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

October 21, 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 – April 1, 2020 through September 30, 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 April 1, 2020 until September 30, 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 – September 30, 2020 was 4.99%.

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.*

- Cokenergy completed a partial retube on HRSG D3 on September 19, 2020, however this has accounted for only 0.21% of the annual venting.

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 April 1, 2020 through September 30, 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 April 1, 2020 through September 30, 2020 there were no incidents of exceedance of the SO2 Daily Limit.

Paragraph 17. – *Emissions Minimization*

- During the reporting period of April 1, 2020 through September 30, 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 April 1, 2020 through September 30, 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*

- See Cokenergy Semiannual Report Dated April 27, 2020 for details.

Paragraph 22a. – *Lead Testing*

- Cokenergy completed the first lead stack testing on December 5 and 6, 2019. See Cokenergy Semiannual Report Dated April 27, 2020 for details. The second lead stack test on the Cokenergy main stack is planned for June or July of 2021. (Paragraph 51.d.).

Paragraph 22b. – *VOC Testing*

- Milestone Complete, See Cokenergy Semiannual Report Dated April 27, 2020 for details. (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 April 1, 2020 – September 30, 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*

- The emissions of SO2 during the first three quarters of 2020 are approximately 4,515 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.*

- Milestone complete- 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. The rule was approved and published in the Indiana Register on April 25, 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 notified DOJ, EPA and IDEM of a planned maintenance event on August 12, 2020 which had the potential to yield bypass venting in excess of 19% and the daily SO2 limit of 1,656 pounds per hour. Cokenergy successfully completed the maintenance on the fenceline expansion joint on September 29, 2020 without impacting any of 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 the annual RATA on the CEMS equipment on May 12, 2020. 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.

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.

There is no noncompliance with the Section VII SEP requirements to report per Paragraph 51.l. Cokenergy received a request for extension from our contractor Elevate Energy on July 15, 2020. On July 21, 2020 Cokenergy formally requested a six-month extension through April 30, 2021 in accordance with paragraph 42 of the consent decree. COVID-19 related stay at home orders impacted the scheduling of the final lead abatement projects that were planned for the spring and summer of 2020. Abatement work did restart in August 2020 and we are on track to complete the final projects over the coming months. DOJ filed a request to approve, among other things, this extension on October 13, 2020 as a modification to the CD.

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

- Quarterly Deviation and Compliance Monitoring Report for the 2nd quarter of 2020
- Quarterly Deviation and Compliance Monitoring Report for the 3rd quarter of 2020

Pursuant to Paragraph 51.o. the following table is a summary of Lightning Stand-Downs during the April 1, 2020 through September 30, 2020 reporting period.

Start Date/Time	Lightning Warning Detail	End Date/Time	Duration	Compliance response impacted due to lightning stand down
4/6/2020 23:35	Alert: Ltg Warning (northwest 4.4)	4/7/2020 1:03	1:28:00	None
4/7/2020 1:08	Alert: Ltg Warning (southwest 8.2)	4/7/2020 3:16	2:08:00	None
4/7/2020 19:52	Alert: Ltg Warning (southwest 9.0)	4/7/2020 22:11	2:19:00	None
4/8/2020 17:12	Alert: Ltg Warning (west 7.1)	4/8/2020 17:55	0:43:00	None
4/27/2020 22:01	Alert: Ltg Warning (northwest 9)	4/27/2020 22:32	0:31:00	None
4/28/2020 18:15	Alert: Ltg Warning (north 5)	4/28/2020 19:19	1:04:00	None
5/14/2020 7:33	Alert: Ltg Warning (northwest 9.6)	5/14/2020 8:10	0:37:00	None
5/14/2020 8:42	Alert: Ltg Warning (northwest 9.3)	5/14/2020 10:18	1:36:00	None
5/14/2020 12:28	Alert: Ltg Warning (northwest 7.4)	5/14/2020 14:19	1:51:00	None
5/14/2020 21:31	Alert: Ltg Warning (south 9.8)	5/15/2020 2:10	4:39:00	None
5/16/2020 23:59	Alert: Ltg Warning (southeast 5.6)	5/17/2020 0:57	0:58:00	None
5/23/2020 15:40	Alert: Ltg Warning (northwest 9.8)	5/23/2020 17:53	2:13:00	None
5/23/2020 18:51	Alert: Ltg Warning (southwest 9.7)	5/23/2020 19:53	1:02:00	None
5/23/2020 21:33	Alert: Ltg Warning (north 9.7)	5/23/2020 22:03	0:30:00	None
5/26/2020 14:02	Alert: Ltg Warning (north 9.8)	5/26/2020 17:25	3:23:00	None
5/27/2020 17:07	Alert: Ltg Warning (south 7.6)	5/27/2020 18:22	1:15:00	None

Start Date/Time	Lightning Warning Detail	End Date/Time	Duration	Compliance response impacted due to lightning stand down
5/28/2020 20:34	Alert: Ltg Warning (north 8.3)	5/28/2020 22:03	1:29:00	None
5/29/2020 1:25	Alert: Ltg Warning (west 9.3)	5/29/2020 2:12	0:47:00	None
6/5/2020 16:19	Alert: Ltg Warning (south 8.5)	6/5/2020 17:23	1:04:00	None
6/10/2020 0:49	Alert: Ltg Warning (west 9.1)	6/10/2020 1:43	0:54:00	None
6/10/2020 8:50	Alert: Ltg Warning (east 2.9)	6/10/2020 10:35	1:45:00	None
6/13/2020 1:03	Alert: Ltg Warning (northwest 5.3)	6/13/2020 4:42	3:39:00	None
6/21/2020 13:06	Alert: Ltg Warning (south 2.0)	6/21/2020 13:41	0:35:00	None
6/21/2020 14:24	Alert: Ltg Warning (west 5.0)	6/21/2020 14:55	0:31:00	None
6/21/2020 15:37	Alert: Ltg Warning (south 3.3)	6/21/2020 16:45	1:08:00	None
6/22/2020 13:33	Alert: Ltg Warning (west 9.3)	6/22/2020 15:45	2:12:00	None
6/22/2020 16:27	Alert: Ltg Warning (southeast 8.8)	6/22/2020 17:22	0:55:00	None
6/22/2020 18:29	Alert: Ltg Warning (west 9.0)	6/22/2020 18:59	0:30:00	None
6/22/2020 19:54	Alert: Ltg Warning (west 4.3)	6/22/2020 20:54	1:00:00	None
6/24/2020 14:20	Alert: Ltg Warning (east 6.7)	6/24/2020 15:42	1:22:00	None
6/24/2020 21:20	Alert: Ltg Warning (northeast 9.1)	6/24/2020 21:54	0:34:00	None
6/26/2020 6:53	Alert: Ltg Warning (south 8.6)	6/26/2020 7:24	0:31:00	None
6/26/2020 12:06	Alert: Ltg Warning (northwest 9.8)	6/26/2020 13:14	1:08:00	None
6/26/2020 19:39	Alert: Ltg Warning (north 9.6)	6/26/2020 22:15	2:36:00	None
6/27/2020 1:33	Alert: Ltg Warning (north 8.1)	6/27/2020 2:04	0:31:00	None
6/27/2020 19:12	Alert: Ltg Warning (east 9.2)	6/27/2020 19:42	0:30:00	None
6/28/2020 12:06	Alert: Ltg Warning (south 9.3)	6/28/2020 13:01	0:55:00	None
6/29/2020 12:35	Alert: Ltg Warning (northwest 9.8)	6/29/2020 13:05	0:30:00	None
6/29/2020 14:32	Alert: Ltg Warning (south 1.1)	6/29/2020 18:29	3:57:00	None
6/29/2020 18:50	Alert: Ltg Warning (southeast 9.6)	6/29/2020 19:51	1:01:00	None
6/29/2020 19:53	Alert: Ltg Warning (west 7.0)	6/29/2020 20:23	0:30:00	None
6/30/2020 1:30	Alert: Ltg Warning (southwest 9.8)	6/30/2020 2:15	0:45:00	None
6/30/2020 18:34	Alert: Ltg Warning (south 9.5)	6/30/2020 19:32	0:58:00	None
7/7/2020 21:43	Alert: Ltg Warning (northwest 9.9)	7/7/2020 23:20	1:37:00	None
7/8/2020 17:39	Alert: Ltg Warning (west 7.7)	7/8/2020 18:09	0:30:00	None
7/8/2020 18:17	Alert: Ltg Warning (south 8.4)	7/8/2020 18:52	0:35:00	None
7/10/2020 0:29	Alert: Ltg Warning (sourthwest 9.9)	7/10/2020 1:10	0:41:00	None
7/12/2020 6:10	Alert: Ltg Warning (southeast 9.0)	7/12/2020 7:55	1:45:00	None
7/19/2020 6:24	Alert: Ltg Warning (west 9.8)	7/19/2020 10:49	4:25:00	None
7/19/2020 11:15	Alert: Ltg Warning (west 9.6)	7/19/2020 12:50	1:35:00	None
7/19/2020 13:19	Alert: Ltg Warning (northeast 8.6)	7/19/2020 13:49	0:30:00	None
8/2/2020 14:17	Alert: Ltg Warning (northwest 5.1)	8/2/2020 15:43	1:26:00	None
8/2/2020 16:08	Alert: Ltg Warning (northwest 7.9)	8/2/2020 16:38	0:30:00	None

Start Date/Time	Lightning Warning Detail	End Date/Time	Duration	Compliance response impacted due to lightning stand down
8/2/2020 16:47	Alert: Ltg Warning (west 9.8)	8/2/2020 18:04	1:17:00	None
8/2/2020 18:42	Alert: Ltg Warning (west 9.2)	8/2/2020 19:58	1:16:00	None
8/10/2020 15:59	Alert: Ltg Warning (west 8.3)	8/10/2020 18:11	2:12:00	None
8/23/2020 16:47	Alert: Ltg Warning (southwest 2.9)	8/23/2020 18:07	1:20:00	None
8/23/2020 18:57	Alert: Ltg Warning (northwest 9.9)	8/23/2020 19:47	0:50:00	None
8/28/2020 11:52	Alert: Ltg Warning (south 4.1)	8/28/2020 12:23	0:31:00	None
8/28/2020 23:05	Alert: Ltg Warning (north 6.1)	8/28/2020 23:35	0:30:00	None
9/1/2020 13:20	Alert: Ltg Warning (west 8.4)	9/1/2020 14:48	1:28:00	None
9/6/2020 6:50	Alert: Ltg Warning (southwest 9.4)	9/6/2020 7:42	0:52:00	None
9/6/2020 8:46	Alert: Ltg Warning (south 7.4)	9/6/2020 9:20	0:34:00	None
9/8/2020 4:16	Alert: Ltg Warning (south 10)	9/8/2020 5:42	1:26:00	None
9/8/2020 14:39	Alert: Ltg Warning (west 9.1)	9/8/2020 15:24	0:45:00	None
9/9/2020 1:20	Alert: Ltg Warning (west 5.0)	9/9/2020 3:24	2:04:00	None
9/28/2020 17:28	Alert: Ltg Warning (north 7.1)	9/28/2020 17:59	0:31:00	None

Per Paragraph 51.p. there were no power outages to report during the April 1, 2020 through September 30, 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: 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

Second Quarter 2020 Deviation and Compliance Monitoring Report

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

July 22, 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 –Second 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 second 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 Second Quarter 2020 Opacity Monitor Audit
- CEMS Second Quarter 2020 Clear Path Audit
- Method 9 Visible Opacity Readings

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

Sincerely,

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) 2nd Quarter 2020 COMS Performance Audit and Clear Path Audit

☒ Report (specify) 2nd 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: July 22, 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: April to June **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: July 22, 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: 2nd 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: 2nd 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: 2nd 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: 2nd Quarter of 2020

Opacity Monitor Downtime

Date/Time of Commencement	Duration of Downtime (minutes)	Reasons for Instrument Downtime	System Repairs and Adjustments
4/9/20 6:00	1559	Opacity monitor impacted by lightning	Completed Method 9 Visible Emissions readings, replacement of RS-422 communication cards
4/10/20 16:00	4019	Opacity monitor impacted by lightning	Completed Method 9 Visible Emissions readings. Replacement of AW power supply, A2 30 board, A2 power supply, and tranceiver main board. Completed clear path audit, completed calibrations.
5/21/20 9:00	120	Quarterly PMs and Opacity Performance Audit	Completed PMs and audit
5/24/20 13:00	2639	Power supply failure on opacity monitor	Completed Method 9 Visible Emissions readings, power supply replaced and opacity monitor calibrated
Total Downtime	8337 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: 2nd Quarter of 2020

SO_2 CEMS Downtime

Date/Time of Commencement	Duration of Downtime (hours)	Reasons for Instrument Downtime	System Repairs and Adjustments
4/7/20 6:00	6	Lightning strike impacted flow monitor	Flow transducer replaced
6/13/20 6:00	1	Flow calibration solenoid stuck	Completed re-calibration
Total Downtime	7 hours		

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

KOONTZ & ASSOCIATES

of Nashville, Tennessee

This is to acknowledge that

RACHEL SHMAGRANOFF

successfully participated in Visible Emissions training on MAR 2 0 2020

and is qualified to evaluate Visible Emissions for a period of six (6) months from the date of certification.

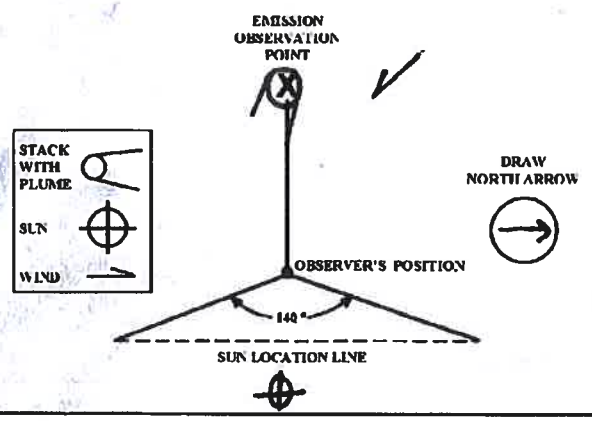
BJ Sykes

Instructor

VISIBLE EMISSION OBSERVATION FORM

Company Name Cokenergy		
Location 3210 Watling		
City East Chicago	**State** IN	**Zip** 46312
Process Equipment HRCC Waste gas stream		**Operating Mode** normal
Control Equipment FGD / BH		**Operating Mode** normal
Describe Emission Point round, vertical stack		
Height of Emission Point 300 ft	**Height Relative to Observer** Start 270 ft End 270 ft	
Distance to Emission Point Start 345 ft End 345 ft	**Direction to Emission Point** Start West End West	
Vertical Angle to Observation Pt. Start 45° End 45°	**Direction to Observation Point** Start East End East	
Describe Emissions Start None	End None	
Emission Color Start N/A End N/A	**If Water Droplet Plume (Circle)** Attached Detached (N/A)	
Point In The Plume At Which Opacity Was Determined Start Stack opening	End Stack opening	
Describe Plume Background Start Clear, blue sky	End Clear, blue sky	
Background Color Start blue End blue	**Sky Condition** Start clear End clear	
Wind Speed Start 15 End 20	**Wind Direction** Start WNW End WNW	
Ambient Temp Start 41° End 43°	**Wet Bulb Temp**	**RH Percent** 51%

SOURCE LAYOUT SKETCH



Additional Information

Observation Date 4/9/2020	**Start Time** 7:29 am	**End Time** 7:59 am

Sec / Min	0	15	30	45	Comments
1	0	0	0	0	
2	0	0	0	/	impacted by quench tower steam
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	avg 0
7	0	0	0	0	
8	0	0	0	0	
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	avg 0
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	
16	0	0	0	0	
17	0	0	0	0	
18	0	0	0	0	avg 0
19	0	0	0	0	
20	0	0	0	0	
21	0	0	0	0	
22	0	0	0	0	
23	0	0	0	0	
24	0	0	0	0	avg 0
25	0	0	0	0	
26	0	0	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	avg 0

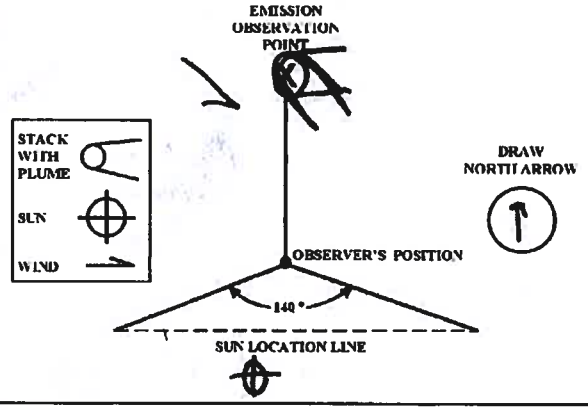
Observer's Name (Print) Rachel Shmagranoff	
Observer's Signature Rachel Shmagranoff	**Date** 4-9-20
Organization primary Energy	
Certified by Koontz + Associates	**Date** 3-20-20

~~Continue on reverse side~~

VISIBLE EMISSION OBSERVATION FORM

Company Name cokenergy			
Location 3210 watling			
City Eastchicago	**State** IN	**Zip** 46312	
Process Equipment HRCC waste gas stream		**Operating Mode** normal	
Control Equipment FGD / BH		**Operating Mode** normal	
Describe Emission Point round, vertical stack			
Height of Emission Point 300	**Height Relative to Observer** Start 300 End 300		
Distance to Emission Point Start 510 ft End 510 ft	**Direction to Emission Point** Start S N End S N		
Vertical Angle to Observation Pt. Start 40° End 40°	**Direction to Observation Point** Start S End S		
Describe Emissions Start NO emissions	End None		
Emission Color Start N/A End N/A	**If Water Droplet Plume (Circle)** Attached Detached (N/A)		
Point In The Plume At Which Opacity Was Determined Start stack opening	End stack opening		
Describe Plume Background Start Overcast Sky	End Cloudy Sky		
Background Color Start blue/white End grey	**Sky Condition** Start cloudy End dark clouds		
Wind Speed Start 23 mph End 19 MPH	**Wind Direction** Start WNW End NW		
Ambient Temp Start 48° End 46°	**Wet Bulb Temp**	**RH Percent** 31%	

SOURCE LAYOUT SKETCH



Additional Information

Observation Date 4/9/2020	Start Time 2:57 PM	End Time 3:27 PM		
Sec / Min	0	15	30	45	Comments
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	avg 0
7	0	0	0	0	
8	0	0	0	0	blue sky
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	avg 0
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	
16	0	0	0	0	cloudy blue bkgd
17	0	0	0	0	
18	0	0	0	0	avg 0
19	0	0	0	0	
20	0	0	0	0	white bkgd
21	0	0	0	0	
22	0	0	0	0	
23	0	0	0	0	
24	0	0	0	0	avg 0
25	0	0	0	0	
26	0	0	0	0	dark grey bkgd
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	avg 0

Observer's Name (Print) Rachel Shmagranoff

Observer's Signature Rachel Shmagranoff **Date** 4-9-2020

Organization Primary Energy

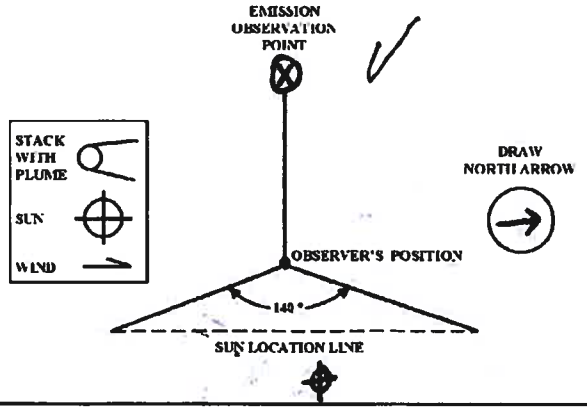
Certified by Koontz + Associates **Date** 3-20-20

Continue on reverse side....

VISIBLE EMISSION OBSERVATION FORM

Company Name Cokenergy		
Location 3210 Watling		
City East Chicago	**State** IN	**Zip** 46312
Process Equipment HRSG waste gas stream		**Operating Mode** normal
Control Equipment FGD | BH		**Operating Mode** normal
Describe Emission Point round, vertical stack		
Height of Emission Point 300ft	**Height Relative to Observer** Start 270ft End 270ft	
Distance to Emission Point Start 350 ft End 345 ft	**Direction to Emission Point** Start West End West	
Vertical Angle to Observation Pt. Start 40° End 40°	**Direction to Observation Point** Start East End East	
Describe Emissions Start No emissions	End White	
Emission Color Start N/A | White End White	**If Water Droplet Plume (Circle)** Attached **Detached** N/A	
Point In The Plume At Which Opacity Was Determined Start Stack opening	End Stack opening	
Describe Plume Background Start blue sky	End blue sky	
Background Color Start blue End blue	**Sky Condition** Start clear End clear	
Wind Speed Start 11 mph End 14 mph	**Wind Direction** Start WNW End WNW	
Ambient Temp Start 35° End 35°	**Wet Bulb Temp**	**RH Percent** 61%

SOURCE LAYOUT SKETCH



Additional Information

Observation Date 4/10	Start Time 6:34 am	End Time 7:04 am

Sec / Min	0	15	30	45	Comments
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	5	
4	5	0	0	0	
5	0	0	0	0	
6	0	0	5	0	avg 0.13
7	0	0	0	0	
8	0	0	0	0	
9	0	0	0	0	
10	0	0	0	0	
11	0	5	0	0	
12	0	0	0	0	avg 0.21
13	0	0	5	0	
14	0	0	0	0	
15	0	0	0	5	
16	0	0	0	0	
17	0	0	0	0	
18	5	0	0	0	avg 0.42
19	0	0	0	0	
20	0	0	0	0	
21	/	/	0	0	blocked by green steam
22	0	0	0	0	
23	0	0	0	5	
24	0	0	0	0	avg 0.21
25	0	0	0	0	
26	0	0	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	avg 0

Observer's Name (Print) Rachel Shmagranoff

Observer's Signature Rachel Shmagranoff — **Date** 4-9-20

Organization Primary Energy

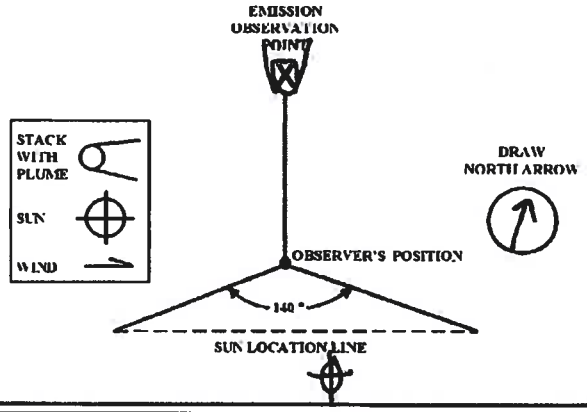
Certified by Koontz + Associates — **Date** 3-20-20

~~Continued on reverse side~~

VISIBLE EMISSION OBSERVATION FORM

Company Name Cokenergy		
Location 3210 Watling		
City East Chicago	**State** IN	**Zip** 46312
Process Equipment MRCC waste gas stream		**Operating Mode** normal
Control Equipment FGD / BH		**Operating Mode** normal
Describe Emission Point round, vertical stack		
Height of Emission Point 300 ft	**Height Relative to Observer** Start 300ft End 300ft	
Distance to Emission Point Start 450 ft End 450 ft	**Direction to Emission Point** Start NW End NW	
Vertical Angle to Observation Pt Start 30° End 30°	**Direction to Observation Point** Start SE End SE	
Describe Emissions Start None, white	End none, white	
Emission Color Start N/A white End white	**If Water Droplet Plume (Circle)** Attached Detached (N/A)	
Point In The Plume At Which Opacity Was Determined Start Stack opening	End Stack opening	
Describe Plume Background Start overcast sky	End overcast sky	
Background Color Start white/blue End white/blue	**Sky Condition** Start cloudy End cloudy	
Wind Speed Start 9 mph End 9 mph	**Wind Direction** Start SSE End SSE	
Ambient Temp Start 50° End 54°	**Wet Bulb Temp**	**RH Percent** 38%

SOURCE LAYOUT SKETCH



Additional Information

Observation Date 4/11/20 **Start Time** 9:35 am **End Time** 10:06 am

Sec / Min	0	15	30	45	Comments
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	avg 0
7	0	0	0	0	
8	0	0	0	5	
9	0	0	0	0	
10	0	5	0	0	
11	0	0	5	0	
12	0	0	0	5	avg 0.83
13	0	5	0	5	
14	0	0	0	0	
15	5	0	0	5	
16	0	5	5	0	
17	0	0	0	0	
18	0	0	0	5	avg 1.46
19	0	0	0	0	
20	0	0	0	0	
21	0	0	0	0	
22	0	0	0	0	
23	0	0	0	0	
24	0	0	0	0	avg 0
25	0	0	0	0	
26	5	0	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	avg 0.21

Observer's Name (Print) Rachel Shmagranoff

Observer's Signature Rachel Shmagranoff **Date** 4/11/2020

Organization Primary Energy

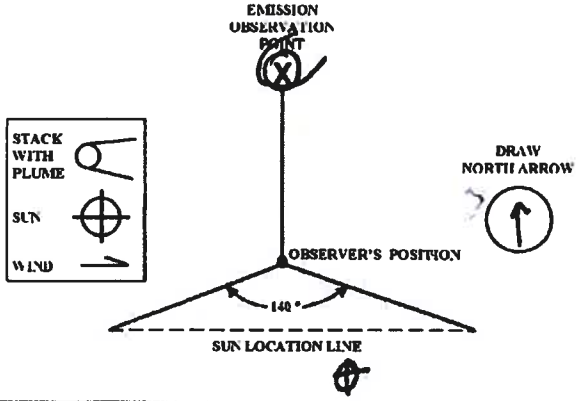
Certified by Koontz + Associates **Date** 3-20-20

Continue on reverse side

VISIBLE EMISSION OBSERVATION FORM

Company Name Cokenergy		
Location 3210 Warling		
City East Chicago	**State** IN	**Zip** 46312
Process Equipment HRCC waste gas stream		**Operating Mode** normal
Control Equipment FGD/BH		**Operating Mode** normal
Describe Emission Point round, vertical stack		
Height of Emission Point 300 ft	**Height Relative to Observer** Start 300ft End 300ft	
Distance to Emission Point Start 590ft End 590ft	**Direction to Emission Point** Start N End N	
Vertical Angle to Observation Pt. Start 27° End 27°	**Direction to Observation Point** Start S End S	
Describe Emissions Start NO emissions, white End none, white		
Emission Color Start N/A white End N/A white	**If Water Droplet Plume (Circle)** Attached Detached (N/A)	
Point In The Plume At Which Opacity Was Determined Start stack opening End stack opening		
Describe Plume Background Start clear, blue sky End overcast sky		
Background Color Start blue End white/blue	**Sky Condition** Start clear End cloudy	
Wind Speed Start 12mph End 12mph	**Wind Direction** Start SSE End S	
Ambient Temp Start 64° End 60°	**Wet Bulb Temp**	**RH Percent** 36%

SOURCE LAYOUT SKETCH



Additional Information

Observation Date	Start Time	End Time
4/11/2020	1:43 pm	2:13 pm

Sec / Min	0	15	30	45	Comments
1	0	0	0	0	
2	0	0	5	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	white, cloudy sky
6	0	0	0	0	avg 0.21
7	0	0	0	0	
8	5	0	5	0	
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	avg 0.42
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	white sky
16	0	0	0	0	
17	0	0	0	0	
18	0	0	0	0	avg 0.0
19	0	0	0	0	blue, overcast sky
20	5	0	0	0	
21	0	0	0	0	
22	0	0	0	0	
23	0	0	0	0	white sky
24	0	0	0	0	avg 0.21
25	0	0	0	0	
26	0	0	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	avg 0

Observer's Name (Print) Rachel Shmagranoff

Observer's Signature Rachel Shmagranoff **Date** 4-11-2020

Organization Primary Energy

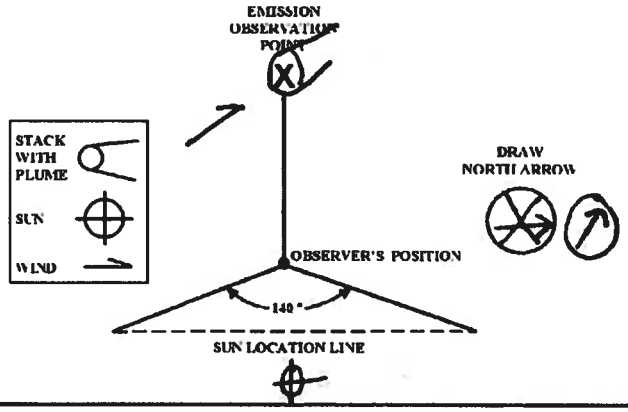
Certified by Icontz + Associates **Date** 3-20-2020

~~Continue on reverse side~~

VISIBLE EMISSION OBSERVATION FORM

Company Name Cokenergy		
Location 3210 Watling St		
City East Chicago	**State** IN	**Zip** 46312
Process Equipment HRSG waste gas stream & ~~one~~		**Operating Mode** ~~one~~ normal
Control Equipment FGD BH		**Operating Mode** Normal
Describe Emission Point round, vertical stack		
Height of Emission Point 300 ft	**Height Relative to Observer** Start 285 ft End 285 ft	
Distance to Emission Point Start 600 ft End 600 ft	**Direction to Emission Point** Start NW End NW	
Vertical Angle to Observation Pt. Start 25° End 25°	**Direction to Observation Point** Start SE End SE	
Describe Emissions Start None End None, white		
Emission Color Start N/A End White	**If Water Droplet Plume (Circle)** Attached Detached (N/A)	
Point In The Plume At Which Opacity Was Determined Start Stack opening End Stack opening		
Describe Plume Background Start overcast sky End overcast sky		
Background Color Start white End White	**Sky Condition** Start Cloudy End cloudy	
Wind Speed Start 9 mph End 9 mph	**Wind Direction** Start S End S	
Ambient Temp Start 56° End 58°	**Wet Bulb Temp**	**RH Percent** 58%

SOURCE LAYOUT SKETCH



Additional Information

Observation Date 4/12/2020	**Start Time** 9:30 am	**End Time** 10:00 am

Sec / Min	0	15	30	45	Comments
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	avg 0.0
7	0	0	0	0	
8	0	0	0	0	
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	avg 0.0
13	0	0	0	0	
14	0	0	0	0	
15	5	5	0	0	
16	0	0	0	0	
17	0	5	5	5	
18	0	0	0	0	avg 1.04
19	0	0	0	0	
20	0	0	0	0	
21	0	0	0	0	
22	0	0	0	0	
23	0	0	0	0	
24	0	0	0	0	avg 0.0
25	0	0	0	0	
26	0	0	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	5	0	0	
30	0	0	0	0	avg 0.21

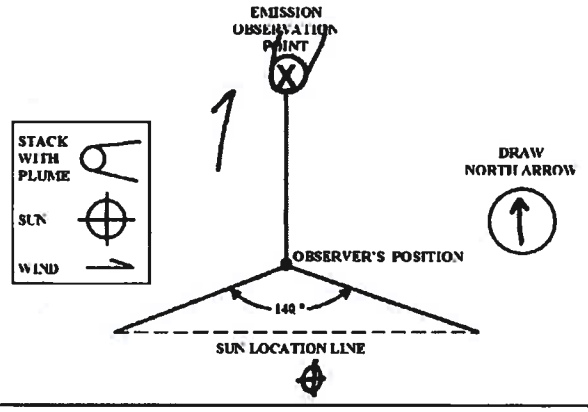
Observer's Name (Print) Rachel Shmagranoff	
Observer's Signature Rachel Shmagranoff	**Date** 4/12/2020
Organization Primary Energy	
Certified by Koontz + Associates	**Date** 3-20-2020

~~**Continue on reverse side**~~

VISIBLE EMISSION OBSERVATION FORM

Company Name cokenergy		
Location 3210 Watling St		
City East Chicago	**State** IN	**Zip** 46312
Process Equipment HRCC waste gas stream		**Operating Mode** normal
Control Equipment FGD/BH		**Operating Mode** normal
Describe Emission Point round, vertical stack		
Height of Emission Point 300 ft	**Height Relative to Observer** Start 300ft End 300ft	
Distance to Emission Point Start 600ft End 600 ft	**Direction to Emission Point** Start N End N	
Vertical Angle to Observation Pt. Start 26° End 26°	**Direction to Observation Point** Start S End S	
Describe Emissions Start None	End light white	
Emission Color Start N/A End White	**If Water Droplet Plume (Circle)** Attached Detached (N/A)	
Point In The Plume At Which Opacity Was Determined Start Stack opening	End Stack opening	
Describe Plume Background Start Cloudy Sky	End cloudy sky	
Background Color Start White End White	**Sky Condition** Start cloudy End cloudy	
Wind Speed Start 13mph End 13mph	**Wind Direction** Start SSE End SSE	
Ambient Temp Start 61° End 61°	**Wet Bulb Temp**	**RH Percent** 66%

SOURCE LAYOUT SKETCH



Additional Information

Observation Date 4/12/2020	Start Time 2:00 pm	End Time 2:30pm		
Sec / Min	0	15	30	45	Comments
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	avg 0.0
7	0	0	0	0	
8	0	0	0	0	
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	avg 0.0
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	
16	0	0	0	0	
17	0	0	0	0	
18	0	0	0	0	avg 0.0
19	0	0	0	0	
20	5	0	0	0	
21	0	0	0	0	
22	0	0	0	0	
23	0	0	0	0	
24	0	0	0	0	avg 0.21
25	0	0	0	0	
26	0	0	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	avg 0

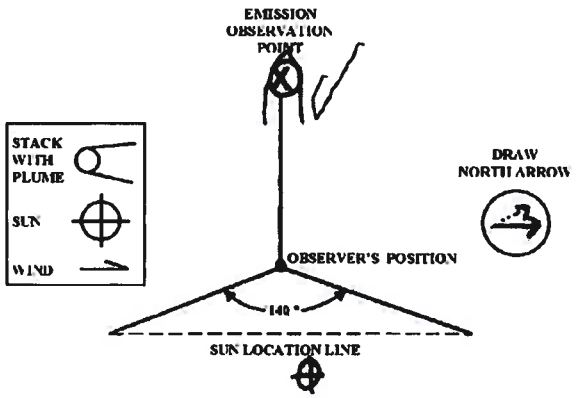
Observer's Name (Print) Rachel Shmagranoff	
Observer's Signature Rachel Shmagranoff	**Date** 4/12/2020
Organization Primary Energy	
Certified by Koontz + Associates	**Date** 3-20-2020

Continue on reverse side

VISIBLE EMISSION OBSERVATION FORM

Company Name Cokenergy		
Location 3210 Watling		
City East Chicago	**State** IN	**Zip** 46312
Process Equipment HRCC Waste gas stream		**Operating Mode** normal
Control Equipment FGD | BH		**Operating Mode** normal
Describe Emission Point round, vertical stack		
Height of Emission Point 300ft	**Height Relative to Observer** Start 270 ft End 270 ft	
Distance to Emission Point Start 500ft End 650ft	**Direction to Emission Point** Start W End NW	
Vertical Angle to Observation Pt. Start 30° End 25°	**Direction to Observation Point** Start E End SE	
Describe Emissions Start none End thin white		
Emission Color Start N/A End white	**If Water Droplet Plume (Circle)** Attached Detached N/A	
Point In The Plume At Which Opacity Was Determined Start stack opening End stack opening		
Describe Plume Background Start cloudy sky End cloudy sky		
Background Color Start grey End grey	**Sky Condition** Start cloudy End cloud	
Wind Speed Start 21mph End 21mph	**Wind Direction** Start NW End NW	
Ambient Temp Start 37° End 37°	**Wet Bulb Temp**	**RH Percent** 79%

SOURCE LAYOUT SKETCH



Additional Information

Observation Date 4/13/20	Start Time 10:49 am	End Time am

Sec / Min	0	15	30	45	Comments
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	avg 0.0
7	0	0	0	0	
8	0	0	0	0	
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	avg 0.0
13	0	5	5	0	
14	0	0	0	0	
15	0	0	0	0	blue Cloudy sky
16	0	0	0	5	
17	5	0	0	0	
18	0	0	0	0	avg 0.83
19	0	0	5	0	
20	0	0	0	0	
21	0	0	0	0	
22	0	0	0	0	
23	0	0	5	5	
24	0	0	0	5	avg 0.83
25	0	0	0	0	grey sky
26	0	0	0	5	
27	5	5	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	5	0	avg 0.83

Observer's Name (Print) Rachel Shmagranoff

Observer's Signature Rachel Shmagranoff **Date** 4-13-2020

Organization Primary Energy

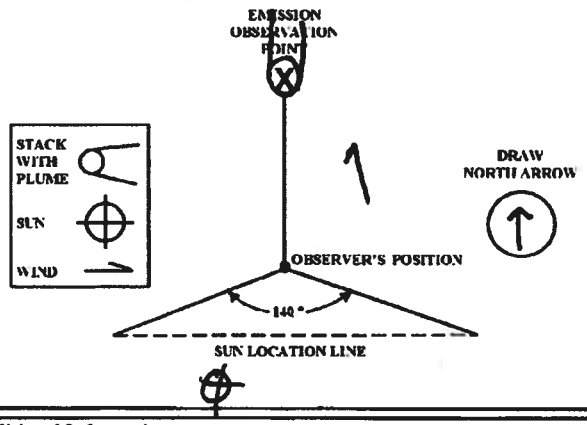
Certified by Koontz + Associates **Date** 3-20-2020

