1.1 Source test reports - to be scanned, not cited in AP-42

Particulate, PM10 and carbon monoxide emission evaluation of
Elrama Power Station Stack
Duquesne Light Company, Elrama PA
Project no. 570
Nov 1, 1996

Prepared by Paul Jadlowiec, Optimal Technologies, Pittsburgh, PA.

PARTICULATE, PM_{10} AND CARBON MONOXIDE EMISSION EVALUATION OF ELRAMA POWER STATION STACK

DUQUESNE LIGHT COMPANY
ELRAMA, PENNSYLVANIA

PROJECT NO. 570

NOVEMBER 1, 1996

PREPARED BY
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MANAGER-SOURCE TESTING

OPTIMAL TECHNOLOGIES
575 WILLIAM PITT WAY
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1.0 EXECUTIVE SUMMARY

Duquesne Light Company contracted Optimal Technologies, Inc. (Optimal) to perform an evaluation of particulate matter, particulate matter under 10 microns (PM_{10}), and carbon monoxide (CO) emissions from the stack located at the Elrama Power Station. The field sampling program was conducted on September 18, 1996. Testing and analyses were conducted using the principles of the U.S. Environmental Protection Agency (EPA) Method 5 and 10 as described in 40 CFR, Part 60, Appendix A and the Pennsylvania Department of Environmental Protection (DEP) "Source Testing Manual." The analytical methodology using a computer controlled scanning electron microscope (CCSEM) was used to analyze the collected particulate for PM_{10}. The test results are required to determine compliance with the particulate emission limit of 0.10 pounds per million BTU (0.10 lb/mmBtu) and to inventory emissions for PM_{10} and CO.

Table 1 presents a summary of the emission sampling results. The particulate emissions averaged 0.084 lb/mmBtu, which is less than the compliance limit. PM_{10} emissions averaged 34.0 percent of the total particulate catch and the CO emissions averaged 58 ppm.

TABLE 1

SUMMARY OF RESULTS

Run No.	Station Net Output Mwhrs/hr	Emissions		
		Total Particulate lb/mmBtu	PM_{10} % of Total Particulate	CO ppm
1	423	0.122	27.5	26
2	426	0.048	50.1	86
3	423	0.082	24.6	63
Average	424	0.084	34.0	58

2.0 SCOPE AND OBJECTIVES

The scope of this project was to determine particulate matter, PM_{10}, and CO emissions from the Elrama Power Station using the principles of EPA Method 5 and 10 and the DEP "Source Testing Manual". The analytical methodology using a CCSEM was used to analyze the collected particulate for PM_{10}. The test results are used to determine compliance with the particulate emission limit of 0.10 lb/mmBtu and inventory emissions for PM_{10} and CO. The following parameters were determined for each sampling run:

• Gas Flow	acfm and dscfm
• Gas Temperature	°F
• Gas Analysis	% by Volume of CO_2 and O_2
• Gas Moisture	% by Volume
• Net Station Output	Mwhrs/hr
• Boiler Heat Input	mmBtu/hr
• Particulate Emissions	gr/dscf, lb/hr and lb/mmBtu
• PM_{10} Emissions	% of total particulate, lb/hr and lb/mmBtu
• CO Emissions	ppm, lb/hr and lb/mmBtu

The field sampling program was performed on September 18, 1996. The Optimal test personnel consisted of Messrs. Paul Jadlowiec, William Stanziana, and Jim Phillippi. Mr. Ed Gaus served as plant liaison for this test program. Boiler heat input data was collected by Mr. Egon Klatt.

3.0 PROCESS DESCRIPTION

The Elrama Power Station common stack receives the combustion gases from four bituminous coal-fired boilers. The gases from each boiler pass through air heaters, mechanical dust collectors, electrostatic precipitators and wet scrubbers prior to discharging to the atmosphere through the common stack. Figure 1 provides a flow diagram for the combustion gases.

The rated boiler heat inputs and gas flow volumes are as follows:

Boiler No.	Heat Input (mmBtu/hr)	Exhaust Gas Flow (acfm)
1	1200	414,000
2	1200	414,000
3	1300	464,000
4	1790	625,000

4.0 PROCEDURES

4.1 FIELD WORK

4.1.1 Field Data Sheets

All field data sheets are contained in Appendix A.

4.1.2 Testing Station and Traverse Location

The sampling test ports on the stack are located approximately 267 feet above ground elevation with a test platform for accessing four test ports located 90 degrees apart. See Figures 1 and 2. The internal diameter of the stack at the sampling location is 26 feet. The nearest downstream disturbance is the stack exit, which is approximately 125 feet (4.8 diameters) from the test location. The nearest upstream disturbance is the inlet breeching which is approximately 143 feet (5.5 diameters) from the test location. EPA Method 1 was utilized to determine the number and location of the traverse points. Twenty-four sampling points were used, six at each test port.

4.1.3 Gas Flow and Gas Temperature Measurements

The gas flow rate and temperature profiles for the gas stream were measured by conducting simultaneous velocity and temperature traverses during each particulate sampling run. Gas velocity head was measured with a calibrated "S"-type pitot tube which was connected to a manometer. The static pressure was measured using the same pitot tube and manometer. A Chrome-Alumel thermocouple attached to a digital indicator was used to measure the gas temperature at each of the traverse points. The gas flow and gas temperature measurements followed the principles of EPA Method 2--Determination Of Stack Gas Velocity And Volumetric Flow Rate ("S"-type Pitot tube).

4.1.4 Carbon Dioxide and Oxygen Determination

An Orsat analyzer was used to determine the molecular weight of the flue gas for the measurement of gas flow during the particulate emission sampling. An integrated sample was collected during each sample run using the principles of EPA Method 3. The average of three analyses was used for each sample run. The following parameters were measured: percent carbon dioxide (CO_2) by volume and percent oxygen (O_2) by volume. The percent nitrogen (N_2) by volume was determined by difference.

4.1.5 Moisture Content Sampling

Moisture sampling was conducted concurrently with particulate sampling using the principles presented in EPA Method 4--Determination Of Moisture Content In Stack Gasses. Parameters evaluated in order to determine the gas stream moisture content were: sample gas volume, sample gas temperature, sample gas pressure, impinger moisture gain, and silica gel moisture gain.

4.1.6 Determination of Particulate Matter Emissions

The principles of EPA Method 5--Determination Of Particulate Matter Emissions From Stationary Sources and the methodology described in the DEP "Source Testing Manual" were used to measure particulate emissions. Particulate matter was withdrawn isokinetically from the gas stream and collected on a glass fiber filter. A series of glass impingers containing distilled water and silica gel collected water vapor. The impinger content volumes were measured after sampling to determine the moisture pickup and saved for analyses of the back half contribution to the total particulate catch in accordance with DEP procedures. A calibrated dry gas meter measured the gas sample volume that exceeded 60 dry standard cubic feet for all sample runs. The average of three 120 minute sample runs constituted the test.

4.1.7 *Determination of PM_{10} Emissions*

PM_{10} emissions were determined for each run by submitting the particulate probe wash and filter catch samples (front half catch) to a laboratory for analyses by CCSEM. The analytical results are reported as the percent of the aerodynamic diameter by weight for the probe wash and filter in the following size classes: 0.2 to 1.0; 1.0 to 2.5; 2.5 to 5.0; 5.0 to 10.0; 10.0 to 50.0; and greater than 50.0 microns. The percentages for the size classes to 10.0 microns were added to determine the percentage of the aerodynamic diameter by weight for the probe wash and filter. The percentages were multiplied by the total particulate catch to determine the amount of particulate collected that was PM_{10}. The PM_{10} emission rate was determined from the flow data for the sampling run. The PM_{10} emission rate was divided by the emission rate calculated from the front half catch and multiplied by 100 to yield the PM_{10} as a percentage of the emission rate.

4.1.8 Determination of CO Emissions

The principles of EPA Method 10--Determination Of Carbon Monoxide Emissions From Stationary Sources (Instrumental Analyzer Procedure) was used for this test program to sample CO. A gas sample was continuously extracted from the stack and a portion of the sample was conveyed to a CO analyzer. The analyzer measured the CO concentration using the principles of nondispersive infrared (NDIR) analysis. Three 60-minute sampling runs constituted the test. One sample run was conducted during each of the three particulate emision tests.

4.1.9 Boiler Heat Input

The boiler heat input for each sample run was calculated by multiplying the net station output by the net station heat rate of 11,498 Btu/Kwhr, which was the value for August, 1996. Station data is shown in Appendix B.

4.2 ANALYTICAL

The "front half " analyses of the particulate train were completed by Optimal in the Pittsburgh, Pennsylvania, laboratory. The "back half" analyses of the particulate train was completed by Air Quality Services. The CCSEM analyses of the collected particulate were completed by R.J. Lee Group. The procedures used to prepare the collected particulate matter for CCSEM analyses are contained with the CCSEM analytical results. Analytical Data is contained in Appendix C.

4.3 CALCULATIONS

Emission calculations were completed by using a computer spreadsheet format. The results of each pertinent parameter are detailed on the spreadsheet for each sampling run and are contained in Appendix D. Sample calculations are included.

4.4 CALIBRATIONS

The following field equipment calibrations are contained in Appendix E:

- Pitot tube
- Thermocouple
- Dry gas meter and orifice
- Nozzle
- CO analyzer
- CO calibration gas certificates

5.0 SUMMARY OF RESULTS

Table 2 presents a summary of pertinent gas sampling, boiler operation data and emission data.

The particulate emissions ranged from 0.048 lb/mmBtu to 0.122 lb/mmBtu. The average emission rate was 0.084 lb/mmBtu. The allowable emission rate is 0.10 lb/mmBtu.

The PM_{10} emission ranged from 24.6 to 50.1 percent of the total particulate catch. The average was 34.0 percent.

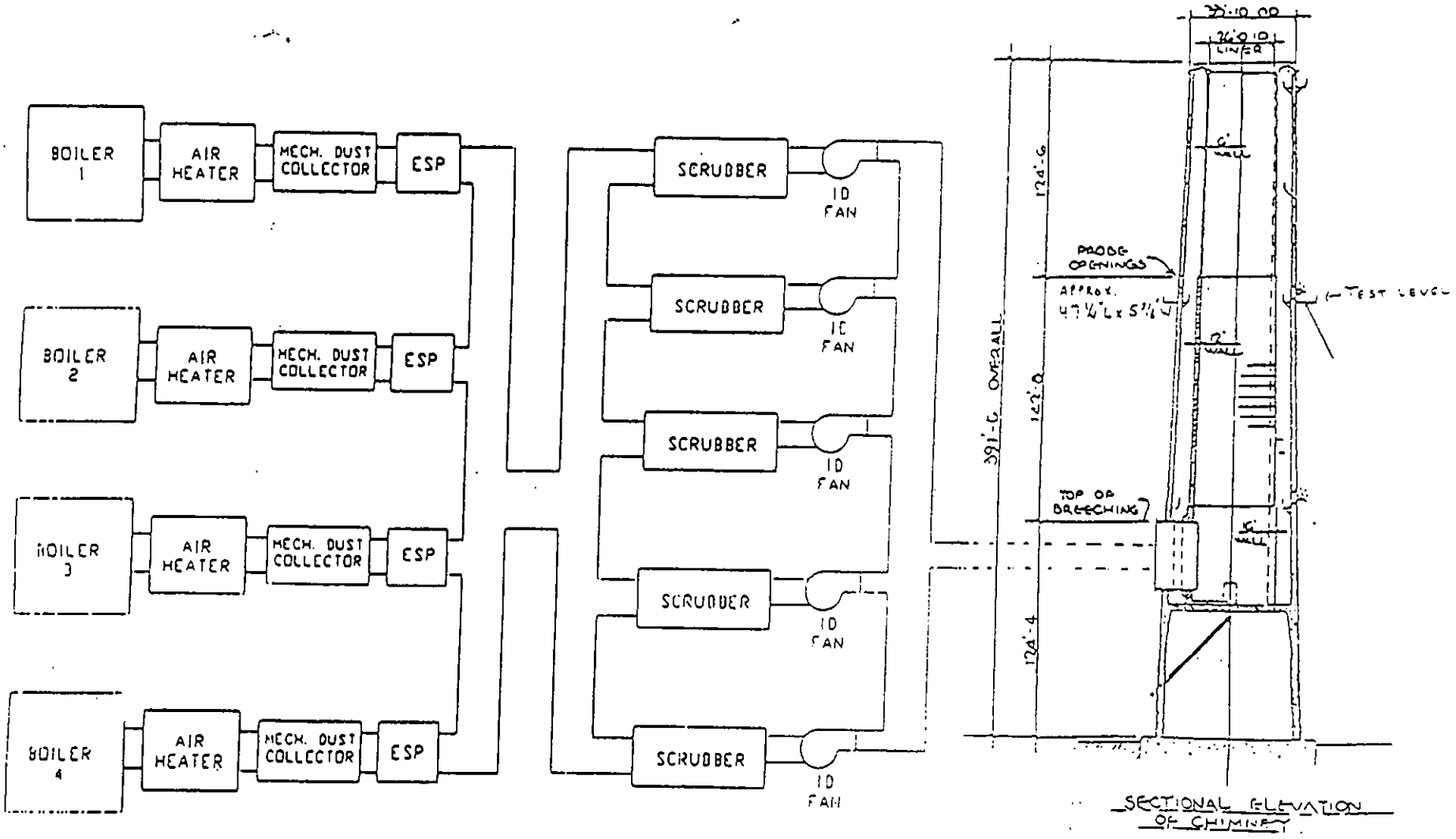
The CO emission concentration ranged from 26 to 86 ppm. The average concentration was 58 ppm.

