

SOUTH CAROLINA PORTS AUTHORITY



**SOUTH
CAROLINA
PORTS**

Continuous Air Monitoring Station for the
Union Pier Terminal

Q4 2021 Quarterly Report

January 2022

**SOUTH CAROLINA PORTS
AUTHORITY –
CONTINUOUS AIR
MONITORING STATION
FOR THE UNION PIER
TERMINAL**

Q4 2021 Quarterly Report

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1 EXECUTIVE SUMMARY

Arcadis was contracted in late October 2014 to provide Continuous Air Monitoring Services to the South Carolina Ports Authority (SCPA) at the Union Pier Terminal in Charleston, SC. Arcadis has followed through on the planned schedule and activities since that award. The major accomplishments were to complete the Quality Assurance Project Plan (QAPP), purchase the instruments, complete the site setup, and then to begin acquiring data. Installation was completed in mid-February 2015 and data acquisition began on February 25. This report is the 28th quarterly data report (fourth quarterly report in year seven of operations) and presents the data summaries requested by SCPA and described in the work scope. This report encompasses a period corresponding to data collected from October 1, 2021 through December 31, 2021.

2 PROJECT DESCRIPTION

SCPA requested a system to provide ambient air quality data including particulate matter less than 2.5 microns (PM_{2.5}), SO₂, and NO₂ at the Union Pier 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, has proven to be reliable, and is generating valid high-quality data suitable for use in dispersion modeling or other potential purposes.

The QAPP may be updated periodically to reflect improvements to the basic operating procedures or to document changes in the air quality standards. This QAPP is written consistent with the current ambient air quality standards for PM, NO_x and SO₂ as defined by the U.S. Environmental Protection Agency.

2.1 Quarterly Results

The 24-hr daily averages for PM_{2.5}, NO, NO₂, NO_x, and SO₂ and the maximum daily values for NO₂ (1-hr average) and SO₂ (1-hr and 3-hr average) for this period are shown in Table 2-1. 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 NO₂ and SO₂ 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

Date	24-hour Averages					Daily Max 1-hr Avg.		Daily Max 3-hr Avg.
	PM _{2.5} (µg/m ³)	NO (ppb)	NO ₂ (ppb)	NO _x (ppb)	SO ₂ (ppb)	NO ₂ (ppb)	SO ₂ (ppb)	SO ₂ (ppb)
10/1/21	11.32	1.85	7.26	9.09	0.36	24.36	0.45	0.40
10/2/21	5.67	1.65	6.33	7.96	0.35	17.37	0.50	0.47
10/3/21	3.61	0.20	1.74	1.91	0.29	4.12	0.36	0.31
10/4/21	4.12	0.81	2.87	3.64	0.18	11.53	0.59	0.43
10/5/21	4.95	1.57	6.46	8.01	0.11	19.42	0.15	0.12
10/6/21	5.59	1.11	3.79	4.88	0.10	8.52	0.14	0.12
10/7/21	4.31	1.64	4.31	5.94	0.09	11.55	0.13	0.11
10/8/21	5.56	0.99	3.77	4.75	0.09	10.94	0.14	0.11
10/9/21	6.32	1.97	5.97	7.93	0.12	13.11	0.21	0.17
10/10/21	5.25	0.27	3.26	3.50	0.10	8.15	0.16	0.13
10/11/21	5.87	1.51	3.82	5.31	0.12	11.57	0.18	0.15
10/12/21	7.74	2.00	6.64	8.63	0.13	20.05	0.20	0.16
10/13/21	6.40	2.65	7.02	9.67	0.15	14.85	0.29	0.19
10/14/21	8.91	4.95	10.52	15.47	0.24	21.13	0.83	0.56