Continue on reverse side

VISIBLE EMISSION OBSERVATION FORM

Company Name cokenergy		
Location 3210 Watling St MC2-991		
City East Chicago	**State** IN	**Zip** 46312
Process Equipment HRCC waste gas stream		**Operating Mode** normal
Control Equipment FGD / BH		**Operating Mode** normal
Describe Emission Point Vertical round stack ID 201		
Height of Emission Point 300ft	**Height Relative to Observer** Start 300 ft End 300 ft	
Distance to Emission Point Start 520ft End 520ft	**Direction to Emission Point** Start N End N	
Vertical Angle to Observation Pt. Start 30° End 30°	**Direction to Observation Point** Start S End S	
Describe Emissions Start None	End White, none	
Emission Color Start none End none	**If Water Droplet Plume (Circle)** Attached Detached (N/A)	
Point In The Plume At Which Opacity Was Determined Start Stack opening	End Stack opening	
Describe Plume Background Start Sky	End Sky	
Background Color Start blue End blue	**Sky Condition** Start Clear End clear	
Wind Speed Start 1mph End 1 mph	**Wind Direction** Start Southeast End Southeast	
Ambient Temp Start 87° End 87°	**Wet Bulb Temp**	**RH Percent** 39%

SOURCE LAYOUT SKETCH



Additional Information

Observation Date	Start Time	End Time
5/24/2020	4:10 pm	4:40 pm

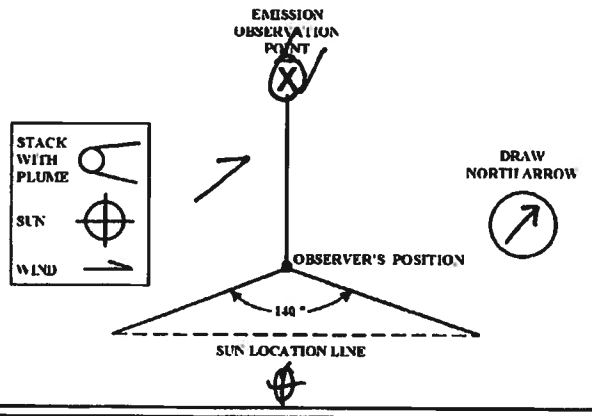
Min \ Sec	0	15	30	45	Comments
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	thin whispy clouds
6	0	0	0	0	0 avg
7	0	0	0	0	
8	0	0	0	0	
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	.21 avg
13	0	0	0	5	blue sky
14	0	0	0	0	
15	0	0	0	0	
16	0	0	0	0	
17	0	0	0	0	
18	0	0	0	0	2 avg
19	0	0	0	0	
20	0	0	0	0	
21	0	0	0	0	
22	0	0	0	0	
23	0	0	0	0	
24	0	0	0	0	0 avg
25	0	0	0	0	
26	0	0	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	0 avg

Observer's Name (Print) Rachel Shmagranoff	
Observer's Signature Rachel Shmagranoff	**Date** 5/24/2020
Organization primary Energy	
Certified by Koontz + Associates	**Date** 3/20/2020
Continue on reverse side X	

VISIBLE EMISSION OBSERVATION FORM

Company Name Cokenergy			
Location 3210 Watling St MC 2-991			
City East Chicago	**State** IN	**Zip** 46312	
Process Equipment HRCC waste gas stream		**Operating Mode** normal	
Control Equipment FGD / SH		**Operating Mode** normal	
Describe Emission Point vertical, round stack 10201			
Height of Emission Point 300ft	**Height Relative to Observer** Start 275 ft End 275 ft		
Distance to Emission Point Start 365 ft End 365 ft	**Direction to Emission Point** Start West End West		
Vertical Angle to Observation Pt. Start 39° End 39°	**Direction to Observation Point** Start east End east		
Describe Emissions Start none End none, 1 White			
Emission Color Start none End none	**If Water Droplet Plume (Circle)** Attached Detached (N/A)		
Point In The Plume At Which Opacity Was Determined Start Stack opening End Stack opening			
Describe Plume Background Start Sky, clear, fluffy clouds End Sky, clear, thin clouds			
Background Color Start blue End blue	**Sky Condition** Start thin + fluffy clouds, clear End blue, clear		
Wind Speed Start 6mph End 6mph	**Wind Direction** Start SSW End SSW		
Ambient Temp Start 77°F End 79°F	**Wet Bulb Temp**	**RH Percent** 65%	

SOURCE LAYOUT SKETCH



Additional Information

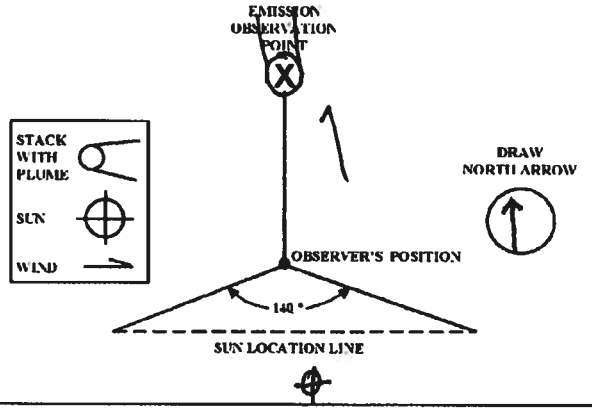
Observation Date 5/25/20	Start Time 9:37	End Time 10:07	
Min \ Sec	**0**	**15**	**30**	**45**	**Comments**
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	cloud bkgd
6	0	0	0	0	avg 0
7	0	0	0	0	blue bkgd
8	0	0	0	0	
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	avg 0 cloud bkgd
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	
16	0	0	0	0	
17	0	0	0	0	blue bkgd
18	0	0	0	0	avg 0
19	0	0	0	0	
20	0	0	0	0	cloud bkgd
21	0	0	0	0	
22	0	0	0	0	
23	0	0	0	0	
24	0	0	0	0	avg 0
25	0	0	0	0	
26	0	0	0	0	blue bkgd
27	0	0	0	5	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	avg .21

Observer's Name (Print) Rachel Shmagranoff	
Observer's Signature Rachel Shmagranoff	**Date** 5/25/20
Organization Primary Energy	
Certified by Koontz Associates	**Date** 3/20/2020
Continue on reverse side X	

VISIBLE EMISSION OBSERVATION FORM

Company Name: Cokenergy		
Location: 3210 Watling St MC2-991		
City: East Chicago	State: IN	Zip: 46312
Process Equipment: HRSG waste gas stream		Operating Mode: normal
Control Equipment: FGD | BH		Operating Mode: normal
Describe Emission Point: vertical, round stack 10201		
Height of Emission Point: 300 ft	Height Relative to Observer: Start 300ft End 300ft	
Distance to Emission Point: Start 580ft End 580ft	Direction to Emission Point: Start S NNW End NNW	
Vertical Angle to Observation Pt.: Start 27° End 27°	Direction to Observation Point: Start SSE End SSE	
Describe Emissions: Start none End		
Emission Color: Start None End	If Water Droplet Plume (Circle): Attached Detached (N/A)	
Point In The Plume At Which Opacity Was Determined: Start Stack opening End Stack opening		
Describe Plume Background: Start blue sky End		
Background Color: Start blue End	Sky Condition: Start clear with clouds End	
Wind Speed: Start 6 mph End 7 mph	Wind Direction: Start SSW End S	
Ambient Temp: Start 85° End 86°	Wet Bulb Temp	RH Percent: 44%

SOURCE LAYOUT SKETCH



Additional Information:

Observation Date: 5/25/20	Start Time: 1:44 pm	End Time: pm

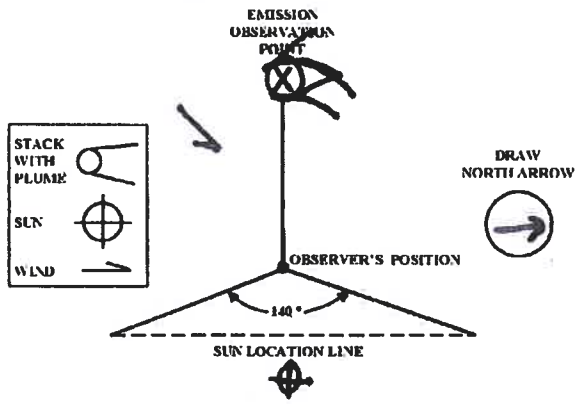
Sec / Min	0	15	30	45	Comments
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	0 avg
7	0	0	0	0	
8	0	0	0	0	
9	0	0	0	0	
10	0	0	0	0	avoid bkgd
11	0	0	0	0	
12	0	0	0	0	0 avg
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	blue bkgd
16	0	0	0	0	
17	0	0	0	0	
18	0	0	0	0	0 avg
19	0	0	0	0	
20	0	0	0	0	
21	0	0	0	0	
22	0	0	0	0	
23	5	0	0	0	
24	0	0	0	0	.21 avg
25	0	0	0	0	cloud bkgd
26	0	0	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	0 avg

Observer's Name (Print): Rachel Shmagranoff	
Observer's Signature: Rachel Shmagranoff	Date: 3/25/20
Organization: Primary Energy	
Certified by: Koontz & Associates	Date: 3/20/20
Continue on reverse side: X	

VISIBLE EMISSION OBSERVATION FORM

Company Name: Cokenergy		
Location: 3210 Watling St MC-2-991		
City: East Chicago	State: IN	Zip: 46312
Process Equipment: HRCC waste gas stream		Operating Mode: normal
Control Equipment: FGD / BH		Operating Mode: normal
Describe Emission Point: Vertical round stack ID 201		
Height of Emission Point: 300 ft	Height Relative to Observer: Start 275 ft End 275 ft	
Distance to Emission Point: Start 350 ft End 350 ft	Direction to Emission Point: Start West End West	
Vertical Angle to Observation Pt: Start 40° End 40°	Direction to Observation Point: Start east End east	
Describe Emissions: Start none	End none, thin white	
Emission Color: Start none End none White	If Water Droplet Plume (Circle): Attached Detached (N/A)	
Point In The Plume At Which Opacity Was Determined: Start Stack opening	End Stack opening	
Describe Plume Background: Start Sky, clear	End Sky, light clouds	
Background Color: Start blue End blue/white	Sky Condition: Start clear End thin overcast	
Wind Speed: Start 5 mph End 5 mph	Wind Direction: Start SSE End SSE	
Ambient Temp: Start 68° End 68°	Wet Bulb Temp	RH Percent: 53%

SOURCE LAYOUT SKETCH



Additional Information

Observation Date: 5/26/20	Start Time: 6:37am	End Time: 7:07am

Sec / Min	0	15	30	45	Comments
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	0 avg
7	0	0	0	0	
8	0	0	0	0	
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	5	5	.42 avg
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	
16	0	0	0	0	thin cloud bkgd
17	0	0	0	0	Still blue
18	0	0	0	0	0 avg
19	0	0	0	5	
20	0	0	0	5	
21	0	5	0	0	
22	0	0	0	0	
23	0	0	0	0	
24	0	0	0	0	.63 avg
25	0	5	0	0	
26	0	0	0	0	
27	0	5	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	.42 avg

Observer's Name (Print): Rachel Shmagranoff	
Observer's Signature: Rachel Shmagranoff	Date: 5/26/20
Organization: Primary Energy	
Certified by: Koontz + Associates	Date: 5/20/20
Continue on reverse side: X	

OPACITY PERFORMANCE AUDIT

FOR

Primary Energy

E. Chicago, IN

Unit: Stack 201

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

Second (2nd) Quarter Results
2020

Audit Completed On: 5/21/2020

PREPARED BY:

Monitoring | Solutions

Leaders in Environmental Monitoring Systems & Services

TABLE OF CONTENTS

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: 5/21/2020

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	0.26	0.20
	PASS	PASS	PASS

Reviewed by: Zachary Russell

Date: _____

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 =

(((Blank 15 - 4) ÷ 16) × Blank 11) - 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: 5/21/2020

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.]

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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 Error 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	YC61	18.20	18.20 %
23 MID	YC62	27.30	27.30 %
24 HIGH	YC63	46.30	46.30 %

[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]

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25 ZERO 0.00

	LOW		MID		HIGH		(If Required) ZERO
26	18.60	27	27.60	28	46.10	29	N/A
30	18.40	31	27.40	32	46.10	33	N/A
34	18.30	35	27.40	36	46.10	37	N/A
38	18.30	39	27.40	40	46.10	41	N/A
42	18.30	43	27.30	44	46.10	45	0.00

[Six-minute average data, if applicable.]

	ZERO		LOW		MID		HIGH		(If Required) ZERO
46	0.00	47	18.30	48	27.40	49	46.20	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

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Span Error (% Op.):

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

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

Optical Surface Dust Accumulation (% OP):

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

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

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

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

59 LOW: $1 - (1 - (\frac{Blank\ 22}{100})^{Blank\ 4})\ x\ 100$ = 18.20 %
(18.20, 1.000)

60 MID: $1 - (1 - (\frac{Blank\ 23}{100})^{Blank\ 4})\ x\ 100$ = 27.30 %
(27.30, 1.000)

61 HIGH $1 - (1 - (\frac{Blank\ 24}{100})^{Blank\ 4})\ x\ 100$ = 46.30 %
(46.30, 1.000)

AUDIT DATA SHEET
MONITORING SOLUTIONS DURAG D-R 290 COMS

Auditor: Dan Bowles Date: 05/21/20
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	0.18	
		71a	0.10	
	MID	63	0.12	
		72a	0.10	
	HIGH	64	-0.20	
		73a	-0.10	
Confidence Coeffecient				
		65	0.16	
		66	0.14	
		67	0.00	
Calibration Error				
		68	0.34	≤ 3% Op
		69	0.26	≤ 3% Op
		70	0.20	≤ 3% Op

Revision: March, 2016

OPACITY LOW FILTER AUDIT

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 5/21/2020

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	18.60	18.20	0.40	0.1600
2	18.40	18.20	0.20	0.0400
3	18.30	18.20	0.10	0.0100
4	18.30	18.20	0.10	0.0100
5	18.30	18.20	0.10	0.0100

n = 5

t(0.975) = 2.776

Mean Ref. Method Value	**18.2000**	***RM***
Sum of Differences	**0.9000**	***Xi***
Arithmetic Mean Difference	**0.1800**	***Xi ave***
Sum of Differences Squared	**0.2300**	***Xi^2***
Standard Deviation	**0.1304**	***sd***
2.5% Error Conf.Coef	**0.1619**	***CC***
Calibration Error	**0.3419**	***percent***

OPACITY MID FILTER AUDIT

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 5/21/2020

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	27.60	27.30	0.30	0.0900
2	27.40	27.30	0.10	0.0100
3	27.40	27.30	0.10	0.0100
4	27.40	27.30	0.10	0.0100
5	27.30	27.30	0.00	0.0000

n = 5

t(0.975) = 2.776

Mean Ref. Method Value	**27.3000**	***RM***
Sum of Differences	**0.6000**	***Xi***
Arithmetic Mean Difference	**0.1200**	***Xi ave***
Sum of Differences Squared	**0.1200**	***Xi^2***
Standard Deviation	**0.1095**	***sd***
2.5% Error Conf.Coef	**0.1360**	***CC***
Calibration Error	**0.2560**	***percent***

OPACITY HIGH FILTER AUDIT

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 5/21/2020

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	46.10	46.30	-0.20	0.0400
2	46.10	46.30	-0.20	0.0400
3	46.10	46.30	-0.20	0.0400
4	46.10	46.30	-0.20	0.0400
5	46.10	46.30	-0.20	0.0400

n = 5

t(0.975) = 2.776

Mean Ref. Method Value	**46.3000**	***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***

05/21/2020	OPACITY, %	
09:19		
09:19:01	0.0	MOS
09:19:03	0.0	MOS
09:19:05	0.0	MOS
09:19:07	0.0	MOS
09:19:09	0.0	MOS
09:19:11	0.0	MOS
09:19:13	0.0	MOS
09:19:15	0.0	MOS
09:19:17	0.0	MOS
09:19:19	0.0	MOS
09:19:21	0.0	MOS
09:19:23	0.0	MOS
09:19:25	0.0	MOS
09:19:27	0.0	MOS
09:19:29	0.0	MOS
09:19:31	0.0	MOS
09:19:33	0.0	MOS
09:19:35	0.0	MOS
09:19:37	0.0	MOS
09:19:39	0.0	MOS
09:19:41	0.0	MOS
09:19:43	2.3	MOS
09:19:45	7.0	MOS
09:19:47	11.7	MOS
09:19:49	16.4	MOS
09:19:51	18.6	MOS
09:19:53	18.6	MOS
09:19:55	18.6	MOS
09:19:57	18.6	MOS
09:19:59	18.6	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

05/21/2020	OPACITY, %	
09:20		
09:20:01	18.6	MOS
09:20:03	18.6	MOS
09:20:05	18.6	MOS
09:20:07	18.6	MOS
09:20:09	18.6	MOS
09:20:11	18.6	MOS
09:20:13	18.6	MOS
09:20:15	18.6	MOS
09:20:17	18.6	MOS
09:20:19	14.2	MOS
09:20:21	15.3	MOS
09:20:23	17.5	MOS
09:20:25	19.6	MOS
09:20:27	25.9	MOS
09:20:29	27.6	MOS
09:20:31	27.6	MOS
09:20:33	27.6	MOS
09:20:35	27.6	MOS
09:20:37	27.7	MOS
09:20:39	27.7	MOS
09:20:41	27.7	MOS
09:20:43	27.6	MOS
09:20:46	27.6	MOS
09:20:48	27.6	MOS
09:20:50	27.7	MOS
09:20:52	27.7	MOS
09:20:54	27.7	MOS
09:20:56	21.4	MOS
09:20:58	25.9	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

05/21/2020	OPACITY, %	
09:21		
09:21:00	30.5	MOS
09:21:02	34.8	MOS
09:21:04	46.0	MOS
09:21:06	46.1	MOS
09:21:08	46.1	MOS
09:21:10	46.1	MOS
09:21:12	46.1	MOS
09:21:14	46.1	MOS
09:21:16	46.1	MOS
09:21:18	46.1	MOS
09:21:20	46.1	MOS
09:21:22	46.1	MOS
09:21:24	46.1	MOS
09:21:26	46.1	MOS
09:21:28	46.1	MOS
09:21:30	46.1	MOS
09:21:32	40.5	MOS
09:21:34	30.1	MOS
09:21:36	23.9	MOS
09:21:38	17.0	MOS
09:21:40	15.7	MOS
09:21:42	18.4	MOS
09:21:44	18.4	MOS
09:21:46	18.4	MOS
09:21:48	18.4	MOS
09:21:50	18.4	MOS
09:21:52	18.4	MOS
09:21:54	18.4	MOS
09:21:56	18.4	MOS
09:21:58	18.4	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

05/21/2020	OPACITY, %	
09:22		
09:22:00	18.4	MOS
09:22:02	18.4	MOS
09:22:04	18.4	MOS
09:22:06	18.4	MOS
09:22:08	18.4	MOS
09:22:10	18.4	MOS
09:22:12	17.2	MOS
09:22:14	15.9	MOS
09:22:16	18.8	MOS
09:22:18	21.1	MOS
09:22:20	25.6	MOS
09:22:22	27.4	MOS
09:22:24	27.4	MOS
09:22:26	27.5	MOS
09:22:28	27.4	MOS
09:22:30	27.4	MOS
09:22:32	27.4	MOS
09:22:34	27.4	MOS
09:22:36	27.4	MOS
09:22:38	27.5	MOS
09:22:40	27.5	MOS
09:22:42	27.5	MOS
09:22:44	27.4	MOS
09:22:46	27.4	MOS
09:22:48	26.1	MOS
09:22:50	24.6	MOS
09:22:52	29.3	MOS
09:22:54	34.0	MOS
09:22:56	40.0	MOS
09:22:58	46.1	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

05/21/2020	OPACITY, %	
09:23		
09:23:00	46.1	MOS
09:23:02	46.1	MOS
09:23:04	46.1	MOS
09:23:06	46.1	MOS
09:23:08	46.1	MOS
09:23:10	46.1	MOS
09:23:12	46.2	MOS
09:23:14	46.2	MOS
09:23:16	46.1	MOS
09:23:18	46.1	MOS
09:23:20	46.1	MOS
09:23:22	46.1	MOS
09:23:24	38.5	MOS
09:23:26	29.8	MOS
09:23:29	22.8	MOS
09:23:31	15.9	MOS
09:23:33	18.3	MOS
09:23:35	18.3	MOS
09:23:37	18.3	MOS
09:23:39	18.3	MOS
09:23:41	18.3	MOS
09:23:43	18.3	MOS
09:23:45	18.3	MOS
09:23:47	18.3	MOS
09:23:49	18.3	MOS
09:23:51	18.3	MOS
09:23:53	18.3	MOS
09:23:55	18.3	MOS
09:23:57	18.3	MOS
09:23:59	18.3	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

05/21/2020	OPACITY, %	
09:24		
09:24:01	15.5	MOS
09:24:03	17.8	MOS
09:24:05	20.0	MOS
09:24:07	22.3	MOS
09:24:09	27.4	MOS
09:24:11	27.4	MOS
09:24:13	27.4	MOS
09:24:15	27.4	MOS
09:24:17	27.4	MOS
09:24:19	27.4	MOS
09:24:21	27.4	MOS
09:24:23	27.4	MOS
09:24:25	27.4	MOS
09:24:27	27.4	MOS
09:24:29	27.4	MOS
09:24:31	27.4	MOS
09:24:33	27.4	MOS
09:24:35	27.4	MOS
09:24:37	23.9	MOS
09:24:39	25.2	MOS
09:24:41	29.9	MOS
09:24:43	34.6	MOS
09:24:45	42.7	MOS
09:24:47	46.1	MOS
09:24:49	46.1	MOS
09:24:51	46.1	MOS
09:24:53	46.1	MOS
09:24:55	46.1	MOS
09:24:57	46.1	MOS
09:24:59	46.1	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

05/21/2020	OPACITY, %	
09:25		
09:25:01	46.1	MOS
09:25:03	46.1	MOS
09:25:05	46.1	MOS
09:25:07	46.1	MOS
09:25:09	46.1	MOS
09:25:11	46.1	MOS
09:25:13	46.1	MOS
09:25:15	35.7	MOS
09:25:17	28.4	MOS
09:25:19	21.2	MOS
09:25:21	14.5	MOS
09:25:23	17.9	MOS
09:25:25	18.3	MOS
09:25:27	18.3	MOS
09:25:29	18.3	MOS
09:25:31	18.3	MOS
09:25:33	18.3	MOS
09:25:35	18.3	MOS
09:25:37	18.3	MOS
09:25:39	18.3	MOS
09:25:41	18.3	MOS
09:25:43	18.3	MOS
09:25:45	18.3	MOS
09:25:47	18.3	MOS
09:25:49	18.3	MOS
09:25:51	18.3	MOS
09:25:53	16.0	MOS
09:25:55	15.2	MOS
09:25:57	17.1	MOS
09:25:59	19.4	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

05/21/2020	OPACITY, %	
09:26		
09:26:01	22.8	MOS
09:26:03	27.4	MOS
09:26:05	27.4	MOS
09:26:07	27.4	MOS
09:26:10	27.4	MOS
09:26:12	27.4	MOS
09:26:14	27.4	MOS
09:26:16	27.4	MOS
09:26:18	27.4	MOS
09:26:20	27.4	MOS
09:26:22	27.4	MOS
09:26:24	27.4	MOS
09:26:26	27.4	MOS
09:26:28	27.4	MOS
09:26:30	25.3	MOS
09:26:32	26.4	MOS
09:26:34	31.1	MOS
09:26:36	35.8	MOS
09:26:38	42.5	MOS
09:26:40	46.2	MOS
09:26:42	46.2	MOS
09:26:44	46.2	MOS
09:26:46	46.1	MOS
09:26:48	46.1	MOS
09:26:50	46.2	MOS
09:26:52	46.1	MOS
09:26:54	46.1	MOS
09:26:56	46.1	MOS
09:26:58	46.2	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

05/21/2020	OPACITY, %
09:27	
09:27:00	46.1 MOS
09:27:02	35.7 MOS
09:27:04	29.2 MOS
09:27:06	23.5 MOS
09:27:08	16.5 MOS
09:27:10	18.2 MOS
09:27:12	18.3 MOS
09:27:14	18.3 MOS
09:27:16	18.3 MOS
09:27:18	18.3 MOS
09:27:20	18.3 MOS
09:27:22	18.3 MOS
09:27:24	18.3 MOS
09:27:26	18.3 MOS
09:27:28	18.3 MOS
09:27:30	18.3 MOS
09:27:32	18.3 MOS
09:27:34	18.3 MOS
09:27:36	18.3 MOS
09:27:38	16.2 MOS
09:27:40	17.0 MOS
09:27:42	19.2 MOS
09:27:44	21.5 MOS
09:27:46	25.8 MOS
09:27:48	27.3 MOS
09:27:50	27.3 MOS
09:27:52	27.3 MOS
09:27:54	27.3 MOS
09:27:56	27.3 MOS
09:27:58	27.3 MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

05/21/2020	OPACITY, %	
09:28		
09:28:00	27.3	MOS
09:28:02	27.3	MOS
09:28:04	27.3	MOS
09:28:06	27.3	MOS
09:28:08	27.3	MOS
09:28:10	27.3	MOS
09:28:12	27.3	MOS
09:28:14	27.3	MOS
09:28:16	22.8	MOS
09:28:18	27.4	MOS
09:28:20	32.1	MOS
09:28:22	36.8	MOS
09:28:24	46.1	MOS
09:28:26	46.1	MOS
09:28:28	46.1	MOS
09:28:30	46.1	MOS
09:28:32	46.1	MOS
09:28:34	46.1	MOS
09:28:36	46.1	MOS
09:28:38	46.1	MOS
09:28:40	46.1	MOS
09:28:42	46.1	MOS
09:28:44	46.1	MOS
09:28:46	46.1	MOS
09:28:48	46.1	MOS
09:28:50	46.1	MOS
09:28:53	36.8	MOS
09:28:55	29.9	MOS
09:28:57	22.9	MOS
09:28:59	16.0	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

05/21/2020	OPACITY, %	
09:29		
09:29:01	18.3	MOS
09:29:03	18.3	MOS
09:29:05	18.3	MOS
09:29:07	18.3	MOS
09:29:09	16.1	MOS
09:29:11	16.8	MOS
09:29:13	19.1	MOS
09:29:15	21.4	MOS
09:29:17	25.9	MOS
09:29:19	27.3	MOS
09:29:21	27.3	MOS
09:29:23	27.3	MOS
09:29:25	27.3	MOS
09:29:27	27.3	MOS
09:29:29	27.3	MOS
09:29:31	21.9	MOS
09:29:33	22.1	MOS
09:29:35	28.0	MOS
09:29:37	33.0	MOS
09:29:39	44.5	MOS
09:29:41	46.1	MOS
09:29:43	46.2	MOS
09:29:45	46.1	MOS
09:29:47	46.1	MOS
09:29:49	46.1	MOS
09:29:51	46.1	MOS
09:29:53	45.5	MOS
09:29:55	33.9	MOS
09:29:57	22.4	MOS
09:29:59	12.3	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

05/21/2020	OPACITY, %	
09:30		
09:30:01	2.1	MOS
09:30:03	0.0	MOS
09:30:05	0.0	MOS
09:30:07	0.0	MOS
09:30:09	0.0	MOS
09:30:11	0.0	MOS
09:30:13	0.0	MOS
09:30:15	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 | 5/21/2020

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	18.30	18.20	0.10	**0.10**
MID	27.40	27.30	0.10	**0.10**
HIGH	46.20	46.30	-0.10	**0.10**
ZERO	0.00	0.00	0.00	**0.00**

Primary Energy Coke

Opacity Report

Created on : May 21, 2020 11:04:27

East Chicago, IN

05/21/2020 - 05/21/2020

05/21/2020

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	1.1 SVC	1.1 SVC	1.0 SVC	1.1 SVC	1.2 SVC	1.1 SVC	1.1 SVC	0.9 SVC	1.0 SVC	1.1 SVC
1	1.1 SVC	1.0 SVC	1.2 SVC	1.1 SVC	1.0 SVC	1.1 SVC	1.2 SVC	1.1 SVC	1.1 SVC	1.1 SVC
2	1.2 SVC	1.0 SVC	1.0 SVC	1.0 SVC	1.1 SVC	1.1 SVC	1.1 SVC	1.0 SVC	1.1 SVC	1.1 SVC
3	1.0 SVC	1.0 SVC	1.1 SVC	1.0 SVC	0.9 SVC	0.9 SVC	1.0 SVC	1.2 SVC	1.0 SVC	1.1 SVC
4	1.1 SVC	1.2 SVC	1.1 SVC	1.0 SVC	1.0 SVC	1.1 SVC	1.0 SVC	1.0 SVC	1.0 SVC	1.0 NSA
5	1.0 SVC	1.0 SVC	1.0 SVC	1.2 SVC	1.1 SVC	1.1 SVC	1.1 SVC	1.1 SVC	1.1 SVC	1.1 SVC
6	1.2 SVC	1.3 SVC	1.1 SVC	1.1 SVC	1.2 SVC	1.2 SVC	1.2 SVC	1.2 SVC	1.1 SVC	1.1 SVC
7	1.2 SVC	1.1 SVC	1.1 SVC	1.1 SVC	1.1 SVC	1.1 SVC	1.0 SVC	1.1 SVC	1.2 SVC	1.1 SVC
8	1.1 SVC	1.1 SVC	1.1 SVC	1.1 SVC	1.1 SVC	1.1 SVC	1.2 NSA	1.0 MOS	1.0 MOS	1.1 MOS
9	1.1 MOS	1.1 MOS	1.0 MOS	19.5 MOS	30.0 MOS	0.0 MOS	0.0 MOS	4.4 MOS	18.3 MOS	18.3 MOS
10	26.8 MOS	27.4 MOS	40.2 MOS	46.2 MOS	30.0 MOS	0.0 MOS	0.4 MOS	1.8 MOS	2.0 MOS	2.0 MOS

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 1.1 % for 85 periods of valid data.

The Fan was in operation for 110 periods

The maximum opacity period average for the day was 1.3 %

There were 25 periods of invalid data

AUDIT 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: **February 28, 2020**
Date of Filter Expiration: **August 28, 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	46.3	53.7	46.4	0.1
YG00	57.8	42.2	57.8	0.0
YG02	86.4	13.6	86.5	0.1

JT Lephardt

Laboratory-Based Transmissometer Operator

See second page for Instrument Information and Details of Certification

Monitoring | Solutions
Leaders in Environmental Monitoring Systems & Services
4440 S. High School Rd., Suite D, Indianapolis, Indiana 46241 Tel: 317.856.9400

REPORT OF CERTIFICATION OF NEUTRAL DENSITY AUDIT FILTERS

- **Calibration of Laboratory-Based Transmissometer**

  Instrument:
  Durag Model 290
  Transceiver S/N 414847, Reflector S/N 412508, Remote S/N 414861
  Reference Material:
  Primary Filters calibrated as specified in section 7.1.(2)(i) of Pt. 60, App. B, spec.1 of a nominal luminous transmittance of 50, 70, and 90 percent.

- **Description of Certification** (Pt. 60, App. B, Spec. 1, 7.2(i)(ii)(iii))
  Conduct the secondary attenuator calibration using a laboratory-based transmissometer calibrated as follows:
  Use at least three primary filters of nominal luminous transmittance 50, 70, and 90 percent, calibrated as specified in section 7.1(2)(i),to calibrate the laboratory-based transmissometer. Determine and record the slope of the calibration line using linear regression through zero opacity. The slope of the calibration line must be between 0.99 and 1.01 and the laboratory-based transmissometer reading for each primary filter must not deviate by more than +/- 2 percent from the linear regression line.

  Immediately following the laboratory-based transmissometer calibration, insert the secondary attenuators and determine and record the percent effective opacity value per secondary attenuator from the calibration curve (linear regression line).

  Recalibrate the secondary attenuators semi-annually if they are used for the required calibration error test.

ZERO ALIGNMENT CHECK

FOR

Primary Energy

East Chicago

Unit(s): Stack 201

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

2020

Testing Completed On: 4/10/2020

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: 4/10/2020

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 % :	0.0
Window Check Value % :	0.2
Zero Alignment Error % :	0.2

PASS

* Zero Alignment Error must be ≤ 2% to pass

Reviewed by: John Pollock

Date: 04/17/20

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

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 2

Third Quarter 2020 Deviation and Compliance Monitoring Report

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

October 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 Quarterly Report –Third 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 third 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 Third Quarter 2020 Opacity Monitor Audit
- CEMS Third Quarter 2020 Cylinder Gas Audit

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

Sincerely,

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) 3rd Quarter 2020 COMS Performance Opacity Audit and Cylinder Gas Audit

☒ Report (specify) 3rd 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: October 16, 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: July to September **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: October 16, 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: 3rd 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: 3rd 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: 3rd 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: 3rd Quarter of 2020

Opacity Monitor Downtime

Date/Time of Commencement	Duration of Downtime (minutes)	Reasons for Instrument Downtime	System Repairs and Adjustments
7/28/20 9:00	60	Quarterly PMs and Opacity Performance Audit	Completed PMs and Audit
Total Downtime	60 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: 3rd Quarter of 2020

SO_2 CEMS Downtime

Date/Time of Commencement	Duration of Downtime (hours)	Reasons for Instrument Downtime	System Repairs and Adjustments
9/19/20 5:41	1.73	Delayed opening of flow monitor span solenoid	Completed re-calibration
9/20/20 5:41	1.23	Delayed opening of flow monitor span solenoid	Completed re-calibration
9/24/20 5:41	1.13	Delayed opening of flow monitor span solenoid	Completed re-calibration
Total Downtime	4.09 hours		

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

CYLINDER GAS AUDIT

FOR

Primary Energy

E. Chicago, IN

Unit: Stack 201

MONITORING SOLUTIONS, INC.
FULL EXTRACTIVE

Third (3rd) Quarter Results
2020

CGA Completed On: 7/28/2020

PREPARED BY:

Monitoring | Solutions
Leaders in Environmental Monitoring Systems & Services

TABLE OF CONTENTS

LIST OF TABLES

Table **Page**

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: 7/28/2020

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: John Pollock

Date: 08/21/2020

Summary of Cylinder Gas Audit Results

Parameter	Low Gas Error	Mid Gas Error
SO2	3.29	4.54
O2 Dry	4.00	5.32
O2 Wet	4.00	5.32
	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 Accuracy of each measurement point using the formula below. The "Accuracy" error must not exceed 15%.

$$A = \left(\frac{C_m - Ca}{C_a}\right) x\ 100 \qquad \leq 15 \text{ percent}$$

Where:

A = Accuracy of the CEMS, percent.

C_m = Average CEMS response during audit in units of applicable standard or appropriate concentration.

C_a = Average audit value (CGA certified value) in units of applicable standard or appropriate concentration.