TABLE 2
SUMMARY OF EMISSION DATA
SEPTEMBER 18, 1996
ELRAMA POWER STATION

Parameter	Run 1	Run 2	Run 3	Average
Time	0900-1128	1200-1432	1535-1756	----------
New Station Output (Mwhrs)	423	426	423	424
Gas Flow (acfm)	1,747,924	1,676,886	1,687,080	1,703,963
Gas Flow (dscfm)	1,333,439	1,309,511	1,299,876	1,314,275
Gas Temp (oF)	124	124	124	124
Oxygen (%)	8.80	8.20	7.93	8.31
Carbon Dioxide	9.00	10.20	10.07	9.76
Moisture Content (%)	12.9	11.1	12.0	12.0
Sample Volume (dscf)	62.713	61.858	60.582	61.718
Isokinetic Ratio (%)	107.9	108.4	107.0	107.8
Boiler Heat Input (mmBtu/hr)	4864	4898	4864	4875
Particulate:				
gr/dscf	0.052	0.021	0.036	0.036
lb/hr	594	236	401	410
lb/mmBtu	0.122	0.048	0.082	0.084
PM_{10}:				
lb/hr	163	119	99	127
lb/mmBtu	0.034	0.024	0.020	0.026
% of Total Particulate	27.5	50.1	24.6	34.0
Carbon Monoxide:				
ppm	26	86	63	58
lb/hr	150	491	358	333
lb/mmBtu	0.031	0.100	0.074	0.068

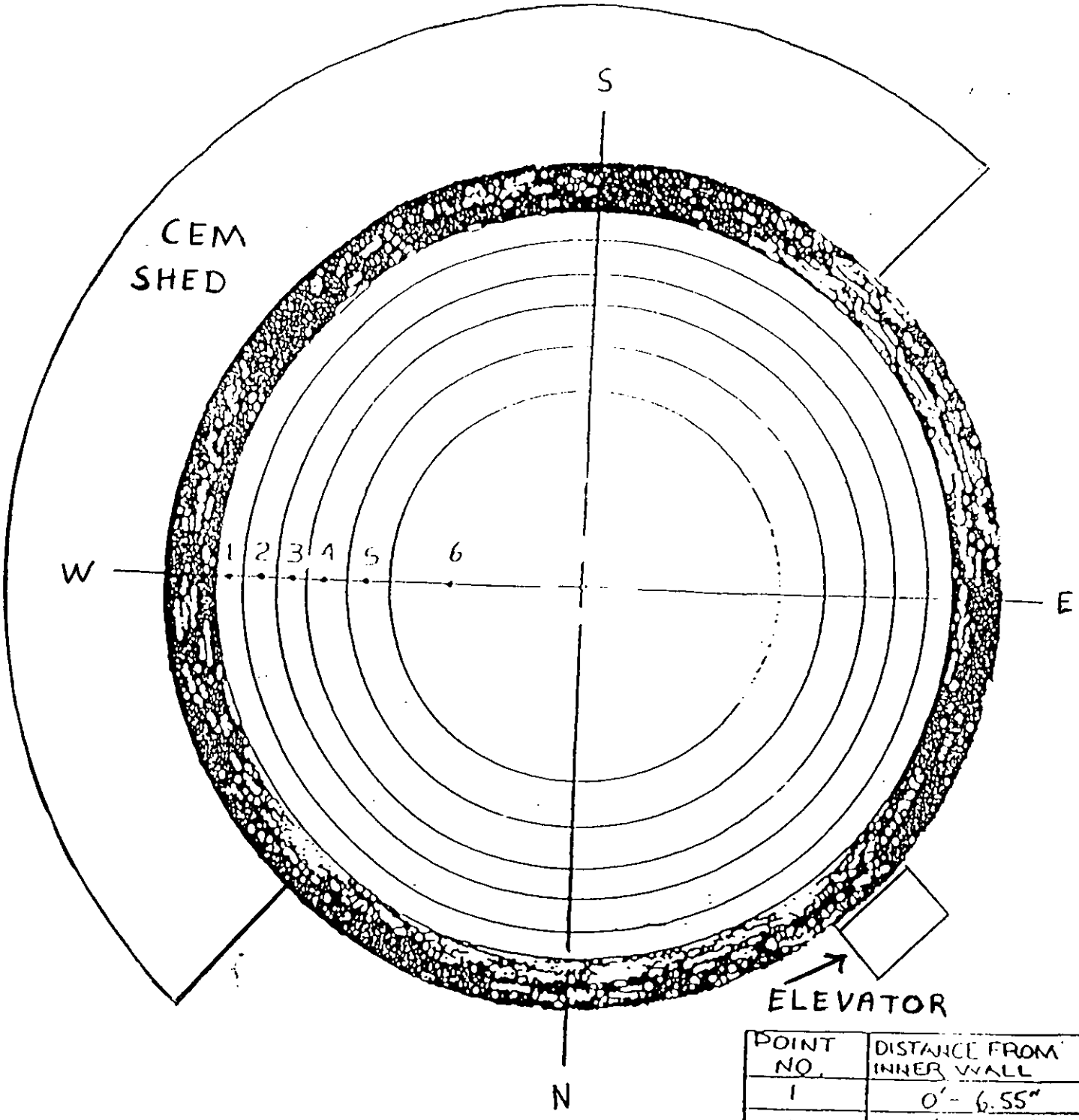
PROCESS FLOW DIAGRAM

FIGURE 1



SAMPLING LOCATION

FIGURE 2



POINT NO.	DISTANCE FROM INNER WALL
1	0' - 6.55"
2	1' - 8.90"
3	3' - 0.82"
4	4' - 7.22"
5	6' - 6.00"
6	9' - 3.07"

Appendix A

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

Plant Duquesne Light Company Elrama Power Station

Date 9-17-96

Sampling location Exhaust Stack

Inside of far wall to outside of nipple 362 in

Inside of near wall to outside of nipple (nipple length): 50 in

Stack inside diameter, inches 312 in

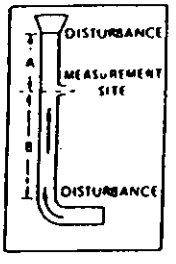
Distance downstream from flow disturbance (Distance B):

143 ~~inches~~ feet / diameter = 5.5 dd

Distance upstream from flow disturbance (Distance A):

125 ~~inches~~ feet / diameter = 4.8 dd

Calculated by Paul Jadlowiec



SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	NIPPLE LENGTH	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	0.021	312	6.6	~~50~~ 68	~~56~~ 74.6
2	0.067		20.9		~~70.9~~ 88.9
3	0.118		36.8		~~86.8~~ 104.8
4	0.177		55.2		~~105.2~~ 123.2
5	0.250		78.0		~~128.0~~ 146
6	0.356		111.1		~~161.1~~ 179.1
7					
8					
9					
10					
11					
12					

Preliminary Traverse

~~EPA METHOD 5~~

FIELD DATA SHEET

Run No: Preliminary Traverse
Date: 9-17-96
Client: Duquesne Light Co
Plant: Elrama Power Station
Location: Exhaust Stack
Project No: —
Test Crew: PJ + JED
Ambient Temperature: 67

Control Box Number: —
Pitot Number: —
Filter Number: —
Umbilical Length: —
Barometric Pressure: —
Static Pressure: -0.50
Assumed Moisture: —
Calculated Multiplier: —

Nozzle Diameter: —
Meter H@: —
Correction Factor: 0.84
Pitot Correction Factor: —
Probe Number: —
Thermocouple No: —
Probe Length. —
Stack Diameter: —

Page of

Traverse Point Number	Elapsed Time 0	Clock Time	Gas Meter Reading	Velocity Head	Orifice Pressure	Pump Vacuum	Meter Temp. In	Meter Temp. Out	Stack Temp.	Probe Temp.	Oven Temp.	Impinger Temp.	Comments
S 1				.60									
2				.71									
3				.76									
4				.81									
5				.90									
6				.95									
	Total/Avg.												

Sample Train Leak Check

Time	in. Hg	CFM
Initial		
Final		

Pitot Leak Check

Pressure	
Static	

Gas Analysis

Run	1	2	3	Avg.
CO2				
O2				
CO				
N2				

Moisture Gain

Impinger	Final Vol.	Inital Vol.	Difference
1			
2			
3			
4			
5			
		Total Gain	

Sheet 2 of 14
Appendix A

EPA METHOD 5
FIELD DATA SHEET

Run No: 1
Date: SEPTEMBER 18, 1996
Client: DUQUESNE LIGHT CO.
Plant: ELRAMA POWER STATION
Location: EXHAUST STACK
Project No: 570
Test Crew: JF & PAJ
Ambient Tempe ature: ~67

Control Box Number: 80900
Pitot Number: 16-1
Filter Number: 294
Umbilical Length: 50'
Barometric Pressure: 29.02
Static Pressure: -0.50
Assumed Moisture: 12%
~~Orifice Meter Coefficient~~ REF. AP = 1.50

Nozzle Diameter: 0.188
Meter H@: 1.957
Correction Factor: 0.959
Pitot Correction Factor: 0.84
Probe Number: 16-1
Thermocouple No: 16-1
Probe Length: 6'
Stack Diameter: 26'

Traverse Point Number		Elapsed Time	Clock Time	Gas Meter Reading	Velocity Head	Orifice Pressure	Pump Vacuum	Meter Temp. In	Meter Temp. Out	Stack Temp.	Probe Temp.	Oven Temp.	Impinger Temp.	Comments
		0	0900	597.929										
N	1	5	0905	600.577	.70	.92	2.0	73	72	124	249/250	248	57	
	2	10	0910	603.350	.85	1.1	2.0	74	72	124		242	55	
	3	15	0915	606.143	.85	1.1	2.0	76	72	124		244	52	
	4	20	0920	609.076	.95	1.2	2.0	78	73	124		251	53	
	5	25	0925	611.998	.95	1.2	2.0	80	74	124		249	54	
	6	30	0930	614.843	.90	1.1	2.0	81	75	124		245	55	
			0945											
W	1	35	0950	617.248	.60	.78	1.5	77	75	124		240	54	
	2	40	0955	620.031	.85	1.1	2.0	77	75	124		250	55	
	3	45	1000	622.861	.90	1.1	2.0	78	74	124		247	52	
	4	50	1005	625.659	.85	1.1	2.0	78	75	124		246	53	
	5	55	1010	628.493	.85	1.1	2.0	79	74	124		247	54	
	6	60	1015	631.324	.85	1.1	3.0	78	74	124		252	57	
		Total/Avg.		65.953	0.905	1.01				123.9				

73.8

Sample Train Leak Check

Time	in. Hg	CFM
Initial	15	0.009
Final	5	0.010

Pitot Leak Check

Pressure	OK
Static	OK

Gas Analysis

Run	1	2	3	Avg.
CO2	9.0	9.0	9.0	9.00
O2	8.8	8.8	8.8	8.80
CO				
N2				

Moisture Gain MW/M

Impinger	Final Vol.	Inital Vol.	Difference
1	287	100	187
2	96 100	100	-4
3	01	0	1
4	240.9	228.0	12.9
5			
Total Gain			96.9

Sheet 3 of 14
Appendix A

EPA METHOD 5
FIELD DATA SHEET

Run No: 2
Date: SEPTEMBER 18, 1996
Client: DUQUESNE LIGHT CO.
Plant: ELRAMA POWER STATION
Location: EXHAUST STACK
Project No: 570
Test Crew: JEP + PAJ
Ambient Temperature: ~70

Control Box Number: 80900
Pitot Number: 16-1
Filter Number: 295
Umbilical Length: 50'
Barometric Pressure: 29.10
Static Pressure: -0.50
Assumed Moisture: 12%
~~Calculated Multiplier~~ REF. A P = 1.50

Nozzle Diameter: 0.188
Meter H@: 1.957
Correction Factor: 0.989
Pitot Correction Factor: 0.84
Probe Number: 16-
Thermocouple No: 16-1
Probe Length: 10'
Stack Diameter: 26'

Traverse Point Number	Elapsed Time	Clock Time	Gas Meter Reading	Velocity Head	Orifice Pressure	Pump Vacuum	Meter Temp. In	Meter Temp. Out	Stack Temp.	Probe Temp.	Oven Temp.	Impinger Temp.	Comments
	0	1200	664.206										
N 1	5	1205	666.647	.60	.78	3.5	70	68	124	248/225	264	65	
2	10	1210	669.240	.70	.90	4.0	70	68	124		267	65	
3	15	1215	672.018	.85	1.1	4.5	71	68	123		239	60	
4	20	1220	674.831	.80	1.0	4.0	71	68	124		243	59	
5	25	1225	677.631	.85	1.1	4.5	72	68	123		243	56	
6	30	1230	680.483	.85	1.1	4.5	73	69	124		251	55	
		1249											
E 1	35	1248	682.719	.50	.65	3.0	75	71	125		251	63	
2	40	1254	685.298	.70	.92	4.0	76	72	124		243	61	
3	45	1259	688.029	.80	1.0	4.5	77	72	124		239	60	
4	50	1304	690.882	.85	1.1	5.0	77	72	124		262	57	
5	55	1309	693.647	.80	1.0	4.5	77	73	124		246	56	
6	60	1314	696.448	.80	1.0	4.5	77	73	124		247	56	
	Total/Avg.		64.952	0.875	0.986				123.8				

74.4

Sample Train Leak Check

Time	in. Hg	CFM
Initial	15	0.010
Final	7	0.010

Pitot Leak Check

Pressure	OK
Static	OK

Gas Analysis

Run	1	2	3	Avg.
CO2	10.2	10.2	10.2	10.20
O2	~~18.2~~	8.2	8.2	8.20
CO				
N2				

Moisture Gain ~~BAD~~

Impinger	Final Vol.	Inital Vol.	Difference
1	252	100	~~157~~ 152
2	100	100	~~+4~~ 0
3	0	0	0
4	245.7	234.0	11.7
5			
		Total Gain	163.7

Sheet 5 of 14 Approved

EPA METHOD 5
FIELD DATA SHEET

Run No: 1 Date: SEPTEMBER 18, 1996 Client: DUQUESNE LIGHT CO. Location: EXHAUST STACK
1020 ELRAMA POWER STATION

Traverse Point No.	Elapsed Time	Clock Time	Gas Meter Reading	Velocity Head	Orifice Pressure	Pump Vacuum	Meter Temp. In	Meter Temp. Out	Stack Temp.	Probe Temp.	Oven Temp.	Impinger Temp	Comments
S 1	05	1025	633.254	.60	.78	2.0	76	73	124	248-251	247	57	
2	70	1030	636.243	.85	1.1	2.0	77	73	124		251	56	
3	75	1035	639.031	.85	1.1	2.5	76	73	124		258	55	
4	80	1040	641.833	.85	1.1	2.5	75	72	124		247	55	
5	85	1045	644.641	.85	1.1	3.0	75	71	124		254	56	
6	90	1050	647.472	.85	1.1	3.0	74	71	124		255	56	
		1058											
E 1	95	1103	649.794	.60	.78	2.5	72	70	124		244	57	
2	100	1108	652.754	.95	1.1	3.5	72	69	123		246	57	
3	105	1113	655.424	.75	.98	3.0	72	69	124		250	56	
4	110	1118	658.361	.85	1.1	3.5	71	68	124		251	57	
5	115	1123	661.042	.85	1.1	3.5	72	69	123		253	57	
6	120	1128	663.882	.90	1.1	3.5	72	69	123		256	58	
Total/Avg.													

