APPENDIX NO. 6

Test Report - Nelson Dewey Cyclone Reburn Optimization and Performance Environmental Tests

Acurex Environmental Technical Report TR-93-101

TEST REPORT
NELSON DEWEY CYCLONE REBURN OPTIMIZATION AND PERFORMANCE ENVIRONMENTAL TESTS

June 1993

Acurex Environmental Project 8408

Prepared For

Babcock & Wilcox
20 S. Van Buren Avenue
Barberton, Ohio 44203

By

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Mountain View, California 94039

Acurex Environmental
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A Geraghty & Miller Company

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SECTION 1

INTRODUCTION

Unit Number 2 of the Nelson Dewey Station of Wisconsin Power and Light was used as the host site for a demonstration of coal reburning for NO_x control. This demonstration was conducted as one of the Clean Coal Technology Round 2 projects. The overall purpose of the demonstration was to evaluate coal reburning as a control option for the B&W cyclone-fired slag tap boiler design as is used in the Nelson Dewey test boiler. The cyclone boiler design features high-intensity slagging combustion which yields high baseline NO_x emissions. This design is also not easily modified for low-NO_x operation by simple combustion modifications.

The scope of the CCT coal reburning program was to conduct initial baseline characterization tests, and then retrofit and test the reburn hardware (pulverizer, reburn burners, overfire air ports) under short term optimization runs and long term performance operation. The post retrofit testing was designed to evaluate the following parameters:

- Effects of reburn configuration on NO_x reduction effectiveness; effects of reburn fuel fraction, stoichiometric ratios, temperatures and mixing configuration
- Effects of reburning on boiler operation: efficiency, carbon loss, fireside temperature distributions, slagging, steam temperatures
- Effects of reburning on environmental loadings from the boiler: NO_x and other criteria species, particulate, particle size, trace metals, organics, ash leaching.

Acurex Environmental was contracted to conduct environmental monitoring to support the third evaluation and to contribute data to B&W and WP&L to support the first and second evaluations.

The schedule for the coal reburning program was as follows:

Baseline Characterization	September 1989 to June 1990
Design & Installation	March 1990 to November 1991
Startup	December 1991 to March 1992
Optimization & Parametric Tests	February 1992 to May 1992
Long Term Performance Tests	June 1992 to December 1992
Western Coal Tests	January 1993

The environmental testing in support of the baseline characterization was documented in a separate report, Reference 1. The purpose of this report is to document the data and results of the three post-retrofit test series: optimization, performance and western coals testing.

The overall purpose and scope of the environmental monitoring component of the clean coals project was documented in an Environmental Monitoring plan, Reference 2. The purpose of the environmental testing was to quantify emissions parameters which may be affected by the reburn retrofit. The emphasis was on gaseous criteria pollutants and particle loading upstream and downstream of the precipitator. Other secondary environmental parameters were also tested on a less frequent basis. The test program for the baseline and optimization tests included the following parameters:

- Continuous emissions monitoring of O_2, NO_x, CO, CO_2, and SO_2
- Particulate loading sampling upstream and downstream of the electrostatic precipitator (ESP)
- Carbon in flyash loss on ignition (LOI) analyses of flyash catch
- Particle sizing upstream and downstream of the ESP
- Metals loading downstream of the ESP
- Total sulfur species at the ESP inlet
- In-situ flyash resistivity at the ESP inlet
- Total organics downstream of the ESP
- Toxicity characterization leachate procedure (TCLP) for the ESP hopper ash slurry

For the performance tests and western coal tests, the effort focused on continuous monitoring, ash loading upstream and downstream of the ESP, and LOI. Long term continuous monitoring was also conducted for the period May 1992 through December 1992. These CEM results were transmitted to B&W directly and magnetic disks of reduced data were submitted intermittently. The quality assurance plan for the optimization series of tests was submitted separately, Reference 3.

In November of 1992, the boiler was subjected to hazardous air pollutant (HAP) testing for triplicate baseline and reburn conditions. This series of tests was separate from the clean coals project and the results are documented in a separate report, Reference 4. The scope of that test program included the following:

- Particulate loading upstream and downstream of the ESP
- Trace metals emissions upstream and downstream of the ESP
- Volatile and semi-volatile organics, aldehydes and chlorides/fluorides emissions downstream of the ESP
- Inlet concentrations in the coal feed stream of trace metals and chlorides/fluorides
- Trace metals concentrations in the ESP hopper and cyclone slag discharge streams

REFERENCES

1. Test Report Nelson Dewey Cyclone Reburn Baseline Environmental Tests, Acurex Technical Report TR-91-101/ESD, March 27, 1991.
2. Environmental Monitoring Plan Babcock & Wilcox Demonstration of Coal Reburning for Cyclone Boiler NO_x Control, Acurex Project 8408, November 18, 1991.
3. Quality Assurance Project Plan Phase III Testing for Cyclone Boiler NO_x Control, Acurex Technical Report 8408-92-01, January 1992.
4. Hazardous Air Pollution Monitoring: Demonstration of Coal Reburning for Cyclone Boiler NO_x Control, Test Report, Acurex Project 6676, June 1993.

SECTION 2

TEST PLAN

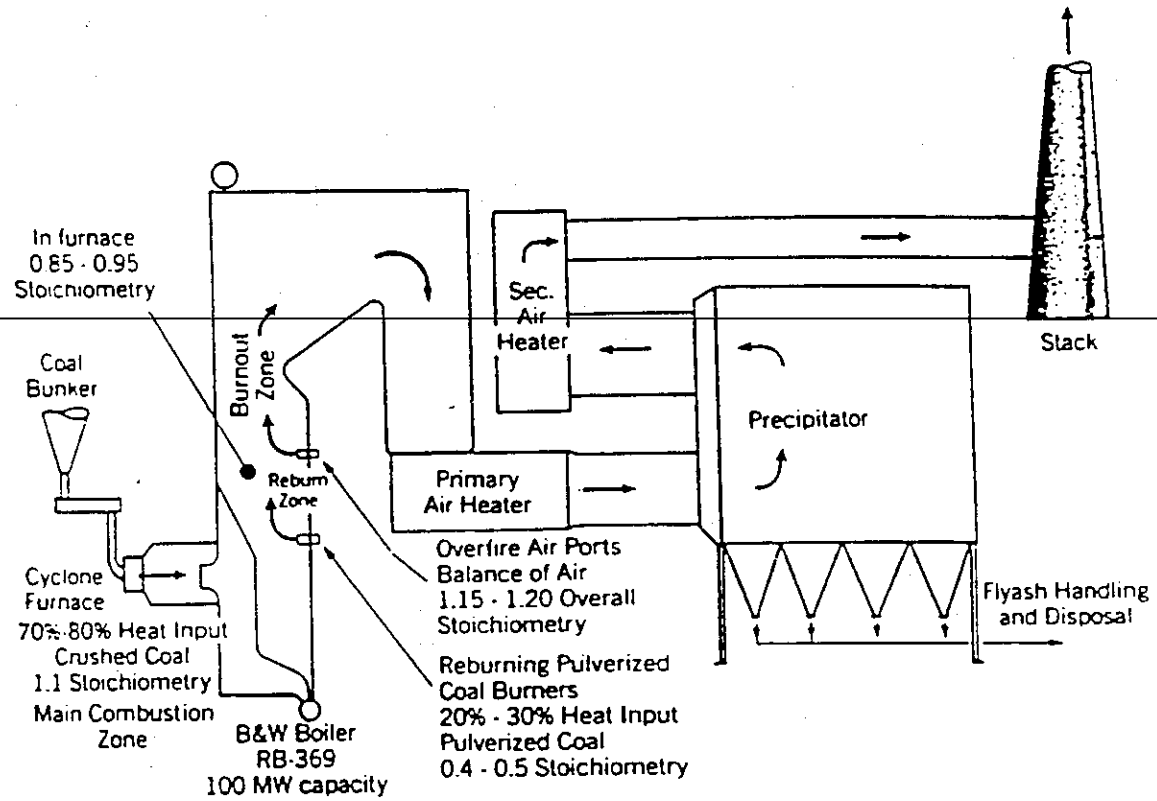
The Phase III testing reported here consisted of three sequential series: optimization tests, performance tests, and western coal tests. This section summarizes the test matrix and protocols for these tests.

2.1 FACILITY

The Nelson Dewey station of Wisconsin Power and Light is located at Cassville, Wisconsin, 50 miles north of Dubuque, Iowa on the Mississippi river. The specifications of the WP&L host site test facility are as follows:

Utility	Wisconsin Power & Light, Nelson Dewey Unit No. 2
Location	County Trunk VV, Cassville, Grant County Wisconsin 53806
Boiler Type	Babcock & Wilcox, cyclone fired reheat
Boiler Model	B&W R8-369
Burner Configuration	Three single-wall cyclones
Preheat	Tubular primary and secondary preheat
Draft type	Forced draft with a duct pressure of 20 in. H_2O at the ESP
Boiler Capacity	100 MW_e
Installed	October, 1962
Fuel	Indiana Lamar bituminous
Reburn burners	pulverized coal single-wall-fired
Particulate control	dual Research Cottrell electrostatic precipitator

Figure 2-1 shows the overall unit 2 configuration with the reburn retrofit. The low-NO_x reburn retrofit consisted of installation of the pulverizer, reburn burners in the upper furnace, overfire air ports, and modifications to the control system. The unit could be operated in either the baseline



Coal reburn project - system layout, cyclone firing.

Figure 2-1. Test facility

mode without the reburn burners or in the low-NO_x mode with approximately 20 percent of the heat input from the reburn burners. Under low NO_x reburn operation, the existing cyclone burners are fired with 70 to 80 percent of the total coal feed as crushed coal. The cyclones are operated at around 110 percent excess air in the main combustion zone. The reburn burners are fired with the remaining 20 to 30 percent of the coal feed as pulverized coal. These reburn burners are operated fuel rich at a reducing stoichiometry of 0.85 to 0.95. This reducing condition converts the nitrogen oxides formed in the cyclone burners to molecular nitrogen, thereby reducing NO_x. The balance of air required to complete combustion is added in the burnout zone above the reburn zone through the use of overfire air ports.

The electrostatic precipitator was installed with dual divided horizontal inlet and outlet ducts. Each section of the divided duct was fitted with four 4 inch ports through which samples

were extracted. Figure 2-2 shows the orientation of the sampling stations relative to the ESP and heat exchangers.

The standard baseline coal used for the bulk of the reburn testing was a Lamar Illinois basin coal. Representative analyses for the baseline coal taken during the HAP testing are listed on Table 2-1. At the conclusion of the reburn demonstration, the unit was converted to a Powder River Basin western coal. The final western coal series was run with this coal.

2.2 TEST MATRIX

2.2.1 Optimization Tests

After installation of the reburn hardware, the reburn system was put through an initial series of start-up and characterization tests. These tests were focused on identifying the preferred operating parameters and did not involve environmental monitoring. Following this initial series of operational tests, the optimization environmental testing was conducted from March 31, 1992 through May 20, 1992. Table 2-2 summarizes the overall run conditions and environmental test matrix for the optimization test series.

The optimization series was run in two stages. From March 31 through May 1, the testing was focused on the major parameters influenced by reburn: CEM's, particulate loading, LOI, and periodic particle sizing and flyash resistivity. The particle sizing and resistivity was sampled to help interpret any changes in ESP performance identified from the particle loading results. During this initial stage, a parametric series of reburn parameters was evaluated: reburn stoichiometry, coal fineness and gas recirculation rate. During this series, three baseline runs were also made to compare to the prior baseline series in Phase I.

The second stage of the optimization tests was run from May 16 through May 20 and was focused on optimum reburn parameters identified during the initial parametric tests. For this stage, more extensive environmental measurements were made including outlet metals, sulfates, total hydrocarbons, and a composite flyash slurry toxicity characterization leachate procedure (TCLP).

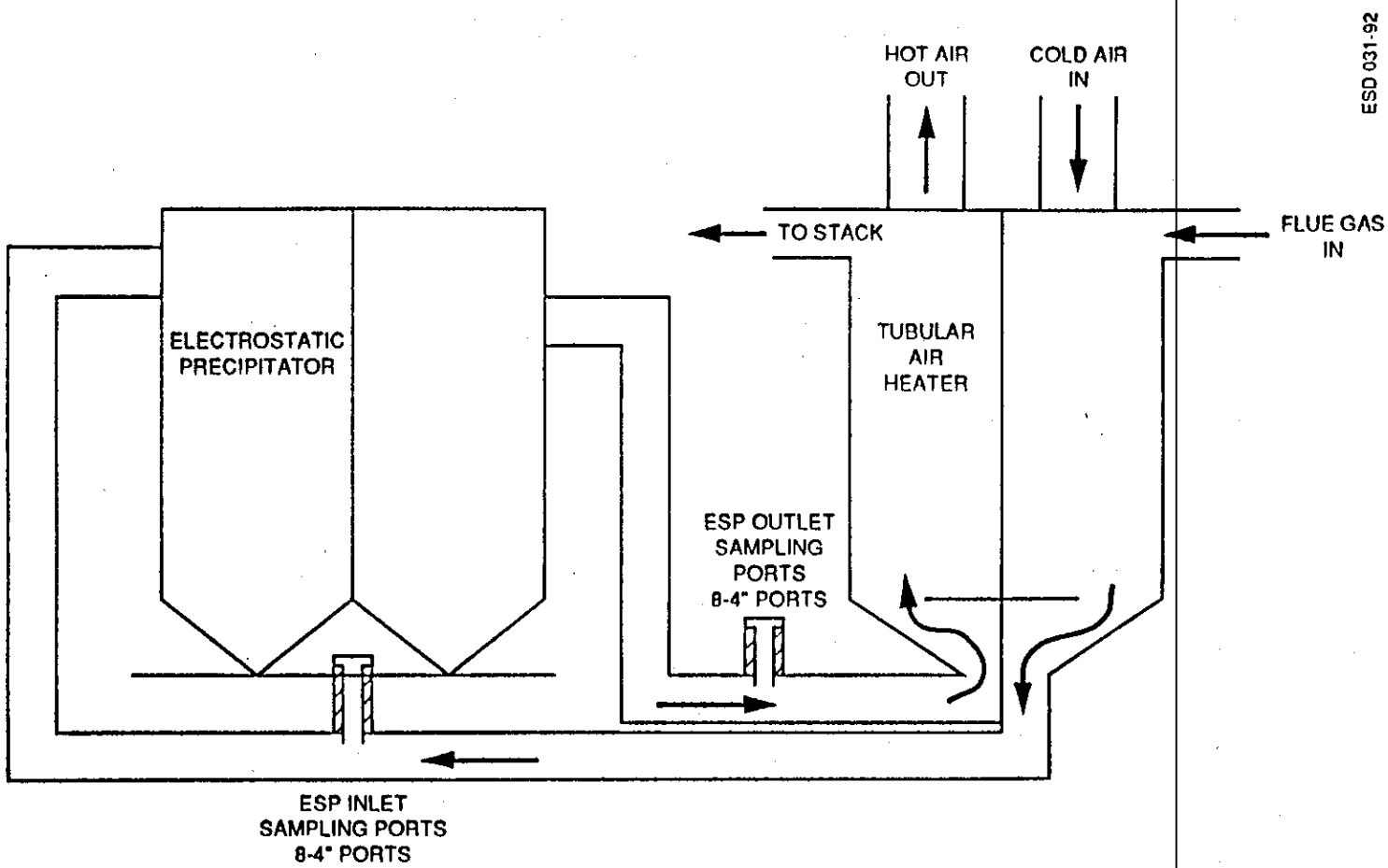


Figure 2-2. Orientation of sampling ports

Table 2-1. Coal analyses

Test Run	1	2	3	4	5	6
Proximate Analysis						
HHV, Btu/lb	11092	11680	11954	11453	11389	11657
Moisture, %	15.68	13.81	12.0	12.94	17.28	12.51
Vol. Mtr, % dry	39.84	40.34	40.0	39.36	39.03	38.81
Fixed C, % dry	52.57	49.65	51.8	51.4	52.56	51.79
Ash, % dry	7.59	10.01	8.21	9.2	8.41	9.40
Ultimate Analysis, percent dry basis						
Carbon	72.9	72.19	72.15	71.57	73.15	71.76
Hydrogen	5.1	5.11	5.11	5.05	5.19	5.08
Nitrogen	1.37	1.27	1.24	1.21	1.27	1.03
Sulfur	1.34	2.32	1.72	1.37	1.57	1.43
Oxygen, Diff.	11.71	9.10	11.6	11.6	10.41	11.3
Ash	7.59	10.01	8.21	9.20	8.41	9.40
Trace Species, ppm, as received						
Arsenic	6.02	19.8	2.69	9.21	5.14	9.33
Beryllium	2.94	3.13	3.04	2.84	3.13	2.69
Cadmium	<1	1.11	70.4	52.2	93.9	<1
Chromium	4.91	11.8	8.6	7.3	11.6	8.8
Mercury	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese	20.5	22.2	29	23.4	24.3	18.7
Nickel	13	13.9	49	37.4	42.3	34.8
Lead	38.5	39.5	10.7	18.1	14.9	11.9
Selenium	<1	<1	<1	<1	<1	<1
Chlorine	58.1	23.2	90.9	65.5	65.3	83.4
Fluoride	<4.74	<3.48	<3.4	<3.45	<4.83	<3.43
Chloride	<17.8	<18.6	<19.3	<17.2	<19.3	<18.3

Table 2-2. Test matrix for optimization tests

Date	B&W Run No.	Acurex Environmental Run No. Inlet/Outlet	Unit Load (MW)	Reburn Rate (Tons/hr)	CEM	Measurements							
						Inlet Part Load	Outlet Part Load	Carbon LOI	Ash Resist.	Outlet Metals	Inlet Sulfate	Part Size	Hydrocarbon
3/31	1A	I1	68	Baseline	X	X		X					
4/1	2A	I2-01	110	3	X	X	X	X	X				
4/2	3A	I3-02	110	3	X	X	X	X					
4/3	4A	I4-03	110	Baseline	X	X	X	X					
4/6	5A	I5-04	82	Baseline	X	X	X	X					
4/7	6A	I6-05	110	13	X	X	X	X					
4/8	7A	I7-06	110	13	X	X	X	X					
4/9	8A	I8-07	110	3	X	X	X	X					
4/10	9A	I9-08	110	13	X	X	X	X					
4/13	10A	I10-09	110	13	X	X	X	X					
4/15	11A	I11-010	82	11.5	X	X	X	X					
4/16	12A	I12-011	82	11.5	X	X	X	X					
4/21	13A	I13-012	82	0.5	X	X	X	X	X				
4/22	14A	I14-013	55	0.5	X	X	X	X	X			X	
4/23	15A	I15-014	58	0.5	X	X	X	X	X			X	
4/24	16A	I16-015	111	0.5	X	X	X	X	X			X	
4/27	17A	I17-016	111	0.05	X	X	X	X	X			X	
4/28	18A	I18-017	90	OPT	X	X	X	X	X			X	
4/29	19A	I19-018	82	OPT	X	X	X	X	X			X	
4/30	20A	I20-019	57	OPT	X	X	X	X				X	
5/1	21A	I21-020	110	OPT	X	X	X	X				X	
5/16	22A	I22-M1	82	OPT	X	X	X	X		X		X	
5/16	23A	I23-M2	59	OPT	X	X	X	X		X			
5/17	24A	I24-M3	58	OPT	X	X	X	X	X	X		X	X
5/17	25A	I25-M4	58	OPT	X	X	X	X	X	X	X		
5/18	26A	I26-M5	110	OPT	X	X	X	X	X	X	X	X	X
5/19	27A	I27-M6	110	OPT	X	X	X	X	X	X	X	X	X
5/19	28A	I28-M7	82	OPT	X	X	X	X	X	X	X	X	
5/20	29A	I29-M8	110	OPT	X	X	X	X	X	X	X	X	
5/20	30A	I30-M9	82	OPT	X	X	X	X	X	X	X	X	

These parameters were sampled for comparison to earlier baseline measurements or to evaluate on an absolute basis whether emissions levels were of concern relative to regulatory thresholds.

2.2.2 Performance Tests

Following the parametric and optimization testing in May 1992, the boiler was subjected to long-term performance testing where reburn was used in a routine operating mode for much of the time. During the performance testing, from June 1992 through December 1992, the gaseous emissions were monitored continuously with the CEM system described in Section 2.3. In addition, during the period September 28 through October 5, 1992, a series of particulate sampling tests were conducted to observe the performance after long term operation and to confirm results of the optimization tests. Table 2-3 summarize the test matrix. The tests included repeats of baseline conditions and triplicate reburn runs at three load conditions. Additional parametric runs were made for how the cyclones were operated at low load and excess air conditions.

2.2.3 Western Coal Tests

Following completion of the demonstration testing on Illinois Basin Lamar coal, the unit was converted to firing Powder River Basin western coal. On January 19 and 20, 1993, particulate loading tests were conducted with western coal with the unit running at the preferred optimum reburn settings selected for western coal. Particulate measurements were made upstream and downstream of the ESP for three load conditions: 110 MW, 82 MW, and 60 MW. A single run was made at each load condition.

2.3 SAMPLING AND ANALYSIS PROTOCOLS

2.3.1 Continuous Emission Monitors

Continuous emission monitoring was made for O_2, NO_x, CO, CO_2, and SO_2. During the baseline testing, the measurements had been made with a mobile laboratory brought in on a short term basis. For the Phase III testing, which included long term CEM monitoring, a CEM facility, shown in Figure 2-3 was built and installed at the site. This is a dilution based system which eliminates the need for a sample conditioning system by diluting the gases below the moisture dew

Table 2-3. Test matrix for performance tests

Date	Run No.	Load	Reburn	Cyclone Rate (Tons/hr)	Measurements			
					CEM	Inlet Part Load	Outlet Part Load	Carbon LOI
9/28	1	110	X	33	X	X	X	X
9/28	2	79		33	X	X	X	X
9/28	3	110	X	33	X	X	X	X
9/29	4	79		33	X	X	X	X
9/29	5	110	X	33	X	X	X	X
9/30	6	54		23	X	X	X	X
9/30	7	82	X	23	X	X	X	X
9/30	8	82	X	23	X	X	X	X
10/1	9	54		23	X	X	X	X
10/2	10	82	X	23	X	X	X	X
10/2	11	40		18	X	X	X	X
10/3	12	60	X	18	X	X	X	X
10/3	13	60	X	18	X	X	X	X
10/3	14	40		18	X	X	X	X
10/4	15	60	X	18	X	X	X	X
10/4	16	38	X	9	X	X	X	X
10/5	17	60	X	18	X	X	X	X
10/5	18	60	X	18	X	X	X	X
10/5	19	110	X	33	X	X	X	X

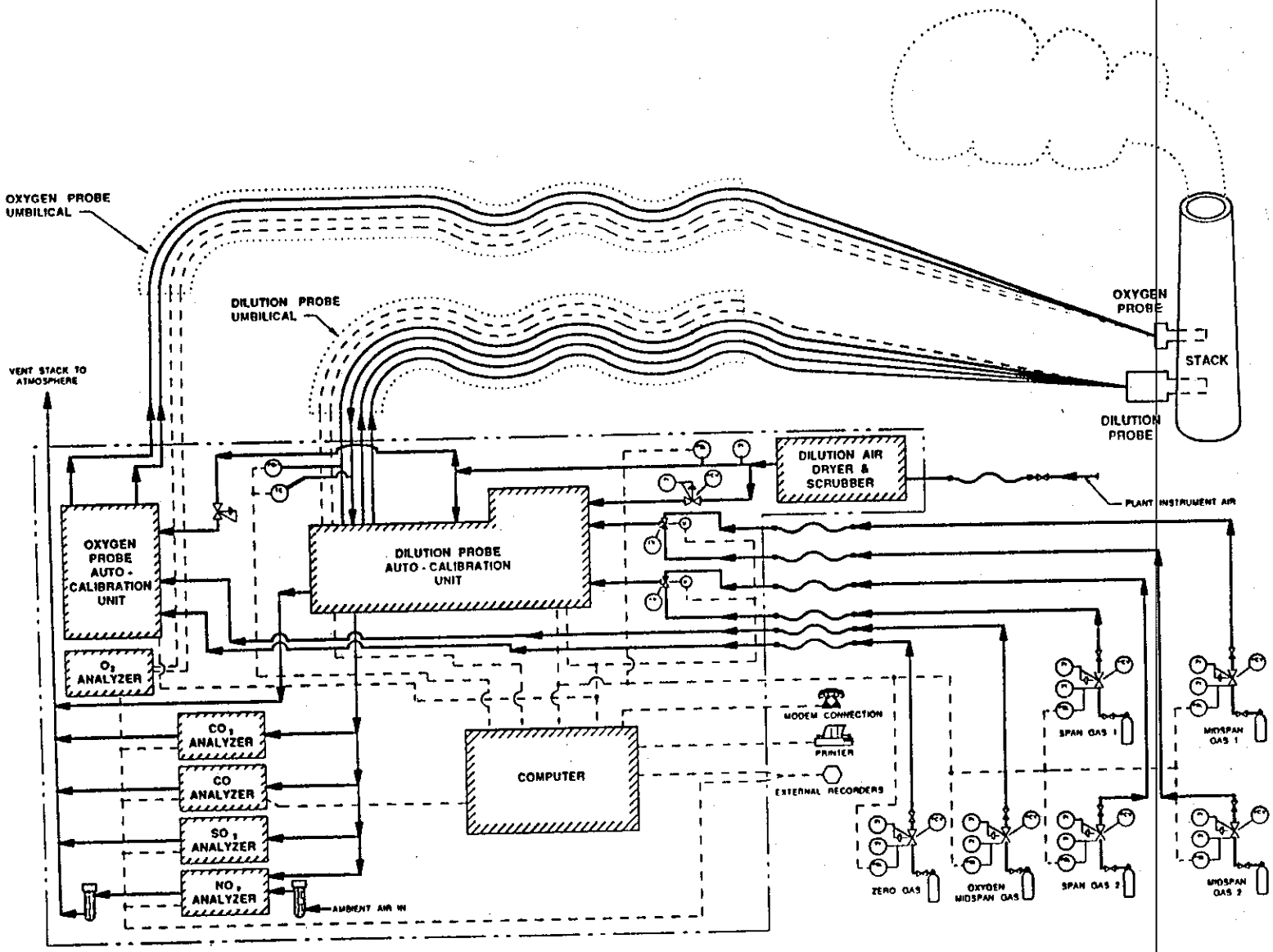


Figure 2-3. Continuous emission monitoring system

point. Calibration gases are sent to the stack and undergo the same dilution as the stack gas as a bias check. The unit was equipped for automatic calibration and remote access by modem to monitor the status during periods where no staff were on-site. The CEM results were transmitted directly to B&W in Barberton for performance monitoring along with the operational data from the Black and Veach system.

The CEM system was installed at the start of the optimization testing and used for that series. During the optimization tests, a series of 8 stratification tests were made to evaluate the degree of NO_x and O_2 stratification across the two ducts at the ESP outlet. Following the optimization tests, a single sample was drawn from each duct at point judged to be near average on the basis of the stratification testing. The two samples were blended in approximately equal proportions and used as the single sample for the remainder of the CEM testing. During the portions of the testing where staff were on-site, the EPA calibration, bias and drift checks were performed manually, usually three times per run. During unmanned testing, calibrations were performed automatically once each day, or when remote modem data monitoring indicated a need for more frequent calibration.

The CEM measurements were made on a wet basis consistent with the dilution procedure which does not dry the sample. Where required, the wet measurements were corrected using either the moisture measurements made on site as part of Methods 1-5, or using estimated flue gas water contents from the coal analyses and ambient humidity. The CEM system was housed in a trailer adjacent to the ESP.

2.3.2 Method 17 Particulate Loading and Particle Sizing

For the ESP inlet particulate characterization, Method 17 rather than Method 5 was selected because of the better performance of Method 17 with the higher particulate loading streams. Figure 2-4 shows the basic Method 17 train. This train was traversed isokinetically across the 8 ports of the ESP inlet ducts. A total sample of approximately 50 dscf was sampled.

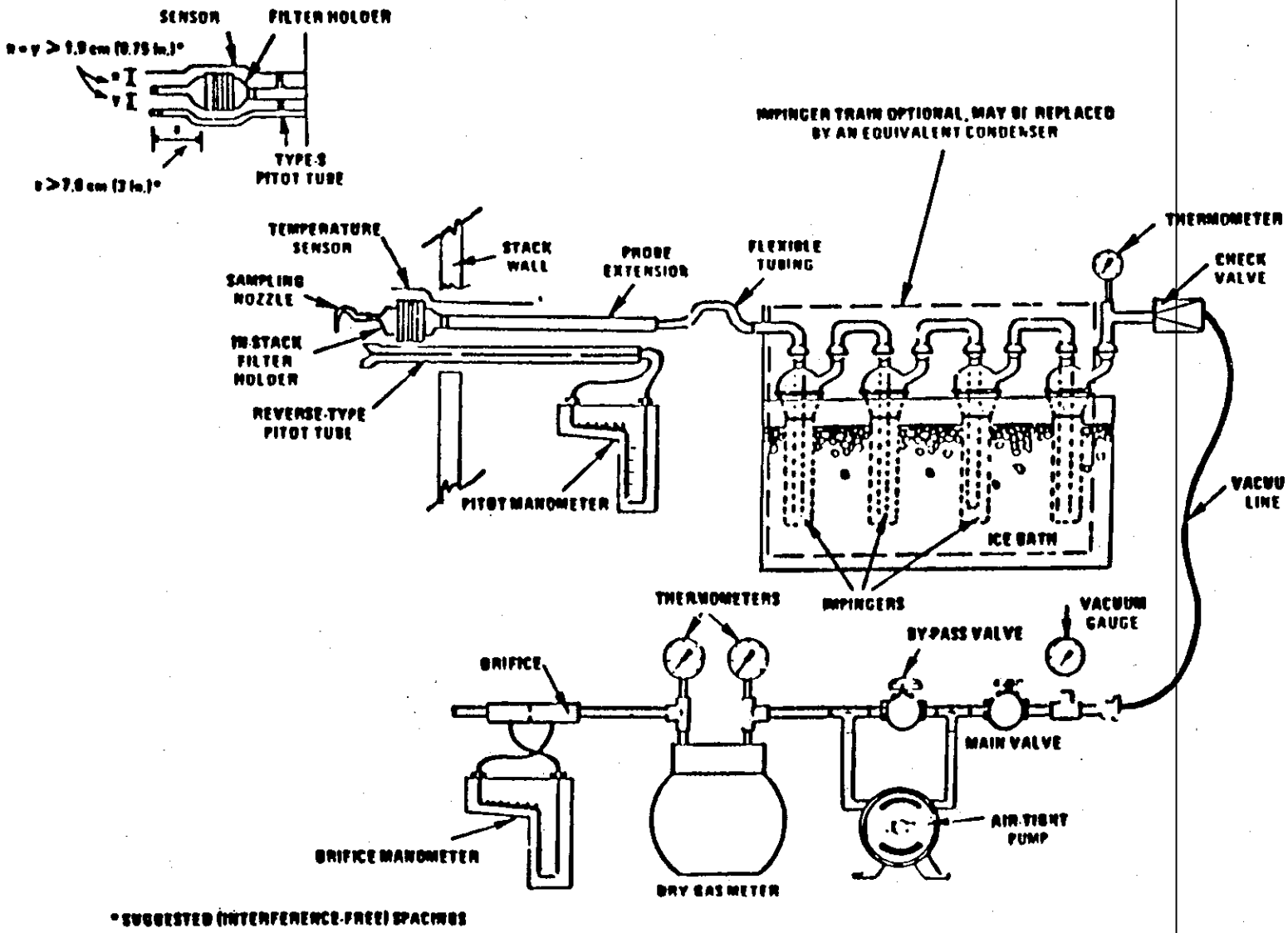


Figure 2-4. Method 17 particulate train

2.3.3 Method 5 Particulate Loading and Trace Metals Loading

For the initial runs in the optimization series and all runs in the performance and western coal series, the particulate loading at the ESP outlet was sampled with the EPA method 5 train which was traversed isokinetically over the 8 ports of the divided duct. For the final 9 runs in the optimization series, the method 5 train was configured for Method 0012 as shown in Figure 2-5 for simultaneously sampling trace metals. The primary modification is to the impinger solutions which are selected to enhance collection of volatile metals. The sample was drawn with the isokinetic traversing protocol of Method 5. After the particle loading was quantified by gravimetric analysis, the filter and impinger catchs were analyzed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. These are the same metals as specified in the RCRA protocol for TCLP.

2.3.4 Particle Sizing

For particle size determination, an Andersen cascade impactor was run at the ESP inlet for 16 of the optimization runs as indicated on Table 2-2. Three ESP outlet duct measurements were also made for comparison. The Andersen impactor uses 8 size fraction cuts and a final filter for size fractionation. The individual size cut filters were weighed to show size distribution. Because of the high grain loading at the ESP inlet, short run times of the order of 4 to 6 minutes were used within the limits of the impactor loading. Longer run times are desirable with this technique, but even with this compromise, the results should be more accurate than the Bahco technique used for the baseline tests.

2.3.5 In-Situ Flyash Resistivity

In-situ measurements of flyash resistivity were made at the ESP inlet duct. Figure 2-6 illustrates the probe which was used. Measurements were made for 10 of the optimization series runs as shown on Table 2-2. The system used here is based on a Southern Research Institute design adapted by Dr. Marlin Anderson who was retained as a subcontractor to set up the system and perform the initial series of resistivity tests. Because the sampling was done upstream of the

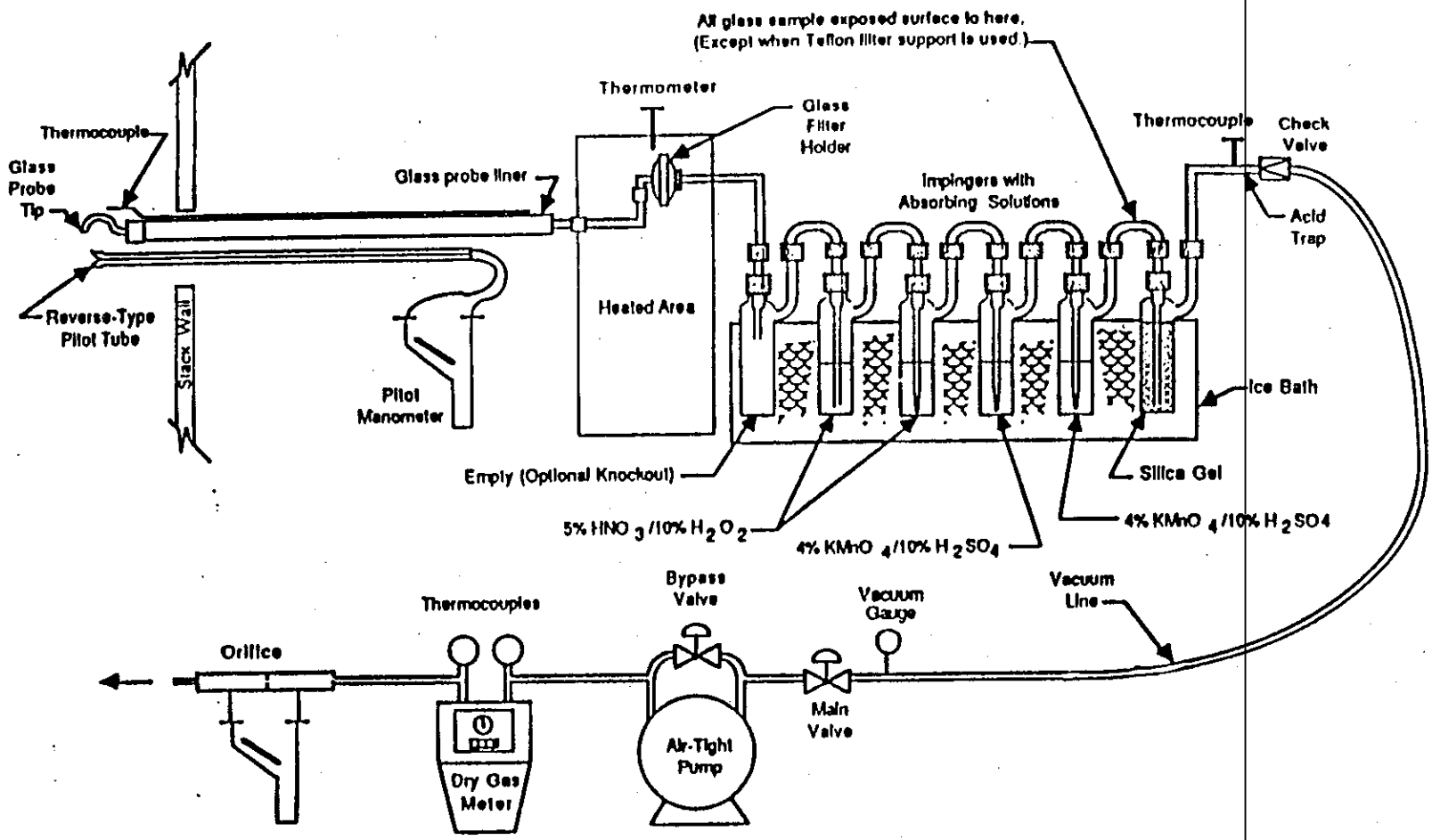


Figure 2-5. Metals sampling train

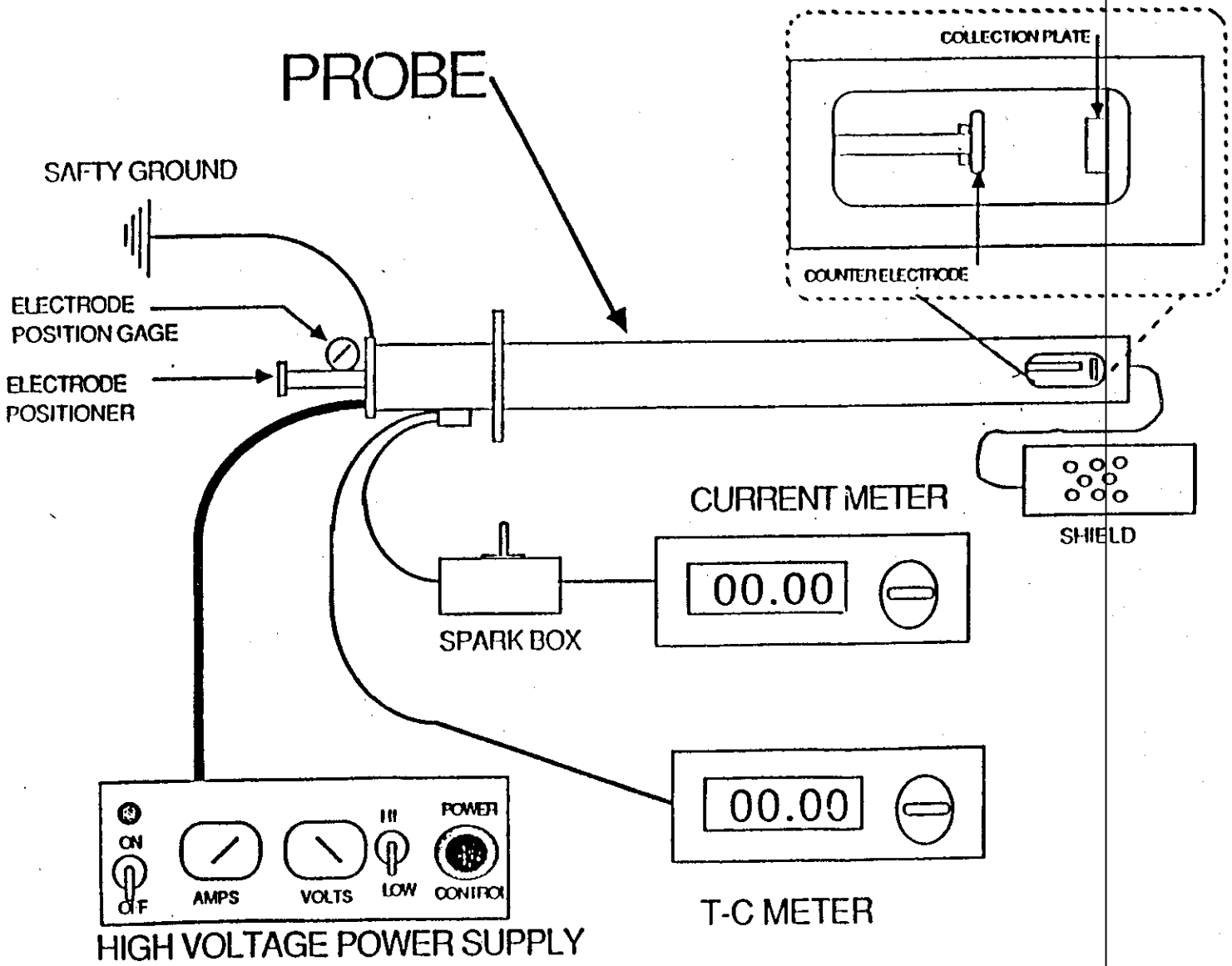


Figure 2-6. In-situ resistivity sampling system

primary preheater, the system was operating at the upper limit of materials capability. For this reason, there were several runs for which measurements were attempted but not achieved.

2.3.6 Method 18 Organics Sampling

To quantitate volatile organics and low boiling point semi-volatiles, flue gas samples were collected in Tedlar bags and shipped in carboys to the Acurex chemical analysis laboratory for Method 18 analysis. Figure 2-7 shows a schematic of the sampling train. This procedure involves gas chromatograph screening analysis of the grab samples and a total hydrocarbon estimate.

2.3.7 Unburned Carbon

Carbon loss in flyash was analyzed by the ASME PTC 28, 4.04 procedure for loss on ignition (LOI). This involves heating a dry particulate sample to 800 C and recording the weight loss. The samples used for analysis were taken from the Method 17 particulate catch at the ESP inlet.

2.3.8 Sulfate Analysis

Gas phase sulfates (H_2SO_4 mist or SO_3) were sampled with the modified miniature acid condensation system (MACs) shown in Figure 2-8. This method replaced the Method 6/8 procedure used for the baseline tests. The MACs gives a better sulfate measurement, because of less interference with SO_2 compared to the baseline procedure. SO_2 was measured with the CEM system, however, so the MACs SO_2 measurement was not used. The MACs was chosen for the better sulfate accuracy which are the species of most interest for the precipitator performance evaluation. Sample was extracted at the ESP outlet ducts at a rate of 3 Liters per minute. The sulfate condensate and impinger catch was analyzed with barium chloride titration as is done for the method 6 train.

2.3.9 Flyash Toxicity Characterization Leachate Procedure

The TCLP procedure has replaced the EP toxicity procedure for screening risk of solid samples. The procedure is from 40 CFR 268 as updated in the March 29, 1990 Federal Register. The flyash slurry samples collected from May 16 through May 20 were composited and subjected

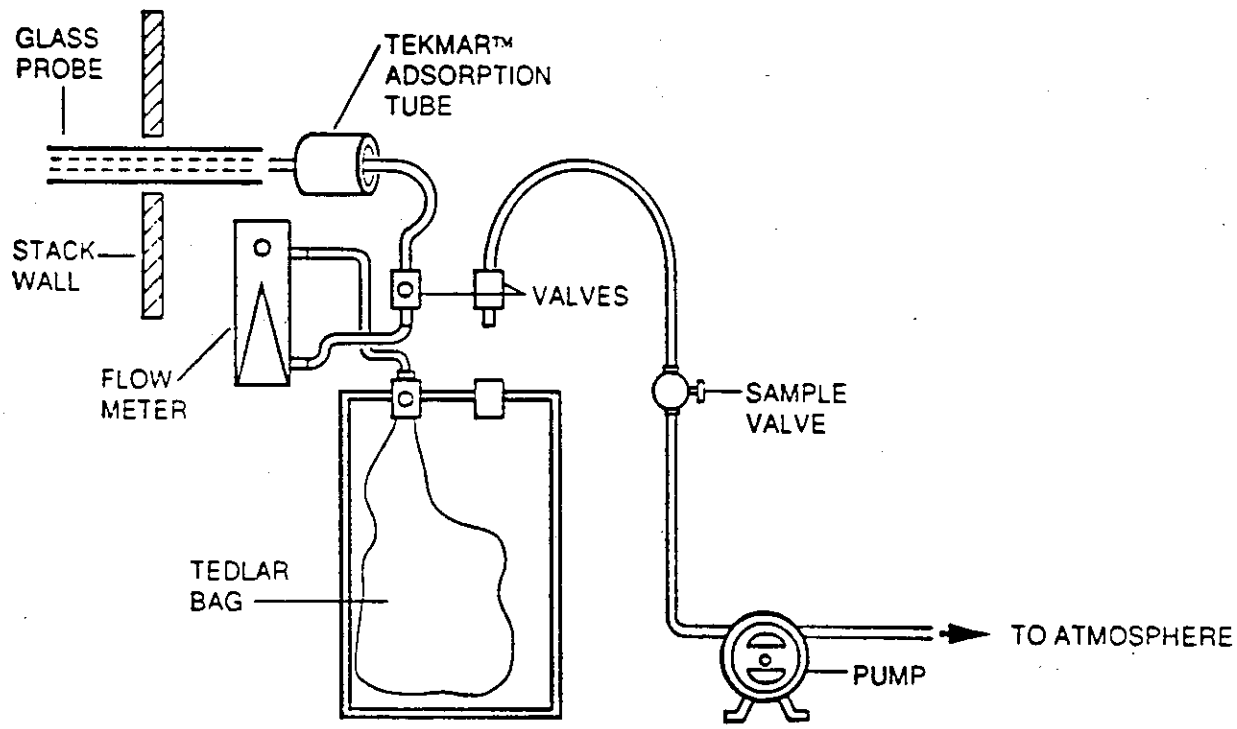


Figure 2-7. Bag sample for organic analyses

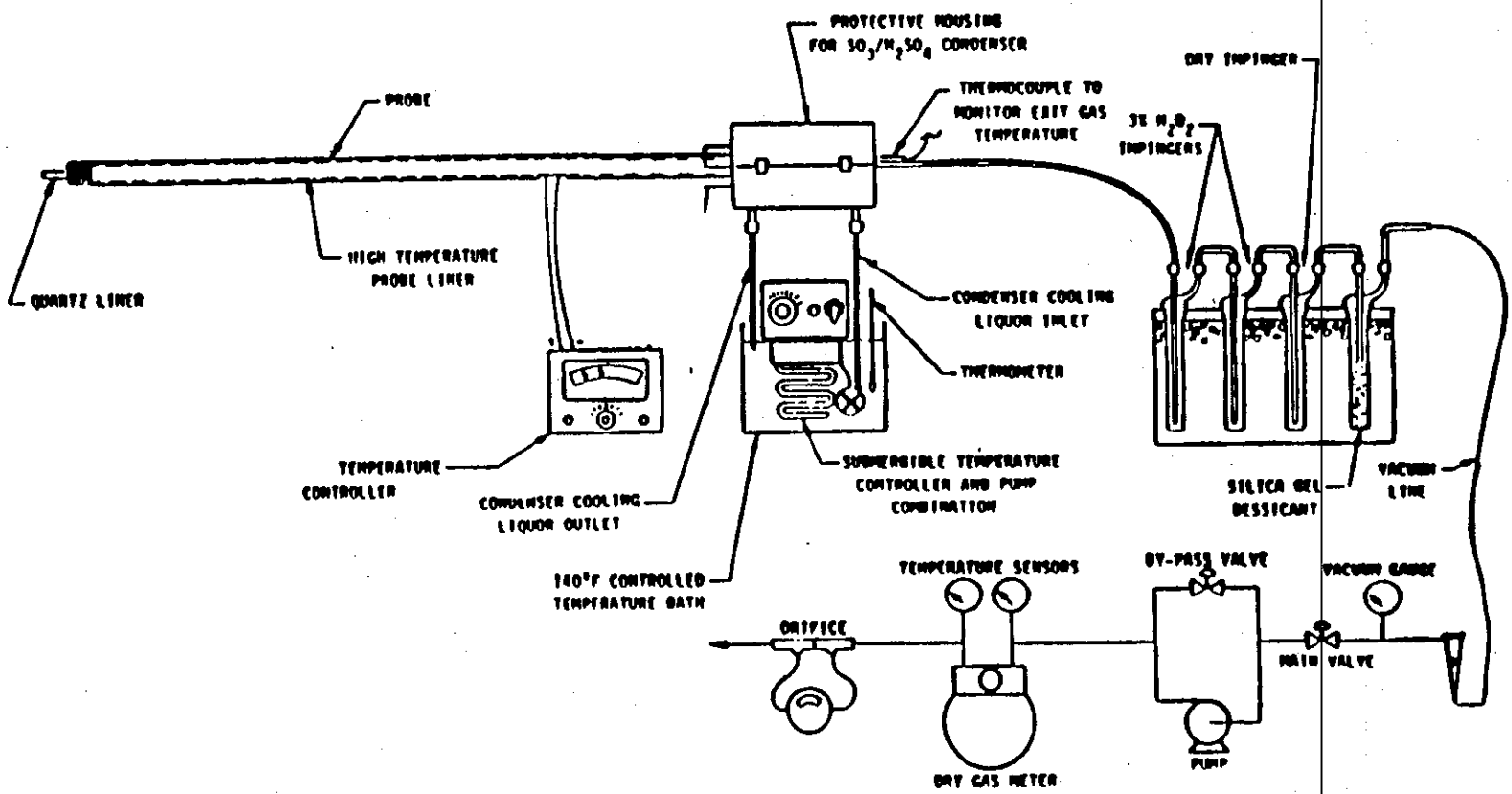


Figure 2-8. Schematic of modified miniature acid condensation system

to the leachate procedure. The leachate was analyzed for arsenic, barium, chromium, cadmium, lead, mercury, and selenium as is specified in the RCRA protocol.

2.4 QUALITY CONTROL

A separate quality assurance project plan was documented for the Phase III testing. The most pervasive aspects of the QA plan are replication of most of the key runs and adherence to the EPA protocols for calibration, leak checking, and sample handling and recovery. Additionally, sampling activities destined for laboratory analysis included provision for blanks, spikes and calibration standards or surrogates.

SECTION 3

TEST RESULTS

The Phase III testing was directed at quantifying environmental parameters which may be significantly modified by conversion to coal reburning. The most conspicuous change with coal reburning is the use of pulverized coal in the upper furnace for 20 to 30 percent of the total heat release. This fuel displaces 20 to 30 percent of the coal which would otherwise be fired in the cyclones. The cyclones are efficient at removing the coal mineral matter and are especially efficient for the particulate sizes above 1 micron. Firing the pulverized coal in the upper furnace would tend to increase the total particle loading as well as shift the particle sizing to larger size fractions. These two impacts would have compensating effects on precipitator performance. The composite effect on emissions discharged to the environment from the precipitator outlet was unknown at the start of the project. Accordingly, most of the environmental monitoring over and above simple NO_x performance was directed at the parameters influencing precipitator performance: particle loading, flyash resistivity, carbon in flyash, particle sizing, and SO_3/SO_4 levels.

The reduced data summaries for the three test series are contained in the Appendices. Original data sheets and laboratory analytical reports are not provided because of the large volume. These are retained by Acurex and will be made available to B&W or DOE as required. The following text summarizes major observations on the results, particularly as relevant to the issues outlined above. More discussion and data analysis are contained in the B&W test report which incorporates the data herein as well as boiler operational data.

3.1 CONTINUOUS EMISSIONS MONITORING DATA

Continuous emissions monitoring was done for the bulk of the Phase III testing. During the periods of on-site sampling, the CEM system was operated manually and data was tabulated for the run periods of the sample trains. At other times, data was stored and disseminated by the data logger and computer with the CEM system. The continuous emissions monitoring data for the Phase III activities are summarized in the appendices as follows:

- Appendix A: Optimization test run averages and typical results for three reburn runs at the three load conditions
- Appendix B: Stratification test results for 8 of the optimization runs
- Appendix K: Performance test quarter-hour averages for the sampling periods
- Appendix N: Western coal quarter-hour averages for the sampling periods
- Appendix Q: Hourly averages for the long-term continuous monitoring period.

In general the measurements are corrected to a dry basis from the as measured wet condition. Unless otherwise indicated, the concentrations are at the as-measured oxygen level and are not corrected to 3 percent oxygen.

The CEM data suggest the following conclusions:

- For cases where baseline testing was repeated, the agreement with the May 1990 testing was good, with full load NO_x emissions varying between 600 to 650 ppm, at 3 percent oxygen.
- NO_x emission reductions at full load met or exceeded the 50 percent goal and were typically between 50 and 55 percent; Percentage NO_x reductions at partial load were less than at full load and at low loads, absolute emissions were higher than at high loads with reburn.
- SO_2 emissions agreed with fuel sulfur but showed variability reflecting the varying coal quality as shown on Table 2-1

- CO emissions were typically low, less than 50 ppm, except during startup or some other definable upset condition.
- Stratification (Tables 3-1 and 3-2 and Appendix B) were significant, approaching 20 percent total NO_x variation in some cases; Stratification levels were comparable to the baseline testing.

Table 3-1. O_2/NO_x stratification results: ESP outlet ducts, baseline, 110 MW, 4/3/92

		Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8
14.2 in depth	O_2 %	4.8	4.2	4.3	4.0	4.4	3.9	3.8	5.1
	NO_x ppm	633	627	627	649	658	646	608	620
24.5 in depth	O_2 %	4.8	4.4	4.3	3.9	4.1	3.8	3.8	4.5
	NO_x ppm	631	627	633	639	607	624	612	601
29.6 in depth	O_2 %	4.8	4.6	4.0	4.1	4.0	3.6	3.1	4.3
	NO_x ppm	629	646	631	645	629	616	603	609
		Duct Average: 4.4% O_2 635 ppm NO_x				Duct Average: 4.1% O_2 619% NO_x			

Table 3-2. O_2/NO_x stratification results: ESP outlet ducts, reburn, 110 MW, 4/2/92

		Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8
14.2 in depth	O_2 %	3.3	3.5	3.5	3.4	3.5	3.7	3.2	3.2
	NO_x ppm	267	286	296	306	335	347	342	344
24.5 in depth	O_2 %	3.3	3.5	3.3	3.5	3.7	3.5	3.1	3.1
	NO_x ppm	274	290	290	311	349	348	331	331
29.6 in depth	O_2 %	3.7	3.3	3.5	3.5	3.7	3.1	3.1	4.3
	NO_x ppm	283	285	296	314	354	337	340	314
		Duct Average: 3.8% O_2 292 ppm NO_x				Duct Average: 3.4% O_2 339% NO_x			

3.2 PARTICULATE LOADING

The particulate loading run summaries and other measurements are shown on Table 3-3 for the optimization testing, on Table 3-4 for the performance testing, and on Table 3-5 for the western coal tests. The particulate loading results show considerable variability as was also experienced during the baseline testing. The high degree of replication of these tests and the QA procedures used throughout indicate this variability reflects actual changes in grain loading. Some of this variability may be due to soot blowing patterns. In nearly all cases, soot blowing was conducted as the routine manner, and this could influence grain loading, particularly at the ESP inlet. Despite this variability, it appears that the introduction of reburning does increase particle loading at the ESP inlet. The increase is not reflected in the particle loading at the ESP outlet, however. The small effect, and in some cases a decrease, at the ESP outlet due to reburn may be attributable to the increase in particle sizing with reburn. The larger size fractions are more readily captured with the ESP. Thus, despite a higher loading, the ESP efficiency may increase to give discharge particle loadings comparable to baseline.

The particle loading with western coal shows an increase both at the ESP inlet and outlet, possibly due to ash composition.

The detailed run summaries for the particulate runs are contained in Appendices C, D, L, M, O and P.

3.3 PARTICLE SIZE DISTRIBUTION

The particle size tabulations are summarized in Appendix H and are plotted in Appendix I. These show the expected reduction in size distribution at the ESP outlet compared to the ESP inlet. In comparison to the impactor runs during the May 1990 baseline tests, there is also the expected increase in particle loading into the ESP with reburn due to the larger pulverized coal size fraction compared to particulate escaping the ESP.

Table 3-3. Summary of test results — optimization tests

Date	Load MW	Reburn	Measurements			ESP Outlet			ESP Eff. (%)	Ash LOI (%)	Inlet resistivity (10^{10} Ohm-cm)
			Flow (dscfm)	Part (gr/dscf)	Part (lb/MMBtu)	Flow (dscfm)	Part (gr/dscf)	Part (lb/MMBtu)			
3/31	68		147,000	1.09	2.06					23.5	
4/1	110	X	234,900	1.90	3.20	248,500	0.021	0.035	98.9	12.4	4.2
4/2	110	X	228,400	2.48	4.13	238,900	0.034	0.058	98.6	10.8	
4/3	110		271,400	0.55	1.00	253,000	0.077	0.014	86.0	3.3	
4/6	82		189,200	1.11	1.95	199,900	0.023	0.041	97.9	8.0	
4/7	110	X	244,200	0.62	1.01	240,000	0.052	0.085	91.8	6.2	
4/8	110	X	239,000	0.97	1.55	246,100	0.056	0.090	94.2	8.1	
4/9	110	X	239,200	1.72	2.77	246,100	0.038	0.062	97.8	14.0	
4/10	110	X	233,400	1.33	2.16	247,300	0.017	0.028	98.7	21.0	
4/13	110	X	235,500	2.82	4.73	243,800	0.014	0.024	99.5	19.9	
4/15	82	X	173,500	1.23	2.16	182,300	0.016	0.028	98.7	16.4	
4/16	82	X	172,000	1.64	2.82	177,800	0.020	0.034	98.8	14.7	
4/21	82	X	179,400	1.82	3.25	191,000	0.014	0.025	99.2	15.2	15
4/22	55	X	119,600	2.05	3.69	124,000	0.025	0.044	98.8	20.0	4.5
4/23	58	X	121,600	2.69	5.05	135,400	0.015	0.028	99.4	20.3	0.37
4/24	111	X	235,600	1.34	2.35	240,300	0.022	0.039	98.4	30.4	0.15
4/27	110	X	232,600	1.49	2.48	236,600	0.042	0.069	97.2	12.4	11
4/28	90	X	196,100	1.40	2.41	195,500	0.017	0.029	98.8	19.0	13
4/29	82	X	179,200	1.96	3.55	184,200	0.021	0.037	99.0	32.3	
4/30	57	X	130,500	2.63	4.75	137,411	0.025	0.0046	99.0	34.9	
5/1	110	X	226,100	1.36	2.35	243,100	0.020	0.034	98.5	11.3	
5/16	82	X	177,300	2.81	4.91	199,400	0.003	0.006	99.9	22.6	
5/16	59	X	121,900	2.92	5.06	146,800	0.013	0.023	99.5	31.5	
5/17	58	X	125,900	2.63	4.82	146,700	0.003	0.005	99.9	34.5	
5/17	58	X	125,900	3.69	6.94	148,000	0.031	0.058	99.2	28.3	
5/18	110	X	231,300	2.07	3.52	244,200	0.016	0.027	99.2	13.9	0.59
5/19	110	X	233,000	1.34	2.29	247,400	0.009	0.015	99.3	14.9	0.95
5/19	82	X	170,700	1.29	2.20	186,600	0.0055	0.0096	99.6	13.6	2.7
5/20	110	X	228,500	2.38	4.06	243,600	0.0084	0.014	99.6	14.3	
5/20	82	X	172,100	2.82	4.81	189,100	0.0037	0.0064	99.9	23.8	

Table 3-4. Summary of test results — performance tests

Date	Load MW	Reburn	Measurements			ESP Outlet			ESP Eff. (%)	Ash LOI (%)
			Flow (dscfm)	Part (gr/dscf)	Part (lb/MMBtu)	Flow (dscfm)	Part (gr/dscf)	Part (lb/MMBtu)		
9/28	110	X	240,800	1.63	2.70	252,200	0.038	0.063	97.7	10.8
9/28	79		185,900	0.99	1.70	170,400	0.0091	0.016	99.1	13.2
9/28	110	X	234,600	1.47	2.45	240,400	0.031	0.051	97.9	8.8
9/29	79		326,500	1.07	1.83	173,500	0.0097	0.017	99.1	3.7
9/29	110	X	227,300	1.40	2.33	238,100	0.041	0.069	97.1	8.8
9/30	54		116,100	1.80	3.18	121,600	0.011	0.020	99.4	11.7
9/30	82	X	190,600	1.58	2.64	178,700	0.015	0.025	99.0	16.8
9/30	82	X	194,500	1.50	2.51	178,200	0.014	0.024	99.1	16.6
10/1	54		126,300	2.05	3.55	138.200	0.023	0.040	98.9	13.4
10/2	82	X	168,900	1.20	1.99	180,300	0.019	0.032	98.4	12.9
10/2	40		128,700	2.33	3.95	133,100	0.016	0.027	99.3	26.1
10/3	60	X	134,900	2.56	4.31	128,500	0.013	0.022	99.5	35.1
10/3	60	X	109,100	0.82	1.57	101,600	0.008	0.015	99.1	11.7
10/3	40		112,500	0.76	1.46	90,400	0.0087	0.017	98.9	12.4
10/4	60	X	139,500	2.51	4.24	135,200	0.0069	0.012	99.7	36.0
10/4	38	X	97,200	1.43	2.62	91,400	0.025	0.046	98.2	21.1
10/5	60	X	141,500	1.75	2.95	126,900	0.035	0.058	98.0	26.6
10/5	60	X	138,100	1.80	3.17	138.300	0.033	0.058	98.2	3.6
10/5	110	X	256,700	0.90	1.55	251,300	0.089	0.15	90.2	16.6

Table 3-5. Summary of test results — Western coal tests

Date 1993	Load MW	Reburn	ESP Inlet			ESP Outlet			ESP Eff. (%)
			Flow (dscfm)	Part (gr/dscf)	Part (lb/MMBtu)	Flow (dscfm)	Part (gr/dscf)	Part (lb/MMBtu)	
1/19	110	X	256,900	3.84	6.38	240,600	0.128	0.212	96.9
1/20	82	X	187,700	1.45	2.40	163,200	0.170	0.283	89.8
1/20	60	X	130,000	1.67	2.77	133,200	0.183	0.303	88.8

3.4 FLYASH RESISTIVITY

The flyash resistivity results are summarized in Table 3-3 and the run details are given in Appendix F. The measured in-situ resistivity ranged from 1.5×10^9 to 1.5×10^{11}. These values span the range measured during the baseline testing in May 1990 and show a comparable average level and degree of variation. On this basis, there does not appear to be a significant change in resistivity with reburning.

3.5 CARBON IN FLYASH

The ash loss on ignition, LOI, results on Tables 3-3 and 3-4 range from 6.2 percent to over 30 percent for some parametric runs. In general the higher levels were for lower loads. The LOI levels spanned the same range as the baseline tests, but the average levels with reburn were somewhat higher.

3.6 TRACE METALS

Table 3-6 summarizes the trace metals results for the optimization runs and compares the emission levels to the 1990 baseline tests and the November 1992 HAP tests. The run summaries are contained at the end of Appendix D, and the analytical results are tabulated in Appendix G. In general, the metals showed a fair degree of replication given the usual variability in trace metals concentration in coal. The agreement with the prior baseline and the HAP runs is satisfactory except for chromium for the 1990 baseline. None of these results show any particular cause for concern.

Table 3-6. Summary of trace metal emissions at ESP outlet: μg/dscm

Metal	Reburn Run									Average Baseline 5/90	Average Baseline 11/92	Average Reburn 11/92
	M_1 5/16	M_2 5/16	M_3 5/17	M_4 5/17	M_5 5/18	M_6 5/19	M_7 5/19	M_8 5/20	M_9 5/20			
Ag	<0.85	<1.14	<1.39	<1.22	<0.68	<0.67	<0.89	<0.65	<0.90	<0.68		
As	3.62	25.6	14.8	57.3	16.9	13.2	38	30.2	53.9	18.1	11.0	12.1
Ba	36.4	26.8	8.78	57.8	20.6	12.1	13	13.8	5.95	39.5		
Cd	2.71	2.10	2.36	4.85	12.6	2.28	6.72	3.16	7.08	2.49	3.98	2.37
Cr	13.5	8.0	4.51	23.2	10.8	5.89	13.6	12.1	6.22	260	20.5	7.40
Pb	46.8	19.4	3.87	61.9	33.4	14.2	13.1	13.1	11.0	10.7	127	78.0
Se	116	72.2	62.7	95.8	231	188	138	188	108	77.0	356	218
Hg	5.92	2.94	3.29	3.67	5.62	6.06	6.28	4.83	4.16	1.35	7.48	5.66

3.7 SULFATES

The results of the MACs train runs are tabulated in Appendix O. The total sulfate levels for the 6 runs which were sampled varied from 9 to 28 ppm. The average of the 6 runs was 15.7 ppm. For the 1990 baseline tests, the sulfate levels varied from 1.4 ppm to 23 ppm with an average of 9.1 ppm. Given the variability in sulfate formation and emission levels, this difference is not significant, and would be unlikely to affect ESP performance.

3.8 HYDROCARBONS

Method 18 hydrocarbon sampling and analyses were conducted for three reburn runs during the optimization testing. All three results showed no detection of total hydrocarbon to a detection limit of 1 ppm. This was consistent with the baseline testing which also showed very low or non-detectable emissions. The November 1992 HAP tests, using more refined techniques, also showed non-detectable hydrocarbon down to the ppb level. In that case, no significant effect of reburning on hydrocarbon emissions was seen.

3.9 TOXICITY CHARACTERIZATION LEACHATE PROCEDURE

The EPA/RCRA TCLP testing was performed on the composite flyash slurry sample collected during May 16 through May 20, 1992 during the optimization testing. The results are summarized on Table 3-7 in terms of leachate concentrations in mg/L. The table also shows the RCRA threshold level which is used to designate whether a sample is hazardous. The composite reburn concentrations are uniformly well below the threshold levels, in most cases by several orders of magnitude. The table also lists the results for the May 1990 baseline test. No significant difference is evident. In both the baseline and reburn case, there is no basis for concern.

Table 3-7. Summary of toxicity characteristic leachate procedure (TCLP) on ash slurry samples, mg/L

TCLP Metal	Composite Baseline	Composite Reburn	RCRA TCLP Threshold Limit
Ag	<0.005	<0.014	5.0
As	<0.2	<0.3	5.0
Ba	0.52	0.093	100
Cd	<0.005	<0.008	1.0
Cr	0.016	0.109	5.0
Hg	<0.0002	<0.004	0.2
Pb	<0.05	<0.3	5.0
Se	<0.2	<0.1	1.0

APPENDIX A

OPTIMIZATION TEST

CONTINUOUS EMISSION MONITOR DATA SUMMARY

A1 — Average CEM Readings
A2 — Typical Result 110-MW Reburn
A3 — Typical Result 82-MW Reburn
A4 — Typical Result 55-MW Reburn

A1 — Average CEM readings, dry basis

Date	O_2	CO	NO_x	SO_2
4/2	2.5	NA	314	1,388
4/6	4.4	47	470	1,099
4/7	3.0	134	298	1,294
4/10	2.9	NA	359	1,539
4/13	3.4	35	339	1,368
4/15	14.2	69	223	1,205
4/16	3.8	49	458	1,257
4/21	4.5	39	299	1,281
4/22	4.6	18	375	1,262
4/23	5.3	63	251	1,314
4/24	4.2	21	303	1,166
4/27	3.3	37	244	1,414
4/29	4.7	71	240	1,302
4/30	4.7	68	305	1,333
5/1	3.9	51	361	1,103
5/16	4.1	61	274	1,192
5/16	4.0	96	314	1,227
5/17	4.9	67	323	1,202
5/17	5.3	66	317	1,146
5/18	3.5	35	323	1,099
5/19	3.4	44	280	1,176
5/19	3.9	51	271	1,179
5/20	3.7	24	268	1,147
5/20	4.0	62	254	1,198

A2 — Typical Result 110-MW Reburn

Continuous Monitoring April 10, 110 MW Reburn

TIME	CO PPM	CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
10:50:09	17	14.3	321	1398	2.7	2.9	15.5	347	15.5
10:50:29	16	14.4	323	1399	2.7	2.9	15.5	349	15.5
10:50:49	20	14.3	324	1398	2.6	2.8	15.4	350	15.4
~~10:51:09~~	~~19~~	~~14.3~~	~~323~~	~~1399~~	~~2.7~~	~~2.9~~	~~15.4~~	~~349~~	~~15.4~~
10:51:29	22	14.4	322	920	2.6	2.8	15.5	348	15.5
10:51:49	17	14.3	322	1400	2.7	2.9	15.4	348	15.4
10:52:09	13	14.3	322	1405	2.6	2.8	15.4	348	15.4
10:52:29	15	14.2	323	1408	2.7	2.9	15.3	349	15.3
10:52:49	16	14.2	323	1409	2.7	2.9	15.3	349	15.3
10:53:09	17	14.2	326	1410	2.8	3.0	15.4	352	15.4
10:53:29	17	14.3	328	1410	2.6	2.8	15.4	355	15.4
10:53:49	16	14.3	331	1413	2.7	2.9	15.4	358	15.4
10:54:09	19	14.2	333	1414	2.7	2.9	15.4	360	15.4
10:54:29	18	14.3	336	1416	2.7	2.9	15.5	363	15.5
10:54:49	19	14.2	338	1416	2.7	2.9	15.4	365	15.4
10:55:09	20	14.3	343	1416	2.7	2.9	15.4	371	15.4
10:55:29	15	14.3	341	1418	2.8	3.0	15.5	369	15.5
10:55:49	14	14.3	340	1416	2.7	2.9	15.4	368	15.4
10:56:09	17	14.3	337	1418	2.6	2.8	15.4	364	15.4
10:56:29	18	14.4	335	1416	2.7	2.9	15.5	362	15.5
10:56:49	16	14.3	335	1420	2.7	2.9	15.4	362	15.4
10:57:09	15	14.3	337	1419	2.6	2.8	15.5	364	15.5
10:57:29	18	14.4	337	1423	2.7	2.9	15.5	364	15.5
10:57:49	18	14.4	337	1421	2.6	2.8	15.5	364	15.5
10:58:09	18	14.3	337	1421	2.6	2.8	15.4	364	15.4
10:58:29	20	14.4	337	1420	2.7	2.9	15.6	364	15.6
10:58:49	19	14.3	336	1420	2.7	2.9	15.4	363	15.4
10:59:09	20	14.2	335	1420	2.6	2.8	15.4	362	15.4
10:59:29	20	14.4	335	1418	2.7	2.9	15.5	362	15.5
10:59:49	18	14.3	333	1418	2.7	2.9	15.5	360	15.5
11:00:09	17	14.2	333	1420	2.7	2.9	15.3	360	15.3
11:00:29	15	14.3	334	1419	2.5	2.7	15.4	361	15.4
11:00:49	18	14.5	335	1418	2.6	2.8	15.7	362	15.7
11:01:09	17	14.2	337	1420	2.6	2.8	15.3	364	15.3
11:01:29	17	14.3	338	1420	2.6	2.8	15.5	365	15.5
11:01:49	17	14.4	336	1423	2.6	2.8	15.5	363	15.5
11:02:09	17	14.2	334	1423	2.6	2.8	15.4	361	15.4
11:02:29	16	14.3	334	1423	2.6	2.8	15.5	361	15.5
11:02:49	17	14.4	335	1421	2.5	2.7	15.5	362	15.5
11:03:09	19	14.4	334	1424	2.7	2.9	15.5	361	15.5
11:03:29	18	14.3	334	1423	2.6	2.8	15.4	361	15.4
11:03:49	19	14.3	334	1415	2.6	2.8	15.5	361	15.5
11:04:09	17	14.3	335	1424	2.5	2.7	15.5	362	15.5
11:04:29	17	14.2	336	1423	2.5	2.7	15.4	363	15.4
11:04:49	19	14.4	336	1423	2.7	2.9	15.6	363	15.6
11:05:09	20	14.3	337	1421	2.6	2.8	15.5	364	15.5
11:05:29	17	14.3	336	1423	2.7	2.9	15.4	363	15.4
11:05:49	18	14.4	340	1416	2.5	2.7	15.5	368	15.5
11:06:09	20	14.3	341	1421	2.4	2.6	15.4	369	15.4
11:06:29	18	14.5	343	1421	2.5	2.7	15.6	371	15.6
11:06:49	17	14.4	344	1425	2.7	2.9	15.5	372	15.5
11:07:09	17	14.3	340	1426	2.7	2.9	15.4	368	15.4
11:07:29	16	14.3	339	1430	2.7	2.9	15.4	366	15.4
11:07:49	15	14.3	338	1430	2.7	2.9	15.4	365	15.4
11:08:09	18	14.3	340	1430	2.6	2.8	15.4	368	15.4
11:08:29	18	14.2	340	1429	2.6	2.8	15.3	368	15.3
11:08:49	19	14.3	339	1428	2.6	2.8	15.5	366	15.5
11:09:09	18	14.3	339	1430	2.5	2.7	15.4	366	15.4
11:09:29	18	14.2	337	1429	2.5	2.7	15.4	364	15.4
11:09:49	17	14.3	338	1430	2.5	2.7	15.5	365	15.5
11:10:09	16	14.4	337	1430	2.5	2.7	15.6	364	15.6
11:10:29	17	14.3	335	1430	2.6	2.8	15.4	362	15.4
11:10:49	15	14.4	333	1430	2.7	2.9	15.5	360	15.5
11:11:09	18	14.2	333	1431	2.7	2.9	15.4	360	15.4
11:11:29	17	14.2	338	1428	2.7	2.9	15.4	365	15.4

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TIME	Wet CO PPM	Wet CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
11:11:49	16	14.3	336	1424	2.6	2.8	15.4	363	15.4
11:12:09	17	14.3	336	1421	2.6	2.8	15.4	363	15.4
11:12:29	17	14.3	336	1420	2.6	2.8	15.5	363	15.5
11:12:49	15	14.4	335	1420	2.8	3.0	15.5	362	15.5
11:13:09	17	14.2	335	1421	2.7	2.9	15.4	362	15.4
11:13:29	17	14.3	335	1421	2.6	2.8	15.5	362	15.5
11:13:49	20	14.3	335	1420	2.6	2.8	15.4	362	15.4
11:14:09	19	14.3	337	1419	2.7	2.9	15.4	364	15.4
11:14:29	20	14.3	339	1419	2.6	2.8	15.5	366	15.5
11:14:49	14	14.3	337	1419	2.7	2.9	15.5	364	15.5
11:15:09	15	14.3	338	1419	2.7	2.9	15.4	365	15.4
11:15:29	16	14.3	338	1419	2.6	2.8	15.5	365	15.5
11:15:49	19	14.3	342	1416	2.6	2.8	15.4	370	15.4
11:16:09	17	14.3	347	1419	2.7	2.9	15.5	375	15.5
11:16:29	20	14.3	347	1420	2.6	2.8	15.5	375	15.5
11:16:49	17	14.2	345	1421	2.6	2.8	15.3	373	15.3
11:17:09	16	14.4	343	1423	2.5	2.7	15.5	371	15.5
11:17:29	18	14.4	339	1424	2.7	2.9	15.6	366	15.6
11:17:49	18	14.2	339	1428	2.5	2.7	15.3	366	15.3
11:18:09	19	14.2	338	1428	2.5	2.7	15.4	365	15.4
11:18:29	18	14.4	345	1425	2.5	2.7	15.6	373	15.6
11:18:49	19	14.3	341	1428	2.6	2.8	15.4	369	15.4
11:19:09	19	14.3	340	1429	2.5	2.7	15.4	368	15.4
11:19:29	18	14.4	336	1426	2.6	2.8	15.6	363	15.6
11:19:49	17	14.2	335	1426	2.6	2.8	15.3	362	15.3
11:20:09	20	14.3	335	1424	2.6	2.8	15.5	362	15.5
11:20:29	17	14.3	336	1421	2.5	2.7	15.5	363	15.5
11:20:49	18	14.4	336	1420	2.6	2.8	15.5	363	15.5
11:21:09	15	14.3	337	1420	2.5	2.7	15.5	364	15.5
11:21:29	18	14.4	338	1421	2.6	2.8	15.6	365	15.6
11:21:49	18	14.4	340	1423	2.5	2.7	15.5	368	15.5
11:22:09	19	14.4	340	1425	2.6	2.8	15.6	368	15.6
11:22:29	19	14.3	338	1428	2.4	2.6	15.5	365	15.5
11:22:49	17	14.4	337	1431	2.5	2.7	15.6	364	15.6
11:23:09	17	14.3	336	1434	2.7	2.9	15.5	363	15.5
11:23:29	19	14.2	336	1436	2.4	2.6	15.4	363	15.4
11:23:49	20	14.4	334	1436	2.8	3.0	15.5	361	15.5
11:24:09	18	14.3	333	1438	2.4	2.6	15.4	360	15.4
11:24:29	17	14.4	334	1436	2.5	2.7	15.5	361	15.5
11:24:49	18	14.4	336	1436	2.5	2.7	15.5	363	15.5
11:25:09	19	14.3	337	1438	2.7	2.9	15.5	364	15.5
11:25:29	20	14.2	335	1439	2.6	2.8	15.4	362	15.4
11:25:49	19	14.3	334	1439	2.7	2.9	15.4	361	15.4
11:26:09	17	14.1	336	1436	2.7	2.9	15.2	363	15.2
11:26:29	17	14.2	341	1434	2.7	2.9	15.4	369	15.4
11:26:49	20	14.3	343	1431	2.7	2.9	15.4	371	15.4
11:27:09	22	14.2	348	1429	2.6	2.8	15.3	376	15.3
11:27:29	22	14.2	353	1428	2.6	2.8	15.4	382	15.4
11:27:49	19	14.3	360	1425	2.6	2.8	15.4	389	15.4
11:28:09	19	14.2	360	1428	2.6	2.8	15.4	389	15.4
11:28:29	20	14.3	358	1426	2.7	2.9	15.5	387	15.5
11:28:49	19	14.3	357	1429	2.6	2.8	15.4	386	15.4
11:29:09	19	14.3	353	1430	2.7	2.9	15.4	382	15.4
11:29:29	19	14.3	360	1429	2.7	2.9	15.5	389	15.5
11:29:49	19	14.2	352	1428	2.7	2.9	15.3	381	15.3
11:30:09	17	14.2	342	1428	2.7	2.9	15.3	370	15.3
11:30:29	18	14.2	334	1421	2.7	2.9	15.4	361	15.4
11:30:49	22	14.2	334	1419	2.6	2.8	15.4	361	15.4
11:31:09	18	14.3	340	1416	2.6	2.8	15.5	368	15.5
11:31:29	18	14.3	351	1418	2.6	2.8	15.5	379	15.5
11:31:49	20	14.3	360	1416	2.7	2.9	15.4	389	15.4
11:32:09	20	14.3	358	1416	2.7	2.9	15.4	387	15.4
11:32:29	19	14.2	350	1415	2.7	2.9	15.3	378	15.3
11:32:49	19	14.3	344	1413	2.6	2.8	15.4	372	15.4
11:33:09	19	14.3	342	1413	2.7	2.9	15.4	370	15.4
11:33:29	20	14.1	341	1413	2.6	2.8	15.3	369	15.3

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TIME	CO PPM	CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
11:33:49	22	14.3	339	1413	2.9	3.1	15.4	366	15.4
11:34:09	15	14.2	337	1411	2.7	2.9	15.3	364	15.3
11:34:29	18	14.0	336	1411	2.7	2.9	15.1	363	15.1
11:34:49	18	14.2	338	1409	2.7	2.9	15.4	365	15.4
11:35:09	20	14.2	340	1409	2.5	2.7	15.3	368	15.3
11:35:29	20	14.1	340	1413	2.6	2.8	15.3	368	15.3
11:35:49	20	14.2	338	1409	2.7	2.9	15.4	365	15.4
11:36:09	20	14.2	335	1414	2.6	2.8	15.4	362	15.4
11:36:29	18	14.2	334	1416	2.6	2.8	15.4	361	15.4
11:36:49	17	14.2	333	1419	2.6	2.8	15.4	360	15.4
11:37:09	18	14.3	332	1421	2.7	2.9	15.5	359	15.5
11:37:29	20	14.2	332	1423	2.6	2.8	15.3	359	15.3
11:37:49	18	14.3	332	1424	3.0	3.2	15.4	359	15.4
11:38:09	18	14.2	334	1425	2.7	2.9	15.3	361	15.3
11:38:29	20	14.1	335	1425	2.7	2.9	15.3	362	15.3
11:38:49	18	14.2	339	1430	2.6	2.8	15.4	366	15.4
11:39:09	18	14.3	345	1424	2.6	2.8	15.4	373	15.4
11:39:29	18	14.3	350	1435	2.6	2.8	15.5	378	15.5
11:39:49	18	14.3	347	1424	2.7	2.9	15.4	375	15.4
11:40:09	18	14.3	338	1424	2.6	2.8	15.4	365	15.4
11:40:29	19	14.3	333	1423	2.7	2.9	15.4	360	15.4
11:40:49	19	14.2	332	1420	2.6	2.8	15.4	359	15.4
11:41:09	17	14.2	330	1418	2.5	2.7	15.4	357	15.4
11:41:29	15	14.3	328	1418	2.6	2.8	15.4	355	15.4
11:41:49	19	14.2	328	1418	2.6	2.8	15.4	355	15.4
11:42:09	22	14.3	330	1418	2.7	2.9	15.4	357	15.4
11:42:29	18	14.2	332	1418	2.7	2.9	15.4	359	15.4
11:42:49	19	14.1	333	1418	2.7	2.9	15.2	360	15.2
11:43:09	19	14.2	335	1415	2.6	2.8	15.3	362	15.3
11:43:29	17	14.3	336	1415	2.7	2.9	15.4	363	15.4
11:43:49	18	14.1	336	1413	2.7	2.9	15.3	363	15.3
11:44:09	17	14.2	335	1413	2.6	2.8	15.3	362	15.3
11:44:29	17	14.2	335	1411	2.7	2.9	15.4	362	15.4
11:44:49	22	14.1	334	1404	2.7	2.9	15.2	361	15.2
11:45:09	19	14.1	334	1411	2.6	2.8	15.3	361	15.3
11:45:29	19	14.3	333	1410	2.7	2.9	15.4	360	15.4
11:45:49	17	14.1	333	1414	2.6	2.8	15.3	360	15.3
11:46:09	16	14.2	333	1413	2.6	2.8	15.4	360	15.4
11:46:29	17	14.2	336	1420	2.6	2.8	15.4	363	15.4
11:46:49	17	14.2	337	1414	2.7	2.9	15.4	364	15.4
11:47:09	20	14.2	337	1413	2.4	2.6	15.4	364	15.4
11:47:29	18	14.3	335	1416	2.7	2.9	15.4	362	15.4
11:47:49	19	14.2	336	1419	2.6	2.8	15.4	363	15.4
11:48:09	20	14.1	342	1420	2.6	2.8	15.2	370	15.2
11:48:29	18	14.2	353	1420	2.7	2.9	15.4	382	15.4
11:48:49	21	14.2	362	1421	2.7	2.9	15.3	391	15.3
11:49:09	18	14.1	368	1421	2.6	2.8	15.3	398	15.3
11:49:29	18	14.3	373	1420	2.6	2.8	15.4	403	15.4
11:49:49	19	14.2	366	1421	2.6	2.8	15.4	396	15.4
11:50:09	19	14.2	360	1424	2.6	2.8	15.4	389	15.4
11:50:29	18	14.3	349	1424	2.7	2.9	15.4	377	15.4
11:50:49	20	14.2	339	1424	2.7	2.9	15.4	366	15.4
11:51:09	20	14.1	333	1425	2.7	2.9	15.2	360	15.2
11:51:29	22	14.2	331	1425	2.7	2.9	15.4	358	15.4
11:51:49	18	14.2	331	1424	2.7	2.9	15.4	358	15.4
11:52:09	18	14.1	331	1424	2.8	3.0	15.2	358	15.2
11:52:29	20	14.1	330	1425	2.7	2.9	15.3	357	15.3
11:52:49	19	14.1	329	1424	2.8	3.0	15.2	356	15.2
11:53:09	20	14.0	331	1421	3.0	3.2	15.2	358	15.2
11:53:29	19	13.9	334	1421	2.7	2.9	15.1	361	15.1
11:53:49	22	14.1	338	1420	2.7	2.9	15.3	365	15.3
11:54:09	20	14.2	341	1419	2.9	3.1	15.3	369	15.3
11:54:29	19	14.1	342	1419	2.7	2.9	15.2	370	15.2
11:54:49	20	14.0	342	1421	2.6	2.8	15.2	370	15.2
11:55:09	20	14.2	343	1419	2.5	2.7	15.4	371	15.4
11:55:29	22	14.3	344	1423	2.6	2.8	15.5	372	15.5

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TIME	CO PPM	CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
11:55:49	20	14.2	342	1426	2.6	2.8	15.4	370	15.4
11:56:09	20	14.3	337	1429	2.6	2.8	15.4	364	15.4
11:56:29	18	14.2	333	1431	2.6	2.8	15.4	360	15.4
11:56:49	18	14.2	332	1434	2.6	2.8	15.4	359	15.4
11:57:09	20	14.1	332	1434	2.6	2.8	15.3	359	15.3
11:57:29	18	14.2	331	1433	2.7	2.9	15.3	358	15.3
11:57:49	21	14.2	332	1433	2.6	2.8	15.3	359	15.3
11:58:09	20	14.3	333	1428	2.7	2.9	15.4	360	15.4
11:58:29	19	14.1	332	1428	2.6	2.8	15.2	359	15.2
11:58:49	22	14.2	331	1425	2.6	2.8	15.4	358	15.4
11:59:09	22	14.2	329	1424	2.6	2.8	15.3	356	15.3
11:59:29	23	14.1	329	1424	2.8	3.0	15.3	356	15.3
11:59:49	22	14.1	329	1425	2.7	2.9	15.2	356	15.2
12:00:19	20	14.1	329	1424	2.8	3.0	15.2	356	15.2
12:00:39	19	14.1	329	1423	2.8	3.0	15.2	356	15.2
12:00:59	19	13.9	331	1419	2.7	2.9	15.0	358	15.0
12:01:19	18	14.1	334	1416	2.5	2.7	15.3	361	15.3
12:01:39	18	14.3	335	1415	2.6	2.8	15.5	362	15.5
12:01:59	19	14.1	335	1416	2.8	3.0	15.3	362	15.3
12:02:19	19	14.1	333	1418	2.7	2.9	15.2	360	15.2
12:02:39	20	14.1	331	1416	2.7	2.9	15.2	358	15.2
12:02:59	22	14.1	332	1415	2.6	2.8	15.2	359	15.2
12:03:19	18	14.1	333	1414	2.6	2.8	15.2	360	15.2
12:03:39	17	14.2	327	1411	2.7	2.9	15.3	354	15.3
12:03:59	19	14.1	325	1411	2.7	2.9	15.2	351	15.2
12:04:19	20	14.1	328	1411	2.6	2.8	15.2	355	15.2
12:04:39	20	14.2	328	1411	2.8	3.0	15.3	355	15.3
12:04:59	19	14.1	328	1411	2.6	2.8	15.2	355	15.2
12:05:19	19	14.2	328	1414	2.5	2.7	15.3	355	15.3
12:05:39	22	14.2	326	1413	2.7	2.9	15.3	352	15.3
12:05:59	22	14.1	324	1415	2.7	2.9	15.2	350	15.2
12:06:19	20	14.1	323	1415	2.7	2.9	15.2	349	15.2
12:06:39	19	14.0	323	1419	2.7	2.9	15.2	349	15.2
12:06:59	19	14.0	324	1418	2.6	2.8	15.1	350	15.1
12:07:19	18	14.1	326	1410	2.7	2.9	15.2	352	15.2
12:07:39	22	14.1	326	1418	2.8	3.0	15.3	352	15.3
12:07:59	20	14.1	327	1421	2.8	3.0	15.2	354	15.2
12:08:19	19	13.9	325	1423	2.8	3.0	15.0	351	15.0
12:08:39	18	14.1	327	1425	2.6	2.8	15.2	354	15.2
12:08:59	20	14.2	328	1423	2.6	2.8	15.3	355	15.3
12:09:19	22	14.0	330	1424	2.6	2.8	15.1	357	15.1
12:09:39	22	14.2	329	1415	2.7	2.9	15.3	356	15.3
12:09:59	20	14.1	323	1429	2.7	2.9	15.3	349	15.3
12:10:19	22	14.1	322	1428	2.7	2.9	15.2	348	15.2
12:10:39	19	14.1	318	1425	2.7	2.9	15.2	344	15.2
12:10:59	20	14.1	319	1423	2.7	2.9	15.2	345	15.2
12:11:19	19	14.1	320	1420	2.8	3.0	15.2	346	15.2
12:11:39	16	14.0	323	1420	2.7	2.9	15.1	349	15.1
12:11:59	19	14.1	324	1419	2.7	2.9	15.3	350	15.3
12:12:19	20	14.1	326	1420	2.7	2.9	15.2	352	15.2
12:12:39	12	14.1	325	1421	2.5	2.7	15.2	351	15.2
12:12:59	18	14.1	325	1421	2.5	2.7	15.3	351	15.3
12:13:19	18	14.2	325	1423	2.7	2.9	15.3	351	15.3
12:13:39	20	14.1	326	1425	2.7	2.9	15.3	352	15.3
12:13:59	20	14.2	326	1424	2.6	2.8	15.3	352	15.3
12:14:19	20	14.1	327	1424	2.6	2.8	15.2	354	15.2
12:14:39	20	14.1	328	1423	2.6	2.8	15.2	355	15.2
12:14:59	20	14.2	327	1416	2.6	2.8	15.4	354	15.4
12:15:19	22	14.2	326	1415	2.7	2.9	15.3	352	15.3
12:15:39	19	13.9	324	1409	2.5	2.7	15.1	350	15.1
12:15:59	20	14.0	322	1405	2.6	2.8	15.2	348	15.2
12:16:19	17	14.1	323	1404	2.6	2.8	15.2	349	15.2
12:16:39	18	14.0	323	1401	2.7	2.9	15.1	349	15.1
12:16:59	22	14.1	324	1401	2.7	2.9	15.2	350	15.2
12:17:19	22	14.0	325	1400	2.6	2.8	15.2	351	15.2
12:17:39	19	13.8	325	1399	2.7	2.9	15.0	351	15.0

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TIME	Wet CO PPM	Wet CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
12:17:59	22	14.0	329	1398	2.5	2.7	15.1	356	15.1
12:18:19	23	14.1	330	1400	2.6	2.8	15.2	357	15.2
12:18:39	22	13.9	329	1404	2.6	2.8	15.0	356	15.0
12:18:59	19	14.0	327	1405	2.6	2.8	15.2	354	15.2
12:19:19	19	14.0	326	1409	2.6	2.8	15.2	352	15.2
12:19:39	22	14.1	326	1413	2.6	2.8	15.2	352	15.2
12:19:59	20	14.0	329	1415	2.6	2.8	15.1	356	15.1
12:20:19	22	14.0	329	1416	2.6	2.8	15.2	356	15.2
12:20:39	20	13.9	328	1420	2.5	2.7	15.0	355	15.0
12:20:59	23	14.1	328	1419	2.5	2.7	15.2	355	15.2
12:21:19	23	14.0	328	1421	2.6	2.8	15.2	355	15.2
12:21:39	20	14.0	328	1423	2.6	2.8	15.1	355	15.1
12:21:59	19	14.0	326	1424	2.6	2.8	15.1	352	15.1
12:22:19	20	14.0	324	1424	2.7	2.9	15.1	350	15.1
12:22:39	18	13.9	324	1424	2.7	2.9	15.1	350	15.1
12:22:59	18	13.9	325	1424	2.6	2.8	15.1	351	15.1
12:23:19	20	14.0	327	1424	2.7	2.9	15.1	354	15.1
12:23:39	22	13.9	326	1423	2.7	2.9	15.0	352	15.0
12:23:59	22	13.8	325	1418	2.7	2.9	15.0	351	15.0
12:24:19	19	13.9	326	1419	2.7	2.9	15.0	352	15.0
12:24:39	20	13.9	327	1416	2.7	2.9	15.0	354	15.0
12:24:59	20	13.8	329	1418	2.6	2.8	14.9	356	14.9
12:25:19	22	14.0	330	1416	2.7	2.9	15.1	357	15.1
12:25:39	22	13.9	331	1418	2.6	2.8	15.0	358	15.0
12:25:59	20	13.8	331	1419	2.7	2.9	15.0	358	15.0
12:26:19	17	14.0	331	1420	2.7	2.9	15.1	358	15.1
12:26:39	21	13.9	330	1423	2.7	2.9	15.1	357	15.1
12:26:59	18	13.8	329	1423	2.5	2.7	15.0	356	15.0
12:27:19	20	14.0	328	1424	2.6	2.8	15.1	355	15.1
12:27:39	19	14.0	329	1426	2.6	2.8	15.1	356	15.1
12:27:59	17	13.9	327	1429	2.6	2.8	15.1	354	15.1
12:28:19	19	14.0	324	1429	2.7	2.9	15.1	350	15.1
12:28:39	19	13.9	323	1430	2.7	2.9	15.1	349	15.1
12:28:59	20	13.9	323	1431	2.6	2.8	15.0	349	15.0
12:29:19	20	13.9	325	1430	2.6	2.8	15.0	351	15.0
12:29:39	20	13.9	326	1429	2.6	2.8	15.1	352	15.1
12:29:59	20	14.1	326	1429	2.6	2.8	15.2	352	15.2
12:30:19	21	14.1	321	1429	2.6	2.8	15.2	347	15.2
12:30:39	19	13.8	326	1430	2.6	2.8	15.0	352	15.0
12:30:59	19	14.0	327	1430	2.6	2.8	15.1	354	15.1
12:31:19	20	14.0	326	1430	2.5	2.7	15.1	352	15.1
12:31:39	20	14.0	327	1430	2.6	2.8	15.1	354	15.1
12:31:59	22	14.0	327	1429	2.7	2.9	15.2	354	15.2
12:32:19	20	13.9	327	1429	2.7	2.9	15.0	354	15.0
12:32:39	19	14.0	326	1428	2.6	2.8	15.1	352	15.1
12:32:59	18	14.0	326	1429	2.5	2.7	15.1	352	15.1
12:33:19	22	13.9	327	1428	2.6	2.8	15.0	354	15.0
12:33:39	17	14.0	328	1418	2.5	2.7	15.2	355	15.2
12:33:59	18	14.0	327	1429	2.7	2.9	15.1	354	15.1
12:34:19	22	13.9	325	1429	2.6	2.8	15.1	351	15.1
12:34:39	18	14.0	323	1430	2.6	2.8	15.1	349	15.1
12:34:59	19	13.9	323	1429	2.7	2.9	15.0	349	15.0
12:35:19	22	13.9	323	1428	2.6	2.8	15.0	349	15.0
12:35:39	20	13.9	323	1425	2.6	2.8	15.0	349	15.0
12:35:59	18	14.0	323	1425	2.7	2.9	15.1	349	15.1
12:36:19	18	13.9	324	1424	2.7	2.9	15.0	350	15.0
12:36:39	19	13.9	325	1424	2.7	2.9	15.0	351	15.0
12:36:59	20	13.9	328	1420	2.7	2.9	15.1	355	15.1
12:37:19	20	13.9	330	1419	2.7	2.9	15.0	357	15.0
12:37:39	22	13.9	331	1418	2.6	2.8	15.1	358	15.1
12:37:59	18	13.9	330	1416	2.6	2.8	15.1	357	15.1
12:38:19	20	14.0	332	1416	2.6	2.8	15.1	359	15.1
12:38:39	20	13.9	328	1418	2.6	2.8	15.1	355	15.1
12:38:59	19	14.0	327	1419	2.7	2.9	15.1	354	15.1
12:39:19	18	14.0	326	1419	2.7	2.9	15.1	352	15.1
12:39:39	19	14.0	326	1420	2.5	2.7	15.1	352	15.1

