Clean Air Status and Trends Network (CASTNET)
Quarterly Data Summary for Second Quarter 2022 (April through June)

Prepared for: U.S. Environmental Protection Agency (EPA), Clean Air Markets Division
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Introduction

This quarterly report summarizes the Clean Air Status and Trends Network (CASTNET) data collected during second quarter 2022. Trends in pollutants measured at eastern and western reference sites are shown. Results from the quality assurance/quality control (QA/QC) program are presented for second quarter data and include completeness and precision of filter concentrations and hourly O_3 concentrations. This report also analyzes data for continuous, trace-level NO_y from eight sites and continuous SO_2 concentrations from three sites. Other QC statistics are given in the CASTNET Second Quarter 2022 Quality Assurance Report (Wood, 2022).

Figure 1. Fourth Highest Daily Maximum 8-hour Average O_3 Concentrations (ppb) through Second Quarter 2022

Figure 1 shows fourth highest daily maximum 8-hour average (DM8A) O_3 concentrations measured through second quarter 2022. Four sites exceeded the 0.070 parts per million (ppm) National Ambient Air Quality Standard for O_3.

Trends

Trend analyses were performed based on filter pack pollutant concentrations measured in micrograms per cubic meter ($\mu g/m^3$) of air at the 34 eastern and 16 western reference sites during second quarter. Trends in quarterly mean filter pack and O_3 concentrations are shown using box plots in Figures 2 through 13.

Second Quarter Concentrations

Quarterly mean HNO_3, NH_4^+, total NO_3^-, SO_2, SO_4^{2-}, Ca^{2+}, and K^+ concentrations decreased at eastern sites in 2022, and NO_3^-, Cl^-, Mg^{2+}, and Na^+ concentrations increased. Quarterly mean HNO_3, NH_4^+, total NO_3^-, and SO_2 concentrations decreased at western sites in 2022 while NO_3^-, SO_4^{2-}, Cl^-, Ca^{2+}, K^+, Mg^{2+}, and Na^+ concentrations increased.

Quarterly O_3 concentrations were analyzed using box plots constructed by averaging all valid hourly O_3 concentrations within second quarter 2022 by site and then averaging those averages for all eastern and western reference sites (Figure 13). The figure shows an overall reduction in quarterly mean O_3 concentrations at eastern and western sites and a slight increase in 2022 levels at eastern sites. Quarterly mean concentrations were higher at the western reference sites than at the eastern sites.

The box plots show an especially significant increase in Ca^{2+} and Mg^{2+} concentrations (Figures 9 and 11) at western reference sites. These two cations are measures of particulate matter (PM) in atmosphere. Figure 14 provides a map of quarterly mean Ca^{2+} concentrations. The high cation concentrations are attributed to wildfires, drought, and incursion of Saharan dust. In 2022, wildfires occurred earlier than usual in the West and covered the most area since 2018. Wildfires produce large amounts of PM that affect air quality. The Southwest, California, and parts of the Northwest have been mired in a major drought for more than 20 years, influenced by climate change. While this drought has improved or worsened at times, the last two years have been particularly dry for the West. Drought conditions expose farmland and soil to wind erosion and produce fugitive dust, which, in turn, affects air quality. About 100 million tons of dust from the Sahara Desert are transported out over the Atlantic each year. The Saharan dust plumes are frequently visible in satellite photos, e.g., NASA MODIS. The dust contributes to air pollution and yet can provide natural fertilizer. Seasonal wind patterns can transport the dust from Africa to the Caribbean and the Gulf of Mexico. Plumes of Saharan dust reached Florida, Texas, and other southern U.S. states in spring 2022.