Sheet 4 of 14
Appendix A

EPA METHOD 5
FIELD DATA SHEET

Run No: 2 Date: SEPTEMBER 18, 1996 Client: DUQUESNE LIGHT CO. Location: ELRAMA POWER STATION

Page 2 of 2

Traverse Point No.	Elapsed Time	Clock Time	Gas Meter Reading	Velocity Head	Orifice Pressure	Pump Vacuum	Meter Temp. In	Meter Temp. Out	Stack Temp.	Probe Temp.	Oven Temp.	Impinger Temp	Comments
		1320											
S 1	65	1325	699.045	.70	.92	4.5	76	73	124	245-255	262	56	
2	70	1330	701.747	.80	1.0	4.5	76	73	124		249	52	
3	75	1335	704.554	.85	1.1	5.0	77	73	124		239	52	
4	80	1340	707.302	.80	1.0	5.0	77	73	124		268	53	
5	85	1345	709.889	.70	.92	4.5	78	73	124		266	55	
6	90	1350	712.752	.85	1.1	5.0	78	74	124		240	56	
		1402											
W 1	95	1407	715.266	.65	.84	4.5	77	73	122		248	59	
2	100	1412	717.917	.70	.94	5.0	80	74	124		254	57	
3	105	1417	720.831	.85	1.1	5.5	81	75	124		268	57	
4	110	1422	723.635	.85	1.1	5.5	82	76	124		254	57	
5	115	1427	726.394	.80	1.0	5.5	84	77	124		238	57	
6	120	1432	729.158	.80	1.0	5.5	84	78	124		265	58	
Total/Avg.					0								

Sheet 6 of 14
Appendix A

EPA METHOD 5
FIELD DATA SHEET

Run No: 3
Date: SEPTEMBER 15, 1996
Client: DUQUESNE LIGHT CO.
Plant: ELRAMA POWER STATION
Location: EXHAUST STACK
Project No: 570
Test Crew: JEP + PAT
Ambient Temperature: ~70

Control Box Number: 80900
Pitot Number: 16-
Filter Number: 296
Umbilical Length: 50'
Barometric Pressure: 29.02
Static Pressure: -0.50
Assumed Moisture: 12%
~~Calculated Moisture~~: 1.50
REF. AP =

Nozzle Diameter: 0.186
Meter H@: 1.957
Correction Factor: 0.989
Pitot Correction Factor: 0.84
Probe Number: 16-
Thermocouple No: 16-
Probe Length: 16'
Stack Diameter: 261

Traverse Point Number	Elapsed Time	Clock Time	Gas Meter Reading	Velocity Head	Orifice Pressure	Pump Vacuum	Meter Temp. In	Meter Temp. Out	Stack Temp.	Probe Temp.	Oven Temp.	Impinger Temp.	Comments
	0	1535	730.273										
S 1	5	1540	732.384	.65	.84	3.0	81	80	123	248 125	257	52	
2	10	1545	735.127	.80	1.0	3.0	81	79	124		258	49	
3	15	1550	737.963	.85	1.1	3.0	82	79	124		267	49	
4	20	1555	740.775	.85	1.1	3.0	83	79	124		247	49	
5	25	1600	743.616	.85	1.1	3.0	84	79	124		234	49	
6	30	1605	746.453	.85	1.1	3.0	85	80	124		258	52	
		1610											
N 1	35	1615	749.060	.60	.78	3.0	84	80	124		237	53	
2	40	1620	751.778	.80	1.0	3.0	86	80	124		249	54	
3	45	1625	754.581	.80	1.0	3.5	86	81	124		265	53	
4	50	1630	757.502	.85	1.1	3.5	86	81	124		235	54	
5	55	1635	760.233	.85	1.1	3.5	86	81	124		232	54	
6	60	1640	763.118	.80	1.0	3.5	87	82	124		259	54	
	Total/Avg.		65.003	0.877	0.989				124.1				

84.6

Sample Train Leak Check

Time	in. Hg	CFM
Initial	15	0.004
Final	7	0.010

Pitot Leak Check

Pressure	OK
Static	OK

Gas Analysis

Run	1	2	3	Avg.
CO2	10.0	10.0	10.2	10.07
O2	8.0	8.0	7.8	7.93
CO				
N2				

Moisture Gain

Impinger	Final Vol.	Inital Vol.	Difference
1	259	100	159
2	102	100	2
3	0	0	0
4	248.8	234.8	14.0
5			
		Total Gain	175.0

Sheet 7 of 14
Appendix A

EPA METHOD 5
FIELD DATA SHEET

Run No: 3 Date: SEPTEMBER 18, 1996 Client: DUQUESNE LIGHT CO., ELFAMA POWER STATION Location: EXHAUST STACK

Page 2 of 2

Traverse Point No.	Elapsed Time	Clock Time	Gas Meter Reading	Velocity Head	Orifice Pressure	Pump Vacuum	Meter Temp. In	Meter Temp. Out	Stack Temp.	Probe Temp.	Oven Temp.	Impinger Temp	Comments
E 1	65	1651	765.491	.60	.78	3.0	87	83	124	248/225	233	57	
2	70	1656	768.086	.70	.92	3.5	88	83	124		254	56	
3	75	1701	770.794	.78	1.0	4.0	89	84	124		251	54	
4	80	1706	773.653	.85	1.1	4.0	89	84	124		242	56	
5	85	1711	776.431	.80	1.0	4.0	90	85	124		248	53	
6	90	1716	779.203	.80	1.0	4.0	90	85	124		255	54	
		1726											
1	95	1731	781.603	.60	.78	3.5	88	86	125		250	57	
2	100	1736	784.220	.70	.92	4.0	88	86	125		264	55	
3	105	1741	786.984	.85	1.1	5.0	89	86	125		245	53	
4	110	1746	789.778	.70	.92	4.0	89	87	125		235	55	
5	115	1751	792.510	.80	1.0	4.5	91	86	124		255	56	
6	120	1756	795.278	.80	1.0	5.0	91	87	124	↓	254	57	
Total/Avg.													

Sheet 8 of 14
Appendix A

DUQUESNE LIGHT COMPANY
ELRAMA POWER STATION
CARBON MONOXIDE EMISSIONS
September 18, 1996
Run No. 1

DATE/TIME	CO ppm
09/18/96 09:00:30	28.3
09/18/96 09:01:30	18.7
09/18/96 09:02:30	19.8
09/18/96 09:03:30	20.8
09/18/96 09:04:30	40.3
09/18/96 09:05:30	27.3
09/18/96 09:06:30	18.7
09/18/96 09:07:30	21.7
09/18/96 09:08:30	17.3
09/18/96 09:09:30	27.7
09/18/96 09:10:30	20.2
09/18/96 09:11:30	15.7
09/18/96 09:12:30	17.3
09/18/96 09:13:30	23.3
09/18/96 09:14:30	23.7
09/18/96 09:15:30	17.7
09/18/96 09:16:30	23.7
09/18/96 09:17:30	16.7
09/18/96 09:18:30	75.8
09/18/96 09:19:30	24.2
09/18/96 09:20:30	18.7
09/18/96 09:21:30	19.2
09/18/96 09:22:30	44.7
09/18/96 09:23:30	26.7
09/18/96 09:24:30	24.2
09/18/96 09:25:30	21.2
09/18/96 09:26:30	16.2
09/18/96 09:27:30	48.8
09/18/96 09:28:30	19.8
09/18/96 09:29:30	20.8
09/18/96 09:30:30	20.8
09/18/96 09:31:30	21.7
09/18/96 09:32:30	21.2
09/18/96 09:33:30	25.2
09/18/96 09:34:30	23.7
09/18/96 09:35:30	20.2
09/18/96 09:36:30	18.7
09/18/96 09:37:30	19.8
09/18/96 09:38:30	41.2
09/18/96 09:39:30	20.2

DUQUESNE LIGHT COMPANY
ELRAMA POWER STATION
CARBON MONOXIDE EMISSIONS
September 18, 1996
Run No. 1

DATE/TIME	CO ppm
09/18/96 09:40:30	22.7
09/18/96 09:41:30	22.3
09/18/96 09:42:30	71.2
09/18/96 09:43:30	22.7
09/18/96 09:44:30	20.8
09/18/96 09:45:30	21.2
09/18/96 09:46:30	31.2
09/18/96 09:47:30	17.3
09/18/96 09:48:30	19.8
09/18/96 09:49:30	21.2
09/18/96 09:50:30	16.3
09/18/96 09:51:30	18.2
09/18/96 09:52:30	17.7
09/18/96 09:53:30	21.7
09/18/96 09:54:30	19.8
09/18/96 09:55:30	27.7
09/18/96 09:56:30	18.2
09/18/96 09:57:30	43.2
09/18/96 09:58:30	20.8
09/18/96 09:59:30	18.2
AVERAGE ppm	**24.7**

CALIBRATION DRIFT CORRECTION CALCULATION

Cavg	Co	Cm	Cma	Cgas
24.7	**0.0**	**77.0**	**80.6**	**25.85**

Cgas = Effluent gas concentration, dry basis, corrected for drift, ppm.
Cavg = Average gas concentration from analyzer.
Co = Average of initial and final system calibration bias check for zero.
Cm = Average of initial and final system calibration bias check for calibration gas.
Cma = Actual concentration of calibration gas.

DUQUESNE LIGHT COMPANY
ELRAMA POWER STATION
CARBON MONOXIDE EMISSIONS
September 18, 1996
Run No. 2

DATE/TIME	CO ppm
09/18/96 12:45:48	112.8
09/18/96 12:46:48	69.8
09/18/96 12:47:48	82.3
09/18/96 12:48:48	67.3
09/18/96 12:49:48	77.7
09/18/96 12:50:48	69.8
09/18/96 12:51:48	60.7
09/18/96 12:52:48	98.2
09/18/96 12:53:48	54.7
09/18/96 12:54:48	55.7
09/18/96 12:55:48	66.3
09/18/96 12:56:48	60.7
09/18/96 12:57:48	121.3
09/18/96 12:58:48	63.2
09/18/96 12:59:48	73.8
09/18/96 13:00:48	118.8
09/18/96 13:01:48	76.8
09/18/96 13:02:48	78.8
09/18/96 13:03:48	82.7
09/18/96 13:04:48	117.3
09/18/96 13:05:48	73.3
09/18/96 13:06:48	116.9
09/18/96 13:07:48	77.3
09/18/96 13:08:48	74.8
09/18/96 13:09:48	119.8
09/18/96 13:10:48	73.8
09/18/96 13:11:48	62.8
09/18/96 13:12:48	72.3
09/18/96 13:13:48	85.8
09/18/96 13:14:48	62.3
09/18/96 13:15:48	84.8
09/18/96 13:16:48	78.7
09/18/96 13:17:48	57.3
09/18/96 13:18:48	84.8
09/18/96 13:19:48	65.8
09/18/96 13:20:48	70.3
09/18/96 13:21:48	83.3
09/18/96 13:22:48	109.8
09/18/96 13:23:48	76.5
09/18/96 13:24:48	62.3

DUQUESNE LIGHT COMPANY
ELRAMA POWER STATION
CARBON MONOXIDE EMISSIONS
September 18, 1996
Run No. 2

DATE/TIME	CO ppm
09/18/96 13:25:48	143.8
09/18/96 13:26:48	94.8
09/18/96 13:27:48	98.8
09/18/96 13:28:48	81.8
09/18/96 13:29:48	57.8
09/18/96 13:30:48	64.8
09/18/96 13:31:48	65.3
09/18/96 13:32:48	59.7
09/18/96 13:33:48	63.8
09/18/96 13:34:48	93.3
09/18/96 13:35:48	275.9
09/18/96 13:36:48	64.8
09/18/96 13:37:48	42.2
09/18/96 13:38:48	43.2
09/18/96 13:39:48	62.3
09/18/96 13:40:48	73.8
09/18/96 13:41:48	89.3
09/18/96 13:42:48	68.8
09/18/96 13:43:48	60.7
09/18/96 13:44:48	122.8
AVERAGE ppm	**82.2**

CALIBRATION DRIFT CORRECTION CALCULATION

Cavg	Co	Cm	Cma	Cgas
82.2	**-0.1**	**76.9**	**80.6**	**86.15**

Cgas = Effluent gas concentration, dry basis, corrected for drift, ppm.
Cavg = Average gas concentration from analyzer.
Co = Average of initial and final system calibration bias check for zero.
Cm = Average of initial and final system calibration bias check for calibration gas.
Cma = Actual concentration of calibration gas.

