5.10. Strip chart or round chart recorder

Not applicable.

The SNIFFER data acquisition system records all of the data from all of the analyzers as digital data.

5.11. Schematic of monitoring system

See Appendix D of this document.

5.12. Oxygen Calibration drift

The acceptable zero drift for this analyzer is negligible as per manufacturer and the acceptable span drift for this analyzer is negligible as per manufacturer. These conform to the requirements defined in 40CFR60 Appendix B (Spec. 3).

As per 40CFR60 Appendix F, the analyzer must be calibrated whenever its reading drifts from the reference gas by two times the amount specified in Appendix B.

If this drift is more than twice the acceptable drift specified in 40CFR60 Appendix B, then the system warns the operator of calibration failure.

At this point the analyzer will be manually calibrated and/or repaired.

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6. Nitrogen Oxides (NO_x) Analyzer

6.1. Analyzer manufacturer and model number

Manufacturer:	Thermo Environmental Instruments, Inc.
Model number:	TECO-42H

6.2. Principle of operation of analyzer

The NO_x analyzer is based on chemiluminescence detection method.

6.3. Range of operation for the analyzer

The NO_x analyzer has the following specifications:

- Range: 0-500 ppm
- Zero Drift: ±0.2 ppm per day
- Span Drift: ± 1 percent of full scale per day
- Repeatability: ± 1 percent of full scale

6.4. Calibration standards for the analyzer

The calibration gases are to be purchased from a specialty gas supplier. The zero gas is 0 ppm NOx, using Oxygen analyzer span gas. The span gas is 400-450 ppm EPA Protocol 1 or certified gas.

All gases used for calibration must be certified as NBS Protocol, EPA Protocol 1 or certified gas.

This calibration is performed in conformance to 40CFR60 Appendix B, Performance Specification 2, and 40CFR60 Appendix F.

6.5. Calibration schedule for the analyzer

The analyzer is automatically calibrated once a day. The calibration is initiated by the computer software running in the analyzer cabinet PLC and is controlled by the associated hardware also located in the gas analyzer cabinet.

At a preset time each day the PLC performs a series of steps to open and close solenoid valves which control the calibration gases. All of the calibration gases are introduced at the analyzer cabinet, and are transported to the probe on the stack via the calibration gas tube inside the sample line. The calibration gas floods the probe cavity and is drawn back down the normal sample gas path.

For specific information on the calibration sequence for this CEMS please refer to the "CEMS calibration" section in this protocol.

6.6. Routine maintenance for the analyzer

Preventative maintenance procedures followed on a routine basis to periodically check the

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CEMS should catch any problems before any data loss occurs.

Most routine maintenance work can be carried out from the front of the analyzer cabinet. This makes the routine maintenance procedures much easier.

6.6.1. Preventative Maintenance by computer

The computer software in the data acquisition system checks the following points on a routine basis.

- The computer monitors the analog output of the NO_x analyzer to insure the value is within the analyzers range.
- The computer monitors the calibration drift on the NO_x analyzer.

If any of the points fall outside of the normal range, an error signal is generated and the operator is notified.

6.6.2. Manual Preventative Maintenance

Log books are maintained at the analyzer cabinet which houses the analyzers and the Allen Bradley PLC (RDCN). The appropriate log books are filled out each time the technician services the CEMS. If sample flow rates change by a large amount over time, it may indicate that the probe is plugged. If the vacuum pump differentials change dramatically, it would indicate excess moisture in the system. These are the types of conditions that the technician looks for each time they visit the analyzer.

More detailed information on operation and maintenance procedures are contained in the Thermo Environmental Instruments, Inc. Instruction manual.

6.6.2.1. Daily Preventative Maintenance

The Allen Bradley PLC (RDCN) checks the zero and the span of the analyzer each day.

There is no additional required maintenance on this analyzer.

6.6.2.2. Monthly Preventive Maintenance

The ozonator air feed drying column contains a desiccant. Replace the spent desiccant with regenerated material. The step by step procedure is found in the Thermo Environmental Instruments, Inc. Instruction Manual.

