.30	0.1248	927299
4	1310	1330	1310 - 1330	12.8	5.1	170.60	0.1181	937682
5	1331	1351	1331 - 1351	12.8	5.1	168.40	0.1181	945943
6	1352	1412	1352 - 1412	12.9	5.1	167.70	0.1181	956953
7	1435	1455	1435 - 1455	13.0	5.0	175.60	0.1213	937175
8	1456	1516	1456 - 1516	13.0	5.0	175.00	0.1213	939944
9	1517	1537	1517 - 1537	13.0	5.1	174.90	0.1213	941718
10	1538	1558	1538 - 1558	13.0	5.0	173.50	0.1213	866919
11							0.1213	#DIV/0!
12							0.1213	#DIV/0!

CEM Data Correction Data Sheet

Plant Name	Cokenergy
Sampling Location	Main Stack
Date	4-Dec-19
CEM Operator	Bill Thomas
Project Number	60616835
Pollutant	O_2

Run No.	Start Time	Stop Time	Obs. Conc. (% or ppm)	Calibration Data			Calibration Corrected Data (% or ppm)
				Cma	Co	Cm	
1	1130	1150	12.6	10.1	-0.1	9.8	12.9
2	1151	1211	12.8	10.1	-0.1	9.8	13.1
3	1212	1232	12.9	10.1	-0.1	9.8	13.2
4	1310	1330	12.8	10.1	-0.1	9.9	13.0
5	1331	1351	12.8	10.1	-0.1	9.9	13.0
6	1352	1412	12.9	10.1	-0.1	9.9	13.1
7	1435	1455	13.0	10.1	-0.1	10.0	13.1
8	1456	1516	13.0	10.1	-0.1	10.0	13.1
9	1517	1537	13.0	10.1	-0.1	10.0	13.1
10	1538	1558	13.0	10.1	-0.1	10.0	13.1
11							
12							
							13.1

Calibration Error Correction

Cgas=(Cobs-Co)*(Cma/(Cm-Co))

CEM Data Correction Data Sheet

Plant Name	Cokenergy
Sampling Location	Main Stack
Date	4-Dec-19
CEM Operator	Bill Thomas
Project Number	60616835
Pollutant	CO_2

Run No.	Start Time	Stop Time	Obs. Conc. (% or ppm)	Calibration Data			Calibration Corrected Data (% or ppm)
				Cma	Co	Cm	
1	1130	1150	5.10	10.0	0.1	9.7	5.20
2	1151	1211	5.2	10.0	0.1	9.7	5.3
3	1212	1232	5.1	10.0	0.1	9.7	5.2
4	1310	1330	5.1	10.0	0.1	9.7	5.2
5	1331	1351	5.1	10.0	0.1	9.7	5.2
6	1352	1412	5.1	10.0	0.1	9.7	5.2
7	1435	1455	5.0	10.0	0.1	9.7	5.1
8	1456	1516	5.0	10.0	0.1	9.7	5.1
9	1517	1537	5.1	10.0	0.1	9.7	5.2
10	1538	1558	5.0	10.0	0.1	9.7	5.1
11							
12							
							5.2

Calibration Error Correction

Cgas=(Cobs-Co)*(Cma/(Cm-Co))

CEM Data Correction Data Sheet

Plant Name	Cokenergy
Sampling Location	Main Stack
Date	4-Dec-19
CEM Operator	Bill Thomas
Project Number	60616835
Pollutant	SO_2

Run No.	Start Time	Stop Time	Obs. Conc. (% or ppm)	Calibration Data			Calibration Corrected Data (% or ppm)
				Cma	Co	Cm	
1	1130	1150	169.5	176.5	0.7	166.8	179.4
2	1151	1211	171.1	176.5	0.7	166.8	181.1
3	1212	1232	172.3	176.5	0.7	166.8	182.4
4	1310	1330	170.6	176.5	0.7	165.6	181.9
5	1331	1351	168.4	176.5	0.7	165.6	179.5
6	1352	1412	167.7	176.5	0.7	165.6	178.7
7	1435	1455	175.6	176.5	0.6	165.3	187.6
8	1456	1516	175.0	176.5	0.6	165.3	187.0
9	1517	1537	174.9	176.5	0.6	165.3	186.8
10	1538	1558	173.5	176.5	0.6	165.3	185.3
11							
12							
							183.0

Calibration Error Correction

Cgas=(Cobs-Co)*(Cma/(Cm-Co))

Reference Method Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 11:31	171.2	12.6	5.1
12/4/2019 11:32	170.9	12.6	5.1
12/4/2019 11:33	169.5	12.6	5.2
12/4/2019 11:34	168.1	12.6	5.1
12/4/2019 11:35	168.8	12.6	5.1
12/4/2019 11:36	169.1	12.6	5.1
12/4/2019 11:37	169.3	12.6	5.1
12/4/2019 11:38	169.3	12.7	5.1
12/4/2019 11:39	168.6	12.6	5.1
12/4/2019 11:40	169.2	12.6	5.1
12/4/2019 11:41	110.6	12.6	5.2
12/4/2019 11:42	169.7	12.6	5.2
12/4/2019 11:43	169.8	12.6	5.2
12/4/2019 11:44	171.4	12.6	5.2
12/4/2019 11:45	174.5	12.6	5.2
12/4/2019 11:46	175.9	12.7	5.1
12/4/2019 11:47	177.7	12.6	5.2
12/4/2019 11:48	181.6	12.6	5.2
12/4/2019 11:49	180.3	12.6	5.2
12/4/2019 11:50	177.9	12.6	5.2
12/4/2019 11:51	176.8	12.6	5.2
Average =	169.5	12.6	5.1

Reference Method Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 11:52	176.4	12.6	5.2
12/4/2019 11:53	174.5	12.7	5.2
12/4/2019 11:54	175.1	12.7	5.2
12/4/2019 11:55	174.2	13.1	5.2
12/4/2019 11:56	172.5	13.0	5.1
12/4/2019 11:57	174.0	12.9	5.2
12/4/2019 11:58	172.3	12.8	5.2
12/4/2019 11:59	171.1	12.8	5.2
12/4/2019 12:00	171.2	12.8	5.2
12/4/2019 12:01	172.1	12.7	5.1
12/4/2019 12:02	167.1	12.8	5.2
12/4/2019 12:03	166.0	12.8	5.1
12/4/2019 12:04	164.8	12.8	5.2
12/4/2019 12:05	167.3	12.8	5.2
12/4/2019 12:06	167.6	12.7	5.2
12/4/2019 12:07	166.8	12.8	5.2
12/4/2019 12:08	167.6	13.1	5.2
12/4/2019 12:09	168.9	12.8	5.1
12/4/2019 12:10	172.5	12.7	5.2
12/4/2019 12:11	175.2	12.7	5.1
12/4/2019 12:12	176.9	12.7	5.1
Average =	171.1	12.8	5.2

Reference Method Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 12:13	178.4	12.7	5.1
12/4/2019 12:14	176.8	12.7	5.1
12/4/2019 12:15	173.8	12.7	5.1
12/4/2019 12:16	173.7	12.7	5.2
12/4/2019 12:17	172.1	12.7	5.1
12/4/2019 12:18	170.3	12.7	5.1
12/4/2019 12:19	171.2	12.7	5.1
12/4/2019 12:20	169.8	12.7	5.1
12/4/2019 12:21	171.7	12.7	5.1
12/4/2019 12:22	172.0	12.8	5.1
12/4/2019 12:23	170.8	12.8	5.1
12/4/2019 12:24	171.1	12.8	5.1
12/4/2019 12:25	172.8	12.9	5.1
12/4/2019 12:26	172.1	13.5	5.1
12/4/2019 12:27	171.7	13.2	5.1
12/4/2019 12:28	171.8	13.0	5.1
12/4/2019 12:29	172.3	13.0	5.1
12/4/2019 12:30	171.2	13.0	5.2
12/4/2019 12:31	172.4	13.0	5.2
12/4/2019 12:32	171.5	13.0	5.1
12/4/2019 12:33	171.3	13.1	5.1
Average =	172.3	12.9	5.1

Reference Method Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 13:10	164.9	12.9	5.1
12/4/2019 13:11	165.8	12.9	5.1
12/4/2019 13:12	167.9	13.0	5.1
12/4/2019 13:13	167.7	12.9	5.1
12/4/2019 13:14	167.3	12.9	5.1
12/4/2019 13:15	171.4	12.9	5.1
12/4/2019 13:16	173.5	12.8	5.1
12/4/2019 13:17	175.5	12.8	5.1
12/4/2019 13:18	176.7	12.8	5.2
12/4/2019 13:19	176.2	12.8	5.2
12/4/2019 13:20	174.2	12.7	5.2
12/4/2019 13:21	172.8	12.8	5.2
12/4/2019 13:22	172.4	12.8	5.1
12/4/2019 13:23	170.4	12.8	5.2
12/4/2019 13:24	170.8	12.8	5.2
12/4/2019 13:25	169.9	12.8	5.2
12/4/2019 13:26	170.0	12.8	5.1
12/4/2019 13:27	169.5	12.8	5.1
12/4/2019 13:28	168.8	12.8	5.1
12/4/2019 13:29	168.9	12.8	5.1
12/4/2019 13:30	168.0	12.8	5.1
Average =	170.6	12.8	5.1

Run 4

Reference Method Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 13:31	168.1	12.8	5.1
12/4/2019 13:32	167.1	12.8	5.1
12/4/2019 13:33	165.5	12.8	5.1
12/4/2019 13:34	166.7	12.8	5.1
12/4/2019 13:35	166.6	12.8	5.1
12/4/2019 13:36	166.7	12.8	5.1
12/4/2019 13:37	164.8	12.8	5.1
12/4/2019 13:38	165.7	12.8	5.1
12/4/2019 13:39	165.9	12.9	5.2
12/4/2019 13:40	167.6	12.9	5.1
12/4/2019 13:41	172.0	12.9	5.1
12/4/2019 13:42	173.2	12.8	5.1
12/4/2019 13:43	172.0	12.9	5.1
12/4/2019 13:44	172.7	12.9	5.1
12/4/2019 13:45	172.0	12.8	5.1
12/4/2019 13:46	169.6	12.9	5.1
12/4/2019 13:47	169.6	12.8	5.1
12/4/2019 13:48	167.9	12.9	5.1
12/4/2019 13:49	168.2	12.8	5.1
12/4/2019 13:50	168.0	12.9	5.1
12/4/2019 13:51	166.8	12.8	5.1
Average =	168.4	12.8	5.1

Reference Method Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 13:52	166.6	12.9	5.1
12/4/2019 13:53	164.8	12.9	5.1
12/4/2019 13:54	167.5	12.9	5.1
12/4/2019 13:55	168.0	12.8	5.1
12/4/2019 13:56	165.7	12.9	5.1
12/4/2019 13:57	165.3	12.8	5.1
12/4/2019 13:58	165.1	12.9	5.1
12/4/2019 13:59	165.8	12.8	5.1
12/4/2019 14:00	165.9	12.8	5.1
12/4/2019 14:01	165.8	12.8	5.1
12/4/2019 14:02	164.0	12.9	5.1
12/4/2019 14:03	163.7	12.9	5.1
12/4/2019 14:04	163.8	12.9	5.1
12/4/2019 14:05	168.7	12.9	5.1
12/4/2019 14:06	172.2	12.9	5.1
12/4/2019 14:07	172.0	12.9	5.1
12/4/2019 14:08	172.3	12.9	5.1
12/4/2019 14:09	174.2	12.9	5.1
12/4/2019 14:10	172.1	12.9	5.1
12/4/2019 14:11	170.0	12.9	5.1
Average =	167.7	12.9	5.1

Run 6

Reference Method Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 14:35	166.8	13.0	5.0
12/4/2019 14:36	168.9	12.9	5.1
12/4/2019 14:37	171.3	13.0	5.0
12/4/2019 14:38	171.6	12.9	5.1
12/4/2019 14:39	172.8	12.9	5.1
12/4/2019 14:40	168.8	12.9	5.0
12/4/2019 14:41	167.6	12.9	5.0
12/4/2019 14:42	167.2	12.9	5.0
12/4/2019 14:43	167.3	13.0	5.0
12/4/2019 14:44	166.7	12.9	5.1
12/4/2019 14:45	166.2	12.9	5.1
12/4/2019 14:46	164.7	13.0	5.1
12/4/2019 14:47	170.4	13.0	5.1
12/4/2019 14:48	209.5	13.0	5.1
12/4/2019 14:49	206.7	13.0	5.1
12/4/2019 14:50	236.0	13.0	5.1
12/4/2019 14:51	193.3	13.0	5.0
12/4/2019 14:52	165.8	13.0	5.1
12/4/2019 14:53	163.7	13.0	5.0
12/4/2019 14:54	160.8	13.0	5.0
12/4/2019 14:55	161.1	13.0	5.0
Average =	175.6	13.0	5.0

Reference Method Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 14:56	173.1	13.0	5.0
12/4/2019 14:57	176.2	13.0	5.0
12/4/2019 14:58	173.7	13.0	5.0
12/4/2019 14:59	171.6	13.0	5.0
12/4/2019 15:00	171.4	13.0	5.0
12/4/2019 15:01	172.0	13.0	5.0
12/4/2019 15:02	172.5	13.0	5.0
12/4/2019 15:03	172.0	13.0	5.0
12/4/2019 15:04	171.7	13.0	5.0
12/4/2019 15:05	175.2	13.0	5.0
12/4/2019 15:06	178.6	13.0	5.0
12/4/2019 15:07	178.3	13.0	5.0
12/4/2019 15:08	181.1	13.0	5.0
12/4/2019 15:09	179.8	13.0	5.1
12/4/2019 15:10	177.9	13.0	5.1
12/4/2019 15:11	178.1	13.0	5.0
12/4/2019 15:12	176.1	13.0	5.0
12/4/2019 15:13	173.8	13.0	5.0
12/4/2019 15:14	173.6	13.0	5.0
12/4/2019 15:15	174.0	13.0	5.0
12/4/2019 15:16	173.4	13.0	5.0
Average =	175.0	13.0	5.0