DUQUESNE LIGHT COMPANY
ELRAMA POWER STATION
CARBON MONOXIDE EMISSIONS
September 18, 1996
Run No. 3

DATE/TIME	CO ppm
09/18/96 15:35:24	73.3
09/18/96 15:36:24	37.8
09/18/96 15:37:24	71.3
09/18/96 15:38:24	45.3
09/18/96 15:39:24	40.7
09/18/96 15:40:24	52.8
09/18/96 15:41:24	64.3
09/18/96 15:42:24	45.7
09/18/96 15:43:24	49.2
09/18/96 15:44:24	42.8
09/18/96 15:45:24	41.2
09/18/96 15:46:24	43.2
09/18/96 15:47:24	36.8
09/18/96 15:48:24	40.8
09/18/96 15:49:24	33.7
09/18/96 15:50:24	31.2
09/18/96 15:51:24	38.2
09/18/96 15:52:24	33.3
09/18/96 15:53:24	38.7
09/18/96 15:54:24	64.3
09/18/96 15:55:24	68.3
09/18/96 15:56:24	68.8
09/18/96 15:57:24	55.3
09/18/96 15:58:24	61.8
09/18/96 15:59:24	74.8
09/18/96 16:00:24	77.3
09/18/96 16:01:24	73.8
09/18/96 16:02:24	85.3
09/18/96 16:03:24	73.8
09/18/96 16:04:24	56.8
09/18/96 16:05:24	57.8
09/18/96 16:06:24	69.8
09/18/96 16:07:24	88.7
09/18/96 16:08:24	81.3
09/18/96 16:09:24	56.3
09/18/96 16:10:24	64.8
09/18/96 16:11:24	67.8
09/18/96 16:12:24	49.7
09/18/96 16:13:24	89.3
09/18/96 16:14:24	72.7

DUQUESNE LIGHT COMPANY
ELRAMA POWER STATION
CARBON MONOXIDE EMISSIONS
September 18, 1996
Run No. 3

DATE/TIME	CO ppm
09/18/96 16:15:24	64.8
09/18/96 16:16:24	87.2
09/18/96 16:17:24	57.8
09/18/96 16:18:24	74.8
09/18/96 16:19:24	69.2
09/18/96 16:20:24	68.3
09/18/96 16:21:24	54.7
09/18/96 16:22:24	64.8
09/18/96 16:23:24	47.8
09/18/96 16:24:24	86.2
09/18/96 16:25:24	70.3
09/18/96 16:26:24	71.7
09/18/96 16:27:24	57.3
09/18/96 16:28:24	74.2
09/18/96 16:29:24	43.7
09/18/96 16:30:24	49.7
09/18/96 16:31:24	52.2
09/18/96 16:32:24	54.7
09/18/96 16:33:24	47.2
09/18/96 16:34:24	102.8
AVERAGE ppm	**60.3**

CALIBRATION DRIFT CORRECTION CALCULATION

Cavg	Co	Cm	Cma	Cgas
60.3	**-0.2**	**76.9**	**80.6**	**63.25**

Cgas = Effluent gas concentration, dry basis, corrected for drift, ppm.
Cavg = Average gas concentration from analyzer.
Co = Average of initial and final system calibration bias check for zero.
Cm = Average of initial and final system calibration bias check for calibration gas.
Cma = Actual concentration of calibration gas.

Run No.	Run Times Start	Run Times End	Avg Output Mwhrs/Hr	Heat Input 10^6BTU/Hr
1	0900	1128	423	4 864
2	1200	1432	426	4 898
3	1535	1756	423	4 864

Duquesne Light Company
Elrama Power Station
Stack Emission Test

HOURLY GENERATION AND LOAD

WEDNESDAY September 18, 1996

OUTPUT / **INTERCHANGE**

HR	CHES	ELRA	PHIL	B.L.	BV-1 DL	BV-2 DL	FORT MART	SAM	ELS	MANS 1	MANS 2	MANS 3	PERY	GENER TOTAL	(+) BV1&2 CAPCO	(+ OR -) NET INT	(-) EXT GEN	(+ OR -) INTER	SYS LOAD	HR
1	301	275	0	-1	393	-5	0	75	108	180	49	97	161	[illegible]	430	-260	-668	90	[illegible]	1
2	264	200	0	-1	395	-5	0	62	109	165	44	80	161	[illegible]	430	-231	-611	90	[illegible]	2
3	202	163	0	0	394	-5	0	62	109	153	47	79	161	1365	430	-132	-611	90	[illegible]	3
4	181	161	0	-1	395	-5	0	62	109	152	43	78	161	[illegible]	430	-142	-603	90	[illegible]	4
5	181	163	0	-1	395	-5	0	62	109	159	46	80	161	1350	430	-126	-617	90	[illegible]	5
6	220	162	0	0	396	-5	0	68	109	178	51	97	161	1437	430	-99	-664	90	[illegible]	6
7	314	255	0	-1	396	-5	0	100	109	162	45	71	161	1607	430	-124	-648	90	[illegible]	7
8	360	376	0	-1	394	-5	0	108	109	152	44	14	161	1712	430	-138	-588	90	[illegible]	8
9	394	420	0	-1	395	-5	0	102	109	149	44	8	161	[illegible]	430	-158	-573	104	[illegible]	9
10	444	421	0	-1	395	-5	0	101	109	152	44	14	161	[illegible]	430	-142	-581	119	[illegible]	10
11	498	425	0	-1	393	-5	0	102	109	147	44	3	161	[illegible]	430	-173	-568	118	[illegible]	11
12	510	423	0	-1	392	-5	0	102	109	158	47	17	161	[illegible]	430	-135	-594	113	[illegible]	12
13	531	424	0	-1	392	-5	0	102	109	145	42	4	161	[illegible]	430	-182	-563	117	[illegible]	13
14	525	427	0	-1	392	-5	0	102	109	148	44	13	161	[illegible]	430	-163	-577	113	[illegible]	14
15	514	426	0	-1	391	-5	0	114	109	147	31	9	161	[illegible]	430	-160	-571	104	[illegible]	15
16	491	422	0	0	391	-5	0	134	109	149	24	20	161	[illegible]	430	-125	-597	103	[illegible]	16
17	485	424	0	-1	390	-5	0	135	109	145	22	8	161	[illegible]	430	-150	-580	106	[illegible]	17
18	475	423	0	-1	389	-5	0	130	109	144	22	4	161	[illegible]	430	-168	-570	104	[illegible]	18
19	452	378	0	-1	390	-5	0	112	109	143	22	28	161	[illegible]	430	-183	-573	103	[illegible]	19
20	495	333	0	0	392	-5	0	98	109	144	23	47	161	[illegible]	430	-137	-582	90	[illegible]	20
21	524	343	0	-1	394	-5	0	101	109	142	22	46	161	[illegible]	430	-164	-581	90	[illegible]	21
22	547	345	0	-1	391	-5	0	101	109	116	13	30	161	1807	430	-213	-530	90	[illegible]	22
23	513	344	0	0	390	-5	0	80	108	141	20	6	161	1758	430	-319	-514	90	[illegible]	23
24	450	285	0	-1	393	-5	0	76	100	150	32	10	161	1651	430	-317	-529	90	[illegible]	24
TOT	9871	8018	0	-19	9428	-120	0	2291	2601	3611	865	859	3854	[illegible]	10320	-4121	-14091	2373	[illegible]	TOT

REMARKS: The heat input was determined by multiplying the average output by the August 1996 station heat rate of 11,498BTU/Kwhr.

EPA METHOD 5
BLANK ANALYTICAL DATA FORM

Client:	Duquesne Light Company	**Sample date:**	09/18/96
Project No:	570	**Analysis date:**	09/24/96
Location:	Exhaust Stack	**Technician:**	BJS

ACETONE BLANK	UNIT	
Acetone rinse container No.		260
Density of acetone (pa)	g/ml	0.7857
Acetone blank volume (Va)	ml	175
Average gross wt.	mg	100727.40
Average tare wt.	mg	100727.30
Weight of blank (Ma)	mg	0.10
Acetone blank wt. (Ca=Ma/(Va x Pa))	mg	0.0007

Note:
In no case should a blank resdue greater than 0.01 mg/g or 0.001% of the blank weight be subtracted from the sample weight.

EPA METHOD 5
ANALYTICAL PARTICULATE DATA

Client: Duquesne Light Company
Project No: 570
Location: Exhaust Stack
Sample date: 09/18/96
Analysis date: 09/24/96
Technician: BJS

	UNIT	RUN 1	RUN 2	RUN 3
ACETONE RINSE				
Acetone rinse container No.		259	257	258
Density of acetone (pa)	g/ml	0.7857	0.7857	0.7857
Acetone rinse volume (Vaw)	ml	180	230	188
Acetone blank (Ca)	mg/g	0.0007	0.0007	0.0007
Wa =(Ca) (Vaw) (pa)	mg	0.10	0.13	0.10
Average gross wt.	mg	69008.70	66432.20	68998.00
Average tare wt.	mg	68888.70	66403.20	68921.90
Acetone blank wt. (Wa)	mg	0.10	0.13	0.10
Wt. of particulate in acetone rinse (Ma)	mg	119.90	28.87	76.00
FILTER				
Filter No.		294	295	296
Average gross wt.	mg	482.40	450.15	460.00
Average tare wt.	mg	391.40	394.50	394.30
Wt. of particulate on filter (Mf)	mg	91.00	55.65	65.70
FINAL WEIGHT				
Wt. of particulate in acetone rinse (Ma)	mg	119.90	28.87	76.00
Wt. of particulate on filter (Mf)	mg	91.00	55.65	65.70
TOTAL WT OF PARTICULATE (Mn)	**mg**	**210.90**	**84.52**	**141.70**

AIR QUALITY SERVICES, INC.

4527 Clairton Boulevard
Pittsburgh, PA 15236
(412) 881-5630

TABLE I
ANALYSIS OF IMPINGER WATER FOR INSOLUBLE PARTICULATE
OPTIMAL TECHNOLOGIES, INC.
U-PARC
575 WILLIAM PITT WAY
PITTSBURGH, PA 15238
SAMPLES RECEIVED: SEPTEMBER 19, 1996

PROJECT PURCHASE ORDER #S-32989

OPTIMAL TECHNOLOGIES ID	AQS LABORATORY NUMBER	PARTICULATE WEIGHT MILLIGRAMS
RUN 1	72887	0.008
RUN 2	72888	0.005
RUN 3	72889	0.005
BLANK	72890	0.002

THE FILTERS WERE WEIGHED ON A MICRO BALANCE CALIBRATED WITH WEIGHTS TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY.

John O. Frohliger
AIR QUALITY SERVICES, INC.

JOB 5354
REPORTED: SEPTEMBER 23, 1996

Client_Name	Optimal Tech.
Client_Number	Run 1
Project_Number	ESH609172
Sample_Number	609967
Comment	Filter No.294
Datafiles	204740_A\609967.*

Mag	Fields	Grid
50	5.6918	6.945
200	6.1096	1.736
600	4.1412	0.579

Classes	#.	Number %	Wt %
Si/Al-rich	273	21.00	62.69
C-rich	191	67.97	13.38
Misc.	37	2.26	5.51
Si-rich	31	1.80	5.21
Fe-rich	24	1.91	7.89
S-rich	18	1.81	1.29
S/Ca-rich	16	2.90	2.83
S/Fe-rich	1	0.31	0.45
Si/S/Fe-rich	2	0.03	0.74
Totals	593	100.00	100.00

Table I

Size Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
Si/Al-rich	21.0	51.6	37.4	6.8	3.3	1.0	0.0
C-rich	68.0	85.9	12.9	0.9	0.1	0.1	0.0
Misc.	2.3	0.0	69.5	28.2	2.1	0.2	0.0
Si-rich	1.8	33.1	35.0	17.1	14.5	0.4	0.0
Fe-rich	1.9	49.3	32.9	12.4	5.0	0.4	0.0
S-rich	1.8	17.3	69.3	11.8	1.3	0.3	0.0
S/Ca-rich	2.9	87.0	10.8	0.8	0.8	0.5	0.0
S/Fe-rich	0.3	0.0	100.0	0.0	0.0	0.0	0.0
Si/S/Fe-rich	0.0	0.0	0.0	0.0	93.7	6.3	0.0
Totals	100.0	73.6	21.4	3.5	1.3	0.3	0.0

Table II

Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
Si/Al-rich	62.7	0.3	3.0	5.5	28.2	63.0	0.0
C-rich	13.4	2.8	9.4	8.1	12.8	67.0	0.0
Misc.	5.5	0.0	15.8	28.6	35.5	20.0	0.0
Si-rich	5.2	0.0	6.5	12.9	71.0	9.6	0.0
Fe-rich	7.9	0.6	9.4	15.0	35.8	39.2	0.0
S-rich	1.3	0.2	32.3	22.7	10.7	34.1	0.0
S/Ca-rich	2.8	0.7	2.6	0.3	8.6	87.8	0.0
S/Fe-rich	0.5	0.0	100.0	0.0	0.0	0.0	0.0
Si/S/Fe-rich	0.7	0.0	0.0	0.0	84.6	15.4	0.0
Totals	100.0	0.6	6.0	8.2	28.9	56.2	0.0

Table III

Aerodynamic Mass Distribution by Aerodynamic Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
Si/Al-rich	62.7	0.2	2.2	4.2	17.8	75.6	0.0
C-rich	13.4	1.9	10.3	7.4	13.5	67.0	0.0
Misc.	5.5	0.0	9.7	24.7	10.1	55.5	0.0
Si-rich	5.2	0.0	1.1	13.1	76.3	9.6	0.0
Fe-rich	7.9	0.0	1.2	9.8	28.0	61.0	0.0
S-rich	1.3	0.2	8.9	46.1	10.7	34.1	0.0
S/Ca-rich	2.8	0.2	3.1	0.3	8.6	87.8	0.0
S/Fe-rich	0.5	0.0	0.0	100.0	0.0	0.0	0.0
Si/S/Fe-rich	0.7	0.0	0.0	0.0	84.6	15.4	0.0
Totals	100.0	0.4	3.6	7.5	20.7	67.8	0.0

