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

Q4 2013 Quarterly Report

January 2014

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Q4 2013 Quarterly Report

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ARCADIS

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 Mt. Pleasant, SC. 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 data. This report is the 11th quarterly data report (third quarterly report in year three of operations) 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 October 1, 2013 through December 31, 2013.

1.2 Project Description

SCSPA requested a system to 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 minimized. 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.

The QAP is updated periodically to reflect improvements to the basic operating procedures or to document changes in the air quality standards. An update was performed on September 20, 2012, following the annual maintenance program and an on-site audit by the S.C. Department of Health and Environmental Control (conducted June 14-15, 2012) to reflect actual procedures at the end of the first year of operation. An update was also performed on October 17, 2013, to reflect changes to the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$. 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 observed, 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. ARCADIS has been able to remotely access the control computer and reliably interact with the instruments. The instruments are very responsive 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 the archived data any time in the future.

2. Quarterly Results

The 24-hr daily averages for $PM_{2.5}$, 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 averages, minimums and maximums for all parameters are summarized in Table 2-2, with the corresponding NAAQS shown in Table 2-3. 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 summarized in Table 2-4.

Table 2-1. 24-Hour Averages

24-hour Averages						Daily Max 1-hr Avg.	
Date	$PM_{2.5}$ ($\mu g/m^3$)	NO (ppb)	NO_2 (ppb)	NO_X (ppb)	SO_2 (ppb)	NO_2 (ppb)	SO_2 (ppb)
10/1/13	11.01	2.65	9.46	12.11	0.17	17.35	1.41
10/2/13	14.86	3.67	12.37	16.04	0.49	26.44	4.32
10/3/13	11.47	3.22	8.90	12.11	0.11	30.24	1.46
10/4/13	7.00	3.86	5.96	9.81	0.10	16.34	1.41
10/5/13	5.20	2.80	4.45	7.24	0.33	19.14	3.64
10/6/13	7.76	1.02	2.03	3.04	0.12	9.29	2.19
10/7/13	1.66	9.83	7.32	17.13	0.09	22.66	1.88
10/8/13	3.79	2.25	3.26	5.48	0.11	6.65	2.21
10/9/13	5.79	3.06	6.00	9.03	0.14	12.98	1.04
10/10/13	5.06	4.70	8.74	13.43	0.69	14.48	2.47
10/11/13	6.20	9.47	16.01	25.48	2.50	26.15	6.50
10/12/13	9.62	0.68	6.14	6.82	0.41	18.39	4.09
10/13/13	5.91	0.53	3.19	3.72	0.09	10.14	1.42
10/14/13	4.84	2.46	4.47	6.91	0.05	16.20	0.89
10/15/13	5.01	1.82	4.86	6.66	0.05	8.66	0.88
10/16/13	8.56	2.75	6.37	9.11	0.05	14.40	0.91
10/17/13	10.46	25.77	12.85	38.62	0.37	33.62	1.67
10/18/13	8.99	6.55	9.44	15.99	0.34	24.03	1.36
10/19/13	9.57	1.74	5.28	7.02	0.48	13.46	3.28
10/20/13	8.89	0.34	3.23	3.56	0.70	10.33	5.11
10/21/13	8.82	2.46	6.23	8.67	0.22	15.25	1.11
10/22/13	11.40	7.68	12.30	19.98	0.08	26.27	0.81