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: 7/28/2020

MONITOR TESTED: SO2
RANGE : 0 - 700 PPM

ANALYZER SERIAL NUMBER: 1152150034

	Run	Time	Reference value	Monitor value	Difference	Error %
Low-level	1	10:55	176.50	182.60	6.10	3.46 %
	2	11:13	176.50	182.10	5.60	3.17 %
	3	11:31	176.50	182.20	5.70	3.23 %
Mid-level	1	11:06	390.70	408.40	17.70	4.53 %
	2	11:24	390.70	407.80	17.10	4.38 %
	3	11:52	390.70	409.10	18.40	4.71 %

Low-level

Arithmetic Mean: 182.30

Tank S/N CC14789

Tank Expiration Date 7/25/2025

CGA Error: 3.29 %

Mid-Level

Arithmetic Mean: 408.43

Tank S/N XC019164B

Tank Expiration Date 12/9/2027

CGA Error: 4.54 %

Date	Parameter	Run#	Timestamp	Type	Expected	Measured	Low Diff	-------	Mid Diff	-------
07/28/2020										
	SO2, PPM	1	10:55:00	QTR_LOW	176.5	182.6	6.1			
	SO2, PPM	1	11:06:00	QTR_MID	390.7	408.4			17.7	
	SO2, PPM	2	11:13:00	QTR_LOW	176.5	182.1	5.6			
	SO2, PPM	2	11:24:00	QTR_MID	390.7	407.8			17.1	
	SO2, PPM	3	11:31:00	QTR_LOW	176.5	182.2	5.7			
	SO2, PPM	3	11:52:00	QTR_MID	390.7	409.1			18.4	

Arithmetic Mean of Quarterly Low : 182.3
Linearity Error of Quarterly Low : 3.3
Calibration Tolerance: 15.0

Arithmetic Mean of Quarterly Mid : 408.4
Linearity Error of Quarterly Mid : 4.5
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: 7/28/2020

MONITOR TESTED: O2 Dry
RANGE : 0 - 25 %

ANALYZER SERIAL NUMBER: 11400

	Run	Time	Reference value	Monitor value	Difference	Error %
Low-level	1	10:55	5.00	5.20	0.20	4.00 %
	2	11:13	5.00	5.20	0.20	4.00 %
	3	11:31	5.00	5.20	0.20	4.00 %
Mid-level	1	11:00	9.97	10.50	0.53	5.32 %
	2	11:19	9.97	10.50	0.53	5.32 %
	3	11:37	9.97	10.50	0.53	5.32 %

Low-level

Arithmetic Mean: 5.20

Tank S/N CC14789

Tank Expiration Date 7/25/2025

CGA Error: 4.00 %

Mid-Level

Arithmetic Mean: 10.50

Tank S/N CC400438

Tank Expiration Date 8/16/2025

CGA Error: 5.32 %

Date	Parameter	Run#	Timestamp	Type	Expected	Measured	Low Diff	-------	Mid Diff	-------
07/28/2020										
	O2 DRY, %	1	10:55:00	QTR_LOW	5.0	5.2	0.2			
	O2 DRY, %	1	11:00:00	QTR_MID	10.0	10.5			0.5	
	O2 DRY, %	2	11:13:00	QTR_LOW	5.0	5.2	0.2			
	O2 DRY, %	2	11:19:00	QTR_MID	10.0	10.5			0.5	
	O2 DRY, %	3	11:31:00	QTR_LOW	5.0	5.2	0.2			
	O2 DRY, %	3	11:37:00	QTR_MID	10.0	5.2			0.5	

Arithmetic Mean of Quarterly Low : 5.2
Linearity Error of Quarterly Low : 4.0
Calibration Tolerance: 15.0

Arithmetic Mean of Quarterly Mid : 10.5
Linearity Error of Quarterly Mid : 5.3
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: 7/28/2020

MONITOR TESTED: O2 Wet
RANGE : 0 - 25 %

ANALYZER SERIAL NUMBER: 11401

	Run	Time	Reference value	Monitor value	Difference	Error %
Low-level	1	10:55	5.00	5.20	0.20	4.00 %
	2	11:13	5.00	5.20	0.20	4.00 %
	3	11:31	5.00	5.20	0.20	4.00 %
Mid-level	1	11:00	9.97	10.50	0.53	5.32 %
	2	11:19	9.97	10.50	0.53	5.32 %
	3	11:37	9.97	10.50	0.53	5.32 %

Low-level

Arithmetic Mean: 5.20

Tank S/N CC14789

Tank Expiration Date 7/25/2025

CGA Error: 4.00 %

Mid-Level

Arithmetic Mean: 10.50

Tank S/N CC400438

Tank Expiration Date 8/16/2025

CGA Error: 5.32 %

Date	Parameter	Run#	Timestamp	Type	Expected	Measured	Low Diff	-------	Mid Diff	-------
07/28/2020										
	O2 WET, %	1	10:55:00	QTR_LOW	5.0	5.2	0.2			
	O2 WET, %	1	11:00:00	QTR_MID	10.0	10.5			0.5	
	O2 WET, %	2	11:13:00	QTR_LOW	5.0	5.2	0.2			
	O2 WET, %	2	11:19:00	QTR_MID	10.0	10.5			0.5	
	O2 WET, %	3	11:31:00	QTR_LOW	5.0	5.2	0.2			
	O2 WET, %	3	11:37:00	QTR_MID	10.0	10.5			0.5	

Arithmetic Mean of Quarterly Low : 5.2
Linearity Error of Quarterly Low : 4.0
Calibration Tolerance: 15.0

Arithmetic Mean of Quarterly Mid : 10.5
Linearity Error of Quarterly Mid : 5.3
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

an Air Liquide company

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

In Service
5/15/20

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI89E15A0052	Reference Number:	54-401666281-1
Cylinder Number:	XC019164B	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:	Dec 09, 2019

Expiration Date: Dec 09, 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 mole/mole 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	390.7 PPM	G1	+/- 1.1% NIST Traceable	12/02/2019, 12/09/2019
CARBON DIOXIDE	10.00 %	10.12 %	G1	+/- 1.2% NIST Traceable	12/02/2019
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	Nov 15, 2019
Nicolet 6700 AHR0801332	FTIR	Nov 25, 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

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

OPACITY PERFORMANCE AUDIT

FOR

Primary Energy

E. Chicago, IN

Unit: Stack 201

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

Third (3rd) Quarter Results
2020

Audit Completed On: 7/28/2020

PREPARED BY:

Monitoring | Solutions

Leaders in Environmental Monitoring Systems & Services

TABLE OF CONTENTS

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: 7/28/2020

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:	0.10	0.08	0.40
	PASS	PASS	PASS

Reviewed by: John Pollock

Date: 08/17/2020

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
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: 7/28/2020

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 Error 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	YL05	17.40	17.40 %
23 MID	YX58	24.30	24.30 %
24 HIGH	ZQ15	43.20	43.20 %

[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	17.50	27	24.30	28	42.80	29	N/A
30	17.50	31	24.30	32	42.80	33	N/A
34	17.50	35	24.30	36	42.80	37	N/A
38	17.50	39	24.20	40	42.80	41	N/A
42	17.50	43	24.30	44	42.80	45	0.00

[Six-minute average data, if applicable.]

	ZERO		LOW		MID		HIGH		(If Required) ZERO
46	0.00	47	17.60	48	24.30	49	42.90	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	10.40 (((Blank 15 - 4.0) ÷ 16) ×	100 Blank 11) -	40.00 Blank 6	=	0.00	%
55	Opacity Data Recorder	40 Blank 16	-	40 Blank 6	=	0.00	

Optical Surface Dust Accumulation (% OP):

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

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

59 LOW: 17.40 1.000

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

= 17.40 %

60 MID: 24.30 1.000

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

= 24.30 %

61 HIGH 43.20 1.000

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

= 43.20 %

AUDIT DATA SHEET
MONITORING SOLUTIONS DURAG D-R 290 COMS

Auditor: Dan Bowles Date: 07/28/20
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	0.10	
		71a	0.20	
	MID	63	-0.02	
		72a	0.00	
	HIGH	64	-0.40	
		73a	-0.30	
Confidence Coeffecient				
		65	0.00	
		66	0.06	
		67	0.00	
Calibration Error				
		68	0.10	≤ 3% Op
		69	0.08	≤ 3% Op
		70	0.40	≤ 3% Op

Revision: March, 2016

OPACITY LOW FILTER AUDIT

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 7/28/2020

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	17.50	17.40	0.10	0.0100
2	17.50	17.40	0.10	0.0100
3	17.50	17.40	0.10	0.0100
4	17.50	17.40	0.10	0.0100
5	17.50	17.40	0.10	0.0100

n = 5

t(0.975) = 2.776

Mean Ref. Method Value	**17.4000**	***RM***
Sum of Differences	**0.5000**	***Xi***
Arithmetic Mean Difference	**0.1000**	***Xi ave***
Sum of Differences Squared	**0.0500**	***Xi^2***
Standard Deviation	**0.0000**	***sd***
2.5% Error Conf.Coef	**0.0000**	***CC***
Calibration Error	**0.1000**	***percent***

OPACITY MID FILTER AUDIT

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 7/28/2020

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	24.30	24.30	0.00	0.0000
2	24.30	24.30	0.00	0.0000
3	24.30	24.30	0.00	0.0000
4	24.20	24.30	-0.10	0.0100
5	24.30	24.30	0.00	0.0000

n = 5

t(0.975) = 2.776

Mean Ref. Method Value	**24.3000**	***RM***
Sum of Differences	**-0.1000**	***Xi***
Arithmetic Mean Difference	**-0.0200**	***Xi ave***
Sum of Differences Squared	**0.0100**	***Xi^2***
Standard Deviation	**0.0447**	***sd***
2.5% Error Conf.Coef	**0.0555**	***CC***
Calibration Error	**0.0755**	***percent***

OPACITY HIGH FILTER AUDIT

Accuracy Determination

Primary Energy | E. Chicago, IN | Stack 201 | 7/28/2020

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	42.80	43.20	-0.40	0.1600
2	42.80	43.20	-0.40	0.1600
3	42.80	43.20	-0.40	0.1600
4	42.80	43.20	-0.40	0.1600
5	42.80	43.20	-0.40	0.1600

n = 5

t(0.975) = 2.776

Mean Ref. Method Value	**43.2000**	***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***

07/28/2020	OPACITY, %	
08:55		
08:55:01	0.0	MOS
08:55:03	0.0	MOS
08:55:05	0.0	MOS
08:55:07	0.0	MOS
08:55:09	0.0	MOS
08:55:11	0.0	MOS
08:55:13	0.0	MOS
08:55:15	0.0	MOS
08:55:17	0.0	MOS
08:55:19	0.0	MOS
08:55:22	0.0	MOS
08:55:24	0.0	MOS
08:55:26	0.0	MOS
08:55:28	0.0	MOS
08:55:30	0.0	MOS
08:55:32	0.0	MOS
08:55:34	0.0	MOS
08:55:36	0.0	MOS
08:55:38	0.0	MOS
08:55:40	0.0	MOS
08:55:42	0.0	MOS
08:55:44	0.0	MOS
08:55:46	0.0	MOS
08:55:48	0.0	MOS
08:55:50	0.0	MOS
08:55:52	2.0	MOS
08:55:54	6.4	MOS
08:55:56	11.8	MOS
08:55:58	15.2	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

07/28/2020	OPACITY, %	
08:56		
08:56:00	17.5	MOS
08:56:02	17.5	MOS
08:56:04	17.5	MOS
08:56:06	17.5	MOS
08:56:08	17.5	MOS
08:56:10	17.5	MOS
08:56:12	17.5	MOS
08:56:14	17.5	MOS
08:56:16	17.5	MOS
08:56:18	17.5	MOS
08:56:20	17.5	MOS
08:56:22	17.5	MOS
08:56:24	17.5	MOS
08:56:26	17.5	MOS
08:56:28	17.5	MOS
08:56:30	17.0	MOS
08:56:32	14.1	MOS
08:56:34	15.5	MOS
08:56:36	17.1	MOS
08:56:38	19.6	MOS
08:56:40	24.3	MOS
08:56:42	24.3	MOS
08:56:44	24.3	MOS
08:56:46	24.3	MOS
08:56:48	24.3	MOS
08:56:50	24.3	MOS
08:56:52	24.3	MOS
08:56:54	24.2	MOS
08:56:56	24.2	MOS
08:56:58	24.2	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

07/28/2020	OPACITY, %	
08:57		
08:57:00	24.2	MOS
08:57:02	24.3	MOS
08:57:04	24.3	MOS
08:57:06	24.2	MOS
08:57:08	22.4	MOS
08:57:10	27.1	MOS
08:57:12	31.7	MOS
08:57:14	36.3	MOS
08:57:16	42.8	MOS
08:57:18	42.8	MOS
08:57:20	42.8	MOS
08:57:22	42.8	MOS
08:57:24	42.8	MOS
08:57:26	42.8	MOS
08:57:28	42.8	MOS
08:57:30	42.8	MOS
08:57:32	42.8	MOS
08:57:34	42.8	MOS
08:57:36	42.8	MOS
08:57:38	42.8	MOS
08:57:40	34.3	MOS
08:57:42	26.6	MOS
08:57:44	20.9	MOS
08:57:46	14.6	MOS
08:57:48	15.1	MOS
08:57:50	17.5	MOS
08:57:52	17.5	MOS
08:57:54	17.5	MOS
08:57:56	17.5	MOS
08:57:58	17.5	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

07/28/2020	OPACITY, %	
08:58		
08:58:00	17.5	MOS
08:58:03	17.5	MOS
08:58:05	17.5	MOS
08:58:07	17.5	MOS
08:58:09	17.5	MOS
08:58:11	13.3	MOS
08:58:13	14.8	MOS
08:58:15	16.5	MOS
08:58:17	18.2	MOS
08:58:19	24.1	MOS
08:58:21	24.3	MOS
08:58:23	24.3	MOS
08:58:25	24.2	MOS
08:58:27	24.2	MOS
08:58:29	24.2	MOS
08:58:31	24.2	MOS
08:58:33	24.2	MOS
08:58:35	24.3	MOS
08:58:37	22.2	MOS
08:58:39	16.1	MOS
08:58:41	20.6	MOS
08:58:43	25.2	MOS
08:58:45	34.5	MOS
08:58:47	42.8	MOS
08:58:49	42.8	MOS
08:58:51	42.8	MOS
08:58:53	42.8	MOS
08:58:55	42.8	MOS
08:58:57	42.8	MOS
08:58:59	42.8	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

07/28/2020	OPACITY, %	
08:59		
08:59:01	42.8	MOS
08:59:03	42.8	MOS
08:59:05	42.8	MOS
08:59:07	42.8	MOS
08:59:09	42.8	MOS
08:59:11	42.8	MOS
08:59:13	40.3	MOS
08:59:15	31.8	MOS
08:59:17	25.4	MOS
08:59:19	19.1	MOS
08:59:21	15.3	MOS
08:59:23	17.5	MOS
08:59:25	17.5	MOS
08:59:27	17.5	MOS
08:59:29	17.5	MOS
08:59:31	17.5	MOS
08:59:33	17.5	MOS
08:59:35	17.5	MOS
08:59:37	17.5	MOS
08:59:39	17.5	MOS
08:59:41	17.5	MOS
08:59:43	17.5	MOS
08:59:45	17.5	MOS
08:59:47	17.4	MOS
08:59:49	14.5	MOS
08:59:51	16.2	MOS
08:59:53	17.9	MOS
08:59:55	21.2	MOS
08:59:57	24.2	MOS
08:59:59	24.2	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

07/28/2020	OPACITY, %	
09:00		
09:00:01	24.2	MOS
09:00:03	24.3	MOS
09:00:05	24.3	MOS
09:00:07	24.3	MOS
09:00:09	24.3	MOS
09:00:11	24.2	MOS
09:00:13	24.2	MOS
09:00:15	24.2	MOS
09:00:17	24.2	MOS
09:00:19	22.8	MOS
09:00:21	19.2	MOS
09:00:23	23.8	MOS
09:00:25	29.6	MOS
09:00:27	37.2	MOS
09:00:29	42.8	MOS
09:00:31	42.8	MOS
09:00:33	42.8	MOS
09:00:35	42.8	MOS
09:00:37	42.8	MOS
09:00:39	42.8	MOS
09:00:41	42.7	MOS
09:00:43	34.8	MOS
09:00:46	24.0	MOS
09:00:48	17.3	MOS
09:00:50	10.9	MOS
09:00:52	12.6	MOS
09:00:54	17.0	MOS
09:00:56	17.4	MOS
09:00:58	17.5	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

07/28/2020	OPACITY, %	
09:01		
09:01:00	17.5	MOS
09:01:02	17.5	MOS
09:01:04	17.5	MOS
09:01:06	17.5	MOS
09:01:08	17.5	MOS
09:01:10	17.5	MOS
09:01:12	17.5	MOS
09:01:14	15.1	MOS
09:01:16	15.2	MOS
09:01:18	16.9	MOS
09:01:20	18.6	MOS
09:01:22	24.2	MOS
09:01:24	24.2	MOS
09:01:26	24.2	MOS
09:01:28	24.2	MOS
09:01:30	24.2	MOS
09:01:32	24.2	MOS
09:01:34	24.2	MOS
09:01:36	22.8	MOS
09:01:38	21.6	MOS
09:01:40	26.2	MOS
09:01:42	30.9	MOS
09:01:44	36.9	MOS
09:01:46	42.7	MOS
09:01:48	42.8	MOS
09:01:50	42.8	MOS
09:01:52	42.8	MOS
09:01:54	42.8	MOS
09:01:56	42.8	MOS
09:01:58	42.8	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

07/28/2020	OPACITY, %	
09:02		
09:02:00	42.7	MOS
09:02:02	42.7	MOS
09:02:04	40.2	MOS
09:02:06	31.4	MOS
09:02:08	25.1	MOS
09:02:10	18.7	MOS
09:02:12	14.9	MOS
09:02:14	17.5	MOS
09:02:16	17.5	MOS
09:02:18	17.5	MOS
09:02:20	17.5	MOS
09:02:22	17.5	MOS
09:02:24	17.5	MOS
09:02:26	17.5	MOS
09:02:28	15.3	MOS
09:02:30	16.3	MOS
09:02:32	18.4	MOS
09:02:34	20.1	MOS
09:02:36	23.8	MOS
09:02:38	24.2	MOS
09:02:40	24.2	MOS
09:02:42	24.2	MOS
09:02:44	24.2	MOS
09:02:46	24.2	MOS
09:02:48	24.2	MOS
09:02:50	24.2	MOS
09:02:52	24.3	MOS
09:02:54	20.7	MOS
09:02:56	23.2	MOS
09:02:58	27.8	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

07/28/2020	OPACITY, %	
09:03		
09:03:00	33.6	MOS
09:03:02	42.6	MOS
09:03:04	42.8	MOS
09:03:06	42.8	MOS
09:03:08	42.8	MOS
09:03:10	42.8	MOS
09:03:12	42.8	MOS
09:03:14	42.8	MOS
09:03:16	42.8	MOS
09:03:18	42.7	MOS
09:03:20	33.8	MOS
09:03:22	27.5	MOS
09:03:24	21.1	MOS
09:03:27	14.9	MOS
09:03:29	17.5	MOS
09:03:31	17.5	MOS
09:03:33	17.5	MOS
09:03:35	17.5	MOS
09:03:37	17.5	MOS
09:03:39	17.5	MOS
09:03:41	16.6	MOS
09:03:43	15.1	MOS
09:03:45	17.0	MOS
09:03:47	18.5	MOS
09:03:49	21.1	MOS
09:03:51	24.2	MOS
09:03:53	24.2	MOS
09:03:55	24.2	MOS
09:03:57	24.2	MOS
09:03:59	24.2	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

07/28/2020	OPACITY, %	
09:04		
09:04:01	20.7	MOS
09:04:03	25.0	MOS
09:04:05	28.8	MOS
09:04:07	33.4	MOS
09:04:09	42.5	MOS
09:04:11	42.8	MOS
09:04:13	42.8	MOS
09:04:15	42.8	MOS
09:04:17	42.8	MOS
09:04:19	40.2	MOS
09:04:21	29.9	MOS
09:04:23	21.4	MOS
09:04:25	10.7	MOS
09:04:27	0.0	MOS
09:04:29	0.0	MOS
09:04:31	0.0	MOS
09:04:33	0.0	MOS
09:04:35	0.0	MOS
09:04:37	0.0	MOS
09:04:39	0.0	MOS
09:04:41	0.0	MOS
09:04:43	0.0	MOS
09:04:45	0.0	MOS
09:04:47	0.0	MOS
09:04:49	0.0	MOS
09:04:51	0.0	MOS
09:04:53	0.0	MOS
09:04:55	0.0	MOS
09:04:57	0.0	MOS
09:04:59	0.0	MOS

Status Code Definitions

MOS = MONITOR OUT OF SERVICE

07/28/2020	OPACITY, %	
09:05		
09:05:01	0.0	MOS
09:05:03	0.0	MOS
09:05:05	0.0	MOS
09:05:07	0.0	MOS
09:05:09	0.0	MOS
09:05:11	0.0	MOS
09:05:13	0.0	MOS
09:05:15	0.0	MOS
09:05:17	0.0	MOS
09:05:19	0.0	MOS
09:05:21	0.0	MOS
09:05:23	0.0	MOS
09:05:25	0.0	MOS
09:05:27	0.0	MOS
09:05:29	0.0	MOS
09:05:31	0.0	MOS
09:05:33	0.0	MOS
09:05:35	0.0	MOS
09:05:37	0.0	MOS
09:05:39	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 7/28/2020

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	17.60	17.40	0.20	**0.20**
MID	24.30	24.30	0.00	**0.00**
HIGH	42.90	43.20	-0.30	**0.30**
ZERO	0.00	0.00	0.00	**0.00**

Primary Energy Coke

Opacity Report

Created on : Jul 28, 2020 10:39:34

East Chicago, IN

07/28/2020 - 07/28/2020

07/28/2020

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	2.2 SVC	2.4 SVC	2.2 SVC	2.2 SVC	2.3 SVC	2.3 SVC	2.3 SVC	2.3 SVC	2.2 SVC	2.3 SVC
1	2.2 SVC	2.1 SVC	2.2 SVC	2.2 SVC	2.1 SVC	2.2 SVC	2.1 SVC	2.2 SVC	2.2 SVC	2.1 SVC
2	2.1 SVC	2.3 SVC	2.2 SVC	2.1 SVC	2.2 SVC	2.2 SVC	2.3 SVC	2.2 SVC	2.2 SVC	2.3 SVC
3	2.3 SVC	2.2 SVC	2.3 SVC	2.2 SVC	2.2 SVC	2.2 SVC	2.2 SVC	2.2 SVC	2.4 SVC	2.2 SVC
4	2.3 SVC	2.3 SVC	2.3 SVC	2.3 SVC	2.3 SVC	2.3 SVC	2.4 SVC	2.2 SVC	2.2 SVC	2.2 NSA
5	2.2 SVC	2.2 SVC	2.2 SVC	2.2 SVC	2.3 SVC	2.3 SVC	2.2 SVC	2.3 SVC	2.5 SVC	2.3 SVC
6	2.2 SVC	2.3 SVC	2.3 SVC	2.2 SVC	2.3 SVC	2.2 SVC	2.2 SVC	2.2 SVC	2.2 SVC	2.2 SVC
7	2.2 SVC	2.2 SVC	2.2 SVC	2.3 SVC	2.2 SVC	2.2 SVC	2.2 SVC	2.2 SVC	2.2 SVC	2.2 SVC
8	2.2 SVC	2.2 SVC	2.2 SVC	2.3 SVC	2.2 MOS	2.4 MOS	2.3 MOS	2.3 MOS	0.9 MOS	17.0 MOS
9	20.0 MOS	0.0 MOS	0.0 MOS	3.4 MOS	17.6 MOS	17.6 MOS	23.7 MOS	24.3 MOS	37.6 MOS	42.9 MOS
10	21.5 MOS	0.0 MOS	0.4 MOS	2.0 MOS	1.9 SVC	1.9 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 2.2 % for 85 periods of valid data.

The Fan was in operation for 106 periods

The maximum opacity period average for the day was 2.5 %

There were 21 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: **February 28, 2020**
Date of Filter Expiration: **August 28, 2020** **Filter Set - E**

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 (%)
VJ84	8.3	91.7	8.3	0.0
YL05	17.4	82.6	17.3	0.1
YX58	24.3	75.7	24.2	0.1
ZQ15	43.2	56.8	46.1	2.9
YF64	58.9	41.1	59.0	0.1
YF67	86.5	13.5	86.6	0.1

Laboratory-Based Transmissometer Operator

See second page for Instrument Information and Details of Certification

Monitoring | Solutions
Leaders in Environmental Monitoring Systems & Services
4440 S. High School Rd., Suite D, Indianapolis, Indiana 46241 Tel: 317.856.9400

REPORT OF CERTIFICATION OF NEUTRAL DENSITY AUDIT FILTERS

- **Calibration of Laboratory-Based Transmissometer**

  Instrument:
  Durag Model 290
  Transceiver S/N 414847, Reflector S/N 412508, Remote S/N 414861
  Reference Material:
  Primary Filters calibrated as specified in section 7.1.(2)(i) of Pt. 60, App. B, spec.1 of a nominal luminous transmittance of 50, 70, and 90 percent.

- **Description of Certification** (Pt. 60, App. B, Spec. 1, 7.2(i)(ii)(iii))
  Conduct the secondary attenuator calibration using a laboratory-based transmissometer calibrated as follows:
  Use at least three primary filters of nominal luminous transmittance 50, 70, and 90 percent, calibrated as specified in section 7.1(2)(i),to calibrate the laboratory-based transmissometer. Determine and record the slope of the calibration line using linear regression through zero opacity. The slope of the calibration line must be between 0.99 and 1.01 and the laboratory-based transmissometer reading for each primary filter must not deviate by more than +/- 2 percent from the linear regression line.

  Immediately following the laboratory-based transmissometer calibration, insert the secondary attenuators and determine and record the percent effective opacity value per secondary attenuator from the calibration curve (linear regression line).

  Recalibrate the secondary attenuators semi-annually if they are used for the required calibration error test.

ATTACHMENT 3

2020 Relative Accuracy Test Audit Report

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

June 25, 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 – 2020 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.1.9 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 May 12, 2020 by TRC. 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 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) 2020 Relative Accuracy Test Audit

☐ 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: June 25, 2020

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

June 25, 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
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Sincerely,

Luke E. Ford
Director EH&S

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Please check what document is being certified:

☐ Annual Compliance Certification Letter

☐ Test Result (specify) _____

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☐ 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: June 25, 2020

CONTINUOUS EMISSIONS MONITORING SYSTEM
RELATIVE ACCURACY DETERMINATION

Performed At
Primary Energy
Cokenergy Facility
HRCC Stack 201
East Chicago, Indiana

Test Date
May 12, 2020

Report No.
TRC Environmental Corporation Report 382355

Report Submittal Date
June 24, 2020

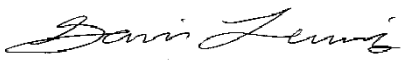
TRC Environmental Corporation
7521 Brush Hill Road
Burr Ridge, Illinois 60527
USA

T 312-533-2042
F 312-533-2070

Report Certification

I certify that to the best of my knowledge:

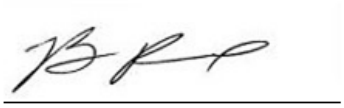
- Testing data and all corresponding information have been checked for accuracy and completeness.
- Sampling and analysis have been conducted in accordance with the approved protocol and applicable reference methods (as applicable).
- All deviations, method modifications, or sampling and analytical anomalies are summarized in the appropriate report narrative(s).



Gavin Lewis
Project Manager

June 24, 2020
Date

TRC was operating in conformance with the requirements of ASTM D7036-04 during this test program.



Bruce Randall
TRC Emission Testing Technical Director

TABLE OF CONTENTS

CONTINUOUS EMISSIONS MONITORING SYSTEM
RELATIVE ACCURACY DETERMINATION

1.0 INTRODUCTION

TRC Environmental Corporation (TRC) performed a continuous emissions monitoring system (CEMS) relative accuracy test on May 12, 2020 at the Cokenergy Facility of Primary Energy in East Chicago, Indiana. The tests were authorized by and performed for Primary Energy.

The purpose of this test program was to evaluate the relative accuracy (RA) of the sulfur dioxide (SO_2) CEMS on HRCC Stack 201 during specified operating conditions. The test program was conducted according to the Indiana Department of Environmental Management (IDEM) Relative Accuracy Test Audit Notification Protocol dated April 3, 2020.

1.1 Project Contact Information

Participants		
Test Facility	Primary Energy Cokenergy Facility East Chicago, Indiana	Mr. Luke Ford Director EH&S 219-397-4626 (phone) lford@primaryenergy.com
Test Coordinator	Primary Energy 3210 Watling Street East Chicago, Indiana 46312 Permit No. T089-36965-00383	
Air Emissions Testing Body (AETB)	TRC Environmental Corporation 7521 Brush Hill Road Burr Ridge, Illinois 60527	Mr. Gavin Lewis Project Manager 312-533-2025 (phone) 312-533-2070 (fax) glewis@trccompanies.com

Rome Rothgeb, Ryan Novosel and Gavin Lewis of TRC conducted the testing. Documentation of the on-site ASTM D7036-04 Qualified Individual(s) (QI) can be located in the appendix to this report.

No personnel from the IDEM observed the testing.

2.0 SUMMARY OF RESULTS

The relative accuracies of the CEMS are as follows:

Load	Parameter	Units	Performance Specifications (40CFR60)		CEMS Performance
			Specification No.	Acceptance Criteria	Relative Accuracy
> 50%	SO_2	lb/hr	2	RA ≤ 20% of the Reference Method	9.55 %

3.0 DISCUSSION OF RESULTS

The complete test results from this program are tabulated in Section 6.0.

The data acquisition and handling system (DAHS) computer printout for the same time periods as the RM testing was used to determine the relative accuracy. The watches of the test crew were synchronized with the CEMS prior to testing.

No problems were encountered with the testing equipment during the course of the test program. Source operation appeared normal during the entire test program and operated at more than 50 percent of full load. The CEMS operation appeared normal with no apparent problems during sampling. No changes or problems were encountered that required modification of any procedures presented in the test plan. No adverse test or environmental conditions were encountered during the conduct of this test program. CEMS operating data was recorded by plant personnel and appended to the report.

4.0 TEST PROCEDURES

All testing, sampling, analytical, and calibration procedures used for this test program were performed in accordance with the methods presented in the following sections. Where applicable, the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, USEPA 600/R-94/038c, September 1994 was used to supplement procedures.

4.1 Determination of Sample Point Locations by USEPA Method 1

This method is applicable to gas streams flowing in ducts, stacks, and flues and is designed to aid in the representative measurement of pollutant emissions and/or total volumetric flow rates from stationary sources. In order to qualify as an acceptable sample location, it must be located at a position at least two stack or duct equivalent diameters downstream and a half equivalent diameter upstream from any flow disturbance.

The cross-section of the measurement site was divided into a number of equal areas, and the traverse points were then located in the center of these areas. The minimum number of points were determined from Figure 1-2 (non-particulate) of USEPA Method 1.

4.2 Volumetric Flow Rate Determination by USEPA Method 2

This method is applicable for the determination of the average velocity and the volumetric flow rate of a gas stream.

The gas velocity head (ΔP) and temperature were measured at traverse points defined by USEPA Method 1. The velocity head was measured with a Type S (Stausscheibe or reverse type) pitot tube and oil-filled manometer; and the gas temperature was measured with a Type K thermocouple. The average gas velocity in the flue was calculated based on: the gas density (as determined by USEPA Methods 3 and 4); the flue gas pressure; the average of the square roots of the velocity heads at each traverse point, and the average flue gas temperature.

4.3 Determination of the Concentration of Gaseous Pollutants Using a Multi-Pollutant Sampling System

Concentrations of the pollutants in the following sub-sections were determined using one sampling system. The number of points at which sample was collected was determined in accordance with 40CFR60 specifications.

A straight-extractive sampling system was used. Gas samples were collected for seven (7) minutes at each of three points (0.4, 1.2 and 2.0 meters) along the stack diameter during each test run. A data logger continuously recorded pollutant concentrations and generated one-minute averages of those concentrations. All calibrations and system checks were conducted using USEPA Protocol gases. Three-point linearity checks were performed prior to sampling, and in the event of a failing system bias or drift test (and subsequent corrective action). System bias and drift checks were performed using the low-level gas and either the mid- or high-level gas prior to and following each test run.

The Low Concentration Analyzers (those that routinely operate with a calibration span of less than 20 ppm) used by TRC are ambient-level analyzers. Per Section 3.12 of Method 7E, a Manufacturer's Stability Test is not required for ambient-level analyzers. Analyzer interference tests were conducted in accordance with the regulations in effect at the time that TRC placed an analyzer model in service.

4.3.1 CO_2 Determination by USEPA Method 3A

This method is applicable for the determination of carbon dioxide (CO_2) concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The CO_2 analyzer was equipped with a non-dispersive infrared (IR) detector.

4.3.2 O_2 Determination by USEPA Method 3A

This method is applicable for the determination of O_2 concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The O_2 analyzer was equipped with a paramagnetic-based detector.

4.3.3 SO_2 Determination by USEPA Method 6C

This method is applicable for the determination of SO_2 concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The SO_2 analyzer was equipped with an ultraviolet (UV) detector.

4.4 Moisture Determination by USEPA Method 4

This method is applicable for the determination of the moisture content of stack gas.

A gas sample was extracted at a constant rate from the source. Moisture was removed from the sample stream by a series of pre-weighed impingers immersed in an ice bath. A minimum of 21 dry standard cubic feet of flue gas was collected during each sample run.

5.0 QUALITY ASSURANCE PROCEDURES

TRC integrates our Quality Management System (QMS) into every aspect of our testing service. We follow the procedures specified in current published versions of the test Method(s) referenced in this report. Any modifications or deviations are specifically identified in the body of the report. We routinely participate in independent, third party audits of our activities, and maintain:

- Accreditation from the Louisiana Environmental Laboratory Accreditation Program (LELAP);
- Accreditation from the Stack Testing Accreditation Council (STAC) and the American Association for Laboratory Accreditation (A2LA) that our operations conform with the requirements of ASTM D 7036 as an Air Emission Testing Body (AETB).

These accreditations demonstrate that our systems for training, equipment maintenance and calibration, document control and project management will fully ensure that project objectives are achieved in a timely and efficient manner with a strict commitment to quality.

All calibrations are performed in accordance with the test Method(s) identified in this report. If a Method allows for more than one calibration approach, or if approved alternatives are available, the calibration documentation in the appendices specifies which approach was used. All measurement devices are calibrated or verified at set intervals against standards traceable to the National Institute of Standards and Technology (NIST). NIST traceability information is available upon request.

ASTM D7036-04 specifies that: *"AETBs shall have and shall apply procedures for estimating the uncertainty of measurement. Conformance with this section may be demonstrated by the use of approved test protocols for all tests. When such protocols are used, reference shall be made to published literature, when available, where estimates of uncertainty for test methods may be found."* TRC conforms with this section by using approved test protocols for all tests.

6.0 TEST RESULTS SUMMARIES

RATA Type: **Sulfur Dioxide (SO_2), lb/hr**
Regulation: **40CFR60**
RM Used: **2-4, 6C**

Customer:	Primary Energy	Project #:	382355
Unit ID:	HRCC	CEM Model:	Thermo Scientific 43i-HL
Sample Loc:	Stack 201	CEM Serial #:	1152150034

Use? 1 = Y 0 = N	Test Run	Date	Start Time	End Time	RM SO_2 lb/hr	CEM SO_2 lb/hr	(RM-CEM) Difference (di)
0	1	5/12/2020	7:45	8:06	1536.19	1370.3	165.9
1	2	5/12/2020	8:35	8:56	1524.49	1364.4	160.1
1	3	5/12/2020	9:15	9:36	1508.28	1371.2	137.1
1	4	5/12/2020	9:48	10:09	1522.12	1373.2	148.9
1	5	5/12/2020	10:21	10:42	1480.38	1370.4	110.0
1	6	5/12/2020	10:53	11:14	1487.07	1373.5	113.6
1	7	5/12/2020	11:25	11:46	1481.33	1366.4	114.9
1	8	5/12/2020	11:57	12:18	1400.31	1265.0	135.3
1	9	5/12/2020	12:30	12:51	1429.71	1325.5	104.2
1	10	5/12/2020	13:03	13:24	1469.00	1374.0	95.0

n	9	
t(0.975)	2.306	
Mean RM Value	1478.077	RM avg
Mean CEM Value	1353.733	CEM avg
Sum of Differences	1119.090	di
Mean Difference	124.343	d avg
Sum of Differences^2	142993.071	di^2
Standard Deviation	21.914	sd
Confidence Coefficient	16.844	CC
RA based on RM	9.55	%

APPENDIX

AETB and QI Information Summary

Facility Name:	Primary Energy – Cokenergy Facility
Location:	HRCC Stack 201
Test Date:	May 12, 2020

Test Parameters:	1, 2, 3A, 4, 6C
QI Last Name:	Lewis
QI First Name:	Gavin
QI Middle Initial:	----
AETB Name:	TRC Environmental Corporation
AETB Phone No:	312-533-2025
AETB Email:	glewis@trccompanies.com
Group 1 Exam Date:	11/07/2017
Provider Name:	Source Evaluation Society
Provider Email:	qstiprogram@gmail.com
Group 3 Exam Date:	01/05/2018
Provider Name:	Source Evaluation Society
Provider Email:	qstiprogram@gmail.com

This is to Certify that:

Gavin Lewis

Is a Qualified Individual as defined in Section 8.3 of ASTM D7036-04 for the following test methods:

EPA Methods 1, 1A, 2, 2A, 2C, 2D, 2F, 2G, 2H, 3, 3B, 4, 5, 5A, 5B, 5D, 5E, 5F, 5i, 17, 19, 201A, and 202.

The individual has met the minimum experience requirements defined in Section 8.3.4.2 of ASTM D7036-04 and has successfully passed a comprehensive examination for the test methods designated above.

This certification is effective until: 11/07/2022

Date of Issue: 01-08-2018

Certificate Number: 01249

Edward J MacKinnon
Air Measurements Practice Quality Manager

TRC

This certificate is the exclusive property of TRC and is non-transferable.

This is to Certify that:

Gavin Lewis

Is a Qualified Individual as defined in Section 8.3 of ASTM D7036-04 for the following test methods:

EPA Methods 3A, 6C, 7E, 10, 10B, 19, 20, 25A.

CEM Performance Specifications PS2, PS3, PS4, PS4A, PS5, PS6, PS7, PS8, and PS15

The individual has met the minimum experience requirements defined in Section 8.3.4.2 of ASTM D7036-04 and has successfully passed a comprehensive examination for the test methods designated above.