Table IV

32.2 % of filt

Appendix C

Client_Name	Optimal Tech.
Client_Number	Run 1
Project_Number	ESH609172
Sample_Number	609968
Comment	Beaker
Datafiles	204740_B\609968.*

Mag	Fields	Grid
50	1.1494	6.945
200	1.0086	1.736
600	0.9969	0.579

Classes	#	Number %	Wt %
Si/Al-rich	155	20.18	28.36
C-rich	175	64.34	8.24
S/Fe-rich	103	1.72	40.25
S-rich	42	4.62	5.07
Si/S/Fe-rich	44	2.73	6.20
S/Ca-rich	28	1.48	6.53
Si-rich	26	3.05	3.53
Fe-rich	10	1.25	1.20
Misc.	10	0.62	0.62
Totals	593	100.00	100.00

Table I

Size Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
Si/Al-rich	20.2	36.4	52.6	8.7	2.0	0.5	0.0
C-rich	64.3	81.8	16.0	1.9	0.3	0.0	0.0
S/Fe-rich	1.7	19.2	19.2	38.0	14.8	8.8	0.0
S-rich	4.6	15.6	64.5	17.3	2.4	0.3	0.0
Si/S/Fe-rich	2.7	71.8	0.0	21.3	5.3	1.6	0.0
S/Ca-rich	1.5	22.4	67.3	4.9	2.5	2.8	0.0
Si-rich	3.1	50.3	32.6	11.9	4.8	0.4	0.0
Fe-rich	1.2	0.0	79.6	17.5	2.9	0.0	0.0
Misc.	0.6	0.0	53.1	46.6	0.0	0.3	0.0
Totals	100.0	64.8	27.5	5.9	1.3	0.4	0.0

Table II

Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
Si/Al-rich	28.4	0.3	7.7	11.7	27.1	53.2	0.0
C-rich	8.2	3.1	13.0	12.5	21.8	49.6	0.0
S/Fe-rich	40.3	0.0	0.1	3.6	18.7	77.6	0.0
S-rich	5.1	0.1	7.3	24.9	17.6	50.1	0.0
Si/S/Fe-rich	6.2	0.1	0.0	15.6	10.2	74.1	0.0
S/Ca-rich	6.5	0.1	4.6	3.4	3.0	88.9	0.0
Si-rich	3.5	0.4	2.9	14.5	38.2	44.2	0.0
Fe-rich	1.2	0.0	39.6	53.4	7.0	0.0	0.0
Misc.	0.6	0.0	36.1	53.7	0.0	10.2	0.0
Totals	100.0	0.4	4.7	9.7	20.2	65.0	0.0

Table III

Aerodynamic Mass Distribution by Aerodynamic Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
Si/Al-rich	28.4	0.1	4.0	9.4	15.6	70.8	0.0
C-rich	8.2	2.3	12.3	12.8	23.1	49.6	0.0
S/Fe-rich	40.3	0.0	0.1	1.4	6.2	76.4	15.8
S-rich	5.1	0.1	7.3	14.6	27.9	50.1	0.0
Si/S/Fe-rich	6.2	0.0	0.1	10.4	15.4	74.1	0.0
S/Ca-rich	6.5	0.0	2.4	3.6	5.2	88.9	0.0
Si-rich	3.5	0.0	3.2	14.5	38.2	44.2	0.0
Fe-rich	1.2	0.0	8.1	55.8	36.1	0.0	0.0
Misc.	0.6	0.0	0.0	86.3	3.5	10.2	0.0
Totals	100.0	0.2	2.9	7.6	13.3	69.5	6.4

Table IV

24.0% finer by wt.

Client_Name	Optimal Tech.
Client_Number	Run 2
Project_Number	ESH609172
Sample_Number	609969
Comment	Filter No. 295
Datafiles	204740_C\609969.*

Mag	Fields	Grid
50	29.2074	6.945
200	9.5940	1.736
600	3.3209	0.579

Classes	#	Number %	Wt %
C-rich	385	87.81	54.02
Si/Al-rich	129	10.80	38.87
Misc.	29	0.40	4.22
Si-rich	9	0.88	1.28
S-rich	8	0.10	1.62
Totals	560	100.00	100.00

Table I

Size Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
C-rich	87.8	76.9	21.6	1.2	0.2	0.0	0.0
Si/Al-rich	10.8	21.5	68.1	8.0	2.3	0.1	0.0
Misc.	0.4	0.0	0.0	96.2	3.7	0.2	0.0
Si-rich	0.9	44.1	44.1	11.9	0.0	0.0	0.0
S-rich	0.1	0.0	0.0	71.2	28.5	0.3	0.0
Totals	100.0	70.3	26.7	2.5	0.5	0.0	0.0

Table II

Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
C-rich	54.0	5.0	22.0	8.0	16.8	48.2	0.0
Si/Al-rich	38.9	0.8	21.8	20.9	44.8	11.7	0.0
Misc.	4.2	0.0	0.0	64.8	10.0	25.2	0.0
Si-rich	1.3	5.9	11.0	83.1	0.0	0.0	0.0
S-rich	1.6	0.0	0.0	24.3	68.7	7.0	0.0
Totals	100.0	3.1	20.5	16.7	28.0	31.7	0.0

Table III

Aerodynamic Mass Distribution by Aerodynamic Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
C-rich	54.0	4.0	17.1	13.8	17.0	48.2	0.0
Si/Al-rich	38.9	0.3	17.4	18.2	44.9	19.2	0.0
Misc.	4.2	0.0	0.0	57.8	17.0	25.2	0.0
Si-rich	1.3	0.0	16.9	44.5	38.6	0.0	0.0
S-rich	1.6	0.0	0.0	24.3	68.7	7.0	0.0
Totals	100.0	2.2	16.2	17.9	29.0	34.6	0.0

Table IV

65.3

Client_Name	Optimal Tech.
Client_Number	Run 2
Project_Number	ESH609172
Sample_Number	609970
Comment	Beaker No. 257
Datafiles	204741_A\609970.*

Mag	Fields	Grid
50	2.8290	6.945
200	2.1185	1.736
600	1.5478	0.579

Classes	#	Number %	Wt %
S/Fe-rich	203	8.08	62.63
C-rich	140	59.25	3.30
S-rich	95	16.19	8.17
Si/Al-rich	50	9.40	10.40
S/Ca-rich	50	0.90	9.78
Si/S/Fe-rich	27	2.08	3.31
Si-rich	22	4.01	1.88
Misc.	3	0.07	0.49
Fe-rich	1	0.03	0.03
Totals	591	100.00	100.00

Table I

Size Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
S/Fe-rich	8.1	5.1	55.6	30.4	7.0	1.9	0.0
C-rich	59.2	71.6	27.6	0.7	0.1	0.0	0.0
S-rich	16.2	14.0	78.2	6.8	0.8	0.2	0.0
Si/Al-rich	9.4	40.9	52.2	5.3	1.4	0.2	0.0
S/Ca-rich	0.9	45.6	0.0	33.3	14.8	6.2	0.0
Si/S/Fe-rich	2.1	19.6	58.9	19.1	1.6	0.7	0.0
Si-rich	4.0	10.2	81.4	8.3	0.0	0.1	0.0
Misc.	0.1	0.0	0.0	48.9	48.9	2.3	0.0
Fe-rich	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Totals	100.0	50.2	42.9	5.6	1.1	0.3	0.0

Table II

Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
S/Fe-rich	62.6	0.0	1.6	6.4	6.1	70.4	15.5
C-rich	3.3	8.0	55.2	9.5	8.0	19.3	0.0
S-rich	8.2	0.2	19.3	16.6	10.6	53.3	0.0
Si/Al-rich	10.4	0.3	6.1	6.1	15.5	72.0	0.0
S/Ca-rich	9.8	0.1	0.0	4.2	15.0	80.6	0.0
Si/S/Fe-rich	3.3	0.2	5.1	14.4	7.5	72.9	0.0
Si-rich	1.9	0.5	16.6	14.3	0.0	68.6	0.0
Misc.	0.5	0.0	0.0	5.9	30.6	63.4	0.0
Fe-rich	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Totals	100.0	0.3	5.5	7.5	8.4	68.5	9.7

Table III

Aerodynamic Mass Distribution by Aerodynamic Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
S/Fe-rich	62.6	0.0	1.1	3.8	9.2	39.0	46.9
C-rich	3.3	6.3	47.7	18.6	8.0	19.3	0.0
S-rich	8.2	0.2	12.8	15.9	17.8	53.3	0.0
Si/Al-rich	10.4	0.2	4.2	5.8	17.8	72.0	0.0
S/Ca-rich	9.8	0.0	0.1	3.4	8.3	88.1	0.0
Si/S/Fe-rich	3.3	0.2	5.1	8.9	13.0	72.9	0.0
Si-rich	1.9	0.0	17.1	14.3	0.0	68.6	0.0
Misc.	0.5	0.0	0.0	5.9	30.6	63.4	0.0
Fe-rich	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Totals	100.0	0.2	4.3	5.9	10.7	49.5	29.4

Table IV

21.1

Client_Name	Optimal Tech.
Client_Number	Run 3
Project_Number	ESH609172
Sample_Number	609971
Comment	Filter No. 296
Datafiles	204741_B\609971.*

Mag	Fields	Grid
50	9.7776	6.945
200	11.7776	1.736
600	4.0084	0.579

Classes	#	Number %	Wt %
Si/Al-rich	253	28.53	62.57
C-rich	242	67.74	28.12
Si-rich	53	1.61	5.24
Misc.	16	1.02	2.90
S/Ca-rich	3	1.06	0.28
S-rich	3	0.03	0.27
S/Fe-rich	1	0.00	0.11
Fe-rich	1	0.00	0.50
Totals	572	100.00	100.00

Table I

Size Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
Si/Al-rich	28.5	53.3	40.9	3.8	1.7	0.4	0.0
C-rich	67.7	76.3	22.8	0.8	0.1	0.1	0.0
Si-rich	1.6	25.9	25.9	44.1	3.9	0.1	0.0
Misc.	1.0	0.0	81.3	18.5	0.0	0.2	0.0
S/Ca-rich	1.1	59.4	39.1	1.5	0.0	0.0	0.0
S-rich	0.0	0.0	0.0	96.4	0.0	3.6	0.0
S/Fe-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0
Fe-rich	0.0	0.0	0.0	0.0	0.0	100.0	0.0
Totals	100.0	67.9	28.7	2.6	0.6	0.2	0.0

Table II

Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
Si/Al-rich	62.6	1.2	5.6	8.6	35.8	48.9	0.0
C-rich	28.1	3.2	13.8	5.3	5.2	72.5	0.0
Si-rich	5.2	1.1	2.2	61.2	23.9	11.7	0.0
Misc.	2.9	0.0	14.8	24.4	0.0	60.8	0.0
S/Ca-rich	0.3	1.6	43.4	55.0	0.0	0.0	0.0
S-rich	0.3	0.0	0.0	34.0	0.0	66.0	0.0
S/Fe-rich	0.1	0.0	0.0	0.0	0.0	100.0	0.0
Fe-rich	0.5	0.0	0.0	0.0	0.0	100.0	0.0
Totals	100.0	1.7	8.0	11.0	25.1	54.1	0.0

Table III

Aerodynamic Mass Distribution by Aerodynamic Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
Si/Al-rich	62.6	0.5	5.3	5.5	19.2	69.5	0.0
C-rich	28.1	2.3	14.7	5.3	5.2	72.5	0.0
Si-rich	5.2	0.0	3.2	47.0	38.1	11.7	0.0
Misc.	2.9	0.0	14.8	18.6	5.7	60.8	0.0
S/Ca-rich	0.3	1.6	43.4	0.0	55.0	0.0	0.0
S-rich	0.3	0.0	0.0	34.0	0.0	66.0	0.0
S/Fe-rich	0.1	0.0	0.0	0.0	0.0	100.0	0.0
Fe-rich	0.5	0.0	0.0	0.0	0.0	100.0	0.0
Totals	100.0	1.0	8.2	8.0	15.8	67.0	0.0

Table IV

33.0

Client_Name	Optimal Tech.
Client_Number	Run 3
Project_Number	ESH609172
Sample_Number	609972
Comment	Filter No. 258
Datafiles	204741_C\609972.*

Mag	Fields	Grid
50	2.5789	6.945
200	4.4501	1.736
600	5.9262	0.579

Classes	#	Number %	Wt %
S/Fe-rich	181	7.74	56.07
Si/S/Fe-rich	75	4.63	15.68
Si/Al-rich	83	11.53	11.20
S-rich	72	17.15	6.87
C-rich	130	52.27	2.97
S/Ca-rich	26	1.53	3.51
Si-rich	26	4.32	2.17
Misc.	5	0.78	1.10
Fe-rich	1	0.05	0.44
Totals	599	100.00	100.00

Table I

Size Distribution by Average Diameter (microns)

Classes	Number %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
S/Fe-rich	7.7	9.2	36.9	25.9	20.5	7.6	0.0
Si/S/Fe-rich	4.6	7.7	46.3	26.2	16.0	3.8	0.0
Si/Al-rich	11.5	25.4	58.8	10.1	4.6	1.2	0.0
S-rich	17.2	38.4	54.1	6.2	0.9	0.4	0.0
C-rich	52.3	79.8	18.4	1.5	0.2	0.1	0.0
S/Ca-rich	1.5	23.3	46.6	17.2	6.9	6.0	0.0
Si-rich	4.3	41.3	41.3	12.2	4.9	0.3	0.0
Misc.	0.8	0.0	91.7	6.8	0.0	1.5	0.0
Fe-rich	0.1	0.0	0.0	0.0	100.0	0.0	0.0
Totals	100.0	54.4	33.9	7.1	3.5	1.1	0.0

Table II

Mass Distribution by Average Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
S/Fe-rich	56.1	0.0	0.6	2.7	16.8	79.9	0.0
Si/S/Fe-rich	15.7	0.0	1.1	5.4	27.7	65.8	0.0
Si/Al-rich	11.2	0.2	3.8	9.4	22.3	64.4	0.0
S-rich	6.9	0.3	11.6	8.3	5.8	74.1	0.0
C-rich	3.0	3.1	13.8	13.4	16.0	53.7	0.0
S/Ca-rich	3.5	0.0	0.5	7.0	9.8	82.6	0.0
Si-rich	2.2	0.5	9.1	22.9	58.6	8.9	0.0
Misc.	1.1	0.0	4.2	2.2	0.0	93.5	0.0
Fe-rich	0.4	0.0	0.0	0.0	100.0	0.0	0.0
Totals	100.0	0.2	2.4	5.1	19.2	73.1	0.0

Table III

Aerodynamic Mass Distribution by Aerodynamic Diameter (microns)

Classes	Mass %	0.2 - 1.0	1.0 - 2.5	2.5 - 5.0	5.0 - 10.0	10.0 - 50.0	>>>
S/Fe-rich	56.1	0.0	0.3	1.5	10.2	65.4	22.6
Si/S/Fe-rich	15.7	0.0	0.6	3.7	12.2	83.4	0.0
Si/Al-rich	11.2	0.0	4.0	5.1	17.5	73.4	0.0
S-rich	6.9	0.1	7.1	11.8	7.0	74.1	0.0
C-rich	3.0	2.0	13.3	11.5	19.5	53.7	0.0
S/Ca-rich	3.5	0.0	0.5	2.4	14.4	82.6	0.0
Si-rich	2.2	0.2	6.9	9.4	38.7	44.9	0.0
Misc.	1.1	0.0	4.2	2.2	0.0	93.5	0.0
Fe-rich	0.4	0.0	0.0	0.0	0.0	100.0	0.0
Totals	100.0	0.1	1.8	3.5	12.0	70.0	12.6

Table IV

17.4

RJ LeeGroup, Inc.

