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Ref. No. 370781

May 7, 1994

Mr. Miles Lalley  
Bethlehem Steel Corporation  
BethEnergy - Lackawanna Coke Division  
1951 Hamburg Turnpike  
P.O. Box 8  
Lackawanna, NY 14218

fax transmittal memo 7671 # of pages >

To: TOM EASTERLY	From: J. LAWRENCE
Co.	Co.
Dept.	Phone #
Fax #	Fax #

Dear Mr. Lalley:

Re: Revised Emissions Testing Summary Report - No. 7 and No. 8 Waste Heat Stacks at Bethlehem Steel Corporation - Lackawanna, New York Facility

This letter, with attachments, constitutes the revised report for the continuous emission monitoring (CEM) performed by Chester Environmental (Chester) on No. 7 and No. 8 Waste Heat Stacks at Bethlehem Steel Corporation - Lackawanna, New York Facility. Concentrations of carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), and total gaseous hydrocarbon compounds (THC) were determined on April 21, 1994 (No. 7 Stack) and April 22, 1994 (No. 8 Stack). Three consecutive two-hour runs were performed on each stack. Volumetric flow measurements for each stack were conducted on April 21, April 22, and May 3, 1994.

The results of the test efforts for Nos. 7 and 8 Stack are presented in Tables 1 and 2, respectively. Gas concentrations and mass emission rates are reported in units of parts per million by volume (ppmv) and pounds per hour (lb/hr), respectively (mass emission rates were calculated from the velocity traverses determined on May 3, 1994 only). Tables 1 and 2 also list other stack and sampling parameters which include exhaust gas flow rate in units of actual cubic feet per minute (acfm), standard cubic feet per minute (scfm), and dry standard cubic feet per minute (dscfm), exhaust gas temperature (°F), and moisture content of the exhaust gas (percent by volume). Actual sampling times for each test are also included in Tables 1 and 2. Copies of the field data sheets for the testing effort are also attached to this letter as an appendix.

Continuous emission monitoring for CO, SO<sub>2</sub>, NO<sub>x</sub>, and THC was accomplished by means of a common gas extraction and conditioning system in accordance with EPA Reference Methods 10, 6C, 7E, and 25A, respectively. Conditioning of the sample gas was accomplished by pulling it from the stack through a stainless steel probe and glass fiber filter maintained at stack temperature. The filtered gas was routed through a heated Teflon line to Chester's mobile CEM laboratory located nearby. The heated line temperature was maintained at 250°F or higher to prevent condensation from occurring in the sample line. The gas was then split at the CEM laboratory. One portion of the stack gas was delivered to the THC monitor, a JUM Model VE-7 Flame Ionization Analyzer (FIA), which requires a "wet" sample. The moisture in the remaining portion of stack gas was removed by a non-contact refrigerative method such that the dew point of the sample

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gas was 40°F or lower. The "dry" sample was then manifolded and routed to the following three analyzers for CO, SO<sub>2</sub>, and NO<sub>x</sub> analysis: Infrared Model 720 CO Analyzer, Western Research Model 721ATM SO<sub>2</sub> Analyzer, and Thermo Electron Model 10AR Chemiluminescent NO<sub>x</sub> Analyzer. Sample gas flow not delivered to the analyzers was sufficient to allow a bypass stream which minimized sample handling residence time.

Data recording was accomplished with the use of a computer based, automated digital data acquisition system. Concentrations of all four parameters were scanned at one-second intervals. The scanned values were averaged every minute, displayed on a system monitor and recorded on magnetic storage media. As a backup system, the data was also continuously recorded on a strip chart recorder.

Instrument calibrations and system bias checks were performed prior to and immediately following each test run to ensure proper instrument operation. System bias and calibration checks fell within method specifications. All calibration gas standards used (CO in N<sub>2</sub>, SO<sub>2</sub> in N<sub>2</sub>, NO in N<sub>2</sub>, propane in N<sub>2</sub>) were certified by the manufacturer to be within at least two percent of the reported concentration.

In order to calculate the gas emission rates in units of pounds per hour, it was necessary to measure the volumetric flow rate from each stack. Volumetric flow rates for each stack were determined in accordance with EPA Reference Methods 1 through 4. Measurements for each stack were performed through three or four test ports at 90 degrees separation in the same horizontal plane (one test port on Waste Heat Stack #7 was inaccessible on May 3, 1994). The sampling ports were located at least eight diameters downstream and at least two diameters upstream of duct disturbances. Twenty-four traverse points were located in accordance with EPA Method 1. Gas velocity measurements were conducted through the test ports; six traverse points were sampled in each test port.

Gas velocities of the exhaust gas were determined using a calibrated S type pitot tube in accordance with EPA Method 2. Positive and negative pitot lines were leak-checked at the beginning and end of each test run. Gas velocity differential pressures were recorded at each traverse point. Static pressure of the process gas stream was measured with the same pitot tube. Process gas temperature was measured with a type K thermocouple.

