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SOUTH CAROLINA PORTS AUTHORITY

SOUTH CAROLINA PORTS

Continuous Air Monitoring Station for the Wando Welch Terminal

Q2 2016 Quarterly Report

July 2016

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SOUTH CAROLINA PORTS AUTHORITY - CONTINUOUS AIR MONITORING STATION FOR THE WANDO WELCH TERMINAL

Q2 2016 Quarterly Report

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1 EXECUTIVE SUMMARY

Arcadis was contracted in late December 2010 to provide continuous air monitoring services to the South Carolina Ports Authority (SCPA) 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 21st quarterly data report (first quarterly report in year six of operations) and presents the data summaries requested by SCPA and described in the scope of work. 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 April 1, 2016 through June 30, 2016.

2 PROJECT DESCRIPTION

SCPA 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 maintains the monitoring instruments, stocks consumables such as filters and calibration gases, and orders 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. The air monitoring project 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.

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 is influenced by local sources and meteorological conditions. Although this is not a typical fence line site, it has proven to be well suited for 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.

2.1 Quarterly Results

The 24-hr daily averages for $PM_{2.5}$, NO, NO_2, NO_X, and SO_2 and the maximum daily values for NO_2 (1-hr average) and SO_2 (1-hr and 3-hr average) 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 limits 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 and Daily Maximums

24-hour Averages						Daily Max 1-hr Avg.		Daily Max 3-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)	SO_2 (ppb)
4/1/16	8.61	6.33	7.47	13.74	0.03	17.34	0.15	0.09
4/2/16	4.32	2.25	5.28	7.48	0.01	12.61	0.05	0.03
4/3/16	6.42	1.03	5.02	5.99	0.19	18.71	0.87	0.52
4/4/16	9.79	18.14	12.95	31.04	0.07	35.83	0.44	0.22
4/5/16	11.70	3.83	8.71	12.51	0.13	21.72	0.79	0.50
4/6/16	7.05	2.03	5.22	7.22	0.01	16.08	0.04	0.03
4/7/16	6.76	3.75	7.53	11.28	0.14	15.26	0.72	0.42
4/8/16	7.78	12.32	13.59	25.91	0.22	40.75	1.29	0.67
4/9/16	4.61	2.84	7.22	10.05	0.11	18.78	0.35	0.20
4/10/16	7.52	0.10	1.46	1.49	0.09	3.40	0.75	0.16
4/11/16	*	10.23	10.71	20.87	0.02	49.33	0.21	0.08
4/12/16	*	15.65	21.01	36.62	0.01	42.62	0.04	0.03
4/13/16	7.88	2.27	4.87	7.11	0.01	11.20	0.05	0.03
4/14/16	7.88	1.94	4.02	5.94	0.02	13.50	0.09	0.07
4/15/16	*	2.26	3.24	5.46	0.00	9.55	0.01	0.00
4/16/16	*	0.63	2.36	2.91	0.01	6.79	0.02	0.01
4/17/16	*	0.01	2.44	2.29	0.01	11.89	0.03	0.01
4/18/16	*	4.23	12.04	16.25	0.05	26.18	0.45	0.32
4/19/16	*	8.18	15.64	23.79	0.19	46.19	1.20	1.00
4/20/16	*	4.29	10.93	15.19	0.16	24.07	0.64	0.50
4/21/16	*	5.73	9.94	15.65	0.01	32.18	0.14	0.08
4/22/16	13.42	4.02	8.08	12.07	0.00	28.86	0.00	0.00
4/23/16	6.34	1.45	6.09	7.51	0.04	12.50	0.33	0.14
4/24/16	7.52	0.12	2.42	2.49	0.00	11.48	0.01	0.00
4/25/16	7.90	11.62	12.31	23.92	0.01	34.14	0.09	0.05
4/26/16	8.68	8.31	11.49	19.78	0.00	32.01	0.02	0.01
4/27/16	9.64	5.24	8.46	13.68	0.01	23.19	0.05	0.03
4/28/16	12.07	5.41	10.25	15.64	0.00	22.08	0.01	0.01
4/29/16	14.00	3.75	7.04	10.75	0.09	19.44	1.03	0.70