24-hour Averages						Daily Max 1-hr Avg.	
Date	**$PM_{2.5}$ ($\mu g/m^3$)**	**NO (ppb)**	**NO_2 (ppb)**	**NO_X (ppb)**	**SO_2 (ppb)**	**NO_2 (ppb)**	**SO_2 (ppb)**
10/23/13	7.62	7.83	12.56	20.39	1.91	22.78	5.20
10/24/13	8.55	4.06	8.28	12.33	0.51	17.70	2.78
10/25/13	9.82	3.75	8.09	11.83	0.75	23.22	3.60
10/26/13	9.38	0.27	4.47	4.73	0.76	16.23	2.68
10/27/13	12.64	1.51	10.35	11.86	1.24	20.04	3.37
10/28/13	18.20	9.96	19.79	29.75	1.67	34.33	3.46
10/29/13	17.95	11.13	13.76	24.89	0.35	25.53	1.97
10/30/13	15.24	8.17	12.99	21.16	0.57	23.87	3.72
10/31/13	12.40	25.68	15.55	41.22	0.25	42.13	2.06
11/1/13	8.38	3.61	6.31	9.93	0.26	12.71	1.20
11/2/13	8.40	5.70	9.04	14.73	1.34	29.99	4.81
11/3/13	8.85	0.13	2.00	2.12	0.31	5.89	1.70
11/4/13	4.76	2.63	5.22	7.85	0.27	13.78	0.86
11/5/13	6.41	2.92	4.70	7.61	0.13	11.59	0.92
11/6/13	7.32	3.34	6.05	9.39	0.14	15.16	1.54
11/7/13	9.27	12.56	14.10	26.66	2.07	26.61	7.99
11/8/13	5.10	2.49	7.92	10.41	0.20	19.04	0.47
11/9/13	10.37	0.72	3.60	4.32	0.28	7.60	0.51
11/10/13	11.14	0.95	7.57	8.52	1.19	15.80	7.05
11/11/13	10.48	0.26	4.14	4.39	0.36	16.85	1.23
11/12/13	14.11	19.73	15.56	35.29	1.47	42.69	6.15
11/13/13	4.65	3.34	5.62	8.96	0.35	13.67	0.81
11/14/13	7.57	2.82	7.45	10.27	0.42	18.96	0.98
11/15/13	9.19	4.86	9.48	14.33	0.20	21.47	1.56
11/16/13	6.18	1.23	5.20	6.42	0.23	22.39	2.74
11/17/13	5.14	0.79	2.77	3.56	0.17	8.66	2.40
11/18/13	6.88	14.00	10.72	24.72	2.20	21.00	9.31
11/19/13	6.68	2.01	5.64	7.64	0.29	15.29	0.59
11/20/13	7.55	3.12	5.49	8.61	0.27	11.64	0.69
11/21/13	8.25	2.09	5.17	7.26	0.15	11.51	1.07
11/22/13	4.85	5.14	7.11	12.25	0.18	16.97	2.48
11/23/13	6.10	3.90	7.61	11.51	0.64	18.42	2.83

24-hour Averages						Daily Max 1-hr Avg.	
Date	**$PM_{2.5}$ ($\mu g/m^3$)**	**NO (ppb)**	**NO_2 (ppb)**	**NO_X (ppb)**	**SO_2 (ppb)**	**NO_2 (ppb)**	**SO_2 (ppb)**
11/24/13	5.00	0.60	1.64	2.24	0.23	3.52	0.45
11/25/13	3.71	2.07	4.45	6.51	0.33	12.08	0.78
11/26/13	8.32	13.47	8.79	22.24	0.25	31.31	1.87
11/27/13	4.84	4.87	6.33	11.19	0.55	13.43	1.94
11/28/13	8.21	0.20	2.44	2.62	0.47	9.51	2.00
11/29/13	9.70	2.39	5.92	8.30	0.55	13.38	1.50
11/30/13	9.74	0.69	3.30	3.98	0.51	7.28	1.50
12/1/13	12.42	1.17	5.40	6.57	0.39	14.79	1.14
12/2/13	18.71	8.72	16.19	24.90	1.54	24.86	5.43
12/3/13	23.78	31.72	23.37	55.08	1.23	41.20	3.46
12/4/13	11.48	11.26	16.10	27.36	0.79	32.72	2.60
12/5/13	4.88	13.41	13.20	26.61	0.37	27.64	3.04
12/6/13	5.40	5.48	7.34	12.82	0.28	15.22	1.91
12/7/13	4.56	0.91	3.61	4.51	0.26	6.90	1.94
12/8/13	3.25	0.62	2.09	2.70	0.15	5.53	2.08
12/9/13	8.54	17.53	10.80	28.30	0.52	30.40	3.07
12/10/13	4.80	5.51	8.96	14.46	0.59	15.76	3.20
12/11/13	5.28	2.96	8.29	11.25	0.33	16.58	1.53
12/12/13	10.36	5.49	11.86	17.35	0.78	24.40	1.91
12/13/13	8.19	5.57	9.99	15.54	0.48	32.77	0.87
12/14/13	9.51	0.28	2.76	3.03	0.20	8.60	1.34
12/15/13	5.37	5.22	10.36	15.57	2.45	23.45	6.85
12/16/13	8.81	13.70	14.93	28.63	1.77	28.66	5.14
12/17/13	6.63	7.46	13.32	20.79	0.92	26.44	3.14
12/18/13	9.80	11.12	18.94	30.06	3.01	33.48	24.13
12/19/13	14.42	37.49	22.54	60.03	0.64	37.14	1.50
12/20/13	12.49	48.95	25.32	74.27	0.99	56.24	3.24
12/21/13	9.47	2.17	6.33	8.50	0.30	20.04	2.25
12/22/13	6.27	0.60	2.24	2.83	0.17	4.17	1.97
12/23/13	7.55	9.03	8.84	17.87	0.37	21.83	1.97
12/24/13	3.31	1.11	3.85	4.95	0.85	8.85	3.79
12/25/13	5.70	0.06	1.52	1.55	0.30	2.64	0.53