This certification is effective until: 01-05-2023

Date of Issue: 01-08-2018

Certificate Number: 01251

Edward J MacKinnon
Air Measurements Practice Quality Manager

TRC

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
07:45:00	185.8	12.0	1396.1
07:46:00	184.5	12.0	1379.9
07:47:00	180.9	12.0	1349.0
07:48:00	181.8	12.0	1339.4
07:49:00	182.5	12.0	1357.1
07:50:00	186.1	12.0	1369.8
07:51:00	186.5	12.0	1386.3
07:52:00	182.9	12.0	1350.4
07:53:00	182.9	12.0	1355.3
07:54:00	186.2	11.9	1387.6
07:55:00	189.5	12.0	1410.8
07:56:00	188.8	11.9	1385.1
07:57:00	184.7	11.9	1365.5
07:58:00	184.8	11.9	1374.4
07:59:00	186.5	11.9	1393.9
08:00:00	186.5	12.0	1359.3
08:01:00	185.0	11.9	1354.1
08:02:00	185.3	11.9	1367.9
08:03:00	186.7	11.9	1375.9
08:04:00	185.8	11.9	1365.0
08:05:00	183.0	11.9	1353.9
Average :	185.1	12.0	1370.3

* Invalid Status

RATA Run # 1

Verified By: _____

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
08:35:00	181.4	12.1	1357.0
08:36:00	181.3	12.1	1372.9
08:37:00	181.7	12.1	1373.9
08:38:00	181.2	12.1	1361.0
08:39:00	178.7	12.1	1332.4
08:40:00	176.5	12.1	1324.6
08:41:00	174.0	12.1	1309.7
08:42:00	181.2	12.1	1369.6
08:43:00	182.8	12.1	1360.6
08:44:00	184.8	12.1	1385.6
08:45:00	183.7	12.1	1380.7
08:46:00	182.3	12.1	1370.0
08:47:00	183.0	12.1	1357.7
08:48:00	183.8	12.1	1383.1
08:49:00	184.2	12.1	1361.1
08:50:00	185.0	12.1	1383.6
08:51:00	184.0	12.1	1371.4
08:52:00	185.6	12.1	1368.5
08:53:00	184.8	12.1	1383.8
08:54:00	184.7	12.1	1379.7
08:55:00	185.6	12.1	1365.7
Average :	182.4	12.1	1364.4

* Invalid Status

RATA Run # 2

Verified By: _____

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
09:15:00	184.0	12.2	1368.8
09:16:00	182.0	12.1	1350.8
09:17:00	182.4	12.2	1342.0
09:18:00	184.8	12.2	1367.8
09:19:00	185.5	12.1	1394.2
09:20:00	186.7	12.2	1387.8
09:21:00	186.8	12.2	1378.7
09:22:00	186.9	12.2	1382.2
09:23:00	185.9	12.2	1367.2
09:24:00	185.8	12.2	1365.7
09:25:00	184.8	12.2	1367.6
09:26:00	186.3	12.2	1384.4
09:27:00	185.5	12.2	1391.6
09:28:00	183.0	12.2	1361.0
09:29:00	179.0	12.2	1315.4
09:30:00	179.2	12.2	1318.1
09:31:00	184.8	12.2	1366.7
09:32:00	190.4	12.2	1410.7
09:33:00	188.7	12.2	1410.9
09:34:00	186.7	12.2	1372.0
09:35:00	185.7	12.2	1391.1
Average :	185.0	12.2	1371.2

* Invalid Status

RATA Run # 3

Verified By: _____

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
09:48:00	181.6	12.2	1339.0
09:49:00	184.6	12.2	1374.0
09:50:00	185.9	12.2	1381.3
09:51:00	188.3	12.2	1394.6
09:52:00	186.8	12.2	1377.5
09:53:00	184.9	12.2	1371.3
09:54:00	184.9	12.2	1368.3
09:55:00	186.3	12.2	1387.6
09:56:00	187.6	12.2	1373.0
09:57:00	185.6	12.2	1376.4
09:58:00	184.8	12.2	1376.0
09:59:00	185.7	12.2	1379.2
10:00:00	184.2	12.2	1357.4
10:01:00	185.4	12.2	1377.4
10:02:00	184.4	12.2	1367.2
10:03:00	183.7	12.2	1359.6
10:04:00	181.4	12.2	1345.8
10:05:00	183.1	12.2	1361.7
10:06:00	186.9	12.2	1380.5
10:07:00	188.7	12.3	1404.1
10:08:00	186.6	12.2	1384.6
Average :	185.3	12.2	1373.2

* Invalid Status

RATA Run # 4

Verified By: 

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
10:21:00	185.4	12.3	1388.1
10:22:00	186.4	12.4	1380.9
10:23:00	183.8	12.4	1350.5
10:24:00	180.9	12.4	1348.1
10:25:00	181.3	12.4	1349.4
10:26:00	183.5	12.4	1364.0
10:27:00	184.3	12.4	1371.8
10:28:00	185.1	12.4	1375.3
10:29:00	182.9	12.4	1351.9
10:30:00	182.6	12.4	1363.1
10:31:00	182.2	12.4	1376.6
10:32:00	185.3	12.4	1392.9
10:33:00	183.8	12.4	1378.7
10:34:00	180.8	12.4	1349.9
10:35:00	182.7	12.4	1362.9
10:36:00	183.7	12.4	1375.9
10:37:00	185.7	12.4	1397.2
10:38:00	184.2	12.4	1387.3
10:39:00	183.5	12.4	1383.4
10:40:00	184.2	12.4	1383.3
10:41:00	182.9	12.4	1347.7
Average :	183.6	12.4	1370.4

* Invalid Status

RATA Run # 5

Verified By: _____

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
10:53:00	185.4	12.5	1384.6
10:54:00	183.7	12.5	1357.4
10:55:00	186.8	12.5	1398.6
10:56:00	185.4	12.5	1377.9
10:57:00	184.5	12.5	1377.5
10:58:00	184.5	12.5	1390.5
10:59:00	184.4	12.5	1382.6
11:00:00	180.2	12.5	1365.1
11:01:00	179.2	12.5	1349.0
11:02:00	180.8	12.5	1363.2
11:03:00	184.2	12.5	1382.6
11:04:00	184.8	12.5	1385.1
11:05:00	184.5	12.5	1386.5
11:06:00	181.3	12.6	1349.6
11:07:00	180.1	12.6	1338.2
11:08:00	182.9	12.6	1347.3
11:09:00	185.2	12.5	1397.8
11:10:00	184.6	12.5	1388.5
11:11:00	186.9	12.5	1385.7
11:12:00	185.1	12.5	1379.7
11:13:00	182.6	12.5	1356.0
Average :	183.7	12.5	1373.5

* Invalid Status

RATA Run # 6

Verified By: _____

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
11:25:00	184.7	12.6	1370.7
11:26:00	186.2	12.5	1398.7
11:27:00	184.7	12.6	1363.7
11:28:00	184.0	12.6	1370.6
11:29:00	184.5	12.5	1382.4
11:30:00	184.2	12.6	1374.0
11:31:00	181.9	12.6	1357.0
11:32:00	181.2	12.6	1354.5
11:33:00	182.4	12.6	1372.2
11:34:00	184.0	12.6	1372.1
11:35:00	185.0	12.6	1369.6
11:36:00	183.7	12.6	1373.5
11:37:00	183.6	12.6	1377.0
11:38:00	181.1	12.6	1359.7
11:39:00	181.3	12.6	1350.9
11:40:00	182.2	12.6	1376.1
11:41:00	182.5	12.7	1351.1
11:42:00	182.2	12.7	1357.0
11:43:00	179.4	12.8	1358.5
11:44:00	178.7	12.8	1340.9
11:45:00	182.3	12.8	1364.7
Average :	182.8	12.6	1366.4

* Invalid Status

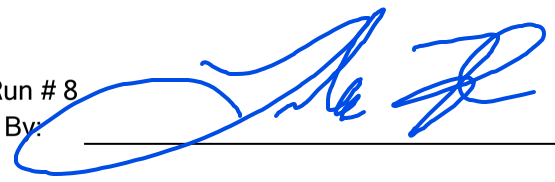
RATA Run # 7

Verified By: _____

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
11:57:00	181.8	12.8	1358.0
11:58:00	182.1	12.8	1360.5
11:59:00	183.0	12.8	1383.2
12:00:00	183.9	12.8	1369.7
12:01:00	183.3	12.8	1385.7
12:02:00	181.7	12.8	1363.5
12:03:00	182.8	12.8	1373.9
12:04:00	180.0	12.8	1360.2
12:05:00	180.4	12.8	1331.1
12:06:00	180.4	12.8	1301.9
12:07:00	173.4	13.0	1236.8
12:08:00	162.0	13.0	1174.0
12:09:00	160.4	13.0	1150.1
12:10:00	163.3	13.0	1181.3
12:11:00	164.4	13.0	1196.0
12:12:00	164.7	13.0	1179.9
12:13:00	163.8	13.0	1170.9
12:14:00	162.5	13.0	1163.9
12:15:00	163.7	13.0	1164.3
12:16:00	164.3	13.0	1192.5
12:17:00	163.1	13.0	1168.6
Average :	172.6	12.9	1265.0

* Invalid Status

RATA Run # 8

Verified By: 

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
12:30:00	160.3	13.0	1216.3
12:31:00	161.4	13.0	1194.6
12:32:00	167.1	13.0	1240.6
12:33:00	163.8	13.0	1231.4
12:34:00	159.3	13.0	1191.1
12:35:00	158.0	13.0	1185.1
12:36:00	163.1	13.0	1233.6
12:37:00	167.0	13.0	1274.9
12:38:00	168.8	13.0	1285.5
12:39:00	172.6	13.0	1303.8
12:40:00	175.4	13.1	1327.7
12:41:00	177.3	13.1	1338.6
12:42:00	179.6	13.1	1363.1
12:43:00	177.9	13.1	1340.1
12:44:00	177.8	13.1	1332.4
12:45:00	209.6	13.1	1550.3
12:46:00	218.7	13.1	1638.9
12:47:00	215.9	13.1	1596.6
12:48:00	178.1	13.1	1353.3
12:49:00	174.1	13.1	1319.4
12:50:00	174.3	13.2	1318.9
Average :	176.2	13.1	1325.5

* Invalid Status

RATA Run # 9

Verified By: _____

Time	SO2, PPM	O2 DRY, %	SO2, LB/HR
13:03:00	181.5	13.1	1366.1
13:04:00	185.5	13.1	1396.4
13:05:00	185.0	13.0	1402.8
13:06:00	182.9	13.0	1403.6
13:07:00	179.1	13.1	1343.6
13:08:00	178.7	13.0	1358.9
13:09:00	180.3	13.0	1369.1
13:10:00	182.2	13.1	1372.3
13:11:00	181.4	13.1	1378.9
13:12:00	179.7	13.1	1343.4
13:13:00	176.1	13.1	1327.2
13:14:00	181.5	13.1	1367.7
13:15:00	184.6	13.1	1391.6
13:16:00	185.7	13.1	1405.1
13:17:00	182.5	13.1	1380.0
13:18:00	179.6	13.1	1349.7
13:19:00	179.7	13.1	1347.4
13:20:00	179.5	13.1	1357.1
13:21:00	185.0	13.1	1394.5
13:22:00	187.8	13.1	1427.2
13:23:00	181.7	13.1	1370.9
Average :	181.9	13.1	1374.0

* Invalid Status

RATA Run # 10

Verified By: _____

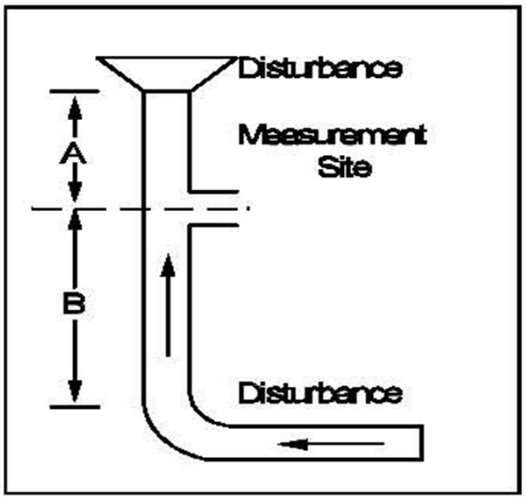
2020 Cokenergy CEMS RATA

Run	Test Date	Start Time	End Time	Main Steam Flow [kpph]	Max Main Steam Flow [kpph]	Tested % Load [%]
1	5/12/2020	7:45	8:05	944	960	98%
2	5/12/2020	8:35	8:55	915	960	95%
3	5/12/2020	9:15	9:35	892	960	93%
4	5/12/2020	9:48	10:08	879	960	92%
5	5/12/2020	10:21	10:41	867	960	90%
6	5/12/2020	10:53	11:13	866	960	90%
7	5/12/2020	11:25	11:45	859	960	90%
8	5/12/2020	11:57	12:17	851	960	89%
9	5/12/2020	12:30	12:50	846	960	88%
10	5/12/2020	13:03	13:23	801	960	83%

Sample Location Information for Volumetric Flow Determination - Round Ducts

Project #:	382355	Duct Diameter:	18.00 feet
Company:	Primary Energy	# of Ports Used:	4
Plant:	Cokenergy Facility	# of Points/Diameter:	8
Unit ID:	HRCC	Total # of points	16
Sample Location:	Stack 201	Sample Plane:	Horizontal
		Port Type:	Nipple
Distance A:	73.80 Feet, 4.10 Duct diameters	Port Length:	7.0 inches
Distance B:	201.00 Feet, 11.17 Duct diameters	Port Inside Diameter:	6.0 inches

Meets Method 1 criteria



Traverse Point Locations

Point	% of diameter	Inches from wall	Inches from port edge
1	3.2	6.9	13.9
2	10.5	22.7	29.7
3	19.4	41.9	48.9
4	32.3	69.8	76.8

Pre-cyclonic flow check conducted? No Reason: Conducted Previously

Part 60 RATA
Initial Stratification Check and Test Point Selection

Project Number:	382355	Test Date:	5/12/2020	
Customer:	Primary Energy	Duct Shape:	Round	
Unit Identification:	HRCC	Diameter:	18	feet
Sample Location:	Stack 201			
		Port Length:	7	inches

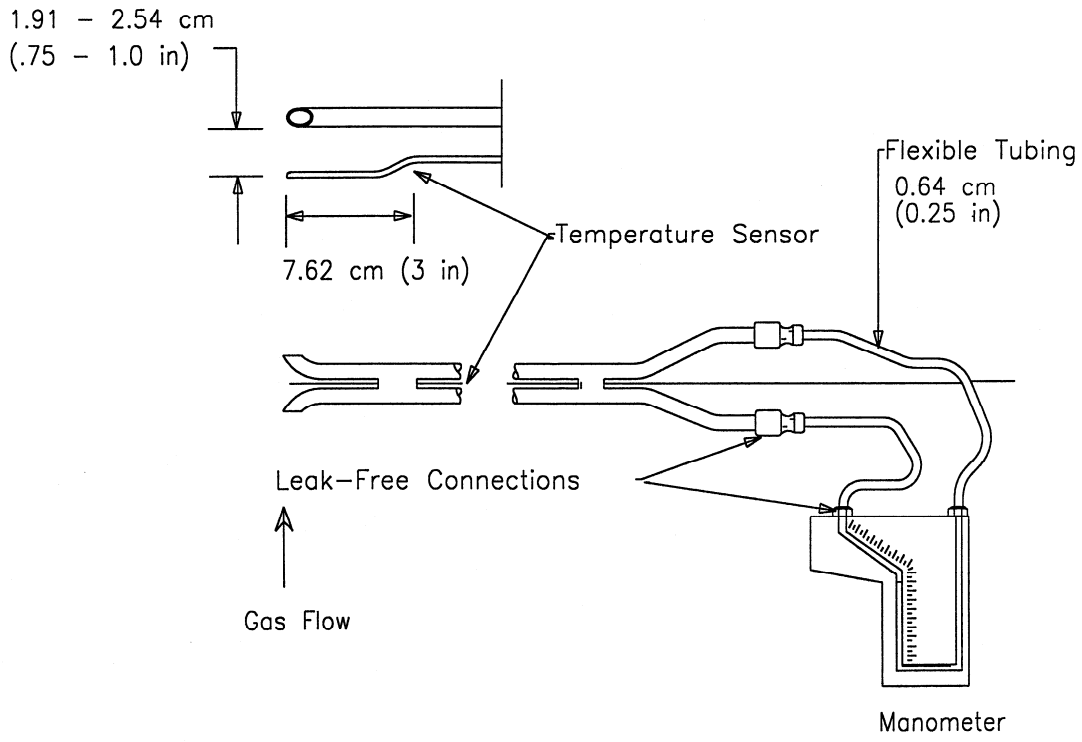
Is the sample location downstream of a wet scrubber, or downstream of a point where two ducts converge? N

No stratification test is required. Can use short line points below, if D > 7.8'

Sampling line/strategy selected: Short Line (0.4, 1.2, 2.0 meters)

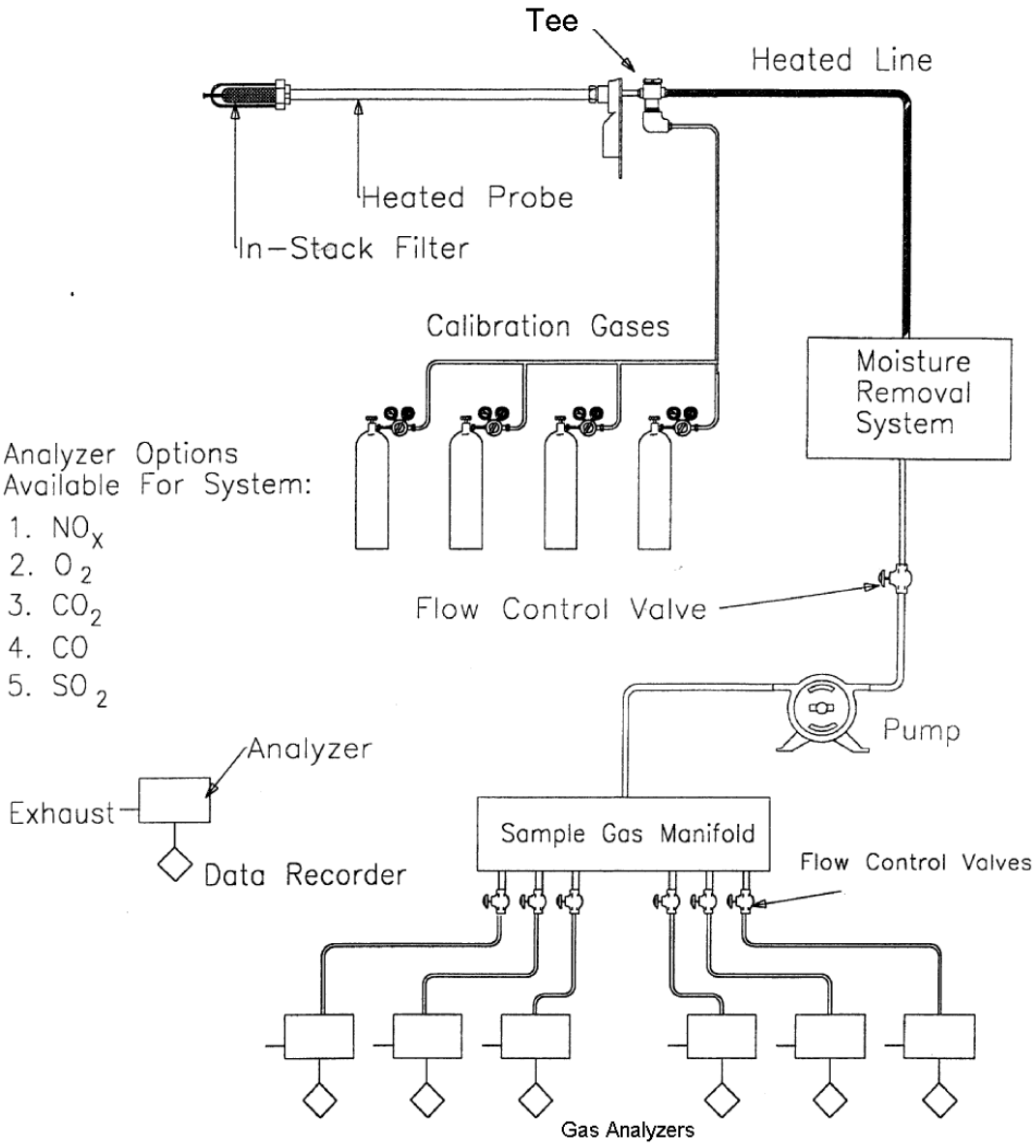
Determination of Stack Gas Velocity and Volumetric Flow Rate

USEPA Promulgated Test Method 2



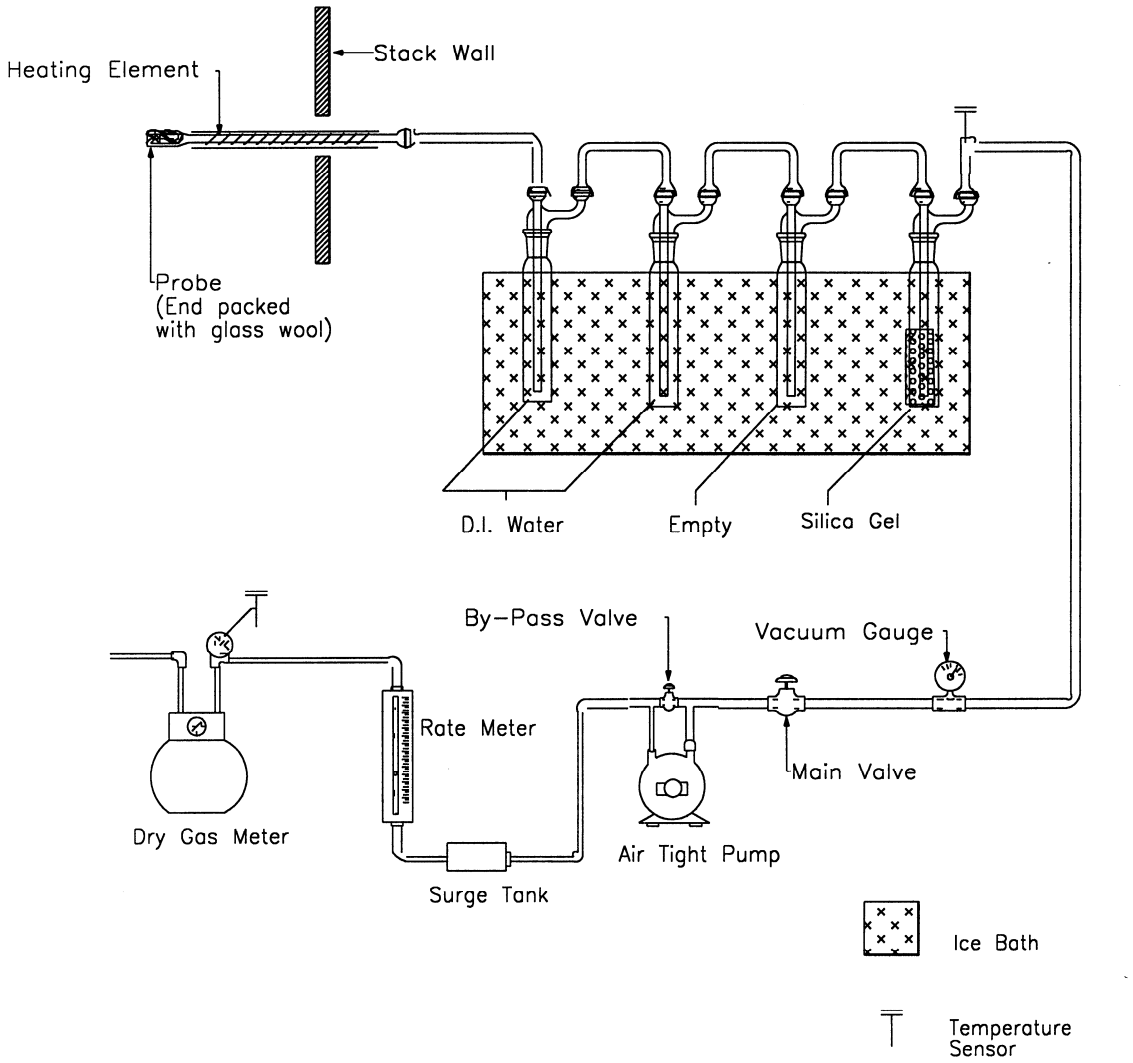
Determination of Multiple Gaseous Pollutants Using an Extractive Sampling Train

USEPA Promulgated Methods 3A and 6C



Determination of Moisture Content in Stack Gases

USEPA Promulgated Method 4



Example Calculations - Effluent Gas Concentration Determination

Project Number:	382355	Test Date:	May 12, 2020
Customer:	Primary Energy	Facility:	Cokenergy Facility
Unit Identification:	HRCC	Run #:	1
Sample Location:	Stack 201		

$$C_{gas} = (C - C_0) \times \frac{C_{ma}}{C_m - C_0}$$

Where:

C_{gas} = Effluent gas concentration (ppm or %vol)

C = Average gas concentration indicated by analyzer (ppm or %vol)

C_0 = Average of pre- and post-test system bias checks using low range gas (ppm or % vol)

C_m = Average of pre- and post-test system bias checks using upscale gas (ppm or % vol)

C_{ma} = Actual concentration of upscale gas (ppm or % vol)

SO_2

C = 182.794 ppm C_0 = 5.707 ppm

C_m = 199.339 ppm C_{ma} = 204.300 ppm

C_{SO2} = 186.843 ppm

CO_2

C = 6.127 %vol C_0 = 0.088 %vol

C_m = 8.812 %vol C_{ma} = 8.753 %vol

C_{CO2} = 6.059 %vol

O_2

C = 11.700 %vol C_0 = 0.050 %vol

C_m = 10.038 %vol C_{ma} = 10.030 %vol

C_{O2} = 11.700 %vol

Note: Interim results are not rounded.

Example Calculations - Pollutant Emission Rate, Volumetric Flow Rate-Based

$$ER = Cgas \times C_f \times Flow \times 60$$

Where:

ER = Pollutant emission rate (lb/hr)

C_{gas} = Pollutant concentration (ppm, wet or dry basis, but the same as flow)

MW = Pollutant molecular weight (gr/gr-mole)

Flow = Volumetric flow rate (cubic feet per minute wet or dry, but the same as C_{gas})

C_f = Conversion factor (ppm to lb/scf)

1.660E-07 = Conversion constant for SO2. From Table 19-1 of Method 19, 40CFR, Appendix A

For SO2

$ER = C_{gas} \times 1.660E\text{-}07 \times Flow \times 60$

C_{gas} = 186.843 ppmvd

Flow = 825,485 DSCFM

ER_{SO2} = 1536.19 lb/hr

Note: Interim results are not rounded.

Example Calculations - Relative Accuracy (RA) and Bias

Project Number:	382355	Test Date:	May 12, 2020
Customer:	Primary Energy	Facility:	Cokenergy Facility
Unit Identification:	HRCC		

Mean Difference:

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

Where:

di = Difference between RM and CEMS values for run "i"

n = Number of runs used to calculate RA

Standard Deviation:

$$Sd = \left[\frac{\sum_{i=1}^{n} d_i^2 - \frac{\left[\sum_{i=1}^{n} d_i\right]^2}{n}}{n-1}\right]^{1/2}$$

Confidence Coefficient:

$$CC = t_{0.025}\frac{Sd}{\sqrt{n}}$$

Where:

$t_{0.025}$ = T values as presented in 40CFR60 or 40CFR75. For 40CFR60, use $t_{0.975,}$ which are the same T values.

Relative Accuracy based on RM:

$$RA = \frac{|\overline{d}| + |CC|}{RM\,avg} \times 100$$

Where:

RM avg = Average RM value for runs used to calculate RA

Relative Accuracy based on Applicable Standard - for Part 60 Applications Only:

$$RA = \frac{|\overline{d}| + |CC|}{App\ \ Std} \times 100$$

Example Calculations - Method 2 Volumetric Flow

Company:	Primary Energy	Project Number:	382355
Unit ID:	HRCC	Test Date:	May 12, 2020
Plant:	Cokenergy Facility	Run #:	1
Sample Location:	Stack 201	Operating Level:	Mid (Normal)

Note: In order to duplicate these examples, results must not be rounded.

Effluent Gas Pressure

$$P_s = P_{bar} + (P_g/13.6)$$

Where:

P_s = Flue gas pressure ("Hg)
P_{bar} = Ambient barometric pressure at sample elevation ("Hg)
P_g = Flue gas gauge pressure ("H_2O)

P_{bar} = 29.28 "Hg P_g = -2.00 "H_2O

P_s = 29.13 "Hg

Average Stack Temperature

$$T_s = \frac{\sum_{i=1}^{n} T_{si}}{n}$$

Where:

T_s = Average effluent gas temperature (^oF)
T_{si} = Effluent gas temperature at point i (^oF)
n = Total number of traverse points

T_s = 272 °F

Actual Meter Volume

$$V_m = Vf - Vi$$

Where:

V_i = Initial meter sample volume (cubic feet)
V_f = Final meter sample volume (cubic feet)
V_m = Sample volume collected at actual conditions (ft^3, dry basis)

Vf = 107.871 cf Vi = 85.088 cf

V_m = 22.783 cubic feet

Example Calculations - Method 2 Volumetric Flow

Company:	Primary Energy	Project Number:	382355
Unit ID:	HRCC	Test Date:	May 12, 2020
Plant:	Cokenergy Facility	Run #:	1
Sample Location:	Stack 201	Operating Level:	Mid (Normal)

Note: In order to duplicate these examples, results must not be rounded.

Standard Meter Volume

$$V_{m(std)} = T_{std}/29.92 \times Y \times V_m \times (P_{bar} + \Delta H /13.6)/(T_m + 460)$$

Where:

$V_{m(std)}$ = Sample volume collected corrected to 29.92"Hg and T_{std} (scf, dry basis)
Y = Dry test meter calibration coefficient (dimensionless)
V_m = Sample volume collected at actual conditions (ft^3, dry basis)
T_m = Average dry test meter temperature (°F)
ΔH= Pressure drop across calibrated orifice ("H2O)
T_{std} = Standard Temperature (°R)

V_m = 22.783 cf P_{bar} = 29.28 "Hg

ΔH= 1.90 "H_2O T_m = 67.8 °F

Y = 0.992 dimensionless T_{std} = 528 °R

$V_{m(std)}$ = 22.231 dscf

Volume of Water Vapor Condensed

$$V_{w(std)} = [(0.04707 \times \text{net ml } H_2O) + (0.04715 \times \text{net grams } H_2O)] \times (T_{std} / 528)$$

Where:

$V_{w(std)}$ = Sample volume collected corrected to 29.92 in. Hg and 528(°R) (ft^3, dry basis)

net grams H_2O = Final moisture weight - initial moisture weight

net grams H_2O = **2816.0** - **2740.5**

$V_{w(std)}$ = 3.560 cf

Moisture Content From Method 4 or Alt-008

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)} =}$$

Where:

B_{ws} = Fractional moisture content (dimensionless)

$V_{w(std)}$ = 3.560 cf $V_{m(std)}$ = 22.231 dscf

B_{ws} = 0.138

Example Calculations - Method 2 Volumetric Flow

Company:	Primary Energy	Project Number:	382355
Unit ID:	HRCC	Test Date:	May 12, 2020
Plant:	Cokenergy Facility	Run #:	1
Sample Location:	Stack 201	Operating Level:	Mid (Normal)

Note: In order to duplicate these examples, results must not be rounded.

Dry Molecular Weight

$$M_d = 0.44 \times (\%CO_2) + 0.32 \times (\%O_2) + 0.28 \times (\%N_2)$$

Where:

M_d = Effluent gas molecular weight (lb/lb-mole, dry basis)
$\%CO_2$ = Effluent gas Carbon Dioxide Content (% volume, dry basis)
$\%O_2$ = Effluent gas Oxygen Content (% volume, dry basis)
$\%N_2$ = Effluent Balance Gas Content (% volume, dry basis)
0.32 = Molecular weight of O2 divided by 100
0.44 = Molecular weight of CO2 divided by 100
0.28 = Molecular weight of Nitrogen divided by 100

$\%CO_2$ = 6.059 $\%O_2$ = 11.700 $\%N_2$ = 82.241

M_d = 29.44 lb/lb-mole From Method 3A, Instrumental

Wet Molecular Weight

$$M_s = Md \times (1-Bws) + (18.0 \times Bws)$$

Where:

M_s = Effluent gas molecular weight (lb/lb-mole, wet basis)
B_{ws} = Effluent gas fractional moisture content (dimensionless)

M_d = 29.44 lb/lb-mole B_{ws} = 0.138 From Method 4

M_s = 27.86 lb/lb-mole

Average Square Root of Velocity Head - applicable to Method 2 only

$$\text{avg}\sqrt{\Delta P} = \frac{\sum_{i=1}^{n} \sqrt{\Delta Pi}}{n}$$

Where:

$\sqrt{\Delta Pi}$ = square root of ΔP at traverse point i
$\text{avg}\sqrt{\Delta P}$ = Average of the square roots of ΔP's at all traverse points

$\text{avg}\sqrt{\Delta P}$ = 1.3099

Example Calculations - Method 2 Volumetric Flow

Company:	Primary Energy	Project Number:	382355
Unit ID:	HRCC	Test Date:	May 12, 2020
Plant:	Cokenergy Facility	Run #:	1
Sample Location:	Stack 201	Operating Level:	Mid (Normal)

Note: In order to duplicate these examples, results must not be rounded.

Average Duct Velocity - applicable to Method 2 only

$$V_s = 85.49 \times Cp \times avg\sqrt{\Delta P} \times ((Ts + 460)/ (Ps \times Ms))^{1/2}$$

Where:

V_s = Average velocity of effluent gas (ft/sec)
C_p = Pitot calibration coefficient (dimensionless)
$avg\sqrt{\Delta P}$ = Average of the square roots of ΔP's at all traverse points
T_s = Average effluent gas temperature (^oF)

C_p =	0.840		T_s =	272	°F
P_s =	29.13	"Hg	M_s =	27.86	lb/lb-mole
$avg\sqrt{\Delta P}$ =	1.3099				

V_s = 89.36 ft/sec

Volumetric Flow Rate (Actual Basis)

Applicable when Method 2 is used alone:

$$Qacfm = V_s \times A \times 60 \text{ sec/min}$$

Where:

Q = Effluent gas volumetric flow rate at actual conditions (acfm)
A = Cross-sectional area of the stack/duct at the test location (ft^2)

V_s =	89.36	ft/sec	A =	254.469	ft^2

Q = 1,364,360 acfm

Example Calculations - Method 2 Volumetric Flow

Company:	Primary Energy	Project Number:	382355
Unit ID:	HRCC	Test Date:	May 12, 2020
Plant:	Cokenergy Facility	Run #:	1
Sample Location:	Stack 201	Operating Level:	Mid (Normal)

Note: In order to duplicate these examples, results must not be rounded.

