APRIL-JUNE 2008
QUARTERLY QUALITY ASSURANCE REPORT

FOR THE

WARREN COUNTY AIR MONITORING PROJECT

Ref. No. 7047.08
September 3, 2008

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Table of Contents

List of Tables

List of Appendices

List of Abbreviations and Terms Used in This Report

ACO – Administrative Consent Order

AMP – Air Monitoring Plan – The document that presents the overall scope of work for the monitoring program.

DQOs - Data Quality Objectives – Established criteria defining data quality goals (i.e., data accuracy, precision, completeness, and representativeness) for the WCAMP. These criteria presented in Table 1-1 of this report

NJDEP - New Jersey Department of Environmental Protection

NAAQS – National Ambient Air Quality Standards set by the U.S. EPA for specific "criteria" pollutants.

PCFA- Pollution Control Financing Authority of Warren County

QAPP – Quality Assurance Project Plan – The document that presents the quality assurance and quality control procedures that will be used in the monitoring program to ensure that high quality, representative data are being measured.

WCAMP – Warren County Air Monitoring Project

SO2 – Sulfur dioxide – A gas formed from the burning of fossil fuels.

Precision - The degree of mutual agreement among a series of individual measurements, values, or results; expressed by the standard deviation.

Accuracy - Accuracy refers to the closeness of measurements to the correct or accepted value of the quantity measured.

Completeness – The number of data values collected and reported over a given time Interval compared to the total number of possible data values for that time interval.

Null Data Codes – The United States Environmental Protection Agency's designated coding system used to replace invalid or missing data values. Typical null data codes that may appear in the tabular data are:

9991 - Level 1 Zero/Span Check
9995 – Multipoint Calibration
9986- Meteorological calibration; Zero/Span Check
9980 – Analyzer/Sensor Malfunction or Failure

ppm – parts per million; a unit of measurement specifying a concentration
mph – miles per hour; a unit of measurement for wind speed
°C – degrees Celsius (or centigrade); a unit of measurement for temperature

1. Introduction

As a condition of an Administrative Consent Order (ACO) between Pollution Control Financing Authority of Warren County (PCFA) and the New Jersey Department of Environmental Protection (NJDEP), PCFA has elected to establish an ambient air monitoring program in the vicinity of the town of Belvidere in Warren County, New Jersey. Specifically, the Supplemental Environmental Project mandated under the ACO and described in the associated Air Monitoring Plan (AMP) and Quality Assurance Project Plan (QAPP) calls for the monitoring of Sulfur Dioxide (SO2), and specified meteorological parameters.

The project has been designated the Warren County Air Monitoring Project (WCAMP). The primary purpose of the WCAMP is to obtain and report air quality information from Belvidere and surrounding areas and, where possible, to compare such air quality concentrations to appropriate federal or state standards.

Under the terms of the ACO, PCFA has retained and oversees a qualified contractor, Enviroplan Consulting, to set up and operate the monitoring program. PCFA is required to coordinate these activities through the New Jersey Department of Environmental Protection (NJDEP).

This report provides the quarterly quality assurance data required for the WCAMP air quality and meteorological monitoring network. Procedures governing operation, maintenance, calibration, data reduction, processing, validation and reporting activities as well as attendant quality control, quality assurance and auditing activities conform to the technical guidance contained in the WCAMP AMP and QAPP. These documents have been reviewed and received conditional approval from the NJDEP.

Section 2 of this report provides an analysis of the pollutant and meteorological data collected during the quarter. Tables 2-1 and 2-2 present the maximum hourly and five-minute averages for continuously - measured pollutants. Tables 2-3 and 2-4 present the SO2 precision results, Table 2-5 presents the SO2 accuracy audit results, Tables 2-6 through 2-9 present the meteorological data summary, Table 2-10 presents the data collection efficiencies by parameter and Table 2-11 presents explanations for missing data.

Additionally, one appendix is included in this report, which presents the quarterly QA forms.