24-hour Averages						Daily Max 1-hr Avg.	
Date	$PM_{2.5}$ ($\mu g/m^3$)	NO (ppb)	NO_2 (ppb)	NO_X (ppb)	SO_2 (ppb)	NO_2 (ppb)	SO_2 (ppb)
12/26/13	7.98	4.03	8.33	12.35	0.42	19.89	1.25
12/27/13	7.63	3.15	7.94	11.08	0.48	19.19	0.97
12/28/13	7.23	0.32	3.58	3.90	0.41	12.37	1.37
12/29/13	6.76	3.82	7.69	11.50	2.53	20.79	9.65
12/30/13	7.08	12.37	14.98	27.35	2.06	21.52	5.26
12/31/13	14.91	5.33	9.97	15.30	1.84	17.53	6.53

Table 2-2. Quarterly Statistics

24-hour Averages						Daily Max 1-hr Avg.	
Date	$PM_{2.5}$ ($\mu g/m^3$)	NO (ppb)	NO_2 (ppb)	NO_X (ppb)	SO_2 (ppb)	NO_2 (ppb)	SO_2 (ppb)
Average	8.51	6.20	8.44	14.64	0.64	19.33	2.85
Minimum	1.66	0.06	1.52	1.55	0.05	2.64	0.45
Maximum	23.78	48.95	25.32	74.27	3.01	56.24	24.13

Table 2-3. National Ambient Air Quality Standards

Pollutant	Primary Standard		Secondary Standard	
	Level	Averaging Time	Level	Averaging Time
NO_2	53 ppb (1)	Annual (Arithmetic Average)	Same as Primary	
	100 ppb	1-hour (2)	None	
SO_2	75 ppb	1-hour (3)	0.5 ppm	3-hour (4)
$PM_{2.5}$	12.0 $\mu g/m^3$	Annual (5) (Arithmetic Average)	15.0 $\mu g/m^3$	Annual (5) (Arithmetic Average)
	35 $\mu g/m^3$	24-hour (6)	Same as Primary	

(1) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(2) To attain this standard, the 3-year average of the 98th percentile (8th highest in a year) of the daily maximum 1-hour average at each monitor within the area must not exceed 100 ppb.

(3) Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile (4th highest in a year) of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

(4) Not to be exceeded more than once per year.

(5) To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from a single or multiple community-oriented monitors must not exceed 12.0 ug/m^3 (primary standard) or 15.0 ug/m^3 (secondary standard) (revised December 14, 2012).

(6) To attain this standard, the 3-year average of the 98th percentile (8th highest in a year) of 24-hour concentrations at each population oriented monitor within an area must not exceed 35 ug/m^3.