Reference Method Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 15:17	173.5	13.0	5.1
12/4/2019 15:18	172.8	13.0	5.1
12/4/2019 15:19	172.2	13.0	5.1
12/4/2019 15:20	174.4	13.0	5.1
12/4/2019 15:21	174.0	13.0	5.1
12/4/2019 15:22	173.4	13.0	5.1
12/4/2019 15:23	174.3	13.0	5.1
12/4/2019 15:24	173.8	13.0	5.1
12/4/2019 15:25	172.6	13.0	5.1
12/4/2019 15:26	172.0	13.0	5.1
12/4/2019 15:27	173.1	13.0	5.1
12/4/2019 15:28	172.6	13.0	5.1
12/4/2019 15:29	172.3	13.0	5.1
12/4/2019 15:30	173.8	13.0	5.1
12/4/2019 15:31	177.6	13.0	5.1
12/4/2019 15:32	178.2	13.1	5.1
12/4/2019 15:33	180.4	13.0	5.1
12/4/2019 15:34	180.0	13.1	5.1
12/4/2019 15:35	179.0	13.0	5.1
12/4/2019 15:36	177.7	13.0	5.1
12/4/2019 15:37	176.3	13.0	5.1
Average =	174.9	13.0	5.1

Reference Method Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 15:38	174.6	13.1	5.1
12/4/2019 15:39	172.8	13.1	5.1
12/4/2019 15:40	173.3	13.1	5.1
12/4/2019 15:41	172.2	13.0	5.1
12/4/2019 15:42	172.3	13.0	5.0
12/4/2019 15:43	171.2	13.1	5.0
12/4/2019 15:44	171.9	13.1	5.0
12/4/2019 15:45	170.4	13.1	5.0
12/4/2019 15:46	171.6	13.1	5.0
12/4/2019 15:47	169.3	13.1	5.0
12/4/2019 15:48	169.1	13.1	5.0
12/4/2019 15:49	171.0	13.1	5.0
12/4/2019 15:50	171.0	13.1	5.0
12/4/2019 15:51	171.2	13.1	5.0
12/4/2019 15:52	170.8	13.0	5.0
12/4/2019 15:53	173.0	13.0	5.1
12/4/2019 15:54	173.8	13.0	5.1
12/4/2019 15:55	177.3	13.0	5.1
12/4/2019 15:56	180.3	13.0	5.1
12/4/2019 15:57	182.3	13.0	5.1
12/4/2019 15:58	183.7	12.9	5.1
Average =	173.5	13.0	5.0

Reference Method Calibration Data

CEM CALIBRATION DATA

Sampling Location	Main Stack
Date	4-Dec-19
Run Number	1
Start Time	1130
Stop Time	1150

Plant Name	Cokenergy
Plant Rep.	Luke Ford
Team Leader	John Carson
CEM Operator	Bill Thomas
Project Number	60616835

	Analyzer Number	Calibration Span
O2		20.99
CO2		20.67
CO		
THC		15
NOx		
SO2		399.9

	Calibration Gas Specification (% of Span)	CALIBRATION ERROR CHECK				SYSTEM CAL CHECK					Calibration Correction Factors
						Pre Run 1		Post Run 1			
		Calibration Value (% or ppm)	Cylinder Number (1)	Analyzer Calibration Response	Difference (% of Span)	System Response	Syst. Bias (% of Span)	System Response	Syst. Bias (% of Span)	Drift (% of Span)	
O2 Zero	<20	0	UHP Nitrogen	0	0.0%	-0.1	-0.5%	-0.1	-0.5%	0.0%	-Co=0.1
O2 Mid	40-60	10.08	CC273267	9.8	-1.3%	9.8	0.0%	9.8	0.0%	0.0%	Cm=9.8
O2 High	100	20.99	CC126166	20.9	-0.4%						
CO2 Zero	<20	0	UHP Nitrogen	0.1	0.5%	0.1	0.0%	0.1	0.0%	0.0%	Co=0.1
CO2 Mid	40-60	9.983	CC273267	9.8	-0.9%	9.7	-0.5%	9.7	-0.5%	0.0%	Cm=9.7
CO2 High	100	20.67	CC126166	20.7	0.1%						
SO2 Zero	<20	0	CC273267	0.1	0.0%	0.7	0.2%	0.6	0.1%	0.0%	Co=0.7
SO2 Mid	40-60	176.5	CC14789	169.5	-1.8%	166	-0.9%	167.5	-0.5%	0.4%	Cm=166.8
SO2 High	100	399.9	CC31822	398	-0.5%						

$$\textbf{Calibration Error} = \left(\frac{\text{Analyzer Response - Calibration Value}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 2\%,\ \pm 5\%\ \text{for THC}$$

$$\textbf{System Bias} = \left(\frac{\text{System Response - Analyzer Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 5\%$$

$$\textbf{Drift} = \left(\frac{\text{Post Test System Response - Pretest System Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 3\%$$

$$\textbf{Co} = \frac{\text{Pretest System Zero Response + Post Test System Zero Response}}{2}$$

$$\textbf{Cm} = \frac{\text{Pretest System Upscale Response + Post Test System Upscale Response}}{2}$$

NR = Not required by EPA Method.

CEM CALIBRATION DATA

Sampling Location	Main Stack
Date	4-Dec-19
Run Number	2
Start Time	1151
Stop Time	1211

Plant Name	Cokenergy
Plant Rep.	Luke Ford
Team Leader	John Carson
CEM Operator	Bill Thomas
Project Number	60616835

	Analyzer Number	Calibration Span
O2		20.99
CO2		20.67
CO		
THC		15
NOx		
SO2		399.9

	Calibration Gas Specification (% of Span)	CALIBRATION ERROR CHECK				SYSTEM CAL CHECK					
		Calibration Value (% or ppm)	Cylinder Number (1)	Analyzer Calibration Response	Difference (% of Span)	Pre Run 2 System Response	Pre Run 2 Syst. Bias (% of Span)	Post Run 2 System Response	Post Run 2 Syst. Bias (% of Span)	Drift (% of Span)	Calibration Correction Factors
O2 Zero	<20	0	UHP Nitrogen	0	0.0%	-0.1	-0.5%	-0.1	-0.5%	0.0%	-Co=0.1
O2 Mid	40-60	10.08	CC273267	9.8	-1.3%	9.8	0.0%	9.8	0.0%	0.0%	Cm=9.8
O2 High	100	20.99	CC126166	20.9	-0.4%						
CO2 Zero	<20	0	UHP Nitrogen	0.1	0.5%	0.1	0.0%	0.1	0.0%	0.0%	Co=0.1
CO2 Mid	40-60	9.983	CC273267	9.8	-0.9%	9.7	-0.5%	9.7	-0.5%	0.0%	Cm=9.7
CO2 High	100	20.67	CC126166	20.7	0.1%						
SO2 Zero	<20	0	CC273267	0.1	0.0%	0.7	0.2%	0.6	0.1%	0.0%	Co=0.7
SO2 Mid	40-60	176.5	CC14789	169.5	-1.8%	166	-0.9%	167.5	-0.5%	0.4%	Cm=166.8
SO2 High	100	399.9	CC31822	398	-0.5%						

$$\textbf{Calibration Error} = \left(\frac{\text{Analyzer Response - Calibration Value}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 2\%,\ \pm 5\%\ \text{for THC}$$

$$\textbf{System Bias} = \left(\frac{\text{System Response - Analyzer Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 5\%$$

$$\textbf{Drift} = \left(\frac{\text{Post Test System Response - Pretest System Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 3\%$$

$$\textbf{Co} = \frac{\text{Pretest System Zero Response + Post Test System Zero Response}}{2}$$

$$\textbf{Cm} = \frac{\text{Pretest System Upscale Response + Post Test System Upscale Response}}{2}$$

NR = Not required by EPA Method.

CEM CALIBRATION DATA

Sampling Location	Main Stack
Date	4-Dec-19
Run Number	3
Start Time	1212
Stop Time	1232

Plant Name	Cokenergy
Plant Rep.	Luke Ford
Team Leader	John Carson
CEM Operator	Bill Thomas
Project Number	60616835

	Analyzer Number	Calibration Span
O2		20.99
CO2		20.67
CO		
THC		15
NOx		
SO2		399.9

	Calibration Gas Specification (% of Span)	CALIBRATION ERROR CHECK				SYSTEM CAL CHECK					
		Calibration Value (% or ppm)	Cylinder Number (1)	Analyzer Calibration Response	Difference (% of Span)	Pre Run 3 System Response	Pre Run 3 Syst. Bias (% of Span)	Post Run 3 System Response	Post Run 3 Syst. Bias (% of Span)	Drift (% of Span)	Calibration Correction Factors
O2 Zero	<20	0	UHP Nitrogen	0	0.0%	-0.1	-0.5%	-0.1	-0.5%	0.0%	-Co=0.1
O2 Mid	40-60	10.08	CC273267	9.8	-1.3%	9.8	0.0%	9.8	0.0%	0.0%	Cm=9.8
O2 High	100	20.99	CC126166	20.9	-0.4%						
CO2 Zero	<20	0	UHP Nitrogen	0.1	0.5%	0.1	0.0%	0.1	0.0%	0.0%	Co=0.1
CO2 Mid	40-60	9.983	CC273267	9.8	-0.9%	9.7	-0.5%	9.7	-0.5%	0.0%	Cm=9.7
CO2 High	100	20.67	CC126166	20.7	0.1%						
SO2 Zero	<20	0	CC273267	0.1	0.0%	0.7	0.2%	0.6	0.1%	0.0%	Co=0.7
SO2 Mid	40-60	176.5	CC14789	169.5	-1.8%	166	-0.9%	167.5	-0.5%	0.4%	Cm=166.8
SO2 High	100	399.9	CC31822	398	-0.5%						

$$\textbf{Calibration Error} = \left(\frac{\text{Analyzer Response - Calibration Value}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 2\%,\ \pm 5\%\ \text{for THC}$$

$$\textbf{System Bias} = \left(\frac{\text{System Response - Analyzer Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 5\%$$

$$\textbf{Drift} = \left(\frac{\text{Post Test System Response - Pretest System Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 3\%$$

$$\textbf{Co} = \frac{\text{Pretest System Zero Response + Post Test System Zero Response}}{2}$$

$$\textbf{Cm} = \frac{\text{Pretest System Upscale Response + Post Test System Upscale Response}}{2}$$

NR = Not required by EPA Method.

CEM CALIBRATION DATA

Sampling Location	Main Stack
Date	4-Dec-19
Run Number	4
Start Time	1310
Stop Time	1330

Plant Name	Cokenergy
Plant Rep.	Luke Ford
Team Leader	John Carson
CEM Operator	Bill Thomas
Project Number	60616835

	Analyzer Number	Calibration Span
O2		20.99
CO2		20.67
CO		
THC		15
NOx		
SO2		399.9

	Calibration Gas Specification (% of Span)	CALIBRATION ERROR CHECK				SYSTEM CAL CHECK					
		Calibration Value (% or ppm)	Cylinder Number (1)	Analyzer Calibration Response	Difference (% of Span)	Pre Run 4 System Response	Pre Run 4 Syst. Bias (% of Span)	Post Run 4 System Response	Post Run 4 Syst. Bias (% of Span)	Drift (% of Span)	Calibration Correction Factors
O2 Zero	<20	0	UHP Nitrogen	0	0.0%	-0.1	-0.5%	-0.1	-0.5%	0.0%	-Co=0.1
O2 Mid	40-60	10.08	CC273267	9.8	-1.3%	9.8	0.0%	10	1.0%	1.0%	Cm=9.9
O2 High	100	20.99	CC126166	20.9	-0.4%						
CO2 Zero	<20	0	UHP Nitrogen	0.1	0.5%	0.1	0.0%	0.1	0.0%	0.0%	Co=0.1
CO2 Mid	40-60	9.983	CC273267	9.8	-0.9%	9.7	-0.5%	9.6	-1.0%	-0.5%	Cm=9.7
CO2 High	100	20.67	CC126166	20.7	0.1%						
SO2 Zero	<20	0	CC273267	0.1	0.0%	0.6	0.1%	0.8	0.2%	0.1%	Co=0.7
SO2 Mid	40-60	176.5	CC14789	169.5	-1.8%	167.5	-0.5%	163.7	-1.5%	-1.0%	Cm=165.6
SO2 High	100	399.9	CC31822	398	-0.5%						

$$\textbf{Calibration Error} = \left(\frac{\text{Analyzer Response - Calibration Value}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 2\%,\ \pm 5\%\ \text{for THC}$$

$$\textbf{System Bias} = \left(\frac{\text{System Response - Analyzer Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 5\%$$

$$\textbf{Drift} = \left(\frac{\text{Post Test System Response - Pretest System Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 3\%$$

$$\textbf{Co} = \frac{\text{Pretest System Zero Response + Post Test System Zero Response}}{2}$$

$$\textbf{Cm} = \frac{\text{Pretest System Upscale Response + Post Test System Upscale Response}}{2}$$

NR = Not required by EPA Method.

CEM CALIBRATION DATA

Sampling Location	Main Stack
Date	4-Dec-19
Run Number	5
Start Time	1331
Stop Time	1351

Plant Name	Cokenergy
Plant Rep.	Luke Ford
Team Leader	John Carson
CEM Operator	Bill Thomas
Project Number	60616835

	Analyzer Number	Calibration Span
O2		20.99
CO2		20.67
CO		
THC		15
NOx		
SO2		399.9

	Calibration Gas Specification (% of Span)	CALIBRATION ERROR CHECK				SYSTEM CAL CHECK					
		Calibration Value (% or ppm)	Cylinder Number (1)	Analyzer Calibration Response	Difference (% of Span)	Pre Run 5 System Response	Pre Run 5 Syst. Bias (% of Span)	Post Run 5 System Response	Post Run 5 Syst. Bias (% of Span)	Drift (% of Span)	Calibration Correction Factors
O2 Zero	<20	0	UHP Nitrogen	0	0.0%	-0.1	-0.5%	-0.1	-0.5%	0.0%	-Co=0.1
O2 Mid	40-60	10.08	CC273267	9.8	-1.3%	9.8	0.0%	10	1.0%	1.0%	Cm=9.9
O2 High	100	20.99	CC126166	20.9	-0.4%						
CO2 Zero	<20	0	UHP Nitrogen	0.1	0.5%	0.1	0.0%	0.1	0.0%	0.0%	Co=0.1
CO2 Mid	40-60	9.983	CC273267	9.8	-0.9%	9.7	-0.5%	9.6	-1.0%	-0.5%	Cm=9.7
CO2 High	100	20.67	CC126166	20.7	0.1%						
SO2 Zero	<20	0	CC273267	0.1	0.0%	0.6	0.1%	0.8	0.2%	0.1%	Co=0.7
SO2 Mid	40-60	176.5	CC14789	169.5	-1.8%	167.5	-0.5%	163.7	-1.5%	-1.0%	Cm=165.6
SO2 High	100	399.9	CC31822	398	-0.5%						

Calibration Error $= \left(\frac{\text{Analyzer Response - Calibration Value}}{\text{Analyzer Span}}\right) \times 100$; allowable error = ±2%, ±5% for THC

System Bias $= \left(\frac{\text{System Response - Analyzer Response}}{\text{Analyzer Span}}\right) \times 100$; allowable error = ±5%

Drift $= \left(\frac{\text{Post Test System Response - Pretest System Response}}{\text{Analyzer Span}}\right) \times 100$; allowable error = ±3%

Co $= \frac{\text{Pretest System Zero Response + Post Test System Zero Response}}{2}$

Cm $= \frac{\text{Pretest System Upscale Response + Post Test System Upscale Response}}{2}$

NR = Not required by EPA Method.