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TIME	Wet CO PPM	Wet CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
12:39:59	18	14.0	327	1420	2.7	2.9	15.1	354	15.1
12:40:19	22	14.0	328	1419	2.7	2.9	15.1	355	15.1
12:40:39	23	13.9	327	1420	2.5	2.7	15.1	354	15.1
12:40:59	22	14.0	326	1419	2.6	2.8	15.2	352	15.2
12:41:19	22	14.0	324	1421	2.7	2.9	15.2	350	15.2
12:41:39	20	13.8	322	1423	2.6	2.8	14.9	348	14.9
12:41:59	19	13.9	322	1421	2.6	2.8	15.1	348	15.1
12:42:19	20	14.0	323	1414	2.5	2.7	15.1	349	15.1
12:42:39	20	13.9	325	1414	2.5	2.7	15.0	351	15.0
12:42:59	22	14.1	327	1424	2.6	2.8	15.2	354	15.2
12:43:19	21	14.0	326	1426	2.7	2.9	15.1	352	15.1
12:43:39	19	13.9	325	1426	2.6	2.8	15.0	351	15.0
12:43:59	17	14.0	325	1428	2.6	2.8	15.1	351	15.1
12:44:19	19	14.0	325	1426	2.6	2.8	15.1	351	15.1
12:44:39	20	13.9	326	1428	2.7	2.9	15.1	352	15.1
12:44:59	19	14.1	326	1428	2.6	2.8	15.2	352	15.2
12:45:19	20	14.0	326	1426	2.6	2.8	15.1	352	15.1
12:45:39	20	14.1	326	1428	2.6	2.8	15.2	352	15.2
12:45:59	19	14.0	326	1428	2.6	2.8	15.1	352	15.1
12:46:19	18	14.0	326	1429	2.6	2.8	15.1	352	15.1
12:46:39	20	14.0	325	1430	2.5	2.7	15.2	351	15.2
12:46:59	22	14.2	323	1430	2.7	2.9	15.3	349	15.3
12:47:19	18	14.0	322	1430	2.7	2.9	15.1	348	15.1
12:47:39	19	14.0	320	1430	2.7	2.9	15.1	346	15.1
12:47:59	20	14.0	319	1429	2.7	2.9	15.1	345	15.1
12:48:19	17	13.9	320	1429	2.7	2.9	15.0	346	15.0
12:48:39	20	14.0	322	1428	2.7	2.9	15.1	348	15.1
12:48:59	23	13.9	324	1424	2.7	2.9	15.0	350	15.0
12:49:19	20	14.0	325	1419	2.7	2.9	15.1	351	15.1
12:49:39	22	14.0	325	1415	2.6	2.8	15.1	351	15.1
12:49:59	18	13.9	325	1413	2.7	2.9	15.0	351	15.0
12:50:19	20	13.9	325	1411	2.7	2.9	15.1	351	15.1
12:50:39	17	13.9	326	1411	2.7	2.9	15.1	352	15.1
12:50:59	19	13.9	327	1410	2.7	2.9	15.0	354	15.0
12:51:19	22	13.9	326	1408	2.7	2.9	15.1	352	15.1
12:51:39	16	13.9	326	1404	2.7	2.9	15.1	352	15.1
12:51:59	20	13.9	325	1400	2.9	3.1	15.0	351	15.0
12:52:19	23	13.8	326	1400	2.8	3.0	14.9	352	14.9
12:52:39	18	13.8	328	1395	2.7	2.9	15.0	355	15.0
12:52:59	22	13.9	331	1394	2.7	2.9	15.0	358	15.0
12:53:19	22	13.9	333	1395	2.7	2.9	15.0	360	15.0
12:53:39	22	14.0	332	1395	2.7	2.9	15.1	359	15.1
12:53:59	20	13.9	330	1396	2.6	2.8	15.1	357	15.1
12:54:19	17	14.0	326	1395	2.8	3.0	15.2	352	15.2
12:54:39	18	14.0	324	1395	2.7	2.9	15.1	350	15.1
12:54:59	20	14.0	321	1394	2.8	3.0	15.1	347	15.1
12:55:19	21	13.9	322	1394	2.7	2.9	15.0	348	15.0
12:55:39	22	14.0	322	1391	2.7	2.9	15.1	348	15.1
12:55:59	20	13.9	326	1394	2.7	2.9	15.0	352	15.0
12:56:19	19	13.9	329	1394	2.6	2.8	15.1	356	15.1
12:56:39	19	14.0	329	1395	2.6	2.8	15.1	356	15.1
12:56:59	19	14.0	332	1401	2.7	2.9	15.1	359	15.1
12:57:19	20	14.0	338	1404	2.7	2.9	15.1	365	15.1
12:57:39	19	14.0	340	1410	2.6	2.8	15.1	368	15.1
12:57:59	23	14.0	336	1414	2.7	2.9	15.2	363	15.2
12:58:19	23	13.8	331	1414	2.7	2.9	15.0	358	15.0
12:58:39	25	13.9	327	1414	2.6	2.8	15.0	354	15.0
12:58:59	22	14.0	327	1414	2.8	3.0	15.2	354	15.2
12:59:19	23	13.8	327	1411	2.7	2.9	15.0	354	15.0
12:59:39	20	13.9	329	1411	2.7	2.9	15.0	356	15.0
12:59:59	20	14.0	326	1410	2.9	3.1	15.2	352	15.2
13:00:19	22	13.9	324	1408	2.9	3.1	15.0	350	15.0
13:00:39	20	13.9	325	1409	2.8	3.0	15.0	351	15.0
13:00:59	20	13.9	323	1408	2.8	3.0	15.0	349	15.0
13:01:19	23	13.8	330	1399	2.7	2.9	14.9	357	14.9
13:01:39	20	13.9	332	1404	2.8	3.0	15.1	359	15.1

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TIME	CO PPM (Wet)	CO2 % (Wet)	NOX PPM (Wet)	SO2 PPM (Wet)	O2 % (Wet)	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
13:01:59	20	13.9	333	1405	2.8	3.0	15.0	360	15.0
13:02:19	19	13.8	333	1404	2.8	3.0	14.9	360	14.9
13:02:39	22	13.8	334	1404	2.6	2.8	14.9	361	14.9
13:02:59	23	14.0	335	1403	2.6	2.8	15.2	362	15.2
13:03:19	22	14.0	334	1403	2.7	2.9	15.2	361	15.2
13:03:39	20	14.0	329	1405	2.7	2.9	15.1	356	15.1
13:03:59	18	14.0	325	1406	2.7	2.9	15.2	351	15.2
13:04:19	20	14.0	322	1409	2.7	2.9	15.1	348	15.1
13:04:39	23	14.0	322	1410	2.8	3.0	15.1	348	15.1
13:04:59	27	13.9	321	1413	2.8	3.0	15.0	347	15.0
13:05:19	25	14.0	321	1410	2.7	2.9	15.1	347	15.1
13:05:39	19	13.9	322	1410	2.6	2.8	15.0	348	15.0
13:05:59	20	14.0	325	1408	2.5	2.7	15.1	351	15.1
13:06:19	23	14.2	327	1410	2.5	2.7	15.3	354	15.3
13:06:39	22	14.0	331	1415	2.6	2.8	15.1	358	15.1
13:06:59	22	14.0	335	1420	2.6	2.8	15.2	362	15.2
13:07:19	18	14.0	343	1424	2.6	2.8	15.1	371	15.1
13:07:39	19	13.9	348	1424	2.7	2.9	15.1	376	15.1
13:07:59	22	14.0	342	1423	2.8	3.0	15.1	370	15.1
13:08:19	19	14.0	342	1421	2.7	2.9	15.1	370	15.1
13:08:39	19	13.9	342	1415	2.6	2.8	15.0	370	15.0
13:08:59	20	14.0	343	1413	2.9	3.1	15.2	371	15.2
13:09:19	23	14.0	343	1409	2.6	2.8	15.1	371	15.1
13:09:39	23	14.0	340	1406	2.7	2.9	15.1	368	15.1
13:09:59	19	14.0	337	1405	2.7	2.9	15.1	364	15.1
13:10:19	17	14.0	335	1414	2.7	2.9	15.1	362	15.1
13:10:39	18	13.9	335	1405	2.7	2.9	15.1	362	15.1
13:10:59	20	13.9	334	1406	2.7	2.9	15.1	361	15.1
13:11:19	22	13.9	335	1406	2.8	3.0	15.0	362	15.0
13:11:39	22	14.0	335	1408	2.7	2.9	15.1	362	15.1
13:11:59	22	14.0	335	1408	2.8	3.0	15.1	362	15.1
13:12:19	20	13.9	335	1410	2.6	2.8	15.0	362	15.0
13:12:39	22	14.0	335	1411	2.7	2.9	15.1	362	15.1
13:12:59	22	14.0	335	1411	2.8	3.0	15.1	362	15.1
13:13:19	20	14.0	333	1410	2.5	2.7	15.1	360	15.1
13:13:39	19	14.1	331	1411	2.7	2.9	15.2	358	15.2
13:13:59	20	14.0	331	1413	2.8	3.0	15.2	358	15.2
13:14:19	22	14.0	332	1414	2.6	2.8	15.1	359	15.1
13:14:39	19	14.1	334	1413	2.8	3.0	15.2	361	15.2
13:14:59	20	13.9	332	1411	2.7	2.9	15.0	359	15.0
13:15:19	22	13.9	331	1410	2.8	3.0	15.0	358	15.0
13:15:39	19	14.0	333	1408	2.6	2.8	15.1	360	15.1
13:15:59	21	13.9	334	1408	2.8	3.0	15.0	361	15.0
13:16:19	20	13.9	334	1408	2.7	2.9	15.1	361	15.1
13:16:39	19	13.9	331	1406	2.7	2.9	15.0	358	15.0
13:16:59	19	13.7	332	1406	2.6	2.8	14.9	359	14.9
13:17:19	20	13.9	332	1406	2.7	2.9	15.0	359	15.0
13:17:39	22	14.0	338	1406	2.8	3.0	15.2	365	15.2
13:17:59	23	13.9	337	1406	2.7	2.9	15.0	364	15.0
13:18:19	22	13.9	336	1408	2.6	2.8	15.1	363	15.1
13:18:39	22	14.0	338	1408	2.6	2.8	15.1	365	15.1
13:18:59	20	14.0	335	1411	2.6	2.8	15.1	362	15.1
13:19:19	18	14.0	338	1415	2.6	2.8	15.1	365	15.1
13:19:39	22	14.1	334	1418	2.8	3.0	15.2	361	15.2
13:19:59	23	13.9	329	1423	2.6	2.8	15.0	356	15.0
13:20:19	22	14.0	328	1423	2.7	2.9	15.1	355	15.1
13:20:39	18	14.0	326	1423	2.8	3.0	15.1	352	15.1
13:20:59	20	14.0	327	1424	2.7	2.9	15.1	354	15.1
13:21:19	20	13.9	327	1424	2.8	3.0	15.0	354	15.0
13:21:39	20	13.9	327	1425	2.7	2.9	15.1	354	15.1
13:21:59	18	13.9	330	1424	2.7	2.9	15.1	357	15.1
13:22:19	20	14.0	328	1423	2.8	3.0	15.1	355	15.1
13:22:39	19	13.9	326	1424	2.8	3.0	15.0	352	15.0
13:22:59	22	13.9	326	1425	2.7	2.9	15.0	352	15.0
13:23:19	23	13.9	327	1426	2.7	2.9	15.0	354	15.0
13:23:39	20	13.9	330	1415	2.8	3.0	15.1	357	15.1

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TIME	CO PPM (Wet)	CO2 % (Wet)	NOX PPM (Wet)	SO2 PPM (Wet)	O2 % (Wet)	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
13:23:59	20	14.0	330	1426	2.9	3.1	15.1	357	15.1
13:24:19	20	13.8	327	1429	2.7	2.9	14.9	354	14.9
13:24:39	18	14.0	325	1426	2.7	2.9	15.1	351	15.1
13:24:59	20	13.9	326	1424	2.8	3.0	15.0	352	15.0
13:25:19	20	13.8	326	1424	2.7	2.9	14.9	352	14.9
13:25:39	20	13.9	326	1416	2.8	3.0	15.0	352	15.0
13:25:59	22	13.9	329	1419	2.6	2.8	15.0	356	15.0
13:26:19	20	13.8	330	1418	2.6	2.8	15.0	357	15.0
13:26:39	20	13.9	331	1415	2.7	2.9	15.0	358	15.0
13:26:59	19	13.9	329	1416	2.7	2.9	15.1	356	15.1
13:27:19	19	13.9	328	1415	2.7	2.9	15.0	355	15.0
13:27:39	20	13.9	328	1415	2.8	3.0	15.1	355	15.1
13:27:59	20	13.9	329	1414	2.7	2.9	15.1	356	15.1
13:28:19	20	13.9	329	1414	2.7	2.9	15.0	356	15.0
13:28:39	18	13.9	329	1413	2.7	2.9	15.0	356	15.0
13:28:59	20	13.9	332	1410	2.6	2.8	15.0	359	15.0
13:29:19	20	14.0	337	1410	2.7	2.9	15.1	364	15.1
13:29:39	22	14.1	338	1410	2.8	3.0	15.2	365	15.2
13:29:59	22	13.9	335	1410	2.7	2.9	15.1	362	15.1
13:30:19	20	13.9	332	1409	2.7	2.9	15.0	359	15.0
13:30:39	20	13.9	327	1405	2.7	2.9	15.0	354	15.0
13:30:59	20	14.0	325	1401	2.7	2.9	15.1	351	15.1
13:31:19	20	14.0	327	1400	2.6	2.8	15.1	354	15.1
13:31:39	22	14.0	329	1399	2.6	2.8	15.1	356	15.1
13:31:59	18	14.0	332	1398	2.6	2.8	15.2	359	15.2
13:32:19	19	14.1	330	1398	2.7	2.9	15.2	357	15.2
13:32:39	22	13.8	326	1400	2.7	2.9	14.9	352	14.9
13:32:59	22	13.9	321	1403	2.7	2.9	15.0	347	15.0
13:33:19	19	13.9	323	1401	2.7	2.9	15.0	349	15.0
13:33:39	18	13.9	325	1401	2.6	2.8	15.0	351	15.0
13:33:59	20	13.9	327	1401	2.7	2.9	15.0	354	15.0
13:34:19	20	14.0	327	1403	2.7	2.9	15.1	354	15.1
13:34:39	20	13.9	328	1406	2.6	2.8	15.0	355	15.0
13:34:59	20	14.0	329	1406	2.7	2.9	15.1	356	15.1
13:35:19	25	14.0	331	1408	2.7	2.9	15.1	358	15.1
13:35:39	19	13.9	333	1410	2.8	3.0	15.0	360	15.0
13:35:59	22	14.0	334	1409	2.7	2.9	15.1	361	15.1
13:36:19	20	13.9	335	1413	2.7	2.9	15.1	362	15.1
13:36:39	19	13.9	336	1414	2.6	2.8	15.0	363	15.0
13:36:59	22	14.0	336	1413	2.6	2.8	15.2	363	15.2
13:37:19	19	14.0	333	1416	2.6	2.8	15.2	360	15.2
13:37:39	18	14.1	330	1415	2.6	2.8	15.2	357	15.2
13:37:59	20	14.0	328	1416	2.7	2.9	15.2	355	15.2
13:38:19	22	13.9	329	1416	2.7	2.9	15.0	356	15.0
13:38:39	19	14.0	330	1414	2.6	2.8	15.1	357	15.1
13:38:59	18	14.0	327	1409	2.7	2.9	15.2	354	15.2
13:39:19	19	14.0	330	1404	2.7	2.9	15.1	357	15.1
13:39:39	20	14.0	329	1400	2.7	2.9	15.1	356	15.1
13:39:59	15	13.9	325	1398	2.7	2.9	15.0	351	15.0
13:40:19	18	13.9	324	1396	2.7	2.9	15.0	350	15.0
13:40:39	20	13.9	325	1394	2.6	2.8	15.1	351	15.1
13:40:59	18	13.9	328	1391	2.7	2.9	15.0	355	15.0
13:41:19	19	13.9	330	1393	2.6	2.8	15.0	357	15.0
13:41:39	20	14.0	330	1393	2.7	2.9	15.1	357	15.1
13:41:59	19	13.8	330	1395	2.6	2.8	15.0	357	15.0
Avg	19	14.1	332	1416	2.7	2.9	15.2	359	15.2
	CO PPM	CO2 %	NOX PPM	SO2 PPM	O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM

A3 — Typical Result 82-MW Reburn

Continuous Monitoring April 15, 82 MW, Reburn

TIME	Wet CO PPM	Wet CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
21:39:19	29	13.6	197	1078	4.0	4.4	14.9	217	32
21:39:39	25	13.5	201	1078	4.1	4.5	14.9	221	28
21:39:59	25	13.5	203	1084	4.1	4.5	14.9	223	28
21:40:19	30	13.5	203	1084	4.0	4.4	14.9	223	33
21:40:39	27	13.5	202	1080	4.0	4.4	14.9	222	30
21:40:59	25	13.5	201	1079	4.0	4.4	14.9	221	28
21:41:19	23	13.5	200	1078	4.0	4.4	14.8	220	25
21:41:39	27	13.5	200	1075	4.0	4.4	14.9	220	30
21:41:59	27	13.5	200	1073	4.0	4.4	14.8	220	30
21:42:19	23	13.6	200	1073	3.8	4.2	14.9	220	25
21:42:39	29	13.6	198	1073	3.9	4.3	15.0	218	32
21:42:59	28	13.6	198	1075	3.9	4.3	14.9	218	31
21:43:19	28	13.6	197	1076	4.1	4.5	14.9	217	31
21:43:39	29	13.5	196	1076	4.0	4.4	14.9	216	32
21:43:59	29	13.4	195	1079	3.9	4.3	14.7	215	32
21:44:19	31	13.5	195	1078	3.8	4.2	14.9	215	34
21:44:39	29	13.6	195	1079	3.8	4.2	14.9	215	32
21:44:59	25	13.4	196	1085	3.8	4.2	14.8	216	28
21:45:19	33	13.6	196	1086	3.8	4.2	15.0	216	36
21:45:39	28	13.7	197	1094	3.8	4.2	15.0	217	31
21:45:59	30	13.5	197	1099	3.7	4.1	14.8	217	33
21:46:19	35	13.6	197	1104	3.5	3.9	15.0	217	39
21:46:39	35	13.9	197	1108	4.0	4.4	15.3	217	39
21:46:59	65	13.4	196	1120	3.6	4.0	14.7	216	72
21:47:19	70	13.7	196	1124	4.0	4.4	15.1	216	77
21:47:39	64	13.5	197	1128	4.0	4.4	14.9	217	70
21:47:59	52	13.6	198	1126	3.8	4.2	14.9	218	57
21:48:19	37	13.6	200	1124	3.9	4.3	14.9	220	41
21:48:39	33	13.6	198	1123	3.8	4.2	14.9	218	36
21:48:59	28	13.5	197	1119	3.8	4.2	14.8	217	31
21:49:19	29	13.6	196	1115	3.9	4.3	14.9	216	32
21:49:39	33	13.6	195	1110	3.8	4.2	15.0	215	36
21:49:59	30	13.6	195	1110	3.7	4.1	15.0	215	33
21:50:19	29	13.6	194	1110	3.8	4.2	14.9	213	32
21:50:39	31	13.6	194	1111	3.9	4.3	15.0	213	34
21:50:59	33	13.5	193	1115	3.8	4.2	14.9	212	36
21:51:19	30	13.6	193	1115	3.9	4.3	14.9	212	33
21:51:39	31	13.6	193	1116	3.9	4.3	15.0	212	34
21:51:59	33	13.6	194	1118	3.8	4.2	15.0	213	36
21:52:19	32	13.6	195	1120	3.9	4.3	14.9	215	35
21:52:39	33	13.5	194	1123	4.0	4.4	14.9	213	36
21:52:59	33	13.5	194	1124	3.8	4.2	14.9	213	36
21:53:19	36	13.4	193	1121	3.9	4.3	14.7	212	40
21:53:39	35	13.5	193	1120	3.8	4.2	14.9	212	39
21:53:59	31	13.5	193	1119	3.8	4.2	14.8	212	34
21:54:19	33	13.4	192	1113	3.7	4.1	14.7	211	36
21:54:39	37	13.6	192	1114	3.9	4.3	14.9	211	41
21:54:59	35	13.6	193	1113	3.8	4.2	14.9	212	39
21:55:19	33	13.5	194	1114	3.8	4.2	14.8	213	36
21:55:39	31	13.6	195	1111	3.8	4.2	15.0	215	34
21:55:59	35	13.6	196	1111	3.6	4.0	15.0	216	39
21:56:19	36	13.6	198	1116	3.8	4.2	15.0	218	40
21:56:39	36	13.7	197	1119	3.7	4.1	15.0	217	40
21:56:59	33	13.7	195	1121	3.8	4.2	15.0	215	36
21:57:19	33	13.5	193	1121	3.8	4.2	14.9	212	36
21:57:39	35	13.6	193	1119	3.8	4.2	15.0	212	39
21:57:59	30	13.6	193	1118	3.8	4.2	15.0	212	33
21:58:19	33	13.7	193	1118	3.7	4.1	15.0	212	36
21:58:39	32	13.7	193	1119	3.8	4.2	15.1	212	35
21:58:59	32	13.6	194	1119	3.7	4.1	15.0	213	35
21:59:19	33	13.6	195	1119	3.8	4.2	15.0	215	36
21:59:39	36	13.6	196	1118	3.6	4.0	15.0	216	40
21:59:59	29	13.7	195	1118	3.7	4.1	15.1	215	32
22:00:19	30	13.7	196	1118	3.8	4.2	15.0	216	33
22:00:39	35	13.6	196	1120	3.7	4.1	15.0	216	39

Continuous Monitoring April 15, 82 MW, Reburn

TIME	Wet CO PPM	Wet CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
22:00:59	36	13.6	195	1116	3.8	4.2	15.0	215	40
22:01:19	28	13.6	194	1115	3.7	4.1	15.0	213	31
22:01:39	31	13.5	194	1115	3.8	4.2	14.9	213	34
22:01:59	30	13.6	193	1116	3.6	4.0	15.0	212	33
22:02:19	30	13.7	193	1116	3.5	3.9	15.1	212	33
22:02:39	40	13.7	193	1115	3.5	3.9	15.1	212	44
22:02:59	44	13.9	192	1121	3.5	3.9	15.3	211	48
22:03:19	45	13.9	192	1128	3.5	3.9	15.3	211	50
22:03:39	48	13.7	192	1129	3.4	3.7	15.1	211	53
22:03:59	47	13.9	192	1129	3.6	4.0	15.3	211	52
22:04:19	45	13.9	192	1129	3.6	4.0	15.2	211	50
22:04:39	39	13.8	192	1128	3.7	4.1	15.1	211	43
22:04:59	38	13.7	192	1123	3.6	4.0	15.1	211	42
22:05:19	47	13.8	192	1121	3.6	4.0	15.1	211	52
22:05:39	55	13.7	192	1120	3.6	4.0	15.1	211	61
22:05:59	58	13.7	190	1119	3.8	4.2	15.0	209	64
22:06:19	57	13.7	188	1113	3.8	4.2	15.0	207	63
22:06:39	52	13.5	187	1105	3.8	4.2	14.9	206	57
22:06:59	65	13.6	188	1100	3.8	4.2	14.9	207	72
22:07:19	60	13.5	190	1095	4.1	4.5	14.8	209	66
22:07:39	42	13.4	194	1091	4.0	4.4	14.8	213	46
22:07:59	38	13.4	197	1085	4.0	4.4	14.7	217	42
22:08:19	43	13.4	201	1079	4.0	4.4	14.8	221	47
22:08:39	35	13.5	205	1075	3.7	4.1	14.8	226	39
22:08:59	35	13.6	208	1075	3.8	4.2	14.9	229	39
22:09:19	47	13.7	208	1074	3.8	4.2	15.0	229	52
22:09:39	49	13.6	205	1081	3.7	4.1	14.9	226	54
22:09:59	40	13.5	200	1084	3.8	4.2	14.9	220	44
22:10:19	40	13.6	199	1085	3.9	4.3	14.9	219	44
22:10:39	43	13.6	198	1090	3.8	4.2	14.9	218	47
22:10:59	45	13.5	198	1093	3.6	4.0	14.8	218	50
22:11:19	42	13.7	200	1094	3.6	4.0	15.0	220	46
22:11:39	52	13.7	201	1095	3.8	4.2	15.1	221	57
22:11:59	52	13.5	200	1099	3.8	4.2	14.9	220	57
22:12:19	40	13.6	199	1098	3.7	4.1	15.0	219	44
22:12:39	36	13.5	199	1099	3.8	4.2	14.9	219	40
22:12:59	53	13.6	201	1098	3.7	4.1	15.0	221	58
22:13:19	56	13.6	202	1101	3.7	4.1	15.0	222	62
22:13:39	45	13.7	203	1104	3.7	4.1	15.1	223	50
22:13:59	44	13.6	203	1103	3.5	3.9	15.0	223	48
22:14:19	42	13.8	201	1104	3.6	4.0	15.1	221	46
22:14:39	50	13.8	199	1105	3.6	4.0	15.2	219	55
22:14:59	67	13.7	193	1108	3.8	4.2	15.1	212	74
22:15:19	62	13.7	192	1111	3.8	4.2	15.1	211	68
22:15:39	47	13.6	191	1109	3.7	4.1	15.0	210	52
22:15:59	42	13.6	192	1109	3.5	3.9	15.0	211	46
22:16:19	45	13.7	195	1108	3.6	4.0	15.1	215	50
22:16:39	60	13.7	195	1109	3.6	4.0	15.1	215	66
22:16:59	70	13.8	195	1110	3.7	4.1	15.1	215	77
22:17:19	76	13.8	195	1111	3.5	3.9	15.1	215	84
22:17:39	93	13.8	197	1116	3.7	4.1	15.2	217	102
22:17:59	72	13.9	198	1120	3.5	3.9	15.3	218	79
22:18:19	49	13.8	199	1126	3.7	4.1	15.2	219	54
22:18:39	44	13.8	198	1126	3.8	4.2	15.2	218	48
22:18:59	48	13.7	199	1125	3.8	4.2	15.0	219	53
22:19:19	37	13.6	201	1123	3.4	3.7	14.9	221	41
22:19:39	39	13.9	203	1119	3.5	3.9	15.2	223	43
22:19:59	60	13.9	202	1123	3.6	4.0	15.3	222	66
22:20:19	65	13.7	200	1124	3.6	4.0	15.1	220	72
22:20:39	61	13.8	195	1124	3.5	3.9	15.1	215	67
22:20:59	55	13.9	192	1125	3.7	4.1	15.3	211	61
22:21:19	62	13.6	192	1128	3.6	4.0	15.0	211	68
22:21:39	53	13.8	194	1124	3.6	4.0	15.1	213	58
22:21:59	55	13.8	195	1119	3.6	4.0	15.2	215	61
22:22:19	52	13.8	195	1123	3.5	3.9	15.1	215	57
22:22:39	62	13.9	194	1124	3.5	3.9	15.3	213	68

Continuous Monitoring April 15, 82 MW, Reburn

TIME	Wet CO PPM	Wet CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
22:22:59	77	14.0	192	1130	3.5	3.9	15.4	211	85
22:23:19	94	13.8	188	1136	3.5	3.9	15.2	207	103
22:23:39	85	13.8	188	1141	3.5	3.9	15.2	207	94
22:23:59	84	13.9	187	1140	3.5	3.9	15.3	206	92
22:24:19	87	13.8	187	1141	3.5	3.9	15.2	206	96
22:24:39	142	14.0	188	1143	3.5	3.9	15.4	207	156
22:24:59	158	13.8	190	1146	3.5	3.9	15.2	209	174
22:25:19	122	13.8	191	1148	3.7	4.1	15.2	210	134
22:25:39	95	13.8	191	1146	3.5	3.9	15.2	210	105
22:25:59	90	13.7	191	1144	3.7	4.1	15.0	210	99
22:26:19	80	13.7	191	1143	3.7	4.1	15.1	210	88
22:26:39	69	13.7	193	1138	3.7	4.1	15.1	212	76
22:26:59	66	13.6	195	1136	3.6	4.0	15.0	215	73
22:27:19	70	13.8	196	1136	3.5	3.9	15.1	216	77
22:27:39	92	13.6	198	1135	3.7	4.1	15.0	218	101
22:27:59	112	13.7	198	1136	3.7	4.1	15.1	218	123
22:28:19	112	13.7	198	1136	3.7	4.1	15.1	218	123
22:28:39	109	13.6	197	1135	3.8	4.2	14.9	217	120
22:28:59	115	13.5	197	1135	3.6	4.0	14.9	217	127
22:29:19	103	13.8	197	1133	3.7	4.1	15.2	217	113
22:29:39	132	13.5	198	1133	3.6	4.0	14.9	218	145
22:29:59	122	13.7	201	1133	3.7	4.1	15.0	221	134
22:30:19	119	13.8	201	1133	3.7	4.1	15.2	221	131
22:30:39	130	13.6	198	1133	3.7	4.1	15.0	218	143
22:30:59	103	13.7	199	1134	3.6	4.0	15.1	219	113
22:31:19	90	13.8	198	1134	3.9	4.3	15.2	218	99
22:31:39	118	13.5	199	1135	3.5	3.9	14.9	219	130
22:31:59	98	13.7	198	1131	3.6	4.0	15.0	218	108
22:32:19	98	13.8	200	1128	3.6	4.0	15.1	220	108
22:32:39	86	13.7	201	1130	3.5	3.9	15.0	221	95
22:32:59	67	13.9	201	1130	3.6	4.0	15.3	221	74
22:33:19	86	13.9	200	1135	3.4	3.7	15.2	220	95
22:33:39	67	13.8	198	1136	3.8	4.2	15.2	218	74
22:33:59	48	13.8	200	1136	3.7	4.1	15.1	220	53
22:34:19	53	13.8	198	1133	3.5	3.9	15.2	218	58
22:34:39	74	13.8	200	1129	3.5	3.9	15.2	220	81
22:34:59	122	13.8	199	1125	3.7	4.1	15.1	219	134
22:35:19	167	13.7	198	1123	3.8	4.2	15.1	218	184
22:35:39	139	13.7	196	1120	3.5	3.9	15.1	216	153
22:35:59	114	13.8	195	1115	3.8	4.2	15.1	215	125
22:36:19	108	13.7	198	1111	3.7	4.1	15.1	218	119
22:36:39	125	13.7	200	1115	3.5	3.9	15.1	220	138
22:36:59	138	13.7	201	1115	3.5	3.9	15.0	221	152
22:37:19	131	13.8	200	1114	3.8	4.2	15.2	220	144
22:37:39	160	13.8	198	1115	3.5	3.9	15.2	218	176
22:37:59	132	13.6	196	1114	3.6	4.0	15.0	216	145
22:38:19	86	13.7	195	1108	3.6	4.0	15.1	215	95
22:38:39	85	13.8	193	1109	3.6	4.0	15.2	212	94
22:38:59	133	13.7	194	1105	3.7	4.1	15.0	213	146
22:39:19	180	13.7	193	1105	3.8	4.2	15.0	212	198
22:39:39	144	13.7	194	1104	3.7	4.1	15.0	213	158
22:39:59	107	13.6	196	1100	3.9	4.3	15.0	216	118
22:40:19	118	13.5	197	1101	3.8	4.2	14.9	217	130
22:40:39	121	13.6	199	1096	4.0	4.4	14.9	219	133
22:40:59	111	13.5	202	1093	4.0	4.4	14.8	222	122
22:41:19	94	13.4	205	1089	3.9	4.3	14.8	226	103
22:41:39	77	13.5	208	1088	3.9	4.3	14.8	229	85
22:41:59	80	13.5	210	1084	4.1	4.5	14.9	231	88
22:42:19	80	13.6	212	1085	4.0	4.4	15.0	233	88
22:42:39	88	13.4	212	1085	3.8	4.2	14.8	233	97
22:42:59	99	13.5	210	1081	4.1	4.5	14.9	231	109
22:43:19	123	13.4	208	1081	4.0	4.4	14.7	229	135
22:43:39	112	13.4	208	1078	4.0	4.4	14.7	229	123
22:43:59	91	13.5	211	1076	3.9	4.3	14.8	232	100
22:44:19	78	13.5	211	1075	3.8	4.2	14.8	232	86
22:44:39	79	13.6	210	1074	3.9	4.3	14.9	231	87

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TIME	CO PPM	CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
22:44:59	73	13.5	209	1080	3.8	4.2	14.9	230	80
22:45:19	60	13.5	208	1081	3.9	4.3	14.9	229	66
22:45:39	59	13.6	209	1083	4.0	4.4	14.9	230	65
22:45:59	79	13.5	208	1088	3.9	4.3	14.9	229	87
22:46:19	88	13.4	210	1084	3.8	4.2	14.7	231	97
22:46:39	67	13.5	211	1083	3.8	4.2	14.9	232	74
22:46:59	82	13.6	211	1079	3.8	4.2	14.9	232	90
22:47:19	98	13.3	211	1083	3.6	4.0	14.7	232	108
22:47:39	86	13.6	211	1080	3.9	4.3	15.0	232	95
22:47:59	91	13.7	211	1084	4.2	4.6	15.1	232	100
22:48:19	58	13.4	210	1091	4.1	4.5	14.7	231	64
22:48:39	43	13.4	212	1096	4.0	4.4	14.7	233	47
22:48:59	49	13.4	218	1098	3.8	4.2	14.8	240	54
22:49:19	68	13.4	224	1098	3.9	4.3	14.8	246	75
22:49:39	73	13.5	226	1093	3.9	4.3	14.9	249	80
22:49:59	80	13.5	218	1090	3.9	4.3	14.8	240	88
22:50:19	80	13.5	215	1090	3.9	4.3	14.8	237	88
22:50:39	69	13.5	209	1089	3.9	4.3	14.9	230	76
22:50:59	78	13.5	206	1091	3.9	4.3	14.9	227	86
22:51:19	67	13.5	206	1095	3.8	4.2	14.9	227	74
22:51:39	55	13.4	207	1095	3.9	4.3	14.8	228	61
22:51:59	62	13.5	209	1096	3.8	4.2	14.9	230	68
22:52:19	73	13.4	210	1095	4.1	4.5	14.8	231	80
22:52:39	77	13.5	212	1095	3.9	4.3	14.8	233	85
22:52:59	77	13.5	213	1096	3.9	4.3	14.9	234	85
22:53:19	65	13.5	214	1100	3.9	4.3	14.8	235	72
22:53:39	67	13.5	215	1099	4.0	4.4	14.9	237	74
22:53:59	72	13.3	214	1095	3.8	4.2	14.7	235	79
22:54:19	75	13.4	213	1093	3.9	4.3	14.7	234	83
22:54:39	79	13.5	211	1090	3.8	4.2	14.8	232	87
22:54:59	84	13.5	210	1094	3.9	4.3	14.8	231	92
22:55:19	60	13.4	211	1091	3.8	4.2	14.8	232	66
22:55:39	52	13.4	211	1086	4.0	4.4	14.7	232	57
22:55:59	60	13.4	211	1086	3.9	4.3	14.7	232	66
22:56:19	55	13.4	209	1083	4.0	4.4	14.7	230	61
22:56:39	54	13.3	210	1078	4.0	4.4	14.6	231	59
22:56:59	72	13.4	210	1076	3.9	4.3	14.7	231	79
22:57:19	69	13.3	212	1074	4.1	4.5	14.7	233	76
22:57:39	63	13.3	213	1073	4.0	4.4	14.6	234	69
22:57:59	57	13.4	215	1074	4.0	4.4	14.7	237	63
22:58:19	48	13.4	217	1073	3.9	4.3	14.7	239	53
22:58:39	57	13.4	219	1075	3.9	4.3	14.7	241	63
22:58:59	65	13.4	219	1073	3.8	4.2	14.7	241	72
22:59:19	55	13.5	217	1075	3.8	4.2	14.9	239	61
22:59:39	48	13.3	215	1078	3.8	4.2	14.6	237	53
22:59:59	52	13.5	215	1078	3.8	4.2	14.9	237	57
23:00:19	43	13.5	215	1079	3.8	4.2	14.8	237	47
23:00:39	43	13.5	216	1081	3.8	4.2	14.9	238	47
23:00:59	47	13.6	216	1086	3.8	4.2	14.9	238	52
23:01:19	39	13.5	214	1089	3.7	4.1	14.8	235	43
23:01:39	40	13.5	213	1090	3.9	4.3	14.9	234	44
23:01:59	48	13.5	214	1090	3.7	4.1	14.9	235	53
23:02:19	59	13.5	213	1094	3.9	4.3	14.9	234	65
23:02:39	57	13.6	213	1096	3.8	4.2	14.9	234	63
23:02:59	59	13.4	212	1099	4.0	4.4	14.8	233	65
23:03:19	72	13.4	212	1100	3.8	4.2	14.8	233	79
23:03:39	58	13.4	213	1099	3.9	4.3	14.7	234	64
23:03:59	53	13.3	215	1094	4.0	4.4	14.7	237	58
23:04:19	52	13.3	216	1091	3.9	4.3	14.7	238	57
23:04:39	47	13.4	215	1089	4.0	4.4	14.7	237	52
23:04:59	48	13.3	218	1086	3.9	4.3	14.6	240	53
23:05:19	58	13.3	219	1088	3.9	4.3	14.7	241	64
23:05:39	58	13.4	222	1086	3.9	4.3	14.7	244	64
23:05:59	50	13.2	221	1089	4.0	4.4	14.5	243	55
23:06:19	53	13.3	221	1088	3.8	4.2	14.6	243	58
23:06:39	62	13.4	220	1090	4.0	4.4	14.7	242	68

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TIME	Wet CO PPM	Wet CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
23:06:59	58	13.3	220	1088	3.9	4.3	14.6	242	64
23:07:19	57	13.4	221	1091	3.8	4.2	14.7	243	63
23:07:39	62	13.4	221	1093	3.7	4.1	14.7	243	68
23:07:59	69	13.4	220	1099	3.8	4.2	14.7	242	76
23:08:19	72	13.4	218	1101	3.8	4.2	14.8	240	79
23:08:39	65	13.4	216	1101	3.7	4.1	14.7	238	72
23:08:59	89	13.4	216	1104	3.8	4.2	14.8	238	98
23:09:19	114	13.5	216	1110	3.8	4.2	14.8	238	125
23:09:39	88	13.4	217	1114	3.9	4.3	14.7	239	97
23:09:59	76	13.4	214	1113	3.9	4.3	14.8	235	84
23:10:19	69	13.4	213	1114	3.9	4.3	14.8	234	76
23:10:39	63	13.4	212	1115	3.9	4.3	14.8	233	69
23:10:59	92	13.4	213	1119	3.8	4.2	14.8	234	101
23:11:19	78	13.5	213	1119	3.9	4.3	14.8	234	86
23:11:39	62	13.4	214	1123	3.9	4.3	14.7	235	68
23:11:59	75	13.3	212	1128	3.8	4.2	14.6	233	83
23:12:19	68	13.4	212	1124	4.0	4.4	14.7	233	75
23:12:39	65	13.4	210	1126	3.7	4.1	14.7	231	72
23:12:59	50	13.4	211	1129	4.0	4.4	14.7	232	55
23:13:19	60	13.3	211	1129	4.0	4.4	14.6	232	66
23:13:39	65	13.3	212	1131	3.9	4.3	14.7	233	72
23:13:59	58	13.3	214	1133	3.9	4.3	14.6	235	64
23:14:19	53	13.3	216	1130	3.8	4.2	14.6	238	58
23:14:39	51	13.4	218	1131	3.8	4.2	14.7	240	56
23:14:59	58	13.5	218	1135	4.0	4.4	14.8	240	64
23:15:19	70	13.2	217	1135	4.0	4.4	14.5	239	77
23:15:39	73	13.3	215	1139	3.8	4.2	14.6	237	80
23:15:59	70	13.4	215	1135	3.8	4.2	14.8	237	77
23:16:19	70	13.4	216	1139	4.0	4.4	14.7	238	77
23:16:39	73	13.3	217	1139	3.9	4.3	14.6	239	80
23:16:59	53	13.4	217	1138	3.9	4.3	14.8	239	58
23:17:19	50	13.4	216	1140	3.8	4.2	14.7	238	55
23:17:39	72	13.3	214	1141	3.9	4.3	14.6	235	79
23:17:59	86	13.3	211	1140	4.0	4.4	14.6	232	95
23:18:19	81	13.3	210	1136	4.0	4.4	14.7	231	89
23:18:39	82	13.3	207	1134	3.8	4.2	14.6	228	90
23:18:59	67	13.4	205	1129	4.0	4.4	14.7	226	74
23:19:19	88	13.3	203	1131	3.9	4.3	14.6	223	97
23:19:39	82	13.2	203	1128	3.9	4.3	14.6	223	90
23:19:59	65	13.3	208	1128	4.0	4.4	14.6	229	72
23:20:19	74	13.3	210	1126	4.0	4.4	14.6	231	81
23:20:39	69	13.2	212	1124	4.0	4.4	14.5	233	76
23:20:59	84	13.3	214	1121	4.0	4.4	14.6	235	92
23:21:19	87	13.3	213	1123	4.0	4.4	14.6	234	96
23:21:39	72	13.1	213	1123	4.0	4.4	14.4	234	79
23:21:59	63	13.2	213	1119	3.8	4.2	14.6	234	69
23:22:19	52	13.3	213	1119	3.8	4.2	14.6	234	57
23:22:39	57	13.2	212	1121	3.9	4.3	14.5	233	63
23:22:59	59	13.3	210	1124	3.9	4.3	14.6	231	65
23:23:19	56	13.2	207	1125	3.9	4.3	14.6	228	62
23:23:39	72	13.2	206	1124	3.9	4.3	14.5	227	79
23:23:59	68	13.2	205	1123	3.8	4.2	14.6	226	75
23:24:19	58	13.3	205	1124	3.8	4.2	14.6	226	64
23:24:39	81	13.2	204	1125	3.8	4.2	14.5	224	89
23:24:59	78	13.3	203	1128	3.8	4.2	14.6	223	86
23:25:19	58	13.3	203	1129	3.8	4.2	14.6	223	64
23:25:39	57	13.3	201	1133	3.8	4.2	14.6	221	63
23:25:59	67	13.2	200	1130	3.8	4.2	14.6	220	74
23:26:19	72	13.3	200	1130	3.7	4.1	14.6	220	79
23:26:39	67	13.4	199	1129	3.6	4.0	14.7	219	74
23:26:59	73	13.4	198	1128	3.9	4.3	14.7	218	80
23:27:19	70	13.3	199	1134	3.7	4.1	14.6	219	77
23:27:39	66	13.3	198	1130	3.8	4.2	14.6	218	73
23:27:59	54	13.3	200	1129	3.7	4.1	14.6	220	59
23:28:19	48	13.2	202	1128	3.7	4.1	14.5	222	53
23:28:39	51	13.3	204	1126	4.0	4.4	14.6	224	56

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TIME	Wet CO PPM	Wet CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
23:28:59	60	13.2	205	1123	3.7	4.1	14.6	226	66
23:29:19	59	13.2	206	1124	3.8	4.2	14.6	227	65
23:29:39	60	13.3	208	1123	4.0	4.4	14.6	229	66
23:29:59	72	13.2	210	1121	3.8	4.2	14.5	231	79
23:30:19	65	13.1	210	1118	3.8	4.2	14.5	231	72
23:30:39	53	13.2	210	1118	3.8	4.2	14.6	231	58
23:30:59	57	13.2	211	1115	3.8	4.2	14.5	232	63
Avg	64	13.5	203	1109	3.8	4.2	14.9	223	70
	CO PPM	CO2 %	NOX PPM	SO2 PPM	O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM

Continuous Monitoring April 22, 55 MW, Reburn

TIME	CO PPM	CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
22:24:09	9	12.9	343	1158	4.1	4.5	14.2	377	9.9
22:24:29	12	13.0	340	1160	4.4	4.8	14.3	374	13.2
22:24:49	13	12.8	338	1170	4.4	4.8	14.1	372	14.3
22:25:09	12	12.7	335	1165	4.3	4.7	14.0	369	13.2
22:25:29	13	12.7	334	1159	4.4	4.8	14.0	367	14.3
22:25:49	12	12.7	335	1156	4.5	5.0	13.9	369	13.2
22:26:09	12	12.7	338	1153	4.4	4.8	13.9	372	13.2
22:26:29	10	12.6	342	1148	4.4	4.8	13.9	376	11.0
22:26:49	12	12.6	346	1144	4.2	4.6	13.9	381	13.2
22:27:09	12	12.8	348	1144	4.2	4.6	14.1	383	13.2
22:27:29	12	12.8	347	1149	4.2	4.6	14.1	382	13.2
22:27:49	13	12.9	344	1159	4.3	4.7	14.1	378	14.3
22:28:09	15	12.7	342	1163	4.4	4.8	14.0	376	16.5
22:28:29	12	12.7	342	1163	4.5	5.0	14.0	376	13.2
22:28:49	10	12.7	344	1160	4.5	5.0	13.9	378	11.0
22:29:09	10	12.5	347	1148	4.4	4.8	13.8	382	11.0
22:29:29	12	12.6	350	1138	4.4	4.8	13.9	385	13.2
22:29:49	11	12.7	353	1125	4.2	4.6	13.9	388	12.1
22:30:09	13	12.6	354	1119	4.3	4.7	13.9	389	14.3
22:30:29	11	12.8	353	1113	4.2	4.6	14.0	388	12.1
22:30:49	10	12.9	350	1108	4.3	4.7	14.1	385	11.0
22:31:09	12	12.7	348	1109	4.2	4.6	13.9	383	13.2
22:31:29	11	12.6	347	1103	4.2	4.6	13.9	382	12.1
22:31:49	10	12.7	347	1104	4.2	4.6	14.0	382	11.0
22:32:09	12	12.8	347	1106	4.2	4.6	14.0	382	13.2
22:32:29	11	12.8	347	1109	4.2	4.6	14.1	382	12.1
22:32:49	12	12.8	346	1110	4.2	4.6	14.1	381	13.2
22:33:09	13	12.9	347	1110	4.2	4.6	14.1	382	14.3
22:33:29	9	12.9	348	1115	4.2	4.6	14.1	383	9.9
22:33:49	13	12.9	348	1120	4.2	4.6	14.1	383	14.3
22:34:09	13	12.8	347	1124	4.2	4.6	14.1	382	14.3
22:34:29	10	12.8	345	1126	4.2	4.6	14.1	380	11.0
22:34:49	13	12.8	343	1130	4.2	4.6	14.1	377	14.3
22:35:09	14	12.9	343	1131	4.2	4.6	14.2	377	15.4
22:35:29	12	12.8	344	1136	4.2	4.6	14.1	378	13.2
22:35:49	11	12.9	344	1138	4.2	4.6	14.2	378	12.1
22:36:09	12	13.0	344	1144	4.2	4.6	14.3	378	13.2
22:36:29	14	12.8	343	1146	4.4	4.8	14.1	377	15.4
22:36:49	13	12.8	339	1146	4.4	4.8	14.1	373	14.3
22:37:09	13	12.7	338	1140	4.3	4.7	14.0	372	14.3
22:37:29	10	12.5	340	1138	4.2	4.6	13.8	374	11.0
22:37:49	10	12.6	343	1138	4.2	4.6	13.9	377	11.0
22:38:09	13	12.6	346	1144	4.3	4.7	13.9	381	14.3
22:38:29	10	12.5	344	1149	4.2	4.6	13.8	378	11.0
22:38:49	12	12.6	342	1146	4.4	4.8	13.9	376	13.2
22:39:09	12	12.8	340	1144	4.4	4.8	14.1	374	13.2
22:39:29	12	12.7	341	1146	4.3	4.7	14.0	375	13.2
22:39:49	10	12.8	342	1144	4.4	4.8	14.1	376	11.0
22:40:09	10	12.8	345	1145	4.2	4.6	14.1	380	11.0
22:40:29	12	12.8	347	1145	4.0	4.4	14.0	382	13.2
22:40:49	13	12.9	348	1148	3.7	4.1	14.2	383	14.3
22:41:09	14	13.1	345	1155	3.9	4.3	14.4	380	15.4
22:41:29	14	13.2	339	1169	3.9	4.3	14.6	373	15.4
22:41:49	14	13.2	328	1184	3.9	4.3	14.5	361	15.4
22:42:09	16	13.2	322	1190	3.9	4.3	14.5	354	17.6
22:42:29	50	13.3	319	1194	4.2	4.6	14.6	351	55.0
22:42:49	90	12.9	315	1200	4.3	4.7	14.2	347	99.0
22:43:09	52	12.9	318	1189	4.2	4.6	14.1	350	57.2
22:43:29	30	13.0	325	1179	4.3	4.7	14.3	358	33.0
22:43:49	30	12.8	335	1173	4.4	4.8	14.0	369	33.0
22:44:09	30	12.8	341	1168	4.5	5.0	14.1	375	33.0
22:44:29	19	12.7	343	1163	4.4	4.8	14.0	377	20.9
22:44:49	14	12.7	345	1156	4.4	4.8	13.9	380	15.4
22:45:09	17	12.7	347	1153	4.3	4.7	14.0	382	18.7
22:45:29	13	12.5	347	1150	4.3	4.7	13.8	382	14.3

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TIME	CO PPM	CO2 %	NOX PPM	SO2 PPM	O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
	Wet								
22:45:49	10	12.5	347	1154	4.2	4.6	13.8	382	11.0
22:46:09	14	12.6	348	1156	4.1	4.5	13.9	383	15.4
22:46:29	15	12.8	348	1158	4.1	4.5	14.0	383	16.5
22:46:49	14	12.9	348	1164	4.2	4.6	14.2	383	15.4
22:47:09	14	13.0	345	1169	4.3	4.7	14.3	380	15.4
22:47:29	15	12.9	343	1171	4.4	4.8	14.2	377	16.5
22:47:49	13	12.8	343	1169	4.4	4.8	14.0	377	14.3
22:48:09	16	12.8	345	1166	4.3	4.7	14.0	380	17.6
22:48:29	13	12.8	347	1164	4.2	4.6	14.1	382	14.3
22:48:49	11	12.9	348	1161	4.2	4.6	14.1	383	12.1
22:49:09	15	12.9	348	1156	4.2	4.6	14.2	383	16.5
22:49:29	12	12.9	347	1156	4.4	4.8	14.2	382	13.2
22:49:49	14	12.9	347	1156	4.4	4.8	14.1	382	15.4
22:50:09	12	12.7	347	1154	4.4	4.8	13.9	382	13.2
22:50:29	12	12.8	347	1151	4.2	4.6	14.1	382	13.2
22:50:49	14	12.8	348	1150	4.3	4.7	14.1	383	15.4
22:51:09	12	12.8	348	1158	4.2	4.6	14.0	383	13.2
22:51:29	14	12.9	346	1164	4.2	4.6	14.2	381	15.4
22:51:49	15	13.0	340	1171	4.2	4.6	14.2	374	16.5
22:52:09	14	12.9	334	1179	4.1	4.5	14.1	367	15.4
22:52:29	12	13.0	331	1184	4.0	4.4	14.3	364	13.2
22:52:49	14	13.1	331	1188	4.1	4.5	14.4	364	15.4
22:53:09	14	13.0	333	1190	4.1	4.5	14.3	366	15.4
22:53:29	15	13.1	336	1186	4.0	4.4	14.4	370	16.5
22:53:49	13	12.9	338	1181	4.0	4.4	14.2	372	14.3
22:54:09	14	12.8	340	1174	4.2	4.6	14.0	374	15.4
22:54:29	13	12.8	340	1173	4.2	4.6	14.1	374	14.3
22:54:49	15	12.9	340	1173	4.1	4.5	14.2	374	16.5
22:55:09	12	12.9	342	1173	4.0	4.4	14.2	376	13.2
22:55:29	14	13.0	342	1175	4.0	4.4	14.3	376	15.4
22:55:49	17	13.1	341	1183	3.9	4.3	14.4	375	18.7
22:56:09	15	13.1	338	1190	4.0	4.4	14.5	372	16.5
22:56:29	14	13.1	335	1195	4.0	4.4	14.4	369	15.4
22:56:49	13	13.1	334	1199	4.0	4.4	14.4	367	14.3
22:57:09	16	13.1	335	1194	4.0	4.4	14.4	369	17.6
22:57:29	14	13.0	338	1196	4.0	4.4	14.3	372	15.4
22:57:49	13	13.0	340	1193	4.0	4.4	14.3	374	14.3
22:58:09	15	13.0	342	1189	4.0	4.4	14.3	376	16.5
22:58:29	12	13.0	342	1184	3.8	4.2	14.3	376	13.2
22:58:49	12	13.1	340	1185	3.7	4.1	14.4	374	13.2
22:59:09	12	13.0	339	1189	3.8	4.2	14.3	373	13.2
22:59:29	13	13.0	337	1191	3.9	4.3	14.3	371	14.3
22:59:49	11	13.0	334	1199	4.0	4.4	14.3	367	12.1
23:00:09	12	13.0	330	1201	4.0	4.4	14.3	363	13.2
23:00:29	13	13.1	329	1203	4.2	4.6	14.4	362	14.3
23:00:49	14	13.0	330	1203	4.3	4.7	14.3	363	15.4
23:01:09	13	12.9	335	1200	4.3	4.7	14.2	369	14.3
23:01:29	13	12.8	339	1191	4.2	4.6	14.1	373	14.3
23:01:49	12	13.0	342	1184	4.2	4.6	14.2	376	13.2
23:02:09	16	12.9	342	1176	4.2	4.6	14.2	376	17.6
23:02:29	14	12.9	339	1180	4.2	4.6	14.2	373	15.4
23:02:49	14	12.9	335	1181	4.2	4.6	14.2	369	15.4
23:03:09	15	12.9	332	1181	4.2	4.6	14.2	365	16.5
23:03:29	17	12.9	330	1178	4.3	4.7	14.1	363	18.7
23:03:49	12	12.8	331	1175	4.4	4.8	14.1	364	13.2
23:04:09	16	12.8	333	1170	4.2	4.6	14.1	366	17.6
23:04:29	17	12.8	338	1168	4.1	4.5	14.1	372	18.7
23:04:49	17	12.9	342	1168	4.0	4.4	14.2	376	18.7
23:05:09	13	13.1	342	1174	4.0	4.4	14.4	376	14.3
23:05:29	13	13.1	340	1180	4.0	4.4	14.4	374	14.3
23:05:49	15	13.0	337	1183	4.1	4.5	14.2	371	16.5
23:06:09	13	13.0	337	1185	4.1	4.5	14.3	371	14.3
23:06:29	12	13.0	338	1185	4.1	4.5	14.3	372	13.2
23:06:49	13	12.9	340	1184	4.2	4.6	14.2	374	14.3
23:07:09	11	12.9	340	1185	4.3	4.7	14.2	374	12.1
23:07:29	10	12.8	339	1185	4.3	4.7	14.1	373	11.0

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TIME	Wet CO PPM	Wet CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
23:07:49	11	12.7	338	1180	4.2	4.6	13.9	372	12.1
23:08:09	13	12.9	338	1173	4.3	4.7	14.1	372	14.3
23:08:29	12	12.9	338	1170	4.2	4.6	14.2	372	13.2
23:08:49	12	12.9	335	1171	4.2	4.6	14.1	369	13.2
23:09:09	16	12.9	333	1169	4.2	4.6	14.2	366	17.6
23:09:29	14	12.9	331	1166	4.2	4.6	14.2	364	15.4
23:09:49	13	12.8	332	1161	4.3	4.7	14.1	365	14.3
23:10:09	13	12.8	336	1159	4.2	4.6	14.1	370	14.3
23:10:29	14	12.9	338	1154	4.1	4.5	14.2	372	15.4
23:10:49	15	12.9	338	1158	4.1	4.5	14.2	372	16.5
23:11:09	14	12.9	337	1158	4.0	4.4	14.2	371	15.4
23:11:29	14	13.0	334	1163	4.0	4.4	14.3	367	15.4
23:11:49	13	12.8	331	1170	4.0	4.4	14.1	364	14.3
23:12:09	17	12.9	331	1176	4.0	4.4	14.2	364	18.7
23:12:29	12	13.1	332	1180	4.0	4.4	14.4	365	13.2
23:12:49	13	13.1	332	1189	4.2	4.6	14.4	365	14.3
23:13:09	11	12.9	331	1189	4.2	4.6	14.1	364	12.1
23:13:29	12	12.9	333	1189	4.1	4.5	14.2	366	13.2
23:13:49	14	13.0	337	1185	4.2	4.6	14.3	371	15.4
23:14:09	15	12.8	341	1186	4.2	4.6	14.1	375	16.5
23:14:29	15	12.9	342	1184	4.2	4.6	14.1	376	16.5
23:14:49	13	12.9	340	1178	4.2	4.6	14.1	374	14.3
23:15:09	13	12.8	341	1176	4.3	4.7	14.1	375	14.3
23:15:29	13	12.9	341	1174	4.2	4.6	14.1	375	14.3
23:15:49	15	12.8	340	1170	4.2	4.6	14.1	374	16.5
23:16:09	14	12.8	341	1170	4.2	4.6	14.1	375	15.4
23:16:29	14	12.8	339	1166	4.2	4.6	14.1	373	15.4
23:16:49	14	12.7	338	1165	4.3	4.7	13.9	372	15.4
23:17:09	18	12.5	337	1163	4.2	4.6	13.7	371	19.8
23:17:29	9	12.6	337	1159	4.3	4.7	13.8	371	9.9
23:17:49	16	12.6	339	1154	4.2	4.6	13.9	373	17.6
23:18:09	15	12.5	342	1145	4.4	4.8	13.8	376	16.5
23:18:29	14	12.5	343	1143	4.3	4.7	13.8	377	15.4
23:18:49	12	12.6	343	1139	4.2	4.6	13.9	377	13.2
23:19:09	17	12.8	341	1139	4.2	4.6	14.1	375	18.7
23:19:29	15	12.9	341	1144	4.2	4.6	14.2	375	16.5
23:19:49	13	12.9	340	1150	4.2	4.6	14.2	374	14.3
23:20:09	15	12.9	340	1155	4.2	4.6	14.1	374	16.5
23:20:29	16	12.8	340	1159	4.2	4.6	14.1	374	17.6
23:20:49	14	12.9	340	1163	3.9	4.3	14.2	374	15.4
23:21:09	13	13.0	341	1164	4.1	4.5	14.3	375	14.3
23:21:29	19	13.0	338	1169	4.0	4.4	14.3	372	20.9
23:21:49	45	13.0	331	1180	3.6	4.0	14.3	364	49.5
23:22:09	50	13.2	327	1184	4.0	4.4	14.6	360	55.0
23:22:29	173	13.2	324	1204	4.2	4.6	14.6	356	190.3
23:22:49	182	13.0	322	1215	4.3	4.7	14.3	354	200.2
23:23:09	82	13.0	321	1210	4.4	4.8	14.3	353	90.2
23:23:29	39	12.7	325	1200	4.3	4.7	14.0	358	42.9
23:23:49	26	12.8	333	1189	4.3	4.7	14.1	366	28.6
23:24:09	18	12.8	338	1180	4.4	4.8	14.1	372	19.8
23:24:29	17	12.7	340	1171	4.3	4.7	14.0	374	18.7
23:24:49	19	12.8	342	1166	4.2	4.6	14.1	376	20.9
23:25:09	15	12.8	343	1160	4.2	4.6	14.1	377	16.5
23:25:29	16	12.8	342	1158	4.3	4.7	14.1	376	17.6
23:25:49	20	12.8	338	1155	4.2	4.6	14.0	372	22.0
23:26:09	13	12.8	338	1150	4.2	4.6	14.1	372	14.3
23:26:29	12	12.7	340	1150	4.2	4.6	14.0	374	13.2
23:26:49	14	12.6	342	1151	4.3	4.7	13.9	376	15.4
23:27:09	15	12.6	343	1153	4.2	4.6	13.8	377	16.5
23:27:29	13	12.5	343	1151	4.2	4.6	13.8	377	14.3
23:27:49	14	12.8	345	1151	4.2	4.6	14.0	380	15.4
23:28:09	15	13.0	346	1156	4.1	4.5	14.2	381	16.5
23:28:29	14	12.9	343	1160	4.2	4.6	14.2	377	15.4
23:28:49	13	12.9	343	1164	4.2	4.6	14.1	377	14.3
23:29:09	14	12.9	343	1166	4.0	4.4	14.2	377	15.4
23:29:29	15	13.0	345	1169	4.1	4.5	14.3	380	16.5

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TIME	CO PPM	CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
23:29:49	15	12.9	346	1175	4.0	4.4	14.2	381	16.5
23:30:09	16	12.9	344	1179	4.1	4.5	14.2	378	17.6
23:30:29	17	13.0	343	1180	4.1	4.5	14.3	377	18.7
23:30:49	14	12.9	341	1186	4.1	4.5	14.2	375	15.4
23:31:09	16	13.0	340	1189	4.2	4.6	14.3	374	17.6
23:31:29	17	13.0	338	1189	4.1	4.5	14.3	372	18.7
23:31:49	15	12.8	338	1186	4.0	4.4	14.1	372	16.5
23:32:09	14	13.0	339	1185	4.0	4.4	14.3	373	15.4
23:32:29	17	13.1	340	1185	4.2	4.6	14.4	374	18.7
23:32:49	14	13.0	341	1185	4.2	4.6	14.3	375	15.4
23:33:09	16	12.9	340	1184	4.3	4.7	14.2	374	17.6
23:33:29	16	12.9	341	1179	4.4	4.8	14.2	375	17.6
23:33:49	16	12.8	342	1169	4.4	4.8	14.1	376	17.6
23:34:09	15	12.7	345	1154	4.4	4.8	14.0	380	16.5
23:34:29	15	12.8	347	1136	4.3	4.7	14.0	382	16.5
23:34:49	14	12.8	348	1121	4.3	4.7	14.1	383	15.4
23:35:09	14	12.8	348	1110	4.4	4.8	14.0	383	15.4
23:35:29	16	12.8	350	1104	4.3	4.7	14.1	385	17.6
23:35:49	14	12.8	349	1105	4.2	4.6	14.0	384	15.4
23:36:09	16	12.8	349	1105	4.2	4.6	14.1	384	17.6
23:36:29	16	12.9	348	1108	4.2	4.6	14.2	383	17.6
23:36:49	17	12.9	348	1115	4.2	4.6	14.2	383	18.7
23:37:09	13	12.8	348	1118	4.2	4.6	14.1	383	14.3
23:37:29	14	13.0	347	1123	4.2	4.6	14.2	382	15.4
23:37:49	12	12.9	347	1123	4.3	4.7	14.2	382	13.2
23:38:09	16	12.8	346	1126	4.3	4.7	14.1	381	17.6
23:38:29	18	12.9	345	1129	4.3	4.7	14.1	380	19.8
23:38:49	18	12.8	343	1128	4.3	4.7	14.1	377	19.8
23:39:09	15	12.8	343	1128	4.2	4.6	14.1	377	16.5
23:39:29	17	12.9	343	1128	4.2	4.6	14.2	377	18.7
23:39:49	18	13.0	341	1130	4.2	4.6	14.2	375	19.8
23:40:09	12	13.0	339	1138	4.2	4.6	14.2	373	13.2
23:40:29	15	12.8	336	1139	4.3	4.7	14.0	370	16.5
23:40:49	16	12.9	336	1139	4.2	4.6	14.1	370	17.6
23:41:09	12	12.8	336	1140	4.2	4.6	14.1	370	13.2
23:41:29	13	12.8	337	1135	4.2	4.6	14.1	371	14.3
23:41:49	17	12.9	339	1135	4.2	4.6	14.2	373	18.7
23:42:09	13	12.9	340	1131	4.2	4.6	14.2	374	14.3
23:42:29	14	12.8	340	1129	4.2	4.6	14.1	374	15.4
23:42:49	16	12.9	339	1128	4.2	4.6	14.2	373	17.6
23:43:09	12	12.9	338	1130	4.2	4.6	14.2	372	13.2
23:43:29	15	12.9	338	1125	4.1	4.5	14.1	372	16.5
23:43:49	16	13.0	339	1128	4.2	4.6	14.3	373	17.6
23:44:09	15	13.0	339	1133	4.2	4.6	14.3	373	16.5
23:44:29	14	13.0	339	1139	4.2	4.6	14.2	373	15.4
23:44:49	16	12.8	338	1143	4.2	4.6	14.1	372	17.6
23:45:09	13	13.0	338	1143	4.1	4.5	14.2	372	14.3
23:45:29	16	13.0	341	1144	4.2	4.6	14.3	375	17.6
23:45:49	17	13.1	343	1146	4.0	4.4	14.4	377	18.7
23:46:09	18	13.1	343	1151	4.0	4.4	14.4	377	19.8
23:46:29	13	13.1	343	1158	4.0	4.4	14.4	377	14.3
23:46:49	15	13.2	342	1160	4.2	4.6	14.5	376	16.5
23:47:09	18	13.1	340	1158	4.2	4.6	14.4	374	19.8
23:47:29	18	13.0	340	1155	4.1	4.5	14.3	374	19.8
23:47:49	17	12.9	341	1148	4.2	4.6	14.2	375	18.7
23:48:09	15	12.9	342	1151	4.2	4.6	14.1	376	16.5
23:48:29	14	12.8	343	1153	4.2	4.6	14.1	377	15.4
23:48:49	15	12.7	344	1153	4.1	4.5	14.0	378	16.5
23:49:09	17	12.8	343	1159	4.1	4.5	14.1	377	18.7
23:49:29	16	12.9	340	1165	4.1	4.5	14.1	374	17.6
23:49:49	17	12.8	338	1175	4.0	4.4	14.1	372	18.7
23:50:09	16	13.2	337	1178	4.1	4.5	14.5	371	17.6
23:50:29	19	13.2	336	1184	4.2	4.6	14.6	370	20.9
23:50:49	15	13.1	336	1191	4.2	4.6	14.4	370	16.5
23:51:09	18	13.1	337	1189	4.2	4.6	14.4	371	19.8
23:51:29	19	13.1	338	1188	4.1	4.5	14.4	372	20.9

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TIME	Wet CO PPM	Wet CO2 %	Wet NOX PPM	Wet SO2 PPM	Wet O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
23:51:49	19	13.0	338	1183	4.2	4.6	14.3	372	20.9
23:52:09	19	13.1	339	1179	4.2	4.6	14.5	373	20.9
23:52:29	18	13.1	339	1176	4.3	4.7	14.4	373	19.8
23:52:49	19	12.9	338	1173	4.3	4.7	14.2	372	20.9
23:53:09	17	13.0	342	1165	4.4	4.8	14.3	376	18.7
23:53:29	17	12.9	346	1161	4.3	4.7	14.2	381	18.7
23:53:49	17	12.9	349	1156	4.2	4.6	14.2	384	18.7
23:54:09	20	13.0	350	1153	4.1	4.5	14.3	385	22.0
23:54:29	16	13.1	347	1156	4.0	4.4	14.4	382	17.6
23:54:49	18	13.1	343	1164	4.0	4.4	14.4	377	19.8
23:55:09	19	13.1	339	1166	4.1	4.5	14.4	373	20.9
23:55:29	20	13.2	337	1168	4.0	4.4	14.5	371	22.0
23:55:49	19	13.1	335	1170	4.1	4.5	14.4	369	20.9
23:56:09	18	13.1	333	1174	4.2	4.6	14.4	366	19.8
23:56:29	15	13.0	333	1170	4.2	4.6	14.3	366	16.5
23:56:49	17	13.0	334	1165	4.2	4.6	14.3	367	18.7
23:57:09	17	13.0	335	1159	4.2	4.6	14.2	369	18.7
23:57:29	16	13.1	338	1154	4.1	4.5	14.4	372	17.6
23:57:49	17	13.1	341	1154	4.0	4.4	14.4	375	18.7
23:58:09	18	12.9	343	1153	4.0	4.4	14.2	377	19.8
23:58:29	17	13.0	342	1158	4.1	4.5	14.2	376	18.7
23:58:49	15	12.9	340	1163	4.2	4.6	14.2	374	16.5
23:59:09	16	12.7	338	1166	4.3	4.7	14.0	372	17.6
23:59:29	15	12.7	339	1161	4.2	4.6	14.0	373	16.5
23:59:49	15	12.7	342	1155	4.2	4.6	14.0	376	16.5
00:00:19	15	13.0	347	1150	4.2	4.6	14.3	382	16.5
00:00:39	14	13.0	347	1149	4.2	4.6	14.3	382	15.4
00:00:59	16	13.1	346	1146	4.2	4.6	14.4	381	17.6
00:01:19	16	13.0	346	1144	4.2	4.6	14.3	381	17.6
00:01:39	16	13.0	346	1145	4.1	4.5	14.3	381	17.6
00:01:59	14	13.1	345	1148	4.2	4.6	14.4	380	15.4
00:02:19	14	13.0	341	1153	4.3	4.7	14.3	375	15.4
00:02:39	21	13.0	339	1156	4.2	4.6	14.2	373	23.1
00:02:59	16	12.9	338	1159	4.2	4.6	14.2	372	17.6
00:03:19	15	13.0	341	1161	4.0	4.4	14.3	375	16.5
00:03:39	15	13.0	341	1169	4.0	4.4	14.3	375	16.5
00:03:59	16	13.1	340	1176	4.0	4.4	14.4	374	17.6
00:04:19	17	13.2	337	1186	4.0	4.4	14.5	371	18.7
00:04:39	21	13.1	335	1195	4.0	4.4	14.4	369	23.1
00:04:59	17	13.0	331	1203	4.2	4.6	14.3	364	18.7
00:05:19	17	13.0	331	1204	4.1	4.5	14.3	364	18.7
00:05:39	18	13.0	331	1205	4.2	4.6	14.3	364	19.8
00:05:59	17	12.9	332	1201	4.2	4.6	14.2	365	18.7
00:06:19	17	13.0	334	1199	4.2	4.6	14.3	367	18.7
00:06:39	16	13.0	336	1196	4.2	4.6	14.3	370	17.6
00:06:59	12	12.7	339	1195	4.2	4.6	14.0	373	13.2
00:07:19	14	12.9	342	1190	4.3	4.7	14.2	376	15.4
00:07:39	15	12.9	344	1179	4.3	4.7	14.2	378	16.5
00:07:59	18	12.9	346	1171	4.2	4.6	14.1	381	19.8
00:08:19	15	13.0	347	1164	4.2	4.6	14.2	382	16.5
00:08:39	17	12.9	347	1155	4.2	4.6	14.2	382	18.7
00:08:59	15	12.9	346	1154	4.3	4.7	14.2	381	16.5
00:09:19	17	13.0	345	1155	4.2	4.6	14.2	380	18.7
00:09:39	18	12.9	345	1158	4.3	4.7	14.2	380	19.8
00:09:59	17	12.9	343	1161	4.3	4.7	14.1	377	18.7
00:10:19	16	12.9	344	1168	4.1	4.5	14.1	378	17.6
00:10:39	16	12.9	344	1173	4.2	4.6	14.2	378	17.6
00:10:59	24	13.0	343	1176	4.3	4.7	14.3	377	26.4
00:11:19	29	12.8	341	1181	4.5	5.0	14.1	375	31.9
00:11:39	25	12.8	338	1183	4.6	5.1	14.1	372	27.5
00:11:59	23	12.5	340	1180	4.5	5.0	13.7	374	25.3
00:12:19	19	12.4	346	1169	4.4	4.8	13.6	381	20.9
00:12:39	17	12.7	354	1159	4.3	4.7	13.9	389	18.7
00:12:59	18	12.8	357	1156	4.3	4.7	14.1	393	19.8
00:13:19	16	12.7	354	1156	4.3	4.7	14.0	389	17.6
00:13:39	16	12.8	347	1158	4.2	4.6	14.1	382	17.6

Continuous Monitoring April 22, 55 MW, Reburn

TIME	CO PPM	CO2 %	NOX PPM	SO2 PPM	O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
	Wet								
00:13:59	14	12.9	344	1158	4.1	4.5	14.2	378	15.4
00:14:19	18	12.9	342	1164	4.2	4.6	14.2	376	19.8
00:14:39	18	13.0	341	1168	4.0	4.4	14.3	375	19.8
00:14:59	16	13.1	338	1166	4.1	4.5	14.5	372	17.6
00:15:19	17	12.9	338	1168	4.2	4.6	14.2	372	18.7
00:15:39	18	12.9	339	1169	4.2	4.6	14.1	373	19.8
00:15:59	16	13.0	342	1166	4.2	4.6	14.3	376	17.6
00:16:19	14	12.9	343	1165	4.2	4.6	14.2	377	15.4
00:16:39	17	13.0	343	1168	4.1	4.5	14.3	377	18.7
00:16:59	15	13.0	342	1169	4.2	4.6	14.3	376	16.5
00:17:19	17	13.0	342	1176	4.3	4.7	14.3	376	18.7
00:17:39	17	12.9	342	1175	4.3	4.7	14.2	376	18.7
00:17:59	17	12.9	342	1169	4.4	4.8	14.1	376	18.7
00:18:19	15	12.9	344	1164	4.4	4.8	14.1	378	16.5
00:18:39	15	12.8	347	1156	4.4	4.8	14.1	382	16.5
00:18:59	18	12.7	349	1150	4.4	4.8	14.0	384	19.8
00:19:19	16	12.7	350	1145	4.3	4.7	14.0	385	17.6
00:19:39	17	12.7	350	1136	4.4	4.8	13.9	385	18.7
00:19:59	14	12.7	352	1134	4.3	4.7	14.0	387	15.4
00:20:19	14	12.7	351	1129	4.2	4.6	14.0	386	15.4
00:20:39	15	12.7	350	1126	4.2	4.6	14.0	385	16.5
00:20:59	15	12.8	348	1126	4.3	4.7	14.1	383	16.5
Avg	17	12.9	341	1161	4.2	4.6	14.2	375	18.3
	CO PPM	CO2 %	NOX PPM	SO2 PPM	O2 %	Dry O2 %	Dry CO2 %	Dry NOX PPM	Dry CO PPM
	Wet								

APPENDIX B

OPTIMIZATION TEST

CONTINUOUS EMISSION MONITOR STRATIFICATION TESTS

Stratification Traverse #1, 1 April 92, Full load w/reburn

Samp. Pt.	CO (PPM)	CO2 (%)	NOx (PPM)	SO2 (PPM)	O2 (%)	NOx (PPM,
A1	74	14.6	262	1273	2.5	280
2	73	14.8	263	1274	2.4	280
3	72	14.5	263	1276	2.4	280
B1	47	14.2	268	1211	2.7	290
2	75	14.3	268	1218	2.6	289
3	48	14.5	272	1244	2.6	293
C1	38	13.7	282	1099	3.1	313
2	64	14.2	285	1151	3.0	314
3	32	14.1	280	1140	3.1	311
D1	32	13.4	264	1033	3.4	298
2	22	14.2	297	1131	2.9	326
3	25	14.1	295	1139	2.9	323
Duct Avg.	50	14.2	275	1182	2.8	300
E1	17	14.1	312	1123	3.1	346
2	17	14.2	312	1130	3.2	348
3	17	14.1	315	1131	3.1	350
F1	23	14.4	316	1103	2.9	346
2	23	14.5	325	1168	2.9	356
3	23	14.7	315	1160	2.9	345
G1	25	14.4	331	1183	3.2	370
2	25	14.6	317	1200	2.5	339
3	27	14.6	319	1211	2.4	339
H1	24	14.1	294	1196	3.2	328
2	30	14.7	305	1254	2.4	324
3	25	14.8	300	1261	2.2	315
Duct Avg.	24	14.5	314	1182	2.8	342

Stratification Traverse #2, 2 April 92, Full load w/reburn, Hi

Samp. Pt.	CO (ppm)	CO2 (%)	NOx (ppm)	SO2 (ppm)	O2 (%)	NOx (ppm,
A1	37	14.2	238	1233	3.3	267
2	37	14.3	244	1229	3.3	274
3	33	13.0	246	1214	3.7	283
B1	37	14.0	251	1213	3.5	286
2	35	14.0	255	1221	3.5	290
3	37	14.0	254	1230	3.3	285
C1	35	13.9	260	1184	3.5	296
2	28	12.5	258	1220	3.3	290
3	30	14.1	260	1223	3.5	296
D1	30	12.3	271	1195	3.4	306
2	30	13.9	273	1213	3.5	311
3	30	14.4	276	1210	3.5	314
Duct Avg.	33	13.7	257	1215	3.4	292
E1	28	14.6	294	1194	3.5	335
2	30	13.9	303	1214	3.7	349
3	32	14.0	307	1193	3.7	354
F1	54	14.4	301	1195	3.7	347
2	37	14.3	306	1221	3.5	348
3	38	14.3	304	1220	3.1	337
G1	50	13.9	306	1218	3.2	342
2	37	13.9	298	1196	3.1	331
3	45	14.3	306	1243	3.1	340
H1	35	14.1	308	1246	3.2	344
2	37	13.6	298	1210	3.1	331
3	40	12.6	262	1071	4.3	314
Duct Avg.	39	14.0	299	1202	3.4	339

Stratification Traverse #3, 3 April 92, Full load baseline

Samp. Pt.	CO (PPM)	CO2 (%)	NOx (PPM)	SO2 (PPM)	O2 (%)	NOx (PPM,
A1	16	12.6	511	1055	4.8	633
2	12	12.6	509	1088	4.8	631
3	11	12.4	507	1111	4.8	629
B1	16	12.6	527	1124	4.2	627
2	27	12.7	520	1126	4.4	627
3	20	12.5	528	1144	4.6	646
C1	17	12.6	523	1136	4.3	627
2	13	12.7	528	1135	4.3	633
3	19	12.6	537	1126	4.0	631
D1	15	13.0	552	1126	4.0	649
2	14	12.8	547	1093	3.9	639
3	16	12.9	545	1115	4.1	645
Duct Avg.	16	12.7	528	1115	4.4	635
E1	11	13.0	545	1065	4.4	658
2	40	13.2	513	1063	4.1	607
3	17	13.0	535	1184	4.0	629
F1	20	13.0	553	1179	3.9	646
2	18	13.4	538	1215	3.8	624
3	19	13.2	528	1190	3.9	616
G1	21	13.4	524	1158	3.8	608
2	19	13.4	528	1171	3.8	612
3	24	13.3	527	1191	3.6	603
H1	22	12.3	490	1116	5.1	620
2	23	12.7	495	1118	4.5	601
3	27	12.9	508	1129	4.3	609
Duct Avg.	22	13.1	524	1148	4.1	619

Stratification Traverse #4, 11 April 92, Full load baseline

Samp. Pt.	CO (PPM)	CO2 (%)	NOx (PPM)	SO2 (PPM)	O2 (%)	NOx (PPM,
A1	N/A	14.0	569	1051	5.2	725
2	N/A	14.3	565	1053	5.2	720
3	N/A	14.4	568	1053	5.4	734
B1	N/A	14.5	550	1036	5.0	691
2	N/A	14.8	575	1039	5.0	723
3	N/A	14.8	573	1048	4.8	710
C1	N/A	14.8	567	1063	4.8	703
2	N/A	14.9	576	1074	4.7	709
3	N/A	15.1	589	1091	4.8	730
D1	N/A	15.0	581	1101	4.6	710
2	N/A	15.1	593	1128	4.6	725
3	N/A	15.3	588	1144	4.7	724
Duct Avg.	0	14.8	575	1073	4.9	717
E1	N/A	15.2	575	1053	4.6	703
2	N/A	15.4	594	1049	4.4	717
3	N/A	15.4	595	1030	4.6	728
F1	N/A	12.2	463	925	4.6	566
2	N/A	14.1	517	749	4.6	632
3	N/A	14.8	503	665	4.7	619
G1	N/A	14.5	509	656	4.6	622
2	N/A	14.5	527	646	4.7	649
3	N/A	14.9	553	700	4.6	676
H1	N/A	14.4	539	711	5.9	723
2	N/A	14.1	512	649	5.7	677
3	N/A	14.0	492	594	5.7	650
Duct Avg.	0	14.5	532	786	4.9	663

Stratification Traverse #5, 13 April 92, Full load w/reburn

Samp. Pt.	CO (PPM)	CO2 (%)	NOx (PPM)	SO2 (PPM)	O2 (%)	NOx (PPM,
A1	37	N/A	284	N/A	3.2	317
2	37	N/A	277	N/A	3.2	309
3	40	N/A	272	N/A	3.0	300
B1	38	N/A	286	N/A	3.0	315
2	37	N/A	276	N/A	2.9	303
3	43	N/A	290	N/A	3.1	322
C1	48	N/A	294	N/A	3.2	328
2	38	N/A	296	N/A	3.3	333
3	38	N/A	295	N/A	3.3	331
D1	37	N/A	293	N/A	3.3	329
2	40	N/A	292	N/A	3.1	324
3	39	N/A	295	N/A	3.2	329
Duct Avg.	39	0.0	288		3.2	320
E1	26	N/A	315	N/A	3.3	354
2	38	N/A	318	N/A	3.4	360
3	38	N/A	318	N/A	3.5	362
F1	33	N/A	324	N/A	3.2	362
2	37	N/A	316	N/A	3.2	353
3	41	N/A	316	N/A	3.1	351
G1	38	N/A	318	N/A	3.0	351
2	40	N/A	322	N/A	3.1	357
3	39	N/A	320	N/A	2.7	347
H1	35	N/A	303	N/A	3.4	343
2	36	N/A	311	N/A	3.0	343
3	38	N/A	322	N/A	2.6	347
Duct Avg.	37	0.0	317		3.1	352

Stratification Traverse #6, 20 May 92, Full Load w/reburn

Samp. Pt.	CO (PPM)	CO2 (%)	NOx (PPM)	SO2* (PPM)	O2 (%)	NOx (PPM,
A1	119	14.0	234	267	4.3	280
2	128	14.0	233	254	4.3	279
3	132	14.1	234	253	4.3	280
B1	143	14.2	236	249	4.2	281
2	145	14.4	236	247	4.2	281
3	148	14.4	237	245	4.1	280
C1	152	14.4	237	244	4.2	282
2	153	14.5	238	245	4.0	280
3	153	14.6	239	247	4.1	283
D1	153	14.7	242	250	4.0	284
2	160	14.7	241	257	3.8	280
3	160	14.8	244	274	3.8	283
Duct Avg.	146	14.4	238	253	4.1	281
E1	155	14.9	243	263	3.9	284
2	158	14.9	243	258	3.8	282
3	153	15.0	245	257	3.7	282
F1	148	15.1	245	252	3.7	282
2	148	15.1	247	252	3.6	283
3	140	15.2	249	257	3.5	283
G1	143	15.3	251	260	3.5	286
2	141	15.3	253	267	3.3	284
3	138	15.4	255	273	3.3	287
H1	133	15.5	258	285	3.4	292
2	133	15.6	260	294	3.5	296
3	137	15.6	256	293	3.5	291
Duct Avg.	144	15.2	250	268	3.6	286

Stratification Traverse #7, 27 May 92, Full Load w/reburn

Samp. Pt.	CO (PPM)	CO2 (%)	NOx (PPM)	SO2 (PPM)	O2 (%)	NOx (PPM,
A1	229	14.9	227	1190	3.9	265
2	299	14.6	229	1194	3.8	266
3	259	14.8	230	1203	3.8	267
B1	190	14.7	225	1146	3.9	263
2	304	14.9	227	1159	3.7	262
3	257	14.8	229	1150	3.7	264
C1	227	14.6	228	1116	3.8	264
2	123	14.5	230	1097	3.8	267
3	103	14.4	229	1021	3.9	267
D1	74	14.1	228	913	4.3	273
2	61	14.0	229	910	4.3	274
3	53	14.1	230	925	4.3	276
Duct Avg.	182	14.5	228	1085	3.9	267
E1	29	13.4	248	784	5.2	316
2	25	13.9	255	807	4.6	312
3	26	13.9	254	860	4.4	306
F1	29	13.6	250	787	5.1	316
2	25	14.2	285	1201	4.1	337
3	20	14.4	292	1203	4.0	343
G1	23	14.6	302	1170	4.1	357
2	36	14.6	296	1179	4.3	355
3	45	15.0	293	1208	4.0	344
H1	26	14.3	287	1116	4.5	349
2	23	14.6	293	1131	4.2	349
3	28	14.6	297	1144	4.1	351
Duct Avg.	28	14.3	279	1049	4.4	337

Stratification Traverse #8, 28 May 92, Full Load w/reburn

Samp. Pt.	CO (PPM)	CO2 (%)	NOx (PPM)	SO2 (PPM)	O2 (%)	NOx (PPM,
A1	195	14.6	235	1054	4.4	284
2	315	14.3	238	1105	4.2	283
3	203	14.5	238	1091	4.3	285
B1	245	14.4	237	1074	4.2	282
2	340	14.6	236	1079	4.1	279
3	231	14.6	241	1069	4.0	283
C1	122	14.2	239	1015	4.2	285
2	97	14.0	240	999	4.3	288
3	75	14.1	236	958	4.5	287
D1	75	13.5	235	850	5.1	297
2	51	13.4	234	808	5.0	294
3	38	13.4	232	781	5.0	292
Duct Avg.	166	14.1	237	990	4.4	286
E1	32	13.0	242	734	5.4	313
2	27	13.7	257	714	4.9	321
3	29	13.7	257	1021	4.9	321
F1	31	13.4	256	935	5.2	326
2	28	13.9	285	1201	4.1	337
3	20	14.4	292	1203	4.0	343
G1	23	14.6	302	1170	4.1	357
2	36	14.6	296	1179	4.3	355
3	45	15.0	293	1208	4.0	344
H1	26	14.3	287	1116	4.5	349
2	23	14.6	293	1131	4.2	349
3	28	14.6	297	1144	4.1	351
Duct Avg.	29	14.2	280	1143	4.5	339

APPENDIX C

OPTIMIZATION TEST

M17 PARTICULATE LOADING AT ESP INLET—DATA SUMMARY

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL Performed by: Eric Squier
Date: 3/31/92 Printed 18-Jun Test No./Type: M17-I1
Sample Location: Unit 2, ESP Inlet Start/Stop Time:

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.203
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(72.00)
Barometric Pressure (in Hg)	P(b)	29.61
Stack Static Pressure (in H2O)	P(stack)	12.000
Gas Meter Initial Reading (cu ft)		44.54
Gas Meter Final Reading (cu ft)		73.10
Net Gas Sample Volume (cu ft)	V(m)	(28.56)
Vol of Liquid Collected (ml)	Vl(c)	80.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.766)
Wt. of Filter Particulate (gm)		1.9972
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(1.9972)
O2 Concentration (by CEM)	% O2	5.30 from run I15:
CO2 Concentration (by CEM)	% CO2	14.40 (no CEM data availab
CO Concentration (by CEM)	% CO	0.0 for this run)
N2 Concentration (by diff.)	% N2	(80.30)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	3.00	0.40	0.49	438	72.0	72.0	0.6325
2	3.00	0.35	0.43	450	70.0	71.0	0.5916
3	3.00	0.44	0.55	465	70.0	71.0	0.6633
B1	3.00	0.41	0.51	448	73.0	72.0	0.6403
2	3.00	0.37	0.44	464	73.0	72.0	0.6083
3	3.00	0.34	0.42	476	74.0	72.0	0.5831
C1	3.00	0.45	0.55	430	75.0	73.0	0.6708
2	3.00	0.45	0.54	435	76.0	73.0	0.6708
3	3.00	0.57	0.68	453	77.0	74.0	0.7550
D1	3.00	0.55	0.66	432	77.0	74.0	0.7416
2	3.00	0.47	0.56	445	79.0	75.0	0.6856
3	3.00	0.54	0.65	459	79.0	75.0	0.7348
E1	3.00	0.47	0.56	443	79.0	75.0	0.6856
2	3.00	0.41	0.49	463	80.0	75.0	0.6403
3	3.00	0.45	0.54	478	80.0	75.0	0.6708
F1	3.00	0.54	0.64	453	79.0	75.0	0.7348
2	3.00	0.46	0.55	452	79.0	75.0	0.6782
3	3.00	0.48	0.56	465	79.0	75.0	0.6928
G1	3.00	0.46	0.55	446	78.0	75.0	0.6782
2	3.00	0.44	0.52	465	78.0	75.0	0.6633
3	3.00	0.43	0.51	480	79.0	75.0	0.6557
H1	3.00	0.57	0.68	478	79.0	75.0	0.7550
2	3.00	0.45	0.53	473	80.0	75.0	0.6708
3	3.00	0.47	0.55	479	80.0	75.0	0.6856
TOTALS	72.00	10.97	13.16	10970.0	1845.0	1774.0	16.1890

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.457
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.545
Avg Stack Temperature (degF)	T(s avg)	=	457.1
Average Meter Temperature (degF)	T(m avg)	=	75.4
Avg SQRT(dP)		=	0.675

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	28.17
Stack Gas Water Vapor Proportion	B(wo)	=	0.118
Mol. Wt., Stack Gas Dry	M(d)	=	30.52
Mol. Wt., Stack Gas Wet	M(s)	=	29.04
Abs Stack Pressure (in Hg)	P(s)	=	30.49
Avg Stack Velocity (ft/sec)	V(s avg)	=	49.3
Isokineticity (%)	% I	=	113.6
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	146963
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	263944
Percent XS Air	PEA	=	33.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.0938
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2232
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.9754
Heat Input Rate, MBtu/hr		=	670.23
Particulate Emission Rate(lb/hr)	E(p)	=	1377.609
Particulate Emission Rate(lb/MBtu)		=	2.0558

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tony Lombardo
Date: 4/1/92 Printed 18-Jun — Test No./Type: M17-12
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1910-2155

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.203
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(72.00)
Barometric Pressure (in Hg)	P(b)	29.54
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		73.32
Gas Meter Final Reading (cu ft)		116.10
Net Gas Sample Volume (cu ft)	V(m)	(42.78)
Vol of Liquid Collected (ml)	Vl(c)	80.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.766)
Wt. of Filter Particulate (gm)		5.1028
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.1028)
O2 Concentration (by CEM)	% O2	3.50 from 29 Apr repeat:
CO2 Concentration (by CEM)	% CO2	15.40 (bad CEM data on
CO Concentration (by CEM)	% CO	0.0 first attempt)
N2 Concentration (by diff.)	% N2	(81.10)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	3.00	0.96	1.03	500	85.0	86.0	0.9798
2	3.00	0.95	1.04	504	86.0	86.0	0.9747
3	3.00	1.01	1.10	514	87.0	86.0	1.0050
B1	3.00	1.00	1.10	446	86.0	85.0	1.0000
2	3.00	0.85	0.89	517	87.0	86.0	0.9220
3	3.00	0.90	0.95	523	87.0	86.0	0.9487
C1	3.00	1.40	1.50	506	87.0	86.0	1.1832
2	3.00	1.10	1.18	517	89.0	86.0	1.0488
3	3.00	1.40	1.50	524	90.0	86.0	1.1832
D1	3.00	1.50	1.65	507	90.0	87.0	1.2247
2	3.00	1.00	1.10	520	81.0	84.0	1.0000
3	3.00	1.20	1.30	529	81.0	84.0	1.0954
E1	3.00	1.50	1.65	537	82.0	83.0	1.2247
2	3.00	1.05	1.12	559	82.0	83.0	1.0247
3	3.00	1.20	1.30	568	82.0	83.0	1.0954
F1	3.00	1.50	1.65	571	83.0	82.0	1.2247
2	3.00	1.10	1.18	571	84.0	82.0	1.0488
3	3.00	1.10	1.18	579	84.0	82.0	1.0488
G1	3.00	1.50	1.65	533	84.0	82.0	1.2247
2	3.00	1.20	1.30	557	85.0	81.0	1.0954
3	3.00	1.20	1.30	568	85.0	81.0	1.0954
H1	3.00	1.50	1.65	578	86.0	81.0	1.2247
2	3.00	1.10	1.18	575	88.0	81.0	1.0488
3	3.00	1.10	1.18	579	89.0	82.0	1.0488
TOTALS	72.00	28.32	30.68	12882.0	2050.0	2011.0	25.9708

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.180
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.278
Avg Stack Temperature (degF)	T(s avg)	=	536.8
Average Meter Temperature (degF)	T(m avg)	=	84.6
Avg SQRT(dP)		=	1.082

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	41.46
Stack Gas Water Vapor Proportion	B(wo)	=	0.083
Mol. Wt., Stack Gas Dry	M(d)	=	30.60
Mol. Wt., Stack Gas Wet	M(s)	=	29.55
Abs Stack Pressure (in Hg)	P(s)	=	31.01
Avg Stack Velocity (ft/sec)	V(s avg)	=	[illegible]
Isokineticity (%)	% I	=	[illegible]
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	234946
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	466782
Percent XS Air	PEA	=	19.5
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.8984
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	3475
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.5167
Heat Input Rate, MBtu/hr		=	1195.12
Particulate Emission Rate(lb/hr)	E(p)	=	3822.384
Particulate Emission Rate(lb/MBtu)		=	3.1989

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tony Lombardo
Date: 4/2/92 Printed 18-Jun — Test No./Type: M17-13
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1132-1357

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.203
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.44
Stack Static Pressure (in H2O)	P(stack)	21.000
Gas Meter Initial Reading (cu ft)		129.70
Gas Meter Final Reading (cu ft)		190.00
Net Gas Sample Volume (cu ft)	V(m)	(60.30)
Vol of Liquid Collected (ml)	Vl(c)	122.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.743)
Wt. of Filter Particulate (gm)		9.4696
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(9.4696)
O2 Concentration (by CEM)	% O2	3.30 from 29 Apr repeat:
CO2 Concentration (by CEM)	% CO2	15.50 (bad CEM data on
CO Concentration (by CEM)	% CO	0.0 first attempt)
N2 Concentration (by diff.)	% N2	(81.20)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.92	0.96	488	78.0	76.0	0.9592
2	4.00	0.88	0.93	490	75.0	73.0	0.9381
3	4.00	1.05	1.10	493	78.0	74.0	1.0247
B1	4.00	1.10	1.18	485	77.0	75.0	1.0488
2	4.00	0.88	0.93	502	81.0	75.0	0.9381
3	4.00	0.92	0.96	507	81.0	75.0	0.9592
C1	4.00	1.10	1.18	489	76.0	75.0	1.0488
2	4.00	1.00	1.22	496	79.0	74.0	1.0000
3	4.00	1.20	1.51	500	81.0	75.0	1.0954
D1	4.00	1.30	1.85	499	84.0	76.0	1.1402
2	4.00	1.20	1.51	500	84.0	76.0	1.0954
3	4.00	1.15	1.50	504	85.0	76.0	1.0724
E1	4.00	1.20	1.51	510	80.0	76.0	1.0954
2	4.00	1.10	1.18	537	84.0	77.0	1.0488
3	4.00	1.15	1.50	545	83.0	76.0	1.0724
E1	4.00	1.30	1.85	548	83.0	76.0	1.1402
2	4.00	1.05	1.10	549	83.0	76.0	1.0247
3	4.00	1.15	1.05	551	83.0	76.0	1.0724
F1	4.00	1.20	1.51	515	80.0	76.0	1.0954
2	4.00	1.10	1.18	529	83.0	75.0	1.0488
3	4.00	1.10	1.18	540	83.0	76.0	1.0488
F1	4.00	1.10	1.18	544	83.0	76.0	1.0488
2	4.00	1.10	1.18	544	84.0	76.0	1.0488
3	4.00	1.15	1.50	543	84.0	76.0	1.0724
TOTALS	96.00	26.40	30.75	12408.0	1952.0	1812.0	25.1372

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.100
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.281
Avg Stack Temperature (degF)	T(s avg)	=	517.0
Average Meter Temperature (degF)	T(m avg)	=	78.4
Avg SQRT(dP)		=	1.047

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	58.93
Stack Gas Water Vapor Proportion	B(wo)	=	0.089
Mol. Wt., Stack Gas Dry	M(d)	=	30.61
Mol. Wt., Stack Gas Wet	M(s)	=	29.49
Abs Stack Pressure (in Hg)	P(s)	=	30.98
Avg Stack Velocity (ft/sec)	V(s avg)	=	77.6
Isokineticity (%)	% I	=	114.9
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	228445
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	447968
Percent XS Air	PEA	=	18.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.4794
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	4487
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.9611
Heat Input Rate, MBtu/hr		=	1175.41
Particulate Emission Rate(lb/hr)	E(p)	=	4854.124
Particulate Emission Rate(lb/MBtu)		=	4.1304

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tony Lombardo
Date: 4/3/92 Printed 18-Jun — Test No./Type: M17-I4
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1140-1348