24-hour Averages						Daily Max 1-hr Avg.		Daily Max 3-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)	SO_2 (ppb)
4/30/16	10.83	0.28	1.28	1.51	0.00	4.15	0.00	0.00
5/1/16	9.76	0.12	0.59	0.68	0.00	4.47	0.00	0.00
5/2/16	8.15	6.69	6.08	12.77	0.00	18.44	0.00	0.00
5/3/16	6.64	5.86	7.48	13.34	0.00	15.77	0.04	0.02
5/4/16	5.79	5.80	11.57	17.37	0.03	21.10	0.56	0.19
5/5/16	7.66	5.67	11.54	17.20	0.21	20.42	1.48	0.57
5/6/16	5.99	6.21	9.85	16.03	0.29	18.58	1.97	0.88
5/7/16	7.40	2.91	9.42	12.28	0.03	19.23	0.15	0.08
5/8/16	14.08	2.50	6.98	9.44	0.12	43.66	0.88	0.47
5/9/16	14.97	5.02	12.79	17.78	0.18	30.00	2.15	1.01
5/10/16	13.18	6.53	12.04	18.54	0.01	31.08	0.05	0.03
5/11/16	6.85	12.40	12.24	24.63	0.03	36.18	0.14	0.09
5/12/16	9.35	6.42	9.85	16.26	0.07	25.91	0.34	0.18
5/13/16	9.95	8.47	11.17	19.63	0.02	26.45	0.09	0.08
5/14/16	8.98	1.86	5.83	7.68	0.08	17.67	0.69	0.43
5/15/16	7.39	0.19	1.87	2.05	0.40	3.77	3.03	1.26
5/16/16	8.83	2.95	6.78	9.72	0.01	24.85	0.04	0.03
5/17/16	7.56	11.71	12.11	23.74	0.01	29.72	0.04	0.02
5/18/16	6.35	6.10	7.06	13.15	0.00	14.90	0.01	0.01
5/19/16	8.32	2.67	4.63	7.28	0.00	14.62	0.00	0.00
5/20/16	8.89	1.39	5.27	6.64	0.00	15.56	0.00	0.00
5/21/16	7.10	1.89	6.13	8.01	0.00	13.33	0.01	0.00
5/22/16	8.07	2.66	4.97	7.62	0.14	13.85	1.49	0.82
5/23/16	11.67	4.52	10.88	15.40	0.29	21.65	2.11	1.12
5/24/16	23.57	10.41	12.87	23.27	0.22	31.45	2.64	1.27
5/25/16	14.34	15.86	14.48	30.32	0.09	38.23	0.42	0.26
5/26/16	7.74	15.20	14.78	29.96	0.01	41.17	0.04	0.03
5/27/16	15.44	2.44	5.35	7.76	0.01	25.04	0.04	0.03
5/28/16	8.20	0.50	1.58	2.05	0.00	3.67	0.01	0.01
5/29/16	4.54	0.86	1.65	2.47	0.00	5.99	0.01	0.00

24-hour Averages						Daily Max 1-hr Avg.		Daily Max 3-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)	SO_2 (ppb)
5/30/16	6.51	4.12	6.96	11.00	0.01	11.51	0.11	0.06
5/31/16	7.17	4.51	7.67	12.09	0.02	14.32	0.10	0.05
6/1/16	9.40	5.66	8.36	13.79	0.05	14.41	0.35	0.28
6/2/16	12.31	5.23	11.69	16.81	0.35	23.28	2.60	1.45
6/3/16	16.43	8.12	9.62	17.69	0.07	27.76	0.33	0.21
6/4/16	4.40	2.00	2.79	4.69	0.02	10.94	0.09	0.05
6/5/16	5.49	0.44	1.94	2.17	0.00	5.30	0.00	0.00
6/6/16	5.69	9.58	8.36	17.90	0.01	17.10	0.06	0.04
6/7/16	6.61	3.64	6.94	10.36	0.09	16.66	0.48	0.35
6/8/16	9.91	6.61	10.47	17.04	0.06	28.28	0.33	0.22
6/9/16	9.27	3.07	7.17	10.11	0.35	20.86	0.64	0.53
6/10/16	12.83	11.32	12.09	23.25	0.45	55.72	1.21	0.94
6/11/16	9.15	4.36	5.13	9.42	0.28	21.65	0.39	0.36
6/12/16	11.08	1.14	4.24	5.38	0.40	15.64	0.72	0.63
6/13/16	12.50	2.90	6.96	9.81	0.51	18.91	1.36	0.84
6/14/16	13.80	5.74	9.44	15.09	0.32	23.09	0.52	0.50
6/15/16	8.55	6.36	9.35	15.66	0.02	20.48	0.20	0.02
6/16/16	6.94	3.28	5.72	8.89	0.06	16.98	0.33	0.22
6/17/16	16.55	2.46	9.58	11.88	0.06	20.90	0.50	0.34
6/18/16	5.77	0.19	1.35	1.34	0.01	4.00	0.04	0.03
6/19/16	4.82	0.16	1.04	1.16	0.01	7.00	0.04	0.03
6/20/16	9.84	8.46	9.91	18.32	0.04	23.63	0.18	0.13
6/21/16	8.28	5.58	9.17	14.74	0.06	21.17	0.48	0.21
6/22/16	10.90	4.65	8.88	13.51	0.23	17.89	1.01	0.88
6/23/16	12.39	4.03	9.10	13.10	0.16	20.92	0.82	0.47
6/24/16	10.91	3.23	6.64	9.79	0.12	17.10	0.69	0.43
6/25/16	10.73	2.12	5.55	7.60	0.10	16.66	0.57	0.41
6/26/16	9.60	0.12	1.00	1.02	0.01	2.44	0.02	0.02
6/27/16	13.55	1.97	4.37	6.20	0.00	11.21	0.02	0.01
6/28/16	9.22	8.02	10.38	18.36	0.10	32.83	1.04	0.66

