

Clean Air Status and Trends Network

Quarterly Data Summary for Fourth Quarter 2023 (October through December)

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 fourth 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 fourth quarter data and include completeness and precision of filter concentrations and hourly O₃ concentrations. This report also analyzes data for continuous, trace-level NO_y from the six of eight sites that were operational during fourth quarter and continuous SO₂ concentrations from one site. Other QC statistics are given in the CASTNET Fourth Quarter 2023 Quality Assurance Report (WSP, 2024).

Figure 1. Fourth Highest Daily Maximum 8-hour Average O₃ Concentrations (ppb) through Fourth Quarter 2023

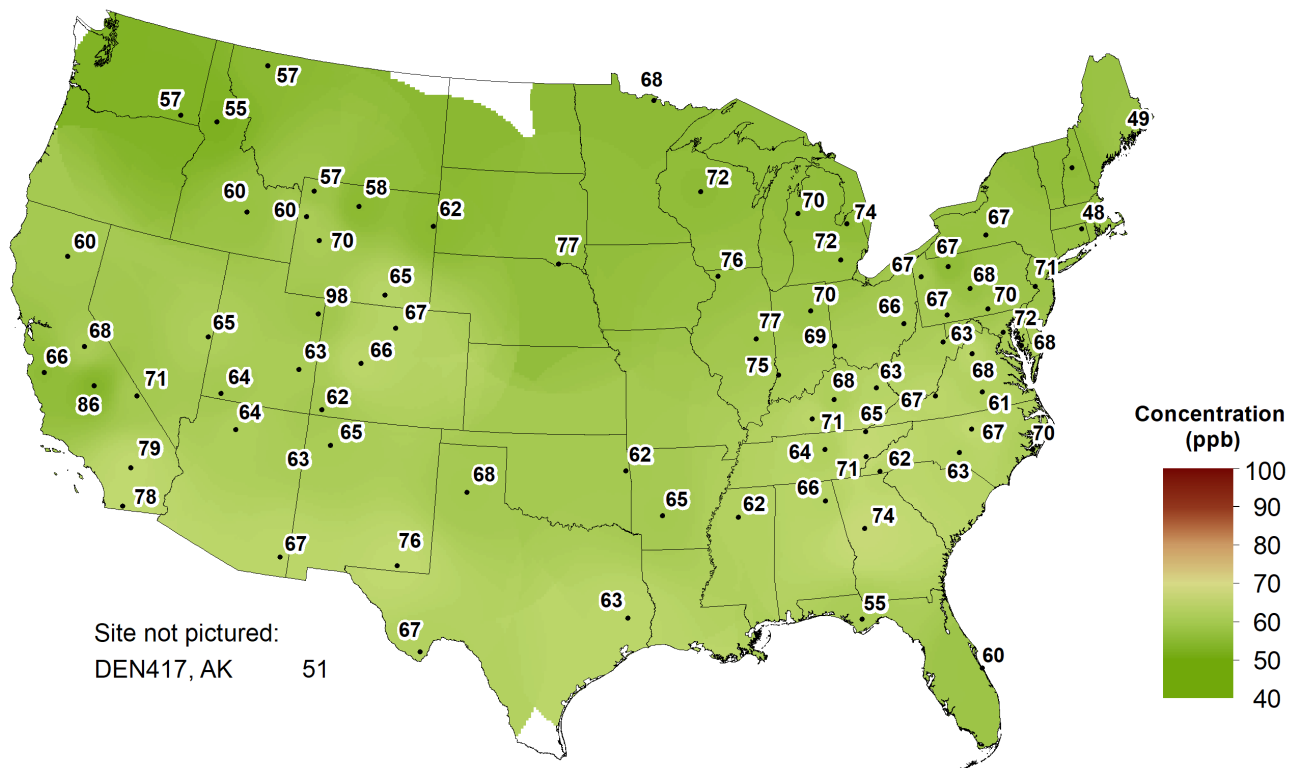


Figure 1 shows fourth highest daily maximum 8-hour average (DM8A) O₃ concentrations measured through fourth quarter 2023. Eighteen sites exceeded the 0.070 parts per million (ppm) National Ambient Air Quality Standard for O₃.

Trends

Trend analyses were performed based on filter pack pollutant concentrations measured in micrograms per cubic meter (µg/m³) of air at the 34 eastern and 16 western reference sites during fourth quarter. Trends in quarterly mean filter pack and O₃ concentrations are shown using box plots in Figures 2 through 13.

Fourth Quarter Concentrations

Quarterly mean HNO₃, NO₃⁻, NH₄⁺, total NO₃⁻, SO₄²⁻, Cl⁻, K⁺, Mg²⁺, and Na⁺ concentrations decreased at eastern sites in 2023, and SO₂ and Ca²⁺ concentrations increased. Quarterly mean NH₄⁺, SO₄²⁻, and Cl⁻ concentrations decreased at western sites in 2023 while HNO₃, NO₃⁻, total NO₃⁻, SO₂, Ca²⁺, K⁺, Mg²⁺, and Na⁺ concentrations increased.

Quarterly O₃ concentrations were analyzed using box plots constructed by averaging all valid hourly O₃ concentrations within fourth quarter 2023 by site and then averaging those averages for all eastern and western reference sites (Figure 13). The figure shows a slight increase in quarterly mean O₃ concentrations at eastern sites and a small decrease at western sites. Quarterly mean concentrations were higher at the western reference sites than at the eastern sites.

Figure 2. Trends in Fourth Quarter Mean HNO₃ Concentrations

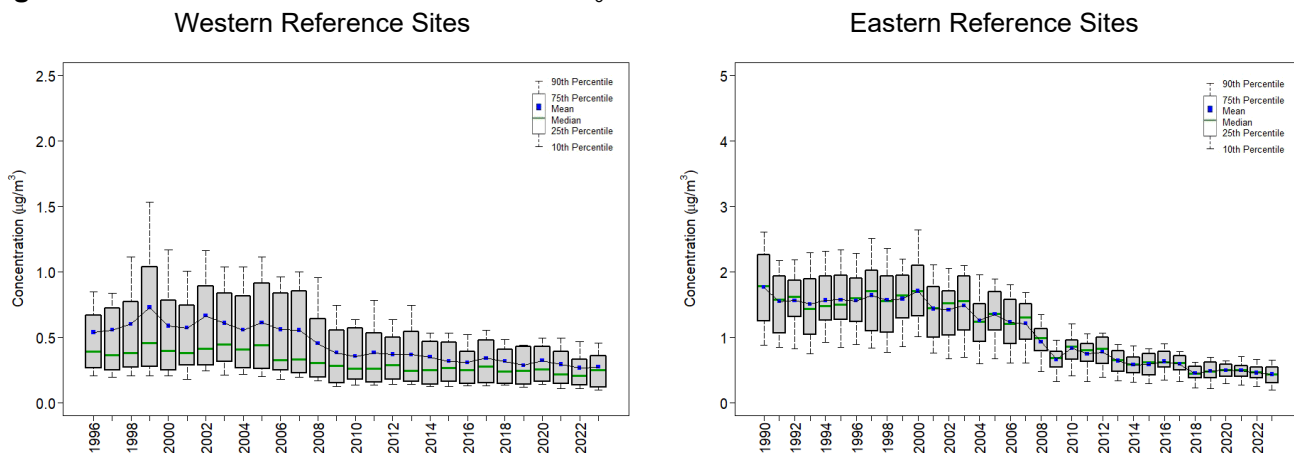
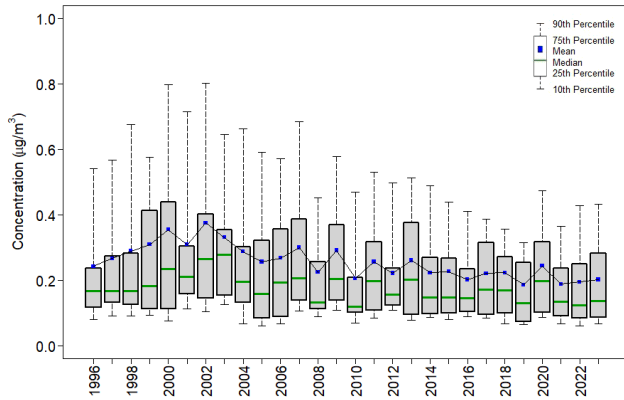


Figure 3. Trends in Fourth Quarter Mean NO₃ Concentrations
Western Reference Sites



Eastern Reference Sites

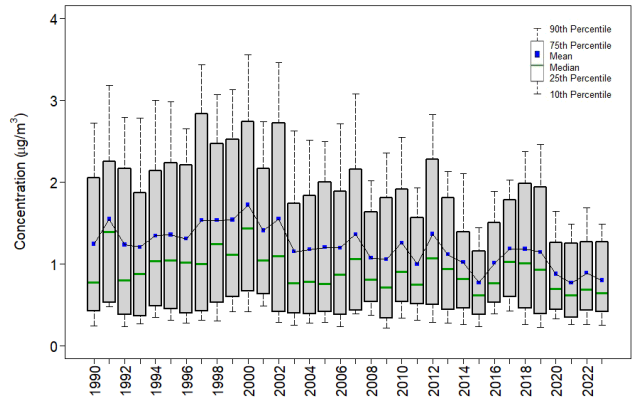
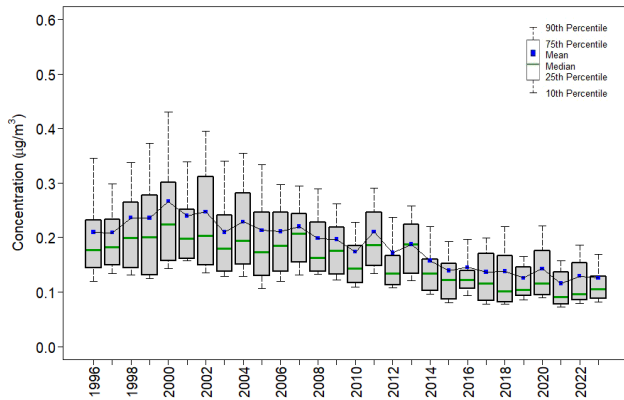


Figure 4. Trends in Fourth Quarter Mean NH₄⁺ Concentrations
Western Reference Sites



