Clean Air Status and Trends Network

Quarterly Data Summary for Second Quarter 2023 (April through June)

Prepared for: U.S. Environmental Protection Agency (EPA), Clean Air Markets Division
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Prepared by: WSP Environment and Infrastructure, Inc., Gainesville, Florida
WSP Project No.: 6064236203
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Introduction

This quarterly report summarizes the Clean Air Status and Trends Network (CASTNET) data collected during second quarter 2023. 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 the six of eight sites that were operational during second quarter and continuous SO_2 concentrations from three sites. Other QC statistics are given in the CASTNET Second Quarter 2023 Quality Assurance Report (WSP, 2023).

Figure 1. Fourth Highest Daily Maximum 8-hour Average O_3 Concentrations (ppb) through Second Quarter 2023

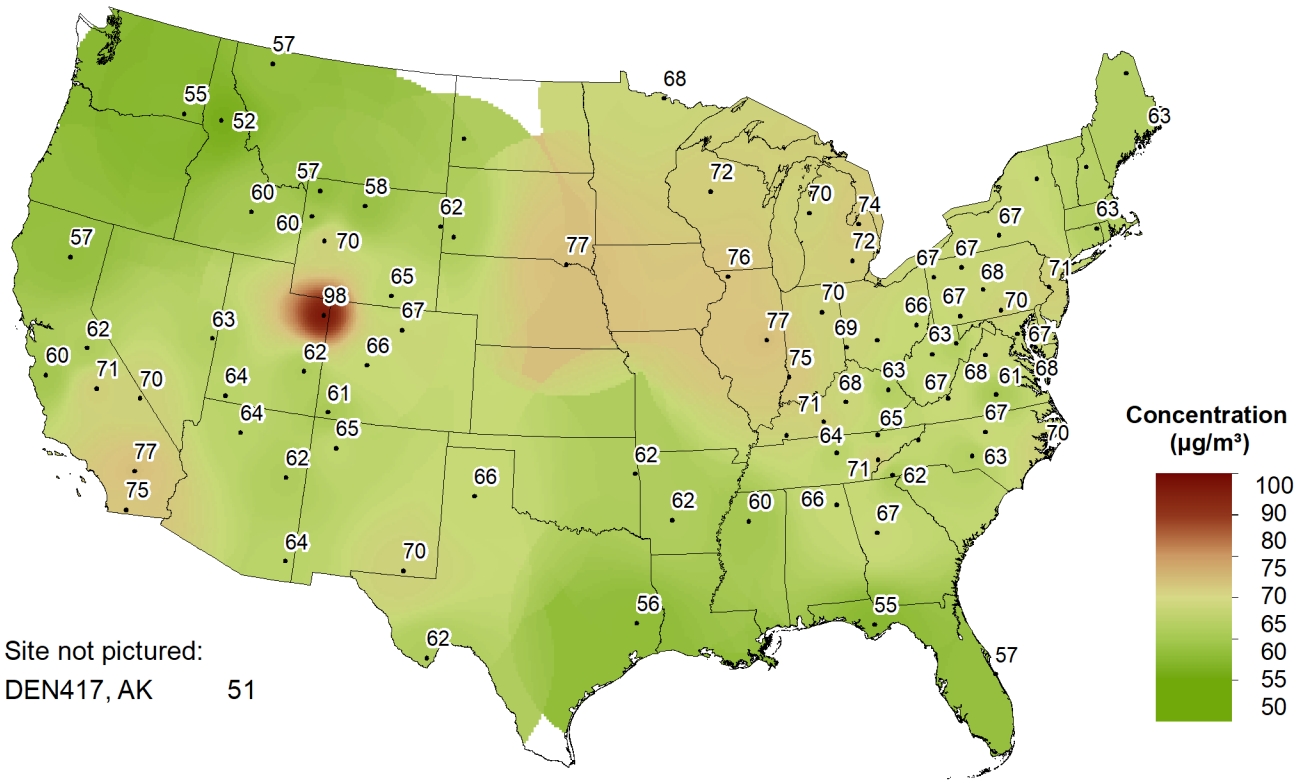


Figure 1 shows fourth highest daily maximum 8-hour average (DM8A) O_3 concentrations measured through second quarter 2023. Fourteen sites exceeded the 0.070 parts per million (ppm) National Ambient Air Quality Standard (NAAQS) for O_3. The 98 parts per billion (ppb) concentration measured at DIN431, UT was discussed in the First Quarter 2023 Data Summary Report. (https://www.epa.gov/system/files/documents/2023-07/Quarterly_2023_Q1.pdf).

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 NO_3^-, total NO_3^-, Cl^-, and Na^+ concentrations decreased at eastern sites in 2023, and HNO_3, NH_4^+, SO_2, Ca^{2+}, and K^+ concentrations increased. SO_4^{2-} and Mg^{2+} concentrations showed no change. Quarterly mean NO_3^-, total NO_3^-, Cl^-, Ca^{2+}, K^+, Mg^{2+}, and Na^+ concentrations decreased at western sites in 2023 while HNO_3, NH_4^+, SO_2, and SO_4^{2-} concentrations increased.

Quarterly O_3 concentrations were analyzed using box plots constructed by averaging all valid hourly O_3 concentrations within second quarter 2023 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. However, mean O_3 concentrations increased in second quarter 2023. Quarterly mean concentrations were higher at the western reference sites than at the eastern sites.

Figure 2. Trends in Second Quarter Mean HNO_3 Concentrations

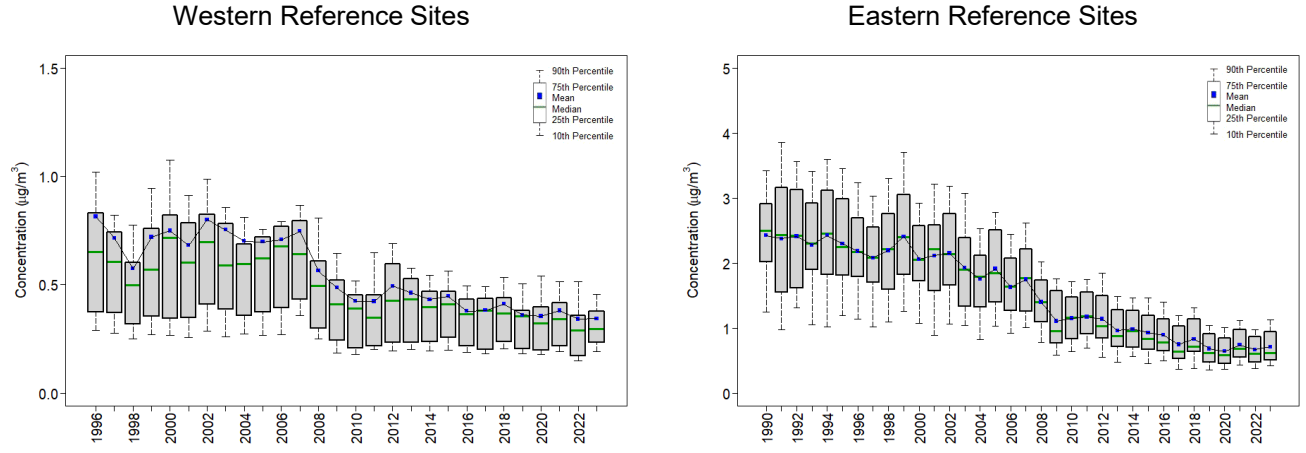
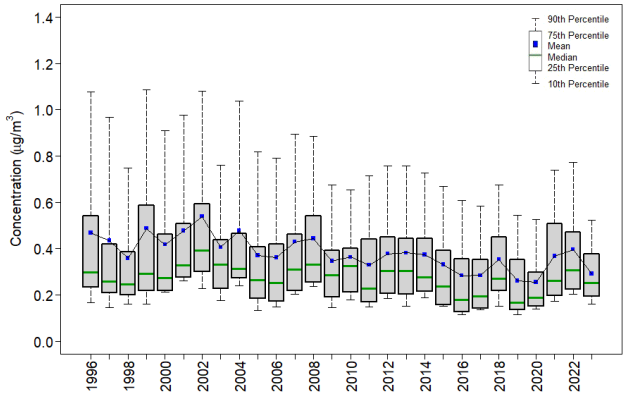


Figure 3. Trends in Second Quarter Mean NO_3^- Concentrations

Western Reference Sites



Eastern Reference Sites

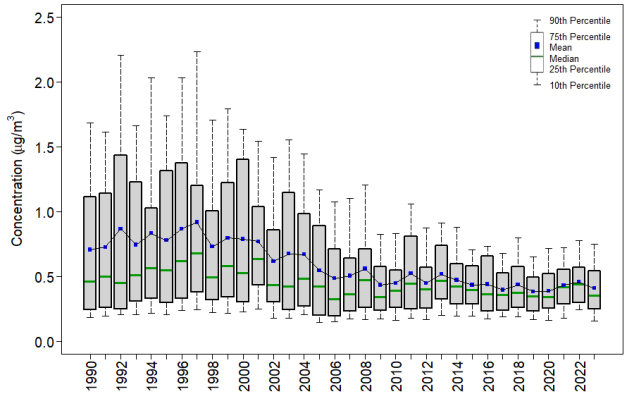
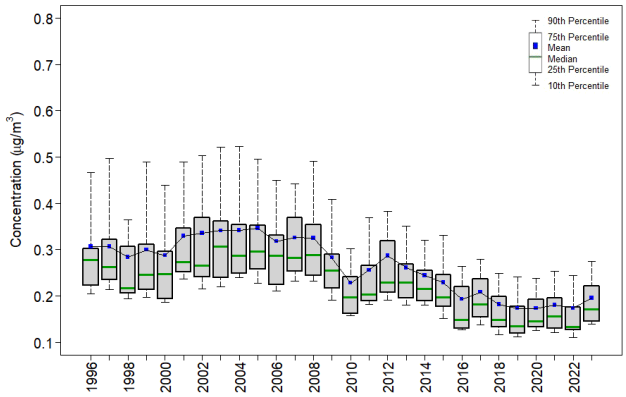


Figure 4. Trends in Second Quarter Mean NH_4^+ Concentrations

Western Reference Sites



Eastern Reference Sites

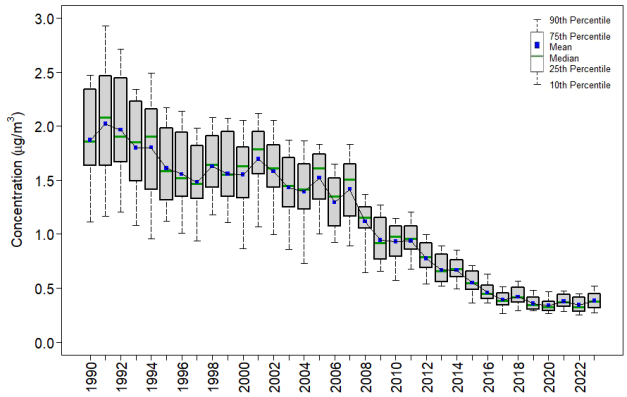
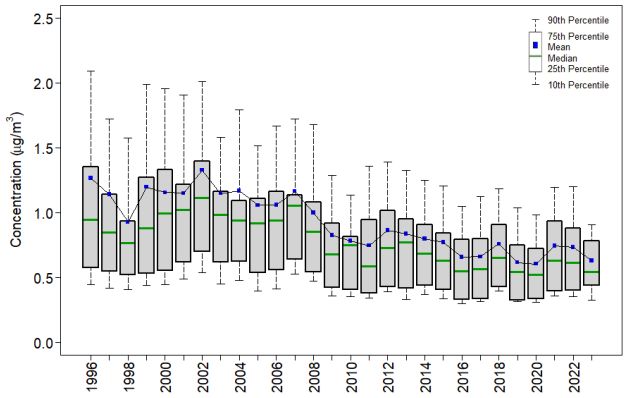