Figure 2. Trends in Second Quarter Mean HNO_3 Concentrations

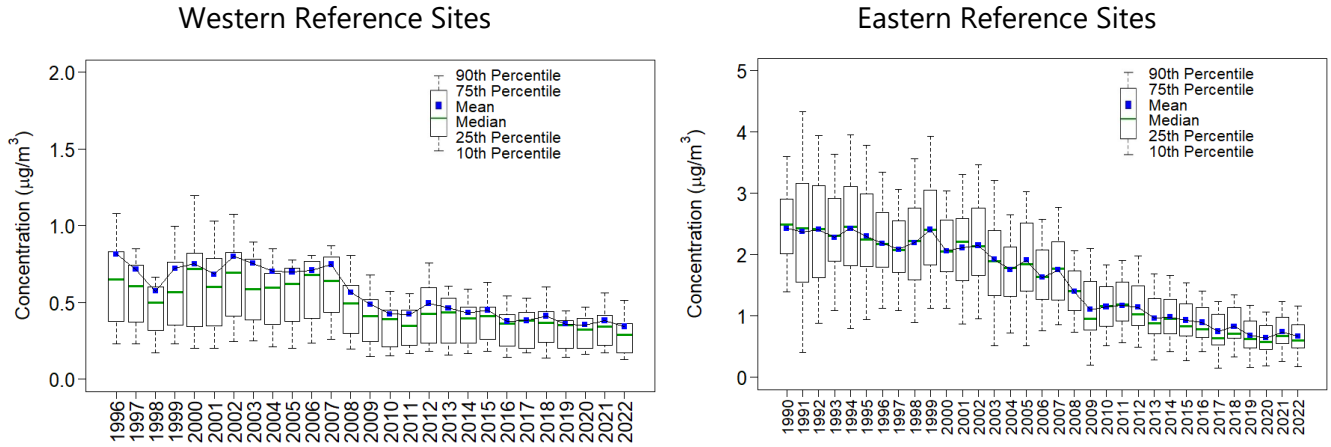


Figure 3. Trends in Second Quarter Mean NO_3^- Concentrations

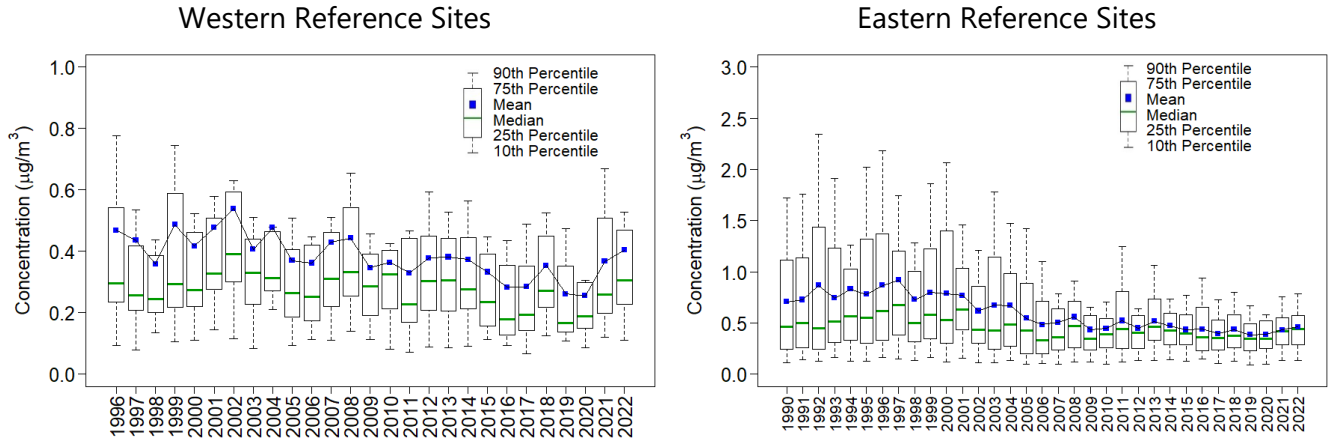


Figure 4. Trends in Second Quarter Mean NH_4^+ Concentrations

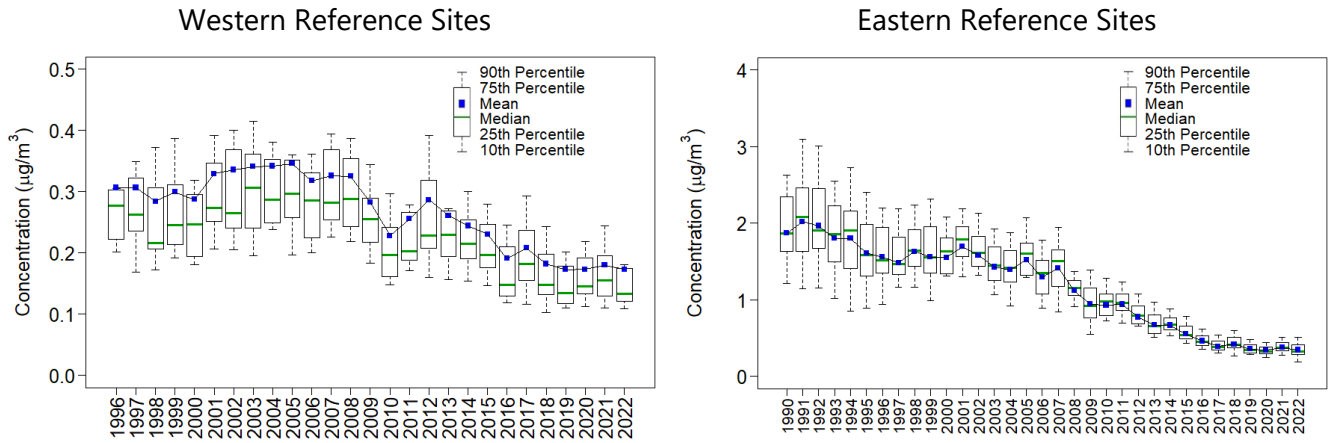


Figure 5. Trends in Second Quarter Mean Total NO_3^- Concentrations

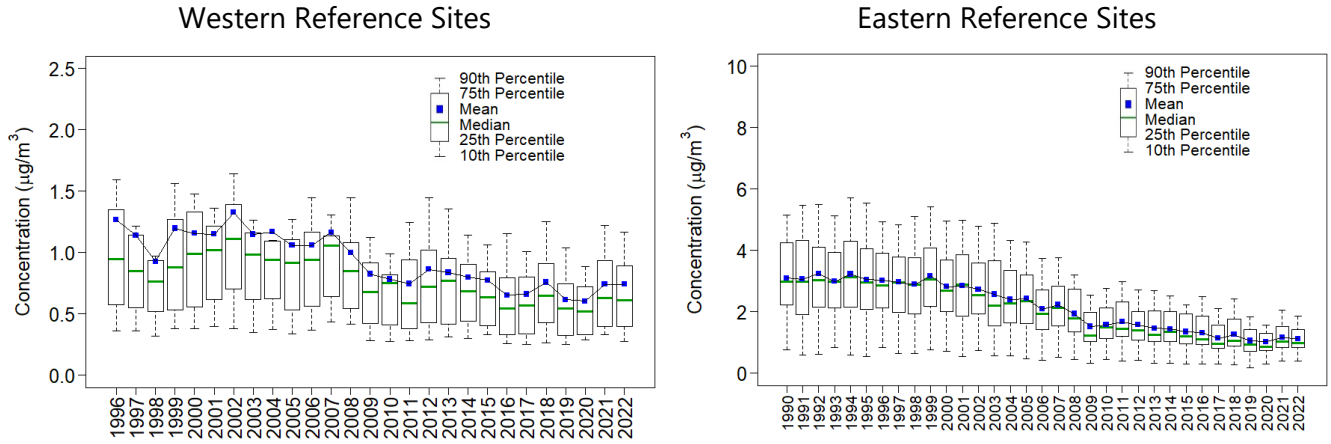


Figure 6. Trends in Second Quarter Mean SO_2 Concentrations

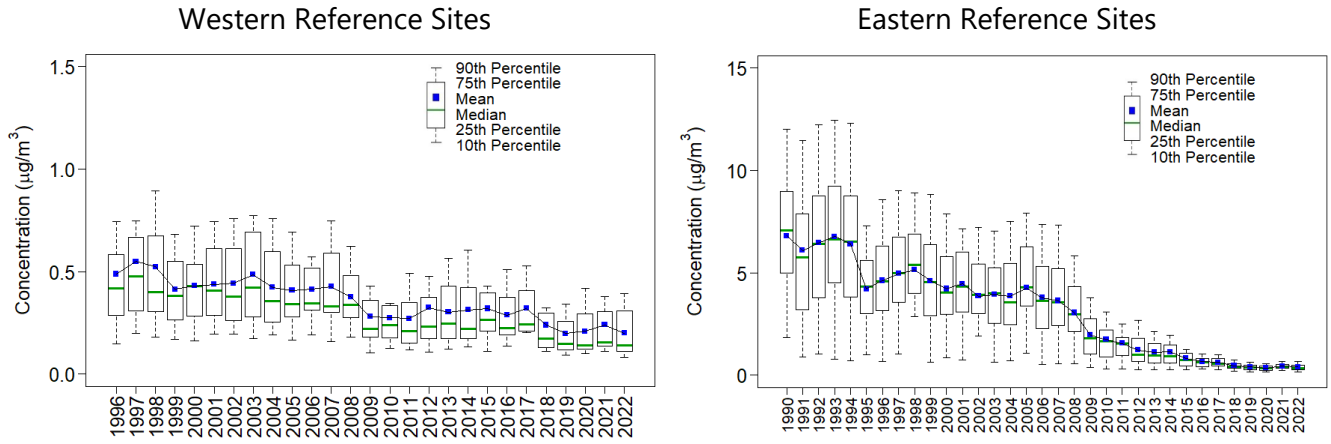


Figure 7. Trends in Second Quarter Mean SO_4^{2-} Concentrations

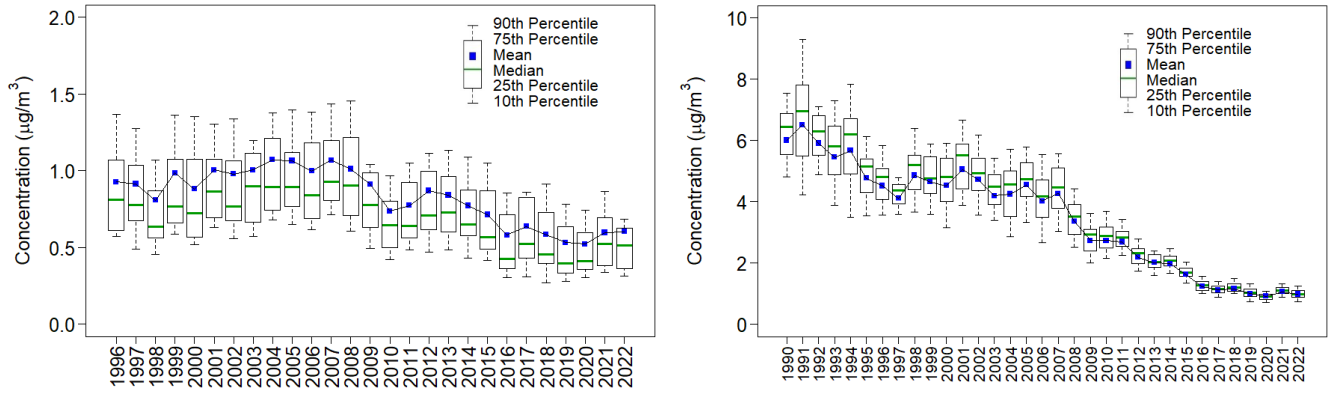


Figure 8. Trends in Second Quarter Mean Cl^- Concentrations

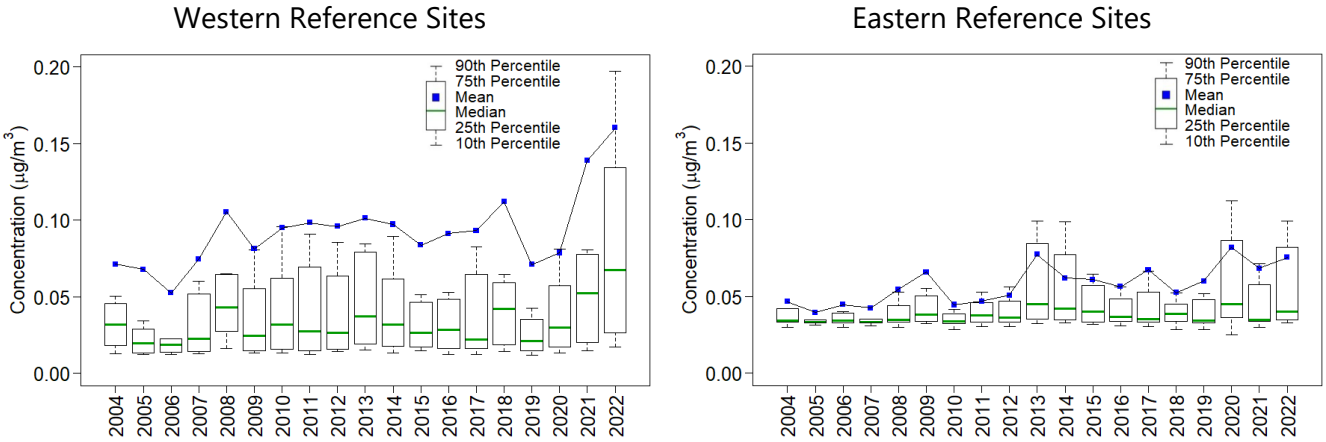


Figure 9. Trends in Second Quarter Mean Ca^{2+} Concentrations

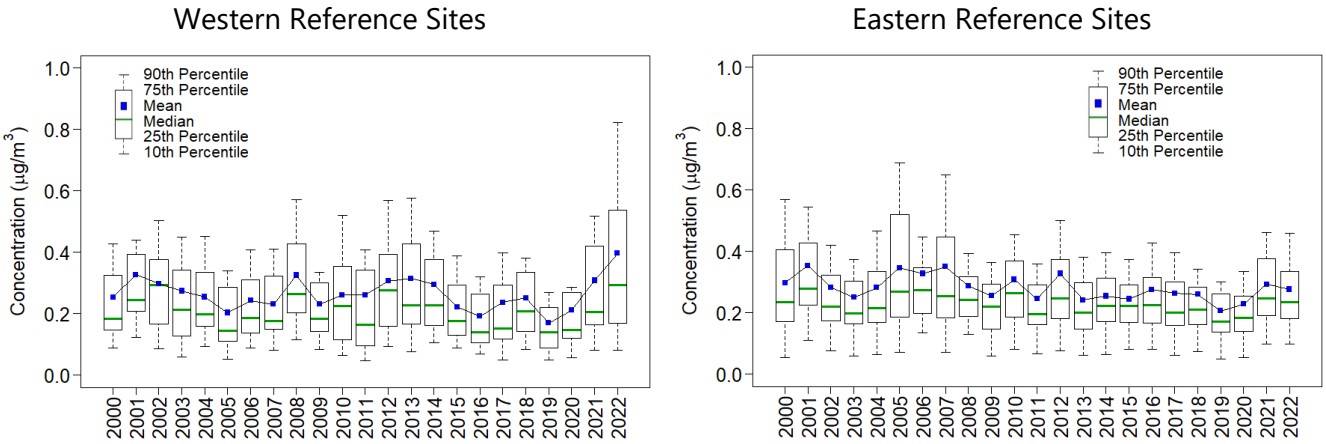


Figure 10. Trends in Second Quarter Mean K^+ Concentrations

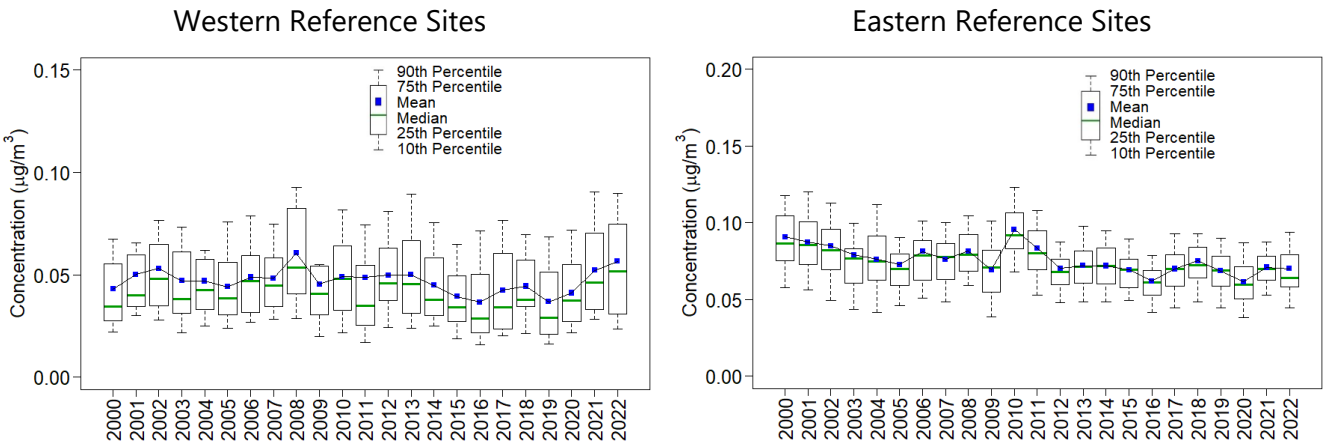


Figure 11. Trends in Second Quarter Mean Mg^{2+} Concentrations

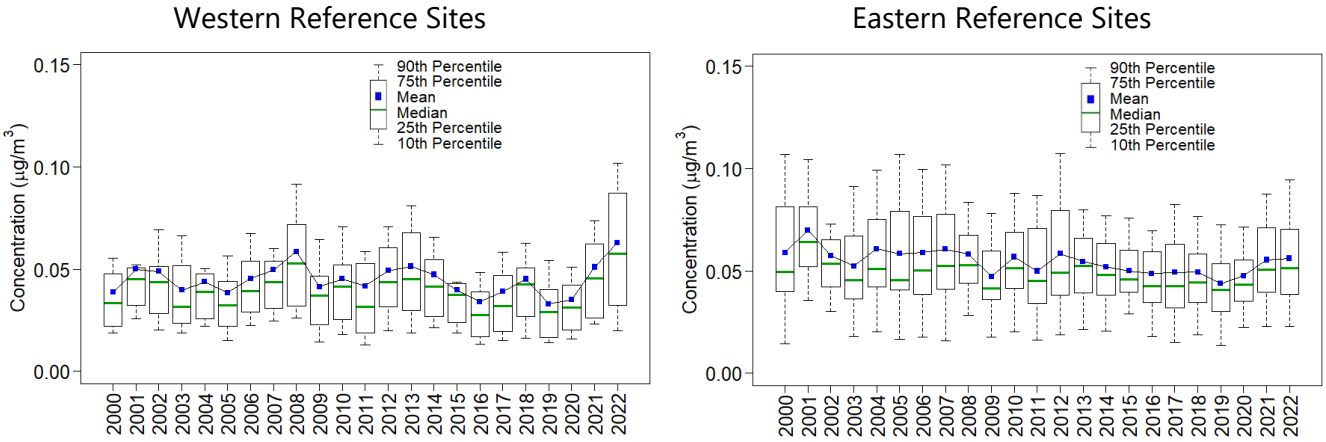


Figure 12. Trends in Second Quarter Mean Na^{+} Concentrations

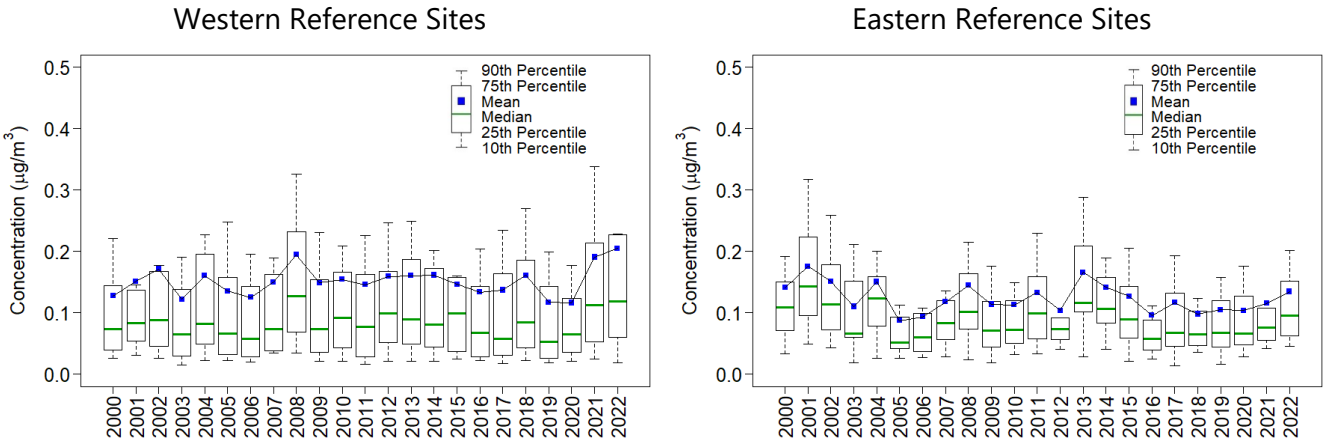


Figure 13. Trends in Second Quarter Mean O_3 Concentrations

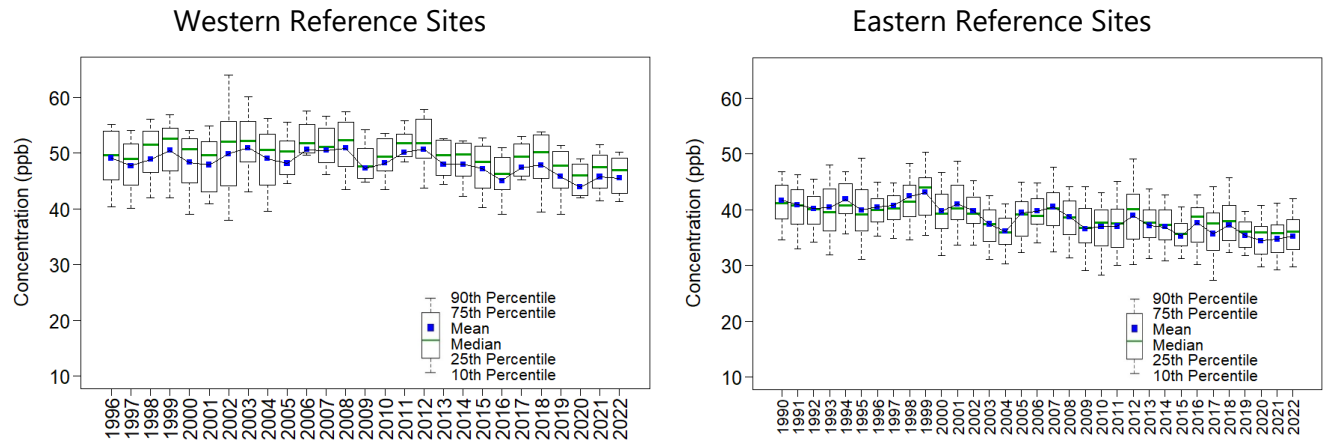
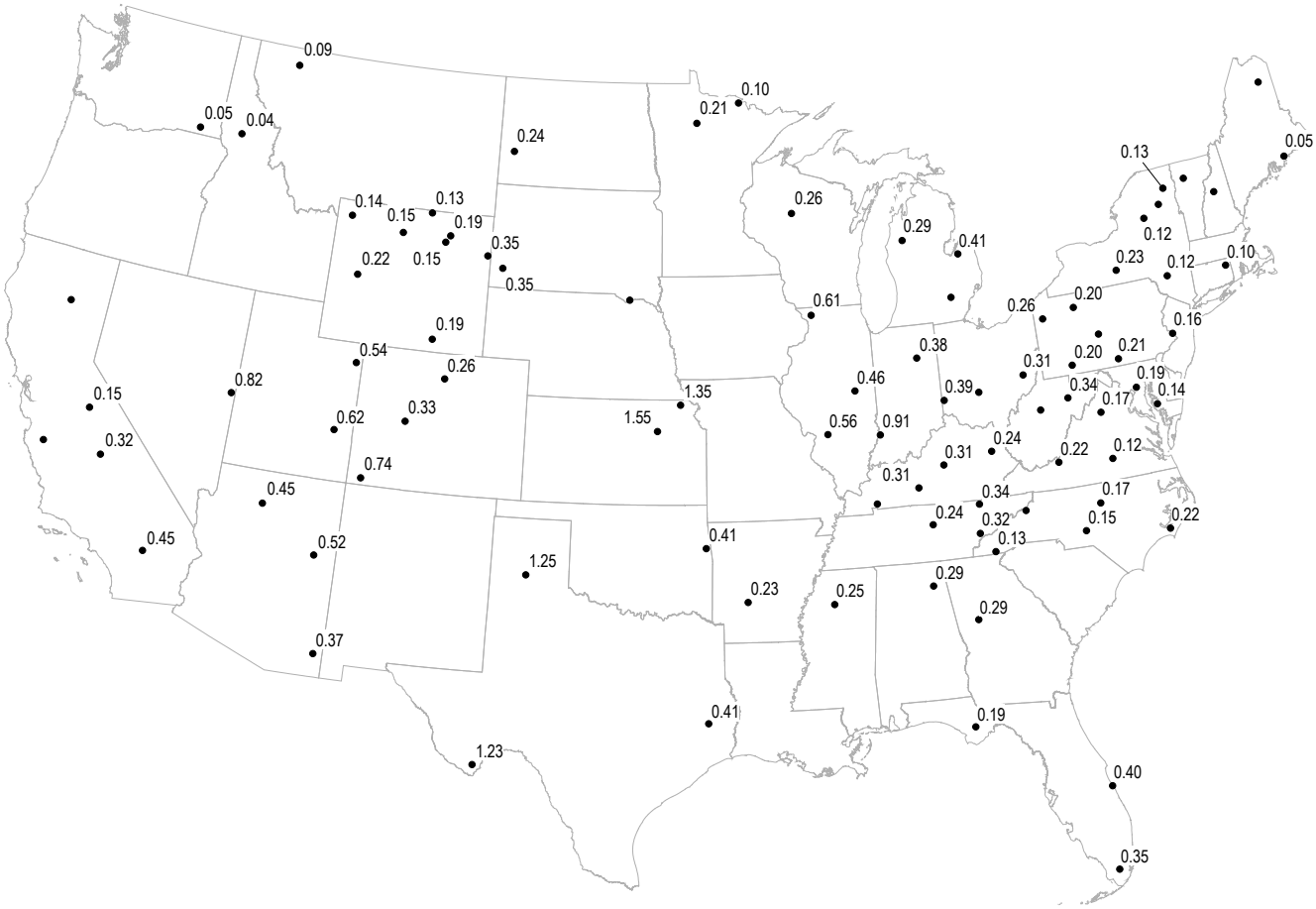


Figure 14. Quarterly Mean Ca^{2+} Concentrations (µg/m^3) for Second Quarter 2022



Changes in 3-year Average Second Quarter Concentrations

Three-year averages of quarterly mean concentrations of total NO_3^-, NH_4^+, SO_2, SO_4^{2-}, and O_3 were reduced over the period 1990–1992 through 2020–2022 for eastern reference sites (Table 1) and 1996–1998 through 2020–2022 for western reference sites (Table 2). Ca^{2+}, K^+, and Mg^{2+} levels declined at eastern sites from 2004–2006 through 2020–2022 while Cl^- and Na^+ values increased. At western sites, Cl^- and all base cation concentrations increased.

