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South Carolina State Ports Authority – Continuous Air Monitoring Station for the Wando Welch Terminal

Q1 2012 Quarterly Report and Annual Summary

April 2012

South Carolina State Ports Authority - Continuous Air Monitoring Station for the Wando Welch Terminal

Q1 2012 Quarterly Report and Annual Summary

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1. Introduction

1.1 Scope

ARCADIS U.S., Inc. (ARCADIS) was contracted in late December 2010 to provide Continuous Air Monitoring Services to the South Carolina State Ports Authority (SCSPA) at the Wando Welch Terminal in Charleston. ARCADIS has followed through on the planned schedule and activities since that award. The major accomplishments were to complete the Quality Assurance Plan (QAP), purchase the instruments, complete the site setup, and then to begin acquiring the data. This report is the fourth quarterly data report and presents the data summaries requested by SCSPA and described in the work scope. The data acquisition was started on May 6, 2011 in line with the court mandated start date. This report encompasses a period corresponding to data taken during the period from January 1, 2012 through March 31, 2012. Since this is the fourth quarterly report, an annual summary is provided, along with a discussion as to how well the Quality Assurance/Quality Control (QA/QC) goals specified in the QAP were met.

1.2 Project Description

SCSPA asked for technical support that will provide ambient air quality data including particulate matter less than 2.5 microns ($PM_{2.5}$), SO_2, and NO_2 for a period of 5 years at the Wando Welch Terminal of the port of Charleston. ARCADIS will maintain the monitoring instruments, stock consumables such as filters and calibration gases, and order spare parts such that downtime will be avoided. ARCADIS has established standard operating procedures to perform daily downloads and to provide Level 1 data validation for the resulting data. This monitoring project setup was relatively straightforward and has proven to be reliable and is generating valid high quality data suitable for use in dispersion modeling or other potential purposes.

As required, periodically the QAP and procedures are updated to reflect improvements to the basic operating procedures. This QAP is written consistent with the current ambient air quality standards for PM, NO_X and SO_2 as defined by the U.S. Environmental Protection Agency. Excursions beyond these standards have not been seen, but a few daily spikes and rises have been noted and correlating local conditions are investigated in local media outlets and recorded when seen. These observations are tabulated and presented in the quarterly reports.

The location selected for sampling and the sampling equipment has proven to be well-suited for the project as it is centrally located to the port activities and has proven to be very responsive to local equipment air emissions and the local meteorological conditions. Although this is not a typical fence line site, it has shown high value in permitting the evaluation of port activities and related air quality effects. We have been able to remotely access the control computer and reliably interact with the instruments. We can see immediate reaction from the instruments in response to events such as container handling equipment and the morning openings of the front gates to entering truck traffic. These patterns can be reviewed in details in the archived data any time in the future if needed.

2. Quarterly Results

The 24-hr daily averages for PM, NO, NO_2, NO_X, and SO_2 and the maximum daily value (1-hr average) for NO_2 and SO_2 for this period are shown in Table 2-1. No exceedances were indicated this quarter. Quarterly statistics showing the averages, minimums and maximums for all parameters are summarized in Table 2-2. 24-hr averages for all constituents are also shown graphically in Figure 2-1. Maximum 1-hr averages for NO_2 and SO_2 are shown in Figure 2-2.

Statistics are broken down by months and are summarized in Table 2-3 for all four quarters of this first monitoring year. Annual summaries are also provided in Figures 2-3 and 2-4 which show the monthly 24-hr averages for all constituents and the monthly maximum 1-hr averages for NO_2 and SO_2, respectively.