24-hour Averages						Daily Max 1-hr Avg.		Daily Max 3-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)	SO_2 (ppb)
6/29/16	8.89	4.68	11.30	15.80	0.17	28.45	2.07	0.97
6/30/16	11.14	7.30	12.06	19.31	0.07	28.79	0.42	0.20

* Data logger failure.

Table 2-2. Quarterly Statistics

24-hour Averages						Daily Max 1-hr Avg.		Daily Max 3-hr Avg.
Date	$PM_{2.5}$ ($\mu g/m^3$)	NO (ppb)	SO_2 (ppb)	NO_X (ppb)	SO_2 (ppb)	NO_2 (ppb)	SO_2 (ppb)	SO_2 (ppb)
Average	9.37	4.89	7.83	12.66	0.09	20.93	0.51	0.29
Minimum	4.32	0.01	0.59	0.68	0.00	2.44	0.00	0.00
Maximum	23.57	18.14	21.01	36.62	0.51	55.72	3.03	1.45

Table 2-3. National Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
NO_2	Primary	1-hour	100 ppb	98th Percentile, averaged over 3 years
	Primary and Secondary	Annual	53 ppb (1)	Annual Mean
SO_2	Primary	1-hour	75 ppb (2)	99th Percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year
$PM_{2.5}$	Primary	Annual	12 µg/m^3	Annual mean, averaged over 3 years
	Secondary	Annual	15 µg/m^3	Annual mean, averaged over 3 years
	Primary and Secondary	24-hour	35 µg/m^3	98th Percentile, averaged over 3 years

(1) The official level of the annual NO2 standard is 0.053 ppm, equal to 53 ppb, shown here for the purpose of clearer comparison to the 1-hour standard.

(2) Final rule signed June 2, 2010. The 1971 annual and 24-hour SO2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