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.203
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.60
Stack Static Pressure (in H2O)	P(stack)	21.000
Gas Meter Initial Reading (cu ft)		191.10
Gas Meter Final Reading (cu ft)		256.30
Net Gas Sample Volume (cu ft)	V(m)	(65.20)
Vol of Liquid Collected (ml)	Vl(c)	112.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.272)
Wt. of Filter Particulate (gm)		2.3125
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(2.3125)
O2 Concentration (by CEM)	% O2	4.70
CO2 Concentration (by CEM)	% CO2	14.70 from 29 Apr repeat:
CO Concentration (by CEM)	% CO	0.0 (no concurrent CEM d
N2 Concentration (by diff.)	% N2	(80.60)avalable)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.20	1.50	482	69.0	69.0	1.0954
2	4.00	1.20	1.50	488	69.0	70.0	1.0954
3	4.00	1.50	1.88	499	70.0	69.0	1.2247
B1	4.00	1.80	2.25	493	71.0	70.0	1.3416
2	4.00	1.30	1.65	517	74.0	69.0	1.1402
3	4.00	1.40	1.75	523	76.0	70.0	1.1832
C1	4.00	1.50	1.88	496	75.0	71.0	1.2247
2	4.00	1.40	1.75	505	78.0	71.0	1.1832
3	4.00	1.50	1.88	517	79.0	71.0	1.2247
D1	4.00	1.80	2.25	506	79.0	72.0	1.3416
2	4.00	1.60	2.00	520	80.0	72.0	1.2649
3	4.00	1.70	2.20	525	81.0	73.0	1.3038
E1	4.00	1.70	2.20	541	78.0	75.0	1.3038
2	4.00	1.40	1.75	564	81.0	73.0	1.1832
3	4.00	1.60	2.00	579	82.0	74.0	1.2649
E1	4.00	1.70	2.20	582	83.0	74.0	1.3038
2	4.00	1.30	1.65	583	84.0	74.0	1.1402
3	4.00	1.50	1.88	488	84.0	75.0	1.2247
F1	4.00	1.50	1.88	544	82.0	75.0	1.2247
2	4.00	1.70	2.20	568	85.0	76.0	1.3038
3	4.00	1.60	2.00	588	86.0	76.0	1.2649
F1	4.00	1.80	2.25	591	88.0	77.0	1.3416
2	4.00	1.60	2.00	591	88.0	77.0	1.2649
3	4.00	1.60	2.00	596	88.0	78.0	1.2649
TOTALS	96.00	36.90	46.50	12886.0	1910.0	1751.0	29.7095

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.538
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.938
Avg Stack Temperature (degF)	T(s avg)	=	536.9
Average Meter Temperature (degF)	T(m avg)	=	76.3
Avg SQRT(dP)		=	1.238

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	64.43
Stack Gas Water Vapor Proportion	B(wo)	=	0.076
Mol. Wt., Stack Gas Dry	M(d)	=	30.54
Mol. Wt., Stack Gas Wet	M(s)	=	29.59
Abs Stack Pressure (in Hg)	P(s)	=	31.14
Avg Stack Velocity (ft/sec)	V(s avg)	=	92.5
Isokineticity (%)	% I	=	1[illegible]
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	271[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	532548
Percent XS Air	PEA	=	26.4
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.5538
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	1088
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.4757
Heat Input Rate, MBtu/hr		=	1285.26
Particulate Emission Rate(lb/hr)	E(p)	=	1288.103
Particulate Emission Rate(lb/MBtu)		=	1.0024

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tony Lombardo
Date: 4/6/92 Printed 18-Jun — Test No./Type: M17-I5
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1326-1522

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.252
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.60
Stack Static Pressure (in H2O)	P(stack)	12.000
Gas Meter Initial Reading (cu ft)		256.60
Gas Meter Final Reading (cu ft)		331.20
Net Gas Sample Volume (cu ft)	V(m)	(74.60)
Vol of Liquid Collected (ml)	Vl(c)	136.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.402)
Wt. of Filter Particulate (gm)		5.0905
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.0905)
O2 Concentration (by CEM)	% O2	4.20
CO2 Concentration (by CEM)	% CO2	11.10
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(84.70)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.80	1.00	468	92.0	85.0	0.8944
2	4.00	0.65	0.82	474	92.0	86.0	0.8062
3	4.00	0.75	0.94	490	93.0	87.0	0.8660
B1	4.00	0.80	1.00	446	95.0	88.0	0.8944
2	4.00	0.65	0.82	459	99.0	88.0	0.8062
3	4.00	0.58	0.69	478	102.0	90.0	0.7616
C1	4.00	0.75	0.94	450	100.0	91.0	0.8660
2	4.00	0.58	0.69	450	103.0	92.0	0.7616
3	4.00	0.75	0.94	472	104.0	93.0	0.8660
D1	4.00	0.80	1.00	453	103.0	97.0	0.8944
2	4.00	0.80	1.00	459	104.0	93.0	0.8944
3	4.00	0.88	1.10	474	105.0	93.0	0.9381
E1	4.00	0.65	0.82	444	103.0	94.0	0.8062
2	4.00	0.65	0.82	443	107.0	95.0	0.8062
3	4.00	0.58	0.69	462	109.0	96.0	0.7616
E1	4.00	0.58	0.69	474	110.0	97.0	0.7616
2	4.00	0.68	0.84	484	110.0	98.0	0.8246
3	4.00	0.68	0.84	496	107.0	98.0	0.8246
F1	4.00	0.75	0.94	456	105.0	98.0	0.8660
2	4.00	0.80	1.00	469	106.0	99.0	0.8660
3	4.00	0.70	0.86	485	107.0	99.0	0.8944
F1	4.00	0.70	0.86	494	108.0	99.0	0.8367
2	4.00	0.70	0.86	500	109.0	99.0	0.8367
3	4.00	0.68	0.84	509	109.0	99.0	0.8367
TOTALS	96.00	16.26	21.00	11289.0	2482.0	2254.0	20.1708

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.678
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.875
Avg Stack Temperature (degF)	T(s avg)	=	470.4
Average Meter Temperature (degF)	T(m avg)	=	98.7
Avg SQRT(dP)		=	0.840

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	70.57
Stack Gas Water Vapor Proportion	B(wo)	=	0.083
Mol. Wt., Stack Gas Dry	M(d)	=	29.94
Mol. Wt., Stack Gas Wet	M(s)	=	28.95
Abs Stack Pressure (in Hg)	P(s)	=	30.46
Avg Stack Velocity (ft/sec)	V(s avg)	=	62.0
Isokineticity (%)	% I	=	107.8
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	169216
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	356947
Percent XS Air	PEA	=	23.1
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.1130
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2122
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.9275
Heat Input Rate, MBtu/hr		=	923.78
Particulate Emission Rate(lb/hr)	E(p)	=	1804.786
Particulate Emission Rate(lb/MBtu)		=	1.9540

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tony Lombardo
Date: 4/7/92 Printed 18-Jun — Test No./Type: M17-I6
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1019-1210

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.203
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.65
Stack Static Pressure (in H2O)	P(stack)	21.000
Gas Meter Initial Reading (cu ft)		342.02
Gas Meter Final Reading (cu ft)		399.95
Net Gas Sample Volume (cu ft)	V(m)	(57.93)
Vol of Liquid Collected (ml)	Vl(c)	101.6
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.782)
Wt. of Filter Particulate (gm)		2.2501
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(2.2501)
O2 Concentration (by CEM)	% O2	3.00
CO2 Concentration (by CEM)	% CO2	15.60
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.40)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.10	1.32	491	77.0	78.0	1.0488
2	4.00	1.30	1.60	509	77.0	78.0	1.1402
3	4.00	1.10	1.32	520	78.0	78.0	1.0488
B1	4.00	1.40	1.75	459	79.0	78.0	1.1832
2	4.00	1.10	1.32	473	81.0	78.0	1.0488
3	4.00	1.10	1.32	491	84.0	79.0	1.0488
C1	4.00	1.20	1.48	467	85.0	80.0	1.0954
2	4.00	1.10	1.32	472	88.0	80.0	1.0488
3	4.00	1.30	1.60	493	90.0	81.0	1.1402
D1	4.00	1.50	1.85	472	88.0	81.0	1.2247
2	4.00	1.20	1.48	478	90.0	81.0	1.0954
3	4.00	1.40	1.75	490	91.0	82.0	1.1832
E1	4.00	1.10	1.32	470	88.0	82.0	1.0488
2	4.00	1.10	1.32	491	91.0	83.0	1.0488
3	4.00	1.10	1.32	506	94.0	84.0	1.0488
E1	4.00	1.10	1.32	517	93.0	83.0	1.0488
2	4.00	1.20	1.48	532	96.0	85.0	1.0954
3	4.00	1.10	1.32	548	96.0	86.0	1.0488
F1	4.00	1.40	1.75	517	94.0	87.0	1.1832
2	4.00	1.40	1.75	528	96.0	87.0	1.1832
3	4.00	1.10	1.32	544	97.0	88.0	1.1832
F1	4.00	1.10	1.32	551	98.0	89.0	1.0488
2	4.00	1.20	1.48	560	99.0	90.0	1.0488
3	4.00	1.20	1.48	565	100.0	90.0	1.0954
TOTALS	96.00	27.70	35.29	12144.0	2150.0	1988.0	26.3887

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.154
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.470
Avg Stack Temperature (degF)	T(s avg)	=	506.0
Average Meter Temperature (degF)	T(m avg)	=	86.2
Avg SQRT(dP)		=	1.100

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	56.23
Stack Gas Water Vapor Proportion	B(wo)	=	0.078
Mol. Wt., Stack Gas Dry	M(d)	=	30.62
Mol. Wt., Stack Gas Wet	M(s)	=	29.63
Abs Stack Pressure (in Hg)	P(s)	=	31.19
Avg Stack Velocity (ft/sec)	V(s avg)	=	80.7
Isokineticity (%)	% I	=	1[illegible]
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	244.
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	464976
Percent XS Air	PEA	=	16.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.6174
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	1099
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.4802
Heat Input Rate, MBtu/hr		=	1277.90
Particulate Emission Rate(lb/hr)	E(p)	=	1292.204
Particulate Emission Rate(lb/MBtu)		=	1.0114

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tony Lombardo
Date: 4/8/92 Printed 18-Jun — Test No./Type: M17-I7
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1115-1330

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.203
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.48
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		400.44
Gas Meter Final Reading (cu ft)		458.35
Net Gas Sample Volume (cu ft)	V(m)	(57.92)
Vol of Liquid Collected (ml)	Vl(c)	115.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.437)
Wt. of Filter Particulate (gm)		3.5014
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(3.5014)
O2 Concentration (by CEM)	% O2	2.60 (from B&W)
CO2 Concentration (by CEM)	% CO2	15.90 (estimate)
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.50)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.10	1.32	484	82.0	83.0	1.0488
2	4.00	0.95	1.15	484	80.0	82.0	0.9747
3	4.00	1.10	1.32	486	82.0	82.0	1.0488
B1	4.00	1.20	1.47	460	83.0	82.0	1.0954
2	4.00	0.93	1.12	468	85.0	82.0	0.9644
3	4.00	0.93	1.12	484	87.0	83.0	0.9644
C1	4.00	1.20	1.47	468	88.0	84.0	1.0954
2	4.00	1.00	1.20	470	90.0	84.0	1.0000
3	4.00	1.30	1.61	484	91.0	84.0	1.1402
D1	4.00	1.40	1.70	458	90.0	85.0	1.1832
2	4.00	1.10	1.32	469	93.0	85.0	1.0488
3	4.00	1.20	1.47	479	93.0	85.0	1.0954
E1	4.00	1.20	1.47	434	92.0	87.0	1.0954
2	4.00	1.20	1.47	453	95.0	87.0	1.0954
3	4.00	1.05	1.30	470	95.0	87.0	1.0247
E1	4.00	1.10	1.32	482	95.0	87.0	1.0488
2	4.00	1.20	1.47	487	95.0	88.0	1.0954
3	4.00	1.10	1.32	495	95.0	87.0	1.0488
F1	4.00	1.30	1.61	478	93.0	88.0	1.1402
2	4.00	1.40	1.70	491	94.0	88.0	1.1402
3	4.00	1.40	1.70	495	96.0	88.0	1.1832
F1	4.00	1.10	1.32	500	97.0	88.0	1.1832
2	4.00	1.10	1.32	503	97.0	89.0	1.0488
3	4.00	1.20	1.47	506	97.0	89.0	1.0488
TOTALS	96.00	26.56	33.74	11488.0	2185.0	2054.0	25.8126

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.107
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.405
Avg Stack Temperature (degF)	T(s avg)	=	478.7
Average Meter Temperature (degF)	T(m avg)	=	86.3
Avg SQRT(dP)		=	1.076

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	55.67
Stack Gas Water Vapor Proportion	B(wo)	=	0.089
Mol. Wt., Stack Gas Dry	M(d)	=	30.65
Mol. Wt., Stack Gas Wet	M(s)	=	29.52
Abs Stack Pressure (in Hg)	P(s)	=	30.95
Avg Stack Velocity (ft/sec)	V(s avg)	=	78.3
Isokineticity (%)	% I	=	103.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	239026
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	450900
Percent XS Air	PEA	=	13.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.9703
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	1689
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.7384
Heat Input Rate, MBtu/hr		=	1278.76
Particulate Emission Rate(lb/hr)	E(p)	=	1967.959
Particulate Emission Rate(lb/MBtu)		=	1.5549

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tony Lombardo

Date: 4/9/92 Printed 18-Jun — Test No./Type: M17-18

Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1100-1245

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.203
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.44
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		458.46
Gas Meter Final Reading (cu ft)		515.87
Net Gas Sample Volume (cu ft)	V(m)	(57.41)
Vol of Liquid Collected (ml)	Vl(c)	115.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.437)
Wt. of Filter Particulate (gm)		6.0893
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(6.0893)
O2 Concentration (by CEM)	% O2	2.70 (from B&W)
CO2 Concentration (by CEM)	% CO2	15.80 (estimate)
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.50)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.10	1.32	459	99.0	101.0	1.0488
2	4.00	1.10	1.32	464	96.0	100.0	1.0488
3	4.00	1.10	1.32	474	96.0	99.0	1.0488
B1	4.00	1.20	1.45	449	96.0	98.0	1.0954
2	4.00	0.90	1.08	461	97.0	97.0	0.9487
3	4.00	0.95	1.18	479	96.0	97.0	0.9747
C1	4.00	1.10	1.32	456	96.0	95.0	1.0488
2	4.00	0.95	1.18	468	95.0	95.0	0.9747
3	4.00	1.40	1.72	478	95.0	95.0	1.1832
D1	4.00	1.50	1.83	449	94.0	93.0	1.2247
2	4.00	1.20	1.45	461	94.0	92.0	1.0954
3	4.00	1.20	1.45	470	95.0	92.0	1.0954
E1	4.00	1.20	1.45	442	93.0	91.0	1.0954
2	4.00	1.30	1.60	451	93.0	91.0	1.1402
3	4.00	1.10	1.32	462	93.0	93.0	1.0488
E1	4.00	1.00	1.20	471	93.0	89.0	1.0000
2	4.00	1.10	1.32	484	93.0	89.0	1.0488
3	4.00	1.20	1.45	492	93.0	89.0	1.0954
F1	4.00	1.30	1.60	470	91.0	87.0	1.1402
2	4.00	1.10	1.32	486	91.0	87.0	1.1402
3	4.00	1.20	1.45	494	92.0	87.0	1.0488
F1	4.00	1.10	1.32	497	92.0	86.0	1.0954
2	4.00	1.20	1.45	501	92.0	86.0	1.0488
3	4.00	1.20	1.45	504	92.0	86.0	1.0954
TOTALS	96.00	26.50	33.55	11322.0	2257.0	2215.0	25.7851

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.104
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.396
Avg Stack Temperature (degF)	T(s avg)	=	471.8
Average Meter Temperature (degF)	T(m avg)	=	93.2
Avg SQRT(dP)		=	1.074

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	54.62
Stack Gas Water Vapor Proportion	B(wo)	=	0.091
Mol. Wt., Stack Gas Dry	M(d)	=	30.64
Mol. Wt., Stack Gas Wet	M(s)	=	29.49
Abs Stack Pressure (in Hg)	P(s)	=	30.91
Avg Stack Velocity (ft/sec)	V(s avg)	=	78.0
Isokineticity (%)	% I	=	[illegible]
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	449280
Percent XS Air	PEA	=	14.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.7201
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	3011
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.3159
Heat Input Rate, MBtu/hr		=	1272.79
Particulate Emission Rate(lb/hr)	E(p)	=	3526.261
Particulate Emission Rate(lb/MBtu)		=	2.7710

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tony Lombardo
Date: 4/10/92 Printed 18-Jun — Test No./Type: M17-19
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1055-1250

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.203
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	19.000
Gas Meter Initial Reading (cu ft)		516.04
Gas Meter Final Reading (cu ft)		571.92
Net Gas Sample Volume (cu ft)	V(m)	(55.88)
Vol of Liquid Collected (ml)	Vl(c)	114.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.366)
Wt. of Filter Particulate (gm)		4.7924
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(4.7924)
O2 Concentration (by CEM)	% O2	2.90
CO2 Concentration (by CEM)	% CO2	15.20
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.00	1.20	436	66.0	67.0	1.0000
2	4.00	0.85	1.02	450	65.0	66.0	0.9220
3	4.00	0.83	1.00	460	66.0	66.0	0.9083
B1	4.00	1.10	1.32	448	67.0	66.0	1.0488
2	4.00	0.80	0.98	462	68.0	66.0	0.8944
3	4.00	0.85	1.02	472	70.0	67.0	0.9220
C1	4.00	1.10	1.32	443	70.0	67.0	1.0488
2	4.00	0.90	1.18	447	72.0	67.0	0.9487
3	4.00	1.20	1.48	469	73.0	67.0	1.0954
D1	4.00	1.50	1.80	432	72.0	68.0	1.2247
2	4.00	1.10	1.32	447	74.0	68.0	1.0488
3	4.00	1.10	1.32	464	75.0	68.0	1.0488
E1	4.00	1.20	1.48	445	74.0	69.0	1.0954
2	4.00	1.10	1.32	450	75.0	69.0	1.0488
3	4.00	1.00	1.20	463	76.0	69.0	1.0000
E1	4.00	1.10	1.32	474	76.0	70.0	1.0488
2	4.00	1.20	1.48	482	77.0	69.0	1.0954
3	4.00	1.10	1.32	487	77.0	69.0	1.0488
F1	4.00	1.20	1.48	468	74.0	69.0	1.0954
2	4.00	1.20	1.48	480	74.0	69.0	1.0954
3	4.00	1.10	1.32	487	74.0	69.0	1.0954
F1	4.00	1.20	1.48	494	76.0	69.0	1.0488
2	4.00	1.10	1.32	497	76.0	69.0	1.0954
3	4.00	1.00	1.20	499	77.0	69.0	1.0488
TOTALS	96.00	24.83	31.36	11156.0	1744.0	1632.0	24.9275

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.034
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.305
Avg Stack Temperature (degF)	T(s avg)	=	464.6
Average Meter Temperature (degF)	T(m avg)	=	70.3
Avg SQRT(dP)		=	1.039

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	55.79
Stack Gas Water Vapor Proportion	B(wo)	=	0.066
Mol. Wt., Stack Gas Dry	M(d)	=	30.55
Mol. Wt., Stack Gas Wet	M(s)	=	29.45
Abs Stack Pressure (in Hg)	P(s)	=	31.02
Avg Stack Velocity (ft/sec)	V(s avg)	=	75.1
Isokineticity (%)	% I	=	105.4
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	233412
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	432310
Percent XS Air	PEA	=	15.5
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.3256
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2346
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.0253
Heat Input Rate, MBtu/hr		=	1228.24
Particulate Emission Rate(lb/hr)	E(p)	=	2651.566
Particulate Emission Rate(lb/MBtu)		=	2.1592

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL
Date: 4/13/92 Printed 18-Jun
Sample Location: Unit 2, ESP Inlet

Performed by: Tony Lombardo
Test No./Type: M17-110
Start/Stop Time: 1105-1257

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.203
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.60
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		573.57
Gas Meter Final Reading (cu ft)		627.11
Net Gas Sample Volume (cu ft)	V(m)	(53.54)
Vol of Liquid Collected (ml)	Vl(c)	98.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.636)
Wt. of Filter Particulate (gm)		9.8267
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(9.8267)
O2 Concentration (by CEM)	% O2	3.40
CO2 Concentration (by CEM)	% CO2	15.10
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.50)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.95	1.05	421	65.0	67.0	0.9747
2	4.00	0.85	0.94	432	63.0	66.0	0.9220
3	4.00	1.00	1.10	452	63.0	65.0	1.0000
B1	4.00	1.10	1.20	432	65.0	65.0	1.0488
2	4.00	0.90	0.98	436	66.0	65.0	0.9487
3	4.00	0.90	0.98	459	67.0	65.0	0.9487
C1	4.00	1.00	1.10	429	67.0	65.0	1.0000
2	4.00	0.85	0.94	433	67.0	65.0	0.9220
3	4.00	1.20	1.32	457	70.0	65.0	1.0954
D1	4.00	1.10	1.20	431	70.0	65.0	1.0488
2	4.00	1.00	1.10	444	71.0	65.0	1.0000
3	4.00	1.20	1.32	458	71.0	65.0	1.0954
E1	4.00	1.10	1.20	429	70.0	65.0	1.0488
2	4.00	1.10	1.20	436	70.0	66.0	1.0488
3	4.00	0.90	0.98	447	70.0	65.0	0.9487
E1	4.00	0.90	0.98	464	71.0	65.0	0.9487
2	4.00	1.20	1.32	473	71.0	65.0	1.0954
3	4.00	1.10	1.20	483	71.0	65.0	1.0488
F1	4.00	1.40	1.58	454	70.0	65.0	1.1832
2	4.00	1.30	1.48	467	71.0	65.0	1.1832
3	4.00	1.10	1.20	479	71.0	65.0	1.1402
F1	4.00	1.10	1.20	487	71.0	65.0	1.0488
2	4.00	1.10	1.20	490	71.0	65.0	1.0488
3	4.00	1.10	1.20	494	72.0	65.0	1.0488
TOTALS	96.00	24.35	27.97	10887.0	1654.0	1564.0	24.7967

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.015
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.165
Avg Stack Temperature (degF)	T(s avg)	=	453.6
Average Meter Temperature (degF)	T(m avg)	=	67.0
Avg SQRT(dP)		=	1.033

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	53.73
Stack Gas Water Vapor Proportion	B(wo)	=	0.079
Mol. Wt., Stack Gas Dry	M(d)	=	30.55
Mol. Wt., Stack Gas Wet	M(s)	=	29.55
Abs Stack Pressure (in Hg)	P(s)	=	31.07
Avg Stack Velocity (ft/sec)	V(s avg)	=	74.0
Isokineticity (%)	% I	=	1[illegible]
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	23[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	426260
Percent XS Air	PEA	=	18.8
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.8219
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	5136
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	2.2447
Heat Input Rate, MBtu/hr		=	1204.85
Particulate Emission Rate(lb/hr)	E(p)	=	5695.492
Particulate Emission Rate(lb/MBtu)		=	4.7279

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tony Lombardo
Date: 4/14/92 Printed 18-Jun — Test No./Type: M17-I11
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 2139-2230

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.203
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.54
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		627.43
Gas Meter Final Reading (cu ft)		668.50
Net Gas Sample Volume (cu ft)	V(m)	(41.07)
Vol of Liquid Collected (ml)	Vl(c)	86.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.072)
Wt. of Filter Particulate (gm)		3.1456
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(3.1456)
O2 Concentration (by CEM)	% O2	4.20
CO2 Concentration (by CEM)	% CO2	14.90
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.75	0.84	407	101.0	104.0	0.8660
2	4.00	0.65	0.71	430	94.0	102.0	0.8062
3	4.00	0.65	0.71	447	92.0	99.0	0.8062
B1	4.00	0.55	0.59	419	92.0	97.0	0.7416
2	4.00	0.43	0.47	439	90.0	95.0	0.6557
3	4.00	0.43	0.47	457	89.0	94.0	0.6557
C1	4.00	0.55	0.59	414	89.0	93.0	0.7416
2	4.00	0.45	0.48	431	87.0	91.0	0.6708
3	4.00	0.63	0.69	449	86.0	90.0	0.7937
D1	4.00	0.70	0.77	431	86.0	89.0	0.8367
2	4.00	0.65	0.71	428	86.0	88.0	0.8062
3	4.00	0.75	0.84	446	86.0	87.0	0.8660
E1	4.00	0.55	0.59	398	86.0	86.0	0.7416
2	4.00	0.58	0.64	398	85.0	85.0	0.7616
3	4.00	0.50	0.54	405	85.0	85.0	0.7071
E1	4.00	0.50	0.54	417	85.0	84.0	0.7071
2	4.00	0.60	0.66	430	84.0	83.0	0.7746
3	4.00	0.60	0.66	439	84.0	83.0	0.7746
F1	4.00	0.65	0.71	412	82.0	81.0	0.8062
2	4.00	0.68	0.75	415	82.0	82.0	0.8062
3	4.00	0.60	0.66	429	82.0	82.0	0.8246
F1	4.00	0.50	0.54	433	82.0	81.0	0.7746
2	4.00	0.55	0.59	442	82.0	81.0	0.7071
3	4.00	0.55	0.59	448	82.0	81.0	0.7416
TOTALS	96.00	13.50	15.34	10264.0	2079.0	2123.0	18.3737

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.563
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.639
Avg Stack Temperature (degF)	T(s avg)	=	427.7
Average Meter Temperature (degF)	T(m avg)	=	87.8
Avg SQRT(dP)		=	0.768

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	39.54
Stack Gas Water Vapor Proportion	B(wo)	=	0.093
Mol. Wt., Stack Gas Dry	M(d)	=	30.55
Mol. Wt., Stack Gas Wet	M(s)	=	29.38
Abs Stack Pressure (in Hg)	P(s)	=	30.57
Avg Stack Velocity (ft/sec)	V(s avg)	=	54.7
Isokineticity (%)	% I	=	101.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	173481
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	314815
Percent XS Air	PEA	=	24.5
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.2275
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2340
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.0229
Heat Input Rate, MBtu/hr		=	846.85
Particulate Emission Rate(lb/hr)	E(p)	=	1824.783
Particulate Emission Rate(lb/MBtu)		=	2.1551

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL Performed by: Tony Lombardo
Date: 4/16/92 Printed 18-Jun Test No./Type: M17-I12
Sample Location: Unit 2, ESP Inlet Start/Stop Time: 2045-2222

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.203
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.64
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		668.65
Gas Meter Final Reading (cu ft)		709.94
Net Gas Sample Volume (cu ft)	V(m)	(41.28)
Vol of Liquid Collected (ml)	Vl(c)	88.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.142)
Wt. of Filter Particulate (gm)		4.2428
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(4.2428)
O2 Concentration (by CEM)	% O2	3.80
CO2 Concentration (by CEM)	% CO2	15.90
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.30)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.50	0.55	400	82.0	84.0	0.7071
2	4.00	0.50	0.55	428	82.0	83.0	0.7071
3	4.00	0.60	0.68	442	83.0	84.0	0.7746
B1	4.00	0.65	0.72	436	84.0	83.0	0.8062
2	4.00	0.50	0.55	445	85.0	84.0	0.7071
3	4.00	0.50	0.55	461	86.0	84.0	0.7071
C1	4.00	0.60	0.68	416	86.0	84.0	0.7746
2	4.00	0.50	0.55	417	88.0	85.0	0.7071
3	4.00	0.65	0.72	436	89.0	85.0	0.8062
D1	4.00	0.77	0.85	428	90.0	86.0	0.8775
2	4.00	0.70	0.79	429	92.0	87.0	0.8367
3	4.00	0.60	0.68	442	93.0	87.0	0.7746
E1	4.00	0.60	0.68	422	92.0	87.0	0.7746
2	4.00	0.62	0.77	402	93.0	88.0	0.7874
3	4.00	0.50	0.55	406	94.0	88.0	0.7071
E1	4.00	0.50	0.55	415	94.0	89.0	0.7071
2	4.00	0.55	0.63	433	94.0	89.0	0.7416
3	4.00	0.55	0.63	441	94.0	89.0	0.7416
F1	4.00	0.60	0.68	427	91.0	89.0	0.7746
2	4.00	0.60	0.68	432	91.0	89.0	0.7746
3	4.00	0.60	0.68	437	91.0	89.0	0.7746
F1	4.00	0.60	0.68	443	91.0	89.0	0.7746
2	4.00	0.58	0.67	449	92.0	89.0	0.7746
3	4.00	0.58	0.67	453	92.0	89.0	0.7616
TOTALS	96.00	13.37	15.74	10340.0	2149.0	2080.0	18.2799

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.557
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.656
Avg Stack Temperature (degF)	T(s avg)	=	430.8
Average Meter Temperature (degF)	T(m avg)	=	88.1
Avg SQRT(dP)		=	0.762

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	39.64
Stack Gas Water Vapor Proportion	B(wo)	=	0.094
Mol. Wt., Stack Gas Dry	M(d)	=	30.70
Mol. Wt., Stack Gas Wet	M(s)	=	29.50
Abs Stack Pressure (in Hg)	P(s)	=	30.67
Avg Stack Velocity (ft/sec)	V(s avg)	=	54.3
Isokineticity (%)	% I	=	10[illegible]
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	172[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	312617
Percent XS Air	PEA	=	21.6
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.6433
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	3060
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.3376
Heat Input Rate, MBtu/hr		=	860.05
Particulate Emission Rate(lb/hr)	E(p)	=	2422.898
Particulate Emission Rate(lb/MBtu)		=	2.8176

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 4/21/92 Printed 18-Jun — Test No./Type: M17-I13
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 2207-2353

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.203
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	28.82
Stack Static Pressure (in H2O)	P(stack)	15.000
Gas Meter Initial Reading (cu ft)		710.12
Gas Meter Final Reading (cu ft)		754.63
Net Gas Sample Volume (cu ft)	V(m)	(44.51)
Vol of Liquid Collected (ml)	Vl(c)	70.9
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.337)
Wt. of Filter Particulate (gm)		4.9819
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(4.9819)
O2 Concentration (by CEM)	% O2	4.50
CO2 Concentration (by CEM)	% CO2	13.80
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.70)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.59	0.68	464	73.0	75.0	0.7681
2	4.00	0.60	0.68	470	73.0	74.0	0.7746
3	4.00	0.58	0.66	486	75.0	74.0	0.7616
B1	4.00	0.61	0.69	480	77.0	75.0	0.7810
2	4.00	0.52	0.59	490	75.0	76.0	0.7211
3	4.00	0.50	0.57	497	80.0	76.0	0.7071
C1	4.00	0.57	0.65	430	80.0	76.0	0.7550
2	4.00	0.51	0.58	444	81.0	77.0	0.7141
3	4.00	0.75	0.86	470	83.0	78.0	0.8660
D1	4.00	0.80	0.91	460	83.0	78.0	0.8944
2	4.00	0.62	0.71	469	84.0	79.0	0.7874
3	4.00	0.68	0.78	474	85.0	79.0	0.8246
E1	4.00	0.67	0.77	470	85.0	80.0	0.8185
2	4.00	0.65	0.74	430	86.0	81.0	0.8062
3	4.00	0.69	0.79	466	87.0	81.0	0.8307
E1	4.00	0.62	0.71	467	88.0	82.0	0.7874
2	4.00	0.59	0.67	459	88.0	82.0	0.7681
3	4.00	0.56	0.64	475	88.0	82.0	0.7483
F1	4.00	0.65	0.74	452	88.0	83.0	0.8062
2	4.00	0.69	0.79	466	88.0	83.0	0.8062
3	4.00	0.65	0.74	470	89.0	84.0	0.8307
F1	4.00	0.91	1.00	474	90.0	84.0	0.8062
2	4.00	0.85	0.97	478	90.0	84.0	0.9539
3	4.00	0.75	0.85	479	91.0	85.0	0.9220
TOTALS	96.00	14.86	17.77	11220.00	2007.0	1908.0	19.2396

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.619
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.740
Avg Stack Temperature (degF)	T(s avg)	=	467.5
Average Meter Temperature (degF)	T(m avg)	=	81.6
Avg SQRT(dP)		=	0.802

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	42.28
Stack Gas Water Vapor Proportion	B(ws)	=	0.073
Mol. Wt., Stack Gas Dry	M(d)	=	30.39
Mol. Wt., Stack Gas Wet	M(s)	=	29.48
Abs Stack Pressure (in Hg)	P(s)	=	29.92
Avg Stack Velocity (ft/sec)	V(s avg)	=	59.0
Isokineticity (%)	% I	=	104.9
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	179412
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	340002
Percent XS Air	PEA	=	26.4
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.8181
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	3529
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.5428
Heat Input Rate, MBtu/hr		=	860.18
Particulate Emission Rate(lb/hr)	E(p)	=	2795.385
Particulate Emission Rate(lb/MBtu)		=	3.2503

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 4/22/92 Printed 18-Jun — Test No./Type: M17-I14
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 2227-0000

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.46
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		754.70
Gas Meter Final Reading (cu ft)		786.66
Net Gas Sample Volume (cu ft)	V(m)	(31.96)
Vol of Liquid Collected (ml)	Vl(c)	66.3
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.121)
Wt. of Filter Particulate (gm)		4.1664
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(4.1664)
O2 Concentration (by CEM)	% O2	4.60
CO2 Concentration (by CEM)	% CO2	14.20
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.20)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.27	0.38	357	70.0	71.0	0.5196
2	4.00	0.27	0.38	389	70.0	70.0	0.5196
3	4.00	0.28	0.39	406	70.0	70.0	0.5292
B1	4.00	0.34	0.40	406	71.0	71.0	0.5831
2	4.00	0.22	0.31	422	72.0	71.0	0.4690
3	4.00	0.18	0.25	427	73.0	72.0	0.4243
C1	4.00	0.24	0.34	380	73.0	71.0	0.4899
2	4.00	0.29	0.31	395	74.0	71.0	0.5385
3	4.00	0.32	0.45	410	74.0	72.0	0.5657
D1	4.00	0.32	0.45	394	75.0	72.0	0.5657
2	4.00	0.27	0.38	401	77.0	73.0	0.5196
3	4.00	0.32	0.45	410	77.0	74.0	0.5657
E1	4.00	0.27	0.38	360	76.0	73.0	0.5196
2	4.00	0.24	0.34	370	77.0	74.0	0.4899
3	4.00	0.24	0.34	389	78.0	74.0	0.4899
E1	4.00	0.27	0.38	384	79.0	75.0	0.5196
2	4.00	0.24	0.34	393	80.0	76.0	0.4899
3	4.00	0.26	0.36	400	80.0	76.0	0.5099
F1	4.00	0.30	0.42	406	79.0	76.0	0.5477
2	4.00	0.26	0.36	413	81.0	77.0	0.5477
3	4.00	0.25	0.35	416	82.0	77.0	0.5099
F1	4.00	0.31	0.43	416	82.0	78.0	0.5000
2	4.00	0.27	0.38	417	82.0	78.0	0.5568
3	4.00	0.28	0.39	417	82.0	78.0	0.5196
TOTALS	96.00	6.23	8.96	9578.00	1834.0	1770.0	12.4904

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.260
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.373
Avg Stack Temperature (degF)	T(s avg)	=	399.1
Average Meter Temperature (degF)	T(m avg)	=	75.1
Avg SQRT(dP)		=	0.520

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	31.36
Stack Gas Water Vapor Proportion	B(ws)	=	0.090
Mol. Wt., Stack Gas Dry	M(d)	=	30.46
Mol. Wt., Stack Gas Wet	M(s)	=	29.33
Abs Stack Pressure (in Hg)	P(s)	=	30.20
Avg Stack Velocity (ft/sec)	V(s avg)	=	36.6
Isokineticity (%)	% I	=	[illegible]
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	115[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	212022
Percent XS Air	PEA	=	27.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.0489
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	4002
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.7490
Heat Input Rate, MBtu/hr		=	569.98
Particulate Emission Rate(lb/hr)	E(p)	=	2100.261
Particulate Emission Rate(lb/MBtu)		=	3.6854

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 4/23/92 Printed 18-Jun — Test No./Type: M17-I15
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 2242-0020

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.53
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		787.89
Gas Meter Final Reading (cu ft)		821.79
Net Gas Sample Volume (cu ft)	V(m)	(33.90)
Vol of Liquid Collected (ml)	Vl(c)	96.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.542)
Wt. of Filter Particulate (gm)		5.7258
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.7258)
O2 Concentration (by CEM)	% O2	5.30
CO2 Concentration (by CEM)	% CO2	14.40
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.30)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.30	0.42	393	79.0	80.0	0.5477
2	4.00	0.29	0.41	406	77.0	79.0	0.5385
3	4.00	0.32	0.45	417	78.0	79.0	0.5657
B1	4.00	0.28	0.39	394	79.0	79.0	0.5292
2	4.00	0.27	0.38	414	80.0	79.0	0.5196
3	4.00	0.27	0.38	421	80.0	79.0	0.5196
C1	4.00	0.31	0.43	396	80.0	79.0	0.5568
2	4.00	0.27	0.36	430	81.0	80.0	0.5196
3	4.00	0.35	0.49	430	82.0	80.0	0.5916
D1	4.00	0.36	0.50	426	82.0	80.0	0.6000
2	4.00	0.30	0.42	431	86.0	82.0	0.5477
3	4.00	0.29	0.41	433	86.0	82.0	0.5385
E1	4.00	0.29	0.41	386	86.0	85.0	0.5385
2	4.00	0.27	0.38	387	87.0	83.0	0.5196
3	4.00	0.26	0.36	404	87.0	83.0	0.5099
E1	4.00	0.30	0.42	400	88.0	84.0	0.5477
2	4.00	0.26	0.36	399	88.0	84.0	0.5099
3	4.00	0.25	0.35	412	88.0	84.0	0.5000
F1	4.00	0.36	0.50	430	88.0	85.0	0.6000
2	4.00	0.30	0.42	440	89.0	85.0	0.6000
3	4.00	0.33	0.46	442	89.0	86.0	0.5745
F1	4.00	0.35	0.49	441	90.0	86.0	0.5916
2	4.00	0.31	0.43	440	91.0	87.0	0.5568
3	4.00	0.32	0.45	442	91.0	87.0	0.5657
TOTALS	96.00	7.21	10.07	10014.00	2032.0	1977.0	13.1887

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.300
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.420
Avg Stack Temperature (degF)	T(s avg)	=	417.3
Average Meter Temperature (degF)	T(m avg)	=	83.5
Avg SQRT(dP)		=	0.550

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	32.83
Stack Gas Water Vapor Proportion	B(wo)	=	0.121
Mol. Wt., Stack Gas Dry	M(d)	=	30.52
Mol. Wt., Stack Gas Wet	M(s)	=	29.00
Abs Stack Pressure (in Hg)	P(s)	=	30.27
Avg Stack Velocity (ft/sec)	V(s avg)	=	39.5
Isokineticity (%)	% I	=	104.3
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	121556
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	227285
Percent XS Air	PEA	=	33.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.6896
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	5487
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	2.3983
Heat Input Rate, MBtu/hr		=	554.37
Particulate Emission Rate(lb/hr)	E(p)	=	2801.812
Particulate Emission Rate(lb/MBtu)		=	5.0549

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 4/24/92 Printed 18-Jun — Test No./Type: M17-I16
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1110-1258

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.53
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		822.98
Gas Meter Final Reading (cu ft)		884.17
Net Gas Sample Volume (cu ft)	V(m)	(61.19)
Vol of Liquid Collected (ml)	Vl(c)	139.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.566)
Wt. of Filter Particulate (gm)		5.1884
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.1884)
O2 Concentration (by CEM)	% O2	4.20
CO2 Concentration (by CEM)	% CO2	15.30
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.50)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.00	1.40	455	73.0	73.0	1.0000
2	4.00	1.30	1.80	461	72.0	73.0	1.1402
3	4.00	0.98	1.40	472	73.0	72.0	0.9899
B1	4.00	1.30	1.82	442	75.0	73.0	1.1402
2	4.00	0.92	1.30	463	77.0	73.0	0.9592
3	4.00	0.99	1.40	476	79.0	73.0	0.9950
C1	4.00	1.10	1.50	437	80.0	74.0	1.0488
2	4.00	0.92	1.30	453	82.0	75.0	0.9592
3	4.00	1.20	1.70	465	84.0	76.0	1.0954
D1	4.00	1.30	1.80	442	83.0	76.0	1.1402
2	4.00	1.20	1.70	456	83.0	76.0	1.0954
3	4.00	1.30	1.80	469	87.0	77.0	1.1402
E1	4.00	1.30	1.80	430	86.0	78.0	1.1402
2	4.00	1.00	1.40	445	88.0	79.0	1.0000
3	4.00	1.10	1.50	478	88.0	79.0	1.0488
E1	4.00	1.10	1.50	475	89.0	79.0	1.0488
2	4.00	1.00	1.40	480	90.0	80.0	1.0000
3	4.00	1.20	1.70	489	91.0	81.0	1.0954
F1	4.00	1.20	1.70	480	89.0	81.0	1.0954
2	4.00	1.10	1.50	499	92.0	82.0	1.0954
3	4.00	1.20	1.70	502	93.0	83.0	1.0954
F1	4.00	1.20	1.70	503	93.0	83.0	1.0954
2	4.00	1.10	1.50	503	93.0	83.0	1.0488
3	4.00	1.10	1.50	504	92.0	83.0	1.0488
TOTALS	96.00	27.11	37.82	11279.00	2032.0	1862.0	25.5163

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.130
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.576
Avg Stack Temperature (degF)	T(s avg)	=	470.0
Average Meter Temperature (degF)	T(m avg)	=	81.1
Avg SQRT(dP)		=	1.063

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	59.73
Stack Gas Water Vapor Proportion	B(wo)	=	0.099
Mol. Wt., Stack Gas Dry	M(d)	=	30.62
Mol. Wt., Stack Gas Wet	M(s)	=	29.37
Abs Stack Pressure (in Hg)	P(s)	=	31.00
Avg Stack Velocity (ft/sec)	V(s avg)	=	77.2
Isokineticity (%)	% I	=	[illegible]
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	2350.[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	444473
Percent XS Air	PEA	=	24.6
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.3404
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2556
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.1170
Heat Input Rate, MBtu/hr		=	1150.10
Particulate Emission Rate(lb/hr)	E(p)	=	2706.079
Particulate Emission Rate(lb/MBtu)		=	2.3533

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 4/27/92 Printed 18-Jun — Test No./Type: M17-117
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1143-1328

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.82
Stack Static Pressure (in H20)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		889.20
Gas Meter Final Reading (cu ft)		949.64
Net Gas Sample Volume (cu ft)	V(m)	(60.43)
Vol of Liquid Collected (ml)	Vl(c)	131.2
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.176)
Wt. of Filter Particulate (gm)		5.7137
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.7137)
O2 Concentration (by CEM)	% O2	3.30
CO2 Concentration (by CEM)	% CO2	15.80
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H20)	Orifice Meter,dH (in H20)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.00	1.40	489	73.0	72.0	1.0000
2	4.00	1.20	1.70	489	73.0	72.0	1.0954
3	4.00	0.97	1.40	492	77.0	73.0	0.9849
B1	4.00	1.29	1.80	475	78.0	74.0	1.1358
2	4.00	0.93	1.30	486	82.0	75.0	0.9644
3	4.00	0.98	1.37	488	83.0	76.0	0.9899
C1	4.00	1.00	1.40	450	83.0	77.0	1.0000
2	4.00	0.99	1.30	465	86.0	77.0	0.9950
3	4.00	1.10	1.50	476	87.0	78.0	1.0488
D1	4.00	1.20	1.70	451	88.0	80.0	1.0954
2	4.00	1.30	1.70	465	90.0	80.0	1.1402
3	4.00	1.10	1.30	479	91.0	81.0	1.0488
E1	4.00	1.20	1.70	470	89.0	82.0	1.0954
2	4.00	0.99	1.40	479	91.0	82.0	0.9950
3	4.00	1.20	1.70	497	92.0	83.0	1.0954
E1	4.00	1.20	1.70	484	92.0	84.0	1.0954
2	4.00	1.00	1.40	489	93.0	85.0	1.0000
3	4.00	1.10	1.50	494	94.0	85.0	1.0488
F1	4.00	1.10	1.50	500	92.0	85.0	1.0488
2	4.00	1.20	1.70	505	92.0	85.0	1.0488
3	4.00	1.10	1.50	514	93.0	87.0	1.0488
F1	4.00	1.10	1.50	512	94.0	86.0	1.0488
2	4.00	1.20	1.70	514	95.0	86.0	1.0954
3	4.00	1.20	1.70	515	95.0	87.0	1.0954
TOTALS	96.00	26.65	36.87	11678.0	2103.0	1932.0	25.2149

FIELD DATA AVERAGES

Avg Velocity Head (in H20)	dP(avg)	=	1.110
Avg Orifice Meter Reading (in H20)	dH(avg)	=	1.536
Avg Stack Temperature (degF)	T(s avg)	=	486.6
Average Meter Temperature (degF)	T(m avg)	=	84.1
Avg SQRT(dP)		=	1.051

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	59.24
Stack Gas Water Vapor Proportion	B(wo)	=	0.094
Mol. Wt., Stack Gas Dry	M(d)	=	30.66
Mol. Wt., Stack Gas Wet	M(s)	=	29.45
Abs Stack Pressure (in Hg)	P(s)	=	31.29
Avg Stack Velocity (ft/sec)	V(s avg)	=	76.4
Isokineticity (%)	% I	=	98.3
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	232618
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	440338
Percent XS Air	PEA	=	18.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.4883
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2693
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.1772
Heat Input Rate, MBtu/hr		=	1196.88
Particulate Emission Rate(lb/hr)	E(p)	=	2966.931
Particulate Emission Rate(lb/MBtu)		=	2.4793

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 4/28/92 Printed 18-Jun — Test No./Type: M17-I18
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1640-1830

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.45
Stack Static Pressure (in H2O)	P(stack)	16.000
Gas Meter Initial Reading (cu ft)		951.74
Gas Meter Final Reading (cu ft)		1003.54
Net Gas Sample Volume (cu ft)	V(m)	(51.79)
Vol of Liquid Collected (ml)	Vl(c)	92.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.354)
Wt. of Filter Particulate (gm)		4.5221
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(4.5221)
O2 Concentration (by CEM)	% O2	3.90 (from B&W)
CO2 Concentration (by CEM)	% CO2	15.10 (estimate)
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.00)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.72	1.01	450	79.0	79.0	0.8485
2	4.00	0.69	0.96	452	78.0	78.0	0.8307
3	4.00	0.70	0.98	462	79.0	80.0	0.8367
B1	4.00	0.72	1.01	448	81.0	79.0	0.8485
2	4.00	0.65	0.91	465	84.0	80.0	0.8062
3	4.00	0.69	0.96	470	85.0	80.0	0.8307
C1	4.00	0.69	0.96	428	85.0	81.0	0.8307
2	4.00	0.65	0.91	440	87.0	81.0	0.8062
3	4.00	0.80	1.20	457	88.0	82.0	0.8944
D1	4.00	0.81	1.22	421	88.0	82.0	0.9000
2	4.00	0.79	1.10	430	90.0	83.0	0.8888
3	4.00	0.82	1.10	451	90.0	83.0	0.9055
E1	4.00	0.75	1.10	433	91.0	85.0	0.8660
2	4.00	0.72	1.00	448	92.0	85.0	0.8485
3	4.00	0.79	1.10	465	92.0	85.0	0.8888
E1	4.00	0.75	1.10	452	94.0	86.0	0.8660
2	4.00	0.72	1.00	457	95.0	87.0	0.8485
3	4.00	0.81	1.10	460	95.0	87.0	0.9000
F1	4.00	0.85	1.20	464	94.0	88.0	0.9220
2	4.00	0.73	1.00	474	94.0	88.0	0.9220
3	4.00	0.77	1.10	480	94.0	88.0	0.8775
F1	4.00	0.87	1.20	480	94.0	88.0	0.9327
2	4.00	0.73	1.00	485	95.0	88.0	0.8544
3	4.00	0.81	1.10	487	94.0	88.0	0.9000
TOTALS	96.00	18.03	25.32	10959	2138.0	2011.0	20.8534

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.751
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.055
Avg Stack Temperature (degF)	T(s avg)	=	456.6
Average Meter Temperature (degF)	T(m avg)	=	86.4
Avg SQRT(dP)		=	0.869

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	49.69
Stack Gas Water Vapor Proportion	B(wo)	=	0.080
Mol. Wt., Stack Gas Dry	M(d)	=	30.57
Mol. Wt., Stack Gas Wet	M(s)	=	29.56
Abs Stack Pressure (in Hg)	P(s)	=	30.63
Avg Stack Velocity (ft/sec)	V(s avg)	=	62.6
Isokineticity (%)	% I	=	
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	19[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	361627
Percent XS Air	PEA	=	22.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.3994
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2621
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.1457
Heat Input Rate, MBtu/hr		=	974.59
Particulate Emission Rate(lb/hr)	E(p)	=	2351.754
Particulate Emission Rate(lb/MBtu)		=	2.4135

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 4/29/92 Printed 18-Jun — Test No./Type: M17-I19
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1700-1845

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.26
Stack Static Pressure (in H20)	P(stack)	15.000
Gas Meter Initial Reading (cu ft)		5.16
Gas Meter Final Reading (cu ft)		53.82
Net Gas Sample Volume (cu ft)	V(m)	(48.66)
Vol of Liquid Collected (ml)	Vl(c)	70.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.318)
Wt. of Filter Particulate (gm)		5.6888
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.6888)
O2 Concentration (by CEM)	% O2	4.70 need CEMs
CO2 Concentration (by CEM)	% CO2	14.40
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H20)	Orifice Meter, dH (in H20)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.60	0.84	448	99.0	100.0	0.7746
2	4.00	0.60	0.84	465	99.0	100.0	0.7746
3	4.00	0.59	0.83	472	100.0	100.0	0.7681
B1	4.00	0.61	0.85	478	102.0	101.0	0.7810
2	4.00	0.51	0.71	477	103.0	101.0	0.7141
3	4.00	0.49	0.70	480	104.0	101.0	0.7000
C1	4.00	0.56	0.78	446	106.0	103.0	0.7483
2	4.00	0.52	0.73	455	106.0	103.0	0.7211
3	4.00	0.74	1.00	474	108.0	104.0	0.8602
D1	4.00	0.80	1.12	476	109.0	104.0	0.8944
2	4.00	0.62	0.87	443	111.0	105.0	0.7874
3	4.00	0.67	0.94	462	111.0	105.0	0.8185
E1	4.00	0.66	0.92	448	111.0	106.0	0.8124
2	4.00	0.66	0.92	444	113.0	107.0	0.8124
3	4.00	0.67	0.95	469	113.0	107.0	0.8185
E1	4.00	0.65	0.91	465	115.0	108.0	0.8062
2	4.00	0.60	0.84	466	115.0	109.0	0.7746
3	4.00	0.60	0.84	473	116.0	109.0	0.7746
F1	4.00	0.64	0.89	470	114.0	109.0	0.8000
2	4.00	0.68	0.95	475	115.0	109.0	0.8000
3	4.00	0.64	0.89	479	116.0	110.0	0.8000
F1	4.00	0.66	0.92	478	115.0	111.0	0.8124
2	4.00	0.68	0.95	482	117.0	111.0	0.8246
3	4.00	0.73	1.00	485	117.0	111.0	0.8544
TOTALS	96.00	15.18	21.19	11210	2635.0	2534.0	19.0327

FIELD DATA AVERAGES

Avg Velocity Head (in H20)	dP(avg)	=	0.633
Avg Orifice Meter Reading (in H20)	dH(avg)	=	0.883
Avg Stack Temperature (degF)	T(s avg)	=	467.1
Average Meter Temperature (degF)	T(m avg)	=	107.7
Avg SQRT(dP)		=	0.795

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	44.79
Stack Gas Water Vapor Proportion	B(wo)	=	0.069
Mol. Wt., Stack Gas Dry	M(d)	=	30.49
Mol. Wt., Stack Gas Wet	M(s)	=	29.63
Abs Stack Pressure (in Hg)	P(s)	=	30.36
Avg Stack Velocity (ft/sec)	V(s avg)	=	57.6
Isokineticity (%)	% I	=	96.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	179176
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	332988
Percent XS Air	PEA	=	26.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.9599
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	3852
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.6834
Heat Input Rate, MBtu/hr		=	846.57
Particulate Emission Rate(lb/hr)	E(p)	=	3009.528
Particulate Emission Rate(lb/MBtu)		=	3.5472

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 4/30/92 Printed 18-Jun — Test No./Type: M17-120
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 0020-0203

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.24
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		55.44
Gas Meter Final Reading (cu ft)		90.61
Net Gas Sample Volume (cu ft)	V(m)	(35.18)
Vol of Liquid Collected (ml)	Vl(c)	59.8
Vol of Liq @ Std. Conds. (scf)	V(w std)	(2.815)
Wt. of Filter Particulate (gm)		5.7382
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.7382)
O2 Concentration (by CEM)	% O2	4.70
CO2 Concentration (by CEM)	% CO2	13.90
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.40)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.30	0.42	451	75.0	75.0	0.5477
2	4.00	0.26	0.36	453	76.0	75.0	0.5099
3	4.00	0.33	0.46	454	78.0	76.0	0.5745
B1	4.00	0.34	0.48	429	80.0	77.0	0.5831
2	4.00	0.29	0.41	446	81.0	78.0	0.5385
3	4.00	0.25	0.35	452	82.0	79.0	0.5000
C1	4.00	0.31	0.43	425	83.0	80.0	0.5568
2	4.00	0.28	0.39	439	84.0	80.0	0.5292
3	4.00	0.35	0.49	451	85.0	81.0	0.5916
D1	4.00	0.38	0.52	415	86.0	82.0	0.6164
2	4.00	0.34	0.48	427	88.0	83.0	0.5831
3	4.00	0.38	0.52	436	88.0	83.0	0.6164
E1	4.00	0.34	0.48	402	88.0	84.0	0.5831
2	4.00	0.30	0.42	420	88.0	84.0	0.5477
3	4.00	0.33	0.46	430	89.0	85.0	0.5831
E1	4.00	0.34	0.48	425	91.0	87.0	0.5568
2	4.00	0.31	0.43	433	90.0	86.0	0.5568
3	4.00	0.31	0.43	445	89.0	86.0	0.6164
F1	4.00	0.38	0.53	432	89.0	86.0	0.6164
2	4.00	0.33	0.46	444	90.0	86.0	0.6164
3	4.00	0.31	0.43	450	90.0	87.0	0.5568
F1	4.00	0.38	0.53	442	91.0	87.0	0.6164
2	4.00	0.32	0.45	450	91.0	88.0	0.5657
3	4.00	0.33	0.46	452	91.0	87.0	0.5745
TOTALS	96.00	7.79	10.87	10503	2063.0	1982.0	13.7374

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.325
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.453
Avg Stack Temperature (degF)	T(s avg)	=	437.6
Average Meter Temperature (degF)	T(m avg)	=	84.3
Avg SQRT(dP)		=	0.572

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	33.71
Stack Gas Water Vapor Proportion	B(wo)	=	0.077
Mol. Wt., Stack Gas Dry	M(d)	=	30.41
Mol. Wt., Stack Gas Wet	M(s)	=	29.48
Abs Stack Pressure (in Hg)	P(s)	=	30.27
Avg Stack Velocity (ft/sec)	V(s avg)	=	41.2
Isokineticity (%)	% I	=	[illegible]
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	130[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	237559
Percent XS Air	PEA	=	28.0
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.6268
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	5162
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	2.2562
Heat Input Rate, MBtu/hr		=	617.92
Particulate Emission Rate(lb/hr)	E(p)	=	2937.199
Particulate Emission Rate(lb/MBtu)		=	4.7542

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 5/1/92 Printed 18-Jun — Test No./Type: M17-I21
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1005-1150

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.15
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		91.51
Gas Meter Final Reading (cu ft)		153.11
Net Gas Sample Volume (cu ft)	V(m)	(61.60)
Vol of Liquid Collected (ml)	Vl(c)	160.0 check moisture catc
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.531)
Wt. of Filter Particulate (gm)		5.1162
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.1162)
O2 Concentration (by CEM)	% O2	3.90
CO2 Concentration (by CEM)	% CO2	15.10
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.00)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.00	1.40	487	88.0	89.0	1.0000
2	4.00	0.90	1.30	487	88.0	89.0	0.9487
3	4.00	1.00	1.40	492	89.0	89.0	1.0000
B1	4.00	1.20	1.70	474	91.0	89.0	1.0954
2	4.00	0.91	1.30	489	93.0	89.0	0.9539
3	4.00	0.93	1.30	496	93.0	90.0	0.9644
C1	4.00	1.10	1.40	465	94.0	89.0	1.0488
2	4.00	0.95	1.30	475	95.0	90.0	0.9747
3	4.00	1.20	1.70	489	97.0	90.0	1.0954
D1	4.00	1.30	1.80	478	95.0	90.0	1.1402
2	4.00	1.10	1.40	480	99.0	91.0	1.0488
3	4.00	1.20	1.70	488	98.0	91.0	1.0954
E1	4.00	1.10	1.40	456	97.0	91.0	1.0488
2	4.00	1.00	1.40	478	100.0	92.0	1.0000
3	4.00	1.00	1.40	488	100.0	92.0	1.0488
E1	4.00	1.10	1.40	470	101.0	92.0	1.0000
2	4.00	1.00	1.40	482	102.0	93.0	1.0488
3	4.00	1.10	1.40	485	102.0	93.0	1.1402
F1	4.00	1.30	1.30	481	100.0	94.0	1.1402
2	4.00	1.00	1.40	492	101.0	93.0	1.1402
3	4.00	1.10	1.50	495	102.0	95.0	1.0488
F1	4.00	1.30	1.80	493	103.0	95.0	1.1402
2	4.00	1.00	1.40	494	104.0	96.0	1.0000
3	4.00	1.10	1.50	495	106.0	95.0	1.0488
TOTALS	96.00	25.89	35.00	11609	2338.0	2197.0	25.1705

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.079
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.458
Avg Stack Temperature (degF)	T(s avg)	=	483.7
Average Meter Temperature (degF)	T(m avg)	=	94.5
Avg SQRT(dP)		=	1.049

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	57.91
Stack Gas Water Vapor Proportion	B(wo)	=	0.115
Mol. Wt., Stack Gas Dry	M(d)	=	30.57
Mol. Wt., Stack Gas Wet	M(s)	=	29.13
Abs Stack Pressure (in Hg)	P(s)	=	30.62
Avg Stack Velocity (ft/sec)	V(s avg)	=	77.5
Isokineticity (%)	% I	=	98.9
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	226113
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	446248
Percent XS Air	PEA	=	22.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.3632
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2554
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.1161
Heat Input Rate, MBtu/hr		=	1123.75
Particulate Emission Rate(lb/hr)	E(p)	=	2641.639
Particulate Emission Rate(lb/MBtu)		=	2.3511

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 5/16/92 Printed 18-Jun — Test No./Type: M17-I22
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1058-1205

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.43
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		154.65
Gas Meter Final Reading (cu ft)		202.10
Net Gas Sample Volume (cu ft)	V(m)	(47.45)
Vol of Liquid Collected (ml)	Vl(c)	91.3
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.297)
Wt. of Filter Particulate (gm)		8.2504
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(8.2504)
O2 Concentration (by CEM)	% O2	4.10
CO2 Concentration (by CEM)	% CO2	14.80
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.10)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.54	0.76	449.00	83.0	83.0	0.7348
2	4.00	0.51	0.71	450.00	84.0	83.0	0.7141
3	4.00	0.56	0.78	454.00	85.0	84.0	0.7483
B1	4.00	0.58	0.84	408.00	86.0	84.0	0.7616
2	4.00	0.52	0.73	430.00	87.0	85.0	0.7211
3	4.00	0.48	0.67	452.00	89.0	85.0	0.6928
C1	4.00	0.59	0.83	406.00	89.0	86.0	0.7681
2	4.00	0.55	0.77	427.00	91.0	86.0	0.7416
3	4.00	0.79	1.10	451.00	92.0	87.0	0.8888
D1	4.00	0.75	1.10	415.00	93.0	88.0	0.8660
2	4.00	0.66	0.92	426.00	94.0	89.0	0.8124
3	4.00	0.71	0.99	449.00	95.0	89.0	0.8426
E1	4.00	0.63	0.88	415.00	94.0	90.0	0.7937
2	4.00	0.54	0.77	431.00	95.0	90.0	0.7348
3	4.00	0.62	0.88	455.00	97.0	91.0	0.7874
E1	4.00	0.62	0.88	444.00	96.0	91.0	0.7416
2	4.00	0.55	0.77	452.00	97.0	91.0	0.7937
3	4.00	0.63	0.88	461.00	97.0	92.0	0.8367
F1	4.00	0.70	0.98	430.00	97.0	92.0	0.8367
2	4.00	0.60	0.84	443.00	98.0	92.0	0.8367
3	4.00	0.62	0.87	455.00	99.0	93.0	0.7874
F1	4.00	0.67	0.95	448.00	100.0	94.0	0.8185
2	4.00	0.61	0.84	458.00	101.0	94.0	0.7810
3	4.00	0.62	0.87	462.00	102.0	95.0	0.7874
TOTALS	96.00	14.65	20.61	10571.00	2241.0	2134.0	18.8281

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.610
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.859
Avg Stack Temperature (degF)	T(s avg)	=	440.5
Average Meter Temperature (degF)	T(m avg)	=	91.1
Avg SQRT(dP)		=	0.785

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	45.24
Stack Gas Water Vapor Proportion	B(wo)	=	0.087
Mol. Wt., Stack Gas Dry	M(d)	=	30.53
Mol. Wt., Stack Gas Wet	M(s)	=	29.44
Abs Stack Pressure (in Hg)	P(s)	=	30.46
Avg Stack Velocity (ft/sec)	V(s avg)	=	56.4
Isokineticity (%)	% I	=	
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	177253
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	325147
Percent XS Air	PEA	=	23.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.8142
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	5334
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	2.3313
Heat Input Rate, MBtu/hr		=	870.56
Particulate Emission Rate(lb/hr)	E(p)	=	4274.992
Particulate Emission Rate(lb/MBtu)		=	4.9115

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 5/16/92 Printed 18-Jun — Test No./Type: M17-I23
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1645-1836

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.43
Stack Static Pressure (in H20)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		203.53
Gas Meter Final Reading (cu ft)		237.77
Net Gas Sample Volume (cu ft)	V(m)	(34.24)
Vol of Liquid Collected (ml)	Vl(c)	75.1
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.535)
Wt. of Filter Particulate (gm)		6.0318
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(6.0318)
O2 Concentration (by CEM)	% O2	4.00
CO2 Concentration (by CEM)	% CO2	15.10
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H20)	Orifice Meter,dH (in H20)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.30	0.42	429.00	99.0	98.0	0.5477
2	4.00	0.27	0.38	430.00	99.0	98.0	0.5196
3	4.00	0.29	0.41	455.00	100.0	99.0	0.5385
B1	4.00	0.30	0.43	426.00	101.0	99.0	0.5477
2	4.00	0.26	0.48	439.00	101.0	100.0	0.5099
3	4.00	0.26	0.38	444.00	102.0	100.0	0.5099
C1	4.00	0.30	0.43	410.00	102.0	100.0	0.5477
2	4.00	0.26	0.38	421.00	104.0	101.0	0.5099
3	4.00	0.32	0.45	426.00	104.0	102.0	0.5657
D1	4.00	0.36	0.50	407.00	104.0	102.0	0.6000
2	4.00	0.35	0.49	412.00	106.0	102.0	0.5916
3	4.00	0.32	0.45	415.00	106.0	102.0	0.5657
E1	4.00	0.30	0.42	391.00	105.0	103.0	0.5477
2	4.00	0.26	0.38	400.00	106.0	103.0	0.5099
3	4.00	0.28	0.38	414.00	107.0	104.0	0.5477
E1	4.00	0.30	0.42	411.00	107.0	104.0	0.5099
2	4.00	0.26	0.38	426.00	106.0	104.0	0.5099
3	4.00	0.26	0.38	433.00	106.0	104.0	0.5745
F1	4.00	0.33	0.46	406.00	106.0	104.0	0.5745
2	4.00	0.27	0.38	422.00	106.0	104.0	0.5745
3	4.00	0.27	0.38	429.00	107.0	104.0	0.5196
F1	4.00	0.32	0.46	430.00	107.0	105.0	0.5657
2	4.00	0.28	0.39	433.00	108.0	105.0	0.5292
3	4.00	0.27	0.38	430.00	109.0	106.0	0.5196
TOTALS	96.00	6.99	10.01	10139.00	2508.0	2453.0	13.0366

FIELD DATA AVERAGES

Avg Velocity Head (in H20)	dP(avg)	=	0.291
Avg Orifice Meter Reading (in H20)	dH(avg)	=	0.417
Avg Stack Temperature (degF)	T(s avg)	=	422.5
Average Meter Temperature (degF)	T(m avg)	=	103.4
Avg SQRT(dP)		=	0.543

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	31.90
Stack Gas Water Vapor Proportion	B(wo)	=	0.100
Mol. Wt., Stack Gas Dry	M(d)	=	30.58
Mol. Wt., Stack Gas Wet	M(s)	=	29.32
Abs Stack Pressure (in Hg)	P(s)	=	30.17
Avg Stack Velocity (ft/sec)	V(s avg)	=	39.0
Isokineticity (%)	% I	=	101.1
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	121874
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	224425
Percent XS Air	PEA	=	23.0
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.9176
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	5498
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	2.4029
Heat Input Rate, MBtu/hr		=	602.13
Particulate Emission Rate(lb/hr)	E(p)	=	3047.482
Particulate Emission Rate(lb/MBtu)		=	5.0620

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 5/17/92 Printed 18-Jun — Test No./Type: M17-I24
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 0934-1126

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		237.89
Gas Meter Final Reading (cu ft)		271.66
Net Gas Sample Volume (cu ft)	V(m)	(33.77)
Vol of Liquid Collected (ml)	Vl(c)	60.6
Vol of Liq @ Std. Conds. (scf)	V(w std)	(2.852)
Wt. of Filter Particulate (gm)		5.5995
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.5995)
O2 Concentration (by CEM)	% O2	4.90
CO2 Concentration (by CEM)	% CO2	14.20
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.27	0.38	429.00	81.0	80.0	0.5196
2	4.00	0.25	0.35	429.00	82.0	81.0	0.5000
3	4.00	0.29	0.41	433.00	82.0	81.0	0.5385
B1	4.00	0.32	0.45	408.00	83.0	82.0	0.5657
2	4.00	0.25	0.35	424.00	83.0	82.0	0.5000
3	4.00	0.25	0.35	434.00	83.0	82.0	0.5000
C1	4.00	0.30	0.42	388.00	83.0	82.0	0.5477
2	4.00	0.27	0.38	402.00	84.0	82.0	0.5196
3	4.00	0.37	0.52	418.00	84.0	82.0	0.6083
D1	4.00	0.36	0.50	416.00	84.0	82.0	0.6000
2	4.00	0.31	0.42	422.00	85.0	82.0	0.5568
3	4.00	0.35	0.49	425.00	85.0	82.0	0.5916
E1	4.00	0.30	0.45	405.00	85.0	83.0	0.5477
2	4.00	0.27	0.38	412.00	85.0	83.0	0.5196
3	4.00	0.32	0.45	421.00	86.0	83.0	0.5657
E1	4.00	0.32	0.45	420.00	86.0	83.0	0.5196
2	4.00	0.27	0.38	421.00	86.0	83.0	0.5385
3	4.00	0.29	0.41	426.00	87.0	84.0	0.5657
F1	4.00	0.32	0.45	414.00	86.0	83.0	0.5657
2	4.00	0.30	0.42	423.00	87.0	83.0	0.5657
3	4.00	0.30	0.42	431.00	87.0	84.0	0.5477
F1	4.00	0.35	0.49	428.00	87.0	84.0	0.5916
2	4.00	0.30	0.42	431.00	87.0	84.0	0.5477
3	4.00	0.28	0.39	436.00	88.0	84.0	0.5292
TOTALS	96.00	7.21	10.13	10096.00	2036.0	1981.0	13.1522

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.300
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.422
Avg Stack Temperature (degF)	T(s avg)	=	420.7
Average Meter Temperature (degF)	T(m avg)	=	83.7
Avg SQRT(dP)		=	0.548

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	32.82
Stack Gas Water Vapor Proportion	B(wo)	=	0.060
Mol. Wt., Stack Gas Dry	M(d)	=	30.47
Mol. Wt., Stack Gas Wet	M(s)	=	29.47
Abs Stack Pressure (in Hg)	P(s)	=	30.36
Avg Stack Velocity (ft/sec)	V(s avg)	=	39.0
Isokineticity (%)	% I	=	1[illegible]
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	125[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	224904
Percent XS Air	PEA	=	29.8
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.6329
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	5238
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	2.2895
Heat Input Rate, MBtu/hr		=	588.72
Particulate Emission Rate(lb/hr)	E(p)	=	2839.920
Particulate Emission Rate(lb/MBtu)		=	4.8247

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 5/16/92 Printed 18-Jun — Test No./Type: M17-123
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1645-1836

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.43
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		203.53
Gas Meter Final Reading (cu ft)		237.77
Net Gas Sample Volume (cu ft)	V(m)	(34.24)
Vol of Liquid Collected (ml)	Vl(c)	75.1
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.535)
Wt. of Filter Particulate (gm)		6.0318
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(6.0318)
O2 Concentration (by CEM)	% O2	4.00
CO2 Concentration (by CEM)	% CO2	15.10
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.30	0.42	429.00	99.0	98.0	0.5477
2	4.00	0.27	0.38	430.00	99.0	98.0	0.5196
3	4.00	0.29	0.41	455.00	100.0	99.0	0.5385
B1	4.00	0.30	0.43	426.00	101.0	99.0	0.5477
2	4.00	0.26	0.48	439.00	101.0	100.0	0.5099
3	4.00	0.26	0.38	444.00	102.0	100.0	0.5099
C1	4.00	0.30	0.43	410.00	102.0	100.0	0.5477
2	4.00	0.26	0.38	421.00	104.0	101.0	0.5099
3	4.00	0.32	0.45	426.00	104.0	102.0	0.5657
D1	4.00	0.36	0.50	407.00	104.0	102.0	0.6000
2	4.00	0.35	0.49	412.00	106.0	102.0	0.5916
3	4.00	0.32	0.45	415.00	106.0	102.0	0.5657
E1	4.00	0.30	0.42	391.00	105.0	103.0	0.5477
2	4.00	0.26	0.38	400.00	106.0	103.0	0.5099
3	4.00	0.28	0.38	414.00	107.0	104.0	0.5477
E1	4.00	0.30	0.42	411.00	107.0	104.0	0.5099
2	4.00	0.26	0.38	426.00	106.0	104.0	0.5099
3	4.00	0.26	0.38	433.00	106.0	104.0	0.5745
F1	4.00	0.33	0.46	406.00	106.0	104.0	0.5745
2	4.00	0.27	0.38	422.00	106.0	104.0	0.5745
3	4.00	0.27	0.38	429.00	107.0	104.0	0.5196
F1	4.00	0.32	0.46	430.00	107.0	105.0	0.5657
2	4.00	0.28	0.39	433.00	108.0	105.0	0.5292
3	4.00	0.27	0.38	430.00	109.0	106.0	0.5196
TOTALS	96.00	6.99	10.01	10139.00	2508.0	2453.0	13.0366

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.291
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.417
Avg Stack Temperature (degF)	T(s avg)	=	422.5
Average Meter Temperature (degF)	T(m avg)	=	103.4
Avg SQRT(dP)		=	0.543

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	31.90
Stack Gas Water Vapor Proportion	B(wo)	=	0.100
Mol. Wt., Stack Gas Dry	M(d)	=	30.58
Mol. Wt., Stack Gas Wet	M(s)	=	29.32
Abs Stack Pressure (in Hg)	P(s)	=	30.17
Avg Stack Velocity (ft/sec)	V(s avg)	=	39.0
Isokineticity (%)	% I	=	101.1
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	121874
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	224425
Percent XS Air	PEA	=	23.0
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.9178
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	5498
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	2.4029
Heat Input Rate, MBtu/hr		=	602.13
Particulate Emission Rate(lb/hr)	E(p)	=	3047.482
Particulate Emission Rate(lb/MBtu)		=	5.0620

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 5/17/92 Printed 18-Jun — Test No./Type: M17-124
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 0934-1126

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		237.89
Gas Meter Final Reading (cu ft)		271.66
Net Gas Sample Volume (cu ft)	V(m)	(33.77)
Vol of Liquid Collected (ml)	Vl(c)	60.6
Vol of Liq @ Std. Conds. (scf)	V(w std)	(2.852)
Wt. of Filter Particulate (gm)		5.5995
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.5995)
O2 Concentration (by CEM)	% O2	4.90
CO2 Concentration (by CEM)	% CO2	14.20
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.27	0.38	429.00	81.0	80.0	0.5196
2	4.00	0.25	0.35	429.00	82.0	81.0	0.5000
3	4.00	0.29	0.41	433.00	82.0	81.0	0.5385
B1	4.00	0.32	0.45	408.00	83.0	82.0	0.5657
2	4.00	0.25	0.35	424.00	83.0	82.0	0.5000
3	4.00	0.25	0.35	434.00	83.0	82.0	0.5000
C1	4.00	0.30	0.42	388.00	83.0	82.0	0.5477
2	4.00	0.27	0.38	402.00	84.0	82.0	0.5196
3	4.00	0.37	0.52	418.00	84.0	82.0	0.6083
D1	4.00	0.36	0.50	416.00	84.0	82.0	0.6000
2	4.00	0.31	0.42	422.00	85.0	82.0	0.5568
3	4.00	0.35	0.49	425.00	85.0	82.0	0.5916
E1	4.00	0.30	0.45	405.00	85.0	83.0	0.5477
2	4.00	0.27	0.38	412.00	85.0	83.0	0.5196
3	4.00	0.32	0.45	421.00	86.0	83.0	0.5657
E1	4.00	0.32	0.45	420.00	86.0	83.0	0.5196
2	4.00	0.27	0.38	421.00	86.0	83.0	0.5385
3	4.00	0.29	0.41	426.00	87.0	84.0	0.5657
F1	4.00	0.32	0.45	414.00	86.0	83.0	0.5657
2	4.00	0.30	0.42	423.00	87.0	83.0	0.5657
3	4.00	0.30	0.42	431.00	87.0	84.0	0.5477
F1	4.00	0.35	0.49	428.00	87.0	84.0	0.5916
2	4.00	0.30	0.42	431.00	87.0	84.0	0.5477
3	4.00	0.28	0.39	436.00	88.0	84.0	0.5292
TOTALS	96.00	7.21	10.13	10096.00	2036.0	1981.0	13.1522

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.300
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.422
Avg Stack Temperature (degF)	T(s avg)	=	420.7
Average Meter Temperature (degF)	T(m avg)	=	83.7
Avg SQRT(dP)		=	0.548

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	32.82
Stack Gas Water Vapor Proportion	B(wo)	=	0.080
Mol. Wt., Stack Gas Dry	M(d)	=	30.47
Mol. Wt., Stack Gas Wet	M(s)	=	29.47
Abs Stack Pressure (in Hg)	P(s)	=	30.36
Avg Stack Velocity (ft/sec)	V(s avg)	=	39.0
Isokineticity (%)	% I	=	1[illegible]
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	12[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	224904
Percent XS Air	PEA	=	29.8
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.6329
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	5238
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	2.2895
Heat Input Rate, MBtu/hr		=	588.72
Particulate Emission Rate(lb/hr)	E(p)	=	2839.920
Particulate Emission Rate(lb/MBtu)		=	4.8247

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 5/17/92 Printed 18-Jun — Test No./Type: M17-I25
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1421-1604

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		271.77
Gas Meter Final Reading (cu ft)		305.87
Net Gas Sample Volume (cu ft)	V(m)	(34.11)
Vol of Liquid Collected (ml)	Vl(c)	84.7
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.987)
Wt. of Filter Particulate (gm)		7.9032
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(7.9032)
O2 Concentration (by CEM)	% O2	5.30
CO2 Concentration (by CEM)	% CO2	14.10
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.60)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.27	0.38	415.00	78.0	78.0	0.5196
2	4.00	0.27	0.38	422.00	78.0	78.0	0.5196
3	4.00	0.31	0.43	430.00	79.0	78.0	0.5568
B1	4.00	0.32	0.45	399.00	80.0	79.0	0.5657
2	4.00	0.27	0.38	416.00	81.0	79.0	0.5196
3	4.00	0.25	0.35	434.00	82.0	80.0	0.5000
C1	4.00	0.32	0.45	406.00	83.0	80.0	0.5657
2	4.00	0.30	0.42	420.00	84.0	81.0	0.5477
3	4.00	0.38	0.53	429.00	85.0	82.0	0.6164
D1	4.00	0.38	0.53	427.00	85.0	82.0	0.6164
2	4.00	0.36	0.50	425.00	86.0	83.0	0.6000
3	4.00	0.36	0.50	430.00	88.0	83.0	0.6000
E1	4.00	0.35	0.49	405.00	88.0	84.0	0.5916
2	4.00	0.28	0.39	412.00	90.0	85.0	0.5292
3	4.00	0.30	0.42	414.00	90.0	86.0	0.5831
E1	4.00	0.34	0.48	420.00	90.0	86.0	0.5477
2	4.00	0.30	0.42	424.00	92.0	87.0	0.5568
3	4.00	0.31	0.43	434.00	92.0	87.0	0.5745
F1	4.00	0.33	0.46	414.00	92.0	88.0	0.5745
2	4.00	0.30	0.42	422.00	93.0	88.0	0.5745
3	4.00	0.31	0.43	431.00	93.0	89.0	0.5568
F1	4.00	0.32	0.44	426.00	94.0	90.0	0.5657
2	4.00	0.31	0.42	425.00	95.0	90.0	0.5568
3	4.00	0.30	0.42	430.00	95.0	90.0	0.5477
TOTALS	96.00	7.54	10.52	10110.00	2093.00	2013.0	13.4863

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.314
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.438
Avg Stack Temperature (degF)	T(s avg)	=	421.3
Average Meter Temperature (degF)	T(m avg)	=	85.5
Avg SQRT(dP)		=	0.562

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	33.03
Stack Gas Water Vapor Proportion	B(wo)	=	0.108
Mol. Wt., Stack Gas Dry	M(d)	=	30.47
Mol. Wt., Stack Gas Wet	M(s)	=	29.13
Abs Stack Pressure (in Hg)	P(s)	=	30.36
Avg Stack Velocity (ft/sec)	V(s avg)	=	40.3
Isokineticity (%)	% I	=	101.3
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	125868
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	232058
Percent XS Air	PEA	=	33.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	3.6919
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	7532
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	3.2921
Heat Input Rate, MBtu/hr		=	574.03
Particulate Emission Rate(lb/hr)	E(p)	=	3982.400
Particulate Emission Rate(lb/MBtu)		=	6.9386

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 5/18/92 Printed 15-Jun — Test No./Type: M17-I26
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1055-1246

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.84
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		306.76
Gas Meter Final Reading (cu ft)		367.84
Net Gas Sample Volume (cu ft)	V(m)	(61.08)
Vol of Liquid Collected (ml)	Vl(c)	143.1
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.736)
Wt. of Filter Particulate (gm)		8.0154
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(8.0154)
O2 Concentration (by CEM)	% O2	3.50
CO2 Concentration (by CEM)	% CO2	15.70
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.69)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.96	1.30	450.00	74.0	74.0	0.9798
2	4.00	0.87	1.20	459.00	74.0	74.0	0.9327
3	4.00	1.00	1.40	462.00	76.0	75.0	1.0000
B1	4.00	1.10	1.50	436.00	77.0	75.0	1.0488
2	4.00	0.91	1.30	456.00	80.0	76.0	0.9539
3	4.00	0.91	1.30	469.00	81.0	76.0	0.9539
C1	4.00	1.10	1.50	426.00	82.0	77.0	1.0488
2	4.00	0.95	1.30	449.00	86.0	78.0	0.9747
3	4.00	1.30	1.80	463.00	86.0	78.0	1.1402
D1	4.00	1.20	1.70	455.00	85.0	78.0	1.0954
2	4.00	1.10	1.50	460.00	88.0	79.0	1.0488
3	4.00	1.10	1.50	465.00	89.0	80.0	1.0488
E1	4.00	1.10	1.50	470.00	90.0	82.0	1.0488
2	4.00	1.00	1.40	482.00	91.0	82.0	1.0000
3	4.00	1.10	1.50	493.00	92.0	83.0	1.0488
E1	4.00	1.10	1.50	486.00	94.0	84.0	1.0488
2	4.00	1.10	1.50	492.00	95.0	85.0	1.0488
3	4.00	1.10	1.50	497.00	95.0	85.0	1.0954
F1	4.00	1.20	1.70	500.00	93.0	86.0	1.0954
2	4.00	1.10	1.50	502.00	94.0	87.0	1.0954
3	4.00	1.10	1.50	504.00	95.0	87.0	1.0488
F1	4.00	1.30	1.80	504.00	95.0	87.0	1.1402
2	4.00	1.10	1.50	505.00	96.0	87.0	1.0488
3	4.00	1.10	1.50	509.00	97.0	88.0	1.0488
TOTALS	96.00	25.90	35.70	11394.00	2105.00	1943.0	24.9941

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.079
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.488
Avg Stack Temperature (degF)	T(s avg)	=	474.8
Average Meter Temperature (degF)	T(m avg)	=	84.3
Avg SQRT(dP)		=	1.041

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	59.87
Stack Gas Water Vapor Proportion	B(wo)	=	0.101
Mol. Wt., Stack Gas Dry	M(d)	=	30.49
Mol. Wt., Stack Gas Wet	M(s)	=	29.22
Abs Stack Pressure (in Hg)	P(s)	=	31.31
Avg Stack Velocity (ft/sec)	V(s avg)	=	75.6
Isokineticity (%)	% I	=	99.9
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	231340
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	43[illegible]
Percent XS Air	PEA	=	2[illegible]
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.0657
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	3825
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.6716
Heat Input Rate, MBtu/hr		=	1163.25
Particulate Emission Rate(lb/hr)	E(p)	=	4095.366
Particulate Emission Rate(lb/MBtu)		=	3.5212

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 5/19/92 Printed 15-Jun — Test No./Type: M17-I27
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 0926-1115

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		369.34
Gas Meter Final Reading (cu ft)		431.03
Net Gas Sample Volume (cu ft)	V(m)	(61.69)
Vol of Liquid Collected (ml)	Vl(c)	141.4
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.656)
Wt. of Filter Particulate (gm)		5.2557
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.2557)
O2 Concentration (by CEM)	% O2	3.40
CO2 Concentration (by CEM)	% CO2	15.70
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.69)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.10	1.54	465.00	70.0	71.0	1.0488
2	4.00	0.90	1.30	466.00	71.0	71.0	0.9487
3	4.00	1.00	1.40	472.00	73.0	71.0	1.0000
B1	4.00	1.10	1.50	443.00	74.0	72.0	1.0488
2	4.00	0.91	1.30	459.00	77.0	73.0	0.9539
3	4.00	0.93	1.30	476.00	76.0	73.0	0.9644
C1	4.00	1.10	1.50	439.00	80.0	74.0	1.0488
2	4.00	1.00	1.40	457.00	82.0	75.0	1.0000
3	4.00	1.40	1.90	470.00	84.0	75.0	1.1832
D1	4.00	1.30	1.80	458.00	83.0	76.0	1.1402
2	4.00	1.00	1.40	463.00	89.0	77.0	1.0000
3	4.00	1.20	1.70	469.00	86.0	77.0	1.0954
E1	4.00	1.10	1.50	450.00	86.0	76.0	1.0488
2	4.00	1.00	1.40	472.00	87.0	79.0	1.0000
3	4.00	1.10	1.50	486.00	88.0	79.0	1.0954
E1	4.00	1.20	1.70	472.00	89.0	80.0	1.0000
2	4.00	1.00	1.40	479.00	89.0	80.0	1.0954
3	4.00	1.20	1.70	480.00	90.0	81.0	1.0954
F1	4.00	1.20	1.70	492.00	89.0	81.0	1.0954
2	4.00	1.10	1.50	497.00	90.0	82.0	1.0954
3	4.00	1.10	1.50	500.00	90.0	82.0	1.0488
F1	4.00	1.20	1.70	500.00	91.0	83.0	1.0954
2	4.00	1.10	1.50	501.00	93.0	83.0	1.0488
3	4.00	1.10	1.50	502.00	93.0	83.0	1.0488
TOTALS	96.00	26.34	36.64	11368.00	2020.00	1854.0	25.2002

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.098
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.527
Avg Stack Temperature (degF)	T(s avg)	=	473.7
Average Meter Temperature (degF)	T(m avg)	=	80.7
Avg SQRT(dP)		=	1.050

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	60.44
Stack Gas Water Vapor Proportion	B(wo)	=	0.099
Mol. Wt., Stack Gas Dry	M(d)	=	30.49
Mol. Wt., Stack Gas Wet	M(s)	=	29.25
Abs Stack Pressure (in Hg)	P(s)	=	31.09
Avg Stack Velocity (ft/sec)	V(s avg)	=	76.4
Isokineticity (%)	% I	=	100.2
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	232963
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	440098
Percent XS Air	PEA	=	20.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.3418
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2484
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.0859
Heat Input Rate, MBtu/hr		=	1171.41
Particulate Emission Rate(lb/hr)	E(p)	=	2678.928
Particulate Emission Rate(lb/MBtu)		=	2.2873

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 5/19/92 Printed 15-Jun — Test No./Type: M17-I28
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1447-1631

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		432.62
Gas Meter Final Reading (cu ft)		479.99
Net Gas Sample Volume (cu ft)	V(m)	(47.37)
Vol of Liquid Collected (ml)	Vl(c)	93.7
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.410)
Wt. of Filter Particulate (gm)		3.7714
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(3.7714)
O2 Concentration (by CEM)	% O2	3.90
CO2 Concentration (by CEM)	% CO2	14.90
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.69)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.55	0.77	456.00	87.0	87.0	0.7416
2	4.00	0.50	0.70	457.00	87.0	88.0	0.7071
3	4.00	0.57	0.79	459.00	89.0	89.0	0.7550
B1	4.00	0.58	0.81	425.00	91.0	89.0	0.7616
2	4.00	0.47	0.66	439.00	93.0	85.0	0.6856
3	4.00	0.46	0.64	458.00	94.0	90.0	0.6782
C1	4.00	0.56	0.78	425.00	94.0	91.0	0.7483
2	4.00	0.50	0.70	440.00	95.0	91.0	0.7071
3	4.00	0.70	0.98	454.00	97.0	92.0	0.8367
D1	4.00	0.70	0.98	440.00	97.0	92.0	0.8367
2	4.00	0.61	0.85	446.00	99.0	93.0	0.7810
3	4.00	0.65	0.91	451.00	99.0	94.0	0.8062
E1	4.00	0.60	0.85	437.00	99.0	94.0	0.7746
2	4.00	0.55	0.77	445.00	100.0	94.0	0.7416
3	4.00	0.60	0.85	458.00	100.0	95.0	0.7616
E1	4.00	0.58	0.81	450.00	101.0	95.0	0.7348
2	4.00	0.54	0.76	454.00	102.0	95.0	0.7746
3	4.00	0.60	0.85	463.00	102.0	96.0	0.7937
F1	4.00	0.63	0.88	457.00	100.0	99.0	0.7937
2	4.00	0.55	0.77	463.00	101.0	96.0	0.7937
3	4.00	0.55	0.77	465.00	101.0	96.0	0.7416
F1	4.00	0.60	0.85	465.00	101.0	96.0	0.7746
2	4.00	0.55	0.77	466.00	101.0	96.0	0.7416
3	4.00	0.55	0.77	468.00	101.0	96.0	0.7416
TOTALS	96.00	13.75	19.27	10841.00	2331.00	2229.0	18.2130

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.573
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.803
Avg Stack Temperature (degF)	T(s avg)	=	451.7
Average Meter Temperature (degF)	T(m avg)	=	95.0
Avg SQRT(dP)		=	0.759

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	45.13
Stack Gas Water Vapor Proportion	B(wo)	=	0.089
Mol. Wt., Stack Gas Dry	M(d)	=	30.49
Mol. Wt., Stack Gas Wet	M(s)	=	29.37
Abs Stack Pressure (in Hg)	P(s)	=	30.65
Avg Stack Velocity (ft/sec)	V(s avg)	=	54.8
Isokineticity (%)	% I	=	102.1
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	17
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	315879
Percent XS Air	PEA	=	20.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.2894
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2387
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.0435
Heat Input Rate, MBtu/hr		=	858.40
Particulate Emission Rate(lb/hr)	E(p)	=	1886.426
Particulate Emission Rate(lb/MBtu)		=	2.1980

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 5/20/92 Printed 15-Jun — Test No./Type: M17-129
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 0933-1130

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.75
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		480.36
Gas Meter Final Reading (cu ft)		541.88
Net Gas Sample Volume (cu ft)	V(m)	(61.53)
Vol of Liquid Collected (ml)	Vl(c)	144.1
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.783)
Wt. of Filter Particulate (gm)		9.0787
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(9.0787)
O2 Concentration (by CEM)	% O2	3.70
CO2 Concentration (by CEM)	% CO2	15.60
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.69)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.99	1.40	464.00	88.0	88.0	0.9950
2	4.00	0.90	1.30	462.00	87.0	88.0	0.9487
3	4.00	0.97	1.40	466.00	89.0	88.0	0.9849
B1	4.00	1.10	1.50	436.00	91.0	89.0	1.0488
2	4.00	0.90	1.30	451.00	92.0	89.0	0.9487
3	4.00	0.85	1.20	469.00	93.0	89.0	0.9220
C1	4.00	1.10	1.50	443.00	95.0	90.0	1.0488
2	4.00	0.95	1.40	453.00	96.0	90.0	0.9747
3	4.00	1.30	1.80	462.00	98.0	90.0	1.1402
D1	4.00	1.20	1.70	451.00	98.0	92.0	1.0954
2	4.00	1.00	1.40	457.00	101.0	93.0	1.0000
3	4.00	1.10	1.50	461.00	102.0	94.0	1.0488
E1	4.00	1.10	1.50	451.00	100.0	94.0	1.0488
2	4.00	1.00	1.40	465.00	102.0	95.0	1.0000
3	4.00	1.10	1.50	476.00	103.0	95.0	1.0488
E1	4.00	1.10	1.50	468.00	104.0	95.0	1.0000
2	4.00	1.00	1.40	476.00	105.0	96.0	1.0000
3	4.00	1.00	1.40	483.00	105.0	96.0	1.0488
F1	4.00	1.10	1.50	485.00	103.0	97.0	1.0488
2	4.00	1.00	1.40	487.00	104.0	97.0	1.0488
3	4.00	1.20	1.70	492.00	105.0	97.0	1.0954
F1	4.00	1.30	1.80	490.00	106.0	97.0	1.1402
2	4.00	1.00	1.40	490.00	107.0	98.0	1.0000
3	4.00	1.10	1.50	491.00	107.0	98.0	1.0488
TOTALS	96.00	25.36	35.40	11229.00	2381.00	2235.0	24.6844

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.057
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.475
Avg Stack Temperature (degF)	T(s avg)	=	467.9
Average Meter Temperature (degF)	T(m avg)	=	96.2
Avg SQRT(dP)		=	1.029

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	58.85
Stack Gas Water Vapor Proportion	B(wo)	=	0.103
Mol. Wt., Stack Gas Dry	M(d)	=	30.49
Mol. Wt., Stack Gas Wet	M(s)	=	29.20
Abs Stack Pressure (in Hg)	P(s)	=	31.22
Avg Stack Velocity (ft/sec)	V(s avg)	=	74.5
Isokineticity (%)	% I	=	99.4
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	228532
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	429236
Percent XS Air	PEA	=	20.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.3803
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	4407
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.9263
Heat Input Rate, MBtu/hr		=	1149.13
Particulate Emission Rate(lb/hr)	E(p)	=	4661.908
Particulate Emission Rate(lb/MBtu)		=	4.0576

B&W/WP&L, Reburn Optimization Test Series

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Tom Drake
Date: 5/20/92 Printed 15-Jun — Test No./Type: M17-I30
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1430-1610

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.75
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		543.53
Gas Meter Final Reading (cu ft)		589.66
Net Gas Sample Volume (cu ft)	V(m)	(46.13)
Vol of Liquid Collected (ml)	Vl(c)	93.8
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.415)
Wt. of Filter Particulate (gm)		8.8225
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(8.8225)
O2 Concentration (by CEM)	% O2	4.00
CO2 Concentration (by CEM)	% CO2	15.20
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.69)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.55	0.77	430.00	93.0		0.7416
2	4.00	0.50	0.70	435.00	93.0		0.7071
3	4.00	0.55	0.77	452.00	93.0		0.7416
B1	4.00	0.60	0.84	430.00	94.0		0.7746
2	4.00	0.50	0.70	445.00	94.0		0.7071
3	4.00	0.48	0.66	456.00	95.0		0.6928
C1	4.00	0.56	0.78	428.00	95.0		0.7483
2	4.00	0.50	0.70	442.00	95.0		0.7071
3	4.00	0.67	0.94	452.00	96.0		0.8185
D1	4.00	0.70	0.98	442.00	96.0		0.8367
2	4.00	0.55	0.77	444.00	97.0		0.7416
3	4.00	0.65	0.91	448.00	97.0		0.8062
E1	4.00	0.60	0.84	429.00	97.0		0.7746
2	4.00	0.55	0.77	444.00	98.0		0.7416
3	4.00	0.60	0.84	452.00	98.0		0.7416
E1	4.00	0.55	0.77	443.00	98.0		0.7211
2	4.00	0.52	0.73	450.00	99.0		0.7681
3	4.00	0.59	0.83	458.00	99.0		0.7874
F1	4.00	0.62	0.84	449.00	98.0		0.7874
2	4.00	0.56	0.78	455.00	98.0		0.7874
3	4.00	0.56	0.78	461.00	99.0		0.7483
F1	4.00	0.66	0.92	460.00	99.0		0.8124
2	4.00	0.55	0.77	461.00	99.0		0.7416
3	4.00	0.57	0.80	462.00	100.0		0.7550
TOTALS	96.00	13.74	19.19	10728.00	2320.00	0.0	18.1900

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.573
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.800
Avg Stack Temperature (degF)	T(s avg)	=	447.0
Average Meter Temperature (degF)	T(m avg)	=	48.3
Avg SQRT(dP)		=	0.758

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	48.20
Stack Gas Water Vapor Proportion	B(wo)	=	0.084
Mol. Wt., Stack Gas Dry	M(d)	=	30.49
Mol. Wt., Stack Gas Wet	M(s)	=	29.44
Abs Stack Pressure (in Hg)	P(s)	=	30.78
Avg Stack Velocity (ft/sec)	V(s avg)	=	54.5
Isokineticity (%)	% I	=	108.1
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	17[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	313659
Percent XS Air	PEA	=	20.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.8244
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	5230
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	2.2857
Heat Input Rate, MBtu/hr		=	865.25
Particulate Emission Rate(lb/hr)	E(p)	=	4165.127
Particulate Emission Rate(lb/MBtu)		=	4.8146

APPENDIX D

OPTIMIZATION TEST

M5 PARTICULATE LOADING AT ESP OUTLET—DATA SUMMARY

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/1/92 Printed 04-Aug — Test No./Type: M5-01
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1910-2210