Table 2-1. 24-Hour Averages

24-hour Averages						Daily Max 1-hr Avg.	
Date	PM ($\mu g/m^3$)	NO (ppb)	NO_2 (ppb)	NO_X (ppb)	SO_2 (ppb)	NO_2 ppb)	SO_2 (ppb)
1/1/12	34.18	2.68	9.39	12.02	0.43	26.30	2.18
1/2/12	4.72	3.04	6.16	9.14	1.23	19.72	8.72
1/3/12	6.21	6.27	8.96	15.20	1.41	14.09	6.47
1/4/12	8.54	10.69	14.13	24.78	3.73	23.90	25.93
1/5/12	21.61	19.95	25.46	45.41	12.29	43.37	64.27
1/6/12	27.86	13.83	19.41	33.21	2.02	33.02	5.26
1/7/12	19.94	0.94	6.32	7.20	0.98	11.63	6.92
1/8/12	14.34	1.26	6.69	7.91	0.99	13.21	3.55
1/9/12	12.03	7.64	13.90	21.51	2.27	27.95	8.69
1/10/12	18.00	11.18	12.17	23.31	4.41	26.95	23.99
1/11/12	8.62	13.38	13.78	27.10	3.76	30.83	47.54
1/12/12	11.38	13.16	14.16	27.31	10.65	25.77	47.76
1/13/12	6.36	4.33	6.63	10.86	0.78	14.76	4.00
1/14/12	7.39	1.18	6.18	7.27	2.70	27.60	27.96
1/15/12	15.32	0.68	5.48	6.08	2.23	13.52	20.82
1/16/12	8.08	1.43	8.81	10.19	0.15	29.63	0.39
1/17/12	15.69	12.31	14.19	26.47	1.98	33.27	17.80

24-hour Averages						Daily Max 1-hr Avg.	
Date	PM ($\mu g/m^3$)	NO (ppb)	NO_2 (ppb)	NO_X (ppb)	SO_2 (ppb)	NO_2 ppb)	SO_2 (ppb)
1/18/12	12.29	9.26	10.32	19.53	2.46	26.37	20.20
1/19/12	12.18	7.54	10.94	18.43	0.21	24.15	0.56
1/20/12	13.99	18.33	15.57	33.88	1.35	32.76	5.07
1/21/12	7.67	1.10	4.92	5.97	1.16	16.88	19.46
1/22/12	7.84	0.40	5.02	5.38	0.06	12.72	0.97
1/23/12	13.82	17.77	10.84	28.55	0.15	26.87	1.11
1/24/12	12.15	16.57	14.59	31.14	1.04	24.14	8.88
1/25/12	12.39	6.18	11.15	17.31	0.11	21.75	0.52
1/26/12	7.23	11.51	10.91	22.38	0.18	29.31	0.93
1/27/12	8.33	8.66	12.28	20.90	7.35	22.66	29.68
1/28/12	8.33	1.39	8.85	10.17	1.01	20.23	3.49
1/29/12	11.49	0.05	4.25	4.21	0.49	8.94	2.47
1/30/12	13.59	9.52	15.40	24.89	2.31	28.57	10.66
1/31/12	13.95	27.36	20.62	47.96	1.03	31.89	4.22
2/1/12	8.80	53.45	15.91	69.34	0.53	53.85	3.46
2/2/12	11.13	6.96	11.83	18.76	6.04	22.47	30.78
2/3/12	11.33	1.65	6.09	7.69	0.27	12.19	0.89
2/4/12	7.10	0.75	4.46	5.17	0.09	10.93	0.58
2/5/12	11.64	0.56	4.23	4.74	2.08	10.21	13.45
2/6/12	10.89	2.08	5.89	7.90	0.08	11.74	0.42
2/7/12	13.73	3.47	8.60	12.02	0.51	17.33	3.34
2/8/12	21.65	5.79	13.99	19.76	1.25	29.20	4.15
2/9/12	17.12	2.72	10.47	13.15	0.48	22.83	1.16
2/10/12	23.00	5.06	13.41	18.45	0.28	25.25	0.81
2/11/12	17.31	2.90	8.68	11.53	3.35	25.03	18.37
2/12/12	5.75	3.77	8.69	12.41	3.77	28.97	17.78
2/13/12	12.30	11.46	15.49	26.91	2.08	29.02	6.32
2/14/12	15.33	18.97	17.60	36.55	0.96	33.07	5.28
2/15/12	15.30	5.03	13.17	18.19	0.69	29.47	2.66
2/16/12	11.69	17.05	17.70	34.73	0.66	31.46	6.14
2/17/12	8.62	3.62	9.79	13.41	0.08	15.34	0.67
2/18/12	10.75	0.11	3.86	3.92	0.06	5.81	0.39