Table 1. Eastern Reference Sites: 3-Year Mean O_3, Nitrogen, Sulfur, Base Cations, and Cl^- Pollutant Concentrations

Parameter	1990–1992 (µg/m^3)	2004–2006 (µg/m^3)	2020–2022 (µg/m^3)	Percent Change
O_3 (ppb)	41		35	-15
Total NO_3^-	3.1		1.1	-65
NH_4^+	2.0		0.4	-82
SO_2	6.5		0.4	-94
SO_4^{2-}	6.1		1.0	-84
Ca^{2+}		0.32	0.27	-17
K^+		0.08	0.07	-12
Mg^{2+}		0.06	0.05	-11
Na^+		0.11	0.12	7
Cl^-		0.04	0.08	73

Note: Ozone concentrations are given as ppb. Concentrations for all other parameters are in µg/m^3.

Table 2. Western Reference Sites: 3-Year Mean O_3, Nitrogen, Sulfur, Base Cations, and Cl^- Pollutant Concentrations

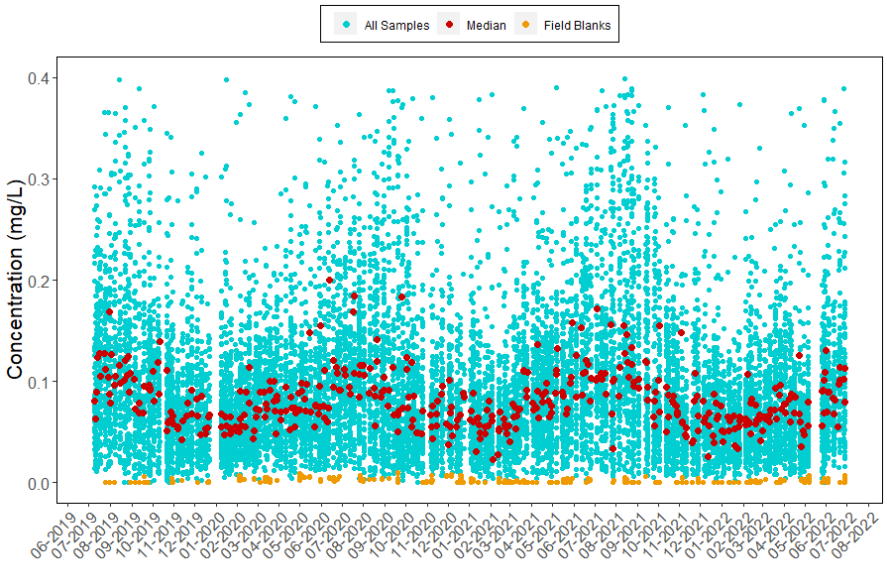
Parameter	1996–1998 (µg/m^3)	2004–2006 (µg/m^3)	2020–2022 (µg/m^3)	Percent Change
O_3 (ppb)	49		45	-7
Total NO_3^-	1.1		0.7	-37
NH_4^+	0.3		0.2	-41
SO_2	0.5		0.2	-58
SO_4^{2-}	0.9		0.6	-35
Ca^{2+}		0.23	0.31	31
K^+		0.05	0.05	7
Mg^{2+}		0.04	0.05	17
Na^+		0.14	0.17	22
Cl^-		0.06	0.13	97

Note: Ozone concentrations are given as ppb. Concentrations for all other parameters are in µg/m^3.

Time Series of Laboratory Analysis Parameters for All Sites

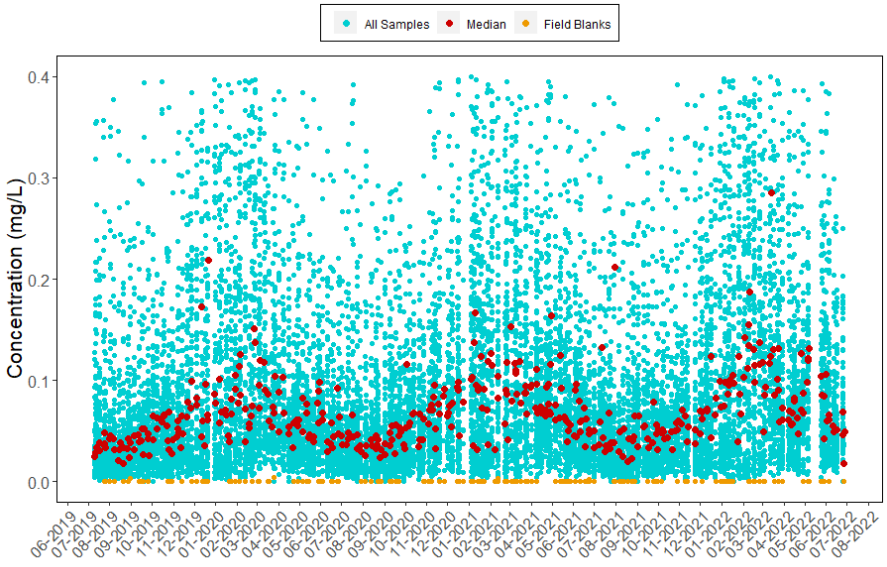
Figures 15 through 25 give time series of laboratory-analyzed concentrations of field samples and field blanks in milligrams per liter (mg/L) of 11 parameters from July 2019 through July 2022 These figures provide indications of potential issues with concentration measurements relative to detection and reporting limits.