Table 1-1: Data Quality Objectives

Parameter	Precision (%)	Accuracy	Completeness (%)
SO2	≤ ±15	Within ±15% of Observed	≥75
Wind Speed	n/a	Within ± 0.2 m/s + 5% of Observed	≥90
Wind Direction	n/a	Within ±5 degrees azimuth of Observed	≥90
Air Temperature	n/a	Within ±5℃ of Observed	≥90
Solar Radiation	n/a	Within ±10% of Observed	≥90

n/a – not applicable

2 Quality Assurance for Pollutant Data

2.1 Maximum Averages for the Quarter

This section provides a summary of the relevant maximum hourly averages for continuously-measured pollutants as they apply to the NAAQS.

Table 2-1: Maximum Hourly and Five-Minute SO2 Averages – Belvidere High School

NAAQS - National Ambient Air Quality Standards			
Pollutant	**Average Time**	**Primary Standard**	**Secondary Standard**
Sulfur Dioxide (SO2)	Annual Arithmetic Mean 24-Hour 3-Hour	0.03 ppm 0.14 ppm -	- - 0.50 ppm

Belvidere High School									
Parameter/ Units	**Maximum Running 3-Hour Conc.**	**Date (Hour)**	**2nd Highest Running 3-Hour Conc.**	**Date (Hour)**	**Maximum Running 24-Hour Conc.**	**Date (Hour)**	**2nd Highest Running 24-Hour Conc.**	**Date (Hour)**	**Annual Arith. Mean-To-Date**
SO2 ppm	.044	4/17 (11)	.029	4/14 (2)	.006	4/14 (20), 4/17 (11)	.005	5/28 (11)	.001
					Maximum 24-Hour Block Conc.	**Date**	**2nd Highest 24-Hour Block Conc.**	**Date**	
					.006	4/17	.005	4/14	

Belvidere High School					
Parameter/Units	**Maximum 5-Minute Conc.**	**Date (Time)**	**5-Minute Averages of 0.3 ppm or Greater**	**1-Hour Average Preceding the 0.3 ppm Average**	**1-Hour Average Following the 0.3 ppm Average**
SO2 ppm	.189	4/17 (10:15)	None	-	-

Maximum Hourly Averages Report - SO2 Validated DataBase
3-Hour Running, Non-Overlapping Averages

2nd Quarter 08

Logger Id : HS
Logger Name : Belvidere HS
Avg Interval: 03 hour
Parameter : SO2
Units : PPM
Avg Type : Backward

Rank	Average	Date	Hour
1	.044	04/17/08	11
2	.029	04/14/08	02
3	.026	05/28/08	00
4	.017	06/01/08	21
5	.016	06/14/08	18
6	.015	06/16/08	11
7	.013	04/24/08	06
8	.013	05/25/08	10
9	.013	06/12/08	17
10	.013	06/15/08	11

Maximum Hourly Averages Report - SO2 Validated DataBase
24-Hour Running, Non-Overlapping Averages

2nd Quarter 08

Logger Id : HS
Logger Name : Belvidere HS
Avg Interval: 24 hour
Parameter : SO2
Units : PPM
Avg Type : Backward

Rank	Average	Date	Hour
1	.006	04/14/08	20
2	.006	04/17/08	11
3	.005	05/28/08	11
4	.004	04/24/08	14
5	.004	06/12/08	16
6	.004	06/15/08	10
7	.002	04/18/08	12
8	.002	06/01/08	21
9	.002	06/10/08	12
10	.002	06/16/08	10

Table 2-2: Maximum Hourly and Five-Minute SO2 Averages – Demeter Farm

NAAQS - National Ambient Air Quality Standards			
Pollutant	**Average Time**	**Primary Standard**	**Secondary Standard**
Sulfur Dioxide (SO2)	Annual Arithmetic Mean 24-Hour 3-Hour	0.03 ppm 0.14 ppm -	- - 0.50 ppm

Demeter Farm									
Parameter/ Units	**Maximum Running 3-Hour Conc.**	**Date (Hour)**	**2nd Highest Running 3-Hour Conc.**	**Date (Hour)**	**Maximum Running 24-Hour Conc.**	**Date (Hour)**	**2nd Highest Running 24-Hour Conc.**	**Date (Hour)**	**Annual Arith. Mean-To-Date**
SO2 ppm	.076	4/18 (9)	.037	5/14 (7)	.016	4/18 (9)	.011	6/10 (22)	.004
					Maximum 24-Hour Block Conc	**Date**	**2nd Highest 24-Hour Block Conc.**	**Date**	
					.014	4/18	.011	6/10	