350 Hochberg Road • Monroeville, PA 15146
412/325-1776 • FAX 412/733-1799

October 8, 1996

Mr. Todd Starner
PA DEP
Source Testing Section

RE: Sample Preparation Processes

Dear Mr. Starner:

Please find below summaries of the sample preparation procedures for probe rinses and quartz/glass-fiber filters.

Preparation of Probe Rinse

Preparation for CCSEM involves resuspending the evaporated particulate matter with approximately 50 ml of filtered acetone. The acetone/particulate mixture is ultrasonically agitated for several seconds to break apart any loosely-bound agglomerate particles. An aliquot of this mixture is poured into a vacuum filtration device onto a 47 mm, 0.2 μm pore size polycarbonate (PC) filter. After redeposition, the PC filter is examined using optical light microscopy to ensure uniformity of particle loading and proper areal concentration. An unacceptable filter (i.e., too lightly or heavily loaded) is reprepared. The acceptable filter is mounted on a carbon planchet SEM stub. This is accomplished by removing a section (~1.5 cm^2) of the PC filter using a clean scalpel blade and placing the section face up on the SEM stub. Colloidal graphite adhesive paint is used to secure the filter to the stub. The final step in the preparation process involves coating the filter with a thin layer of carbon using evaporative deposition under vacuum techniques. The carbon coating does not interfere with the analysis and is used to dissipate the electrical charge (i.e., uneven illumination) induced by the electron beam.

Preparation of Quartz & Glass-Fiber Filters

Preparation of glass-fiber and quartz filters is performed by liberating the particulate matter and depositing it onto a PC filter. The removal of particles from the original filter must be accomplished in a manner that will maintain the original characteristics of the particulate matter. The method of redeposition begins with an examination of the original filter by optical light microscopy. While this analysis is not performed in a quantitative manner, it can provide valuable information about the characteristics and size distribution of the sample. Each filter is also examined for any defects such as holes, signs of inadequate sealing, or the growth of mold or fungus that would invalidate the sample. Extraction of the particulate matter from the original sample is accomplished through a pressurized fluid flow process. Initially, several disks are removed from a glass-fiber or a quartz-fiber filter using a 1.2 cm diameter brass punch. For each sample, a filter disk is placed in a pressure filtration holder. Perforated stainless steel screens (~130 μm mesh size) are used to secure the filter in the filtration holder and to minimize the redeposition of large fibers from the

filter. Silicon tubes are attached to both openings of the pressure filtration holder. While applying pressure, filtered acetone is forced through the non-exposed side of the filter flushing particles from the filter. The total quantity of particulate matter available for redeposition is controlled by varying the number of filter disks extracted for each sample. The acetone/particulate mixture is collected in a clean beaker. The particles are redeposited onto a 47 mm, 0.2 μm pore size PC filter by pouring the acetone/particulate mixture into a vacuum filtration device. After redeposition, the PC filter is examined using light microscopy to ensure uniformity of loading and proper areal concentration. An unacceptable filter (i.e., too lightly or heavily loaded) is reprepared. The acceptable filter is mounted on a carbon planchet SEM stub. This is accomplished by removing a section (~1.5 cm^2) of the PC filter using a clean scalpel blade and placing the section face up on the SEM stubs. Colloidal graphite adhesive paint is used to secure the filter to the stub. The final step in the preparation process for CCSEM involves coating the filters with a thin layer of carbon using evaporative deposition under vacuum techniques. The carbon coating does not interfere with the analysis and is used to dissipate the electrical charge (i.e., uneven illumination) induced by the electron beam.

If you have any questions concerning the above information, please feel free to call me.

Sincerely,

Steve Schlaegle

Steven F. Schlaegle
Project Manager
Environmental Services

SFS:dls

c: Paul Jadlowiec, Optimal Technologies

DUQUESNE LIGHT COMPANY
ELRAMA POWER STATION
SEPTEMBER 19, 1996
PROJECT NO. 570

PARTICULATE AND CARBON MONOXIDE EMISSIONS

SYMBOL		DESCRIPTION		RUN NO. 1	RUN NO. 2	RUN NO. 3	AVERAGE
Tbcta	=	Duration of test, min.	=	120	120	120	120
Vm	=	Dry sample volume (meter conditions), cu. ft.	=	65.953	64.952	65.005	65.303
SQRT(dP)	=	Average of square roots of pitot pressure , in. water	=	0.905	0.875	0.877	0.886
dH	=	Orifice pressure drop, in. water	=	1.010	0.986	0.989	0.995
Ts	=	Average stack temperature, deg. F	=	123.9	123.8	124.1	123.9
Tm	=	Average dry gas meter temperature, deg. F	=	73.8	74.4	84.6	77.6
CO2	=	CO2 in stack gas, %	=	9.00	10.20	10.07	9.76
O2	=	O2 in stack gas, %	=	8.80	8.20	7.93	8.31
CO+N2	=	CO and N2 in stack gas, %	=	82.20	81.60	82.00	81.93
Pbar	=	Barometric pressure, in. Hg.	=	29.02	29.10	29.02	29.05
Pa	=	Static pressure, in. water	=	-0.50	-0.50	-0.50	-0.50
Ps	=	Stack pressure (absolute), in. Hg.	=	28.98	29.06	28.98	29.01
Cp	=	Pitot correction factor, dimensionless	=	0.84	0.84	0.84	0.84
Y	=	Dry gas meter correction factor	=	0.989	0.989	0.989	0.989
Dn	=	Diameter of nozzle, in.	=	0.1880	0.1880	0.1880	0.1880
Ds	=	Diameter of stack, ft.	=	26.0	26.0	26.0	26.00
Vlc	=	Volume of liquid collected in impingers and silica gel, ml	=	196.9	163.7	175.0	178.5
Fh	=	Front half catch, mg	=	210.90	84.52	141.70	145.71
Bh	=	Back half catch, mg	=	0.008	0.005	0.005	0.006
Mn	=	Total particulate catch, mg	=	210.908	84.525	141.705	145.71
Co	=	Carbon monoxide concentration, ppm	=	24.7	82.2	60.3	55.7
Btu	=	Boiler heat input, mmBtu/hr	=	4864	4898	4864	4875
		CALCULATED VALUES					
An	=	Area of the nozzle, sq. ft.	=	1.928E-04	1.928E-04	1.928E-04	1.928E-04
A	=	Area of the stack, sq. ft.	=	530.929	530.929	530.929	530.929
Md	=	Dry molecular weight of stack gas, dry basis, lb/lb-mole	=	29.79	29.96	29.93	29.89
Vw(std)	=	Volume of liquid collected, cu. ft.	=	9.268	7.705	8.237	8.403
Ms	=	Molecular weight of stack gas, wet basis, lb/lb-mole	=	28.27	28.63	28.50	28.47
Vm(std)	=	Dry sample volume (standard conditions), dscf	=	62.713	61.858	60.582	61.718
Vs	=	Stack velocity, ft/sec	=	54.87	52.64	52.96	53.49
Bws	=	Moisture content of the gas stream, %	=	12.9	11.1	12.0	12.0
Qs	=	Stack gas flow, acfm	=	1747924	1676886	1687080	1703963
Qsd	=	Stack gas flow, dscfm	=	1333439	1309511	1299876	1314275
I	=	Isokinetic ratio, %	=	107.9	108.4	107.0	107.8
		PARTICULATE EMISSION SUMMARY					
Cs	=	Particulate concentration, gr/dscf	=	0.052	0.021	0.036	0.036
E	=	Particulate emission rate, lb/hr	=	594	236	401	410
Ebtu	=	Particulate emission rate, lb/mmBtu	=	0.122	0.048	0.082	0.084
		CARBON MONOXIDE EMISSION SUMMARY					
C's	=	Carbon monoxide concentration, ppm	=	25.85	86.15	63.25	58.42
E	=	Particulate emission rate, lb/hr	=	150	491	358	333
Ebtu	=	Particulate emission rate, lb/mmBtu	=	0.031	0.100	0.074	0.068

DUQUESNE LIGHT COMPANY
ELRAMA POWER STATION
SEPTEMBER 19, 1996
PROJECT NO. 570

PM-10 EMISSIONS

SYMBOL		DESCRIPTION		RUN NO. 1	RUN NO. 2	RUN NO. 3	AVERAGE
Theta	=	Duration of test, min.	=	120	120	120	120
Vm	=	Dry sample volume (meter conditions), cu. ft.	=	65.953	64.952	65.005	65.303
SQRT(dP)	=	Average of square roots of pitot pressure , in. water	=	0.905	0.875	0.877	0.886
dH	=	Orifice pressure drop, in. water	=	1.010	0.986	0.989	0.995
Ts	=	Average stack temperature, deg. F	=	123.9	123.8	124.1	123.9
Tm	=	Average dry gas meter temperature, deg. F	=	73.8	74.4	84.6	77.6
CO2	=	CO2 in stack gas, %	=	9.00	10.20	10.07	9.76
O2	=	O2 in stack gas, %	=	8.80	8.20	7.93	8.31
CO+N2	=	CO and N2 in stack gas, %	=	82.20	81.60	82.00	81.93
Pbar	=	Barometric pressure, in. Hg.	=	29.02	29.10	29.02	29.05
Pa	=	Static pressure, in. water	=	-0.50	-0.50	-0.50	-0.50
Ps	=	Stack pressure (absolute), in. Hg.	=	28.98	29.06	28.98	29.01
Cp	=	Pitot correction factor, dimensionless	=	0.84	0.84	0.84	0.84
Y	=	Dry gas meter correction factor	=	0.989	0.989	0.989	0.989
Dn	=	Diameter of nozzle, in.	=	0.1880	0.1880	0.1880	0.1880
Ds	=	Diameter of stack, ft	=	26.0	26.0	26.0	26.00
Vlc	=	Volume of liquid collected in impingers and silica gel, ml	=	196.9	163.7	175.0	178.5
Ma	=	Weight of particulate in acetone rinse, mg	=	119.90	28.87	76.00	74.92
Mf	=	Weight of particulate on filter, mg	=	91.00	55.65	65.70	70.78
Fh	=	Front half catch, mg	=	210.90	84.52	141.70	145.71
Btu	=	Boiler heat input, mmBtu/hr	=	4864	4898	4864	4875
%PM-10	=	Percentage of PM-10 in acetone rinse, %	=	24.0	21.1	17.4	20.8
%PM-10	=	Percentage of PM-10 on filter, %	=	32.2	65.3	33.0	43.5
		CALCULATED VALUES					
An	=	Area of the nozzle, sq. ft.	=	1.928E-04	1.928E-04	1.928E-04	1.928E-04
A	=	Area of the stack, sq. ft.	=	530.929	530.929	530.929	530.929
Md	=	Dry molecular weight of stack gas, dry basis, lb/lb-mole	=	29.79	29.96	29.93	29.89
Vw(std)	=	Volume of liquid collected, cu. ft.	=	9.268	7.705	8.237	8.403
Ms	=	Molecular weight of stack gas, wet basis, lb/lb-mole	=	28.27	28.63	28.50	28.47
Vm(std)	=	Dry sample volume (standard conditions), dscf	=	62.713	61.858	60.582	61.718
Vs	=	Stack velocity, ft/sec	=	54.87	52.64	52.96	53.49
Bws	=	Moisture content of the gas stream, %	=	12.9	11.1	12.0	12.0
Qs	=	Stack gas flow, acfm	=	1747924	1676886	1687080	1703963
Qsd	=	Stack gas flow, dscfm	=	1333439	1309511	1299876	1314275
I	=	Isokinetic ratio, %	=	107.9	108.4	107.0	107.8
Efh	=	Front half emission rate, lb/hr	=	593	237	402	411
MnMaPM-10	=	Weight of PM-10 in acetone rinse, mg	=	28.78	6.09	13.22	16.03
MnMfPM-10	=	Weight of PM-10 on filter, mg	=	29.30	36.34	21.68	29.11
MnPM-10	=	Total weight of PM-10 catch, mg	=	58.08	42.43	34.91	45.14
		PM-10 EMISSIONS					
PM-10Cs	=	PM-10 concentration, gr/dscf	=	0.014	0.011	0.009	0.011
PM-10E	=	PM-10 emission rate, lb/hr	=	163	119	99	127
PM-10Ebtu	=	PM-10 emission rate, lb/mmBtu	=	0.034	0.024	0.020	0.026
PM-10%	=	PM-10 emission , % of front half particulate	=	27.5	50.1	24.6	34.0