Figure 15. Concentrations of NO_3^- (as N) from Nylon Filters



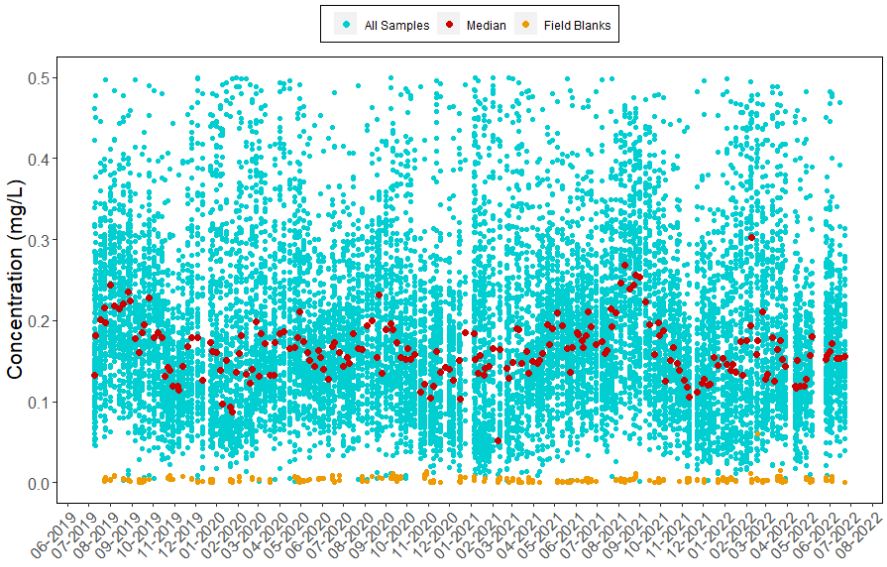
Note: Nominal reporting limit is 0.008 mg/L.

Figure 16. Concentrations of NO_3^- (as N) from Teflon Filters



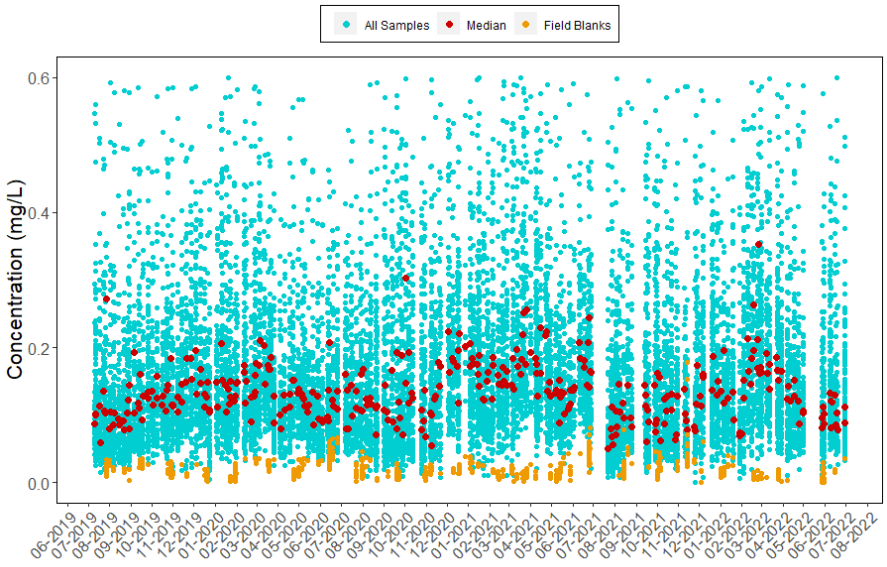
Note: Nominal reporting limit is 0.008 mg/L.

Figure 17. Concentrations of NH_4^+ (as N) from Teflon Filters



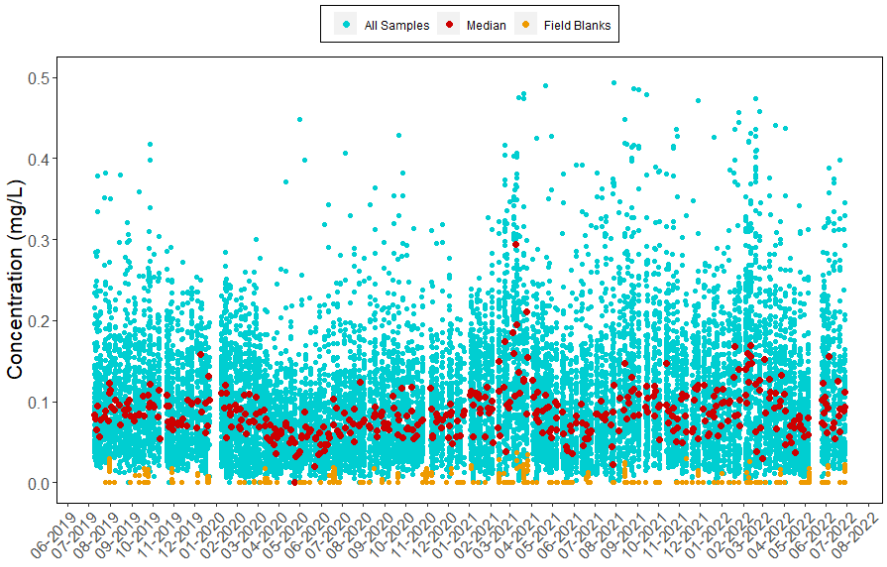
Note: Nominal reporting limit is 0.020 mg/L.

Figure 18. Concentrations of SO_2 from K_2CO_3-impregnated Cellulose Filters



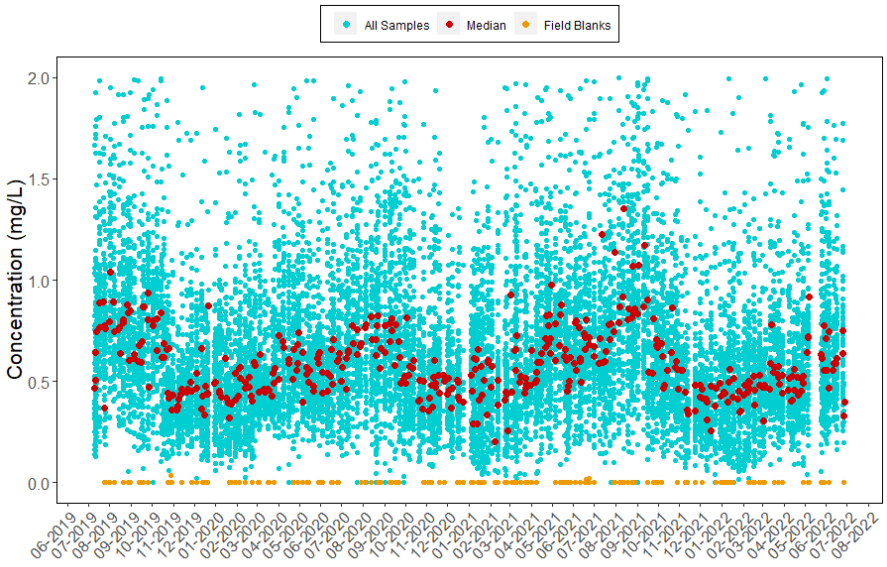
Note: Nominal reporting limit is 0.040 mg/L.

Figure 19. Concentrations of SO_4^{2-} from Nylon Filters



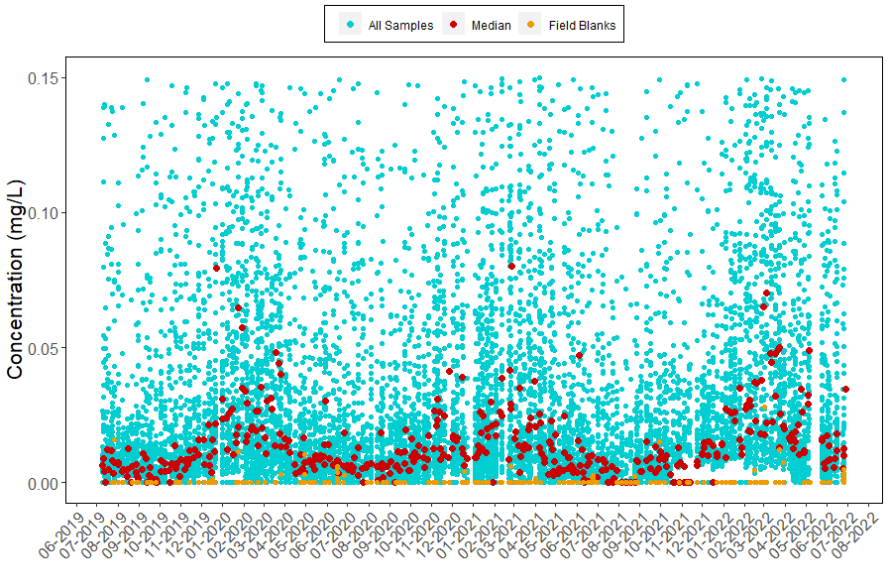
Note: Nominal reporting limit is 0.040 mg/L.

Figure 20. Concentrations of SO_4^{2-} from Teflon Filters



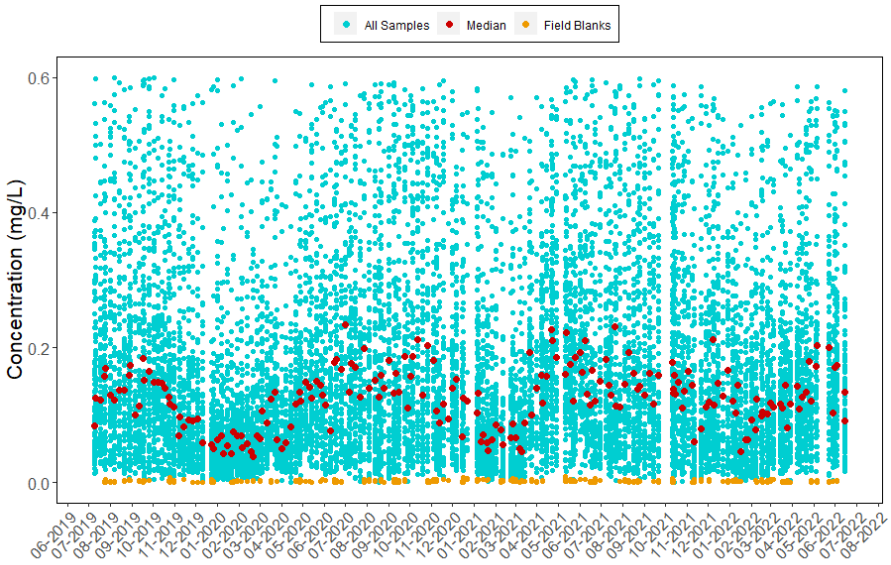
Note: Nominal reporting limit is 0.040 mg/L.

Figure 21. Concentrations of Cl^- from Teflon Filters



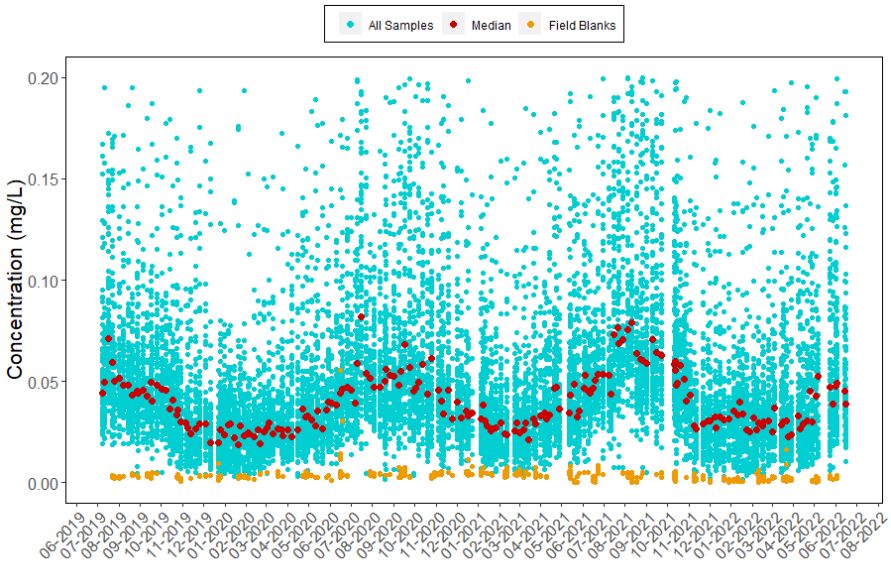
Note: Nominal reporting limit is 0.020 mg/L.