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.172
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.44
Stack Static Pressure (in H2O)	P(stack)	19.000
Gas Meter Initial Reading (cu ft)		60.30
Gas Meter Final Reading (cu ft)		102.20
Net Gas Sample Volume (cu ft)	V(m)	(41.90)
Vol of Liquid Collected (ml)	Vl(c)	81.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.813)
Wt. of Filter Particulate (gm)		0.0557
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0557)
O2 Concentration (by CEM)	% O2	3.80
CO2 Concentration (by CEM)	% CO2	15.40
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.80)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.4	0.73	496	60.0	60.0	1.1832
2	4.00	1.1	0.57	496	62.0	60.0	1.0488
3	4.00	1.1	0.57	498	64.0	60.0	1.0488
B1	4.00	1.4	0.73	500	65.0	61.0	1.1832
2	4.00	1.5	0.78	502	67.0	62.0	1.2247
3	4.00	1.3	0.68	505	69.0	62.0	1.1402
C1	4.00	1.0	0.52	503	70.0	64.0	1.0000
2	4.00	1.4	0.73	507	71.0	64.0	1.1832
3	4.00	1.5	0.78	507	71.0	64.0	1.2247
D1	4.00	1.6	0.84	515	72.0	65.0	1.2649
2	4.00	1.5	0.78	514	73.0	66.0	1.2247
3	4.00	1.1	0.57	512	73.0	66.0	1.0488
E1	4.00	1.2	0.63	532	74.0	67.0	1.0954
2	4.00	1.1	0.57	544	74.0	67.0	1.0488
3	4.00	0.9	0.47	546	75.0	68.0	0.9487
F1	4.00	1.5	0.78	551	75.0	69.0	1.2247
2	4.00	1.4	0.73	550	75.0	70.0	1.1832
3	4.00	1.4	0.73	547	75.0	70.0	1.1832
G1	4.00	1.5	0.78	551	76.0	71.0	1.2247
2	4.00	1.3	0.68	555	76.0	71.0	1.1402
3	4.00	1.3	0.68	550	76.0	72.0	1.1402
H1	4.00	1.1	0.57	518	77.0	72.0	1.0488
2	4.00	1.5	0.78	528	77.0	72.0	1.2247
3	4.00	1.3	0.68	534	79.0	73.0	1.1402
TOTALS	96.00	31.40	16.36	12561.0	1726.0	1596.0	27.3783

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.308
~~Avg Orifice Meter Reading (in H2O)~~	~~dH(avg)~~	~~=~~	~~0.682~~
Avg Stack Temperature (degF)	T(s avg)	=	523.4
Average Meter Temperature (degF)	T(m avg)	=	69.2
Avg SQRT(dP)		=	1.141

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	41.60
Stack Gas Water Vapor Proportion	B(wo)	=	0.084
Mol. Wt., Stack Gas Dry	M(d)	=	30.62
Mol. Wt., Stack Gas Wet	M(s)	=	29.56
Abs Stack Pressure (in Hg)	P(s)	=	30.84
Avg Stack Velocity (ft/sec)	V(s avg)	=	85.1
Isokineticity (%)	% I	=	103.6
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	248456
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	490126
Percent XS Air	PEA	=	21.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0207
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	36
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0168
Heat Input Rate, MBtu/hr		=	1242.05
Particulate Emission Rate(lb/hr)	E(p)	=	43.991
Particulate Emission Rate(lb/MBtu)		=	0.0354

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/2/92 Printed 04-Aug — Test No./Type: M5-02
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1130-1405

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.172
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.44
Stack Static Pressure (in H2O)	P(stack)	19.000
Gas Meter Initial Reading (cu ft)		60.30
Gas Meter Final Reading (cu ft)		102.20
Net Gas Sample Volume (cu ft)	V(m)	(41.90)
Vol of Liquid Collected (ml)	Vl(c)	65.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.060)
Wt. of Filter Particulate (gm)		0.0930
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0930)
O2 Concentration (by CEM)	% O2	3.60
CO2 Concentration (by CEM)	% CO2	15.50
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.30	0.68	490	56.0	54.0	1.1402
2	4.00	1.10	0.57	490	59.0	55.0	1.0488
3	4.00	1.10	0.57	490	61.0	56.0	1.0488
B1	4.00	1.30	0.68	494	62.0	57.0	1.1402
2	4.00	1.40	0.73	496	65.0	58.0	1.1832
3	4.00	1.20	0.62	497	66.0	58.0	1.0954
C1	4.00	1.00	0.52	497	66.0	59.0	1.0000
2	4.00	1.30	0.68	501	68.0	60.0	1.1402
3	4.00	0.98	0.51	501	68.0	60.0	0.9899
D1	4.00	1.50	0.78	509	66.0	61.0	1.2247
2	4.00	1.50	0.78	508	69.0	61.0	1.2247
3	4.00	1.10	0.57	506	70.0	62.0	1.0488
E1	4.00	0.20	0.62	532	67.0	62.0	0.4472
2	4.00	1.10	0.57	542	70.0	63.0	1.0488
3	4.00	0.80	0.41	540	71.0	64.0	0.8944
F1	4.00	1.40	0.73	544	69.0	64.0	1.1832
2	4.00	1.30	0.68	544	71.0	64.0	1.1402
3	4.00	1.30	0.68	541	72.0	64.0	1.1402
G1	4.00	1.40	0.73	545	71.0	64.0	1.1832
2	4.00	1.20	0.62	545	72.0	65.0	1.0954
3	4.00	1.20	0.62	544	72.0	65.0	1.0954
H1	4.00	1.10	0.57	510	70.0	65.0	1.0488
2	4.00	1.50	0.78	522	72.0	66.0	1.2247
3	4.00	1.20	0.62	525	73.0	66.0	1.0954
TOTALS	96.00	28.48	15.32	12413.0	1626.0	1473.0	25.8822

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.187
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.638
Avg Stack Temperature (degF)	T(s avg)	=	517.2
Average Meter Temperature (degF)	T(m avg)	=	64.6
Avg SQRT(dP)		=	1.078

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	41.96
Stack Gas Water Vapor Proportion	B(wo)	=	0.068
Mol. Wt., Stack Gas Dry	M(d)	=	30.62
Mol. Wt., Stack Gas Wet	M(s)	=	29.77
Abs Stack Pressure (in Hg)	P(s)	=	30.84
Avg Stack Velocity (ft/sec)	V(s avg)	=	79.9
Isokineticity (%)	% I	=	109.0
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	2
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	460255
Percent XS Air	PEA	=	20.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0342
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	63
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0275
Heat Input Rate, MBtu/hr		=	1208.19
Particulate Emission Rate(lb/hr)	E(p)	=	69.987
Particulate Emission Rate(lb/MBtu)		=	0.0579

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/3/92 Printed 04-Aug — Test No./Type: M5-03
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1138-1335

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.172
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.60
Stack Static Pressure (in H2O)	P(stack)	21.000
Gas Meter Initial Reading (cu ft)		102.40
Gas Meter Final Reading (cu ft)		147.20
Net Gas Sample Volume (cu ft)	V(m)	(44.80)
Vol of Liquid Collected (ml)	Vl(c)	89.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.189)
Wt. of Filter Particulate (gm)		0.2221
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.2221)
O2 Concentration (by CEM)	% O2	4.70
CO2 Concentration (by CEM)	% CO2	14.70
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.60)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.60	0.83	496	66.0	65.0	1.2649
2	4.00	1.50	0.78	496	68.0	66.0	1.2247
3	4.00	1.30	0.68	499	70.0	66.0	1.1402
B1	4.00	1.50	0.78	503	70.0	66.0	1.2247
2	4.00	1.70	0.88	510	72.0	67.0	1.3038
3	4.00	1.40	0.73	512	73.0	67.0	1.1832
C1	4.00	1.40	0.73	518	70.0	66.0	1.1832
2	4.00	1.60	0.83	521	72.0	66.0	1.2649
3	4.00	1.30	0.68	522	73.0	67.0	1.1402
D1	4.00	1.60	0.83	530	71.0	66.0	1.2649
2	4.00	1.80	0.93	532	73.0	67.0	1.3416
3	4.00	1.30	0.68	531	75.0	67.0	1.1402
E1	4.00	1.50	0.78	511	72.0	68.0	1.2247
2	4.00	1.60	0.83	582	74.0	68.0	1.2649
3	4.00	1.10	0.57	585	75.0	68.0	1.0488
F1	4.00	1.10	0.57	583	73.0	69.0	1.0488
2	4.00	1.10	0.57	589	75.0	69.0	1.0488
3	4.00	0.97	0.51	585	75.0	70.0	0.9849
G1	4.00	1.10	0.57	590	75.0	70.0	1.0488
2	4.00	1.20	0.62	593	75.0	70.0	1.0954
3	4.00	0.91	0.47	588	76.0	71.0	0.9539
H1	4.00	1.60	0.83	559	76.0	71.0	1.2649
2	4.00	1.80	0.94	564	79.0	72.0	1.3416
3	4.00	1.10	0.57	563	80.0	72.0	1.0488
TOTALS	96.00	33.08	17.19	13062.0	1758.0	1634.0	28.0512

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.378
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.716
Avg Stack Temperature (degF)	T(s avg)	=	544.3
Average Meter Temperature (degF)	T(m avg)	=	70.7
Avg SQRT(dP)		=	1.169

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	44.60
Stack Gas Water Vapor Proportion	B(wo)	=	0.086
Mol. Wt., Stack Gas Dry	M(d)	=	30.54
Mol. Wt., Stack Gas Wet	M(s)	=	29.46
Abs Stack Pressure (in Hg)	P(s)	=	31.14
Avg Stack Velocity (ft/sec)	V(s avg)	=	87.8
Isokineticity (%)	% I	=	109.3
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	253027
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	505766
Percent XS Air	PEA	=	28.4
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0768
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	151
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0660
Heat Input Rate, MBtu/hr		=	1198.33
Particulate Emission Rate(lb/hr)	E(p)	=	166.596
Particulate Emission Rate(lb/MBtu)		=	0.1390

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/6/92 Printed 04-Aug — Test No./Type: M5-04
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1325-1519

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.172
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.60
Stack Static Pressure (in H2O)	P(stack)	12.000
Gas Meter Initial Reading (cu ft)		147.30
Gas Meter Final Reading (cu ft)		182.90
Net Gas Sample Volume (cu ft)	V(m)	(35.60)
Vol of Liquid Collected (ml)	Vl(c)	62.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(2.918)
Wt. of Filter Particulate (gm)		0.0527
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0527)
O2 Concentration (by CEM)	% O2	4.20
CO2 Concentration (by CEM)	% CO2	11.10
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(84.70)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.90	0.47	483	79.0	77.0	0.9487
2	4.00	0.78	0.41	483	80.0	78.0	0.8832
3	4.00	0.77	0.40	484	81.0	78.0	0.8775
B1	4.00	1.10	0.57	489	81.0	79.0	1.0488
2	4.00	0.95	0.49	490	83.0	79.0	0.9747
3	4.00	0.80	0.42	490	84.0	79.0	0.8944
C1	4.00	0.62	0.32	489	83.0	80.0	0.7874
2	4.00	0.77	0.40	489	84.0	79.0	0.8775
3	4.00	0.68	0.35	489	84.0	80.0	0.8246
D1	4.00	1.00	0.52	492	84.0	81.0	1.0000
2	4.00	1.10	0.57	493	85.0	81.0	1.0488
3	4.00	0.82	0.43	493	85.0	81.0	0.9055
E1	4.00	0.71	0.37	508	83.0	80.0	0.8426
2	4.00	0.70	0.36	510	84.0	81.0	0.8367
3	4.00	0.40	0.21	508	84.0	80.0	0.6325
F1	4.00	0.95	0.49	509	82.0	80.0	0.9747
2	4.00	0.88	0.46	511	83.0	80.0	0.9381
3	4.00	0.81	0.42	510	84.0	80.0	0.9000
G1	4.00	0.79	0.41	510	83.0	80.0	0.8888
2	4.00	0.80	0.42	511	84.0	80.0	0.8944
3	4.00	0.87	0.45	509	84.0	80.0	0.9327
H1	4.00	0.77	0.40	481	84.0	81.0	0.8775
2	4.00	0.86	0.45	492	85.0	81.0	0.9274
3	4.00	0.61	0.32	493	85.0	81.0	0.7810
TOTALS	96.00	19.44	10.11	11916.0	1998.0	1916.0	21.4975

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.810
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.421
Avg Stack Temperature (degF)	T(s avg)	=	496.5
Average Meter Temperature (degF)	T(m avg)	=	81.5
Avg SQRT(dP)		=	0.896

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	34.70
Stack Gas Water Vapor Proportion	B(wo)	=	0.078
Mol. Wt., Stack Gas Dry	M(d)	=	29.94
Mol. Wt., Stack Gas Wet	M(s)	=	29.02
Abs Stack Pressure (in Hg)	P(s)	=	30.48
Avg Stack Velocity (ft/sec)	V(s avg)	=	66.9
Isokineticity (%)	% I	=	107.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	19[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	385285
Percent XS Air	PEA	=	23.1
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0234
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	45
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0195
Heat Input Rate, MBtu/hr		=	975.80
Particulate Emission Rate(lb/hr)	E(p)	=	40.158
Particulate Emission Rate(lb/MBtu)		=	0.0412

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier

Date: 4/7/92 Printed 04-Aug — Test No./Type: M5-05

Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1017-1209

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.172
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.50
Stack Static Pressure (in H2O)	P(stack)	21.000
Gas Meter Initial Reading (cu ft)		183.10
Gas Meter Final Reading (cu ft)		226.50
Net Gas Sample Volume (cu ft)	V(m)	(43.40)
Vol of Liquid Collected (ml)	Vl(c)	88.7
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.175)
Wt. of Filter Particulate (gm)		0.1418
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.1418)
O2 Concentration (by CEM)	% O2	3.00
CO2 Concentration (by CEM)	% CO2	15.60
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.40)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.40	0.73	499	74.0	73.0	1.1832
2	4.00	1.20	0.62	499	76.0	74.0	1.0954
3	4.00	1.30	0.68	499	79.0	75.0	1.1402
B1	4.00	1.50	0.78	500	80.0	75.0	1.2247
2	4.00	1.40	0.73	505	83.0	76.0	1.1832
3	4.00	1.30	0.68	505	83.0	76.0	1.1402
C1	4.00	1.10	0.57	501	83.0	77.0	1.0488
2	4.00	1.40	0.73	509	84.0	77.0	1.1832
3	4.00	1.10	0.57	509	85.0	77.0	1.0488
D1	4.00	1.50	0.78	516	83.0	77.0	1.2247
2	4.00	1.60	0.83	516	84.0	77.0	1.2649
3	4.00	1.20	0.62	514	85.0	78.0	1.0954
E1	4.00	1.30	0.68	557	82.0	78.0	1.1402
2	4.00	1.10	0.57	558	85.0	78.0	1.0488
3	4.00	0.74	0.38	556	85.0	79.0	0.8602
F1	4.00	1.40	0.73	561	84.0	79.0	1.1832
2	4.00	1.20	0.62	563	85.0	80.0	1.0954
3	4.00	1.20	0.62	562	86.0	80.0	1.0954
G1	4.00	1.30	0.68	563	85.0	80.0	1.1402
2	4.00	1.10	0.57	564	86.0	80.0	1.0488
3	4.00	0.98	0.51	562	87.0	81.0	0.9899
H1	4.00	1.40	0.73	542	86.0	81.0	1.1832
2	4.00	0.98	0.51	543	88.0	82.0	0.9899
3	4.00	0.98	0.51	543	88.0	82.0	0.9899
TOTALS	96.00	29.68	15.43	12746.0	2006.0	1872.0	26.5983

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.237
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.643
Avg Stack Temperature (degF)	T(s avg)	=	531.1
Average Meter Temperature (degF)	T(m avg)	=	80.8
Avg SQRT(dP)		=	1.108

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	42.25
Stack Gas Water Vapor Proportion	B(wo)	=	0.090
Mol. Wt., Stack Gas Dry	M(d)	=	30.62
Mol. Wt., Stack Gas Wet	M(s)	=	29.48
Abs Stack Pressure (in Hg)	P(s)	=	31.04
Avg Stack Velocity (ft/sec)	V(s avg)	=	82.8
Isokineticity (%)	% I	=	109.2
Stack Gas STD Vol. Flow (dscfm)	Q(s)	=	239974
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	477036
Percent XS Air	PEA	=	16.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0516
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	92
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0403
Heat Input Rate, MBtu/hr		=	1255.77
Particulate Emission Rate(lb/hr)	E(p)	=	106.487
Particulate Emission Rate(lb/MBtu)		=	0.0848

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/8/92 Printed 04-Aug — Test No./Type: M5-06
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1109-1309

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.172
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.48
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		226.70
Gas Meter Final Reading (cu ft)		268.90
Net Gas Sample Volume (cu ft)	V(m)	(42.20)
Vol of Liquid Collected (ml)	Vl(c)	73.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.460)
Wt. of Filter Particulate (gm)		0.1499
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.1499)
O2 Concentration (by CEM)	% O2	2.60 (from B&W)
CO2 Concentration (by CEM)	% CO2	15.90 (estimate)
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.50)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.30	0.68	486	72.0	71.0	1.1402
2	4.00	1.10	0.57	488	74.0	72.0	1.0488
3	4.00	1.40	0.73	487	76.0	72.0	1.1832
B1	4.00	1.40	0.73	491	78.0	73.0	1.1832
2	4.00	1.30	0.68	492	79.0	73.0	1.1402
3	4.00	1.20	0.65	492	80.0	73.0	1.0954
C1	4.00	1.20	0.65	475	79.0	74.0	1.0954
2	4.00	1.30	0.68	490	80.0	74.0	1.1402
3	4.00	1.20	0.65	490	80.0	74.0	1.0954
D1	4.00	1.50	0.78	489	78.0	74.0	1.2247
2	4.00	1.50	0.78	492	80.0	74.0	1.2247
3	4.00	1.30	0.68	492	80.0	74.0	1.1402
E1	4.00	1.40	0.73	499	77.0	74.0	1.1832
2	4.00	1.00	0.52	503	79.0	74.0	1.0000
3	4.00	0.90	0.47	501	80.0	75.0	0.9487
F1	4.00	1.30	0.68	500	79.0	75.0	1.1402
2	4.00	1.30	0.68	504	79.0	74.0	1.1402
3	4.00	1.10	0.57	503	80.0	74.0	1.0488
G1	4.00	1.20	0.62	504	79.0	75.0	1.0954
2	4.00	1.20	0.62	505	80.0	75.0	1.0954
3	4.00	0.93	0.48	503	80.0	74.0	0.9644
H1	4.00	1.50	0.78	504	79.0	75.0	1.2247
2	4.00	1.00	0.52	506	80.0	75.0	1.0000
3	4.00	0.97	0.50	505	80.0	74.0	0.9849
TOTALS	96.00	29.50	15.43	11901.0	1888.0	1772.0	26.5377

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.229
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.643
Avg Stack Temperature (degF)	T(s avg)	=	495.9
Average Meter Temperature (degF)	T(m avg)	=	76.3
Avg SQRT(dP)		=	1.106

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	41.40
Stack Gas Water Vapor Proportion	B(wo)	=	0.077
Mol. Wt., Stack Gas Dry	M(d)	=	30.65
Mol. Wt., Stack Gas Wet	M(s)	=	29.67
Abs Stack Pressure (in Hg)	P(s)	=	30.95
Avg Stack Velocity (ft/sec)	V(s avg)	=	81.0
Isokineticity (%)	% I	=	104.4
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	24
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	466614
Percent XS Air	PEA	=	13.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0559
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	.97
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0425
Heat Input Rate, MBtu/hr		=	1316.40
Particulate Emission Rate(lb/hr)	E(p)	=	117.792
Particulate Emission Rate(lb/MBtu)		=	0.0895

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/9/92 Printed 04-Aug — Test No./Type: M5-07
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1100-1249

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.172
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.44
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		268.80
Gas Meter Final Reading (cu ft)		309.90
Net Gas Sample Volume (cu ft)	V(m)	(41.10)
Vol of Liquid Collected (ml)	Vl(c)	45.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(2.142)
Wt. of Filter Particulate (gm)		0.1005
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.1005)
O2 Concentration (by CEM)	% O2	2.70 (from B&W)
CO2 Concentration (by CEM)	% CO2	15.80 (estimate)
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.50)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.30	0.68	482	68.0	66.0	1.1402
2	4.00	1.10	0.57	481	69.0	67.0	1.0488
3	4.00	1.00	0.52	480	71.0	68.0	1.0000
B1	4.00	1.50	0.78	482	72.0	68.0	1.2247
2	4.00	1.20	0.62	484	74.0	68.0	1.0954
3	4.00	1.30	0.68	484	75.0	69.0	1.1402
C1	4.00	0.86	0.45	483	73.0	69.0	0.9274
2	4.00	1.20	0.62	484	74.0	69.0	1.0954
3	4.00	1.00	0.52	484	75.0	69.0	1.0000
D1	4.00	1.50	0.78	486	74.0	70.0	1.2247
2	4.00	1.50	0.78	488	76.0	70.0	1.2247
3	4.00	1.10	0.57	488	77.0	70.0	1.0488
E1	4.00	1.10	0.57	493	75.0	70.0	1.0488
2	4.00	1.10	0.57	500	76.0	71.0	1.0488
3	4.00	0.62	0.32	499	77.0	71.0	0.7874
F1	4.00	1.40	0.73	497	76.0	71.0	1.1832
2	4.00	1.10	0.57	503	77.0	71.0	1.0488
3	4.00	1.10	0.57	505	77.0	71.0	1.0488
G1	4.00	1.30	0.68	503	76.0	71.0	1.1402
2	4.00	1.10	0.57	504	77.0	71.0	1.0488
3	4.00	1.10	0.57	503	77.0	71.0	1.0488
H1	4.00	1.20	0.62	505	75.0	71.0	1.0954
2	4.00	1.30	0.68	505	77.0	71.0	1.1402
3	4.00	1.20	0.62	504	78.0	71.0	1.0954
TOTALS	96.00	28.18	14.64	11827.0	1796.0	1674.0	25.9052

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.174
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.610
Avg Stack Temperature (degF)	T(s avg)	=	492.8
Average Meter Temperature (degF)	T(m avg)	=	72.3
Avg SQRT(dP)		=	1.079

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	40.56
Stack Gas Water Vapor Proportion	B(wo)	=	0.050
Mol. Wt., Stack Gas Dry	M(d)	=	30.64
Mol. Wt., Stack Gas Wet	M(s)	=	30.00
Abs Stack Pressure (in Hg)	P(s)	=	30.91
Avg Stack Velocity (ft/sec)	V(s avg)	=	78.6
Isokineticity (%)	% I	=	102.2
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	246091
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	452544
Percent XS Air	PEA	=	14.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0382
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	67
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0292
Heat Input Rate, MBtu/hr		=	1309.36
Particulate Emission Rate(lb/hr)	E(p)	=	80.606
Particulate Emission Rate(lb/MBtu)		=	0.0616

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/10/92 Printed 04-Aug — Test No./Type: M5-08
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1053-1338

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.172
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	19.000
Gas Meter Initial Reading (cu ft)		310.60
Gas Meter Final Reading (cu ft)		351.40
Net Gas Sample Volume (cu ft)	V(m)	(40.80)
Vol of Liquid Collected (ml)	Vl(c)	59.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(2.777)
Wt. of Filter Particulate (gm)		0.0476
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0476)
O2 Concentration (by CEM)	% O2	2.90
CO2 Concentration (by CEM)	% CO2	15.20
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.40	0.73	471	49.0	48.0	1.1832
2	4.00	1.10	0.57	471	52.0	49.0	1.0488
3	4.00	1.10	0.57	471	53.0	49.0	1.0488
B1	4.00	1.40	0.73	474	54.0	50.0	1.1832
2	4.00	1.30	0.68	475	56.0	50.0	1.1402
3	4.00	1.20	0.62	475	56.0	50.0	1.0954
C1	4.00	1.10	0.57	472	55.0	51.0	1.0488
2	4.00	1.20	0.62	474	57.0	51.0	1.0954
3	4.00	0.95	0.49	474	56.0	51.0	0.9747
D1	4.00	1.10	0.57	473	56.0	51.0	1.0488
2	4.00	1.40	0.73	477	57.0	52.0	1.1832
3	4.00	1.10	0.57	479	58.0	52.0	1.0488
E1	4.00	1.20	0.62	497	50.0	49.0	1.0954
2	4.00	1.10	0.57	497	51.0	49.0	1.0488
3	4.00	0.57	0.30	495	53.0	50.0	0.7550
F1	4.00	1.40	0.73	492	52.0	50.0	1.1832
2	4.00	1.20	0.62	501	54.0	50.0	1.0954
3	4.00	1.20	0.62	500	55.0	50.0	1.1832
G1	4.00	1.30	0.68	500	55.0	50.0	1.0954
2	4.00	1.20	0.62	501	56.0	50.0	1.0954
3	4.00	1.20	0.62	500	56.0	50.0	1.0954
H1	4.00	1.30	0.68	502	55.0	50.0	1.1402
2	4.00	1.30	0.68	502	57.0	51.0	1.1402
3	4.00	1.20	0.62	500	57.0	51.0	1.0954
TOTALS	96.00	28.52	14.81	11673.0	1310.0	1204.0	26.1227

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.188
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.617
Avg Stack Temperature (degF)	T(s avg)	=	486.4
Average Meter Temperature (degF)	T(m avg)	=	52.4
Avg SQRT(dP)		=	1.088

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	42.09
Stack Gas Water Vapor Proportion	B(wo)	=	0.062
Mol. Wt., Stack Gas Dry	M(d)	=	30.55
Mol. Wt., Stack Gas Wet	M(s)	=	29.77
Abs Stack Pressure (in Hg)	P(s)	=	31.02
Avg Stack Velocity (ft/sec)	V(s avg)	=	79.1
Isokineticity (%)	% I	=	105.6
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	2
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	455
Percent XS Air	PEA	=	15.5
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0174
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	31
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0135
Heat Input Rate, MBtu/hr		=	1301.31
Particulate Emission Rate(lb/hr)	E(p)	=	36.977
Particulate Emission Rate(lb/MBtu)		=	0.0284

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/13/92 Printed 04-Aug — Test No./Type: M5-09
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1104-1254

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.172
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.60
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		351.80
Gas Meter Final Reading (cu ft)		392.70
Net Gas Sample Volume (cu ft)	V(m)	(40.90)
Vol of Liquid Collected (ml)	Vl(c)	97.7
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.599)
Wt. of Filter Particulate (gm)		0.0397
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0397)
O2 Concentration (by CEM)	% O2	3.40
CO2 Concentration (by CEM)	% CO2	15.10
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.50)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.30	0.68	462	42.0	40.0	1.1402
2	4.00	1.10	0.57	461	44.0	40.0	1.0488
3	4.00	1.10	0.57	462	46.0	41.0	1.0488
B1	4.00	1.50	0.78	464	46.0	41.0	1.2247
2	4.00	1.30	0.68	467	48.0	42.0	1.1402
3	4.00	1.30	0.68	468	50.0	43.0	1.1402
C1	4.00	1.10	0.57	470	49.0	44.0	1.0488
2	4.00	1.20	0.62	472	51.0	44.0	1.0954
3	4.00	0.95	0.49	472	51.0	44.0	0.9747
D1	4.00	1.50	0.78	475	50.0	45.0	1.2247
2	4.00	1.50	0.78	478	52.0	45.0	1.2247
3	4.00	1.10	0.57	477	53.0	46.0	1.0488
E1	4.00	1.20	0.62	488	50.0	46.0	1.0954
2	4.00	1.20	0.62	489	52.0	46.0	1.0954
3	4.00	0.88	0.46	488	53.0	47.0	0.9381
F1	4.00	1.20	0.62	489	52.0	47.0	1.0954
2	4.00	1.30	0.68	494	53.0	47.0	1.1402
3	4.00	1.10	0.57	493	54.0	47.0	1.0954
G1	4.00	1.20	0.62	493	53.0	48.0	1.1402
2	4.00	1.30	0.68	495	54.0	48.0	1.0488
3	4.00	1.30	0.68	494	55.0	48.0	1.1402
H1	4.00	1.10	0.57	471	53.0	48.0	1.0488
2	4.00	1.30	0.68	478	54.0	49.0	1.1402
3	4.00	1.20	0.62	482	55.0	49.0	1.0954
TOTALS	96.00	29.23	15.19	11482.0	1220.0	1085.0	26.4337

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.218
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.633
Avg Stack Temperature (degF)	T(s avg)	=	478.4
Average Meter Temperature (degF)	T(m avg)	=	48.0
Avg SQRT(dP)		=	1.101

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	42.52
Stack Gas Water Vapor Proportion	B(wo)	=	0.098
Mol. Wt., Stack Gas Dry	M(d)	=	30.55
Mol. Wt., Stack Gas Wet	M(s)	=	29.33
Abs Stack Pressure (in Hg)	P(s)	=	31.07
Avg Stack Velocity (ft/sec)	V(s avg)	=	80.3
Isokineticity (%)	% I	=	108.2
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	243772
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	462332
Percent XS Air	PEA	=	18.8
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0144
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	26
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0115
Heat Input Rate, MBtu/hr		=	1247.14
Particulate Emission Rate(lb/hr)	E(p)	=	30.117
Particulate Emission Rate(lb/MBtu)		=	0.0242

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/15/92 Printed 04-Aug — Test No./Type: M5-010
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 2139-2330

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.172
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.54
Stack Static Pressure (in H20)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		393.40
Gas Meter Final Reading (cu ft)		424.10
Net Gas Sample Volume (cu ft)	V(m)	(30.70)
Vol of Liquid Collected (ml)	Vl(c)	64.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.036)
Wt. of Filter Particulate (gm)		0.0326
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0326)
O2 Concentration (by CEM)	% O2	4.20
CO2 Concentration (by CEM)	% CO2	14.90
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H20)	Orifice Meter,dH (in H20)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.65	0.34	468	58.0	57.0	0.8062
2	4.00	0.62	0.32	466	58.0	57.0	0.7874
3	4.00	0.58	0.30	465	58.0	57.0	0.7616
B1	4.00	0.74	0.38	462	59.0	57.0	0.8602
2	4.00	0.74	0.38	468	60.0	58.0	0.8602
3	4.00	0.66	0.34	469	61.0	58.0	0.8124
C1	4.00	0.62	0.32	463	61.0	58.0	0.7874
2	4.00	0.68	0.35	465	62.0	58.0	0.8246
3	4.00	0.58	0.30	464	62.0	58.0	0.7616
D1	4.00	0.63	0.33	464	61.0	58.0	0.7937
2	4.00	0.70	0.36	465	62.0	59.0	0.8367
3	4.00	0.60	0.31	463	62.0	59.0	0.7746
E1	4.00	0.66	0.34	446	61.0	59.0	0.8124
2	4.00	0.66	0.34	458	63.0	59.0	0.8124
3	4.00	0.55	0.29	457	63.0	59.0	0.7416
F1	4.00	0.82	0.43	452	62.0	59.0	0.9055
2	4.00	0.82	0.43	455	63.0	59.0	0.9055
3	4.00	0.68	0.35	451	64.0	59.0	0.9055
G1	4.00	0.48	0.25	445	63.0	59.0	0.9055
2	4.00	0.48	0.25	448	64.0	60.0	0.8246
3	4.00	0.34	0.18	446	63.0	60.0	0.5831
H1	4.00	0.57	0.30	419	62.0	59.0	0.7550
2	4.00	0.76	0.39	424	63.0	60.0	0.8718
3	4.00	0.69	0.36	428	63.0	60.0	0.8307
TOTALS	96.00	15.31	7.94	10911.0	1478.0	1406.0	19.5204

FIELD DATA AVERAGES

Avg Velocity Head (in H20)	dP(avg)	=	0.638
Avg Orifice Meter Reading (in H20)	dH(avg)	=	0.331
Avg Stack Temperature (degF)	T(s avg)	=	454.6
Average Meter Temperature (degF)	T(m avg)	=	60.1
Avg SQRT(dP)		=	0.813

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	31.09
Stack Gas Water Vapor Proportion	B(wo)	=	0.089
Mol. Wt., Stack Gas Dry	M(d)	=	30.55
Mol. Wt., Stack Gas Wet	M(s)	=	29.44
Abs Stack Pressure (in Hg)	P(s)	=	30.57
Avg Stack Velocity (ft/sec)	V(s avg)	=	58.9
Isokineticity (%)	% I	=	105.8
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	1[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	33[illegible]
Percent XS Air	PEA	=	24.5
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0162
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	31
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0135
Heat Input Rate, MBtu/hr		=	889.82
Particulate Emission Rate(lb/hr)	E(p)	=	25.231
Particulate Emission Rate(lb/MBtu)		=	0.0284

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier

~~Date: 4/16/92 Printed 04-Aug~~ Test No./Type: M5-011

Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 2048-2232

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.172
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.64
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		424.30
Gas Meter Final Reading (cu ft)		455.10
Net Gas Sample Volume (cu ft)	V(m)	(30.80)
Vol of Liquid Collected (ml)	Vl(c)	79.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.719)
Wt. of Filter Particulate (gm)		0.0392
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0392)
O2 Concentration (by CEM)	% O2	3.80
CO2 Concentration (by CEM)	% CO2	15.90
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.30)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.75	0.39	476	62.0	61.0	0.8660
2	4.00	0.64	0.33	474	64.0	62.0	0.8000
3	4.00	0.63	0.33	473	65.0	62.0	0.7937
B1	4.00	0.83	0.43	472	66.0	63.0	0.9110
2	4.00	0.76	0.40	475	67.0	64.0	0.8718
3	4.00	0.74	0.38	476	68.0	64.0	0.8602
C1	4.00	0.49	0.25	471	69.0	65.0	0.7000
2	4.00	0.75	0.39	471	70.0	65.0	0.8660
3	4.00	0.60	0.31	468	71.0	66.0	0.7746
D1	4.00	0.54	0.28	470	71.0	66.0	0.7348
2	4.00	0.75	0.39	470	71.0	67.0	0.8660
3	4.00	0.59	0.31	467	72.0	67.0	0.7681
E1	4.00	0.77	0.40	441	71.0	68.0	0.8775
2	4.00	0.61	0.32	458	72.0	68.0	0.7810
3	4.00	0.52	0.27	456	73.0	69.0	0.7211
F1	4.00	0.73	0.38	454	72.0	69.0	0.8544
2	4.00	0.69	0.36	455	73.0	69.0	0.8307
3	4.00	0.67	0.35	452	73.0	69.0	0.8544
G1	4.00	0.47	0.24	447	72.0	69.0	0.8307
2	4.00	0.43	0.22	449	72.0	69.0	0.8185
3	4.00	0.38	0.20	448	72.0	69.0	0.6164
H1	4.00	0.60	0.31	420	72.0	69.0	0.7746
2	4.00	0.72	0.37	425	72.0	70.0	0.8485
3	4.00	0.63	0.33	429	73.0	70.0	0.7937
TOTALS	96.00	15.29	7.94	10997.0	1683.0	1600.0	19.4140

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.637
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.331
Avg Stack Temperature (degF)	T(s avg)	=	458.2
Average Meter Temperature (degF)	T(m avg)	=	68.4
Avg SQRT(dP)		=	0.809

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	30.81
Stack Gas Water Vapor Proportion	B(wo)	=	0.106
Mol. Wt., Stack Gas Dry	M(d)	=	30.70
Mol. Wt., Stack Gas Wet	M(s)	=	29.33
Abs Stack Pressure (in Hg)	P(s)	=	30.67
Avg Stack Velocity (ft/sec)	V(s avg)	=	58.7
Isokineticity (%)	% I	=	107.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	177803
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	338060
Percent XS Air	PEA	=	21.8
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0196
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	37
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0160
Heat Input Rate, MBtu/hr		=	888.85
Particulate Emission Rate(lb/hr)	E(p)	=	29.925
Particulate Emission Rate(lb/MBtu)		=	0.0337

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/21/92 Printed 04-Aug — Test No./Type: M5-D12
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 2204-2356

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.172
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	28.82
Stack Static Pressure (in H2O)	P(stack)	15.000
Gas Meter Initial Reading (cu ft)		455.90
Gas Meter Final Reading (cu ft)		487.30
Net Gas Sample Volume (cu ft)	V(m)	(31.40)
Vol of Liquid Collected (ml)	Vl(c)	34.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(1.600)
Wt. of Filter Particulate (gm)		0.0294
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0294)
O2 Concentration (by CEM)	% O2	4.50
CO2 Concentration (by CEM)	% CO2	13.80
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.70)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.76	0.40	485	43.0	43.0	0.8718
2	4.00	0.71	0.37	484	44.0	43.0	0.8426
3	4.00	0.65	0.34	483	45.0	43.0	0.8062
B1	4.00	0.91	0.47	485	46.0	43.0	0.9539
2	4.00	0.83	0.43	487	47.0	44.0	0.9110
3	4.00	0.76	0.40	488	48.0	44.0	0.8718
C1	4.00	0.61	0.31	483	48.0	44.0	0.7810
2	4.00	0.65	0.34	483	48.0	45.0	0.8062
3	4.00	0.58	0.30	484	49.0	45.0	0.7616
D1	4.00	0.67	0.35	483	48.0	45.0	0.8185
2	4.00	0.70	0.36	482	48.0	45.0	0.8367
3	4.00	0.61	0.31	481	49.0	45.0	0.7810
E1	4.00	0.84	0.44	466	48.0	45.0	0.9165
2	4.00	0.75	0.39	475	49.0	45.0	0.8660
3	4.00	0.54	0.28	474	49.0	46.0	0.7348
F1	4.00	0.80	0.42	471	49.0	46.0	0.8944
2	4.00	0.66	0.34	470	50.0	46.0	0.8124
3	4.00	0.62	0.32	467	50.0	46.0	0.8944
G1	4.00	0.56	0.29	467	49.0	46.0	0.8124
2	4.00	0.64	0.33	467	50.0	46.0	0.7874
3	4.00	0.57	0.30	467	50.0	46.0	0.7550
H1	4.00	0.73	0.38	441	49.0	46.0	0.8544
2	4.00	0.89	0.46	446	49.0	46.0	0.9434
3	4.00	0.64	0.33	448	50.0	46.0	0.8000
TOTALS	96.00	16.68	8.66	11367.0	1155.0	1079.0	20.1137

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.695
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.361
Avg Stack Temperature (degF)	T(s avg)	=	473.6
Average Meter Temperature (degF)	T(m avg)	=	46.5
Avg SQRT(dP)		=	0.838

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	31.86
Stack Gas Water Vapor Proportion	B(wo)	=	0.046
Mol. Wt., Stack Gas Dry	M(d)	=	30.39
Mol. Wt., Stack Gas Wet	M(s)	=	29.80
Abs Stack Pressure (in Hg)	P(s)	=	29.92
Avg Stack Velocity (ft/sec)	V(s avg)	=	61.6
Isokineticity (%)	% I	=	103.4
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	1[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	3[illegible]
Percent XS Air	PEA	=	26.4
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0142
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	28
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0121
Heat Input Rate, MBtu/hr		=	915.93
Particulate Emission Rate(lb/hr)	E(p)	=	23.297
Particulate Emission Rate(lb/MBtu)		=	0.0254

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier

Date: 4/22/92 Printed 04-Aug Test No./Type: M5-013

Sample Location: Unit 2, ESP Outlet Start/Stop Time: 2224-0011

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.46
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		487.50
Gas Meter Final Reading (cu ft)		521.00
Net Gas Sample Volume (cu ft)	V(m)	(33.50)
Vol of Liquid Collected (ml)	Vl(c)	73.8
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.474)
Wt. of Filter Particulate (gm)		0.0544
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0544)
O2 Concentration (by CEM)	% O2	4.60
CO2 Concentration (by CEM)	% CO2	14.20
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.20)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.27	0.38	429	48.0	47.0	0.5196
2	4.00	0.30	0.42	432	48.0	47.0	0.5477
3	4.00	0.28	0.39	431	50.0	48.0	0.5292
B1	4.00	0.35	0.49	439	51.0	48.0	0.5916
2	4.00	0.35	0.49	432	52.0	49.0	0.5916
3	4.00	0.33	0.46	431	53.0	49.0	0.5745
C1	4.00	0.26	0.36	427	53.0	50.0	0.5099
2	4.00	0.30	0.42	427	55.0	50.0	0.5477
3	4.00	0.28	0.39	425	56.0	51.0	0.5292
D1	4.00	0.27	0.38	425	56.0	51.0	0.5196
2	4.00	0.30	0.42	425	57.0	52.0	0.5477
3	4.00	0.28	0.39	423	58.0	52.0	0.5292
E1	4.00	0.32	0.45	417	57.0	53.0	0.5657
2	4.00	0.28	0.39	422	59.0	54.0	0.5292
3	4.00	0.22	0.31	421	59.0	54.0	0.4690
F1	4.00	0.35	0.49	415	59.0	55.0	0.5916
2	4.00	0.33	0.46	418	60.0	55.0	0.5745
3	4.00	0.32	0.45	416	61.0	55.0	0.5916
G1	4.00	0.15	0.21	411	59.0	55.0	0.5745
2	4.00	0.20	0.28	412	60.0	55.0	0.5657
3	4.00	0.17	0.24	411	60.0	56.0	0.4123
H1	4.00	0.28	0.39	397	59.0	56.0	0.5292
2	4.00	0.35	0.49	397	60.0	57.0	0.5916
3	4.00	0.35	0.49	393	61.0	56.0	0.5916
TOTALS	96.00	6.89	9.64	10076.0	1351.0	1255.0	13.1238

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.287
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.402
Avg Stack Temperature (degF)	T(s avg)	=	419.8
Average Meter Temperature (degF)	T(m avg)	=	54.3
Avg SQRT(dP)		=	0.547

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	34.22
Stack Gas Water Vapor Proportion	B(wo)	=	0.092
Mol. Wt., Stack Gas Dry	M(d)	=	30.46
Mol. Wt., Stack Gas Wet	M(s)	=	29.31
Abs Stack Pressure (in Hg)	P(s)	=	30.20
Avg Stack Velocity (ft/sec)	V(s avg)	=	39.2
Isokineticity (%)	% I	=	106.6
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	124001
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	225528
Percent XS Air	PEA	=	27.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0245
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	46
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0210
Heat Input Rate, MBtu/hr		=	590.89
Particulate Emission Rate(lb/hr)	E(p)	=	26.084
Particulate Emission Rate(lb/MBtu)		=	0.0442

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/23/92 Printed 04-Aug — Test No./Type: M5-014
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 2240-0025

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.53
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		521.20
Gas Meter Final Reading (cu ft)		557.90
Net Gas Sample Volume (cu ft)	V(m)	(36.70)
Vol of Liquid Collected (ml)	Vl(c)	71.7
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.375)
Wt. of Filter Particulate (gm)		0.0355
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0355)
O2 Concentration (by CEM)	% O2	5.30
CO2 Concentration (by CEM)	% CO2	14.40
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.30)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.38	0.53	433	55.0	54.0	0.6164
2	4.00	0.38	0.53	439	55.0	54.0	0.6164
3	4.00	0.32	0.45	438	55.0	54.0	0.5657
B1	4.00	0.44	0.62	438	56.0	55.0	0.6633
2	4.00	0.41	0.57	441	58.0	55.0	0.6403
3	4.00	0.39	0.55	442	60.0	55.0	0.6245
C1	4.00	0.33	0.46	436	60.0	56.0	0.5745
2	4.00	0.38	0.53	441	61.0	56.0	0.6164
3	4.00	0.33	0.46	439	62.0	57.0	0.5745
D1	4.00	0.32	0.45	440	62.0	58.0	0.5657
2	4.00	0.38	0.53	440	64.0	58.0	0.6164
3	4.00	0.33	0.46	439	65.0	59.0	0.5745
E1	4.00	0.34	0.48	419	64.0	59.0	0.5831
2	4.00	0.37	0.52	443	65.0	60.0	0.6083
3	4.00	0.25	0.35	442	66.0	60.0	0.5000
F1	4.00	0.37	0.52	432	65.0	61.0	0.6083
2	4.00	0.37	0.52	441	67.0	61.0	0.6083
3	4.00	0.37	0.52	439	68.0	62.0	0.6083
G1	4.00	0.39	0.55	436	67.0	62.0	0.6083
2	4.00	0.25	0.35	436	68.0	63.0	0.6083
3	4.00	0.23	0.32	434	68.0	63.0	0.4796
H1	4.00	0.33	0.46	417	68.0	63.0	0.5745
2	4.00	0.41	0.57	416	69.0	64.0	0.6403
3	4.00	0.43	0.60	413	69.0	64.0	0.6557
TOTALS	96.00	8.50	11.90	10434.0	1517.0	1413.0	14.3315

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.354
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.496
Avg Stack Temperature (degF)	T(s avg)	=	434.8
Average Meter Temperature (degF)	T(m avg)	=	61.0
Avg SQRT(dP)		=	0.597

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	37.10
Stack Gas Water Vapor Proportion	B(wo)	=	0.083
Mol. Wt., Stack Gas Dry	M(d)	=	30.52
Mol. Wt., Stack Gas Wet	M(s)	=	29.47
Abs Stack Pressure (in Hg)	P(s)	=	30.27
Avg Stack Velocity (ft/sec)	V(s avg)	=	42.9
Isokineticity (%)	% I	=	105.8
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	135[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	24[illegible]
Percent XS Air	PEA	=	33.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0148
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	30
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0132
Heat Input Rate, MBtu/hr		=	617.29
Particulate Emission Rate(lb/hr)	E(p)	=	17.140
Particulate Emission Rate(lb/MBtu)		=	0.0278

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier

Date: 4/24/92 Printed 04-Aug — Test No./Type: M5-015

Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1108-1255

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.55
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		558.20
Gas Meter Final Reading (cu ft)		623.20
Net Gas Sample Volume (cu ft)	V(m)	(65.00)
Vol of Liquid Collected (ml)	Vl(c)	147.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.943)
Wt. of Filter Particulate (gm)		0.0933
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0933)
O2 Concentration (by CEM)	% O2	4.20
CO2 Concentration (by CEM)	% CO2	15.30
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.50)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.20	1.70	468	54.0	53.0	1.0954
2	4.00	1.10	1.50	469	55.0	53.0	1.0488
3	4.00	1.10	1.50	469	57.0	53.0	1.0488
B1	4.00	1.50	2.10	470	60.0	56.0	1.2247
2	4.00	1.40	2.00	474	63.0	56.0	1.1832
3	4.00	1.20	1.70	473	64.0	55.0	1.0954
C1	4.00	1.10	1.50	466	63.0	55.0	1.0488
2	4.00	1.30	1.80	471	66.0	56.0	1.1402
3	4.00	1.10	1.50	471	67.0	57.0	1.0488
D1	4.00	1.10	1.50	471	66.0	57.0	1.0488
2	4.00	1.30	1.80	472	68.0	58.0	1.1402
3	4.00	1.10	1.50	472	69.0	58.0	1.0488
E1	4.00	1.20	1.70	466	65.0	59.0	1.0954
2	4.00	1.20	1.70	490	69.0	59.0	1.0954
3	4.00	0.85	1.20	490	71.0	60.0	0.9220
F1	4.00	1.30	1.80	492	70.0	61.0	1.1402
2	4.00	1.50	2.10	497	73.0	63.0	1.2247
3	4.00	1.40	2.00	496	74.0	62.0	1.1402
G1	4.00	0.92	1.30	496	71.0	62.0	1.2247
2	4.00	0.92	1.30	496	72.0	63.0	1.1832
3	4.00	0.73	1.00	496	73.0	63.0	0.9592
H1	4.00	1.20	1.70	475	71.0	63.0	0.9592
2	4.00	1.40	2.00	480	73.0	64.0	0.8544
3	4.00	1.20	1.70	484	74.0	64.0	1.0954
TOTALS	96.00	28.32	39.60	11504.0	1608.0	1410.0	26.0661

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.180
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.650
Avg Stack Temperature (degF)	T(s avg)	=	479.3
Average Meter Temperature (degF)	T(m avg)	=	62.9
Avg SQRT(dP)		=	1.088

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	65.72
Stack Gas Water Vapor Proportion	B(wo)	=	0.096
Mol. Wt., Stack Gas Dry	M(d)	=	30.62
Mol. Wt., Stack Gas Wet	M(s)	=	29.41
Abs Stack Pressure (in Hg)	P(s)	=	31.02
Avg Stack Velocity (ft/sec)	V(s avg)	=	79.1
Isokineticity (%)	% I	=	105.6
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	240271
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	455844
Percent XS Air	PEA	=	24.6
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0219
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	42
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0183
Heat Input Rate, MBtu/hr		=	1173.04
Particulate Emission Rate(lb/hr)	E(p)	=	45.104
Particulate Emission Rate(lb/MBtu)		=	0.0385

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/27/92 Printed 04-Aug — Test No./Type: M5-016
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1135-1325

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.82
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		623.50
Gas Meter Final Reading (cu ft)		686.60
Net Gas Sample Volume (cu ft)	V(m)	(63.10)
Vol of Liquid Collected (ml)	Vl(c)	123.3
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.804)
Wt. of Filter Particulate (gm)		0.1690
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.1690)
O2 Concentration (by CEM)	% O2	3.30
CO2 Concentration (by CEM)	% CO2	15.80
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.40	2.00	487	65.0	63.0	1.1832
2	4.00	1.20	1.70	487	67.0	63.0	1.0954
3	4.00	1.10	1.50	487	70.0	64.0	1.0488
B1	4.00	1.40	2.00	482	71.0	65.0	1.1832
2	4.00	1.30	1.80	490	74.0	65.0	1.1402
3	4.00	1.20	1.70	490	76.0	66.0	1.0954
C1	4.00	1.10	1.50	484	75.0	67.0	1.0488
2	4.00	1.20	1.70	486	79.0	68.0	1.0954
3	4.00	0.94	1.30	486	80.0	69.0	0.9695
D1	4.00	0.99	1.40	486	80.0	70.0	0.9950
2	4.00	1.20	1.70	486	81.0	71.0	1.0954
3	4.00	0.96	1.30	486	82.0	71.0	0.9798
E1	4.00	1.20	1.70	480	77.0	72.0	1.0954
2	4.00	1.10	1.50	505	81.0	73.0	1.0488
3	4.00	0.88	1.20	504	83.0	73.0	0.9381
F1	4.00	1.20	1.70	506	81.0	74.0	1.0954
2	4.00	1.30	1.80	509	84.0	75.0	1.1402
3	4.00	1.20	1.70	507	85.0	75.0	1.0954
G1	4.00	1.30	1.80	506	84.0	76.0	1.1402
2	4.00	1.00	1.40	508	86.0	76.0	1.0954
3	4.00	0.64	0.90	507	86.0	77.0	1.1402
H1	4.00	1.00	1.40	488	83.0	77.0	1.0000
2	4.00	1.30	1.80	493	86.0	77.0	0.8000
3	4.00	0.93	1.30	496	87.0	77.0	1.0000
TOTALS	96.00	27.04	37.80	11846.0	1903.0	1704.0	25.5195

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.127
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.575
Avg Stack Temperature (degF)	T(s avg)	=	493.6
Average Meter Temperature (degF)	T(m avg)	=	75.1
Avg SQRT(dP)		=	1.063

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	62.89
Stack Gas Water Vapor Proportion	B(wo)	=	0.064
Mol. Wt., Stack Gas Dry	M(d)	=	30.66
Mol. Wt., Stack Gas Wet	M(s)	=	29.59
Abs Stack Pressure (in Hg)	P(s)	=	31.29
Avg Stack Velocity (ft/sec)	V(s avg)	=	77.5
Isokineticity (%)	% I	=	102.6
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	2[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	4[illegible]
Percent XS Air	PEA	=	18.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0415
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	75
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0328
Heat Input Rate, MBtu/hr		=	1217.51
Particulate Emission Rate(lb/hr)	E(p)	=	84.063
Particulate Emission Rate(lb/MBtu)		=	0.0691

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/28/92 Printed 04-Aug — Test No./Type: M5-017
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1628-1830

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.45
Stack Static Pressure (in H2O)	P(stack)	16.000
Gas Meter Initial Reading (cu ft)		686.90
Gas Meter Final Reading (cu ft)		740.90
Net Gas Sample Volume (cu ft)	V(m)	(54.00)
Vol of Liquid Collected (ml)	Vl(c)	115.7
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.446)
Wt. of Filter Particulate (gm)		0.0582
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0582)
O2 Concentration (by CEM)	% O2	3.90
CO2 Concentration (by CEM)	% CO2	15.10
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.00)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.84	1.20	453	64.0	63.0	0.9165
2	4.00	0.78	1.10	456	65.0	63.0	0.8832
3	4.00	0.72	1.00	457	68.0	65.0	0.8485
B1	4.00	1.10	1.50	456	70.0	66.0	1.0488
2	4.00	0.85	1.20	462	73.0	66.0	0.9220
3	4.00	0.88	1.20	462	75.0	67.0	0.9381
C1	4.00	0.68	0.95	458	74.0	68.0	0.8246
2	4.00	0.84	1.20	458	76.0	68.0	0.9165
3	4.00	0.68	0.95	457	77.0	69.0	0.8246
D1	4.00	0.68	0.95	458	76.0	69.0	0.8246
2	4.00	0.79	1.10	459	77.0	70.0	0.8888
3	4.00	0.74	1.00	458	78.0	70.0	0.8602
E1	4.00	0.83	1.20	454	75.0	70.0	0.9110
2	4.00	0.74	1.00	473	78.0	71.0	0.8602
3	4.00	0.60	0.84	472	79.0	71.0	0.7746
F1	4.00	0.90	1.30	468	77.0	71.0	0.9487
2	4.00	0.92	1.30	477	79.0	72.0	0.9592
3	4.00	0.86	1.20	476	80.0	72.0	0.9487
G1	4.00	0.60	0.84	475	79.0	72.0	0.9592
2	4.00	0.62	0.87	476	80.0	73.0	0.9274
3	4.00	0.45	0.63	476	80.0	73.0	0.7746
H1	4.00	0.76	1.10	456	79.0	73.0	0.7874
2	4.00	0.93	1.30	461	80.0	74.0	0.6708
3	4.00	0.85	1.20	464	81.0	74.0	0.8718
TOTALS	96.00	18.64	26.13	11122.0	1820.0	1670.0	21.0900

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.777
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.089
Avg Stack Temperature (degF)	T(s avg)	=	463.4
Average Meter Temperature (degF)	T(m avg)	=	72.7
Avg SQRT(dP)		=	0.879

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	53.33
Stack Gas Water Vapor Proportion	B(wo)	=	0.093
Mol. Wt., Stack Gas Dry	M(d)	=	30.57
Mol. Wt., Stack Gas Wet	M(s)	=	29.41
Abs Stack Pressure (in Hg)	P(s)	=	30.63
Avg Stack Velocity (ft/sec)	V(s avg)	=	63.9
Isokineticity (%)	% I	=	105.4
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	195457
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	368050
Percent XS Air	PEA	=	22.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0166
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	32
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0138
Heat Input Rate, MBtu/hr		=	971.39
Particulate Emission Rate(lb/hr)	E(p)	=	28.210
Particulate Emission Rate(lb/MBtu)		=	0.0290

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/29/92 Printed 04-Aug — Test No./Type: M5-018
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1700-1843

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.26
Stack Static Pressure (in H2O)	P(stack)	15.000
Gas Meter Initial Reading (cu ft)		742.00
Gas Meter Final Reading (cu ft)		793.71
Net Gas Sample Volume (cu ft)	V(m)	(51.71)
Vol of Liquid Collected (ml)	Vl(c)	92.3
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.345)
Wt. of Filter Particulate (gm)		0.0648
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0648)
O2 Concentration (by CEM)	% O2	4.70
CO2 Concentration (by CEM)	% CO2	14.40
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.82	1.10	479	85.0	84.0	0.9055
2	4.00	0.71	0.99	479	87.0	85.0	0.8426
3	4.00	0.64	0.90	478	89.0	85.0	0.8000
B1	4.00	0.90	1.30	474	90.0	86.0	0.9487
2	4.00	0.80	1.10	481	93.0	87.0	0.8944
3	4.00	0.76	1.00	481	94.0	87.0	0.8718
C1	4.00	0.63	0.88	477	93.0	88.0	0.7937
2	4.00	0.71	0.99	478	95.0	88.0	0.8426
3	4.00	0.60	0.84	476	97.0	89.0	0.7746
D1	4.00	0.66	0.92	477	96.0	89.0	0.8124
2	4.00	0.71	0.99	478	97.0	90.0	0.8426
3	4.00	0.60	0.84	476	98.0	90.0	0.7746
E1	4.00	0.74	1.00	475	95.0	91.0	0.8602
2	4.00	0.72	1.00	482	98.0	91.0	0.8485
3	4.00	0.49	0.69	480	100.0	92.0	0.7000
F1	4.00	0.83	1.20	475	99.0	92.0	0.9110
2	4.00	0.81	1.10	479	101.0	93.0	0.9000
3	4.00	0.77	1.10	477	102.0	93.0	0.9110
G1	4.00	0.51	0.71	474	100.0	94.0	0.9000
2	4.00	0.48	0.67	475	101.0	94.0	0.8775
3	4.00	0.40	0.56	475	101.0	94.0	0.7141
H1	4.00	0.66	0.92	454	100.0	94.0	0.6928
2	4.00	0.80	1.10	456	102.0	95.0	0.6325
3	4.00	0.78	1.10	460	103.0	95.0	0.8124
TOTALS	96.00	16.53	23.00	11396.0	2316.0	2166.0	19.8638

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.689
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.958
Avg Stack Temperature (degF)	T(s avg)	=	474.8
Average Meter Temperature (degF)	T(m avg)	=	93.4
Avg SQRT(dP)		=	0.826

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	48.83
Stack Gas Water Vapor Proportion	B(wo)	=	0.082
Mol. Wt., Stack Gas Dry	M(d)	=	30.49
Mol. Wt., Stack Gas Wet	M(s)	=	29.47
Abs Stack Pressure (in Hg)	P(s)	=	30.36
Avg Stack Velocity (ft/sec)	V(s avg)	=	60.7
Isokineticity (%)	% I	=	102.4
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	1[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	34[illegible]
Percent XS Air	PEA	=	26.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0205
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	.40
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0176
Heat Input Rate, MBtu/hr		=	872.24
Particulate Emission Rate(lb/hr)	E(p)	=	32.341
Particulate Emission Rate(lb/MBtu)		=	0.0371

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 4/30/92 Printed 04-Aug — Test No./Type: M5-019
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 0021-0205

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.24
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		794.11
Gas Meter Final Reading (cu ft)		833.41
Net Gas Sample Volume (cu ft)	V(m)	(39.30)
Vol of Liquid Collected (ml)	Vl(c)	73.7
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.469)
Wt. of Filter Particulate (gm)		0.0628
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0628)
O2 Concentration (by CEM)	% O2	4.70 need CM data
CO2 Concentration (by CEM)	% CO2	13.90
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.40)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.45	0.63	457	70.0	70.0	0.6708
2	4.00	0.39	0.55	457	71.0	70.0	0.6245
3	4.00	0.37	0.52	456	72.0	70.0	0.6083
B1	4.00	0.48	0.67	453	73.0	70.0	0.6928
2	4.00	0.47	0.66	459	75.0	71.0	0.6856
3	4.00	0.40	0.56	459	77.0	72.0	0.6325
C1	4.00	0.37	0.52	454	77.0	73.0	0.6083
2	4.00	0.41	0.57	456	78.0	73.0	0.6403
3	4.00	0.34	0.48	454	80.0	74.0	0.5831
D1	4.00	0.28	0.39	454	79.0	74.0	0.5292
2	4.00	0.39	0.55	455	80.0	74.0	0.6245
3	4.00	0.33	0.46	453	80.0	75.0	0.5745
E1	4.00	0.38	0.53	454	78.0	74.0	0.6164
2	4.00	0.37	0.52	458	80.0	75.0	0.6083
3	4.00	0.27	0.38	457	80.0	75.0	0.5196
F1	4.00	0.44	0.62	448	79.0	75.0	0.6633
2	4.00	0.42	0.59	456	80.0	76.0	0.6481
3	4.00	0.38	0.53	454	81.0	76.0	0.6633
G1	4.00	0.30	0.42	449	81.0	76.0	0.6481
2	4.00	0.28	0.39	449	81.0	76.0	0.6164
3	4.00	0.25	0.35	446	81.0	76.0	0.5477
H1	4.00	0.38	0.53	428	80.0	76.0	0.5292
2	4.00	0.49	0.69	427	81.0	76.0	0.5000
3	4.00	0.47	0.66	426	82.0	77.0	0.6164
TOTALS	96.00	9.11	12.77	10819.0	1876.0	1774.0	14.6511

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.380
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.532
Avg Stack Temperature (degF)	T(s avg)	=	450.8
Average Meter Temperature (degF)	T(m avg)	=	76.0
Avg SQRT(dP)		=	0.610

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	36.24
Stack Gas Water Vapor Proportion	B(wo)	=	0.083
Mol. Wt., Stack Gas Dry	M(d)	=	30.41
Mol. Wt., Stack Gas Wet	M(s)	=	29.36
Abs Stack Pressure (in Hg)	P(s)	=	30.27
Avg Stack Velocity (ft/sec)	V(s avg)	=	44.4
Isokineticity (%)	% I	=	107.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	137407
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	255541
Percent XS Air	PEA	=	28.0
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0253
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	50
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0217
Heat Input Rate, MBtu/hr		=	650.75
Particulate Emission Rate(lb/hr)	E(p)	=	29.813
Particulate Emission Rate(lb/MBtu)		=	0.0458

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 5/1/92 Printed 04-Aug — Test No./Type: M5-020
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 0021-0205

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.218
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.15
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		833.61
Gas Meter Final Reading (cu ft)		902.51
Net Gas Sample Volume (cu ft)	V(m)	(68.90)
Vol of Liquid Collected (ml)	Vl(c)	164.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.743)
Wt. of Filter Particulate (gm)		0.0847
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0847)
O2 Concentration (by CEM)	% O2	3.90
CO2 Concentration (by CEM)	% CO2	15.10
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.00)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.70	2.40	474	79.0	77.0	1.3038
2	4.00	1.30	1.80	484	81.0	77.0	1.1402
3	4.00	1.30	1.80	484	83.0	78.0	1.1402
B1	4.00	1.30	1.80	476	84.0	79.0	1.1402
2	4.00	1.50	2.10	488	87.0	79.0	1.2247
3	4.00	1.30	1.80	488	89.0	80.0	1.1402
C1	4.00	1.10	1.50	484	89.0	81.0	1.0488
2	4.00	1.40	2.00	489	91.0	81.0	1.1832
3	4.00	1.10	1.50	485	92.0	82.0	1.0488
D1	4.00	1.10	1.50	485	91.0	82.0	1.0488
2	4.00	1.40	2.00	486	92.0	83.0	1.1832
3	4.00	1.10	1.50	486	93.0	83.0	1.0488
E1	4.00	1.30	1.80	485	89.0	84.0	1.1402
2	4.00	1.20	1.70	495	93.0	85.0	1.0954
3	4.00	0.93	1.30	494	94.0	85.0	0.9644
F1	4.00	1.60	2.20	489	92.0	85.0	1.2649
2	4.00	1.30	1.80	495	95.0	86.0	1.1402
3	4.00	1.30	1.80	492	96.0	87.0	1.2649
G1	4.00	0.98	1.40	481	94.0	87.0	1.1402
2	4.00	1.00	1.40	484	96.0	88.0	1.1402
3	4.00	0.75	1.10	482	97.0	88.0	0.9899
H1	4.00	1.30	1.80	453	95.0	88.0	1.0000
2	4.00	1.60	2.20	455	97.0	88.0	0.8660
3	4.00	1.30	1.80	456	98.0	89.0	1.1402
TOTALS	96.00	30.16	42.00	11570.0	2187.0	2002.0	26.7974

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.257
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.750
Avg Stack Temperature (degF)	T(s avg)	=	482.1
Average Meter Temperature (degF)	T(m avg)	=	87.3
Avg SQRT(dP)		=	1.117

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	65.68
Stack Gas Water Vapor Proportion	B(wo)	=	0.105
Mol. Wt., Stack Gas Dry	M(d)	=	30.57
Mol. Wt., Stack Gas Wet	M(s)	=	29.25
Abs Stack Pressure (in Hg)	P(s)	=	30.62
Avg Stack Velocity (ft/sec)	V(s avg)	=	82.2
Isokineticity (%)	% I	=	104.3
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	24[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	473700
Percent XS Air	PEA	=	22.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0199
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	37.
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0163
Heat Input Rate, MBtu/hr		=	1207.92
Particulate Emission Rate(lb/hr)	E(p)	=	41.431
Particulate Emission Rate(lb/MBtu)		=	0.0343

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 5/16/92 Printed 04-Aug — Test No./Type: M5/Metals-M1
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1055-1240

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.250
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.43
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		903.71
Gas Meter Final Reading (cu ft)		975.70
Net Gas Sample Volume (cu ft)	V(m)	(71.99)
Vol of Liquid Collected (ml)	Vl(c)	150.1
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.065)
Wt. of Filter Particulate (gm)		0.0153
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0153)
Wt of Total Metals (ug)	M(m)	495.1
O2 Concentration (by CEM)	% O2	4.10
CO2 Concentration (by CEM)	% CO2	14.80
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.10)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.84	2.00	453	81.0	77.0	0.9165
2	4.00	0.78	1.80	453	80.0	77.0	0.8832
3	4.00	0.72	1.70	455	87.0	78.0	0.8485
B1	4.00	1.00	2.40	454	85.0	79.0	1.0000
2	4.00	0.92	2.20	457	88.0	79.0	0.9592
3	4.00	0.86	2.00	455	89.0	80.0	0.9274
C1	4.00	0.82	1.90	461	91.0	81.0	0.9055
2	4.00	0.87	2.00	464	93.0	82.0	0.9327
3	4.00	0.81	1.90	463	93.0	83.0	0.9000
D1	4.00	0.83	2.00	458	94.0	83.0	0.9110
2	4.00	0.86	2.00	453	95.0	84.0	0.9274
3	4.00	0.80	1.90	457	96.0	85.0	0.8944
E1	4.00	0.90	2.10	455	96.0	86.0	0.9487
2	4.00	0.83	2.00	456	97.0	86.0	0.9110
3	4.00	0.62	1.50	453	97.0	87.0	0.7874
F1	4.00	0.85	2.00	448	97.0	87.0	0.9220
2	4.00	0.76	1.80	445	98.0	88.0	0.8718
3	4.00	0.73	1.70	450	98.0	88.0	0.9220
G1	4.00	0.64	1.50	448	98.0	89.0	0.8718
2	4.00	0.70	1.60	450	98.0	89.0	0.8544
3	4.00	0.66	1.60	452	98.0	89.0	0.8000
H1	4.00	0.81	1.90	446	98.0	89.0	0.8367
2	4.00	0.96	2.30	448	99.0	89.0	0.8124
3	4.00	0.72	1.70	453	99.0	90.0	0.9000
TOTALS	96.00	19.29	45.50	10887.0	2245.0	2025.0	21.4439

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.804
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.896
Avg Stack Temperature (degF)	T(s avg)	=	453.6
Average Meter Temperature (degF)	T(m avg)	=	89.0
Avg SQRT(dP)		=	0.893

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	69.09
Stack Gas Water Vapor Proportion	B(wo)	=	0.093
Mol. Wt., Stack Gas Dry	M(d)	=	30.53
Mol. Wt., Stack Gas Wet	M(s)	=	29.37
Abs Stack Pressure (in Hg)	P(s)	=	30.46
Avg Stack Velocity (ft/sec)	V(s avg)	=	64.6
Isokineticity (%)	% I	=	101.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	199355
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	373496
Percent XS Air	PEA	=	23.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0034
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	6
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0028
Heat Input Rate, MBtu/hr		=	979.11
Particulate Emission Rate(lb/hr)	E(p)	=	5.842
Particulate Emission Rate(lb/MBtu)		=	0.0060
Total Metals Emission Rate(lb/MBtu)		=	0.00019

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 5/16/92 Printed 04-Aug — Test No./Type: M5/Metals-M2
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1630-1833

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.250
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.43
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		975.80
Gas Meter Final Reading (cu ft)		1029.61
Net Gas Sample Volume (cu ft)	V(m)	(53.81)
Vol of Liquid Collected (ml)	Vl(c)	118.8
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.592)
Wt. of Filter Particulate (gm)		0.0435
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0435)
Wt of Total Metals (ug)	M(m)	225.3
O2 Concentration (by CEM)	% O2	4.00
CO2 Concentration (by CEM)	% CO2	15.10
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.41	0.96	434	89.0	88.0	0.6403
2	4.00	0.43	1.00	436	90.0	88.0	0.6557
3	4.00	0.42	0.98	435	92.0	89.0	0.6481
B1	4.00	0.51	1.20	433	94.0	89.0	0.7141
2	4.00	0.50	1.20	436	95.0	89.0	0.7071
3	4.00	0.53	1.20	435	96.0	89.0	0.7280
C1	4.00	0.45	1.10	438	97.0	90.0	0.6708
2	4.00	0.48	1.10	440	98.0	91.0	0.6928
3	4.00	0.47	1.10	441	98.0	91.0	0.6856
D1	4.00	0.46	1.10	439	99.0	91.0	0.6782
2	4.00	0.48	1.10	439	99.0	92.0	0.6928
3	4.00	0.41	0.96	437	99.0	92.0	0.6403
E1	4.00	0.42	0.98	442	99.0	92.0	0.6481
2	4.00	0.39	0.92	443	99.0	92.0	0.6245
3	4.00	0.33	0.78	441	99.0	93.0	0.5745
F1	4.00	0.43	1.00	438	99.0	93.0	0.6557
2	4.00	0.41	0.96	439	99.0	93.0	0.6403
3	4.00	0.42	0.98	437	99.0	93.0	0.6557
G1	4.00	0.40	0.94	433	100.0	93.0	0.6403
2	4.00	0.42	0.99	435	99.0	93.0	0.6481
3	4.00	0.41	0.96	434	100.0	93.0	0.6325
H1	4.00	0.43	1.00	430	99.0	93.0	0.6481
2	4.00	0.43	1.00	436	99.0	93.0	0.6403
3	4.00	0.42	0.99	435	100.0	93.0	0.6557
TOTALS	96.00	10.46	24.50	10486.0	2337.0	2193.0	15.8178

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.436
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.021
Avg Stack Temperature (degF)	T(s avg)	=	436.9
Average Meter Temperature (degF)	T(m avg)	=	94.4
Avg SQRT(dP)		=	0.659

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	51.02
Stack Gas Water Vapor Proportion	B(wo)	=	0.099
Mol. Wt., Stack Gas Dry	M(d)	=	30.58
Mol. Wt., Stack Gas Wet	M(s)	=	29.33
Abs Stack Pressure (in Hg)	P(s)	=	30.17
Avg Stack Velocity (ft/sec)	V(s avg)	=	47.7
Isokineticity (%)	% I	=	102.0
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	14[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	27[illegible]
Percent XS Air	PEA	=	2[illegible]
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0132
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	25
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0108
Heat Input Rate, MBtu/hr		=	725.32
Particulate Emission Rate(lb/hr)	E(p)	=	16.555
Particulate Emission Rate(lb/MBtu)		=	0.0228
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 5/17/92 Printed 04-Aug — Test No./Type: M5/Metals-M3
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 0920-1120

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.250
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		29.71
Gas Meter Final Reading (cu ft)		82.50
Net Gas Sample Volume (cu ft)	V(m)	(52.80)
Vol of Liquid Collected (ml)	Vl(c)	121.3
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.710)
Wt. of Filter Particulate (gm)		0.0091
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0091)
Wt of Total Metals (ug)	M(m)	145.2
O2 Concentration (by CEM)	% O2	4.90
CO2 Concentration (by CEM)	% CO2	14.20
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.42	0.99	438	71.0	69.0	0.6481
2	4.00	0.44	1.00	440	73.0	69.0	0.6633
3	4.00	0.45	1.10	439	75.0	70.0	0.6708
B1	4.00	0.49	1.20	435	78.0	70.0	0.7000
2	4.00	0.47	1.10	438	79.0	71.0	0.6856
3	4.00	0.51	1.20	442	80.0	71.0	0.7141
C1	4.00	0.47	1.10	441	81.0	71.0	0.6856
2	4.00	0.49	1.20	443	80.0	72.0	0.7000
3	4.00	0.49	1.20	442	80.0	72.0	0.7000
D1	4.00	0.43	1.00	440	81.0	72.0	0.6557
2	4.00	0.45	1.10	443	81.0	73.0	0.6708
3	4.00	0.40	0.98	444	81.0	73.0	0.6325
E1	4.00	0.43	1.00	437	80.0	73.0	0.6557
2	4.00	0.37	0.87	445	80.0	73.0	0.6083
3	4.00	0.36	0.80	442	80.0	73.0	0.6000
F1	4.00	0.42	0.99	440	81.0	73.0	0.6481
2	4.00	0.40	0.94	446	81.0	73.0	0.6325
3	4.00	0.41	0.96	447	81.0	73.0	0.6481
G1	4.00	0.39	0.91	437	81.0	73.0	0.6325
2	4.00	0.43	1.00	440	81.0	73.0	0.6403
3	4.00	0.42	0.99	439	81.0	74.0	0.6245
H1	4.00	0.41	0.92	438	82.0	74.0	0.6557
2	4.00	0.42	0.99	441	82.0	74.0	0.6481
3	4.00	0.42	0.99	442	82.0	75.0	0.6403
TOTALS	96.00	10.39	24.53	10579.0	1912.0	1734.0	15.7605

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.433
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.022
Avg Stack Temperature (degF)	T(s avg)	=	440.8
Average Meter Temperature (degF)	T(m avg)	=	76.0
Avg SQRT(dP)		=	0.657

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	52.12
Stack Gas Water Vapor Proportion	B(wo)	=	0.099
Mol. Wt., Stack Gas Dry	M(d)	=	30.47
Mol. Wt., Stack Gas Wet	M(s)	=	29.24
Abs Stack Pressure (in Hg)	P(s)	=	30.36
Avg Stack Velocity (ft/sec)	V(s avg)	=	47.5
Isokineticity (%)	% I	=	104.3
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	146669
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	273655
Percent XS Air	PEA	=	29.8
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0027
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	5
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0023
Heat Input Rate, MBtu/hr		=	686.05
Particulate Emission Rate(lb/hr)	E(p)	=	3.390
Particulate Emission Rate(lb/MBtu)		=	0.0049
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 5/17/92 Printed 04-Aug — Test No./Type: M5/Metals-M4
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1417-1600

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.250
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.84
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		82.60
Gas Meter Final Reading (cu ft)		134.81
Net Gas Sample Volume (cu ft)	V(m)	(52.20)
Vol of Liquid Collected (ml)	Vl(c)	107.8
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.074)
Wt. of Filter Particulate (gm)		0.1036
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.1036)
Wt of Total Metals (ug)	M(m)	438.6
O2 Concentration (by CEM)	% O2	5.30
CO2 Concentration (by CEM)	% CO2	14.10
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.60)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.40	0.94	434	74.0	72.0	0.6325
2	4.00	0.42	0.99	436	76.0	72.0	0.6481
3	4.00	0.41	0.96	435	77.0	72.0	0.6403
B1	4.00	0.47	1.10	431	79.0	73.0	0.6856
2	4.00	0.45	1.10	437	81.0	74.0	0.6708
3	4.00	0.49	1.20	436	82.0	74.0	0.7000
C1	4.00	0.46	1.10	434	84.0	75.0	0.6782
2	4.00	0.50	1.20	438	84.0	75.0	0.7071
3	4.00	0.51	1.20	437	85.0	75.0	0.7141
D1	4.00	0.41	0.96	439	85.0	76.0	0.6403
2	4.00	0.46	1.10	441	85.0	77.0	0.6782
3	4.00	0.42	0.99	438	85.0	76.0	0.6481
E1	4.00	0.41	0.96	433	86.0	77.0	0.6403
2	4.00	0.38	0.89	436	87.0	78.0	0.6164
3	4.00	0.33	0.78	436	87.0	78.0	0.5745
F1	4.00	0.41	0.96	434	87.0	79.0	0.6403
2	4.00	0.40	0.94	435	88.0	79.0	0.6325
3	4.00	0.42	0.99	437	89.0	80.0	0.6403
G1	4.00	0.38	0.89	435	89.0	80.0	0.6325
2	4.00	0.42	0.99	438	90.0	80.0	0.6481
3	4.00	0.41	0.96	437	90.0	81.0	0.6164
H1	4.00	0.40	0.94	437	90.0	81.0	0.6481
2	4.00	0.43	1.00	440	90.0	81.0	0.6403
3	4.00	0.41	0.96	439	90.0	82.0	0.6325
TOTALS	96.00	10.20	24.10	10473.0	2040.0	1847.0	15.6054

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.425
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.004
Avg Stack Temperature (degF)	T(s avg)	=	436.4
Average Meter Temperature (degF)	T(m avg)	=	81.0
Avg SQRT(dP)		=	0.650

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	51.43
Stack Gas Water Vapor Proportion	B(wo)	=	0.090
Mol. Wt., Stack Gas Dry	M(d)	=	30.47
Mol. Wt., Stack Gas Wet	M(s)	=	29.35
Abs Stack Pressure (in Hg)	P(s)	=	30.87
Avg Stack Velocity (ft/sec)	V(s avg)	=	46.4
Isokineticity (%)	% I	=	102.0
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	1[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	267[illegible]
Percent XS Air	PEA	=	33.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0311
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	63
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0277
Heat Input Rate, MBtu/hr		=	674.93
Particulate Emission Rate(lb/hr)	E(p)	=	39.430
Particulate Emission Rate(lb/MBtu)		=	0.0584
Total Metals Emission Rate(lb/MBtu)		=	0.00025

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples, Worksheet 2

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 5/18/92 Printed 04-Aug — Test No./Type: M5/Metals-M5
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1047-1250

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.250
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.84
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		134.90
Gas Meter Final Reading (cu ft)		221.00
Net Gas Sample Volume (cu ft)	V(m)	(86.10)
Vol of Liquid Collected (ml)	Vl(c)	169.4
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.974)
Wt. of Filter Particulate (gm)		0.0854
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0854)
Wt of Total Metals (ug)	M(m)	768.1
O2 Concentration (by CEM)	% O2	3.50
CO2 Concentration (by CEM)	% CO2	15.70
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.80)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.30	3.10	468	83.0	76.0	1.1402
2	4.00	1.20	2.80	470	88.0	78.0	1.0954
3	4.00	1.10	2.60	469	89.0	78.0	1.0488
B1	4.00	1.40	3.30	471	92.0	79.0	1.1832
2	4.00	1.30	3.10	474	94.0	80.0	1.1402
3	4.00	1.30	3.10	472	95.0	81.0	1.1402
C1	4.00	1.10	2.60	470	96.0	81.0	1.0488
2	4.00	1.20	2.80	473	97.0	83.0	1.0954
3	4.00	0.99	2.30	469	97.0	83.0	0.9950
D1	4.00	1.00	2.40	468	98.0	84.0	1.0000
2	4.00	1.50	3.50	470	99.0	85.0	1.2247
3	4.00	1.10	2.60	472	101.0	86.0	1.0488
E1	4.00	1.10	2.60	471	100.0	86.0	1.0488
2	4.00	1.20	2.80	473	102.0	87.0	1.0954
3	4.00	0.60	1.40	472	102.0	88.0	0.7746
F1	4.00	1.30	3.10	472	102.0	89.0	1.1402
2	4.00	1.20	2.80	474	104.0	90.0	1.0954
3	4.00	1.10	2.60	473	105.0	91.0	1.1402
G1	4.00	1.20	2.80	466	106.0	92.0	1.0954
2	4.00	1.30	3.10	468	106.0	93.0	1.0488
3	4.00	1.20	2.80	468	107.0	94.0	1.0954
H1	4.00	1.30	3.10	470	108.0	94.0	1.1402
2	4.00	1.20	2.80	471	108.0	95.0	1.0954
3	4.00	1.10	2.60	469	109.0	95.0	1.1402
TOTALS	96.00	28.29	66.70	11293.0	2388.0	2068.0	26.0709

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.179
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	2.779
Avg Stack Temperature (degF)	T(s avg)	=	470.5
Average Meter Temperature (degF)	T(m avg)	=	92.8
Avg SQRT(dP)		=	1.086

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	83.36
Stack Gas Water Vapor Proportion	B(wo)	=	0.067
Mol. Wt., Stack Gas Dry	M(d)	=	30.65
Mol. Wt., Stack Gas Wet	M(s)	=	29.55
Abs Stack Pressure (in Hg)	P(s)	=	31.31
Avg Stack Velocity (ft/sec)	V(s avg)	=	78.2
Isokineticity (%)	% I	=	100.2
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	244220
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	450634
Percent XS Air	PEA	=	19.6
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0158
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	29
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0126
Heat Input Rate, MBtu/hr		=	1242.29
Particulate Emission Rate(lb/hr)	E(p)	=	33.064
Particulate Emission Rate(lb/MBtu)		=	0.0266
Total Metals Emission Rate(lb/MBtu)		=	0.00024

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples, Worksheet 2

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 5/19/92 Printed 04-Aug — Test No./Type: M5/Metals-M6
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 0925-1123

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.250
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		221.21
Gas Meter Final Reading (cu ft)		308.60
Net Gas Sample Volume (cu ft)	V(m)	(87.40)
Vol of Liquid Collected (ml)	Vl(c)	186.9
Vol of Liq @ Std. Conds. (scf)	V(w std)	(8.797)
Wt. of Filter Particulate (gm)		0.0493
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0493)
Wt of Total Metals (ug)	M(m)	575.0
O2 Concentration (by CEM)	% O2	3.40
CO2 Concentration (by CEM)	% CO2	15.70
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.40	3.20	466	71.0	68.0	1.1832
2	4.00	1.20	2.80	468	77.0	69.0	1.0954
3	4.00	1.10	2.60	467	82.0	70.0	1.0488
B1	4.00	1.30	3.10	465	85.0	71.0	1.1402
2	4.00	1.20	2.80	465	87.0	72.0	1.0954
3	4.00	1.20	2.80	464	89.0	73.0	1.0954
C1	4.00	1.20	2.80	468	91.0	74.0	1.0954
2	4.00	1.30	3.10	470	92.0	76.0	1.1402
3	4.00	0.99	2.30	469	93.0	77.0	0.9950
D1	4.00	1.10	2.60	472	93.0	78.0	1.0488
2	4.00	1.50	3.50	473	94.0	79.0	1.2247
3	4.00	1.20	2.80	471	96.0	80.0	1.0954
E1	4.00	1.30	3.10	469	97.0	81.0	1.1402
2	4.00	1.20	2.60	471	97.0	82.0	1.0954
3	4.00	0.61	1.40	468	97.0	82.0	0.7810
F1	4.00	1.50	3.50	467	97.0	83.0	1.2247
2	4.00	1.30	3.10	469	99.0	84.0	1.1402
3	4.00	1.20	2.80	470	100.0	85.0	1.2247
G1	4.00	1.40	3.30	474	102.0	86.0	1.1402
2	4.00	1.30	3.10	476	103.0	87.0	1.0954
3	4.00	1.30	3.10	475	105.0	88.0	1.1832
H1	4.00	1.20	2.80	476	106.0	89.0	1.1402
2	4.00	1.30	3.10	478	106.0	90.0	1.1402
3	4.00	1.10	2.60	477	107.0	91.0	1.0954
TOTALS	96.00	29.40	68.90	11288.00	2266.0	1915.0	26.6591

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.225
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	2.871
Avg Stack Temperature (degF)	T(s avg)	=	470.3
Average Meter Temperature (degF)	T(m avg)	=	87.1
Avg SQRT(dP)		=	1.111

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	84.90
Stack Gas Water Vapor Proportion	B(wo)	=	0.094
Mol. Wt., Stack Gas Dry	M(d)	=	30.65
Mol. Wt., Stack Gas Wet	M(s)	=	29.46
Abs Stack Pressure (in Hg)	P(s)	=	31.09
Avg Stack Velocity (ft/sec)	V(s avg)	=	80.4
Isokineticity (%)	% I	=	100.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	2[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	46[illegible]
Percent XS Air	PEA	=	18.9
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0090
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	16
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0071
Heat Input Rate, MBtu/hr		=	1265.94
Particulate Emission Rate(lb/hr)	E(p)	=	18.996
Particulate Emission Rate(lb/MBtu)		=	0.0150
Total Metals Emission Rate(lb/MBtu)		=	0.00016

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples, Worksheet 2

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 5/19/92 Printed 04-Aug — Test No./Type: M5/Metals-M7
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1445-1635

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.250
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		308.81
Gas Meter Final Reading (cu ft)		376.51
Net Gas Sample Volume (cu ft)	V(m)	(67.70)
Vol of Liquid Collected (ml)	Vl(c)	138.3
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.510)
Wt. of Filter Particulate (gm)		0.0232
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0232)
Wt of Total Metals (ug)	M(m)	409.0
O2 Concentration (by CEM)	% O2	3.90
CO2 Concentration (by CEM)	% CO2	14.90
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.20)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.78	1.80	460	87.0	86.0	0.8832
2	4.00	0.73	1.70	462	90.0	86.0	0.8544
3	4.00	0.66	1.60	461	92.0	87.0	0.8124
B1	4.00	0.90	2.10	459	95.0	88.0	0.9487
2	4.00	0.82	1.90	461	97.0	88.0	0.9055
3	4.00	0.77	1.80	463	98.0	89.0	0.8775
C1	4.00	0.63	1.50	462	99.0	89.0	0.7937
2	4.00	0.64	1.50	464	99.0	90.0	0.8000
3	4.00	0.59	1.40	462	100.0	91.0	0.7681
D1	4.00	0.66	1.60	463	100.0	91.0	0.8124
2	4.00	0.70	1.60	463	101.0	92.0	0.8367
3	4.00	0.64	1.50	461	101.0	92.0	0.8000
E1	4.00	0.83	2.00	460	102.0	92.0	0.9110
2	4.00	0.74	1.70	461	103.0	93.0	0.8602
3	4.00	0.56	1.30	461	103.0	93.0	0.7483
F1	4.00	0.82	1.90	462	103.0	93.0	0.9055
2	4.00	0.68	1.60	464	103.0	93.0	0.8246
3	4.00	0.65	1.50	463	102.0	93.0	0.9055
G1	4.00	0.59	1.40	465	102.0	93.0	0.8246
2	4.00	0.66	1.60	463	102.0	93.0	0.8062
3	4.00	0.60	1.40	464	102.0	93.0	0.7681
H1	4.00	0.72	1.70	463	102.0	94.0	0.8124
2	4.00	0.87	2.00	465	103.0	94.0	0.7746
3	4.00	0.68	1.60	465	104.0	94.0	0.8485
TOTALS	96.00	16.92	39.70	11097.00	2390.0	2187.0	20.0824

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.705
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.654
Avg Stack Temperature (degF)	T(s avg)	=	462.4
Average Meter Temperature (degF)	T(m avg)	=	95.4
Avg SQRT(dP)		=	0.837

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	64.59
Stack Gas Water Vapor Proportion	B(wo)	=	0.092
Mol. Wt., Stack Gas Dry	M(d)	=	30.54
Mol. Wt., Stack Gas Wet	M(s)	=	29.39
Abs Stack Pressure (in Hg)	P(s)	=	30.65
Avg Stack Velocity (ft/sec)	V(s avg)	=	60.8
Isokineticity (%)	% I	=	101.6
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	186568
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	350227
Percent XS Air	PEA	=	22.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0055
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	10
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0045
Heat Input Rate, MBtu/hr		=	927.21
Particulate Emission Rate(lb/hr)	E(p)	=	8.872
Particulate Emission Rate(lb/MBtu)		=	0.0096
Total Metals Emission Rate(lb/MBtu)		=	0.00017

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples, Worksheet 2

KINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

ant: WPL — Performed by: Eric Squier

ate: 5/20/92 Printed 04-Aug — Test No./Type: M5/Metals-M8

ample Location: Unit 2, ESP Outlet — Start/Stop Time: 0935-1126

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.250
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.75
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		376.71
Gas Meter Final Reading (cu ft)		464.81
Net Gas Sample Volume (cu ft)	V(m)	(88.10)
Vol of Liquid Collected (ml)	Vl(c)	191.1
Vol of Liq @ Std. Conds. (scf)	V(w std)	(8.995)
Wt. of Filter Particulate (gm)		0.0465
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0465)
Wt of Total Metals (ug)	M(m)	634.7
O2 Concentration (by CEM)	% O2	3.70
CO2 Concentration (by CEM)	% CO2	15.60
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.70)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.50	3.50	462	76.0	74.0	1.2247
2	4.00	1.30	3.10	464	82.0	75.0	1.1402
3	4.00	1.10	2.60	463	86.0	76.0	1.0488
B1	4.00	1.40	3.30	461	89.0	77.0	1.1832
2	4.00	1.20	2.80	462	92.0	78.0	1.0954
3	4.00	1.30	3.10	462	93.0	79.0	1.1402
C1	4.00	1.20	2.80	463	94.0	80.0	1.0954
2	4.00	1.10	2.60	465	96.0	81.0	1.0488
3	4.00	1.40	3.30	464	97.0	82.0	1.1832
D1	4.00	1.20	2.60	462	98.0	83.0	1.0954
2	4.00	1.00	2.40	463	98.0	84.0	1.0000
3	4.00	1.10	2.60	462	98.0	85.0	1.0488
E1	4.00	1.40	3.30	460	99.0	86.0	1.1832
2	4.00	1.30	3.10	462	101.0	87.0	1.1402
3	4.00	1.20	2.80	464	103.0	88.0	1.0954
F1	4.00	1.00	2.40	465	103.0	89.0	1.0000
2	4.00	0.63	1.50	467	104.0	89.0	0.7937
3	4.00	1.40	3.30	466	103.0	90.0	1.0000
G1	4.00	1.50	3.50	467	105.0	91.0	0.7937
2	4.00	1.40	3.30	469	106.0	92.0	1.1832
3	4.00	1.20	2.80	468	107.0	92.0	1.2247
H1	4.00	1.30	3.10	466	107.0	93.0	1.1832
2	4.00	1.20	2.80	468	108.0	94.0	1.0954
3	4.00	1.20	2.80	465	108.0	94.0	1.1402
TOTALS	96.00	29.53	69.40	11140.00	2353.0	2039.0	26.1374

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.230
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	2.892
Avg Stack Temperature (degF)	T(s avg)	=	464.2
Average Meter Temperature (degF)	T(m avg)	=	91.5
Avg SQRT(dP)		=	1.089

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	85.27
Stack Gas Water Vapor Proportion	B(wo)	=	0.095
Mol. Wt., Stack Gas Dry	M(d)	=	30.64
Mol. Wt., Stack Gas Wet	M(s)	=	29.44
Abs Stack Pressure (in Hg)	P(s)	=	31.22
Avg Stack Velocity (ft/sec)	V(s avg)	=	78.4
Isokineticity (%)	% I	=	1[illegible]
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	2[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	451723
Percent XS Air	PEA	=	21.0
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0084
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	16
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0068
Heat Input Rate, MBtu/hr		=	1224.91
Particulate Emission Rate(lb/hr)	E(p)	=	17.581
Particulate Emission Rate(lb/MBtu)		=	0.0144
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Optimization Test Series

ESP Outlet Method 5 Samples, Worksheet 2

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 5/20/92 Printed 04-Aug — Test No./Type: M5/Metals-M9
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 0935-1126

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.250
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	1.0100
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.74
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		465.01
Gas Meter Final Reading (cu ft)		533.71
Net Gas Sample Volume (cu ft)	V(m)	(68.70)
Vol of Liquid Collected (ml)	Vl(c)	159.9
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.526)
Wt. of Filter Particulate (gm)		0.0155
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0155)
Wt of Total Metals (ug)	M(m)	359.9
O2 Concentration (by CEM)	% O2	4.00
CO2 Concentration (by CEM)	% CO2	15.20
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.80)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.84	2.00	461	97.0	97.0	0.9165
2	4.00	0.83	2.00	463	99.0	97.0	0.9110
3	4.00	0.86	2.00	462	101.0	97.0	0.9274
B1	4.00	0.88	2.10	460	103.0	97.0	0.9381
2	4.00	0.81	1.90	461	104.0	97.0	0.9000
3	4.00	0.79	1.90	461	104.0	97.0	0.8888
C1	4.00	0.69	1.60	463	105.0	97.0	0.8307
2	4.00	0.68	1.60	466	105.0	97.0	0.8246
3	4.00	0.62	1.50	467	105.0	97.0	0.7874
D1	4.00	0.68	1.60	465	104.0	96.0	0.8246
2	4.00	0.74	1.70	468	104.0	96.0	0.8602
3	4.00	0.67	1.60	463	103.0	96.0	0.8185
E1	4.00	0.82	1.90	462	103.0	96.0	0.9055
2	4.00	0.78	1.80	465	104.0	96.0	0.8832
3	4.00	0.62	1.50	464	103.0	95.0	0.7874
F1	4.00	0.83	2.00	463	103.0	95.0	0.9110
2	4.00	0.70	1.60	463	103.0	95.0	0.8367
3	4.00	0.69	1.60	462	103.0	95.0	0.9110
G1	4.00	0.62	1.50	458	103.0	95.0	0.8367
2	4.00	0.65	1.50	460	103.0	95.0	0.8307
3	4.00	0.60	1.40	459	102.0	95.0	0.7874
H1	4.00	0.71	1.70	457	102.0	95.0	0.8062
2	4.00	0.85	2.00	459	102.0	95.0	0.7746
3	4.00	0.70	1.60	458	104.0	95.0	0.8426
TOTALS	96.00	17.66	41.60	11090.00	2469.0	2303.0	20.5409

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.736
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.733
Avg Stack Temperature (degF)	T(s avg)	=	462.1
Average Meter Temperature (degF)	T(m avg)	=	99.4
Avg SQRT(dP)		=	0.856

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	65.35
Stack Gas Water Vapor Proportion	B(wo)	=	0.103
Mol. Wt., Stack Gas Dry	M(d)	=	30.59
Mol. Wt., Stack Gas Wet	M(s)	=	29.29
Abs Stack Pressure (in Hg)	P(s)	=	30.77
Avg Stack Velocity (ft/sec)	V(s avg)	=	62.2
Isokineticity (%)	% I	=	101.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	189085
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	358080
Percent XS Air	PEA	=	23.1
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0037
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	7
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0030
Heat Input Rate, MBtu/hr		=	934.20
Particulate Emission Rate(lb/hr)	E(p)	=	5.938
Particulate Emission Rate(lb/MBtu)		=	0.0064
Total Metals Emission Rate(lb/MBtu)		=	0.00015