Demeter Farm					
Parameter/Units	**Maximum 5-Minute Conc.**	**Date (Time)**	**5-Minute Averages of 0.3 ppm or Greater**	**1-Hour Average Preceding the 0.3 ppm Average**	**1-Hour Average Following the 0.3 ppm Average**
SO2 ppm	.568	4/18 (09:05)	None	.093	.006

Maximum Hourly Averages Report - SO2 Validated DataBase
3-Hour Running, Non-Overlapping Averages

2nd Quarter 08

Logger Id : DF
Logger Name : Demeter Farm
Avg Interval: 03 hour
Parameter : SO2
Units : PPM
Avg Type : Backward

Rank	Average	Date	Hour
1	.076	04/18/08	09
2	.037	05/14/08	07
3	.035	05/25/08	07
4	.026	04/10/08	08
5	.025	04/17/08	10
6	.021	05/20/08	18
7	.021	05/25/08	01
8	.021	05/28/08	00
9	.021	06/10/08	08
10	.020	04/29/08	22

Maximum Hourly Averages Report - SO2 Validated DataBase
24-Hour Running, Non-Overlapping Averages

2nd Quarter 08

Logger Id : DF
Logger Name : Demeter Farm
Avg Interval: 24 hour
Parameter : SO2
Units : PPM
Avg Type : Backward

Rank	Average	Date	Hour
1	.016	04/18/08	09
2	.011	06/10/08	22
3	.008	05/25/08	08
4	.007	05/14/08	11
5	.007	05/20/08	17
6	.007	06/20/08	22
7	.007	06/27/08	19
8	.006	06/08/08	13
9	.005	04/10/08	18
10	.005	04/14/08	21

2.2 Precision Checks

Precision checks for the continuous gas analyzers are scheduled to be performed at least once every two weeks to assess the quality of the monitoring data being reported. Two-point instrument precision response checks are performed by challenging each continuous pollutant analyzer with a known pollutant test gas concentration between 0.095 ppm and 0.105 ppm and between 0.380 ppm and 0.420 ppm. Pollutant test gas concentrations are generated using a currently-certified NIST-traceable dilution calibrator apparatus and certified gas standards.

The results of Level-1 zero/span checks performed biweekly on the SO_2 analyzers in conjunction with precision checks were within established acceptability limits.

The following equations are used for calculating data precision for the continuous analyzers. These equations conform to those contained in 40 CFR Part 58, Appendix B for reporting single instrument data precision for automated measurements used in PSD monitoring programs.

The percent difference for each precision check is calculated using the following equation:

$$d_i = \frac{Y_i - X_i}{X_i} \times 100 \qquad \text{Equation (1)}$$

where, d_i is the percent difference for each precision check,
x_i is the known concentration of the test gas used for the i-th precision check, and
y_i is the pollutant analyzer's indicated concentration for the i-th precision check.

For each instrument, the quarterly average percent difference (d_j) is calculated using Equation 2, and the standard deviation of these differences (S_j) using Equation 3.

$$d_j = \frac{1}{n}\sum_{i=1}^{n} d_i \qquad \text{Equation (2)}$$

$$S_j = \sqrt{\frac{1}{n-1}\left[\sum d_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} d_i\right)^2\right]} \qquad \text{Equation (3)}$$

where,
n is the number of precision checks performed on the instrument during the quarter.