Volumetric Flow Rate (Standard Wet Basis)

Standard cubic feet per minute (Wet):

$$Q_{std} = Q \times (T_{std}/29.92) \times (P_s/(T_s + 460))$$

Where:

Q_{std} = Effluent gas volumetric flow rate corrected to 29.92"Hg and 528°R (scfm)

Q = 1,364,360 acfm P_s = 29.13 "Hg

Ts (avg) = 272 °F T_{std} = 528 °R

Q_{std} = 957,668 scfm

Standard cubic feet per hour (Wet):

$$Q_{sw} = Q_{std} \times 60 \text{ min/hr}$$

Q_{sw} = 57,460,079 scfh

Volumetric Flow Rate (Standard Dry Basis)

Standard cubic feet per minute (Dry):

$$Q_{dscfm} = Q_{std} \times (1-B_{ws})$$

B_{ws} = 0.138 dimensionless

Q_{dscfm} = 825,485 dscfm

Standard cubic feet per hour (Dry):

$$Q_{sd} = Q_{dscfm} \times 60 \text{ min/hr}$$

Q_{sd} = 49,529,125 dscfh

Example Calculations - Moisture (Method 4)

Company:	Primary Energy	Project Number:	382355
Plant:	Cokenergy Facility	Test Date:	May 12, 2020
Unit ID:	HRCC	Run #:	1
Sample Location:	Stack 201	Operating Level:	> 50% Load

Effluent Gas Pressure

$$P_s = P_{bar} + (P_g / 13.6)$$

Where:

P_s = Flue gas pressure ("Hg)
P_{bar} = Ambient barometric pressure at sample elevation ("Hg)
P_g = Flue gas gauge pressure ("H_2O)

P_{bar} = 29.28 "Hg P_g = -2.00 "H_2O

P_s = 29.13 "Hg

Actual Meter Volume

$$V_m = Vf - Vi$$

Where:

V_i = Initial meter sample volume (Cubic Feet or Liters)
V_f = Final meter sample volume (Cubic Feet or Liters)
V_m = Sample volume collected at actual conditions (dcf)

V_f = 107.871 cf V_i = 85.088 cf

V_m = 22.783 dcf

Example Calculations - Moisture (Method 4)

Company:	Primary Energy	Project Number:	382355
Plant:	Cokenergy Facility	Test Date:	May 12, 2020
Unit ID:	HRCC	Run #:	1
Sample Location:	Stack 201	Operating Level:	> 50% Load

Sample Volume at Standard Conditions

$$V_{m(std)} = (T_{std} / 29.92) \times Y \times V_m \times (P_{bar} + P_m / 13.6)/(T_m + 460)$$

Where:

$V_{m(std)}$ = Sample volume collected corrected to 29.92 "Hg and 528 °R (dscf)
Y = Dry test meter calibration coefficient (dimensionless)
T_m = Average dry test meter temperature (°F)
P_m = Average dry test meter pressure ("H_2O)
T_{std} = Standard temperature 528 °R

V_m =	22.783	dcf	P_{bar} =	29.28	"Hg
P_m =	1.90	"H_2O	T_m =	67.8	°F
Y =	0.992		T_{std} =	528.0	°R

$V_{m(std)}$ = 22.230 dscf

Volume of Water Vapor Condensed at Standard Conditions

$$V_{wc(std)} = 0.04715 \times (T_{std} / 528) \times M_{H2O}$$

Where:

$V_{wc(std)}$ = Volume of water vapor collected corrected to 29.92 "Hg and 528 °R (scf)
M_{H2O} = Net weight gain of impingers (grams)

M_{H2O} = **75.5** grams

$V_{wc(std)}$ = 3.560 scf

Moisture Content

$$B_{ws} = \frac{V_{wc(std)}}{V_{wc(std)} + V_{m(std)}}$$

Where:

B_{ws} = Fractional moisture content (dimensionless)

$V_{wc(std)}$ =	3.560	scf	$V_{m(std)}$ =	22.230	dscf

B_{ws} = 0.138

Example Calculations - Moisture (Method 4)

Company:	Primary Energy	Project Number:	382355
Plant:	Cokenergy Facility	Test Date:	May 12, 2020
Unit ID:	HRCC	Run #:	1
Sample Location:	Stack 201	Operating Level:	> 50% Load

Dry Molecular Weight

$$M_d = 0.44 \times (\%CO_2) + 0.32 \times (\%O_2) + 0.28 \times (\%N_2)$$

Where:

M_d = Effluent gas molecular weight (lb/lb-mole, dry basis)
$\%CO_2$ = Effluent gas Carbon Dioxide Content (% volume, dry basis)
$\%O_2$ = Effluent gas Oxygen Content (% volume, dry basis)
$\%N_2$ = Effluent gas Nitrogen Content (% volume, dry basis)
0.32 = Molecular weight of O_2, divided by 100
0.44 = Molecular weight of CO_2, divided by 100
0.28 = Molecular weight of N_2, divided by 100

$\%CO_2$ = 6.1 $\%O_2$ = 11.7 $\%N_2$ = 82.2

M_d = 29.44 lb/lb-mole

Wet Molecular Weight

$$M_s = M_d \times (1 - B_{ws}) + (18.0 \times B_{ws})$$

Where:

M_s = Effluent gas molecular weight (lb/lb-mole, wet basis)

M_d = 29.44 lb/lb-mole B_{ws} = 0.138

M_s = 27.86 lb/lb-mole

Instrumental Reference Method Field Data

Project Number:	382355	Start Date:	5/12/2020
Customer:	Primary Energy	Facility:	Cokenergy Facility
Unit Identification:	HRCC	Recorded by:	Gavin Lewis
Sample Location:	Stack 201	Fc Factor:	-
Load Level/Condition:	> 50% Load	Fd Factor:	-

RM Analyzer Information			
Reference Method Probe Type (Moisture Basis):			Extractive (Dry)
Pollutant	Manufacturer	Model #	Serial Number
NO_X	-	-	-
SO_2	Thermo	43C	43CHL-77495-386
CO	-	-	-
CO_2	Servomex	1440	1415D/3497
O_2	Servomex	1440	1420D/3497

CEM System Information			
CEM System Probe Type (Moisture Basis):			Extractive (Dry)
Pollutant	Manufacturer/Model	Serial Number	
		Primary	Backup
NO_X	-	-	-
SO_2	Thermo Scientific 43i-HL	1152150034	-
CO	-	-	-
CO_2	-	-	-
O_2	Brand Gaus 4705	11401	-

Reference Method Results Summary

Project Number:	382355	Start Date:	5/12/20
Customer:	Primary Energy	End Date:	5/12/20
Unit Identification:	HRCC	Facility:	Cokenergy Facility
Sample Location:	Stack 201	Recorded by:	Gavin Lewis
RM Probe Type	Extractive (Dry)	Fc Factor:	-
Load Level/Condition:	> 50% Load	Fd Factor:	-

Reference Method Concentrations - As Measured Moisture Basis

Run #	Date	Start Time	End Time	NOx ppmvd	SO2 ppmvd	CO ppmvd	CO2 % v/v dry	O2 % v/v dry
1	5/12/20	7:45	8:06	-	186.843	-	6.059	11.700
2	5/12/20	8:35	8:56	-	185.076	-	6.011	11.840
3	5/12/20	9:15	9:36	-	186.986	-	5.981	11.920
4	5/12/20	9:48	10:09	-	188.018	-	5.968	11.934
5	5/12/20	10:21	10:42	-	185.725	-	5.857	12.130
6	5/12/20	10:53	11:14	-	186.468	-	5.795	12.246
7	5/12/20	11:25	11:46	-	185.582	-	5.754	12.356
8	5/12/20	11:57	12:18	-	175.322	-	5.590	12.637
9	5/12/20	12:30	12:51	-	178.630	-	5.518	12.749
10	5/12/20	13:03	13:24	-	181.698	-	5.506	12.765

Reference Method Concentrations - CEMS Moisture Basis

Run #	NOx ppmvd	SO2 ppmvd	CO ppmvd	CO2 % v/v dry	O2 % v/v dry
1	-	186.843	-	6.059	11.700
2	-	185.076	-	6.011	11.840
3	-	186.986	-	5.981	11.920
4	-	188.018	-	5.968	11.934
5	-	185.725	-	5.857	12.130
6	-	186.468	-	5.795	12.246
7	-	185.582	-	5.754	12.356
8	-	175.322	-	5.590	12.637
9	-	178.630	-	5.518	12.749
10	-	181.698	-	5.506	12.765

Reference Method Results

Bws	Flow DSCFM
-	825,485
-	827,021
-	809,869
-	812,811
-	800,284
-	800,695
-	801,415
-	801,918
-	803,591
-	811,729

Moisture correction applied to "As Measured" data: **None**

Reference Method Pollutant Emission Rates*

Run #	NOx lb/MMBtu	SO2 lb/MMBtu	CO lb/MMBtu	NOx lb/hr	SO2 lb/hr	CO lb/hr	Fc Factor	Fd Factor
1	-	-	-	-	1536.19	-	-	-
2	-	-	-	-	1524.49	-	-	-
3	-	-	-	-	1508.28	-	-	-
4	-	-	-	-	1522.12	-	-	-
5	-	-	-	-	1480.38	-	-	-
6	-	-	-	-	1487.07	-	-	-
7	-	-	-	-	1481.33	-	-	-
8	-	-	-	-	1400.31	-	-	-
9	-	-	-	-	1429.71	-	-	-
10	-	-	-	-	1469.00	-	-	-

* - lb/MMBtu based on measured concentrations and EPA F-Factor; lb/hr based on measured concentrations and volume flow.

Primary Energy Cokenergy 2020 May 12

Initial Calibration Error Test

Date/Time:	5/12/2020	6:38:52
Result:	PASS	

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Reference Cylinder IDs

	Zero ID:	Low ID:	Mid ID:	High ID:
SO2	EB0037831		CC447467	SG9151303BAL
CO2	EB0037831		EB0094259	EB0065406
O2	EB0037831		EB0094259	EB0065406

Calibration Error Results

Channel:	SO2	CO2	O2
Units:	ppmvd	% dry	% dry
Span:	452.600	17.720	22.260
Range:	500	25	25
Method:	EPA 7E	EPA 7E	EPA 7E
Zero Ref:	0.000	0.000	0.000
Zero Cal:	0.000	0.075	0.000
Zero Error:	0.00%	0.40%	0.00%
Low Ref:			
Low Cal:			
Low Error:			
Mid Ref:	204.300	8.753	10.030
Mid Cal:	207.599	8.925	10.125
Mid Error:	0.70%	1.00%	0.40%
High Ref:	452.600	17.720	22.260
High Cal:	449.239	17.650	22.275
High Error:	-0.70%	-0.40%	0.10%
Cal Result:	PASSED	PASSED	PASSED

Primary Energy Cokenergy 2020 May 12

Initial System Bias Check

Date/Time:	5/12/2020	6:46:42
Result:	PASS	

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Reference Cylinder IDs

	Low ID	Upscale ID	Span ID
SO2	EB0037831	CC447467	SG9151303BAL
CO2	EB0037831	EB0094259	EB0065406
O2	EB0037831	EB0094259	EB0065406

System Bias Check Results

Analyte:	SO2	CO2	O2
Units:	ppmvd	% dry	% dry
Span:	452.600	17.720	22.260
Range:	500	25	25
Method:	EPA 7E	EPA 7E	EPA 7E
Low Cal:	0.000	0.075	0.000
Low Sys:	4.956	0.075	0.050
Low Bias:	1.10%	0.00%	0.20%
Upscale Cal:	207.599	8.925	10.125
Upscale Sys:	199.089	8.825	10.025
Upscale Bias	-1.90%	-0.60%	-0.40%
Bias Result:	PASSED	PASSED	PASSED

Primary Energy Cokenergy 2020 May 12

Run 1 Final Bias & Drift Check

Date/Time:	5/12/2020	8:13:12
Result:	PASS	

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Reference Cylinder IDs

	Low ID	Upscale ID	Span ID
SO2	EB0037831	CC447467	SG9151303BAL
CO2	EB0037831	EB0094259	EB0065406
O2	EB0037831	EB0094259	EB0065406

System Bias Check Results

Analyte:	SO2	CO2	O2
Units:	ppmvd	% dry	% dry
Span:	452.600	17.720	22.260
Range:	500	25	25
Method:	EPA 7E	EPA 7E	EPA 7E
Low Cal:	0.000	0.075	0.000
Low Sys:	6.458	0.100	0.050
Low Bias:	1.40%	0.10%	0.20%
Upscale Cal:	207.599	8.925	10.125
Upscale Sys:	199.590	8.800	10.050
Upscale Bias	-1.80%	-0.70%	-0.30%
Bias Result:	PASSED	PASSED	PASSED

System Bias Drift Results

Low Drift:	0.30%	0.10%	0.00%
Mid Drift:	0.10%	-0.10%	0.10%
Drift Result:	PASSED	PASSED	PASSED
Cal Result:	OK	OK	OK

Test Run 1 Bias Correction Calculations:

	SO2	CO2	O2
Low init:	4.956	0.075	0.050
Low final:	6.458	0.100	0.050
Mid Init:	199.089	8.825	10.025
Mid Final:	199.590	8.800	10.050
Run Avg:	182.794	6.127	11.700
Co:	5.707	0.088	0.050
Cm:	199.339	8.812	10.038
Coa:	0.000	0.000	0.000
Cma:	204.300	8.753	10.030
Corrected:	186.843	6.059	11.700

Primary Energy Cokenergy 2020 May 12

Test Run 1

Start:	5/12/2020	7:45:00
End:	5/12/2020	8:06:01

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Time	Entry	SO2 ppmvd	CO2 % dry	O2 % dry
07:46:00	1 min avg:	181.583	6.113	11.717
07:47:00	1 min avg:	180.226	6.107	11.724
07:48:00	1 min avg:	178.378	6.103	11.725
07:49:00	1 min avg:	179.637	6.114	11.721
07:50:00	1 min avg:	182.010	6.111	11.727
07:51:00	1 min avg:	184.349	6.110	11.718
07:52:00	1 min avg:	184.153	6.121	11.710
07:53:00	1 min avg:	182.450	6.103	11.725
07:54:00	1 min avg:	182.703	6.125	11.702
07:55:00	1 min avg:	186.122	6.128	11.691
07:56:00	1 min avg:	186.273	6.125	11.708
07:57:00	1 min avg:	184.711	6.133	11.690
07:58:00	1 min avg:	181.889	6.137	11.678
07:59:00	1 min avg:	182.590	6.140	11.674
08:00:00	1 min avg:	185.450	6.131	11.699
08:01:00	1 min avg:	182.031	6.137	11.696
08:02:00	1 min avg:	182.563	6.146	11.672
08:03:00	1 min avg:	183.725	6.148	11.679
08:04:00	1 min avg:	183.981	6.148	11.677
08:05:00	1 min avg:	181.520	6.145	11.684
08:06:00	1 min avg:	182.328	6.140	11.689
08:06:01	Test Avgs:	182.794	6.127	11.700

Primary Energy Cokenergy 2020 May 12

Run 2 Final Bias & Drift Check

Date/Time:	5/12/2020	9:03:12
Result:	PASS	

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Reference Cylinder IDs

	Low ID	Upscale ID	Span ID
SO2	EB0037831	CC447467	SG9151303BAL
CO2	EB0037831	EB0094259	EB0065406
O2	EB0037831	EB0094259	EB0065406

System Bias Check Results

Analyte:	SO2	CO2	O2
Units:	ppmvd	% dry	% dry
Span:	452.600	17.720	22.260
Range:	500	25	25
Method:	EPA 7E	EPA 7E	EPA 7E
Low Cal:	0.000	0.075	0.000
Low Sys:	7.459	0.100	0.075
Low Bias:	1.60%	0.10%	0.30%
Upscale Cal:	207.599	8.925	10.125
Upscale Sys:	200.090	8.775	10.050
Upscale Bias	-1.70%	-0.80%	-0.30%
Bias Result:	PASSED	PASSED	PASSED

System Bias Drift Results

Low Drift:	0.20%	0.00%	0.10%
Mid Drift:	0.10%	-0.10%	0.00%
Drift Result:	PASSED	PASSED	PASSED
Cal Result:	OK	OK	OK

Test Run 2 Bias Correction Calculations:

	SO2	CO2	O2
Low init:	6.458	0.100	0.050
Low final:	7.459	0.100	0.075
Mid Init:	199.590	8.800	10.050
Mid Final:	200.090	8.775	10.050
Run Avg:	181.690	6.066	11.852
Co:	6.958	0.100	0.063
Cm:	199.840	8.788	10.050
Coa:	0.000	0.000	0.000
Cma:	204.300	8.753	10.030
Corrected:	185.076	6.011	11.840

Primary Energy Cokenergy 2020 May 12

Test Run 2

Start:	5/12/2020	8:35:00
End:	5/12/2020	8:56:01

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Time	Entry	SO2 ppmvd	CO2 % dry	O2 % dry
08:36:00	1 min avg:	180.357	6.081	11.818
08:37:00	1 min avg:	181.537	6.075	11.825
08:38:00	1 min avg:	179.993	6.071	11.838
08:39:00	1 min avg:	178.733	6.074	11.848
08:40:00	1 min avg:	177.042	6.075	11.847
08:41:00	1 min avg:	174.795	6.071	11.839
08:42:00	1 min avg:	179.228	6.074	11.831
08:43:00	1 min avg:	182.917	6.064	11.857
08:44:00	1 min avg:	183.165	6.055	11.863
08:45:00	1 min avg:	183.670	6.052	11.870
08:46:00	1 min avg:	182.245	6.053	11.870
08:47:00	1 min avg:	181.206	6.054	11.865
08:48:00	1 min avg:	182.643	6.056	11.872
08:49:00	1 min avg:	183.036	6.069	11.854
08:50:00	1 min avg:	183.292	6.071	11.853
08:51:00	1 min avg:	183.343	6.050	11.881
08:52:00	1 min avg:	183.005	6.072	11.843
08:53:00	1 min avg:	186.073	6.062	11.860
08:54:00	1 min avg:	182.627	6.063	11.861
08:55:00	1 min avg:	184.947	6.075	11.845
08:56:00	1 min avg:	181.642	6.063	11.856
08:56:01	Test Avgs:	181.690	6.066	11.852

Primary Energy Cokenergy 2020 May 12

Run 3 Final Bias & Drift Check

Date/Time:	5/12/2020	9:43:03
Result:	PASS	
Operator:	Gavin Lewis	
Plant:	Primary Energy Cokenergy	
Location:	Stack	
Source ID:	HRCC Stack 201	

Reference Cylinder IDs

	Low ID	Upscale ID	Span ID
SO2	EB0037831	CC447467	SG9151303BAL
CO2	EB0037831	EB0094259	EB0065406
O2	EB0037831	EB0094259	EB0065406

System Bias Check Results

Analyte:	SO2	CO2	O2
Units:	ppmvd	% dry	% dry
Span:	452.600	17.720	22.260
Range:	500	25	25
Method:	EPA 7E	EPA 7E	EPA 7E
Low Cal:	0.000	0.075	0.000
Low Sys:	7.459	0.100	0.050
Low Bias:	1.60%	0.10%	0.20%
Upscale Cal:	207.599	8.925	10.125
Upscale Sys:	201.091	8.800	10.050
Upscale Bias	-1.40%	-0.70%	-0.30%
Bias Result:	PASSED	PASSED	PASSED

System Bias Drift Results

Low Drift:	0.00%	0.00%	-0.10%
Mid Drift:	0.20%	0.10%	0.00%
Drift Result:	PASSED	PASSED	PASSED
Cal Result:	OK	OK	OK

Test Run 3 Bias Correction Calculations:

	SO2	CO2	O2
Low init:	7.459	0.100	0.075
Low final:	7.459	0.100	0.050
Mid Init:	200.090	8.775	10.050
Mid Final:	201.091	8.800	10.050
Run Avg:	184.223	6.036	11.932
Co:	7.459	0.100	0.063
Cm:	200.591	8.788	10.050
Coa:	0.000	0.000	0.000
Cma:	204.300	8.753	10.030
Corrected:	186.986	5.981	11.920

Primary Energy Cokenergy 2020 May 12

Test Run 3

Start:	5/12/2020	9:15:00
End:	5/12/2020	9:36:00

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Time	Entry	SO2 ppmvd	CO2 % dry	O2 % dry
09:15:59	1 min avg:	183.542	6.040	11.908
09:16:59	1 min avg:	182.293	6.050	11.899
09:17:59	1 min avg:	183.587	6.041	11.917
09:18:59	1 min avg:	184.831	6.034	11.920
09:19:59	1 min avg:	184.813	6.050	11.896
09:20:59	1 min avg:	186.073	6.043	11.919
09:21:59	1 min avg:	185.286	6.037	11.930
09:22:59	1 min avg:	184.822	6.049	11.925
09:23:59	1 min avg:	184.908	6.049	11.908
09:24:59	1 min avg:	184.298	6.027	11.945
09:25:59	1 min avg:	184.045	6.049	11.920
09:26:59	1 min avg:	185.383	6.042	11.931
09:27:59	1 min avg:	182.865	6.046	11.921
09:28:59	1 min avg:	179.910	6.035	11.945
09:29:59	1 min avg:	176.279	6.025	11.955
09:30:59	1 min avg:	181.986	6.026	11.950
09:31:59	1 min avg:	186.065	6.043	11.933
09:32:59	1 min avg:	190.190	6.022	11.970
09:33:59	1 min avg:	186.335	6.022	11.963
09:34:59	1 min avg:	186.085	6.025	11.951
09:35:59	1 min avg:	185.072	6.010	11.972
09:36:00	Test Avgs:	184.223	6.036	11.932

Primary Energy Cokenergy 2020 May 12

Run 4 Final Bias & Drift Check

Date/Time:	5/12/2020	10:16:37
Result:	PASS	

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Reference Cylinder IDs

	Low ID	Upscale ID	Span ID
SO2	EB0037831	CC447467	SG9151303BAL
CO2	EB0037831	EB0094259	EB0065406
O2	EB0037831	EB0094259	EB0065406

System Bias Check Results

Analyte:	SO2	CO2	O2
Units:	ppmvd	% dry	% dry
Span:	452.600	17.720	22.260
Range:	500	25	25
Method:	EPA 7E	EPA 7E	EPA 7E
Low Cal:	0.000	0.075	0.000
Low Sys:	5.957	0.100	0.050
Low Bias:	1.30%	0.10%	0.20%
Upscale Cal:	207.599	8.925	10.125
Upscale Sys:	199.590	8.800	10.075
Upscale Bias	-1.80%	-0.70%	-0.20%
Bias Result:	PASSED	PASSED	PASSED

System Bias Drift Results

Low Drift:	-0.30%	0.00%	0.00%
Mid Drift:	-0.30%	0.00%	0.10%
Drift Result:	PASSED	PASSED	PASSED
Cal Result:	OK	OK	OK

Test Run 4 Bias Correction Calculations:

	SO2	CO2	O2
Low init:	7.459	0.100	0.050
Low final:	5.957	0.100	0.050
Mid Init:	201.091	8.800	10.050
Mid Final:	199.590	8.800	10.075
Run Avg:	184.909	6.032	11.963
Co:	6.708	0.100	0.050
Cm:	200.340	8.800	10.063
Coa:	0.000	0.000	0.000
Cma:	204.300	8.753	10.030
Corrected:	188.018	5.968	11.934

Primary Energy Cokenergy 2020 May 12

Test Run 4

Start:	5/12/2020	9:48:01
End:	5/12/2020	10:09:01

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Time	Entry	SO2 ppmvd	CO2 % dry	O2 % dry
09:49:00	1 min avg:	181.846	6.030	11.944
09:50:00	1 min avg:	185.485	6.025	11.955
09:51:00	1 min avg:	185.324	6.030	11.951
09:52:00	1 min avg:	188.844	6.029	11.957
09:53:00	1 min avg:	184.258	6.043	11.935
09:54:00	1 min avg:	184.067	6.040	11.942
09:55:00	1 min avg:	185.096	6.025	11.975
09:56:00	1 min avg:	186.118	6.042	11.950
09:57:00	1 min avg:	185.831	6.029	11.953
09:58:00	1 min avg:	183.770	6.027	11.967
09:59:00	1 min avg:	184.329	6.040	11.955
10:00:00	1 min avg:	184.375	6.025	11.973
10:01:00	1 min avg:	184.876	6.041	11.948
10:02:00	1 min avg:	186.019	6.051	11.942
10:03:00	1 min avg:	182.705	6.029	11.971
10:04:00	1 min avg:	182.224	6.026	11.975
10:05:00	1 min avg:	182.124	6.039	11.965
10:06:00	1 min avg:	185.363	6.045	11.962
10:07:00	1 min avg:	187.634	6.020	12.005
10:08:00	1 min avg:	187.392	6.013	12.013
10:09:00	1 min avg:	185.403	6.025	11.984
10:09:01	Test Avgs:	184.909	6.032	11.963

Primary Energy Cokenergy 2020 May 12

Run 5 Final Bias & Drift Check

Date/Time:	5/12/2020	10:49:02
Result:	PASS	

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Reference Cylinder IDs

	Low ID	Upscale ID	Span ID
SO2	EB0037831	CC447467	SG9151303BAL
CO2	EB0037831	EB0094259	EB0065406
O2	EB0037831	EB0094259	EB0065406

System Bias Check Results

Analyte:	SO2	CO2	O2
Units:	ppmvd	% dry	% dry
Span:	452.600	17.720	22.260
Range:	500	25	25
Method:	EPA 7E	EPA 7E	EPA 7E
Low Cal:	0.000	0.075	0.000
Low Sys:	7.480	0.100	0.075
Low Bias:	1.70%	0.10%	0.30%
Upscale Cal:	207.599	8.925	10.125
Upscale Sys:	200.382	8.825	10.075
Upscale Bias	-1.60%	-0.60%	-0.20%
Bias Result:	PASSED	PASSED	PASSED

System Bias Drift Results

Low Drift:	0.30%	0.00%	0.10%
Mid Drift:	0.20%	0.10%	0.00%
Drift Result:	PASSED	PASSED	PASSED
Cal Result:	OK	OK	OK

Test Run 5 Bias Correction Calculations:

	SO2	CO2	O2
Low init:	5.957	0.100	0.050
Low final:	7.480	0.100	0.075
Mid Init:	199.590	8.800	10.075
Mid Final:	200.382	8.825	10.075
Run Avg:	182.414	5.930	12.171
Co:	6.718	0.100	0.063
Cm:	199.986	8.812	10.075
Coa:	0.000	0.000	0.000
Cma:	204.300	8.753	10.030
Corrected:	185.725	5.857	12.130

Primary Energy Cokenergy 2020 May 12

Test Run 5

Start:	5/12/2020	10:21:00
End:	5/12/2020	10:42:01

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Time	Entry	SO2 ppmvd	CO2 % dry	O2 % dry
10:22:00	1 min avg:	183.402	5.956	12.111
10:23:00	1 min avg:	183.396	5.950	12.124
10:24:00	1 min avg:	181.208	5.950	12.130
10:25:00	1 min avg:	179.871	5.934	12.153
10:26:00	1 min avg:	180.369	5.933	12.156
10:27:00	1 min avg:	184.257	5.944	12.149
10:28:00	1 min avg:	183.847	5.938	12.155
10:29:00	1 min avg:	182.081	5.927	12.173
10:30:00	1 min avg:	183.217	5.935	12.164
10:31:00	1 min avg:	180.961	5.941	12.155
10:32:00	1 min avg:	183.513	5.916	12.197
10:33:00	1 min avg:	183.741	5.919	12.194
10:34:00	1 min avg:	181.565	5.925	12.182
10:35:00	1 min avg:	180.321	5.922	12.196
10:36:00	1 min avg:	181.505	5.924	12.184
10:37:00	1 min avg:	183.629	5.925	12.175
10:38:00	1 min avg:	184.402	5.915	12.197
10:39:00	1 min avg:	181.338	5.923	12.187
10:40:00	1 min avg:	183.508	5.925	12.188
10:41:00	1 min avg:	181.831	5.921	12.200
10:42:00	1 min avg:	182.738	5.902	12.219
10:42:01	Test Avgs:	182.414	5.930	12.171

Primary Energy Cokenergy 2020 May 12

Run 6 Final Bias & Drift Check

Date/Time:	5/12/2020	11:20:06
Result:	PASS	

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Reference Cylinder IDs

	Low ID	Upscale ID	Span ID
SO2	EB0037831	CC447467	SG9151303BAL
CO2	EB0037831	EB0094259	EB0065406
O2	EB0037831	EB0094259	EB0065406

System Bias Check Results

Analyte:	SO2	CO2	O2
Units:	ppmvd	% dry	% dry
Span:	452.600	17.720	22.260
Range:	500	25	25
Method:	EPA 7E	EPA 7E	EPA 7E
Low Cal:	0.000	0.075	0.000
Low Sys:	6.958	0.100	0.050
Low Bias:	1.50%	0.10%	0.20%
Upscale Cal:	207.599	8.925	10.125
Upscale Sys:	199.729	8.815	10.050
Upscale Bias	-1.70%	-0.60%	-0.30%
Bias Result:	PASSED	PASSED	PASSED

System Bias Drift Results

Low Drift:	-0.10%	0.00%	-0.10%
Mid Drift:	-0.10%	-0.10%	-0.10%
Drift Result:	PASSED	PASSED	PASSED
Cal Result:	OK	OK	OK

Test Run 6 Bias Correction Calculations:

	SO2	CO2	O2
Low init:	7.480	0.100	0.075
Low final:	6.958	0.100	0.050
Mid Init:	200.382	8.825	10.075
Mid Final:	199.729	8.815	10.050
Run Avg:	183.224	5.873	12.272
Co:	7.219	0.100	0.063
Cm:	200.055	8.820	10.063
Coa:	0.000	0.000	0.000
Cma:	204.300	8.753	10.030
Corrected:	186.468	5.795	12.246

Primary Energy Cokenergy 2020 May 12

Test Run 6

Start:	5/12/2020	10:53:00
End:	5/12/2020	11:14:00

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Time	Entry	SO2 ppmvd	CO2 % dry	O2 % dry
10:53:59	1 min avg:	185.066	5.887	12.242
10:54:59	1 min avg:	185.802	5.894	12.227
10:55:59	1 min avg:	186.309	5.873	12.262
10:56:59	1 min avg:	184.571	5.882	12.252
10:57:59	1 min avg:	183.471	5.882	12.252
10:58:59	1 min avg:	184.206	5.878	12.258
10:59:59	1 min avg:	181.737	5.880	12.256
11:00:59	1 min avg:	178.815	5.876	12.257
11:01:59	1 min avg:	179.603	5.875	12.275
11:02:59	1 min avg:	182.676	5.872	12.279
11:03:59	1 min avg:	184.528	5.863	12.289
11:04:59	1 min avg:	183.423	5.878	12.269
11:05:59	1 min avg:	182.703	5.860	12.297
11:06:59	1 min avg:	178.724	5.856	12.302
11:07:59	1 min avg:	180.138	5.850	12.303
11:08:59	1 min avg:	184.539	5.854	12.306
11:09:59	1 min avg:	183.741	5.875	12.280
11:10:59	1 min avg:	184.962	5.875	12.275
11:11:59	1 min avg:	185.635	5.875	12.269
11:12:59	1 min avg:	183.402	5.872	12.288
11:13:59	1 min avg:	183.635	5.875	12.277
11:14:00	Test Avgs:	183.224	5.873	12.272

Primary Energy Cokenergy 2020 May 12

Run 7 Final Bias & Drift Check

Date/Time:	5/12/2020	11:52:11
Result:	PASS	
Operator:	Gavin Lewis	
Plant:	Primary Energy Cokenergy	
Location:	Stack	
Source ID:	HRCC Stack 201	

Reference Cylinder IDs

	Low ID	Upscale ID	Span ID
SO2	EB0037831	CC447467	SG9151303BAL
CO2	EB0037831	EB0094259	EB0065406
O2	EB0037831	EB0094259	EB0065406

System Bias Check Results

Analyte:	SO2	CO2	O2
Units:	ppmvd	% dry	% dry
Span:	452.600	17.720	22.260
Range:	500	25	25
Method:	EPA 7E	EPA 7E	EPA 7E
Low Cal:	0.000	0.075	0.000
Low Sys:	6.458	0.100	0.050
Low Bias:	1.40%	0.10%	0.20%
Upscale Cal:	207.599	8.925	10.125
Upscale Sys:	200.591	8.800	10.050
Upscale Bias	-1.50%	-0.70%	-0.30%
Bias Result:	PASSED	PASSED	PASSED

System Bias Drift Results

Low Drift:	-0.10%	0.00%	0.00%
Mid Drift:	0.20%	-0.10%	0.00%
Drift Result:	PASSED	PASSED	PASSED
Cal Result:	OK	OK	OK

Test Run 7 Bias Correction Calculations:

	SO2	CO2	O2
Low init:	6.958	0.100	0.050
Low final:	6.458	0.100	0.050
Mid Init:	199.729	8.815	10.050
Mid Final:	200.591	8.800	10.050
Run Avg:	182.436	5.824	12.369
Co:	6.708	0.100	0.050
Cm:	200.160	8.807	10.050
Coa:	0.000	0.000	0.000
Cma:	204.300	8.753	10.030
Corrected:	185.582	5.754	12.356

Primary Energy Cokenergy 2020 May 12

Test Run 7

Start:	5/12/2020	11:25:00
End:	5/12/2020	11:46:00

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Time	Entry	SO2 ppmvd	CO2 % dry	O2 % dry
11:25:59	1 min avg:	184.737	5.851	12.301
11:26:59	1 min avg:	185.187	5.875	12.280
11:27:59	1 min avg:	184.148	5.853	12.309
11:28:59	1 min avg:	184.031	5.859	12.307
11:29:59	1 min avg:	183.005	5.873	12.290
11:30:59	1 min avg:	182.929	5.853	12.322
11:31:59	1 min avg:	181.173	5.850	12.325
11:32:59	1 min avg:	181.573	5.849	12.337
11:33:59	1 min avg:	184.385	5.849	12.349
11:34:59	1 min avg:	184.743	5.850	12.335
11:35:59	1 min avg:	182.582	5.829	12.352
11:36:59	1 min avg:	183.334	5.825	12.363
11:37:59	1 min avg:	180.832	5.825	12.370
11:38:59	1 min avg:	180.147	5.825	12.370
11:39:59	1 min avg:	180.816	5.832	12.357
11:40:59	1 min avg:	180.653	5.825	12.373
11:41:59	1 min avg:	182.001	5.798	12.415
11:42:59	1 min avg:	181.322	5.757	12.484
11:43:59	1 min avg:	179.653	5.750	12.494
11:44:59	1 min avg:	181.892	5.742	12.509
11:45:59	1 min avg:	181.998	5.739	12.514
11:46:00	Test Avgs:	182.436	5.824	12.369

Primary Energy Cokenergy 2020 May 12

Run 8 Final Bias & Drift Check

Date/Time:	5/12/2020	12:24:02
Result:	PASS	

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Reference Cylinder IDs

	Low ID	Upscale ID	Span ID
SO2	EB0037831	CC447467	SG9151303BAL
CO2	EB0037831	EB0094259	EB0065406
O2	EB0037831	EB0094259	EB0065406

System Bias Check Results

Analyte:	SO2	CO2	O2
Units:	ppmvd	% dry	% dry
Span:	452.600	17.720	22.260
Range:	500	25	25
Method:	EPA 7E	EPA 7E	EPA 7E
Low Cal:	0.000	0.075	0.000
Low Sys:	5.957	0.100	0.050
Low Bias:	1.30%	0.10%	0.20%
Upscale Cal:	207.599	8.925	10.125
Upscale Sys:	198.088	8.825	10.050
Upscale Bias	-2.10%	-0.60%	-0.30%
Bias Result:	PASSED	PASSED	PASSED

System Bias Drift Results

Low Drift:	-0.10%	0.00%	0.00%
Mid Drift:	-0.60%	0.10%	0.00%
Drift Result:	PASSED	PASSED	PASSED
Cal Result:	OK	OK	OK

Test Run 8 Bias Correction Calculations:

	SO2	CO2	O2
Low init:	6.458	0.100	0.050
Low final:	5.957	0.100	0.050
Mid Init:	200.591	8.800	10.050
Mid Final:	198.088	8.825	10.050
Run Avg:	171.945	5.664	12.650
Co:	6.207	0.100	0.050
Cm:	199.339	8.812	10.050
Coa:	0.000	0.000	0.000
Cma:	204.300	8.753	10.030
Corrected:	175.322	5.590	12.637

Primary Energy Cokenergy 2020 May 12

Test Run 8

Start:	5/12/2020	11:57:01
End:	5/12/2020	12:18:01

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Time	Entry	SO2 ppmvd	CO2 % dry	O2 % dry
11:58:00	1 min avg:	180.494	5.723	12.540
11:59:00	1 min avg:	183.236	5.717	12.552
12:00:00	1 min avg:	182.322	5.723	12.550
12:01:00	1 min avg:	182.816	5.717	12.552
12:02:00	1 min avg:	181.069	5.714	12.560
12:03:00	1 min avg:	181.083	5.724	12.547
12:04:00	1 min avg:	180.788	5.701	12.576
12:05:00	1 min avg:	179.967	5.700	12.578
12:06:00	1 min avg:	179.432	5.701	12.575
12:07:00	1 min avg:	178.751	5.683	12.611
12:08:00	1 min avg:	164.769	5.621	12.725
12:09:00	1 min avg:	160.326	5.608	12.746
12:10:00	1 min avg:	161.208	5.622	12.728
12:11:00	1 min avg:	165.686	5.613	12.744
12:12:00	1 min avg:	164.724	5.631	12.720
12:13:00	1 min avg:	165.102	5.618	12.732
12:14:00	1 min avg:	163.447	5.625	12.725
12:15:00	1 min avg:	162.527	5.625	12.725
12:16:00	1 min avg:	163.726	5.625	12.725
12:17:00	1 min avg:	164.286	5.627	12.716
12:18:00	1 min avg:	165.089	5.635	12.714
12:18:01	Test Avgs:	171.945	5.664	12.650

Primary Energy Cokenergy 2020 May 12

Run 9 Final Bias & Drift Check

Date/Time:	5/12/2020	12:57:45
Result:	PASS	

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Reference Cylinder IDs

	Low ID	Upscale ID	Span ID
SO2	EB0037831	CC447467	SG9151303BAL
CO2	EB0037831	EB0094259	EB0065406
O2	EB0037831	EB0094259	EB0065406

System Bias Check Results

Analyte:	SO2	CO2	O2
Units:	ppmvd	% dry	% dry
Span:	452.600	17.720	22.260
Range:	500	25	25
Method:	EPA 7E	EPA 7E	EPA 7E
Low Cal:	0.000	0.075	0.000
Low Sys:	7.960	0.100	0.050
Low Bias:	1.80%	0.10%	0.20%
Upscale Cal:	207.599	8.925	10.125
Upscale Sys:	201.091	8.825	10.071
Upscale Bias	-1.40%	-0.60%	-0.20%
Bias Result:	PASSED	PASSED	PASSED

System Bias Drift Results

Low Drift:	0.40%	0.00%	0.00%
Mid Drift:	0.70%	0.00%	0.10%
Drift Result:	PASSED	PASSED	PASSED
Cal Result:	OK	OK	OK

Test Run 9 Bias Correction Calculations:

	SO2	CO2	O2
Low init:	5.957	0.100	0.050
Low final:	7.960	0.100	0.050
Mid Init:	198.088	8.825	10.050
Mid Final:	201.091	8.825	10.071
Run Avg:	175.386	5.600	12.774
Co:	6.958	0.100	0.050
Cm:	199.590	8.825	10.060
Coa:	0.000	0.000	0.000
Cma:	204.300	8.753	10.030
Corrected:	178.630	5.518	12.749

Primary Energy Cokenergy 2020 May 12

Test Run 9

Start:	5/12/2020	12:30:00
End:	5/12/2020	12:51:00

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Time	Entry	SO2 ppmvd	CO2 % dry	O2 % dry
12:30:59	1 min avg:	158.240	5.607	12.751
12:31:59	1 min avg:	164.069	5.643	12.690
12:32:59	1 min avg:	165.830	5.625	12.707
12:33:59	1 min avg:	160.091	5.625	12.720
12:34:59	1 min avg:	157.305	5.625	12.717
12:35:59	1 min avg:	158.941	5.622	12.734
12:36:59	1 min avg:	164.920	5.625	12.725
12:37:59	1 min avg:	167.478	5.610	12.756
12:38:59	1 min avg:	170.681	5.600	12.775
12:39:59	1 min avg:	174.598	5.590	12.789
12:40:59	1 min avg:	175.915	5.591	12.790
12:41:59	1 min avg:	177.630	5.590	12.796
12:42:59	1 min avg:	180.011	5.579	12.800
12:43:59	1 min avg:	175.281	5.589	12.800
12:44:59	1 min avg:	184.805	5.600	12.800
12:45:59	1 min avg:	223.502	5.600	12.790
12:46:59	1 min avg:	221.608	5.600	12.785
12:47:59	1 min avg:	186.766	5.604	12.782
12:48:59	1 min avg:	171.185	5.600	12.788
12:49:59	1 min avg:	173.125	5.564	12.837
12:50:59	1 min avg:	171.206	5.516	12.916
12:51:00	Test Avgs:	175.386	5.600	12.774