6.6.2.3. Quarterly PM

In three out of four quarters, this analyzer will have a cylinder gas audit (CGA) performed on it. This audit is performed in conformance with 40CFR60 Appendix F section 5.1 and all applicable subparagraphs.

Thermo Environmental Instruments, Inc. TECO-42H instruction manual specifies the procedures for quarterly preventative maintenance for:

1. inspection and replacement of the capillaries;
2. inspection and cleaning of the thermoelectric cooler fans.

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3. inspection and cleaning of the fan guards

6.6.2.4. Yearly Preventative Maintenance

Once a year a relative accuracy test audit (RATA) or relative accuracy audit (RAA) is performed.

This audit is performed in conformance to 40CFR60 Appendix F.

6.6.3. Project responsibility

Specific individuals are responsible for insuring the system complies with the operational protocol.

See the Appendix A of this document for the project responsibility personnel.

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6.6.4. Recommended Spare Parts

The following table shows spare parts and consumable. For the complete list of manufacturer's spare parts, refer to the Instruction Manual.

PART NUMBER	DESCRIPTION
4121	Capillary - ozone - 10 mil
4113	Capillary - sample - 5 mil
4126	Capillary - bypass - 20 mil
4157	Charcoal
6998	Desiccant
4510	Fuse
8138	Solenoid
4800	O-Ring capillary
9464	Twin Head Pump Repair Kit
5013	Bypass Pump Repair Kit

6.7. NO_x reports

6.7.1. Daily NO_x reports

Two styles of daily reports for NO_x are available for printing on the printer. The first report prints the average value for every minute in any calendar day. The second report is a line graph of one minute values. The first report includes other status information such as fault conditions and calibration status. A sample of each report is included in Appendix C of this document.

6.7.2. Quarterly NO_x report

A sample quarterly NO_x report as required by the US EPA and Pennsylvania Department of Environmental Resources (DER) is included in Appendix C of this document.

6.8. Parameters monitored by SNIFFER

Allen Bradley PLC (RDCN) monitors a signal from the Thermo Environmental Instruments, Inc. NO_x analyzer corresponding to NO_x ppm. It also monitors two digital lines which indicate when the NO_x analyzer is performing calibration and if the unit has failed calibration. The final signal being monitored by the remote data collection unit is an analyzer fault line. The SNIFFER data acquisition units saves to the hard disk the following data once each minute:

- NO_x ppm
- NO_x corrected to 7.0% oxygen.

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- Analyzer calibration status

6.9. Rate of data collection for analyzer

The remote data collection unit takes a reading from the Thermo Environmental Instruments, Inc. NO_x analyzer once every few seconds. The SNIFFER data acquisition system requests the latest data value from the remote data collection unit four or more times each minute. These readings are averaged together in the data acquisition system to construct a one minute average. The actual analyzer reading and analyzer status information (calibration and fault status) are transmitted from the remote data collection unit to the data acquisition computer.

6.10. Schematic of monitoring system

See Appendix D of this document.

6.11. NO_x Calibration drift

The acceptable zero drift for this analyzer is ± 0.2 ppm per day and the acceptable span drift for this analyzer is ± 1 percent of full scale per day. These conform to the requirements defined in 40CFR60 Appendix B (Spec. 2).

As per 40CFR60 Appendix F, the analyzer must be calibrated whenever its reading drifts from the reference gas by two times the amount specified in Appendix B.

During calibration the system compares the known concentration of the span gas to the reading from the analyzer. If the reading is different, the system automatically adjusts the reading in software.

If this drift is more than twice the acceptable drift specified in 40CFR60 Appendix B, then the system warns the operator of calibration failure.

At this point the analyzer may be manually calibrated and or repaired.

6.12. Equations to Compute Corrected NO_x Emissions.

The equations used to compute the emissions follow:

Correction of NO_x to 7.0 % Oxygen on a dry basis

$$NO_x \text{ corrected} = \frac{(20.95\% - 7.0\%)}{(20.95\% - O_2\% \text{ dry})} * NO_x(\text{PPMVD})$$

6.13. Equations to Compute NO_x Mass Emissions.

The NO_x emission is recorded in three units.

