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# SOUTH CAROLINA PORTS AUTHORITY

SOUTH CAROLINA PORTS

## Continuous Air Monitoring Station for the Union Pier Terminal

Q4 2019 Quarterly Report

January 2020

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

Q4 2019 Quarterly Report

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# CONTENTS



# TABLES



# FIGURES

# 1 EXECUTIVE SUMMARY

Arcadis was contracted in late October 2014 to provide Continuous Air Monitoring Services to the South Carolina State Ports Authority (SCSPA) 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 20th quarterly data report (fourth quarterly report in year five of operations) and presents the data summaries requested by SCSPA and described in the work scope. This report encompasses a period corresponding to data taken during the period from October 1, 2019 through December 31, 2019.

# 2 PROJECT DESCRIPTION

SCSPA requested a system to provide ambient air quality data including particulate matter less than 2.5 microns (PM2.5), 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, NOX 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, $NO_2$, $NO_X$, 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. 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) |
| 10/1/19 | 9.87 | 0.40 | 3.08 | 3.46 | 0.03 | 14.26 | 0.05 | 0.05 |
| 10/2/19 | 11.24 | 1.30 | 4.79 | 6.07 | 0.06 | 14.36 | 0.28 | 0.17 |
| 10/3/19 | 9.70 | 0.80 | 2.90 | 3.65 | 0.07 | 6.69 | 0.18 | 0.14 |
| 10/4/19 | 9.39 | 0.90 | 2.70 | 3.51 | 0.08 | 6.21 | 0.27 | 0.21 |
| 10/5/19 | 6.10 | 1.17 | 2.09 | 3.25 | 0.02 | 5.44 | 0.05 | 0.03 |
| 10/6/19 | 8.80 | 0.65 | 2.10 | 2.71 | 0.03 | 8.51 | 0.05 | 0.03 |
| 10/7/19 | 6.21 | 1.42 | 4.64 | 6.03 | 0.02 | 12.35 | 0.08 | 0.05 |
| 10/8/19 | 5.14 | 2.56 | 5.20 | 7.58 | 0.03 | 15.34 | 0.06 | 0.05 |
| 10/9/19 | 6.86 | 0.06 | 1.36 | 0.94 | 0.02 | 3.71 | 0.05 | 0.03 |
| 10/10/19 | 6.95 | 0.71 | 2.25 | 2.55 | 0.02 | 5.10 | 0.04 | 0.03 |
| 10/11/19 | 6.87 | 0.60 | 4.38 | 4.52 | 0.04 | 9.25 | 0.08 | 0.06 |
| 10/12/19 | 6.84 | 0.72 | 4.14 | 4.72 | 0.05 | 14.29 | 0.10 | 0.09 |
| 10/13/19 | 8.11 | 0.15 | 2.04 | 2.16 | 0.05 | 7.74 | 0.10 | 0.07 |
| 10/14/19 | 7.57 | 2.58 | 4.63 | 7.08 | 0.05 | 15.92 | 0.08 | 0.07 |