Figure 5. Trends in Second Quarter Mean Total NO_3^- Concentrations

Western Reference Sites



Eastern Reference Sites

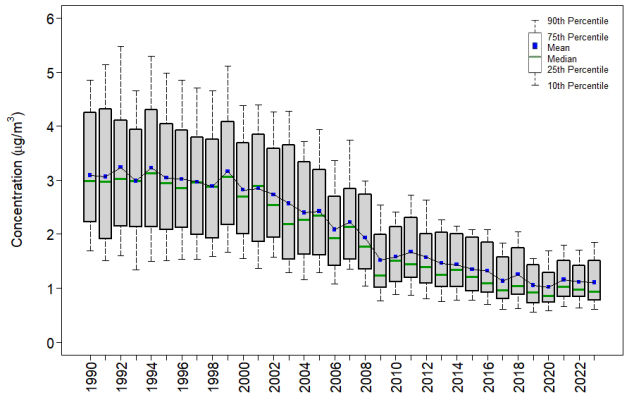
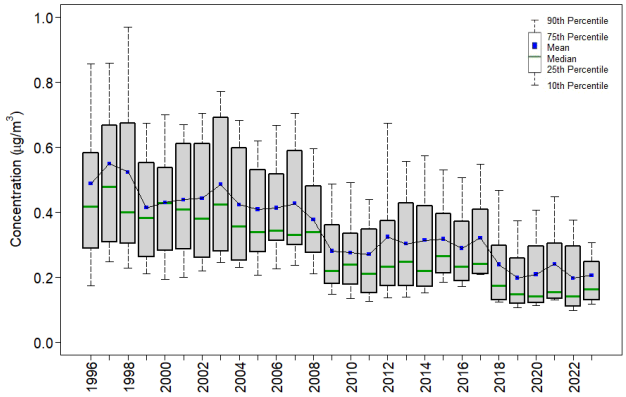


Figure 6. Trends in Second Quarter Mean SO_2 Concentrations

Western Reference Sites



Eastern Reference Sites

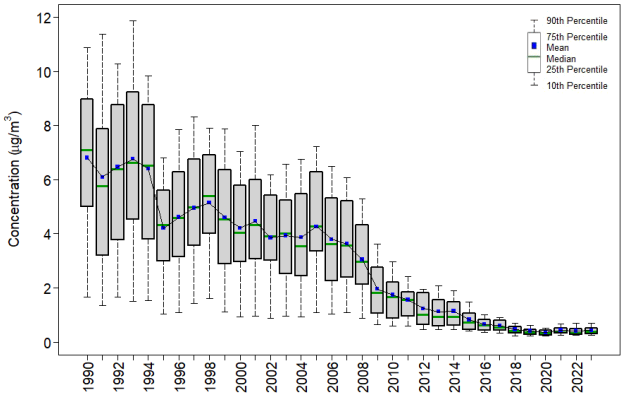
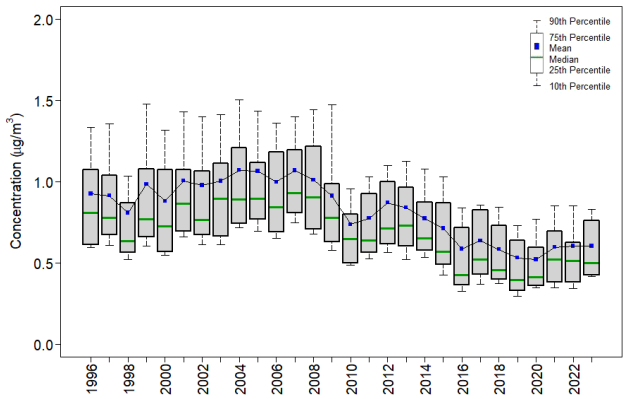


Figure 7. Trends in Second Quarter Mean SO_4^{2-} Concentrations

Western Reference Sites



Eastern Reference Sites

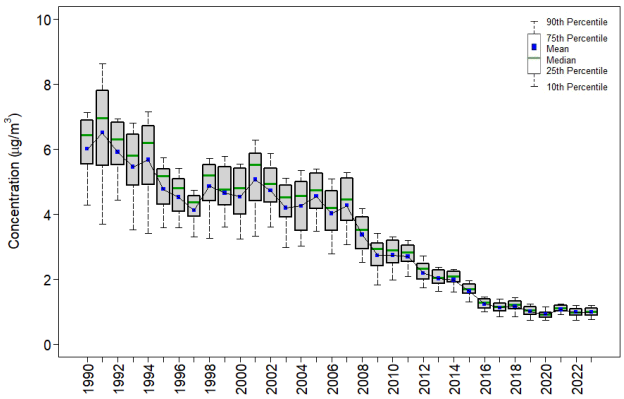
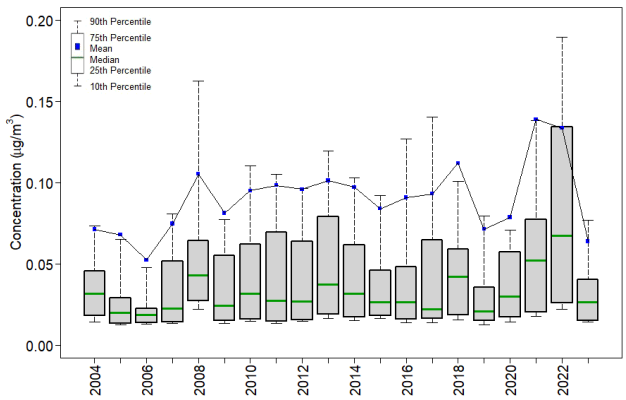


Figure 8. Trends in Second Quarter Mean Cl^- Concentrations

Western Reference Sites



Eastern Reference Sites

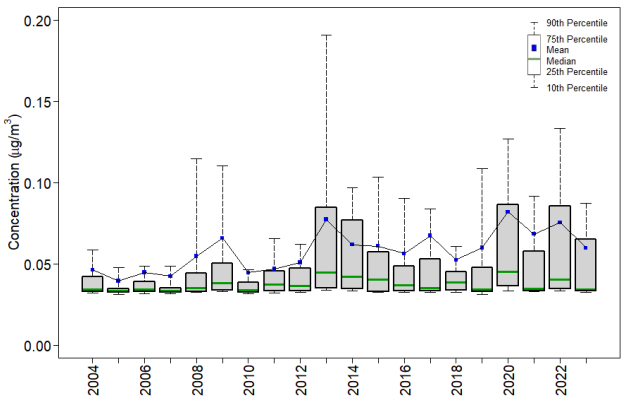
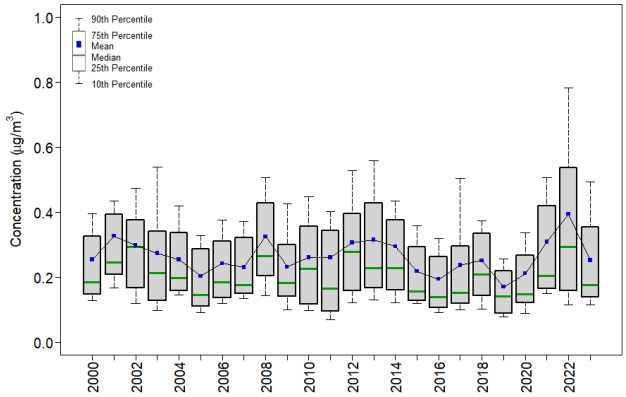


Figure 9. Trends in Second Quarter Mean Ca^{2+} Concentrations

Western Reference Sites



Eastern Reference Sites

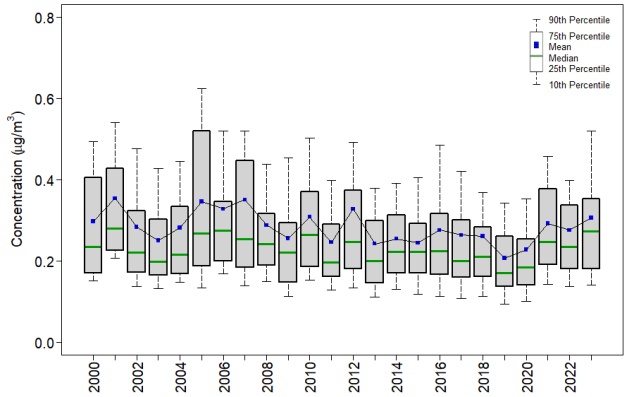
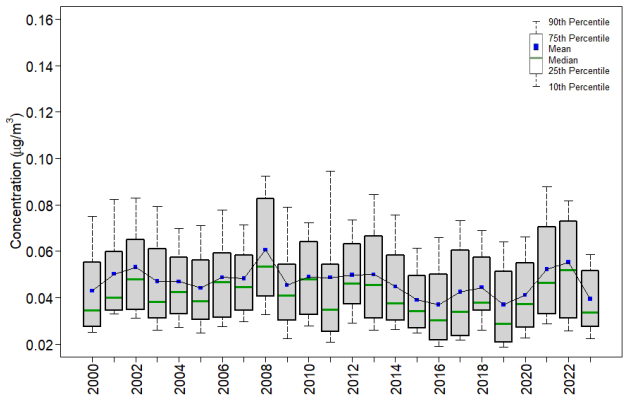


Figure 10. Trends in Second Quarter Mean K^{+} Concentrations

Western Reference Sites



Eastern Reference Sites

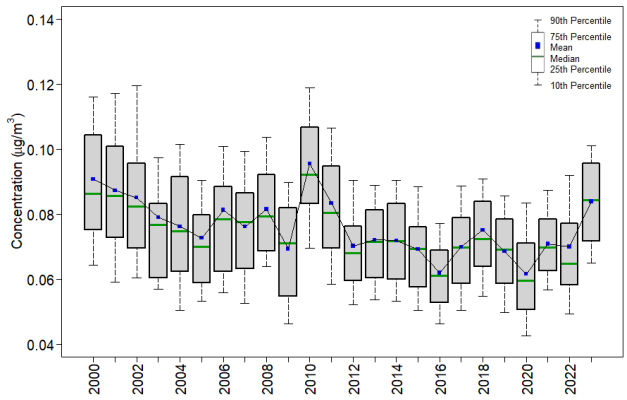
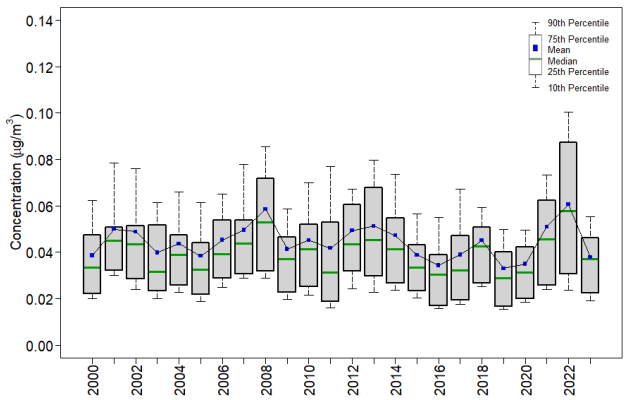