24-hour Averages						Daily Max 1-hr Avg.		Daily Max 3-hr Avg.
Date	PM _{2.5} (µg/m ³)	NO (ppb)	NO ₂ (ppb)	NO _x (ppb)	SO ₂ (ppb)	NO ₂ (ppb)	SO ₂ (ppb)	SO ₂ (ppb)
10/15/21	11.39	0.80	4.23	4.96	0.17	8.51	0.27	0.22
10/16/21	12.81	0.21	2.42	2.61	0.19	4.35	0.33	0.29
10/17/21	6.91	0.40	4.76	5.14	0.24	11.10	0.40	0.28
10/18/21	7.66	0.89	6.24	7.11	0.36	12.11	1.23	0.59
10/19/21	10.40	3.08	6.78	9.80	0.34	27.16	0.69	0.60
10/20/21	10.47	0.85	5.65	6.47	0.32	14.70	0.76	0.52
10/21/21	6.44	1.61	6.37	7.94	0.23	23.86	0.45	0.33
10/22/21	4.13	0.84	2.93	3.66	0.21	7.27	0.51	0.38
10/23/21	10.33	0.85	5.99	6.82	0.22	33.05	0.36	0.32
10/24/21	8.57	1.61	8.09	9.69	0.22	27.22	0.41	0.32
10/25/21	3.18	0.68	4.39	5.05	0.14	14.61	0.19	0.16
10/26/21	7.48	1.62	3.68	5.13	0.16	6.31	0.25	0.22
10/27/21	6.04	1.10	6.53	7.59	0.32	17.09	0.72	0.63
10/28/21	6.71	2.06	7.73	9.78	0.20	19.72	0.44	0.32
10/29/21	6.11	1.37	2.44	3.50	0.17	4.51	0.25	0.21
10/30/21	5.06	0.57	2.39	2.94	0.19	4.25	0.24	0.21
10/31/21	6.04	0.56	2.58	3.14	0.20	6.61	0.26	0.22
11/1/21	7.41	1.34	6.32	7.62	0.33	12.80	1.09	0.81
11/2/21	8.87	2.71	10.12	12.82	0.07	22.19	0.19	0.11
11/3/21	10.24	0.60	3.94	4.52	0.00	13.52	0.02	0.00
11/4/21	7.51	1.66	6.42	8.08	0.34	9.51	0.73	0.60
11/5/21	6.41	0.69	3.43	4.08	0.30	5.77	0.43	0.41
11/6/21	4.47	0.12	2.30	2.40	0.27	3.45	0.32	0.30
11/7/21	5.51	0.41	4.94	5.34	0.20	15.75	0.63	0.48
11/8/21	9.66	1.95	15.50	17.45	0.87	38.45	1.83	1.61
11/9/21	13.73	5.64	15.75	21.34	0.78	29.76	2.59	1.77
11/10/21	13.53	2.20	10.88	13.01	0.42	20.17	0.73	0.66
11/11/21	6.95	3.21	6.44	9.56	0.03	18.48	0.33	0.00
11/12/21	8.44	1.90	1.24	2.69	0.01	4.17	0.09	0.04
11/13/21	12.06	0.56	1.70	2.05	0.03	7.01	0.12	0.08
11/14/21	11.04	1.65	1.74	3.14	0.05	9.31	0.29	0.19
11/15/21	9.66	1.36	1.93	2.80	0.03	10.08	0.09	0.07
11/16/21	12.21	3.16	4.19	7.16	0.04	13.48	0.12	0.10
11/17/21	11.26	7.82	9.25	17.02	0.12	24.69	0.73	0.47
11/18/21	7.28	9.69	4.71	14.25	0.12	16.97	0.41	0.22
11/19/21	7.13	1.17	1.28	2.18	0.10	4.45	0.23	0.14