The 95% Probability Limits for data precision, are calculated as follows:

Upper 95% Probability Limit = $d_j + (1.96)(S_j)$ Equation (4)
Lower 95% Probability Limit = $d_j - (1.96)(S_j)$ Equation (5)

Table 2-3: **SO2 Single Analyzer Precision Check Results for Belvidere High School**

Data Period: April-June 2008

Date	Input ppm	Response ppm	Percent Difference	d_j	S_j	95% Probability Limits Upper	Lower
4/ 9/08	.100	.098	-2.00				
4/30/08	.100	.098	-2.00				
5/ 7/08	.100	.100	0.00				
5/21/08	.100	.100	0.00				
6/ 4/08	.100	.099	-1.00				
6/19/08	.100	.099	-1.00	-1.00	0.89	0.74	-2.74

Date	Input ppm	Response Ppm	Percent Difference	d_j	S_j	95% Probability Limits Upper	Lower
4/ 9/08	.400	.393	-1.75				
4/30/08	.400	.399	-0.25				
5/ 7/08	.400	.396	-1.00				
5/21/08	.400	.402	0.50				
6/ 4/08	.400	.400	0.00				
6/19/08	.400	.400	0.00	-0.42	0.82	1.19	-2.02

Combined Precision Check Statistical Results- Belvidere HS			
d_j	S_j	95% Probability Limits Upper	Lower
-0.71	0.87	0.99	-2.42

Table 2-4: **SO2 Single Analyzer Precision Check Results for Demeter Farm**

Data Period: April-June 2008

Date	Input ppm	Response ppm	Percent Difference	d_j	S_j	95% Probability Limits Upper	Lower
4/17/08	.100	.102	2.00				
4/30/08	.100	.100	0.00				
5/14/08	.100	.100	0.00				
5/28/08	.100	.102	2.00				
6/11/08	.100	.102	2.00				
6/25/08	.100	.099	-1.00	0.83	1.33	3.44	-1.78

Date	Input ppm	Response Ppm	Percent Difference	d_j	S_j	95% Probability Limits Upper	Lower
4/17/08	.400	.398	-0.50				
4/30/08	.400	.398	-0.50				
5/14/08	.400	.402	0.50				
5/28/08	.400	.401	0.25				
6/11/08	.400	.399	-0.25				
6/25/08	.400	.404	1.00	0.08	0.61	1.28	-1.12

Combined Precision Check Statistical Results- Demeter Farm			
d_j	S_j	95% Probability Limits Upper	Lower
0.45	1.06	2.53	-1.63

2.3 Accuracy

Independent quality assurance audits are performed once per quarter on the air quality measurement systems. These audits are conducted by qualified personnel not associated with the routine operation and calibration of the monitoring systems, under the supervision of Enviroplan Consulting's Quality Assurance Department using certified, independent calibration standards and equipment. Table 2-5 summarizes the air quality audit results obtained by Enviroplan Consulting during the quarter.

For continuous gas analyzers, the audit consists of challenging each monitor with gas of five known concentrations (including zero), which fall within the instrument's measurement range (0-2.0 ppm). The five known audit gas test input concentrations are within the ranges specified in 40 CFR Part 58, Appendix B. As Table 2-5 indicates, the response of the SO_2 gas analyzer to the all upscale (i.e., non-zero) audit test gas concentrations by were well within the VDEQ and U.S. EPA quality assurance goal of ±15 percent.

The equation used to calculate measurement accuracy is as follows:

$$d_i = \left[\frac{Y_i - X_i}{X_i} \right] x\ 100$$

where:
d_i = the difference, in percent, between the known (audit) flow rate and the corresponding sampler-indicated flow rate.
X_i = the known (audit) flow rate.
Y_i = the corresponding sampler-indicated flow rate.

Table 2-5: **SO_2 Accuracy Audit Results**

Site	Date	Audit Conc. ppm	Indicated Conc.*(DAS) ppm	Percent Difference
Belvidere High School	Audit Equipment Unavailable			
SO_2				
Demeter Farm	Audit Equipment Unavailable			
SO_2				

Notes to Table 2-5:

*DAS - Data Acquisition System

2.4 Meteorological Data

This meteorological data summary includes the data collected at the Belvidere High School and Demeter Farm sites from April 1, 2008 through June 30, 2008. Tables 2-6 through 2-10 present the maximum and average values for each meteorological parameter.