CEM CALIBRATION DATA

Sampling Location	Main Stack
Date	4-Dec-19
Run Number	6
Start Time	1352
Stop Time	1412

Plant Name	Cokenergy
Plant Rep.	Luke Ford
Team Leader	John Carson
CEM Operator	Bill Thomas
Project Number	60616835

	Analyzer Number	Calibration Span
O2		20.99
CO2		20.67
CO		
THC		15
NOx		
SO2		399.9

	Calibration Gas Specification (% of Span)	CALIBRATION ERROR CHECK				SYSTEM CAL CHECK					
		Calibration Value (% or ppm)	Cylinder Number (1)	Analyzer Calibration Response	Difference (% of Span)	Pre Run 6 System Response	Pre Run 6 Syst. Bias (% of Span)	Post Run 6 System Response	Post Run 6 Syst. Bias (% of Span)	Drift (% of Span)	Calibration Correction Factors
O2 Zero	<20	0	UHP Nitrogen	0	0.0%	-0.1	-0.5%	-0.1	-0.5%	0.0%	-Co=0.1
O2 Mid	40-60	10.08	CC273267	9.8	-1.3%	9.8	0.0%	10	1.0%	1.0%	Cm=9.9
O2 High	100	20.99	CC126166	20.9	-0.4%						
CO2 Zero	<20	0	UHP Nitrogen	0.1	0.5%	0.1	0.0%	0.1	0.0%	0.0%	Co=0.1
CO2 Mid	40-60	9.983	CC273267	9.8	-0.9%	9.7	-0.5%	9.6	-1.0%	-0.5%	Cm=9.7
CO2 High	100	20.67	CC126166	20.7	0.1%						
SO2 Zero	<20	0	CC273267	0.1	0.0%	0.6	0.1%	0.8	0.2%	0.1%	Co=0.7
SO2 Mid	40-60	176.5	CC14789	169.5	-1.8%	167.5	-0.5%	163.7	-1.5%	-1.0%	Cm=165.6
SO2 High	100	399.9	CC31822	398	-0.5%						

$$\textbf{Calibration Error} = \left(\frac{\text{Analyzer Response - Calibration Value}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 2\%,\ \pm 5\%\ \text{for THC}$$

$$\textbf{System Bias} = \left(\frac{\text{System Response - Analyzer Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 5\%$$

$$\textbf{Drift} = \left(\frac{\text{Post Test System Response - Pretest System Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 3\%$$

$$\textbf{Co} = \frac{\text{Pretest System Zero Response + Post Test System Zero Response}}{2}$$

$$\textbf{Cm} = \frac{\text{Pretest System Upscale Response + Post Test System Upscale Response}}{2}$$

NR = Not required by EPA Method.

CEM CALIBRATION DATA

Sampling Location	Main Stack
Date	4-Dec-19
Run Number	7
Start Time	1435
Stop Time	1455

Plant Name	Cokenergy
Plant Rep.	Luke Ford
Team Leader	John Carson
CEM Operator	Bill Thomas
Project Number	60616835

	Analyzer Number	Calibration Span
O2		20.99
CO2		20.67
CO		
THC		15
NOx		
SO2		399.9

	Calibration Gas Specification (% of Span)	CALIBRATION ERROR CHECK				SYSTEM CAL CHECK					
		Calibration Value (% or ppm)	Cylinder Number (1)	Analyzer Calibration Response	Difference (% of Span)	Pre Run 7 System Response	Pre Run 7 Syst. Bias (% of Span)	Post Run 7 System Response	Post Run 7 Syst. Bias (% of Span)	Drift (% of Span)	Calibration Correction Factors
O2 Zero	<20	0	UHP Nitrogen	0	0.0%	-0.1	-0.5%	-0.1	-0.5%	0.0%	-Co=0.1
O2 Mid	40-60	10.08	CC273267	9.8	-1.3%	10	1.0%	9.9	0.5%	-0.5%	Cm=10.0
O2 High	100	20.99	CC126166	20.9	-0.4%						
CO2 Zero	<20	0	UHP Nitrogen	0.1	0.5%	0.1	0.0%	0.1	0.0%	0.0%	Co=0.1
CO2 Mid	40-60	9.983	CC273267	9.8	-0.9%	9.6	-1.0%	9.7	-0.5%	0.5%	Cm=9.7
CO2 High	100	20.67	CC126166	20.7	0.1%						
SO2 Zero	<20	0	CC273267	0.1	0.0%	0.8	0.2%	0.4	0.1%	-0.1%	Co=0.6
SO2 Mid	40-60	176.5	CC14789	169.5	-1.8%	163.7	-1.5%	166.8	-0.7%	0.8%	Cm=165.3
SO2 High	100	399.9	CC31822	398	-0.5%						

Calibration Error $= \left(\frac{\text{Analyzer Response - Calibration Value}}{\text{Analyzer Span}}\right) \times 100$; allowable error = ±2%, ±5% for THC

System Bias $= \left(\frac{\text{System Response - Analyzer Response}}{\text{Analyzer Span}}\right) \times 100$; allowable error = ±5%

Drift $= \left(\frac{\text{Post Test System Response - Pretest System Response}}{\text{Analyzer Span}}\right) \times 100$; allowable error = ±3%

Co $= \frac{\text{Pretest System Zero Response + Post Test System Zero Response}}{2}$

Cm $= \frac{\text{Pretest System Upscale Response + Post Test System Upscale Response}}{2}$

NR = Not required by EPA Method.

CEM CALIBRATION DATA

Sampling Location	Main Stack
Date	4-Dec-19
Run Number	8
Start Time	1456
Stop Time	1516

Plant Name	Cokenergy
Plant Rep.	Luke Ford
Team Leader	John Carson
CEM Operator	Bill Thomas
Project Number	60616835

	Analyzer Number	Calibration Span
O2		20.99
CO2		20.67
CO		
THC		15
NOx		
SO2		399.9

	Calibration Gas Specification (% of Span)	CALIBRATION ERROR CHECK				SYSTEM CAL CHECK					
		Calibration Value (% or ppm)	Cylinder Number (1)	Analyzer Calibration Response	Difference (% of Span)	Pre Run 8 System Response	Pre Run 8 Syst. Bias (% of Span)	Post Run 8 System Response	Post Run 8 Syst. Bias (% of Span)	Drift (% of Span)	Calibration Correction Factors
O2 Zero	<20	0	UHP Nitrogen	0	0.0%	-0.1	-0.5%	-0.1	-0.5%	0.0%	-Co=0.1
O2 Mid	40-60	10.08	CC273267	9.8	-1.3%	10	1.0%	9.9	0.5%	-0.5%	Cm=10.0
O2 High	100	20.99	CC126166	20.9	-0.4%						
CO2 Zero	<20	0	UHP Nitrogen	0.1	0.5%	0.1	0.0%	0.1	0.0%	0.0%	Co=0.1
CO2 Mid	40-60	9.983	CC273267	9.8	-0.9%	9.6	-1.0%	9.7	-0.5%	0.5%	Cm=9.7
CO2 High	100	20.67	CC126166	20.7	0.1%						
SO2 Zero	<20	0	CC273267	0.1	0.0%	0.8	0.2%	0.4	0.1%	-0.1%	Co=0.6
SO2 Mid	40-60	176.5	CC14789	169.5	-1.8%	163.7	-1.5%	166.8	-0.7%	0.8%	Cm=165.3
SO2 High	100	399.9	CC31822	398	-0.5%						

$$\textbf{Calibration Error} = \left(\frac{\text{Analyzer Response - Calibration Value}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 2\%,\ \pm 5\%\ \text{for THC}$$

$$\textbf{System Bias} = \left(\frac{\text{System Response - Analyzer Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 5\%$$

$$\textbf{Drift} = \left(\frac{\text{Post Test System Response - Pretest System Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 3\%$$

$$\textbf{Co} = \frac{\text{Pretest System Zero Response + Post Test System Zero Response}}{2}$$

$$\textbf{Cm} = \frac{\text{Pretest System Upscale Response + Post Test System Upscale Response}}{2}$$

NR = Not required by EPA Method.

CEM CALIBRATION DATA

Sampling Location	Main Stack
Date	4-Dec-19
Run Number	9
Start Time	1517
Stop Time	1537

Plant Name	Cokenergy
Plant Rep.	Luke Ford
Team Leader	John Carson
CEM Operator	Bill Thomas
Project Number	60616835

	Analyzer Number	Calibration Span
O2		20.99
CO2		20.67
CO		
THC		15
NOx		
SO2		399.9

	Calibration Gas Specification (% of Span)	CALIBRATION ERROR CHECK				SYSTEM CAL CHECK					
		Calibration Value (% or ppm)	Cylinder Number (1)	Analyzer Calibration Response	Difference (% of Span)	Pre Run 9 System Response	Pre Run 9 Syst. Bias (% of Span)	Post Run 9 System Response	Post Run 9 Syst. Bias (% of Span)	Drift (% of Span)	Calibration Correction Factors
O2 Zero	<20	0	UHP Nitrogen	0	0.0%	-0.1	-0.5%	-0.1	-0.5%	0.0%	-Co=0.1
O2 Mid	40-60	10.08	CC273267	9.8	-1.3%	10	1.0%	9.9	0.5%	-0.5%	Cm=10.0
O2 High	100	20.99	CC126166	20.9	-0.4%						
CO2 Zero	<20	0	UHP Nitrogen	0.1	0.5%	0.1	0.0%	0.1	0.0%	0.0%	Co=0.1
CO2 Mid	40-60	9.983	CC273267	9.8	-0.9%	9.6	-1.0%	9.7	-0.5%	0.5%	Cm=9.7
CO2 High	100	20.67	CC126166	20.7	0.1%						
SO2 Zero	<20	0	CC273267	0.1	0.0%	0.8	0.2%	0.4	0.1%	-0.1%	Co=0.6
SO2 Mid	40-60	176.5	CC14789	169.5	-1.8%	163.7	-1.5%	166.8	-0.7%	0.8%	Cm=165.3
SO2 High	100	399.9	CC31822	398	-0.5%						

$$\textbf{Calibration Error} = \left(\frac{\text{Analyzer Response - Calibration Value}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 2\%,\ \pm 5\%\ \text{for THC}$$

$$\textbf{System Bias} = \left(\frac{\text{System Response - Analyzer Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 5\%$$

$$\textbf{Drift} = \left(\frac{\text{Post Test System Response - Pretest System Response}}{\text{Analyzer Span}}\right) \times 100;\ \text{allowable error} = \pm 3\%$$

$$\textbf{Co} = \frac{\text{Pretest System Zero Response + Post Test System Zero Response}}{2}$$

$$\textbf{Cm} = \frac{\text{Pretest System Upscale Response + Post Test System Upscale Response}}{2}$$

NR = Not required by EPA Method.

CEM CALIBRATION DATA

Sampling Location	Main Stack
Date	4-Dec-19
Run Number	10
Start Time	1538
Stop Time	1558

Plant Name	Cokenergy
Plant Rep.	Luke Ford
Team Leader	John Carson
CEM Operator	Bill Thomas
Project Number	60616835

	Analyzer Number	Calibration Span
O2		20.99
CO2		20.67
CO		
THC		15
NOx		
SO2		399.9

	Calibration Gas Specification (% of Span)	CALIBRATION ERROR CHECK				SYSTEM CAL CHECK					
		Calibration Value (% or ppm)	Cylinder Number (1)	Analyzer Calibration Response	Difference (% of Span)	Pre Run 10 System Response	Pre Run 10 Syst. Bias (% of Span)	Post Run 10 System Response	Post Run 10 Syst. Bias (% of Span)	Drift (% of Span)	Calibration Correction Factors
O2 Zero	<20	0	UHP Nitrogen	0	0.0%	-0.1	-0.5%	-0.1	-0.5%	0.0%	-Co=0.1
O2 Mid	40-60	10.08	CC273267	9.8	-1.3%	10	1.0%	9.9	0.5%	-0.5%	Cm=10.0
O2 High	100	20.99	CC126166	20.9	-0.4%						
CO2 Zero	<20	0	UHP Nitrogen	0.1	0.5%	0.1	0.0%	0.1	0.0%	0.0%	Co=0.1
CO2 Mid	40-60	9.983	CC273267	9.8	-0.9%	9.6	-1.0%	9.7	-0.5%	0.5%	Cm=9.7
CO2 High	100	20.67	CC126166	20.7	0.1%						
SO2 Zero	<20	0	CC273267	0.1	0.0%	0.8	0.2%	0.4	0.1%	-0.1%	Co=0.6
SO2 Mid	40-60	176.5	CC14789	169.5	-1.8%	163.7	-1.5%	166.8	-0.7%	0.8%	Cm=165.3
SO2 High	100	399.9	CC31822	398	-0.5%						

Calibration Error $= \left(\frac{\text{Analyzer Response - Calibration Value}}{\text{Analyzer Span}} \right) \times 100$; allowable error = ±2%, ±5% for THC

System Bias $= \left(\frac{\text{System Response - Analyzer Response}}{\text{Analyzer Span}} \right) \times 100$; allowable error = ±5%

Drift $= \left(\frac{\text{Post Test System Response - Pretest System Response}}{\text{Analyzer Span}} \right) \times 100$; allowable error = ±3%

$$\textbf{Co} = \frac{\text{Pretest System Zero Response + Post Test System Zero Response}}{2}$$

$$\textbf{Cm} = \frac{\text{Pretest System Upscale Response + Post Test System Upscale Response}}{2}$$

NR = Not required by EPA Method.

