RELATIVE ACCURACY TEST AUDIT
C BLAST FURNACE BAGHOUSE EXHAUST STACK
AK STEEL CORPORATION
DEARBORN WORKS
DEARBORN, MICHIGAN

RECEIVED
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AIR QUALITY DIV.

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1. INTRODUCTION

Environmental Quality Management, Inc. (EQM) was retained by AK Steel Corporation Dearborn Works (AK Steel) in Dearborn, Michigan to conduct a Relative Accuracy Test Audit (RATA) on the plant's sulfur dioxide (SO_2) and flow continuous emission monitoring system (CEMS) serving the C Blast Furnace (C-Furnace) Baghouse exhaust stack. The test program was conducted on April 27, 2017.

The purpose of the testing was to comply with the Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) No. MI-ROP-A8640-2016a as well as to meet the quality assurance requirements for CEMS systems specified in 40 CFR 60, Appendix B.

The plant monitors are:

<u>Sulfur Dioxide Analyzer</u>	<u>Flow Analyzer</u>
Manufacturer: TECO	Manufacturer: Monitoring Solutions, Inc.
Model: 43iHL	Model: CEMFLOW (Type-S)
Serial No.: 1226354722	

Reference method sampling was conducted to evaluate the operation of the CEMs according to Performance Specification 2 (SO_2) and 6 (flow) procedures.[*] The specification tests evaluate the CEM daily operation and calibration system.

Sampling was conducted according to EPA Methods 1, 2, 3A, 4, and 6C for sampling point location, stack gas flow and composition (CO_2 and O_2 percent), moisture, and SO_2, respectively.

Mr. David Pate of AK Steel coordinated process operations and field sampling efforts. Messrs. Chris Janzen, Nick Pharo, Eric Zang, Gary Drexler, and Ben Fern of EQM conducted the air sampling efforts.

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[*] 40 CFR Appendix B, Performance Test Specification 2 and 6.

2. SUMMARY OF TEST RESULTS

The exhaust of the C Blast Furnace (C-Furnace) Baghouse was sampled on April 27, 2017 to evaluate the facility's CEM system. Twelve 21-minute sampling runs were conducted. Table 2-1 presents the plant CEM readings and corresponding reference method results. All of the test periods conducted in the relative accuracy (RA) determination are shown.

The RA of the SO_2 CEM shall be no greater than 20 percent of the mean value of the reference method (RM) test data in terms of the units of the emission standard (lb/hr). The RA was 9.9 percent in terms of pounds of SO_2 per hour.

The RA of the SO_2 CEM based on concentrations was required to be no greater than 20 percent of the mean value of the reference method test data on a part-per-million (ppm) basis. The facility CEM was measured on a dry basis, and the EQM instrument was measured on a dry basis. The RA was 12.6 percent in terms of ppm SO_2.

The RA of the flow CEM was required to be no greater than 20 percent of the mean value of the reference method test data. The RA was 2.1 percent in terms of exhaust gas flow.

Calculations are presented in Appendix A.

Table 2-1. Testing Summary for C-Furnace Baghouse RATA

April 27, 2017 Plant: AK Steel Dearborn Works, Dearborn, Michigan

Run No.	Time[a]	Reference Method			AK Steel CEM Data		
		SO_2		Flow, Kscfm[d]	SO_2		Flow, Kscfm[d]
		lb/hr[b]	ppm[c]		lb/hr[b]	ppm[c]	
1[e]	0730-0750	103.2	20.9	497.9	108.7	24.5	490.2
2	0815-0835	26.0	7.6	344.5	16.8	4.9	346.1
3[e]	0846-0906	111.1	25.5	497.9	96.0	20.9	477.5
4	0916-0936	166.7	34.0	498.5	153.7	31.1	503.4
5	0947-1007	165.2	34.1	494.8	164.2	33.4	502.6
6	1037-1057	24.2	7.0	354.9	17.3	5.1	349.8
7	1106-1126	46.1	13.9	340.9	38.4	11.3	345.3
8	1136-1156	53.2	15.9	334.7	51.6	13.8	345.6
9[e]	1204-1224	204.8	41.4	505.4	184.2	37.3	507.1
10	1238-1258	182.8	38.3	488.2	177.0	36.4	494.0
11	1307-1327	140.7	29.6	483.4	139.5	29.8	498.7
12	1355-1415	31.9	9.5	342.2	23.7	7.2	335.4
RA (%)		--	--	--	**9.9**	**12.6**	**2.1**

[a] Times listed are not corrected for Daylight Savings Time, and are therefore 60 minutes behind actual time and process time as a result (i.e., Run #1 began at 08:30 AM and Run #12 ended at 3:15 PM EDT).

[b] Pounds per hour.

[c] Parts per million, dry basis.

[d] Thousand standard cubic feet per minute. The Flow times vary for each run and are included in Appendix A and C.

[e] Run not used in the RA calculation.