Figure 22. Concentrations of Ca^{2+} from Teflon Filters



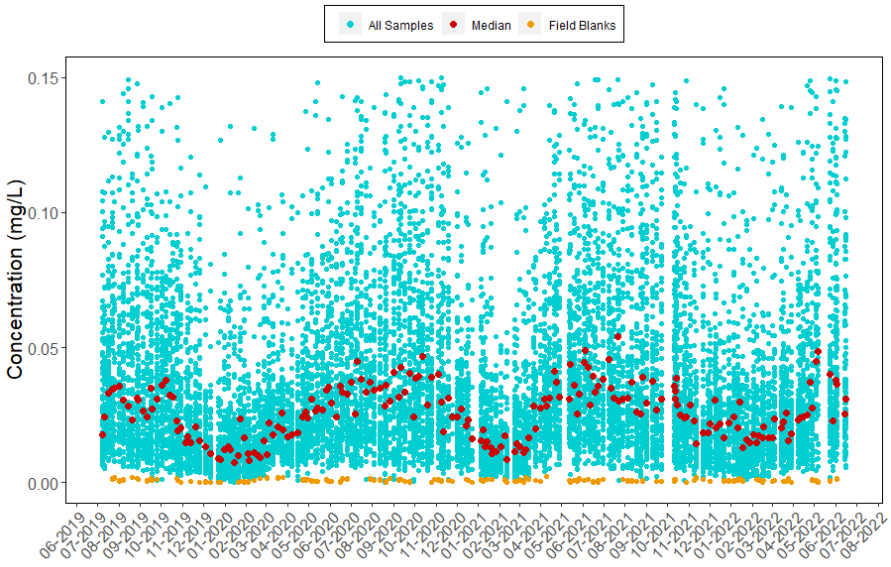
Note: Nominal reporting limit is 0.006 mg/L.

Figure 23. Concentrations of K^+ from Teflon Filters



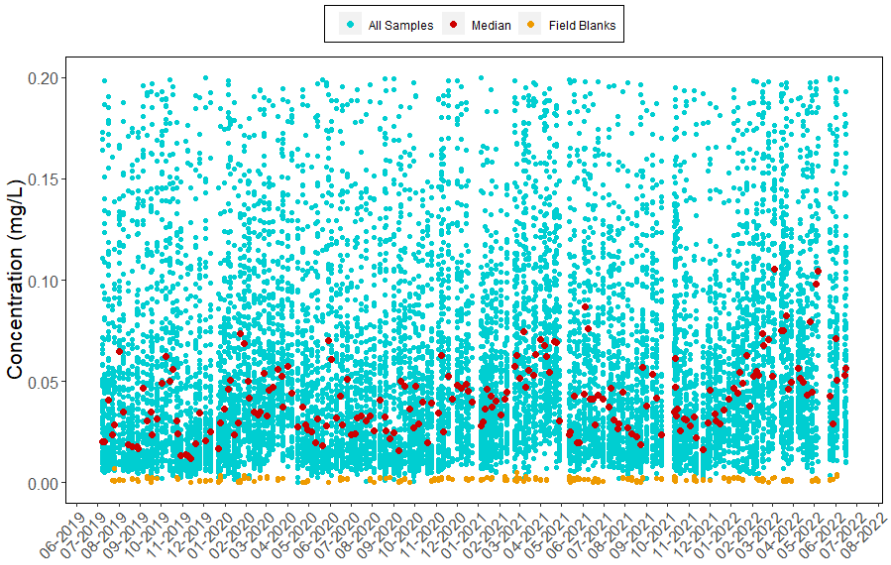
Note: Nominal reporting limit is 0.006 mg/L.

Figure 24. Concentrations of Mg^{2+} from Teflon Filters



Note: Nominal reporting limit is 0.003 mg/L.

Figure 25. Concentrations of Na^+ from Teflon Filters



Note: Nominal reporting limit is 0.005 mg/L.

Time Series of Concentration Differences from Co-located Sites

Figures 26 and 27 show times series of concentration differences between the two sets of co-located sites.

Figure 26. Time Series of Filter Concentration Differences between MCK131 and MCK231, KY

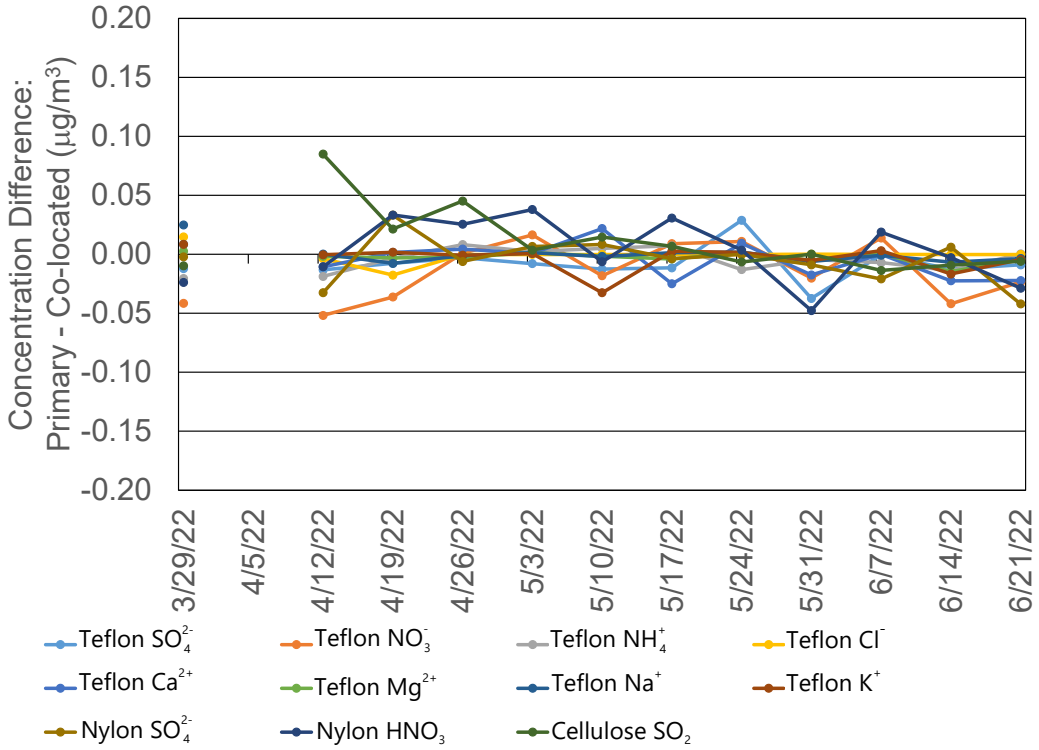
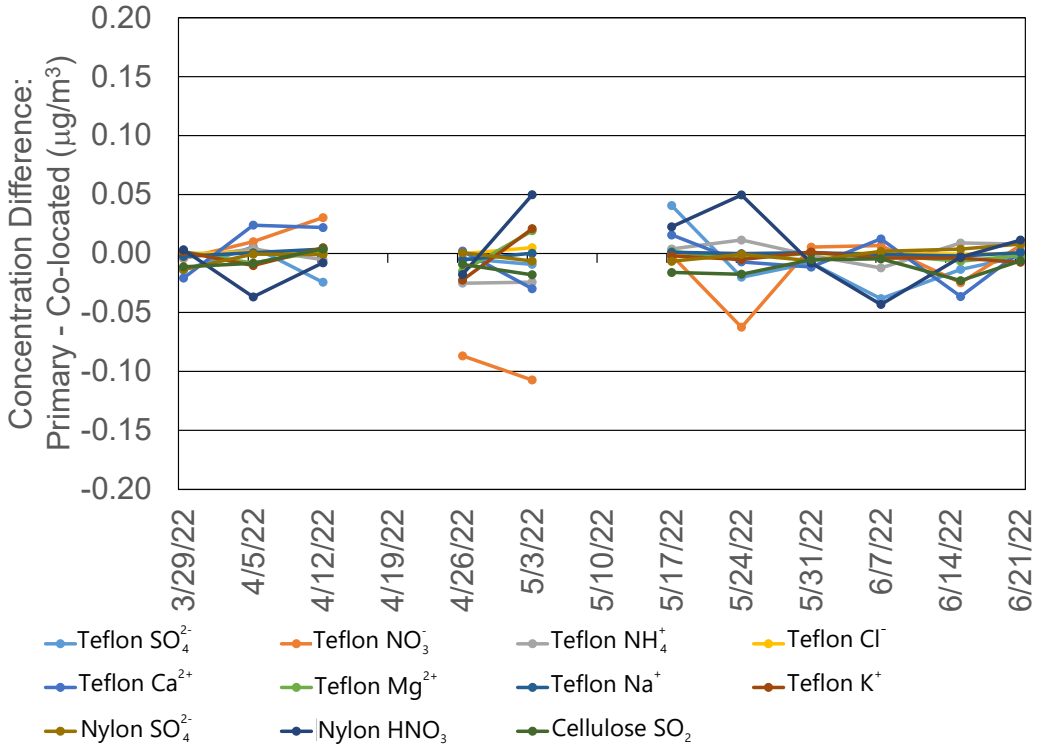


Figure 27. Time Series of Filter Concentration Differences between ROM406 and ROM206, CO



Precision of Filter Pack Concentrations

Table 3 shows mean absolute relative percent differences (MARPD) for concentrations measured at MCK131/231 and ROM406/206 during second quarter 2022. The MARPD values met the 20 percent criterion.

Table 3. Precision (MARPD) for Co-located Filter Pack Data during Second Quarter 2022

	Total NO_3^-	HNO_3	NO_3^-	NH_4^+	SO_2	SO_4^{2-}	Ca^{2+}	Mg^{2+}	Na^+	K^+	Cl^-
MCK131/231, KY											
$\overline{X}$ (µg/m³)	1.35	0.83	0.53	0.42	0.41	1.10	0.32	0.06	0.12	0.09	0.05
$\overline{Y}$ (µg/m³)	1.35	0.83	0.54	0.42	0.43	1.11	0.32	0.06	0.13	0.09	0.05
MAD	0.04	0.02	0.02	0.01	0.06	0.01	0.01	0.00	0.00	0.01	0.00
MARPD	3.19	2.89	5.05	1.95	14.00	1.34	4.44	5.44	2.99	6.40	1.88
ROM406/206, CO											
$\overline{X}$ (µg/m³)	0.79	0.41	0.38	0.18	0.14	0.53	0.33	0.05	0.08	0.05	0.03
$\overline{Y}$ (µg/m³)	0.81	0.41	0.41	0.18	0.16	0.54	0.33	0.05	0.08	0.06	0.03
MAD	0.04	0.03	0.04	0.01	0.01	0.02	0.02	0.01	0.00	0.01	0.00
MARPD	5.69	11.57	9.73	7.99	10.29	3.93	6.80	12.98	3.29	18.54	3.29

Completeness for Filter Pack Concentrations

Table 4 shows CASTNET sites with less than 90 percent completeness for weekly filter pack concentrations. Comments are included to provide information on why these sites experienced low data completeness.