APPENDIX E

OPTIMIZATION TEST

MACS TRAIN SULFATE MEASUREMENT DATA SUMMARY

MACS Analysis, ESP Inlet

Run Number	Run Date	MWe	Sample ID	Stack Gas Collected (Vmstd)	Titrant Normality (Nt)	Sample Titer Volume (Vt)	Blank Titer Volume (Vtb)	Liquid Sample Volume (Vsol)	Liquid Aliquot Volume (Va)	Weight of SO2 (gm)	[SO2] (PPM)	Weight of SO3 (gm)	[SO3] (PPM)	CEMS [SO2]	Run Total Gas Pha [SO3]
SO3-1	17 May	58	SO3-1-I	5.06	0.09130	23.08	0.00	93	20	0.3138	824	N/A	N/A	1094	25
SO3-2	18 May	110	SO3-2-I	4.88	0.09130	16.50	0.00	130	20	0.3136	854	N/A	N/A	995	10
SO3-3	19 May	110	SO3-3-I	5.44	0.09130	22.53	0.00	128	20	0.4217	1030	N/A	N/A	1063	20
SO3-4	19 May	82	SO3-4-I	5.93	0.09130	29.37	0.00	130	20	0.5582	1251	N/A	N/A	1072	8
SO3-5	20 May	100	SO3-5-I	5.70	0.09130	22.07	0.00	128	20	0.4130	962	N/A	N/A	1032	12
SO3-6	20 May	82	SO3-6-I	7.49	0.09130	28.17	0.00	130	20	0.5354	949	N/A	N/A	1084	8
SO3-1	17 May	58	SO3-1-C	5.06	0.00917	3.04	0.00	78.3	20	N/A	N/A	0.0044	17	-	-
SO3-2	18 May	110	SO3-2-C	4.88	0.00855	1.20	0.00	68	20	N/A	N/A	0.0014	6	-	-
SO3-3	19 May	110	SO3-3-C	5.44	0.00855	4.53	0.00	50	20	N/A	N/A	0.0039	14	-	-
SO3-4	19 May	82	SO3-4-C	5.93	0.00855	1.93	0.00	46	20	N/A	N/A	0.0015	5	-	-
SO3-5	20 May	100	SO3-5-C	5.70	0.00855	1.58	0.00	79	20	N/A	N/A	0.0021	7	-	-
SO3-6	20 May	82	SO3-6-C	7.49	0.00855	1.07	0.00	84	20	N/A	N/A	0.0015	4	-	-
SO3-1	17 May	58	SO3-1-Pr	5.06	0.00855	1.90	0.00	66	20	N/A	N/A	0.0021	8	-	-
SO3-2	18 May	110	SO3-2-Pr	4.88	0.00855	1.10	0.00	46	20	N/A	N/A	0.0009	4	-	-
SO3-3	19 May	110	SO3-3-Pr	5.44	0.00855	1.80	0.00	57	20	N/A	N/A	0.0018	6	-	-
SO3-4	19 May	82	SO3-4-Pr	5.93	0.00855	1.25	0.00	45	20	N/A	N/A	0.0010	3	-	-
SO3-5	20 May	100	SO3-5-Pr	5.70	0.00855	1.75	0.00	52	20	N/A	N/A	0.0016	5	-	-
SO3-6	20 May	82	SO3-6-Pr	7.49	0.00855	1.45	0.00	64	20	N/A	N/A	0.0016	4	-	-
SO3-1	17 May	58	SO3-1-Pl	5.06	0.00855	0.50	0.10	101	20	N/A	N/A	0.0007	3	-	-
SO3-2	18 May	110	SO3-2-Pl	4.88	0.00855	0.53	0.10	75	20	N/A	N/A	0.0006	2	-	-
SO3-3	19 May	110	SO3-3-Pl	5.44	0.00855	0.50	0.10	93	20	N/A	N/A	0.0006	2	-	-
SO3-4	19 May	82	SO3-4-Pl	5.93	0.00855	0.40	0.10	97	20	N/A	N/A	0.0005	2	-	-
SO3-5	20 May	100	SO3-5-Pl	5.70	0.00855	0.27	0.10	65	20	N/A	N/A	0.0002	1	-	-
SO3-6	20 May	82	SO3-6-Pl	7.49	0.00855	0.40	0.10	99	20	N/A	N/A	0.0005	1	-	-
N/A	composite	N/A	IPA Blank	N/A	0.00855	0.00	0.00	20	20	N/A	N/A	N/A	N/A	-	-
N/A	composite	N/A	DI Blank	N/A	0.00855	0.00	0.00	20	20	N/A	N/A	N/A	N/A	-	-
N/A	composite	N/A	H2O2 Blank	N/A	0.00855	0.00	0.00	23	20	N/A	N/A	N/A	N/A	-	-
N/A	composite	N/A	Plug Blank	N/A	0.00855	0.10	0.00	100	20	N/A	N/A	N/A	N/A	-	-

SO3-x-I = Impinger Sample (SO2)
SO3-x-C = Condenser Sample (gas phase SO3)
SO3-x-Pr = Probe Sample (gas phase SO3)
SO3-x-Pl = Glass Plug Sample (particulate absorbed SO3)

APPENDIX F

OPTIMIZATION TEST

FLYASH RESISTIVITY AT ESP INLET—DATA SUMMARY

Resistivity Calculations

Date	Run	MWe	V-I Curve Data I(uA)	Delta V (KV)	Plate Area(cm2)	Ash Depth(cm)	Spark Data Volts	uAmps	Ash Resistivity, Ohm/c from V-I Curve	Spark
1 Apr	RI2	110	1.00	3.151	5	0.175	800	1.68	9.0E+10	4.2E+10
21 Apr	RIE1	98	2.00	0.470	5	0.053	100	0.19	2.2E+10	1.5E+11
21 Apr	RI13	82	0.48	8.470	5	0.427	*	*	2.1E+11	*
22 Apr	RI14	57	1.00	4.814	5	0.091	100	0.28	2.6E+11	4.5E+10
23 Apr	RI15	57	0.75	3.610	5	0.248	100	1.24	9.7E+10	3.7E+09
24 Apr	RI16	110	1.00	1.590	5	0.073	100	9.8	1.1E+11	1.5E+09
27 Apr	RI17	110	1.00	2.056	5	0.100	100	0.1	1.0E+11	1.1E+11
28 Apr	RI18	90	1.00	2.889	5	0.105	100	0.08	1.4E+11	1.3E+11
29 Apr	RI19	82	1.00	4.000	5	0.143	*	*	1.4E+11	*
17 May	RI24	55	2.00	2.000	5	0.210	*	*	2.4E+10	*
17 May	RI25	58	2.55	2.000	5	0.186	*	*	2.1E+10	*
18 May	RI26	110	1.00	3.745	5	0.236	400	3.07	7.9E+10	5.9E+09
19 May	RI27	110	1.00	4.467	5	0.067	200	3.39	3.3E+11	9.5E+09
19 May	RI28	82	1.00	3.813	5	0.282	100	0.14	6.8E+10	2.7E+10
20 May	RI29	110	1.00	3.326	5	0.439	*	*	3.8E+10	*
20 May	RI30	82	2.00	1.200	5	0.439	*	*	6.8E+09	*

* - premature spark, no spark data

Resistivity Data, Nelson Dewey Station, Unit 2, North ESP Inlet

Run I2, 4/1/92, 110MWe

Plate Voltage	Current, uA Clean	Dirty
4.0	0.00	0.00
5.0	0.16	0.01
6.0	0.37	0.02
7.0	0.56	0.04
8.0	0.87	0.12
9.0	1.00	0.25
10.0	1.56	0.53
11.0	1.83	0.62
12.0	2.32	1.12
13.0	2.85	1.49
14.0	3.48	1.90
15.0	4.15	2.53

Run E1, 4/21/92, 98MWe

Plate Voltage	Current, uA Clean	Dirty
6.0	0.00	0.09
7.0	0.05	0.14
8.0	0.18	0.24
9.0	0.42	0.27
10.0	0.62	0.52
11.0	0.81	0.63
12.0	1.06	0.89
13.0	1.45	1.18
14.0	2.02	1.72
15.0	2.74	2.42
16.0	3.30	

Run I13, 4/21/92, 82MWe

Plate Voltage,K	Current, uA Clean	Dirty
5.0	0.00	0.00
6.0	0.14	0.09
7.0	0.34	0.09
8.0	0.46	0.14
9.0	0.52	0.12
10.0	0.81	0.24
11.0	0.94	0.27
12.0	1.48	0.32
13.0	1.75	0.33
14.0	2.11	0.38
15.0	2.44	0.40
16.0	2.91	0.42
17.0	3.15	0.47

Run I14, 4/22/92, 57MWe

Plate Voltage	Current, uA Clean	Dirty
5.0	0.00	0.00
6.0	0.06	0.00
7.0	0.21	0.00
8.0	0.37	0.00
9.0	0.50	0.03
10.0	0.81	0.07
11.0	1.11	0.09
12.0	1.49	0.14
13.0	1.89	0.22
14.0	1.96	0.55
15.0	2.48	0.77
16.0	2.96	1.22
17.0	3.68	

Run I15, 4/23/92, 57MWe

Plate Voltage	Current, uA Clean	Dirty
7.0	0.00	0.00
8.0	0.06	0.00
9.0	0.48	0.00
10.0	0.77	0.00
11.0	1.01	0.09
12.0	1.28	0.39
13.0	1.67	0.58
14.0	2.00	0.77
15.0	2.22	
16.0	2.64	
17.0	3.08	

Run I16, 4/24/92, 110M

Plate Voltage	Current, uA Clean	Dirty
6.0	0.00	0.00
7.0	0.14	0.13
8.0	0.32	0.16
9.0	0.53	0.34
10.0	0.79	0.39
11.0	1.08	0.58
12.0	1.28	0.96
13.0	1.71	1.19
14.0	2.14	1.55
15.0	2.82	1.74
16.0	3.29	2.28
17.0	4.01	

Run I17, 4/27/92, 110MWe

Plate Voltage	Current, uA Clean	Current, uA Dirty
6.0	0.00	0.00
7.0	0.40	0.00
8.0	0.72	0.12
9.0	1.22	0.32
10.0	1.52	0.89
11.0	1.84	1.11
12.0	2.32	1.49
13.0	2.78	2.07
14.0	3.56	2.50
15.0	3.97	3.15
16.0	4.73	
17.0	5.52	

Run I18, 4/28/92, 90MWe

Plate Voltage	Current, uA Clean	Current, uA Dirty
6.0	0.00	0.00
7.0	0.03	0.00
8.0	0.03	0.00
9.0	0.37	0.03
10.0	0.34	0.06
11.0	0.97	0.11
12.0	1.33	0.20
13.0	1.60	0.32
14.0	2.21	1.14
15.0	2.71	1.55
16.0	3.50	1.87
17.0	4.00	2.36

Run I24, 5/17/92, 55MW

Plate Voltage	Current, uA Clean	Current, uA Dirty
4.0	0.00	0.00
5.0	0.26	0.28
6.0	0.36	0.50
7.0	0.62	0.75
8.0	0.82	1.12
9.0	1.07	1.73
10.0	1.41	2.01
11.0	1.65	2.37
12.0	2.02	2.73
13.0	2.64	3.19
14.0	3.08	
15.0	3.56	
16.0	4.22	

Run I25, 5/17/92, 58MWe

Plate Voltage	Current, uA Clean	Dirty
3.0	0.00	0.00
4.0	0.12	0.00
5.0	0.32	0.00
6.0	0.59	0.04
7.0	0.84	0.48
8.0	1.14	1.67
9.0	1.61	2.55
10.0	2.15	4.75
11.0	2.56	6.30
12.0	3.32	7.78
13.0	4.03	9.98

Run I26, 5/18/92, 110MWe

Plate Voltage	Current, uA Clean	Dirty
4.0	0.00	0.00
5.0	0.05	0.00
6.0	0.44	0.00
7.0	0.66	0.00
8.0	0.97	0.03
9.0	1.18	0.07
10.0	1.67	0.35
11.0	2.01	0.68
12.0	2.49	0.97
13.0	2.75	1.45
14.0	3.64	1.73
15.0		2.14

Run I27, 5/19/92, 110M

Plate Voltage	Current, uA Clean	Dirty
4.0	0.00	0.00
5.0	0.05	0.00
6.0	0.34	0.00
7.0	0.59	0.00
8.0	0.80	0.00
9.0	1.03	0.03
10.0	1.44	0.05
11.0	1.74	0.06
12.0	2.08	0.62
13.0	2.64	0.81
14.0	3.30	1.42
15.0	3.94	
16.0	4.75	

Run I28, 5/19/92, 82MWe

Plate Voltage	Current, uA Clean	Current, uA Dirty
4.0	0.00	0.00
5.0	0.03	0.00
6.0	0.19	0.00
7.0	0.46	0.00
8.0	0.78	0.00
9.0	1.10	0.03
10.0	1.41	0.07
11.0	1.71	0.15
12.0	2.03	0.42
13.0	2.71	0.86
14.0	3.34	2.41
15.0	4.02	3.17
16.0	4.68	

Run I29, 5/20/92, 110MWe

Plate Voltage	Current, uA Clean	Current, uA Dirty
4.0	0.00	0.00
5.0	0.04	0.00
6.0	0.18	0.00
7.0	0.34	0.00
8.0	0.52	0.00
9.0	0.70	0.03
10.0	0.90	0.08
11.0	1.44	0.19
12.0	1.73	0.46
13.0	2.30	0.90
14.0	2.76	1.49
15.0	3.57	1.72

Run I30, 5/20/92, 82MW

Plate Voltage	Current, uA Clean	Current, uA Dirty
4.0	0.00	0.00
5.0	0.05	0.00
6.0	0.26	0.25
7.0	0.45	0.57
8.0	0.73	0.94
9.0	1.11	1.50
10.0	1.58	2.01
11.0	1.91	2.66
12.0	2.36	3.30
13.0	2.96	4.01
14.0	3.65	4.63
15.0	4.26	5.57
16.0	4.81	

Run I14, 4/22/92, 57MWe

Plate Voltage	Current, uA Clean	Dirty
5.0	0.00	0.00
6.0	0.06	0.00
7.0	0.21	0.00
8.0	0.37	0.00
9.0	0.50	0.03
10.0	0.81	0.07
11.0	1.11	0.09
12.0	1.49	0.14
13.0	1.89	0.22
14.0	1.96	0.55
15.0	2.48	0.77
16.0	2.96	1.22
17.0	3.68	
18.0	4.04	

Run I15, 4/23/92, 57MWe

Plate Voltage	Current, uA Clean	Dirty
7.0	0.00	0.00
8.0	0.06	0.00
9.0	0.48	0.00
10.0	0.77	0.00
11.0	1.01	0.09
12.0	1.28	0.39
13.0	1.67	0.58
14.0	2.00	0.77
15.0	2.22	
16.0	2.64	
17.0	3.08	

Run I16, 4/24/92, 110M

Plate Voltage	Current, uA Clean	Dirty
6.0	0.00	0.00
7.0	0.14	0.13
8.0	0.32	0.16
9.0	0.53	0.34
10.0	0.79	0.39
11.0	1.08	0.58
12.0	1.28	0.96
13.0	1.71	1.19
14.0	2.14	1.55
15.0	2.82	1.74
16.0	3.29	2.28
17.0	4.01	

Run I17, 4/27/92, 110MWe

Plate Voltage	Current, uA Clean	Dirty
6.0	0.00	0.00
7.0	0.40	0.00
8.0	0.72	0.12
9.0	1.22	0.32
10.0	1.52	0.89
11.0	1.84	1.11
12.0	2.32	1.49
13.0	2.78	2.07
14.0	3.58	2.50
15.0	3.97	3.15
16.0	4.73	
17.0	5.52	

Run I18, 4/28/92, 90MWe

Plate Voltage	Current, uA Clean	Dirty
6.0	0.00	0.00
7.0	0.03	0.00
8.0	0.03	0.00
9.0	0.37	0.03
10.0	0.34	0.06
11.0	0.97	0.11
12.0	1.33	0.20
13.0	1.60	0.32
14.0	2.21	1.14
15.0	2.71	1.55
16.0	3.50	1.87
17.0	4.00	2.36

Run I24, 5/17/92, 55MW

Plate Voltage	Current, uA Clean	Dirty
4.0	0.00	0.00
5.0	0.26	0.28
6.0	0.36	0.50
7.0	0.62	0.75
8.0	0.82	1.12
9.0	1.07	1.73
10.0	1.41	2.01
11.0	1.65	2.37
12.0	2.02	2.73
13.0	2.64	3.19
14.0	3.08	
15.0	3.56	
16.0	4.22	
17.0	4.86	
18.0	5.69	
19.0	6.66	

Run I25, 5/17/92, 58MWe

Plate Voltage	Current, uA Clean	Dirty
3.0	0.00	0.00
4.0	0.12	0.00
5.0	0.32	0.00
6.0	0.59	0.04
7.0	0.84	0.48
8.0	1.14	1.67
9.0	1.61	2.55
10.0	2.15	4.75
11.0	2.56	6.30
12.0	3.32	7.78
13.0	4.03	9.98

Run I26, 5/18/92, 110MWe

Plate Voltage	Current, uA Clean	Dirty
4.0	0.00	0.00
5.0	0.05	0.00
6.0	0.44	0.00
7.0	0.66	0.00
8.0	0.97	0.03
9.0	1.18	0.07
10.0	1.67	0.35
11.0	2.01	0.68
12.0	2.49	0.97
13.0	2.75	1.45
14.0	3.64	1.73
15.0		2.14

Run I27, 5/19/92, 110M

Plate Voltage	Current, uA Clean	Dirty
4.0	0.00	0.00
5.0	0.05	0.00
6.0	0.34	0.00
7.0	0.59	0.00
8.0	0.80	0.00
9.0	1.03	0.03
10.0	1.44	0.05
11.0	1.74	0.06
12.0	2.08	0.62
13.0	2.64	0.81
14.0	3.30	1.42
15.0	3.94	
16.0	4.75	
17.0	5.42	

Run I28, 5/19/92, 82MWe

Plate Voltage	Current, uA Clean	Dirty
4.0	0.00	0.00
5.0	0.03	0.00
6.0	0.19	0.00
7.0	0.46	0.00
8.0	0.78	0.00
9.0	1.10	0.03
10.0	1.41	0.07
11.0	1.71	0.15
12.0	2.03	0.42
13.0	2.71	0.86
14.0	3.34	2.41
15.0	4.02	3.17
16.0	4.68	
17.0	5.65	

Run I29, 5/20/92, 110MWe

Plate Voltage	Current, uA Clean	Dirty
4.0	0.00	0.00
5.0	0.04	0.00
6.0	0.18	0.00
7.0	0.34	0.00
8.0	0.52	0.00
9.0	0.70	0.03
10.0	0.90	0.08
11.0	1.44	0.19
12.0	1.73	0.46
13.0	2.30	0.90
14.0	2.76	1.49
15.0	3.57	1.72

Run I30, 5/20/92, 82MW

Plate Voltage	Current, uA Clean	Dirty
4.0	0.00	0.00
5.0	0.05	0.00
6.0	0.26	0.25
7.0	0.45	0.57
8.0	0.73	0.94
9.0	1.11	1.50
10.0	1.58	2.01
11.0	1.91	2.66
12.0	2.36	3.30
13.0	2.96	4.01
14.0	3.65	4.63
15.0	4.26	5.57
16.0	4.81	
17.0	5.80	

APPENDIX G

OPTIMIZATION TEST

TRACE METALS AT ESP OUTLET—DATA SUMMARY

B&W2 - Metals Anlysis

Run 1 - Front Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.7	69.09	199355	< 0.000
Arsenic	69.3	"	"	0.026
Barium	68.4	"	"	0.026
Cadmium	4.17	"	"	0.002
Chromium	22.6	"	"	0.009
Lead	71.8	"	"	0.027
Selenium	11.5	"	"	0.004
Total Metals	< 248.5	"	"	< 0.095

Run 1 - Back Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.959	69.09	199355	< 0.000
Arsenic	1.6	"	"	0.001
Barium	3.1	"	"	0.001
Cadmium	1.15	"	"	0.000
Chromium	3.99	"	"	0.002
Lead	19.9	"	"	0.008
Selenium	216	"	"	0.082
Total Metals	< 246.6	"	"	< 0.094
Total Train	< 495.1	"	"	<0.1890

Run 2 - Front Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.7	51.02	146808	< 0.000
Arsenic	32.6	"	"	0.012
Barium	34.8	"	"	0.013
Cadmium	2.35	"	"	0.001
Chromium	11.5	"	"	0.004
Lead	27.9	"	"	0.011
Selenium	22.0	"	"	0.008
Total Metals	< 131.9	"	"	< 0.050

Run 2 - Back Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.95	51.02	146808	< 0.000
Arsenic	4.28	"	"	0.002
Barium	3.66	"	"	0.001
Cadmium	0.676	"	"	0.000
Chromium	< 1.63	"	"	< 0.001
Lead	< 0.271	"	"	< 0.000
Selenium	81.9	"	"	0.031
Total Metals	< 93.4	"	"	< 0.036
Total Train	< 225.2	"	"	<0.0859

Run 3 - Front Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 1.08	52.12	146669	< 0.000
Arsenic	21.8	"	"	0.008
Barium	9.35	"	"	0.004
Cadmium	2.25	"	"	0.001
Chromium	4.8	"	"	0.002
Lead	5.69	"	"	0.002
Selenium	17.1	"	"	0.007
Total Metals	< 62.1	"	"	< 0.024

Run 3 - Back Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.959	52.12	146669	< 0.000
Arsenic	< 0.274	"	"	< 0.000
Barium	3.51	"	"	0.001
Cadmium	1.220	"	"	0.000
Chromium	1.83	"	"	0.001
Lead	< 0.274	"	"	< 0.000
Selenium	75.0	"	"	0.029
Total Metals	< 83.1	"	"	< 0.032
Total Train	< 145.1	"	"	<0.0554

Run 4 - Front Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	0.731	51.43	147993	0.000
Arsenic	82.2	"	"	0.031
Barium	83.2	"	"	0.032
Cadmium	5.82	"	"	0.002
Chromium	33.3	"	"	0.013
Lead	87.8	"	"	0.034
Selenium	15.7	"	"	0.006
Total Metals	308.8	"	"	0.118

Run 4 - Back Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 1.02	51.43	147993	< 0.000
Arsenic	0.669	"	"	0.000
Barium	< 2.91	"	"	< 0.001
Cadmium	1.16	"	"	0.000
Chromium	< 1.75	"	"	< 0.001
Lead	1.29	"	"	0.000
Selenium	121	"	"	0.046
Total Metals	< 129.8	"	"	< 0.050
Total Train	< 438.6	"	"	<0.1674

Run 5 - Front Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.700	83.36	244220	< 0.000
Arsenic	39.2	"	"	0.015
Barium	48.4	"	"	0.018
Cadmium	28.9	"	"	0.011
Chromium	23.7	"	"	0.009
Lead	76.7	"	"	0.029
Selenium	17.5	"	"	0.007
Total Metals	< 235.1	"	"	< 0.090

Run 5 - Back Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.900	83.36	244220	< 0.000
Arsenic	0.360	"	"	0.000
Barium	< 2.57	"	"	< 0.001
Cadmium	0.756	"	"	0.000
Chromium	1.56	"	"	0.001
Lead	1.83	"	"	0.001
Selenium	525	"	"	0.200
Total Metals	< 533.0	"	"	< 0.203
Total Train	< 768.1	"	"	<0.2932

Run 6 - Front Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.700	84.9	247446	< 0.000
Arsenic	31.6	"	"	0.012
Barium	29.2	"	"	0.011
Cadmium	4.85	"	"	0.002
Chromium	14.2	"	"	0.005
Lead	32.8	"	"	0.013
Selenium	20.2	"	"	0.008
Total Metals	< 133.6	"	"	< 0.051

Run 6 - Back Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.906	84.9	247446	< 0.000
Arsenic	0.259	"	"	0.000
Barium	< 2.59	"	"	< 0.001
Cadmium	0.640	"	"	0.000
Chromium	< 1.55	"	"	< 0.001
Lead	1.50	"	"	0.001
Selenium	434	"	"	0.166
Total Metals	< 441.4	"	"	< 0.169
Total Train	< 575.0	"	"	<0.2195

Run 7 - Front Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.700	64.59	186568	< 0.000
Arsenic	26.8	"	"	0.010
Barium	18.5	"	"	0.007
Cadmium	11.30	"	"	0.004
Chromium	22.8	"	"	0.009
Lead	22.1	"	"	0.008
Selenium	17.1	"	"	0.007
Total Metals	< 119.3	"	"	< 0.046

Run 7 - Back Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.926	64.59	186568	< 0.000
Arsenic	42.7	"	"	0.016
Barium	5.3	"	"	0.002
Cadmium	1.03	"	"	0.000
Chromium	1.95	"	"	0.001
Lead	1.76	"	"	0.001
Selenium	236	"	"	0.090
Total Metals	< 289.7	"	"	< 0.111
Total Train	< 409.0	"	"	<0.1561

Run 8 - Front Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.700	85.27	243603	< 0.000
Arsenic	38.4	"	"	0.015
Barium	33.4	"	"	0.013
Cadmium	7.05	"	"	0.003
Chromium	27.5	"	"	0.010
Lead	30.2	"	"	0.012
Selenium	14.3	"	"	0.005
Total Metals	< 151.6	"	"	< 0.058

Run 8 - Back Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.884	85.27	243603	< 0.000
Arsenic	34.9	"	"	0.013
Barium	< 2.53	"	"	< 0.001
Cadmium	0.614	"	"	0.000
Chromium	1.85	"	"	0.001
Lead	1.36	"	"	0.001
Selenium	441	"	"	0.168
Total Metals	< 483.1	"	"	< 0.184
Total Train	< 634.7	"	"	<0.2422

Run 9 - Front Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.700	85.27	243603	< 0.000
Arsenic	21.4	"	"	0.008
Barium	11.0	"	"	0.004
Cadmium	12.4	"	"	0.005
Chromium	9.23	"	"	0.004
Lead	18.8	"	"	0.007
Selenium	10.7	"	"	0.004
Total Metals	< 84.2	"	"	< 0.032

Run 9 - Back Half

Metal	ug/sample	Vmstd (ft3)	Qs (ACFM)	Emissio Rate (lb/hr)
Silver	< 0.969	85.27	243603	< 0.000
Arsenic	78.4	"	"	0.030
Barium	< 2.77	"	"	< 0.001
Cadmium	0.670	"	"	0.000
Chromium	2.24	"	"	0.001
Lead	1.62	"	"	0.001
Selenium	189	"	"	0.072
Total Metals	< 275.7	"	"	< 0.105
Total Train	< 359.9	"	"	<0.1373

APPENDIX H

OPTIMIZATION TEST

PARTICULATE SIZING DATA SUMMARY AT ESP INLET AND OUTLET

WP&L Particle Sizing

Run And1, Inlet, 11 Apr, Full Load Baseline

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (microns)
E-time=	3	1	0.7	2.9	97.1	11.6
Vm=	1.105	2	1.5	6.3	90.8	7.2
Pb=	29.44	3	3.7	15.5	75.3	4.9
Ts=	460	4	4.1	17.2	58.2	3.4
Sstat=	21	5	3.7	15.5	42.7	2.1
Tm=	70	6	5.6	23.4	19.2	1.0
Delta h=	0.416	7	1.4	5.9	13.4	0.66
Delta p=	0.95	8	0.8	3.3	10.0	0.44
Dn=	0.172	Backup	2.4	10.0	0.0 <	0.44
% Isokin=	91.9	Total	23.9	100.0		
Imp ACFM=	0.63					

Run And2, Inlet, 22 Apr

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (micron
E-time=	6	1	0.5	4.1	95.9	16.3
Vm=	1.209	2	0.3	2.5	93.4	10.2
Pb=	29.54	3	0.3	2.5	91.0	6.9
Ts=	400	4	0.4	3.3	87.7	4.7
Sstat=	10	5	0.6	4.9	82.8	3.0
Tm=	50	6	3.9	32.0	50.8	1.50
Delta h=	0.098	7	2.2	18.0	32.8	0.95
Delta p=	0.30	8	1.6	13.1	19.7	0.64
Dn=	0.172	Backup	2.4	19.7	0.0 <	0.64
% Isokin=	91.2	Total	12.2	100.0		
Imp ACFM=	0.34					

Run And3, Inlet, 23 Apr

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (microns)
E-time=	4	1	17.5	16.2	83.8	13.9
Vm=	1.139	2	11.6	10.8	73.0	8.6
Pb=	29.53	3	27.2	25.2	47.8	5.9
Ts=	420	4	10.9	10.1	37.7	4.0
Sstat=	10	5	12.4	11.5	26.2	2.6
Tm=	85	6	15.7	14.6	11.6	1.3
Delta h=	0.105	7	7.8	7.2	4.4	0.79
Delta p=	0.30	8	3.2	3.0	1.4	0.54
Dn=	0.172	Backup	1.5	1.4	0.0 <	0.54
% Isokin=	121.9	Total	107.8	100.0		
Imp ACFM=	0.47					

Run And4, Inlet, 24 Apr

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (micron
E-time=	4	1	4.5	7.3	92.7	11.3
Vm=	1.716	2	7.1	11.5	81.2	7.0
Pb=	29.55	3	13.4	21.8	59.4	4.8
Ts=	430	4	8.1	13.1	46.3	3.3
Sstat=	20	5	9.9	16.1	30.2	2.1
Tm=	70	6	10.9	17.7	12.5	1.00
Delta h=	0.617	7	4.1	6.7	5.8	0.64
Delta p=	1.05	8	1.8	2.9	2.9	0.43
Dn=	0.172	Backup	1.8	2.9	0.0 <	0.43
% Isokin=	100.5	Total	61.6	100.0		
Imp ACFM=	0.71					

WP&L Particle Sizing

Run And5, Inlet, 27 Apr

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (microns)
E-time=	4	1	5.6	7.3	92.7	10.9
Vm=	1.784	2	9.7	12.7	79.9	6.8
Pb=	29.82	3	20.9	27.4	52.5	4.6
Ts=	470	4	13.0	17.1	35.4	3.2
Sstat=	20	5	10.8	14.2	21.3	2.0
Tm=	90	6	9.3	12.2	9.1	1.0
Delta h=	0.534	7	3.3	4.3	4.7	0.61
Delta p=	1.10	8	1.3	1.7	3.0	0.41
Dn=	0.172	Backup	2.3	3.0	0.0 <	0.41
% Isokin=	101.0	Total	76.2	100.0		
Imp ACFM=	0.75					

Run And6, Inlet, 28 Apr

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (micron
E-time=	4	1	2.8	5.5	94.5	11.8
Vm=	1.497	2	4.2	8.3	86.2	7.3
Pb=	29.45	3	10.7	21.1	65.1	5.0
Ts=	460	4	8.6	17.0	48.1	3.4
Sstat=	16	5	9.7	19.1	29.0	2.2
Tm=	70	6	9.5	18.7	10.3	1.10
Delta h=	0.481	7	2.3	4.5	5.7	0.67
Delta p=	0.84	8	1.3	2.6	3.2	0.45
Dn=	0.172	Backup	1.6	3.2	0.0 <	0.45
% Isokin=	99.9	Total	50.7	100.0		
Imp ACFM=	0.65					

Run And7, Inlet, 29 Apr

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (microns)
E-time=	4	1	26.7	33.9	66.1	11.9
Vm=	1.536	2	8.4	10.7	55.5	7.4
Pb=	29.26	3	10.7	13.6	41.9	5.0
Ts=	470	4	8.6	10.9	31.0	3.4
Sstat=	15	5	9.7	12.3	18.7	2.2
Tm=	100	6	9.5	12.1	6.6	1.1
Delta h=	0.3	7	2.3	2.9	3.7	0.67
Delta p=	0.75	8	1.3	1.6	2.0	0.45
Dn=	0.172	Backup	1.6	2.0	0.0 <	0.45
% Isokin=	103.0	Total	78.8	100.0		
Imp ACFM=	0.64					

Run And8, Inlet, 1 May

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (micron
E-time=	4	1	19.5	25.3	74.7	13.4
Vm=	1.177	2	14.5	18.8	55.8	8.4
Pb=	29.24	3	9.9	12.9	43.0	5.7
Ts=	430	4	8.3	10.8	32.2	3.9
Sstat=	10	5	8.0	10.4	21.8	2.5
Tm=	75	6	9.8	12.7	9.1	1.2
Delta h=	0.259	7	4.1	5.3	3.8	0.77
Delta p=	0.45	8	1.5	1.9	1.8	0.52
Dn=	0.172	Backup	1.4	1.8	0.0 <	0.52
% Isokin=	104.9	Total	77	100.0		
Imp ACFM=	0.50					

WP&L Particle Sizing

Run And9, Inlet, 1 May, 110MWe

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (microns)
E-time=	4	1	6.5	14.6	85.4	11.2
Vm=	1.668	2	4.2	9.4	76.0	7.0
Pb=	29.15	3	7.0	15.7	60.2	4.7
Ts=	480	4	7.9	17.8	42.5	3.2
Sstat=	20	5	5.0	11.2	31.2	2.1
Tm=	80	6	10.1	22.7	8.5	1.00
Delta h=	0.684	7	2.2	4.9	3.6	0.63
Delta p=	1.20	8	0.8	1.8	1.8	0.43
Dn=	0.172	Backup	0.8	1.8	0.0 <	0.43
% Isokin=	91.5	Total	44.5	100.0		
Imp ACFM=	0.72					

Run And10, Inlet, 16 May, 82MWe

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (micron
E-time=	4	1	12.6	15.3	84.7	13.4
Vm=	1.239	2	12.5	15.2	69.5	8.4
Pb=	29.43	3	13.0	15.8	53.7	5.7
Ts=	430	4	11.2	13.6	40.1	3.9
Sstat=	14	5	12.2	14.8	25.3	2.5
Tm=	98	6	12.9	15.7	9.6	1.2
Delta h=	0.77	7	5.4	6.6	3.0	0.77
Delta p=	0.46	8	1.4	1.7	1.3	0.52
Dn=	0.172	Backup	1.1	1.3	0.0 <	0.52
% Isokin=	104.8	Total	82.3	100.0		
Imp ACFM=	0.50					

Run And11, Inlet, 17 May, 57MWe

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (microns)
E-time=	4	1	22.9	35.7	64.3	17.0
Vm=	0.804	2	6.5	10.1	54.1	10.6
Pb=	29.62	3	10.3	16.1	38.1	7.2
Ts=	420	4	3.3	5.1	32.9	4.9
Sstat=	20	5	7.2	11.2	21.7	3.2
Tm=	98	6	8.8	13.7	8.0	1.60
Delta h=	0.113	7	3.6	5.6	2.3	0.99
Delta p=	0.40	8	1.4	2.2	0.2	0.67
Dn=	0.154	Backup	0.1	0.2	0.0 <	0.67
% Isokin=	89.9	Total	64.1	100.0		
Imp ACFM=	0.31					

Run And12, Inlet, 18 May, 110MWe

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (micron
E-time=	4	1	9.9	22.3	77.7	12.3
Vm=	1.438	2	8.6	19.4	58.2	7.6
Pb=	29.84	3	7.3	16.5	41.8	5.2
Ts=	460	4	6.0	13.5	28.2	3.5
Sstat=	14	5	5.5	12.4	15.8	2.3
Tm=	90	6	5.6	12.6	3.2	1.1
Delta h=	0.387	7	0.7	1.6	1.6	0.70
Delta p=	1.10	8	0.7	1.6	0.0	0.47
Dn=	0.162	Backup	0.0	0.0	0.0 <	0.47
% Isokin=	91.9	Total	44.3	100.0		
Imp ACFM=	0.60					

WP&L Particle Sizing

Run And13, Inlet, 19 May, 110MWe

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (microns)
E-time=	4	1	4.9	14.4	85.6	11.8
Vm=	1.5	2	4.5	13.2	72.4	7.3
Pb=	29.74	3	5.5	16.1	56.3	5.0
Ts=	475	4	5.3	15.5	40.8	3.4
Sstat=	20	5	5.1	15.0	25.8	2.2
Tm=	78	6	6.5	19.1	6.7	1.10
Delta h=	0.373	7	1.9	5.6	1.2	0.67
Delta p=	1.30	8	0.0	0.0	1.2	0.45
Dn=	0.162	Backup	0.4	1.2	0.0 <	0.45
% Isokin=	90.1	Total	34.1	100.0		
Imp ACFM=	0.65					

Run And14, Inlet, 19 May, 82MWe

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (micron
E-time=	4	1	2.1	8.0	92.0	13.9
Vm=	1.154	2	2.1	8.0	84.0	8.6
Pb=	29.62	3	3.6	13.7	70.3	5.9
Ts=	440	4	4.4	16.7	53.6	4.0
Sstat=	14	5	6.2	23.6	30.0	2.6
Tm=	95	6	4.6	17.5	12.5	1.3
Delta h=	0.258	7	1.5	5.7	6.8	0.79
Delta p=	0.70	8	0.3	1.1	5.7	0.54
Dn=	0.162	Backup	1.5	5.7	0.0 <	0.54
% Isokin=	90.3	Total	26.3	100.0		
Imp ACFM=	0.47					

Run And15, Inlet, 20 May, 110MWe

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (microns)
E-time=	4	1	8.3	12.4	87.6	12.5
Vm=	1.412	2	9.8	14.6	72.9	7.8
Pb=	29.74	3	12.1	18.1	54.9	5.3
Ts=	460	4	11.9	17.8	37.1	3.6
Sstat=	20	5	9.3	13.9	23.2	2.3
Tm=	95	6	10.0	14.9	8.2	1.10
Delta h=	0.398	7	3.5	5.2	3.0	0.71
Delta p=	1.05	8	0.8	1.2	1.8	0.48
Dn=	0.162	Backup	1.2	1.8	0.0 <	0.48
% Isokin=	90.8	Total	66.9	100.0		
Imp ACFM=	0.58					

Run And16, Inlet, 20 May, 82MWe

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (micron
E-time=	4	1	17.5	18.1	81.9	14.5
Vm=	1.052	2	11.7	12.1	69.8	9.0
Pb=	29.72	3	20.8	21.5	48.3	6.1
Ts=	450	4	21.6	22.3	26.0	4.2
Sstat=	14	5	6.9	7.1	18.8	2.7
Tm=	95	6	6.5	6.7	12.1	1.3
Delta h=	0.204	7	6.1	6.3	5.8	0.83
Delta p=	0.70	8	4.1	4.2	1.6	0.56
Dn=	0.154	Backup	1.5	1.6	0.0 <	0.56
% Isokin=	91.7	Total	96.7	100.0		
Imp ACFM=	0.43					

Run And01, Outlet, 16 May, 82MWe

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (microns)
E-time=	60	1	0.1	2.1	97.9	13.4
Vm=	17.619	2	0.3	6.2	91.7	8.4
Pb=	29.43	3	0.5	10.3	81.4	5.7
Ts=	460	4	1.0	20.7	60.7	3.9
Sstat=	14	5	0.9	19.4	41.3	2.5
Tm=	80	6	1.0	20.7	20.7	1.20
Delta h=	0.281	7	0.5	10.3	10.3	0.77
Delta p=	0.90	8	0.4	8.3	2.1	0.52
Dn=	0.148	Backup	0.1	2.1	0.0 <	0.52
% Isokin=	100.6	Total	4.8	100.0		
Imp ACFM=	0.50					

Run And02, Outlet, 17 May, 58MWe

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (micron
E-time=	60	1	0.0	0.0	100.0	15.0
Vm=	14.294	2	0.2	4.5	95.5	9.4
Pb=	29.62	3	0.9	20.5	75.0	6.4
Ts=	440	4	0.9	20.5	54.5	4.3
Sstat=	14	5	0.7	15.9	38.6	2.8
Tm=	80	6	0.7	15.9	22.7	1.4
Delta h=	0.157	7	0.4	9.1	13.6	0.87
Delta p=	0.50	8	0.4	9.1	4.5	0.59
Dn=	0.148	Backup	0.2	4.5	0.0 <	0.59
% Isokin=	108.6	Total	4.4	100.0		
Imp ACFM=	0.40					

Run And03, Outlet, 19 May, 110MWe

Sampling Data		Stage	Catch(mg)	%	Cum. % Less Than	ECD (microns)
E-time=	60	1	0.2	3.1	96.9	12.3
Vm=	21.124	2	0.5	7.7	89.2	7.6
Pb=	29.62	3	0.6	9.2	80.0	5.2
Ts=	470	4	1.3	20.0	60.0	3.5
Sstat=	20	5	1.1	16.9	43.1	2.3
Tm=	84	6	1.2	18.5	24.6	1.10
Delta h=	0.377	7	0.7	10.8	13.8	0.70
Delta p=	1.20	8	0.6	9.2	4.6	0.47
Dn=	0.148	Backup	0.3	4.6	0.0 <	0.47
% Isokin=	103.8	Total	6.5	100.0		
Imp ACFM=	0.60					