| 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) |
| 10/15/19 | 12.03 | 0.59 | 4.66 | 5.20 | 0.06 | 19.20 | 0.12 | 0.09 |
| 10/16/19 | 6.36 | 2.22 | 2.74 | 4.51 | 0.04 | 5.60 | 0.08 | 0.05 |
| 10/17/19 | 11.93 | 2.02 | 8.99 | 10.89 | 0.22 | 23.38 | 1.38 | 0.71 |
| 10/18/19 | 7.88 | 0.67 | 6.28 | 6.88 | 0.14 | 17.81 | 0.24 | 0.20 |
| 10/19/19 | 10.65 | 3.70 | 3.89 | 7.47 | 0.10 | 21.43 | 0.21 | 0.17 |
| 10/20/19 | 5.99 | 0.54 | 2.32 | 2.84 | 0.06 | 6.93 | 0.12 | 0.08 |
| 10/21/19 | 6.33 | 1.03 | 3.01 | 3.99 | 0.06 | 11.01 | 0.10 | 0.08 |
| 10/22/19 | 7.48 | 1.86 | 2.45 | 4.09 | 0.07 | 5.14 | 0.12 | 0.10 |
| 10/23/19 | 7.41 | 1.81 | 5.81 | 7.58 | 0.19 | 19.89 | 1.08 | 0.61 |
| 10/24/19 | 12.34 | 0.93 | 4.69 | 5.61 | 0.15 | 11.67 | 0.41 | 0.33 |
| 10/25/19 | 5.35 | 0.66 | 3.50 | 4.15 | 0.07 | 9.98 | 0.10 | 0.09 |
| 10/26/19 | 10.27 | 5.83 | 5.34 | 11.14 | 0.08 | 18.97 | 0.19 | 0.15 |
| 10/27/19 | ^ | 0.29 | 1.30 | 1.56 | 0.05 | 2.08 | 0.07 | 0.06 |
| 10/28/19 | ^ | 0.02 | 2.12 | 2.09 | 0.03 | 2.22 | 0.04 | 0.00 |
| 10/29/19 | ^ | * | * | * | * | * | * | * |
| 10/30/19 | ^ | 1.71 | 3.72 | 4.95 | 0.58 | 13.44 | 0.68 | 0.64 |
| 10/31/19 | ^ | 1.18 | 1.94 | 3.07 | 0.57 | 6.25 | 0.67 | 0.62 |
| 11/1/19 | ^ | 1.16 | 5.28 | 6.42 | 0.72 | 15.29 | 1.00 | 0.91 |
| 11/2/19 | ^ | 1.82 | 5.77 | 7.56 | 1.03 | 16.63 | 2.44 | 1.81 |
| 11/3/19 | ^ | 0.72 | 3.71 | 4.36 | 0.92 | 8.65 | 1.02 | 0.98 |
| 11/4/19 | ^ | 0.71 | 4.51 | 5.13 | 0.91 | 8.97 | 1.10 | 1.08 |
| 11/5/19 | ^ | 2.52 | 7.24 | 9.70 | 0.81 | 15.48 | 0.95 | 0.88 |
| 11/6/19 | ^ | 1.07 | 2.20 | 3.24 | 0.22 | 11.89 | 0.77 | 0.29 |
| 11/7/19 | ^ | 2.15 | 6.66 | 8.74 | 0.13 | 11.57 | 0.24 | 0.21 |
| 11/8/19 | ^ | 0.33 | 1.56 | 1.88 | 0.11 | 3.86 | 0.20 | 0.18 |
| 11/9/19 | ^ | 0.79 | 4.72 | 5.50 | 0.32 | 16.55 | 0.44 | 0.42 |
| 11/10/19 | ^ | 1.12 | 7.44 | 8.55 | 0.61 | 20.80 | 1.95 | 1.63 |
| 11/11/19 | ^ | 9.79 | 10.88 | 20.67 | 0.13 | 27.07 | 0.57 | 0.33 |
| 11/12/19 | ^ | 0.52 | 3.22 | 3.67 | 0.00 | 7.43 | 0.02 | 0.01 |
| 11/13/19 | ^ | 0.25 | 2.28 | 2.32 | 0.01 | 4.56 | 0.05 | 0.02 |
| 11/14/19 | ^ | 1.09 | 4.13 | 5.07 | 0.01 | 10.56 | 0.01 | 0.01 |
| 11/15/19 | ^ | 1.87 | 5.25 | 7.10 | 0.00 | 8.72 | 0.01 | 0.01 |
| 11/16/19 | ^ | 0.84 | 2.96 | 3.79 | 0.00 | 7.93 | 0.01 | 0.01 |
| 11/17/19 | ^ | 0.37 | 1.85 | 2.20 | 0.03 | 4.80 | 0.24 | 0.11 |
| 11/18/19 | ^ | 2.46 | 6.54 | 8.97 | 0.00 | 15.90 | 0.01 | 0.01 |
| 11/19/19 | ^ | 4.29 | 9.62 | 13.89 | 0.02 | 26.34 | 0.08 | 0.05 |