24-hour Averages						Daily Max 1-hr Avg.		Daily Max 3-hr Avg.
Date	PM _{2.5} (µg/m ³)	NO (ppb)	NO ₂ (ppb)	NO _x (ppb)	SO ₂ (ppb)	NO ₂ (ppb)	SO ₂ (ppb)	SO ₂ (ppb)
11/20/21	8.37	0.75	0.35	0.73	0.14	2.09	0.25	0.21
11/21/21	6.72	1.40	1.00	2.22	0.11	4.18	0.27	0.24
11/22/21	8.91	2.35	2.73	4.75	0.07	7.72	0.14	0.11
11/23/21	9.09	0.90	4.33	4.83	0.36	22.94	1.30	0.97
11/24/21	8.03	1.64	2.82	4.29	0.26	14.92	1.30	0.71
11/25/21	7.29	1.50	2.96	4.34	0.24	10.19	0.65	0.49
11/26/21	6.58	0.38	1.03	1.10	0.16	5.84	0.51	0.37
11/27/21	9.85	0.72	1.83	2.21	0.13	8.79	0.51	0.28
11/28/21	9.74	0.47	0.14	0.26	0.18	2.84	0.40	0.37
11/29/21	10.59	1.37	2.92	4.06	0.28	12.26	0.91	0.62
11/30/21	11.35	6.41	6.93	13.07	0.26	21.32	0.59	0.37
12/1/21	16.93	2.63	3.31	5.81	0.28	11.38	0.83	0.66
12/2/21	15.51	1.30	2.33	3.37	0.21	7.65	0.67	0.57
12/3/21	20.26	2.16	5.09	7.15	0.22	24.54	0.82	0.61
12/4/21	20.42	0.56	0.39	0.69	0.09	4.19	0.36	0.24
12/5/21	15.96	1.99	3.21	5.09	0.34	9.63	0.54	0.48
12/6/21	16.60	3.27	0.87	3.78	0.03	6.84	0.34	0.00
12/7/21	11.42	1.63	1.58	3.06	0.16	12.97	0.83	0.83
12/8/21	6.93	1.25	1.30	2.27	0.01	5.20	0.05	0.00
12/9/21	11.58	4.12	3.15	7.20	0.50	10.69	1.28	1.18
12/10/21	18.81	2.89	6.77	9.49	0.82	16.15	2.11	1.93
12/11/21	10.35	0.25	1.90	2.13	0.02	13.02	0.13	0.00
12/12/21	6.58	0.65	1.67	2.28	0.28	5.83	0.53	0.39
12/13/21	6.40	0.99	2.30	3.26	0.32	10.10	1.37	0.70
12/14/21	9.33	1.59	5.17	6.68	0.04	17.40	0.50	0.06
12/15/21	9.89	1.84	6.69	8.51	0.00	17.66	0.02	0.01
12/16/21	9.48	5.09	12.86	17.94	0.36	18.90	1.43	1.09
12/17/21	7.67	7.64	8.65	16.24	0.21	18.08	0.67	0.30
12/18/21	3.46	1.46	3.44	4.85	0.02	12.47	0.24	0.00
12/19/21	4.62	0.21	0.36	0.53	0.05	1.86	0.29	0.14
12/20/21	5.83	0.54	0.95	1.48	0.48	3.76	1.93	0.83
12/21/21	6.40	1.45	3.84	5.28	0.10	9.39	1.26	0.23
12/22/21	10.34	1.72	4.95	6.47	1.62	12.26	3.04	2.69
12/23/21	10.19	2.81	8.82	11.63	0.68	23.48	2.12	1.70
12/24/21	15.80	12.38	10.70	23.08	0.02	27.52	0.19	0.00
12/25/21	6.22	0.17	0.65	0.79	0.74	3.18	2.02	1.61

24-hour Averages						Daily Max 1-hr Avg.		Daily Max 3-hr Avg.
Date	PM _{2.5} (µg/m ³)	NO (ppb)	NO ₂ (ppb)	NO _x (ppb)	SO ₂ (ppb)	NO ₂ (ppb)	SO ₂ (ppb)	SO ₂ (ppb)
12/26/21	7.46	0.52	2.76	3.22	0.43	14.81	0.81	0.58
12/27/21	8.56	0.76	2.26	2.97	0.36	5.69	0.84	0.60
12/28/21	5.89	0.61	1.06	1.63	0.32	3.57	0.64	0.44
12/29/21	7.98	0.55	1.14	1.64	0.31	3.73	0.58	0.54
12/30/21	8.23	0.60	2.66	3.23	0.27	11.45	0.42	0.38
12/31/21	10.18	0.42	0.63	0.98	0.25	3.46	0.63	0.35

Table 2-2. Quarterly Statistics

24-hour Averages						Daily Max 1-hr Avg.		Daily Max 3-hr Avg.
Date	PM _{2.5} (µg/m ³)	NO (ppb)	NO ₂ (ppb)	NO _x (ppb)	SO ₂ (ppb)	NO ₂ (ppb)	SO ₂ (ppb)	SO ₂ (ppb)
Average	8.81	1.87	4.43	6.20	0.24	12.82	0.62	0.45
Minimum	3.18	0.12	0.14	0.26	0.00	1.86	0.02	0.00
Maximum	20.42	12.38	15.75	23.08	1.62	38.45	3.04	2.69

Table 2-3. National Ambient Air Quality Standards

Pollutant	Primary/Secondary	Averaging Time	Level	Form
NO ₂	Primary	1-hour	100 ppb	98 th Percentile, averaged over 3 years
	Primary and Secondary	Annual	53 ppb ⁽¹⁾	Annual Mean
SO ₂	Primary	1-hour	75 ppb ⁽²⁾	99 th 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	98 th Percentile, averaged over 3 years

- (1) The level of the annual NO₂ standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.
- (2) The previous SO₂ standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO₂ standards or is not meeting the requirements of a SIP call under the previous SO₂ standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