Figure 11. Trends in Second Quarter Mean Mg^{2+} Concentrations

Western Reference Sites



Eastern Reference Sites

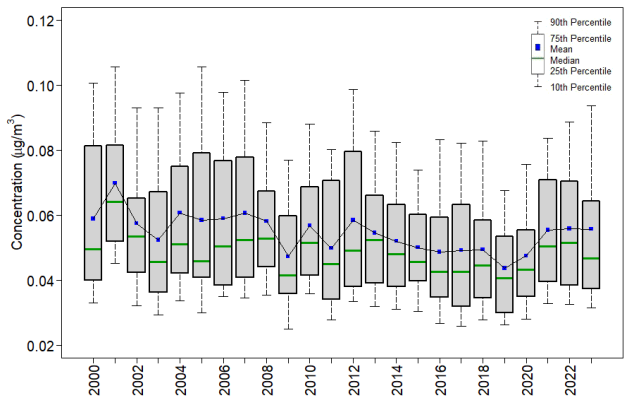
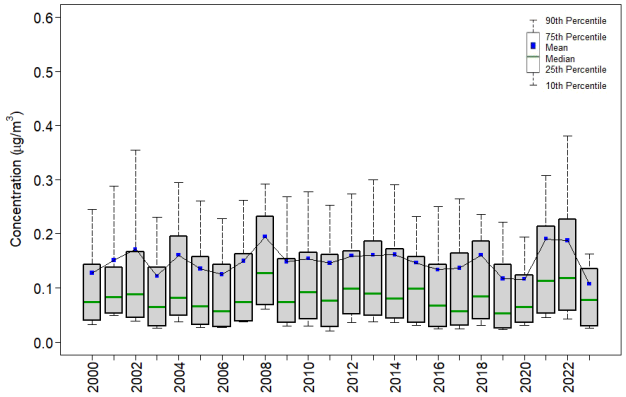


Figure 12. Trends in Second Quarter Mean Na^+ Concentrations

Western Reference Sites



Eastern Reference Sites

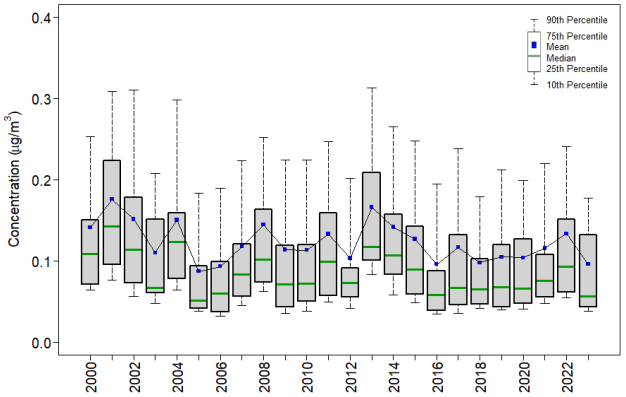
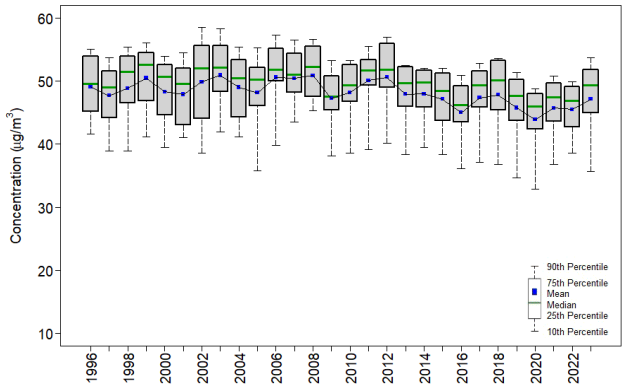
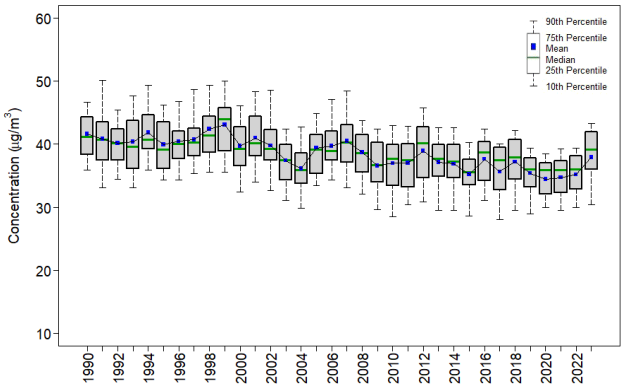


Figure 13. Trends in Second Quarter Mean O_3 Concentrations

Western Reference Sites



Eastern Reference Sites



Changes in 3-Year Average Second Quarter Concentrations

As shown in Table 1 and Table 2, 3-year averages of quarterly mean concentrations of total NO_3^-, NH_4^+, SO_2, and SO_4^{2-} were reduced over the period 1990–1992 through 2021–2023 for eastern reference sites and 1996–1998 through 2021–2023 for western reference sites. O_3 concentrations showed reductions at eastern and western reference sites. Ca^{2+}, K^+ and Mg^{2+} levels declined at eastern sites from 2004–2006 through 2021–2023. Cl^- and Na^+ concentrations increased. At western sites, Cl^- and the four base cation concentrations increased.

Table 1. Eastern Reference Sites: 3-Year Mean values (ppb or µg/m^3)

Parameter	O_3 (ppb)	Total NO_3^-	NH_4^+	SO_2	SO_4^{2-}	Ca^{2+}	K^+	Mg^{2+}	Na^+	Cl^-
1990–1992	41	3.1	2.0	6.5	6.1					
2004–2006						0.32	0.08	0.06	0.11	0.04
2021–2023	36	1.1	0.4	0.4	1.0	0.29	0.07	0.06	0.11	0.07
Percent Change	-12	-64	-81	-94	-84	-9	-2	-6	4	56

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

Table 2. Western Reference Sites: 3-Year Mean Values (ppb or µg/m^3)

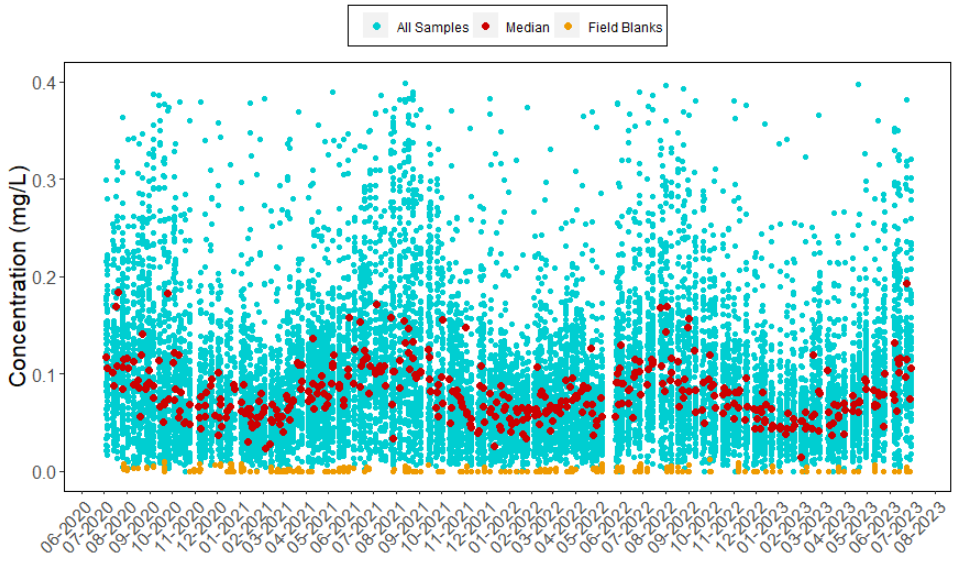
Parameter	O_3 (ppb)	Total NO_3^-	NH_4^+	SO_2	SO_4^{2-}	Ca^{2+}	K^+	Mg^{2+}	Na^+	Cl^-
1990–1992	49	1.1	0.3	0.5	0.9					
2004–2006						0.23	0.05	0.04	0.14	0.06
2021–2023	46	0.7	0.2	0.2	0.6	0.32	0.05	0.05	0.16	0.11
Percent Change	-5	-37	-39	-59	-32	36	5	17	15	76

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

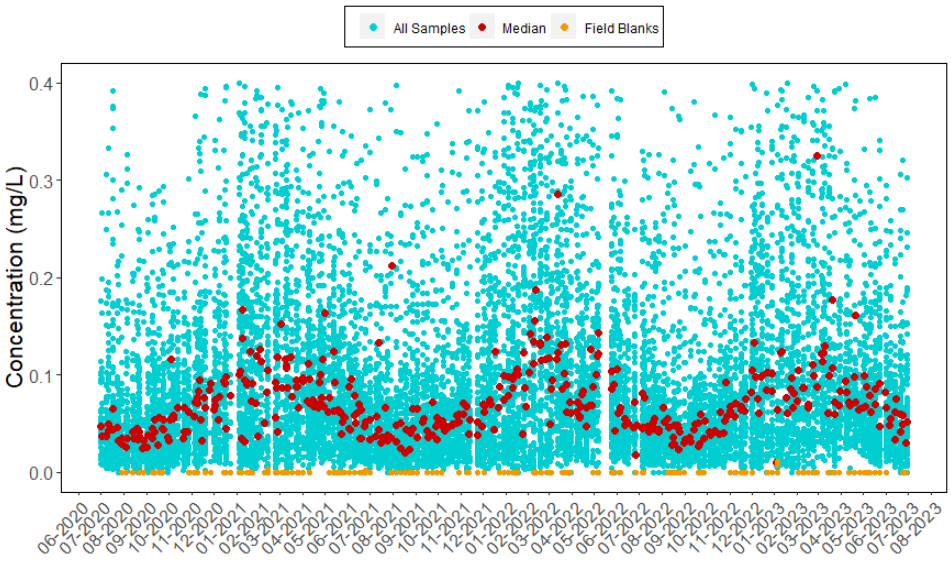
Figures 14 through 24 give time series of laboratory-analyzed concentrations of field samples and field blanks in milligrams per liter (mg/L) of 11 parameters from third quarter 2020 through second quarter 2023. These figures provide indications of potential issues with concentration measurements relative to detection and reporting limits.