Eastern Reference Sites

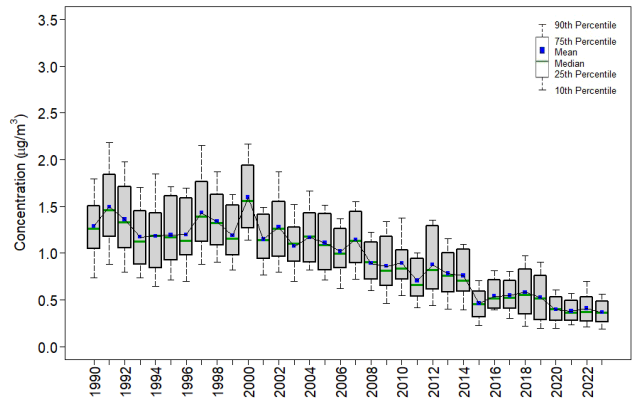
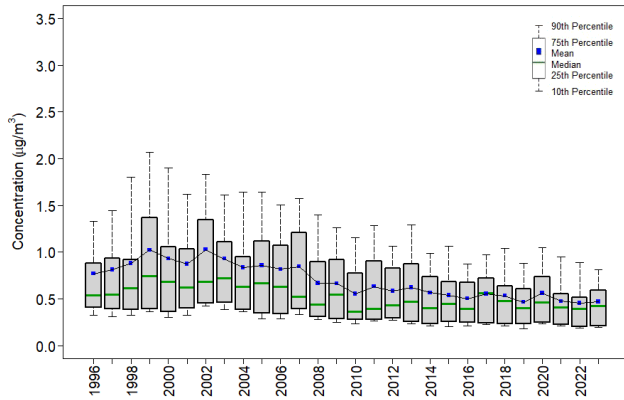


Figure 5. Trends in Fourth Quarter Mean Total NO₃ Concentrations
Western Reference Sites



Eastern Reference Sites

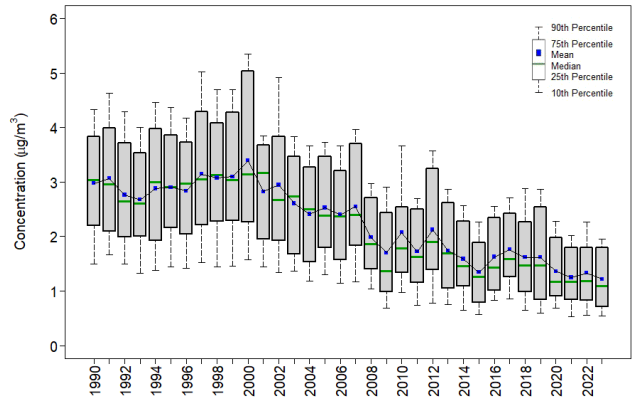
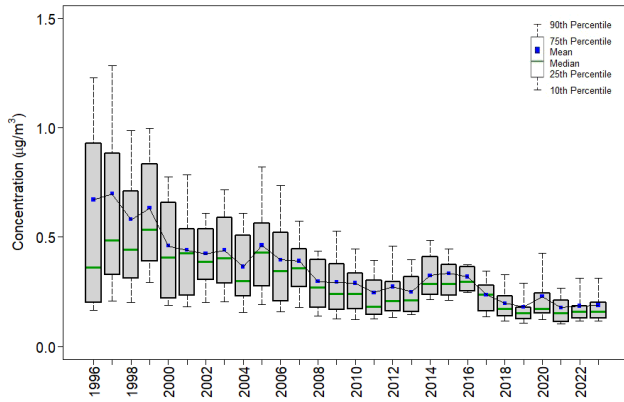


Figure 6. Trends in Fourth Quarter Mean SO₂ Concentrations
Western Reference Sites



Eastern Reference Sites

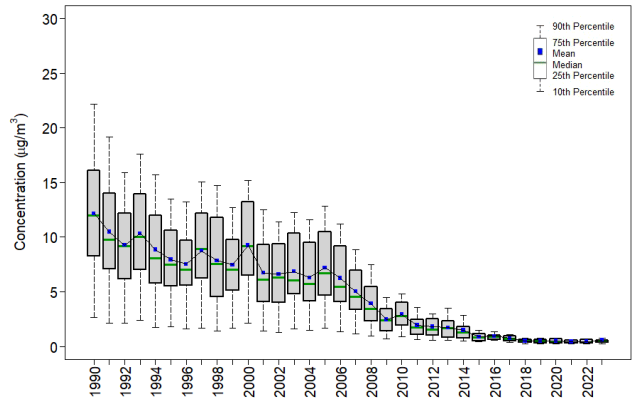
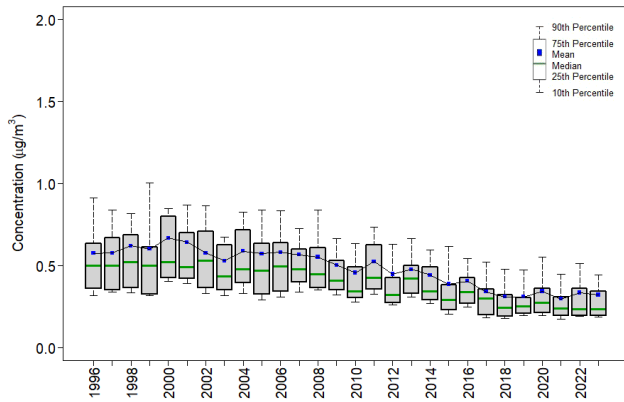


Figure 7. Trends in Fourth Quarter Mean SO₄²⁻ Concentrations
Western Reference Sites



Eastern Reference Sites

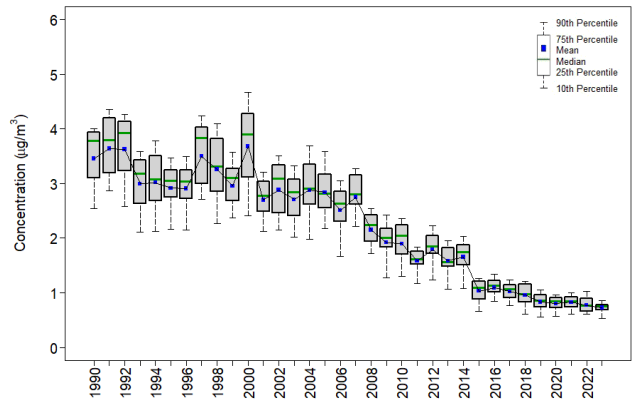
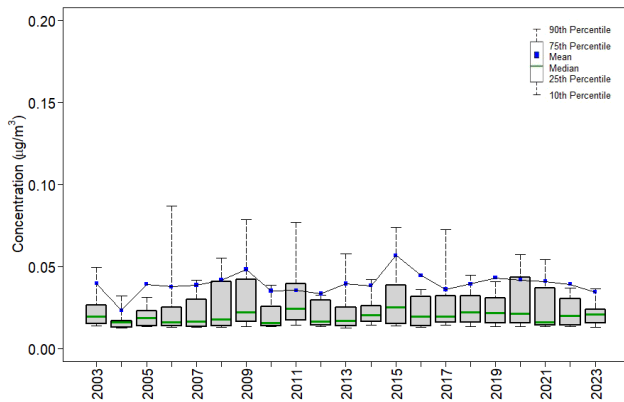


Figure 8. Trends in Fourth Quarter Mean Cl⁻ Concentrations
Western Reference Sites



Eastern Reference Sites

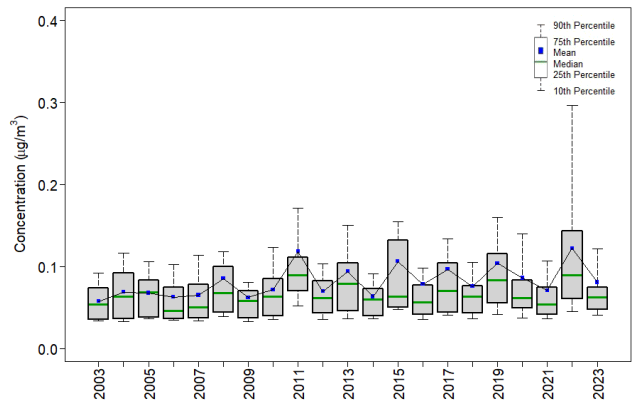
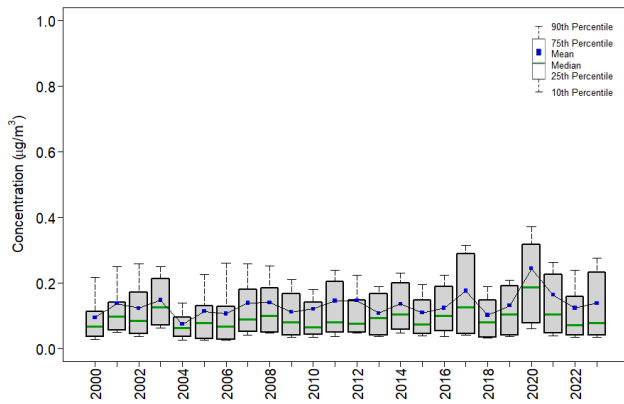


Figure 9. Trends in Fourth Quarter Mean Ca²⁺ Concentrations
Western Reference Sites



Eastern Reference Sites

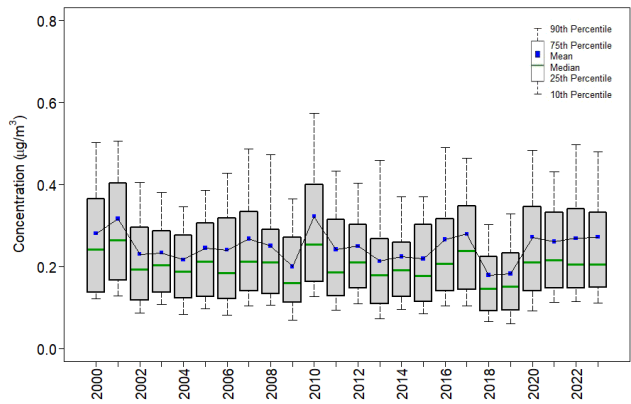
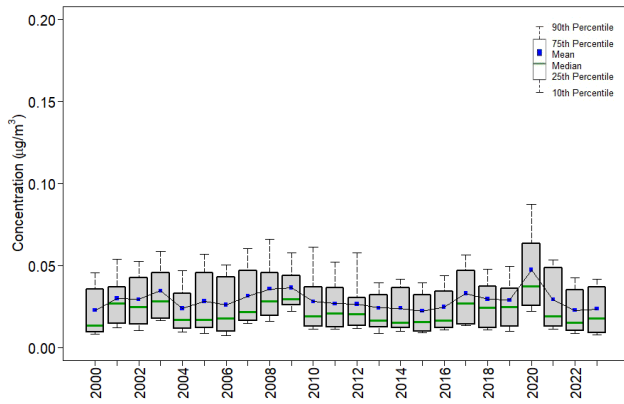


Figure 10. Trends in Fourth Quarter Mean K⁺ Concentrations
Western Reference Sites