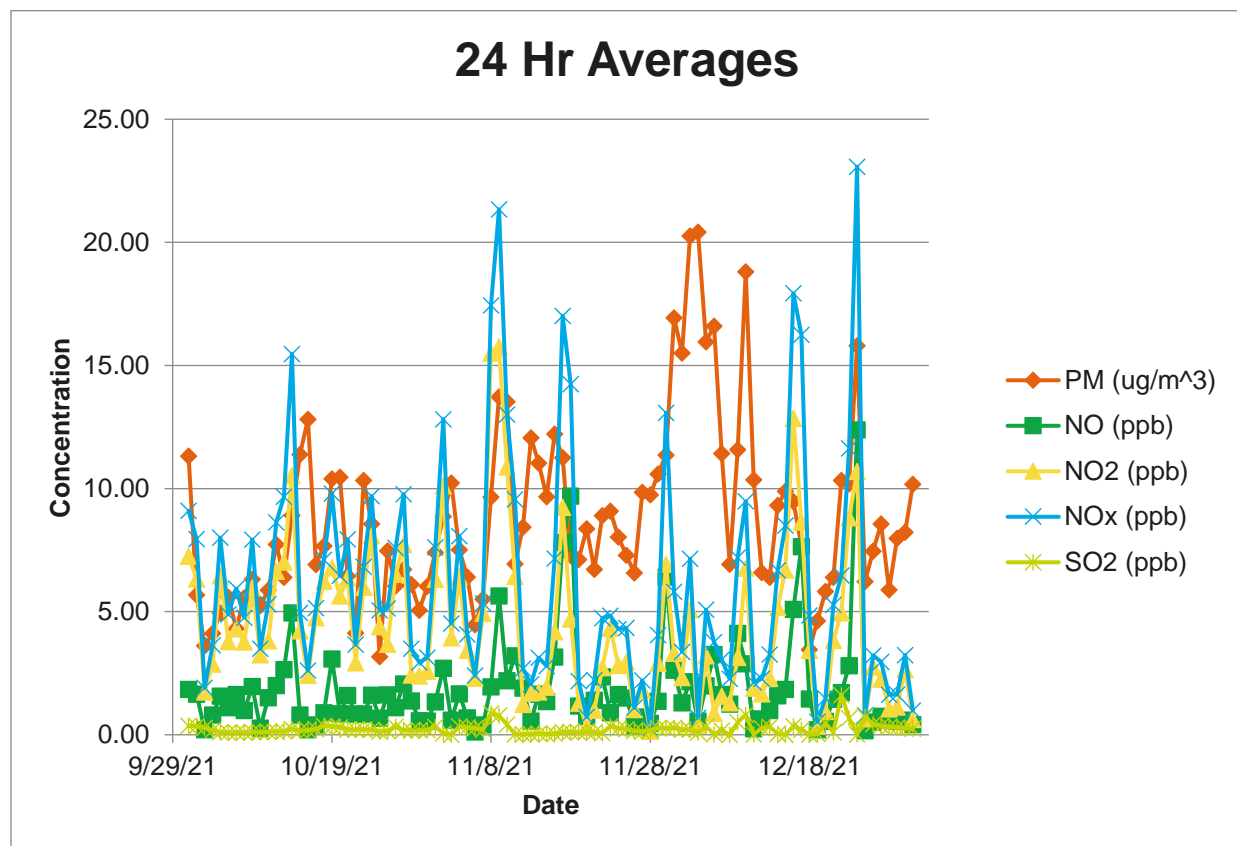


Figure 2-1. 24-hour Averages

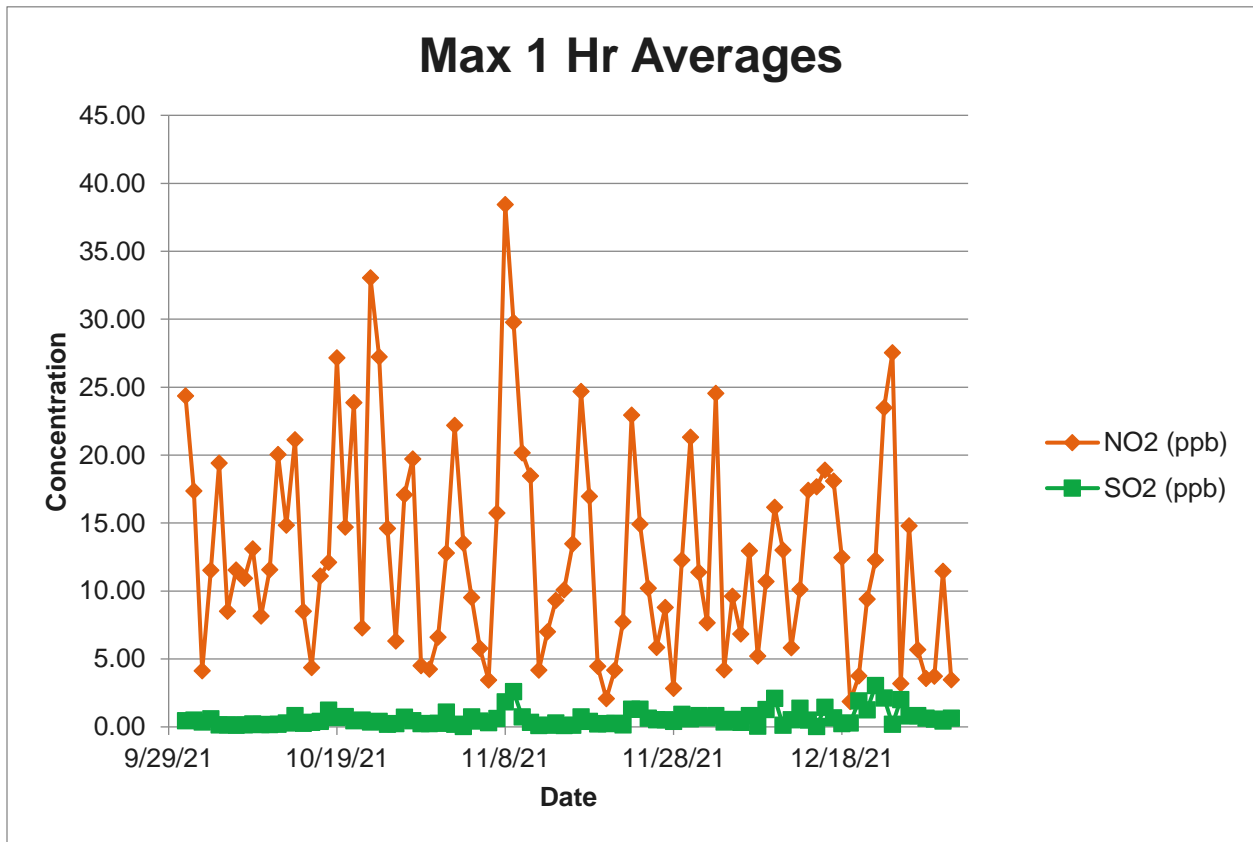


Figure 2-2. Max 1-hour Averages

Table 2-4. Monthly Statistics

Month	Monthly Averages					Monthly Daily Max 1-hr Avg.		Daily Max 3-hr Avg.
	PM _{2.5} (µg/m ³)	NO (ppb)	NO ₂ (ppb)	NO _x (ppb)	SO ₂ (ppb)	NO ₂ (ppb)	SO ₂ (ppb)	SO ₂ (ppb)
10/21	6.95	1.36	5.06	6.39	0.20	14.16	0.39	0.30
11/21	9.00	2.19	4.64	6.65	0.21	13.10	0.59	0.43
12/21	10.49	2.07	3.59	5.57	0.31	11.19	0.89	0.62

3 QUALITY ASSURANCE/QUALITY CONTROL

QA/QC procedures applied to this project are described in a QAPP titled *South Carolina Ports Authority–Continuous Air Monitoring Station for the Union Pier Terminal* (February 2015, Revision 0).

3.1 Daily and Quarterly QC/Validation

According to the QAP prepared for this work, results are reviewed for anomalies and validated daily. 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 PAC Display data logging software is remotely accessed from the Arcadis office in Durham, NC where the instrumentation is monitored for alarms and the data trends are reviewed for irregularities. NO_x and SO₂ zero and calibration values displayed on the PAC Display screen from the previous calibration event are recorded in the QC Log Book. After checking the PAC Display system for any anomalies, the H05 raw data file from the previous day is downloaded to Arcadis' Durham, NC server. The data file is saved to the project folder on the server and then processed by a Microsoft Excel macro. The resulting Excel file provides values for daily averages and maxima as well as alarm and calibration information. This 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 on the SCSPA QA/QC Daily Comment Sheet. The Project Manager is notified of any issues immediately.

Percent completeness for Quarter 4 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. One daily Excel file per week was validated by verifying the formulas and inputs used in the Microsoft Excel macro calculations are correct. The ranges used to calculate the PM 2.5 24-hour average, NO₂ Daily Max 1-hour average, SO₂ Daily Max 1-hour average, and the 24-hour averages for PM, NO, NO₂, NO_x, and SO₂ were checked during each validation. Four random hourly average ranges for PM, NO, NO₂, NO_x, and SO₂ were also checked during each validation.

The quarterly data was assessed as follows:

- Percent completeness for Quarter 4 was 98.82%.
- 100% of the validated Quarter 4 data was flagged as "good".



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