They are:

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- NO_x analyzer readings.
- NO_x analyzer readings corrected to 7.0% oxygen.
- NO_x emissions rate in pounds per hour.

  NO_x(lbs/hr) = NO_x(lbs/MMBtu) * (fuel consumption MMBtu/hr)

The equation used to compute NO_x emissions in (lbs per MMBtu) is defined in 40CFR60 Method 19 and is as follows:

$$E = C * F (20.9 / (20.9 - O_2\%))$$

E = emissions in lbs/MMBtu
C = NO_x in lb/scf = NO_x(ppm) * ($1.194 * 10^{-7}$)
F = Fuel factor in dscf/MMBtu

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7. Calibration of CEMS analyzers

Daily calibration is accomplished by routing certified calibration gases up through the sample line to the probe and back down the normal extraction gas sample path to the analyzer.

Each analyzer is first fed a zero gas to establish the base line and then fed a span gas. These two readings determine the slope and offset values used to correct the analyzer readings.

Although each analyzer may be calibrated individually, the normal, automatic calibration performed daily by the CEMS system calibrates all of the analyzers together as quickly as possible.

This is accomplished by calibrating one or more analyzers simultaneously. For example, several analyzers may be zero calibrated at the same time or one analyzers span gas may also be used as the zero gas for a second analyzer. This therefore reduces the overall time the CEMS is in calibration.

The calibration sequence described below represents the actual calibration of all analyzers in this CEMS.

The steps below do not mention the "wait" times which permit the calibration gases to purge the sample lines sufficiently. These delay times may be altered to match the length of the sample lines.

In addition to this fixed time delay, the CEMS also takes multiple readings during the sample time to insure the analyzer reading has stabilized. This helps verify the line has been completely purged and only pure calibration gas is being sampled.

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7.1. Calibration Timing Sequence Chart

Step	Time seconds	Operation			Gas flowing		Comments
		Purge	Zero	Span	O_2 Span	NO_x Span	
1	120	x			x		
2	30		NO_x		x		
3	120	x					
4	30		O_2				
6	120	x			x		
7	30			O_2	x		
8	120	x				x	
9	30			NO_x		x	
10	180	x					Purge Sample Line
11							Resume Sampling

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8. Monitored Data Points

The following signals are collected from various instruments either in the CEM analyzer cabinet or other sources at the site.

- O_2 Oxygen
- O_2 Analyzer fault
- NO_x Nitrogen-oxides
- NO_x Analyzer fault
- Opacity
- Coke Oven Gas Flow
- Fuel Factor (Fd) for Coke Oven Gas

9. Calculated Data Points

The following values are calculated in the CEM system.

- NO_x corrected to 7.0% O_2
- NO_x Lbs/mmBTU

10. Process Status Input

The following digital signal is read by the RDCN and recorded on the hard disk. It is used to determine number of hours of operation for B-Battery. The emission limit episodes are discounted while the process signal indicates the process is off.

Process on/off	Digital input

11. Alarms

The following alarms are output by the RDCN when high emissions or analyzer failure is detected. Also refer to the "Lockout" section for further specific control points.

• CEMS calibration failure	Digital output
• CEMS high emissions alarm	Digital output
• CEMS trouble alarm	Digital output

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12. Lockout control

This system has no lockout requirements.

13. Emission Limits

This system determines if the process is operating by a digital input to the CEM system. This input is provided by the plant DCS and is on only during the period in which the CEM system is to test for emissions exceedances.

While in operation, the CEM system will be taking readings of all pollutants, correcting them to 7 percent O2 and generating a rolling hourly average. The rolling hourly average is based on minute average calculated by the DCN. The rolling hourly average will be valid if there are a minimum of 45 valid minute averages during the last 60 minutes.

The air permit is a construction permit. It is our assumption that PADER will establish concentration limits for each of the emissions. Therefore this CEM system will contain emission limit software although the excess level is unknown at this time.