Eastern Reference Sites

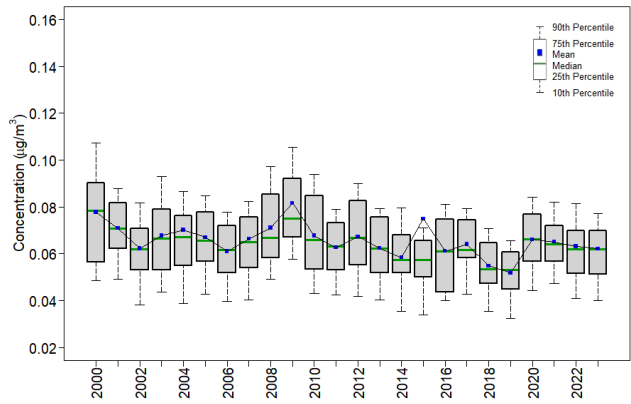
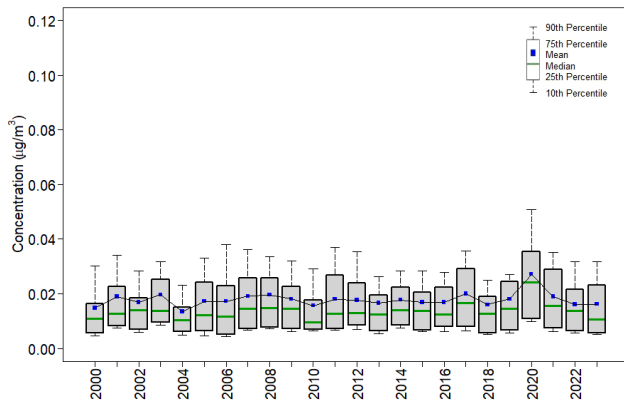


Figure 11. Trends in Fourth Quarter Mean Mg²⁺ Concentrations
Western Reference Sites



Eastern Reference Sites

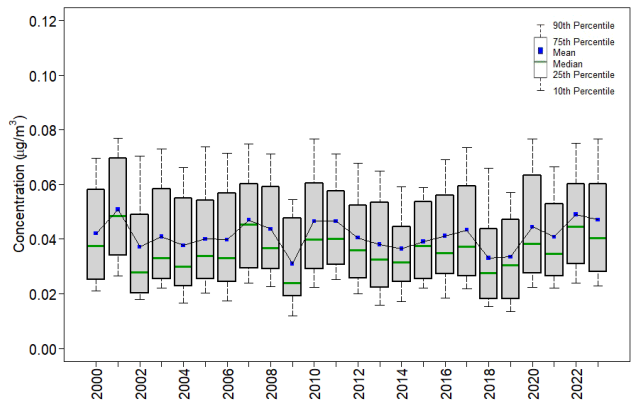
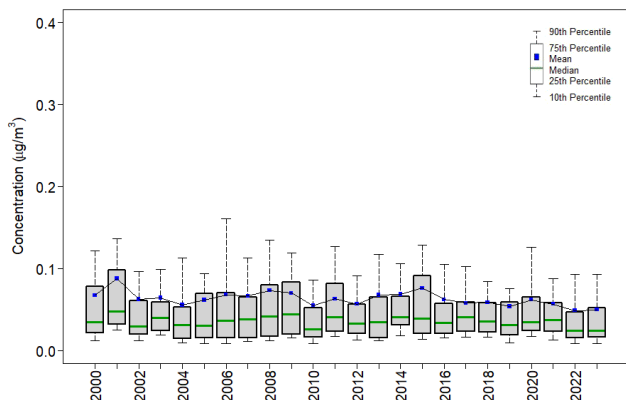


Figure 12. Trends in Fourth Quarter Mean Na⁺ Concentrations
Western Reference Sites



Eastern Reference Sites

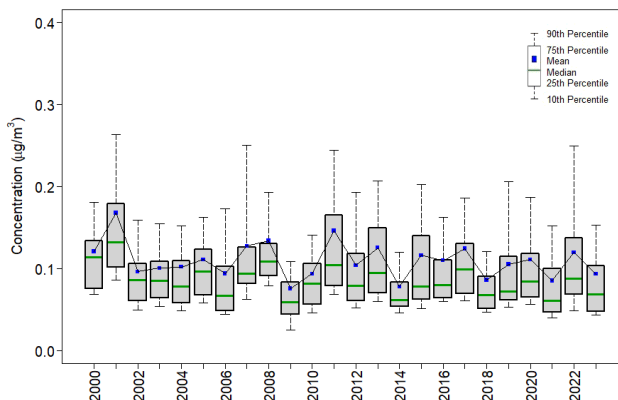
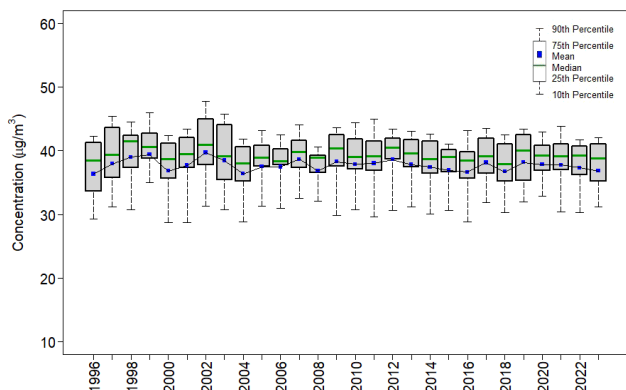
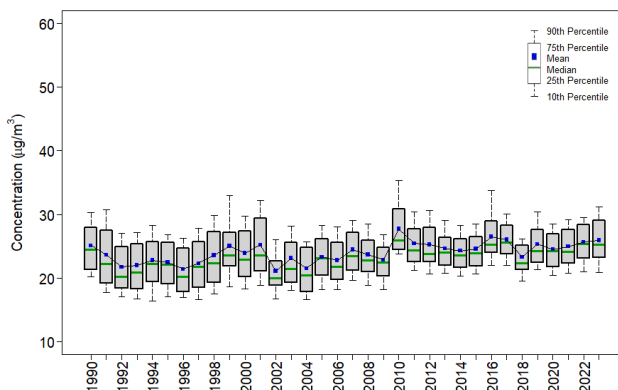


Figure 13. Trends in Fourth Quarter Mean O₃ Concentrations
Western Reference Sites



Eastern Reference Sites



Changes in 3-Year Average Fourth Quarter Concentrations

As shown in Table 1 and Table 2, three-year averages of quarterly mean concentrations of total NO₃⁻, NH₄⁺, SO₂, and SO₄²⁻ were reduced over the period 1990–1992 through 2021–2023 for eastern reference sites and 1996–1998 through 2021–2023 for western reference sites. O₃ concentrations increased at eastern sites and showed a small change at western reference sites. K⁺ and Na⁺ levels declined at eastern sites from 2004–2006 through 2021–2023. Other ion values increased. At western sites, Mg²⁺, Ca²⁺ and Cl⁻ increased and other ion concentrations decreased.

Table 1. Eastern Reference Sites: 3-Year Mean Values (ppb or µg/m³)

Parameter	O ₃ (ppb)	Total NO ₃ ⁻	NH ₄ ⁺	SO ₂	SO ₄ ²⁻	Ca ²⁺	K ⁺	Mg ²⁺	Na ⁺	Cl ⁻
1990–1992	24	2.9	1.4	10.6	3.6					
2004–2006						0.23	0.07	0.04	0.10	0.07
2021–2023	26	1.3	0.4	0.5	0.8	0.27	0.06	0.05	0.10	0.09
Percent Change	9	-57	-72	-95	-78	14	-4	17	-3	37

Note: Ozone concentrations are given as ppb. Concentrations for all other parameters are given as µg/m³.

Table 2. Western Reference Sites: 3-Year Mean Values (ppb or $\mu\text{g}/\text{m}^3$)

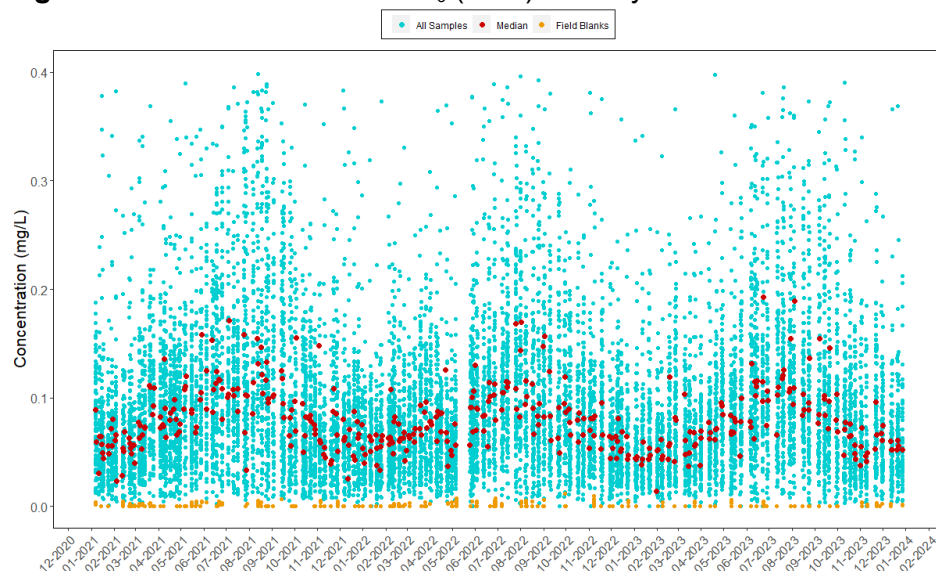
Parameter	O ₃ (ppb)	Total NO ₃ ⁻	NH ₄ ⁺	SO ₂	SO ₄ ²⁻	Ca ²⁺	K ⁺	Mg ²⁺	Na ⁺	Cl ⁻
1990–1992	38	0.8	0.2	0.7	0.6					
2004–2006						0.10	0.03	0.02	0.06	0.03
2021–2023	37	0.5	0.1	0.2	0.3	0.14	0.03	0.02	0.05	0.04
Percent Change	-1	-43	-43	-72	-46	45	-3	7	-16	15

Note: Ozone concentrations are given as ppb. Concentrations for all other parameters are in $\mu\text{g}/\text{m}^3$.

Time Series of Laboratory Analysis Parameters for All Sites

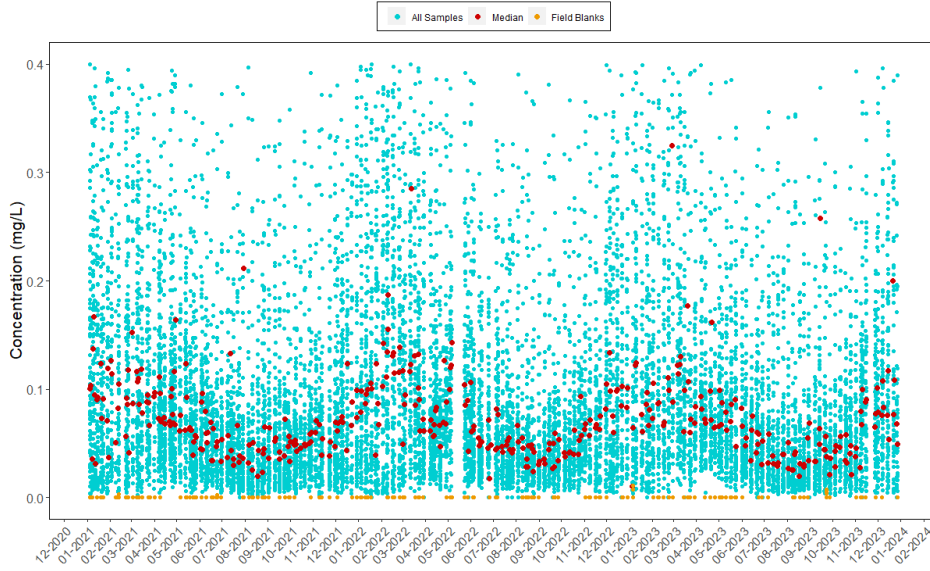
Figures 14 through 24 give time series of laboratory-analyzed concentrations of field samples and field blanks in milligrams per liter (mg/L) of 11 parameters from first quarter 2021 through fourth quarter 2023. These figures provide indications of potential issues with concentration measurements relative to detection and reporting limits.