Figure 14. Concentrations of NO_3^- (as N) from Nylon Filters



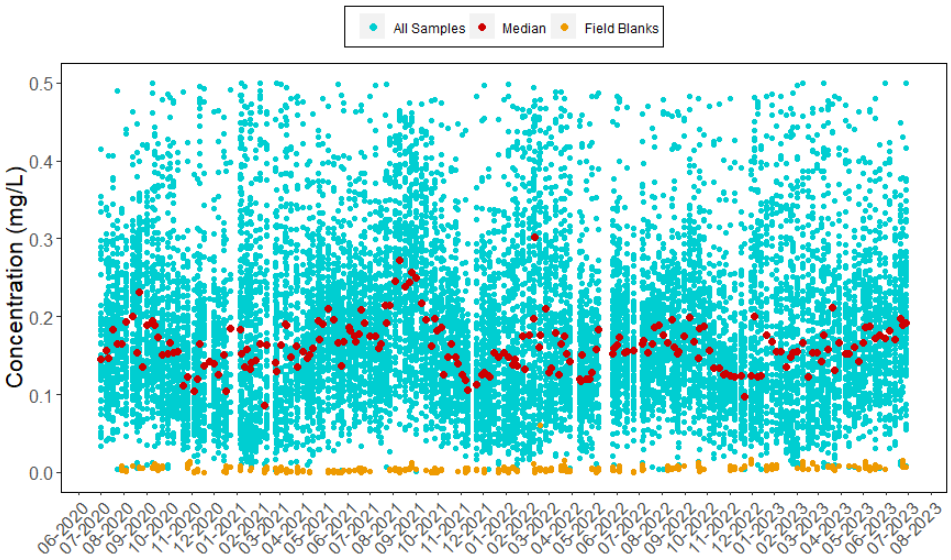
Note: Nominal reporting limit is 0.008 mg/L

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



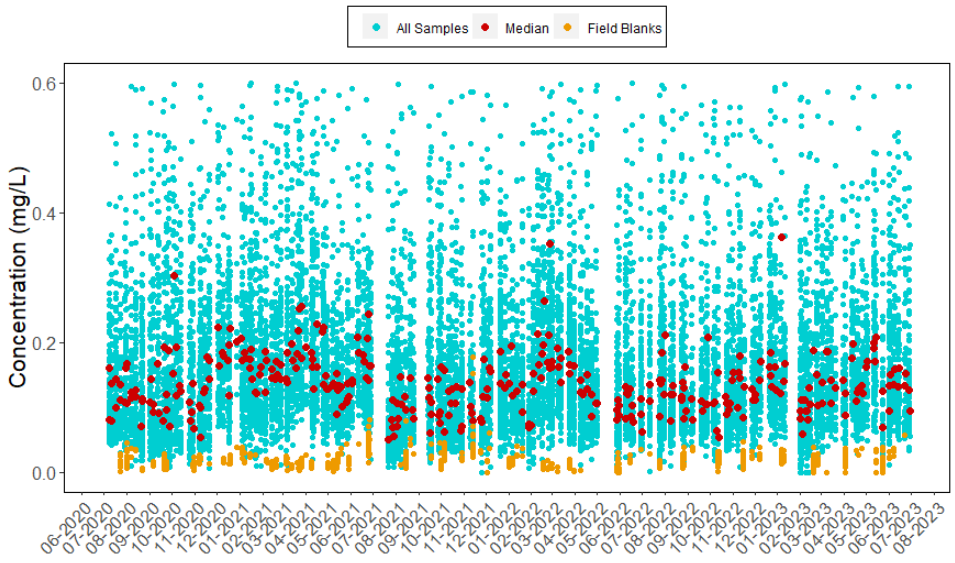
Note: Nominal reporting limit is 0.008 mg/L

Figure 16. Concentrations of NH_4^+ (as N) from Teflon Filters



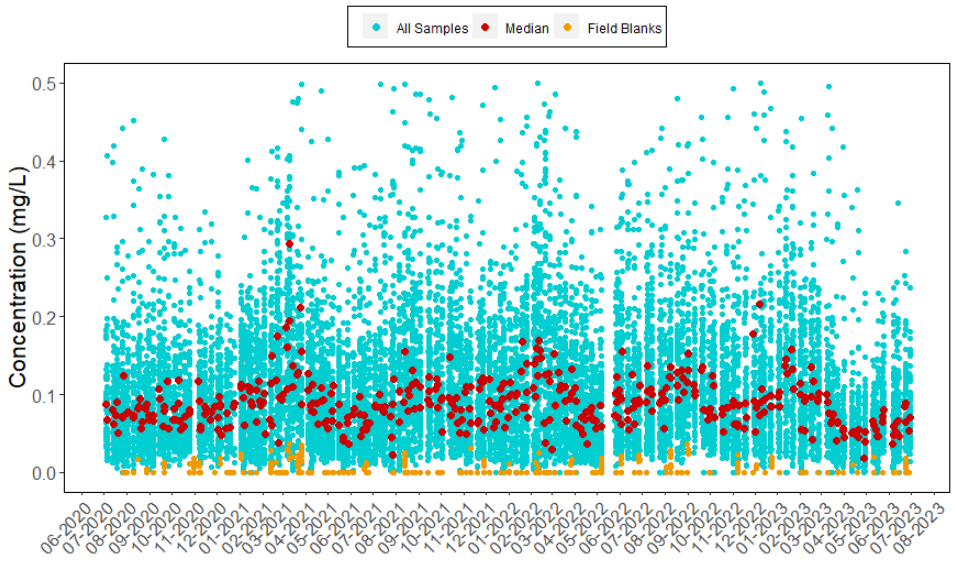
Note: Nominal reporting limit is 0.020 mg/L

Figure 17. Concentrations of SO_2 from K_2CO_3-impregnated Cellulose Filters



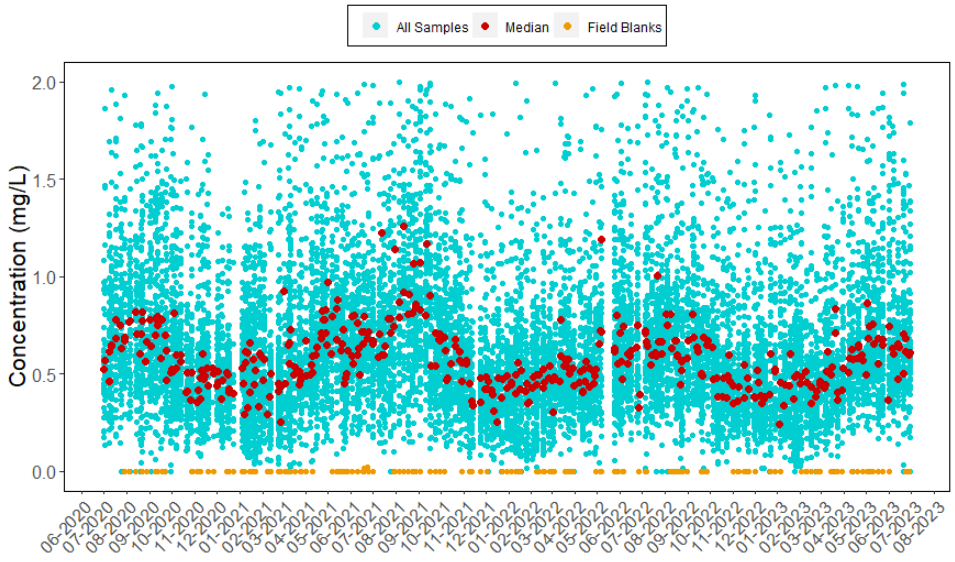
Note: Nominal reporting limit is 0.040 mg/L

Figure 18. Concentrations of SO_4^{2-} from Nylon Filters



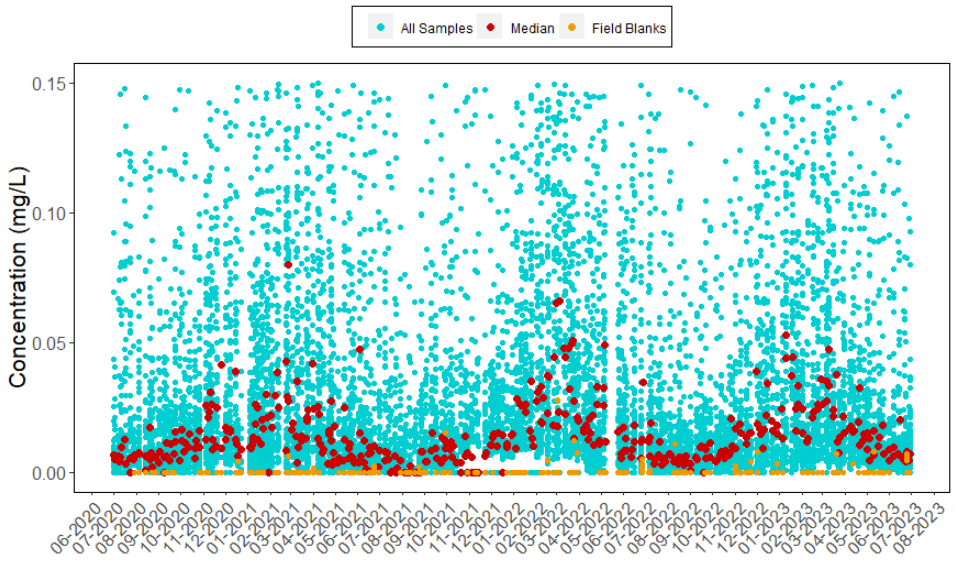
Note: Nominal reporting limit is 0.040 mg/L

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



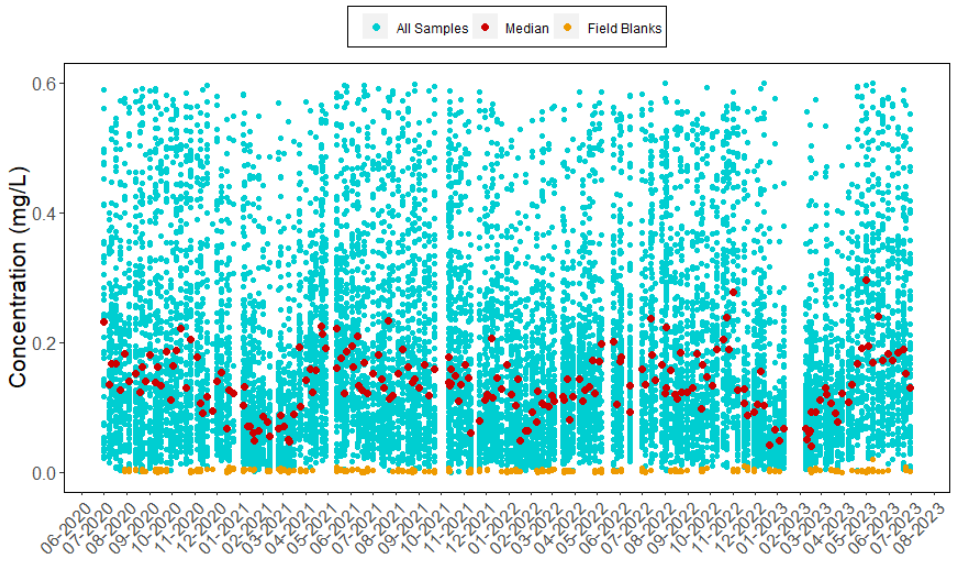
Note: Nominal reporting limit is 0.040 mg/L

Figure 20. Concentrations of Cl^- from Teflon Filters



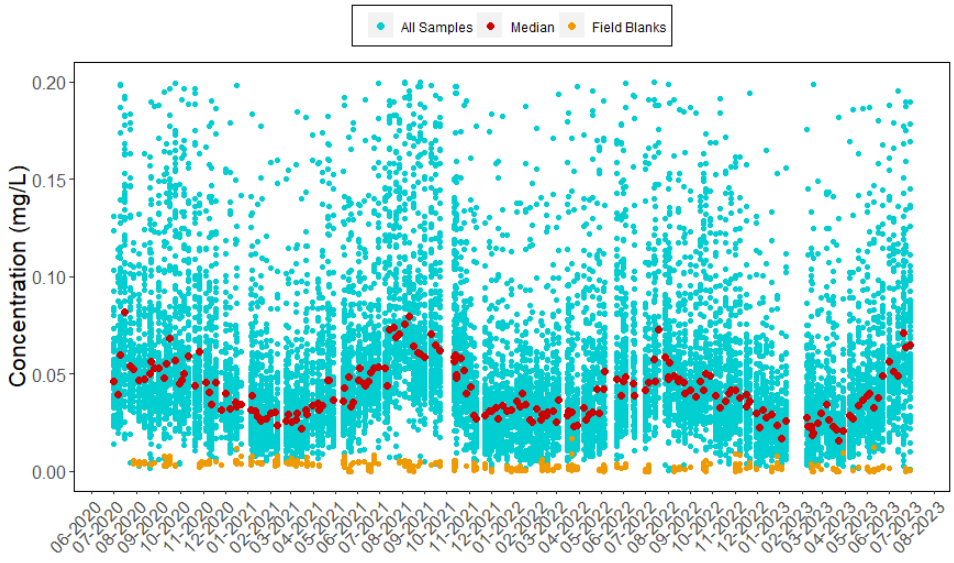
Note: Nominal reporting limit is 0.020 mg/L