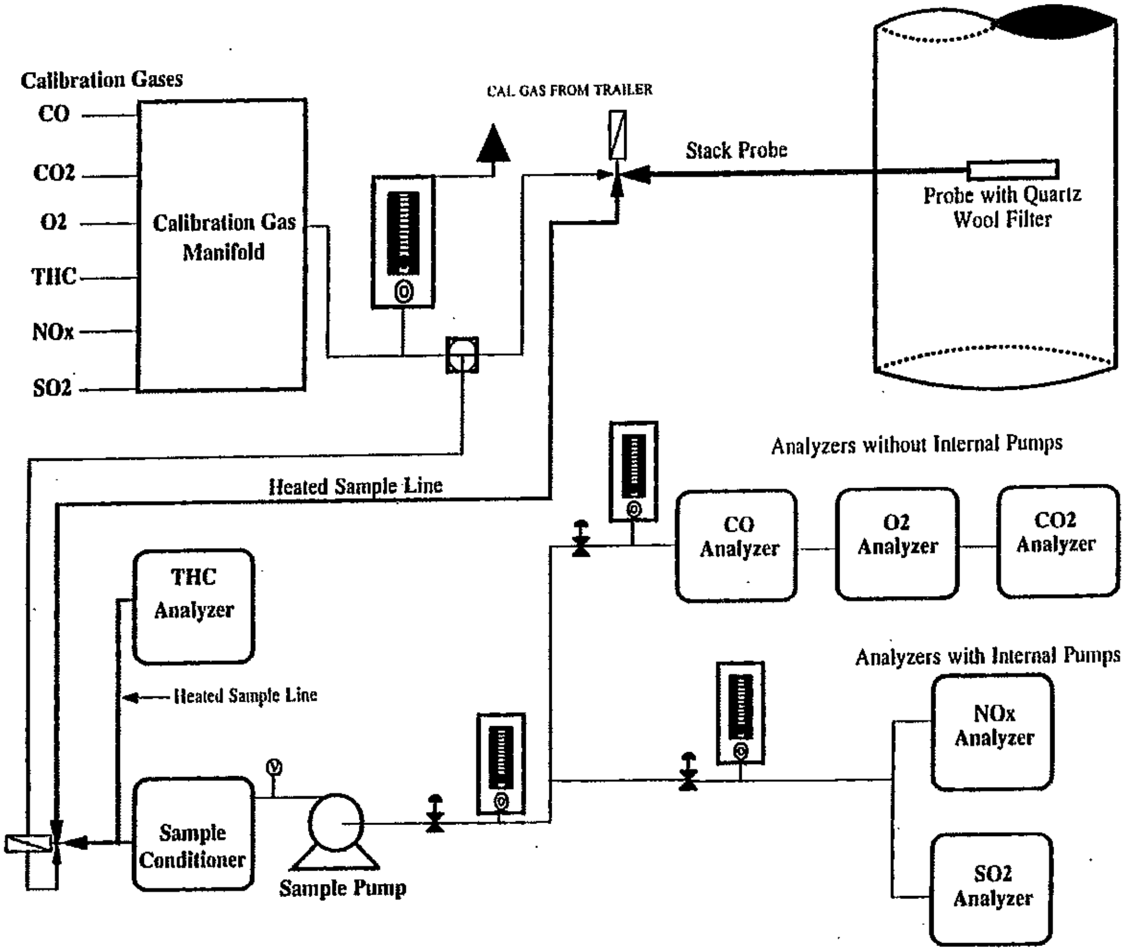

Figure 3-2. CEM Sampling System
(Note: Only O_2, CO_2, and SO_2 Analyzers were used)

4. QUALITY ASSURANCE/QUALITY CONTROL

The field sampling quality assurance for this project includes the use of calibrated source sampling equipment, reference test methods, sample chain of custody, and traceability protocols for recording and calculating data.

Field quality control checks include the following:

- Pre- and post-test leak checks of sampling trains.
- Recording of all field data on standard data forms that also serve as checklists.
- Adherence to reference test methods as published in the most recent revisions of the Federal Register, 40 CFR 60, Appendix A, EPA Reference Methods 2, 3A, 4, and 6C, July 1, 2008.
- Calibration of dry gas meters and thermocouples, as specified in EPA-600/4-77-027B, "Quality Assurance Handbook for Air Pollution Measurement Systems," Volume III - Stationary Source Specific Methods.
- The CEM system met all performance requirements of EPA Methods 3A and 6C.
- CEM system leak checks and integrity checks, including response time, linearity of each calibration gas standard, drift checks, and correlation coefficients.
- Pre- and post-test calibrations. The SO_2 analyzer was calibrated with two EPA Protocol One sulfur-dioxide-in-nitrogen standards in the analytical range; zero N_2 calibration data is presented in Table 4-1.

4.1 Pretest Preparation and Calibration

Before the instruments were brought to the test site, each analyzer was checked in the laboratory following the analyzer manufacturer-recommended procedures. The check included, at a minimum, examining the analyzer's overall status for any obvious component damage, verifying secure placement of electronic cards, and checking filters, gauges, and rotometers for wear or damage.