The pollutants that will be measured are:

	Pollutant	Units
•	NOx corrected to 7.0% O2 Limit: (Undetermined at this time)	ppm dry
•	NOx lb/MMBTU Limit: (Undetermined at this time)	lb./MMBTU
•	NOx lb/hr Limit: (Undetermined at this time)	lb./hr

Opacity will be monitored in the stack. The instantaneous readings will be collected in real time by the RDCN. From these values both one minute and six minute averages will be calculated and stored on the DAS. For a one minute average to be valid at least 6 readings will be required. For a six minute average to be valid at least 5 minute averages must be valid.

•	Opacity 6 min. avg. Limit: (Undetermined at this time)	%

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14. Quality control / Quality Assurance

The primary guidelines for this section are those outlined in 40CFR60 Appendix F.

The quality control plan is made up of six items.

- Calibration of the CEMS analyzers on a daily basis
- Determination of calibration drift and adjustment
- Preventative maintenance of the CEMS
- Recording the data and calculation of emissions rates, and reporting the results
- Accuracy audit procedures
- Corrective actions for CEMS components which do not meet the above criteria

If the CEMS has two consecutive quarters of excessive inaccuracies then this current QA/QC plan must be re-written to correct the deficiencies.

14.1. Calibration Drift

All analyzers are calibrated using the criteria set forth in 40CFR60 Appendix F and Appendix B.

Refer to the "Calibration Drift" section for each analyzer for specific details.

If the analyzer fails the drift calibration for five consecutive days, the analyzer is considered out-of-control. In addition, if the calibration drift error is four times the applicable drift specification at any time, the analyzer is considered out-of-control.

The analyzer remains out-of-control until the completion of a calibration drift test which results in a calibration drift within the corresponding allowable calibration drift limit.

The data during the out-of-control period is marked as invalid data. All data collected from the CEMS is kept for two years.

14.2. Data Accuracy

Data accuracy is verified by performing a set of quarterly audits. There are three types of quarterly audits;

- Relative Accuracy Test Audit (RATA)
- Cylinder Gas Audit (CGA)
- Relative Accuracy Audit (RAA)

14.2.1. Relative Accuracy Test Audit (RATA)

When the CEMS is first certified this audit is one of the audits performed by the

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stack testing firm in accordance with the performance specifications outlined in 40CFR60 Appendix B. The relative accuracy specifications are listed below:

- Performance Specification 2

  Performance Specification 2 (NO_x, SO_2) twenty (20) percent of the mean value of the reference method (RM) test data in units of emissions standard or five (5) percent of applicable emissions standard.

  If the limits defined in performance specification 2 are less than 2.5 ppm NO_x, then the minimum accuracy of 2.5 ppm NO_x will be used as outlined in the NESCAUM guide.

- Performance Specification 3

  Performance Specification 3 (O_2, CO_2) twenty (20) percent of the mean value of the reference method (RM) test data or one (1) percent O_2 or CO_2.

- Performance Specification 4

  Performance Specification 4 (CO) ten (10) percent of the mean value of the reference method (RM) test data in units of emissions standard or five (5) percent of applicable emissions standard.

  If the limits defined in performance specification 4 are less than five (5) ppm then performance specification 4A will be used.

- Performance Specification 4A

  Performance Specification 4 (CO) ten (10) percent of the mean value of the reference method (RM) test data in units of emissions standard or five (5) ppm, whichever is higher.

- Equations and calculations

  The equations specified in

Arithmetic Mean:	EPA 40CFR60 App. B PS2 eq. 2-1
Standard Deviation:	EPA 40CFR60 App. B PS2 eq. 2-2
Confidence Coefficient:	EPA 40CFR60 App. B PS2 eq. 2-3
RA:	EPA 40CFR60 App. B PS2 eq. 2-4

All span and zero gases used for these audits must be "EPA Protocol I".

The required audit gases are found in Appendix B of this document.