Duquesne Light Company
Elrama Power Station

Sample Calculations - Run No. 1

PARTICULATE AND CO EMISSIONS

Equation 5-1

$$V_{M(Std)} = (17.64\,^{\circ}R/in\,Hg)(65.953\,dcf)(0.989)\left(\frac{29.02\,in\,Hg + \frac{(1.010\,in\,H_2O)}{13.6\,in\,H_2O/in\,Hg}}{533.8\,^{\circ}R}\right) = \underline{62.713\,dscf}$$

Equation 5-2

$$V_{W(Std)} = (0.04707\,ft^3/gm)(196.9\,gm) = \underline{9.268\,scf}$$

Equation 5-3

$$B_{WS} = 9.268\,scf/(9.268\,scf + 62.713\,dscf) = \underline{0.129} \text{ or}$$

$$0.129 \times 100\,\% = 12.9\,\%$$

Equation 3-2

$$M_d = (0.44)(9.00\%) + (0.32)(8.80\%) + (0.28)(82.20\%)$$

$$= \underline{29.79\,lb/lb\text{-}mole}$$

Equation 2-5

$$M_S = 29.79\,lb/lb\text{-}mole\,(1 - 0.129) + 18.0(0.129)$$

$$= \underline{28.27\,lb/lb\text{-}mole}$$

Appendix D

Duquesne Light Company
Elrama Power Station

Sample Calculation – Run No. 1

Equation 2-6

$P_s = 29.02 \text{ in Hg} + (-0.04 \text{ in Hg}) = \underline{28.98 \text{ in Hg}}$

Equation 2-8

$T_s = 460 + 123.9\,^{\circ}F = \underline{583.9\,^{\circ}R}$

Equation 2-9

$$V_s = 85.49 \frac{(ft)(lb/lb\text{-}mole)(in\,Hg)}{(sec)\quad(^{\circ}K)\quad(in\,H_2O)} (0.84)(0.905 \text{ in } H_2O) \left(\frac{583.9\,^{\circ}R}{(28.98 \text{ in Hg})(28.27 \text{ lb/lb-mole})}\right)^{1/2} = \underline{54.87 \text{ ft/sec}}$$

A – Cross Sectional Area of Stack

$A = \pi (26)^2/4 = \underline{530.929 \text{ ft}^2}$

Equation 2-10

$Q_{sd} = 3{,}600 \text{ sec/hr}\,(1-0.129)(54.87 \text{ ft/sec})(530.929 \text{ ft}^2)$

$\left(\frac{528\,^{\circ}R}{583.9\,^{\circ}R}\right)\left(\frac{28.98 \text{ in Hg}}{29.92 \text{ in Hg}}\right) = \underline{80{,}006{,}321 \text{ dscf/hr}}$ or

$(80{,}000{,}321 \text{ dscf/hr})(1 \text{ hr}/60 \text{ min}) = 1{,}333{,}439 \text{ dscf/min}$

Equation 5-7

$I = (100)(583.9\,^{\circ}R)\left[(0.002669 \text{ in Hg ft}^3/\text{ml-R}^{\circ})(196.9 \text{ ml}) + ((65.953 \text{ dcf})(0.989)/533.8\,^{\circ}R)(29.02 \text{ in Hg} \cdot (1.010 \text{ in } H_2O/(13.6 \text{ in } H_2O/\text{in Hg}))\right]/(60 \text{ sec/min})(120 \text{ min})(54.87 \text{ ft/sec})(28.98 \text{ in Hg})(0.0001928 \text{ ft}^2)$

$= \underline{107.9\ \%}$

Duquesne Light Company
Elrama Power Station

Sample Calculations – Run No. 1

Equation 5-6 (Particulate Emissions)

$C_s = (0.0154 \text{ mg/grain})(210.908 \text{ mg}/62.713 \text{ dscf})$

$= \underline{0.052 \text{ grain/dscf}}$ or $(0.052 \text{ grain/dscf})$

$(1 \text{ lb}/7000 \text{ grain}) = 7.43 \times 10^{-6} \text{ lb/dscf}$

$E = (7.43 \times 10^{-6} \text{ lb/dscf})(80,006,321 \text{ dscf/hr}) = \underline{\underline{594 \text{ lb/hr}}}$

$E_{BTU} = 594 \text{ lb/hr} / (4864 \text{ MM Btu/hr}) = \underline{\underline{0.122 \text{ lb/MM Btu}}}$

Carbon Monoxide Emissions

$E = (25.85 \text{ ppm})(80,006,321 \text{ dscf/hr})(28 \text{ lb/lb-mole}) /$
$386,000,000 \text{ ft}^3\text{/lb-mole} = \underline{\underline{150 \text{ lb/hr}}}$

$E_{BTU} = 150 \text{ lb/hr} / 4864 \text{ MM Btu/hr} = \underline{\underline{0.031 \text{ lb/MM Btu}}}$

Appendix D

Duquesne Light Company
Elrama Power Station

Sample Calculations - Run No. 1

PM-10 EMISSIONS

Fh = 119.90 mg (1st beaker) + 91.00 mg (Total filter) = 210.90 mg

Mn Ma PM-10 = (24.0% (Avg. No. 1 run) / 100) (119.90 mg) = 28.78 mg

Mn Mf PM-10 = (32.2% (Avg. No. 1 run) / 100) (91.00 mg) = 29.30 mg

Mn PM-10 = 28.78 mg + 29.30 mg = 58.08 mg

PM-10CS = (0.0154 mg/grain) (58.08 mg / 62.713 dscf)

= 0.014 grain/dscf or (0.014 grain/dscf) (1 lb/7000 grain) = 2.04×10^{-6} lb/dscf

PM-10E = (2.04×10^{-6} lb/dscf) (80,006,321 dscf/hr)

= 163 lb/hr

E_{Btu} = 163 lb/hr / (4864 mm Btu/hr) = 0.034 lb/mm Btu

$E\% = \frac{163 \text{ lb/hr}}{592 \text{ lb/hr}} \times 100 = 27.5\%$

Duquesne Light Company
Elrama Power Station

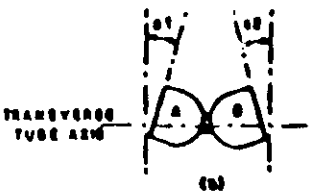
TYPE S PITOT TUBE CONSTRUCTION SPECIFICATIONS

TYPE S PITOT TUBE NO. 14ft Probe DATE 9-17-96 TECHNICIAN P. J

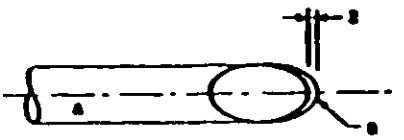
CONSTRUCTION STANDARDS :

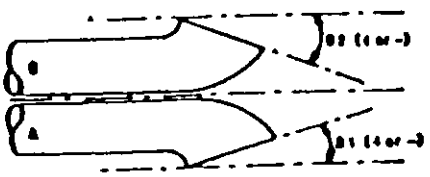
1. D1 - between 0.48 and 0.95 centimeters
2. Pa = Pb $1.05\ D1 \leq P \leq 1.50\ D1$
3. $\alpha 1, \alpha 2 < 10°$
4. $\beta 1, \beta 2 < 5°$
5. $Z \leq 0.32$ cm
6. $W \leq 0.08$ cm

D1 = 0.948
Pa = 1.37
Pb = 1.37



α1 = 0
α2 = 0





β1 = 0
β2 = 0

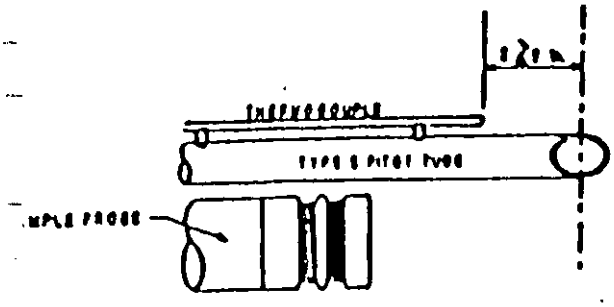
Z = 0
W = 0

TYPE S PITOT TUBE ALIGNMENT SPECIFICATIONS

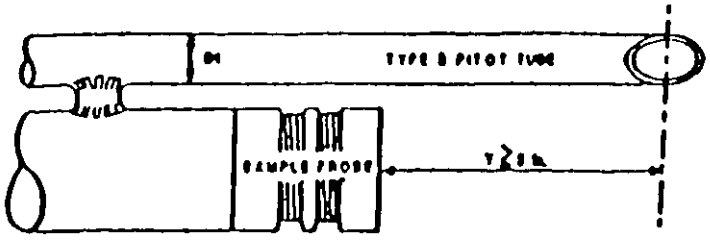
Client: Duquesne Light Company
Location: Elrama Power Station
Date: Exhaust Stack
Technician: 9-17-96 Paul Jadlowiec

PITOT ALIGNMENT STANDARDS:

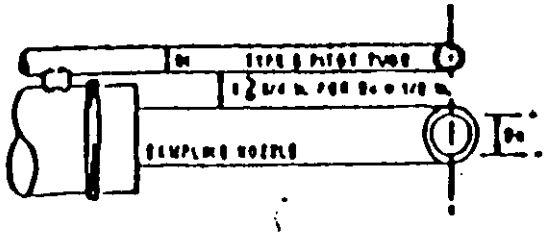
1. X ≥ 3/4 in.
2. Ip must be higher than Np
3. Z ≥ 1.90 cm
4. Y ≥ 3 in.



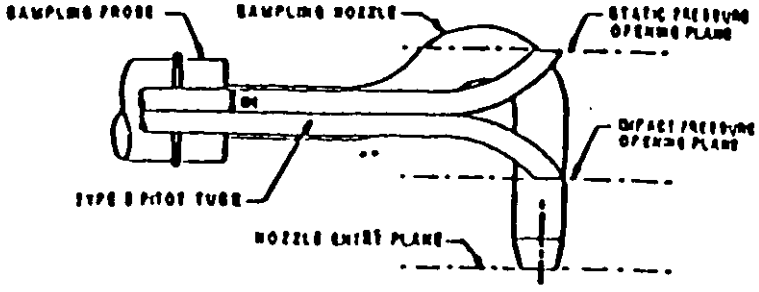
Z = 2.0 in



Y = 3.1 in



X = 1.3 in



Is Ip higher than Np = Yes

STACK GAS THERMOCOUPLE CALIBRATION

Client: Duquesne Light Company

Location: Elrama Power Station

Date: 9-20-96

Technician: Paul Jadlowiec

TEMPERATURE SOURCE	TEMPERATURE	REFERENCE	% DIFFERENCE
Water Bath	120°F	120°F	0 %

DRY GAS METER AND ORIFICE CALIBRATION

08/01/96 **OPERATOR: JEP** **CONSOLE: 80900**

WET TEST METER GAS VOLUMES AND TEMPERATURES

Orifice Manometer Setting (in. H2O)	Initial Reading ft (cf) Vw	Temp. (deg F) Tw	Final Reading ft (cf) Vw	Temp. (deg F) Tw	Net Volume (ft) Vw	Avg. Temp. (F) Tw
1.00	0.000	67.0	5.001	67.0	5.001	67.0
1.50	0.000	67.0	5.000	67.0	5.000	67.0
2.00	0.000	67.0	5.000	67.0	5.000	67.0
3.00	0.000	67.0	5.000	67.0	5.000	67.0

DRY TEST METER VOLUMES AND TEMPERATURES

Orifice Manometer Setting (in. H2O)	Initial Reading (cf) Vd	Final Reading (cf) Vd	Temperature Inlet (deg f) Ti	Outlet (deg f) Td	Net Volume (ft) Vd	Avg. Temp. (deg f) Td
1.00	309.151	314.348	86.0	79.0	5.197	82.5
1.50	315.373	320.555	88.0	80.0	5.182	84.0
2.00	321.593	326.762	85.0	79.0	5.169	82.0
3.00	327.798	332.990	87.0	79.0	5.192	83.0

Orifice Manometer Setting (in. H2O)	Total Test Time (min.)	Barometer Reading Inches ("Hg)
1.00	9.217	29.23
1.50	7.650	29.23
2.00	6.700	29.23
3.00	5.483	29.23

	Gamma	delta H
	0.988	1.886
	0.992	1.944
	0.990	1.996
	0.985	2.001
Average	**0.989**	**1.957**

Duquesne Light Co.
Elrama Power Station

Appendix E

NOZZLE CALIBRATION DATA FORM

Date 9-17-96 Calibrated by Paul Jadlowiec

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
9-18-96 Exhaust Stack Source Test	0.188	0.188	0.188	0.000	0.1880

where:

[a] $D_{1,2,3}$ = three different nozzles diameters, mm (in.); each diameter must be within (0.025 mm) 0.001 in.

[b] ΔD = maximum difference between any two diameters, mm (in.), $\Delta D \leq$ (0.10 mm) 0.004 in.

[c] D_{avg} = average of D_1, D_2, and D_3.

OPTIMAL TECHNOLOGIES, INC.