Primary Energy Cokenergy 2020 May 12

Run 10 Final Bias & Drift Check

Date/Time:	5/12/2020	13:32:43
Result:	PASS	

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Reference Cylinder IDs

	Low ID	Upscale ID	Span ID
SO2	EB0037831	CC447467	SG9151303BAL
CO2	EB0037831	EB0094259	EB0065406
O2	EB0037831	EB0094259	EB0065406

System Bias Check Results

Analyte:	SO2	CO2	O2
Units:	ppmvd	% dry	% dry
Span:	452.600	17.720	22.260
Range:	500	25	25
Method:	EPA 7E	EPA 7E	EPA 7E
Low Cal:	0.000	0.075	0.000
Low Sys:	6.958	0.100	0.050
Low Bias:	1.50%	0.10%	0.20%
Upscale Cal:	207.599	8.925	10.125
Upscale Sys:	200.090	8.825	10.075
Upscale Bias	-1.70%	-0.60%	-0.20%
Bias Result:	PASSED	PASSED	PASSED

System Bias Drift Results

Low Drift:	-0.20%	0.00%	0.00%
Mid Drift:	-0.20%	0.00%	0.00%
Drift Result:	PASSED	PASSED	PASSED
Cal Result:	OK	OK	OK

Test Run 10 Bias Correction Calculations:

	SO2	CO2	O2
Low init:	7.960	0.100	0.050
Low final:	6.958	0.100	0.050
Mid Init:	201.091	8.825	10.071
Mid Final:	200.090	8.825	10.075
Run Avg:	179.225	5.589	12.805
Co:	7.459	0.100	0.050
Cm:	200.591	8.825	10.073
Coa:	0.000	0.000	0.000
Cma:	204.300	8.753	10.030
Corrected:	181.698	5.506	12.765

Primary Energy Cokenergy 2020 May 12

Test Run 10

Start:	5/12/2020	13:03:00
End:	5/12/2020	13:24:01

Operator:	Gavin Lewis
Plant:	Primary Energy Cokenergy
Location:	Stack
Source ID:	HRCC Stack 201

Time	Entry	SO2 ppmvd	CO2 % dry	O2 % dry
13:04:00	1 min avg:	181.713	5.607	12.775
13:05:00	1 min avg:	183.081	5.601	12.784
13:06:00	1 min avg:	181.898	5.623	12.757
13:07:00	1 min avg:	179.050	5.602	12.779
13:08:00	1 min avg:	175.187	5.601	12.777
13:09:00	1 min avg:	176.952	5.609	12.775
13:10:00	1 min avg:	178.909	5.602	12.775
13:11:00	1 min avg:	179.054	5.600	12.787
13:12:00	1 min avg:	177.436	5.597	12.792
13:13:00	1 min avg:	173.590	5.596	12.800
13:14:00	1 min avg:	176.341	5.593	12.801
13:15:00	1 min avg:	179.875	5.575	12.823
13:16:00	1 min avg:	186.462	5.573	12.846
13:17:00	1 min avg:	181.390	5.573	12.829
13:18:00	1 min avg:	178.963	5.577	12.818
13:19:00	1 min avg:	176.290	5.575	12.826
13:20:00	1 min avg:	177.106	5.575	12.825
13:21:00	1 min avg:	179.370	5.572	12.840
13:22:00	1 min avg:	183.585	5.575	12.828
13:23:00	1 min avg:	180.523	5.566	12.841
13:24:00	1 min avg:	176.943	5.570	12.836
13:24:01	Test Avgs:	179.225	5.589	12.805

Volumetric Flow Test Run Data Summary

Primary Energy
Cokenergy Facility
HRCC Stack 201

Operating Level:	**Mid (Normal)**	**Mid (Normal)**	**Mid (Normal)**	**Mid (Normal)**	**Mid (Normal)**	**Mid (Normal)**	**Mid (Normal)**	**Mid (Normal)**	**Mid (Normal)**	**Mid (Normal)**	
Run No.:	1	2	3	4	5	6	7	8	9	10	**Average**
Start Date:	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	
End Date:	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	
Start Time:	7:45	8:35	9:15	9:48	10:21	10:53	11:25	11:57	12:30	13:03	
End Time:	7:52	8:43	9:23	9:55	10:28	11:01	11:35	12:04	12:39	13:09	
Test Parameters											
P_{bar} - Barometric pressure, inches Hg	29.28	29.28	29.26	29.28	29.26	29.26	29.26	29.28	29.26	29.28	29.27
P_g - Stack Pressure, inches of H2O	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00
P_s - Absolute stack pressure, inches Hg	29.13	29.13	29.11	29.13	29.11	29.11	29.11	29.13	29.11	29.13	29.123
T_s - Average stack temperature, °F	272.4	272.4	272.3	271.8	271.8	271.8	270.9	270.3	269.7	269.8	271.3
% CO_2:	6.059	6.011	5.981	5.968	5.857	5.795	5.754	5.590	5.518	5.506	5.804
% O_2:	11.700	11.840	11.920	11.934	12.130	12.246	12.356	12.637	12.749	12.765	12.228
% Nitrogen:	82.2	82.1	82.1	82.1	82.0	82.0	81.9	81.8	81.7	81.7	82.0
M_d - dry basis lb/lb mole	29.437	29.435	29.434	29.432	29.422	29.417	29.415	29.400	29.393	29.392	29.418
Stack Diameter, Feet	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	
A - Cross Sectional Area of Stack, Ft^2	254.47	254.47	254.47	254.47	254.47	254.47	254.47	254.47	254.47	254.47	
Method 2 Results											
Average ΔP	1.731	1.725	1.656	1.656	1.613	1.594	1.594	1.600	1.606	1.631	1.641
Average Sqrt ΔP	1.310	1.309	1.283	1.284	1.265	1.259	1.259	1.261	1.263	1.274	1.277
Bws - Moisture content fraction	0.138	0.136	0.136	0.134	0.134	0.129	0.129	0.130	0.130	0.129	0.132
Ms - wet basis lb/lb mole	27.859	27.884	27.881	27.901	27.891	27.947	27.945	27.913	27.906	27.925	27.905
Average Velocity (ft/sec)	89.36	89.28	87.49	87.50	86.21	85.73	85.71	85.80	85.97	86.62	86.97
Actual cubic feet per minute (ACFM)	1,364,360	1,363,086	1,335,743	1,335,944	1,316,266	1,308,953	1,308,676	1,310,004	1,312,632	1,322,578	1,327,824
Standard cubic feet per minute (SCFM)	957,668	956,856	937,098	938,524	924,143	919,009	919,835	922,190	924,197	931,680	933,120
Standard cubic feet per hour (SCFH)	57,460,079	57,411,343	56,225,856	56,311,412	55,448,592	55,140,530	55,190,129	55,331,418	55,451,793	55,900,791	55,987,194
Dry Standard cubic feet per minute (DSCFM)	825,485	827,021	809,869	812,811	800,284	800,695	801,415	801,918	803,591	811,729	809,482
Dry Standard cubic feet per hour (DSCFH)	49,529,125	49,621,257	48,592,143	48,768,683	48,017,059	48,041,710	48,084,924	48,115,083	48,215,481	48,703,739	48,568,920

Standard conditions of 29.92 in/Hg and 68° F

METHOD 2 VOLUMETRIC FLOW DATA

Project No:	382355	**Operating Level:**	Mid (Normal)
Company:	Primary Energy	**Run No.:**	1
Plant:	Cokenergy Facility	**Start Date:**	5/12/2020
Unit ID:	HRCC	**End Date:**	5/12/2020
Sample Location:	Stack 201	**Start Time:**	07:45
Pitot ID:	890A	**End Time:**	07:52
Pitot Coefficient:	0.84	**RM Testers:**	Rome Rothgeb

Test Parameters		
P_{bar} - Barometric pressure, inches Hg		29.28
P_g - Stack Pressure, inches of H_2O		-2.00
P_s - Absolute stack pressure, inches Hg		29.13
T_s - Average stack temperature, °F		272.4
Gas Molecular Weight Method:	% CO_2:	6.059
Method 3A, Instrumental	% O_2:	11.700
	% Nitrogen:	82.241
M_d - dry basis lb/lb mole		29.44
M_s - wet basis lb/lb mole		27.86
Stack Diameter, Feet		18.00
A - Cross Sectional Area of Stack, Ft^2		254.47
B_{ws} - Moisture content fraction		0.138

Moisture Determination	
Method Used:	4
Meter Calibration:	0.992
Initial Meter Volume (cf)	85.088
Final Meter Volume (cf)	107.871
Meter Temperature, deg F:	67.8
Meter Volume Vm(std):	22.231
Meter Volume Vw(std):	3.560
Delta H:	1.90
Train Initial Weight, g:	2740.5
Train Final Weight, g:	2816.0
Condensate Initial Vol, mL:	0.0
Condensate Final Vol, mL:	0.0

Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)	Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)
A	**01**	1.70	1.3038	268	88.68	**C**	**01**	1.50	1.2247	273	83.58
A	**02**	2.10	1.4491	272	98.83	**C**	**02**	1.80	1.3416	273	91.56
A	**03**	2.10	1.4491	274	98.96	**C**	**03**	1.70	1.3038	273	88.98
A	**04**	1.50	1.2247	273	83.58	**C**	**04**	1.10	1.0488	272	71.53
B	**01**	1.50	1.2247	273	83.58	**D**	**01**	2.20	1.4832	273	101.22
B	**02**	1.70	1.3038	273	88.98	**D**	**02**	2.20	1.4832	273	101.22
B	**03**	1.70	1.3038	272	88.92	**D**	**03**	2.00	1.4142	273	96.51
B	**04**	1.20	1.0954	273	74.76	**D**	**04**	1.70	1.3038	271	88.86

Method 2 Results	
Average ΔP	1.7313
Average Sqrt ΔP	1.3099
Average Velocity (ft/sec)	89.36
No WAF Applied to this Test	
Actual cubic feet per minute (ACFM)	1,364,360
Standard cubic feet per minute (SCFM)	957,668
Standard cubic feet per hour (SCFH)	57,460,079
Dry Standard cubic feet per minute (DSCFM)	825,485
Dry Standard cubic feet per hour (DSCFH)	49,529,125

Leak Checks:

Pitot: Pre-Test: Pass

Post-Test: Pass

Moisture Train:

Pre-Test: 0.000 CFM @ 5.0 in. Hg

Post-Test: 0.000 CFM @ 5.0 in. Hg

Comments:

Standard conditions of 29.92 in/Hg and 68° F

METHOD 2 VOLUMETRIC FLOW DATA

Project No:	382355	**Operating Level:**	Mid (Normal)
Company:	Primary Energy	**Run No.:**	2
Plant:	Cokenergy Facility	**Start Date:**	5/12/2020
Unit ID:	HRCC	**End Date:**	5/12/2020
Sample Location:	Stack 201	**Start Time:**	08:35
Pitot ID:	890A	**End Time:**	08:43
Pitot Coefficient:	0.84	**RM Testers:**	Rome Rothgeb

Test Parameters		
P_{bar} - Barometric pressure, inches Hg		29.28
P_g - Stack Pressure, inches of H_2O		-2.00
P_s - Absolute stack pressure, inches Hg		29.13
T_s - Average stack temperature, ^oF		272.4
Gas Molecular Weight Method:	% CO_2:	6.011
Method 3A, Instrumental	% O_2:	11.840
	% Nitrogen:	82.149
M_d - dry basis lb/lb mole		29.44
M_s - wet basis lb/lb mole		27.88
Stack Diameter, Feet		18.00
A - Cross Sectional Area of Stack, Ft^2		254.47
B_{ws} - Moisture content fraction		0.136

Moisture Determination	
Method Used:	4
Meter Calibration:	0.992
Initial Meter Volume (cf)	8.280
Final Meter Volume (cf)	31.124
Meter Temperature, deg F:	70.8
Meter Volume Vm(std):	22.165
Meter Volume Vw(std):	3.480
Delta H:	1.90
Train Initial Weight, g:	2669.6
Train Final Weight, g:	2743.4
Condensate Initial Vol, mL:	0.0
Condensate Final Vol, mL:	0.0

Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)	Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)
A	**01**	1.70	1.3038	270	88.76	**C**	**01**	1.70	1.3038	273	88.94
A	**02**	1.90	1.3784	273	94.03	**C**	**02**	1.70	1.3038	273	88.94
A	**03**	2.10	1.4491	273	98.85	**C**	**03**	1.60	1.2649	273	86.29
A	**04**	1.80	1.3416	272	91.46	**C**	**04**	1.10	1.0488	271	71.45
B	**01**	1.40	1.1832	273	80.71	**D**	**01**	1.80	1.3416	272	91.46
B	**02**	1.60	1.2649	273	86.29	**D**	**02**	2.20	1.4832	272	101.11
B	**03**	1.70	1.3038	273	88.94	**D**	**03**	2.10	1.4491	273	98.85
B	**04**	1.50	1.2247	272	83.49	**D**	**04**	1.70	1.3038	272	88.88

Method 2 Results	
Average ΔP	1.7250
Average Sqrt ΔP	1.3093
Average Velocity (ft/sec)	89.28
No WAF Applied to this Test	
Actual cubic feet per minute (ACFM)	1,363,086
Standard cubic feet per minute (SCFM)	956,856
Standard cubic feet per hour (SCFH)	57,411,343
Dry Standard cubic feet per minute (DSCFM)	827,021
Dry Standard cubic feet per hour (DSCFH)	49,621,257

Leak Checks:

Pitot: Pre-Test: Pass

Post-Test: Pass

Moisture Train:

Pre-Test: 0.000 CFM @ 5.0 in. Hg

Post-Test: 0.000 CFM @ 5.0 in. Hg

Comments:

Standard conditions of 29.92 in/Hg and 68º F

METHOD 2 VOLUMETRIC FLOW DATA

Project No:	382355	**Operating Level:**	Mid (Normal)
Company:	Primary Energy	**Run No.:**	3
Plant:	Cokenergy Facility	**Start Date:**	5/12/2020
Unit ID:	HRCC	**End Date:**	5/12/2020
Sample Location:	Stack 201	**Start Time:**	09:15
Pitot ID:	890A	**End Time:**	09:23
Pitot Coefficient:	0.84	**RM Testers:**	Rome Rothgeb

Test Parameters		
P_{bar} - Barometric pressure, inches Hg		29.26
P_g - Stack Pressure, inches of H_2O		-2.00
P_s - Absolute stack pressure, inches Hg		29.11
T_s - Average stack temperature, ^oF		272.3
Gas Molecular Weight Method:	% CO_2:	5.981
Method 3A, Instrumental	% O_2:	11.920
	% Nitrogen:	82.099
M_d - dry basis lb/lb mole		29.43
M_s - wet basis lb/lb mole		27.88
Stack Diameter, Feet		18.00
A - Cross Sectional Area of Stack, Ft^2		254.47
B_{ws} - Moisture content fraction		0.136

Moisture Determination	
Method Used:	4
Meter Calibration:	0.992
Initial Meter Volume (cf)	8.280
Final Meter Volume (cf)	31.124
Meter Temperature, deg F:	70.8
Meter Volume Vm(std):	22.150
Meter Volume Vw(std):	3.480
Delta H:	1.90
Train Initial Weight, g:	2669.6
Train Final Weight, g:	2743.4
Condensate Initial Vol, mL:	0.0
Condensate Final Vol, mL:	0.0

Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)	Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)
A	**01**	1.80	1.3416	270	91.37	**C**	**01**	1.50	1.2247	273	83.58
A	**02**	1.90	1.3784	272	94.00	**C**	**02**	1.60	1.2649	273	86.32
A	**03**	2.00	1.4142	272	96.44	**C**	**03**	1.50	1.2247	273	83.58
A	**04**	1.60	1.2649	272	86.26	**C**	**04**	1.10	1.0488	271	71.47
B	**01**	1.40	1.1832	273	80.74	**D**	**01**	1.80	1.3416	273	91.56
B	**02**	1.70	1.3038	273	88.98	**D**	**02**	2.10	1.4491	273	98.89
B	**03**	1.70	1.3038	273	88.98	**D**	**03**	1.90	1.3784	273	94.06
B	**04**	1.20	1.0954	272	74.70	**D**	**04**	1.70	1.3038	271	88.85

Method 2 Results	
Average ΔP	1.6563
Average Sqrt ΔP	1.2826
Average Velocity (ft/sec)	87.49
No WAF Applied to this Test	
Actual cubic feet per minute (ACFM)	1,335,743
Standard cubic feet per minute (SCFM)	937,098
Standard cubic feet per hour (SCFH)	56,225,856
Dry Standard cubic feet per minute (DSCFM)	809,869
Dry Standard cubic feet per hour (DSCFH)	48,592,143

Leak Checks:

Pitot: Pre-Test: Pass

Post-Test: Pass

Moisture Train:

Pre-Test: 0.000 CFM @ 5.0 in. Hg

Post-Test: 0.000 CFM @ 5.0 in. Hg

Comments:

Standard conditions of 29.92 in/Hg and 68º F

METHOD 2 VOLUMETRIC FLOW DATA

Project No:	382355	**Operating Level:**	Mid (Normal)
Company:	Primary Energy	**Run No.:**	4
Plant:	Cokenergy Facility	**Start Date:**	5/12/2020
Unit ID:	HRCC	**End Date:**	5/12/2020
Sample Location:	Stack 201	**Start Time:**	09:48
Pitot ID:	890A	**End Time:**	09:55
Pitot Coefficient:	0.84	**RM Testers:**	Rome Rothgeb

Test Parameters		
P_{bar} - Barometric pressure, inches Hg		29.28
P_g - Stack Pressure, inches of H_2O		-2.00
P_s - Absolute stack pressure, inches Hg		29.13
T_s - Average stack temperature, ^oF		271.8
Gas Molecular Weight Method:	% CO_2:	5.968
Method 3A, Instrumental	% O_2:	11.934
	% Nitrogen:	82.098
M_d - dry basis lb/lb mole		29.43
M_s - wet basis lb/lb mole		27.90
Stack Diameter, Feet		18.00
A - Cross Sectional Area of Stack, Ft^2		254.47
B_{ws} - Moisture content fraction		0.134

Moisture Determination	
Method Used:	4
Meter Calibration:	0.992
Initial Meter Volume (cf)	33.331
Final Meter Volume (cf)	56.140
Meter Temperature, deg F:	73.7
Meter Volume Vm(std):	22.011
Meter Volume Vw(std):	3.404
Delta H:	1.90
Train Initial Weight, g:	2743.4
Train Final Weight, g:	2815.6
Condensate Initial Vol, mL:	0.0
Condensate Final Vol, mL:	0.0

Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)
A	**01**	1.70	1.3038	272	88.85
A	**02**	1.80	1.3416	272	91.43
A	**03**	2.00	1.4142	272	96.37
A	**04**	1.60	1.2649	271	86.14
B	**01**	1.50	1.2247	272	83.46
B	**02**	1.70	1.3038	272	88.85
B	**03**	1.70	1.3038	272	88.85
B	**04**	1.40	1.1832	271	80.58
C	**01**	1.70	1.3038	272	88.85
C	**02**	1.50	1.2247	272	83.46
C	**03**	1.60	1.2649	272	86.20
C	**04**	1.10	1.0488	271	71.42
D	**01**	1.70	1.3038	272	88.85
D	**02**	2.00	1.4142	272	96.37
D	**03**	1.80	1.3416	272	91.43
D	**04**	1.70	1.3038	272	88.85

Method 2 Results	
Average ΔP	1.6563
Average Sqrt ΔP	1.2841
Average Velocity (ft/sec)	87.50
No WAF Applied to this Test	
Actual cubic feet per minute (ACFM)	1,335,944
Standard cubic feet per minute (SCFM)	938,524
Standard cubic feet per hour (SCFH)	56,311,412
Dry Standard cubic feet per minute (DSCFM)	812,811
Dry Standard cubic feet per hour (DSCFH)	48,768,683

Leak Checks:

Pitot: Pre-Test: Pass

Post-Test: Pass

Moisture Train:

Pre-Test: 0.000 CFM @ 5.0 in. Hg

Post-Test: 0.000 CFM @ 5.0 in. Hg

Comments:

Standard conditions of 29.92 in/Hg and 68º F

METHOD 2 VOLUMETRIC FLOW DATA

Project No:	382355	**Operating Level:**	Mid (Normal)
Company:	Primary Energy	**Run No.:**	5
Plant:	Cokenergy Facility	**Start Date:**	5/12/2020
Unit ID:	HRCC	**End Date:**	5/12/2020
Sample Location:	Stack 201	**Start Time:**	10:21
Pitot ID:	890A	**End Time:**	10:28
Pitot Coefficient:	0.84	**RM Testers:**	Rome Rothgeb

Test Parameters		
P_{bar} - Barometric pressure, inches Hg		29.26
P_g - Stack Pressure, inches of H_2O		-2.00
P_s - Absolute stack pressure, inches Hg		29.11
T_s - Average stack temperature, ^oF		271.8
Gas Molecular Weight Method:	% CO_2:	5.857
Method 3A, Instrumental	% O_2:	12.130
	% Nitrogen:	82.013
M_d - dry basis lb/lb mole		29.42
M_s - wet basis lb/lb mole		27.89
Stack Diameter, Feet		18.00
A - Cross Sectional Area of Stack, Ft^2		254.47
B_{ws} - Moisture content fraction		0.134

Moisture Determination	
Method Used:	4
Meter Calibration:	0.992
Initial Meter Volume (cf)	33.331
Final Meter Volume (cf)	56.140
Meter Temperature, deg F:	73.7
Meter Volume Vm(std):	21.996
Meter Volume Vw(std):	3.404
Delta H:	1.90
Train Initial Weight, g:	2743.4
Train Final Weight, g:	2815.6
Condensate Initial Vol, mL:	0.0
Condensate Final Vol, mL:	0.0

Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)
A	**01**	1.70	1.3038	272	88.90
A	**02**	1.80	1.3416	272	91.48
A	**03**	1.90	1.3784	272	93.98
A	**04**	1.50	1.2247	271	83.45
B	**01**	1.50	1.2247	272	83.51
B	**02**	1.50	1.2247	272	83.51
B	**03**	1.70	1.3038	272	88.90
B	**04**	1.30	1.1402	271	77.69
C	**01**	1.50	1.2247	272	83.51
C	**02**	1.50	1.2247	272	83.51
C	**03**	1.40	1.1832	272	80.67
C	**04**	0.91	0.9539	271	65.00
D	**01**	2.20	1.4832	272	101.13
D	**02**	2.00	1.4142	272	96.42
D	**03**	1.70	1.3038	272	88.90
D	**04**	1.70	1.3038	271	88.84

Method 2 Results	
Average ΔP	1.6131
Average Sqrt ΔP	1.2646
Average Velocity (ft/sec)	86.21
No WAF Applied to this Test	
Actual cubic feet per minute (ACFM)	1,316,266
Standard cubic feet per minute (SCFM)	924,143
Standard cubic feet per hour (SCFH)	55,448,592
Dry Standard cubic feet per minute (DSCFM)	800,284
Dry Standard cubic feet per hour (DSCFH)	48,017,059

Leak Checks:

Pitot: Pre-Test: Pass

Post-Test: Pass

Moisture Train:

Pre-Test: 0.000 CFM @ 5.0 in. Hg

Post-Test: 0.000 CFM @ 5.0 in. Hg

Comments:

Standard conditions of 29.92 in/Hg and 68º F

METHOD 2 VOLUMETRIC FLOW DATA

Project No:	382355	**Operating Level:**	Mid (Normal)
Company:	Primary Energy	**Run No.:**	6
Plant:	Cokenergy Facility	**Start Date:**	5/12/2020
Unit ID:	HRCC	**End Date:**	5/12/2020
Sample Location:	Stack 201	**Start Time:**	10:53
Pitot ID:	890A	**End Time:**	11:01
Pitot Coefficient:	0.84	**RM Testers:**	Rome Rothgeb

Test Parameters		
P_{bar} - Barometric pressure, inches Hg		29.26
P_g - Stack Pressure, inches of H_2O		-2.00
P_s - Absolute stack pressure, inches Hg		29.11
T_s - Average stack temperature, ^oF		271.8
Gas Molecular Weight Method:	% CO_2:	5.795
Method 3A, Instrumental	% O_2:	12.246
	% Nitrogen:	81.959
M_d - dry basis lb/lb mole		29.42
M_s - wet basis lb/lb mole		27.95
Stack Diameter, Feet		18.00
A - Cross Sectional Area of Stack, Ft^2		254.47
B_{ws} - Moisture content fraction		0.129

Moisture Determination	
Method Used:	4
Meter Calibration:	0.992
Initial Meter Volume (cf)	56.350
Final Meter Volume (cf)	79.209
Meter Temperature, deg F:	70.5
Meter Volume Vm(std):	22.177
Meter Volume Vw(std):	3.277
Delta H:	1.90
Train Initial Weight, g:	2654.6
Train Final Weight, g:	2724.1
Condensate Initial Vol, mL:	0.0
Condensate Final Vol, mL:	0.0

Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)
A	**01**	1.90	1.3784	272	93.89
A	**02**	1.80	1.3416	272	91.38
A	**03**	1.80	1.3416	272	91.38
A	**04**	1.50	1.2247	271	83.37
B	**01**	1.50	1.2247	272	83.42
B	**02**	1.60	1.2649	272	86.16
B	**03**	1.50	1.2247	272	83.42
B	**04**	1.00	1.0000	271	68.07

Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)
C	**01**	1.30	1.1402	272	77.66
C	**02**	1.60	1.2649	272	86.16
C	**03**	1.70	1.3038	272	88.81
C	**04**	1.40	1.1832	271	80.54
D	**01**	1.70	1.3038	272	88.81
D	**02**	1.80	1.3416	272	91.38
D	**03**	1.90	1.3784	272	93.89
D	**04**	1.50	1.2247	271	83.37

Method 2 Results	
Average ΔP	1.5938
Average Sqrt ΔP	1.2589
Average Velocity (ft/sec)	85.73
No WAF Applied to this Test	
Actual cubic feet per minute (ACFM)	1,308,953
Standard cubic feet per minute (SCFM)	919,009
Standard cubic feet per hour (SCFH)	55,140,530
Dry Standard cubic feet per minute (DSCFM)	800,695
Dry Standard cubic feet per hour (DSCFH)	48,041,710

Leak Checks:

Pitot: Pre-Test: Pass

Post-Test: Pass

Moisture Train:

Pre-Test: 0.000 CFM @ 5.0 in. Hg

Post-Test: 0.000 CFM @ 5.0 in. Hg

Comments:

Standard conditions of 29.92 in/Hg and 68º F

METHOD 2 VOLUMETRIC FLOW DATA

Project No:	382355	**Operating Level:**	Mid (Normal)
Company:	Primary Energy	**Run No.:**	7
Plant:	Cokenergy Facility	**Start Date:**	5/12/2020
Unit ID:	HRCC	**End Date:**	5/12/2020
Sample Location:	Stack 201	**Start Time:**	11:25
Pitot ID:	890A	**End Time:**	11:35
Pitot Coefficient:	0.84	**RM Testers:**	Rome Rothgeb

Test Parameters		
P_{bar} - Barometric pressure, inches Hg		29.26
P_g - Stack Pressure, inches of H_2O		-2.00
P_s - Absolute stack pressure, inches Hg		29.11
T_s - Average stack temperature, ^oF		270.9
Gas Molecular Weight Method:	% CO_2:	5.754
Method 3A, Instrumental	% O_2:	12.356
	% Nitrogen:	81.890
M_d - dry basis lb/lb mole		29.41
M_s - wet basis lb/lb mole		27.95
Stack Diameter, Feet		18.00
A - Cross Sectional Area of Stack, Ft^2		254.47
B_{ws} - Moisture content fraction		0.129

Moisture Determination	
Method Used:	4
Meter Calibration:	0.992
Initial Meter Volume (cf)	56.350
Final Meter Volume (cf)	79.209
Meter Temperature, deg F:	70.5
Meter Volume Vm(std):	22.177
Meter Volume Vw(std):	3.277
Delta H:	1.90
Train Initial Weight, g:	2654.6
Train Final Weight, g:	2724.1
Condensate Initial Vol, mL:	0.0
Condensate Final Vol, mL:	0.0

Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)
A	**01**	1.50	1.2247	271	83.37
A	**02**	1.70	1.3038	271	88.75
A	**03**	1.90	1.3784	271	93.83
A	**04**	1.70	1.3038	271	88.75
B	**01**	1.50	1.2247	271	83.37
B	**02**	1.50	1.2247	271	83.37
B	**03**	1.60	1.2649	271	86.10
B	**04**	1.30	1.1402	271	77.61
C	**01**	1.40	1.1832	271	80.54
C	**02**	1.40	1.1832	271	80.54
C	**03**	1.60	1.2649	271	86.10
C	**04**	1.10	1.0488	271	71.39
D	**01**	1.80	1.3416	271	91.33
D	**02**	1.90	1.3784	271	93.83
D	**03**	1.90	1.3784	271	93.83
D	**04**	1.70	1.3038	270	88.69

Method 2 Results	
Average ΔP	1.5938
Average Sqrt ΔP	1.2592
Average Velocity (ft/sec)	85.71
No WAF Applied to this Test	
Actual cubic feet per minute (ACFM)	1,308,676
Standard cubic feet per minute (SCFM)	919,835
Standard cubic feet per hour (SCFH)	55,190,129
Dry Standard cubic feet per minute (DSCFM)	801,415
Dry Standard cubic feet per hour (DSCFH)	48,084,924

Leak Checks:

Pitot: Pre-Test: Pass

Post-Test: Pass

Moisture Train:

Pre-Test: 0.000 CFM @ 5.0 in. Hg

Post-Test: 0.000 CFM @ 5.0 in. Hg

Comments:

Standard conditions of 29.92 in/Hg and 68º F

METHOD 2 VOLUMETRIC FLOW DATA

Project No:	382355	**Operating Level:**	Mid (Normal)
Company:	Primary Energy	**Run No.:**	8
Plant:	Cokenergy Facility	**Start Date:**	5/12/2020
Unit ID:	HRCC	**End Date:**	5/12/2020
Sample Location:	Stack 201	**Start Time:**	11:57
Pitot ID:	890A	**End Time:**	12:04
Pitot Coefficient:	0.84	**RM Testers:**	Rome Rothgeb

Test Parameters		
P_{bar} - Barometric pressure, inches Hg		29.28
P_g - Stack Pressure, inches of H_2O		-2.00
P_s - Absolute stack pressure, inches Hg		29.13
T_s - Average stack temperature, ^oF		270.3
Gas Molecular Weight Method:	% CO_2:	5.590
Method 3A, Instrumental	% O_2:	12.637
	% Nitrogen:	81.773
M_d - dry basis lb/lb mole		29.40
M_s - wet basis lb/lb mole		27.91
Stack Diameter, Feet		18.00
A - Cross Sectional Area of Stack, Ft^2		254.47
B_{ws} - Moisture content fraction		0.130

Moisture Determination	
Method Used:	4
Meter Calibration:	0.992
Initial Meter Volume (cf)	79.409
Final Meter Volume (cf)	102.230
Meter Temperature, deg F:	70.3
Meter Volume Vm(std):	22.163
Meter Volume Vw(std):	3.324
Delta H:	1.90
Train Initial Weight, g:	2697.9
Train Final Weight, g:	2768.4
Condensate Initial Vol, mL:	0.0
Condensate Final Vol, mL:	0.0

Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)	Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)
A	**01**	2.00	1.4142	270	96.22	**C**	**01**	1.50	1.2247	271	83.39
A	**02**	1.80	1.3416	270	91.28	**C**	**02**	1.50	1.2247	271	83.39
A	**03**	1.80	1.3416	271	91.35	**C**	**03**	1.60	1.2649	271	86.12
A	**04**	1.70	1.3038	270	88.71	**C**	**04**	1.20	1.0954	269	74.48
B	**01**	1.50	1.2247	271	83.39	**D**	**01**	1.70	1.3038	271	88.77
B	**02**	1.60	1.2649	271	86.12	**D**	**02**	1.70	1.3038	271	88.77
B	**03**	1.50	1.2247	270	83.33	**D**	**03**	2.00	1.4142	271	96.29
B	**04**	1.00	1.0000	267	67.90	**D**	**04**	1.50	1.2247	270	83.33

Method 2 Results	
Average ΔP	1.6000
Average Sqrt ΔP	1.2608
Average Velocity (ft/sec)	85.80
No WAF Applied to this Test	
Actual cubic feet per minute (ACFM)	1,310,004
Standard cubic feet per minute (SCFM)	922,190
Standard cubic feet per hour (SCFH)	55,331,418
Dry Standard cubic feet per minute (DSCFM)	801,918
Dry Standard cubic feet per hour (DSCFH)	48,115,083

Leak Checks:

Pitot: Pre-Test: Pass

Post-Test: Pass

Moisture Train:

Pre-Test: 0.000 CFM @ 5.0 in. Hg

Post-Test: 0.000 CFM @ 5.0 in. Hg

Comments:

Standard conditions of 29.92 in/Hg and 68º F

METHOD 2 VOLUMETRIC FLOW DATA

Project No:	382355	**Operating Level:**	Mid (Normal)
Company:	Primary Energy	**Run No.:**	9
Plant:	Cokenergy Facility	**Start Date:**	5/12/2020
Unit ID:	HRCC	**End Date:**	5/12/2020
Sample Location:	Stack 201	**Start Time:**	12:30
Pitot ID:	890A	**End Time:**	12:39
Pitot Coefficient:	0.84	**RM Testers:**	Rome Rothgeb

Test Parameters		
P_{bar} - Barometric pressure, inches Hg		29.26
P_g - Stack Pressure, inches of H_2O		-2.00
P_s - Absolute stack pressure, inches Hg		29.11
T_s - Average stack temperature, °F		269.7
Gas Molecular Weight Method:	% CO_2:	5.518
Method 3A, Instrumental	% O_2:	12.749
	% Nitrogen:	81.733
M_d - dry basis lb/lb mole		29.39
M_s - wet basis lb/lb mole		27.91
Stack Diameter, Feet		18.00
A - Cross Sectional Area of Stack, Ft^2		254.47
B_{ws} - Moisture content fraction		0.130

Moisture Determination	
Method Used:	4
Meter Calibration:	0.992
Initial Meter Volume (cf)	79.409
Final Meter Volume (cf)	102.230
Meter Temperature, deg F:	70.3
Meter Volume Vm(std):	22.148
Meter Volume Vw(std):	3.324
Delta H:	1.90
Train Initial Weight, g:	2697.9
Train Final Weight, g:	2768.4
Condensate Initial Vol, mL:	0.0
Condensate Final Vol, mL:	0.0

Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)
A	**01**	1.70	1.3038	270	88.75
A	**02**	1.80	1.3416	270	91.33
A	**03**	2.10	1.4491	270	98.64
A	**04**	1.40	1.1832	269	80.49
B	**01**	1.50	1.2247	270	83.37
B	**02**	1.50	1.2247	270	83.37
B	**03**	1.70	1.3038	270	88.75
B	**04**	1.30	1.1402	269	77.56

Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)
C	**01**	1.40	1.1832	270	80.54
C	**02**	1.50	1.2247	270	83.37
C	**03**	1.50	1.2247	270	83.37
C	**04**	1.10	1.0488	269	71.34
D	**01**	1.80	1.3416	270	91.33
D	**02**	1.90	1.3784	270	93.83
D	**03**	2.00	1.4142	270	96.27
D	**04**	1.50	1.2247	268	83.26

Method 2 Results	
Average ΔP	1.6063
Average Sqrt ΔP	1.2632
Average Velocity (ft/sec)	85.97
No WAF Applied to this Test	
Actual cubic feet per minute (ACFM)	1,312,632
Standard cubic feet per minute (SCFM)	924,197
Standard cubic feet per hour (SCFH)	55,451,793
Dry Standard cubic feet per minute (DSCFM)	803,591
Dry Standard cubic feet per hour (DSCFH)	48,215,481

Leak Checks:

Pitot: Pre-Test: Pass

Post-Test: Pass

Moisture Train:

Pre-Test: 0.000 CFM @ 5.0 in. Hg

Post-Test: 0.000 CFM @ 5.0 in. Hg

Comments:

Standard conditions of 29.92 in/Hg and 68° F

METHOD 2 VOLUMETRIC FLOW DATA

Project No:	382355	**Operating Level:**	Mid (Normal)
Company:	Primary Energy	**Run No.:**	10
Plant:	Cokenergy Facility	**Start Date:**	5/12/2020
Unit ID:	HRCC	**End Date:**	5/12/2020
Sample Location:	Stack 201	**Start Time:**	13:03
Pitot ID:	890A	**End Time:**	13:09
Pitot Coefficient:	0.84	**RM Testers:**	Rome Rothgeb