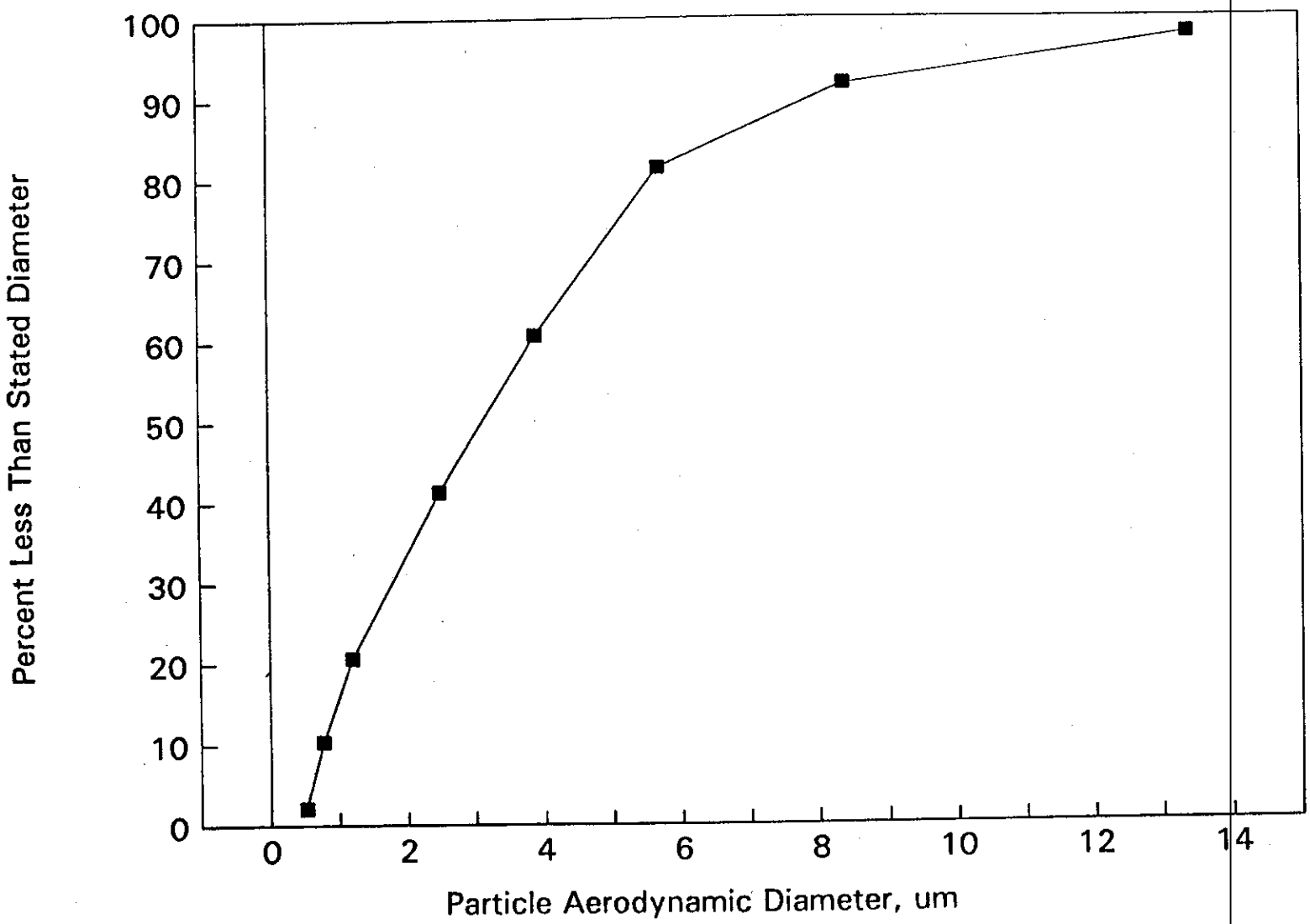
APPENDIX I

OPTIMIZATION TEST

PARTICLE SIZING PLOTS—
ESP INLET AND OUTLET

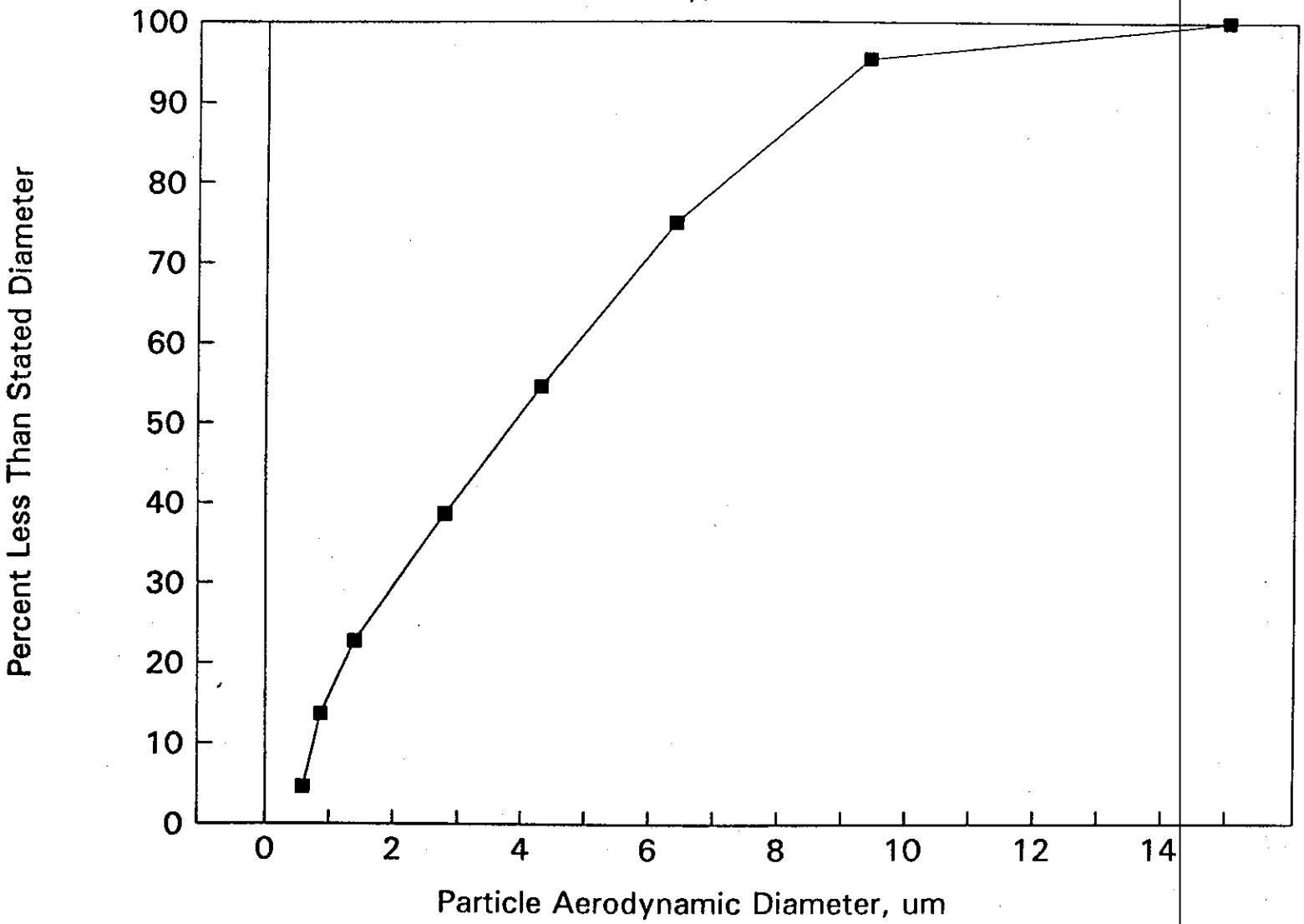
ESP Outlet Run 1

16 May, 1992



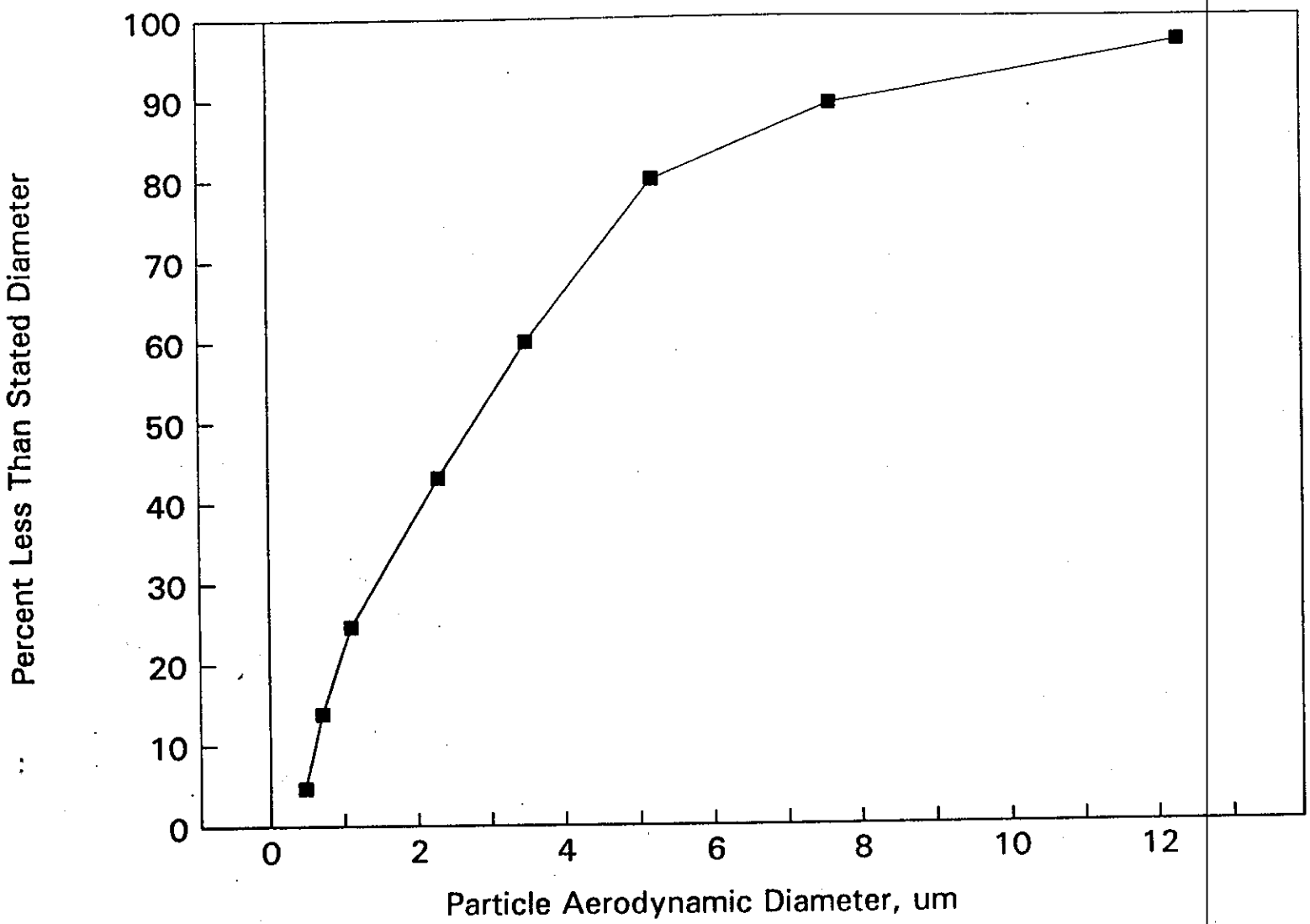
ESP Outlet Run 2

17 May, 1992



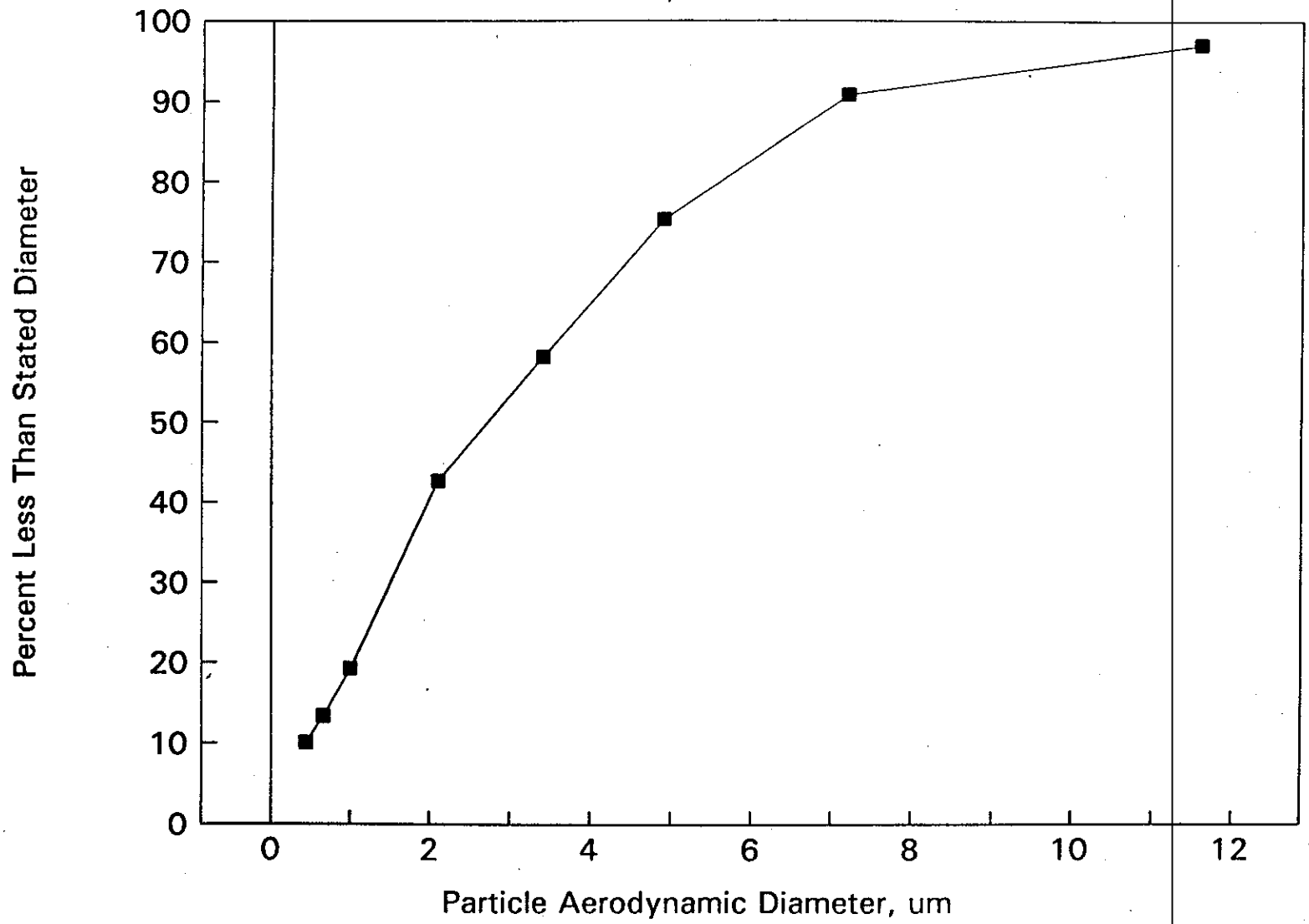
ESP Outlet Run 3

19 May, 1992



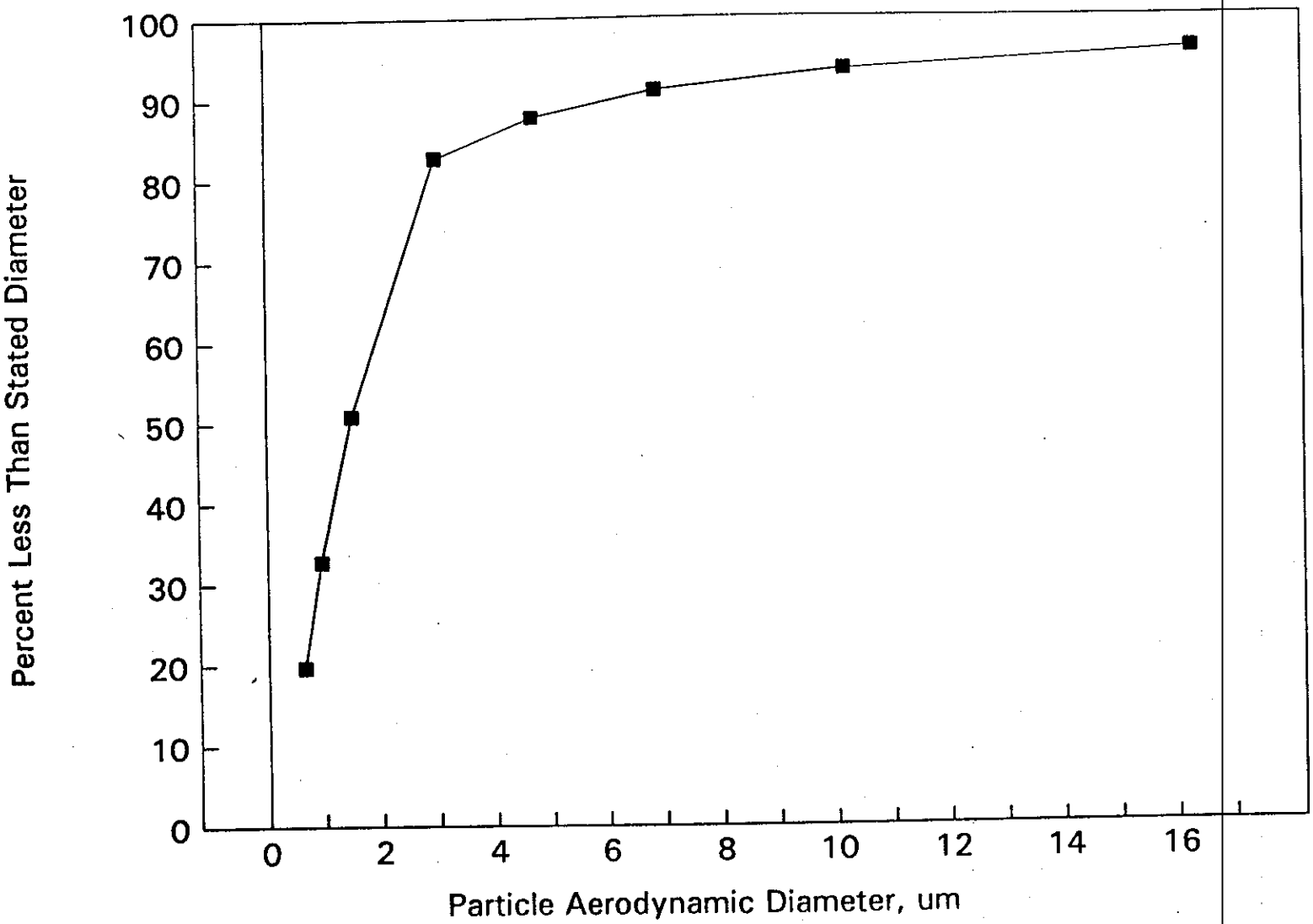
ESP Inlet Run 1

11 April, 1992



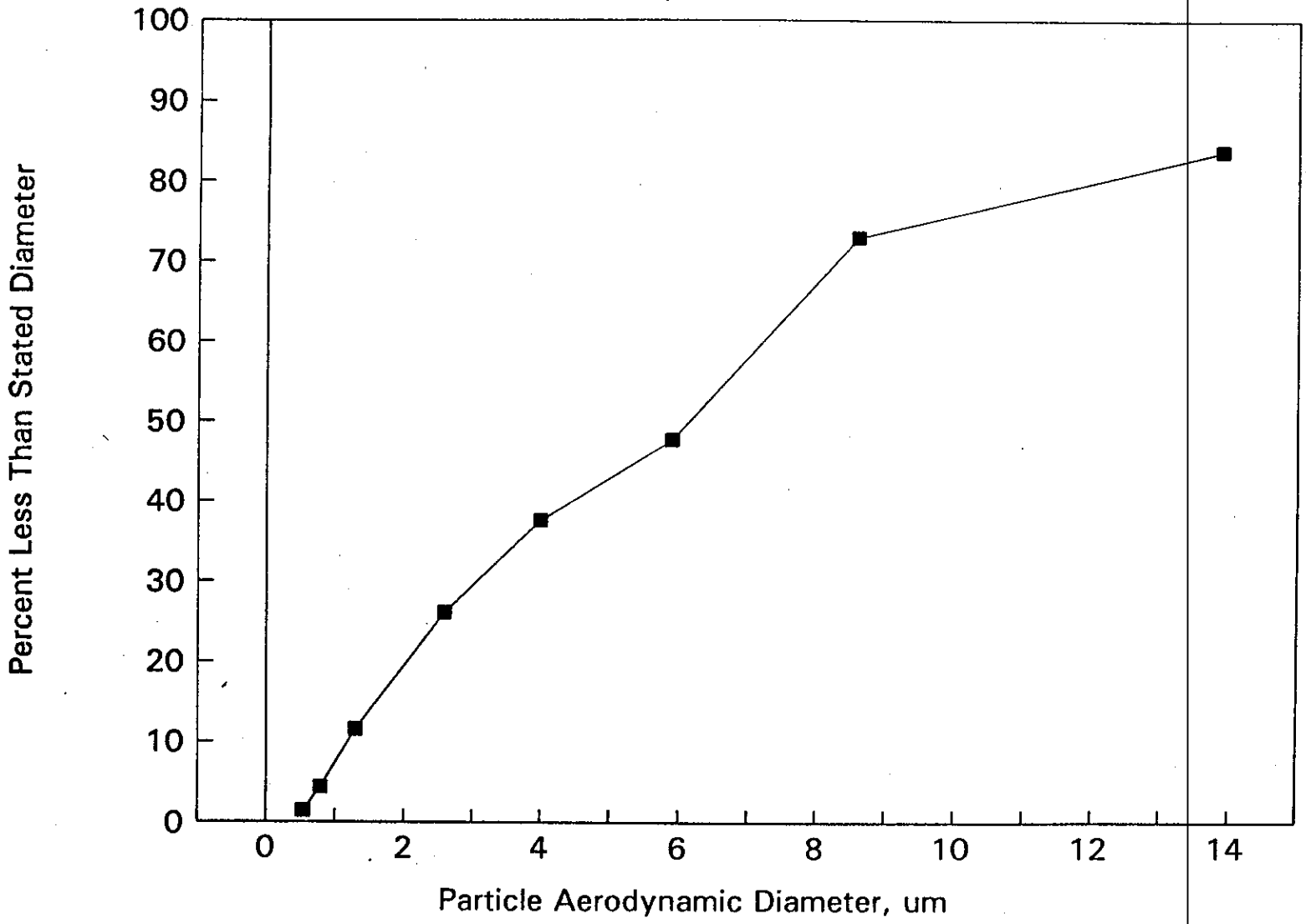
ESP Inlet Run 2

22 April, 1992



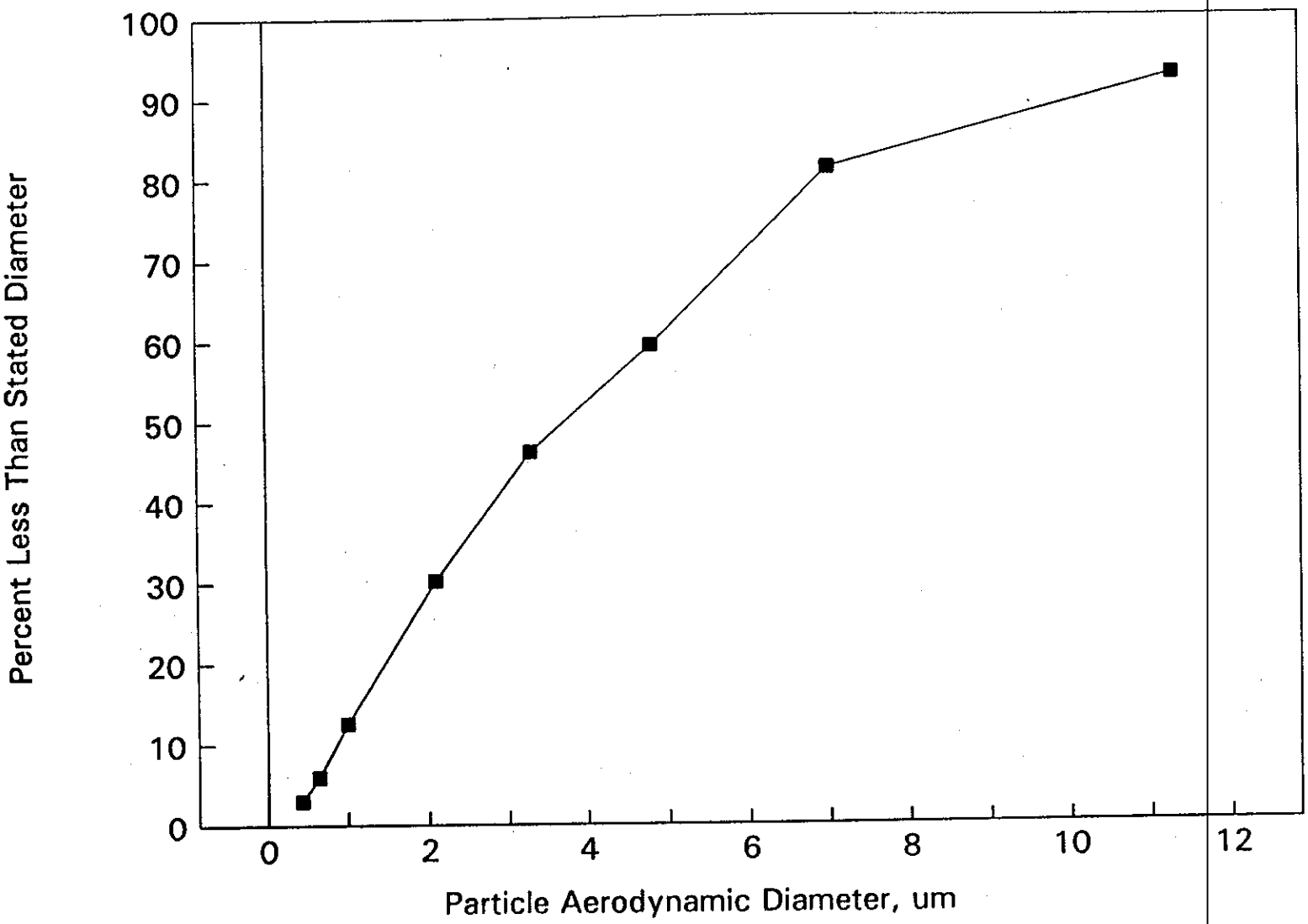
ESP Inlet Run 3

23 April, 1992



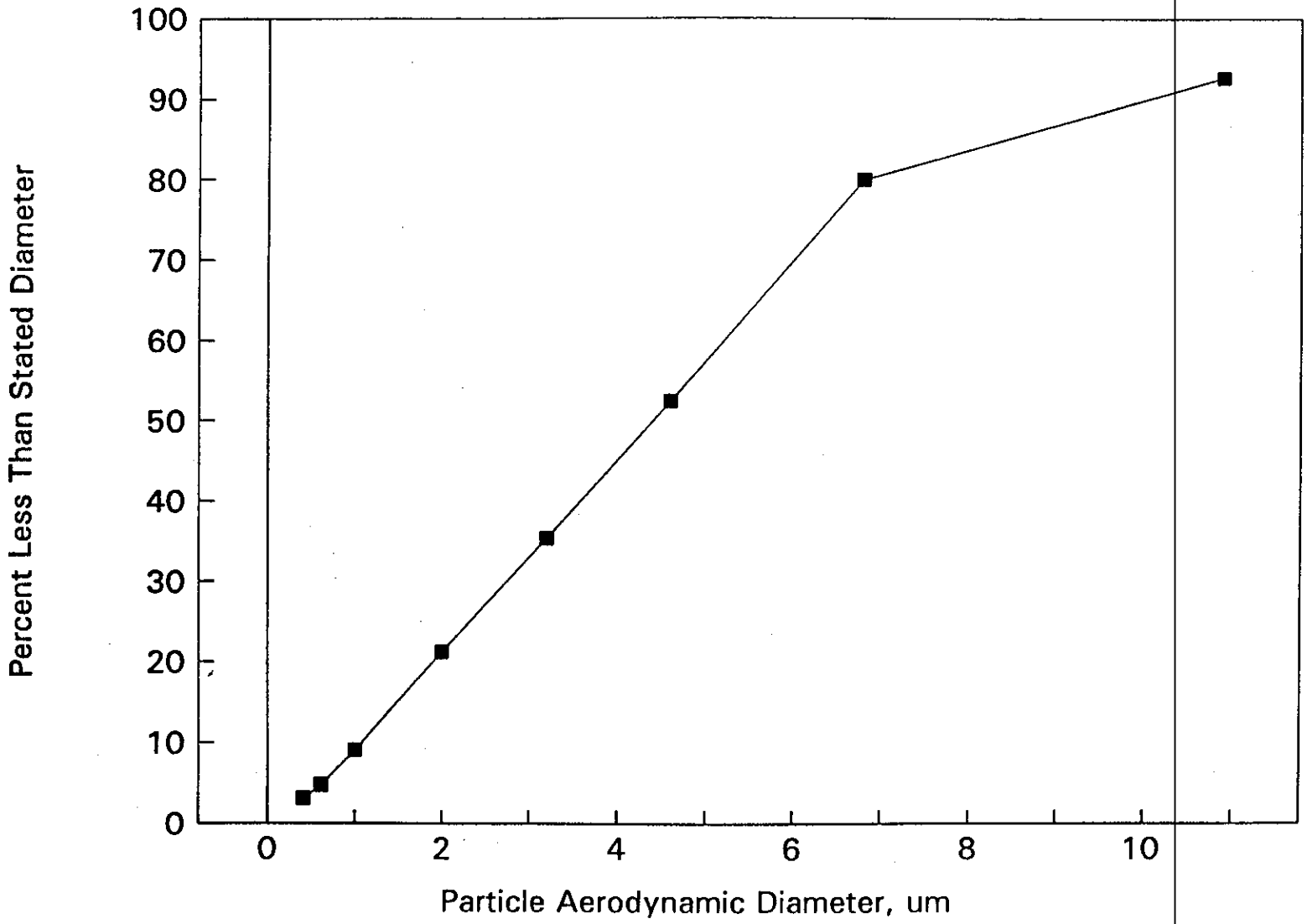
ESP Inlet Run 4

24 April, 1992



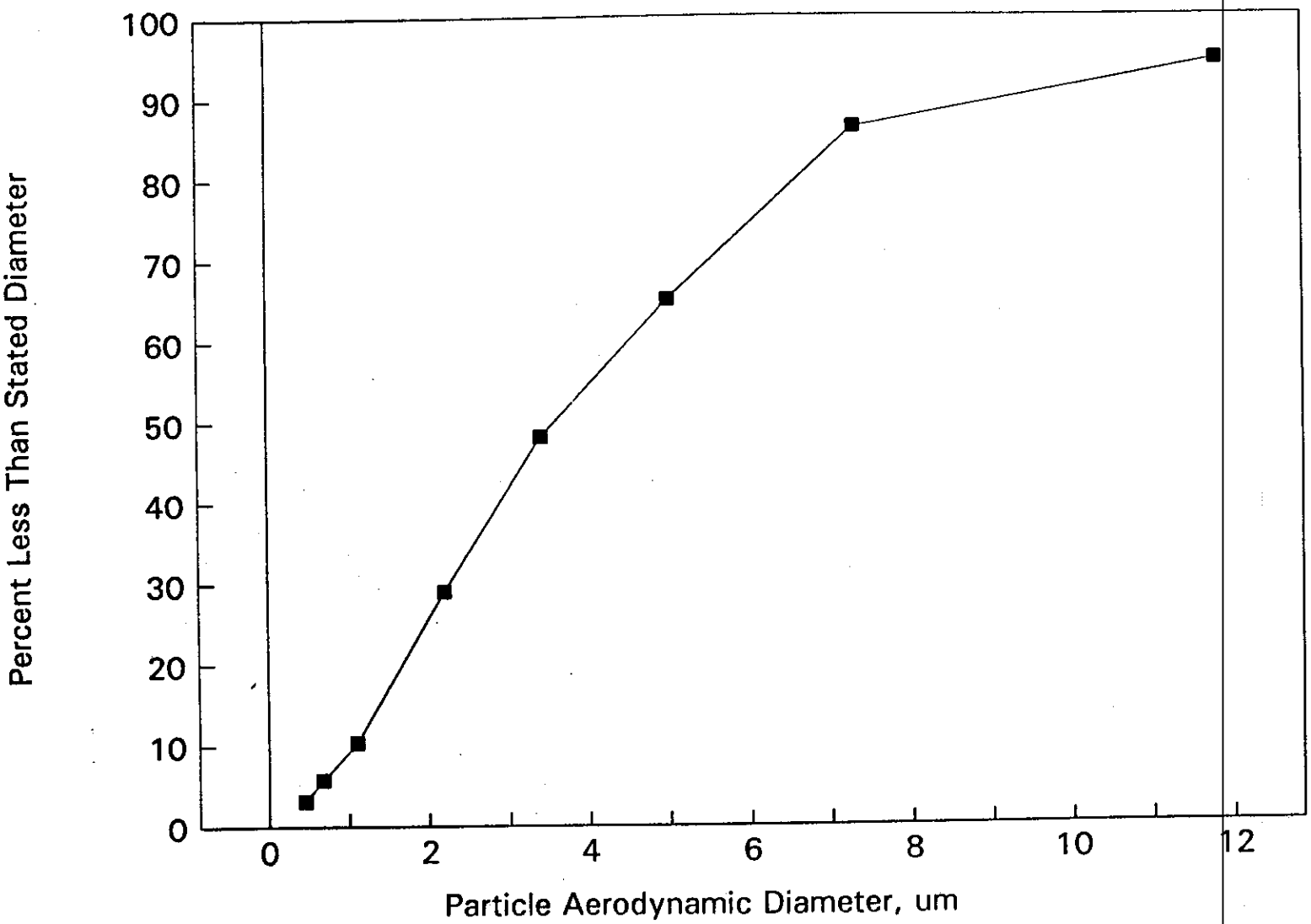
ESP Inlet Run 5

27 April, 1992



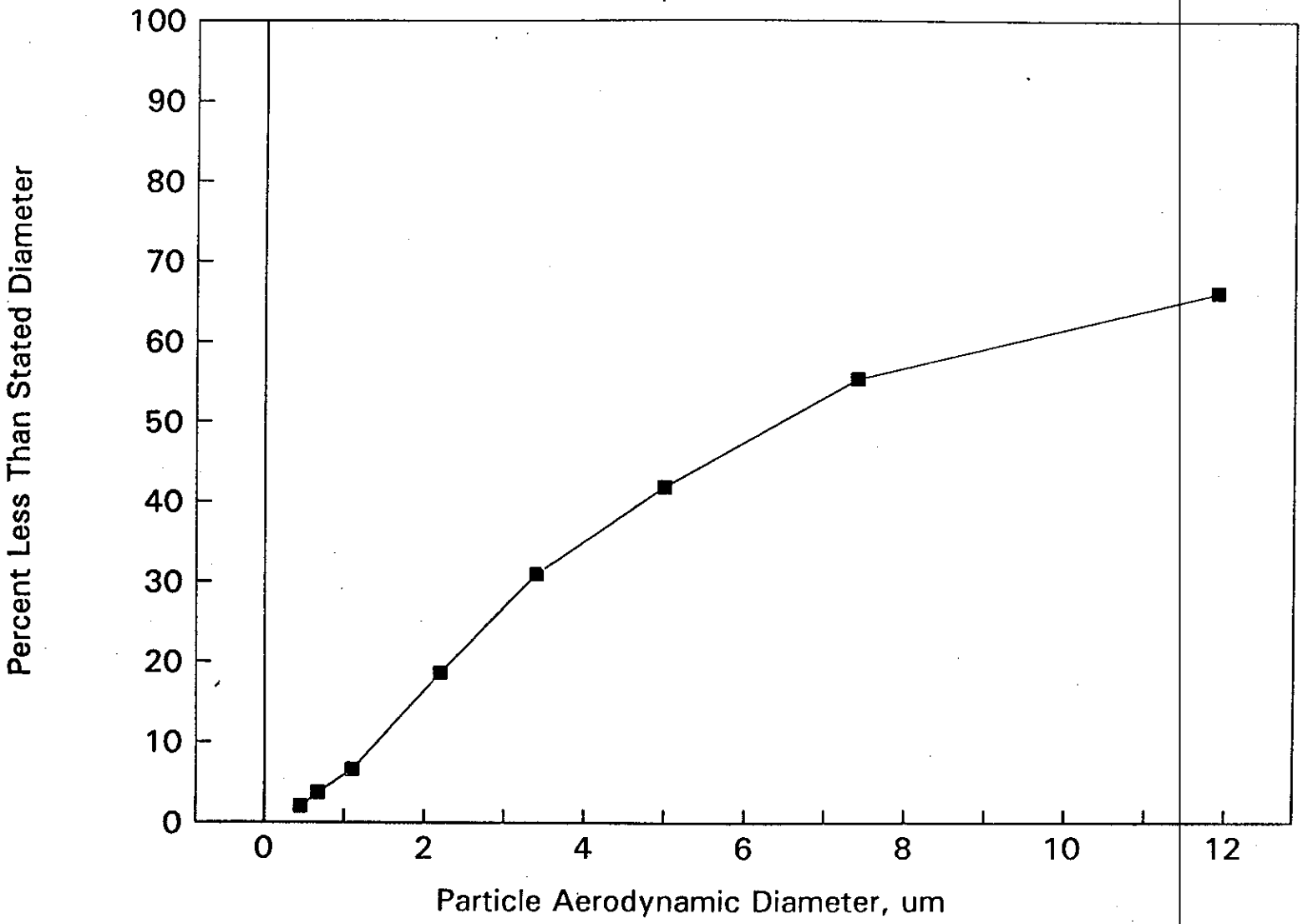
ESP Inlet Run 6

28 April, 1992



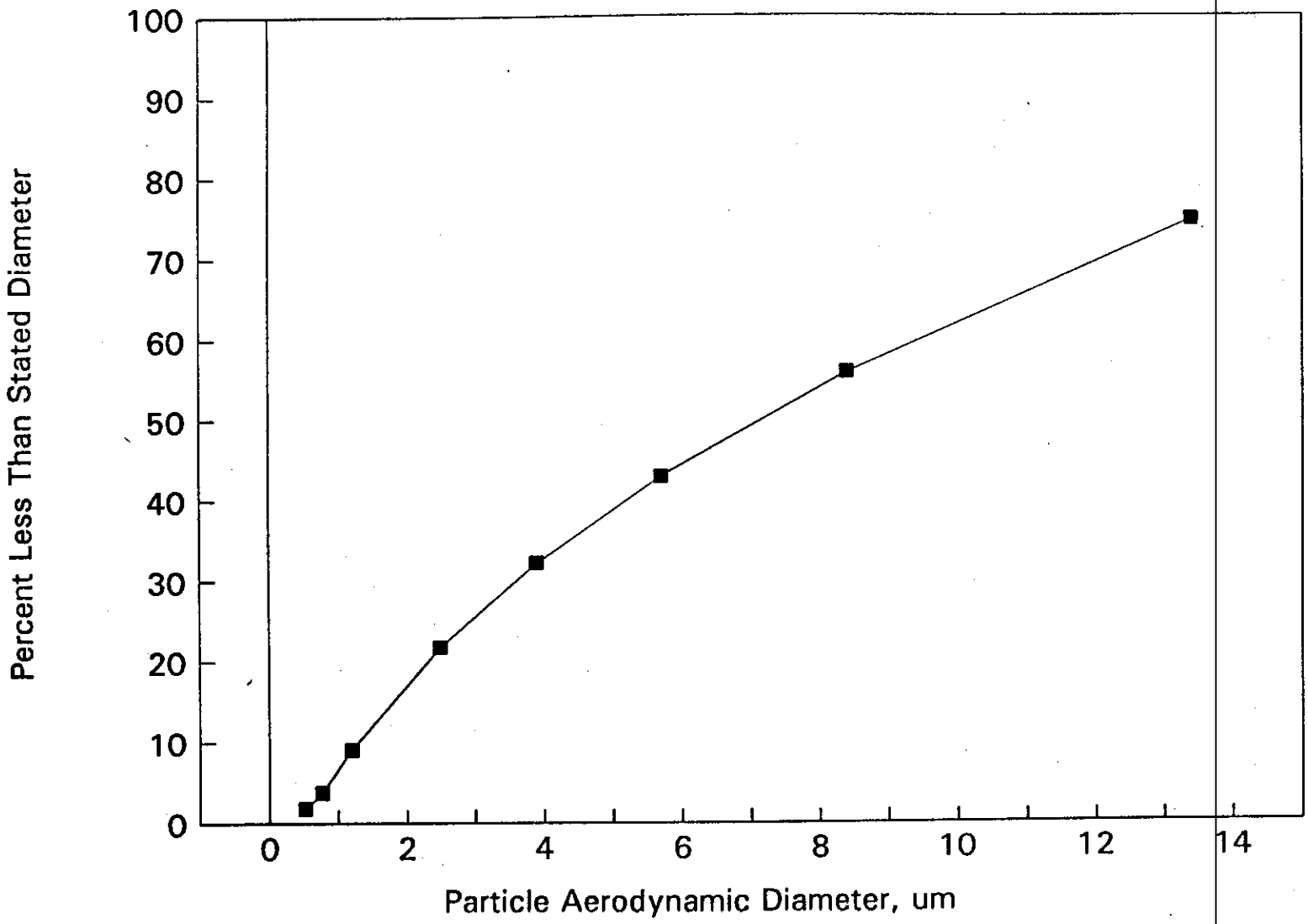
ESP Inlet Run 7

29 April, 1992



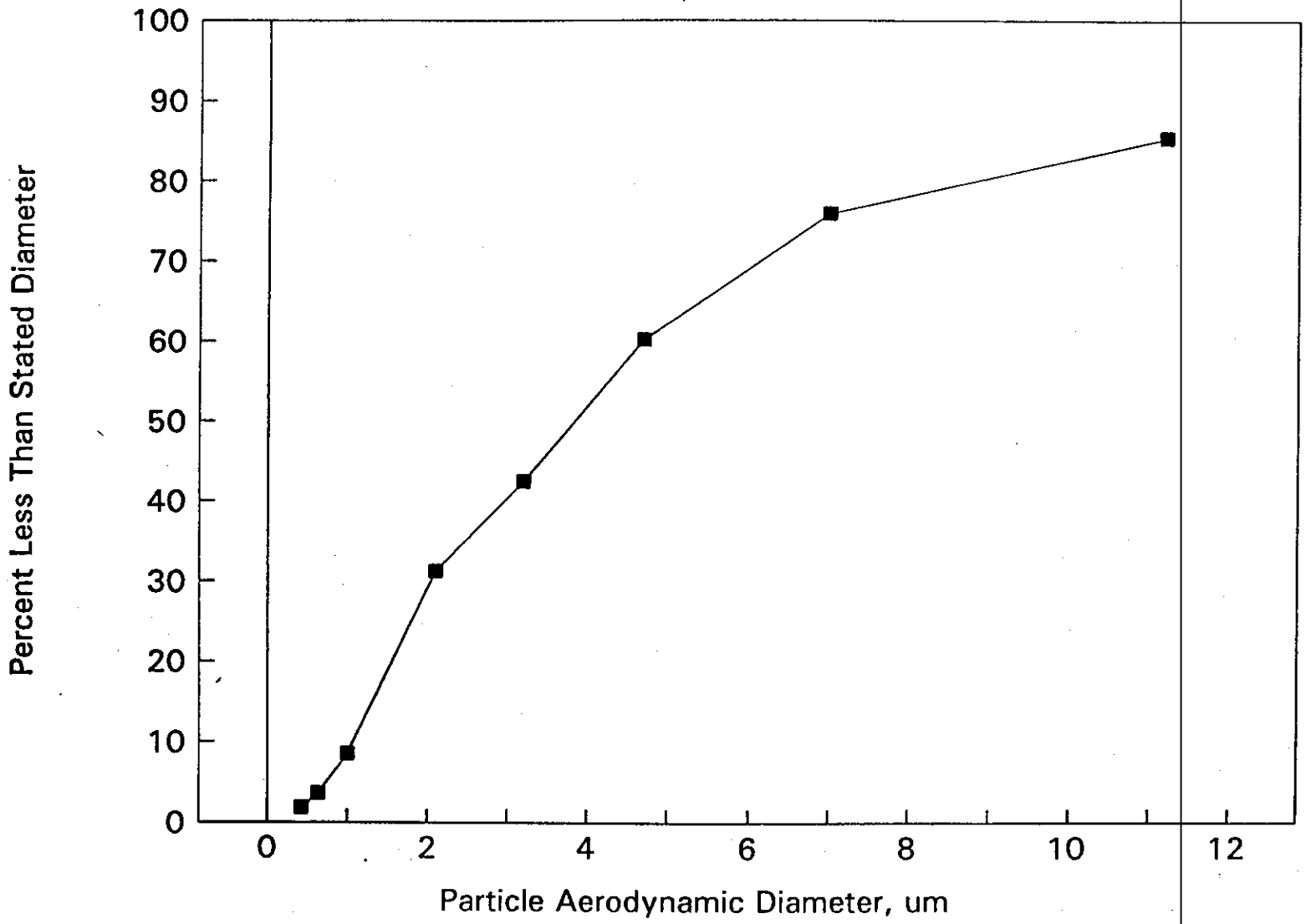
ESP Inlet Run 8

1 May, 1992



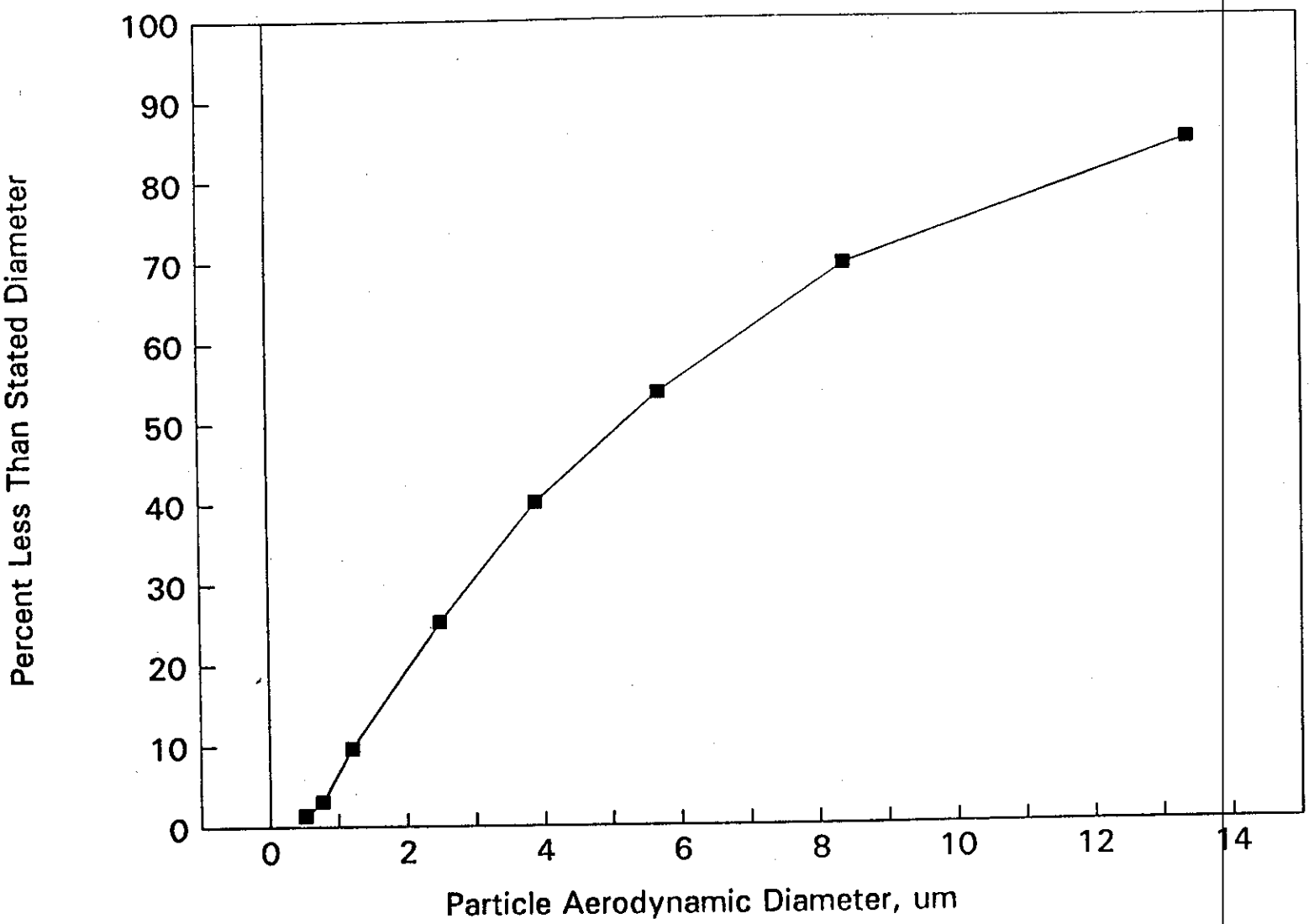
ESP Inlet Run 9

1 May, 1992



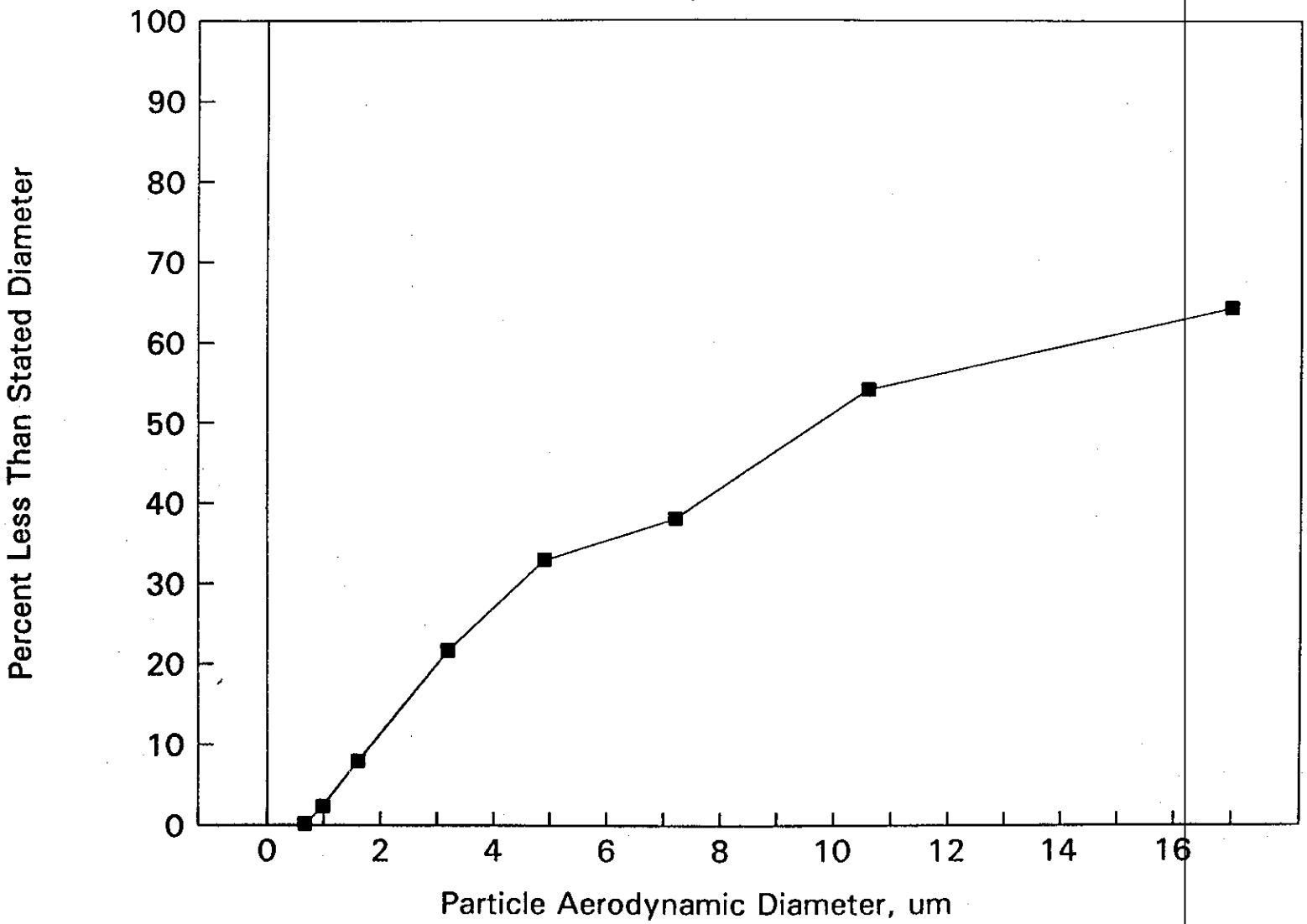
ESP Inlet Run 10

16 May, 1992



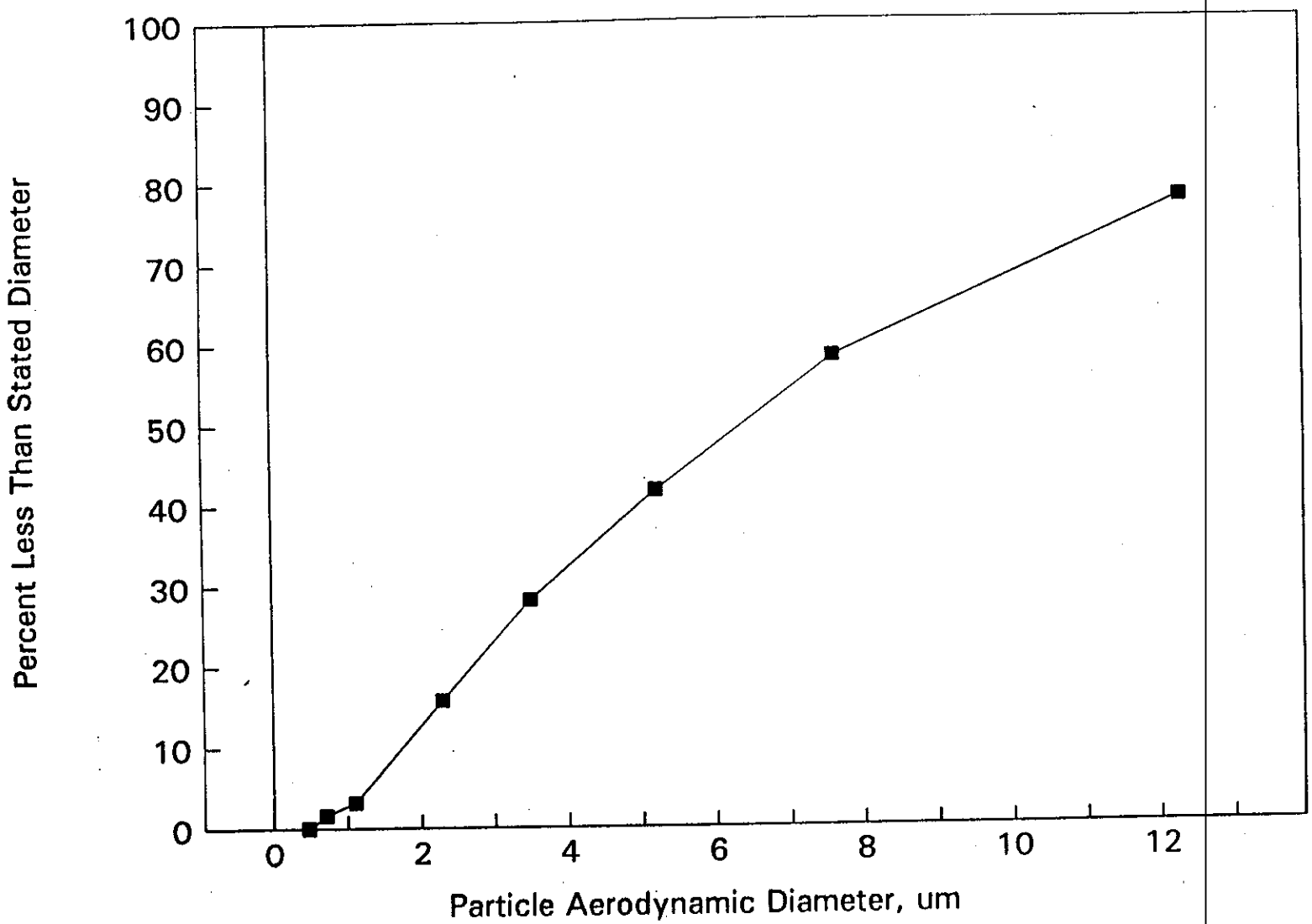
ESP Inlet Run 11

17 May, 1992



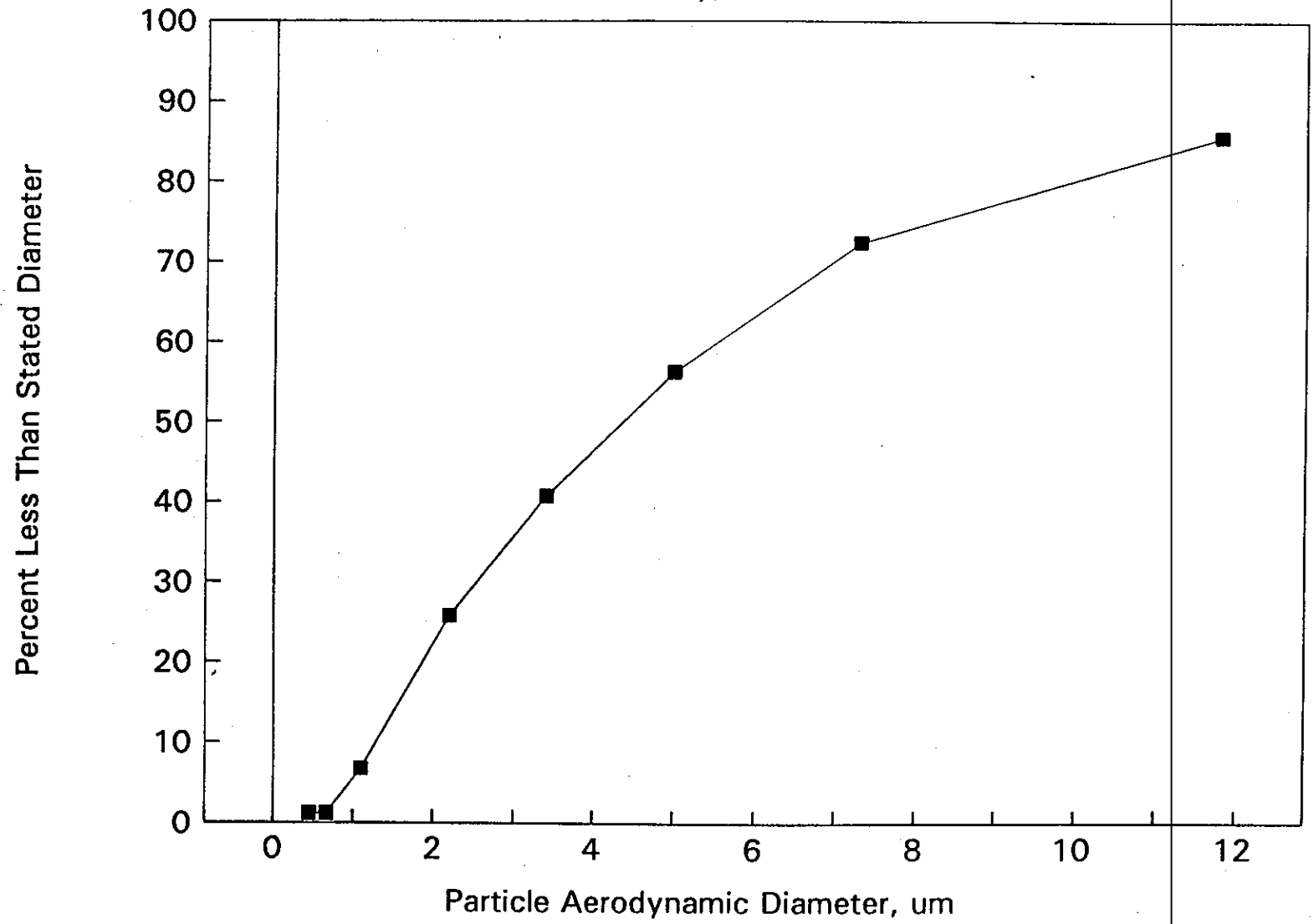
ESP Inlet Run 12

18 May, 1992



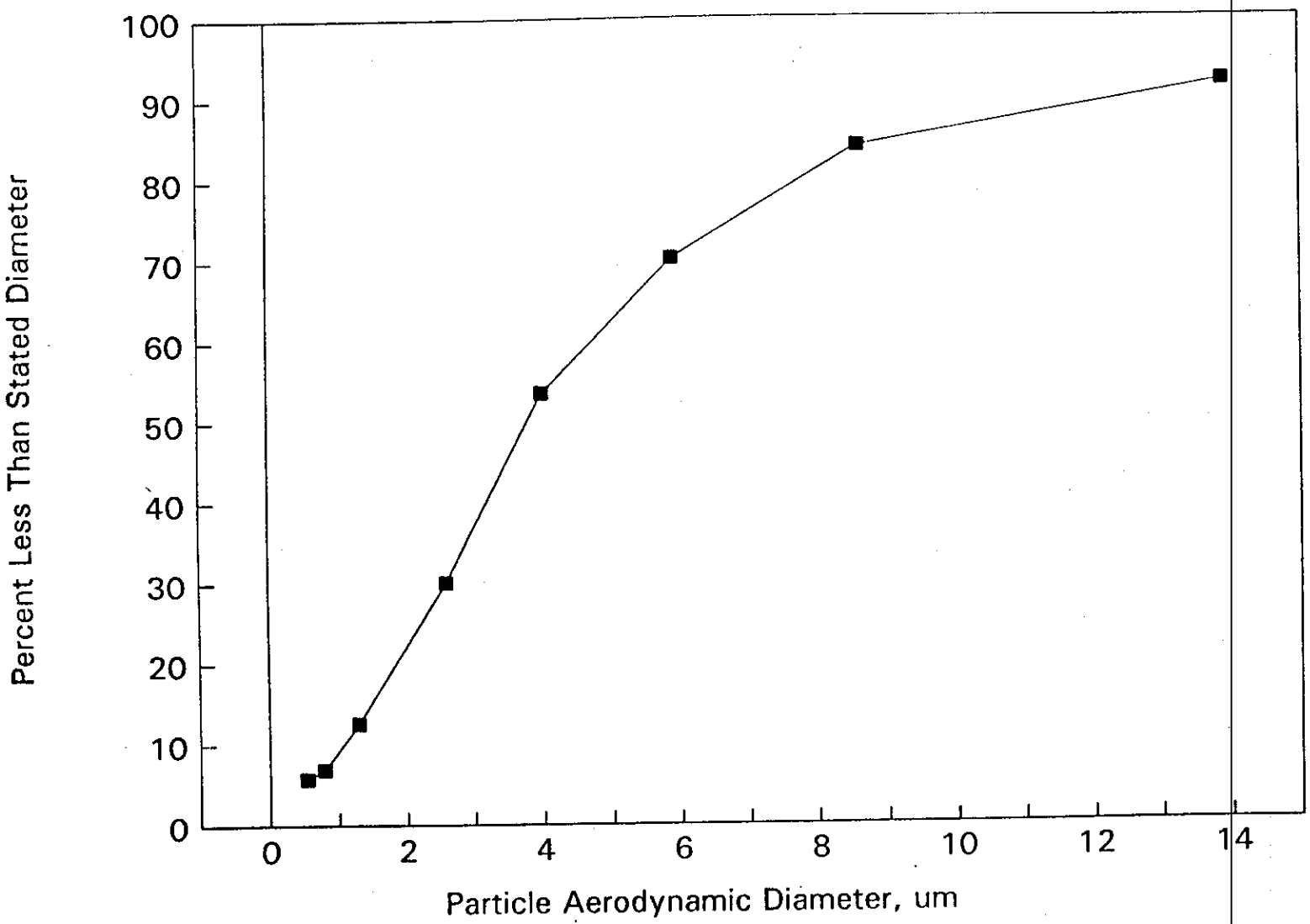
ESP Inlet Run 13

19 May, 1992



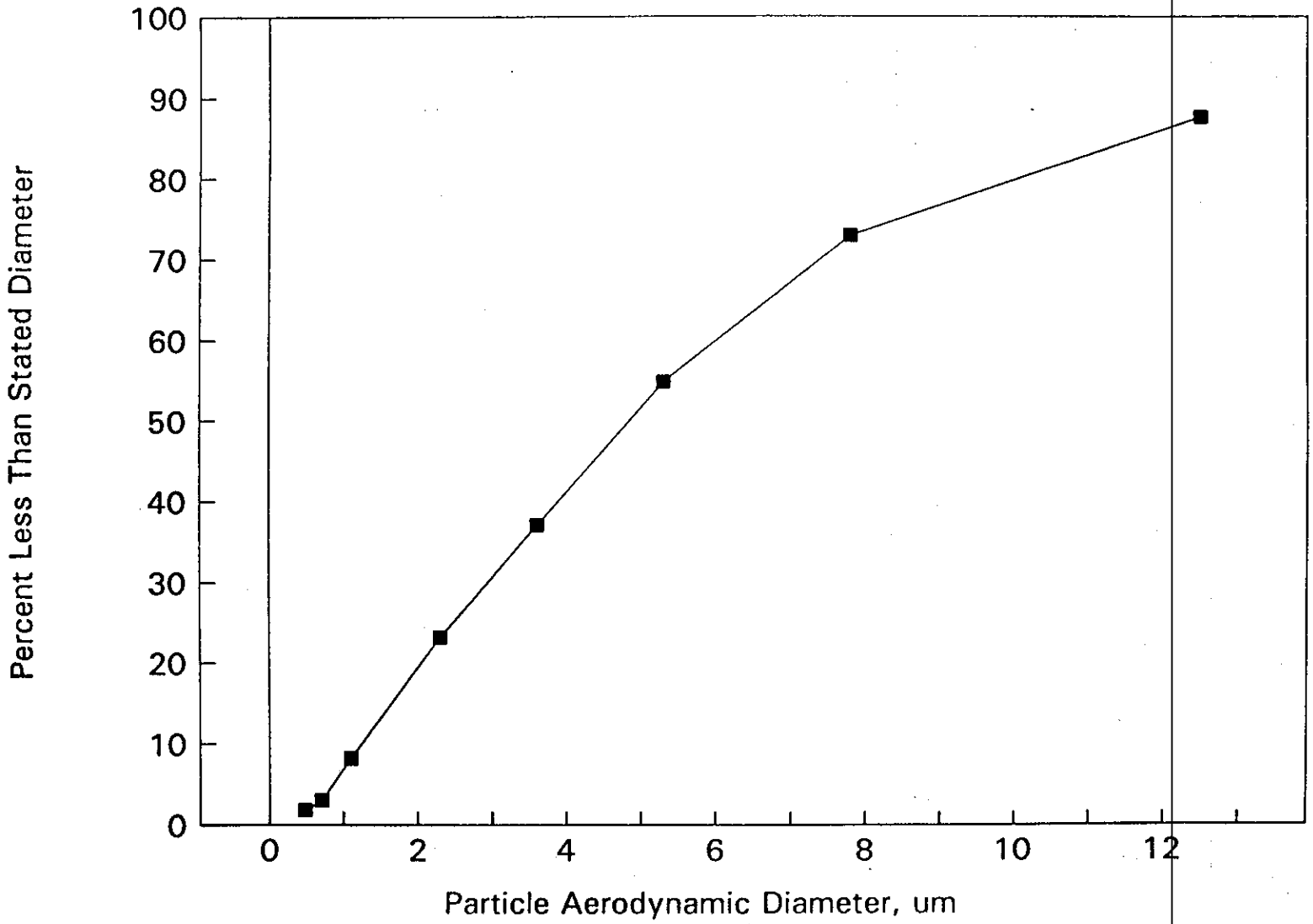
ESP Inlet Run 14

19 May, 1992



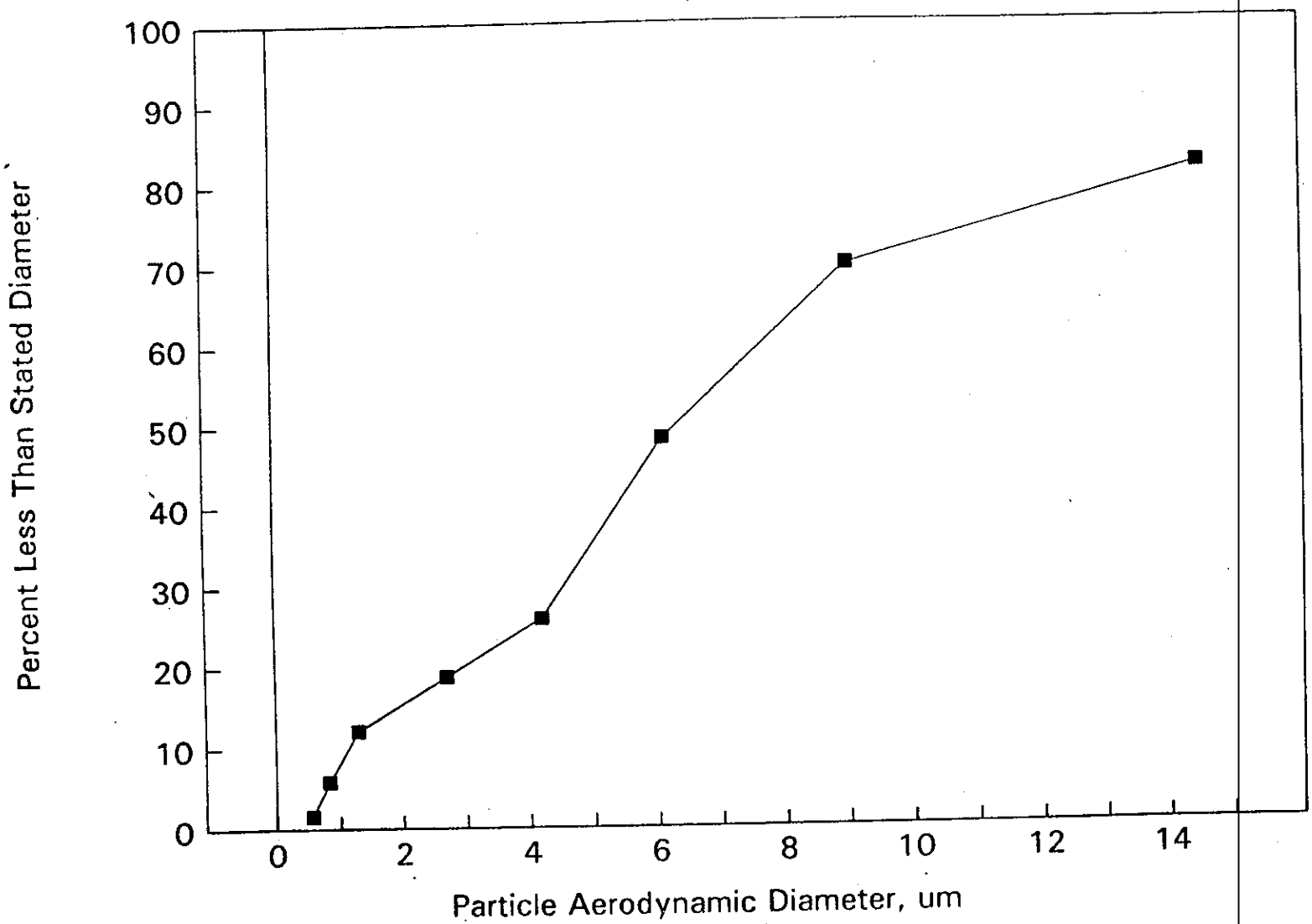
ESP Inlet Run 15

20 May, 1992



ESP Inlet Run 16

20 May, 1992



APPENDIX J

OPTIMIZATION TEST

CARBON IN FLYASH
LOI DATA SUMMARY

B&W - Cassville. Ash % Carbon (ASTM-D3178) Re

Date	Sample #	% Carbon
3/31	I1	23.5
4/1	I2	12.4
4/2	I3	10.8
4/3	I4	3.3
4/6	I5	8.0
4/7	I6	6.2
4/8	I7	8.1
4/9	I8	14.0
4/10	I9	21.0
4/13	I10	19.9
4/15	I11	16.4
4/16	I12	14.7
4/21	I13	15.2
4/22	I14	20.0
4/23	I15	20.3
4/24	I16	30.4
4/27	I17	12.4
4/28	I18	19.0
4/29	I19	32.3
5/1	I20	34.9
5/1	I21	11.3
5/16	I22	22.6
5/16	I23	31.5
5/17	I24	34.5
5/17	I25	28.3
5/18	I26	13.9
5/19	I27	14.9
5/19	I28	13.6
5/20	I29	14.3
5/20	I30	23.8

APPENDIX K

PERFORMANCE TEST

CONTINUOUS EMISSION MONITOR DATA SUMMARY

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
10:00:21	28-Sep-92	15.22	15.22	15.39	308.85	1254.86	1255.03	3.41
10:15:21	28-Sep-92	16.73	16.71	15.39	303.93	1238.56	1238.87	3.18
10:30:21	28-Sep-92	25.31	25.35	15.39	308.23	1258.49	1258.73	3.18
10:45:21	28-Sep-92	22.87	22.81	15.39	313.34	1274.55	1274.58	3.18
11:00:21	28-Sep-92	15.27	15.18	15.39	313.34	1286.38	1286.27	3.18
11:15:21	28-Sep-92	19.13	19.11	15.39	309.06	1286.38	1286.27	3.18
11:30:21	28-Sep-92	20.90	20.84	15.39	314.41	1269.66	1269.59	3.18
11:45:21	28-Sep-92	14.18	14.10	15.39	311.44	1271.86	1271.92	3.18
12:00:21	28-Sep-92	14.18	14.10	15.51	309.97	1279.40	1279.14	3.18
12:15:21	28-Sep-92	14.18	14.10	15.51	312.99	1283.45	1283.50	3.18
12:30:21	28-Sep-92	16.06	16.01	15.51	316.88	1294.21	1294.39	3.18
12:45:21	28-Sep-92	17.61	17.61	15.51	313.44	1296.91	1297.21	3.18
13:00:21	28-Sep-92	21.48	21.51	15.51	350.03	1320.73	1320.80	3.51
13:15:21	28-Sep-92	18.57	18.63	15.38	505.76	1596.67	1596.56	4.18
13:30:21	28-Sep-92	9.31	9.39	15.51	544.46	1297.12	1297.31	4.18
13:45:21	28-Sep-92	9.31	9.39	15.51	520.37	1326.65	1326.96	3.67
14:00:21	28-Sep-92	12.16	12.32	15.62	508.60	1358.60	1358.67	3.67
14:15:21	28-Sep-92	20.60	20.80	15.62	527.42	1311.38	1311.62	3.67
14:30:21	28-Sep-92	13.67	13.81	15.62	536.53	1296.85	1297.06	3.91
14:45:21	28-Sep-92	13.67	13.81	15.62	534.31	1273.49	1273.85	3.91
15:00:21	28-Sep-92	15.14	15.25	15.62	544.79	1268.20	1268.86	3.91
15:15:21	28-Sep-92	15.14	16.25	15.62	552.10	1327.40	1327.83	3.91
15:30:21	28-Sep-92	17.19	17.26	15.62	567.85	1336.27	1336.80	3.91
15:45:21	28-Sep-92	17.19	17.26	15.52	584.22	1298.15	1298.56	3.91
16:00:21	28-Sep-92	31.81	31.98	15.52	596.07	1305.01	1305.38	3.91
16:15:21	28-Sep-92	16.78	16.98	15.52	547.72	1328.45	1328.62	3.91
16:30:21	28-Sep-92	16.78	16.98	15.52	544.44	1360.73	1361.14	3.91
16:45:21	28-Sep-92	16.78	16.98	15.52	539.41	1351.12	1351.41	3.91
17:00:21	28-Sep-92	16.78	16.98	15.67	536.95	1334.91	1335.37	4.28
17:15:21	28-Sep-92	21.05	21.28	15.37	514.11	1304.38	1304.83	5.33
17:30:21	28-Sep-92	13.62	13.81	15.45	542.96	1333.25	1333.66	3.92
17:45:21	28-Sep-92	13.62	13.81	15.45	570.11	1358.82	1359.05	3.57
18:00:21	28-Sep-92	9.69	9.96	15.45	584.38	1357.77	1357.95	3.57
18:15:21	28-Sep-92	8.69	8.83	15.45	588.43	1334.56	1334.96	3.57
18:30:21	28-Sep-92	12.09	12.18	15.27	509.44	1261.75	1262.02	3.27
18:45:21	28-Sep-92	47.43	47.77	15.38	382.61	1269.02	1269.30	2.74
19:00:21	28-Sep-92	19.98	20.04	15.54	332.56	1266.74	1267.00	3.36
19:15:21	28-Sep-92	18.29	18.36	15.54	318.93	1245.00	1245.38	3.36
19:30:21	28-Sep-92	18.29	18.36	15.54	312.69	1241.54	1241.98	3.36
19:45:21	28-Sep-92	18.29	18.36	15.54	316.23	1243.20	1243.59	3.36
20:00:21	28-Sep-92	18.29	18.36	15.77	324.18	1254.84	1254.74	3.36
20:15:21	28-Sep-92	16.99	16.80	15.77	327.09	1266.27	1266.00	3.36
20:30:21	28-Sep-92	16.99	16.80	15.94	329.67	1263.97	1263.87	3.36
20:45:21	28-Sep-92	16.99	16.80	15.94	327.71	1267.58	1267.48	3.36
21:00:21	28-Sep-92	18.80	18.63	15.76	328.33	1274.16	1274.00	3.36
21:15:21	28-Sep-92	17.07	16.92	15.60	320.34	1287.18	1286.81	3.36
21:30:21	28-Sep-92	17.07	16.92	15.60	315.17	1289.37	1289.23	3.15
21:45:21	28-Sep-92	17.07	16.92	15.60	311.81	1321.14	1320.87	3.15
22:00:21	28-Sep-92	17.07	16.92	15.60	315.02	1339.51	1339.20	3.15
22:15:21	28-Sep-92	26.07	25.98	15.69	308.16	1349.51	1349.37	3.68
22:30:21	28-Sep-92	18.06	17.78	15.69	319.77	1300.76	1300.59	3.68

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
22:45:21	28-Sep-92	20.19	20.00	15.69	316.35	1342.98	1342.79	3.68
23:00:21	28-Sep-92	22.81	22.72	15.69	324.46	1391.69	1391.36	3.68
23:15:21	28-Sep-92	36.42	36.34	15.69	304.30	1545.11	1544.68	3.32
23:30:21	28-Sep-92	32.08	31.89	15.80	386.73	1541.31	1540.80	4.54
23:45:21	28-Sep-92	37.06	36.95	15.80	272.85	1357.77	1357.43	3.43
01:30:21	29-Sep-92	46.87	47.12	15.28	310.43	1268.63	1268.40	4.71
01:45:21	29-Sep-92	50.83	51.06	15.43	304.81	1311.10	1311.15	4.71
02:00:21	29-Sep-92	53.36	53.62	15.43	303.30	1327.16	1327.19	4.71
02:15:21	29-Sep-92	53.36	53.62	15.53	310.14	1304.27	1304.15	4.71
02:30:21	29-Sep-92	45.20	45.44	15.53	324.32	1313.22	1313.07	4.71
02:45:21	29-Sep-92	43.07	43.29	15.53	327.22	1305.10	1304.70	4.71
03:00:21	29-Sep-92	41.60	41.82	15.53	339.98	1321.73	1321.54	4.98
03:15:21	29-Sep-92	41.60	41.82	15.53	334.15	1312.23	1312.21	4.73
03:30:21	29-Sep-92	41.60	41.82	15.53	334.36	1328.11	1328.23	4.73
03:45:21	29-Sep-92	38.11	38.33	15.53	360.47	1329.46	1329.47	4.97
04:00:21	29-Sep-92	38.11	37.33	15.53	365.67	1312.97	1312.63	4.97
04:15:21	29-Sep-92	38.11	37.33	15.53	358.17	1312.97	1312.63	4.97
04:30:21	29-Sep-92	38.11	37.33	15.53	366.14	1321.69	1321.57	4.97
04:45:21	29-Sep-92	39.29	39.47	15.53	368.71	1323.22	1322.88	4.97
05:00:21	29-Sep-92	39.29	39.47	15.53	369.88	1335.43	1335.38	4.97
05:15:21	29-Sep-92	30.70	30.82	15.53	383.84	1322.80	1322.53	4.97
05:30:21	29-Sep-92	28.98	29.15	15.53	382.26	1309.61	1309.48	4.97
05:45:21	29-Sep-92	28.98	29.15	15.53	391.20	1312.24	1311.92	4.97
06:00:21	29-Sep-92	61.23	61.35	15.53	302.63	1379.50	1379.42	3.28
06:15:21	29-Sep-92	26.27	26.34	15.53	267.62	1299.41	1299.36	3.28
06:30:21	29-Sep-92	24.06	24.17	15.53	258.69	1299.41	1299.36	3.28
06:45:21	29-Sep-92	24.06	24.17	15.43	307.51	1297.21	1297.00	3.67
07:00:21	29-Sep-92	19.02	19.07	15.33	292.93	1230.46	1230.42	3.35
07:15:21	29-Sep-92	28.52	28.56	15.45	278.18	1308.70	1308.64	3.35
11:00:21	29-Sep-92	1.58	1.72	15.25	624.03	1263.96	1263.83	4.00
11:15:21	29-Sep-92	3.12	3.24	15.25	606.37	1253.80	1253.50	4.00
11:30:21	29-Sep-92	3.12	3.24	15.25	574.05	1256.97	1256.84	4.00
11:45:21	29-Sep-92	3.12	3.24	15.25	535.08	1245.00	1244.83	3.78
12:00:21	29-Sep-92	6.94	7.07	15.25	525.13	1267.97	1267.98	3.52
12:15:21	29-Sep-92	8.70	8.85	15.41	529.09	1285.00	1285.14	3.77
12:30:21	29-Sep-92	21.66	21.80	15.41	524.41	1269.05	1269.19	3.77
12:45:21	29-Sep-92	9.72	9.87	15.41	534.66	1286.32	1286.37	3.77
13:00:21	29-Sep-92	11.32	11.48	15.29	517.22	1274.95	1275.05	3.77
13:15:21	29-Sep-92	11.32	11.48	15.29	512.11	1278.02	1278.15	3.77
13:30:21	29-Sep-92	12.93	13.00	15.29	511.34	1296.78	1296.74	3.77
13:45:21	29-Sep-92	12.93	14.01	15.29	513.37	1298.93	1298.89	3.77
14:00:21	29-Sep-92	12.93	14.01	15.29	517.28	1277.21	1277.39	3.77
14:15:21	29-Sep-92	12.93	12.32	15.29	525.75	1273.57	1273.80	3.77
14:30:21	29-Sep-92	11.65	12.32	15.29	524.04	1261.34	1261.41	3.77
14:45:21	29-Sep-92	11.65	12.32	15.29	526.74	1253.23	1253.21	3.77
15:00:21	29-Sep-92	13.04	12.32	15.29	533.05	1288.22	1288.45	3.77
15:15:21	29-Sep-92	11.79	12.32	15.29	534.29	1285.40	1285.54	3.77
15:30:21	29-Sep-92	21.93	22.10	15.29	534.59	1299.26	1299.20	3.77
15:45:21	29-Sep-92	9.33	9.41	15.14	522.08	1256.21	1255.99	4.82
16:00:21	29-Sep-92	11.17	11.30	15.14	459.65	1248.16	1247.91	3.71
16:15:21	29-Sep-92	19.03	19.16	15.23	311.32	1260.80	1260.74	3.32

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
16:30:21	29-Sep-92	35.35	35.57	15.23	316.42	1260.80	1260.74	3.32
16:45:21	29-Sep-92	23.39	23.59	15.23	311.50	1234.19	1233.91	3.32
17:00:21	29-Sep-92	19.84	20.02	15.13	319.81	1234.19	1235.14	3.32
17:15:21	29-Sep-92	24.82	25.05	15.13	319.81	1251.64	1251.75	3.32
17:30:21	29-Sep-92	24.82	25.05	15.13	319.91	1268.03	1267.92	3.32
17:45:21	29-Sep-92	24.82	25.05	15.13	319.01	1273.52	1273.27	3.32
18:00:21	29-Sep-92	23.02	23.20	15.13	305.40	1281.66	1281.41	3.32
18:15:21	29-Sep-92	23.02	23.20	15.13	300.78	1281.66	1281.41	3.32
18:30:21	29-Sep-92	21.87	22.01	15.13	301.51	1283.58	1283.41	3.32
18:45:21	29-Sep-92	21.87	22.01	15.13	299.97	1287.28	1287.15	3.32
19:00:21	29-Sep-92	21.87	22.01	15.13	295.40	1283.40	1283.24	3.32
19:15:21	29-Sep-92	21.87	22.01	15.05	295.86	1283.40	1283.24	3.32
19:30:21	29-Sep-92	21.87	22.01	15.05	297.39	1283.40	1283.24	3.32
19:45:21	29-Sep-92	21.87	22.01	15.05	299.18	1274.88	1274.77	3.32
20:00:21	29-Sep-92	21.87	22.01	15.05	307.74	1281.32	1281.33	3.57
20:15:21	29-Sep-92	29.04	29.33	15.05	313.49	1283.90	1283.82	3.57
20:30:21	29-Sep-92	26.29	26.55	15.05	329.19	1286.82	1286.71	3.57
20:45:21	29-Sep-92	34.30	34.56	15.05	326.14	1286.82	1286.71	3.33
21:00:21	29-Sep-92	31.60	31.70	15.05	338.22	1285.47	1285.23	3.33
21:15:21	29-Sep-92	27.86	28.16	15.05	327.12	1284.38	1285.23	3.33
21:30:21	29-Sep-92	27.86	28.16	15.05	308.90	1284.38	1283.92	3.33
21:45:21	29-Sep-92	20.34	20.47	15.05	303.85	1286.65	1286.42	3.07
22:00:21	29-Sep-92	14.65	14.81	15.05	285.61	1291.65	1291.54	3.07
22:15:21	29-Sep-92	13.64	14.81	15.15	291.91	1299.59	1299.61	3.07
22:30:21	29-Sep-92	26.66	26.89	15.15	280.30	1312.16	1312.14	3.07
22:45:21	29-Sep-92	49.02	49.33	15.15	282.81	1319.32	1319.32	3.38
23:00:21	29-Sep-92	34.20	34.46	15.15	282.81	1335.80	1335.94	3.38
23:15:21	29-Sep-92	72.97	73.19	15.15	274.59	1447.19	1447.32	3.10
23:30:21	29-Sep-92	52.59	52.88	15.30	299.10	1559.05	1559.04	4.51
23:45:21	29-Sep-92	52.59	52.88	15.12	330.53	1435.06	1435.09	5.17
00:00:21	30-Sep-92	55.80	56.14	15.24	288.52	1357.42	1357.53	4.57
01:30:21	30-Sep-92	56.32	56.49	15.27	358.24	1271.16	1271.28	4.99
01:45:21	30-Sep-92	52.92	53.05	15.27	367.33	1267.90	1268.04	4.99
02:00:21	30-Sep-92	55.94	56.05	15.27	365.82	1292.63	1292.54	4.99
02:15:21	30-Sep-92	54.07	54.20	15.27	371.19	1296.40	1296.47	4.99
02:30:21	30-Sep-92	48.90	48.94	15.37	331.27	1298.70	1298.59	4.99
02:45:21	30-Sep-92	43.81	43.87	15.37	336.87	1279.11	1279.08	4.99
03:00:21	30-Sep-92	41.63	41.86	15.37	327.38	1279.11	1279.08	4.99
03:15:21	30-Sep-92	40.27	40.27	15.37	334.52	1270.17	1270.16	4.99
03:30:21	30-Sep-92	40.27	40.27	15.37	331.69	1270.17	1270.16	4.99
03:45:21	30-Sep-92	41.64	41.69	15.37	331.81	1270.17	1270.16	4.71
04:00:21	30-Sep-92	41.64	41.69	15.37	343.70	1271.83	1271.80	4.71
04:15:21	30-Sep-92	41.64	41.69	15.37	355.38	1296.26	1296.19	4.71
04:30:21	30-Sep-92	38.23	38.25	15.16	411.26	1393.98	1393.58	4.30
04:45:21	30-Sep-92	13.48	13.48	15.16	482.39	1232.65	1232.66	4.30
05:00:21	30-Sep-92	9.24	9.17	15.35	453.25	1261.68	1261.78	3.64
05:15:21	30-Sep-92	10.43	10.35	15.35	430.24	1256.28	1256.29	3.64
05:30:21	30-Sep-92	12.15	12.05	15.35	437.36	1238.82	1238.89	3.64
05:45:21	30-Sep-92	8.39	8.30	15.35	459.03	1250.93	1250.84	3.64
06:00:21	30-Sep-92	22.74	22.70	15.35	440.68	1261.53	1261.40	3.20
06:15:21	30-Sep-92	9.33	9.24	15.35	464.26	1257.42	1257.36	3.20

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
06:30:21	30-Sep-92	5.56	5.52	15.35	517.46	1234.88	1234.87	3.42
06:45:21	30-Sep-92	3.91	3.87	15.35	474.09	1244.32	1244.30	2.77
07:00:21	30-Sep-92	3.91	3.87	15.35	481.16	1236.69	1236.63	2.77
07:15:21	30-Sep-92	2.65	2.56	15.23	511.50	1245.46	1245.54	3.57
07:30:21	30-Sep-92	1.56	1.48	15.23	531.10	1253.97	1254.10	3.57
07:45:21	30-Sep-92	1.56	1.48	15.23	538.38	1268.20	1268.23	3.57
08:00:21	30-Sep-92	1.56	1.48	15.23	549.88	1282.31	1282.09	3.57
08:15:21	30-Sep-92	1.56	1.48	15.23	549.25	1252.29	1252.26	3.36
08:30:21	30-Sep-92	1.56	1.48	15.11	541.33	1254.87	1254.86	3.57
08:45:21	30-Sep-92	1.56	1.48	15.11	543.58	1254.87	1254.86	3.57
09:00:21	30-Sep-92	1.56	1.48	15.11	540.88	1210.69	1210.55	3.57
09:15:21	30-Sep-92	1.56	1.48	15.11	531.44	1216.50	1216.40	3.57
09:30:21	30-Sep-92	2.93	2.90	15.11	547.27	1226.60	1226.50	3.57
09:45:21	30-Sep-92	2.93	2.90	15.11	557.62	1239.91	1240.03	3.36
10:00:21	30-Sep-92	2.93	2.90	15.11	557.62	1239.91	1240.03	3.36
10:15:21	30-Sep-92	4.38	4.36	15.11	541.74	1210.24	1210.19	3.36
10:30:21	30-Sep-92	4.38	4.36	15.11	530.09	1229.37	1229.51	3.36
10:45:21	30-Sep-92	5.85	5.80	15.33	531.58	1241.90	1242.14	3.36
11:00:21	30-Sep-92	5.85	5.80	15.20	538.63	1208.07	1208.09	3.36
11:15:21	30-Sep-92	5.85	5.80	15.20	555.86	1185.43	1185.58	3.62
11:30:21	30-Sep-92	13.49	13.47	15.08	487.12	1207.83	1207.83	2.68
11:45:21	30-Sep-92	13.49	13.47	15.08	431.88	1212.26	1212.04	3.14
12:00:21	30-Sep-92	16.82	16.70	15.08	444.46	1201.75	1201.70	4.05
12:15:21	30-Sep-92	19.51	19.47	15.35	448.13	1234.17	1233.82	4.05
12:30:21	30-Sep-92	22.59	22.51	15.35	459.42	1239.03	1238.49	4.05
12:45:21	30-Sep-92	25.45	25.43	15.35	457.29	1195.48	1195.23	4.05
13:00:21	30-Sep-92	26.99	26.96	15.35	463.52	1172.19	1171.81	4.05
13:15:21	30-Sep-92	26.99	26.96	15.25	474.68	1224.28	1224.05	4.05
13:30:21	30-Sep-92	30.27	30.35	15.25	476.37	1227.14	1226.93	4.05
13:45:21	30-Sep-92	30.27	30.35	15.25	480.82	1227.14	1226.93	4.26
14:00:21	30-Sep-92	31.91	31.96	15.25	494.12	1220.78	1220.58	4.26
14:15:21	30-Sep-92	42.78	42.74	15.25	479.67	1232.54	1232.12	4.26
14:30:21	30-Sep-92	28.73	28.66	15.07	478.19	1220.77	1220.65	4.26
14:45:21	30-Sep-92	31.29	31.24	15.30	482.49	1225.58	1225.23	3.86
15:00:21	30-Sep-92	25.35	25.25	15.30	480.56	1254.14	1253.83	3.19
15:15:21	30-Sep-92	21.52	21.38	15.22	499.67	1225.08	1224.69	3.43
15:30:21	30-Sep-92	18.02	17.90	15.12	509.31	1201.65	1201.02	3.43
15:45:21	30-Sep-92	18.02	17.90	15.12	515.87	1176.62	1176.42	3.43
16:00:21	30-Sep-92	16.35	16.20	15.12	530.88	1158.17	1157.88	3.89
16:15:21	30-Sep-92	13.13	13.01	14.85	478.67	1098.71	1098.54	3.89
16:30:21	30-Sep-92	26.82	26.71	14.99	351.00	1128.69	1128.73	3.41
16:45:21	30-Sep-92	32.78	32.67	14.99	291.33	1140.71	1140.41	3.41
17:00:21	30-Sep-92	40.51	40.47	15.08	285.94	1128.25	1128.17	3.41
17:15:21	30-Sep-92	36.16	36.15	15.08	294.52	1123.28	1122.88	3.41
17:30:21	30-Sep-92	93.50	93.49	14.97	295.58	1135.71	1135.53	3.41
17:45:21	30-Sep-92	36.23	36.19	15.10	286.57	1128.28	1128.29	3.41
18:00:21	30-Sep-92	36.23	36.19	15.10	296.52	1134.11	1133.83	3.41
18:15:21	30-Sep-92	39.33	39.29	15.01	287.91	1153.18	1153.07	3.41
18:30:21	30-Sep-92	33.15	33.08	15.01	288.10	1154.54	1154.30	3.41
18:45:21	30-Sep-92	36.02	35.94	15.01	292.85	1140.08	1139.92	3.41
19:00:21	30-Sep-92	36.02	35.94	15.10	291.04	1152.57	1152.29	3.41

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
19:15:21	30-Sep-92	34.75	34.67	15.10	284.53	1152.57	1152.29	3.41
19:30:21	30-Sep-92	37.78	37.69	15.10	293.67	1167.06	1166.70	3.41
19:45:21	30-Sep-92	34.12	33.97	14.98	290.91	1157.03	1156.59	3.41
20:00:21	30-Sep-92	36.09	36.00	14.98	293.48	1168.27	1168.00	3.41
20:15:21	30-Sep-92	37.71	37.67	14.98	301.38	1176.18	1175.70	3.41
20:30:21	30-Sep-92	37.71	37.67	14.98	301.00	1166.62	1166.20	3.41
20:45:21	30-Sep-92	37.71	37.67	14.98	294.78	1176.39	1176.05	3.41
21:00:21	30-Sep-92	37.71	37.67	14.98	304.94	1184.22	1183.84	3.41
21:15:21	30-Sep-92	37.71	37.67	14.98	285.84	1186.85	1186.39	3.41
21:30:21	30-Sep-92	37.71	37.67	14.98	292.54	1186.85	1186.39	3.41
21:45:21	30-Sep-92	39.93	39.90	15.09	297.74	1197.86	1197.66	3.41
22:00:21	30-Sep-92	42.33	42.34	15.09	303.57	1196.67	1196.45	3.41
22:15:21	30-Sep-92	48.81	48.86	15.00	273.96	1186.90	1186.46	3.41
22:30:21	30-Sep-92	60.31	60.35	15.00	246.47	1194.82	1194.63	2.88
22:45:21	30-Sep-92	56.65	56.64	15.00	285.51	1315.85	1315.52	2.88
23:00:21	30-Sep-92	68.51	68.45	15.00	302.92	1770.24	1769.66	4.03
23:15:21	30-Sep-92	66.81	66.79	15.00	371.00	1304.60	1304.33	5.28
23:30:21	30-Sep-92	70.27	70.22	15.09	338.65	1234.59	1234.55	4.94
23:45:21	30-Sep-92	70.27	70.22	15.09	337.20	1224.91	1224.48	4.94
01:30:21	01-Oct-92	60.68	60.71	15.17	367.52	1198.45	1198.47	5.14
01:45:21	01-Oct-92	61.74	61.79	15.17	367.74	1206.52	1206.55	5.14
02:00:21	01-Oct-92	61.74	61.79	15.29	366.05	1208.39	1208.49	5.14
02:15:21	01-Oct-92	60.03	60.10	15.29	367.08	1204.06	1204.19	5.14
02:30:21	01-Oct-92	61.57	61.61	15.29	365.29	1204.06	1204.19	5.14
02:45:21	01-Oct-92	59.54	59.58	15.29	361.64	1212.04	1211.95	5.14
03:00:21	01-Oct-92	59.54	59.58	15.29	361.13	1213.35	1213.13	5.14
03:15:21	01-Oct-92	61.25	61.32	15.29	359.08	1213.35	1213.13	5.14
03:30:21	01-Oct-92	62.74	62.81	15.29	359.76	1215.55	1215.55	5.14
03:45:21	01-Oct-92	58.02	57.90	15.29	362.87	1213.41	1213.25	5.14
04:00:21	01-Oct-92	58.02	57.90	15.29	364.22	1213.41	1213.25	5.14
04:15:21	01-Oct-92	59.80	59.95	15.29	365.91	1210.95	1211.08	5.14
04:30:21	01-Oct-92	59.80	59.95	15.29	369.59	1220.76	1220.77	5.14
04:45:21	01-Oct-92	56.30	56.31	15.29	369.14	1220.76	1220.77	5.14
05:00:21	01-Oct-92	55.06	55.09	15.29	372.19	1216.89	1216.97	5.14
05:15:21	01-Oct-92	47.17	47.22	15.29	339.97	1261.76	1261.94	4.22
05:30:21	01-Oct-92	39.39	39.38	15.29	326.49	1258.38	1258.40	3.51
05:45:21	01-Oct-92	30.88	30.83	15.29	355.07	1238.38	1238.76	3.26
06:00:21	01-Oct-92	27.88	27.83	15.29	382.82	1226.00	1226.34	3.26
06:15:21	01-Oct-92	14.64	14.58	15.17	408.01	1226.00	1226.34	3.04
06:30:21	01-Oct-92	11.42	11.35	15.17	423.93	1249.22	1249.62	2.68
06:45:21	01-Oct-92	14.18	14.14	15.17	423.93	1184.39	1184.54	3.01
07:00:21	01-Oct-92	14.18	14.14	15.01	487.43	1270.57	1270.79	3.96
07:15:21	01-Oct-92	3.32	3.28	15.16	535.51	1235.10	1234.97	3.96
07:30:21	01-Oct-92	10.50	10.49	15.16	544.84	1233.66	1233.65	3.69
14:00:21	01-Oct-92	16.48	16.62	14.92	611.34	1249.85	1249.61	4.01
14:15:21	01-Oct-92	28.99	29.31	14.92	608.30	1269.07	1269.52	4.01
14:30:21	01-Oct-92	37.46	37.93	14.92	607.99	1288.61	1289.69	4.01
14:45:21	01-Oct-92	45.39	45.95	14.92	606.02	1303.89	1305.22	4.01
15:00:21	01-Oct-92	52.02	52.69	14.92	597.76	1314.26	1315.65	4.01
15:15:21	01-Oct-92	55.69	56.52	14.92	584.78	1305.79	1307.30	4.01
15:30:21	01-Oct-92	58.91	59.67	14.92	586.28	1303.72	1305.33	4.01

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
15:45:21	01-Oct-92	60.30	61.03	14.92	585.67	1297.98	1299.79	4.01
16:00:21	01-Oct-92	64.35	65.11	14.92	582.21	1286.83	1288.64	4.01
16:15:21	01-Oct-92	63.26	64.06	14.92	598.01	1295.99	1297.94	4.01
16:30:21	01-Oct-92	63.26	64.06	14.92	578.78	1300.82	1302.60	4.01
16:45:21	01-Oct-92	63.26	64.06	14.92	573.43	1295.95	1297.78	4.01
17:00:21	01-Oct-92	63.26	64.06	14.92	570.09	1287.02	1288.87	4.01
17:15:21	01-Oct-92	63.26	64.06	14.92	577.06	1277.39	1279.06	4.01
17:30:21	01-Oct-92	63.26	64.06	14.92	580.55	1244.04	1245.58	4.01
17:45:21	01-Oct-92	61.85	62.70	14.92	575.15	1239.75	1241.22	4.01
18:00:21	01-Oct-92	60.41	61.23	14.92	570.50	1241.98	1243.43	4.01
18:15:21	01-Oct-92	58.76	59.68	14.92	569.17	1220.68	1222.24	4.01
18:30:21	01-Oct-92	58.76	59.68	14.92	564.17	1205.74	1207.33	4.01
18:45:21	01-Oct-92	56.54	57.52	14.80	560.40	1203.12	1204.62	4.01
19:00:21	01-Oct-92	56.54	57.52	14.80	564.58	1208.56	1210.15	4.01
19:15:21	01-Oct-92	54.63	55.59	14.80	558.51	1197.68	1199.31	4.01
19:30:21	01-Oct-92	53.06	54.05	14.80	554.68	1189.07	1190.69	4.01
19:45:21	01-Oct-92	51.60	52.54	14.80	555.53	1197.36	1198.99	4.01
20:00:21	01-Oct-92	51.60	52.54	14.80	558.96	1204.82	1206.40	4.01
20:15:21	01-Oct-92	50.16	51.08	14.80	567.58	1209.14	1210.66	4.01
20:30:21	01-Oct-92	36.92	37.66	14.80	563.89	1215.12	1216.05	4.01
20:45:21	01-Oct-92	12.47	12.97	14.71	567.98	1181.27	1181.81	4.01
21:00:21	01-Oct-92	10.89	11.36	14.71	573.51	1181.27	1181.81	4.01
21:15:21	01-Oct-92	15.08	15.48	14.81	582.67	1186.45	1187.59	4.01
23:00:21	01-Oct-92	11.15	11.12	15.00	471.63	1247.63	1247.42	4.09
23:15:21	01-Oct-92	15.20	15.26	15.00	483.95	1223.85	1223.86	4.09
23:30:21	01-Oct-92	18.55	18.62	15.10	492.71	1256.22	1256.12	4.09
23:45:21	01-Oct-92	18.55	18.62	15.10	493.22	1259.06	1259.17	4.09
00:00:21	02-Oct-92	20.62	20.78	15.10	496.98	1250.65	1250.75	4.09
00:15:21	02-Oct-92	19.15	19.18	15.10	504.38	1246.19	1246.24	4.09
00:30:21	02-Oct-92	21.18	21.23	15.01	499.84	1265.27	1265.52	3.58
00:45:21	02-Oct-92	18.34	18.41	15.01	481.23	1212.60	1212.62	3.58
01:00:21	02-Oct-92	18.34	18.41	14.78	471.97	1188.15	1188.45	3.58
01:15:21	02-Oct-92	57.80	57.96	14.78	341.23	1156.35	1156.68	2.70
01:30:21	02-Oct-92	22.58	22.71	14.93	304.03	1185.85	1186.13	3.29
01:45:21	02-Oct-92	28.68	28.80	14.93	273.35	1180.13	1180.41	3.29
02:00:21	02-Oct-92	28.68	28.80	14.93	267.77	1165.27	1165.57	3.29
02:15:21	02-Oct-92	32.26	32.40	14.93	263.39	1175.27	1175.78	3.29
02:30:21	02-Oct-92	36.94	37.10	14.93	258.10	1187.60	1187.78	3.07
02:45:21	02-Oct-92	47.99	48.20	14.93	257.32	1195.23	1195.49	3.07
03:00:21	02-Oct-92	76.41	76.62	15.04	258.56	1197.65	1197.94	3.07
03:15:21	02-Oct-92	75.39	75.62	15.14	262.94	1188.60	1188.92	3.07
03:30:21	02-Oct-92	79.52	79.68	15.01	262.72	1184.83	1184.87	3.07
03:45:21	02-Oct-92	62.29	62.44	14.90	267.61	1173.43	1173.45	3.07
04:00:21	02-Oct-92	70.08	70.23	14.90	266.13	1156.51	1156.74	3.07
04:15:21	02-Oct-92	46.58	46.75	14.90	264.16	1156.51	1156.74	3.07
04:30:21	02-Oct-92	57.31	57.49	14.90	239.97	1258.96	1259.50	3.07
04:45:21	02-Oct-92	69.19	69.40	14.90	239.18	1320.10	1320.42	3.07
05:00:21	02-Oct-92	48.40	48.61	14.98	293.54	1394.19	1394.79	3.51
05:15:21	02-Oct-92	73.65	73.84	14.98	204.40	1263.98	1264.61	2.80
05:30:21	02-Oct-92	56.91	57.16	14.98	229.21	1253.08	1253.52	3.04
05:45:21	02-Oct-92	43.02	43.27	14.98	265.48	1223.85	1224.29	3.31

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
06:00:21	02-Oct-92	33.75	33.93	14.98	287.92	1191.62	1191.89	3.61
06:15:21	02-Oct-92	28.84	29.01	14.86	292.60	1193.48	1193.88	3.61
06:30:21	02-Oct-92	27.47	27.66	14.86	254.37	1210.53	1211.06	3.02
06:45:21	02-Oct-92	36.62	36.78	14.86	248.70	1215.12	1215.60	3.02
07:00:21	02-Oct-92	32.53	32.70	14.86	254.38	1215.12	1215.60	3.02
07:15:21	02-Oct-92	14.73	14.90	14.86	274.89	1213.86	1214.03	3.37
07:30:21	02-Oct-92	5.72	5.74	14.86	289.16	1204.56	1204.76	3.37
07:45:21	02-Oct-92	9.98	10.07	14.86	278.24	1200.16	1200.44	3.37
09:30:21	02-Oct-92	17.85	17.95	15.06	274.66	1305.63	1306.02	3.10
09:45:21	02-Oct-92	17.85	17.95	15.20	286.77	1333.14	1333.53	3.10
10:00:21	02-Oct-92	17.85	17.95	15.20	292.76	1326.55	1326.65	3.10
12:00:21	02-Oct-92	9.04	8.70	15.17	310.16	1266.68	1266.97	3.34
12:15:21	02-Oct-92	9.04	8.70	15.17	312.04	1283.94	1284.08	3.34
12:30:21	02-Oct-92	10.05	8.70	15.17	315.21	1291.13	1291.17	3.34
12:45:21	02-Oct-92	9.03	8.70	15.17	315.35	1285.63	1285.91	3.34
13:00:21	02-Oct-92	7.35	6.99	15.30	304.81	1295.61	1295.67	3.34
13:15:21	02-Oct-92	7.35	6.99	15.30	303.96	1283.66	1283.62	3.34
13:30:21	02-Oct-92	5.88	5.38	15.30	294.89	1253.03	1252.53	3.34
13:45:21	02-Oct-92	5.88	5.38	15.30	293.99	1263.20	1262.80	3.34
14:00:21	02-Oct-92	2.92	2.39	15.22	295.13	1241.80	1241.25	3.34
14:15:21	02-Oct-92	5.29	4.68	15.22	292.69	1245.00	1244.41	3.34
14:30:21	02-Oct-92	2.93	2.35	15.22	299.52	1245.00	1244.41	3.34
14:45:21	02-Oct-92	10.04	9.48	15.22	293.13	1231.85	1231.23	3.34
15:00:21	02-Oct-92	19.42	18.88	15.22	268.29	1229.99	1229.26	2.98
15:15:21	02-Oct-92	21.18	20.63	15.22	260.05	1234.81	1234.11	2.98
15:30:21	02-Oct-92	19.78	19.24	15.22	258.83	1238.09	1237.55	2.98
15:45:21	02-Oct-92	35.11	34.70	15.22	266.08	1243.02	1242.53	2.98
16:00:21	02-Oct-92	20.63	20.11	15.22	265.45	1259.99	1259.66	2.98
16:15:21	02-Oct-92	14.82	14.25	15.22	270.59	1284.03	1283.67	2.98
16:30:21	02-Oct-92	14.82	14.25	15.22	274.35	1286.66	1286.23	2.98
16:45:21	02-Oct-92	12.54	12.01	15.22	278.69	1286.66	1286.23	2.98
17:00:21	02-Oct-92	29.80	29.32	15.22	284.91	1287.85	1287.39	2.98
17:15:21	02-Oct-92	13.53	12.97	15.22	276.31	1289.85	1289.38	3.18
17:30:21	02-Oct-92	14.69	14.12	15.22	276.67	1289.85	1289.38	3.18
17:45:21	02-Oct-92	14.69	14.12	15.22	277.76	1281.34	1280.88	3.18
18:00:21	02-Oct-92	14.69	14.12	15.22	276.08	1287.28	1286.85	3.18
18:15:21	02-Oct-92	17.86	17.30	15.22	287.69	1293.74	1293.44	3.18
18:30:21	02-Oct-92	35.79	35.89	15.22	287.36	1284.84	1284.45	3.18
18:45:21	02-Oct-92	52.75	52.36	15.22	284.54	1291.72	1291.27	2.58
19:00:21	02-Oct-92	55.87	55.51	15.22	278.59	1281.39	1280.92	2.58
19:15:21	02-Oct-92	81.25	80.97	15.22	274.86	1263.20	1263.14	2.58
19:30:21	02-Oct-92	96.43	96.20	15.22	275.41	1298.08	1298.18	2.58
19:45:21	02-Oct-92	105.79	105.62	15.22	272.06	1306.44	1306.42	2.58
20:00:21	02-Oct-92	92.69	92.44	15.22	277.42	1314.45	1314.15	2.58
20:15:21	02-Oct-92	43.71	43.46	15.22	277.86	1270.57	1270.49	2.85
20:30:21	02-Oct-92	20.68	20.37	15.22	274.01	1308.37	1308.13	3.14
20:45:21	02-Oct-92	19.04	18.79	15.31	285.44	1322.01	1321.86	3.14
21:00:21	02-Oct-92	16.88	16.54	15.31	288.17	1297.94	1297.85	3.97
21:15:21	02-Oct-92	16.88	16.54	15.22	308.31	1315.27	1315.27	3.97
21:30:21	02-Oct-92	27.64	27.41	15.22	300.60	1517.01	1517.16	3.61
21:45:21	02-Oct-92	25.56	25.38	15.22	356.84	1677.43	1677.66	4.29

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
22:00:21	02-Oct-92	26.61	26.42	15.22	380.79	1387.07	1387.43	4.29
22:15:21	02-Oct-92	32.28	32.14	15.22	309.91	1334.28	1334.69	3.57
22:30:21	02-Oct-92	42.91	42.72	15.35	321.30	1341.09	1341.35	3.57
22:45:21	02-Oct-92	45.82	45.75	15.35	320.54	1327.33	1327.70	3.57
23:00:21	02-Oct-92	47.11	47.08	15.35	317.15	1292.52	1292.91	3.57
23:15:21	02-Oct-92	48.38	48.32	15.35	321.21	1302.52	1302.90	3.57
23:30:21	02-Oct-92	49.67	49.62	15.35	319.64	1331.13	1331.38	3.57
23:45:21	02-Oct-92	50.87	50.85	15.35	319.07	1329.62	1329.82	3.57
00:00:21	03-Oct-92	50.87	50.85	15.35	327.21	1341.40	1341.62	3.57
00:15:21	03-Oct-92	52.93	52.93	15.35	323.25	1344.54	1344.83	3.57
00:30:21	03-Oct-92	52.93	52.93	15.35	328.06	1344.54	1344.83	3.57
00:45:21	03-Oct-92	54.41	54.46	15.35	364.52	1334.81	1335.51	3.94
01:00:21	03-Oct-92	53.39	53.37	15.35	362.17	1351.95	1352.43	3.94
01:15:21	03-Oct-92	55.08	55.17	15.27	351.06	1339.08	1339.42	3.61
01:30:21	03-Oct-92	57.78	57.67	15.27	345.92	1329.01	1329.46	3.61
01:45:21	03-Oct-92	61.42	61.31	15.27	347.22	1338.40	1338.72	3.61
02:00:21	03-Oct-92	68.45	68.31	15.27	343.91	1343.59	1344.02	3.40
02:15:21	03-Oct-92	72.97	72.87	15.27	336.51	1340.80	1341.20	3.40
02:30:21	03-Oct-92	72.97	72.87	15.27	320.53	1348.75	1349.23	3.40
02:45:21	03-Oct-92	77.06	76.97	15.27	322.42	1338.81	1339.20	3.40
03:00:21	03-Oct-92	77.06	76.97	15.27	323.09	1334.55	1334.82	3.40
03:15:21	03-Oct-92	75.63	75.54	15.27	309.51	1303.70	1304.04	3.14
03:30:21	03-Oct-92	79.28	79.20	15.12	372.14	1315.04	1315.65	3.57
03:45:21	03-Oct-92	43.02	42.90	15.12	455.33	1398.96	1399.34	4.14
04:00:21	03-Oct-92	26.13	26.05	15.34	435.03	1329.59	1329.97	3.50
04:15:21	03-Oct-92	32.68	32.48	15.34	460.21	1341.10	1341.54	3.78
04:30:21	03-Oct-92	36.63	36.45	15.34	479.38	1277.16	1277.62	4.37
04:45:21	03-Oct-92	30.91	30.78	15.34	515.25	1283.16	1283.58	5.18
05:00:21	03-Oct-92	28.86	28.86	15.34	564.58	1254.49	1255.13	5.69
05:15:21	03-Oct-92	32.22	32.28	15.34	581.35	1293.63	1294.48	5.69
05:30:21	03-Oct-92	35.18	35.36	15.49	582.84	1307.30	1308.47	5.69
05:45:21	03-Oct-92	37.11	37.32	15.61	588.37	1307.30	1308.47	5.69
06:00:21	03-Oct-92	38.65	38.92	15.61	583.15	1318.50	1319.28	5.69
06:15:21	03-Oct-92	38.65	38.92	15.61	567.93	1305.80	1307.01	5.69
06:30:21	03-Oct-92	39.80	40.11	15.61	578.26	1321.49	1322.73	5.69
06:45:21	03-Oct-92	39.80	40.11	15.61	580.36	1313.20	1314.30	5.69
07:00:21	03-Oct-92	39.80	40.11	15.47	586.17	1299.43	1300.78	5.69
07:15:21	03-Oct-92	42.32	42.61	15.47	514.36	1326.59	1327.67	4.47
07:30:21	03-Oct-92	42.32	42.61	15.47	449.60	1358.02	1358.90	3.05
07:45:21	03-Oct-92	47.60	47.86	15.47	451.60	1338.62	1339.85	3.05
08:00:21	03-Oct-92	40.41	40.66	15.39	458.80	1292.03	1293.17	3.60
08:15:21	03-Oct-92	35.94	36.23	15.39	462.22	1242.26	1243.25	3.81
08:30:21	03-Oct-92	35.94	36.23	15.39	455.11	1183.57	1184.63	3.81
08:45:21	03-Oct-92	26.56	26.81	15.39	466.96	1191.74	1192.84	3.81
09:00:21	03-Oct-92	26.56	26.81	15.30	464.24	1245.77	1246.71	3.81
09:15:21	03-Oct-92	19.67	19.78	15.18	508.14	1315.76	1316.79	4.07
09:30:21	03-Oct-92	15.98	16.11	15.18	535.07	1370.69	1371.79	4.07
09:45:21	03-Oct-92	11.56	11.74	15.18	490.64	1391.55	1392.68	4.07
10:00:21	03-Oct-92	12.81	12.98	15.18	498.52	1354.70	1355.72	4.07
10:15:21	03-Oct-92	14.41	14.57	15.18	464.65	1351.18	1352.27	4.07
10:30:21	03-Oct-92	19.12	19.17	15.18	464.58	1385.44	1386.29	3.83

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
10:45:21	03-Oct-92	19.12	19.17	15.28	466.26	1382.86	1384.11	3.83
~~11:00:21~~	~~03-Oct-92~~	~~19.12~~	~~19.17~~	~~15.28~~	~~464.66~~	~~1374.39~~	~~1375.31~~	~~3.83~~
11:15:21	03-Oct-92	21.22	21.29	15.28	470.77	1344.13	1345.20	3.83
11:30:21	03-Oct-92	23.94	24.11	15.28	474.66	1328.78	1329.80	3.83
11:45:21	03-Oct-92	23.94	24.11	15.28	488.32	1308.86	1309.91	3.83
12:00:21	03-Oct-92	25.98	26.24	15.28	475.36	1312.30	1313.30	3.83
12:15:21	03-Oct-92	27.25	27.54	15.28	472.46	1315.04	1316.19	3.83
12:30:21	03-Oct-92	28.78	29.12	15.28	473.25	1355.44	1356.12	3.83
12:45:21	03-Oct-92	28.78	29.12	15.28	472.56	1370.87	1371.60	3.83
13:00:21	03-Oct-92	31.02	31.26	15.28	474.69	1373.25	1374.07	3.83
13:15:21	03-Oct-92	31.02	31.26	15.20	475.63	1370.20	1371.18	4.24
13:30:21	03-Oct-92	24.71	25.00	15.20	472.44	1364.54	1365.57	4.24
13:45:21	03-Oct-92	22.02	22.21	15.20	476.69	1298.86	1300.05	4.24
14:00:21	03-Oct-92	22.02	22.21	15.20	481.45	1359.21	1360.34	4.24
14:15:21	03-Oct-92	22.02	22.21	15.20	478.86	1374.31	1375.34	4.02
14:30:21	03-Oct-92	20.34	20.57	15.20	475.66	1333.57	1334.73	4.02
14:45:21	03-Oct-92	20.34	20.57	15.20	476.54	1333.57	1334.73	4.02
15:00:21	03-Oct-92	19.24	19.44	15.20	478.62	1354.72	1355.81	4.02
15:15:21	03-Oct-92	19.24	19.44	15.20	479.76	1314.60	1315.68	4.02
15:30:21	03-Oct-92	22.28	22.56	15.20	483.74	1291.79	1292.84	4.02
15:45:21	03-Oct-92	39.61	39.92	15.20	477.93	1260.49	1261.80	4.02
16:00:21	03-Oct-92	25.85	26.16	15.20	490.93	1306.89	1308.08	4.02
16:15:21	03-Oct-92	25.85	26.16	15.20	478.81	1369.07	1370.15	3.79
16:30:21	03-Oct-92	23.39	23.69	15.20	478.72	1335.28	1336.69	3.79
16:45:21	03-Oct-92	23.39	23.69	15.20	474.83	1325.04	1326.11	3.79
17:00:21	03-Oct-92	23.39	23.69	15.20	478.81	1279.88	1280.98	4.03
17:15:21	03-Oct-92	23.39	23.69	15.20	480.12	1301.07	1302.37	4.03
17:30:21	03-Oct-92	23.39	23.69	15.20	478.68	1278.47	1279.51	3.74
17:45:21	03-Oct-92	24.54	24.82	15.20	480.04	1256.04	1257.11	3.74
18:00:21	03-Oct-92	24.54	24.82	15.20	487.30	1247.76	1248.77	3.74
18:15:21	03-Oct-92	26.05	26.26	15.20	491.17	1274.49	1275.42	3.74
18:30:21	03-Oct-92	26.05	26.26	15.20	494.92	1262.99	1264.04	3.94
18:45:21	03-Oct-92	26.05	26.26	15.20	515.62	1309.62	1310.79	3.94
19:00:21	03-Oct-92	26.05	26.26	15.20	519.27	1332.43	1333.62	3.94
19:15:21	03-Oct-92	19.52	19.66	15.20	586.04	1329.72	1330.91	3.94
19:30:21	03-Oct-92	16.03	16.17	15.20	581.93	1307.70	1308.88	3.94
19:45:21	03-Oct-92	14.53	14.63	15.20	561.42	1291.08	1292.16	3.71
20:00:21	03-Oct-92	14.53	14.63	15.20	535.46	1291.08	1292.16	3.71
20:15:21	03-Oct-92	20.52	20.61	15.20	537.14	1318.49	1319.51	4.61
20:30:21	03-Oct-92	24.75	24.88	15.09	547.84	1306.20	1307.50	6.05
20:45:21	03-Oct-92	20.17	20.24	15.21	596.78	1255.68	1257.07	6.05
21:00:21	03-Oct-92	17.12	17.27	15.21	599.48	1290.81	1292.12	6.05
21:15:21	03-Oct-92	19.65	19.71	15.21	597.87	1325.33	1326.50	6.05
21:30:21	03-Oct-92	21.64	21.72	15.21	595.68	1311.44	1312.51	5.78
21:45:21	03-Oct-92	23.57	23.71	15.41	601.02	1265.92	1267.06	5.78
22:00:21	03-Oct-92	25.68	25.88	15.41	604.32	1292.94	1294.15	5.78
22:15:21	03-Oct-92	26.77	26.99	15.52	602.64	1245.73	1247.03	5.78
22:30:21	03-Oct-92	28.21	28.50	15.52	604.55	1297.27	1298.46	5.78
22:45:21	03-Oct-92	29.49	29.80	15.60	599.76	1291.04	1292.31	5.78
23:00:21	03-Oct-92	29.49	29.80	15.60	602.10	1312.61	1313.85	5.78
23:15:21	03-Oct-92	31.60	31.92	15.60	578.15	1299.14	1300.46	5.41

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
23:30:21	03-Oct-92	36.68	37.01	15.60	474.60	1356.59	1357.71	4.25
23:45:21	03-Oct-92	31.49	31.81	15.60	450.01	1346.12	1347.17	3.64
00:00:21	04-Oct-92	71.20	71.42	15.18	372.05	1229.12	1230.09	3.26
00:15:21	04-Oct-92	98.10	98.42	15.37	266.51	1241.17	1242.05	3.26
00:30:21	04-Oct-92	65.15	65.46	15.37	269.90	1346.01	1346.95	3.02
00:45:21	04-Oct-92	54.33	54.73	15.37	298.61	1333.50	1334.65	3.42
01:00:21	04-Oct-92	52.88	53.21	15.37	316.25	1335.27	1336.33	3.42
01:15:21	04-Oct-92	57.11	57.48	15.37	300.54	1314.12	1315.11	3.42
01:30:21	04-Oct-92	59.67	60.01	15.49	307.49	1329.71	1330.76	3.42
01:45:21	04-Oct-92	57.66	58.01	15.59	311.65	1324.99	1325.99	3.42
02:00:21	04-Oct-92	56.24	56.61	15.59	313.37	1294.73	1295.79	3.42
02:15:21	04-Oct-92	57.29	57.64	15.59	312.03	1301.05	1302.17	3.42
02:30:21	04-Oct-92	57.29	57.64	15.46	319.70	1328.49	1329.41	3.42
02:45:21	04-Oct-92	52.17	52.42	15.46	321.00	1326.43	1327.28	3.42
03:00:21	04-Oct-92	46.64	46.67	15.46	331.24	1334.86	1335.10	3.95
03:15:21	04-Oct-92	59.93	59.98	15.46	308.05	1347.72	1347.90	4.86
03:30:21	04-Oct-92	63.13	63.15	15.46	327.44	1330.83	1331.16	5.20
03:45:21	04-Oct-92	64.97	64.93	15.57	328.39	1274.97	1275.30	5.20
04:00:21	04-Oct-92	66.25	66.14	15.57	323.62	1280.17	1280.51	5.20
04:15:21	04-Oct-92	66.25	66.14	15.57	325.68	1284.56	1284.99	5.20
04:30:21	04-Oct-92	68.94	68.80	15.57	329.89	1292.09	1292.69	5.20
04:45:21	04-Oct-92	70.35	70.24	15.57	326.75	1299.72	1300.41	5.20
05:00:21	04-Oct-92	70.35	70.24	15.57	327.35	1318.51	1318.69	5.20
05:15:21	04-Oct-92	70.35	70.24	15.57	324.48	1309.26	1309.67	5.20
05:30:21	04-Oct-92	70.35	70.24	15.57	328.36	1297.17	1297.73	5.20
05:45:21	04-Oct-92	71.65	71.54	15.57	320.83	1282.09	1282.43	5.20
06:00:21	04-Oct-92	71.65	71.54	15.57	323.46	1260.25	1260.50	5.20
06:15:21	04-Oct-92	70.29	70.22	15.66	324.19	1262.67	1263.19	5.20
06:30:21	04-Oct-92	70.29	70.22	15.66	325.66	1264.95	1265.36	5.20
06:45:21	04-Oct-92	70.29	70.22	15.66	325.59	1263.15	1263.69	4.97
07:00:21	04-Oct-92	70.29	70.22	15.66	327.00	1269.08	1269.68	4.97
07:15:21	04-Oct-92	70.29	69.18	15.66	326.39	1251.84	1252.28	4.97
07:30:21	04-Oct-92	67.99	67.86	15.66	329.63	1257.64	1258.09	4.97
07:45:21	04-Oct-92	67.99	67.86	15.66	336.09	1271.14	1271.53	5.23
08:00:21	04-Oct-92	41.86	41.62	15.54	369.13	1258.60	1259.12	5.67
08:15:21	04-Oct-92	29.87	29.65	15.54	368.14	1209.61	1210.02	5.67
08:30:21	04-Oct-92	32.36	32.11	15.54	362.11	1289.67	1290.14	5.67
08:45:21	04-Oct-92	32.36	32.11	15.54	353.44	1339.89	1340.24	5.46
09:00:21	04-Oct-92	36.12	35.94	15.18	353.77	1338.75	1339.22	5.46
09:15:21	04-Oct-92	42.34	42.17	15.56	341.91	1383.34	1383.85	5.21
09:30:21	04-Oct-92	38.39	38.32	15.56	336.69	1300.99	1301.54	5.21
09:45:21	04-Oct-92	38.39	38.32	15.56	325.90	1237.35	1237.86	5.21
10:00:21	04-Oct-92	29.45	29.32	15.56	343.83	1204.75	1205.93	5.53
12:00:21	04-Oct-92	45.12	45.15	15.10	322.77	1224.24	1224.25	4.78
12:15:21	04-Oct-92	52.17	52.20	15.10	278.69	1233.06	1233.21	4.48
12:30:21	04-Oct-92	57.25	57.23	15.10	252.47	1245.91	1245.72	4.27
12:45:21	04-Oct-92	66.46	66.34	15.20	233.58	1253.87	1253.61	4.27
13:00:21	04-Oct-92	63.49	63.66	15.20	243.21	1267.35	1267.23	4.27
13:15:21	04-Oct-92	60.57	60.66	15.20	257.47	1258.77	1258.72	4.27
13:30:21	04-Oct-92	61.86	61.96	15.20	255.18	1268.90	1268.64	4.27
13:45:21	04-Oct-92	61.86	61.96	15.20	257.95	1284.42	1283.97	4.27

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
14:00:21	04-Oct-92	60.57	60.61	15.20	252.97	1273.26	1272.87	4.27
14:15:21	04-Oct-92	61.84	61.89	15.20	251.47	1270.73	1270.45	4.27
14:30:21	04-Oct-92	61.84	61.89	15.20	265.35	1278.96	1278.72	4.27
14:45:21	04-Oct-92	61.84	61.89	15.20	257.67	1294.53	1294.55	4.27
15:00:21	04-Oct-92	66.10	66.14	15.20	257.07	1309.57	1309.60	4.27
15:15:21	04-Oct-92	58.25	58.16	15.20	260.51	1280.35	1280.22	4.27
15:30:21	04-Oct-92	58.25	58.16	15.28	265.57	1176.92	1176.79	4.27
15:45:21	04-Oct-92	58.25	58.16	15.28	267.52	1315.99	1315.81	4.27
16:00:21	04-Oct-92	86.01	86.02	15.28	272.52	1364.39	1364.31	3.93
16:15:21	04-Oct-92	48.29	48.25	15.28	374.96	1363.25	1364.31	3.54
16:30:21	04-Oct-92	108.39	108.07	15.18	396.97	1266.61	1267.42	3.54
16:45:21	04-Oct-92	26.24	26.18	15.05	486.84	1259.74	1259.65	4.14
17:00:21	04-Oct-92	20.46	20.37	15.25	486.49	1382.15	1382.13	3.04
17:15:21	04-Oct-92	22.61	22.53	15.25	493.98	1338.86	1338.68	3.04
17:30:21	04-Oct-92	24.13	23.99	15.25	502.36	1364.64	1364.47	3.35
17:45:21	04-Oct-92	24.13	25.01	15.25	502.87	1312.30	1312.06	3.35
18:00:21	04-Oct-92	24.13	25.01	14.96	477.12	1242.57	1242.71	4.59
18:15:21	04-Oct-92	35.27	35.25	15.12	283.78	1255.83	1255.82	3.26
18:30:21	04-Oct-92	57.92	57.89	15.32	214.50	1261.02	1260.97	2.53
18:45:21	04-Oct-92	61.86	61.75	15.32	272.77	1318.25	1317.73	3.12
19:00:21	04-Oct-92	43.29	43.26	15.32	318.57	1335.77	1335.60	3.84
19:15:21	04-Oct-92	51.37	51.27	15.40	333.73	1387.56	1387.46	5.32
19:30:21	04-Oct-92	58.79	58.75	15.40	365.34	1333.62	1333.58	5.64
19:45:21	04-Oct-92	51.46	51.46	15.31	429.77	1285.63	1285.70	5.64
20:00:21	04-Oct-92	39.78	39.72	15.31	417.54	1317.84	1317.51	4.96
20:15:21	04-Oct-92	42.61	42.56	15.49	391.19	1322.13	1321.73	4.96
20:30:21	04-Oct-92	45.01	44.88	15.49	387.11	1295.27	1295.13	4.96
20:45:21	04-Oct-92	46.12	46.05	15.65	384.02	1272.40	1272.29	4.71
21:00:21	04-Oct-92	46.12	46.05	15.49	381.35	1316.74	1316.40	4.71
21:15:21	04-Oct-92	49.03	48.93	15.49	384.43	1274.60	1274.48	4.71
21:30:21	04-Oct-92	49.03	48.93	15.49	388.45	1325.80	1325.50	4.93
21:45:21	04-Oct-92	51.73	51.77	15.62	389.88	1270.38	1270.28	4.93
22:00:21	04-Oct-92	51.73	51.77	15.62	394.44	1323.01	1323.12	4.93
22:15:21	04-Oct-92	53.60	53.60	15.62	391.88	1353.00	1353.24	4.93
22:30:21	04-Oct-92	53.60	53.60	15.62	363.01	1356.82	1356.96	4.08
22:45:21	04-Oct-92	58.40	58.50	15.62	374.46	1332.51	1332.48	4.08
23:00:21	04-Oct-92	58.40	58.50	15.62	367.00	1326.76	1326.76	4.08
23:15:21	04-Oct-92	58.40	58.50	15.50	347.25	1333.01	1333.20	3.87
23:30:21	04-Oct-92	58.40	58.50	15.50	300.92	1347.27	1347.32	3.34
23:45:21	04-Oct-92	60.82	60.89	15.58	277.64	1330.03	1329.98	3.34
00:00:21	05-Oct-92	73.52	73.51	15.68	292.74	1305.80	1305.85	3.34
00:15:21	05-Oct-92	60.40	60.37	15.49	292.49	1335.79	1335.43	3.34
00:30:21	05-Oct-92	58.72	58.69	15.49	285.87	1380.02	1379.66	3.34
00:45:21	05-Oct-92	60.30	60.29	15.49	291.47	1392.83	1392.68	3.34
01:00:21	05-Oct-92	58.48	58.54	15.49	296.01	1389.24	1389.09	3.34
01:15:21	05-Oct-92	58.48	58.54	15.49	301.64	1372.95	1373.00	3.55
01:30:21	05-Oct-92	61.92	62.02	15.49	300.27	1406.19	1406.14	3.55
01:45:21	05-Oct-92	60.23	60.33	15.49	308.91	1409.76	1409.73	3.55
02:00:21	05-Oct-92	66.65	66.68	15.40	332.29	1384.32	1384.34	4.12
02:15:21	05-Oct-92	56.87	56.92	15.52	318.43	1386.08	1386.02	3.73
02:30:21	05-Oct-92	62.69	62.80	15.52	325.40	1360.40	1360.46	4.15

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
02:45:21	05-Oct-92	62.69	62.80	15.52	335.37	1366.77	1366.65	4.15
03:00:21	05-Oct-92	62.69	62.80	15.52	334.16	1358.39	1358.29	4.15
03:15:21	05-Oct-92	60.04	60.16	15.41	338.98	1361.64	1361.72	4.15
03:30:21	05-Oct-92	58.44	58.52	15.41	336.05	1371.74	1371.83	4.15
03:45:21	05-Oct-92	56.04	55.98	15.41	334.19	1375.18	1375.53	4.15
04:00:21	05-Oct-92	54.77	54.71	15.41	336.31	1380.45	1380.50	4.15
04:15:21	05-Oct-92	54.77	54.71	15.41	333.48	1369.65	1369.65	4.15
04:30:21	05-Oct-92	53.51	53.47	15.41	333.48	1335.08	1335.31	4.15
06:00:21	05-Oct-92	22.59	22.31	15.12	338.25	1292.50	1292.78	3.78
06:15:21	05-Oct-92	22.59	22.31	15.12	346.93	1314.35	1314.46	3.78
06:30:21	05-Oct-92	22.59	22.31	15.12	316.14	1332.80	1332.84	3.25
06:45:21	05-Oct-92	21.22	20.97	15.12	290.80	1311.86	1312.18	3.25
07:00:21	05-Oct-92	27.39	27.16	15.12	295.18	1317.19	1317.46	3.25
07:15:21	05-Oct-92	27.39	28.19	15.12	319.45	1332.05	1332.17	3.25
07:30:21	05-Oct-92	29.03	28.19	15.20	320.94	1323.24	1323.44	3.25
07:45:21	05-Oct-92	27.89	28.19	15.20	319.03	1324.79	1325.03	3.25
08:00:21	05-Oct-92	19.55	19.28	15.20	343.42	1327.89	1328.06	3.25
08:15:21	05-Oct-92	21.77	21.47	15.20	334.64	1336.36	1336.27	2.96
08:30:21	05-Oct-92	23.37	23.06	15.20	323.95	1357.42	1357.42	2.96
08:45:21	05-Oct-92	20.35	20.05	15.20	329.50	1346.68	1346.59	2.96
09:00:21	05-Oct-92	17.58	17.25	15.20	332.54	1341.63	1341.72	3.18
09:15:21	05-Oct-92	14.26	13.93	15.20	315.73	1359.10	1359.13	3.42
09:30:21	05-Oct-92	21.72	21.34	15.20	304.68	1304.47	1304.35	3.42
09:45:21	05-Oct-92	10.33	9.95	15.20	305.25	1313.56	1313.33	3.42
10:00:21	05-Oct-92	17.51	17.15	15.20	309.35	1341.26	1341.01	3.42
10:15:21	05-Oct-92	27.40	27.08	15.20	304.07	1339.70	1339.51	3.42
10:30:21	05-Oct-92	40.09	39.69	15.20	296.12	1333.75	1333.55	3.42
10:45:21	05-Oct-92	34.72	34.31	15.08	293.76	1322.59	1322.30	3.21
11:00:21	05-Oct-92	34.72	34.31	15.24	296.77	1314.65	1314.66	3.21
11:15:21	05-Oct-92	34.72	34.31	15.24	296.77	1314.65	1314.66	3.21
11:30:21	05-Oct-92	30.91	30.56	15.24	308.09	1291.27	1291.18	3.21
11:45:21	05-Oct-92	37.34	36.91	15.12	292.70	1248.37	1248.07	3.21
12:00:21	05-Oct-92	76.62	76.39	15.12	272.63	1238.03	1237.87	3.21
12:15:21	05-Oct-92	43.70	43.41	15.12	255.06	1271.56	1271.15	2.87
12:30:21	05-Oct-92	33.66	33.29	15.12	267.50	1297.74	1297.41	2.87
12:45:21	05-Oct-92	60.49	60.25	15.22	399.59	1379.53	1379.45	2.87
13:00:21	05-Oct-92	14.74	14.54	15.22	464.43	1545.94	1546.08	3.33
13:15:21	05-Oct-92	14.74	14.54	15.22	489.18	1576.49	1576.90	3.33
13:30:21	05-Oct-92	14.74	14.54	15.22	480.89	1381.08	1381.40	3.04
13:45:21	05-Oct-92	14.74	14.54	15.22	476.86	1339.83	1340.27	3.04
14:00:21	05-Oct-92	18.51	18.49	15.14	435.80	1406.30	1406.53	3.04
14:15:21	05-Oct-92	18.51	18.49	15.14	466.67	1559.25	1559.72	3.26
14:30:21	05-Oct-92	20.86	20.92	15.14	489.86	1422.37	1422.80	3.26
14:45:21	05-Oct-92	19.37	19.41	15.30	513.87	1319.18	1319.80	4.15
15:00:21	05-Oct-92	19.37	19.41	15.30	494.09	1256.78	1257.58	4.42

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
15:15:21	05-Oct-92	19.37	19.41	15.18	410.35	1238.37	1238.96	3.65
15:30:21	05-Oct-92	23.67	23.75	15.18	381.67	1271.37	1272.21	3.65
15:45:21	05-Oct-92	22.47	22.55	15.18	431.60	1262.25	1262.84	4.03
16:00:21	05-Oct-92	35.24	35.33	15.18	365.27	1275.30	1275.89	2.72
16:15:21	05-Oct-92	41.33	41.39	15.31	350.29	1305.85	1306.61	2.72
16:30:21	05-Oct-92	37.58	37.67	15.21	358.98	1310.81	1311.50	3.18
16:45:21	05-Oct-92	22.65	22.75	15.21	354.91	1286.80	1287.53	3.46
17:00:21	05-Oct-92	30.65	30.80	15.21	396.23	1279.19	1280.00	3.46
17:15:21	05-Oct-92	25.02	25.11	15.13	447.04	1314.91	1315.68	3.46
17:30:21	05-Oct-92	25.02	25.11	15.13	499.23	1309.53	1310.36	3.46
17:45:21	05-Oct-92	21.02	21.10	15.13	510.21	1320.81	1321.46	3.46
18:00:21	05-Oct-92	18.12	18.19	15.03	523.16	1322.98	1323.66	3.79
18:15:21	05-Oct-92	18.12	18.19	15.03	513.00	1329.93	1330.83	3.79
18:30:21	05-Oct-92	18.12	18.19	15.03	500.12	1332.67	1333.44	3.47
18:45:21	05-Oct-92	32.36	32.49	15.03	413.51	1335.86	1336.37	3.00
19:00:21	05-Oct-92	21.61	21.69	15.03	409.67	1338.28	1338.88	3.00
19:15:21	05-Oct-92	26.44	26.52	15.03	404.94	1325.15	1325.87	3.20
19:30:21	05-Oct-92	26.44	26.52	15.13	381.65	1345.93	1346.59	3.20
19:45:21	05-Oct-92	26.44	26.52	15.13	363.10	1364.02	1364.65	3.20
20:00:21	05-Oct-92	25.30	25.30	15.13	353.45	1360.77	1361.91	3.40
20:15:21	05-Oct-92	29.63	29.69	15.13	340.75	1328.95	1329.68	3.40
20:30:21	05-Oct-92	29.63	29.69	15.13	351.57	1335.17	1335.98	3.63
20:45:21	05-Oct-92	29.63	29.69	15.13	353.57	1320.76	1321.43	3.63
21:00:21	05-Oct-92	36.32	36.40	15.13	332.35	1297.13	1297.98	3.13
21:15:21	05-Oct-92	33.54	33.62	15.31	378.17	1305.47	1306.40	3.43
21:30:21	05-Oct-92	27.59	27.67	15.12	524.52	1437.55	1437.94	3.73
21:45:21	05-Oct-92	15.99	15.88	15.01	591.76	1256.05	1256.34	4.08
22:00:21	05-Oct-92	9.74	9.49	15.01	582.59	1277.31	1277.24	3.58
22:15:21	05-Oct-92	9.74	9.49	15.15	587.25	1280.48	1280.44	3.58
22:30:21	05-Oct-92	11.18	10.88	15.29	595.66	1267.89	1267.97	3.58
22:45:21	05-Oct-92	13.50	13.16	15.29	602.98	1248.61	1248.21	3.56
23:00:21	05-Oct-92	13.50	13.16	15.29	618.22	1268.11	1268.12	3.86
23:15:21	05-Oct-92	13.50	13.16	15.29	625.15	1261.21	1261.22	3.86
23:30:21	05-Oct-92	11.78	11.41	15.38	624.41	1208.72	1208.68	3.86
23:45:21	05-Oct-92	11.78	11.41	15.38	620.94	1223.27	1223.04	3.86
00:00:21	06-Oct-92	11.78	11.41	15.21	607.86	1223.27	1223.04	3.86
00:15:21	06-Oct-92	13.61	13.23	15.21	592.95	1219.76	1219.95	4.09
00:30:21	06-Oct-92	11.75	11.38	15.21	574.58	1232.82	1232.82	4.39
00:45:21	06-Oct-92	9.19	8.74	15.12	583.50	1223.47	1223.31	4.62
01:00:21	06-Oct-92	11.73	11.31	15.12	530.88	1237.28	1237.17	3.97
01:15:21	06-Oct-92	17.68	17.32	15.32	495.49	1242.80	1242.70	3.97
01:30:21	06-Oct-92	14.69	14.26	15.32	473.60	1241.40	1241.29	4.32
01:45:21	06-Oct-92	37.44	35.46	21.79	810.32	2136.30	2134.59	11.68
02:00:21	06-Oct-92	46.22	40.62	1.60	78.58	174.04	169.10	21.00
02:15:21	06-Oct-92	61.14	57.19	-0.64	9.16	-26.90	-29.58	21.00
02:30:21	06-Oct-92	79.33	75.66	-1.00	1.91	-74.86	-77.49	21.00
02:45:21	06-Oct-92	88.58	85.24	-1.00	0.82	-93.98	-96.34	21.00
03:00:21	06-Oct-92	66.05	62.71	-1.00	2.47	-104.77	-105.76	21.00
03:15:21	06-Oct-92	73.57	69.66	-1.35	1.91	-111.82	-114.65	21.00
03:30:21	06-Oct-92	82.12	78.55	-1.15	1.40	-116.35	-119.50	21.00
03:45:21	06-Oct-92	67.04	63.24	-1.15	2.48	-119.67	-126.37	21.00

APPENDIX L

PERFORMANCE TEST

M17 PARTICULATE LOADING AT ESP INLET—DATA SUMMARY

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 9/28/92 Printed 29-Oct — Test No./Type: M17-I101
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1100-1250

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.89
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		947.16
Gas Meter Final Reading (cu ft)		1015.51
Net Gas Sample Volume (cu ft)	V(m)	(68.35)
Vol of Liquid Collected (ml)	Vl(c)	122.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.743)
Wt. of Filter Particulate (gm)		7.0081
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(7.0081)
O2 Concentration (by CEM)	% O2	3.23
CO2 Concentration (by CEM)	% CO2	15.46
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.31)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.96	1.81	438.00	78.0	79.0	0.9798
2	4.00	0.93	1.77	458.00	82.0	79.0	0.9644
3	4.00	0.93	1.77	460.00	83.0	79.0	0.9644
B1	4.00	1.02	2.28	470.00	84.0	80.0	1.0100
2	4.00	0.96	1.82	477.00	83.0	79.0	0.9798
3	4.00	0.98	1.86	480.00	85.0	80.0	0.9899
C1	4.00	1.20	2.28	483.00	86.0	80.0	1.0954
2	4.00	1.20	2.28	474.00	86.0	80.0	1.0954
3	4.00	1.80	3.42	480.00	88.0	81.0	1.3416
D1	4.00	1.50	2.85	481.00	87.0	81.0	1.2247
2	4.00	1.20	2.28	481.00	88.0	81.0	1.0954
3	4.00	1.20	2.28	478.00	88.0	82.0	1.0954
E1	4.00	1.20	2.28	466.00	87.0	81.0	1.0954
2	4.00	1.30	2.47	483.00	88.0	82.0	1.1402
3	4.00	1.00	1.90	489.00	88.0	82.0	1.0000
E1	4.00	1.00	1.90	494.00	88.0	82.0	0.9950
2	4.00	0.99	1.88	495.00	88.0	82.0	1.0954
3	4.00	1.20	2.28	499.00	88.0	82.0	1.0000
F1	4.00	1.00	3.04	476.00	89.0	83.0	1.0000
2	4.00	1.60	3.04	488.00	90.0	83.0	1.0000
3	4.00	1.20	2.28	495.00	90.0	83.0	1.0954
F1	4.00	1.20	2.28	496.00	91.0	83.0	1.0954
2	4.00	1.40	2.66	501.00	91.0	83.0	1.1832
3	4.00	1.20	2.28	506.00	92.0	83.0	1.0954
TOTALS	96.00	28.17	54.99	11548.00	2088.00	1950.0	25.6320

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.174
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	2.291
Avg Stack Temperature (degF)	T(s avg)	=	481.2
Average Meter Temperature (degF)	T(m avg)	=	84.1
Avg SQRT(dP)		=	1.068

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	66.54
Stack Gas Water Vapor Proportion	B(wo)	=	0.079
Mol. Wt., Stack Gas Dry	M(d)	=	30.60
Mol. Wt., Stack Gas Wet	M(s)	=	29.60
Abs Stack Pressure (in Hg)	P(s)	=	31.35
Avg Stack Velocity (ft/sec)	V(s avg)	=	77.2
Isokineticity (%)	% I	=	94.2
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	240775
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	444807
Percent XS Air	PEA	=	17.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.6251
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2529
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.2803
Heat Input Rate, MBtu/hr		=	1243.77
Particulate Emission Rate(lb/hr)	E(p)	=	3353.301
Particulate Emission Rate(lb/MBtu)		=	2.6985

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 9/28/92 Printed 29-Oct — Test No./Type: M17-I102
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1500-1654

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.90
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		17.11
Gas Meter Final Reading (cu ft)		72.10
Net Gas Sample Volume (cu ft)	V(m)	(55.00)
Vol of Liquid Collected (ml)	Vl(c)	93.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.378)
Wt. of Filter Particulate (gm)		3.4098
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(3.4098)
O2 Concentration (by CEM)	% O2	3.83
CO2 Concentration (by CEM)	% CO2	15.45
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.72)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.62	1.18	447.00	74.0	75.0	0.7874
2	4.00	0.61	1.16	446.00	75.0	75.0	0.7810
3	4.00	0.59	1.12	457.00	78.0	76.0	0.7681
B1	4.00	0.64	1.22	462.00	80.0	77.0	0.8000
2	4.00	0.61	1.16	439.00	82.0	77.0	0.7810
3	4.00	0.56	1.06	460.00	84.0	78.0	0.7483
C1	4.00	0.70	1.33	469.00	85.0	79.0	0.8367
2	4.00	0.66	1.25	448.00	86.0	80.0	0.8124
3	4.00	0.67	1.27	457.00	87.0	81.0	0.8185
D1	4.00	0.82	1.56	465.00	88.0	82.0	0.9055
2	4.00	0.71	1.35	450.00	89.0	82.0	0.8426
3	4.00	0.74	1.41	459.00	90.0	83.0	0.8602
E1	4.00	0.75	1.43	448.00	91.0	84.0	0.8660
2	4.00	0.69	1.31	452.00	91.0	85.0	0.8307
3	4.00	0.60	1.14	454.00	92.0	85.0	0.8000
E1	4.00	0.64	1.22	457.00	92.0	86.0	0.8124
2	4.00	0.66	1.25	458.00	93.0	87.0	0.8124
3	4.00	0.66	1.25	461.00	93.0	87.0	0.8426
F1	4.00	0.71	1.35	429.00	93.0	88.0	0.8426
2	4.00	0.69	1.31	442.00	93.0	88.0	0.8426
3	4.00	0.61	1.16	448.00	94.0	88.0	0.7810
F1	4.00	0.61	1.16	454.00	94.0	88.0	0.7810
2	4.00	0.64	1.22	457.00	94.0	89.0	0.8000
3	4.00	0.67	1.27	460.00	94.0	89.0	0.8185
TOTALS	96.00	15.86	30.14	10879.00	2112.00	1989.0	19.5718

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.661
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.256
Avg Stack Temperature (degF)	T(s avg)	=	453.3
Average Meter Temperature (degF)	T(m avg)	=	85.4
Avg SQRT(dP)		=	0.815

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	53.29
Stack Gas Water Vapor Proportion	B(wo)	=	0.076
Mol. Wt., Stack Gas Dry	M(d)	=	30.63
Mol. Wt., Stack Gas Wet	M(s)	=	29.67
Abs Stack Pressure (in Hg)	P(s)	=	30.93
Avg Stack Velocity (ft/sec)	V(s avg)	=	56.4
Isokineticity (%)	% I	=	97.8
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	165653
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	336527
Percent XS Air	PEA	=	21.9
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.9672
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	1642
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.8050
Heat Input Rate, MBtu/hr		=	927.47
Particulate Emission Rate(lb/hr)	E(p)	=	1572.440
Particulate Emission Rate(lb/MBtu)		=	1.6957

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 9/28/92 Printed 29-Oct — Test No./Type: M17-I103
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1913-2055

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.90
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		76.00
Gas Meter Final Reading (cu ft)		146.30
Net Gas Sample Volume (cu ft)	V(m)	(70.30)
Vol of Liquid Collected (ml)	Vl(c)	146.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.872)
Wt. of Filter Particulate (gm)		6.3691
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(6.3691)
O2 Concentration (by CEM)	% O2	3.40
CO2 Concentration (by CEM)	% CO2	15.97
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.63)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.00	1.90	483.00	86.0	87.0	1.0000
2	4.00	1.00	1.90	483.00	87.0	87.0	1.0000
3	4.00	0.99	1.80	484.00	90.0	88.0	0.9950
B1	4.00	1.00	1.90	489.00	91.0	88.0	1.0000
2	4.00	0.97	1.84	468.00	94.0	89.0	0.9849
3	4.00	0.94	1.79	482.00	94.0	89.0	0.9695
C1	4.00	1.20	2.28	480.00	95.0	90.0	1.0954
2	4.00	1.00	1.90	477.00	97.0	90.0	1.0000
3	4.00	1.30	2.47	485.00	98.0	91.0	1.1402
D1	4.00	1.20	2.28	493.00	98.0	92.0	1.0954
2	4.00	1.00	1.90	483.00	100.0	93.0	1.0000
3	4.00	1.20	2.28	490.00	100.0	93.0	1.0954
E1	4.00	1.20	2.28	468.00	99.0	93.0	1.0954
2	4.00	1.20	2.28	492.00	100.0	93.0	1.0954
3	4.00	1.00	1.90	497.00	100.0	94.0	1.0000
E1	4.00	1.00	1.90	499.00	100.0	94.0	1.0954
2	4.00	1.20	2.28	500.00	101.0	94.0	1.0954
3	4.00	1.20	2.28	506.00	101.0	95.0	1.1402
F1	4.00	1.30	2.47	480.00	102.0	96.0	1.1402
2	4.00	1.30	2.47	495.00	102.0	95.0	1.1402
3	4.00	1.20	2.28	501.00	102.0	94.0	1.0954
F1	4.00	1.10	2.09	506.00	102.0	96.0	1.0488
2	4.00	1.20	2.28	509.00	101.0	96.0	1.0954
3	4.00	1.00	1.90	512.00	101.0	96.0	1.0000
TOTALS	96.00	26.70	50.65	11762.00	2341.0	2213.0	25.4179

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.113
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	2.110
Avg Stack Temperature (degF)	T(s avg)	=	490.1
Average Meter Temperature (degF)	T(m avg)	=	94.9
Avg SQRT(dP)		=	1.059

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	67.10
Stack Gas Water Vapor Proportion	B(wc)	=	0.093
Mol. Wt., Stack Gas Dry	M(d)	=	30.69
Mol. Wt., Stack Gas Wet	M(s)	=	29.51
Abs Stack Pressure (in Hg)	P(s)	=	31.37
Avg Stack Velocity (ft/sec)	V(s avg)	=	77.0
Isokineticity (%)	% I	=	97.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	234560
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	443777
Percent XS Air	PEA	=	19.0
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.4645
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2665
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.1650
Heat Input Rate, MBtu/hr		=	1200.01
Particulate Emission Rate(lb/hr)	E(p)	=	2943.990
Particulate Emission Rate(lb/MBtu)		=	2.4537

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 9/29/92 Printed 29-Oct — Test No./Type: M17-I104
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1330-1534