Figure 14. Concentrations of NO₃⁻ (as N) from Nylon Filters



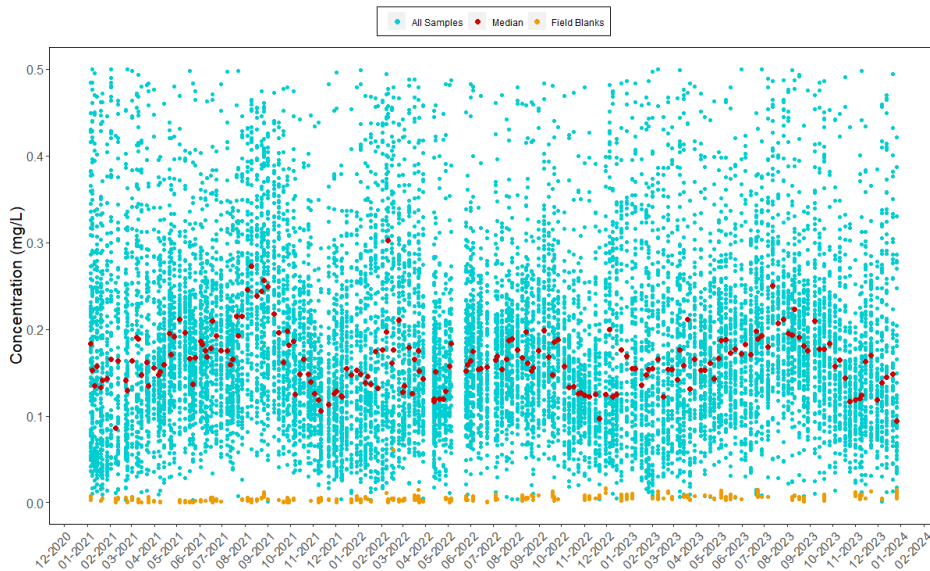
Note: Nominal reporting limit is 0.008 mg/L

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



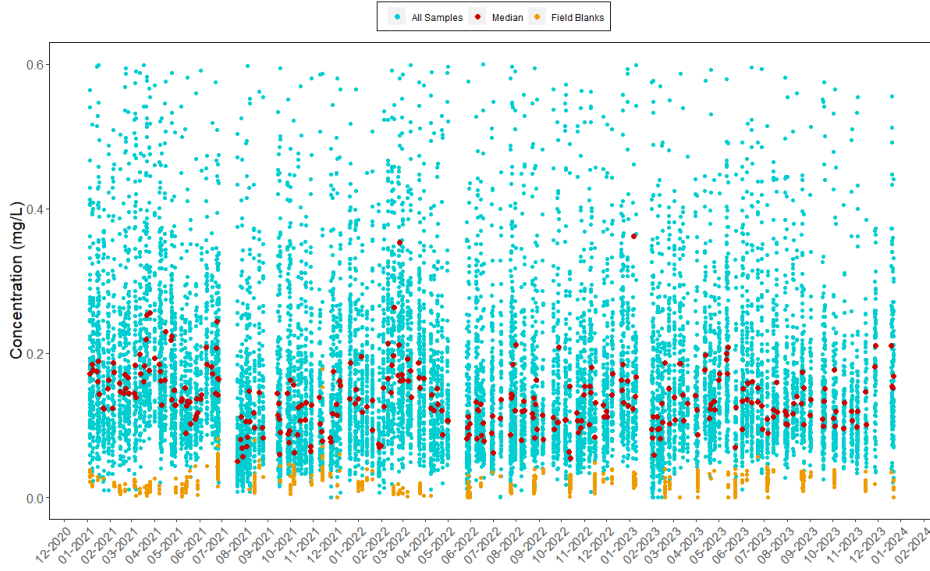
Note: Nominal reporting limit is 0.008 mg/L

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



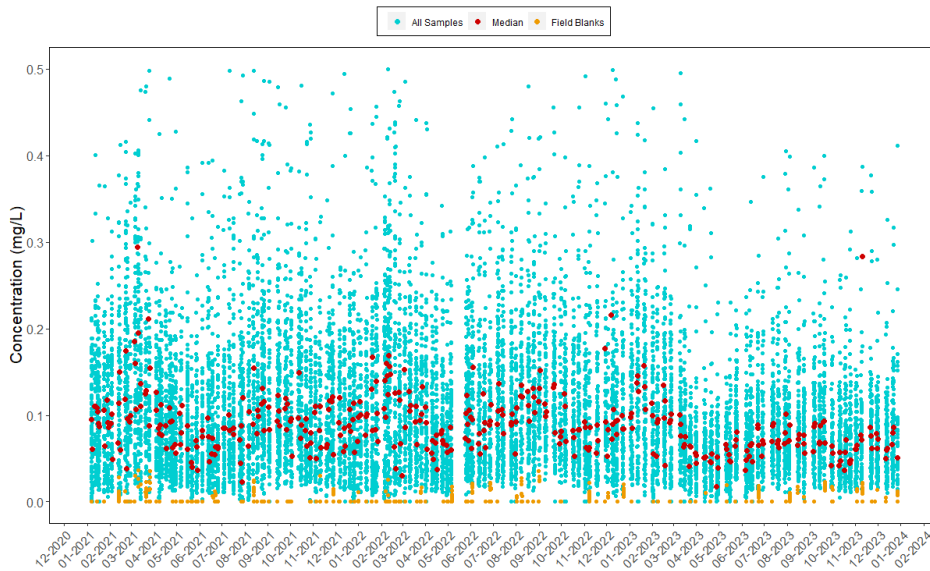
Note: Nominal reporting limit is 0.020 mg/L

Figure 17. Concentrations of SO₂ from K₂CO₃-impregnated Cellulose Filters



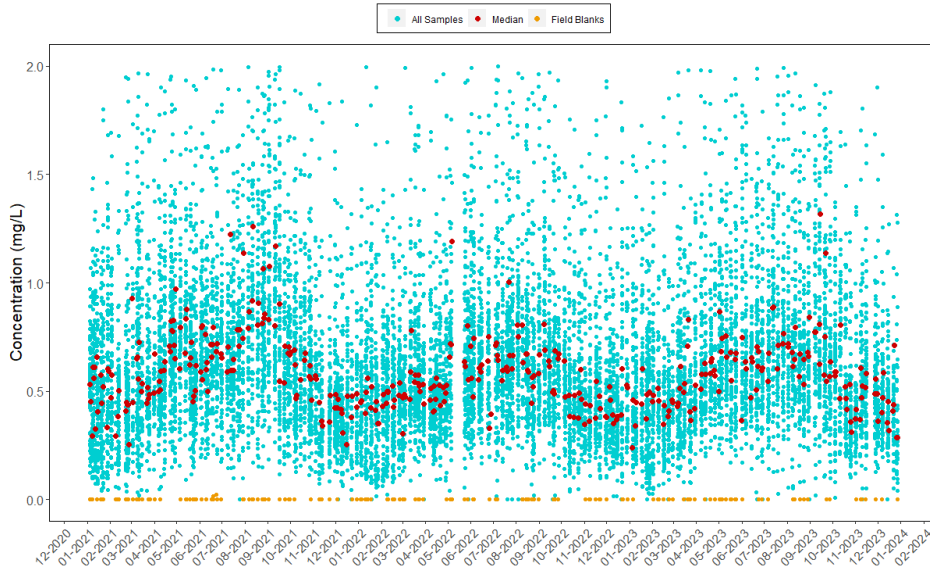
Note: Nominal reporting limit is 0.040 mg/L

Figure 18. Concentrations of SO₄²⁻ from Nylon Filters



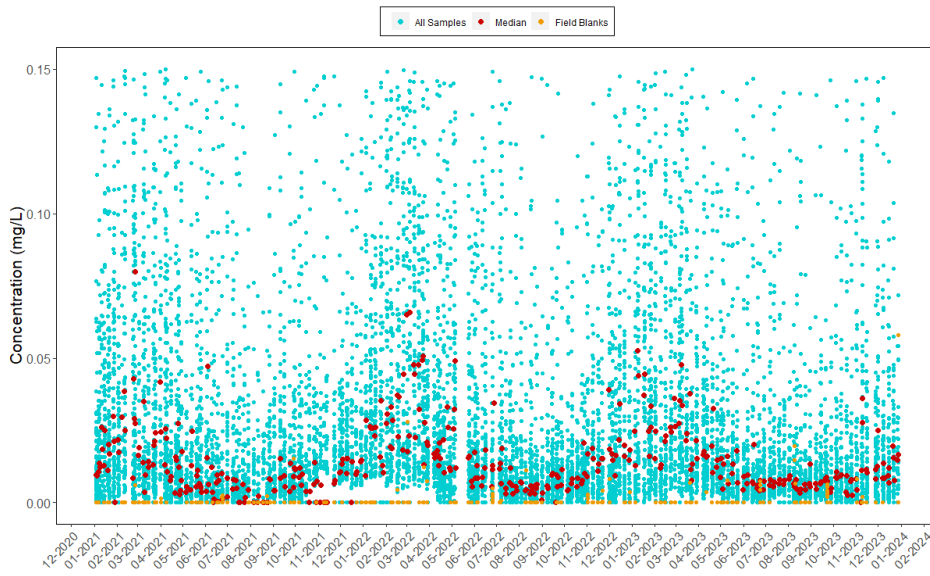
Note: Nominal reporting limit is 0.040 mg/L