Test Parameters		
P_{bar} - Barometric pressure, inches Hg		29.28
P_g - Stack Pressure, inches of H_2O		-2.00
P_s - Absolute stack pressure, inches Hg		29.13
T_s - Average stack temperature, °F		269.8
Gas Molecular Weight Method:	% CO_2:	5.506
Method 3A, Instrumental	% O_2:	12.765
	% Nitrogen:	81.729
M_d - dry basis lb/lb mole		29.39
M_s - wet basis lb/lb mole		27.92
Stack Diameter, Feet		18.00
A - Cross Sectional Area of Stack, Ft^2		254.47
B_{ws} - Moisture content fraction		0.129

Moisture Determination	
Method Used:	4
Meter Calibration:	0.992
Initial Meter Volume (cf)	2.454
Final Meter Volume (cf)	25.216
Meter Temperature, deg F:	69.4
Meter Volume Vm(std):	22.144
Meter Volume Vw(std):	3.272
Delta H:	1.90
Train Initial Weight, g:	2661.8
Train Final Weight, g:	2731.2
Condensate Initial Vol, mL:	0.0
Condensate Final Vol, mL:	0.0

Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)	Port	Point	ΔP (in. H_2O)	√ΔP	Temp (°F)	Velocity (V_S)
A	**01**	2.10	1.4491	270	98.58	**C**	**01**	1.50	1.2247	270	83.31
A	**02**	1.80	1.3416	270	91.26	**C**	**02**	1.50	1.2247	270	83.31
A	**03**	1.90	1.3784	270	93.77	**C**	**03**	1.40	1.1832	270	80.49
A	**04**	1.50	1.2247	270	83.31	**C**	**04**	1.30	1.1402	269	77.51
B	**01**	1.40	1.1832	270	80.49	**D**	**01**	1.90	1.3784	270	93.77
B	**02**	1.40	1.1832	270	80.49	**D**	**02**	1.90	1.3784	270	93.77
B	**03**	1.60	1.2649	270	86.05	**D**	**03**	2.00	1.4142	270	96.20
B	**04**	1.40	1.1832	269	80.43	**D**	**04**	1.50	1.2247	269	83.26

Method 2 Results	
Average ΔP	1.6313
Average Sqrt ΔP	1.2736
Average Velocity (ft/sec)	86.62
No WAF Applied to this Test	
Actual cubic feet per minute (ACFM)	1,322,578
Standard cubic feet per minute (SCFM)	931,680
Standard cubic feet per hour (SCFH)	55,900,791
Dry Standard cubic feet per minute (DSCFM)	811,729
Dry Standard cubic feet per hour (DSCFH)	48,703,739

Leak Checks:

Pitot: Pre-Test: Pass

Post-Test: Pass

Moisture Train:

Pre-Test: 0.000 CFM @ 5.0 in. Hg

Post-Test: 0.000 CFM @ 5.0 in. Hg

Comments:

Standard conditions of 29.92 in/Hg and 68° F

Method 4 Test Run Data Summary

Company: Primary Energy
Plant: Cokenergy Facility
Unit: HRCC
Location: Stack 201

Test Run Number	1	2	3	4	5	6	Average
Source Condition	> 50% Load	> 50% Load	> 50% Load	> 50% Load	> 50% Load	> 50% Load	
Date	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	5/12/20	
Start Time	7:45	8:35	9:40	10:50	11:45	12:45	
End Time	8:15	9:05	10:10	11:20	12:15	13:15	
Sample Duration (min):	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Gas CO_2 Content (%v/v dry):	6.059	5.996	5.913	5.775	5.554	5.506	5.800
Gas O_2 Content (%v/v dry):	11.700	11.880	12.032	12.301	12.693	12.765	12.229
Gas N_2 Content (%v/v dry):	82.241	82.124	82.056	81.925	81.753	81.729	81.971
Gas Dry MW, M_d (lb/lb-mole):	29.44	29.43	29.43	29.42	29.40	29.39	29.42
Gas Wet MW, M_s (lb/lb-mole):	27.86	27.88	27.90	27.95	27.91	27.92	27.90
Barometric Pressure, P_{bar} ("Hg)	29.28	29.28	29.26	29.26	29.28	29.26	29.27
Flue Pressure, P_s ("Hg)	29.13	29.13	29.11	29.11	29.13	29.11	29.12
Meter Y	0.992	0.992	0.992	0.992	0.992	0.992	0.992
Meter Pressure, P_m ("H_2O):	1.90	1.90	1.90	1.90	1.90	1.90	1.90
Meter Temperature, T_m (^oF):	67.8	70.8	73.7	70.5	70.3	69.4	70.4
Meter Volume, V_m (dcf):	22.783	22.844	22.809	22.859	22.821	22.762	22.813
Meter Volume, V_m (L):	645.143	646.870	645.879	647.295	646.219	644.548	645.992
Meter Volume, V_m (dcm):	0.645	0.647	0.646	0.647	0.646	0.645	0.646
Meter Volume, $V_{m(std)}$ (dscf):	22.230	22.167	21.997	22.177	22.162	22.128	22.143
Meter Volume, $V_{m(std)}$ (dscm):	0.629	0.628	0.623	0.628	0.628	0.627	0.627
Moisture Volume, $V_{wc(std)}$ (scf):	3.560	3.480	3.404	3.277	3.324	3.272	3.386
Fractional Moisture Content, B_{ws}:	0.138	0.136	0.134	0.129	0.130	0.129	0.133

Moisture Test Run Data

Company:	Primary Energy	**Project #:**	382355	**Console Operator:**	Rome Rothgeb
Plant:	Cokenergy Facility	**Test Method:**	4	**Console ID:**	E26
Unit ID:	HRCC	**Test Run #:**	1	**Meter Y :**	0.992
Location:	Stack 201	**Test Date(s):**	5/12/2020	**Orifice ΔH@i:**	1.808
				Probe Temp. °F	250
Unit Operating Mode:	> 50% Load	**Barometric Pressure ("Hg):**	29.28	**Static Pressure ("H_2O):**	-2.00

Pre Leak Check: 0.000 @ 5"

Post Leak Check: 0.000 @ 5"

		Dry Gas Meter						
Port & Point ID	Clock Time	Volume Cubic Feet	Pressure ("H_2O)	Inlet (^oF)	Outlet (^oF)	Vacuum ("Hg)	Impinger Outlet (^oF)	Stack (^oF)
	7:45:00	85.088	1.90	70.0	70.0	1.0	61.0	
	7:50:00	88.910	1.90	68.0	68.0	1.0	51.0	
	7:55:00	92.700	1.90	66.0	67.0	1.0	52.0	
	8:00:00	96.490	1.90	67.0	67.0	1.0	54.0	
	8:05:00	100.300	1.90	69.0	66.0	1.0	56.0	
	8:10:00	104.080	1.90	70.0	66.0	1.0	57.0	
	8:15:00	107.871						
	Net Volume:	22.783						
		Average:	1.90	67.8			55.2	

Moisture Data		
Impinger ID	Tare wt. (grams)	Final wt. (grams)
	717.0	776.7
	692.9	702.0
	559.0	559.8
	771.6	777.5
Net:		75.5

Gas Analysis (%v/v dry)		
	O_2	CO_2
	11.700	6.059
Average:	11.700	6.059

Moisture Test Run Data

Company:	Primary Energy	**Project #:**	382355	**Console Operator:**	Rome Rothgeb
Plant:	Cokenergy Facility	**Test Method:**	4	**Console ID:**	E26
Unit ID:	HRCC	**Test Run #:**	2	**Meter Y :**	0.992
Location:	Stack 201	**Test Date(s):**	5/12/2020	**Orifice ΔH@i:**	1.808
				Probe Temp. °F	250
Unit Operating Mode:	> 50% Load	**Barometric Pressure ("Hg):**	29.28	**Static Pressure ("H_2O):**	-2.00

Pre Leak Check: 0.000 @ 5"

Post Leak Check: 0.000 @ 5"

		Dry Gas Meter						
Port & Point ID	Clock Time	Volume Cubic Feet	Pressure ("H_2O)	Inlet (^oF)	Outlet (^oF)	Vacuum ("Hg)	Impinger Outlet (^oF)	Stack (^oF)
	8:35:00	8.280	1.90	69.0	68.0	1.0	64.0	
	8:40:00	12.090	1.90	72.0	68.0	1.0	57.0	
	8:45:00	15.890	1.90	73.0	69.0	1.0	56.0	
	8:50:00	19.690	1.90	73.0	69.0	1.0	56.0	
	8:55:00	23.500	1.90	74.0	69.0	1.0	57.0	
	9:00:00	27.320	1.90	75.0	70.0	1.0	59.0	
	9:05:00	31.124						
	Net Volume:	22.844						
		Average:	1.90	70.8			58.2	

Moisture Data		
Impinger ID	Tare wt. (grams)	Final wt. (grams)
	645.4	702.5
	702.0	711.2
	559.8	561.3
	762.4	768.4
Net:		73.8

	Gas Analysis (%v/v dry)	
	O_2	CO_2
	11.840	6.011
	11.920	5.981
Average:	11.880	5.996

Moisture Test Run Data

Company:	Primary Energy	**Project #:**	382355	**Console Operator:**	Rome Rothgeb
Plant:	Cokenergy Facility	**Test Method:**	4	**Console ID:**	E26
Unit ID:	HRCC	**Test Run #:**	3	**Meter Y :**	0.992
Location:	Stack 201	**Test Date(s):**	5/12/2020	**Orifice ΔH@i:**	1.808
				Probe Temp. °F	250
Unit Operating Mode:	> 50% Load	**Barometric Pressure ("Hg):**	29.26	**Static Pressure ("H_2O):**	-2.00

Pre Leak Check: 0.000 @ 5"

Post Leak Check: 0.000 @ 5"

		Dry Gas Meter						
Port & Point ID	Clock Time	Volume Cubic Feet	Pressure ("H_2O)	Inlet (^oF)	Outlet (^oF)	Vacuum ("Hg)	Impinger Outlet (^oF)	Stack (^oF)
	9:40:00	33.331	1.90	73.0	73.0	1.0	63.0	
	9:45:00	37.100	1.90	73.0	72.0	1.0	57.0	
	9:50:00	40.930	1.90	75.0	72.0	1.0	57.0	
	9:55:00	44.720	1.90	76.0	73.0	1.0	56.0	
	10:00:00	48.500	1.90	76.0	72.0	1.0	56.0	
	10:05:00	52.410	1.90	77.0	72.0	1.0	57.0	
	10:10:00	56.140						
	Net Volume:	22.809						
		Average:	1.90	73.7			57.7	

Moisture Data		
Impinger ID	Tare wt. (grams)	Final wt. (grams)
	702.5	760.5
	711.2	719.1
	561.3	563.0
	768.4	773.0
Net:		72.2

Gas Analysis (%v/v dry)	
O_2	CO_2
11.934	5.968
12.130	5.857
Average: 12.032	5.913

Moisture Test Run Data

Company:	Primary Energy	**Project #:**	382355	**Console Operator:**	Rome Rothgeb
Plant:	Cokenergy Facility	**Test Method:**	4	**Console ID:**	E26
Unit ID:	HRCC	**Test Run #:**	4	**Meter Y :**	0.992
Location:	Stack 201	**Test Date(s):**	5/12/2020	**Orifice ΔH@i:**	1.808
				Probe Temp. °F	250
Unit Operating Mode:	> 50% Load	**Barometric Pressure ("Hg):**	29.26	**Static Pressure ("H_2O):**	-2.00

Pre Leak Check: 0.000 @ 5"

Post Leak Check: 0.000 @ 5"

		Dry Gas Meter						
Port & Point ID	Clock Time	Volume Cubic Feet	Pressure ("H_2O)	Inlet (^oF)	Outlet (^oF)	Vacuum ("Hg)	Impinger Outlet (^oF)	Stack (^oF)
	10:50:00	56.350	1.90	71.0	70.0	1.0	64.0	
	10:55:00	60.140	1.90	70.0	70.0	1.0	55.0	
	11:00:00	63.940	1.90	72.0	71.0	1.0	56.0	
	11:05:00	67.740	1.90	71.0	69.0	1.0	55.0	
	11:10:00	71.580	1.90	71.0	69.0	1.0	57.0	
	11:15:00	75.400	1.90	73.0	69.0	1.0	58.0	
	11:20:00	79.209						
	Net Volume:	22.859						
		Average:	1.90	70.5			57.5	

Moisture Data		
Impinger ID	Tare wt. (grams)	Final wt. (grams)
	658.6	715.3
	660.0	667.3
	563.0	563.6
	773.0	777.9
Net:		69.5

Gas Analysis (%v/v dry)		
	O_2	CO_2
	12.246	5.795
	12.356	5.754
Average:	12.301	5.775

Moisture Test Run Data

Company:	Primary Energy	**Project #:**	382355	**Console Operator:**	Rome Rothgeb
Plant:	Cokenergy Facility	**Test Method:**	4	**Console ID:**	E26
Unit ID:	HRCC	**Test Run #:**	5	**Meter Y :**	0.992
Location:	Stack 201	**Test Date(s):**	5/12/2020	**Orifice ΔH@i:**	1.808
				Probe Temp. °F	250
Unit Operating Mode:	> 50% Load	**Barometric Pressure ("Hg):**	29.28	**Static Pressure ("H_2O):**	-2.00

Pre Leak Check: 0.000 @ 5"

Post Leak Check: 0.000 @ 5"

		Dry Gas Meter						
Port & Point ID	Clock Time	Volume Cubic Feet	Pressure ("H_2O)	Inlet (^oF)	Outlet (^oF)	Vacuum ("Hg)	Impinger Outlet (^oF)	Stack (^oF)
	11:45:00	79.409	1.90	70.0	71.0	1.0	60.0	
	11:50:00	83.220	1.90	70.0	70.0	1.0	55.0	
	11:55:00	87.020	1.90	70.0	70.0	1.0	54.0	
	12:00:00	90.840	1.90	71.0	69.0	1.0	55.0	
	12:05:00	94.630	1.90	72.0	69.0	1.0	58.0	
	12:10:00	98.440	1.90	73.0	69.0	1.0	59.0	
	12:15:00	102.230						
	Net Volume:	22.821						
		Average:	1.90	70.3			56.8	

Moisture Data		
Impinger ID	Tare wt. (grams)	Final wt. (grams)
	715.3	770.8
	667.3	674.6
	563.6	565.0
	751.7	758.0
Net:		70.5

Gas Analysis (%v/v dry)	
O_2	CO_2
12.637	5.590
12.749	5.518
Average: 12.693	5.554

Moisture Test Run Data

Company:	Primary Energy	**Project #:**	382355	**Console Operator:**	Rome Rothgeb
Plant:	Cokenergy Facility	**Test Method:**	4	**Console ID:**	E26
Unit ID:	HRCC	**Test Run #:**	6	**Meter Y :**	0.992
Location:	Stack 201	**Test Date(s):**	5/12/2020	**Orifice ΔH@i:**	1.808
				Probe Temp. °F	250
Unit Operating Mode:	> 50% Load	**Barometric Pressure ("Hg):**	29.26	**Static Pressure ("H_2O):**	-2.00

Pre Leak Check: 0.000 @ 5"

Post Leak Check: 0.000 @ 5"

		Dry Gas Meter						
Port & Point ID	Clock Time	Volume Cubic Feet	Pressure ("H_2O)	Inlet (^oF)	Outlet (^oF)	Vacuum ("Hg)	Impinger Outlet (^oF)	Stack (^oF)
	12:45:00	2.454	1.90	69.0	69.0	1.0	65.0	
	12:50:00	6.250	1.90	68.0	68.0	1.0	58.0	
	12:55:00	10.030	1.90	70.0	68.0	1.0	58.0	
	13:00:00	13.810	1.90	71.0	68.0	1.0	60.0	
	13:05:00	17.600	1.90	72.0	68.0	1.0	62.0	
	13:10:00	21.420	1.90	73.0	69.0	1.0	61.0	
	13:15:00	25.216						
	Net Volume:	22.762						
		Average:	1.90	69.4			60.7	

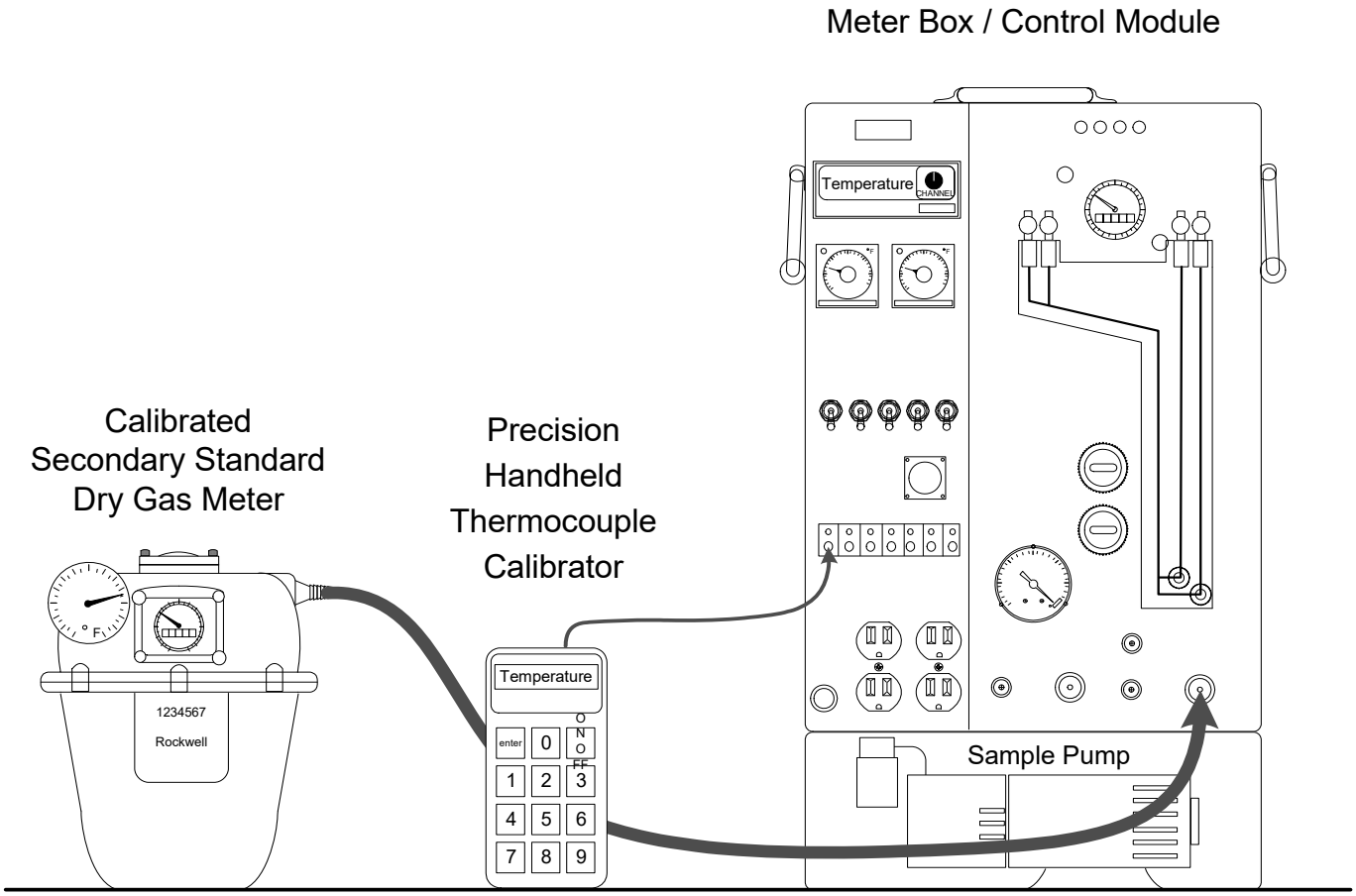
Moisture Data		
Impinger ID	Tare wt. (grams)	Final wt. (grams)
	664.2	718.0
	674.6	682.9
	565.0	566.8
	758.0	763.5
Net:		69.4

Gas Analysis (%v/v dry)	
O_2	CO_2
12.765	5.506
12.765	5.506

Average:

Equipment Configuration for Meter Box Calibration

USEPA Promulgated Method 5



Pre Test DGM Calibration

(before use, as left data)

Control Module I.D. No.	E-26	System Leak Check:	Passed @ 9" w.c. @ > 5 min.	Date:	01-10-2018
Standard Meter I.D. No.:	3623853	Standard Meter Calibration Date:	08-04-2017	Calibrated By:	L. Campo
Standard Meter (Y_{ds}):	0.9941	Standard Meter Calibration Due Date:	08-04-2018	Barometric Pressure :	29.38

Run Number	Orifice Setting in.H_20	Meter Pressure in.H_20	Standard Meter Volume Vr	Control Module DGM Volume Vd	Standard Meter Temp. F Tr	Dry Gas Meter Inlet Temp. F Tdi	Dry Gas Meter Outlet Temp. F Tdo	Dry Gas Meter Avg. Temp. F Td	Time Min.	Time Sec.	Gamma Correction Coef. Y	Pressure equal to: 0.75 cfm @ STP (DH@)	Flow Rate (Q) scfm
Initial			693.352	727.121	73	72	72						
Final			700.268	734.054	73	72	72						
Difference 1	0.35	0.35	6.916	6.933	73	72	72	72	20	13	0.989	1.733	0.33
Initial			685.079	718.893	73	72	72						
Final			692.951	726.725	73	72	72						
Difference 2	0.85	0.85	7.872	7.832	73	72	72	72	15	3	0.995	1.800	0.51
Initial			700.716	734.499	73	72	72						
Final			708.594	742.334	73	72	72						
Difference 3	2.00	2.00	7.878	7.835	73	72	72	72	10	4	0.993	1.892	0.76
								Pre Test Calibration Factor (Y_{avg})			0.992	1.808	

Specifications: CFR 40, Part 60, Appendix A, Method 5, section 10.3.1. Calibration Before Use.

Pre Test Temperature Indicator Calibration

(For K-Type Thermocouples)

Date: 01-10-2018

Name: L. Campo

Control Module Number: E-26

Ambient Temperature: 73 ^{o}F

Reference std. thermocouple calibrator: Omega Engineering, Inc. Model No. CL23A *****

Reference std. thermocouple calibrator serial number: T-236796

Date of reference std. calibration verification: 6/1/2017

Due date of reference std. calibration verification: 6/1/2018

Reference Thermometer (^{o}F)	Thermometer Under Test (^{o}F)	Temperature Difference (%)
0	1	0.2
600	600	0.0
1200	1199	0.1

$$\text{Temperature Difference, \%} = \frac{\text{Ref. std. temp. } (^{o}F + 460) - \text{Therm. under test temp. } (^{o}F + 460)}{\text{Reference std temp. } (^{o}F + 460)} \times 100 \leq 1.5\ \%$$

** Reference std. is directly traceable to NIST (National Institute of Standards and Technology)*

Field Calibration Tool Identification

Analyst:	Rome Rothgeb
Date:	5/11/2020
Project Number:	382355
Client:	Primary Energy
Test Location:	HRCC Stack 201

Calibration Tools: Include all of the tools from the field calibration kit that you will be using on this project. (See SOP AM-CAL-025 for instructions on re-verification)

Item	ID#	S/N	Calibration Due Date
Digital Caliper	DG004	--	3/19/2021
Thermometer	TH004	91221470	3/19/2021
Barometer	BA004	150494724	9/17/2020
Calibration Weight	W100-004	2345	3/19/2021
Calibration Weight A	W500-004A	9079	3/19/2021
Calibration Weight B	W500-004B	9083	3/19/2021
Type A Angle Finder	AF004	--	3/19/2021
Plastic/Magnetic Torpedo Level		--	--

Pre-Test Thermocouple Calibration Checks

Analyst:	Rome Rothgeb
Date:	5/11/2020
Project Number:	382355
Client:	Primary Energy
Test Location:	HRCC Stack 201

(See SOP AM-CAL-005 for instructions)

Console/Meter Box ID #	E26
Probe ID#	890
Test Location/Measurement Point Info:	HRCC Stack 201
NIST Thermometer ID #	TH004

Procedure 1: Calibrate thermocouple against a reference thermometer.

After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacturer, using a reference thermometer.

Procedure 2: Check the response of the thermocouple to a change in temperature.

Check the "continuity" of the thermocouple by subjecting it to a change in temperature (e.g., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections.

Measurement	T/C Temp, °F	NIST Thermometer Temp, °F	Difference, °F (± 2)	Continuity Check	Overall Status
Stack	55	55.3	0.3	Pass	Pass
Filter					
Impinger Exit	55	56.3	1.3	Pass	Pass
Meter in	56	55.8	0.2	Pass	Pass
Meter Out	55	55.1	0.1	Pass	Pass
Probe	55	55.4	0.4	Pass	Pass
Other					
Other					

Notes:

Post-Test Thermocouple Calibration Checks

Analyst:	Rome Rothgeb
Date:	5/12/2020
Project Number:	382355
Client:	Primary Energy
Test Location:	HRCC Stack 201

(See SOP AM-CAL-005 for instructions)

Console/Meter Box ID #	E26
Probe ID#	890
Test Location/Measurement Point Info:	HRCC Stack 201
NIST Thermometer ID #	TH004

Procedure 1: Calibrate thermocouple against a reference thermometer.

After each test run series, check the accuracy (and, hence, the calibration) of each thermocouple system at ambient temperature, or any other temperature, within the range specified by the manufacturer, using a reference thermometer.

Procedure 2: Check the response of the thermocouple to a change in temperature.

Check the "continuity" of the thermocouple by subjecting it to a change in temperature (e.g., removing it from the stack or touching an ice cube). This step will also check for loose connections and reversed connections.

Measurement	T/C Temp, °F	NIST Thermometer Temp, °F	Difference, °F (± 2)	Continuity Check	Overall Status
Stack	68	68.4	0.4	Pass	Pass
Filter					
Impinger Exit	68	68.8	0.8	Pass	Pass
Meter in	69	68.7	0.3	Pass	Pass
Meter Out	68	68.3	0.3	Pass	Pass
Probe	68	68.5	0.5	Pass	Pass
Other					
Other					

Notes:

PRE-TEST TYPE S PITOT TUBE INSPECTION

(See SOP AM-CAL-006 for Instructions)

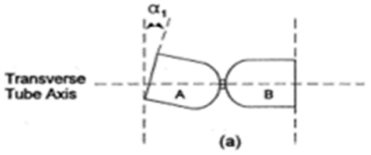
Pitot Tube No. : 890 Date: 5/11/2020 Analyst: Rome Rothgeb

Project Number: 382355 Client: Primary Energy Test Location: HRCC Stack 201

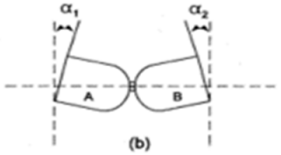
Type S Pitot tube face openings meet alignment specifications illustrated in Figures 2-2 and 2-3 of Method 2?

x yes _____ no

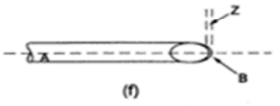
Comments: _____



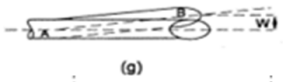
Limit:
$\alpha_1 < 10°$



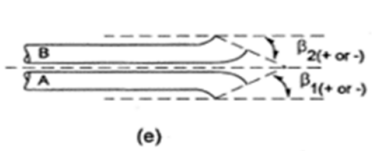
Limit:
$\alpha_2 < 10°$



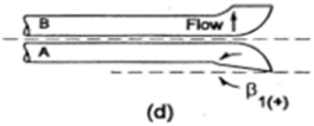
Limit:
$Z \leq 1/8\ (0.125)$ inch

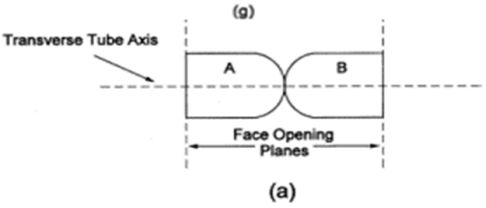


Limit:
$W \leq 1/32\ (0.0132)$ inch

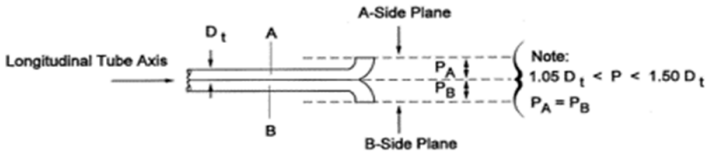


Limit:
$\beta_1 < 5°$
$\beta_2 < 5°$

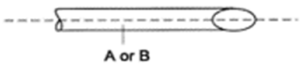




Requirement:
Face opening planes perpendicular to transverse axis



Requirement:
Face opening planes parallel to longitudinal axis



Requirement:
Both legs of equal length and centerlines coincident when viewed from both sides.

POST-TEST TYPE S PITOT TUBE INSPECTION

(See SOP AM-CAL-006 for Instructions)

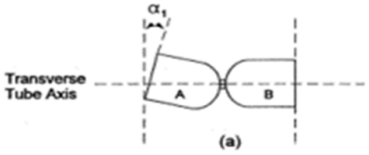
Pitot Tube No. : 890 Date: 5/12/2020 Analyst: Rome Rothgeb

Project Number: 382355 Client: Primary Energy Test Location: HRCC Stack 201

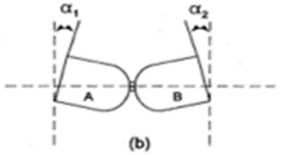
Type S Pitot tube face openings meet alignment specifications illustrated in Figures 2-2 and 2-3 of Method 2?

x yes _____ no

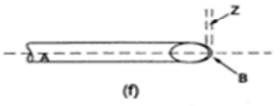
Comments: _____



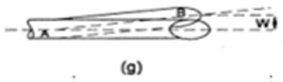
Limit:
$\alpha_1 < 10°$



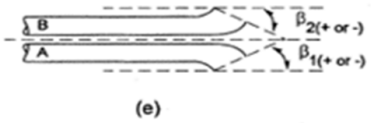
Limit:
$\alpha_2 < 10°$



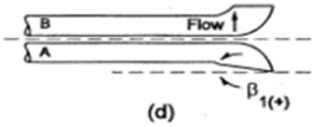
Limit:
$Z \leq 1/8\ (0.125)$ inch

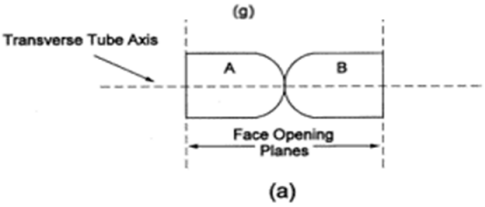


Limit:
$W \leq 1/32\ (0.0132)$ inch

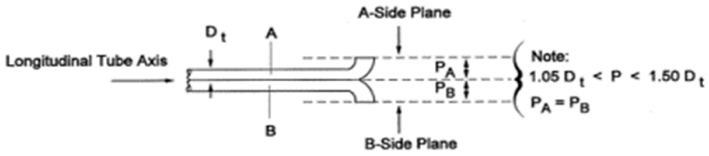


Limit:
$\beta_1 < 5°$
$\beta_2 < 5°$

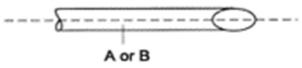




Requirement:
Face opening planes perpendicular to transverse axis



Requirement:
Face opening planes parallel to longitudinal axis



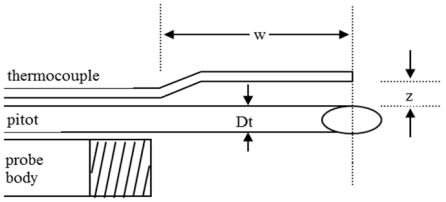
Requirement:
Both legs of equal length and centerlines coincident when viewed from both sides.

PRE-TEST PITOT TUBE ASSEMBLY INSPECTION

Analyst:	Rome Rothgeb
Date:	5/11/2020
Project Number:	382355
Test Location:	HRCC Stack 201
EPA Probe Configuration:	Method 2

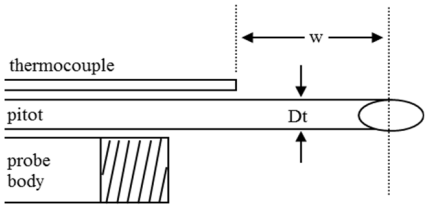
Pitot Assembly Intercomponent Spacings Meet Requirements x Yes ____ No
(See SOP AM-CAL-006 for Instructions)

Configuration A

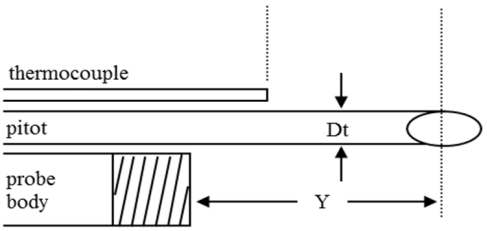


Requirements
D_t = ≥ 3/16" to ≤ 3/8"
W = ≥ 3 inches
Z = ≥ 0.75 inches

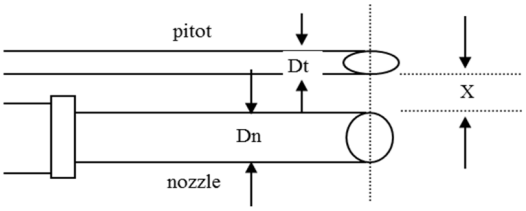
Configuration B



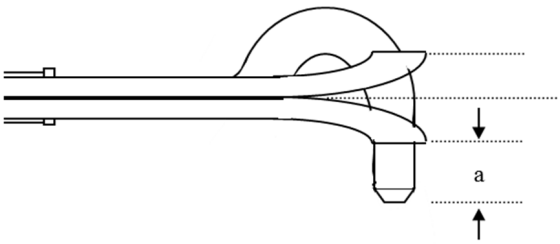
Requirements
D_t = ≥ 3/16" to ≤ 3/8"
W = ≥ 2 inches



Requirements
D_t = ≥ 3/16" to ≤ 3/8"



Requirements
D_t = ≥ 3/16" to ≤ 3/8"
X = ≥ 0.75 inches



Requirements

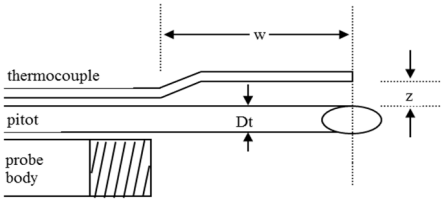
a = ≥ 0 inches

POST-TEST PITOT TUBE ASSEMBLY INSPECTION

Analyst:	Rome Rothgeb
Date:	5/12/2020
Project Number:	382355
Test Location:	HRCC Stack 201
EPA Probe Configuration:	Method 2

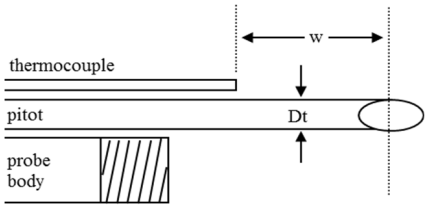
Pitot Assembly Intercomponent Spacings Meet Requirements x Yes ____ No
(See SOP AM-CAL-006 for Instructions)

Configuration A

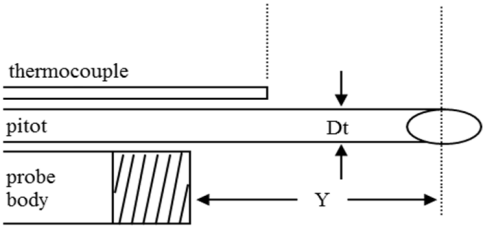


Requirements
D_t = ≥ 3/16" to ≤ 3/8"
W = ≥ 3 inches
Z = ≥ 0.75 inches

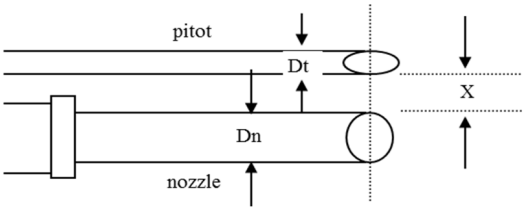
Configuration B



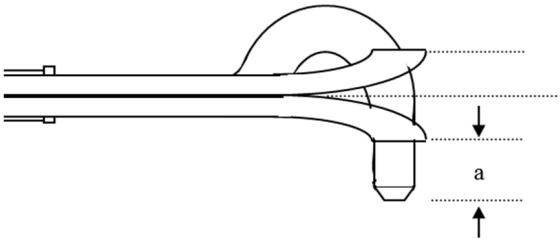
Requirements
D_t = ≥ 3/16" to ≤ 3/8"
W = ≥ 2 inches



Requirements
D_t = ≥ 3/16" to ≤ 3/8"



Requirements
D_t = ≥ 3/16" to ≤ 3/8"
X = ≥ 0.75 inches



Requirements

a = ≥ 0 inches

Top Loading Field Balance Check

Analyst:	Rome Rothgeb
Project Number:	382355
Client:	Primary Energy
Test Location:	HRCC Stack 201

(See SOP AM-CAL-009 for instructions)

Type of Scale	Lab Top-loading Scale
Scale ID#	3

Tolerance (g) = +/- 0.5

Date	Reference Weight Serial Number	Nominal Weight Value* (g)	Weight Found (g)	Difference	Pass
5/11/2020	9079	500.0	500.0	0.0	YES
5/12/2020	9079	500.0	500.0	0.0	YES

*Weight (ASTM Class 6 or better) must be at least 500 g or within 50 g of loaded impinger.