14.2.2. Cylinder Gas Audits (CGA)

This audit is performed in three out of four quarters. This audit challenges the CEMS with cylinder gases of known concentration at two points for each monitored pollutant.

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Each pollutant is monitored at a mid range which is calculated as between 20 to 30 percent of the monitors span value.

The high range is calculated as being between 50 to 60 percent of span.

The cylinder gas audit routes the audit cylinder gas through the entire CEMS; (i.e. up to stack probe and back through the sample conditioning system to the analyzers).

The cylinder gases must be introduced three times for each range, for each analyzer. In other words, to audit one analyzer six data points must be recorded. The cylinder gases must be EPA protocol I gases.

The difference between the cylinder gas known value and the CEMS result is used to assess the accuracy of the CEMS.

The required audit gases are found in Appendix B of this document.

14.2.3. Relative Accuracy Audit (RAA)

The relative accuracy audit is similar to the Relative Accuracy Test Audit (RATA) except less data is recorded. The relative accuracy audit can be performed in three out of four quarters. It requires three sets of data in contrast to the RATA which requires nine sets of data. The relative difference between the mean of the reference method (RM) values and the mean of the CEMS values is used to assess the accuracy of the CEMS.

14.3. Excessive Inaccuracies

If the relative accuracy of the RATA exceeds twenty (20) percent then the CEMS is out-of-control. If the relative accuracy exceeds fifteen (15) percent of the CGA or the RAA then the CEMS is out-of-control. The CEMS remains out-of-control from the time that the system fails the RATA, CGA or RAA until the system passes the RATA, CGA or RAA. If the system fails a RATA then only a RATA is used to certify that the CEMS is no longer out-of-control.

The data during the out-of-control period is marked as invalid data.

14.4. Calculation for CEMS data accuracy

The RATA relative accuracy calculations are outlined in the performance specification section of 40CFR60 Appendix B.

The RAA relative accuracy calculations are calculated in the emissions standard units (for instance lbs/hr or lbs/MMBTU).

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The CGA relative accuracy calculations are calculated in the units of the concentration appropriate for the analyzer (for instance O_2 in percent, and CO in ppm).

The equation used to compute relative accuracy for CGA or RAA is:

$$A = \frac{C\ meas - C\ audit}{C\ audit} * 100$$

A = accuracy in percent

C meas = Average CEMS response during the audit in units of applicable standard or appropriate concentration

C audit = Average audit value (CGA certified value or three run average for RAA) in units of applicable standard or appropriate concentration

14.5. Reporting Requirements

Samples of the required reports are found in Appendix C of this document.

Depending on the type of report, they can be produced on a daily or quarterly basis.

Certain reports such as the calibration summary report will prompt the user for a start and stop date. The report will determine if there is data present for the specified days and if so will compile the requested report period into the report.

Refer to Appendix C of this document for the list of reports.

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APPENDIX A Project personnel

The following is a list of key project personnel and their corresponding responsibilities.

Overall Project	Manager of Environmental Control
Overall Quality Assurance	Manager of Environmental Control
Performance Auditing	Manager of Environmental Control
Data Processing	Manager of Operations
Sampling Quality Control	Manager of Operations
Sampling Operations	Manager of Operations

In case of incomplete personnel list, be advised U. S. Steel Corp. is presently organizing the staffing and will furnish the names and duties prior to operation of the CEMS equipment.

Definitions of project responsibilities:

<u>Overall Project Management</u> - Responsible individual who assures the system conforms to all state and federal regulations and that all reports are submitted promptly and accurately.

<u>Overall Quality Assurance</u> - Manages the CEMS system. Responsible for ensuring all sampling operations, sampling quality control and data processing activities are performed.

<u>Performance Auditing</u> - Ensures the required quarterly audits are performed. Provides tracking of performance information.

<u>Data Processing</u> - Examines daily backup logs. Assures all daily reports are printed and distributed. Performs regular full backups.

<u>Sampling Quality Control</u> - Inspects daily calibration information. Assures all daily automatic checks were performed. Maintains spare parts inventory.

<u>Sampling Operations</u> - Performs daily maintenance.