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



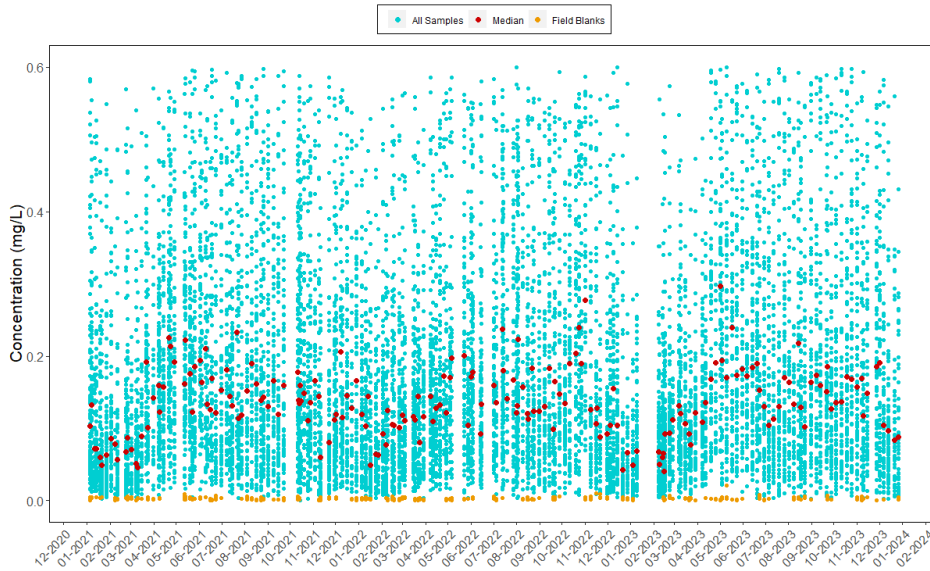
Note: Nominal reporting limit is 0.040 mg/L

Figure 20. Concentrations of Cl^- from Teflon Filters



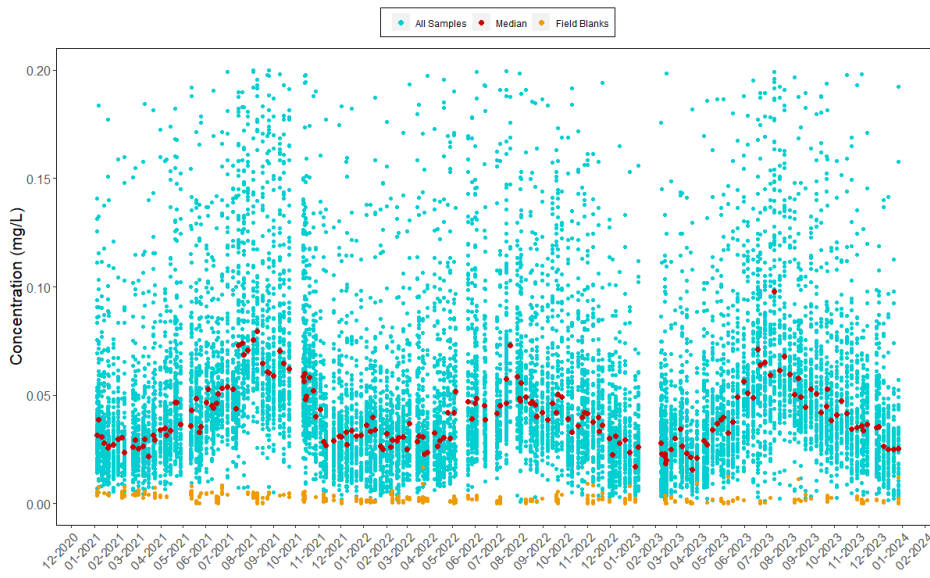
Note: Nominal reporting limit is 0.020 mg/L

Figure 21. Concentrations of Ca²⁺ from Teflon Filters



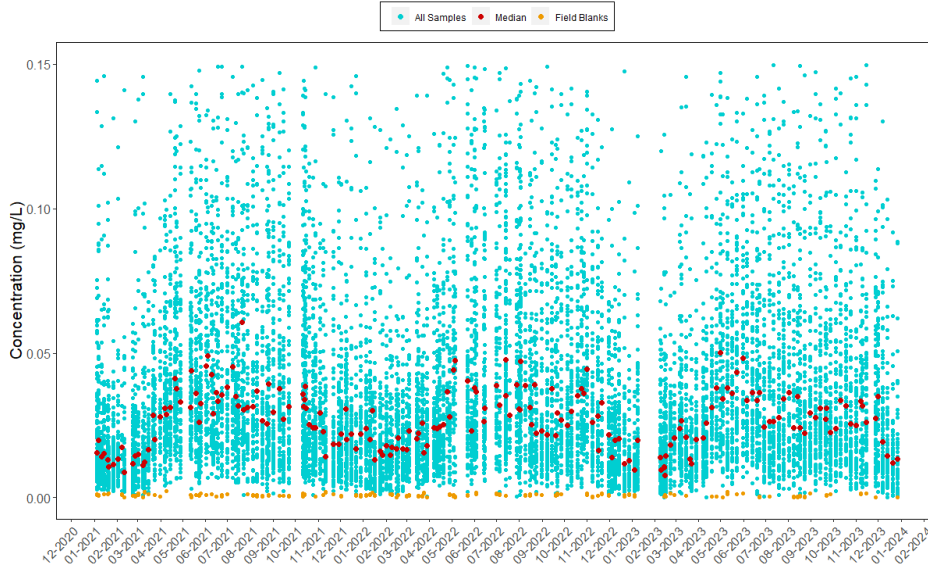
Note: Nominal reporting limit is 0.006 mg/L

Figure 22. Concentrations of K⁺ from Teflon Filters



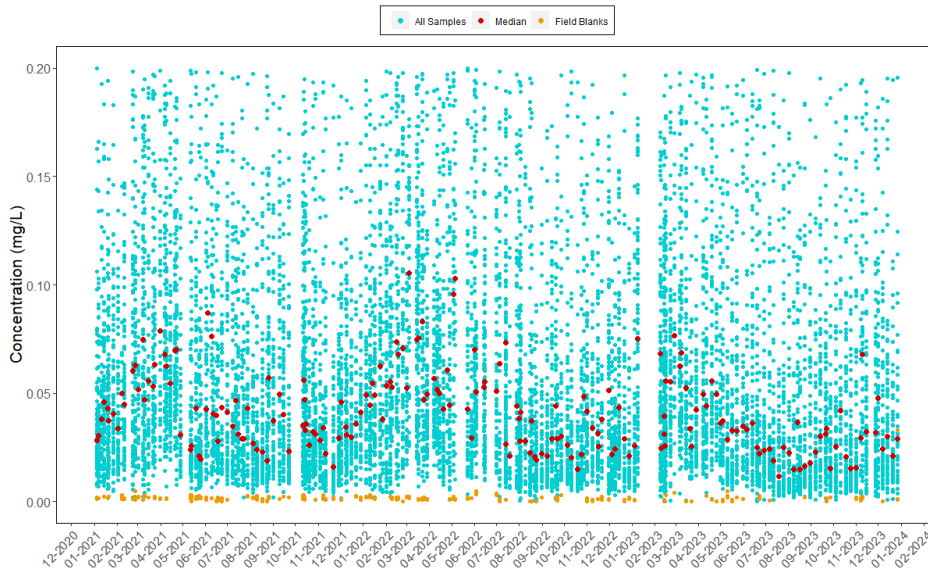
Note: Nominal reporting limit is 0.006 mg/L

Figure 23. Concentrations of Mg²⁺ 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. The concentrations difference shown for 10/17/23 in Figure 25 resulted from erroneous automatic selection of analytical peak. It will be updated during the next level of data validation.

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

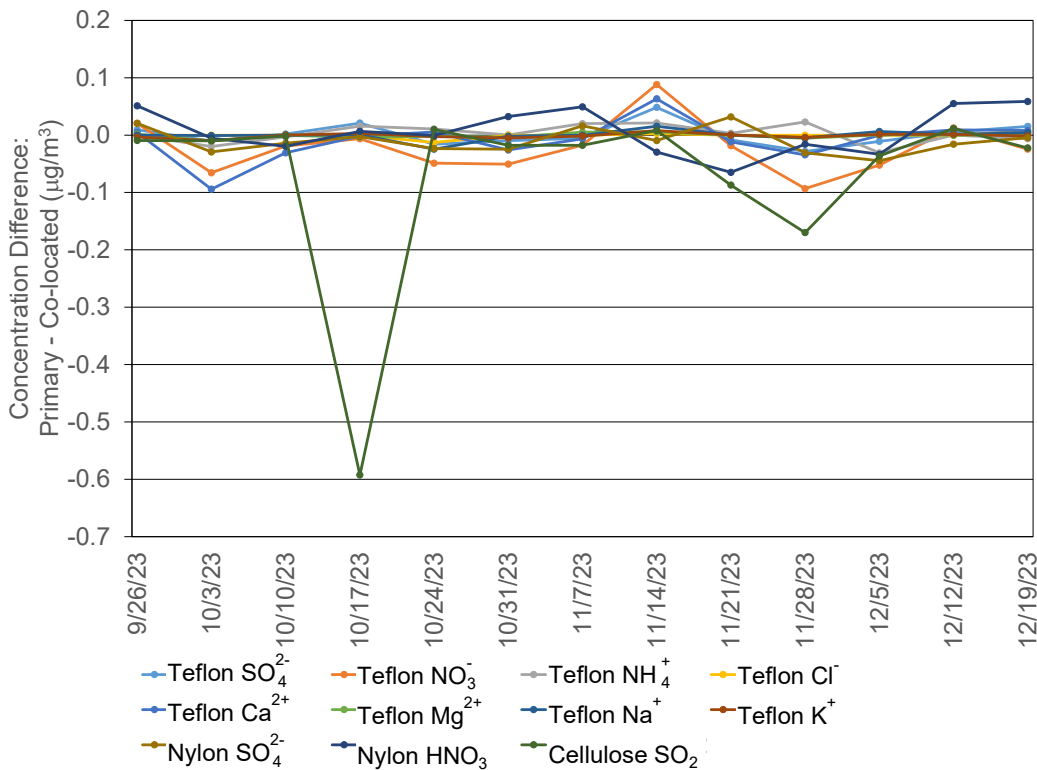
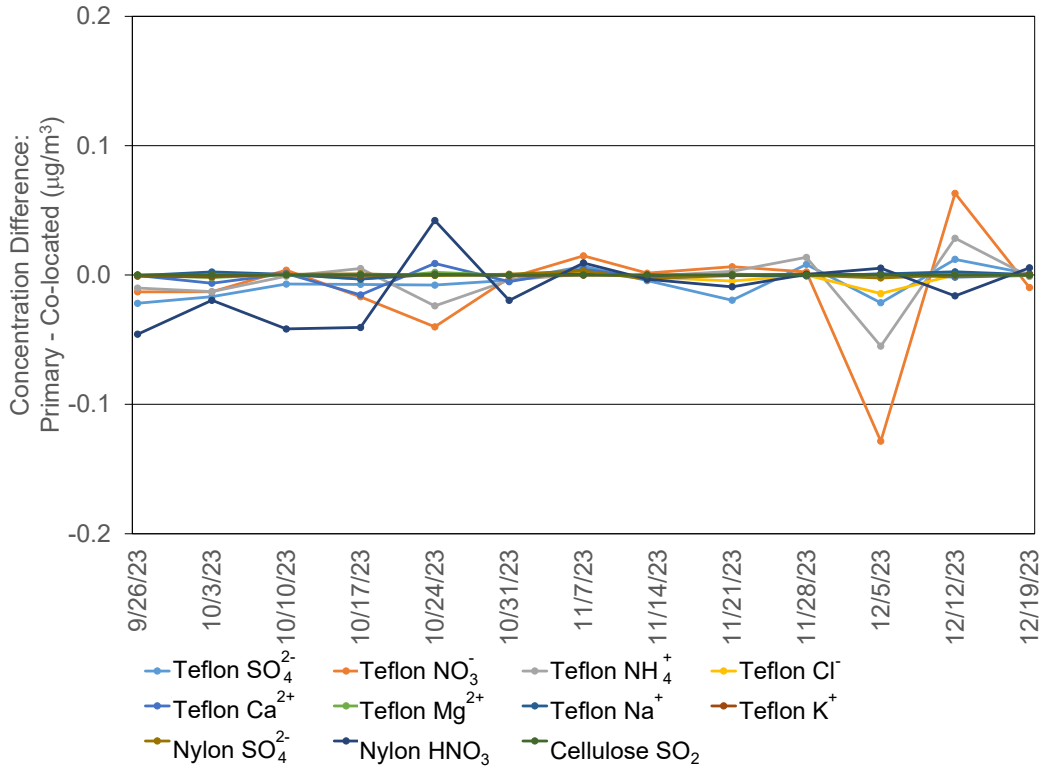