| 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) |
| 11/20/19 | ^ | 6.09 | 13.51 | 19.59 | 0.10 | 33.91 | 0.41 | 0.29 |
| 11/21/19 | ^ | 4.32 | 8.87 | 11.19 | 0.08 | 22.16 | 0.68 | 0.39 |
| 11/22/19 | ^ | 13.09 | 6.20 | 19.21 | 0.25 | 26.84 | 0.65 | 0.48 |
| 11/23/19 | ^ | 0.59 | 2.17 | 2.70 | 0.12 | 6.02 | 0.43 | 0.26 |
| 11/24/19 | ^ | 0.57 | 2.88 | 3.43 | 0.06 | 7.88 | 0.13 | 0.10 |
| 11/25/19 | ^ | 3.54 | 7.88 | 11.35 | 0.11 | 15.41 | 0.26 | 0.20 |
| 11/26/19 | ^ | 8.79 | 9.42 | 18.04 | 0.01 | 21.00 | 0.08 | 0.00 |
| 11/27/19 | ^ | 2.71 | 4.92 | 7.36 | 0.48 | 15.50 | 0.90 | 0.80 |
| 11/28/19 | ^ | 0.20 | 2.10 | 2.16 | 0.96 | 13.56 | 4.03 | 2.57 |
| 11/29/19 | ^ | 1.16 | 3.66 | 4.67 | 1.00 | 14.66 | 5.11 | 3.40 |
| 11/30/19 | ^ | 2.20 | 7.26 | 9.36 | 0.52 | 17.07 | 0.91 | 0.83 |
| 12/1/19 | ^ | 0.05 | 1.24 | 1.16 | 0.34 | 3.50 | 0.45 | 0.38 |
| 12/2/19 | ^ | 1.30 | 2.46 | 3.47 | 0.37 | 4.98 | 0.49 | 0.44 |
| 12/3/19 | ^ | 5.77 | 5.30 | 10.61 | 0.53 | 10.16 | 1.69 | 1.28 |
| 12/4/19 | ^ | 1.36 | 5.20 | 6.53 | 0.50 | 12.24 | 0.79 | 0.67 |
| 12/5/19 | ^ | 4.19 | 10.25 | 14.44 | 0.72 | 27.86 | 2.43 | 2.02 |
| 12/6/19 | ^ | 9.21 | 11.80 | 20.23 | 0.05 | 21.02 | 0.52 | 0.00 |
| 12/7/19 | ^ | 0.43 | 4.17 | 4.18 | 0.03 | 11.72 | 0.16 | 0.13 |
| 12/8/19 | ^ | 0.34 | 2.20 | 2.39 | 0.02 | 6.20 | 0.08 | 0.04 |
| 12/9/19 | ^ | 4.82 | 4.59 | 9.08 | 0.02 | 17.01 | 0.18 | 0.11 |
| 12/10/19 | ^ | 0.42 | 2.64 | 2.98 | 0.01 | 4.89 | 0.04 | 0.03 |
| 12/11/19 | ^ | 0.40 | 3.29 | 3.63 | 0.01 | 7.45 | 0.03 | 0.01 |
| 12/12/19 | ^ | 0.92 | 3.63 | 4.52 | 0.02 | 10.54 | 0.05 | 0.04 |
| 12/13/19 | ^ | 2.23 | 5.22 | 7.44 | 0.01 | 12.21 | 0.03 | 0.02 |
| 12/14/19 | ^ | 3.24 | 4.07 | 7.16 | 0.01 | 7.93 | 0.03 | 0.01 |
| 12/15/19 | ^ | 0.60 | 3.20 | 3.12 | 0.02 | 8.57 | 0.08 | 0.05 |
| 12/16/19 | ^ | 5.05 | 5.54 | 10.21 | 0.00 | 15.49 | 0.01 | 0.00 |
| 12/17/19 | ^ | 0.49 | 1.15 | 1.50 | 0.05 | 4.01 | 0.13 | 0.10 |
| 12/18/19 | ^ | 0.97 | 7.30 | 8.11 | 0.53 | 24.25 | 1.62 | 1.33 |
| 12/19/19 | ^ | 1.38 | 6.70 | 7.77 | 0.27 | 20.92 | 0.41 | 0.39 |
| 12/20/19 | ^ | 2.02 | 7.02 | 9.01 | 0.31 | 20.74 | 0.73 | 0.52 |
| 12/21/19 | ^ | 0.80 | 3.28 | 4.08 | 0.25 | 5.49 | 0.37 | 0.33 |
| 12/22/19 | ^ | 0.34 | 2.40 | 2.69 | 0.17 | 6.33 | 0.30 | 0.26 |
| 12/23/19 | ^ | 3.10 | 2.88 | 5.94 | 0.07 | 13.94 | 0.18 | 0.12 |
| 12/24/19 | ^ | 0.60 | 3.21 | 3.81 | 0.04 | 7.68 | 0.08 | 0.07 |
| 12/25/19 | ^ | 1.05 | 5.73 | 6.77 | 0.09 | 19.53 | 0.20 | 0.17 |