Figure 21. Concentrations of Ca^{2+} from Teflon Filters



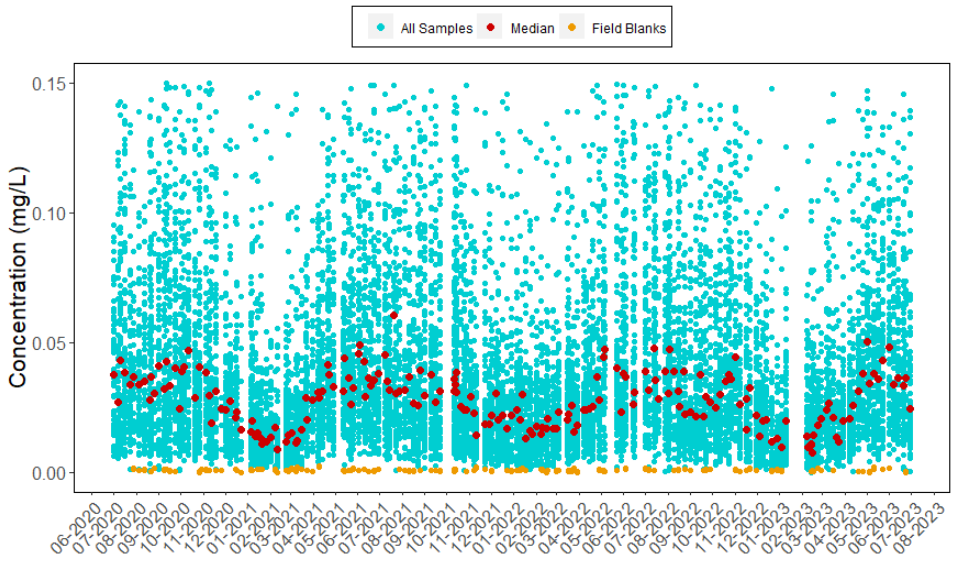
Note: Nominal reporting limit is 0.006 mg/L

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



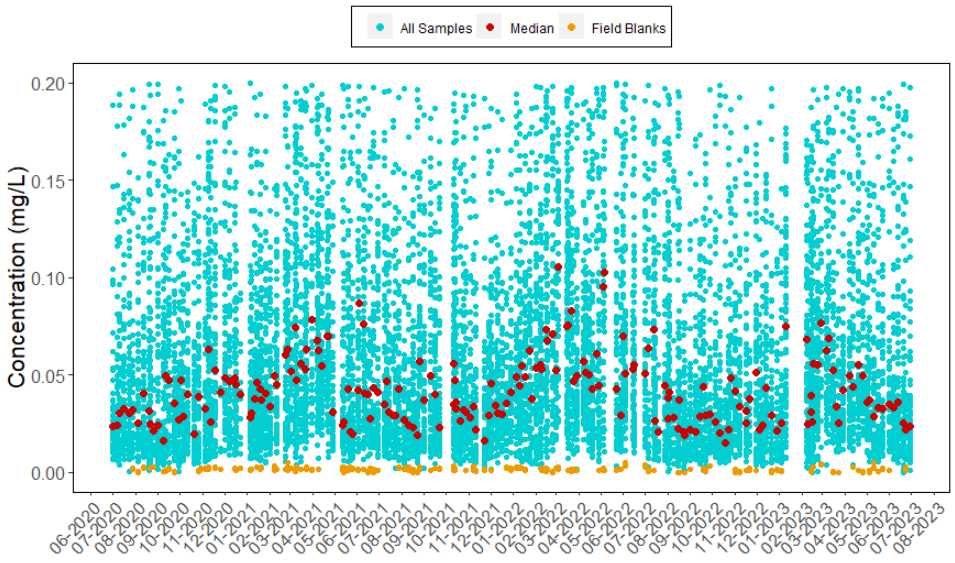
Note: Nominal reporting limit is 0.006 mg/L

Figure 23. Concentrations of Mg^{2+} from Teflon Filters



Note: Nominal reporting limit is 0.003 mg/L

Figure 24. 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 25 and 26 show times series of concentration differences between the two sets of co-located sites.

Figure 25. Time Series of Filter Concentration Differences between MCK131 and MCK231, KY

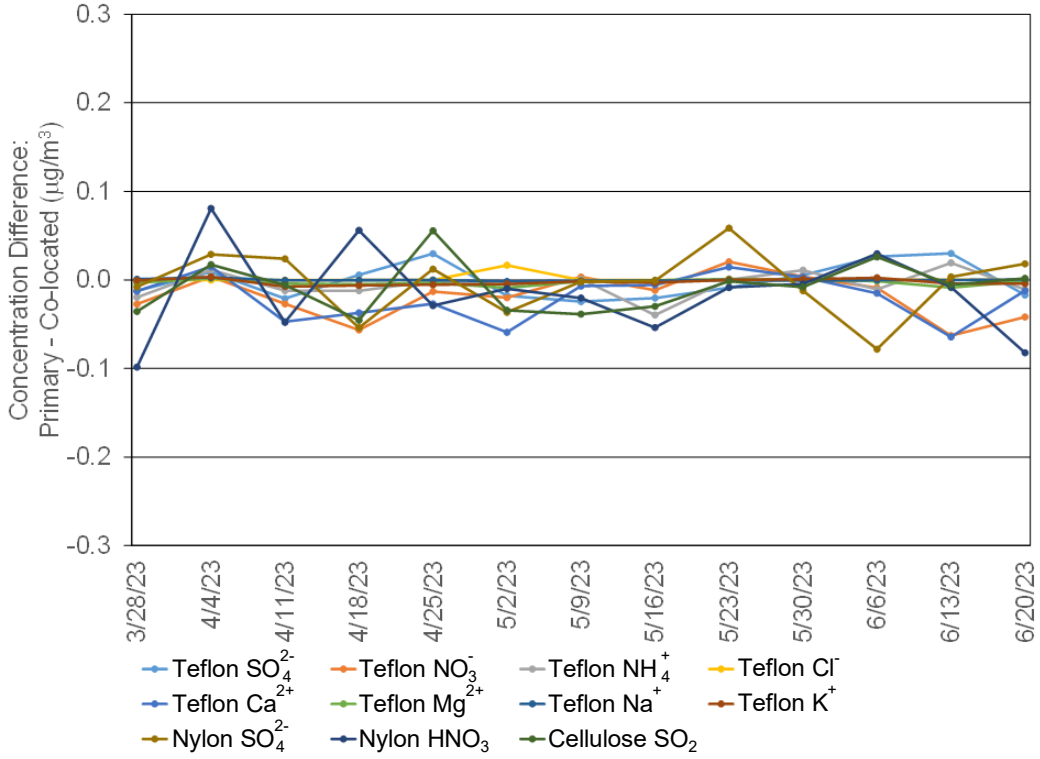
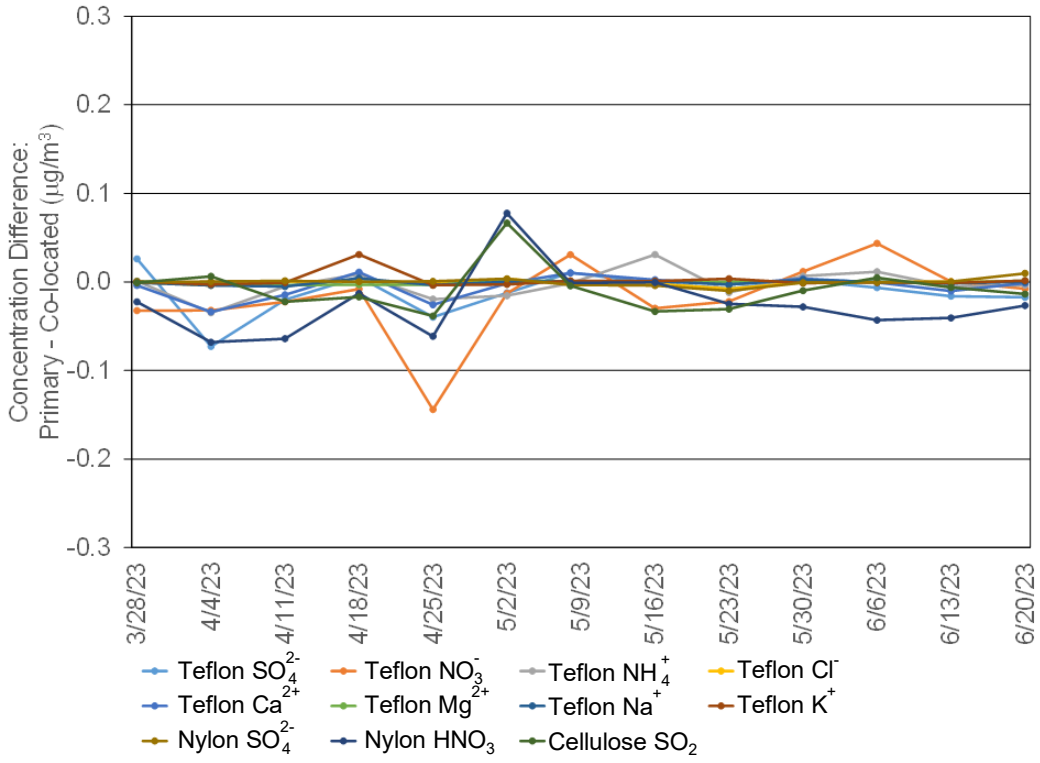


Figure 26. Time Series of Filter Concentration Differences between ROM406 and ROM206, CO



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 2023. The MARPD values met the 20 percent criterion.