Primary Energy Cokenergy 2020 May 12

Response Time

Date/Time:	5/12/2020	6:55:07
Operator:	Gavin Lewis	
Plant:	Primary Energy Cokenergy	
Location:	Stack	
Source ID:	HRCC Stack 201	

Response Time Results

Analyte:	SO2		CO2		O2	
Units:	ppmvd		% dry		% dry	
Span:	452.600		17.720		22.260	
Range:	500		25		25	
Method:	EPA 7E		EPA 7E		EPA 7E	
Upscale Lvl:	189.134		8.325		9.524	
Dnscale Lvl:	22.630		0.886		1.113	
Upscale (s):	1:46		1:05		1:06	
Dnscale (s):	1:40		1:04		1:04	
	Upscale	Dnscale	Upscale	Dnscale	Upscale	Dnscale
	4.956	192.581	0.075	8.800	0.025	10.025
	4.956	192.581	0.075	8.800	0.025	10.025
	4.956	192.581	0.075	8.800	0.025	10.025
	4.956	192.581	0.075	8.800	0.025	10.025
	4.956	192.581	0.075	8.800	0.025	10.025
	4.956	192.581	0.075	8.800	0.025	10.025
	4.455	192.581	0.075	8.800	0.025	10.025
	4.455	192.581	0.075	8.800	0.025	10.025
	4.455	192.581	0.075	8.800	0.025	10.025
	4.455	194.083	0.075	8.800	0.025	10.025
	4.455	194.083	0.075	8.800	0.025	10.025
	4.455	194.083	0.075	8.800	0.025	10.025
	4.455	194.083	0.075	8.800	0.025	10.025
	4.455	194.083	0.075	8.800	0.025	10.025
	4.455	194.083	0.075	8.800	0.025	10.025
	4.455	194.083	0.075	8.800	0.025	10.025
	4.005	194.083	0.075	8.800	0.025	10.025
	4.005	194.083	0.075	8.823	0.025	10.025
	4.005	194.083	0.075	8.802	0.025	10.025
	4.005	196.586	0.075	8.800	0.025	10.025
	4.005	196.586	0.075	8.800	0.025	10.025
	4.005	196.586	0.075	8.823	0.025	10.025
	4.005	196.586	0.075	8.825	0.025	10.025
	4.005	196.586	0.075	8.802	0.025	10.025
	4.005	196.586	0.075	8.800	0.025	10.025
	4.005	196.586	0.075	8.823	0.025	10.025
	3.955	196.586	0.075	8.825	0.025	10.025
	4.005	196.586	0.075	8.825	0.025	10.025
	4.005	196.586	0.075	8.825	0.025	10.025
	4.005	197.587	0.075	8.825	0.025	10.025
	4.005	197.587	0.075	8.825	0.025	10.025
	4.005	197.587	0.075	8.825	0.025	10.025
	4.005	197.587	0.075	8.825	0.025	10.025

Primary Energy Cokenergy 2020 May 12

Response Time

Date/Time:	5/12/2020	6:55:07
Operator:	Gavin Lewis	
Plant:	Primary Energy Cokenergy	
Location:	Stack	
Source ID:	HRCC Stack 201	

Response Time Results

Analyte:	SO2		CO2		O2	
Units:	ppmvd		% dry		% dry	
Span:	452.600		17.720		22.260	
Range:	500		25		25	
Method:	EPA 7E		EPA 7E		EPA 7E	
Upscale Lvl:	189.134		8.325		9.524	
Dnscale Lvl:	22.630		0.886		1.113	
Upscale (s):	1:46		1:05		1:06	
Dnscale (s):	1:40		1:04		1:04	
	Upscale	Dnscale	Upscale	Dnscale	Upscale	Dnscale
	4.005	197.587	0.075	8.825	0.025	10.043
	3.955	197.587	0.075	8.825	0.025	10.050
	3.955	197.587	0.075	8.825	0.025	10.050
	3.454	197.587	0.075	8.825	0.025	10.050
	3.454	197.587	0.075	8.825	0.025	10.050
	3.454	197.587	0.075	8.825	0.025	10.050
	3.454	198.088	0.075	8.825	0.025	10.050
	3.504	198.088	0.075	8.825	0.025	10.050
	3.454	198.088	0.075	8.825	0.025	10.050
	3.504	198.088	0.075	8.825	0.025	10.050
	3.454	198.088	0.075	8.825	0.025	10.050
	3.454	198.088	0.075	8.825	0.025	10.050
	3.454	198.088	0.075	8.825	0.025	10.050
	3.454	198.088	0.075	8.825	0.025	10.050
	3.454	198.088	0.075	8.825	0.025	10.050
	3.454	198.088	0.075	8.825	0.025	10.050
	3.454	199.089	0.075	8.825	0.025	10.050
	3.454	199.089	0.075	8.825	0.025	10.050
	3.454	199.089	0.075	8.825	0.025	10.050
	3.454	199.089	0.075	8.825	0.025	10.050
	3.454	199.089	0.075	8.825	0.025	10.050
	3.454	199.089	0.075	8.825	0.025	10.050
	3.454	199.089	0.075	8.825	0.046	10.029
	3.454	199.089	0.167	8.665	0.154	9.817
	3.454	199.089	0.565	7.940	0.931	9.046
	3.454	199.089	1.860	6.225	2.646	7.567
	3.454	198.088	3.854	4.196	4.808	5.550
	3.454	198.088	5.698	2.558	6.508	3.658
	3.454	198.088	6.973	1.577	7.671	2.287
	3.454	198.088	7.648	1.019	8.412	1.429
	3.454	198.088	8.021	0.746	8.900	0.925
	3.454	198.088	8.210		9.246	
	3.454	198.088	8.363		9.488	

Primary Energy Cokenergy 2020 May 12

Response Time

Date/Time:	5/12/2020	6:55:07
Operator:	Gavin Lewis	
Plant:	Primary Energy Cokenergy	
Location:	Stack	
Source ID:	HRCC Stack 201	

Response Time Results

Analyte:	SO2		CO2		O2	
Units:	ppmvd		% dry		% dry	
Span:	452.600		17.720		22.260	
Range:	500		25		25	
Method:	EPA 7E		EPA 7E		EPA 7E	
Upscale Lvl:	189.134		8.325		9.524	
Dnscale Lvl:	22.630		0.886		1.113	
Upscale (s):	1:46		1:05		1:06	
Dnscale (s):	1:40		1:04		1:04	
	Upscale	Dnscale	Upscale	Dnscale	Upscale	Dnscale
	36.994	198.088			9.650	
	36.994	198.088				
	36.994	198.088				
	36.994	150.581				
	36.994	150.581				
	36.994	150.581				
	36.994	150.581				
	36.994	150.581				
	36.994	150.581				
	36.994	150.581				
	111.534	150.581				
	111.534	150.581				
	111.534	150.581				
	111.534	73.538				
	111.534	73.538				
	111.534	73.538				
	111.534	73.538				
	111.534	73.538				
	111.534	73.538				
	111.534	73.538				
	165.549	73.538				
	165.549	73.538				
	165.549	73.538				
	165.549	32.990				
	165.549	32.990				
	165.549	32.990				
	165.549	32.990				
	165.549	32.990				
	165.549	32.990				
	165.549	32.990				
	183.070	32.990				
	183.070	32.990				
	183.070	32.990				

Primary Energy Cokenergy 2020 May 12

Response Time

Date/Time:	5/12/2020	6:55:07
Operator:	Gavin Lewis	
Plant:	Primary Energy Cokenergy	
Location:	Stack	
Source ID:	HRCC Stack 201	

Response Time Results

Analyte:	SO2		CO2		O2	
Units:	ppmvd		% dry		% dry	
Span:	452.600		17.720		22.260	
Range:	500		25		25	
Method:	EPA 7E		EPA 7E		EPA 7E	
Upscale Lvl:	189.134		8.325		9.524	
Dnscale Lvl:	22.630		0.886		1.113	
Upscale (s):	1:46		1:05		1:06	
Dnscale (s):	1:40		1:04		1:04	
	Upscale	Dnscale	Upscale	Dnscale	Upscale	Dnscale
	183.070	19.974				
	183.070					
	183.070					
	183.070					
	183.070					
	183.070					
	183.070					
	189.577					

ANALYZER INTERFERENCE RESPONSE TEST

USEPA Reference Method: 6C Analyzer Type: SO_2

Analyzer Manufacturer: TECO Model Number: 43C

Date of Test: 2/23/2007

Test No.	Time	SO_2 ppm (wet)		Percent Difference
		Method 6C	Method 6	
1	1713-1743	92.73	92.02	0.77
2	1752-1822	214.16	209.55	2.20
3	1919-1949	734.74	735.69	-0.13
			Total Percent Difference	2.84

Total percent difference allowable is ≤ 7%.

Detailed interference response test data is maintained on file and is available upon request.

ANALYZER INTERFERENCE RESPONSE TEST

USEPA Reference Method: 3A Analyzer Type: CO_2

Analyzer Manufacturer: Servomex Model Number: 1440

Analyzer Span: 0-20%

Test Performed by: D. Grabowski Date: 1/23/1998

Interference Gas	Interference Gas Concentration	Affect of Interference Gas on Analyzer	
		Analyzer Response, ppm	Percent of Span
NO_x	498.0 ppm	-0.02	-0.10
SO_2	208.9 ppm	-0.02	-0.10
CO	450.7 ppm	-0.02	-0.10
CO_2	10.06%	--	--
O_2	22.5%	-0.02	-0.10
	Total Response (sum)	-0.04	-0.40

Total affect on analyzer reading must be < 2% of analyzer span.

Detailed interference response test data is maintained on file and is available upon request.

ANALYZER INTERFERENCE RESPONSE TEST

USEPA Reference Method: _____3A_____ Analyzer Type: _____O_2_____

Analyzer Manufacturer: _____Servomex__ Model Number: _____1440_____

Analyzer Span: _____0-25%_____

Test Performed by: _____D. Grabowski____ Date: _____1/23/1998_____

Interference Gas	Interference Gas Concentration	Affect of Interference Gas on Analyzer	
		Analyzer Response, ppm	Percent of Span
NO_x	498.0 ppm	0.02	0.08
SO_2	208.9 ppm	0.02	0.08
CO	450.7 ppm	0.00	0.00
CO_2	10.06%	0.00	0.00
O_2	22.5%	--	--
	Total Response (sum)	0.04	0.16

Total affect on analyzer reading must be < 2% of analyzer span.

Detailed interference response test data is maintained on file and is available upon request.

CERTIFICATE OF BATCH ANALYSIS

EB0037831

Grade of Product: CEM-CAL ZERO

Part Number:	NI CZ15A	Reference Number:	136-401709243-1
Cylinder Analyzed:	CC94837	Cylinder Volume:	142.0 CF
Laboratory:	192 - Elk Grove (SAP) - IL	Cylinder Pressure:	2000 PSIG
Analysis Date:	Jan 20, 2020	Valve Outlet:	580
Lot Number:	136-401709243-1		

Expiration Date: Jan 20, 2028

ANALYTICAL RESULTS

Component	Requested Purity		Certified Concentration
NITROGEN	99.9995 %		99.9995 %
CARBON DIOXIDE	< 1.0 PPM	<LDL	0.18 PPM
NOx	< 0.1 PPM	<	0.1 PPM
SO2	< 0.1 PPM	<	0.1 PPM
THC	< 0.1 PPM		0.08 PPM
CARBON MONOXIDE	< 0.5 PPM	<LDL	0.18 PPM

Permanent Notes: Airgas certifies that the contents of this cylinder meet the requirements of 40 CFR 72.2

Cylinders in Batch:

CC111664., CC129202, CC179949, CC203404., CC214337, CC313062, CC313864.., CC335649, CC338029, CC462759, CC46623, CC94837, EB0031043, EB0033993, EB0037831, EB0039226, EB0039248, EB0087991, EB0095533, SG901759

Impurities verified against analytical standards traceable to NIST by weight and/or analysis.

Signature on file

Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0203	Reference Number:	54-124481088-1
Cylinder Number:	CC447467	Cylinder Volume:	144.4 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12015	Valve Outlet:	660
Gas Code:	SO2,BALN	Certification Date:	Mar 16, 2015

Expiration Date: Mar 16, 2023

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 mole/mole 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	200.0 PPM	204.3 PPM	G1	+/- 0.8% NIST Traceable	03/07/2015, 03/16/2015
NITROGEN	Balance			-	

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12062904	CC407305	483.1 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.6%	Jul 18, 2018

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801332	FTIR	Mar 08, 2015

Triad Data Available Upon Request

Signature on file

Approved for Release

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:	E05NI90E15A7762	Reference Number:	54-401083591-1
Cylinder Number:	SG9151303BAL	Cylinder Volume:	149.3 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12018	Valve Outlet:	660
Gas Code:	CO,CO2,NO,NOX,SO2,BALN	Certification Date:	Jan 03, 2018

Expiration Date: Jan 03, 2026

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
NOX	450.0 PPM	460.5 PPM	G1	+/- 0.7% NIST Traceable	12/22/2017, 01/03/2018
CARBON MONOXIDE	450.0 PPM	444.9 PPM	G1	+/- 0.9% NIST Traceable	12/27/2017
NITRIC OXIDE	450.0 PPM	460.5 PPM	G1	+/- 0.7% NIST Traceable	12/22/2017, 01/03/2018
SULFUR DIOXIDE	450.0 PPM	452.6 PPM	G1	+/- 1.0% NIST Traceable	12/22/2017, 01/03/2018
CARBON DIOXIDE	9.000 %	8.985 %	G1	+/- 1.0% NIST Traceable	12/22/2017
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	14060114	CC432959	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 18, 2019
PRM	12367	APEX1099237	10.0 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Jun 02, 2017
NTRM	15060416	CC449822	496.8 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	May 04, 2021
GMIS	1114201605	CC506716	4.995 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Nov 14, 2019
NTRM	16060130	CC437452	515.2 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 16, 2021
NTRM	13060614	CC413600	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 19, 2019

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AMP0900100	FTIR	Dec 21, 2017
CO-1 SIEMENS ULTRAMAT 6E N1J5700	NDIR	Dec 13, 2017
Nicolet 6700 AMP0900100	FTIR	Dec 21, 2017
Nicolet 6700 AMP0900100	FTIR	Dec 21, 2017
Nicolet 6700 AMP0900100	FTIR	Dec 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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI81E15A37P2	Reference Number:	54-401780291-1
Cylinder Number:	EB0094259	Cylinder Volume:	150.3 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12020	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Apr 07, 2020

Expiration Date: Apr 07, 2028

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 mole/mole 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	9.000 %	8.753 %	G1	+/- 0.7% NIST Traceable	04/07/2020
OXYGEN	10.00 %	10.03 %	G1	+/- 1.8% NIST Traceable	04/07/2020
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010601	K002531	13.94 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 30, 2024
NTRM	98050916	SG9168259BAL	16.04 % OXYGEN/NITROGEN	+/- 0.6%	Oct 06, 2021

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO2-1 HORIBA VIA-510 V1E3H7P5	NDIR	Mar 18, 2020
O2-1 HORIBA MPA-510 3VUYL9NR	Paramagnetic	Mar 26, 2020

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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI60E15A1069	Reference Number:	54-401478395-1
Cylinder Number:	EB0065406	Cylinder Volume:	158.2 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	18.00 %	17.72 %	G1	+/- 0.7% NIST Traceable	04/18/2019
OXYGEN	22.00 %	22.26 %	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

TRC

Method 2 Velocity Traverse Data

Project No:	382355	Test Date(s):	5-12-20	Duct Dimensions:	18'
Company:	Primary Energy	Operating Level:	750%	Duct Area (ft^2):	254.47
Plant:	Cokenergy	Recorded by:	Rose	% CO_2:	~~5.85~~ 16.059 / 6.011
Unit ID:	HRCI Stack 201	Pitot ID:	890	% O_2:	11.7 / 11.84
Sample Location:	Stack	Pitot Coefficient Cp:	.84		

Run No: 1 Time: 7:45 - 7:52
P_{bar} ("H_g): 29.28 Static ("H_2O): -2

Port-Point	Δp "H_2O	T_s (°F)	a
A-1	1.7	268	
2	2.1	272	
3	2.1	274	
4	1.5	273	
~~5~~			
~~6~~			
B-1	1.5	273	
2	1.7	273	
3	1.7	272	
4	1.2	273	
C-1	1.5	273	
2	1.8	273	
3	1.7	273	
4	1.1	272	
D-1	2.2	273	
2	2.2	273	
3	2.6	273	
4	1.7	271	
Avg.	1.7313	272	

Leak Check Pre: ✓ Post: ✓

Run No: 2 Time: 8:36 - 8:43
P_{bar} ("H_g): 29.28 Static ("H_2O): -2

Port-Point	Δp "H_2O	T_s (°F)	a
A-1	1.7	270	
2	1.9	273	
3	2.1	273	
4	1.8	272	
B-1	1.4	273	
2	1.6	273	
3	1.7	273	
4	1.5	272	
C-1	1.7	273	
2	1.7	273	
3	1.6	273	
4	1.1	271	
D-1	1.8	272	
2	2.2	272	
3	2.1	273	
4	1.7	272	
Avg.	1.725	272	

Leak Check Pre: ✓ Post: ✓

Run No: _____ Time: _____ - _____
P_{bar} ("H_g): _____ Static ("H_2O): _____

Port-Point	Δp "H_2O	T_s (°F)	a
Avg.			

Leak Check Pre: _____ Post: _____

Moisture Test Data

Time	Meter Vol (ft^3) *or* (L)	ΔH ("H_2O)	Meter Temp. (°F)		Vacuum ("Hg)	Outlet Temp (°F)
Net						
Avg.						

Meter ID: Y=
ΔH@I:

Train Weight

Initial		g
Final		g
Gain		g

Moisture Leak Check

Pre		@	"Hg
Post		@	"Hg

Field Balance ID:
Standard Weight ID:
(g)
Nominal:
Measured
Comments:

TRC

Method 2 Velocity Traverse Data

Project No:	382355	Test Date(s):	5-12-20	Duct Dimensions:	18'
Company:	Primary Energy	Operating Level:	>50%	Duct Area (ft^2):	254.47
Plant:	Cokenergy	Recorded by:	Rose	% CO_2:	5.981 / 5.968 / 5.857
Unit ID:	HRSG Stack 201	Pitot ID:	890	% O_2:	11.920 / 11.934 / 12.130
Sample Location:	Stack	Pitot Coefficient Cp:	.84		

Run No: 3 Time: 9:15 - 9:23
P_{bar} ("H_g): 29.26 Static ("H_2O): -2

Port-Point	Δp "H_2O	T_s (°F)	a
A-1	1.8	270	
2	1.9	272	
3	2.0	272	
4	1.6	272	
B-1	1.4	273	
2	1.7	273	
3	1.7	273	
4	1.2	272	
C-1	1.5	273	
2	1.6	273	
3	1.5	273	
4	1.1	271	
D-1	1.8	273	
2	2.1	273	
3	1.9	273	
4	1.7	271	
Avg.	1.6563	272	

Leak Check Pre: ✓ Post: ✓

Run No: 4 Time: 9:48 - 9:55
P_{bar} ("H_g): 29.28 Static ("H_2O): -.2

Port-Point	Δp "H_2O	T_s (°F)	a
A-1	1.7	272	
2	1.8	272	
3	2.0	272	
4	1.6	271	
B-1	1.5	272	
2	1.7	272	
3	1.7	272	
4	1.4	271	
C-1	1.7	272	
2	1.5	272	
3	1.6	272	
4	1.1	271	
D-1	1.7	272	
2	2.0	272	
3	1.8	272	
4	1.7	272	
Avg.	1.6563	272	

Leak Check Pre: ✓ Post: ✓

Run No: 5 Time: 10:21 - 10:28
P_{bar} ("H_g): 29.26 Static ("H_2O): -2

Port-Point	Δp "H_2O	T_s (°F)	a
A-1	1.7	272	
2	1.8	272	
3	1.9	272	
4	1.5	271	
B-1	1.5	272	
2	1.5	272	
3	1.7	272	
4	1.3	271	
C-1	1.5	272	
2	1.5	272	
3	1.4	272	
4	.91	271	
D-1	2.2	272	
2	2.0	272	
3	1.7	272	
4	1.7	271	
Avg.	1.6131	272	

Leak Check Pre: ✓ Post: ✓

Moisture Test Data

Time	Meter Vol (ft^3) *or* (L)	ΔH ("H_2O)	Meter Temp. (°F)		Vacuum ("Hg)	Outlet Temp (°F)
Net						
Avg.						

Meter ID: Y=
ΔH@I:

Train Weight

Initial		g
Final		g
Gain		g

Moisture Leak Check

Pre		@ "Hg
Post		@ "Hg

Field Balance ID:
Standard Weight ID:
(g)
Nominal:
Measured
Comments:

TRC

Method 2 Velocity Traverse Data

Project No: 382355
Company: Primary Energy
Plant: Cokenergy
Unit ID: HRCL Stack 201
Sample Location: Stack

Test Date(s): 5-12-20
Operating Level: >50%
Recorded by: Rome
Pitot ID: 890
Pitot Coefficient Cp: .84

Duct Dimensions: 18'
Duct Area (ft^2): 254.47
% CO_2: 5.195 | 5.754 | 5.590
% O_2: 12.246 | 12.356 | 12.637

Run No: 6 Time: 10:53 - 11:01
P_{bar} ("H_g): 29.26 Static ("H_2O): ~2

Port-Point	Δp "H_2O	T_s (°F)	a
A-1	1.6	272	
2	1.8	272	
3	1.8	272	
4	1.5	271	
B-1	1.5	272	
2	1.6	272	
3	1.5	272	
4	1.0	271	
C-1	1.3	272	
2	1.6	272	
3	1.7	272	
4	1.4	271	
D-1	1.7	272	
2	1.8	272	
3	1.9	272	
4	1.5	271	
Avg.	1.5938	272	

Leak Check Pre: ✓ Post: ✓

Run No: 7 Time: ~~11:35~~ 11:25 - 11:35
P_{bar} ("H_g): 29.26 Static ("H_2O): -2

Port-Point	Δp "H_2O	T_s (°F)	a
A-1	1.5	271	
2	1.7	271	
3	1.9	271	
4	1.7	271	
B-1	1.5	271	
2	1.5	271	
3	1.6	271	
4	1.5	271	
C-1	1.4	271	
2	1.4	271	
3	1.6	271	
4	1.1	271	
D-1	1.8	271	
2	1.9	271	
3	1.9	271	
4	1.7	270	
Avg.	1.5938	271	

Leak Check Pre: ✓ Post: ✓

Run No: 8 Time: 11:57 12:04
P_{bar} ("H_g): 29.28 Static ("H_2O): -2

Port-Point	Δp "H_2O	T_s (°F)	a
A-1	2.0	270	
2	1.8	270	
3	1.8	271	
4	1.7	270	
B-1	1.5	271	
2	1.6	271	
3	1.5	270	
4	1.0	269	
C-1	1.5	271	
2	1.5	271	
3	1.6	271	
4	1.2	269	
D-1	1.7	271	
2	1.7	271	
3	2.0	271	
4	1.5	270	
Avg.	1.600	270	

Leak Check Pre: ✓ Post: ✓

Moisture Test Data

Time	Meter Vol (ft^3) or (L)	ΔH ("H_2O)	Meter Temp. (°F)	Vacuum ("Hg)	Outlet Temp (°F)
Net					
Avg.					

Meter ID: Y=
ΔH@:

Train Weight

Initial		g
Final		g
Gain		g

Moisture Leak Check

Pre		@ "Hg
Post		@ "Hg

Field Balance ID:
Standard Weight ID:
(g)
Nominal:
Measured
Comments:

TRC Report 38355

TRC

Method 2 Velocity Traverse Data

Project No: 382355
Company: Primary Energy
Plant: Cokenergy
Unit ID: HRCC Stack 201
Sample Location: Stack

Test Date(s): 5-12-20
Operating Level: >50%
Recorded by: Rome
Pitot ID: 890
Pitot Coefficient Cp: .84

Duct Dimensions: 191
Duct Area (ft^2): 254.47
% CO_2: 5.518 | 5.506
% O_2: 12.749 | 12.765

Run No: 9 Time: 12:30 - 12:39
P_{bar} ("H_g): 29.26 Static ("H_2O): -2

Port-Point	Δp "H_2O	T_s (°F)	a
A-1	1.7	270	
2	1.8	270	
3	2.1	270	
4	1.4	269	
B-1	1.5	270	
2	1.5	270	
3	1.7	270	
4	1.3	269	
C-1	1.4	270	
2	1.5	270	
3	1.5	270	
4	1.1	269	
D-1	1.8	270	
2	1.9	270	
3	2.0	270	
4	1.5	268	
Avg.	1.6063	270	

Leak Check Pre: ✓ Post: ✓

Run No: 10 Time: 13:03 - 13:09
P_{bar} ("H_g): 29.28 Static ("H_2O): -2

Port-Point	Δp "H_2O	T_s (°F)	a
A-1	2.1	270	
2	1.8	270	
3	1.9	270	
4	1.5	270	
B-1	1.4	270	
2	1.4	270	
3	1.6	270	
4	1.4	269	
C-1	1.5	270	
2	1.5	270	
3	1.4	270	
4	1.3	269	
D-1	1.9	270	
2	1.9	270	
3	2.0	270	
4	1.5	269	
Avg.	1.6313	270	

Leak Check Pre: ✓ Post: ✓

Run No: _____ Time: _____ - _____
P_{bar} ("H_g): _____ Static ("H_2O): -2

Port-Point	Δp "H_2O	T_s (°F)	a
Avg.			

Leak Check Pre: _____ Post: _____

Moisture Test Data

Time	Meter Vol (ft^3) or (L)	ΔH ("H_2O)	Meter Temp. (°F)		Vacuum ("Hg)	Outlet Temp (°F)
Net						
Avg.						

Meter ID: Y=
ΔH@:

Train Weight

Initial		g
Final		g
Gain		g

Moisture Leak Check

Pre		@ "Hg
Post		@ "Hg

Field Balance ID:
Standard Weight ID:
(g)
Nominal:
Measured
Comments:

TRC

Moisture Test Run Data

Company: Primary Energy
Plant: CokeNergy
Unit ID: HRCC Stack 201
Location: Stack

Project #: 382355
Test Method: 4
Test Run #: 1
Test Date(s): 5-12-20

Console Operator: Rome
Console ID: E26
Meter Y: .992
Orifice ΔH@i: 1.808
Probe Temp. °F: 250

Unit Operating Mode: >50%
Barometric Pressure ("Hg): 29.28
Static Pressure ("H_2O): -.2

Pre Leak Check: .000 @ 5"
Post Leak Check: .000 @ 5"

Port & Point ID	Clock Time	Dry Gas Meter Volume Liters / Cubic Feet	Dry Gas Meter Pressure ("H_2O)	Dry Gas Meter Inlet (°F)	Dry Gas Meter Outlet (°F)	Vacuum ("Hg)	Impinger Outlet (°F)	Stack (°F)	Probe (°F)	Filter (°F)
	7:45	85.088	1.9	70	70	1	61			
	7:50	88.91	1.9	66	68	1	51			
	7:55	92.7	1.9	66	67	1	52			
RR 5-12-20 96.49	8:00	~~98.49~~	1.9	67	67	1	54			
	8:05	100.3	1.9	69	66	1	56			
	8:10	104.08	1.9	70	66	1	57			
	8:15	107.871								
	Net Volume:	22.783								
		Average:	1.9	67.8						

Moisture Data

Impinger ID	Tare wt. (grams)	Final wt. (grams)
	717	776.7
	692.9	702.0
	559.0	559.8
	771.6	777.5
	Net:	75.5

Pump/Orifice* Leak Check: Pass / Fail / N/A

Gas Analysis (%v/v dry)	
O_2	CO_2
11.700	6.059
Average:	

Balance Calibration Check

Field Balance ID:	
Standard Weight ID:	
Actual (g):	
Measured (g):	
Reading within 0.5 g? (Y/N):	

Comments:

*Required for ALT-009 Meter Calibration Checks

TRC

Moisture Test Run Data

Company: Primary Energy
Plant: Cokenergy
Unit ID: HR CIS Stack 201
Location: Stack

Project #: 382355
Test Method: 4
Test Run #: 2
Test Date(s): 5-12-20

Console Operator: Rome
Console ID: E26
Meter Y: .992
Orifice ΔH@i: 1.808
Probe Temp. °F 250

Unit Operating Mode: 750%
Barometric Pressure ("Hg): 29.28
Static Pressure ("H_2O): -2

Pre Leak Check: .000 @ 5"
Post Leak Check: .000 @ 5"

Port & Point ID	Clock Time	Dry Gas Meter Volume Liters / Cubic Feet	Dry Gas Meter Pressure ("H_2O)	Dry Gas Meter Inlet (°F)	Dry Gas Meter Outlet (°F)	Dry Gas Meter Vacuum ("Hg)	Impinger Outlet (°F)	Stack (°F)	Probe (°F)	Filter (°F)
	8:35	8.280	1.9	69	68	1	64			
	8:40	12.09	1.9	72	68	1	57			
	8:45	15.89	1.9	73	69	1	56			
	8:50	19.69	1.9	73	69	1	56			
	8:55	23.5	1.9	74	69	1	57			
	9:00	27.32	1.9	75	70	1	59			
	9:05	31.124								
Net Volume:		22.844								
Average:			1.9		70.8					

Moisture Data		
Impinger ID	Tare wt. (grams)	Final wt. (grams)
	645.4	702.5
	702.0	711.2
	559.0	561.3
	762.4	768.4
	Net:	73.8

Pump/Orifice* Leak Check: Pass / Fail / N/A

Gas Analysis (%v/v dry)	O_2	CO_2
	11.840	6.011
	11.920	5.981
Average:	11.880	5.996

Balance Calibration Check

Field Balance ID:	
Standard Weight ID:	
Actual (g):	
Measured (g):	
Reading within 0.5 g? (Y/N):	

Comments:

*Required for ALT-009 Meter Calibration Checks

TRC

Moisture Test Run Data

Company: Primary Energy
Plant: Cokenergy
Unit ID: HRCG Stack 201
Location: Stack

Project #: 382355
Test Method: 4
Test Run #: 3
Test Date(s): 5-12-20

Console Operator: Rome
Console ID: E26
Meter Y: .992
Orifice ΔH@i: 1.809
Probe Temp. °F 250

Unit Operating Mode: >50%
Barometric Pressure ("Hg): 29.26
Static Pressure ("H_2O): -2

Pre Leak Check: .000 @ 5"
Post Leak Check: .000 @ 5"

Port & Point ID	Clock Time	Dry Gas Meter Volume Liters / Cubic Feet	Pressure ("H_2O)	Inlet (°F)	Outlet (°F)	Vacuum ("Hg)	Impinger Outlet (°F)	Stack (°F)	Probe (°F)	Filter (°F)
	9:40	33.331	1.9	73	73	1	63			
	9:45	37.1	1.9	73	72	1	57			
	9:50	40.93	1.9	75	72	1	57			
	9:55	44.72	1.9	76	73	1	56			
	10:00	48.5	1.9	76	72	1	56			
	10:05	52.41	1.9	77	72	1	57			
	10:10	56.140								
Net Volume:		22.809								
Average:			1.9	73.7						

Moisture Data

Impinger ID	Tare wt. (grams)	Final wt. (grams)
	702.5	760.5
	711.2	719.1
	561.3	563.0
	769.4	773.0

Net: ~~73.8~~ 72.2 RA 5-12-20

Pump/Orifice* Leak Check: Pass / Fail / N/A

Gas Analysis (%v/v dry)

O_2	CO_2
11.934	5.968
12.130	5.857
Average: 12.032	5.913

Balance Calibration Check

Field Balance ID:	
Standard Weight ID:	
Actual (g):	
Measured (g):	
Reading within 0.5 g? (Y/N):	

Comments:

*Required for ALT-009 Meter Calibration Checks

TRC

Moisture Test Run Data

Company: Primary Energy
Plant: Cokenergy
Unit ID: HRCC Stack 2011
Location: Stack

Project #: 382355
Test Method: 4
Test Run #: 4
Test Date(s): 5-12-20

Console Operator: Ramc
Console ID: E26
Meter Y: .998
Orifice ΔH@i: 1.80
Probe Temp. °F 250

Unit Operating Mode: >50%
Barometric Pressure ("Hg): 29.26
Static Pressure ("H_2O): -2

Pre Leak Check: .000 @ 5"
Post Leak Check: .000 @ 5"

Port & Point ID	Clock Time	Dry Gas Meter Volume Liters / Cubic Feet	Dry Gas Meter Pressure ("H_2O)	Dry Gas Meter Inlet (°F)	Dry Gas Meter Outlet (°F)	Dry Gas Meter Vacuum ("Hg)	Impinger Outlet (°F)	Stack (°F)	Probe (°F)	Filter (°F)
	10:50	56.350	1.9	71	70	1	64			
	10:55	60.14	1.9	70	70	1	55			
	11:00	63.94	1.9	72	71	1	56			
	11:05	67.74	1.9	71	69	1	55			
	11:10	71.58	1.9	71	69	1	57			
	11:15	75.4	1.9	73	69	1	58			
	11:20	79.209								
Net Volume:		22.859								
Average:			1.9	70.8						

Moisture Data

Impinger ID	Tare wt. (grams)	Final wt. (grams)
	658.6	715.3
	660.0	667.3
	563.0	563.6
	773.0	777.9
Net:		69.5

Pump/Orifice* Leak Check: Pass / Fail / N/A

Gas Analysis (%v/v dry)

	O_2	CO_2
	12.246	5.795
	12.356	5.754
Average:	12.301	5.775

Balance Calibration Check

Field Balance ID:	
Standard Weight ID:	
Actual (g):	
Measured (g):	
Reading within 0.5 g? (Y/N):	

Comments:

*Required for ALT-009 Meter Calibration Checks

TRC

Moisture Test Run Data

Company: Primary Energy
Plant: Cokenergy
Unit ID: HRCC Stack 201
Location: Stack

Project #: 382355
Test Method: 4
Test Run #: 5
Test Date(s): 5-12-20

Console Operator: Rome
Console ID: E26
Meter Y: .992
Orifice ΔH@i: 1.808
Probe Temp. °F: 250

Unit Operating Mode: >50%
Barometric Pressure ("Hg): 29.28
Static Pressure ($"H_2O$): ~ 2

Pre Leak Check: .000 @ 5"
Post Leak Check: .000 @ 5"

Port & Point ID	Clock Time	Dry Gas Meter Volume Liters / Cubic Feet	Pressure ($"H_2O$)	Inlet (°F)	Outlet (°F)	Vacuum ("Hg)	Impinger Outlet (°F)	Stack (°F)	Probe (°F)	Filter (°F)
	11:45	79.409	1.9	70	71	1	60			
	11:50	83.22	1.9	70	70	1	55			
	11:55	87.02	1.9	70	70	1	54			
	12:00	90.84	1.9	71	69	1	55			
	12:05	94.63	1.9	72	69	1	58			
	12:10	98.44	1.9	73	69	1	59			
	12:15	102.23								
	Net Volume:	22.821								
	Average:		1.9	70.3						

Moisture Data		
Impinger ID	Tare wt. (grams)	Final wt. (grams)
	715.3	770.8
	667.3	674.6
	563.6	565.0
	751.7	758
	Net:	

Pump/Orifice* Leak Check: Pass / Fail / N/A

Gas Analysis (%v/v dry)	
O_2	CO_2
12.637	5.590
12.749	5.518
Average: 12.693	5.554

Balance Calibration Check	
Field Balance ID:	
Standard Weight ID:	
Actual (g):	
Measured (g):	
Reading within 0.5 g? (Y/N):	

Comments:

*Required for ALT-009 Meter Calibration Checks

TRC

Moisture Test Run Data

Company: Primary Energy
Plant: Cokenergy
Unit ID: HRCC Stack 201
Location: Stack

Project #: 382355
Test Method: 4
Test Run #: 6
Test Date(s): 5-12-20

Console Operator: Rome
Console ID: E26
Meter Y: .992
Orifice ΔH@i: 1.808
Probe Temp. °F: 250

Unit Operating Mode: >50%
Barometric Pressure ("Hg): 29.26
Static Pressure ("H_2O): -2

Pre Leak Check: .000 @ 5"
Post Leak Check: .000 @ 5"

Port & Point ID	Clock Time	Dry Gas Meter Volume Liters / Cubic Feet	Pressure ("H_2O)	Inlet (°F)	Outlet (°F)	Vacuum ("Hg)	Impinger Outlet (°F)	Stack (°F)	Probe (°F)	Filter (°F)
	12:45	2.454	1.9	69	69	1	65			
	12:50	6.25	1.9	68	68	1	58			
	12:55	10.03	1.9	70	68	1	58			
	13:00	13.81	1.9	71	68	1	60			
	13:05	17.6	1.9	72	68	1	62			
	13:10	21.42	1.9	73	69	1	61			
	13:15	25.216								
	Net Volume:	22.762								
		Average:	1.9	69.4						

Moisture Data

Impinger ID	Tare wt. (grams)	Final wt. (grams)
	664.2	718.0
	674.6	682.9
	565	566.8
	758	763.5
		Net: 69.4

Pump/Orifice* Leak Check: Pass / Fail / N/A

Gas Analysis (%v/v dry)

	O_2	CO_2
	12.765	5.506
Average:		

Balance Calibration Check

Field Balance ID:	
Standard Weight ID:	
Actual (g):	
Measured (g):	
Reading within 0.5 g? (Y/N):	

Comments:

*Required for ALT-009 Meter Calibration Checks