Table 4-1. Performance Specifications for Methods 3A and 6C

Parameter	Performance Test	Specification
Oxygen/ Carbon Dioxide	Sampling System Bias	±5% of span for zero and upscale calibration gases
	Zero Drift	±3% of span over test run period
	Upscale Calibration Drift	±3% of span over test run period
	Analyzer Calibration Error	±2% of span for zero, mid-, and high-range calibration gases
Sulfur Dioxide	Sampling System Bias	±5% of span for zero and upscale calibration gases
	Zero Drift	±3% of span over test run period
	Upscale Calibration Drift	±3% of span over test run period
	Analyzer Calibration Error	±2% of span for zero, mid-, and high-range calibration gases

Each analyzer was plumbed to accept calibration gas as it would in field operation. The calibration gases were injected at the same flow rate and pressure at which an effluent sample would enter the analyzer. If the analyzer is flow- and/or pressure-sensitive, then flow- and/or pressure-sensitive devices were used during all analyzer operations. Settings were recorded and maintained to ensure that valid data was obtained. A zero gas and a high-range calibration gas were injected one at a time. Then the analyzer's output was adjusted and recorded on the recording device until both gases could be injected and the proper response obtained without analyzer adjustments. All flow and pressure settings were maintained at appropriate levels throughout the calibration procedures.

4.2 Analyzer Field Setup

4.2.1 Analyzer Calibration Error Test

The analyzers were allowed to warm up a minimum of 1 hour before initiation of any calibration procedures. The length of the warmup period depends on the type of analyzer being used. A zero gas and a high-range calibration gas (100 percent of scale) were introduced into each analyzer, one at a time. The analyzer's output was adjusted as necessary to match the concentration of the calibration gases. This process was repeated until the proper response to both gases was obtained without analyzer adjustment.

Once the analyzer setup procedures were completed, the calibration error (CE) test was performed as follows. Zero, mid-, and high-range calibration gases (as defined in the test method) were introduced into each analyzer and the response recorded. No adjustments were made to the analyzer's output. The analyzer flow rate and/or pressure settings were maintained at their original recorded set-points as required throughout this process.

The analyzer's CE response for each calibration gas was recorded. The difference between the recorded gas concentration displayed by the gas analyzer and the known calibration gas tag value for each cylinder did not exceed the allowable calibration error of ±2% of the instrument span for the O_2, CO_2, and SO_2 instruments. The following equation was used to calculate the CE for each gas:

$$\text{CE} = \frac{\text{Analyzer Response} - \text{Known Gas Value}}{\text{Analyzer Span}} 100\%$$

Individual CE values for both instruments are contained in Appendix B.

4.2.2 Sampling System Bias Check

Once the CE test was successfully completed, the sampling system bias check was initiated. No adjustments were made to the analyzer's output after the CE test was completed. If adjustments were required for any reason, the CE test was repeated prior to the sampling system bias check.

Sampling system bias is the difference between the analyzer response exhibited when a known concentration gas was introduced directly into the analyzer (direct analyzer calibration) and when the same gas was introduced at the outlet of the sampling probe (system calibration). The system bias was determined for both the zero and an upscale calibration gas. The upscale for each analyzer was the calibration gas that most closely approximated the respective effluent gas concentration. The following equation was used to calculate the system bias for both the zero and upscale calibration gases:

$$\text{System Bias} = \frac{\text{System Response} - \text{Analyzer Response}}{\text{Instrument Span}} 100\%$$

Individual bias check results are contained in Appendix B.

5. FACILITY/PROCESS DESCRIPTION

Molten iron (hot metal) is produced in the blast furnaces by heating iron ore pellets and other iron-bearing materials, coke, limestone, slag, or other fluxing material. Burden materials consisting of iron ore pellets, flux material (slag, limestone, or dolomite), and a carbon source (usually coke) are delivered to and charged into the top of the furnace. Additional carbon is supplied to the furnace by injecting natural gas and pulverized coal into the hot blast section of the furnace. Preheated combustion (hot blast) air is pushed vertically through the burden material in the furnace from tuyeres located at the bottom of the furnace. The components of the burden chemically react with the hot blast air to reduce the iron oxides into elemental iron and melt. The blast furnace produces molten iron, blast furnace gas, and slag.

Periodically, the molten iron and slag are cast from the furnace into a trough and iron runners in the floor of the casthouse. The slag is separated from the molten iron in the trough prior to entering refractory-lined bottle cars. The slag is then diverted to slag pots. The molten iron is transported in bottle cars to the BOF for use in the steelmaking process.

Emissions generated within the casthouse from the molten iron and slag that are cast from the C Blast Furnace are captured by numerous collection hoods and are routed to a baghouse that is used to control particulate emissions from the process.

Process and production data is included in Appendix C along with the AK Steel Baghouse Stack CEMS reports for each of the RATA test runs. During the RATA, the blast furnace averaged 291.4 tons per hour which is greater than 50% of rated capacity.