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	30.10
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		148.21
Gas Meter Final Reading (cu ft)		207.56
Net Gas Sample Volume (cu ft)	V(m)	(59.35)
Vol of Liquid Collected (ml)	Vl(c)	87.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.095)
Wt. of Filter Particulate (gm)		4.0230
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(4.0230)
O2 Concentration (by CEM)	% O2	3.80
CO2 Concentration (by CEM)	% CO2	15.05
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.15)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.62	1.18	420.00	74.0	73.0	0.7874
2	4.00	0.55	1.05	430.00	74.0	74.0	0.7416
3	4.00	0.55	1.05	453.00	76.0	75.0	0.7416
B1	4.00	0.60	1.14	444.00	76.0	75.0	0.7746
2	4.00	0.57	1.08	444.00	80.0	75.0	0.7550
3	4.00	0.54	1.03	467.00	82.0	76.0	0.7348
C1	4.00	0.64	1.22	462.00	83.0	77.0	0.8000
2	4.00	0.60	1.14	450.00	84.0	78.0	0.7746
3	4.00	0.72	1.34	459.00	86.0	79.0	0.8485
D1	4.00	0.78	1.48	440.00	86.0	80.0	0.8832
2	4.00	0.70	1.33	461.00	87.0	80.0	0.8367
3	4.00	0.70	1.33	467.00	88.0	81.0	0.8367
E1	4.00	0.65	1.24	440.00	87.0	81.0	0.8062
2	4.00	0.56	1.06	450.00	88.0	82.0	0.7483
3	4.00	0.65	1.24	457.00	89.0	83.0	0.8426
E1	4.00	0.71	1.35	450.00	88.0	83.0	0.8000
2	4.00	0.64	1.22	442.00	90.0	84.0	0.8185
3	4.00	0.67	1.27	450.00	91.0	84.0	0.8124
F1	4.00	0.66	1.25	445.00	87.0	85.0	0.8124
2	4.00	0.59	1.12	452.00	88.0	85.0	0.8124
3	4.00	0.60	1.14	459.00	90.0	85.0	0.7746
F1	4.00	0.64	1.22	466.00	91.0	86.0	0.8000
2	4.00	0.60	1.14	464.00	92.0	86.0	0.7746
3	4.00	0.60	1.14	467.00	92.0	87.0	0.7746
TOTALS	96.00	15.14	28.76	10839.00	2049.00	1934.0	19.0914

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.631
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.198
Avg Stack Temperature (degF)	T(s avg)	=	451.6
Average Meter Temperature (degF)	T(m avg)	=	83.0
Avg SQRT(dP)		=	0.795

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	58.15
Stack Gas Water Vapor Proportion	B(wo)	=	0.066
Mol. Wt., Stack Gas Dry	M(d)	=	30.56
Mol. Wt., Stack Gas Wet	M(s)	=	29.73
Abs Stack Pressure (in Hg)	P(s)	=	31.13
Avg Stack Velocity (ft/sec)	V(s avg)	=	56.7
Isokineticity (%)	% I	=	107.8
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	183529
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	326544
Percent XS Air	PEA	=	21.6
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.0675
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	1988
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.8689
Heat Input Rate, MBtu/hr		=	918.97
Particulate Emission Rate(lb/hr)	E(p)	=	1681.738
Particulate Emission Rate(lb/MBtu)		=	1.8303

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 9/29/92 Printed 29-Oct — Test No./Type: M17-1105
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1710-1914

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	30.10
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		210.91
Gas Meter Final Reading (cu ft)		275.53
Net Gas Sample Volume (cu ft)	V(m)	(64.62)
Vol of Liquid Collected (ml)	Vl(c)	158.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.437)
Wt. of Filter Particulate (gm)		5.6487
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.6487)
O2 Concentration (by CEM)	% O2	3.37
CO2 Concentration (by CEM)	% CO2	15.48
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.15)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.98	1.67	470.00	82.0	83.0	0.9899
2	4.00	0.87	1.48	479.00	82.0	83.0	0.9327
3	4.00	1.00	1.70	486.00	83.0	83.0	1.0000
B1	4.00	1.00	1.70	468.00	85.0	84.0	1.0000
2	4.00	0.86	1.46	486.00	86.0	83.0	0.9274
3	4.00	0.87	1.48	505.00	86.0	84.0	0.9327
C1	4.00	1.00	1.70	467.00	86.0	85.0	1.0000
2	4.00	0.97	1.65	480.00	89.0	85.0	0.9849
3	4.00	1.20	2.04	493.00	91.0	86.0	1.0954
D1	4.00	1.30	2.21	460.00	91.0	87.0	1.1402
2	4.00	1.10	1.87	476.00	94.0	87.0	1.0488
3	4.00	1.10	1.87	497.00	95.0	88.0	1.0488
E1	4.00	1.20	2.04	486.00	96.0	89.0	1.0954
2	4.00	1.10	1.87	497.00	89.0	90.0	1.0488
3	4.00	1.00	1.70	501.00	100.0	99.0	1.0000
E1	4.00	1.00	1.70	509.00	102.0	100.0	1.0000
2	4.00	1.00	1.70	508.00	101.0	93.0	1.0488
3	4.00	1.10	1.87	514.00	101.0	94.0	1.1832
F1	4.00	1.40	2.38	493.00	93.0	93.0	1.1832
2	4.00	1.20	2.04	498.00	94.0	93.0	1.1832
3	4.00	0.99	1.68	510.00	97.0	93.0	0.9950
F1	4.00	0.98	1.67	523.00	98.0	93.0	0.9899
2	4.00	1.10	1.87	526.00	100.0	94.0	1.0488
3	4.00	1.00	1.70	531.00	102.0	95.0	1.0000
TOTALS	96.00	25.32	43.05	11863.00	2223.0	2144.0	24.8774

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.055
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.794
Avg Stack Temperature (degF)	T(s avg)	=	494.3
Average Meter Temperature (degF)	T(m avg)	=	91.0
Avg SQRT(dP)		=	1.037

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	62.48
Stack Gas Water Vapor Proportion	B(wc)	=	0.106
Mol. Wt., Stack Gas Dry	M(d)	=	30.61
Mol. Wt., Stack Gas Wet	M(s)	=	29.27
Abs Stack Pressure (in Hg)	P(s)	=	31.57
Avg Stack Velocity (ft/sec)	V(s avg)	=	75.6
Isokineticity (%)	% I	=	93.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	227316
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	435710
Percent XS Air	PEA	=	18.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.3950
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2535
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.1078
Heat Input Rate, MBtu/hr		=	1164.94
Particulate Emission Rate(lb/hr)	E(p)	=	2717.586
Particulate Emission Rate(lb/MBtu)		=	2.3332

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 9/30/92 Printed 29-Oct — Test No./Type: M17-1106
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1240-1445

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	30.10
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		275.80
Gas Meter Final Reading (cu ft)		311.16
Net Gas Sample Volume (cu ft)	V(m)	(35.36)
Vol of Liquid Collected (ml)	Vl(c)	80.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.766)
Wt. of Filter Particulate (gm)		4.0000
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(4.0000)
O2 Concentration (by CEM)	% O2	4.32
CO2 Concentration (by CEM)	% CO2	15.62
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.06)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.27	0.46	345.00	85.0	86.0	0.5196
2	4.00	0.24	0.41	368.00	84.0	86.0	0.4899
3	4.00	0.26	0.44	399.00	85.0	86.0	0.5099
B1	4.00	0.24	0.41	416.00	86.0	88.0	0.4899
2	4.00	0.24	0.41	401.00	86.0	86.0	0.4899
3	4.00	0.23	0.39	416.00	87.0	87.0	0.4796
C1	4.00	0.22	0.37	434.00	87.0	87.0	0.4690
2	4.00	0.26	0.44	407.00	87.0	87.0	0.5099
3	4.00	0.33	0.56	416.00	87.0	87.0	0.5745
D1	4.00	0.35	0.60	396.00	88.0	87.0	0.5916
2	4.00	0.26	0.44	418.00	90.0	88.0	0.5099
3	4.00	0.31	0.53	423.00	90.0	88.0	0.5568
E1	4.00	0.26	0.44	378.00	90.0	88.0	0.5099
2	4.00	0.26	0.44	399.00	90.0	88.0	0.5099
3	4.00	0.23	0.39	409.00	91.0	89.0	0.4690
E1	4.00	0.22	0.37	413.00	90.0	88.0	0.4796
2	4.00	0.23	0.39	412.00	90.0	88.0	0.4796
3	4.00	0.23	0.39	416.00	89.0	88.0	0.5385
F1	4.00	0.29	0.49	375.00	87.0	86.0	0.5385
2	4.00	0.27	0.46	387.00	86.0	87.0	0.5385
3	4.00	0.24	0.41	400.00	87.0	87.0	0.4899
F1	4.00	0.24	0.41	409.00	88.0	87.0	0.4899
2	4.00	0.21	0.36	415.00	89.0	87.0	0.4583
3	4.00	0.21	0.36	418.00	89.0	87.0	0.4583
TOTALS	96.00	6.10	10.37	9670.00	2108.0	2093.0	12.1504

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.254
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.432
Avg Stack Temperature (degF)	T(s avg)	=	402.9
Average Meter Temperature (degF)	T(m avg)	=	87.5
Avg SQRT(dP)		=	0.506

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	34.29
Stack Gas Water Vapor Proportion	B(wo)	=	0.099
Mol. Wt., Stack Gas Dry	M(d)	=	30.67
Mol. Wt., Stack Gas Wet	M(s)	=	29.42
Abs Stack Pressure (in Hg)	P(s)	=	30.84
Avg Stack Velocity (ft/sec)	V(s avg)	=	35.5
Isokineticity (%)	% I	=	100.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	116052
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	204245
Percent XS Air	PEA	=	25.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.7998
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	3456
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.5106
Heat Input Rate, MBtu/hr		=	562.51
Particulate Emission Rate(lb/hr)	E(p)	=	1790.017
Particulate Emission Rate(lb/MBtu)		=	3.1827

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 9/30/92 Printed 29-Oct — Test No./Type: M17-I107
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1710-1900

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	30.10
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		311.31
Gas Meter Final Reading (cu ft)		369.55
Net Gas Sample Volume (cu ft)	V(m)	(58.24)
Vol of Liquid Collected (ml)	Vl(c)	80.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.766)
Wt. of Filter Particulate (gm)		5.7138
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.7138)
O2 Concentration (by CEM)	% O2	3.33
CO2 Concentration (by CEM)	% CO2	15.07
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.60)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.66	1.12	434.00	86.0	86.0	0.8124
2	4.00	0.60	1.02	437.00	86.0	86.0	0.7746
3	4.00	0.65	1.11	444.00	88.0	86.0	0.8062
B1	4.00	0.63	1.07	449.00	90.0	87.0	0.7937
2	4.00	0.63	1.07	423.00	93.0	88.0	0.7937
3	4.00	0.60	1.00	440.00	95.0	89.0	0.7746
C1	4.00	0.67	1.14	435.00	97.0	91.0	0.8185
2	4.00	0.63	1.07	430.00	100.0	92.0	0.7937
3	4.00	0.77	1.31	443.00	101.0	93.0	0.8775
D1	4.00	0.75	1.28	400.00	100.0	94.0	0.8660
2	4.00	0.66	1.12	424.00	103.0	95.0	0.8124
3	4.00	0.70	1.19	442.00	103.0	95.0	0.8367
E1	4.00	0.70	1.19	452.00	104.0	96.0	0.8367
2	4.00	0.66	1.12	445.00	104.0	96.0	0.8124
3	4.00	0.60	1.02	451.00	104.0	97.0	0.7810
E1	4.00	0.61	1.04	454.00	104.0	98.0	0.8062
2	4.00	0.65	1.11	456.00	104.0	98.0	0.8062
3	4.00	0.65	1.11	460.00	103.0	98.0	0.8602
F1	4.00	0.74	1.26	426.00	102.0	98.0	0.8602
2	4.00	0.70	1.19	445.00	102.0	98.0	0.8602
3	4.00	0.65	1.11	453.00	101.0	98.0	0.8062
F1	4.00	0.65	1.11	461.00	103.0	100.0	0.8062
2	4.00	0.70	1.19	462.00	101.0	98.0	0.8367
3	4.00	0.67	1.14	466.00	102.0	98.0	0.8185
TOTALS	96.00	15.93	27.09	10632.00	2376.0	2255.0	19.6510

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.664
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.129
Avg Stack Temperature (degF)	T(s avg)	=	443.0
Average Meter Temperature (degF)	T(m avg)	=	96.5
Avg SQRT(dP)		=	0.819

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	55.66
Stack Gas Water Vapor Proportion	B(wo)	=	0.063
Mol. Wt., Stack Gas Dry	M(d)	=	30.54
Mol. Wt., Stack Gas Wet	M(s)	=	29.75
Abs Stack Pressure (in Hg)	P(s)	=	31.13
Avg Stack Velocity (ft/sec)	V(s avg)	=	58.1
Isokineticity (%)	% I	=	99.6
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	190562
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	334433
Percent XS Air	PEA	=	18.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.5838
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2871
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.2549
Heat Input Rate, MBtu/hr		=	978.82
Particulate Emission Rate(lb/hr)	E(p)	=	2586.607
Particulate Emission Rate(lb/MBtu)		=	2.6430

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 9/30/92 Printed 29-Oct — Test No./Type: M17-I108
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1945-2131

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	30.10
Stack Static Pressure (in H20)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		370.01
Gas Meter Final Reading (cu ft)		425.33
Net Gas Sample Volume (cu ft)	V(m)	(55.32)
Vol of Liquid Collected (ml)	Vl(c)	76.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.601)
Wt. of Filter Particulate (gm)		5.1345
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.1345)
O2 Concentration (by CEM)	% O2	3.34
CO2 Concentration (by CEM)	% CO2	15.03
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.63)

Sample Point	dClock Time	Velocity Head, dP (in H20)	Orifice Meter,dH (in H20)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.62	1.05	450.00	88.0	90.0	0.7874
2	4.00	0.57	0.97	451.00	89.0	90.0	0.7550
3	4.00	0.70	1.20	453.00	89.0	90.0	0.8367
B1	4.00	0.70	1.20	413.00	92.0	90.0	0.8367
2	4.00	0.60	1.02	441.00	93.0	91.0	0.7746
3	4.00	0.63	1.07	458.00	94.0	91.0	0.7937
C1	4.00	0.69	1.16	430.00	95.0	92.0	0.8307
2	4.00	0.68	1.16	450.00	98.0	94.0	0.8246
3	4.00	0.85	1.45	459.00	99.0	94.0	0.9220
D1	4.00	0.82	1.39	443.00	99.0	94.0	0.9055
2	4.00	0.74	1.26	454.00	101.0	95.0	0.8602
3	4.00	0.76	1.29	460.00	102.0	96.0	0.8718
E1	4.00	0.74	1.26	446.00	103.0	97.0	0.8602
2	4.00	0.70	1.20	460.00	103.0	97.0	0.8367
3	4.00	0.64	1.09	463.00	104.0	98.0	0.7937
E1	4.00	0.63	1.07	472.00	106.0	100.0	0.8660
2	4.00	0.75	1.24	465.00	106.0	99.0	0.8775
3	4.00	0.77	1.30	466.00	105.0	100.0	0.8718
F1	4.00	0.76	1.29	440.00	105.0	100.0	0.8718
2	4.00	0.80	1.36	453.00	105.0	100.0	0.8718
3	4.00	0.69	1.16	461.00	105.0	100.0	0.8307
F1	4.00	0.67	1.14	467.00	105.0	100.0	0.8185
2	4.00	0.70	1.20	471.00	105.0	101.0	0.8367
3	4.00	0.72	1.22	472.00	105.0	101.0	0.8485
TOTALS	96.00	16.93	28.75	10898.00	2396.0	2300.0	20.1827

FIELD DATA AVERAGES

Avg Velocity Head (in H20)	dP(avg)	=	0.705
Avg Orifice Meter Reading (in H20)	dH(avg)	=	1.198
Avg Stack Temperature (degF)	T(s avg)	=	454.1
Average Meter Temperature (degF)	T(m avg)	=	97.8
Avg SQRT(dP)		=	0.841

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	52.76
Stack Gas Water Vapor Proportion	B(wo)	=	0.064
Mol. Wt., Stack Gas Dry	M(d)	=	30.54
Mol. Wt., Stack Gas Wet	M(s)	=	29.74
Abs Stack Pressure (in Hg)	P(s)	=	31.13
Avg Stack Velocity (ft/sec)	V(s avg)	=	60.0
Isokineticity (%)	% I	=	92.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	194458
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	345654
Percent XS Air	PEA	=	16.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.5017
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2724
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.1904
Heat Input Rate, MBtu/hr		=	998.26
Particulate Emission Rate(lb/hr)	E(p)	=	2502.512
Particulate Emission Rate(lb/MBtu)		=	2.5073

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 10/01/92 Printed 29-Oct — Test No./Type: M17-I1D9
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 2250-0030

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.84
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		425.50
Gas Meter Final Reading (cu ft)		463.74
Net Gas Sample Volume (cu ft)	V(m)	(38.23)
Vol of Liquid Collected (ml)	Vl(c)	66.1
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.111)
Wt. of Filter Particulate (gm)		4.7831
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(4.7831)
O2 Concentration (by CEM)	% O2	3.98
CO2 Concentration (by CEM)	% CO2	15.11
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.91)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.33	0.56	386.00	101.0	103.0	0.5745
2	4.00	0.21	0.36	413.00	101.0	103.0	0.4583
3	4.00	0.24	0.41	425.00	101.0	103.0	0.4899
B1	4.00	0.31	0.53	425.00	102.0	103.0	0.5568
2	4.00	0.30	0.51	426.00	101.0	103.0	0.5477
3	4.00	0.27	0.46	445.00	101.0	102.0	0.5196
C1	4.00	0.31	0.53	450.00	101.0	102.0	0.5568
2	4.00	0.21	0.36	431.00	101.0	101.0	0.4583
3	4.00	0.36	0.61	441.00	100.0	101.0	0.6000
D1	4.00	0.39	0.66	410.00	100.0	100.0	0.6245
2	4.00	0.34	0.58	431.00	100.0	100.0	0.5831
3	4.00	0.34	0.58	442.00	99.0	99.0	0.5831
E1	4.00	0.31	0.53	419.00	98.0	98.0	0.5568
2	4.00	0.33	0.56	431.00	99.0	98.0	0.5745
3	4.00	0.30	0.51	434.00	96.0	97.0	0.5568
E1	4.00	0.31	0.53	437.00	96.0	96.0	0.5477
2	4.00	0.30	0.51	438.00	96.0	96.0	0.5292
3	4.00	0.28	0.48	438.00	95.0	95.0	0.5745
F1	4.00	0.33	0.56	401.00	94.0	94.0	0.5745
2	4.00	0.34	0.58	403.00	93.0	94.0	0.5745
3	4.00	0.30	0.51	409.00	93.0	93.0	0.5477
F1	4.00	0.30	0.51	414.00	93.0	93.0	0.5477
2	4.00	0.28	0.48	420.00	92.0	92.0	0.5292
3	4.00	0.28	0.48	424.00	93.0	92.0	0.5292
TOTALS	96.00	7.27	12.39	10193.00	2346.0	2358.0	13.1944

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.303
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.516
Avg Stack Temperature (degF)	T(s avg)	=	424.7
Average Meter Temperature (degF)	T(m avg)	=	98.0
Avg SQRT(dP)		=	0.550

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	36.08
Stack Gas Water Vapor Proportion	B(wo)	=	0.079
Mol. Wt., Stack Gas Dry	M(d)	=	30.58
Mol. Wt., Stack Gas Wet	M(s)	=	29.58
Abs Stack Pressure (in Hg)	P(s)	=	30.58
Avg Stack Velocity (ft/sec)	V(s avg)	=	39.0
Isokineticity (%)	% I	=	97.4
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	126262
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	224919
Percent XS Air	PEA	=	22.9
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.0456
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	3650
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.6628
Heat Input Rate, MBtu/hr		=	624.65
Particulate Emission Rate(lb/hr)	E(p)	=	2214.066
Particulate Emission Rate(lb/MBtu)		=	3.5451

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 10/02/92 Printed 29-Oct — Test No./Type: M17-I110
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 0200-0340

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.84
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		464.71
Gas Meter Final Reading (cu ft)		515.71
Net Gas Sample Volume (cu ft)	V(m)	(51.00)
Vol of Liquid Collected (ml)	Vl(c)	129.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.096)
Wt. of Filter Particulate (gm)		3.7322
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(3.7322)
O2 Concentration (by CEM)	% O2	3.24
CO2 Concentration (by CEM)	% CO2	15.41
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.35)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.66	1.12	411.00	94.0	94.0	0.8124
2	4.00	0.48	0.82	424.00	93.0	94.0	0.6928
3	4.00	0.55	0.94	444.00	95.0	94.0	0.7416
B1	4.00	0.57	0.97	438.00	97.0	95.0	0.7550
2	4.00	0.48	0.82	442.00	98.0	95.0	0.6928
3	4.00	0.50	0.85	463.00	99.0	96.0	0.7071
C1	4.00	0.55	0.94	444.00	99.0	96.0	0.7416
2	4.00	0.56	0.95	442.00	100.0	97.0	0.7483
3	4.00	0.68	1.16	457.00	101.0	97.0	0.8246
D1	4.00	0.77	1.31	435.00	101.0	97.0	0.8775
2	4.00	0.64	1.09	452.00	101.0	97.0	0.8000
3	4.00	0.61	1.04	461.00	103.0	98.0	0.7810
E1	4.00	0.62	1.05	450.00	103.0	99.0	0.7874
2	4.00	0.62	1.05	453.00	103.0	98.0	0.7874
3	4.00	0.48	0.82	456.00	104.0	99.0	0.7071
E1	4.00	0.50	0.85	459.00	104.0	100.0	0.7141
2	4.00	0.51	0.87	460.00	105.0	100.0	0.7141
3	4.00	0.51	0.87	465.00	104.0	100.0	0.8000
F1	4.00	0.64	1.09	430.00	104.0	100.0	0.8000
2	4.00	0.72	1.22	437.00	104.0	100.0	0.8000
3	4.00	0.57	0.97	440.00	104.0	100.0	0.7550
F1	4.00	0.57	0.97	453.00	106.0	102.0	0.7550
2	4.00	0.58	0.99	454.00	105.0	102.0	0.7616
3	4.00	0.59	1.00	457.00	105.0	101.0	0.7681
TOTALS	96.00	13.96	23.76	10727.00	2432.0	2351.0	18.3247

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.582
~~Avg Orifice Meter Reading (in H2O)~~	~~dH(avg)~~	~~=~~	~~0.990~~
Avg Stack Temperature (degF)	T(s avg)	=	447.0
Average Meter Temperature (degF)	T(m avg)	=	99.6
Avg SQRT(dP)		=	0.764

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	48.04
Stack Gas Water Vapor Proportion	B(wo)	=	0.113
Mol. Wt., Stack Gas Dry	M(d)	=	30.60
Mol. Wt., Stack Gas Wet	M(s)	=	29.16
Abs Stack Pressure (in Hg)	P(s)	=	30.87
Avg Stack Velocity (ft/sec)	V(s avg)	=	55.0
Isokineticity (%)	% I	=	97.0
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	168921
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	316922
Percent XS Air	PEA	=	17.8
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.1985
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2162
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.9450
Heat Input Rate, MBtu/hr		=	872.10
Particulate Emission Rate(lb/hr)	E(p)	=	1735.434
Particulate Emission Rate(lb/MBtu)		=	1.9903

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 10/02/92 Printed 29-Oct — Test No./Type: M17-I111
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 0200-0340

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.71
Stack Static Pressure (in H2O)	P(stack)	9.000
Gas Meter Initial Reading (cu ft)		516.00
Gas Meter Final Reading (cu ft)		556.24
Net Gas Sample Volume (cu ft)	V(m)	(40.24)
Vol of Liquid Collected (ml)	Vl(c)	86.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.072)
Wt. of Filter Particulate (gm)		5.6452
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.6452)
O2 Concentration (by CEM)	% O2	3.59
CO2 Concentration (by CEM)	% CO2	15.61
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.80)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.34	0.58	453.00	103.0	107.0	0.5831
2	4.00	0.35	0.60	454.00	103.0	107.0	0.5916
3	4.00	0.34	0.58	450.00	103.0	106.0	0.5831
B1	4.00	0.34	0.58	427.00	103.0	105.0	0.5831
2	4.00	0.30	0.51	439.00	103.0	104.0	0.5477
3	4.00	0.32	0.54	452.00	103.0	104.0	0.5657
C1	4.00	0.33	0.56	460.00	103.0	104.0	0.5745
2	4.00	0.32	0.54	440.00	103.0	104.0	0.5657
3	4.00	0.41	0.70	441.00	104.0	104.0	0.6403
D1	4.00	0.40	0.68	430.00	104.0	104.0	0.6325
2	4.00	0.32	0.54	439.00	105.0	104.0	0.5657
3	4.00	0.37	0.63	439.00	104.0	104.0	0.6083
E1	4.00	0.34	0.55	435.00	106.0	105.0	0.5831
2	4.00	0.35	0.60	439.00	106.0	104.0	0.5916
3	4.00	0.32	0.54	442.00	107.0	105.0	0.5568
E1	4.00	0.31	0.53	442.00	107.0	105.0	0.5385
2	4.00	0.29	0.49	444.00	106.0	105.0	0.6325
3	4.00	0.40	0.57	449.00	106.0	105.0	0.5831
F1	4.00	0.34	0.55	413.00	105.0	105.0	0.5831
2	4.00	0.36	0.61	414.00	106.0	105.0	0.5831
3	4.00	0.28	0.48	419.00	106.0	105.0	0.5292
F1	4.00	0.28	0.48	431.00	106.0	105.0	0.5292
2	4.00	0.30	0.51	437.00	105.0	104.0	0.5477
3	4.00	0.30	0.51	444.00	105.0	104.0	0.5477
TOTALS	96.00	8.01	13.46	10533.00	2512.0	2514.0	13.8467

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.334
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.561
Avg Stack Temperature (degF)	T(s avg)	=	438.9
Average Meter Temperature (degF)	T(m avg)	=	104.7
Avg SQRT(dP)		=	0.577

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	37.36
Stack Gas Water Vapor Proportion	B(wo)	=	0.098
Mol. Wt., Stack Gas Dry	M(d)	=	30.64
Mol. Wt., Stack Gas Wet	M(s)	=	29.40
Abs Stack Pressure (in Hg)	P(s)	=	30.37
Avg Stack Velocity (ft/sec)	V(s avg)	=	41.6
Isokineticity (%)	% I	=	96.9
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	128740
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	239442
Percent XS Air	PEA	=	20.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.3316
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	4290
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.8731
Heat Input Rate, MBtu/hr		=	651.49
Particulate Emission Rate(lb/hr)	E(p)	=	2572.652
Particulate Emission Rate(lb/MBtu)		=	3.9496

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 10/03/92 Printed 29-Oct — Test No./Type: M17-I112
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 0112-0306

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.71
Stack Static Pressure (in H2O)	P(stack)	9.000
Gas Meter Initial Reading (cu ft)		556.41
Gas Meter Final Reading (cu ft)		597.62
Net Gas Sample Volume (cu ft)	V(m)	(41.21)
Vol of Liquid Collected (ml)	Vl(c)	81.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.813)
Wt. of Filter Particulate (gm)		6.3773
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(6.3773)
O2 Concentration (by CEM)	% O2	3.48
CO2 Concentration (by CEM)	% CO2	15.44
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.08)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.35	0.60	390.00	98.0	99.0	0.5916
2	4.00	0.31	0.53	410.00	97.0	98.0	0.5568
3	4.00	0.35	0.60	433.00	98.0	98.0	0.5916
B1	4.00	0.35	0.60	410.00	99.0	99.0	0.5916
2	4.00	0.30	0.53	425.00	100.0	99.0	0.5477
3	4.00	0.30	0.53	433.00	100.0	99.0	0.5477
C1	4.00	0.35	0.60	415.00	102.0	100.0	0.5916
2	4.00	0.32	0.54	421.00	102.0	101.0	0.5657
3	4.00	0.43	0.71	430.00	103.0	101.0	0.6557
D1	4.00	0.43	0.71	421.00	104.0	101.0	0.6557
2	4.00	0.37	0.63	429.00	104.0	101.0	0.6083
3	4.00	0.40	0.68	434.00	103.0	101.0	0.6325
E1	4.00	0.34	0.58	424.00	103.0	102.0	0.5831
2	4.00	0.35	0.60	430.00	104.0	102.0	0.5916
3	4.00	0.31	0.53	434.00	104.0	102.0	0.5477
E1	4.00	0.30	0.53	434.00	105.0	102.0	0.5831
2	4.00	0.34	0.58	436.00	105.0	102.0	0.5745
3	4.00	0.33	0.56	438.00	105.0	103.0	0.6325
F1	4.00	0.40	0.68	415.00	105.0	102.0	0.6325
2	4.00	0.38	0.65	416.00	105.0	103.0	0.6325
3	4.00	0.34	0.58	423.00	105.0	103.0	0.5831
F1	4.00	0.36	0.61	426.00	106.0	103.0	0.6000
2	4.00	0.35	0.60	433.00	106.0	103.0	0.5916
3	4.00	0.35	0.60	435.00	106.0	103.0	0.5916
TOTALS	96.00	8.41	14.36	10195.00	2469.0	2427.0	14.2802

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.350
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.598
Avg Stack Temperature (degF)	T(s avg)	=	424.8
Average Meter Temperature (degF)	T(m avg)	=	102.0
Avg SQRT(dP)		=	0.595

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	38.45
Stack Gas Water Vapor Proportion	B(wo)	=	0.090
Mol. Wt., Stack Gas Dry	M(d)	=	30.61
Mol. Wt., Stack Gas Wet	M(s)	=	29.47
Abs Stack Pressure (in Hg)	P(s)	=	30.37
Avg Stack Velocity (ft/sec)	V(s avg)	=	42.5
Isokineticity (%)	% I	=	97.2
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	134852
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	244693
Percent XS Air	PEA	=	19.4
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.5595
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	4680
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	2.0453
Heat Input Rate, MBtu/hr		=	686.75
Particulate Emission Rate(lb/hr)	E(p)	=	2958.004
Particulate Emission Rate(lb/MBtu)		=	4.3080

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 10/03/92 Printed 29-Oct — Test No./Type: M17-I113
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 0520-0700

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.71
Stack Static Pressure (in H20)	P(stack)	5.000
Gas Meter Initial Reading (cu ft)		599.91
Gas Meter Final Reading (cu ft)		633.40
Net Gas Sample Volume (cu ft)	V(m)	(33.49)
Vol of Liquid Collected (ml)	Vl(c)	64.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.036)
Wt. of Filter Particulate (gm)		1.6902
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(1.6902)
O2 Concentration (by CEM)	% O2	5.69
CO2 Concentration (by CEM)	% CO2	15.66
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(78.65)

Sample Point	dClock Time	Velocity Head, dP (in H20)	Orifice Meter,dH (in H20)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.29	0.49	419.00	86.0	88.0	0.5385
2	4.00	0.22	0.37	419.00	86.0	88.0	0.4690
3	4.00	0.22	0.37	418.00	86.0	88.0	0.4690
B1	4.00	0.22	0.37	400.00	88.0	88.0	0.4690
2	4.00	0.20	0.34	387.00	88.0	88.0	0.4472
3	4.00	0.21	0.36	399.00	88.0	87.0	0.4583
C1	4.00	0.23	0.39	404.00	89.0	88.0	0.4796
2	4.00	0.23	0.39	388.00	90.0	88.0	0.4796
3	4.00	0.26	0.44	398.00	90.0	88.0	0.5099
D1	4.00	0.25	0.43	393.00	90.0	89.0	0.5000
2	4.00	0.24	0.41	396.00	90.0	89.0	0.4899
3	4.00	0.24	0.41	405.00	90.0	90.0	0.4899
E1	4.00	0.21	0.36	387.00	90.0	91.0	0.4583
2	4.00	0.21	0.36	396.00	89.0	91.0	0.4583
3	4.00	0.33	0.56	400.00	90.0	91.0	0.4472
E1	4.00	0.20	0.34	405.00	90.0	92.0	0.4583
2	4.00	0.21	0.36	406.00	91.0	90.0	0.4690
3	4.00	0.22	0.37	408.00	90.0	89.0	0.4899
F1	4.00	0.24	0.41	388.00	91.0	89.0	0.4899
2	4.00	0.23	0.39	380.00	91.0	90.0	0.4899
3	4.00	0.23	0.39	380.00	91.0	89.0	0.4796
F1	4.00	0.20	0.34	396.00	91.0	89.0	0.4472
2	4.00	0.22	0.37	399.00	92.0	90.0	0.4690
3	4.00	0.22	0.37	404.00	92.0	90.0	0.4690
TOTALS	96.00	5.53	9.39	9575.00	2149.0	2140.0	11.4256

FIELD DATA AVERAGES

Avg Velocity Head (in H20)	dP(avg)	=	0.230
Avg Orifice Meter Reading (in H20)	dH(avg)	=	0.391
Avg Stack Temperature (degF)	T(s avg)	=	399.0
Average Meter Temperature (degF)	T(m avg)	=	89.4
Avg SQRT(dP)		=	0.476

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	31.95
Stack Gas Water Vapor Proportion	B(wo)	=	0.087
Mol. Wt., Stack Gas Dry	M(d)	=	30.73
Mol. Wt., Stack Gas Wet	M(s)	=	29.63
Abs Stack Pressure (in Hg)	P(s)	=	30.05
Avg Stack Velocity (ft/sec)	V(s avg)	=	33.6
Isokineticity (%)	% I	=	99.6
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	109098
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	193328
Percent XS Air	PEA	=	37.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.8162
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	1706
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.7464
Heat Input Rate, MBtu/hr		=	465.11
Particulate Emission Rate(lb/hr)	E(p)	=	763.159
Particulate Emission Rate(lb/MBtu)		=	1.5734

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 10/03/92 Printed 29-Oct — Test No./Type: M17-I114
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 2130-2310

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.74
Stack Static Pressure (in H2O)	P(stack)	5.000
Gas Meter Initial Reading (cu ft)		634.01
Gas Meter Final Reading (cu ft)		666.35
Net Gas Sample Volume (cu ft)	V(m)	(32.35)
Vol of Liquid Collected (ml)	Vl(c)	42.6
Vol of Liq @ Std. Conds. (scf)	V(w std)	(2.005)
Wt. of Filter Particulate (gm)		1.5522
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(1.5522)
O2 Concentration (by CEM)	% O2	5.74
CO2 Concentration (by CEM)	% CO2	15.36
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(78.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.21	0.36	380.00	75.0	76.0	0.4583
2	4.00	0.22	0.37	388.00	74.0	75.0	0.4690
3	4.00	0.23	0.39	397.00	73.0	74.0	0.4796
B1	4.00	0.21	0.36	367.00	73.0	73.0	0.4583
2	4.00	0.21	0.36	373.00	73.0	72.0	0.4583
3	4.00	0.22	0.37	381.00	73.0	72.0	0.4690
C1	4.00	0.22	0.37	383.00	72.0	71.0	0.4690
2	4.00	0.22	0.37	386.00	71.0	71.0	0.4690
3	4.00	0.27	0.46	402.00	73.0	72.0	0.5196
D1	4.00	0.25	0.43	383.00	76.0	74.0	0.5000
2	4.00	0.27	0.46	386.00	77.0	74.0	0.5196
3	4.00	0.24	0.41	399.00	78.0	74.0	0.4899
E1	4.00	0.22	0.37	387.00	79.0	76.0	0.4690
2	4.00	0.21	0.36	389.00	79.0	76.0	0.4583
3	4.00	0.23	0.39	394.00	80.0	76.0	0.4472
E1	4.00	0.20	0.34	399.00	80.0	77.0	0.4583
2	4.00	0.21	0.36	402.00	81.0	77.0	0.4690
3	4.00	0.22	0.37	405.00	81.0	77.0	0.5000
F1	4.00	0.25	0.43	385.00	81.0	77.0	0.5000
2	4.00	0.24	0.41	388.00	81.0	78.0	0.5000
3	4.00	0.21	0.36	390.00	81.0	78.0	0.4583
F1	4.00	0.20	0.34	397.00	81.0	78.0	0.4472
2	4.00	0.23	0.39	401.00	81.0	78.0	0.4796
3	4.00	0.24	0.41	403.00	81.0	78.0	0.4899
TOTALS	96.00	5.43	9.24	9365.00	1854.0	1804.0	11.4364

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.226
~~Avg Orifice Meter Reading (in H2O)~~	~~dH(avg)~~	~~=~~	~~0.385~~
Avg Stack Temperature (degF)	T(s avg)	=	390.2
Average Meter Temperature (degF)	T(m avg)	=	76.2
Avg SQRT(dP)		=	0.477

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	31.65
Stack Gas Water Vapor Proportion	B(wo)	=	0.060
Mol. Wt., Stack Gas Dry	M(d)	=	30.69
Mol. Wt., Stack Gas Wet	M(s)	=	29.93
Abs Stack Pressure (in Hg)	P(s)	=	30.11
Avg Stack Velocity (ft/sec)	V(s avg)	=	33.2
Isokineticity (%)	% I	=	95.9
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	112513
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	191451
Percent XS Air	PEA	=	38.0
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.7566
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	1589
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.6943
Heat Input Rate, MBtu/hr		=	498.65
Particulate Emission Rate(lb/hr)	E(p)	=	729.746
Particulate Emission Rate(lb/MBtu)		=	1.4637

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 10/04/92 Printed 29-Oct — Test No./Type: M17-I115
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 0100-0240

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.74
Stack Static Pressure (in H2O)	P(stack)	9.000
Gas Meter Initial Reading (cu ft)		666.50
Gas Meter Final Reading (cu ft)		707.16
Net Gas Sample Volume (cu ft)	V(m)	(40.66)
Vol of Liquid Collected (ml)	Vl(c)	82.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.860)
Wt. of Filter Particulate (gm)		6.4607
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(6.4607)
O2 Concentration (by CEM)	% O2	3.58
CO2 Concentration (by CEM)	% CO2	15.59
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.83)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.40	0.68	407.00	72.0	72.0	0.6325
2	4.00	0.28	0.48	408.00	71.0	72.0	0.5292
3	4.00	0.32	0.54	410.00	72.0	72.0	0.5657
B1	4.00	0.37	0.63	374.00	73.0	73.0	0.6083
2	4.00	0.32	0.54	385.00	74.0	73.0	0.5657
3	4.00	0.32	0.54	401.00	75.0	73.0	0.5657
C1	4.00	0.40	0.68	375.00	75.0	73.0	0.6325
2	4.00	0.36	0.61	391.00	76.0	73.0	0.6000
3	4.00	0.40	0.68	404.00	77.0	73.0	0.6325
D1	4.00	0.45	0.75	391.00	77.0	74.0	0.6708
2	4.00	0.40	0.68	402.00	78.0	74.0	0.6325
3	4.00	0.36	0.61	411.00	79.0	74.0	0.6000
E1	4.00	0.37	0.63	405.00	78.0	75.0	0.6083
2	4.00	0.36	0.61	411.00	79.0	75.0	0.6000
3	4.00	0.33	0.56	412.00	80.0	76.0	0.5745
E1	4.00	0.33	0.56	416.00	80.0	75.0	0.6000
2	4.00	0.36	0.61	419.00	80.0	76.0	0.6000
3	4.00	0.36	0.61	421.00	81.0	76.0	0.6557
F1	4.00	0.43	0.73	395.00	81.0	77.0	0.6557
2	4.00	0.44	0.75	399.00	82.0	77.0	0.6557
3	4.00	0.35	0.60	409.00	82.0	78.0	0.5916
F1	4.00	0.36	0.61	418.00	82.0	78.0	0.6000
2	4.00	0.36	0.61	420.00	84.0	79.0	0.6000
3	4.00	0.36	0.61	425.00	84.0	79.0	0.6000
TOTALS	96.00	8.79	14.91	9709.00	1872.0	1797.0	14.5767

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.366
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.621
Avg Stack Temperature (degF)	T(s avg)	=	404.5
Average Meter Temperature (degF)	T(m avg)	=	76.4
Avg SQRT(dP)		=	0.607

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	39.78
Stack Gas Water Vapor Proportion	B(wo)	=	0.088
Mol. Wt., Stack Gas Dry	M(d)	=	30.64
Mol. Wt., Stack Gas Wet	M(s)	=	29.52
Abs Stack Pressure (in Hg)	P(s)	=	30.40
Avg Stack Velocity (ft/sec)	V(s avg)	=	42.8
Isokineticity (%)	% I	=	97.2
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	139483
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	246576
Percent XS Air	PEA	=	20.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	2.5056
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	4608
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	2.0139
Heat Input Rate, MBtu/hr		=	706.26
Particulate Emission Rate(lb/hr)	E(p)	=	2995.377
Particulate Emission Rate(lb/MBtu)		=	4.2419

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 10/04/92 Printed 29-Oct — Test No./Type: M17-I116
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 2030-2215

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.81
Stack Static Pressure (in H2O)	P(stack)	5.000
Gas Meter Initial Reading (cu ft)		707.41
Gas Meter Final Reading (cu ft)		735.91
Net Gas Sample Volume (cu ft)	V(m)	(28.50)
Vol of Liquid Collected (ml)	Vl(c)	53.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(2.495)
Wt. of Filter Particulate (gm)		2.6018
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(2.6018)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	4.88
CO2 Concentration (by CEM)	% CO2	15.68
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(79.44)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.18	0.31	384.00	75.0	75.0	0.4243
2	4.00	0.16	0.27	383.00	74.0	75.0	0.4000
3	4.00	0.16	0.27	388.00	74.0	75.0	0.4000
B1	4.00	0.18	0.31	337.00	75.0	74.0	0.4243
2	4.00	0.16	0.27	355.00	75.0	74.0	0.4000
3	4.00	0.16	0.27	379.00	75.0	74.0	0.4000
C1	4.00	0.16	0.27	366.00	75.0	74.0	0.4000
2	4.00	0.16	0.27	375.00	76.0	74.0	0.4000
3	4.00	0.22	0.37	386.00	76.0	74.0	0.4690
D1	4.00	0.21	0.36	371.00	76.0	74.0	0.4583
2	4.00	0.17	0.29	377.00	76.0	74.0	0.4123
3	4.00	0.17	0.29	385.00	76.0	74.0	0.4123
E1	4.00	0.17	0.29	370.00	76.0	74.0	0.4123
2	4.00	0.17	0.29	373.00	76.0	74.0	0.4123
3	4.00	0.16	0.27	378.00	76.0	74.0	0.4000
F1	4.00	0.15	0.26	383.00	76.0	74.0	0.3873
2	4.00	0.17	0.29	385.00	76.0	74.0	0.4123
3	4.00	0.18	0.31	387.00	76.0	74.0	0.4243
G1	4.00	0.19	0.32	350.00	76.0	74.0	0.4359
2	4.00	0.19	0.32	351.00	76.0	74.0	0.4359
3	4.00	0.16	0.27	355.00	75.0	73.0	0.4000
H1	4.00	0.17	0.29	367.00	75.0	74.0	0.4123
2	4.00	0.17	0.29	372.00	76.0	74.0	0.4123
3	4.00	0.17	0.29	378.00	75.0	73.0	0.4123
TOTALS	96.00	4.14	7.04	8935.00	1812.0	1704.0	9.9577

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.173
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.293
Avg Stack Temperature (degF)	T(s avg)	=	372.3
Average Meter Temperature (degF)	T(m avg)	=	73.3
Avg SQRT(dP)		=	0.415

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	28.10
Stack Gas Water Vapor Proportion	B(wo)	=	0.082
Mol. Wt., Stack Gas Dry	M(d)	=	30.70
Mol. Wt., Stack Gas Wet	M(s)	=	29.67
Abs Stack Pressure (in Hg)	P(s)	=	30.18
Avg Stack Velocity (ft/sec)	V(s avg)	=	28.7
Isokineticity (%)	% I	=	96.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	97242
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	165465
Percent XS Air	PEA	=	30.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.4288
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2839
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.2409
Heat Input Rate, MBtu/hr		=	455.42
Particulate Emission Rate(lb/hr)	E(p)	=	1190.739
Particulate Emission Rate(lb/MBtu)		=	2.6151
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 10/05/92 Printed 29-Oct — Test No./Type: M17-I117
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 0010-0142

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.81
Stack Static Pressure (in H2O)	P(stack)	9.000
Gas Meter Initial Reading (cu ft)		736.10
Gas Meter Final Reading (cu ft)		777.53
Net Gas Sample Volume (cu ft)	V(m)	(41.43)
Vol of Liquid Collected (ml)	Vl(c)	113.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.319)
Wt. of Filter Particulate (gm)		4.6652
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(4.6652)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.51
CO2 Concentration (by CEM)	% CO2	15.95
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.54)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.35	0.60	336.00	66.0	66.0	0.5916
2	4.00	0.33	0.56	367.00	66.0	68.0	0.5745
3	4.00	0.39	0.66	397.00	66.0	66.0	0.6245
B1	4.00	0.42	0.71	350.00	67.0	66.0	0.6481
2	4.00	0.35	0.60	366.00	69.0	66.0	0.5916
3	4.00	0.35	0.60	403.00	70.0	67.0	0.5916
C1	4.00	0.40	0.68	384.00	70.0	67.0	0.6325
2	4.00	0.36	0.61	392.00	71.0	68.0	0.6000
3	4.00	0.45	0.77	409.00	72.0	68.0	0.6708
D1	4.00	0.45	0.77	401.00	72.0	68.0	0.6708
2	4.00	0.40	0.68	407.00	73.0	69.0	0.6325
3	4.00	0.42	0.71	420.00	74.0	69.0	0.6481
E1	4.00	0.40	0.68	410.00	73.0	69.0	0.6325
2	4.00	0.40	0.68	415.00	74.0	70.0	0.6325
3	4.00	0.37	0.63	418.00	74.0	70.0	0.6083
F1	4.00	0.35	0.61	423.00	75.0	70.0	0.5916
2	4.00	0.49	0.68	426.00	75.0	70.0	0.7000
3	4.00	0.40	0.68	428.00	75.0	71.0	0.6325
G1	4.00	0.43	0.73	393.00	75.0	71.0	0.6557
2	4.00	0.43	0.73	397.00	75.0	71.0	0.6557
3	4.00	0.39	0.66	407.00	76.0	71.0	0.6245
H1	4.00	0.38	0.65	418.00	76.0	72.0	0.6164
2	4.00	0.41	0.70	424.00	77.0	72.0	0.6403
3	4.00	0.40	0.68	430.00	77.0	72.0	0.6325
TOTALS	96.00	9.52	16.06	9621.00	1738.0	1585.0	15.0989

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.397
~~Avg Orifice Meter Reading (in H2O)~~	~~dH(avg)~~	~~=~~	~~0.669~~
Avg Stack Temperature (degF)	T(s avg)	=	400.9
Average Meter Temperature (degF)	T(m avg)	=	69.2
Avg SQRT(dP)		=	0.629

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	41.19
Stack Gas Water Vapor Proportion	B(wo)	=	0.114
Mol. Wt., Stack Gas Dry	M(d)	=	30.69
Mol. Wt., Stack Gas Wet	M(s)	=	29.24
Abs Stack Pressure (in Hg)	P(s)	=	30.47
Avg Stack Velocity (ft/sec)	V(s avg)	=	44.4
Isokineticity (%)	% I	=	99.2
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	141503
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	255786
Percent XS Air	PEA	=	19.6
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.7475
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	3200
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.3988
Heat Input Rate, MBtu/hr		=	719.38
Particulate Emission Rate(lb/hr)	E(p)	=	2119.140
Particulate Emission Rate(lb/MBtu)		=	2.9463
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 10/05/92 Printed 29-Oct — Test No./Type: M17-1118
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 0245-0430

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.81
Stack Static Pressure (in H2O)	P(stack)	9.000
Gas Meter Initial Reading (cu ft)		777.68
Gas Meter Final Reading (cu ft)		818.19
Net Gas Sample Volume (cu ft)	V(m)	(40.51)
Vol of Liquid Collected (ml)	Vl(c)	82.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.860)
Wt. of Filter Particulate (gm)		4.6930
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(4.6930)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	4.30
CO2 Concentration (by CEM)	% CO2	15.52
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.18)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.34	0.58	419.00	65.0	66.0	0.5831
2	4.00	0.28	0.49	424.00	65.0	66.0	0.5292
3	4.00	0.32	0.54	429.00	66.0	66.0	0.5657
B1	4.00	0.39	0.66	395.00	67.0	66.0	0.6245
2	4.00	0.32	0.54	402.00	68.0	66.0	0.5657
3	4.00	0.32	0.54	425.00	69.0	66.0	0.5657
C1	4.00	0.38	0.65	403.00	69.0	66.0	0.6164
2	4.00	0.38	0.65	415.00	70.0	67.0	0.6164
3	4.00	0.44	0.75	437.00	71.0	67.0	0.6633
D1	4.00	0.45	0.77	425.00	71.0	68.0	0.6708
2	4.00	0.38	0.65	433.00	73.0	68.0	0.6164
3	4.00	0.39	0.66	441.00	73.0	68.0	0.6245
E1	4.00	0.40	0.68	415.00	73.0	68.0	0.6325
2	4.00	0.39	0.66	423.00	73.0	68.0	0.6245
3	4.00	0.33	0.56	431.00	74.0	69.0	0.5745
F1	4.00	0.35	0.60	433.00	74.0	69.0	0.5916
2	4.00	0.32	0.54	437.00	74.0	69.0	0.5657
3	4.00	0.35	0.60	440.00	74.0	69.0	0.5916
G1	4.00	0.45	0.77	395.00	73.0	70.0	0.6708
2	4.00	0.43	0.73	402.00	73.0	70.0	0.6557
3	4.00	0.37	0.63	417.00	75.0	70.0	0.6083
H1	4.00	0.35	0.60	426.00	76.0	71.0	0.5916
2	4.00	0.35	0.60	432.00	76.0	71.0	0.5916
3	4.00	0.37	0.63	435.00	76.0	71.0	0.6083
TOTALS	96.00	8.85	15.08	10134.00	1718.0	1564.0	14.5484

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.369
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.628
Avg Stack Temperature (degF)	T(s avg)	=	422.3
Average Meter Temperature (degF)	T(m avg)	=	68.4
Avg SQRT(dP)		=	0.606

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	40.34
Stack Gas Water Vapor Proportion	B(wo)	=	0.087
Mol. Wt., Stack Gas Dry	M(d)	=	30.66
Mol. Wt., Stack Gas Wet	M(s)	=	29.55
Abs Stack Pressure (in Hg)	P(s)	=	30.47
Avg Stack Velocity (ft/sec)	V(s avg)	=	43.1
Isokineticity (%)	% I	=	99.6
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	138065
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	248193
Percent XS Air	PEA	=	25.5
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.7950
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	3443
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.5048
Heat Input Rate, MBtu/hr		=	670.02
Particulate Emission Rate(lb/hr)	E(p)	=	2123.931
Particulate Emission Rate(lb/MBtu)		=	3.1705
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September, 1992

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling/Janek
Date: 10/05/92 Printed 29-Oct — Test No./Type: M17-1119
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 2155-2340

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.86
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		818.41
Gas Meter Final Reading (cu ft)		892.40
Net Gas Sample Volume (cu ft)	V(m)	(73.99)
Vol of Liquid Collected (ml)	Vl(c)	181.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(8.520)
Wt. of Filter Particulate (gm)		4.1800
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(4.1800)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.86
CO2 Concentration (by CEM)	% CO2	15.63
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.51)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.20	2.04	504.00	82.0	83.0	1.0954
2	4.00	1.10	1.87	503.00	81.0	83.0	1.0488
3	4.00	1.20	2.04	499.00	82.0	83.0	1.0954
B1	4.00	1.60	2.72	441.00	84.0	83.0	1.2649
2	4.00	1.20	2.04	466.00	88.0	85.0	1.0954
3	4.00	1.10	1.87	489.00	88.0	84.0	1.0488
C1	4.00	1.40	2.38	489.00	89.0	84.0	1.1832
2	4.00	1.30	2.21	490.00	90.0	85.0	1.1402
3	4.00	1.60	2.72	500.00	92.0	86.0	1.2649
D1	4.00	1.70	2.89	442.00	94.0	86.0	1.3038
2	4.00	1.50	2.55	490.00	94.0	87.0	1.2247
3	4.00	1.50	2.55	501.00	95.0	87.0	1.2247
E1	4.00	1.50	2.55	460.00	94.0	88.0	1.2247
2	4.00	1.40	2.38	508.00	95.0	87.0	1.1832
3	4.00	1.20	2.04	518.00	95.0	87.0	1.0954
F1	4.00	1.20	2.04	522.00	95.0	88.0	1.0954
2	4.00	1.40	2.38	524.00	94.0	87.0	1.1832
3	4.00	1.40	2.38	529.00	93.0	87.0	1.1832
G1	4.00	1.60	2.72	488.00	91.0	87.0	1.2649
2	4.00	1.60	2.72	507.00	92.0	87.0	1.2649
3	4.00	1.40	2.38	518.00	93.0	87.0	1.1832
H1	4.00	1.40	2.38	529.00	92.0	87.0	1.1832
2	4.00	1.50	2.55	532.00	91.0	86.0	1.2247
3	4.00	1.50	2.55	540.00	91.0	86.0	1.2247
TOTALS	96.00	33.50	56.95	11989.00	2175.0	2060.0	28.3015

FIELD DATA AVERAGES

~~Avg Velocity Head (in H2O)~~	dP(avg)	=	1.396
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	2.373
Avg Stack Temperature (degF)	T(s avg)	=	499.5
Average Meter Temperature (degF)	T(m avg)	=	88.2
Avg SQRT(dP)		=	1.179

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	71.44
Stack Gas Water Vapor Proportion	B(wo)	=	0.107
Mol. Wt., Stack Gas Dry	M(d)	=	30.66
Mol. Wt., Stack Gas Wet	M(s)	=	29.31
Abs Stack Pressure (in Hg)	P(s)	=	31.33
Avg Stack Velocity (ft/sec)	V(s avg)	=	86.6
Isokineticity (%)	% I	=	94.9
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	256699
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	498631
Percent XS Air	PEA	=	22.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.9029
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	1687
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.7375
Heat Input Rate, MBtu/hr		=	1278.76
Particulate Emission Rate(lb/hr)	E(p)	=	1986.224
Particulate Emission Rate(lb/MBtu)		=	1.5535
Total Metals Emission Rate(lb/MBtu)		=	0.00000

APPENDIX M

PERFORMANCE TEST

M5 PARTICULATE LOADING AT ESP OUTLET—DATA SUMMARY

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 9/28/92 Printed 29-Oct — Test No./Type: M5/0-101
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1100-1252

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.90
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		894.31
Gas Meter Final Reading (cu ft)		977.81
Net Gas Sample Volume (cu ft)	V(m)	(83.50)
Vol of Liquid Collected (ml)	Vl(c)	155.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.296)
Wt. of Filter Particulate (gm)		0.2046
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.2046)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.23
CO2 Concentration (by CEM)	% CO2	15.46
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.31)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.80	3.80	477	60.0	60.0	1.3416
2	4.00	1.30	3.10	476	61.0	60.0	1.1402
3	4.00	1.10	2.60	475	64.0	60.0	1.0488
B1	4.00	1.10	2.60	474	65.0	60.0	1.0488
2	4.00	1.20	2.90	473	66.0	60.0	1.0954
3	4.00	2.00	4.80	473	68.0	61.0	1.4142
C1	4.00	1.10	2.60	473	67.0	61.0	1.0488
2	4.00	1.20	2.90	479	70.0	61.0	1.0954
3	4.00	1.10	2.60	480	71.0	61.0	1.0488
D1	4.00	1.50	3.60	482	67.0	61.0	1.2247
2	4.00	1.40	3.40	485	71.0	61.0	1.1832
3	4.00	1.20	2.90	484	71.0	61.0	1.0954
E1	4.00	1.10	2.60	489	65.0	60.0	1.0488
2	4.00	1.20	2.90	494	69.0	61.0	1.0954
3	4.00	0.98	2.40	493	71.0	61.0	0.9899
F1	4.00	0.93	2.20	494	67.0	61.0	0.9644
2	4.00	0.93	2.20	496	69.0	61.0	0.9644
3	4.00	0.73	1.80	497	70.0	61.0	0.9644
G1	4.00	1.70	1.70	496	70.0	61.0	0.9644
2	4.00	2.20	2.20	497	70.0	61.0	0.8544
3	4.00	2.20	2.20	497	70.0	61.0	1.3038
H1	4.00	1.00	1.00	468	68.0	62.0	1.4832
2	4.00	3.40	3.40	482	70.0	62.0	1.4832
3	4.00	2.60	2.60	485	73.0	62.0	1.0000
TOTALS	96.00	34.97	65.00	11619.0	1633.0	1399.0	26.9019

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.457
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	2.708
Avg Stack Temperature (degF)	T(s avg)	=	484.1
Average Meter Temperature (degF)	T(m avg)	=	63.2
Avg SQRT(dP)		=	1.121

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	83.89
Stack Gas Water Vapor Proportion	B(wo)	=	0.080
Mol. Wt., Stack Gas Dry	M(d)	=	30.60
Mol. Wt., Stack Gas Wet	M(s)	=	29.59
Abs Stack Pressure (in Hg)	P(s)	=	31.37
Avg Stack Velocity (ft/sec)	V(s avg)	=	81.2
Isokineticity (%)	% I	=	106.0
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	252224
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	467560
Percent XS Air	PEA	=	17.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0376
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	68
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0297
Heat Input Rate, MBtu/hr		=	1302.92
Particulate Emission Rate(lb/hr)	E(p)	=	81.359
Particulate Emission Rate(lb/MBtu)		=	0.0625
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 9/28/92 Printed 29-Oct — Test No./Type: M5/0-102
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1500-1650

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.244
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.90
Stack Static Pressure (in H20)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		978.71
Gas Meter Final Reading (cu ft)		1039.40
Net Gas Sample Volume (cu ft)	V(m)	(60.70)
Vol of Liquid Collected (ml)	Vl(c)	104.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.895)
Wt. of Filter Particulate (gm)		0.0355
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0355)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.83
CO2 Concentration (by CEM)	% CO2	15.45
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.72)

Sample Point	dClock Time	Velocity Head, dP (in H20)	Orifice Meter, dH (in H20)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.96	2.30	468.00	57.0	56.0	0.9798
2	4.00	0.67	1.60	467.00	58.0	56.0	0.8185
3	4.00	0.56	1.30	467.00	61.0	57.0	0.7483
B1	4.00	0.57	1.40	467.00	63.0	58.0	0.7550
2	4.00	0.63	1.50	467.00	65.0	58.0	0.7937
3	4.00	0.90	2.20	467.00	67.0	59.0	0.9487
C1	4.00	0.50	1.20	468.00	67.0	60.0	0.7071
2	4.00	0.63	1.50	471.00	69.0	61.0	0.7937
3	4.00	0.52	1.20	469.00	71.0	62.0	0.7211
D1	4.00	0.76	1.80	461.00	70.0	62.0	0.8718
2	4.00	0.72	1.70	461.00	73.0	63.0	0.8485
3	4.00	0.64	1.50	462.00	74.0	64.0	0.8000
E1	4.00	0.53	1.30	462.00	70.0	64.0	0.7280
2	4.00	0.58	1.40	465.00	73.0	65.0	0.7616
3	4.00	0.42	1.00	463.00	75.0	66.0	0.6481
F1	4.00	0.54	1.30	458.00	71.0	66.0	0.7348
2	4.00	0.42	1.00	458.00	74.0	67.0	0.6481
3	4.00	0.35	0.84	457.00	74.0	67.0	0.7348
G1	4.00	0.33	0.80	457.00	75.0	67.0	0.6481
2	4.00	0.42	1.00	457.00	75.0	68.0	0.5916
3	4.00	0.48	1.20	457.00	75.0	68.0	0.5745
H1	4.00	0.63	1.50	430.00	73.0	67.0	0.6481
2	4.00	0.78	1.90	434.00	75.0	68.0	0.6928
3	4.00	0.71	1.70	437.00	76.0	67.0	0.7937
TOTALS	96.00	14.25	34.14	11030.00	1681.0	1516.0	17.9905

FIELD DATA AVERAGES

Avg Velocity Head (in H20)	dP(avg)	=	0.594
Avg Orifice Meter Reading (in H20)	dH(avg)	=	1.423
Avg Stack Temperature (degF)	T(s avg)	=	459.6
Average Meter Temperature (degF)	T(m avg)	=	66.6
Avg SQRT(dP)		=	0.750

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	60.40
Stack Gas Water Vapor Proportion	B(wo)	=	0.075
Mol. Wt., Stack Gas Dry	M(d)	=	30.63
Mol. Wt., Stack Gas Wet	M(s)	=	29.68
Abs Stack Pressure (in Hg)	P(s)	=	30.93
Avg Stack Velocity (ft/sec)	V(s avg)	=	53.9
Isokineticity (%)	% I	=	109.2
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	170[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	3,[illegible]
Percent XS Air	PEA	=	[illegible]
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.00[illegible]
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	17
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0074
Heat Input Rate, MBtu/hr		=	850.29
Particulate Emission Rate(lb/hr)	E(p)	=	13.233
Particulate Emission Rate(lb/MBtu)		=	0.0156
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 9/28/92 Printed 29-Oct — Test No./Type: M5-0-103
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1920-2110

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.244
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.90
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		40.00
Gas Meter Final Reading (cu ft)		124.60
Net Gas Sample Volume (cu ft)	V(m)	(84.60)
Vol of Liquid Collected (ml)	Vl(c)	191.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(8.990)
Wt. of Filter Particulate (gm)		0.1654
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.1654)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.40
CO2 Concentration (by CEM)	% CO2	15.97
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.63)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.60	3.60	485	59.0	58.0	1.2649
2	4.00	1.30	2.90	486	64.0	59.0	1.1402
3	4.00	1.20	2.70	487	68.0	60.0	1.0954
B1	4.00	1.10	2.50	487	72.0	61.0	1.0488
2	4.00	1.30	2.40	488	73.0	62.0	1.1402
3	4.00	1.60	3.60	488	76.0	63.0	1.2649
C1	4.00	1.10	2.50	488	74.0	64.0	1.0488
2	4.00	1.30	2.90	493	77.0	65.0	1.1402
3	4.00	1.10	2.50	493	79.0	66.0	1.0488
D1	4.00	1.60	3.60	495	75.0	66.0	1.2649
2	4.00	1.50	3.40	496	80.0	66.0	1.2247
3	4.00	1.20	2.70	496	81.0	67.0	1.0954
E1	4.00	1.30	2.90	497	74.0	67.0	1.1402
2	4.00	1.30	2.90	505	78.0	68.0	1.1402
3	4.00	0.96	2.20	505	80.0	68.0	0.9798
F1	4.00	1.10	2.50	498	74.0	67.0	1.0488
2	4.00	1.00	2.30	505	78.0	68.0	1.0000
3	4.00	0.78	1.80	505	78.0	68.0	1.0488
G1	4.00	0.76	1.70	505	78.0	69.0	1.0000
2	4.00	0.92	2.10	506	78.0	69.0	0.8832
3	4.00	1.50	3.40	507	80.0	69.0	0.8718
H1	4.00	1.30	2.90	488	76.0	69.0	0.9592
2	4.00	1.60	3.60	492	81.0	70.0	1.2247
3	4.00	1.40	3.20	494	82.0	70.0	1.1402
TOTALS	96.00	29.82	66.80	11889.00	1815.0	1579.0	26.2141

FIELD DATA AVERAGES

~~Avg Velocity Head (in H2O)~~	~~dP(avg)~~	~~=~~	~~1.243~~
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	2.783
Avg Stack Temperature (degF)	T(s avg)	=	495.4
Average Meter Temperature (degF)	T(m avg)	=	70.7
Avg SQRT(dP)		=	1.092

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	83.81
Stack Gas Water Vapor Proportion	B(wo)	=	0.097
Mol. Wt., Stack Gas Dry	M(d)	=	30.69
Mol. Wt., Stack Gas Wet	M(s)	=	29.48
Abs Stack Pressure (in Hg)	P(s)	=	31.37
Avg Stack Velocity (ft/sec)	V(s avg)	=	79.7
Isokineticity (%)	% I	=	107.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	240364
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	459344
Percent XS Air	PEA	=	19.0
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0305
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	55
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0242
Heat Input Rate, MBtu/hr		=	1229.81
Particulate Emission Rate(lb/hr)	E(p)	=	62.748
Particulate Emission Rate(lb/MBtu)		=	0.0510
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 9/29/92 Printed 29-Oct — Test No./Type: M5/0-104
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1328-1518

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.244
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	30.10
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		124.81
Gas Meter Final Reading (cu ft)		184.01
Net Gas Sample Volume (cu ft)	V(m)	(59.20)
Vol of Liquid Collected (ml)	Vl(c)	87.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.095)
Wt. of Filter Particulate (gm)		0.0369
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0369)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.80
CO2 Concentration (by CEM)	% CO2	15.05
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.15)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.80	1.80	472	61.0	61.0	0.8944
2	4.00	0.65	1.50	473	62.0	61.0	0.8062
3	4.00	0.52	1.20	473	64.0	61.0	0.7211
B1	4.00	0.55	1.20	473	65.0	62.0	0.7416
2	4.00	0.62	1.40	473	67.0	62.0	0.7874
3	4.00	0.73	1.60	474	69.0	63.0	0.8544
C1	4.00	0.54	1.20	476	69.0	64.0	0.7348
2	4.00	0.58	1.30	478	72.0	65.0	0.7616
3	4.00	0.50	1.10	477	75.0	66.0	0.7071
D1	4.00	0.75	1.70	467	74.0	67.0	0.8660
2	4.00	0.71	1.60	467	77.0	68.0	0.8426
3	4.00	0.59	1.30	467	79.0	68.0	0.7681
E1	4.00	0.55	1.20	466	74.0	69.0	0.7416
2	4.00	0.63	1.40	468	78.0	69.0	0.7937
3	4.00	0.45	1.00	467	79.0	70.0	0.6708
F1	4.00	0.50	1.10	459	76.0	70.0	0.7071
2	4.00	0.52	1.20	461	79.0	71.0	0.7211
3	4.00	0.41	0.92	459	80.0	71.0	0.7071
G1	4.00	0.38	0.85	458	79.0	71.0	0.7211
2	4.00	0.47	1.10	459	79.0	71.0	0.6403
3	4.00	0.65	1.50	460	80.0	72.0	0.6164
H1	4.00	0.70	1.60	435	78.0	72.0	0.6856
2	4.00	0.77	1.70	439	81.0	73.0	0.8062
3	4.00	0.75	1.70	443	82.0	73.0	0.8367
TOTALS	96.00	14.32	32.17	11144.00	1779.0	1620.0	18.1333

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.597
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.340
Avg Stack Temperature (degF)	T(s avg)	=	464.3
Average Meter Temperature (degF)	T(m avg)	=	70.8
Avg SQRT(dP)		=	0.756

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	58.82
Stack Gas Water Vapor Proportion	B(wo)	=	0.065
Mol. Wt., Stack Gas Dry	M(d)	=	30.56
Mol. Wt., Stack Gas Wet	M(s)	=	29.74
Abs Stack Pressure (in Hg)	P(s)	=	31.13
Avg Stack Velocity (ft/sec)	V(s avg)	=	54.2
Isokineticity (%)	% I	=	104.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	173503
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	3[illegible]
Percent XS Air	PEA	=	[illegible]
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0097
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	18
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0079
Heat Input Rate, MBtu/hr		=	867.35
Particulate Emission Rate(lb/hr)	E(p)	=	14.402
Particulate Emission Rate(lb/MBtu)		=	0.0166
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 9/29/92 Printed 29-Oct — Test No./Type: M5/0-105
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1710-1902

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	30.10
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		184.11
Gas Meter Final Reading (cu ft)		266.51
Net Gas Sample Volume (cu ft)	V(m)	(82.40)
Vol of Liquid Collected (ml)	Vl(c)	184.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(8.661)
Wt. of Filter Particulate (gm)		0.2150
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.2150)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.37
CO2 Concentration (by CEM)	% CO2	15.48
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.15)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.60	3.40	494	66.0	66.0	1.2649
2	4.00	1.20	2.50	494	69.0	66.0	1.0954
3	4.00	1.10	2.30	495	71.0	66.0	1.0488
B1	4.00	1.10	2.30	495	74.0	67.0	1.0488
2	4.00	1.30	2.70	496	76.0	68.0	1.1402
3	4.00	1.50	3.20	497	79.0	68.0	1.2247
C1	4.00	0.94	2.00	501	76.0	69.0	0.9695
2	4.00	1.20	2.50	502	80.0	70.0	1.0954
3	4.00	1.10	2.30	503	83.0	71.0	1.0488
D1	4.00	1.60	3.40	504	81.0	72.0	1.2649
2	4.00	1.50	3.20	505	86.0	72.0	1.2247
3	4.00	1.20	2.50	505	88.0	73.0	1.0954
E1	4.00	1.70	3.60	505	83.0	75.0	1.3038
2	4.00	1.20	2.50	509	89.0	76.0	1.0954
3	4.00	0.89	1.90	510	91.0	76.0	0.9434
F1	4.00	1.30	2.70	507	86.0	77.0	1.1402
2	4.00	0.92	1.90	513	91.0	78.0	0.9592
3	4.00	0.94	2.00	513	91.0	78.0	1.1402
G1	4.00	0.76	1.60	514	91.0	79.0	0.9592
2	4.00	0.74	1.50	514	91.0	79.0	0.9695
3	4.00	0.93	2.00	515	90.0	79.0	0.8718
H1	4.00	1.50	3.20	492	87.0	79.0	0.8602
2	4.00	1.60	3.40	499	92.0	80.0	0.9644
3	4.00	1.40	2.90	504	93.0	79.0	1.2247
TOTALS	96.00	29.22	61.50	12086.00	2004.0	1763.0	25.9538

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.218
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	2.563
Avg Stack Temperature (degF)	T(s avg)	=	503.6
Average Meter Temperature (degF)	T(m avg)	=	76.5
Avg SQRT(dP)		=	1.081

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	80.94
Stack Gas Water Vapor Proportion	B(wo)	=	0.097
Mol. Wt., Stack Gas Dry	M(d)	=	30.61
Mol. Wt., Stack Gas Wet	M(s)	=	29.39
Abs Stack Pressure (in Hg)	P(s)	=	31.57
Avg Stack Velocity (ft/sec)	V(s avg)	=	79.1
Isokineticity (%)	% I	=	108.3
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	238072
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	455818
Percent XS Air	PEA	=	18.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0410
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	74
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0325
Heat Input Rate, MBtu/hr		=	1220.07
Particulate Emission Rate(lb/hr)	E(p)	=	83.619
Particulate Emission Rate(lb/MBtu)		=	0.0685
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 9/30/92 Printed 29-Oct — Test No./Type: M5/0-106
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1241-1430

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	30.10
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		266.90
Gas Meter Final Reading (cu ft)		308.60
Net Gas Sample Volume (cu ft)	V(m)	(41.70)
Vol of Liquid Collected (ml)	Vl(c)	98.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.636)
Wt. of Filter Particulate (gm)		0.0302
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0302)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	4.32
CO2 Concentration (by CEM)	% CO2	15.62
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.06)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.37	0.78	444.00	71.0	71.0	0.6083
2	4.00	0.33	0.69	444.00	72.0	71.0	0.5745
3	4.00	0.29	0.61	443.00	73.0	71.0	0.5385
B1	4.00	0.28	0.59	442.00	74.0	72.0	0.5292
2	4.00	0.32	0.67	441.00	75.0	72.0	0.5657
3	4.00	0.36	0.76	442.00	76.0	72.0	0.6000
C1	4.00	0.23	0.48	433.00	76.0	72.0	0.4796
2	4.00	0.32	0.67	440.00	77.0	73.0	0.5657
3	4.00	0.31	0.65	438.00	78.0	73.0	0.5568
D1	4.00	0.32	0.67	429.00	77.0	74.0	0.5657
2	4.00	0.38	0.80	428.00	79.0	74.0	0.6164
3	4.00	0.33	0.69	426.00	80.0	75.0	0.5745
E1	4.00	0.29	0.61	424.00	77.0	75.0	0.5385
2	4.00	0.30	0.63	430.00	79.0	75.0	0.5477
3	4.00	0.24	0.50	428.00	80.0	75.0	0.4899
F1	4.00	0.18	0.38	423.00	78.0	75.0	0.4243
2	4.00	0.21	0.44	423.00	79.0	75.0	0.4583
3	4.00	0.20	0.42	421.00	79.0	75.0	0.4472
G1	4.00	0.19	0.40	420.00	79.0	75.0	0.4359
2	4.00	0.22	0.46	420.00	79.0	76.0	0.4690
3	4.00	0.26	0.55	422.00	80.0	76.0	0.5099
H1	4.00	0.36	0.76	404.00	79.0	76.0	0.6000
2	4.00	0.39	0.82	405.00	81.0	76.0	0.6245
3	4.00	0.39	0.82	404.00	82.0	77.0	0.6245
TOTALS	96.00	7.07	14.85	10274.00	1860.0	1776.0	12.9444

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.295
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.619
~~Avg Stack Temperature (degF)~~	~~T(s avg)~~	~~=~~	~~428.1~~
Average Meter Temperature (degF)	T(m avg)	=	75.8
Avg SQRT(dP)		=	0.539

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	40.98
Stack Gas Water Vapor Proportion	B(wo)	=	0.102
Mol. Wt., Stack Gas Dry	M(d)	=	30.67
Mol. Wt., Stack Gas Wet	M(s)	=	29.38
Abs Stack Pressure (in Hg)	P(s)	=	30.84
Avg Stack Velocity (ft/sec)	V(s avg)	=	38.3
Isokineticity (%)	% I	=	107.4
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	121577
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	22[illegible]
Percent XS Air	PEA	=	[illegible]
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0[illegible]
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	[illegible]
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0095
Heat Input Rate, MBtu/hr		=	589.29
Particulate Emission Rate(lb/hr)	E(p)	=	11.840
Particulate Emission Rate(lb/MBtu)		=	0.0201
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 9/30/92 Printed 29-Oct — Test No./Type: M5/0-107
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1710-1900

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	30.10
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		308.71
Gas Meter Final Reading (cu ft)		366.10
Net Gas Sample Volume (cu ft)	V(m)	(57.40)
Vol of Liquid Collected (ml)	Vl(c)	131.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.190)
Wt. of Filter Particulate (gm)		0.0548
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0548)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.33
CO2 Concentration (by CEM)	% CO2	15.07
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.60)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.95	1.80	444.00	75.0	74.0	0.9747
2	4.00	0.67	1.30	448.00	76.0	75.0	0.8185
3	4.00	0.57	1.10	448.00	78.0	75.0	0.7550
B1	4.00	0.59	1.10	448.00	80.0	76.0	0.7681
2	4.00	0.74	1.40	449.00	83.0	77.0	0.8602
3	4.00	0.97	1.80	451.00	85.0	77.0	0.9849
C1	4.00	0.58	1.10	444.00	84.0	78.0	0.7616
2	4.00	0.68	1.30	452.00	87.0	79.0	0.8246
3	4.00	0.53	1.00	451.00	89.0	80.0	0.7280
D1	4.00	1.00	1.90	445.00	87.0	81.0	1.0000
2	4.00	0.79	1.50	447.00	91.0	81.0	0.8888
3	4.00	0.72	1.40	449.00	92.0	82.0	0.8485
E1	4.00	0.59	1.10	446.00	89.0	83.0	0.7681
2	4.00	0.66	1.30	459.00	92.0	84.0	0.8124
3	4.00	0.52	0.99	459.00	93.0	84.0	0.7211
F1	4.00	0.58	1.10	460.00	91.0	84.0	0.7616
2	4.00	0.46	0.87	462.00	92.0	84.0	0.6782
3	4.00	0.39	0.74	461.00	91.0	84.0	0.6245
G1	4.00	0.40	0.76	461.00	91.0	84.0	0.6325
2	4.00	0.45	0.86	461.00	91.0	83.0	0.6708
3	4.00	0.53	1.00	462.00	90.0	83.0	0.7280
H1	4.00	0.60	1.10	441.00	88.0	83.0	0.7746
2	4.00	0.79	1.50	447.00	90.0	83.0	0.8888
3	4.00	0.72	1.40	447.00	91.0	83.0	0.8485
TOTALS	96.00	15.48	29.42	10842.00	2096.0	1937.0	19.1222

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.645
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.226
Avg Stack Temperature (degF)	T(s avg)	=	451.6
Average Meter Temperature (degF)	T(m avg)	=	84.0
Avg SQRT(dP)		=	0.797

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	55.63
Stack Gas Water Vapor Proportion	B(wo)	=	0.100
Mol. Wt., Stack Gas Dry	M(d)	=	30.54
Mol. Wt., Stack Gas Wet	M(s)	=	29.29
Abs Stack Pressure (in Hg)	P(s)	=	31.13
Avg Stack Velocity (ft/sec)	V(s avg)	=	57.2
Isokineticity (%)	% I	=	99.2
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	178667
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	329571
Percent XS Air	PEA	=	16.3
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0152
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	28
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0120
Heat Input Rate, MBtu/hr		=	917.82
Particulate Emission Rate(lb/hr)	E(p)	=	23.278
Particulate Emission Rate(lb/MBtu)		=	0.0254
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 9/30/92 Printed 29-Oct — Test No./Type: M5/0-108
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1949-2139

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	30.10
Stack Static Pressure (in H2O)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		366.30
Gas Meter Final Reading (cu ft)		423.41
Net Gas Sample Volume (cu ft)	V(m)	(57.10)
Vol of Liquid Collected (ml)	Vl(c)	127.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.978)
Wt. of Filter Particulate (gm)		0.0509
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0509)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.34
CO2 Concentration (by CEM)	% CO2	15.03
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.63)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.80	1.50	457.00	73.0	73.0	0.8944
2	4.00	0.65	1.20	458.00	74.0	73.0	0.8062
3	4.00	0.61	1.20	459.00	77.0	73.0	0.7810
B1	4.00	0.65	1.20	460.00	79.0	74.0	0.8062
2	4.00	0.62	1.20	459.00	81.0	74.0	0.7874
3	4.00	0.74	1.40	461.00	83.0	75.0	0.8602
C1	4.00	0.57	1.10	462.00	81.0	75.0	0.7550
2	4.00	0.67	1.30	464.00	84.0	76.0	0.8185
3	4.00	0.61	1.20	464.00	85.0	76.0	0.7810
D1	4.00	0.83	1.60	462.00	83.0	77.0	0.9110
2	4.00	0.81	1.50	462.00	86.0	77.0	0.9000
3	4.00	0.57	1.10	463.00	87.0	78.0	0.7550
E1	4.00	0.67	1.30	465.00	82.0	78.0	0.8185
2	4.00	0.63	1.20	469.00	85.0	78.0	0.7937
3	4.00	0.51	0.97	467.00	86.0	78.0	0.7141
F1	4.00	0.57	1.10	467.00	83.0	78.0	0.7550
2	4.00	0.55	1.00	471.00	84.0	78.0	0.7416
3	4.00	0.44	0.84	470.00	85.0	78.0	0.6633
G1	4.00	0.42	0.80	470.00	84.0	78.0	0.6481
2	4.00	0.52	0.99	471.00	85.0	78.0	0.7211
3	4.00	0.52	0.99	473.00	85.0	78.0	0.7211
H1	4.00	0.72	1.40	448.00	83.0	78.0	0.8485
2	4.00	0.87	1.70	453.00	85.0	78.0	0.9327
3	4.00	0.83	1.60	456.00	87.0	78.0	0.9110
TOTALS	96.00	15.38	29.39	11111.00	1987.0	1837.0	19.1250

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.641
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.225
Avg Stack Temperature (degF)	T(s avg)	=	463.0
Average Meter Temperature (degF)	T(m avg)	=	79.7
Avg SQRT(dP)		=	0.797

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	55.79
Stack Gas Water Vapor Proportion	B(wo)	=	0.097
Mol. Wt., Stack Gas Dry	M(d)	=	30.54
Mol. Wt., Stack Gas Wet	M(s)	=	29.32
Abs Stack Pressure (in Hg)	P(s)	=	31.13
Avg Stack Velocity (ft/sec)	V(s avg)	=	57.5
Isokineticity (%)	% I	=	99.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	178176
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	3[illegible]
Percent XS Air	PEA	=	[illegible]
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0141
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	26
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0112
Heat Input Rate, MBtu/hr		=	914.68
Particulate Emission Rate(lb/hr)	E(p)	=	21.505
Particulate Emission Rate(lb/MBtu)		=	0.0235
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
~~Date: 10/01/92 Printed 29-Oct~~ Test No./Type: M5/0-109
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 2245-0035

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.84
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		423.70
Gas Meter Final Reading (cu ft)		465.10
Net Gas Sample Volume (cu ft)	V(m)	(41.40)
Vol of Liquid Collected (ml)	Vl(c)	84.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.977)
Wt. of Filter Particulate (gm)		0.0611
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0611)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.98
CO2 Concentration (by CEM)	% CO2	15.11
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.91)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.43	0.82	479.00	73.0	73.0	0.6557
2	4.00	0.35	0.67	481.00	73.0	73.0	0.5916
3	4.00	0.28	0.53	479.00	74.0	73.0	0.5292
B1	4.00	0.28	0.53	478.00	75.0	73.0	0.5292
2	4.00	0.36	0.68	476.00	76.0	73.0	0.6000
3	4.00	0.39	0.74	475.00	77.0	73.0	0.6245
C1	4.00	0.29	0.55	473.00	75.0	73.0	0.5385
2	4.00	0.35	0.67	472.00	77.0	73.0	0.5916
3	4.00	0.31	0.59	470.00	77.0	73.0	0.5568
D1	4.00	0.42	0.80	457.00	76.0	73.0	0.6481
2	4.00	0.42	0.80	456.00	78.0	73.0	0.6481
3	4.00	0.33	0.63	454.00	78.0	73.0	0.5745
E1	4.00	0.33	0.63	446.00	75.0	73.0	0.5745
2	4.00	0.34	0.64	450.00	76.0	73.0	0.5831
3	4.00	0.28	0.53	448.00	77.0	73.0	0.5292
F1	4.00	0.26	0.49	437.00	74.0	72.0	0.5099
2	4.00	0.25	0.48	436.00	76.0	72.0	0.5000
3	4.00	0.21	0.40	434.00	75.0	72.0	0.4583
G1	4.00	0.38	0.38	433.00	75.0	72.0	0.6164
2	4.00	0.42	0.42	433.00	75.0	72.0	0.6481
3	4.00	0.48	0.48	433.00	75.0	72.0	0.6928
H1	4.00	0.61	0.61	414.00	75.0	73.0	0.7810
2	4.00	0.78	0.78	413.00	76.0	73.0	0.8832
3	4.00	0.84	0.84	410.00	78.0	74.0	0.9165
TOTALS	96.00	9.39	14.69	10837.00	1816.0	1673.0	14.7806

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.391
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.612
Avg Stack Temperature (degF)	T(s avg)	=	451.5
Average Meter Temperature (degF)	T(m avg)	=	72.7
Avg SQRT(dP)		=	0.616

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	40.56
Stack Gas Water Vapor Proportion	B(wo)	=	0.089
Mol. Wt., Stack Gas Dry	M(d)	=	30.58
Mol. Wt., Stack Gas Wet	M(s)	=	29.45
Abs Stack Pressure (in Hg)	P(s)	=	30.58
Avg Stack Velocity (ft/sec)	V(s avg)	=	44.5
Isokineticity (%)	% I	=	93.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	138156
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	256289
Percent XS Air	PEA	=	22.9
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0232
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	44
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0191
Heat Input Rate, MBtu/hr		=	683.36
Particulate Emission Rate(lb/hr)	E(p)	=	27.515
Particulate Emission Rate(lb/MBtu)		=	0.0403
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 10/02/92 Printed 29-Oct — Test No./Type: M5/0-110
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 0157-0346

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.84
Stack Static Pressure (in H20)	P(stack)	14.000
Gas Meter Initial Reading (cu ft)		465.21
Gas Meter Final Reading (cu ft)		522.71
Net Gas Sample Volume (cu ft)	V(m)	(57.50)
Vol of Liquid Collected (ml)	Vl(c)	126.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.954)
Wt. of Filter Particulate (gm)		0.0702
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0702)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.24
CO2 Concentration (by CEM)	% CO2	15.41
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.35)

Sample Point	dClock Time	Velocity Head, dP (in H20)	Orifice Meter,dH (in H20)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.87	1.70	461.00	70.0	69.0	0.9327
2	4.00	0.71	1.30	465.00	71.0	69.0	0.8426
3	4.00	0.66	1.30	465.00	74.0	70.0	0.8124
B1	4.00	0.71	1.30	465.00	75.0	70.0	0.8426
2	4.00	0.69	1.30	466.00	77.0	71.0	0.8307
3	4.00	0.87	1.70	467.00	79.0	72.0	0.9327
C1	4.00	0.59	1.10	466.00	78.0	72.0	0.7681
2	4.00	0.72	1.40	471.00	80.0	73.0	0.8485
3	4.00	0.64	1.20	471.00	82.0	74.0	0.8000
D1	4.00	0.89	1.70	459.00	80.0	74.0	0.9434
2	4.00	0.81	1.50	463.00	83.0	75.0	0.9000
3	4.00	0.65	1.20	464.00	85.0	75.0	0.8062
E1	4.00	0.69	1.30	446.00	80.0	75.0	0.8307
2	4.00	0.65	1.20	454.00	83.0	76.0	0.8062
3	4.00	0.53	1.00	452.00	84.0	76.0	0.7280
F1	4.00	0.53	1.00	442.00	81.0	76.0	0.7280
2	4.00	0.52	0.99	443.00	83.0	76.0	0.7211
3	4.00	0.44	0.84	442.00	83.0	76.0	0.6633
G1	4.00	0.42	0.80	441.00	83.0	76.0	0.6481
2	4.00	0.52	0.99	442.00	83.0	76.0	0.7211
3	4.00	0.55	1.00	444.00	83.0	76.0	0.7416
H1	4.00	0.47	0.89	419.00	81.0	76.0	0.6856
2	4.00	0.79	1.50	425.00	82.0	76.0	0.8888
3	4.00	0.82	1.60	427.00	82.0	76.0	0.9055
TOTALS	96.00	15.74	29.81	10860.00	1922.0	1699.0	19.3281

FIELD DATA AVERAGES

Avg Velocity Head (in H20)	dP(avg)	=	0.656
Avg Orifice Meter Reading (in H20)	dH(avg)	=	1.242
Avg Stack Temperature (degF)	T(s avg)	=	452.5
Average Meter Temperature (degF)	T(m avg)	=	75.4
Avg SQRT(dP)		=	0.805

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	56.13
Stack Gas Water Vapor Proportion	B(wo)	=	0.096
Mol. Wt., Stack Gas Dry	M(d)	=	30.60
Mol. Wt., Stack Gas Wet	M(s)	=	29.39
Abs Stack Pressure (in Hg)	P(s)	=	30.87
Avg Stack Velocity (ft/sec)	V(s avg)	=	58.0
Isokineticity (%)	% I	=	99.2
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	180323
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	33[illegible]
Percent XS Air	PEA	=	
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0193
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	35
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0152
Heat Input Rate, MBtu/hr		=	930.97
Particulate Emission Rate(lb/hr)	E(p)	=	29.825
Particulate Emission Rate(lb/MBtu)		=	0.0320
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 10/02/92 Printed 29-Oct — Test No./Type: M5/0-111
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 2248-0036

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.71
Stack Static Pressure (in H2O)	P(stack)	9.000
Gas Meter Initial Reading (cu ft)		523.00
Gas Meter Final Reading (cu ft)		566.61
Net Gas Sample Volume (cu ft)	V(m)	(43.61)
Vol of Liquid Collected (ml)	Vl(c)	90.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(4.236)
Wt. of Filter Particulate (gm)		0.0439
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0439)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.59
CO2 Concentration (by CEM)	% CO2	15.61
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.80)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.56	1.10	454.00	73.0	73.0	0.7483
2	4.00	0.38	0.72	459.00	74.0	73.0	0.6164
3	4.00	0.33	0.63	460.00	75.0	74.0	0.5745
B1	4.00	0.33	0.63	459.00	76.0	74.0	0.5745
2	4.00	0.38	0.72	459.00	77.0	74.0	0.6164
3	4.00	0.50	0.95	460.00	79.0	75.0	0.7071
C1	4.00	0.28	0.53	456.00	79.0	75.0	0.5292
2	4.00	0.36	0.68	459.00	80.0	76.0	0.6000
3	4.00	0.31	0.59	457.00	81.0	76.0	0.5568
D1	4.00	0.43	0.82	449.00	81.0	77.0	0.6557
2	4.00	0.43	0.82	449.00	84.0	78.0	0.6557
3	4.00	0.35	0.67	447.00	85.0	78.0	0.5916
E1	4.00	0.33	0.63	441.00	82.0	78.0	0.5745
2	4.00	0.35	0.67	455.00	85.0	79.0	0.5916
3	4.00	0.28	0.53	455.00	86.0	80.0	0.5292
F1	4.00	0.33	0.63	445.00	84.0	80.0	0.5745
2	4.00	0.30	0.57	447.00	86.0	80.0	0.5477
3	4.00	0.25	0.48	445.00	87.0	81.0	0.5000
G1	4.00	0.25	0.48	443.00	86.0	81.0	0.5000
2	4.00	0.30	0.57	443.00	86.0	80.0	0.5477
3	4.00	0.30	0.57	444.00	86.0	80.0	0.5477
H1	4.00	0.35	0.67	425.00	83.0	80.0	0.5916
2	4.00	0.48	0.91	424.00	85.0	80.0	0.6928
3	4.00	0.46	0.87	423.00	85.0	80.0	0.6782
TOTALS	96.00	8.62	16.44	10758.00	1965.0	1782.0	14.3018

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.359
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.665
Avg Stack Temperature (degF)	T(s avg)	=	448.3
Average Meter Temperature (degF)	T(m avg)	=	78.1
Avg SQRT(dP)		=	0.596

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	42.12
Stack Gas Water Vapor Proportion	B(wo)	=	0.091
Mol. Wt., Stack Gas Dry	M(d)	=	30.64
Mol. Wt., Stack Gas Wet	M(s)	=	29.49
Abs Stack Pressure (in Hg)	P(s)	=	30.37
Avg Stack Velocity (ft/sec)	V(s avg)	=	43.1
Isokineticity (%)	% I	=	100.8
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	133096
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	248231
Percent XS Air	PEA	=	20.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0161
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	30
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0129
Heat Input Rate, MBtu/hr		=	673.54
Particulate Emission Rate(lb/hr)	E(p)	=	18.357
Particulate Emission Rate(lb/MBtu)		=	0.0273
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 10/03/92 Printed 29-Oct — Test No./Type: M5/O-112
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 0124-0313

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.71
Stack Static Pressure (in H20)	P(stack)	9.000
Gas Meter Initial Reading (cu ft)		566.71
Gas Meter Final Reading (cu ft)		609.70
Net Gas Sample Volume (cu ft)	V(m)	(43.00)
Vol of Liquid Collected (ml)	Vl(c)	109.3
Vol of Liq @ Std. Conds. (scf)	V(w std)	(5.145)
Wt. of Filter Particulate (gm)		0.0343
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0343)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.48
CO2 Concentration (by CEM)	% CO2	15.44
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.08)

Sample Point	dClock Time	Velocity Head, dP (in H20)	Orifice Meter, dH (in H20)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.45	0.86	442.00	75.0	75.0	0.6708
2	4.00	0.35	0.67	446.00	77.0	76.0	0.5916
3	4.00	0.31	0.59	446.00	79.0	76.0	0.5568
B1	4.00	0.30	0.57	445.00	80.0	77.0	0.5477
2	4.00	0.32	0.61	444.00	81.0	77.0	0.5657
3	4.00	0.40	0.76	445.00	82.0	77.0	0.6325
C1	4.00	0.32	0.61	441.00	81.0	77.0	0.5657
2	4.00	0.36	0.68	444.00	83.0	78.0	0.6000
3	4.00	0.32	0.61	442.00	84.0	78.0	0.5657
D1	4.00	0.43	0.82	436.00	83.0	78.0	0.6557
2	4.00	0.42	0.80	436.00	85.0	79.0	0.6481
3	4.00	0.35	0.67	434.00	86.0	79.0	0.5916
E1	4.00	0.35	0.67	426.00	83.0	79.0	0.5916
2	4.00	0.33	0.63	440.00	85.0	80.0	0.5745
3	4.00	0.31	0.59	439.00	85.0	80.0	0.5568
F1	4.00	0.34	0.65	432.00	83.0	80.0	0.5831
2	4.00	0.27	0.51	433.00	85.0	80.0	0.5196
3	4.00	0.23	0.44	433.00	85.0	80.0	0.4796
G1	4.00	0.21	0.40	431.00	85.0	80.0	0.4583
2	4.00	0.25	0.48	432.00	86.0	80.0	0.5000
3	4.00	0.31	0.59	433.00	86.0	81.0	0.5568
H1	4.00	0.35	0.67	414.00	84.0	80.0	0.5916
2	4.00	0.45	0.86	416.00	86.0	81.0	0.6708
3	4.00	0.44	0.84	413.00	86.0	80.0	0.6633
TOTALS	96.00	8.17	15.58	10443.00	1995.0	1808.0	13.9378

FIELD DATA AVERAGES

Avg Velocity Head (in H20)	dP(avg)	=	0.340
Avg Orifice Meter Reading (in H20)	dH(avg)	=	0.649
Avg Stack Temperature (degF)	T(s avg)	=	435.1
Average Meter Temperature (degF)	T(m avg)	=	79.2
Avg SQRT(dP)		=	0.581

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	41.44
Stack Gas Water Vapor Proportion	B(wo)	=	0.110
Mol. Wt., Stack Gas Dry	M(d)	=	30.61
Mol. Wt., Stack Gas Wet	M(s)	=	29.22
Abs Stack Pressure (in Hg)	P(s)	=	30.37
Avg Stack Velocity (ft/sec)	V(s avg)	=	41.9
Isokineticity (%)	% I	=	102.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	128[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	24.[illegible]
Percent XS Air	PEA	=	19.[illegible]
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0126
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	23
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0102
Heat Input Rate, MBtu/hr		=	654.43
Particulate Emission Rate(lb/hr)	E(p)	=	14.058
Particulate Emission Rate(lb/MBtu)		=	0.0215
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 10/03/92 Printed 29-Oct — Test No./Type: M5/0-113
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 0518-0707

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.71
Stack Static Pressure (in H2O)	P(stack)	9.000
Gas Meter Initial Reading (cu ft)		609.81
Gas Meter Final Reading (cu ft)		642.91
Net Gas Sample Volume (cu ft)	V(m)	(33.10)
Vol of Liquid Collected (ml)	Vl(c)	60.5
Vol of Liq @ Std. Conds. (scf)	V(w std)	(2.848)
Wt. of Filter Particulate (gm)		0.0162
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0162)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	5.69
CO2 Concentration (by CEM)	% CO2	15.66
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(78.65)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.25	0.48	408.00	66.0	65.0	0.5000
2	4.00	0.22	0.42	423.00	66.0	66.0	0.4690
3	4.00	0.20	0.38	427.00	67.0	66.0	0.4472
B1	4.00	0.20	0.38	426.00	68.0	66.0	0.4472
2	4.00	0.20	0.38	425.00	69.0	66.0	0.4472
3	4.00	0.24	0.46	424.00	70.0	67.0	0.4899
C1	4.00	0.18	0.34	422.00	69.0	67.0	0.4243
2	4.00	0.20	0.38	424.00	71.0	67.0	0.4472
3	4.00	0.19	0.36	422.00	72.0	68.0	0.4359
D1	4.00	0.25	0.48	419.00	71.0	68.0	0.5000
2	4.00	0.25	0.48	419.00	72.0	68.0	0.5000
3	4.00	0.21	0.40	417.00	73.0	69.0	0.4583
E1	4.00	0.19	0.36	411.00	71.0	69.0	0.4359
2	4.00	0.21	0.40	415.00	73.0	70.0	0.4583
3	4.00	0.17	0.32	415.00	74.0	70.0	0.4123
F1	4.00	0.19	0.36	403.00	73.0	70.0	0.4359
2	4.00	0.15	0.29	406.00	75.0	71.0	0.3873
3	4.00	0.13	0.25	406.00	75.0	71.0	0.3606
G1	4.00	0.13	0.25	405.00	72.0	72.0	0.3606
2	4.00	0.15	0.29	404.00	72.0	72.0	0.3873
3	4.00	0.17	0.32	404.00	72.0	72.0	0.4123
H1	4.00	0.13	0.25	398.00	72.0	72.0	0.3606
2	4.00	0.28	0.53	399.00	72.0	72.0	0.5292
3	4.00	0.26	0.49	397.00	73.0	73.0	0.5099
TOTALS	96.00	4.75	9.05	9919.00	1708.0	1584.0	10.6162