24-hour Averages						Daily Max 1-hr Avg.	
Date	PM ($\mu g/m^3$)	NO (ppb)	NO_2 (ppb)	NO_X (ppb)	SO_2 (ppb)	NO_2 ppb)	SO_2 (ppb)
2/19/12	3.58	0.04	2.51	2.49	0.10	3.77	0.77
2/20/12	6.92	0.15	4.93	5.01	0.21	15.46	1.74
2/21/12	10.15	11.44	12.98	24.38	0.23	35.94	2.10
2/22/12	10.51	7.59	11.49	19.06	0.61	23.88	3.46
2/23/12	10.22	6.82	7.44	14.23	0.25	12.62	1.17
2/24/12	14.86	6.83	8.71	15.53	1.05	15.17	8.57
2/25/12	6.26	4.42	11.72	16.12	3.11	27.94	11.74
2/26/12	9.05	0.05	4.68	4.65	0.26	12.73	0.99
2/27/12	8.82	14.04	16.47	30.47	0.16	35.32	1.00
2/28/12	10.25	1.93	7.07	8.97	0.16	11.42	1.06
2/29/12	10.00	9.83	10.11	19.91	0.21	27.78	0.89
3/1/12	10.10	12.17	10.61	22.78	2.16	19.57	15.98
3/2/12	11.12	12.33	8.50	20.81	1.09	14.97	9.17
3/3/12	9.93	2.14	7.52	9.65	0.25	22.99	1.95
3/4/12	4.47	1.27	5.89	7.11	4.61	17.29	24.21
3/5/12	6.44	3.41	8.13	11.48	0.85	15.51	5.48
3/6/12	9.65	2.00	6.66	8.61	0.27	13.71	1.63
3/7/12	13.20	2.72	7.28	9.96	0.04	19.95	0.42
3/8/12	6.56	12.19	13.64	25.82	0.36	34.73	2.98
3/9/12	9.86	7.47	11.35	18.81	4.82	24.39	33.98
3/10/12	9.24	0.11	3.69	3.75	0.13	4.98	0.51
3/11/12	9.78	0.09	3.43	3.47	0.04	5.52	0.34
3/12/12	7.42	8.86	11.07	19.91	0.06	28.89	0.48
3/13/12	8.59	21.15	14.60	35.75	0.46	36.03	2.98
3/14/12	7.65	11.68	12.98	24.65	2.08	34.57	15.64
3/15/12	7.86	18.40	10.08	28.46	0.62	22.46	2.55
3/16/12	3.43	13.26	11.58	24.83	3.78	29.45	21.03
3/17/12	6.02	1.91	7.12	9.02	1.03	16.00	2.68
3/18/12	7.78	0.50	6.19	6.67	0.60	16.33	1.76
3/19/12	10.88	18.18	14.78	32.95	2.86	27.82	18.36
3/20/12	10.01	13.29	10.54	23.81	0.16	19.46	0.60
3/21/12	7.25	10.80	12.29	23.07	0.03	29.33	0.60

24-hour Averages						Daily Max 1-hr Avg.	
Date	PM ($\mu g/m^3$)	NO (ppb)	NO_2 (ppb)	NO_X (ppb)	SO_2 (ppb)	NO_2 ppb)	SO_2 (ppb)
3/22/12	4.54	9.26	10.69	19.94	0.13	24.55	0.87
3/23/12	8.41	16.73	12.90	29.63	0.70	25.39	3.18
3/24/12	6.00	0.39	3.86	4.24	0.27	8.77	2.45
3/25/12	6.97	2.86	10.06	12.90	9.83	30.27	42.54
3/26/12	12.80	3.90	12.07	15.96	1.17	20.73	4.25
3/27/12	5.63	1.94	7.47	9.38	0.38	13.33	4.08
3/28/12	11.35	8.93	12.46	21.38	0.19	39.04	0.83
3/29/12	17.25	3.79	12.99	16.78	4.48	29.13	21.46
3/30/12	19.15	8.76	16.25	25.01	5.54	34.31	28.32
3/31/12	9.72	1.88	7.04	8.92	2.94	14.54	18.95

Table 2-2. Quarterly Statistics

24-hour Averages						Daily Max 1-hr Avg.	
Date	PM ($\mu g/m^3$)	NO (ppb)	NO_2 (ppb)	NO_X (ppb)	SO_2 (ppb)	NO_2 (ppb)	SO_2 (ppb)
Average	11.08	7.70	10.32	17.99	1.68	22.78	9.57
Minimum	3.43	0.04	2.51	2.49	0.03	3.77	0.34
Maximum	34.18	53.45	25.46	69.34	12.29	53.85	64.27