Table 4. Sites with less than 90 Percent Data Completeness for Filter Concentrations for Second Quarter 2022 (1 of 2)

Site ID	Nylon HNO_3	Teflon NO_3^-	Teflon NH_4^+	Teflon SO_4^{2-}	Nylon SO_4^{2-}	Cellulose SO_2	Teflon Minor Cations	Teflon Cl^-	Comment
EGB181, ON	23	23	23	23	23	23	23	23	The site restarted filter pack sampling on June 15, 2022.
SAN189, NE	23	23	23	23	23	23	23	23	Tribal partner decided to pause filter pack sampling until October 1, 2022.
ASH135, ME	31	31	31	31	31	31	31	31	Site was mothballed due to EPA's FY2022 budget.
CDR119, WV	31	31	31	31	31	31	31	31	Site was mothballed due to EPA's FY2022 budget.
DCP114, OH	31	31	31	31	31	31	31	31	Site was mothballed due to EPA's FY2022 budget.
PNF126, NC	31	31	31	31	31	31	31	31	Site was mothballed due to EPA's FY2022 budget.
ANA115, MI	38	38	38	38	38	38	38	38	Site was mothballed due to EPA's FY2022 budget.
CDZ171, KY	38	38	38	38	38	38	38	38	Site was mothballed due to EPA's FY2022 budget.
HWF187, NY	38	38	38	38	38	38	38	38	Site was mothballed due to EPA's FY2022 budget.
PSU106, PA	38	38	38	38	38	38	38	38	Site was mothballed due to EPA's FY2022 budget.
UND002, VT	38	38	38	38	38	38	38	38	Site was mothballed due to EPA's FY2022 budget.
WST109, NH	38	38	38	38	38	38	38	38	Site was mothballed due to EPA's FY2022 budget.
LAV410, CA	54	54	54	54	54	54	54	54	Flow system leak affected six samples between 5/3/22 and 6/15/22.
PIN414, CA	54	54	54	54	54	54	54	54	Flow system leak affected six samples between 4/26/22 and 6/7/22.

Table 4. Sites with less than 90 Percent Data Completeness for Filter Concentrations for Second Quarter 2022 (2 of 2)

Site ID	Nylon HNO_3	Teflon NO_3^-	Teflon NH_4^+	Teflon SO_4^{2-}	Nylon SO_4^{2-}	Cellulose SO_2	Teflon Minor Cations	Teflon Cl^-	Comment
NEC602, WY	77	77	77	77	77	77	77	77	There was one 2-week sample and one 3-week sample during the quarter.
CAT175, NY	85	85	85	85	85	85	85	85	Power failures affected two samples.
DEN417, AK	85	85	85	85	85	85	85	85	Flow system leak affected one sample. Another sample had not been received by the laboratory in time for this report.
FOR605, WY	85	85	85	85	85	85	85	85	Analyses for one sample were cancelled due to equipment issues onsite. Flow data are missing from 7/1/22 forward, affecting a second sample.
THR422, ND	85	85	85	85	85	85	85	85	One sample was lost in shipping, and the following sample was not installed due to blizzard conditions.

Precision of Ozone Concentrations

Time series of co-located hourly O_3 concentration differences for second quarter 2022 are provided in Figures 28 and 29 for MCK131/231 and ROM406/206, respectively. The figures indicate no consistent bias between the co-located analyzers at these site locations.

Figure 28. Time Series of the Differences in Co-located O_3 Concentrations for MCK131/231, KY

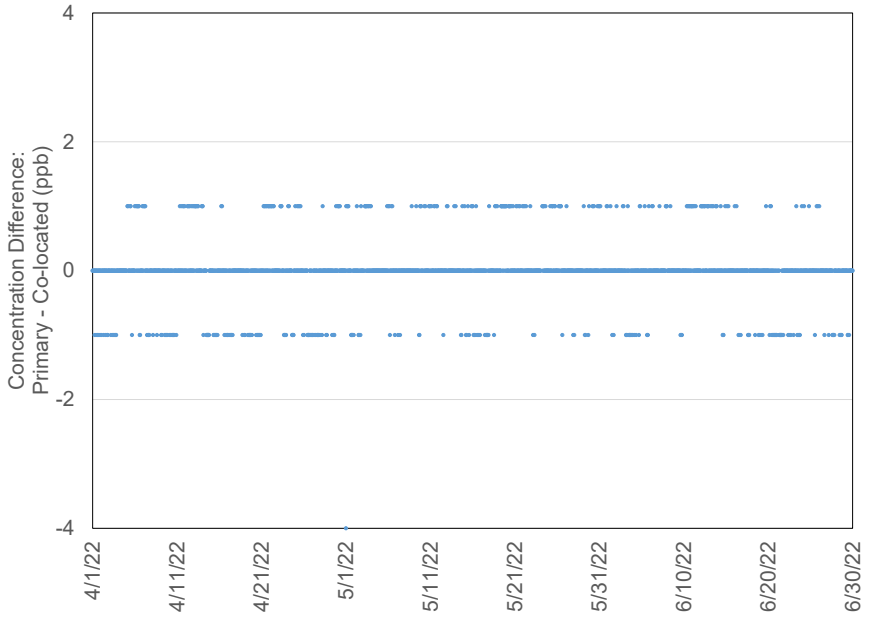


Figure 29. Time Series of the Differences in Co-located O_3 Concentrations for ROM406/206, CO

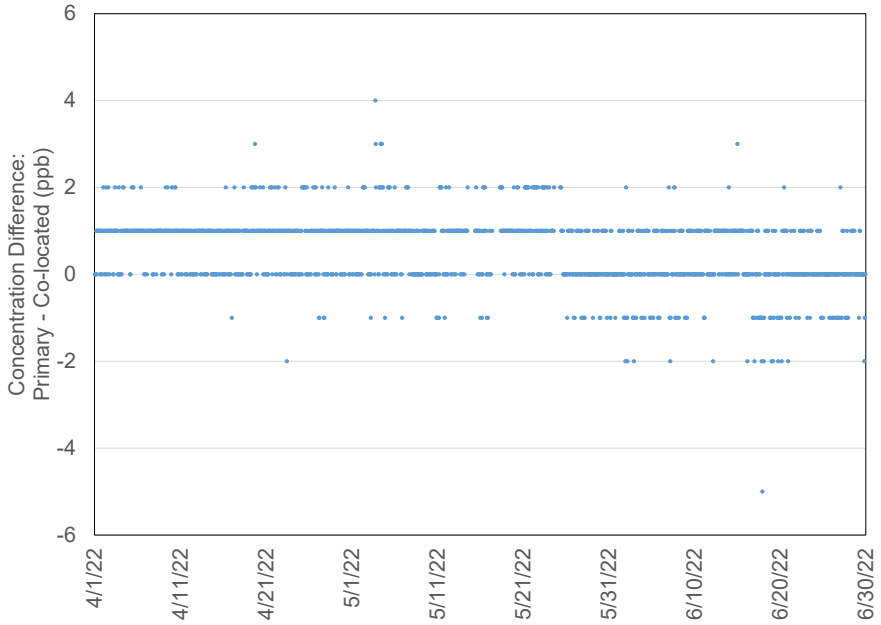


Table 5 gives MARPD data for O_3 data measured at the two co-located sites.

Table 5. Quarterly Precision (MARPD) for Co-located O_3 Concentrations

Site Pair	Quarter	Start Date	MARPD	Records
MCK131/231, KY				
	3	7/1/21	0.8	2082
	4	10/1/21	1.0	2086
	1	1/1/22	1.1	2046
	2	4/1/22	0.6	2066
ROM406/206, CO				
	3	7/1/21	1.4	2078
	4	10/1/21	1.7	2075
	1	1/1/22	2.0	1970
	2	4/1/22	1.5	1932

Completeness for O_3 Concentrations

Calculation of an annual O_3 value requires 75 percent completeness. However, calculation of the 3-year design value used for regulatory purposes requires 90 percent completeness. Table 6 shows CASTNET sites with less than 90 percent completeness for DM8A O_3 concentrations. Comments are provided for these sites.

Table 6. Sites with less than 90 Percent Data Completeness for DM8A Concentrations during Second Quarter 2022

Site ID	Percent Completeness	Comments
ASH135, ME	36	Site was mothballed due to EPA's FY2022 budget.
HWF187, NY	41	Site was mothballed due to EPA's FY2022 budget.
WST109, NH	43	Site was mothballed due to EPA's FY2022 budget.
PNF126, NC	43	Site was mothballed due to EPA's FY2022 budget.
CDZ171, KY	43	Site was mothballed due to EPA's FY2022 budget.
DCP114, OH	43	Site was mothballed due to EPA's FY2022 budget.
CDR119, WV	43	Site was mothballed due to EPA's FY2022 budget.
PAL190, TX	74	Most of June was invalidated due to QC failures. The analyzer was replaced on June 30.
GRB411, NV	77	Data were invalidated from late March to late April for a failed sample pump.
QAK172, OH	88	Data were invalidated because of site polling issues in early April and early June.
GRC474, AZ	88	Data were invalidated from late April to early May for a failed sample pump.
SUM156, FL	89	Data were invalidated because of site polling issues in early May and analyzer malfunction mid-June. Analyzer was replaced 6/18/22.

Table 7 shows CASTNET sites with less than 90 percent completeness for hourly O_3 concentrations. Comments are provided for these sites. The annual average for each of these sites is included for reference.

Table 7. Sites with less than 90 Percent Data Completeness for O_3 Concentrations

Site ID	Q2 2022	Q3 2021–Q2 2022	Comments
ASH135, ME	37	82	Site was mothballed due to EPA's FY2022 budget.
HWF187, NY	43	84	Site was mothballed due to EPA's FY2022 budget.
DCP114, OH	43	85	Site was mothballed due to EPA's FY2022 budget.
PNF126, NC	43	84	Site was mothballed due to EPA's FY2022 budget.
WST109, NH	43	84	Site was mothballed due to EPA's FY2022 budget.
CDZ171, KY	43	85	Site was mothballed due to EPA's FY2022 budget.
CDR119, WV	44	79	Site was mothballed due to EPA's FY2022 budget.
PAL190, TX	75	92	Most of June data were invalidated due to QC failures. The analyzer was replaced June 30.
GRB411, NV	77	92	Data were invalidated late March to late April for a failed sample pump.

Filter Pack Total Nitrate and Continuous Trace-level NO_y Concentrations at Eight CASTNET Sites

Figures 30 through 37 show a comparison of weekly average continuous NO_y measurements with weekly filter pack total NO_3^- concentrations collected at the eight sites with NO_y measurements. The NO_y concentrations were consistently higher than the total NO_3^- levels at all sites except for PND165 during first half of the quarter. The average weekly NO_y levels, the weekly total NO_3^- concentrations, and their ratios for the eight sites with available data are shown in Table 8. Ratios of NO_y to total NO_3^- varied from 3.43 at PND165 to 7.65 at PNF126.

Table 8. Summary of Total NO_3^- and NO_y Measurements for Second Quarter 2022

Site ID	Elevation	Total NO_3^- (ppb)	NO_y (ppb)	Ratio
DUK008, NC	164*	0.47	2.01	4.42
BVL130, IL	213	0.76	4.52	5.23
MAC426, KY	243	0.50	1.95	3.91
HWF187, NY ϕ	497	0.14	0.75	5.77
GRS420, TN	793	0.39	1.46	3.97
PNF126, NC ϕ	1216	0.28	1.29	7.65
PND165, WY	2386	0.15	0.48	3.43
ROM206, CO	2742	0.24	1.10	4.86

Note: * The inlet of the enhanced NO_y monitor is located at the top of the 30-meter tower.
ϕ Site was mothballed due to EPA's FY2022 budget. This summary represents only the first six weeks of the quarter when sampling was active.