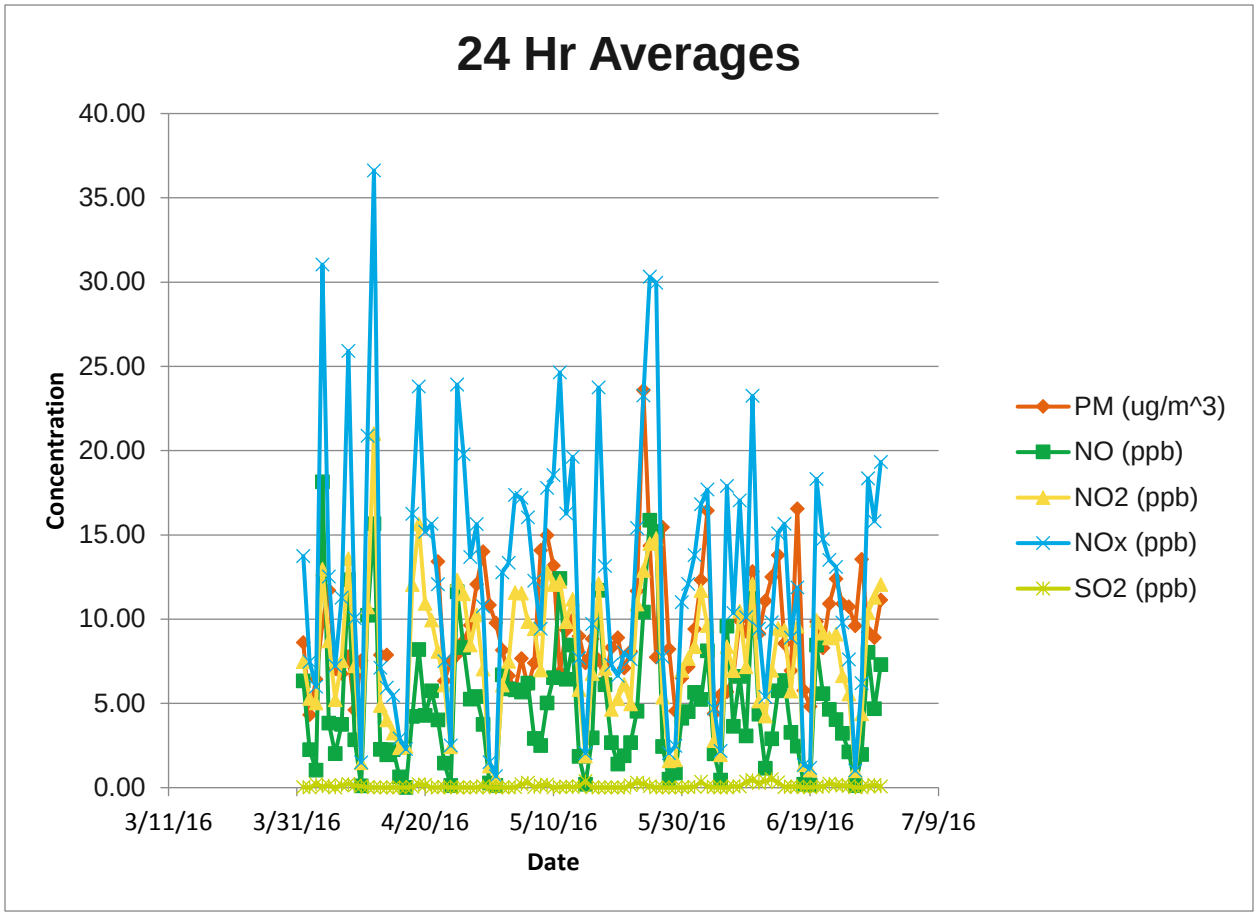

Figure 2-1. 24-hour Averages

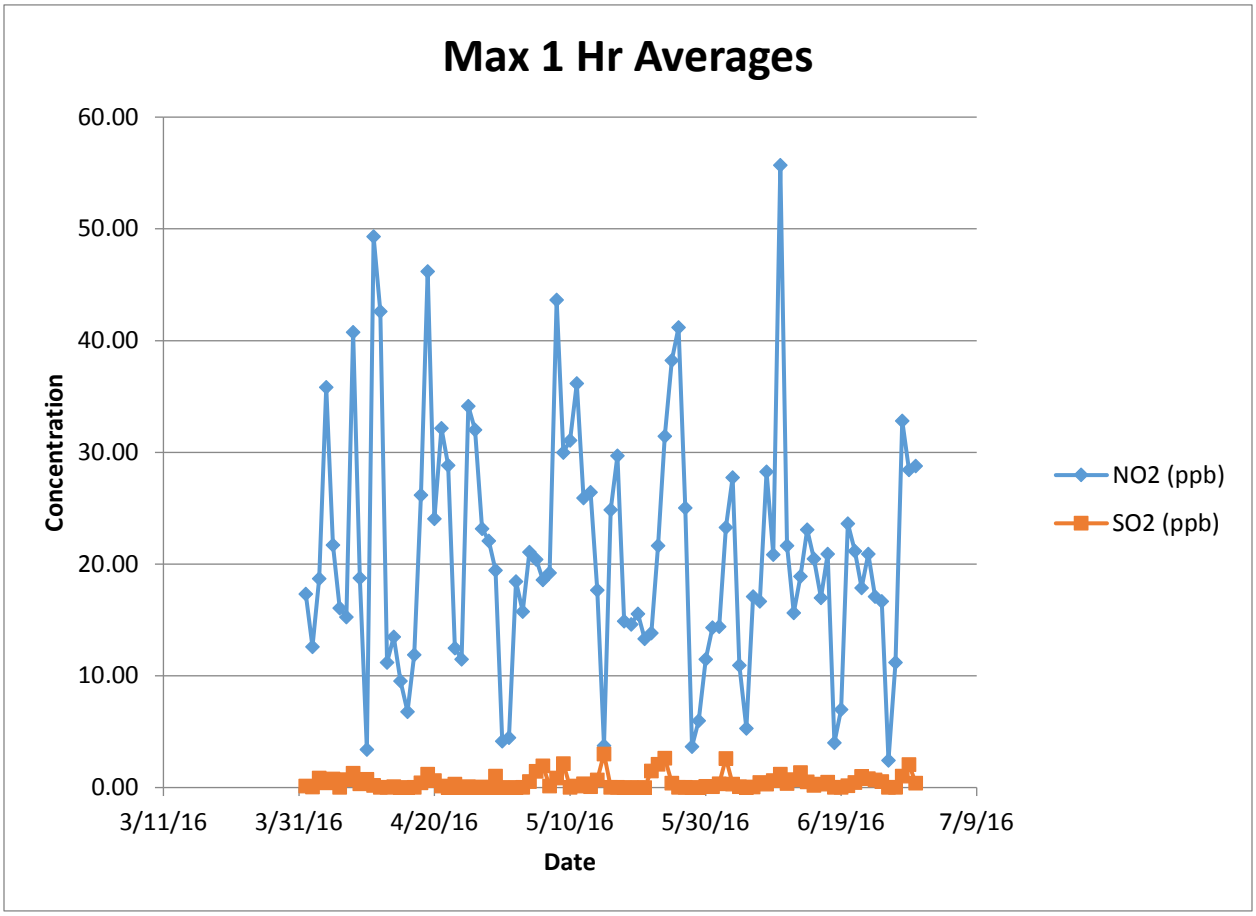

Figure 2-2. Max 1-hour Averages

Table 2-4. Monthly Statistics

	Monthly Averages					Monthly Daily Max 1-hr Avg.		Daily Max 3-hr Avg.
Month	$PM_{2.5}$ ($\mu g/m^3$)	NO (ppb)	SO_2 (ppb)	NO_X (ppb)	SO_2 (ppb)	NO_2 (ppb)	SO_2 (ppb)	SO_2 (ppb)
4/15	8.61	4.94	7.97	12.87	0.06	22.06	0.33	0.20
5/15	9.37	5.30	8.14	13.42	0.07	21.05	0.60	0.29
6/15	9.90	4.41	7.35	11.67	0.14	19.67	0.58	0.38

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 and Quarterly 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. The occurrence and duration of normal calibration and maintenance activities are also recorded.

Daily QC checks were performed in accordance with section 5.1 of the QAPP. The data acquisition system (Opto 22's PAC Display) is remotely accessed from the Arcadis office located in Durham, NC, where instrumentation and trends are monitored for alarms and other irregularities. NOx and SO2 zero and calibration information is displayed by the system from the most recent calibration event and are recorded in the QC Log Book. After checking for irregularities, the data file from the previous day is sent via email to the Durham, NC office. The file is saved to a common folder on the Durham office's server and then post processed with a Microsoft Excel macro. The resulting Excel file provides values for daily averages and maxima, and also alarm and calibration information. This summary information is recorded on the daily QC log sheet. Comments and observations regarding data quality are noted on the QC log sheet, and are also entered into the SCPA QA/QC Daily Comment Sheet. The Arcadis project manager is notified of any issues immediately.

Percent completeness for Quarter 1 was calculated by dividing both the number of hours flagged by the macro as "Insufficient Data" as well as hours for which no data was obtained by the total number of hours in the quarter. Each of the three instruments (5014i, 42i, and 43i) typically produces 24 hours of data each day, for a total of 72 hours per day of recorded data. Problems with the data acquisition system, normal calibration periods for the NOx and SO2 instruments, and normal maintenance of the instruments resulted in instances of incomplete or invalid data.

The data for this quarter were assessed as follows:

- 100% of the validated data were flagged as "good".
- Percent completeness was 94.49%.

The QAP stated a completeness goal of 75% for $PM_{2.5}$, SO_2 and NO_X. The data collected from April 1, 2016 through June 30, 2016 met this goal.

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