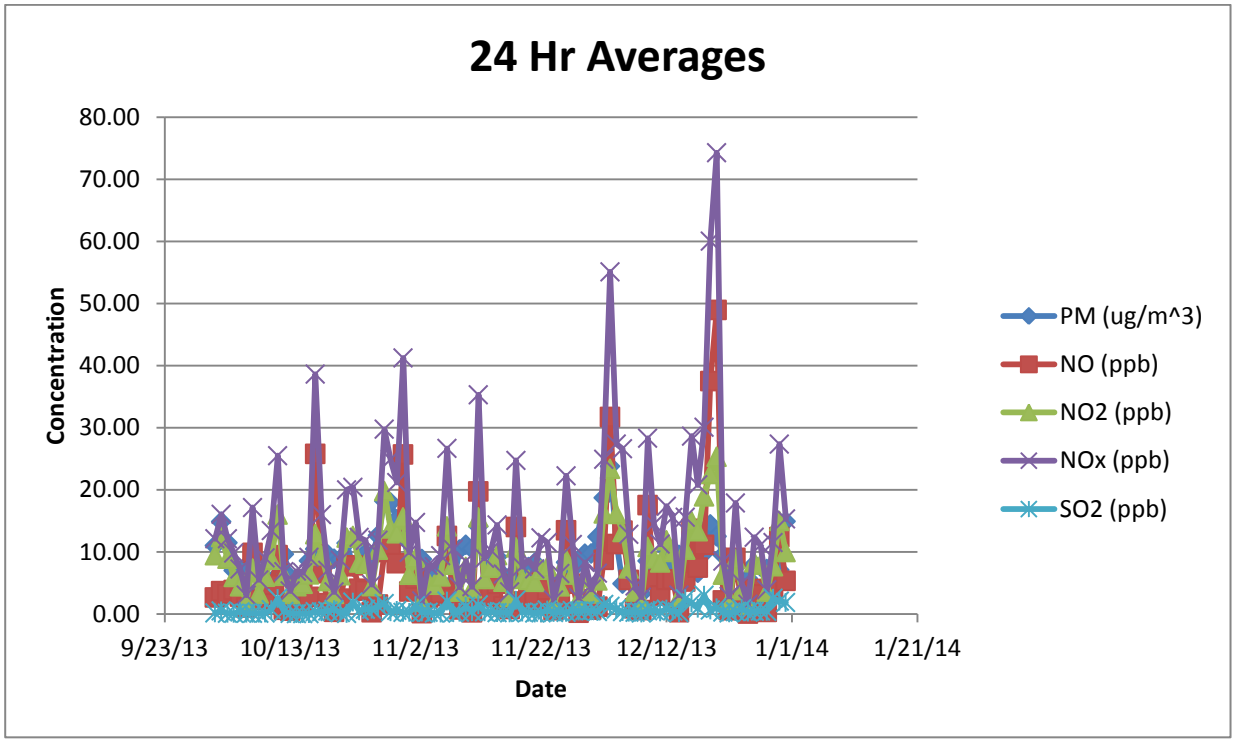

Figure 2-1. 24-hour Averages

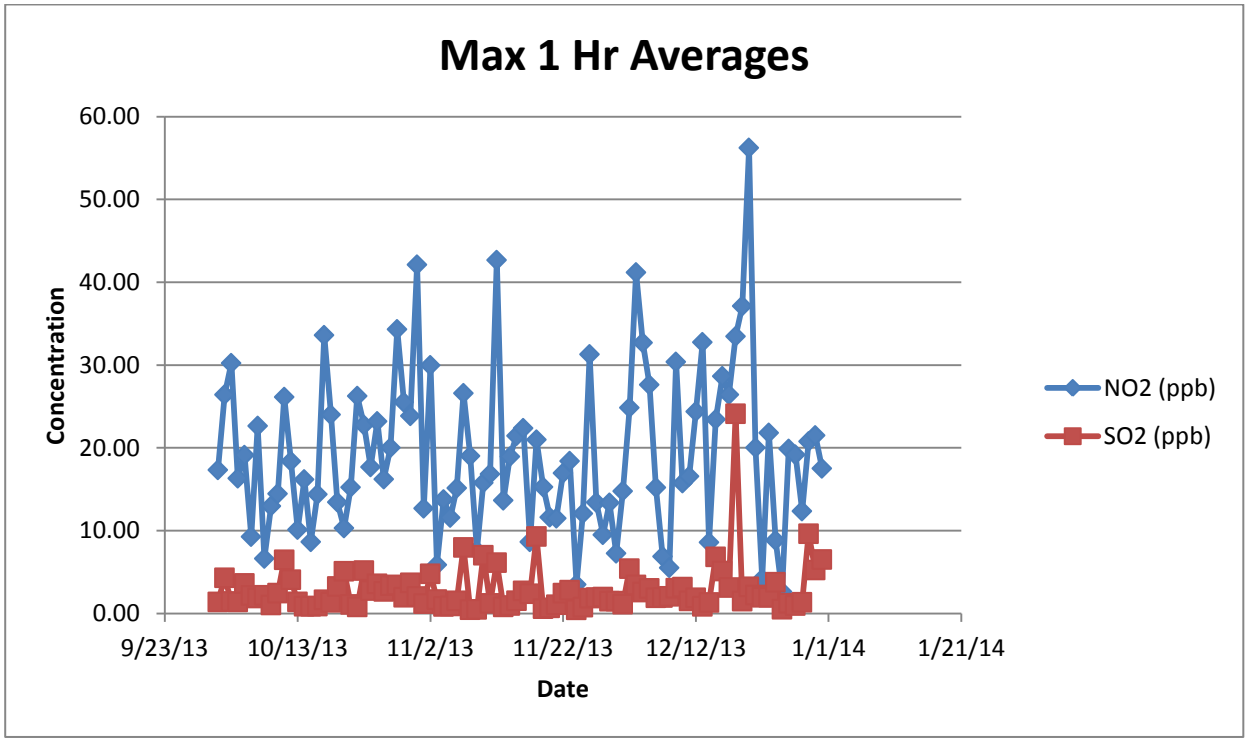

Figure 2-2. Max 1-hour Averages

Table 2-4. Monthly Statistics

Monthly Averages						Monthly Daily Max 1-hr Avg.	
Month	**$PM_{2.5}$ ($\mu g/m^3$)**	**NO (ppb)**	**NO_2 (ppb)**	**NO_X (ppb)**	**SO_2 (ppb)**	**NO_2 (ppb)**	**SO_2 (ppb)**
October 2013	9.15	5.54	8.54	14.07	0.51	19.95	2.54
November 2013	7.57	4.09	6.38	10.46	0.53	16.27	2.33
December 2013	8.79	8.92	10.34	19.26	0.88	21.66	3.65

2.1 Specific Data Notes

Normal maintenance and instrument calibration procedures were performed several times this quarter. Additional notes can be found in the QA/QC Daily Comment Sheet summary shown in Table 3-1.

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3. Quality Assurance/Quality Control

QA/QC procedures applied to this project are described in a Quality Assurance Plan titled *Continuous Air Monitoring Station for the Wando Welch Terminal* (October 17, 2013, Revision 3).

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 are recorded on QA/QC Daily Comment Sheets and are summarized in Table 3-1. This table contains a description of any anomalies that occurred over the past quarter along with a record of normal calibration and maintenance activities and the date of occurrence.

Table 3-1. QA/QC Daily Comment Sheet

Date	Comment
10/27/2013	Insufficient data 4:00 - 6:00 due to NOx calibration.
11/4/2013	Two SO_2 calibration events (1:00 and 2:00) due to daylight savings adjustment. Zero check at 0:00 due to same issue.
11/29/2013	Insufficient data 4:00 - 6:00 due to NOx calibration.
12/17/2013	43i alarm from 16:43 - 17:12 and from 22:23 through end of day.