Figure 26. Time Series of Filter Concentration Differences between ROM406 and ROM206, CO



Precision of Filter Pack Concentrations

Table 3 shows mean absolute relative percent differences (MARPD) for concentrations measured at MCK131/231 and ROM406/206 during fourth quarter 2023. The MARPD values met the 20 percent criterion except for NO_3^- at ROM. The high MARPD was caused by low concentrations and large differences during three weeks of the fourth quarter. These were differences likely caused by the different exposure times for the co-located filter packs. The filter packs are changed at different times of the day on Tuesdays based on the schedule of the independent site operators. Therefore, the two sites collect pollutants during short term upslope events (particularly on sample change dates) on different filter packs.

Table 3. Precision (MARPD) for Co-located Filter Pack Data during Fourth 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											
\bar{X} ($\mu\text{g}/\text{m}^3$)	1.55	0.71	0.85	0.44	0.46	0.84	0.32	0.04	0.09	0.06	0.08
\bar{Y} ($\mu\text{g}/\text{m}^3$)	1.57	0.71	0.87	0.43	0.53	0.84	0.33	0.04	0.10	0.06	0.08
MAD	0.05	0.03	0.04	0.01	0.08	0.01	0.02	0.00	0.00	0.00	0.00
MARPD	3.36	3.81	5.47	3.40	14.89	1.98	6.57	6.59	5.90	5.26	1.50
ROM406/206, CO											
\bar{X} ($\mu\text{g}/\text{m}^3$)	0.37	0.25	0.13	0.12		0.25	0.05	0.01	0.02	0.01	0.02
\bar{Y} ($\mu\text{g}/\text{m}^3$)	0.39	0.26	0.14	0.12	0.16	0.26	0.06	0.01	0.02	0.01	0.02
MAD	0.04	0.02	0.03	0.01		0.01	0.00	0.00	0.00	0.00	0.00
MARPD	11.03	9.43	22.11	12.21		6.65	8.07	11.19	13.17	4.48	10.44

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 Fourth Quarter 2023

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	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	0.0	0.0	0.0	0.0	Site mothballed due to EPA's FY2022 budget.
BBE401, TX	53.8	53.8	53.8	53.8	53.8	53.8	53.8	0.0	Flow was invalid during December due to a malfunctioning mass flow controller.
CDR119, WV	0.0	0.0	0.0	0.0	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	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	0.0	0.0	0.0	0.0	Site mothballed due to EPA's FY2022 budget.
HWF187, NY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Site mothballed due to EPA's FY2022 budget.
JOT403, CA	61.5	61.5	61.5	61.5	61.5	61.5	61.5	0.0	Site had power issues from the beginning of the quarter to November 7.
KIC003, KS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Site is not in operation.
LPO010, CA	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	There were two 2-week samples during the quarter.
MKG113, PA	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5	The site operator has not been able to perform his duties since the end of November due to personal injury.
NIC001, NY	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	There was one 3-week sample during the quarter.
PNF126, NC	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	Site mothballed due to EPA's FY2022 budget.
SHN418, VA	84.6	84.6	84.6	84.6	84.6	84.6	84.6	0.0	Power failure affected two samples.
THR422, ND	61.5	61.5	61.5	61.5	61.5	61.5	61.5	0.0	Flow was flagged as invalid during December.
UND002, VT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Site mothballed due to EPA's FY2022 budget.
WST109, NH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Site mothballed due to EPA's FY2022 budget.

Note: SO₂ analysis is currently on hold at NPS sites.

Precision of Ozone Concentrations

Time series of co-located hourly O₃ concentration differences for fourth 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 O₃ Concentrations for MCK131/231, KY

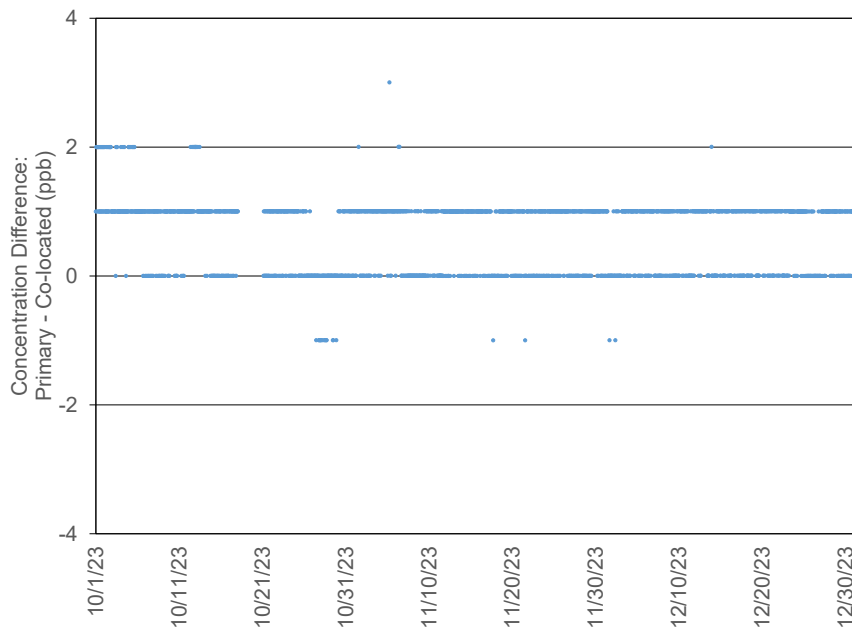


Figure 28. Time Series of the Difference in Co-located O₃ Concentrations for ROM406/206, CO

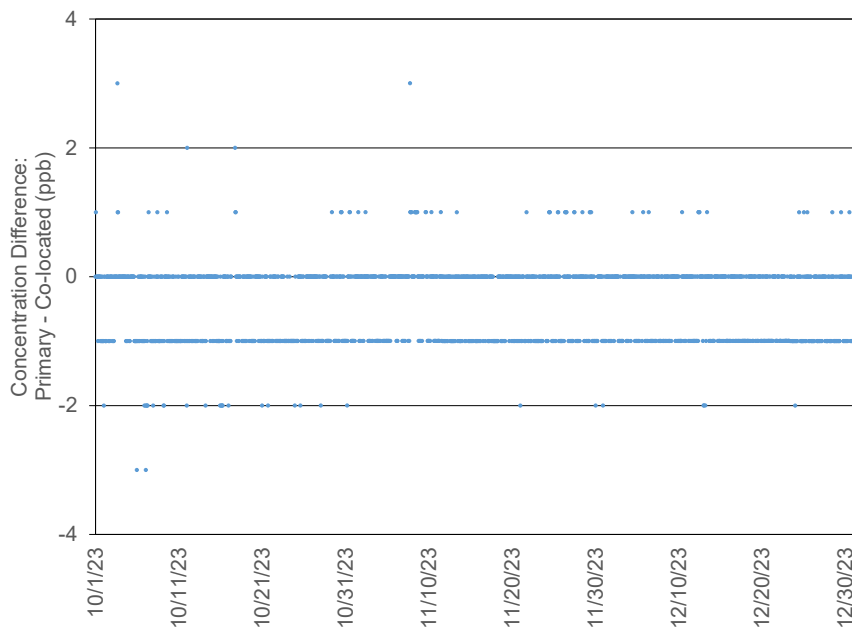


Table 5 gives MARPD data for O₃ data measured at the two co-located sites.

Table 5. Quarterly Precision (MARPD) for Co-located O₃ Concentrations

Site Pair	Quarter	Start Date	MARPD	Records
MCK131/231, KY				
	1	1/1/2023	0.9	2040
	2	4/1/2023	1.7	2036
	3	7/1/2023	3.6	1912
	4	10/1/2023	2.2	2031
ROM406/206, CO				
	1	1/1/2023	1.2	2046
	2	4/1/2023	1.6	2052
	3	7/1/2023	1.6	2038
	4	10/1/2023	1.2	2072

Completeness for Ozone Concentrations

Calculation of an annual O₃ 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 O₃ concentrations. Comments are provided for these sites.

Tables 6. Sites with less than 90 Percent Data Completeness for DM8A Concentrations during Fourth Quarter 2023

Site ID	Percent Completeness	Comments
ASH135, ME	0	Site mothballed due to EPA's FY2022 budget.
CAD150, AR	85	The site analyzer stopped functioning 11/17/2023 and was replaced 11/28/2023.
CDR119, WV	0	Site mothballed due to EPA's FY2022 budget.
CDZ171, KY	0	Site mothballed due to EPA's FY2022 budget.
CNT169, WY	79	The ozone sample pump failed 12/1/2023. The analyzer was repaired 12/12/2023. Additionally, the data logger went offline in early November and had to be rebooted.
DCP114, OH	0	Site mothballed due to EPA's FY2022 budget.
HWF187, NY	0	Site mothballed due to EPA's FY2022 budget.
JOT403, CA	46	Site had power issues from the beginning of the quarter to 11/7/2023.
LAV410, CA	89	Data were invalidated 11/1/2023 to 11/6/2023.
PNF126, NC	0	Site mothballed due to EPA's FY2022 budget.
SHN418, VA	77	Power failure affected ozone data November 3 - 14.
SPD111, TN	87	Power issues beginning 10/28/2023 led to replacement of the analyzer on 11/8/2023.
VOY413, MN	14	The site analyzer began to malfunction in October and was replaced in December. Associated data were invalidated.
WST109, NH	75	Site had been mothballed until late October.