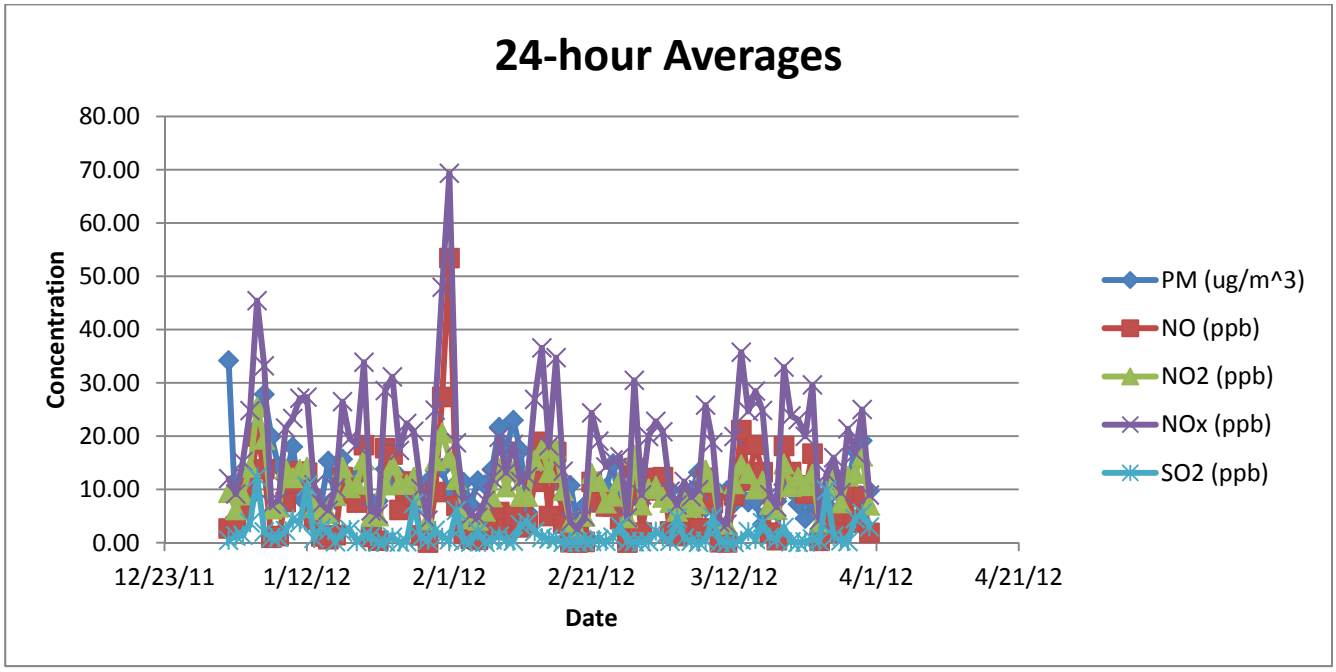

Figure 2-1. 24-hour Averages

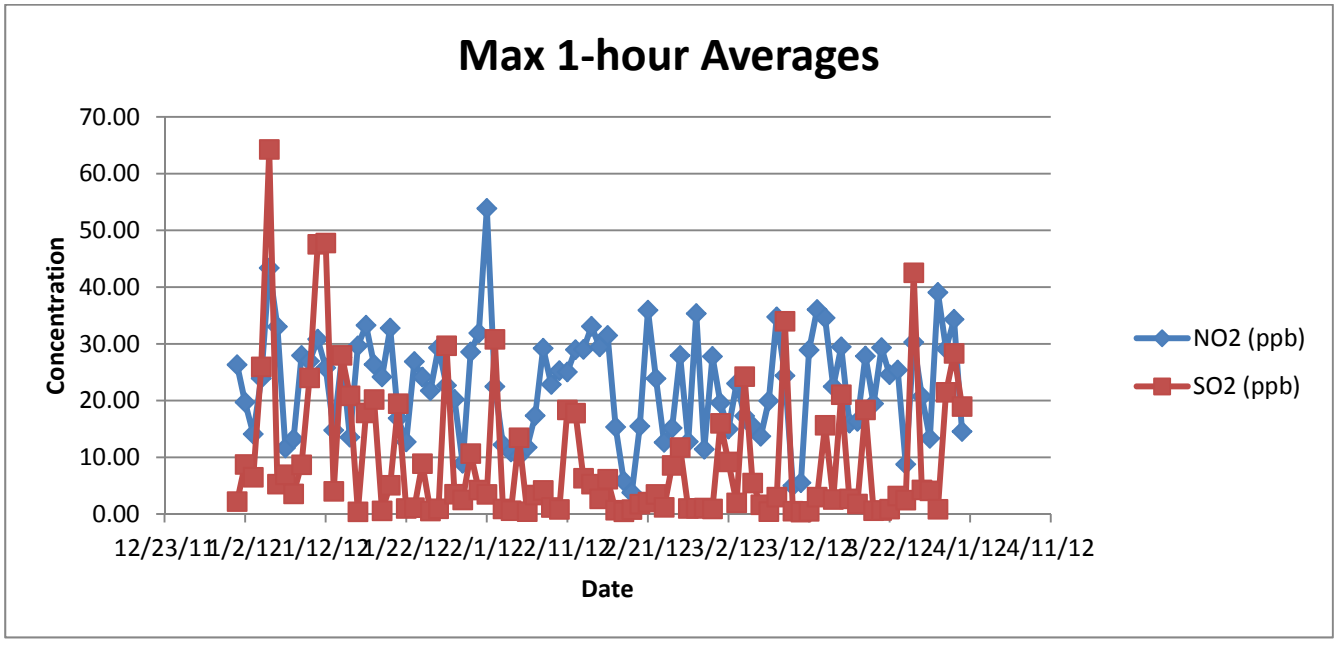

Figure 2-2. Max 1-hour Averages

Table 2-3. Monthly Statistics for All Four Quarters of the First Monitoring Year

Monthly Averages						Monthly Daily Max 1-hr Avg.	
Month	PM ($\mu g/m^3$)	NO (ppb)	NO_2 (ppb)	NO_X (ppb)	SO_2 (ppb)	NO_2 (ppb)	SO_2 (ppb)
May 2011	11.73	3.63	4.44	8.04	0.93	15.86	5.97
June 2011	16.95	2.68	3.63	6.26	1.18	13.55	6.90
July 2011	13.50	3.19	3.77	6.89	2.48	11.27	24.34
August 2011	13.52	2.83	6.02	8.81	1.01	17.12	4.78
September 2011	8.17	5.20	6.06	11.22	0.82	16.40	4.50
October 2011	8.70	5.94	7.72	13.61	1.36	19.89	7.46
November 2011	8.14	6.94	7.91	14.83	1.20	19.61	5.43
December 2011	9.19	11.79	10.25	21.99	0.97	21.55	5.15
January 2012	12.76	8.37	11.21	19.54	2.29	23.96	13.89
February 2012	11.52	7.19	9.93	17.09	1.02	21.94	5.18
March 2012	9.00	7.50	9.80	17.28	1.68	22.39	9.36