SOURCE TESTING INSTRUMENT CALIBRATION RECORD

Client: Duquesne Light Elrama Power Station Proj #: 570
Location: Stack Date: 9/19/96
Run #'s: 1, 2, 3 Inst. Supplier: Optimal
Parameter: CO RANGE 0 to 500ppm Inst. Manufacturer: TECO 49C
Operators: WAS Longin Sys. Bias-Inst: 291 S.Train: 290
Response Time (sec.) 116sec

RUN # 1 Start Time: 9:00 Stop Time: 10:00 Inst Range 0→500ppm

DAT 84

Cal. Gas Conc.	Pre-Test			Post-Test			% Drift
	Inst.	Chart	Logger	Inst.	Chart	Logger	
ZA	0.0			0.1		-0.1	—
291	291		291	290		290	-0.2%
80.6	77		77	77		77	0%
25.3	24		24	24		24	0%
9.9	8.9		8.9	9.0		8.9	0%

RUN # 2 Start Time: 12:45 Stop Time: 13:45

DAT 85

Cal. Gas Conc.	Pre-Test			Post-Test			% Drift
	Inst.	Chart	Logger	Inst.	Chart	Logger	
ZA	0.1		-0.1	-0.2		-0.3	—
291	290		290	289		289	-0.2%
80.6	77		77	76		76.7	0.1%
25.3	24		24	23		23	-0.2%
9.9	9.0		8.9	9.0		8.9	0%

RUN # 3 Start Time: 15:35 Stop Time: 16:35

DAT 86

Cal. Gas Conc.	Pre-Test			Post-Test			% Drift
	Inst.	Chart	Logger	Inst.	Chart	Logger	
ZA	-0.2		-0.3	-0.2		-0.3	—
291	291		291	293		292	+0.2%
80.6	77		77	77		76.8	0%
25.3	24		24	23.6		23.4	-0.1%
9.9	9.0		9.0	8.8		8.8	-0.0%

Scott Specialty Gases, Inc.

6141 EASTON ROAD, P.O. BOX 310, PLUMSTEADVILLE, PA 18949-0310 (215) 766-8861 FAX: (215) 766-0320

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
Control Analytics
C/O Optimal Technologies
575 William Pitt Way
Pittsburgh, PA 15238

Assay Laboratory
Scott Specialty Gases, Inc.
6141 Easton Road
P.O. Box 310
Plumsteadville, PA 18949-0310

Purchase Order 713
Scott Project # 01-75952-001

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standards; 1 Procedure #G1, Section Number 3.0.4; September, 1993.

Cylinder Number	ALM054076	**Certification Date**	02-13-96	**Expiration Date**	02-13-98
Cylinder Pressure	2000 psig+	**Previous Certification Dates**	None		

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Carbon monoxide	9.94 ppm	±1% NIST Traceable
Balance Gas: Nitrogen		

+Do not use when cylinder is less than 150 psig.

*Analytical uncertainty is inclusive of usual known error sources which at least includes precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
NTRM1677	12-06-96	ALM022322	10.08 ppm CO in N_2

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
CO: Horiba/CFA310A/474091	01-19-96	NDIR

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components: Carbon monoxide

First Triad Analysis

Date: 02-06-96 Response Units: Volts
Z1=0.0016 R1=0.4102 T1=0.4054
R2=0.4100 Z2=0.0002 T2=0.4056
Z3=0.0000 T3=0.4047 R3=0.4092
Avg. Conc. of Cust. Cyl. 9.97 ppm

Second Triad Analysis

Date: 02-13-96 Response Units: Volts
Z1=0.0022 R1=0.4136 T1=0.4053
R2=0.4124 Z2=0.0012 T2=0.4060
Z3=0.0013 T3=0.4043 R3=0.4103
Avg. Conc. of Cust. Cyl. 9.91 ppm

Calibration Curve

Concentration= $A+Bx+Cx^2+Dx^3+Ex^4$
r=0.99998 NTRM2635
Constants: A=4.6921E-02
B=2.4175E+01 C=0.0000E+00
D=0.0000E+00 E=0.0000E+00

Special Notes:

Analyst Terrance Boswell

Scott Specialty Gases, Inc.

6141 EASTON ROAD, P.O. BOX 310, PLUMSTEADVILLE, PA 18949-0310 (215) 766-8861 FAX: (215) 766-0320

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
Control Analytics
C/O Optimal Technologies
575 William Pitt Way
Pittsburgh, PA 15238

Assay Laboratory
Scott Specialty Gases, Inc.
6141 Easton Road
P.O. Box 310
Plumsteadville, PA 18949-0310

Purchase Order 713
Scott Project # 01-75952-002

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay & Certification of Gaseous Calibration Standar 1 Procedure #G1, Section Number 3.0.4; September, 1993.

Cylinder Number AAL14824
Cylinder Pressure 2000 psig+
Certification Date 02-06-96
Previous Certification Dates None
Expiration Date 02-0[illegible]

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Carbon monoxide	25.3 ppm	±1% NIST Traceable
Balance Gas: Nitrogen		

*Do not use when cylinder is less than 150 psig.
*Analytical uncertainty is inclusive of usual known error sources which at least includes precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
NTRM2635	07-31-97	CLM003676	23.9 ppm CO in N_2

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
CO: Horiba/CFA310A/474091	01-15-96	NDIR

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components	First Triad Analysis	Second Triad Analysis	Calibration Curve
Carbon monoxide	Date: 01-30-96 Response Units: Volts Z1=0.0014 R1=0.2226 T1=0.2359 R2=0.2235 Z2=0.0013 T2=0.2361 Z3=0.0011 T3=0.2358 R3=0.2230 Avg. Conc. of Cust. Cyl. 25.3 ppm	Date: 02-06-96 Response Units: Volts Z1=0.0008 R1=0.2209 T1=0.2360 R2=0.2207 Z2=0.0010 T2=0.2337 Z3=0.0011 T3=0.2337 R3=0.2204 Avg. Conc. of Cust. Cyl. 25.4 ppm	Concentration=$A+Bx+Cx^2+Dx^3+Ex^4$ r=0.99999 NTRM1678 Constants: A=4.6586E-02 B=7.1443E+01 C=0.0000E+00 D=0.0000E+00 E=0.0000E+00

Special Notes:

Analyst Terrance P. Boswell

Scott Specialty Gases

6141 Easton Road, PO Box 310 Plumsteadville PA 18949-0310 PHONE: (215) 766-8861 FAX: (215) 766-0320

CERTIFICATE OF ANALYSIS: Interference-Free™ EPA Protocol Gas

Customer
CONTROL ANALYTICS
C/O OPTIMAL TECHNOLOGIES
575 WILLIAM PITT WAY
PITTSBURGH, PA 15238

Assay Laboratory
Scott Specialty Gases, Inc.
6141 Easton Road
Plumsteadville, PA 18949

Purchase Order *713*
Scott Project # *7595203A*

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay and Certification of Gaseous Calibration Standards: Procedure G1; September, 1993.

Cylinder Number *AAL21186*
Cylinder Pressure+ *1855 PSIG*
Previous Certification Dates
Certification Date *2/5/96*
Expiration Date *2/5/99*

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Accuracy*
Carbon Monoxide	80.6 ppm	± 1% Directly NIST Traceable
Nitrogen	Balance Gas	

+ Do not use when cylinder pressure is below 150 psig.
** Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes.*

REFERENCE STANDARD

Type/Sample No.	Expiration Date	Cylinder Number	Concentration
NTRM11679	*8/11/96*	*ALM041543*	*97.1 ppm CO in N2*

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Method
Nicolet FTIR/8220/AAB9300174	*1/18/96*	*Scott Enhanced FTIR*

ANALYZER READINGS

(Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components *CO*

First Triad Analysis

Date: 1/29/96	Resp. Units: ppm		
Z1= 0.00	R1= 97.10	T1= 80.4	
R2= 97.13	Z2= 0.00	T2= 80.4	
Z3= 0.00	T3= 80.5	R3= 97.16	
Avg. Concentration: 80.5	ppm		

Second Triad Analysis

Date: 2/5/96	Resp. Units: ppm		
Z1= 0.05	R1= 97.10	T1= 80.8	
R2= 97.46	Z2= 0.19	T2= 80.9	
Z3= 0.22	T3= 80.7	R3= 97.53	
Avg. Concentration: 80.8	ppm		

Calibration Curve

Concentration = A+Bx+Cx2+Dx3+Ex4	
R= 0.99999	[illegible]56
Constants:	A= -4.55E-01
B= 2.66E-01	C= 3.84E-04
D= 3.91E-06	E= 2.70E-09

Special Notes:

Analyst: Garren R. Kroll

Air Products and Chemicals, Inc.
P.O. BOX 351
R.D. #1
TAMAQUA, PA 18252

Certificate of Analysis - EPA Protocol Gas Standard

PERFORMED ACCORDING TO EPA TRACEABILITY PROTOCOL FOR ASSAY AND CERTIFICATION OF GASEOUS CALIBRATION STANDARDS (PROCEDURE #G1)

Customer:
AIR PRODUCTS & CHEMICALS
CAROL PORTER
FREEPORT RD, ROUTE 28
CREIGHTON PA 15030

PO: 055-94 Rel:

Notes:

Order No: 148-012359-03
Batch No: 255-58321

Cylinder No: SG9107455BAL
Cylinder Pressure*: 2000 psig
Certification Date: 11/13/94
Expiration Date: 11/13/96

*** Certified Concentration ***		********* Reference Standards *********		********** Analytical Instrumentation **********			
Component	Certified Concentration	Cylinder #	Standard Number	Concentration	Instrument Make/Model	Serial Number	Last Calibration	Measurement Principal
CARBON MONOXIDE	291 ±1.47 PPM	SG9113535BAL	GMIS	506.5000 PPM	Hewlett Packar	2518A052	10/14/94	GC-FID

Balance Gas: Nitrogen

* Standard should not be used below 150 psig

Analyst: Michael Wagner

Approved By: Ken Roubik

Sheet 10 of 10
Appendix E

PDEP0005

Duquesne Light

411 Seventh Avenue
P.O. Box 1930
Pittsburgh, PA 15230-1930

(412) 393-6000

November 13, 1996
EAU(2):151-96

Mr. Joseph Pezze
PA Department of Environmental Protection
Regional Air Quality Manager
Southwest Region
400 Waterfront Drive
Pittsburgh,, PA 15222

Roy:
These are source test that were identified last summer but not scanned.
Ron M

Dear Mr. Pezze:

On September 18, 1996, Duquesne Light Company's contractor Optimal Technologies, Inc. (Optimal) performed total particulate, PM-10 and CO emissions tests at the Elrama Power Station. Based on the average of three runs, results indicate that total particulate emissions are within the applicable emission limit of 0.1 lbs./MMBtu as specified in 25 PA Code §123.11. The PM-10 and CO emissions tests were conducted to comply with Condition #7 of RACT Plan Approval #63-000-014.

Enclosed are two (2) copies of the report for your use. Please contact Sharon Stubbs at (412) 393-6098 should you have any questions.

Very truly yours,

Bob Orchowski

Robert W. Orchowski
Manager of Environmental Affairs

Enclosure

c: T. Starner, Harrisburg, DEP - w/ one(1) enclosure

#735-96

DELIVERING QUALITY ENERGY

COMMONWEALTH OF PENNSYLVANIA
Department of Environmental Protection
March 20, 1997
717-787-9483

SUBJECT: Source Test Review
[redacted]
To Datafile: Elrama Power Station
Union Township, Washington County

TO: Tom Joseph
Engineering Services Section
Southwest Regional Office

FROM: Bryon Richwine BR
Air Pollution Control Engineer
Source Testing Section
Division of Source Testing and Monitoring

THROUGH: L. Blaine DeHaven
Chief
Division of Source Testing and Monitoring

Timothy R. Brooks TRB
Chief
Source Testing Section
Division of Source Testing and Monitoring

Duquesne Light Company operates four bituminous coal fired boilers at its Elrama Power Station. Boilers 1 and 2 each have a heat input of 1,200 MMBtu/hr with an exhaust gas flow of 414,000 acfm, while Boilers 3 and 4 have heat inputs of 1,300 and 1,790 MMBtu/hr with exhaust flows of 464,000 and 625,000 acfm, respectively. The combustion gases from these four boilers are exhausted through air heaters, mechanical dust collectors, electrostatic precipitators, and wet scrubbers prior to discharging to the atmosphere through a common 26 feet inside diameter stack.

On September 18, 1996 Optimal Technologies of Pittsburgh, Pennsylvania performed testing to determine total particulate (PADEP method 5), carbon monoxide (EPA method 10), and PM10 (electron microscope scanning of the particulate front half) emissions in the outlet stack of Duquesne Light Company's Elrama Power Station to comply with condition # 7 of RACT Plan

approval 63-000-014. The test runs were conducted in accordance with the preapproved test protocol and appear to be representative of the actual emissions at the operating conditions at the time of testing.

The following information was extracted from the test report:

Particulate Emissions Summary:

Run No.	1	2	3
Test Date	09/18/96	09/18/96	09/18/96
Test Time	9:00-11:28	12:00-14:32	15:35-17:56
Flowrate [dscfm]	1,333,400	1,309,500	1,299,900
Emission Rate [lb./hr]	594	236	401
Concentration [gr./dscf]	0.052	0.021	0.036
Emission Rate [lb./MMBtu] [based on heat input]	0.122	0.048	0.082
Isokinetic Rate [%]	107.9	108.4	107.0

PM10 Emissions Summary:

Run No.	1	2	3
Test Date	09/18/96	09/18/96	09/18/96
Test Time	9:00-11:28	12:00-14:32	15:35-17:56
Flowrate [dscfm]	1,333,400	1,309,500	1,299,900
Emission Rate [lb./hr]	163	119	99
Concentration [gr./dscf]	0.014	0.011	0.009
Emission Rate [lb./MMBtu] [based on heat input]	0.034	0.024	0.020
Percent of Total Particulate [%]	27.5	50.1	24.6

Carbon Monoxide Emissions Summary:

Run No.	1	2	3
Test Date	09/18/96	09/18/96	09/18/96
Test Time	9:00-10:00	12:45-13:45	15:35-16:35
Flowrate [dscfm]	1,333,400	1,309,500	1,299,900
Emission Rate [lb./hr]	150	491	358
Concentration [ppm] [dry]	26	86	63
Emission Rate [lb./MMBtu] [based on heat input]	0.031	0.100	0.074

cc: RACT File 63-000-014
Technical Support Section - Krish Ramamurthy
Compliance and Enforcement - Scott Kepner
EPA/TRB
[redacted]
Reading File, Source Testing Section

LBD:TRB:BR:br