Table 7 shows CASTNET sites with less than 90 percent completeness for hourly O₃ concentrations. Comments are provided for these sites. The average for the first quarter 2023 through fourth quarter 2023 is included for reference.

Table 7. Sites with less than 90 Percent Data Completeness for O₃ Concentrations

Site ID	Q4 2023	Q1 2023 – Q4 2023	Comments
ASH135, ME	0	0	Site mothballed due to EPA's FY2022 budget.
CAD150, AR	88	96	The site analyzer stopped functioning 11/17/2023 and was replaced 11/28/2023.
CDR119, WV	0	0	Site mothballed due to EPA's FY2022 budget.
CDZ171, KY	0	0	Site mothballed due to EPA's FY2022 budget.
CNT169, WY	83	95	The ozone sample pump failed 12/1. The analyzer was repaired 12/12/2023. Additionally, the data logger went offline in early November and had to be rebooted.
DCP114, OH	0	0	Site mothballed due to EPA's FY2022 budget.
HWF187, NY	0	0	Site mothballed due to EPA's FY2022 budget.
JOT403, CA	51	82	Site had power issues from the beginning of the quarter to 11/7/2023.
PNF126, NC	0	0	Site mothballed due to EPA's FY2022 budget.
SHN418, VA	84	87	Power failure affected ozone data from 11/3/2023 to 11/14/2023.
SPD111, TN	88	96	Power issues beginning 10/28/2023 led to replacement of the analyzer on 11/8/2023.
VOY413, MN	14	72	The site analyzer began to malfunction in October and was replaced in December. Associated data were invalidated.
WST109, NH	76	19	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 35 show a comparison of weekly average continuous NO_y measurements with weekly filter pack total NO₃ concentrations collected at the six of eight sites with NO_y measurements. The NO_y concentrations were consistently higher than the total NO₃ levels at all sites. The average weekly NO_y levels, the weekly total NO₃ concentrations, and their ratios for the six sites with available data are shown in Table 8. Ratios of NO_y to total NO₃ varied from 2.98 at GRS420 to 6.32 at PND165. No data are available from HWF187 and PNF126 for fourth quarter 2023. These sites were mothballed in May 2022 due to EPA's budget constraints.

Table 8. Summary of Total NO₃/NO_y Measurements for Q4 2023

Site ID	Elevation	Total NO ₃ (ppb)	NO _y (ppb)	Ratio
DUK008, NC	164*	0.67	2.82	4.55
BVL130, IL	213	0.75	3.87	5.38
MAC426, KY	243	Site is no longer measuring trace-level gases.		
HWF187, NY [‡]	497	Site mothballed due to EPA's FY2022 budget.		
GRS420, TN	793	0.39	1.46	4.05
PNF126, NC [‡]	1216	Site mothballed due to EPA's FY2022 budget.		
PND165, WY	2386	0.09	0.80	9.17
ROM206, CO	2742	0.13	0.79	6.24

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

[‡]The site was mothballed in second quarter 2022 due to EPA's FY2022 budget. No measurements were recorded during fourth quarter 2023.