12/19/2013	Inst. Alarm displaying on 5014i upon remote login - Started at 22:50. 43i alarm from 0:44 - 17:26.
12/20/2013	5014i alarm due to low filter roll. Will not record this alarm occurrence daily until roll has been exchanged.
12/22/2013	Intermittent 43i alarms (low flow).
12/23/2013	Intermittent 43i alarms (low flow).
12/24/2013	Intermittent 43i alarms (low flow).
12/25/2013	43i alarm entire day (low flow).
12/26/2013	43i alarm displaying upon remote login (low flow). 43i alarm entire day (low flow).
12/27/2013	Intermittent 43i and 42i alarms all day (low flow and high flow, respectively)
12/28/2013	Intermittent 43i and 42i alarms all day (low flow and high flow, respectively)

Date	Comment
12/29/2013	Intermittent 43i alarms (low flow).
12/30/2013	43i sample flow alarm displaying upon remote login. 43i alarms all day. Intermittent 42i alarms.
12/31/2013	43i sample flow alarm displaying upon remote login. 43i alarms all day. Intermittent 42i alarms.

The 5014i alarms of 12/19/13 and afterwards were triggered by the filter tape counter. This is not an indication that the instrument is out of filter media, but only a warning to the operator that it will need to be replaced soon. The filter roll was replaced on 1/3/14. The intermittent alarms on the 42i and 43i were traced to failing flow transducers in the units. These components were replaced in both instruments on 1/6/14. The flow transducers report the sample flow through the unit. The NO_X and SO_2 data were not compromised as the sample flow was maintained throughout the period and the units continued to pass their daily QC checks.

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 99.82%.