Table 3. Precision (MARPD) for Co-located Filter Pack Data during Second Quarter 2023

	Total NO_3^-	HNO_3	NO_3^-	NH_4^+	SO_2	SO_4^{2-}	Ca^{2+}	Mg^{2+}	Na^+	K^+	Cl^-
MCK131/231, KY											
$\overline{X}$ ($\mu g/m^3$)	1.33	0.93	0.41	0.46	0.42	1.07	0.34	0.05	0.04	0.09	0.03
$\overline{Y}$ ($\mu g/m^3$)	1.36	0.94	0.43	0.46	0.43	1.08	0.36	0.05	0.04	0.09	0.03
MAD	0.05	0.04	0.02	0.01	0.04	0.02	0.02	0.00	0.00	0.00	0.00
MARPD	3.76	4.43	5.79	2.75	8.87	1.66	6.47	6.30	1.68	4.08	3.62
ROM406/206, CO											
$\overline{X}$ ($\mu g/m^3$)	0.69	0.39	0.31	0.24	0.17	0.56	0.19	0.02	0.04	0.04	0.02
$\overline{Y}$ ($\mu g/m^3$)	0.75	0.42	0.33	0.24	0.18	0.57	0.19	0.03	0.04	0.04	0.02
MAD	0.07	0.05	0.04	0.02	0.03	0.02	0.01	0.00	0.00	0.01	0.00
MARPD	10.10	14.05	13.48	7.21	14.59	5.16	6.92	7.04	7.71	12.77	11.05

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 2023 (1 of 2)

Site ID	Teflon SO_4^{2-}	Teflon NO_3^-	Teflon NH_4^+	Teflon Minor Cations	Teflon Cl^-	Nylon HNO_3	Nylon SO_4^{2-}	Cellulose SO_2	Comments
ANA115, MI	0	0	0	0	0	0	0	0	Site mothballed due to EPA's FY2022 budget.
ASH135, ME	0	0	0	0	0	0	0	0	Site mothballed due to EPA's FY2022 budget.
BWR139, MD	85	85	85	85	85	85	85	85	There were three 2-week samples during the period.
CDR119, WV	0	0	0	0	0	0	0	0	Site mothballed due to EPA's FY2022 budget.
CDZ171, KY	0	0	0	0	0	0	0	0	Site mothballed due to EPA's FY2022 budget.
DCP114, OH	0	0	0	0	0	0	0	0	Site mothballed due to EPA's FY2022 budget.
EGB181, ON	85	85	85	85	85	85	85	85	A polling issue affected one sampling week. Another week had insufficient flow volume.
FOR605, WY	85	85	85	85	85	85	85	85	One week was affected by flow pump failure. Another week had insufficient data to calculate flow volume.
GLR468, MT	77	77	77	77	77	77	77	77	There were two 2-week samples during the period. One of the 2-week samples was invalidated due to missing data.
HWF187, NY	0	0	0	0	0	0	0	0	Site mothballed due to EPA's FY2022 budget.
KIC003, KS	38	38	38	38	38	38	38	38	This site did not operate until June.
PNF126, NC	0	0	0	0	0	0	0	0	Site mothballed due to EPA's FY2022 budget.
PSU106, PA	0	0	0	0	0	0	0	0	Site mothballed due to EPA's FY2022 budget.
SHE604, WY	85	85	85	85	85	85	85	85	Two weeks were affected by missing flow data.
SHN418, VA	85	85	85	85	85	85	85	85	Two weeks were affected by missing data due to data logger issues.
SUM156, FL	85	85	85	85	85	85	85	85	Two weeks were affected by missing data due to data logger issues.

Table 4. Sites with less than 90 Percent Data Completeness for Filter Concentrations for Second Quarter 2023 (2 of 2)

Site ID	Teflon SO_4^{2-}	Teflon NO_3^-	Teflon NH_4^+	Teflon Minor Cations	Teflon Cl^-	Nylon HNO_3	Nylon SO_4^{2-}	Cellulose SO_2	Comments
THR422, ND	69	69	69	69	69	69	69	69	Four weeks starting in late May were affected by mass flow controller malfunctions.
UND002, VT	0	0	0	0	0	0	0	0	Site mothballed due to EPA's FY2022 budget.
VOY413, MN	85	85	85	85	85	85	85	85	There were two 2-week samples during the period.
WST109, NH	0	0	0	0	0	0	0	0	Site mothballed due to EPA's FY2022 budget.

Precision of Ozone Concentrations

Time series of co-located hourly O_3 concentration differences for second quarter 2023 are provided in Figures 27 and 28 for MCK131/231 and ROM406/206, respectively. The figures indicate no consistent bias between the co-located analyzers at these site locations.

Figure 27. Time Series of the Difference in Co-located O_3 Concentrations for MCK131/231, KY

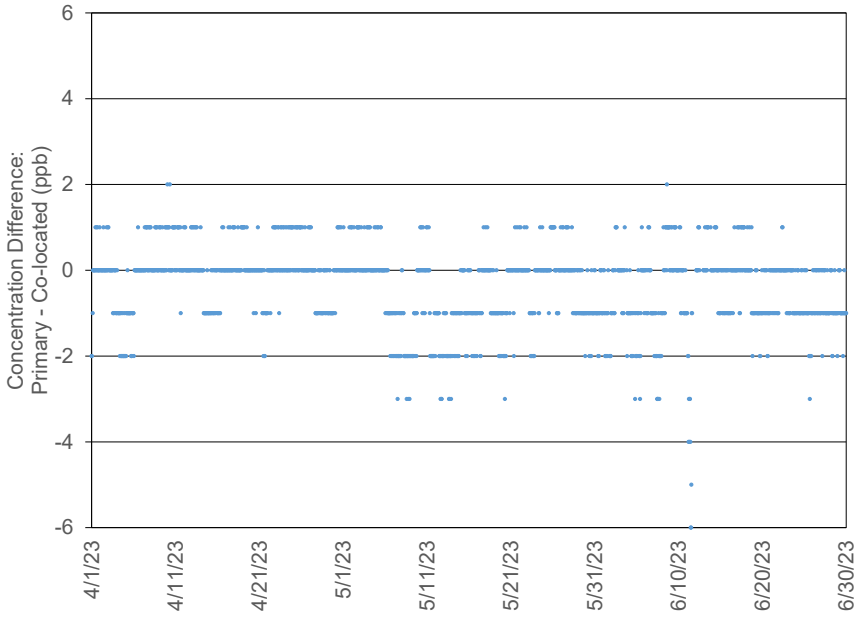


Figure 28. Time Series of the Difference in Co-located O_3 Concentrations for ROM406/206, CO

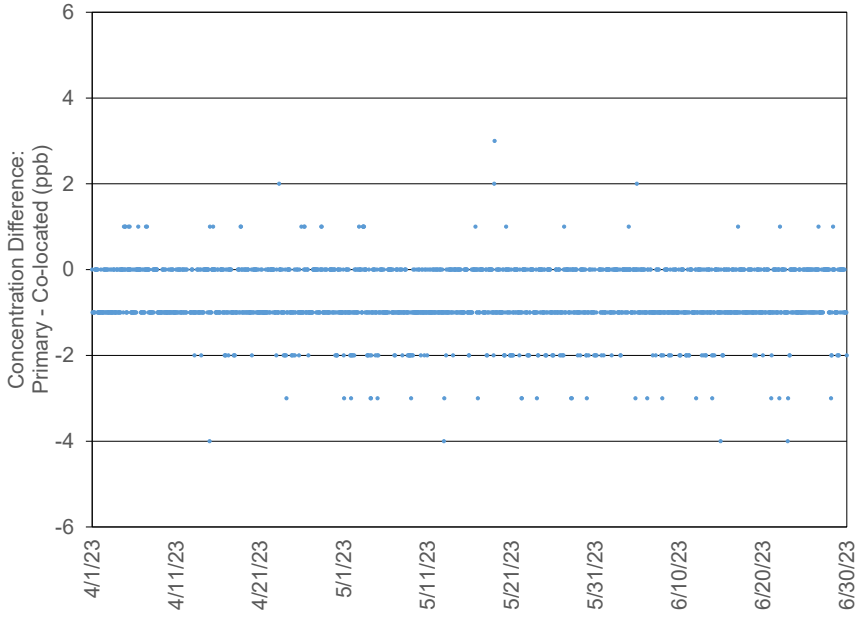


Table 5 gives MARPD data for O_3 data measured at the two co-located sites.

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

Site Pair	Quarter	Start Date	MARPD	Records
MCK131/231, KY				
	3	7/1/22	0.8	2058
	4	10/1/22	0.6	2098
	1	1/1/23	0.9	2040
	2	4/1/23	1.7	2036
ROM406/206, CO				
	3	7/1/22	1.8	1638
	4	10/1/22	1.5	1531
	1	1/1/23	1.2	2046
	2	4/1/23	1.6	2052

Completeness for Ozone 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 2023

Site ID	Percent Completeness	Comments
ASH135, ME	0	Site mothballed due to EPA's FY2022 budget.
CAN407, UT	88	O_3 analyzer pump failed affecting nine days in April.
CDR119, WV	0	Site mothballed due to EPA's FY2022 budget.
CDZ171, KY	0	Site mothballed due to EPA's FY2022 budget.
CHA467, AZ	89	Measurement values dropped to zero and were invalidated for eight days in June.
CVL151, MS	89	The analyzer sample pump failed on 5/8/2023 and was replaced 5/12/2023.
DCP114, OH	0	Site mothballed due to EPA's FY2022 budget.
HWF187, NY	0	Site mothballed due to EPA's FY2022 budget.
MKG113, PA	87	The analyzer malfunctioned and was replaced in early May.
PNF126, NC	0	Site mothballed due to EPA's FY2022 budget.
PRK134, WI	87	Data were invalidated due to power failure and subsequent data logger malfunction.
QAK172, OH	87	Data were invalidated due to intermittent power failures in April.
SHN418, VA	76	Data were invalidated due to data logger malfunction in May.
SUM156, FL	84	Data were invalidated during April when analyzer bench temperatures exceeded the criterion.
WST109, NH	0	Site mothballed due to EPA's FY2022 budget.

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 2023	Q3 2022 – Q2 2023	Comments
ASH135, ME	0	0	Site mothballed due to EPA's FY2022 budget.
CAN407, UT	89	96	O_3 analyzer pump failed affecting nine days in April.
CDR119, WV	0	0	Site mothballed due to EPA's FY2022 budget.
CDZ171, KY	0	0	Site mothballed due to EPA's FY2022 budget.
DCP114, OH	0	0	Site mothballed due to EPA's FY2022 budget.
HWF187, NY	0	0	Site mothballed due to EPA's FY2022 budget.
MKG113, PA	89	96	The analyzer malfunctioned and was replaced in early May.
PNF126, NC	0	0	Site mothballed due to EPA's FY2022 budget.
PRK134, WI	89	96	Data were invalidated due to a power failure and subsequent data logger malfunction.
QAK172, OH	88	95	Data were invalidated due to intermittent power failures in April.
SHN418, VA	79	93	Data were invalidated due to data logger malfunction in May.
SUM156, FL	88	96	Data were invalidated during April when analyzer bench temperatures exceeded the criterion.
WST109, NH	0	0	Site mothballed due to EPA's FY2022 budget.

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

Figures 29 through 36 show a comparison of weekly average continuous NO_y measurements with weekly filter pack total NO_3^- concentrations collected at the six sites with NO_y measurements. The NO_y concentrations were consistently higher than the total NO_3^- levels at all sites. The average weekly NO_y levels, the weekly total NO_3^- concentrations, and their ratios for the six sites with available data are shown in Table 8. Ratios of NO_y to total NO_3^- varied from 3.89 at GRS420, TN to 6.99 at ROM206, CO. No data are available from HWF187, NY and PNF126, NC for second quarter 2023. These sites were mothballed in May 2022 due to EPA's budget constraints.

Table 8. Sites with less than 90 Percent Data Completeness for O_3 Concentrations

Site ID	Elevation	Total NO_3^- (ppb)	NO_y (ppb)	Ratio
DUK008, NC	164*	0.41	1.85	4.56
BVL130, IL	213	0.91	4.44	4.91
MAC426, KY	243	0.47	2.53	5.35
HWF187, NY	497	Site mothballed due to EPA's FY2022 budget.		
GRS420, TN	793	0.37	1.41	3.89
PNF126, NC	1216	Site mothballed due to EPA's FY2022 budget.		
PND165, WY	2386	0.17	0.87	5.47
ROM206, CO	2742	0.23	1.49	6.99

Note: *The inlet of the enhanced NO_y monitor is located at the top of the 30-meter tower.