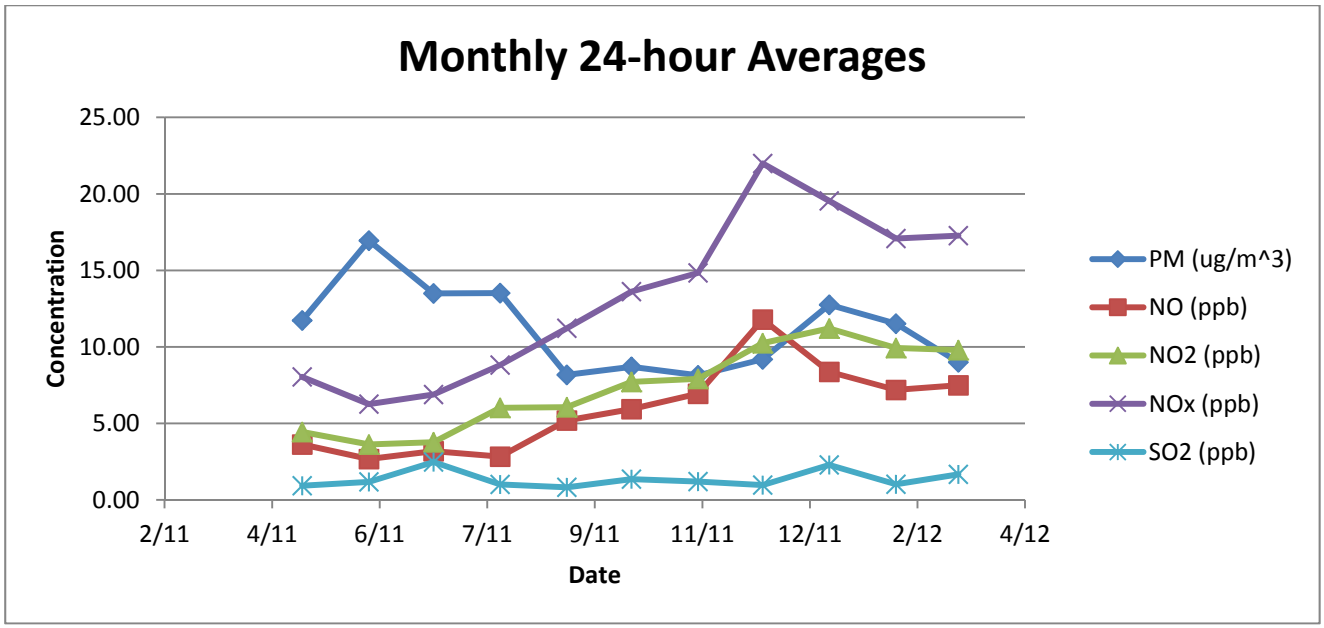

Figure 2-3. Monthly 24-hour Averages

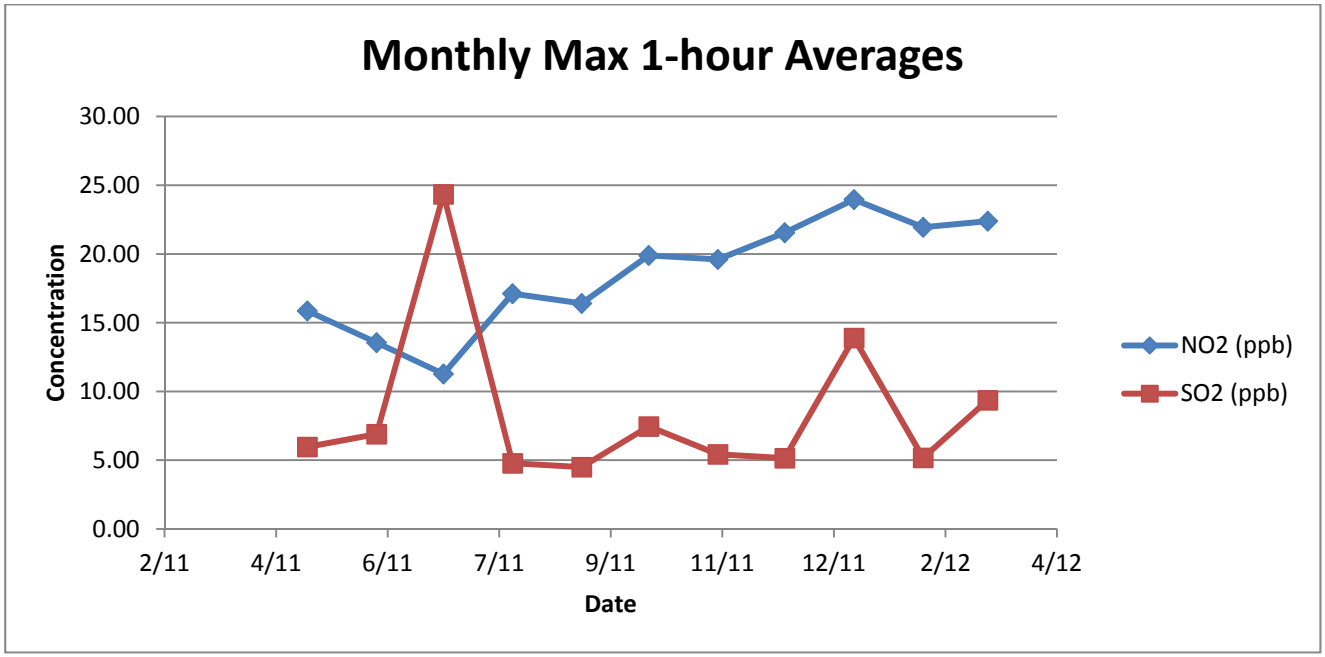

Figure 2-4. Monthly Max 1-hour Averages

The National Ambient Air Quality Standards (NAAQS) for NO_2, SO_2, and $PM_{2.5}$ are being met at the Wando Welch Terminal.