Three velocity traverses were completed on each stack during the April 1994 test effort; these measurements were coincident with the CEM testing. Following the testing, it was discovered that the differential pressure gauge used (a magnehelic gauge) was faulty. The gas velocity measurements were determined again for both stacks on May 3, 1994.

Dry gas molecular weight of the exhaust gas (concentrations of CO<sub>2</sub>, O<sub>2</sub>, and N<sub>2</sub> by difference) was determined with the use of Fyrite apparatus in accordance with EPA Method 3.

Percent moisture content, by volume, of the exhaust gas was determined in accordance with EPA Method 4. Moisture content was determined by knowledge of the weight gain of the four sample train impingers and dry gas volume sampled. Only one EPA Method 4 run was completed for each stack. The sampling duration for each EPA Method 4 test was one hour.

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The velocity head pressures, along with stack gas composition, moisture content, and the cross-sectional area of the stacks were used to determine the volumetric stack gas flow rates.

Chester appreciates the opportunity to provide air quality engineering services to Bethlehem Steel Corporation. We sincerely apologize for any inconvenience caused by the faulty magnehelic gauge. If you have any questions regarding this letter report, please call me at (412) 825-9760 or Mr. Mark Grunebach at (412) 825-9761.

Very Truly Yours,

John P. Shimshock  
Air Quality Project Scientist  
Chester Environmental

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BETHLEHEM STEEL CORPORATION - LACKAWANNA, NEW YORK  
 WASTE HEAT STACK #7 - APRIL 21, 1994

TABLE 1  
 SUMMARY OF EMISSIONS RESULTS

Test Number		1	2	3	Average	#/MBCU
<b>Concentrations and Mass Emission Rates</b>						
Carbon Monoxide	(ppmv)	73.6	81.9	74.6	76.7	0127
	(lb/hr)	17.6	19.6	17.9	18.4	
Sulfur Dioxide	(ppmv)	469.6	465.0	482.5	472.4	1679
	(lb/hr)	257.0	254.5	264.1	258.6	
Nitrogen Oxides (as NO2)	(ppmv)	325.9	303.9	324.2	318.0	0866
	(lb/hr)	128.2	119.6	127.5	125.1	
Total Gaseous Hydrocarbon Compounds (as propane equivalents)	(ppmv)	1.9	8.1	6.9	5.6	00167
	(lb/hr)	0.8	3.5	3.0	2.4	
<b>Stack Conditions</b>						
Flow Rate	(acfm)	133900				
	(scfm)	64000				
	(dscfm)	55900				
Temperature	(°F)	628				
Moisture Content	(%)	12.6				
<b>Sampling Conditions</b>						
Test times		1230	1457	1715		
		to 1429	to 1657	to 1915		
Sampling Time	(minutes)	119	120	120		

CO, SO2, NOx Emission Rate (lb/hr) =  
 Conc. (ppmv) \* Stack Volumetric Flow Rate (dscfm) \*  
 Molecular Weight (g/mol) \* (1.53E-07)

THC Emission Rate (lb/hr) =  
 Conc. (ppmv) \* Stack Volumetric Flow Rate (scfm) \*  
 Molecular Weight (g/mol) \* (1.53E-07)

BETHLEHEM STEEL CORPORATION - LACKAWANNA, NEW YORK  
 WASTE HEAT STACK #1 - APRIL 22, 1994

TABLE 2  
 SUMMARY OF EMISSIONS RESULTS

Test Number		1	2	3	Average	#/m <sup>3</sup> air
<b>Concentrations and Mass Emission Rates</b>						
Carbon Monoxide	(ppmv)	21.2	26.9	45.9	31.3	.060
	(lb/hr)	6.5	8.3	14.2	9.7	
Sulfur Dioxide	(ppmv)	434.8	427.0	447.4	436.4	1.917
	(lb/hr)	306.5	301.0	315.4	307.7	
Nitrogen Oxides (as NO <sub>2</sub> )	(ppmv)	255.2	255.6	261.3	257.4	.812
	(lb/hr)	129.3	129.5	132.4	130.4	
Total Gaseous Hydrocarbon Compounds (as propane equivalents)	(ppmv)	4.8	8.0	7.4	6.7	.023
	(lb/hr)	2.6	4.4	4.1	3.7	
<b>Stack Conditions</b>						
Flow Rate	(acfm)	172600				
	(scfm)	81900				
	(dscfm)	72000				
Temperature	(°F)	635				
Moisture Content	(%)	12.1				
<b>Sampling Conditions</b>						
Test times		0843	1110	1327		
		to 1055	to 1310	to 1527		
Sampling Time	(minutes)	110 *	120	120		

CO, SO<sub>2</sub>, NO<sub>x</sub> Emission Rate (lb/hr) =  
 Conc. (ppmv) \* Stack Volumetric Flow Rate (dscfm) \*  
 Molecular Weight (g/mol) \* (1.53E-07)

THC Emission Rate (lb/hr) =  
 Conc. (ppmv) \* Stack Volumetric Flow Rate (acfm) \*  
 Molecular Weight (g/mol) \* (1.53E-07)