Figure 29. Comparison of DUK008, NC Weekly Mean NO_y and Total NO_3^- Concentrations

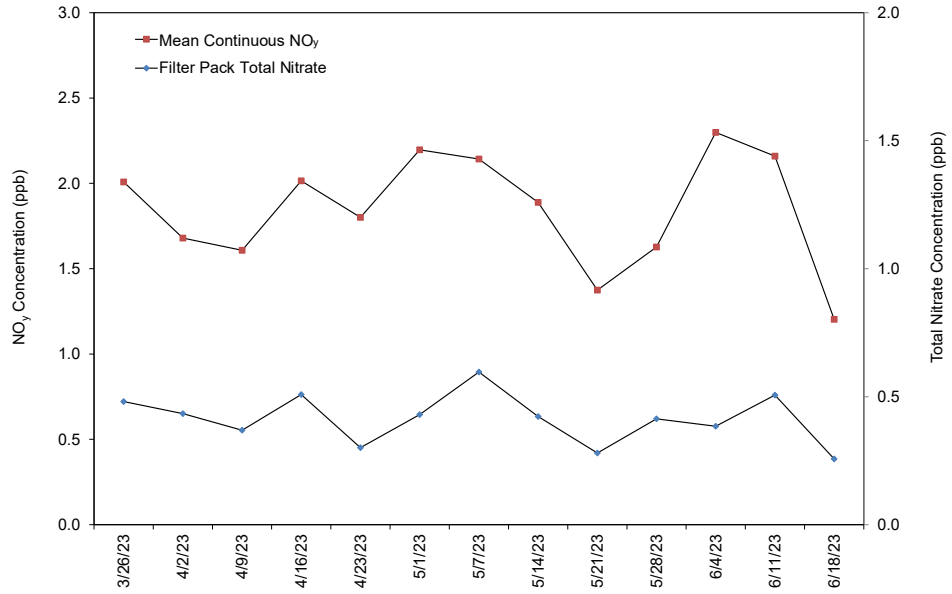


Figure 30. Comparison of BVL130, IL Weekly Mean NO_y and Total NO_3^- Concentrations

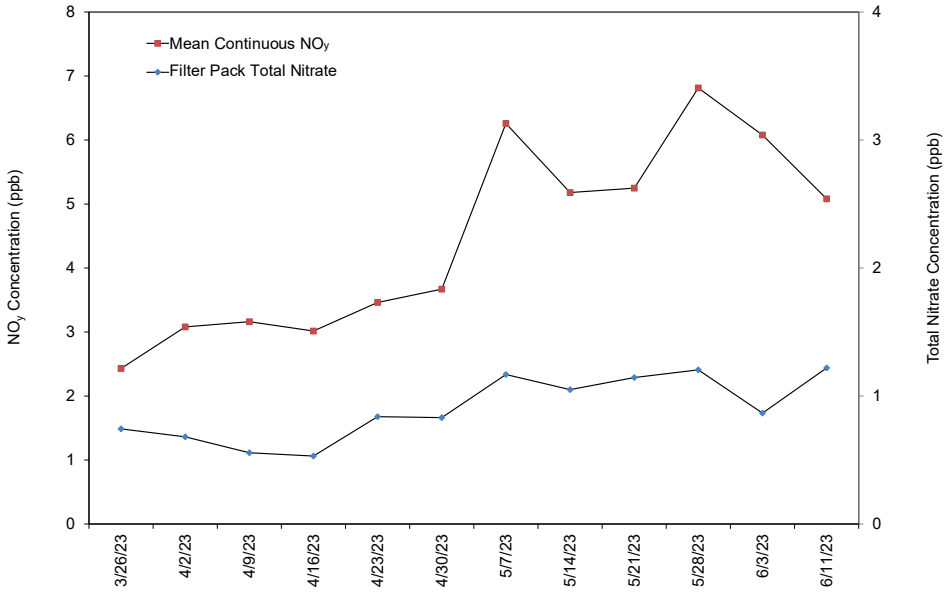


Figure 31. Comparison of MAC426, KY Weekly Mean NO_y and Total NO_3^- Concentrations

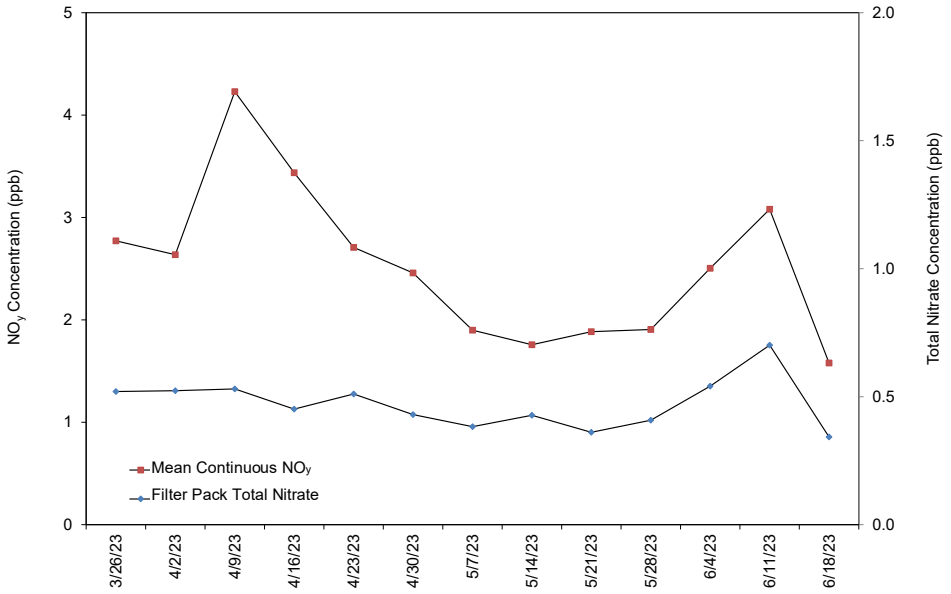


Figure 32. Comparison of HWF187, NY Weekly Mean NO_y and Total NO_3^- Concentrations

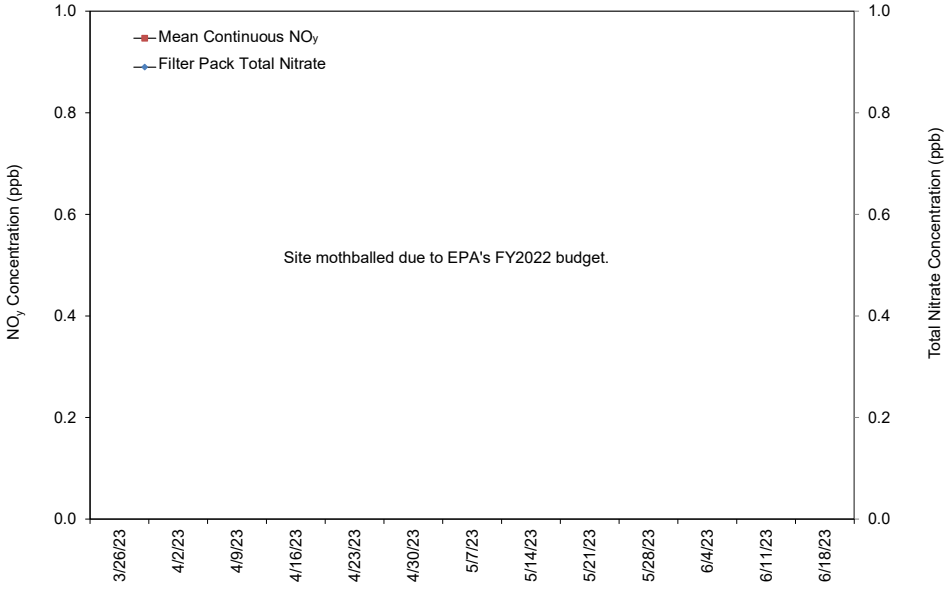


Figure 33. Comparison of GRS420, TN Weekly Mean NO_y and Total NO_3^- Concentrations

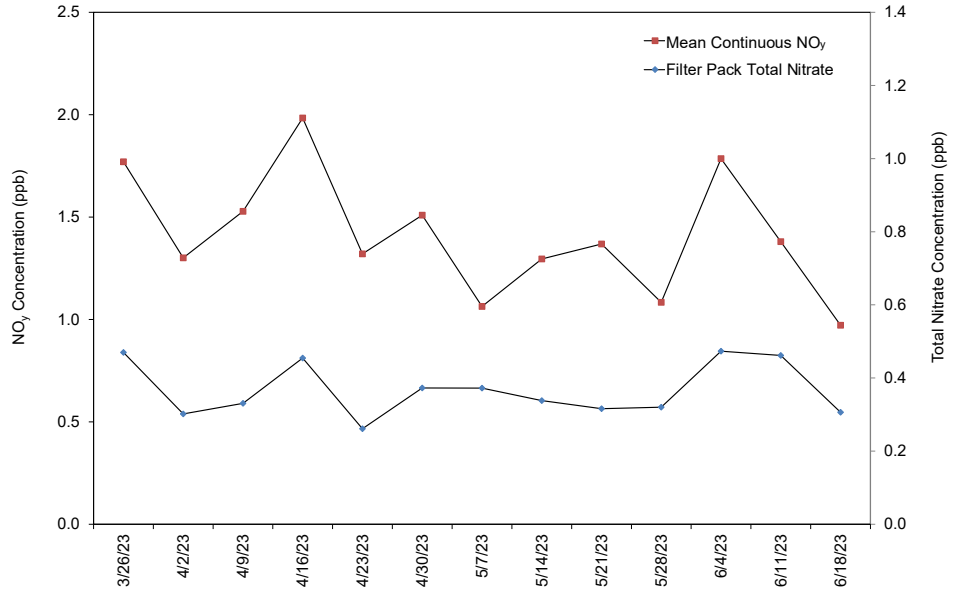


Figure 34. Comparison of PNF126, NC Weekly Mean NO_y and Total NO_3^- Concentrations

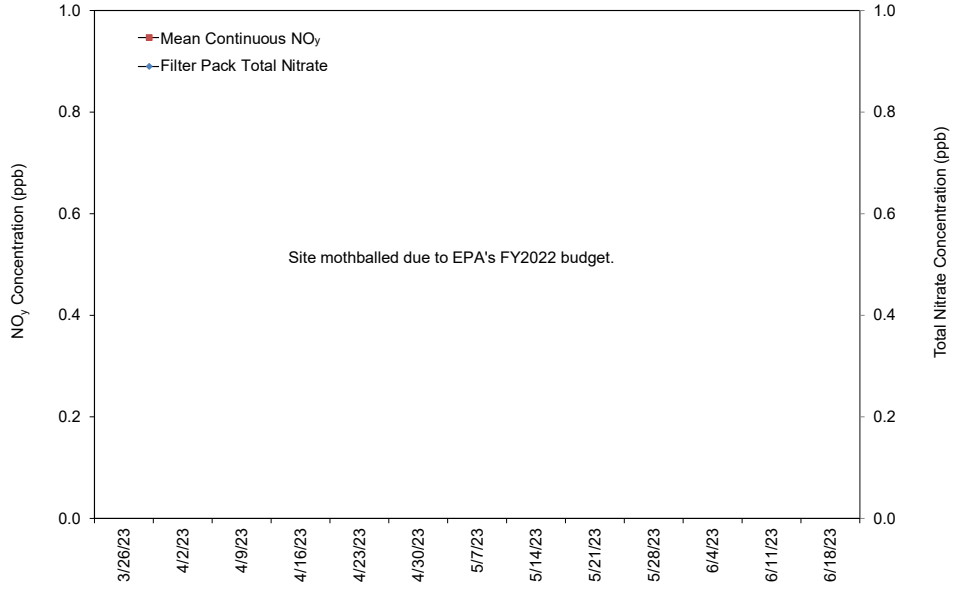


Figure 35. Comparison of PND165, WY Weekly Mean NO_y and Total NO_3^- Concentrations