Figure 30. Comparison of DUK008 Weekly Mean NO_y and Total NO_3^- Concentrations

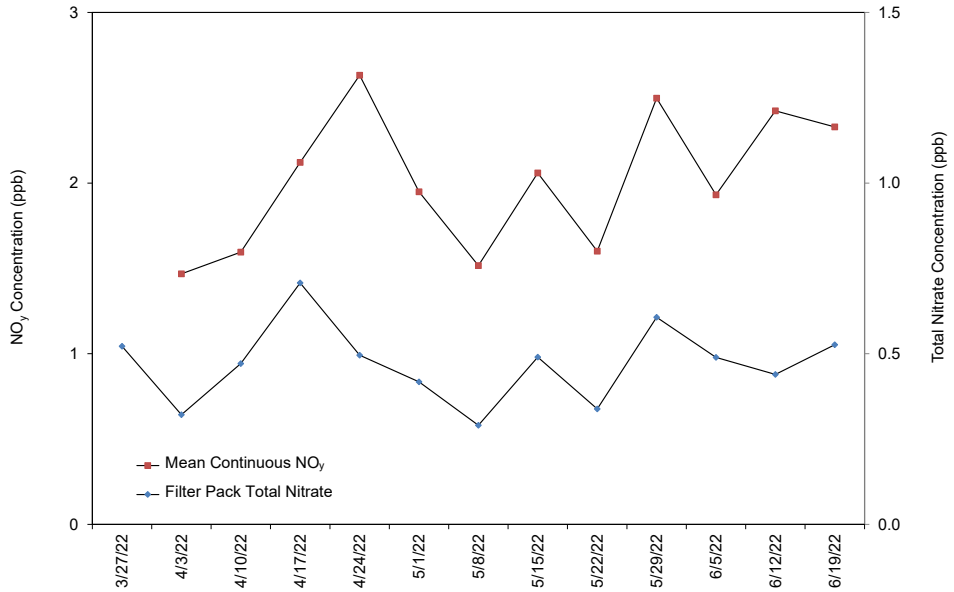


Figure 31. Comparison of BVL130 Weekly Mean NO_y and Total NO_3^- Concentrations

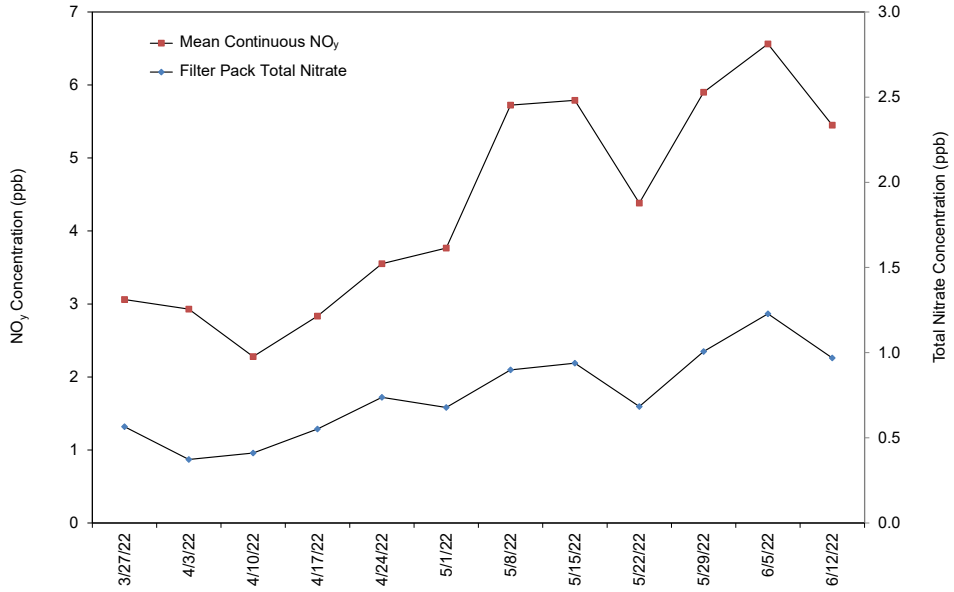


Figure 32. Comparison of MAC426 Weekly Mean NO_y and Total NO_3^- Concentrations

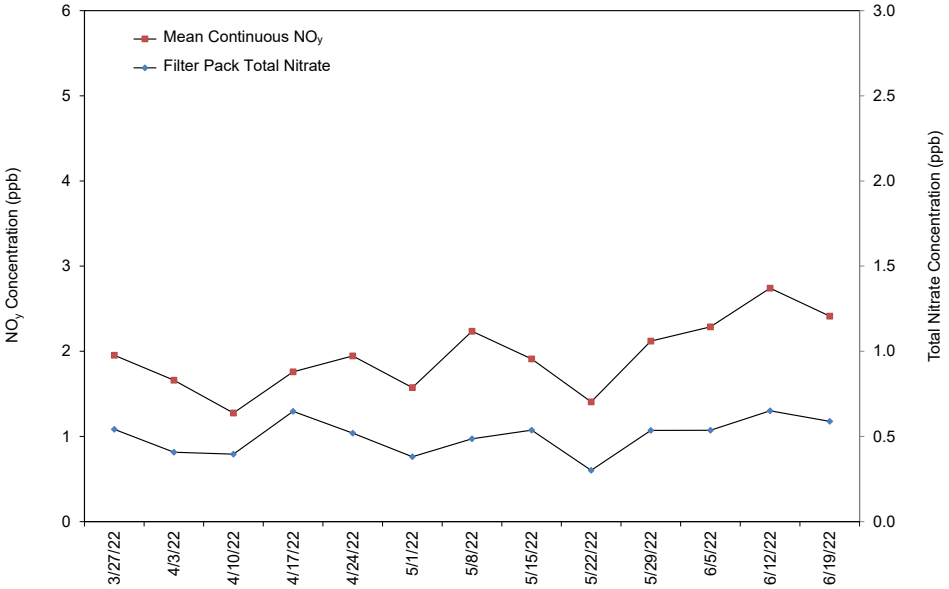


Figure 33. Comparison of HWF187 Weekly Mean NO_y and Total NO_3^- Concentrations

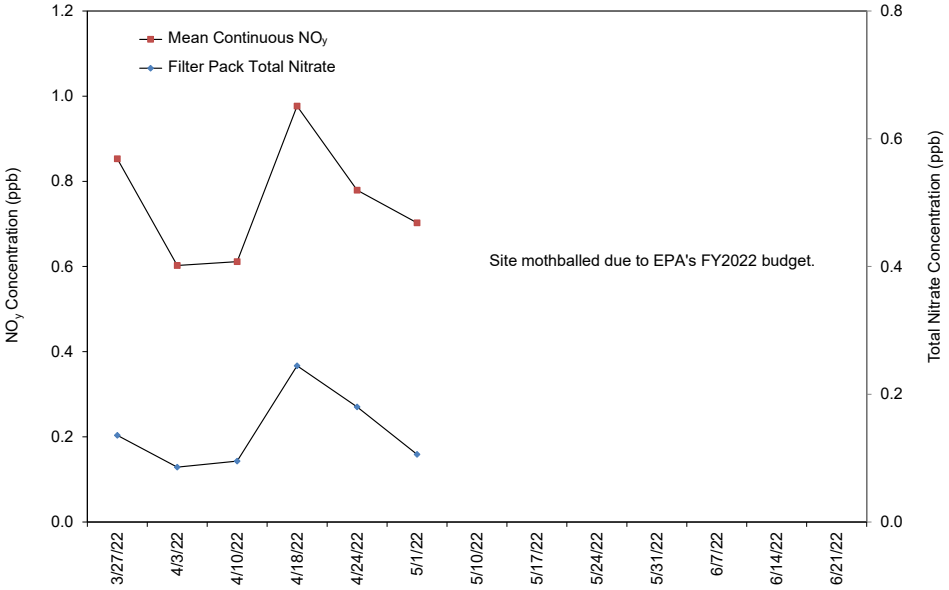


Figure 34. Comparison of GRS420 Weekly Mean NO_y and Total NO_3^- Concentrations

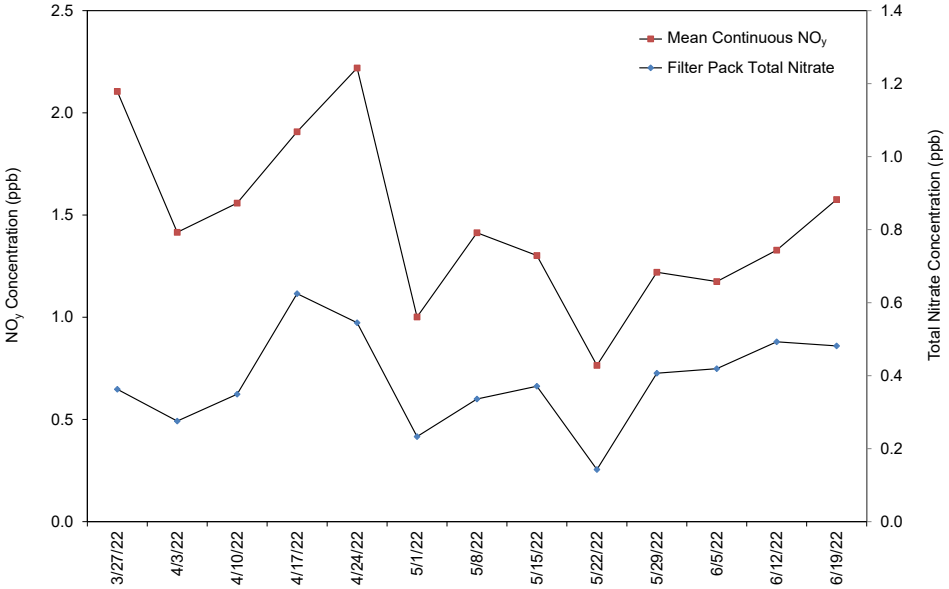


Figure 35. Comparison of PNF126 Weekly Mean NO_y and Total NO_3^- Concentrations

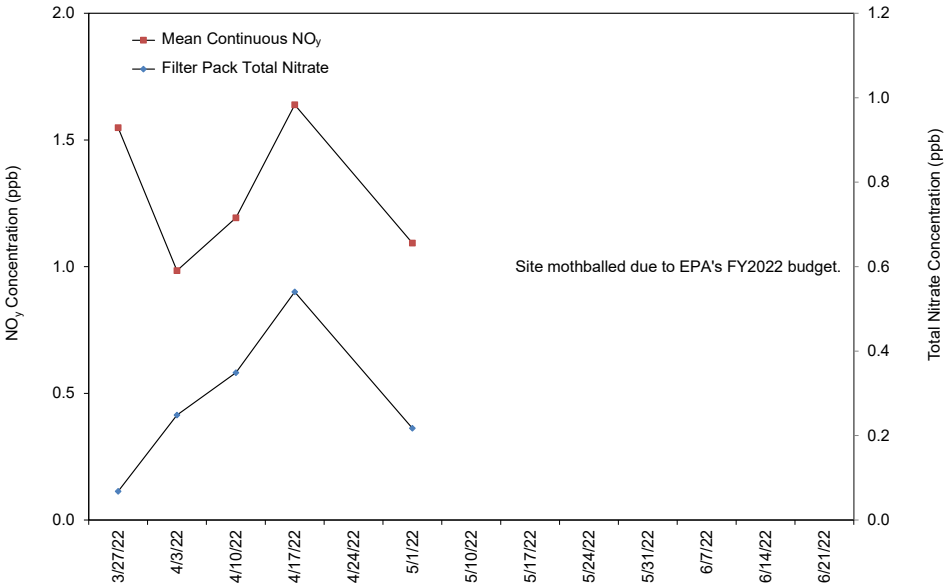


Figure 36. Comparison of PND165 Weekly Mean NO_y and Total NO_3^- Concentrations

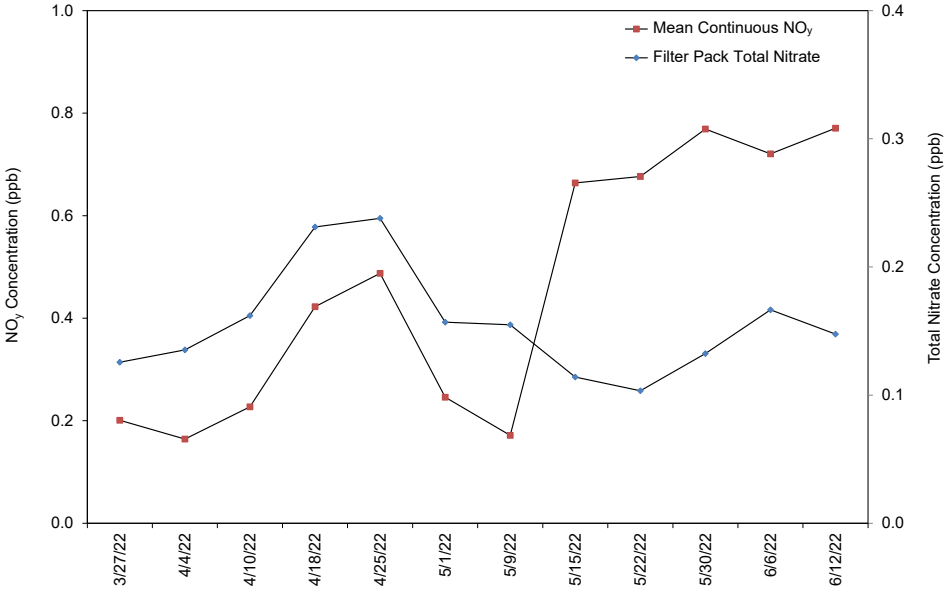
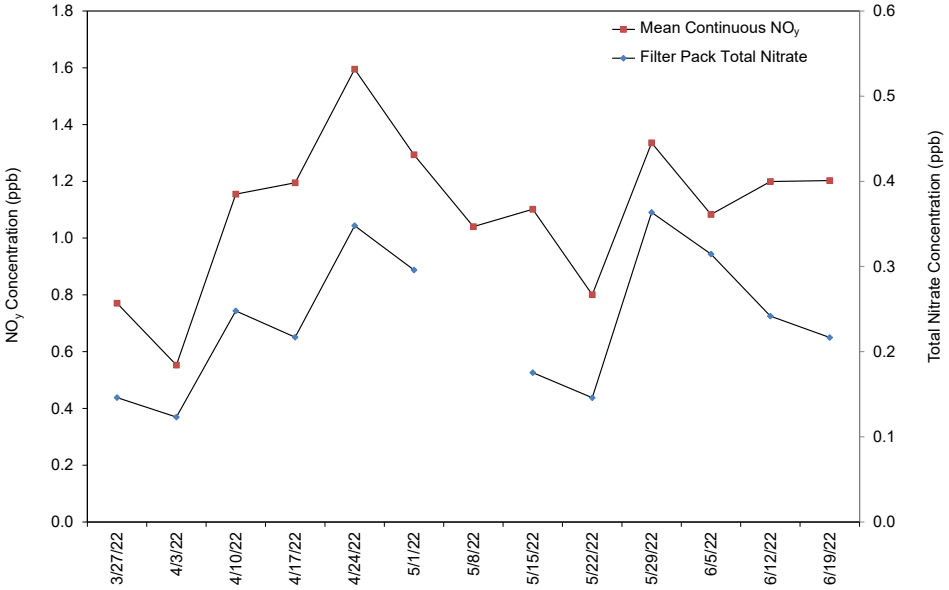


Figure 37. Comparison of ROM206 Weekly Mean NO_y and Total NO_3^- Concentrations



Filter Pack and Continuous Trace-level Gas Sulfur Dioxide Concentrations

Figures 38 through 40 provide diagrams that compare weekly filter pack SO_2 concentrations with continuous trace-level gas data measured at BVL130, MAC426, and GRS420. The continuously measured trace-level concentrations were higher than filter pack concentrations at BVL130 and were comparable at MAC426 and GRS420.

Figure 38. Comparison of BVL130 Weekly Mean SO_2 Concentrations

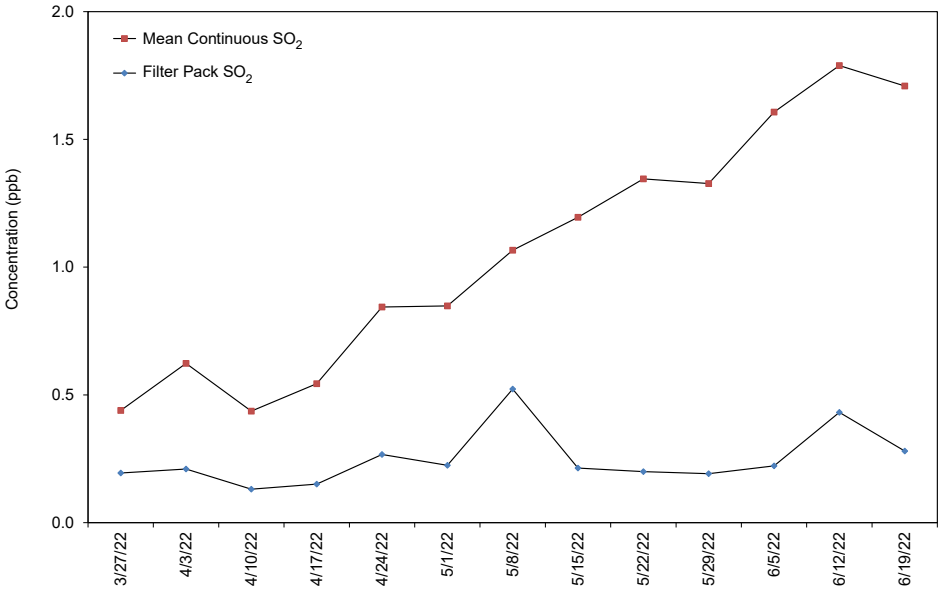


Figure 39. Comparison of MAC426 Weekly Mean SO_2 Concentrations

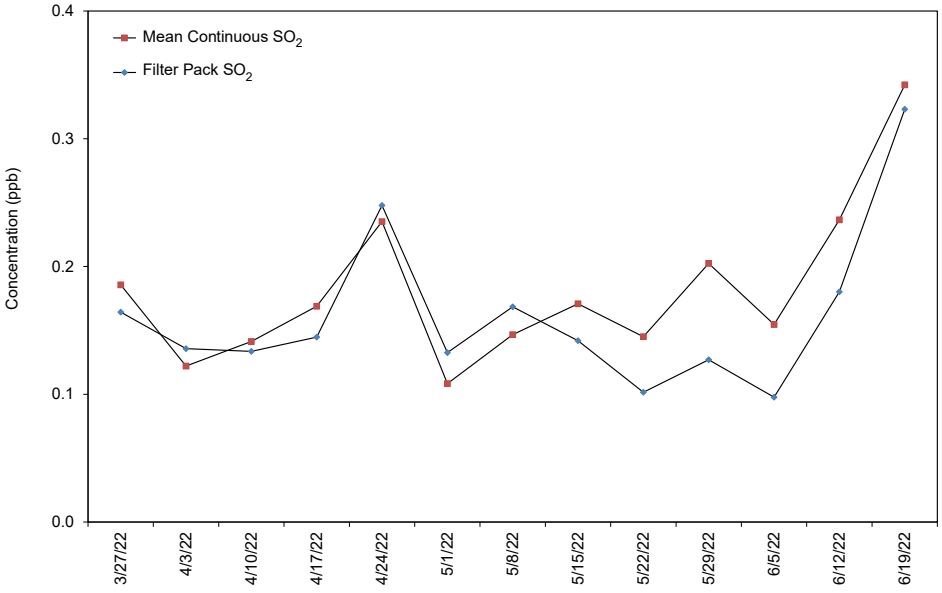
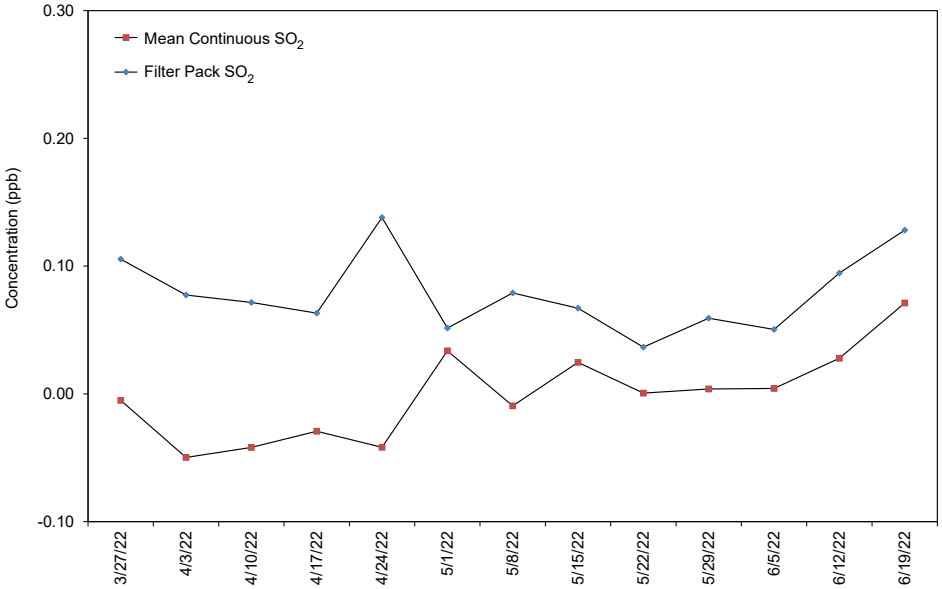


Figure 40. Comparison of GRS420 Weekly Mean SO_2 Concentrations



Completeness for Continuous Trace-level Gas Measurements

Table 9 shows the percent completeness for CASTNET trace-level gas measurements. Comments are provided for sites with less than 90 percent completeness for hourly trace-level gas concentrations during second quarter 2022. The average for third quarter 2021 through second quarter 2022 for each of the sites is included for reference.

Table 9. Percent Data Completeness for Continuous Trace-level Gas Measurements (1 of 2)

Site ID	Parameter*	Q2 2022	Q3 2021 – Q2 2022	Comments
BVL130, IL	CO	44	52	The CO analyzer experienced QC check failures in May and June. A loose Ethernet cable was fixed in July and resolved the issue.
	NO	92	89	
	NOY	92	93	
	NOYDIF	92	89	
	SO2_GA	91	89	
CHC432, NM	NO	97	97	
	NOX	97	97	