Reference Method Direct Calibration Results
Source: Main Stack Cokenergy
Date: 12/4/19 NOTE: DAS time is EST; plant time is CST

	SO2, ppm	O2, %	CO2, %
12/4/2019 9:49	1.0	-0.1	0.2
12/4/2019 9:50	1.0	0.0	0.1
12/4/2019 9:51	1.2	0.0	0.1
12/4/2019 9:52	1.0	-0.1	0.1
12/4/2019 9:53	1.0	17.9	13.8
12/4/2019 9:54	1.1	21.0	20.5
12/4/2019 9:55	1.1	20.9	20.8
12/4/2019 9:56	0.2	20.9	20.8
12/4/2019 9:57	-0.1	20.9	20.7
12/4/2019 9:58	-0.1	12.4	14.5
12/4/2019 9:59	0.1	9.8	9.8
12/4/2019 10:00	0.1	9.8	9.8
12/4/2019 10:01	0.2	9.8	9.8
12/4/2019 10:02	107.8	6.6	9.7
12/4/2019 10:03	387.8	-0.1	9.7
12/4/2019 10:04	393.8	-0.1	9.7
12/4/2019 10:05	398.8	-0.1	9.8
12/4/2019 10:06	396.6	-0.1	9.8
12/4/2019 10:07	395.6	-0.2	9.8
12/4/2019 10:08	400.1	-0.2	9.7
12/4/2019 10:09	398.0	-0.2	9.7
12/4/2019 10:10	359.4	0.9	9.7
12/4/2019 10:11	175.5	4.8	9.8
12/4/2019 10:12	171.0	4.8	9.9
12/4/2019 10:13	169.5	4.8	9.8

Reference Method Bias Check Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 10:19	160.0	11.3	5.3
12/4/2019 10:20	27.1	0.1	1.8
12/4/2019 10:21	5.6	-0.1	0.2
12/4/2019 10:22	3.2	-0.1	0.2
12/4/2019 10:23	2.4	-0.1	0.1
12/4/2019 10:24	2.1	-0.1	0.1
12/4/2019 10:25	1.7	-0.1	0.1
12/4/2019 10:26	1.5	-0.1	0.1
12/4/2019 10:27	1.6	4.2	2.7
12/4/2019 10:28	1.6	9.8	9.6
12/4/2019 10:29	0.9	9.8	9.7
12/4/2019 10:30	0.7	9.8	9.7
12/4/2019 10:31	19.2	8.5	9.7
12/4/2019 10:32	152.4	4.8	9.8
12/4/2019 10:33	162.5	4.8	9.7
12/4/2019 10:34	164.5	4.8	9.8
12/4/2019 10:35	166.1	4.8	9.8
12/4/2019 10:36	166.0	4.8	9.8

Reference Method Bias Check Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 12:35	89.0	7.1	2.8
12/4/2019 12:36	7.5	-0.1	0.1
12/4/2019 12:37	3.8	-0.1	0.1
12/4/2019 12:38	2.9	0.7	0.2
12/4/2019 12:39	4.2	9.7	8.4
12/4/2019 12:40	1.4	9.8	9.6
12/4/2019 12:41	1.0	9.8	9.7
12/4/2019 12:42	0.6	9.8	9.7
12/4/2019 12:43	0.5	9.9	9.7
12/4/2019 12:44	111.1	6.3	9.3
12/4/2019 12:45	162.6	4.9	9.8
12/4/2019 12:46	165.2	4.9	9.7
12/4/2019 12:47	167.3	4.9	9.8
12/4/2019 12:48	166.9	4.9	9.8
12/4/2019 12:49	167.3	4.9	9.8
12/4/2019 12:50	167.5	4.9	9.8

Reference Method Bias Check Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 14:12	168.6	12.9	5.1
12/4/2019 14:13	104.6	15.0	5.1
12/4/2019 14:14	18.9	17.4	5.1
12/4/2019 14:15	18.1	17.2	4.8
12/4/2019 14:16	12.5	0.3	0.3
12/4/2019 14:17	3.0	-0.1	0.1
12/4/2019 14:18	1.7	-0.1	0.1
12/4/2019 14:19	1.1	0.3	0.1
12/4/2019 14:20	20.5	8.9	6.1
12/4/2019 14:21	1.6	9.9	9.6
12/4/2019 14:22	0.8	10.0	9.6
12/4/2019 14:23	0.5	10.5	9.7
12/4/2019 14:24	102.4	6.9	9.2
12/4/2019 14:25	159.0	5.0	9.7
12/4/2019 14:26	163.8	5.0	9.7
12/4/2019 14:27	163.7	4.9	9.7

Reference Method Bias Check Results
Source: Main Stack Cokenergy
Date: 12/4/19

	SO2, ppm	O2, %	CO2, %
12/4/2019 15:59	182.7	13.5	5.2
12/4/2019 16:00	26.8	1.0	0.9
12/4/2019 16:01	5.3	-0.1	0.1
12/4/2019 16:02	2.6	-0.1	0.1
12/4/2019 16:03	5.0	0.7	0.2
12/4/2019 16:04	6.9	9.4	7.8
12/4/2019 16:05	1.1	9.9	9.7
12/4/2019 16:06	0.6	9.9	9.7
12/4/2019 16:07	0.4	9.9	9.7
12/4/2019 16:08	19.6	10.1	9.2
12/4/2019 16:09	141.8	5.0	9.7
12/4/2019 16:10	160.5	4.9	9.8
12/4/2019 16:11	164.6	4.9	9.8
12/4/2019 16:12	165.6	4.9	9.8
12/4/2019 16:13	165.4	4.9	9.8
12/4/2019 16:14	166.2	4.9	9.9

Calibration Gas Certification Sheets

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
12722 S. Wentworth Ave.
Chicago, IL 60628
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI80E15A0138	Reference Number:	54-401474856-1
Cylinder Number:	CC273267	Cylinder Volume:	150.9 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12019	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Apr 18, 2019

Expiration Date: Apr 18, 2027

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	10.00 %	9.893 %	G1	+/- 1.2% NIST Traceable	04/18/2019
OXYGEN	10.00 %	10.08 %	G1	+/- 1.0% NIST Traceable	04/18/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060714	CC413664	16.939 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 08, 2019
NTRM	98051019	SG9168269BAL	12.05 % OXYGEN/NITROGEN	+/- 0.7%	Dec 14, 2023

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO2-1 HORIBA VIA-510 V1E3H7P5	NDIR	Mar 26, 2019
O2-1 HORIBA MPA-510 3VUYL9NR	Paramagnetic	Mar 23, 2019

Triad Data Available Upon Request

Approved for Release

Airgas

Airgas Specialty Gases
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Chicago, IL 60628
(773) 785-3000 Fax: (773) 785-1928
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E03NI58E15A02X7	Reference Number:	54-124417638-2
Cylinder Number:	CC126166	Cylinder Volume:	160.6 CF
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2014 PSIG
PGVP Number:	B12014	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Feb 10, 2014

Expiration Date: Feb 10, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	21.00 %	20.67 %	G2	+/- 2% NIST Traceable	02/10/2014
OXYGEN	21.00 %	20.99 %	G1	+/- 1.0% NIST Traceable	02/08/2014
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08061321	CC255428	20.09 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jun 28, 2018
NTRM	06120210	CC195743	20.90 % OXYGEN/NITROGEN	+/- 0.4%	Dec 01, 2015

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO2-1 HORIBA VIA-510 V1E3H7P5	NDIR	Feb 10, 2014
O2-1 HORIBA MPA-510 3VUYL9NR	Paramagnetic	Jan 21, 2014

Triad Data Available Upon Request

Notes:

Approved for Release

Airgas
an Air Liquide company

In Service 9/29/17

Airgas USA, LLC
12722 S. Wentworth Ave.
Chicago, IL 60628
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI84E15A0007	Reference Number:	54-124629354-1
Cylinder Number:	CC14789	Cylinder Volume:	150.4 CF
Laboratory:	124 - Chicago - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12017	Valve Outlet:	660
Gas Code:	CO2,O2,SO2,BALN	Certification Date:	Jul 25, 2017

Expiration Date: Jul 25, 2025

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
SULFUR DIOXIDE	175.0 PPM	176.5 PPM	G1	+/- 1.0% NIST Traceable	07/17/2017, 07/25/2017
OXYGEN	5.000 %	5.009 %	G1	+/- 1.0% NIST Traceable	07/18/2017
CARBON DIOXIDE	10.00 %	10.00 %	G1	+/- 0.9% NIST Traceable	07/17/2017
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	16060140	CC437515	515.2 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 16, 2021
NTRM	11060719	CC338460	4.861 % OXYGEN/NITROGEN	+/- 0.4%	Dec 13, 2022
NTRM	13060635	CC413759	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 09, 2019

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801332	FTIR	Jun 21, 2017
O2-1 HORIBA MPA-510 3VUYL9NR	Paramagnetic	Jul 17, 2017
Nicolet 6700 AHR0801332	FTIR	Jul 21, 2017

Triad Data Available Upon Request

Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
12722 S. Wentworth Ave.
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Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI89E15A0052	Reference Number:	54-401594677-1
Cylinder Number:	CC31822	Cylinder Volume:	149.9 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12019	Valve Outlet:	660
Gas Code:	CO2,SO2,BALN	Certification Date:	Sep 16, 2019

Expiration Date: Sep 16, 2027

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
SULFUR DIOXIDE	385.0 PPM	399.9 PPM	G1	+/- 1.1% NIST Traceable	09/09/2019, 09/16/2019
CARBON DIOXIDE	10.00 %	9.808 %	G1	+/- 1.0% NIST Traceable	09/09/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	10010726	AAL072978	491.9 PPM SULFUR DIOXIDE/NITROGEN	+/- 1.0%	Jul 06, 2022
NTRM	12061517	CC354769	19.87 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801332	FTIR	Aug 27, 2019
Nicolet 6700 AHR0801332	FTIR	Aug 27, 2019

Triad Data Available Upon Request

Approved for Release

Sampling Equipment Calibration Data

CDS-04S
5 Point Console Dry Gas Meter Calibration

Console ID
URS-001

		Initials	Date
Calibrated by		WCT	3/9/19
Reviewed by		CS	3/11/19
Console Sticker	Prepared	WCT	3/9/19
	Reviewed	CS	3/11/19
	Affixed	WCT	3/9/19
MCL-01 or MCL-33 Prepared			

Console Calibration Expiration Date
8-Mar-2020

Orifice ID:	IX-40		IX-48		IX-55		IX-63		IX-73	
Orifice K':	0.2384		0.3480		0.4592		0.5885		0.8125	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b	Run #4a	Run #4b	Run #5a	Run #5b
Initial Reading, (ft^3)	892.295	897.648	903.962	909.992	864.631	870.688	939.507	948.114	955.993	966.842
Final Reading, (ft^3)	897.648	903.962	909.992	916.021	870.688	876.778	948.114	955.993	966.842	977.715
Difference, (ft^3)	5.353	6.314	6.030	6.029	6.057	6.090	8.607	7.879	10.849	10.873
Initial Meter Temp., (°F)	70	71	72	72	64	66	67	68	70	71
Final Meter Temp., (°F)	71	72	72	73	66	67	68	70	71	73
Average Meter Temp., (°F)	70.5	71.5	72.0	72.5	65.0	66.5	67.5	69.0	70.5	72.0
Test Time (min.)	17	20	13	13	10	10	11	10	10	10
Orifice Manometer Reading, ("H_2O)	0.33	0.33	0.68	0.68	1.20	1.20	1.90	1.90	3.60	3.60
Barometric Pressure, ("Hg)	29.26		29.26		29.26		29.23		29.23	
Ambient Temperature, (°F)	71		71		71		71		71	
Pump Vacuum, ("Hg)	22	22	19	19	15	15	19.5	19.5	16.5	16.5
Standard Volume of the Meter, (V_{mstd})	5.212	6.137	5.860	5.854	5.973	5.988	8.453	7.716	10.640	10.634
Standard Volume of Critical Orifice, (V_{crstd})	5.146	6.054	5.744	5.744	5.831	5.831	8.211	7.465	10.306	10.306
Flow Rate (cfm)	0.307	0.307	0.451	0.450	0.597	0.599	0.768	0.772	1.064	1.063
DGM Calibration Factor, (Y)	0.987	0.987	0.980	0.981	0.976	0.974	0.971	0.967	0.969	0.969
Average DGM Calibration Factor (Y)	0.987		0.981		0.975		0.969		0.969	
Delta H@, ("H_2O)	1.975	1.971	1.908	1.906	1.964	1.959	1.893	1.888	1.887	1.882
Average ΔH@, ("H_2O)	1.973		1.907		1.962		1.891		1.885	

Current Average Y	0.976
All Individual Y within 2% of mean?	TRUE
Average Delta $H_@$	1.923
All individual $\Delta H_@$ within 0.20"H_2O of mean	TRUE

CDS-04S DGM 5 point against orifice
Per EM SOP-002
Issued: January 2018

Temperature Readout Calibration
Isokinetic Sampling Consoles

Calibrated by	Initials	WCT
	Date	3/9/19
Reviewed by	Initials	CS
	Date	3/11/19

Readout ID Number	URS-001

Reference Thermometer	ID Number	2490
	Calibration Exp Date	5/22/19
Reference Thermocouple	ID Number	SR2
	Calibration Exp Date	3/9/19
Voltage Generator	ID Number	T-311348
	Calibration Exp Date	

Temperature Readout Calibration	
Reference Thermometer (°F)	70
Temperature Readout (°F)	68
Was readout adjusted?	Y / N
Do these agree within 2°F	Y / N

Temperature Readout Linearity Check

Channel	Voltage (mV)	Temperature (°F)		
		Theoretical	Observed	Difference [1]
Stack 1	-0.0	32		
	-1.0	-10	-8	+2
	0.0	32	32	0
	1.0	77	76	-1
	3.0	165	165	0
	5.0	251	252	1
	7.0	341	342	1
	10.0	475	473	-2
	15.0	692	693	1
	20.0	905	905	0
	30.0	1329	1328	-1
	40.0	1772	1771	-1