| 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) |
| 12/26/19 | ^ | 4.64 | 10.19 | 14.83 | 0.01 | 23.64 | 0.10 | 0.00 |
| 12/27/19 | ^ | 2.22 | 9.46 | 11.67 | 0.23 | 19.44 | 0.57 | 0.45 |
| 12/28/19 | ^ | 2.21 | 5.51 | 7.68 | 0.14 | 14.51 | 0.23 | 0.19 |
| 12/29/19 | ^ | 0.27 | 3.34 | 3.59 | 0.11 | 8.91 | 0.16 | 0.14 |
| 12/30/19 | ^ | 1.50 | 3.31 | 4.52 | 0.09 | 6.44 | 0.15 | 0.11 |
| 12/31/19 | ^ | 1.04 | 4.23 | 5.07 | 0.20 | 7.32 | 0.32 | 0.29 |

^ Instrument failure
* Data acquisition error

**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) | $NO_2$ (ppb) | $NO_X$ (ppb) | $SO_2$ (ppb) | $NO_2$ (ppb) | $SO_2$ (ppb) | $SO_2$ (ppb) |
| Average | 8.22 | 1.97 | 4.66 | 6.49 | 0.20 | 12.70 | 0.49 | 0.36 |
| Minimum | 5.14 | 0.02 | 1.15 | 0.94 | 0.00 | 2.08 | 0.01 | 0.00 |
| Maximum | 12.34 | 13.09 | 13.51 | 20.67 | 1.03 | 33.91 | 5.11 | 3.40 |

**Table 2-3. National Ambient Air Quality Standards**

| Pollutant | Primary/ Secondary | Averaging Time | Level | Form |
|---|---|---|---|---|
| NO2 | Primary | 1-hour | 100 ppb | 98th Percentile, averaged over 3 years |
| | Primary and Secondary | Annual | 53 ppb (1) | Annual Mean |
| SO2 | 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 |
| PM2.5 | Primary | Annual | 12 µg/m3 | Annual mean, averaged over 3 years |
| | Secondary | Annual | 15 µg/m3 | Annual mean, averaged over 3 years |
| | Primary and Secondary | 24-hour | 35 µg/m3 | 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.