\* = Interference from gas conditioning unit during these periods:  
 0907 to 0911; 0917 to 0921; 0929 to 0943  
 Data voided during these periods; interference problem corrected at 0943

# STACK GAS SAMPLING GAS VELOCITY SHEET

PLANT Bath Energy  
 LOCATION BATTERY #7  
 ACTIVITY NO# WASTE HEAT  
 TESTERS MB, ML

DATE 5/3/94  
 TEST # FLOW  
 PROBE # 10-1  
 B.P. 29.55

PAGE #  
 STK DIA. (in.)  
 STK WIDTH (in.)  
 COMMENTS

1 of 2  
137

TIME: OPACITY 1805

PORT	POINT	VELOCITY AP in. H2O	TEMP. F	STATIC PRESSURE
A	48.7	.080	628	-1.4
	34.2	.075		
	24.3	.070		
	16.2	.065		
	9.2	.050		
	2.9	.035		
B	48.7	.090	628	-1.4
	34.2	.090		
	24.3	.090		
	16.2	.080		
	9.2	.075		
	2.9	.050		

TIME: 1820-1825

PORT	POINT	VELOCITY AP in. H2O	TEMP. F	STATIC PRESSURE
C	48.7	.085	628	-1.4
	34.2	.090		
	24.3	.080		
	16.2	.070		
	9.2	.055		
	2.9	.040		
D	48.7	NOT ACCESSIBLE		
	34.2			
	24.3			
	16.2			
	9.2			
	2.9			

- A. Ave. AP - in/H2O
- B. Average Stack Temperature - F
- C. Average Stack Temperature (F + 460) - R
- D. Avg. Molecular Weight - (g/mol)
- E. Stack Pressure (in. Hg), B.P. + (static P/13.6)
- F. Pilot Correction Factor
- G. Velocity (U/Sec),  $85.49 \times F \times ((A \times C)/(D \times E))^{1/2}$
- H. Stack Area - sq. ft. Round:  $3.14 \times (STK \text{ DIA})^2 / (4 \times 144)$   
 Rectangular:  $(L \times W) / 144$
- I. Flow Rate,  $G \times H \times 60$  - ACFM
- J. Flow Rate,  $(528 \times E \times I) / (29.92 \times C)$  - SCFM

0.070  
~~0.069~~  
628  
1088  
28.07  
29.45  
0.84  
21.8  
102.37  


---

133900  
64000

12% O2  
6.5% CO2  
81.5% N2  
H2O(w) = 12.6%  
⇒ MW = 28.07



# STACK GAS SAMPLING GAS VELOCITY SHEET

PI -  
 LOCATION  
 ACTIVITY NO#  
 TEST #S

Bethenergy  
BATTEN/SPECK/HO  
Waste Heat  
MB, ML

DATE  
 TEST #  
 PROBE #  
 B.P.

5/3/94  
FLOW  
10-1  
29.55

PAGE #  
 STK DIA. (in.)  
 STK WIDTH (in.)  
 COMMENTS

2062  
1487

TIME: 7:00

PORT	POINT	VELOCITY AP in. H <sub>2</sub> O	TEMP. F	STATIC PRESSURE
52.6	A	.130	636	-1.5
37.0		.110		
2		.100		
17.2		.095		
9.9		.090		
3.2		.040		
	52.6	.110	633	-1.5
	37.0	.100		
	26.2	.090		
	17.5	.080		
	9.9	.060		
	3.2	.035		

TIME: 1730 END

PORT	POINT	VELOCITY AP in. H <sub>2</sub> O	TEMP. F	STATIC PRESSURE
C	52.6	.110	635	-1.6
	37.0	.120		
	26.2	.100		
	17.5	.090		
	9.9	.070		
	3.2	.040		
D	52.6	.120	635	-1.5
	37.0	.100		
	26.2	.090		
	17.5	.070		
	9.9	.065		
	3.2	.045		

- A. Ave. AP - in/H<sub>2</sub>O
- B. Average Stack Temperature
- C. Average Stack Temperature (F + 460) - R
- D. Ave. Molecular Weight - (g/mol)
- E. Stack Pressure (in. Hg), B.P. + (static P/13.6)
- F. Pitot Correction Factor
- G. Velocity (ft/sec),  $85.49 \times F \times ((A \times C)/(D \times E))^{-1/2}$
- H. Stack Area - sq. ft. Round:  $3.14 \times (\text{STK DIA})^2 / (4 \times 144)$   
 Rectangular:  $(L \times W) / 144$
- I. Flow Rate,  $G \times H \times 60$  - ACFM
- J. Flow Rate,  $(528 \times E \times I) / (29.92 \times C)$  - SCFM

0.085  
~~0.0834~~  
635  
1095  
28.13  
~~29.44~~  
0.84  
24.1  
119.47  
1726.00  
819.00

12% O<sub>2</sub>  
 6.5% CO<sub>2</sub>  
 81.5% N<sub>2</sub>  
 (LOW) = 12.170  
 ⇒ MW = 28.13