Channel	Voltage (mV)	Temperature (°F)		
		Theoretical	Observed	Difference [1]
Probe 2	0.0	32	32	0
	5.0	251	252	1
Filter 3	0.0	32	32	0
	5.0	251	252	1
Exit 4	0.0	32	32	0
	1.0	77	76	-1
Aux 5	0.0	32	32	0
	~~1.0~~	~~77~~ 121	121	0
6	0.0	32		
	2.0	121		
7	0.0	32		
	2.0	121		

[1] Difference is calculated as follows:

Difference = $Temp_{Observed}$ - $Temp_{Theoretical}$

Acceptable difference is ±5 °F for temperatures below 1000 °F and ±10 °F for temperatures above 1000 °F

Are these met? Y / N

Pre/Post Test Console Calibration Check

Console ID		URS-001
Calibrated by	Initials	WCT
	Date	12/17/19
Reviewed by	Initials	JC
	Date	12/18/19

Orifice ID:	IX-48		IX-55		IX-63	
Orifice K':	0.3480 ✓		0.4592 ✓		0.5885 ✓	
Dry Gas Meter	Run #1a	Run #1b	Run #2a	Run #2b	Run #3a	Run #3b
Initial Reading, (ft^3)	548.023 ✓	553.709 ✓	559.393 ✓	565.648	571.907 ✓	579.902 ✓
Final Reading, (ft^3)	553.709 ✓	559.393 ✓	565.648 ✓	571.907	579.902 ✓	587.942
Difference, (ft^3)	5.686	5.684	6.255	6.259	7.995	8.040
Initial Meter Temp., (°F)	70 ✓	70 ✓	72 ✓	73	74 ✓	75
Final Meter Temp., (°F)	70 ✓	72 ✓	73 ✓	74	75 ✓	75
Average Meter Temp., (°F)	70.0	71.0	72.5	73.5	74.5	75.0
Test Time (min.)	12 ✓	12 ✓	10 ✓	10	10 ✓	10
Orifice Manometer Reading, ("H_2O)	0.70 ✓	0.70 ✓	1.20 ✓	1.20	2.00 ✓	2.00
Barometric Pressure, ("Hg)	29.19 ✓		29.19 ✓		29.19 ✓	
Ambient Temperature, (°F)	70 ✓		70 ✓		70 ✓	
Pump Vacuum, ("Hg)	20 ✓	20 ✓	18.5 ✓	18.5 ✓	17 ✓	17 ✓
Standard Volume of the Meter, (V_{mstd})	5.534	5.522	6.067	6.059	7.741	7.777
Standard Volume of Critical Orifice, (V_{crstd})	5.295	5.295	5.822	5.822	7.462	7.462
DGM Calibration Factor, (Y)	0.957	0.959	0.960	0.961	0.964	0.959
Delta H@	1.97	1.97	1.94	1.93	1.97	1.97

Average Y =	0.960
Reference Y_d =	0.976
Percent Difference =	-1.7
Is Measured Y within 5% of Reference Y_d?	TRUE
Average Delta H@ =	1.958

CDS-0453: *DGM 3 point cal check against orifice*
Per *EM SOP-003*
Issued: *August 2017*

Three-Point Dry Gas Meter Calibration Check

(Against Critical Orifice)

Console ID	URS-001
Maintenance Documented with MCL-33?	Y / N

Calibrated by	Initials	WCT
	Date	12/17/19
Reviewed by	Initials	JC
	Date	12/18/19

Thermometer	ID Number	
	Calibration Exp Date	
Barometer	ID Number	weather channel
	Calibration Exp Date	
Leak Check	(+)	
	(-)	0.007@24"

		Run 1A	Run 1B	Run 2A	Run 2B	Run 3A	Run 3B
Critical Orifice	Identification Number	1X-48		1X-55		1X-63	
	Orifice Cal Exp Date	0.3480		0.4592		0.5885	
	K Factor	548.023					
Subject DGM	DGM Initial Reading (ft^3)	~~547.910~~	553.709	559.393	565.648	571.907	579.902
	DGM Final Reading (ft^3)	553.709	559.393	565.648	571.907	579.902	587.942
	Initial Temperature (°F)	~~70~~ 69	70	72	73	74	75
	Final Temperature (°F)	70	72	73	74	75	75
Test Time (minutes)		12	12	10	10	10	10
Orifice Manometer, ΔH ("H_2O)		0.70	0.70	1.2	1.2	2.0	2.0
Barometric Pressure ("Hg)		29.19		→		→	
Ambient Temperature (°F)		70		→		→	
Pump Vacuum ("Hg) [1]		20	20	18½	18½	17	17

[1] Calibration must be performed with a pump vacuum ≥15 "Hg.
If pump vacuum does not exceed 17"Hg, red-tag the pump for service.

Check the readout against a Traceable Thermometer

Reference Thermometer	ID Number	
	Calibration Expiration Date	
Thermocouple	ID Number	
	Calibration Expiration Date	
Thermometer Reading (°F)		
Readout Reading (°F)		

Readings must agree within 2°F. Is this met? **Y / N**

Notes:

Check the readout linearity (one channel only)

Voltage Supply	ID Number	
	Calibration Expiration Date	
Channel No.		*For VOST Consoles, select DGM Channel*

Voltage (mv)	Temperature (°F)		
	Theoretical	Observed	Difference
-1.0	-10		
0.0	32		
1.0	77		
2.0	121		
3.0	165		

Readings must agree within 5°F. Is this met? **Y / N**

S-Type Pitot Tube Inspection

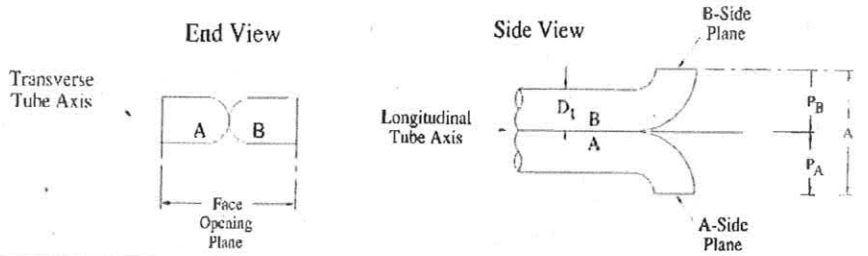
Probe ID	NA
Pitot ID	HST-8

Calibrated by	Initials	JC
	Date	4/5/19
Reviewed by	Initials	
	Date	

Caliper	ID	UT-01
	Calibration Exp Date	

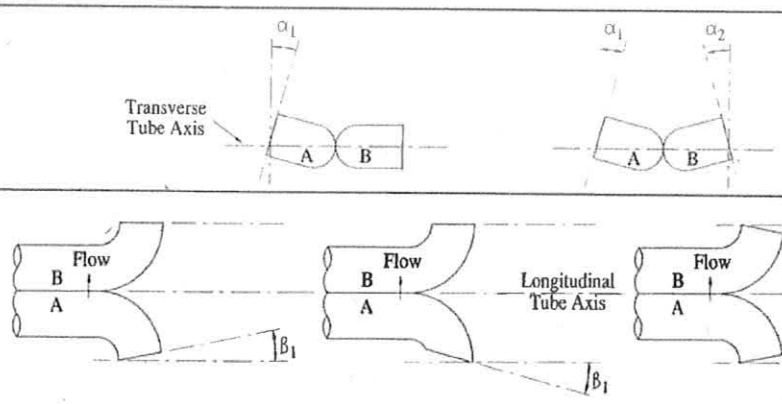
Angle Finder	ID	Sonin G58
	Calibration Exp Date	

General Pitot Tube Alignment

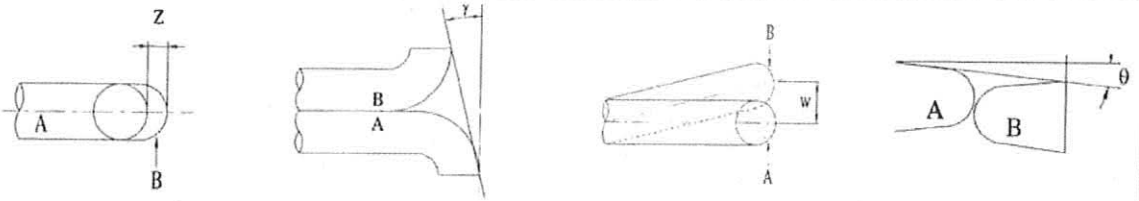


A = 0.932 "
D_t = 0.375"
0.188" ≤ D_t ≤ 0.375"? Y (y/n)
$1.05 \le A/2D_t \le 1.50$? Y (y/n)

Misalignment



α_1 = 2.5 °
α_2 = 4.6 °
$\alpha_1 \le 10°$? Y (y/n)
$\alpha_2 \le 10°$? Y (y/n)
β_1 = 1.5
β_2 = 0.8
$\beta_1 \le 5°$? Y (y/n)
$\beta_2 \le 5°$? Y (y/n)



γ = 0.8 °
θ = 1.5 °
Z = A tan(γ) = 0.012
W = A tan(θ) = 0.022
Z ≤ 0.125"? Y (y/n)
W ≤ 0.031"? Y (y/n)

Acceptability for Use (Circle Selection)	If all answers are "Y", this pitot tube is available for use, and may be assigned a correction factor of 0.84	If all answers except the first (D_t) are "Y", this pitot tube is available for use, but needs to be calibrated using a wind tunnel.	Any other situation, the pitot tube must be removed from service.

Stack Thermocouple Calibration

Thermometer (or Readout/TC)	ID	2490
	Calibration Exp Date	
Temperature Readout	ID	HH308
	Calibration Exp Date	

Calibrated by	Initials	JC
	Date	4/4/19
Reviewed by	Initials	
	Date	

Reference Thermometer	Thermocouple Readout	Compare Readings	Function Check
T_F 72 °F	T_F 72.3 °F	$\frac{T_{abs,TC}}{T_{abs,RT}}$ = 1.00	3°F change in readout upon external temperature stimulus?
$T_{abs,RT}$ 532 °R [1]	$T_{abs,TC}$ 532.3 R	Between 0.985 and 1.015? (Y) N	(Y) N

1 T_{abs} (°R) = T_F (°F) + 460

pitots good at 20 % ± C

Temperature Sensor Calibration

Readout ID Number	HH308
Thermometer ID Number	2490
Probe ID:	HST-8

Calibrated by	Initials	DC
	Date	5/14/19
Reviewed by	Initials	
	Date	

Thermometer Reading (°F)	Temperature Readout and Sensor Reading (°F)	Error
68	68	0%
198	196	-0.3%
294	292	-0.3%
384	381	-0.4%
492	484	-0.8%
		Good

Error is calculated according to the following equation:

$$\text{Error} = \frac{T_{Sens} - T_{Ref}}{T_{Ref} + 460} \times 100\%$$

CDS-09: Temperature Sensor
Per: EM SOP-001
Revised: April 2019
Document reviewed biennially

Where

T_{sens} is the temperature reading from the sensor and

T_{ref} is the temperature reading from the reference thermometer

Acceptance criteria: Error is less than ±1.5%, absolute

Temperature Sensor Calibration

Readout ID Number	URS-002
Thermometer ID Number	2490
Thermometer Expiration Date	5/22/20
Sensor ID Number	HST 8

Calibrated by	Initials	WCT
	Date	12/13/19
Reviewed by	Initials	JC
	Date	12/18/19

Thermometer Reading (°F)	Temperature Readout and Sensor Reading (°F)	Error
72	69	-0.6%
210	209	-0.1%

Error is calculated according to the following equation:

$$\text{Error} = \frac{T_{Sens} - T_{Ref}}{T_{Ref} + 460} \times 100\%$$

CDS-09: Temperature Sensor
Per: EM SOP-001
Revised: April 2019
Document reviewed biennially

Where

T_{sens} is the temperature reading from the sensor and

T_{ref} is the temperature reading from the reference thermometer

Acceptance criteria: Error is less than ±1.5%, absolute

Field Data Sheets

Velocity Traverse Data

Plant Name:	Cokenergy
Sampling Location:	Main Stack
Project Number:	60616835
	Note: Time shown is CST

Run #	1	2	3
Date	4-Dec-19	4-Dec-19	4-Dec-19
Time	1032-1041	1055-1107	1118-1129
Location	Main Stack	Main Stack	Main Stack
Pitot Tube Coefficient	0.84	0.84	0.84
Stack Diameter, ft	18	18	18
Stack Length, ft		0	0
Stack Area, sq. ft.	254.5	254.5	254.5
Barometric Pressure, in. Hg	28.902	28.902	28.902
Static Pressure, in. H_20	-1.20	-1.2	-1.2
Stack Gas O_2, %	12.93%	13.13%	13.24%
Stack Gas CO_2, %	5.20%	5.30%	5.20%
Stack Gas N_2, %	81.87%	81.56%	81.56%
Dry Gas Molecular Weight	29.349153	29.373937	29.361371
Moisture Content, %	12.48%	12.48%	12.48%
Wet Gas Molecular Weight	27.93	27.95	27.94
Stack Gas Flow, acfm	1340700	1341712	1307909
Stack Gas Flow, scfm	937476	942938	927299

Traverse Point	Stack Temp.	Velocity Pressure	Sq. Root of Vel. Press.	Stack Temp.	Velocity Pressure	Sq. Root of Vel. Press.	Stack Temp.	Velocity Pressure	Sq. Root of Vel. Press.
1	274	1.5	1.22	261	1.5	1.22	260	1.6	1.26
2	274	1.6	1.26	261	1.8	1.34	261	1.5	1.22
3	273	1.3	1.14	263	1.3	1.14	262	1	1.00
4	263	2.1	1.45	262	2	1.41	261	1.8	1.34
5	267	2	1.41	264	1.9	1.38	265	1.9	1.38
6	268	1.9	1.38	267	1.7	1.30	266	1.6	1.26
7	265	2	1.41	264	1.8	1.34	257	1.7	1.30
8	267	1.8	1.34	265	2	1.41	260	1.9	1.38
9	268	1.5	1.22	266	1.7	1.30	263	1.8	1.34
10	262	1.6	1.26	263	1.4	1.18	243	1.7	1.30
11	264	1.5	1.22	265	1.6	1.26	244	1.5	1.22
12	266	1.2	1.10	266	1.4	1.18	249	1.3	1.14
Average	268		1.29	264		1.29	258		1.26