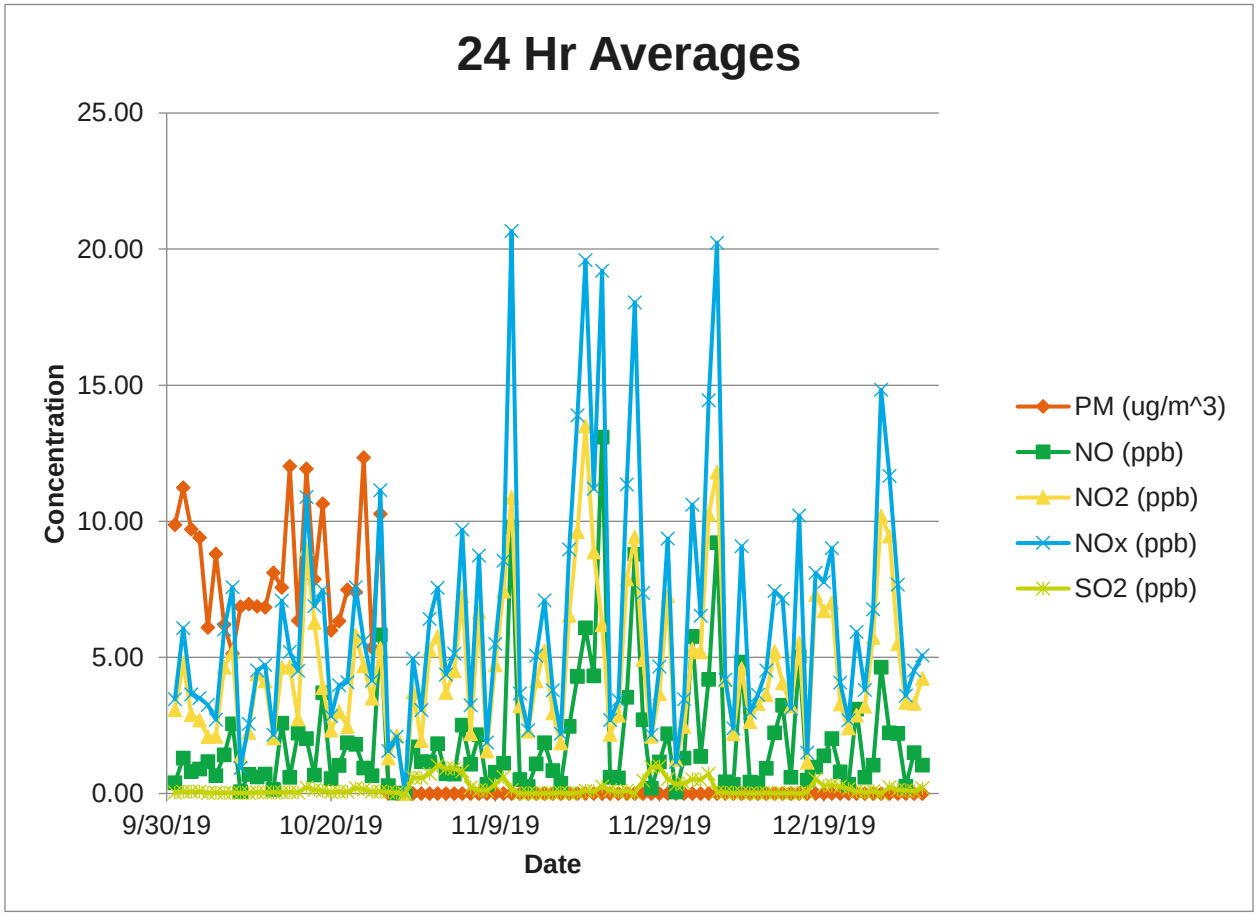


**Figure 2-1. 24-hour Averages**

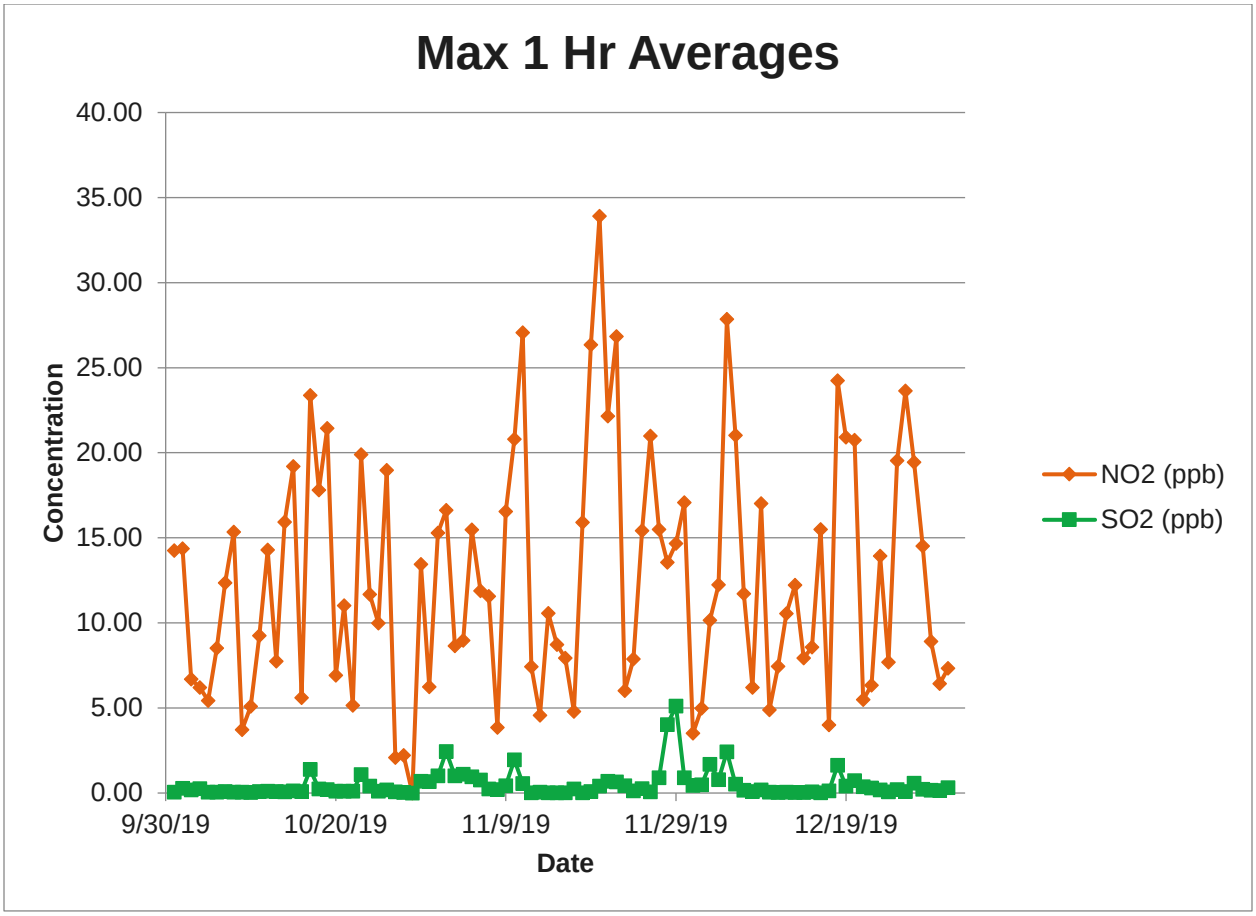


**Figure 2-2. Max 1-hour Averages**

**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) | $NO_2$ (ppb) | $NO_X$ (ppb) | $SO_2$ (ppb) | $NO_2$ (ppb) | $SO_2$ (ppb) | $SO_2$ (ppb) |
| 10/19 | 8.22 | 1.30 | 3.63 | 4.81 | 0.10 | 11.14 | 0.24 | 0.17 |
| 11/19 | ^ | 2.57 | 5.49 | 7.93 | 0.32 | 14.57 | 0.82 | 0.61 |
| 12/19 | ^ | 2.03 | 4.85 | 6.72 | 0.17 | 12.42 | 0.41 | 0.31 |

^ Instrument failure

# 3 QUALITY ASSURANCE/QUALITY CONTROL

QA/QC procedures applied to this project are described in a QAPP titled *South Carolina State 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. NOx 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, NOx, and SO2 were checked during each validation. Four random hourly average ranges for PM, NO, NO2, NOx, and SO2 were also checked during each validation.

The quarterly data was assessed as follows:

- Percent completeness for Quarter 4 was 73.04%.
- 100% of the validated Quarter 4 data was flagged as "good".

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