Figure 29. Comparison of DUK008 Weekly Mean NO_y and Total NO₃⁻ Concentrations

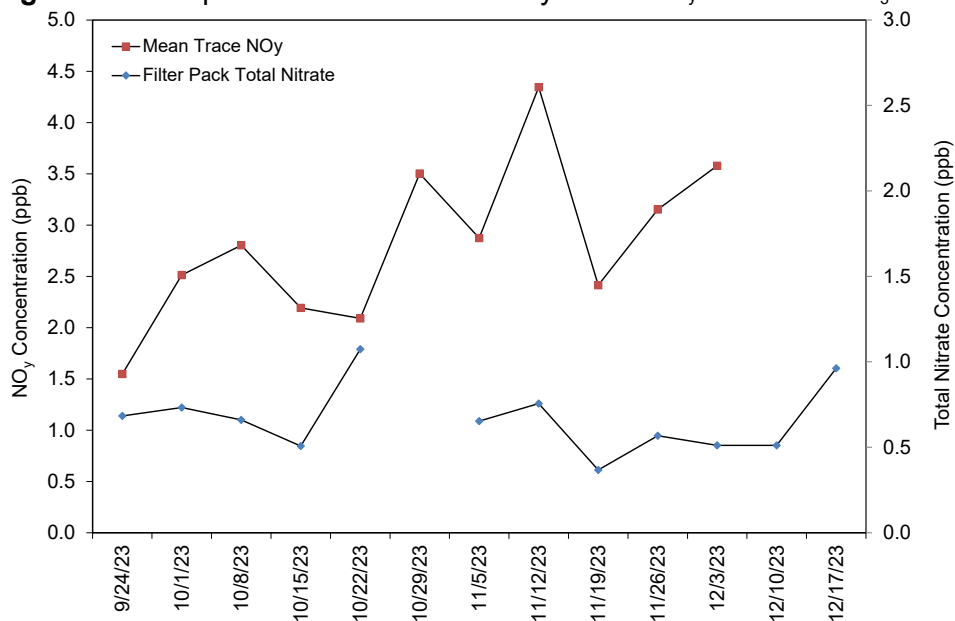


Figure 30. Comparison of BVL130 Weekly Mean NO_y and Total NO₃ Concentrations

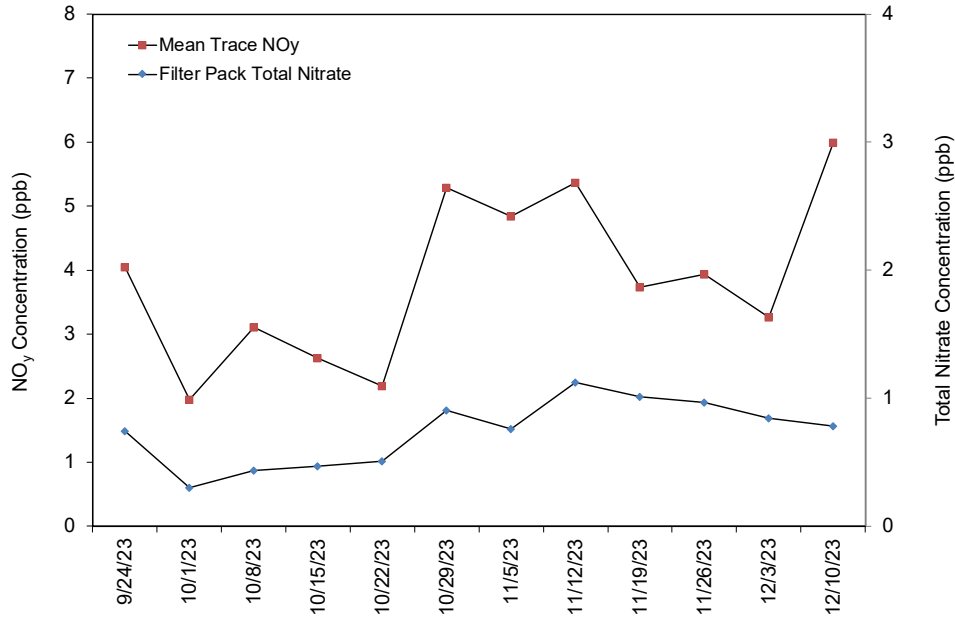


Figure 31. Comparison of HWF187 Weekly Mean NO_y and Total NO₃ Concentrations

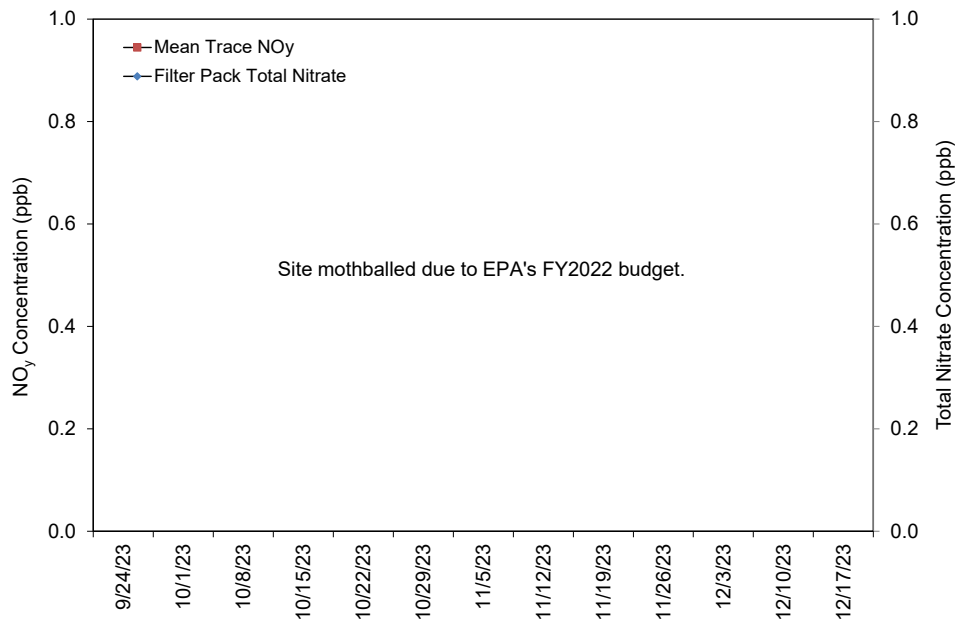


Figure 32. Comparison of GRS420 Weekly Mean NO_y and Total NO₃ Concentrations

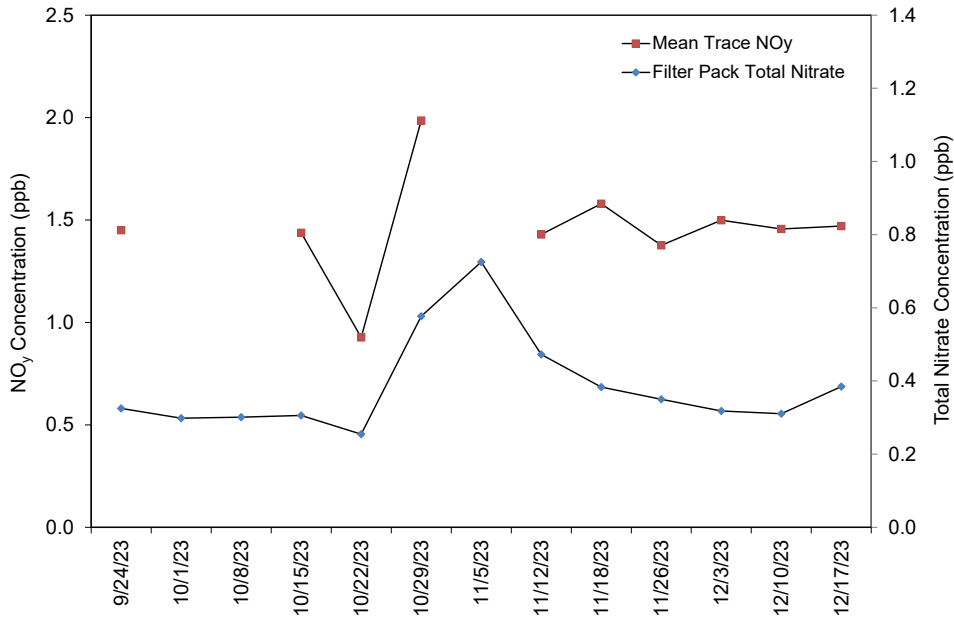


Figure 33. Comparison of PNF126 Weekly Mean NO_y and Total NO₃ Concentrations

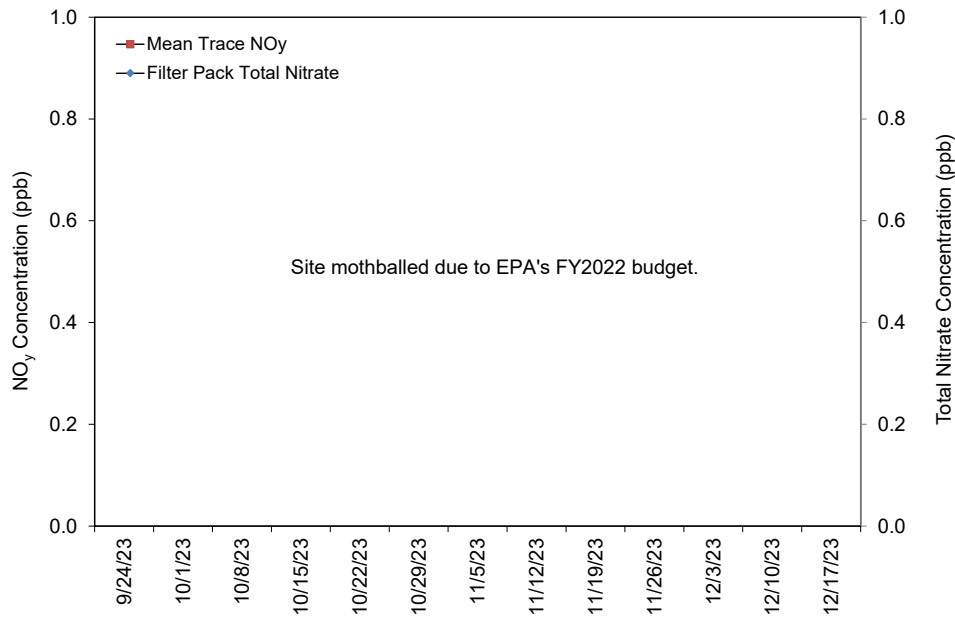


Figure 34. Comparison of PND165 Weekly Mean NO_y and Total NO₃ Concentrations

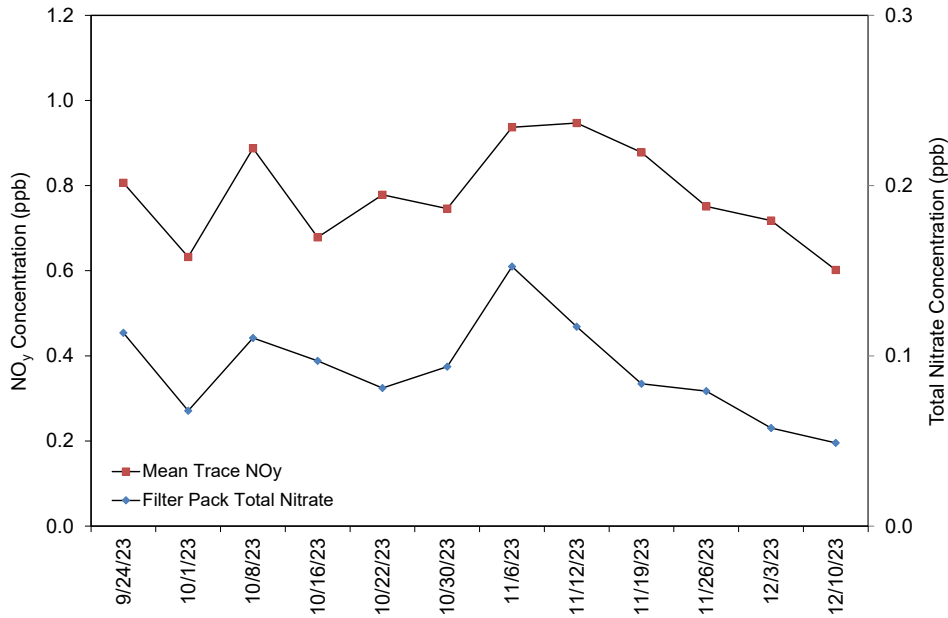
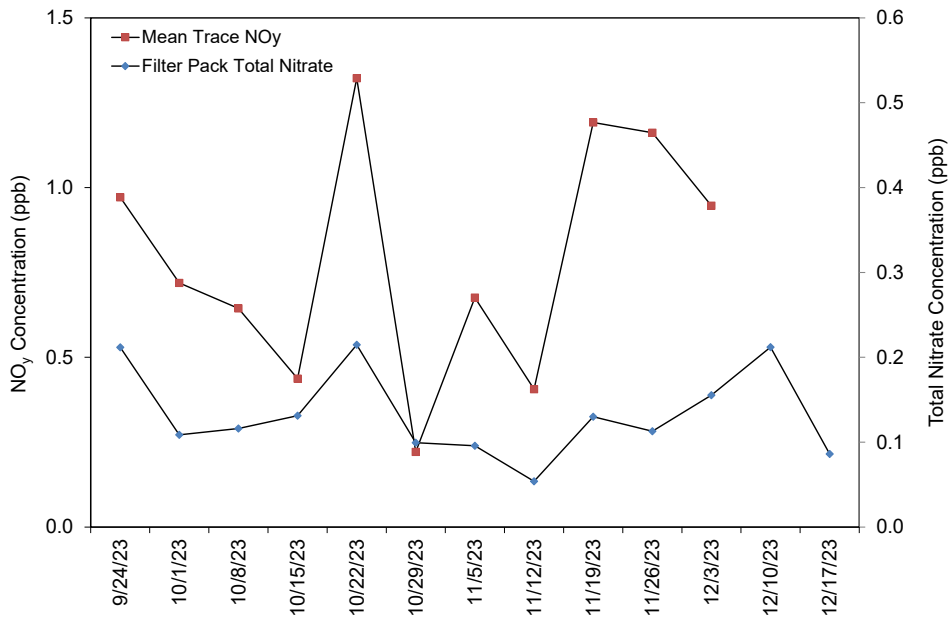


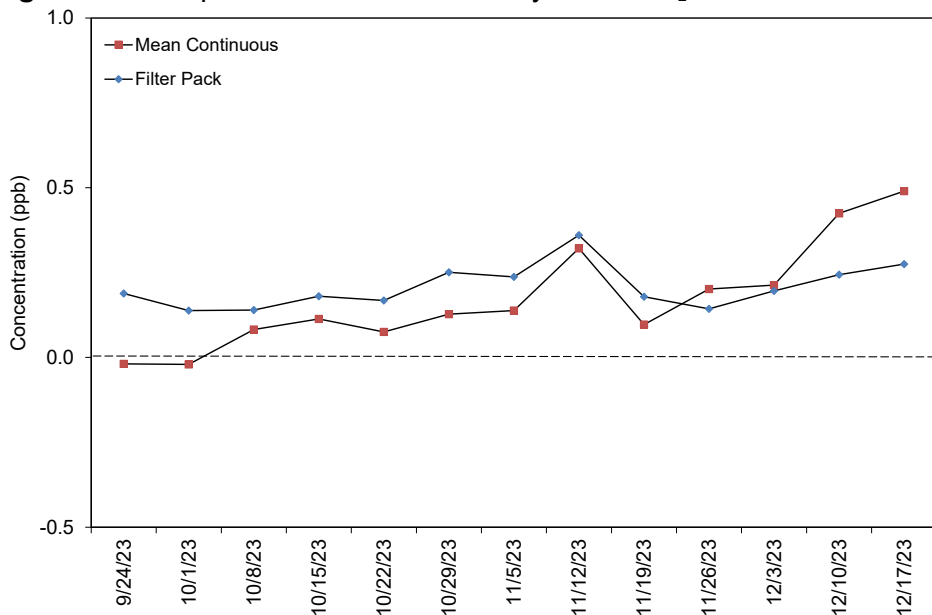
Figure 35. Comparison of ROM206 Weekly Mean NO_y and Total NO₃ Concentrations



Filter Pack and Continuous Trace-level Gas Sulfur Dioxide Concentrations

Figure 36 provides a diagram that compares weekly filter pack SO₂ concentrations with continuous trace-level gas data measured at BVL130. The continuously measured trace-level concentrations were comparable to the filter pack concentrations.

Figure 36. Comparison of BVL130 Weekly Mean SO₂ 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 fourth quarter 2023. The average for first quarter 2023 through fourth 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	Q4 2023	Q1 2023– Q4 2023	Comments
BVL130, IL	CO	95	75	The analyzer drifted out of calibration on 10/29/2023 and was recalibrated 11/3/2023.
	NO	92	89	
	NOY	88	88	
	NOYDIF	88	88	
	SO2_GA	95	86	
CHC432, NM	NO	98	96	
	NOX	98	96	
	NOXDIF	98	96	

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

Site ID	Parameter	Q4 2023	Q1 2023– Q4 2023	Comments
DUK008, NC	HNO3	63	76	The analyzer was stuck in zero mode from 12/6/2023 through the end of the month. Additionally, the ozone generator was off for several days during November.
	NH3	63	82	
	NO	63	84	
	NO2_TRUE	63	84	
	NOX_TRUE	63	84	
	NOY	63	84	
	NOY_MINUS	63	76	
	NOYDIF	63	84	
	TNX	63	82	
GRS420, TN	CO	89	90	
	NO	72	86	
	NOY	72	86	
	NOYDIF	84	88	
	SO2_GA	91	80	
HWF187, NY	NO	0	0	Site mothballed due to EPA's FY2022 budget.
	NOY	0	0	
	NOYDIF	0	0	
MAC426, KY	CO	0	76	Site is no longer measuring trace-level gases.
	NO	0	84	
	NOY	0	84	
	NOYDIF	0	84	
	SO2_GA	0	84	
PND165, WY	NO	91	92	
	NOY	91	91	
	NOYDIF	91	91	
PNF126, NC	NO	0	0	Site mothballed due to EPA's FY2022 budget.
	NOY	0	0	
	NOYDIF	0	0	
ROM206, CO	NO	79	89	QC failures in December required replacement of the pre-reactor and sample solenoid assemblies. Associated data were invalidated.
	NOY	79	89	
	NOYDIF	79	89	

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
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. 2024. Clean Air Status and Trends Network (CASTNET) Fourth Quarter 2023 Quality Assurance Report. <https://java.epa.gov/castnet/documents.do>