FIELD DATA AVERAGES

~~Avg Velocity Head (in H2O)~~	~~dP(avg)~~	~~=~~	~~0.195~~
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.377
Avg Stack Temperature (degF)	T(s avg)	=	413.3
Average Meter Temperature (degF)	T(m avg)	=	68.6
Avg SQRT(dP)		=	0.442

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	32.52
Stack Gas Water Vapor Proportion	B(wo)	=	0.061
Mol. Wt., Stack Gas Dry	M(d)	=	30.73
Mol. Wt., Stack Gas Wet	M(s)	=	29.71
Abs Stack Pressure (in Hg)	P(s)	=	30.37
Avg Stack Velocity (ft/sec)	V(s avg)	=	31.3
Isokineticity (%)	% I	=	102.0
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	101580
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	180004
Percent XS Air	PEA	=	37.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0077
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	16
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0070
Heat Input Rate, MBtu/hr		=	451.68
Particulate Emission Rate(lb/hr)	E(p)	=	6.683
Particulate Emission Rate(lb/MBtu)		=	0.0148
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 10/03/92 Printed 29-Oct — Test No./Type: M5/O-114
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 2128-2317

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.71
Stack Static Pressure (in H2O)	P(stack)	5.000
Gas Meter Initial Reading (cu ft)		643.01
Gas Meter Final Reading (cu ft)		672.71
Net Gas Sample Volume (cu ft)	V(m)	(29.70)
Vol of Liquid Collected (ml)	Vl(c)	59.3
Vol of Liq @ Std. Conds. (scf)	V(w std)	(2.791)
Wt. of Filter Particulate (gm)		0.0165
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0165)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	5.74
CO2 Concentration (by CEM)	% CO2	15.36
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(78.90)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.28	0.53	420.00	69.0	69.0	0.5292
2	4.00	0.21	0.40	424.00	69.0	69.0	0.4583
3	4.00	0.17	0.32	425.00	70.0	69.0	0.4123
B1	4.00	0.16	0.30	424.00	70.0	69.0	0.4000
2	4.00	0.17	0.32	423.00	71.0	69.0	0.4123
3	4.00	0.23	0.44	422.00	71.0	69.0	0.4796
C1	4.00	0.14	0.27	420.00	71.0	69.0	0.3742
2	4.00	0.17	0.32	422.00	72.0	69.0	0.4123
3	4.00	0.17	0.32	420.00	72.0	69.0	0.4123
D1	4.00	0.23	0.44	415.00	71.0	69.0	0.4796
2	4.00	0.22	0.42	416.00	73.0	69.0	0.4690
3	4.00	0.17	0.32	413.00	73.0	69.0	0.4123
E1	4.00	0.14	0.27	400.00	71.0	69.0	0.3742
2	4.00	0.18	0.34	407.00	72.0	69.0	0.4243
3	4.00	0.13	0.25	409.00	72.0	69.0	0.3606
F1	4.00	0.10	0.19	390.00	71.0	68.0	0.3162
2	4.00	0.12	0.23	399.00	71.0	69.0	0.3464
3	4.00	0.10	0.19	400.00	71.0	68.0	0.3162
G1	4.00	0.08	0.15	398.00	71.0	68.0	0.2828
2	4.00	0.10	0.19	398.00	71.0	68.0	0.3162
3	4.00	0.11	0.21	399.00	71.0	68.0	0.3317
H1	4.00	0.09	0.17	386.00	70.0	68.0	0.3000
2	4.00	0.17	0.32	390.00	70.0	68.0	0.4123
3	4.00	0.24	0.46	391.00	71.0	68.0	0.4899
TOTALS	96.00	3.88	7.37	9811.00	1704.0	1580.0	9.5221

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.162
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.307
Avg Stack Temperature (degF)	T(s avg)	=	408.8
Average Meter Temperature (degF)	T(m avg)	=	68.4
Avg SQRT(dP)		=	0.397

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	29.19
Stack Gas Water Vapor Proportion	B(wo)	=	0.087
Mol. Wt., Stack Gas Dry	M(d)	=	30.69
Mol. Wt., Stack Gas Wet	M(s)	=	29.58
Abs Stack Pressure (in Hg)	P(s)	=	30.08
Avg Stack Velocity (ft/sec)	V(s avg)	=	28.2
Isokineticity (%)	% I	=	102.8
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	90[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	1[illegible]
Percent XS Air	PEA	=	[illegible]
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0067
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	18
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0080
Heat Input Rate, MBtu/hr		=	400.76
Particulate Emission Rate(lb/hr)	E(p)	=	6.744
Particulate Emission Rate(lb/MBtu)		=	0.0168
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 10/04/92 Printed 29-Oct — Test No./Type: M5/0-115
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 0101-0244

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.74
Stack Static Pressure (in H2O)	P(stack)	9.000
Gas Meter Initial Reading (cu ft)		672.80
Gas Meter Final Reading (cu ft)		715.41
Net Gas Sample Volume (cu ft)	V(m)	(42.60)
Vol of Liquid Collected (ml)	Vl(c)	79.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.719)
Wt. of Filter Particulate (gm)		0.0188
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0188)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.58
CO2 Concentration (by CEM)	% CO2	15.59
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.83)

Sample Point	dClock Time	Velocity Head, dP (in H20)	Orifice Meter, dH (in H20)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.34	0.65	391.00	60.0	60.0	0.5831
2	4.00	0.36	0.68	405.00	62.0	60.0	0.6000
3	4.00	0.32	0.61	412.00	63.0	60.0	0.5657
B1	4.00	0.33	0.63	413.00	64.0	61.0	0.5745
2	4.00	0.36	0.68	413.00	66.0	61.0	0.6000
3	4.00	0.45	0.86	414.00	67.0	61.0	0.6708
C1	4.00	0.33	0.63	414.00	65.0	61.0	0.5745
2	4.00	0.38	0.72	418.00	68.0	62.0	0.6164
3	4.00	0.33	0.63	417.00	68.0	62.0	0.5745
D1	4.00	0.46	0.87	412.00	68.0	63.0	0.6782
2	4.00	0.45	0.86	413.00	71.0	64.0	0.6708
3	4.00	0.37	0.70	412.00	73.0	64.0	0.6083
E1	4.00	0.35	0.67	406.00	70.0	65.0	0.5916
2	4.00	0.36	0.68	416.00	72.0	65.0	0.6000
3	4.00	0.28	0.53	417.00	73.0	65.0	0.5292
F1	4.00	0.31	0.59	415.00	72.0	66.0	0.5568
2	4.00	0.28	0.53	416.00	74.0	67.0	0.5292
3	4.00	0.24	0.46	415.00	74.0	68.0	0.4899
G1	4.00	0.22	0.42	414.00	75.0	68.0	0.4690
2	4.00	0.26	0.49	416.00	75.0	68.0	0.5099
3	4.00	0.28	0.53	417.00	75.0	69.0	0.5292
H1	4.00	0.39	0.74	402.00	74.0	69.0	0.6245
2	4.00	0.45	0.86	402.00	76.0	69.0	0.6708
3	4.00	0.46	0.87	402.00	77.0	70.0	0.6782
TOTALS	96.00	8.36	15.89	9872.00	1682.0	1478.0	14.0950

FIELD DATA AVERAGES

Avg Velocity Head (in H20)	dP(avg)	=	0.348
Avg Orifice Meter Reading (in H20)	dH(avg)	=	0.662
Avg Stack Temperature (degF)	T(s avg)	=	411.3
Average Meter Temperature (degF)	T(m avg)	=	65.8
Avg SQRT(dP)		=	0.587

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	42.15
Stack Gas Water Vapor Proportion	B(wo)	=	0.081
Mol. Wt., Stack Gas Dry	M(d)	=	30.64
Mol. Wt., Stack Gas Wet	M(s)	=	29.61
Abs Stack Pressure (in Hg)	P(s)	=	30.40
Avg Stack Velocity (ft/sec)	V(s avg)	=	41.5
Isokineticity (%)	% I	=	99.3
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	135219
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	238985
Percent XS Air	PEA	=	20.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0059
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	13
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0055
Heat Input Rate, MBtu/hr		=	684.67
Particulate Emission Rate(lb/hr)	E(p)	=	7.959
Particulate Emission Rate(lb/MBtu)		=	0.0116
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 10/04/92 Printed 29-Oct — Test No./Type: M5/0-116
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 2028-2221

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.81
Stack Static Pressure (in H2O)	P(stack)	5.000
Gas Meter Initial Reading (cu ft)		715.51
Gas Meter Final Reading (cu ft)		745.00
Net Gas Sample Volume (cu ft)	V(m)	(29.49)
Vol of Liquid Collected (ml)	Vl(c)	59.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(2.777)
Wt. of Filter Particulate (gm)		0.0481
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0481)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	4.88
CO2 Concentration (by CEM)	% CO2	15.68
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(79.44)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.25	0.48	407.00	64.0	64.0	0.5000
2	4.00	0.18	0.34	412.00	65.0	64.0	0.4243
3	4.00	0.15	0.29	412.00	66.0	64.0	0.3873
B1	4.00	0.15	0.29	411.00	67.0	64.0	0.3873
2	4.00	0.16	0.30	410.00	66.0	64.0	0.4000
3	4.00	0.23	0.44	409.00	67.0	64.0	0.4796
C1	4.00	0.09	0.17	408.00	66.0	64.0	0.3000
2	4.00	0.18	0.34	408.00	67.0	65.0	0.4243
3	4.00	0.17	0.32	407.00	68.0	65.0	0.4123
D1	4.00	0.21	0.40	405.00	67.0	65.0	0.4583
2	4.00	0.20	0.38	405.00	69.0	65.0	0.4472
3	4.00	0.17	0.32	403.00	69.0	65.0	0.4123
E1	4.00	0.15	0.29	395.00	67.0	65.0	0.3873
2	4.00	0.16	0.30	397.00	69.0	65.0	0.4000
3	4.00	0.11	0.21	397.00	69.0	65.0	0.3317
F1	4.00	0.13	0.25	388.00	67.0	65.0	0.3606
2	4.00	0.11	0.21	390.00	68.0	65.0	0.3317
3	4.00	0.11	0.21	389.00	68.0	65.0	0.3317
G1	4.00	0.11	0.21	388.00	68.0	65.0	0.3317
2	4.00	0.12	0.23	388.00	68.0	65.0	0.3464
3	4.00	0.12	0.23	387.00	68.0	65.0	0.3464
H1	4.00	0.17	0.32	382.00	67.0	65.0	0.4123
2	4.00	0.21	0.40	383.00	68.0	65.0	0.4583
3	4.00	0.23	0.44	380.00	69.0	65.0	0.4796
TOTALS	96.00	3.87	7.37	9561.00	1617.0	1488.0	9.5503

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.161
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.307
Avg Stack Temperature (degF)	T(s avg)	=	396.4
Average Meter Temperature (degF)	T(m avg)	=	64.7
Avg SQRT(dP)		=	0.398

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	29.29
Stack Gas Water Vapor Proportion	B(wo)	=	0.087
Mol. Wt., Stack Gas Dry	M(d)	=	30.70
Mol. Wt., Stack Gas Wet	M(s)	=	29.60
Abs Stack Pressure (in Hg)	P(s)	=	30.16
Avg Stack Velocity (ft/sec)	V(s avg)	=	28.0
Isokineticity (%)	% I	=	102.0
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	9[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	1[illegible]
Percent XS Air	PEA	=	
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0253
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	50
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0220
Heat Input Rate, MBtu/hr		=	428.19
Particulate Emission Rate(lb/hr)	E(p)	=	19.861
Particulate Emission Rate(lb/MBtu)		=	0.0464
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier

Date: 10/04/92 Printed 29-Oct — Test No./Type: M5/0-117

Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 2356-0150

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.81
Stack Static Pressure (in H2O)	P(stack)	9.000
Gas Meter Initial Reading (cu ft)		745.10
Gas Meter Final Reading (cu ft)		785.51
Net Gas Sample Volume (cu ft)	V(m)	(40.40)
Vol of Liquid Collected (ml)	Vl(c)	84.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.954)
Wt. of Filter Particulate (gm)		0.0906
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0906)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.51
CO2 Concentration (by CEM)	% CO2	15.95
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.54)

Sample Point	dClock Time	Velocity Head, dP (in H20)	Orifice Meter, dH (in H20)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.56	1.06	410.00	58.0	58.0	0.7483
2	4.00	0.31	0.59	414.00	59.0	58.0	0.5568
3	4.00	0.29	0.55	415.00	61.0	58.0	0.5385
B1	4.00	0.28	0.53	416.00	62.0	58.0	0.5292
2	4.00	0.33	0.63	417.00	63.0	59.0	0.5745
3	4.00	0.44	0.84	418.00	64.0	59.0	0.6633
C1	4.00	0.20	0.38	419.00	63.0	60.0	0.4472
2	4.00	0.34	0.65	424.00	65.0	60.0	0.5831
3	4.00	0.29	0.55	423.00	66.0	61.0	0.5385
D1	4.00	0.40	0.76	411.00	65.0	61.0	0.6325
2	4.00	0.40	0.76	417.00	67.0	62.0	0.6325
3	4.00	0.33	0.63	421.00	68.0	62.0	0.5745
E1	4.00	0.27	0.51	417.00	65.0	62.0	0.5196
2	4.00	0.32	0.61	421.00	68.0	63.0	0.5657
3	4.00	0.22	0.42	423.00	69.0	63.0	0.4690
F1	4.00	0.25	0.48	420.00	66.0	63.0	0.5000
2	4.00	0.25	0.48	423.00	68.0	63.0	0.5000
3	4.00	0.20	0.38	422.00	68.0	63.0	0.4472
G1	4.00	0.19	0.36	421.00	69.0	64.0	0.4359
2	4.00	0.24	0.46	422.00	68.0	64.0	0.4899
3	4.00	0.26	0.49	425.00	69.0	64.0	0.5099
H1	4.00	0.35	0.67	425.00	66.0	64.0	0.5916
2	4.00	0.45	0.86	425.00	68.0	64.0	0.6708
3	4.00	0.45	0.86	425.00	69.0	64.0	0.6708
TOTALS	96.00	7.62	14.51	10074.00	1574.0	1413.0	13.3892

FIELD DATA AVERAGES

Avg Velocity Head (in H20)	dP(avg)	=	0.318
Avg Orifice Meter Reading (in H20)	dH(avg)	=	0.605
Avg Stack Temperature (degF)	T(s avg)	=	419.8
Average Meter Temperature (degF)	T(m avg)	=	62.2
Avg SQRT(dP)		=	0.558

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	40.34
Stack Gas Water Vapor Proportion	B(wo)	=	0.089
Mol. Wt., Stack Gas Dry	M(d)	=	30.69
Mol. Wt., Stack Gas Wet	M(s)	=	29.58
Abs Stack Pressure (in Hg)	P(s)	=	30.47
Avg Stack Velocity (ft/sec)	V(s avg)	=	39.6
Isokineticity (%)	% I	=	101.2
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	126953
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	228058
Percent XS Air	PEA	=	19.6
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0347
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	63
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0277
Heat Input Rate, MBtu/hr		=	645.41
Particulate Emission Rate(lb/hr)	E(p)	=	37.716
Particulate Emission Rate(lb/MBtu)		=	0.0584
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 10/05/92 Printed 29-Oct — Test No./Type: M5/0-118
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 0244-0438

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.81
Stack Static Pressure (in H20)	P(stack)	9.000
Gas Meter Initial Reading (cu ft)		785.61
Gas Meter Final Reading (cu ft)		829.40
Net Gas Sample Volume (cu ft)	V(m)	(43.79)
Vol of Liquid Collected (ml)	Vl(c)	82.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(3.860)
Wt. of Filter Particulate (gm)		0.0939
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.0939)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	4.30
CO2 Concentration (by CEM)	% CO2	15.52
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.18)

Sample Point	dClock Time	Velocity Head, dP (in H20)	Orifice Meter, dH (in H20)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.52	0.99	427.00	57.0	57.0	0.7211
2	4.00	0.39	0.74	433.00	58.0	57.0	0.6245
3	4.00	0.36	0.68	435.00	60.0	57.0	0.6000
B1	4.00	0.35	0.67	435.00	61.0	57.0	0.5916
2	4.00	0.37	0.70	435.00	63.0	58.0	0.6083
3	4.00	0.49	0.93	436.00	64.0	58.0	0.7000
C1	4.00	0.32	0.61	433.00	62.0	59.0	0.5657
2	4.00	0.39	0.74	440.00	65.0	59.0	0.6245
3	4.00	0.33	0.63	440.00	66.0	59.0	0.5745
D1	4.00	0.48	0.91	434.00	64.0	60.0	0.6928
2	4.00	0.46	0.87	436.00	67.0	61.0	0.6782
3	4.00	0.40	0.76	436.00	68.0	61.0	0.6325
E1	4.00	0.37	0.70	422.00	64.0	61.0	0.6083
2	4.00	0.37	0.70	437.00	67.0	61.0	0.6083
3	4.00	0.27	0.51	435.00	68.0	62.0	0.5196
F1	4.00	0.29	0.55	430.00	65.0	62.0	0.5385
2	4.00	0.29	0.55	435.00	67.0	62.0	0.5385
3	4.00	0.25	0.48	432.00	68.0	62.0	0.5000
G1	4.00	0.25	0.48	433.00	68.0	63.0	0.5000
2	4.00	0.28	0.53	433.00	68.0	63.0	0.5292
3	4.00	0.30	0.57	435.00	68.0	63.0	0.5477
H1	4.00	0.44	0.84	416.00	66.0	62.0	0.6633
2	4.00	0.50	0.95	418.00	69.0	63.0	0.7071
3	4.00	0.48	0.91	415.00	70.0	63.0	0.6928
TOTALS	96.00	8.95	17.00	10361.00	1563.0	1387.0	14.5670

FIELD DATA AVERAGES

Avg Velocity Head (in H20)	dP(avg)	=	0.373
Avg Orifice Meter Reading (in H20)	dH(avg)	=	0.708
Avg Stack Temperature (degF)	T(s avg)	=	431.7
Average Meter Temperature (degF)	T(m avg)	=	61.5
Avg SQRT(dP)		=	0.607

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	43.80
Stack Gas Water Vapor Proportion	B(wo)	=	0.081
Mol. Wt., Stack Gas Dry	M(d)	=	30.66
Mol. Wt., Stack Gas Wet	M(s)	=	29.63
Abs Stack Pressure (in Hg)	P(s)	=	30.47
Avg Stack Velocity (ft/sec)	V(s avg)	=	43.3
Isokineticity (%)	% I	=	100.9
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	136273
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	24[illegible]
Percent XS Air	PEA	=	2[illegible]
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.033[illegible]
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	6[illegible]
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0277
Heat Input Rate, MBtu/hr		=	671.03
Particulate Emission Rate(lb/hr)	E(p)	=	39.210
Particulate Emission Rate(lb/MBtu)		=	0.0584
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, September 1992

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Eric Squier
Date: 10/05/92 Printed 29-Oct — Test No./Type: M5/0-119
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 2150-2337

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.240
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.86
Stack Static Pressure (in H2O)	P(stack)	20.000
Gas Meter Initial Reading (cu ft)		829.70
Gas Meter Final Reading (cu ft)		910.61
Net Gas Sample Volume (cu ft)	V(m)	(80.90)
Vol of Liquid Collected (ml)	Vl(c)	178.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(8.378)
Wt. of Filter Particulate (gm)		0.4576
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.4576)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.86
CO2 Concentration (by CEM)	% CO2	15.63
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(80.51)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	2.10	4.00	493.00	67.0	66.0	1.4491
2	4.00	1.30	2.50	503.00	71.0	67.0	1.1402
3	4.00	1.20	2.30	505.00	74.0	68.0	1.0954
B1	4.00	1.20	2.30	505.00	76.0	69.0	1.0954
2	4.00	1.30	2.50	505.00	79.0	69.0	1.1402
3	4.00	1.80	3.40	506.00	81.0	70.0	1.3416
C1	4.00	1.20	2.30	504.00	79.0	70.0	1.0954
2	4.00	1.30	2.50	512.00	82.0	71.0	1.1402
3	4.00	1.20	2.30	512.00	84.0	72.0	1.0954
D1	4.00	1.80	3.40	511.00	82.0	72.0	1.3416
2	4.00	1.70	3.20	514.00	85.0	72.0	1.3038
3	4.00	1.20	2.30	514.00	86.0	73.0	1.0954
E1	4.00	1.30	2.50	517.00	81.0	72.0	1.1402
2	4.00	1.40	2.70	528.00	84.0	73.0	1.1832
3	4.00	1.10	2.10	528.00	84.0	71.0	1.0488
F1	4.00	1.10	2.10	521.00	81.0	72.0	1.0488
2	4.00	0.95	1.80	523.00	83.0	73.0	0.9747
3	4.00	0.79	1.50	523.00	84.0	73.0	0.8888
G1	4.00	0.78	1.50	522.00	84.0	73.0	0.8832
2	4.00	0.90	1.70	524.00	84.0	73.0	0.9487
3	4.00	1.20	2.30	526.00	84.0	74.0	1.0954
H1	4.00	1.70	3.20	494.00	83.0	73.0	1.3038
2	4.00	1.90	3.60	497.00	86.0	74.0	1.3784
3	4.00	1.90	3.60	500.00	88.0	74.0	1.3784
TOTALS	96.00	32.32	61.60	12287.00	1952.0	1640.0	27.6065

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.347
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	2.567
Avg Stack Temperature (degF)	T(s avg)	=	512.0
Average Meter Temperature (degF)	T(m avg)	=	74.8
Avg SQRT(dP)		=	1.150

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	79.38
Stack Gas Water Vapor Proportion	B(wo)	=	0.095
Mol. Wt., Stack Gas Dry	M(d)	=	30.66
Mol. Wt., Stack Gas Wet	M(s)	=	29.45
Abs Stack Pressure (in Hg)	P(s)	=	31.33
Avg Stack Velocity (ft/sec)	V(s avg)	=	84.8
Isokineticity (%)	% I	=	100.6
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	251276
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	488355
Percent XS Air	PEA	=	22.2
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.0669
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	166
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.0726
Heat Input Rate, MBtu/hr		=	1251.74
Particulate Emission Rate(lb/hr)	E(p)	=	191.523
Particulate Emission Rate(lb/MBtu)		=	0.1530
Total Metals Emission Rate(lb/MBtu)		=	0.00000

APPENDIX N

WESTERN COAL TEST

CONTINUOUS EMISSION MONITOR DATA SUMMARY

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
15:00:18	19-Jan-93	-61.88	-63.11	31.40	-72.22	2230.83	2230.67	11.05
15:15:18	19-Jan-93	138.74	138.24	23.39	-128.52	1466.27	1466.13	6.62
15:30:18	19-Jan-93	29.71	29.56	14.46	238.55	241.07	240.86	3.11
15:45:18	19-Jan-93	29.71	29.56	14.46	240.91	246.56	246.35	3.11
16:00:18	19-Jan-93	29.71	29.56	14.46	240.37	246.56	245.17	3.11
16:15:18	19-Jan-93	31.84	31.65	14.54	240.68	239.23	238.99	3.11
16:30:18	19-Jan-93	34.41	34.28	14.54	254.44	234.60	234.24	3.35
16:45:18	19-Jan-93	31.37	31.25	14.65	244.55	235.68	235.39	3.35
17:00:18	19-Jan-93	31.37	31.25	14.65	242.58	240.79	240.47	3.35
17:15:18	19-Jan-93	33.67	33.45	14.65	250.35	239.31	238.94	3.35
17:30:18	19-Jan-93	33.67	33.45	14.65	252.91	240.60	240.35	3.35
17:45:18	19-Jan-93	35.12	35.16	14.65	258.18	243.98	243.66	3.35
18:00:18	19-Jan-93	31.89	31.71	14.65	257.70	241.82	241.43	3.35
18:15:18	19-Jan-93	31.89	31.71	14.65	246.24	241.82	241.43	3.35
18:30:18	19-Jan-93	35.98	35.82	14.65	236.13	246.31	246.04	3.35
18:45:18	19-Jan-93	30.76	30.57	14.65	240.42	238.17	237.91	3.35
19:00:18	19-Jan-93	29.35	29.18	14.65	234.09	238.17	237.91	3.35
19:15:18	19-Jan-93	29.35	29.18	14.65	239.39	238.17	237.91	3.35
19:30:18	19-Jan-93	22.95	22.82	14.65	224.47	240.70	240.42	3.35
19:45:18	19-Jan-93	22.95	22.82	14.65	203.64	240.70	240.42	3.35
20:00:18	19-Jan-93	21.12	21.01	14.65	192.51	243.34	243.05	3.35
20:15:18	19-Jan-93	23.11	22.96	14.65	194.70	235.45	235.09	3.35
20:30:18	19-Jan-93	30.37	30.17	14.54	254.78	242.44	242.13	3.35
20:45:18	19-Jan-93	47.42	47.16	14.54	473.80	350.29	349.95	4.43
21:00:18	19-Jan-93	51.54	51.36	14.54	540.73	244.70	244.45	4.43
21:15:18	19-Jan-93	44.24	43.88	14.54	537.09	234.02	233.80	4.43
21:30:18	19-Jan-93	52.32	52.01	14.54	506.45	229.95	229.61	4.43
21:45:18	19-Jan-93	54.59	54.26	14.54	498.94	228.85	228.48	4.43

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
05:00:18	20-Jan-93	18.62	14.44	4.04	162.44	-2.25	-6.71	14.47
05:15:18	20-Jan-93	72.76	72.23	15.63	393.04	150.81	150.19	4.48
05:30:18	20-Jan-93	93.49	93.09	15.11	449.46	219.36	218.83	4.00
05:45:18	20-Jan-93	59.33	58.78	14.89	466.71	204.40	203.78	4.00
06:00:18	20-Jan-93	71.02	70.51	14.68	464.14	204.40	203.78	4.00
06:15:18	20-Jan-93	47.90	47.24	14.28	454.21	219.85	219.30	4.00
06:30:18	20-Jan-93	47.90	47.24	14.16	490.33	225.61	225.05	4.00
06:45:18	20-Jan-93	38.86	38.22	14.03	498.78	217.66	217.16	4.32
07:00:18	20-Jan-93	41.16	40.49	13.83	471.74	211.78	211.23	4.60
07:15:18	20-Jan-93	31.14	30.46	13.69	421.58	232.23	231.69	4.28
07:30:18	20-Jan-93	31.14	30.46	14.11	287.76	231.09	230.62	3.69
07:45:18	20-Jan-93	33.15	32.52	14.22	296.51	224.53	223.97	3.95
08:00:18	20-Jan-93	28.66	28.11	14.48	234.25	249.92	249.33	3.12
08:15:18	20-Jan-93	29.81	29.15	14.61	247.48	237.71	237.10	3.12
08:30:18	20-Jan-93	25.12	24.54	14.73	230.46	242.58	242.04	3.12
08:45:18	20-Jan-93	25.12	24.54	14.73	234.78	242.58	242.04	3.12
09:00:18	20-Jan-93	25.12	24.54	14.59	248.55	219.16	218.64	3.12
09:15:18	20-Jan-93	25.12	24.54	14.59	230.85	223.68	223.19	3.12
09:30:18	20-Jan-93	124.65	124.06	14.72	256.36	229.27	228.75	3.53
09:45:18	20-Jan-93	40.06	39.43	14.72	324.08	223.09	222.51	3.93
10:00:18	20-Jan-93	111.22	110.57	14.72	290.94	229.07	228.54	3.36
10:15:18	20-Jan-93	320.91	320.20	14.72	274.05	233.93	233.30	3.36
10:30:18	20-Jan-93	281.40	280.69	14.72	241.62	232.03	231.43	3.59
10:45:18	20-Jan-93	475.88	475.26	14.72	210.97	226.51	225.92	3.59
11:00:18	20-Jan-93	378.96	378.48	14.72	230.34	226.51	225.92	3.59
11:15:18	20-Jan-93	480.43	452.35	14.72	230.93	222.61	222.17	3.59
11:30:18	20-Jan-93	196.15	195.88	14.72	237.53	222.61	222.17	3.59
11:45:18	20-Jan-93	106.01	105.73	14.60	233.94	227.01	226.56	3.59

Time	Date	CEM_MEAS DRY_COL OUT	CEM_MEAS DRY_COH OUT	CEM_MEAS DRY_CO2 OUT	CEM_MEAS DRY_NOX OUT	CEM_MEAS DRY_SO2L OUT	CEM_MEAS DRY_SO2H OUT	CEM_MEAS DRY_O2 OUT
12:00:18	20-Jan-93	69.00	68.59	14.46	235.41	221.71	221.25	3.59
12:15:18	20-Jan-93	60.24	59.87	14.38	250.67	218.36	218.01	3.79
12:30:18	20-Jan-93	55.00	54.63	14.38	250.23	217.11	216.70	3.79
12:45:18	20-Jan-93	127.37	127.19	14.48	237.21	223.05	222.55	3.49
13:00:18	20-Jan-93	115.40	115.20	14.48	243.31	223.05	222.55	3.49
13:15:18	20-Jan-93	71.40	71.53	14.48	246.63	224.94	224.34	3.49
13:30:18	20-Jan-93	55.52	55.16	14.38	250.54	220.39	220.04	3.76
13:45:18	20-Jan-93	52.89	55.16	14.38	255.06	211.33	211.03	3.76
14:00:18	20-Jan-93	65.96	65.69	14.29	267.22	209.64	209.16	4.37
14:15:18	20-Jan-93	98.19	97.96	14.47	237.04	218.81	218.57	4.12
14:30:18	20-Jan-93	83.56	83.27	14.47	258.86	227.53	227.05	4.12
14:45:18	20-Jan-93	63.72	63.43	14.47	287.14	225.64	225.35	4.12
15:00:18	20-Jan-93	101.69	101.49	14.47	300.55	225.64	225.35	4.12
15:15:18	20-Jan-93	99.46	99.24	14.47	305.70	239.00	238.73	4.12
15:30:18	20-Jan-93	78.00	77.76	14.47	309.24	252.78	252.50	3.88
15:45:18	20-Jan-93	131.77	131.63	14.47	304.37	258.93	258.68	3.88
16:00:18	20-Jan-93	100.16	100.01	14.47	310.83	257.40	256.96	3.88
16:15:18	20-Jan-93	71.98	71.81	14.47	309.86	265.74	265.38	3.88
16:30:18	20-Jan-93	79.90	79.76	14.58	352.69	275.41	275.15	3.88
16:45:18	20-Jan-93	87.50	87.28	14.15	491.83	322.29	322.04	4.97
17:00:18	20-Jan-93	73.29	73.16	14.01	502.32	279.78	279.37	4.49
17:15:18	20-Jan-93	58.64	58.48	14.17	465.67	283.43	283.31	3.56
17:30:18	20-Jan-93	61.10	61.01	14.03	505.68	273.49	273.32	4.06
17:45:18	20-Jan-93	51.46	51.34	14.03	518.83	266.58	266.29	4.06
18:00:18	20-Jan-93	56.91	56.86	13.89	533.43	261.80	261.52	4.06
18:15:18	20-Jan-93	123.44	123.35	13.89	541.33	264.40	264.22	4.06
18:30:18	20-Jan-93	292.85	292.68	13.89	538.30	251.71	251.56	4.06
18:45:18	20-Jan-93	46.98	47.01	13.89	532.71	256.76	256.62	4.06

APPENDIX O

WESTERN COAL TEST

M17 PARTICULATE LOADING AT ESP INLET—DATA SUMMARY

B&W/WP&L, Reburn Test Series, Low Sulfur Coal, Jan 93

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling

Date: 1/19/93 Printed 02-Feb — Test No./Type: M17-11, 110MWe

Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1445-1710

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	30.28
Stack Static Pressure (in H2O)	P(stack)	18.000
Gas Meter Initial Reading (cu ft)		425.97
Gas Meter Final Reading (cu ft)		508.33
Net Gas Sample Volume (cu ft)	V(m)	(82.36)
Vol of Liquid Collected (ml)	Vl(c)	168.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.908)
Wt. of Filter Particulate (gm)		20.3396
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(20.3396)
O2 Concentration (by CEM)	% O2	3.23
CO2 Concentration (by CEM)	% CO2	15.46
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.31)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.40	2.52	483.00	71.0	70.0	1.1832
2	4.00	1.20	2.16	489.00	73.0	70.0	1.0954
3	4.00	1.40	2.52	495.00	75.0	71.0	1.1832
B1	4.00	1.50	2.70	437.00	76.0	72.0	1.2247
2	4.00	1.15	2.07	436.00	78.0	72.0	1.0724
3	4.00	1.10	1.98	474.00	78.0	72.0	1.0488
C1	4.00	1.40	2.52	450.00	78.0	73.0	1.1832
2	4.00	1.35	2.43	461.00	79.0	73.0	1.1619
3	4.00	1.60	2.88	492.00	81.0	74.0	1.2649
D1	4.00	1.85	3.33	470.00	75.0	73.0	1.3601
2	4.00	1.50	2.70	474.00	78.0	73.0	1.2247
3	4.00	1.55	2.79	502.00	83.0	74.0	1.2450
E1	4.00	1.35	2.43	471.00	80.0	74.0	1.1619
2	4.00	1.30	2.34	484.00	81.0	74.0	1.1402
3	4.00	1.20	2.16	497.00	82.0	74.0	1.0954
E1	4.00	1.20	2.16	508.00	82.0	74.0	1.0954
2	4.00	1.20	2.16	513.00	83.0	74.0	1.0954
3	4.00	1.20	2.16	530.00	83.0	74.0	1.0488
F1	4.00	1.10	1.98	488.00	79.0	74.0	1.0488
2	4.00	1.50	2.70	490.00	80.0	75.0	1.0488
3	4.00	1.50	2.70	495.00	82.0	75.0	1.2247
F1	4.00	1.25	2.25	517.00	84.0	75.0	1.1180
2	4.00	1.25	2.25	529.00	85.0	75.0	1.1180
3	4.00	1.25	2.25	537.00	85.0	75.0	1.1180
TOTALS	96.00	32.30	58.14	11722.00	1911.00	1760.0	27.5614

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.346
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	2.423
Avg Stack Temperature (degF)	T(s avg)	=	486.4
Average Meter Temperature (degF)	T(m avg)	=	76.5
Avg SQRT(dP)		=	1.146

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	81.66
Stack Gas Water Vapor Proportion	B(wo)	=	0.086
Mol. Wt., Stack Gas Dry	M(d)	=	30.60
Mol. Wt., Stack Gas Wet	M(s)	=	29.49
Abs Stack Pressure (in Hg)	P(s)	=	31.60
Avg Stack Velocity (ft/sec)	V(s avg)	=	83.2
Isokineticity (%)	% I	=	106.4
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	256902
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	479182
Percent XS Air	PEA	=	17.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	3.8432
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	6928
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	3.0278
Heat Input Rate, MBtu/hr		=	1352.84
Particulate Emission Rate(lb/hr)	E(p)	=	8461.372
Particulate Emission Rate(lb/MBtu)		=	6.3770

B&W/WP&L, Reburn Test Series, Low Sulfur Coal, Jan 93

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling
Date: 1/20/93 Printed 02-Feb — Test No./Type: M17-I2, B2MWe
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1110-1315

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.232
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		508.93
Gas Meter Final Reading (cu ft)		569.83
Net Gas Sample Volume (cu ft)	V(m)	(60.89)
Vol of Liquid Collected (ml)	Vl(c)	157.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.390)
Wt. of Filter Particulate (gm)		5.6043
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.6043)
O2 Concentration (by CEM)	% O2	3.23
CO2 Concentration (by CEM)	% CO2	15.46
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.31)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.70	1.26	468.00	64.0	63.0	0.8367
2	4.00	0.62	1.12	457.00	61.0	61.0	0.7874
3	4.00	0.73	1.31	460.00	62.0	61.0	0.8544
B1	4.00	0.73	1.31	433.00	63.0	61.0	0.8544
2	4.00	0.66	1.19	464.00	66.0	62.0	0.8124
3	4.00	0.62	1.12	469.00	67.0	62.0	0.7874
C1	4.00	0.83	1.49	420.00	68.0	63.0	0.9110
2	4.00	0.77	1.39	432.00	70.0	64.0	0.8775
3	4.00	0.86	1.55	448.00	72.0	64.0	0.9274
D1	4.00	0.86	1.55	409.00	70.0	65.0	0.9274
2	4.00	0.88	1.58	419.00	73.0	65.0	0.9381
3	4.00	0.88	1.58	433.00	74.0	66.0	0.9381
E1	4.00	0.69	1.24	424.00	69.0	66.0	0.8307
2	4.00	0.72	1.30	430.00	72.0	67.0	0.8485
3	4.00	0.68	1.22	441.00	73.0	67.0	0.8307
E1	4.00	0.69	1.24	449.00	74.0	67.0	0.8062
2	4.00	0.65	1.17	456.00	75.0	68.0	0.7937
3	4.00	0.63	1.13	463.00	75.0	68.0	0.8718
F1	4.00	0.76	1.37	446.00	72.0	68.0	0.8718
2	4.00	0.73	1.31	455.00	74.0	68.0	0.8718
3	4.00	0.68	1.22	458.00	74.0	68.0	0.8246
F1	4.00	0.66	1.19	460.00	75.0	69.0	0.8124
2	4.00	0.68	1.22	465.00	76.0	69.0	0.8246
3	4.00	0.72	1.30	465.00	76.0	69.0	0.8485
TOTALS	96.00	17.43	31.37	10724.00	1695.00	1571.0	20.4874

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.726
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.307
Avg Stack Temperature (degF)	T(s avg)	=	446.8
Average Meter Temperature (degF)	T(m avg)	=	68.0
Avg SQRT(dP)		=	0.854

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	59.85
Stack Gas Water Vapor Proportion	B(wo)	=	0.110
Mol. Wt., Stack Gas Dry	M(d)	=	30.60
Mol. Wt., Stack Gas Wet	M(s)	=	29.22
Abs Stack Pressure (in Hg)	P(s)	=	30.36
Avg Stack Velocity (ft/sec)	V(s avg)	=	62.0
Isokineticity (%)	% I	=	108.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	187728
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	357
Percent XS Air	PEA	=	17.
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.4450
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	2605
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.1384
Heat Input Rate, MBtu/hr		=	988.57
Particulate Emission Rate(lb/hr)	E(p)	=	2324.692
Particulate Emission Rate(lb/MBtu)		=	2.3976

B&W/WP&L, Reburn Test Series, Low Sulfur Coal, Jan 93

ESP Inlet Method 17 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Bowling
Date: 1/20/93 Printed 02-Feb — Test No./Type: M17-I3, 60MWe
Sample Location: Unit 2, ESP Inlet — Start/Stop Time: 1354-1651

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.256
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9900
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	6.000
Gas Meter Initial Reading (cu ft)		570.02
Gas Meter Final Reading (cu ft)		620.65
Net Gas Sample Volume (cu ft)	V(m)	(50.63)
Vol of Liquid Collected (ml)	Vl(c)	128.3
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.039)
Wt. of Filter Particulate (gm)		5.3468
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(5.3468)
O2 Concentration (by CEM)	% O2	3.23
CO2 Concentration (by CEM)	% CO2	15.46
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.31)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter,dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.38	0.68	418.00	68.0	67.0	0.6164
2	4.00	0.35	0.63	420.00	68.0	67.0	0.5916
3	4.00	0.37	0.67	429.00	67.0	66.0	0.6083
B1	4.00	0.32	0.58	433.00	68.0	66.0	0.5657
2	4.00	0.30	0.54	435.00	69.0	66.0	0.5477
3	4.00	0.35	0.63	439.00	70.0	67.0	0.5916
C1	4.00	0.41	0.74	395.00	70.0	67.0	0.6403
2	4.00	0.45	0.81	384.00	72.0	67.0	0.6708
3	4.00	0.37	0.67	389.00	73.0	68.0	0.6083
D1	4.00	0.36	0.65	408.00	74.0	68.0	0.6000
2	4.00	0.44	0.79	425.00	74.0	68.0	0.6633
3	4.00	0.43	0.77	435.00	75.0	69.0	0.6557
E1	4.00	0.30	0.54	388.00	72.0	68.0	0.5477
2	4.00	0.33	0.59	389.00	74.0	68.0	0.5745
3	4.00	0.31	0.56	392.00	75.0	69.0	0.5477
E1	4.00	0.30	0.54	400.00	75.0	69.0	0.5196
2	4.00	0.27	0.49	405.00	76.0	69.0	0.5196
3	4.00	0.27	0.49	420.00	75.0	69.0	0.5745
F1	4.00	0.33	0.59	400.00	72.0	69.0	0.5745
2	4.00	0.34	0.61	403.00	73.0	69.0	0.5745
3	4.00	0.30	0.54	407.00	75.0	69.0	0.5477
F1	4.00	0.30	0.54	414.00	75.0	69.0	0.5477
2	4.00	0.30	0.54	418.00	76.0	69.0	0.5477
3	4.00	0.28	0.50	424.00	76.0	69.0	0.5292
TOTALS	96.00	8.16	14.69	9870.00	1742.00	1632.0	13.9646

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.340
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.612
Avg Stack Temperature (degF)	T(s avg)	=	411.3
Average Meter Temperature (degF)	T(m avg)	=	70.3
Avg SQRT(dP)		=	0.582

CALCULATED VALUES

Meter Volume (std, cu. ft.)	V(m std)	=	49.46
Stack Gas Water Vapor Proportion	B(wo)	=	0.109
Mol. Wt., Stack Gas Dry	M(d)	=	30.60
Mol. Wt., Stack Gas Wet	M(s)	=	29.23
Abs Stack Pressure (in Hg)	P(s)	=	30.06
Avg Stack Velocity (ft/sec)	V(s avg)	=	41.6
Isokineticity (%)	% I	=	106.5
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	130042
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	239650
Percent XS Air	PEA	=	17.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	1.6679
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	3007
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	1.3141
Heat Input Rate, MBtu/hr		=	684.80
Particulate Emission Rate(lb/hr)	E(p)	=	1858.642
Particulate Emission Rate(lb/MBtu)		=	2.7676

APPENDIX P

WESTERN COAL TEST

M5 PARTICULATE LOADING AT ESP OUTLET—DATA SUMMARY

B&W/WP&L, Reburn Test Series, Low Sulfur Coal, Jan 93

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Janek
Date: 1/19/93 Printed 02-Feb — Test No./Type: M5/0-1
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1100-1252

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.236
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta).	(96.00)
Barometric Pressure (in Hg)	P(b)	30.28
Stack Static Pressure (in H2O)	P(stack)	18.000
Gas Meter Initial Reading (cu ft)		734.41
Gas Meter Final Reading (cu ft)		813.81
Net Gas Sample Volume (cu ft)	V(m)	(79.39)
Vol of Liquid Collected (ml)	Vl(c)	193.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(9.085)
Wt. of Filter Particulate (gm)		0.6457
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.6457)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.23
CO2 Concentration (by CEM)	% CO2	15.46
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.31)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	1.20	2.46	487.00	85.0	84.0	1.0954
2	4.00	1.20	2.46	497.00	81.0	82.0	1.0954
3	4.00	0.65	1.33	499.00	90.0	88.0	0.8062
B1	4.00	1.20	2.46	512.00	84.0	83.0	1.0954
2	4.00	1.30	2.67	513.00	86.0	83.0	1.1402
3	4.00	1.50	3.08	514.00	89.0	83.0	1.2247
C1	4.00	1.40	2.87	514.00	91.0	84.0	1.1832
2	4.00	1.30	2.67	513.00	92.0	84.0	1.1402
3	4.00	1.40	2.87	515.00	94.0	84.0	1.1832
D1	4.00	1.70	3.49	518.00	91.0	85.0	1.3038
2	4.00	1.80	3.69	520.00	94.0	85.0	1.3416
3	4.00	1.30	2.67	520.00	96.0	85.0	1.1402
E1	4.00	0.76	1.56	535.00	89.0	85.0	0.8718
2	4.00	0.82	1.68	534.00	92.0	86.0	0.9055
3	4.00	1.30	2.67	540.00	93.0	85.0	1.1402
F1	4.00	1.30	2.67	541.00	95.0	86.0	1.1402
2	4.00	0.95	1.95	539.00	95.0	86.0	0.9747
3	4.00	0.94	1.93	540.00	96.0	86.0	1.1402
G1	4.00	0.94	1.93	538.00	96.0	87.0	0.9747
2	4.00	1.20	2.46	540.00	96.0	87.0	0.9695
3	4.00	1.90	3.90	541.00	97.0	87.0	0.9695
H1	4.00	1.90	3.90	542.00	99.0	87.0	1.0954
2	4.00	1.00	2.05	542.00	100.0	88.0	1.3784
3	4.00	1.20	2.46	543.00	99.0	88.0	1.3784
TOTALS	96.00	30.16	61.83	12597.0	2220.0	1960.0	26.6883

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	1.257
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	2.576
Avg Stack Temperature (degF)	T(s avg)	=	524.9
Average Meter Temperature (degF)	T(m avg)	=	87.1
Avg SQRT(dP)		=	1.112

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	77.92
Stack Gas Water Vapor Proportion	B(wo)	=	0.104
Mol. Wt., Stack Gas Dry	M(d)	=	30.60
Mol. Wt., Stack Gas Wet	M(s)	=	29.29
Abs Stack Pressure (in Hg)	P(s)	=	31.60
Avg Stack Velocity (ft/sec)	V(s avg)	=	82.4
Isokineticity (%)	% I	=	106.7
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	240629
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	474474
Percent XS Air	PEA	=	17.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.1279
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	230
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.1007
Heat Input Rate, MBtu/hr		=	1267.15
Particulate Emission Rate(lb/hr)	E(p)	=	263.656
Particulate Emission Rate(lb/MBtu)		=	0.2121
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, Low Sulfur Coal, Jan 93

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Janek

Date: 1/20/93 Printed 02-Feb Test No./Type: M5/0-2

Sample Location: Unit 2, ESP Outlet Start/Stop Time: 1100-1252

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.236
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	10.000
Gas Meter Initial Reading (cu ft)		814.00
Gas Meter Final Reading (cu ft)		869.51
Net Gas Sample Volume (cu ft)	V(m)	(55.50)
Vol of Liquid Collected (ml)	Vl(c)	145.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(6.825)
Wt. of Filter Particulate (gm)		0.5965
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.5965)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.23
CO2 Concentration (by CEM)	% CO2	15.46
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.31)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.62	1.27	458.00	63.0	61.0	0.7874
2	4.00	0.62	1.27	459.00	69.0	67.0	0.7874
3	4.00	0.78	1.60	460.00	69.0	67.0	0.8832
B1	4.00	0.78	1.60	460.00	72.0	68.0	0.8832
2	4.00	0.67	1.37	460.00	74.0	69.0	0.8185
3	4.00	0.72	1.48	467.00	77.0	71.0	0.8485
C1	4.00	0.56	1.15	469.00	79.0	72.0	0.7483
2	4.00	0.52	1.07	470.00	80.0	73.0	0.7211
3	4.00	0.61	1.25	502.00	81.0	73.0	0.7810
D1	4.00	0.65	1.33	514.00	82.0	74.0	0.8062
2	4.00	0.74	1.52	460.00	84.0	75.0	0.8602
3	4.00	0.77	1.58	463.00	85.0	76.0	0.8775
E1	4.00	0.49	1.00	465.00	83.0	78.0	0.7000
2	4.00	0.55	1.13	468.00	88.0	78.0	0.7416
3	4.00	0.43	0.88	468.00	88.0	79.0	0.6557
F1	4.00	0.43	0.88	470.00	89.0	80.0	0.6557
2	4.00	0.35	0.72	485.00	89.0	81.0	0.5916
3	4.00	0.50	1.03	500.00	90.0	82.0	0.6557
G1	4.00	0.56	1.15	510.00	91.0	82.0	0.5916
2	4.00	0.55	1.13	520.00	91.0	82.0	0.7071
3	4.00	0.58	1.19	530.00	92.0	84.0	0.7483
H1	4.00	0.64	1.31	489.00	92.0	83.0	0.7416
2	4.00	0.53	1.09	470.00	92.0	84.0	0.7616
3	4.00	0.38	0.78	473.00	93.0	84.0	0.8000
TOTALS	96.00	14.03	28.76	11490.0	1993.0	1739.0	18.1533

FIELD DATA AVERAGES

Avg Velocity Head (in H2O)	dP(avg)	=	0.585
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	1.198
Avg Stack Temperature (degF)	T(s avg)	=	478.8
Average Meter Temperature (degF)	T(m avg)	=	77.8
Avg SQRT(dP)		=	0.756

CALCULATED VALUES

Meter Volume (std. cu. ft.)	V(m std)	=	54.04
Stack Gas Water Vapor Proportion	B(wo)	=	0.112
Mol. Wt., Stack Gas Dry	M(d)	=	30.60
Mol. Wt., Stack Gas Wet	M(s)	=	29.19
Abs Stack Pressure (in Hg)	P(s)	=	30.36
Avg Stack Velocity (ft/sec)	V(s avg)	=	55.9
Isokineticity (%)	% I	=	109.1
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	163[illegible]
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	32[illegible]
Percent XS Air	PEA	=	[illegible]
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.1703
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	307
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.1342
Heat Input Rate, MBtu/hr		=	859.19
Particulate Emission Rate(lb/hr)	E(p)	=	238.151
Particulate Emission Rate(lb/MBtu)		=	0.2826
Total Metals Emission Rate(lb/MBtu)		=	0.00000

B&W/WP&L, Reburn Test Series, Low Sulfur Coal, Jan 93

ESP Outlet Method 5 Samples

ISOKINETIC PERFORMANCE WORKSHEET AND PARTICULATE CALCULATIONS

Plant: WPL — Performed by: Janek
Date: 1/20/93 Printed 02-Feb — Test No./Type: M5/0-3
Sample Location: Unit 2, ESP Outlet — Start/Stop Time: 1100-1252

PARAMETER	SYMBOL	VALUE (calc.)
Nozzle Diameter, Actual (in)	N(d)	0.251
Pitot Tube Correction Factor	C(p)	0.8400
Gas Meter Correction Factor	(alpha)	0.9990
Stack (Duct) Dimensions (in):		
Radius (if round)	R	0.00
Length (if rectangular)	L	64.00
Width (if rectangular)	W	216.00
Area of Stack (sq ft)	A(s)	(96.00)
# of Sample Points	#	24
Total Sampling Time (min)	(theta)	(96.00)
Barometric Pressure (in Hg)	P(b)	29.62
Stack Static Pressure (in H2O)	P(stack)	4.000
Gas Meter Initial Reading (cu ft)		869.60
Gas Meter Final Reading (cu ft)		917.51
Net Gas Sample Volume (cu ft)	V(m)	(47.90)
Vol of Liquid Collected (ml)	Vl(c)	159.0
Vol of Liq @ Std. Conds. (scf)	V(w std)	(7.484)
Wt. of Filter Particulate (gm)		0.5459
Wt. of Probe Wash Particulate (gm)		0.0000
Wt of Combined Particulate (gm)	M(p)	(0.5459)
Wt of Total Metals (ug)	M(m)	0.0
O2 Concentration (by CEM)	% O2	3.23
CO2 Concentration (by CEM)	% CO2	15.46
CO Concentration (by CEM)	% CO	0.0
N2 Concentration (by diff.)	% N2	(81.31)

Sample Point	dClock Time	Velocity Head, dP (in H2O)	Orifice Meter, dH (in H2O)	Stack Temp (degF)	Gas Temp in	Meter (degF) out	SQRT(dP)
A1	4.00	0.45	0.92	454.00	78.0	79.0	0.6708
2	4.00	0.43	0.88	452.00	78.0	79.0	0.6557
3	4.00	0.44	0.90	451.00	80.0	79.0	0.6633
B1	4.00	0.43	0.88	451.00	81.0	79.0	0.6557
2	4.00	0.44	0.90	460.00	84.0	79.0	0.6633
3	4.00	0.43	0.88	472.00	85.0	80.0	0.6557
C1	4.00	0.35	0.72	450.00	85.0	81.0	0.5916
2	4.00	0.41	0.84	448.00	87.0	81.0	0.6403
3	4.00	0.44	0.90	450.00	91.0	83.0	0.6633
D1	4.00	0.47	0.96	450.00	89.0	82.0	0.6856
2	4.00	0.45	0.92	449.00	90.0	83.0	0.6708
3	4.00	0.41	0.84	446.00	90.0	83.0	0.6403
E1	4.00	0.27	0.55	436.00	87.0	83.0	0.5196
2	4.00	0.35	0.72	437.00	88.0	84.0	0.5916
3	4.00	0.34	0.70	437.00	89.0	84.0	0.5831
F1	4.00	0.37	0.76	436.00	90.0	84.0	0.6083
2	4.00	0.46	0.94	436.00	91.0	85.0	0.6782
3	4.00	0.34	0.70	435.00	92.0	85.0	0.6083
G1	4.00	0.32	0.66	434.00	92.0	85.0	0.6782
2	4.00	0.31	0.64	433.00	92.0	85.0	0.5831
3	4.00	0.36	0.74	434.00	92.0	86.0	0.5657
H1	4.00	0.35	0.72	433.00	92.0	86.0	0.5568
2	4.00	0.31	0.64	431.00	94.0	87.0	0.6000
3	4.00	0.34	0.70	431.00	94.0	87.0	0.5916
TOTALS	96.00	9.27	19.00	10646.0	2111.0	1902.0	15.0211

FIELD DATA AVERAGES

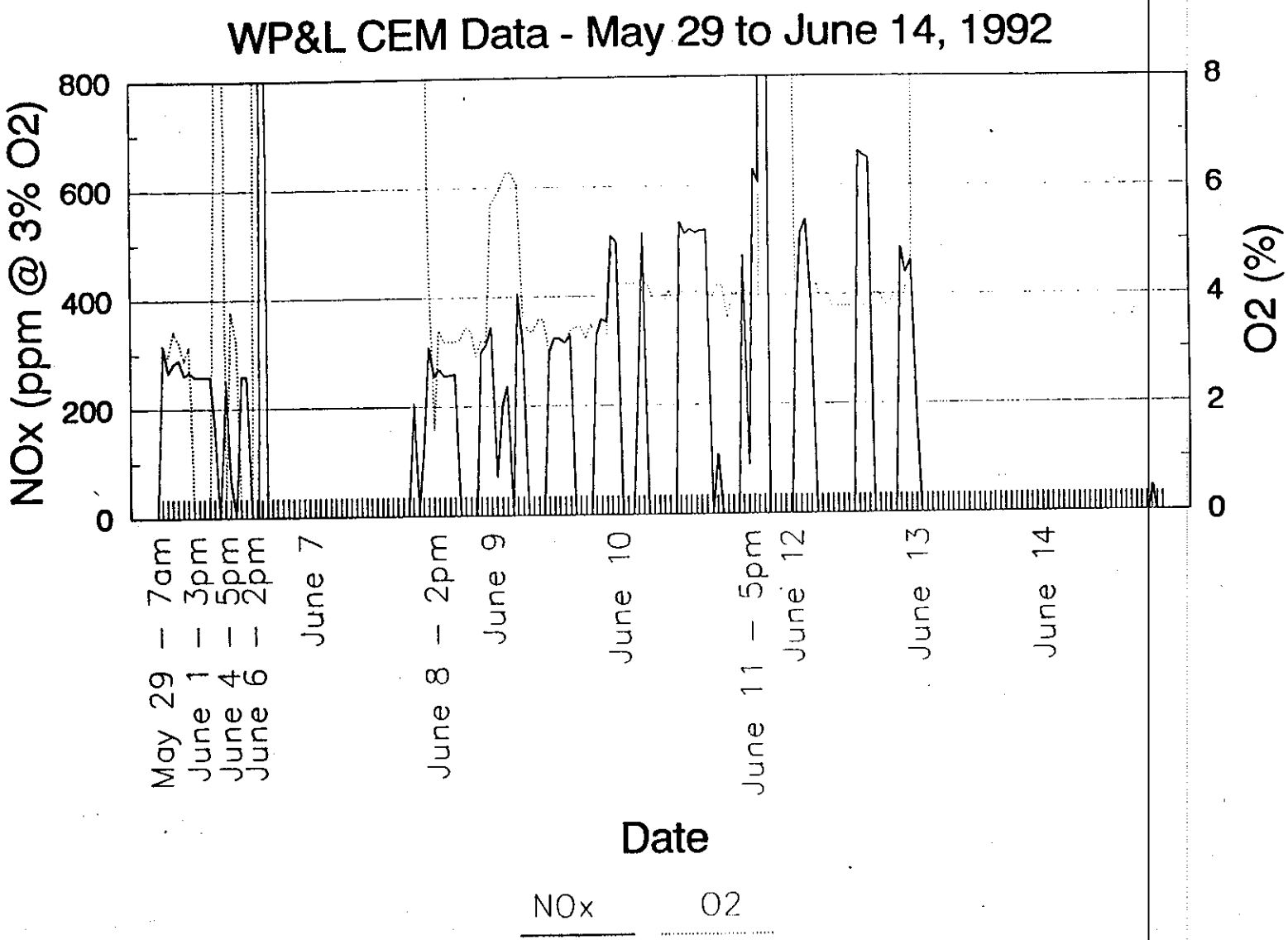
Avg Velocity Head (in H2O)	dP(avg)	=	0.38E
Avg Orifice Meter Reading (in H2O)	dH(avg)	=	0.792
Avg Stack Temperature (degF)	T(s avg)	=	443.6
Average Meter Temperature (degF)	T(m avg)	=	83.6
Avg SQRT(dP)		=	0.626

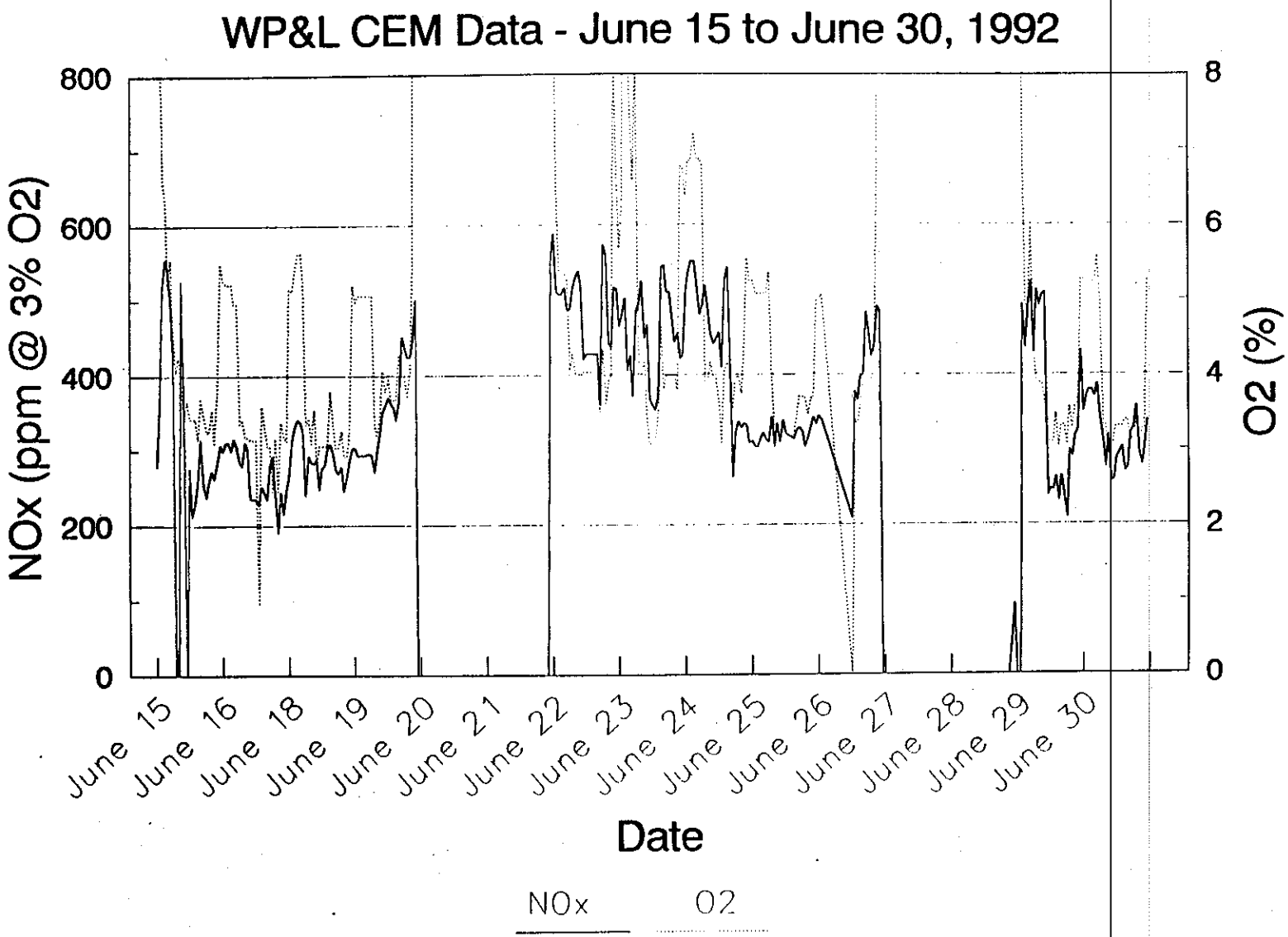
CALCULATED VALUES

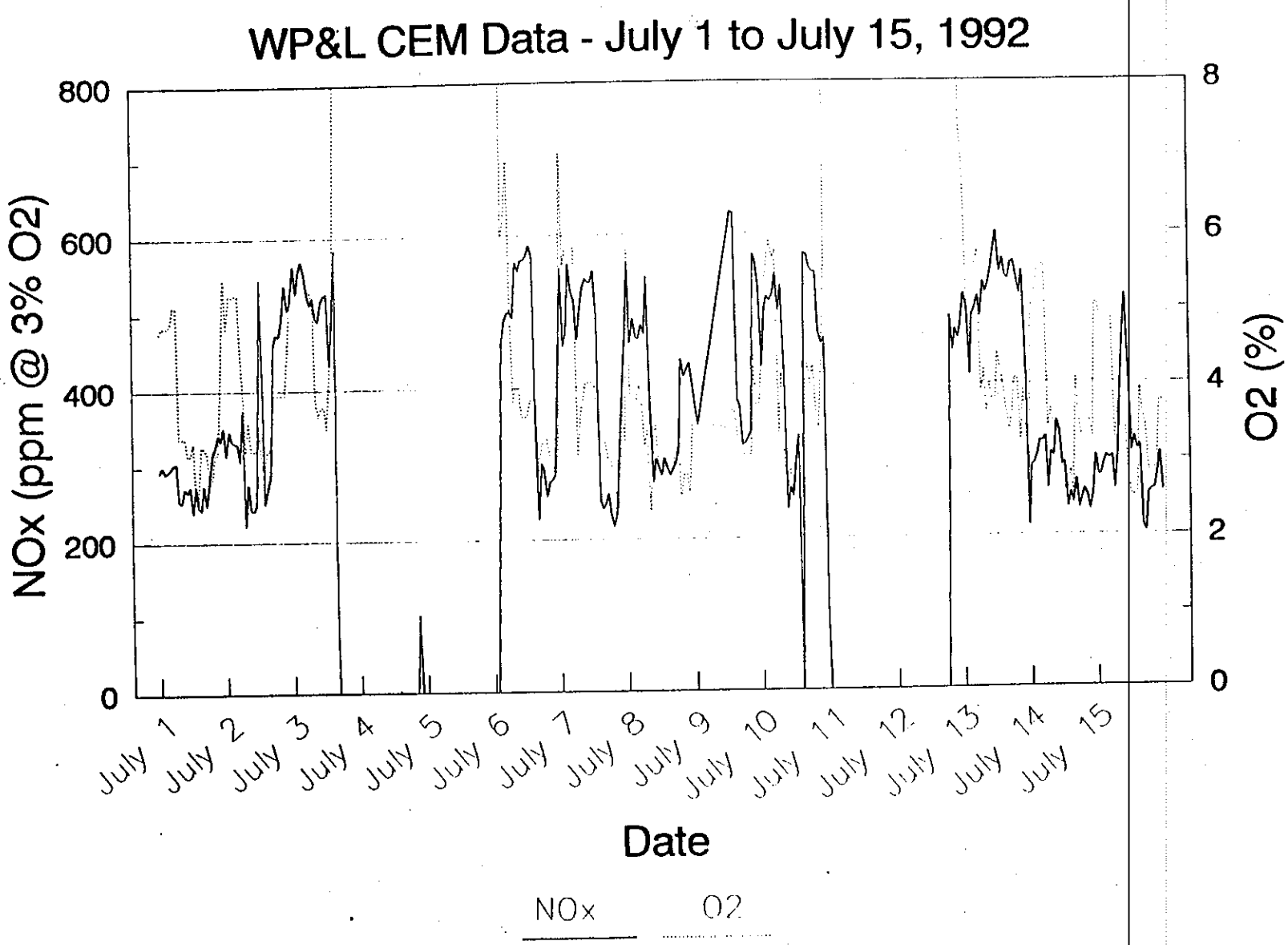
Meter Volume (std, cu. ft.)	V(m std)	=	46.09
Stack Gas Water Vapor Proportion	B(wo)	=	0.140
Mol. Wt., Stack Gas Dry	M(d)	=	30.60
Mol. Wt., Stack Gas Wet	M(s)	=	26.64
Abs Stack Pressure (in Hg)	P(s)	=	29.91
Avg Stack Velocity (ft/sec)	V(s avg)	=	46.0
Isokineticity (%)	% I	=	100.8
Stack Gas STD Vol Flow (dscfm)	Q(s)	=	133159
Actual Stack Gas Vol Flow (acfm)	Q(a)	=	264936
Percent XS Air	PEA	=	17.7
Particulate Loading, dry(gr/dscf)	C(s std)	=	0.1828
Particulate Loading, @7% O2(mg/dscm)	C(s std)	=	329
Particulate Loading, dry @ 7 % O2 (gr/dscf)		=	0.1440
Heat Input Rate, MBtu/hr		=	701.21
Particulate Emission Rate(lb/hr)	E(p)	=	208.556
Particulate Emission Rate(lb/MBtu)		=	0.3032
Total Metals Emission Rate(lb/MBtu)		=	0.00000

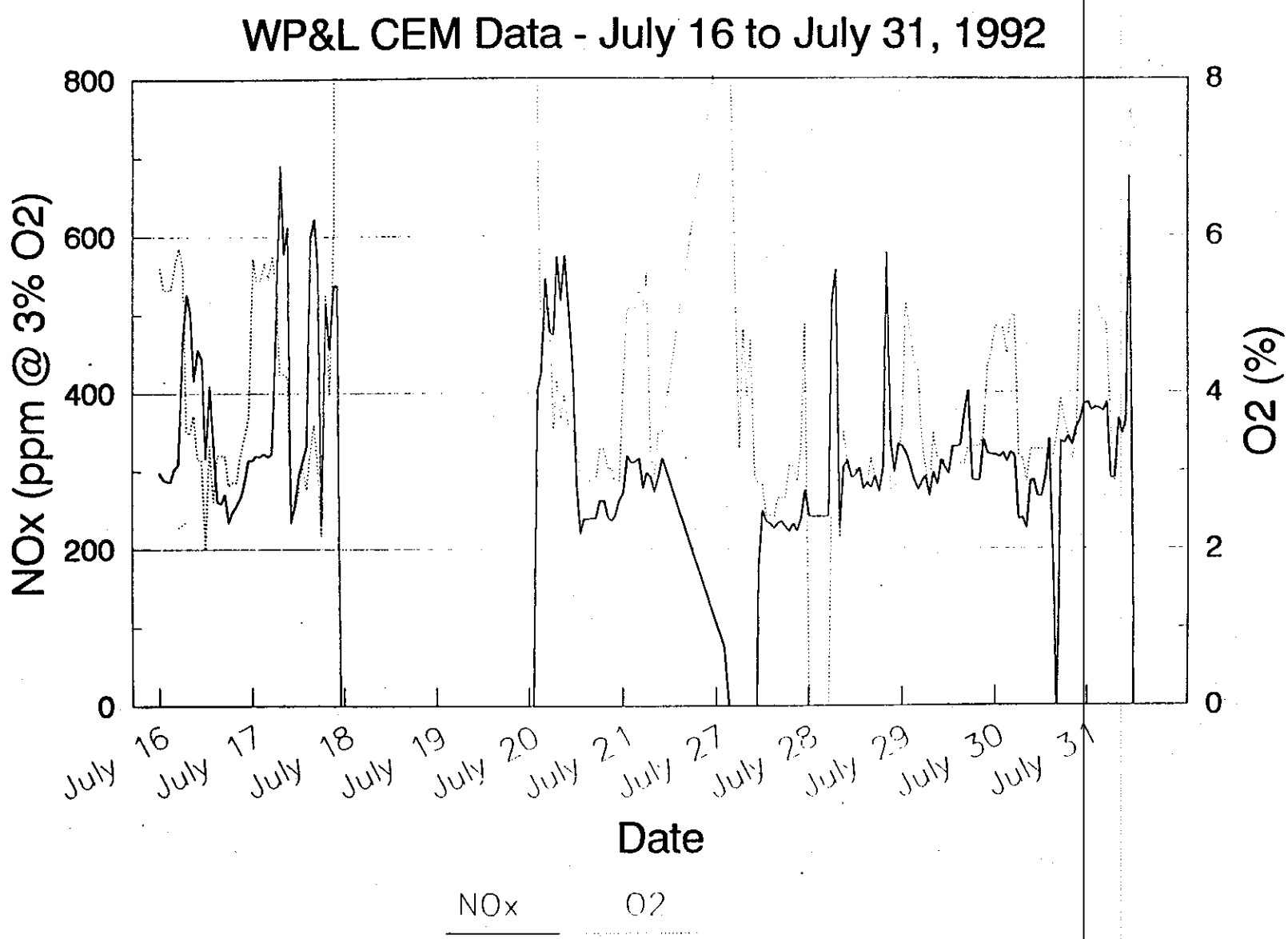
APPENDIX Q

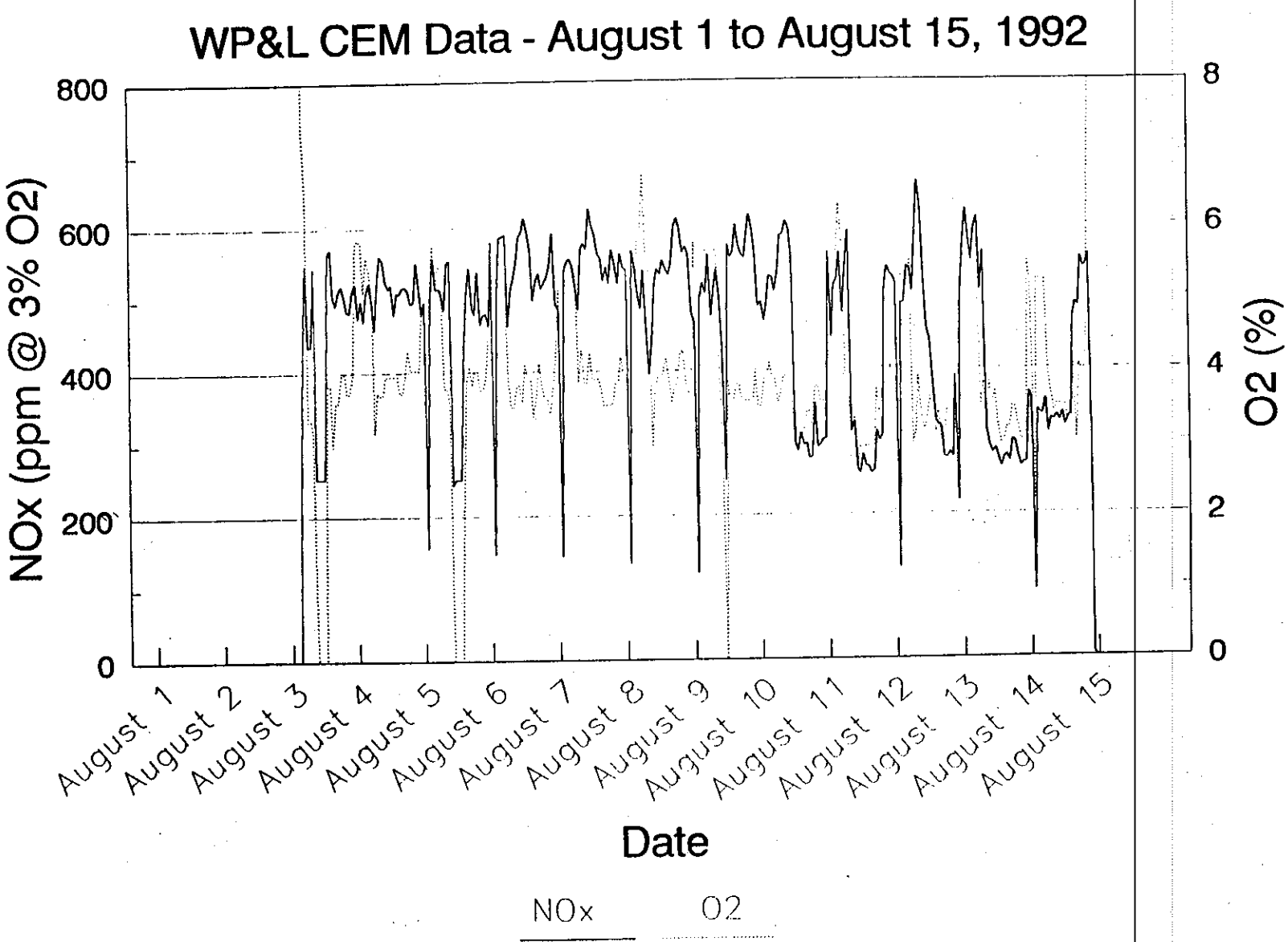
LONG-TERM CONTINUOUS EMISSION MONITORING SUMMARY: HOURLY DATA AVERAGES

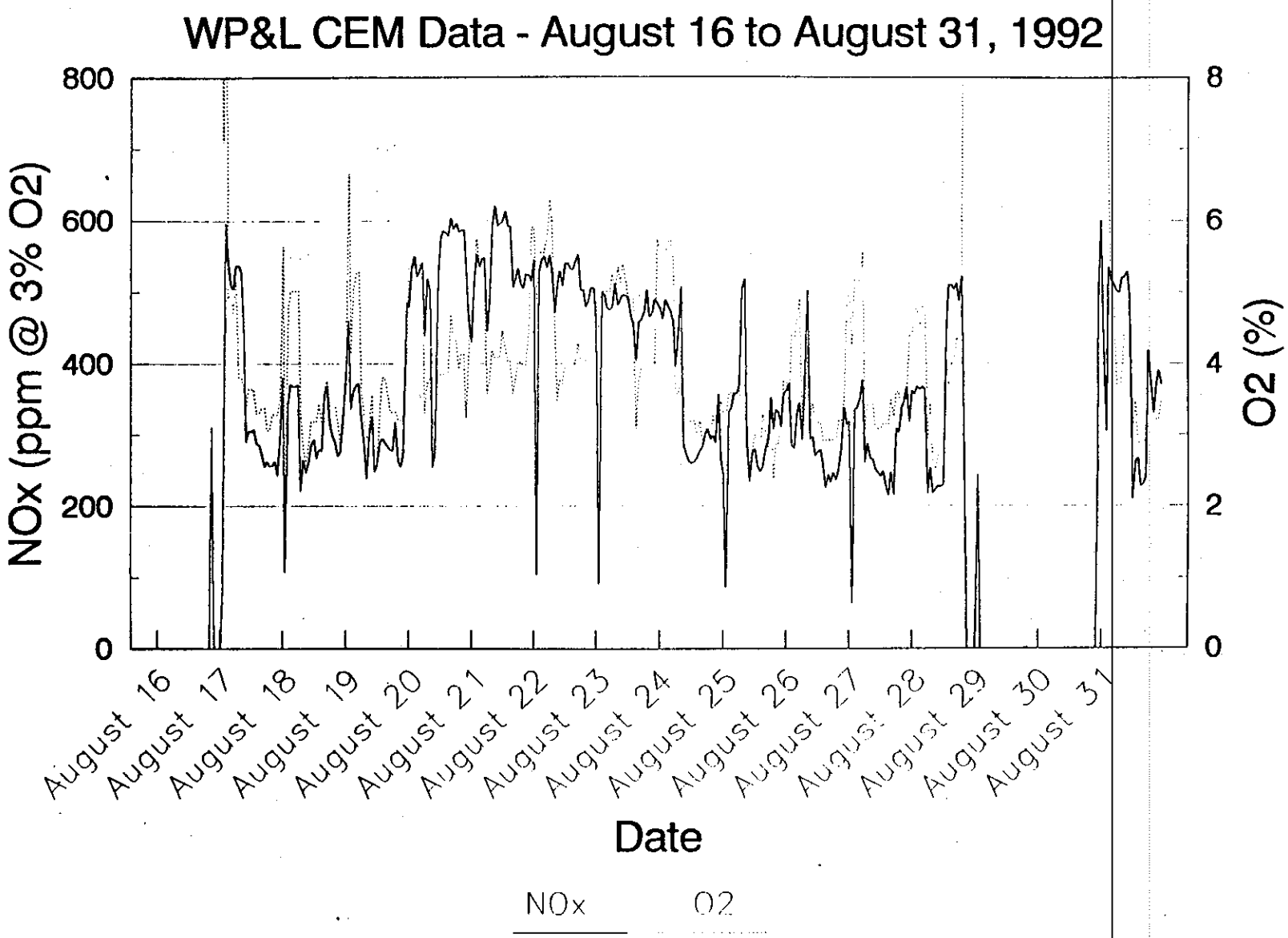

WP&L CEM Data - May 29 to June 14, 1992
NOx (ppm @ 3% O2)
800
600
400
200
0
O2 (%)
8
6
4
2
0
May 29 – 7am
June 1 – 3pm
June 4 – 5pm
June 6 – 2pm
June 7
June 8 – 2pm
June 9
June 10
June 11 – 5pm
June 12
June 13
June 14
Date
NOx
O2

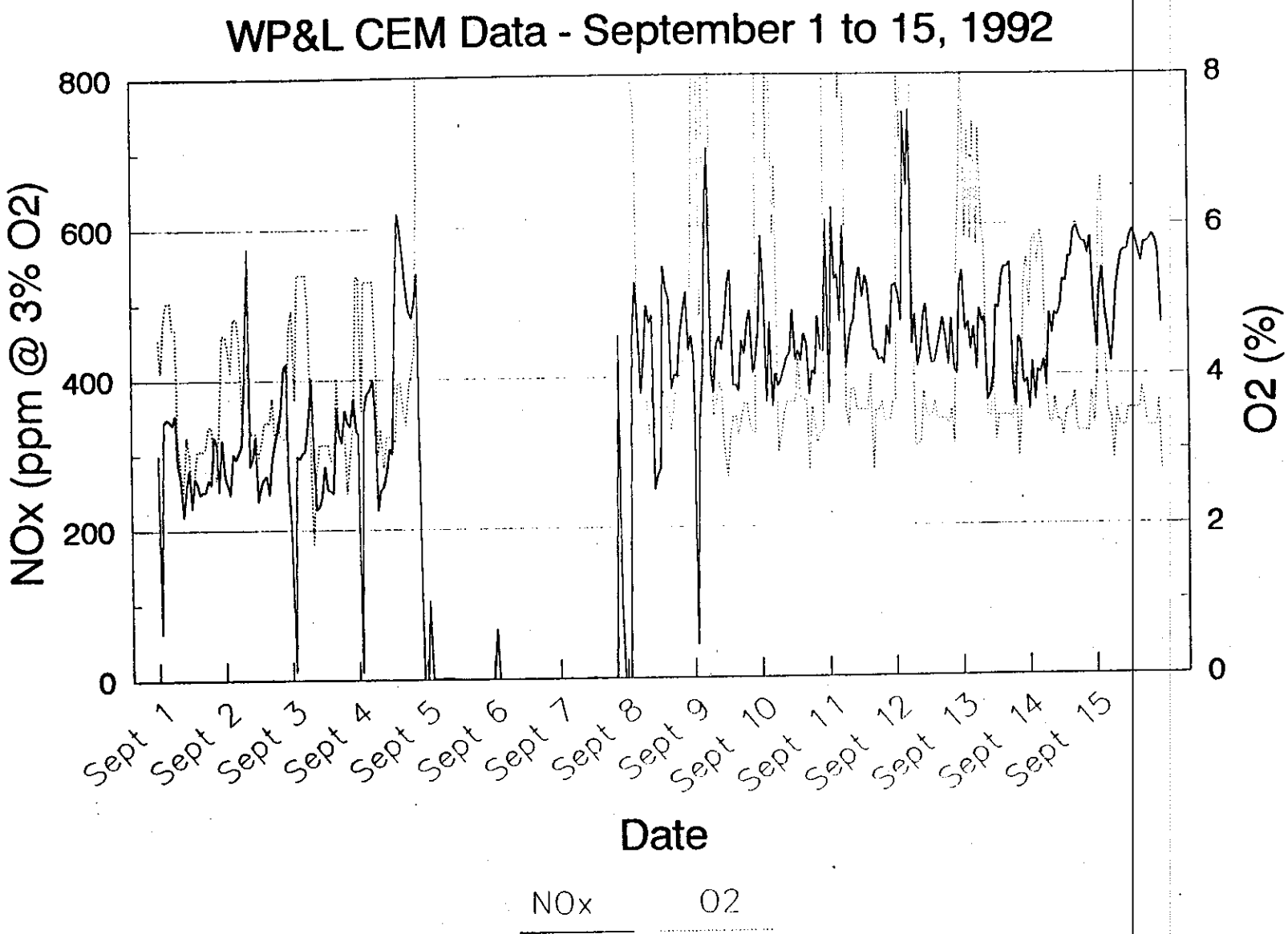

WP&L CEM Data - June 15 to June 30, 1992
NOx (ppm @ 3% O2)
O2 (%)
800
600
400
200
0
8
6
4
2
0
June 15
June 16
June 18
June 19
June 20
June 21
June 22
June 23
June 24
June 25
June 26
June 27
June 28
June 29
June 30
Date
NOx
O2

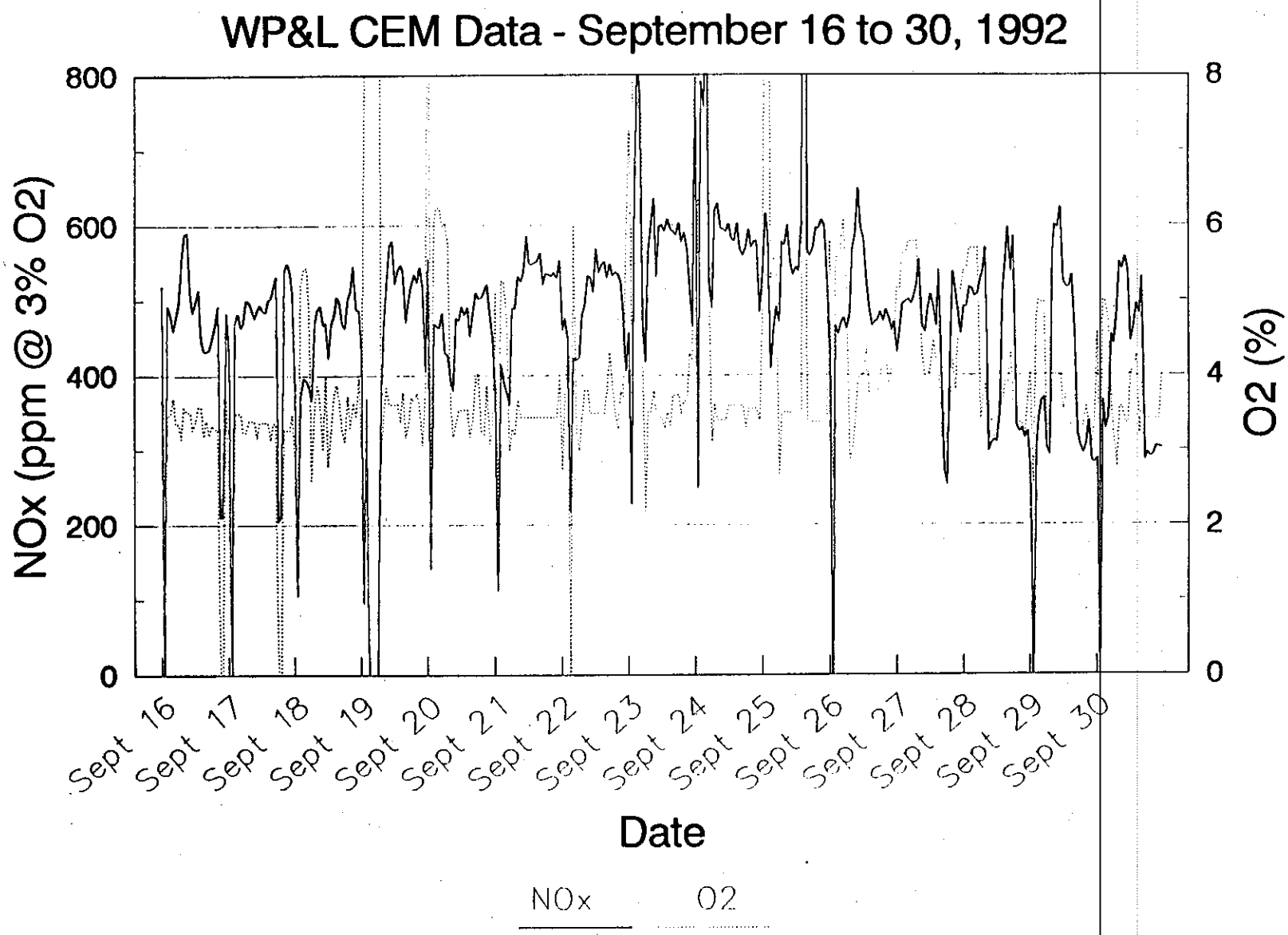

WP&L CEM Data - July 1 to July 15, 1992
NOx (ppm @ 3% O2)
O2 (%)
800
600
400
200
0
8
6
4
2
0
July 1
July 2
July 3
July 4
July 5
July 6
July 7
July 8
July 9
July 10
July 11
July 12
July 13
July 14
July 15
Date
NOx
O2

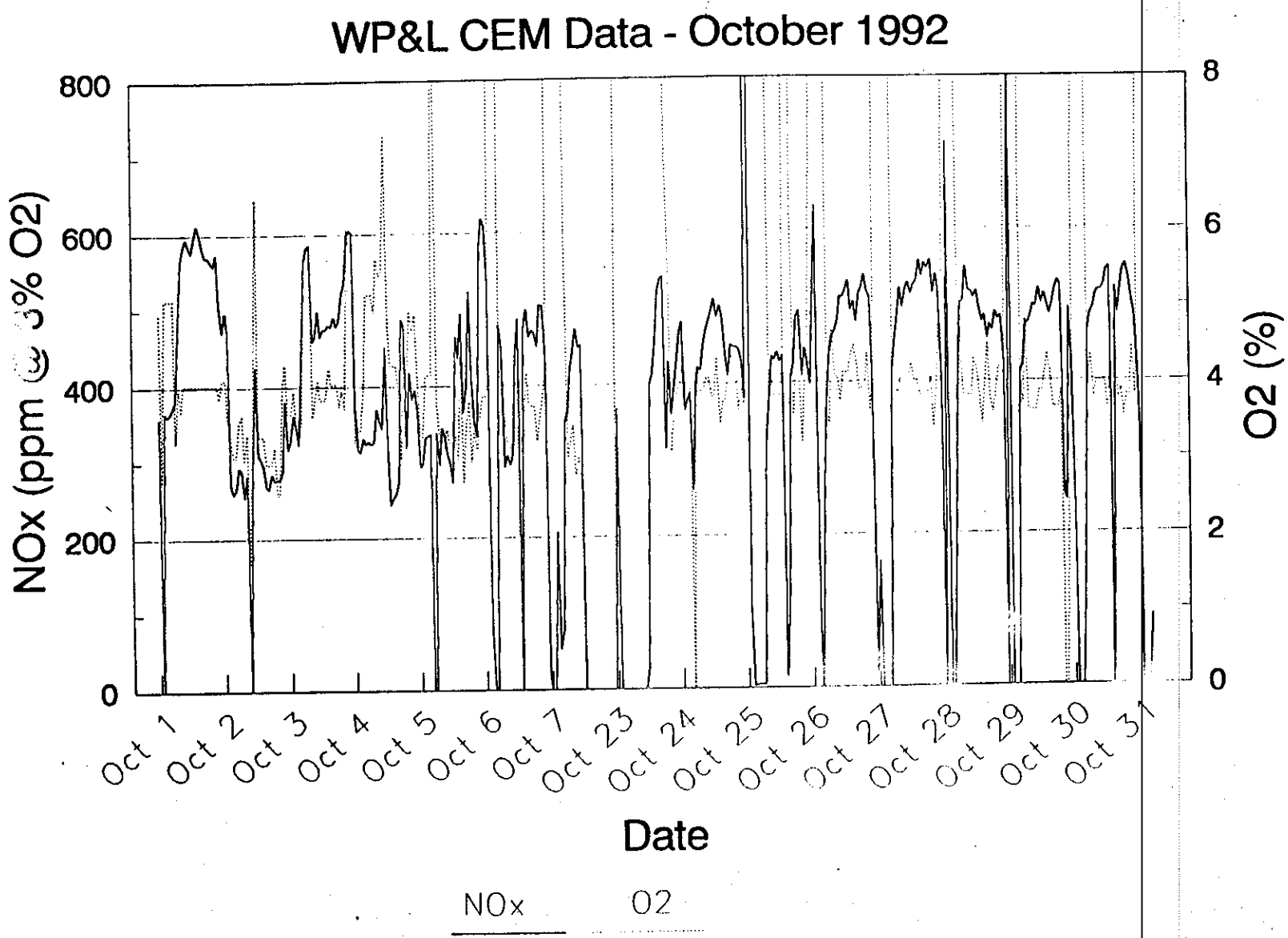

WP&L CEM Data - July 16 to July 31, 1992
NOx (ppm @ 3% O2)
O2 (%)
800
600
400
200
0
8
6
4
2
0
July 16
July 17
July 18
July 19
July 20
July 21
July 27
July 28
July 29
July 30
July 31
Date
NOx
O2

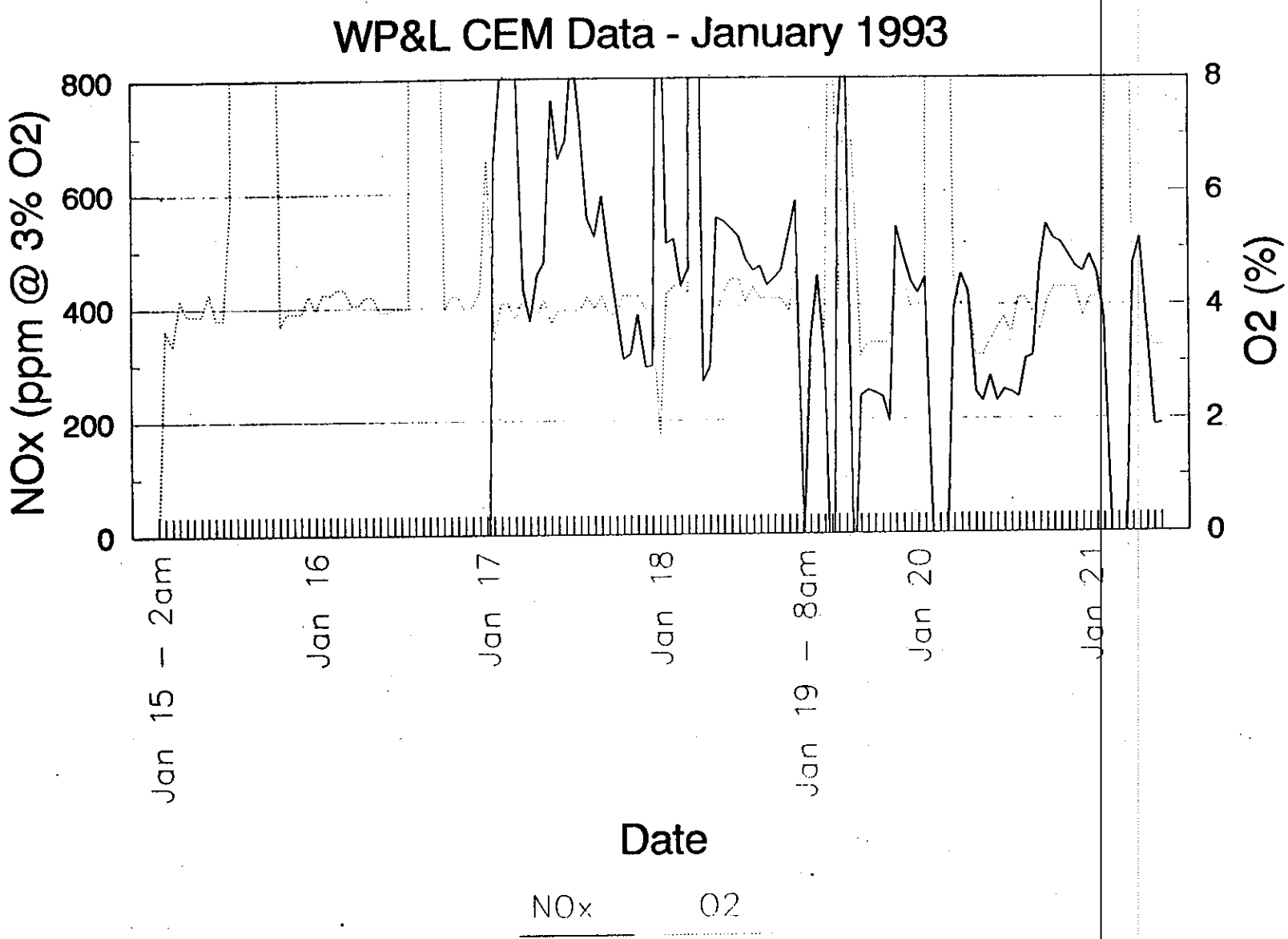

WP&L CEM Data - August 1 to August 15, 1992
NOx (ppm @ 3% O2)
800
600
400
200
0
O2 (%)
8
6
4
2
0
August 1
August 2
August 3
August 4
August 5
August 6
August 7
August 8
August 9
August 10
August 11
August 12
August 13
August 14
August 15
Date
NOx
O2


WP&L CEM Data - August 16 to August 31, 1992
NOx (ppm @ 3% O2)
O2 (%)
800
600
400
200
0
8
6
4
2
0
August 16
August 17
August 18
August 19
August 20
August 21
August 22
August 23
August 24
August 25
August 26
August 27
August 28
August 29
August 30
August 31
Date
NOx
O2


WP&L CEM Data - September 1 to 15, 1992
NOx (ppm @ 3% O2)
O2 (%)
800
600
400
200
0
8
6
4
2
0
Sept 1
Sept 2
Sept 3
Sept 4
Sept 5
Sept 6
Sept 7
Sept 8
Sept 9
Sept 10
Sept 11
Sept 12
Sept 13
Sept 14
Sept 15
Date
NOx
O2


WP&L CEM Data - September 16 to 30, 1992
NOx (ppm @ 3% O2)
O2 (%)
800
600
400
200
0
8
6
4
2
0
Sept 16
Sept 17
Sept 18
Sept 19
Sept 20
Sept 21
Sept 22
Sept 23
Sept 24
Sept 25
Sept 26
Sept 27
Sept 28
Sept 29
Sept 30
Date
NOx
O2


WP&L CEM Data - October 1992
NOx (ppm @ 3% O2)
O2 (%)
800
600
400
200
0
8
6
4
2
0
Oct 1
Oct 2
Oct 3
Oct 4
Oct 5
Oct 6
Oct 7
Oct 23
Oct 24
Oct 25
Oct 26
Oct 27
Oct 28
Oct 29
Oct 30
Oct 31
Date
NOx
O2


WP&L CEM Data - January 1993
NOx (ppm @ 3% O2)
800
600
400
200
0
O2 (%)
8
6
4
2
0
Jan 15 - 2am
Jan 16
Jan 17
Jan 18
Jan 19 - 8am
Jan 20
Jan 21
Date
NOx
O2