Table 2-6: **Horizontal Wind Speed Data Summary**

	Belvidere High School				Demeter Farm			
Month	**Average mph**	**Maximum mph**	**Date**	**Hour**	**Average mph**	**Maximum mph**	**Date**	**Hour**
April	4.2	12.5	4/1	23	9.2	27.2	4/2	5
May	3.4	12.2	5/19	12	8.7	20.8	5/27	23
June	2.8	8.7	6/1	11	7.1	16.6	6/16	17

Table 2-7: **Horizontal Wind Direction Data Summary**

	Belvidere High School	Demeter Farm
Month	**Average Degrees**	**Average Degrees**
April	42	73
May	357	308
June	345	255

Table 2-8: **Ambient Temperature Data Summary**

Demeter Farm				
Month	**Average °C**	**Maximum °C**	**Date**	**Hour**
April	10.3	25.9	4/18	16
May	12.7	26.4	5/27	14,15
June	20.8	32.2	6/10	14

Table 2-9: **Solar Radiation Data Summary**

Demeter Farm				
Month	**Average W/M^2**	**Maximum W/M^2**	**Date**	**Hour**
April	199	916	4/14	12
May	215	967	5/28	11
June	258	973	6/19	13

2.5 Meteorological Audits

Meteorological audits are performed at (minimum) semi-annual intervals subsequent to initial startup calibration of the meteorological monitoring system.

There were no audits performed on the meteorological system during this quarter.

Table 2-10**:** **Quarterly Data Recovery Rates**

Site	Parameter	Month	Monthly Data Recovery Rate (%)	Quarterly Data Recovery Rate (%)
Belvidere High School	SO2	April	98.2	
		May	89.0	
		June	99.0	
	Horizontal Wind Speed	April	99.6	
		May	98.7	
		June	98.5	
	Horizontal Wind Direction	April	99.6	
		May	99.7	
		June	99.2	
	Standard Deviation	April	99.6	
		May	99.7	
		June	99.2	
Demeter Farm	SO2	April	99.6	
		May	99.7	
		June	99.7	
	Horizontal Wind Speed	April	99.2	
		May	99.5	
		June	99.7	
	Horizontal Wind Direction	April	99.2	
		May	99.6	
		June	99.7	
	Standard Deviation	April	99.2	
		May	99.6	
		June	99.7	
	Temperature	April	99.2	
		May	99.7	
		June	99.7	
	Solar Radiation	April	99.4	
		May	99.7	
		June	99.7	

General Notes:
Data collection efficiencies are based on the number of valid data values reported from a given monitor divided by the total number of possible data values in the reporting period. For continuously-measured parameters, the total number of possible data values is the number of hours in the reporting period; for episodic monitors, the total number of possible data values is the number of scheduled sample events in the reporting period. The resulting ratio is expressed as a percentage.

When monitoring operations begin other than on the first day and hour of the reporting period, or in instances where agency approval for suspension of monitoring for a portion of the reporting period has occurred, calculation of data collection efficiencies for the reporting period is as described above except that the total number of possible data values is pro-rated in accordance with the actual active monitoring interval.

n/a – not applicable

Table 2-11**:** **Missing Data Report**

The following table describes periods of invalid data due to instrument malfunction, power outages and weather related data loss. Periods of routine instrument testing are not included in explanations of missing data.

April			
Site	**Date (Hours)**	**Parameter**	**Explanation**
Belvidere HS	4/10 (14-18), 4/16 (16-17), 4/30 (21-23)	SO2	Shelter temperature out of analyzer operating range

May			
Site	**Date (Hours)**	**Parameter**	**Explanation**
Belvidere HS	5/1 (0-11, 22-23), 5/2 (0-12), 5/3 (1-11, 22-23), 5/4 (0-10), 5/5 (1-9), 5/6 (0-9), 5/7 (1-8)	SO2	Shelter temperature out of analyzer operating range
	5/24 (23),5/25 (3-6), 5/28 (20), 5/29 (2, 21)	HWS	Sensor malfunction
Demeter Farm	5/14 (9)	HWS	Sensor malfunction

June			
Site	**Date (Hours)**	**Parameter**	**Explanation**
Belvidere HS	6/8 (21-22)	All parameters	Power outage
	6/6 (20, 22), 6/7 95), 6/8 (3), 6/10 (23)	HWS	Sensor malfunction

Appendix A: Quality Assurance Forms

No forms for Quarter 2, 2008