- The primary standard for **NO_2** is 53 ppb (annual arithmetic average) or 100 ppb (3-year average of the 98th percentile of the daily maximum 1-hour average must not exceed 100 ppb). Table 2-3 and Figures 2-3 and 2-4 show that the monthly 24-hr averages and monthly daily maximum 1-hr averages were below 53 ppb for this first year of monitoring.

- The primary standard for **SO_2** is 30 ppb (annual arithmetic average) or 140 ppb (24-hour average, not to be exceeded more than once per year). Table 2-3 and Figures 2-3 and 2-4 show that the monthly 24-hr averages and monthly daily maximum 1-hr averages were below 30 ppb for this first year of monitoring.

- The primary standard for **$PM_{2.5}$** is 15.0 µg/m^3 (annual arithmetic average; 3-year average of the weighted annual mean $PM_{2.5}$ concentration must not exceed 15.0 µg/m^3) or 35.0 µg/m^3 (24-hour average; 3-year average of the

98th percentile of the 24-hour concentrations must not exceed 35.0 µg/m^3). The $PM_{2.5}$ NAAQS was met for this year of monitoring.

2.1 Specific Data Notes

System maintenance steps were implemented at several periods within this quarter, but no unexpected events were seen. During early March, there was insufficient data for one hour due to the daylight savings time shift. This issue was noted on the QA/QC Daily Comment Sheet.

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3. Quality Assurance/Quality Control

QA/QC procedures applied to this project are described in a Quality Assurance Project Plan titled *Continuous Air Monitoring Station for the Wando Welch Terminal* (July 8, 2011).

3.1 Daily QC/Validation

According to the QAP prepared for this work, results were reviewed for anomalies and validated on a daily basis. These validations were recorded on QA/QC Daily Comment Sheets. Exceedances of the EPA Ambient Air Quality guidelines found in the daily validations were logged and are summarized in Table 3-1. The table contains the date the anomaly occurred and the reason/comment.

Table 3-1. QA/QC Daily Comment Sheet

Date	Comment
2/10/2012	Graphs not displaying in excel file. Data looks fine otherwise.
3/11/2012	Insufficient data from 2:00 - 3:00 due to daylight savings time change.
3/25/2012	Power failure at 12:06 causing skewed data points for PM, NO, and SO_2
3/26/2012	Graphs not displaying in excel file. Data looks fine otherwise.

3.2 Quarterly Data Validation

The quarterly data were assessed as follows: 100% of the validated Quarter 4 data were flagged as "good". Percent completeness for Quarter 4 was calculated by dividing the number of hours flagged by the macro as "Insufficient Data" for any parameter by the total number of hours in the quarter. Percent completeness for Quarter 4 was 99.95%.

The QAP stated a completeness goal of 90% for $PM_{2.5}$, SO_2 and NO_X. The data collected from May 6, 2011 through March 31, 2012 exceeded this goal.

3.3 Equipment Calibration

As stated in the QAP, daily zero/span checks were performed on the gas analyzers ($PM_{2.5}$, SO_2 and NO_2), and a full calibration was performed if any instrument did not

pass the zero/span check. Calibration of the $PM_{2.5}$ monitor, using the mass foil kit provided by the manufacturer, will be performed in June 2012 during the scheduled annual maintenance visit.

3.4 Meteorological Data

The QAP stated a completeness goal of 90% for ambient temperature, relative humidity, wind speed, wind direction, and barometric pressure. The data collected from May 6, 2011 through March 31, 2012 exceeded this goal.

Immediate corrective action was initiated for any equipment failure. In addition, the meteorological sensors will be checked during the scheduled annual maintenance visit in June 2012 to ensure they are consistently providing accurate data.