	NOXDIF	97	97	
DUK008, NC	HNO3	85		• Monitoring restarted August 2021, but QC activities were not fully operational until December 2021. As a result, the average for Q3 2021 through Q2 2022 was not calculated. • The QC check runs for NH3 result in three to six hours of invalid data every two days for all parameters. • Data for all parameters were invalidated for 4/1/22 to 4/5/22 due to calibration activities. • NH3 and TNX had several QC check failures in June.
	NH3	62		
	NO	85		
	NO2_TRUE	85		
	NOX_TRUE	85		
	NOY	85		
	NOY_MINUS	85		
	NOYDIF	85		
	TNX	62		
GRS420, TN	CO	88	85	The CO analyzer failed QC checks in mid-April. Numerous calibrations and maintenance checks throughout the quarter also affected data completeness.
	NO	93	88	
	NOY	93	88	
	NOYDIF	93	88	
	SO2_GA	93	87	
HWF187, NY	NO	40	79	Site was mothballed due to EPA's FY2022 budget.
	NOY	40	79	
	NOYDIF	40	79	
MAC426, KY	CO	96	96	
	NO	97	97	
	NOY	97	97	
	NOYDIF	97	97	
	SO2_GA	97	97	
PND165, WY	NO	92	86	The analyzer drifted out of calibration in May and was re-calibrated.
	NOY	88	84	
	NOYDIF	88	84	

Table 9. Percent Data Completeness for Continuous Trace-level Gas Measurements (2 of 2)

Site ID	Parameter*	Q2 2022	Q3 2021 – Q2 2022	Comments
PNF126, NC	NO	38	75	Site was mothballed due to EPA's FY2022 budget.
	NOY	38	74	
	NOYDIF	38	74	
ROM206, CO	NO	94	95	
	NOY	94	95	
	NOYDIF	94	95	

Note: * See Table 10

The parameters listed in Table 9 are both calculated and measured. Table 10 provides information on how the parameters listed in Table 9 are obtained.

Table 10. CASTNET Trace-level Gas Measurements

Parameter Name	How Obtained	Description of Process
CO	Measured	Gas filter correlation
HNO3	Calculated	NOY minus NOY_MINUS
NH3	Calculated	TNX minus NOY
NO	Measured	Chemiluminescence reaction/no converter used
NO2_TRUE	Calculated	NOX_TRUE minus NO
NOX_TRUE	Measured	Photolytic converter
NOY	Measured	Molybdenum converter at 315° Celsius
NOYDIF	Calculated	NOY minus NO
NOY_MINUS	Measured	Sodium carbonate denuder followed by molybdenum converter at 315° Celsius
NOX	Measured	Molybdenum converter at 325° Celsius
NOXDIF	Calculated	NOX minus NO
SO2_GA	Measured	Ultraviolet fluorescence
TNX	Measured	Platinum/stainless steel converter at 825° Celsius followed by molybdenum converter at 315° Celsius

References

Wood Environment & Infrastructure Solutions, Inc. 2022. *Clean Air Status and Trends Network (CASTNET) Second Quarter 2022 Quality Assurance Report.* https://java.epa.gov/castnet/documents.do