Velocity Traverse Data

Plant Name:	Cokenergy
Sampling Location:	Main Stack
Project Number:	60616835
	Note: Time shown is CST

Run #	4	5	6
Date	4-Dec-19	4-Dec-19	4-Dec-19
Time	1214-1222	1234-1242	1254-1304
Location	Main Stack	Main Stack	Main Stack
Pitot Tube Coefficient	0.84	0.84	0.84
Stack Diameter, ft	18	18	18
Stack Length, ft	0	0	0
Stack Area, sq. ft.	254.5	254.5	254.5
Barometric Pressure, in. Hg	28.902	28.902	28.902
Static Pressure, in. H_20	-1.2	-1.2	-1.2
Stack Gas O_2, %	13.00%	13.00%	13.10%
Stack Gas CO_2, %	5.23%	5.23%	5.23%
Stack Gas N_2, %	81.77%	81.77%	81.67%
Dry Gas Molecular Weight	29.3564	29.3564	29.360432
Moisture Content, %	11.81%	11.81%	11.81%
Wet Gas Molecular Weight	28.02	28.02	28.02
Stack Gas Flow, acfm	1322708	1328935	1341737
Stack Gas Flow, scfm	937682	945943	956953

Traverse Point	Stack Temp.	Velocity Pressure	Sq. Root of Vel. Press.	Stack Temp.	Velocity Pressure	Sq. Root of Vel. Press.	Stack Temp.	Velocity Pressure	Sq. Root of Vel. Press.
1	255	1.6	1.26	247	1.7	1.30	250	1.7	1.30
2	256	1.7	1.30	250	1.6	1.26	251	1.6	1.26
3	258	1.3	1.14	251	1.4	1.18	252	1.1	1.05
4	253	1.8	1.34	252	1.8	1.34	253	2.1	1.45
5	258	1.9	1.38	256	2.1	1.45	255	2.1	1.45
6	261	1.7	1.30	258	1.6	1.26	258	1.6	1.26
7	261	1.8	1.34	258	1.8	1.34	252	1.8	1.34
8	262	1.6	1.26	260	1.9	1.38	254	2	1.41
9	264	1.7	1.30	262	1.6	1.26	257	1.9	1.38
10	252	1.5	1.22	250	1.5	1.22	251	1.5	1.22
11	254	1.6	1.26	256	1.7	1.30	252	1.7	1.30
12	258	1.5	1.22	257	1.3	1.14	255	1.4	1.18
Average	258		1.28	255		1.29	253		1.30

Velocity Traverse Data

Plant Name:	Cokenergy
Sampling Location:	Main Stack
Project Number:	60616835
	Note: Time shown is CST

Run #	7	8	9
Date	4-Dec-19	4-Dec-19	4-Dec-19
Time	1338-1346	1400-1410	1418-1427
Location	Main Stack	Main Stack	Main Stack
Pitot Tube Coefficient	0.84	0.84	0.84
Stack Diameter, ft	18	18	18
Stack Length, ft	0	0	0
Stack Area, sq. ft.	254.5	254.5	254.5
Barometric Pressure, in. Hg	28.902	28.902	28.902
Static Pressure, in. H_20	-1.2	-1.2	-1.2
Stack Gas O_2, %	13.14%	13.14%	13.14%
Stack Gas CO_2, %	5.12%	5.12%	5.23%
Stack Gas N_2, %	81.74%	81.74%	81.63%
Dry Gas Molecular Weight	29.345111	29.345111	29.361836
Moisture Content, %	12.13%	12.13%	12.13%
Wet Gas Molecular Weight	27.97	27.97	27.98
Stack Gas Flow, acfm	1314621	1322663	1327321
Stack Gas Flow, scfm	937175	939944	941718

Traverse Point	Stack Temp.	Velocity Pressure	Sq. Root of Vel. Press.	Stack Temp.	Velocity Pressure	Sq. Root of Vel. Press.	Stack Temp.	Velocity Pressure	Sq. Root of Vel. Press.
1	250	1.7	1.30	252	1.7	1.30	252	1.6	1.26
2	251	1.7	1.30	252	1.5	1.22	253	1.7	1.30
3	253	1.2	1.10	253	1.2	1.10	254	1.2	1.10
4	251	2	1.41	259	2	1.41	257	2	1.41
5	254	2.1	1.45	261	2	1.41	260	2.2	1.48
6	257	1.7	1.30	262	1.7	1.30	261	1.5	1.22
7	252	1.5	1.22	253	1.8	1.34	259	1.7	1.30
8	258	1.6	1.26	255	2.1	1.45	262	1.8	1.34
9	259	1.7	1.30	258	1.5	1.22	263	1.7	1.30
10	250	1.5	1.22	254	1.4	1.18	253	1.4	1.18
11	253	1.6	1.26	255	1.5	1.22	254	1.6	1.26
12	256	1.3	1.14	257	1.4	1.18	257	1.5	1.22
Average	254		1.27	256		1.28	257		1.28

Velocity Traverse Data

Plant Name:	Cokenergy
Sampling Location:	Main Stack
Project Number:	60616835
	Note: Time shown is CST

									preliminary	
Run #		10			11			12		
Date		4-Dec-19			4-Dec-19					
Time		1442-1452								
Location		Main Stack			Main Stack			Main Stack		
Pitot Tube Coefficient		0.84			0.84			0.84		
Stack Diameter, ft		18			18			18		
Stack Length, ft		0			0			0		
Stack Area, sq. ft.		254.5			0.0			0.0		
Barometric Pressure, in. Hg		28.902			28.902			28.902		
Static Pressure, in. H_20		-1.2						-0.28		
Stack Gas O_2, %		13.14%			#VALUE!			21.00%		
Stack Gas CO_2, %		5.12%			#VALUE!			0.00%		
Stack Gas N_2, %		81.74%			#VALUE!			79%		
Dry Gas Molecular Weight		29.345111			#VALUE!			28.84		
Moisture Content, %		12.13%			12.13%			12.13%		
Wet Gas Molecular Weight		27.97			#VALUE!			27.52		
Stack Gas Flow, acfm		1220757			#DIV/0!			#DIV/0!		
Stack Gas Flow, scfm		866919			#DIV/0!			#DIV/0!		
Traverse Point	Stack Temp.	Velocity Pressure	Sq. Root of Vel. Press.	Stack Temp.	Velocity Pressure	Sq. Root of Vel. Press.	Stack Temp.	Velocity Pressure	Sq. Root of Vel. Press.	
1	253	1.6	1.26							
2	253	1.6	1.26							
3	252	1	1.00							
4	254	1.9	1.38							
5	257	2	1.41							
6	261	1.5	1.22							
7	256	1.6	1.26							
8	259	2	1.41							
9	261	1.6	1.26							
10	254	1.4	1.18							
11	257	1.5	1.22							
12	260	1.3	1.14							
Average	256		1.18	#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	

AECOM

VELOCITY TRAVERSE DATA SHEET

Project Name: **Annual SO2 RATA Test**

Project No.: **60616835**

Date: 12/3/19 4

Test No.: 2-1

Location: Main Stack

Personnel: WL / SJ

Traverse Point	Velocity Pressure	Stack Temperature	
A-1	1.5	274	
A-2	1.6	274	
A-3	1.3	273	
B-1	2.1	263	
B-2	2.0	267	
B-3	1.9	268	
C-1	2.0	265	
C-2	1.8	267	
C-3	1.5	268	
D-1	1.6	262	
D-2	1.5	264	
D-3	1.2	266	
Average			

Start Test : 10:32

End Test : 10:41

Stack Dimensions : Circular; 216" diameter

Barometric Pressure, Pbar : 28.90 in. Hg

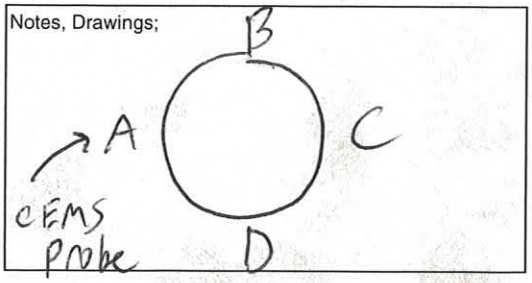
Static Pressure : -1.2 in. H_2O

P

Pitot Positive Leak Check : ✓ > 3 in. H_2O

Pitot Negative Leak Check : ✓ > 3 in. H_2O

Notes, Drawings;



Pitot Tube Type : S Type I.D. No. : HST8

Pitot Coefficient, Cp : 0.84

Manometer Type : Oil I.D. No. : URS-001

Thermometer Type : Type K I.D. No. : URS-001

AECOM

VELOCITY TRAVERSE DATA SHEET

Project Name: **Annual SO2 RATA Test**

Project No.: **60616835**

Date: 12/6/19

Test No.: 1-2

Location: Main Stack

Personnel: WL/SJ

Traverse Point	Velocity Pressure	Stack Temperature	
A-1	1.5	261	
A-2	1.8	261	
A-3	1.3	263	
B-1	2.0	262	
B-2	1.9	264	
B-3	1.7	267	
C-1	1.8	264	
C-2	2.0	265	
C-3	1.7	266	
D-1	1.4	263	
D-2	1.6	265	
D-3	1.4	266	
Average			

Start Test : 10:55

End Test : 11:07

Stack Dimensions : Circular; 216" diameter

Barometric Pressure, Pbar : 28.90 in. Hg

Static Pressure : -1.2 in. H_2O

P [redacted]

Pitot Positive Leak Check : ✓ > 3 in. H_2O

Pitot Negative Leak Check : ✓ > 3 in. H_2O

Notes, Drawings;

Pitot Tube Type : S Type I.D. No. :

Pitot Coefficient, Cp : 0.84

Manometer Type : Oil I.D. No. : URS-001

Thermometer Type : Type K I.D. No. : URS-001

AECOM

VELOCITY TRAVERSE DATA SHEET

Project Name: **Annual SO2 RATA Test**

Project No.: **60616835**

Date: 12/4/19

Test No.: 1-3

Location: Main Stack

Personnel: WL/SJ

Traverse Point	Velocity Pressure	Stack Temperature	
A-1	1.6	260	
A-2	1.5	261	
A-3	1.0	262	
B-1	1.8	261	
B-2	1.9	265	
B-3	1.6	266	
C-1	1.7	257	
C-2	1.9	260	
C-3	1.8	263	
D-1	1.7	243	
D-2	1.5	244	
D-3	1.3	249	
Average			

Start Test : 11:18

End Test : 11:29

Stack Dimensions : Circular; 216" diameter

Barometric Pressure, Pbar : 28.90 in. Hg

Static Pressure : -1.2 in. H_2O

P [redacted]

Pitot Positive Leak Check : ✓ > 3 in. H_2O

Pitot Negative Leak Check : ✓ > 3 in. H_2O

Notes, Drawings;

Pitot Tube Type : S Type I.D. No. :

Pitot Coefficient, Cp : 0.84

Manometer Type : Oil I.D. No. : URS-001

Thermometer Type : Type K I.D. No. : URS-001

AECOM

VELOCITY TRAVERSE DATA SHEET

Project Name: **Annual SO2 RATA Test**

Project No.: **60616835**

Date: 12/4/19

Test No.: 4

Location: Main Stack

Personnel: WL/SJ

Traverse Point	Velocity Pressure	Stack Temperature	
A-1	1.6	255	
A-2	1.7	256	
A-3	1.3	258	
B-1	1.8	253	
B-2	1.9	258	
B-3	1.7	261	
C-1	1.8	261	
C-2	1.6	262	
C-3	1.7	264	
D-1	1.5	252	
D-2	1.6	254	
D-3	1.5	258	
Average			

Start Test : 12:14

End Test : 12:22

Stack Dimensions : Circular; 216" diameter

Barometric Pressure, Pbar : 28.90 in. Hg

Static Pressure : -1.2 in. H_2O

P [redacted]

Pitot Positive Leak Check : ✓ > 3 in. H_2O

Pitot Negative Leak Check : ✓ > 3 in. H_2O

Notes, Drawings;

Pitot Tube Type : S Type I.D. No. :

Pitot Coefficient, Cp : 0.84

Manometer Type : Oil I.D. No. URS-001

Thermometer Type : Type K I.D. No. URS-001

AECOM

VELOCITY TRAVERSE DATA SHEET

Project Name: **Annual SO2 RATA Test**

Project No.: **60616835**

Date: 12/4/19

Test No.: 5

Location: Main Stack

Personnel: WL/SJ

Traverse Point	Velocity Pressure	Stack Temperature	
A-1	1.7	247	
A-2	1.6	250	
A-3	1.4	251	
B-1	1.8	252	
B-2	2.1	256	
B-3	1.6	258	
C-1	1.8	256	
C-2	1.9	260	
C-3	1.6	262	
D-1	1.5	250	
D-2	1.7	256	
D-3	1.3	257	
Average			

Start Test : 12:34

End Test : 12:42

Stack Dimensions : Circular; 216" diameter

Barometric Pressure, Pbar : 28.90 in. Hg

Static Pressure : -1.2 in. H_2O

P [redacted]

Pitot Positive Leak Check : ✓ > 3 in. H_2O

Pitot Negative Leak Check : ✓ > 3 in. H_2O

Notes, Drawings;

Pitot Tube Type : S Type I.D. No. :

Pitot Coefficient, Cp : 0.84

Manometer Type : Oil I.D. No. : URS-001

Thermometer Type : Type K I.D. No. : URS-001

AECOM

VELOCITY TRAVERSE DATA SHEET

Project Name: **Annual SO2 RATA Test**

Project No.: **60616835**

Date: 12/4/19

Test No.: 6

Location: Main Stack

Personnel: WL/SJ

Traverse Point	Velocity Pressure	Stack Temperature	
A-1	1.7	250	
A-2	1.6	251	
A-3	1.1	252	
B-1	2.1	253	
B-2	2.1	255	
B-3	1.6	258	
C-1	1.8	252	
C-2	2.0	254	
C-3	1.9	257	
D-1	1.5	251	
D-2	1.7	252	
D-3	1.4	255	
Average			