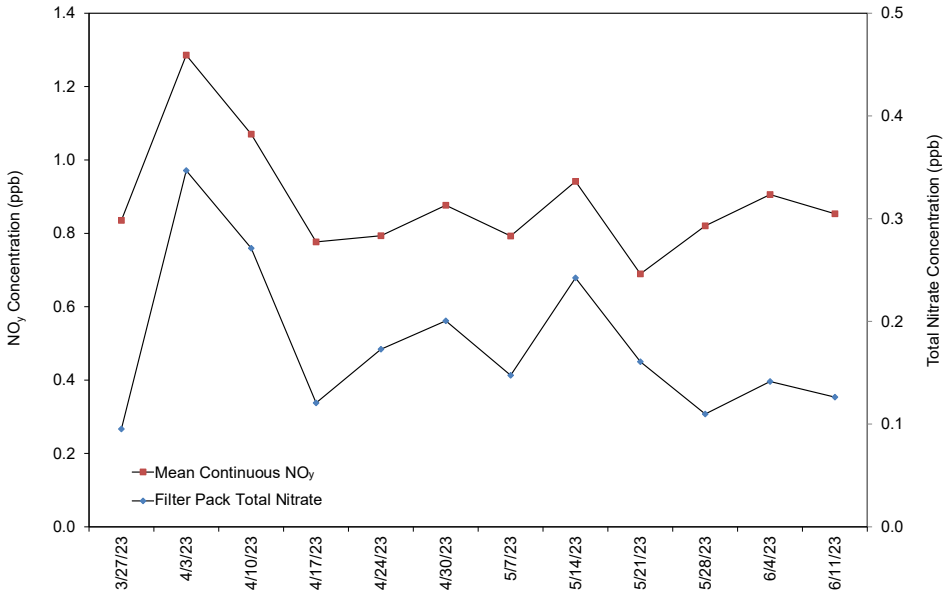
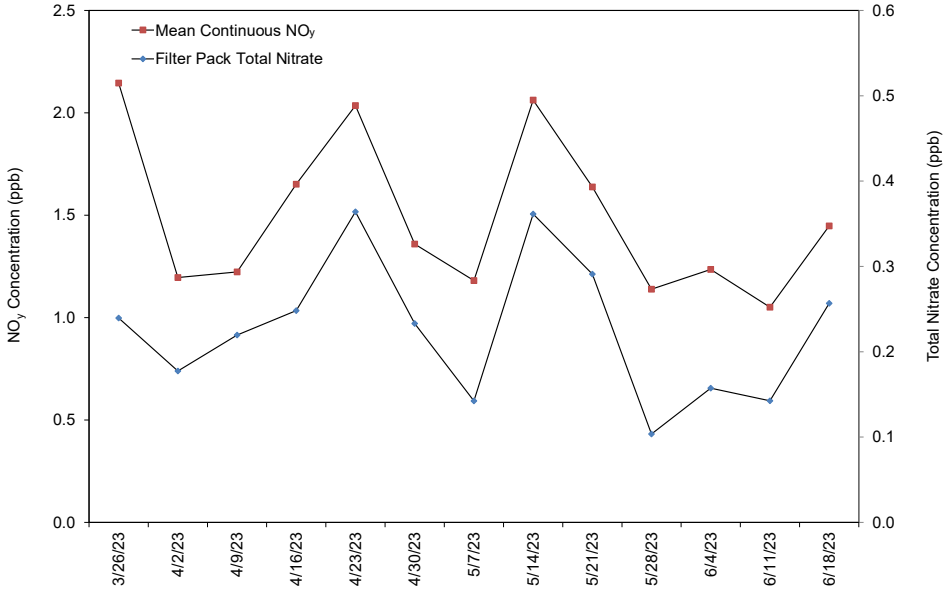


Figure 36. Comparison of ROM206, CO Weekly Mean NO_y and Total NO_3^- Concentrations



Filter Pack and Continuous Trace-level Gas Sulfur Dioxide Concentrations

Figures 37 through 39 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 37. Comparison of BVL130, IL Weekly Mean SO_2 Concentrations

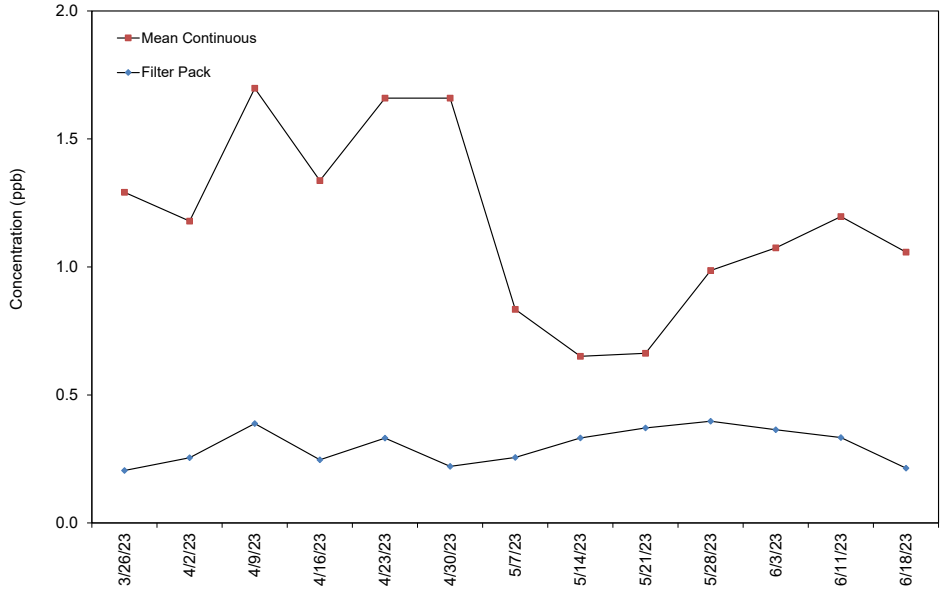


Figure 38. Comparison of MAC426, KY Weekly Mean SO_2 Concentrations

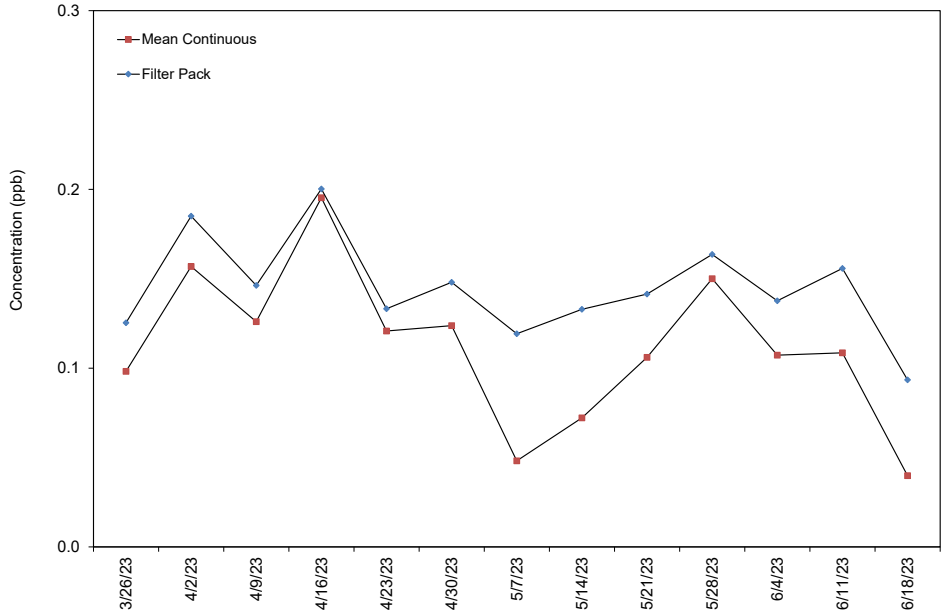
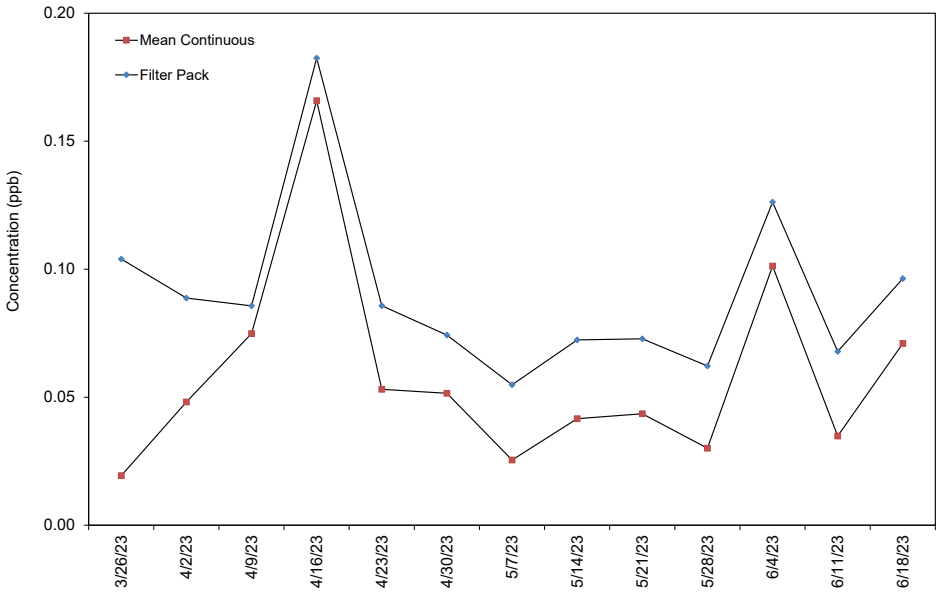


Figure 39. Comparison of GRS420, TN Weekly Mean SO_2 Concentrations



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 2023. The average for third quarter 2022 through second quarter 2023 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 2023	Q3 2022–Q2 2023	Comments
BVL130, IL	CO	93	47	
	NO	90	83	
	NOY	90	76	
	NOYDIF	90	76	
	SO2_GA	85	86	Data were invalidated due to analyzer malfunction in late June.
CHC432, NM	NO	96	97	
	NOX	96	97	
	NOXDIF	96	97	
DUK008, NC	HNO3	93	71	
	NH3	93	68	
	NO	93	82	
	NO2_TRUE	93	82	
	NOX_TRUE	93	82	
	NOY	93	82	
	NOY_MINUS	93	71	
	NOYDIF	93	82	
	TNX	93	71	

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

Site ID	Parameter	Q2 2023	Q3 2022–Q2 2023	Comments
GRS420, TN	CO	95	90	
	NO	95	94	
	NOY	95	94	
	NOYDIF	95	93	
	SO2_GA	95	73	
HWF187, NY	NO	0	0	Site mothballed due to EPA's FY2022 budget.
	NOY	0	0	
	NOYDIF	0	0	
MAC426, KY	CO	84	89	CO analyzer pump failed affecting data for 10 days in April.
	NO	95	97	
	NOY	95	97	
	NOYDIF	95	97	
	SO2_GA	95	92	
PND165, WY	NO	92	93	
	NOY	92	92	
	NOYDIF	92	92	
PNF126, NC	NO	0	0	Site mothballed due to EPA's FY2022 budget.
	NOY	0	0	
	NOYDIF	0	0	
ROM206, CO	NO	90	94	
	NOY	90	94	
	NOYDIF	90	94	

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	Obtained How	Description of Process
CO	Measured	Gas filter correlation
HNO3	Calculated	NOY minus NOY-MINUS
NH	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 convert at 315° Celsius

Reference

WSP USA Environment & Infrastructure Inc. 2023. Clean Air Status and Trends Network (CASTNET) Second Quarter 2023 Quality Assurance Report. https://java.epa.gov/castnet/documents.do