Start Test : 12:54

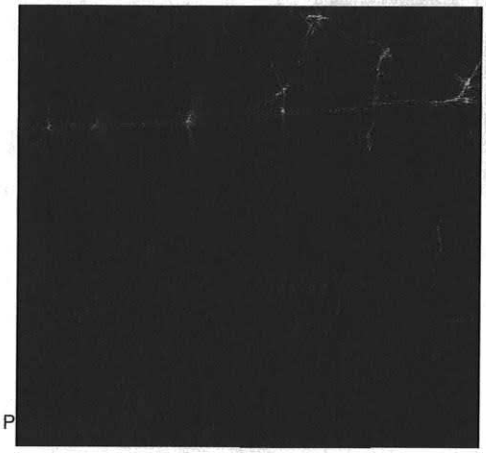
End Test : 13:04

Stack Dimensions : Circular; 216" diameter

Barometric Pressure, Pbar : 28.90 in. Hg

Static Pressure : -1.2 in. H_2O

P



Pitot Positive Leak Check : ✓ > 3 in. H_2O

Pitot Negative Leak Check : ✓ > 3 in. H_2O

Notes, Drawings;

Pitot Tube Type : S Type I.D. No. :

Pitot Coefficient, Cp : 0.84

Manometer Type : Oil I.D. No. : URS-001

Thermometer Type : Type K I.D. No. : URS-001

AECOM

VELOCITY TRAVERSE DATA SHEET

Project Name: **Annual SO2 RATA Test**

Project No.: **60616835**

Date: 12/4/19

Test No.: 7

Location: Main Stack

Personnel: WL/SJ

Traverse Point	Velocity Pressure	Stack Temperature	
A-1	1.7	250	
A-2	1.7	251	
A-3	1.2	253	
B-1	2.0	251	
B-2	2.1	254	
B-3	1.7	257	
C-1	1.5	252	
C-2	1.6	258	
C-3	1.7	259	
D-1	1.5	250	
D-2	1.6	253	
D-3	1.3	256	
Average			

Start Test : 13:38

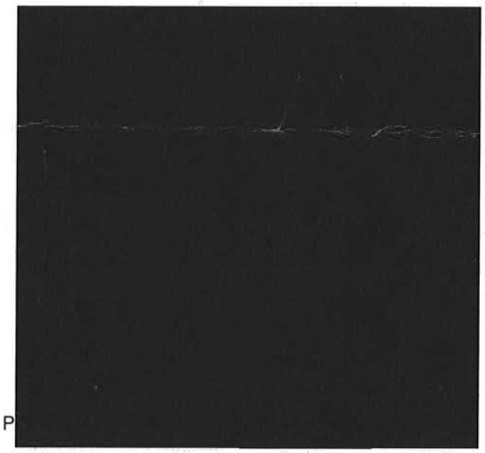
End Test : 13:46

Stack Dimensions : Circular; 216" diameter

Barometric Pressure, Pbar : 28.90 in. Hg

Static Pressure : -1.2 in. H_2O

P



Pitot Positive Leak Check : ✓ > 3 in. H_2O

Pitot Negative Leak Check : ✓ > 3 in. H_2O

Notes, Drawings;

Pitot Tube Type : S Type I.D. No. : HST8

Pitot Coefficient, Cp : 0.84

Manometer Type : Oil I.D. No. : URS-001

Thermometer Type : Type K I.D. No. : URS-001

AECOM

VELOCITY TRAVERSE DATA SHEET

Project Name: **Annual SO2 RATA Test**

Project No.: **60616835**

Date: 12/4/19

Test No.: 8

Location: Main Stack

Personnel: WL/SJ

Traverse Point	Velocity Pressure	Stack Temperature	
A-1	1.7	252	
A-2	1.5	252	
A-3	1.2	253	
B-1	2.0	259	
B-2	2.0	261	
B-3	1.7	262	
C-1	1.8	253	
C-2	2.1	255	
C-3	1.5	258	
D-1	1.4	254	
D-2	1.5	255	
D-3	1.4	257	
Average			

Start Test : 14:00

End Test : 14:10

Stack Dimensions : Circular; 216" diameter

Barometric Pressure, Pbar: SJ 28.90 in. Hg

Static Pressure : -1.2 in. H_2O

P

Pitot Positive Leak Check : ✓ > 3 in. H_2O

Pitot Negative Leak Check : ✓ > 3 in. H_2O

Notes, Drawings;

Pitot Tube Type : S Type I.D. No. : HST8

Pitot Coefficient, Cp : 0.84

Manometer Type : Oil I.D. No. : URS-001

Thermometer Type : Type K I.D. No. : URS-001

AECOM

VELOCITY TRAVERSE DATA SHEET

Project Name: **Annual SO2 RATA Test**

Project No.: **60616835**

Date: 12/4/19

Test No.: 9

Location: Main Stack

Personnel: WL/SJ

Traverse Point	Velocity Pressure	Stack Temperature	
A-1	1.6	252	
A-2	1.7	253	
A-3	1.2	254	
B-1	2.0	257	
B-2	2.2	260	
B-3	1.5	261	
C-1	1.7	259	
C-2	1.8	262	
C-3	1.7	263	
D-1	1.4	253	
D-2	1.6	254	
D-3	1.5	257	
Average			

Start Test : 14:18

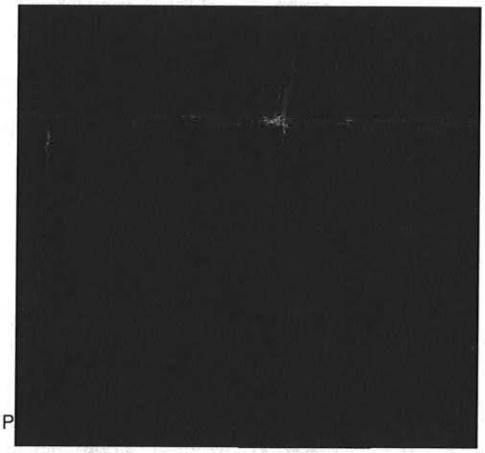
End Test : 14:27

Stack Dimensions : Circular; 216" diameter

Barometric Pressure, Pbar : 28.90 in. Hg

Static Pressure : -1.2 in. H_2O

P



Pitot Positive Leak Check : ✓ > 3 in. H_2O

Pitot Negative Leak Check : ✓ > 3 in. H_2O

Notes, Drawings;

Pitot Tube Type : S Type I.D. No. : HST8

Pitot Coefficient, Cp : 0.84

Manometer Type : Oil I.D. No. : URS-001

Thermometer Type : Type K I.D. No. : URS-001

AECOM

VELOCITY TRAVERSE DATA SHEET

Project Name: **Annual SO2 RATA Test**

Project No.: **60616835**

Date: 12/4/19

Test No.: 10

Location: Main Stack

Personnel: WL/SJ

Traverse Point	Velocity Pressure	Stack Temperature	
A-1	1.6	253	
A-2	1.6	253	
A-3	1.0	252	
B-1	1.9	254	
B-2	2.0	257	
B-3	1.5	261	
C-1	1.6	256	
C-2	2.0	259	
C-3	1.6	261	
D-1	1.4	254	
D-2	1.5	257	
D-3	1.3	260	
Average			

Start Test : 14:42

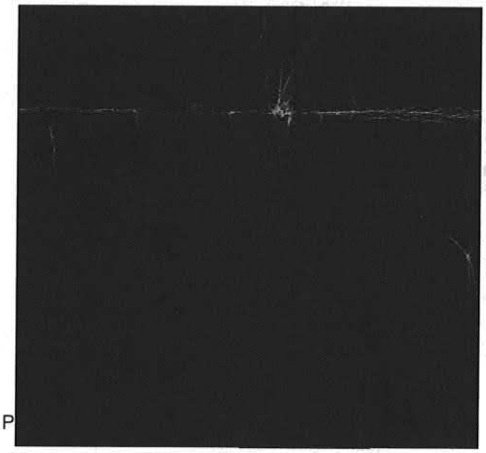
End Test : 14:58

Stack Dimensions : Circular; 216" diameter

Barometric Pressure, Pbar : 28.90 in. Hg

Static Pressure : -1.2 in. H_2O

P



Pitot Positive Leak Check : ✓ > 3 in. H_2O

Pitot Negative Leak Check : ✓ > 3 in. H_2O

Notes, Drawings;

Pitot Tube Type : S Type I.D. No. : HST8

Pitot Coefficient, Cp : 0.84

Manometer Type : Oil I.D. No. : URS-001

Thermometer Type : Type K I.D. No. : URS-001

Moisture Determination Data

Plant Name:	Cokenergy
Sampling Location:	Main Stack
Project Number:	60616835
	Note: Time shown is CST

Run #	1			2			3			4		
Date	4-Dec-19			4-Dec-19			4-Dec-19			4-Dec-19		
Time	1030-1130			1212-1312			1337-1437					
Location	Main Stack			Main Stack			Main Stack			Main Stack		
	Initial Wt.	Final Wt.	Wt. Gain	Initial Wt.	Final Wt.	Wt. Gain	Initial Wt.	Final Wt.	Wt. Gain	Initial Wt.	Final Wt.	Wt. Gain
Impinger #1	688.7	769.1	80.4	685.6	760.2	74.6	769.1	845.1	76	728.5		
Impinger #2	676.2	676.3	0.1	669.2	668.1	-1.1	676.3	677.5	1.2	707.7		
Impinger #3	611.8	611.8	0	605.3	605.4	0.1	611.8	612.6	0.8	603.6		
Impinger #4	848.2	853.8	5.6	801.5	808.7	7.2	853.8	859	5.2	959.4		
Condensed Water, g		86.1			80.8			83.2			0	
DGMCF		0.976			0.976			0.976			0.976	
Barometric Pressure (" Hg)		28.902			28.90			28.90			28.90	
Average DGM Temp (¦F)		57			63			65				
Average Delta H (in wc)		0.75			0.75			0.75				
Meter Volume (acf)		29.542			29.859			29.926				
Corrected Volume of Gas sampled (acf)		28.833			29.142			29.208			0.000	
Volume at Meter (dscf)		28.499			28.474			28.429			0.000	
Flue Gas Moisture (%)		12.48%			11.81%			12.13%			#DIV/0!	

AECOM

EPA M4 DATA SHEET

Project Name: Annual SO2 RATA Test | Test No.: M-1 | Stack Dimensions: Circular; 216"

Project No.: 60616835 | Location: Main Stack | Barometric Pressure: 28.90 in. Hg

Date: 12/3/19 4 | Personnel: WL / SJ | Static Pressure: -1.2 in. H_2O

Average ΔH: 0.75

VELOCITY TRAVERSE

TRAVERSE POINT	VELOCITY PRESSURE (ΔP)	STACK TEMP.
[redacted]		
Average		

IMPINGER WEIGHTS

Impinger	Initial Wt.	Final Wt.	Total
1	688.7	769.1	80.4
2	676.2	676.3	0.1
3	611.8	611.8	0.0
4	648.7	853.8	5.1 / 5.1
Total			85.6

PITOT LEAK CHECK (> 3")

[redacted]

TRAIN LEAK CHECK (ft^3 @ in, Hg.)

INITIAL	0.005 @	10
FINAL	0.005 @	10

MOISTURE TRAIN

SAMPLING TIME Clock	SAMPLING TIME Sample	DRY GAS METER	DGM TEMP.	LAST IMPINGER TEMP.	TRAIN VACUUM	ΔH
10:30	0	453.768	52	46	1.5	0.75
	5	456.18	56	43	1.5	
	10	458.62	57	42	1.5	
	15	461.09	57	41	1.5	
	20	463.54	57	44	1.5	
	25	466.00	58	46	1.5	
	30	468.45	59	47	1.5	
	40	473.41	60	46	1.5	
	50	478.36	60	47	1.5	
11:30	60	483.310	61	47	1.5	

Control Console I.D.: URS-001 | ΔH@: 1.923 | Y: 0.976

Pitot Tube Type: S | I.D. No.: | Coefficient: 0.84

Manometer Type: Oil Incl. | I.D. No.: URS-001

Thermometer Type: K | I.D. No.: URS-001

NOTES:

AECOM

EPA M4 DATA SHEET

Project Name: Annual SO2 RATA Test
Test No.: 11-2
Stack Dimensions: Circular; 216"

Project No.: 60616835
Location: Main Stack
Barometric Pressure: 28.90 in. Hg

Date: 12/4/19
Personnel: WL/SJ
Static Pressure: -1.2 in. H_2O

Average ΔH: 0.75

VELOCITY TRAVERSE

TRAVERSE POINT	VELOCITY PRESSURE (ΔP)	STACK TEMP.
[redacted]		
Average		

IMPINGER WEIGHTS

Impinger	Initial Wt.	Final Wt.	Total
1	685.6	760.2	74.6
2	669.2	668.1	-1.1
3	605.3	605.4	0.1
4	801.5	808.7	7.2
Total			80.8

PITOT LEAK CHECK (> 3")

[redacted]

TRAIN LEAK CHECK (ft^3 @ in, Hg.)

INITIAL	0.005 @ 10
FINAL	0.005 @ 10

MOISTURE TRAIN

SAMPLING TIME Clock	SAMPLING TIME Sample	DRY GAS METER	DGM TEMP.	LAST IMPINGER TEMP.	TRAIN VACUUM	ΔH
12:12	0	484.164	61	47	1.5	0.75
	5	486.59	61	47	1.5	
	10	489.17	62	46	1.5	
	15	491.56	63	49	1.5	
	20	494.03	63	51	1.5	
	25	496.54	64	53	1.5	
	30	499.02	65	53	1.5	
	40	504.03	65	55	1.5	
	50	509.02	66	57	1.5	
13:12	60	514.023	66	56	1.5	

Control Console I.D.: URS-001 ΔH@: 1.923 Y: 0.976

Pitot Tube Type: S I.D. No.: _____ Coefficient: 0.84

Manometer Type: Oil Incl. I.D. No.: URS-001

Thermometer Type: K I.D. No.: URS-001

NOTES: _____

AECOM

EPA M4 DATA SHEET

Project Name: Annual SO2 RATA Test
Project No.: 60616835
Date: 12/4/19
Test No.: M3
Location: Main Stack
Personnel: WL/SJ
Stack Dimensions: Circular; 216"
Barometric Pressure: 28.90 in. Hg
Static Pressure: -1.2 in. H_2O
Average ΔH: 0.75

VELOCITY TRAVERSE

TRAVERSE POINT	VELOCITY PRESSURE (ΔP)	STACK TEMP.
[redacted]		
Average		

IMPINGER WEIGHTS

Impinger	Initial Wt.	Final Wt.	Total
1	769.1	845.1	
2	676.3	677.5	
3	611.8	612.6	
4	853.8	859.0	
Total			

PITOT LEAK CHECK (> 3")

[redacted]

TRAIN LEAK CHECK (ft^3 @ in, Hg.)

INITIAL	0.00 @ 10
FINAL	0.005 @ 10

MOISTURE TRAIN

SAMPLING TIME Clock	SAMPLING TIME Sample	DRY GAS METER	DGM TEMP.	LAST IMPINGER TEMP.	TRAIN VACUUM	ΔH
13:37	0	514.195	63	53	1.5	0.75
	5	516.61	63	50	1.5	
	10	519.11	63	49	1.5	
	15	521.61	64	50	1.5	
	20	524.09	64	51	1.5	
	25	526.58	65	53	1.5	
	30	529.08	66	55	1.5	
	40	534.10	67	53	1.5	
	50	539.11	67	55	1.5	
14:37	60	544.121	68	56	1.5	

Control Console I.D.: URS-001
ΔH@: 1.923
Y: 0.976
Pitot Tube Type: S
I.D. No.: HST8
Coefficient: 0.84
Manometer Type: Oil Incl.
I.D. No.: URS-001
Thermometer Type: K
I.D. No.: URS-001

NOTES:

Appendix B
INSTALLED CEMS SUPPORTING DOCUMENTATION

Primary Energy Coke

East Chicago, IN

RATA Data Report

12/4/2019 10:30:00 AM - 12/4/2019 10:50:00 AM

Created on : Dec 04, 2019 15:30:14

STACK 201

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
10:30:00	181.6	13.1	1261.8
10:31:00	182.3	13.1	1275.0
10:32:00	184.4	13.1	1283.8
10:33:00	182.6	13.1	1271.3
10:34:00	183.8	13.1	1285.1
10:35:00	183.6	13.1	1313.9
10:36:00	184.2	13.1	1309.0
10:37:00	183.1	13.1	1268.5
10:38:00	183.3	13.1	1295.5
10:39:00	182.7	13.1	1273.4
10:40:00	183.4	13.1	1281.4
10:41:00	183.3	13.1	1282.7
10:42:00	184.4	13.1	1267.1
10:43:00	184.1	13.1	1258.8
10:44:00	183.6	13.1	1266.0
10:45:00	184.4	13.1	1277.0
10:46:00	184.3	13.1	1276.9
10:47:00	183.2	13.1	1277.1
10:48:00	185.1	13.1	1273.4
10:49:00	182.9	13.1	1261.9
10:50:00	183.3	13.1	1261.9
Average :	183.5	13.1	1277.2

* Invalid Status

RATA Run # 1
Verified By: _____

Primary Energy Coke

East Chicago, IN

RATA Data Report

12/4/2019 10:51:00 AM - 12/4/2019 11:11:00 AM

Created on : Dec 04, 2019 15:33:39

STACK 201

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
10:51:00	184.7	13.1	1271.0
10:52:00	183.3	13.1	1279.6
10:53:00	183.6	13.1	1279.9
10:54:00	184.2	13.1	1274.3
10:55:00	183.3	13.1	1286.4
10:56:00	182.1	13.1	1259.4
10:57:00	184.1	13.1	1287.6
10:58:00	183.6	13.1	1273.1
10:59:00	182.2	13.1	1257.1
11:00:00	183.7	13.1	1285.1
11:01:00	183.0	13.2	1272.4
11:02:00	182.6	13.1	1270.5
11:03:00	182.4	13.1	1259.5
11:04:00	180.7	13.1	1251.9
11:05:00	181.7	13.1	1257.2
11:06:00	182.5	13.1	1274.8
11:07:00	181.5	13.1	1259.3
11:08:00	182.7	13.1	1250.3
11:09:00	182.9	13.1	1269.9
11:10:00	182.9	13.1	1246.6
11:11:00	182.7	13.2	1241.9
Average :	182.9	13.1	1267.0

* Invalid Status

RATA Run # 2

Verified By: _____

Primary Energy Coke

East Chicago, IN

RATA Data Report

12/4/2019 11:12:00 AM - 12/4/2019 11:32:00 AM

Created on : Dec 04, 2019 15:33:53

STACK 201

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
11:12:00	182.1	13.2	1256.5
11:13:00	181.6	13.1	1259.4
11:14:00	179.9	13.2	1255.5
11:15:00	181.0	13.1	1257.8
11:16:00	182.4	13.1	1258.6
11:17:00	181.9	13.2	1255.0
11:18:00	181.6	13.2	1245.1
11:19:00	180.8	13.2	1227.4
11:20:00	180.5	13.2	1239.7
11:21:00	182.6	13.1	1266.5
11:22:00	182.8	13.2	1268.8
11:23:00	180.8	13.2	1260.0
11:24:00	181.5	13.2	1269.4
11:25:00	181.3	13.2	1257.3
11:26:00	181.1	13.2	1249.5
11:27:00	181.7	13.2	1265.0
11:28:00	180.4	13.2	1252.9
11:29:00	180.8	13.2	1261.1
11:30:00	179.6	13.2	1257.4
11:31:00	180.6	13.2	1263.3
11:32:00	178.6	13.2	1234.3
Average :	181.1	13.2	1255.3

* Invalid Status

RATA Run # 3
Verified By: _____

Primary Energy Coke

East Chicago, IN

RATA Data Report

12/4/2019 12:10:00 PM - 12/4/2019 12:30:00 PM

Created on : Dec 04, 2019 15:34:11

STACK 201

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
12:10:00	177.8	13.3	1241.2
12:11:00	178.2	13.3	1236.9
12:12:00	179.8	13.3	1243.0
12:13:00	178.7	13.3	1235.0
12:14:00	177.3	13.3	1223.6
12:15:00	178.4	13.3	1232.3
12:16:00	177.7	13.2	1222.5
12:17:00	178.0	13.2	1228.8
12:18:00	178.7	13.2	1238.6
12:19:00	177.4	13.2	1220.2
12:20:00	178.5	13.2	1241.7
12:21:00	177.7	13.2	1231.8
12:22:00	176.8	13.2	1228.6
12:23:00	177.9	13.2	1221.9
12:24:00	178.0	13.2	1222.9
12:25:00	178.5	13.2	1227.6
12:26:00	177.5	13.2	1219.7
12:27:00	177.1	13.2	1217.1
12:28:00	177.1	13.2	1225.6
12:29:00	176.7	13.2	1225.4
12:30:00	177.2	13.2	1225.2
Average :	177.9	13.2	1229.0

* Invalid Status

RATA Run # 4

Verified By: _____

Primary Energy Coke

East Chicago, IN

RATA Data Report

12/4/2019 12:31:00 PM - 12/4/2019 12:51:00 PM

Created on : Dec 04, 2019 15:34:21

STACK 201

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
12:31:00	177.6	13.3	1207.8
12:32:00	176.7	13.3	1200.6
12:33:00	176.1	13.2	1225.0
12:34:00	177.0	13.2	1209.4
12:35:00	177.6	13.3	1219.3
12:36:00	177.4	13.3	1218.6
12:37:00	173.7	13.2	1201.3
12:38:00	176.1	13.3	1212.0
12:39:00	175.8	13.3	1198.9
12:40:00	175.8	13.2	1224.3
12:41:00	177.1	13.3	1216.4
12:42:00	177.3	13.3	1226.1
12:43:00	175.8	13.3	1218.5
12:44:00	176.0	13.3	1203.6
12:45:00	176.6	13.2	1210.7
12:46:00	176.3	13.3	1227.8
12:47:00	175.7	13.3	1217.3
12:48:00	175.9	13.3	1223.4
12:49:00	175.6	13.3	1224.3
12:50:00	175.5	13.3	1201.4
12:51:00	176.1	13.3	1228.1
Average :	176.3	13.3	1215.0

* Invalid Status

RATA Run # 5

Verified By: _____

Primary Energy Coke

East Chicago, IN

RATA Data Report

12/4/2019 12:52:00 PM - 12/4/2019 1:12:00 PM

Created on : Dec 04, 2019 15:34:44

STACK 201

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
12:52:00	175.4	13.3	1220.1
12:53:00	174.5	13.3	1218.9
12:54:00	176.6	13.3	1224.2
12:55:00	176.8	13.3	1229.0
12:56:00	173.4	13.3	1199.4
12:57:00	174.8	13.3	1204.3
12:58:00	175.3	13.3	1209.1
12:59:00	175.1	13.3	1204.4
13:00:00	175.6	13.3	1222.4
13:01:00	175.9	13.3	1214.8
13:02:00	174.4	13.3	1206.0
13:03:00	172.8	13.3	1201.7
13:04:00	172.4	13.3	1196.6
13:05:00	173.7	13.3	1198.9
13:06:00	174.2	13.3	1212.8
13:07:00	173.1	13.3	1194.1
13:08:00	173.7	13.3	1200.7
13:09:00	174.4	13.3	1215.9
13:10:00	174.3	13.3	1203.4
13:11:00	174.7	13.3	1206.4
13:12:00	174.8	13.3	1200.8
Average :	174.6	13.3	1208.8

* Invalid Status

RATA Run # 6
Verified By: _____

Primary Energy Coke

East Chicago, IN

RATA Data Report

12/4/2019 1:35:00 PM - 12/4/2019 1:55:00 PM

Created on : Dec 04, 2019 15:35:03

STACK 201

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
13:35:00	173.0	13.3	1196.3
13:36:00	173.5	13.4	1185.6
13:37:00	173.9	13.4	1209.8
13:38:00	173.4	13.4	1179.4
13:39:00	173.5	13.4	1193.1
13:40:00	172.4	13.4	1181.2
13:41:00	172.8	13.4	1188.1
13:42:00	171.9	13.4	1167.2
13:43:00	172.5	13.4	1177.6
13:44:00	173.1	13.3	1190.3
13:45:00	173.5	13.4	1197.7
13:46:00	173.6	13.4	1178.7
13:47:00	178.8	13.4	1218.6
13:48:00	216.2	13.4	1483.7
13:49:00	214.3	13.4	1462.1
13:50:00	245.3	13.4	1704.4
13:51:00	205.7	13.4	1410.6
13:52:00	177.0	13.4	1204.3
13:53:00	171.4	13.4	1176.2
13:54:00	167.8	13.4	1153.0
13:55:00	168.7	13.4	1164.4
Average :	182.0	13.4	1248.7

* Invalid Status

RATA Run # 7
Verified By: _____

Primary Energy Coke

East Chicago, IN

RATA Data Report

12/4/2019 1:56:00 PM - 12/4/2019 2:16:00 PM

Created on : Dec 04, 2019 15:35:13

STACK 201

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
13:56:00	177.9	13.4	1222.4
13:57:00	182.8	13.4	1258.6
13:58:00	181.0	13.4	1244.6
13:59:00	178.8	13.4	1225.0
14:00:00	179.7	13.4	1222.8
14:01:00	181.0	13.4	1245.7
14:02:00	182.1	13.4	1256.0
14:03:00	181.1	13.4	1232.0
14:04:00	181.9	13.4	1249.0
14:05:00	181.6	13.4	1247.7
14:06:00	182.7	13.4	1247.6
14:07:00	182.3	13.4	1257.0
14:08:00	184.4	13.4	1242.7
14:09:00	181.0	13.4	1234.0
14:10:00	181.6	13.4	1239.5
14:11:00	182.2	13.4	1262.0
14:12:00	181.1	13.4	1247.8
14:13:00	180.2	13.5	1237.7
14:14:00	180.7	13.5	1237.2
14:15:00	181.7	13.4	1256.5
14:16:00	180.8	13.4	1241.4
Average :	181.3	13.4	1243.2

* Invalid Status

RATA Run # 8

Verified By: _____

Primary Energy Coke

East Chicago, IN

RATA Data Report

12/4/2019 2:17:00 PM - 12/4/2019 2:37:00 PM

Created on : Dec 04, 2019 15:35:26

STACK 201

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
14:17:00	181.4	13.4	1260.9
14:18:00	180.7	13.4	1240.4
14:19:00	182.4	13.4	1245.7
14:20:00	182.8	13.4	1261.7
14:21:00	181.9	13.4	1259.1
14:22:00	181.3	13.4	1227.9
14:23:00	182.1	13.4	1242.2
14:24:00	182.7	13.4	1236.5
14:25:00	182.6	13.4	1240.4
14:26:00	181.1	13.4	1233.8
14:27:00	182.5	13.4	1238.8
14:28:00	181.7	13.4	1234.4
14:29:00	181.9	13.5	1244.7
14:30:00	180.6	13.4	1241.5
14:31:00	182.9	13.4	1256.6
14:32:00	182.1	13.5	1251.1
14:33:00	182.1	13.5	1240.2
14:34:00	182.3	13.5	1240.9
14:35:00	182.6	13.5	1257.6
14:36:00	181.7	13.5	1242.0
14:37:00	183.5	13.5	1246.8
Average :	182.0	13.4	1244.9

* Invalid Status

RATA Run # 9

Verified By: _____

Primary Energy Coke

East Chicago, IN

RATA Data Report

12/4/2019 2:38:00 PM - 12/4/2019 2:58:00 PM

Created on : Dec 04, 2019 15:35:38

STACK 201

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
14:38:00	182.2	13.5	1238.4
14:39:00	181.5	13.5	1238.3
14:40:00	180.3	13.5	1233.0
14:41:00	181.3	13.4	1256.3
14:42:00	182.2	13.5	1233.3
14:43:00	182.1	13.5	1252.0
14:44:00	180.7	13.5	1234.6
14:45:00	180.4	13.5	1240.3
14:46:00	180.0	13.5	1230.6
14:47:00	179.7	13.5	1226.0
14:48:00	179.0	13.5	1225.7
14:49:00	179.1	13.5	1214.6
14:50:00	180.1	13.5	1241.1
14:51:00	181.7	13.5	1243.3
14:52:00	182.6	13.4	1256.4
14:53:00	184.2	13.4	1256.7
14:54:00	184.3	13.4	1272.6
14:55:00	187.1	13.4	1275.6
14:56:00	186.6	13.4	1269.0
14:57:00	186.0	13.4	1262.9
14:58:00	186.5	13.3	1276.7
Average :	182.3	13.5	1246.5

* Invalid Status

RATA Run # 10

Verified By: _____