Clean Air Status and Trends Network

Quarterly Data Summary for Third Quarter 2023 (July through September)

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 third 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 third 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 third quarter and continuous SO_2 concentrations from three sites. Other QC statistics are given in the CASTNET Third Quarter 2023 Quality Assurance Report (WSP, 2023).

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

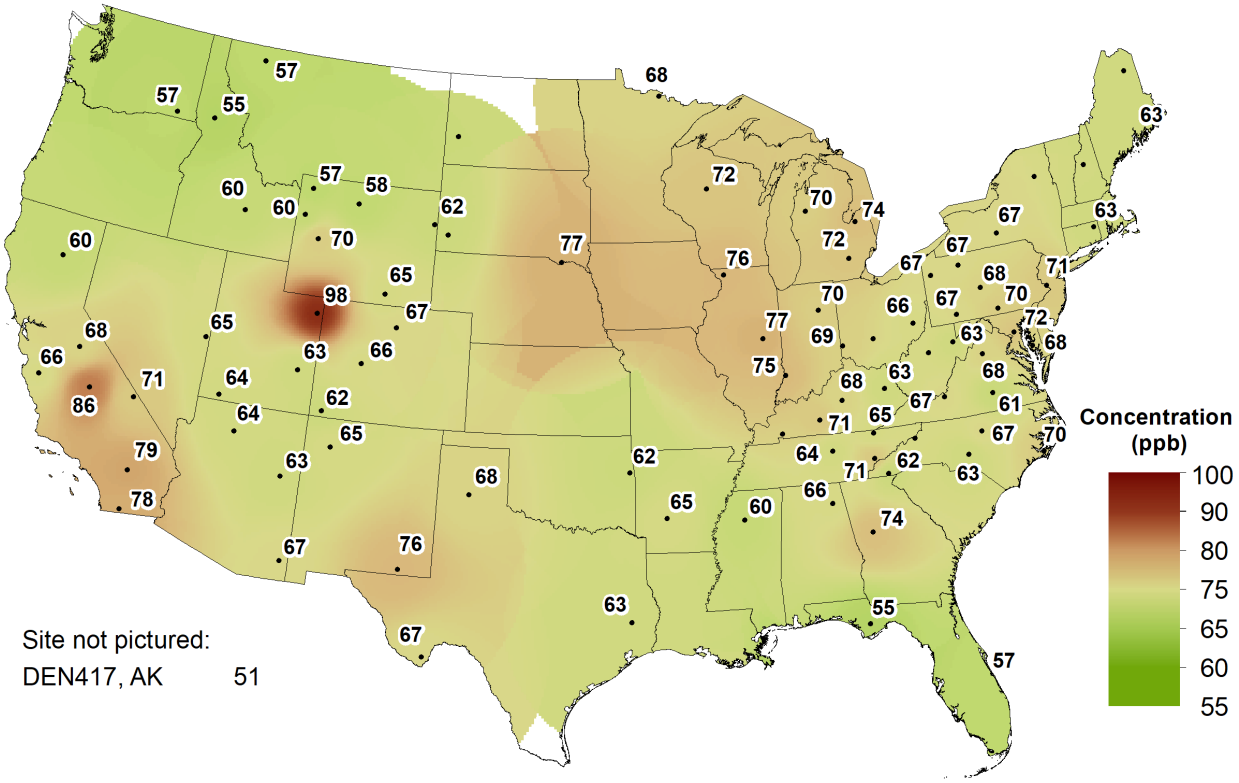


Figure 1 shows fourth highest daily maximum 8-hour average (DM8A) O_3 concentrations measured through third quarter 2023. Eighteen sites exceeded the 0.070 parts per million (ppm) National Ambient Air Quality Standard (NAAQS) for O_3.

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 third quarter. Trends in quarterly mean filter pack and O_3 concentrations are shown using box plots in Figures 2 through 13.

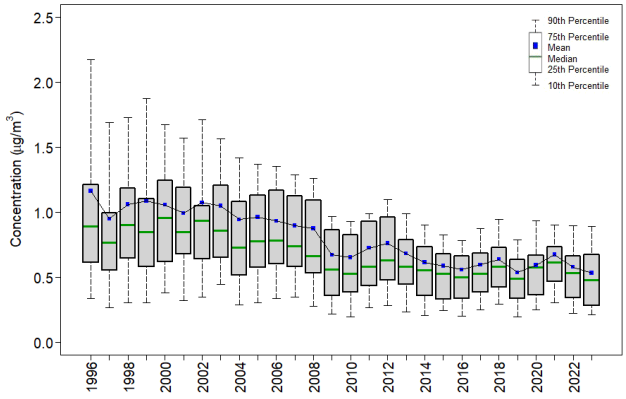
Third Quarter Concentrations

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

Quarterly O_3 concentrations were analyzed using box plots constructed by averaging all valid hourly O_3 concentrations within third quarter 2023 by site and then averaging those averages for all eastern and western reference sites (Figure 13). The figure shows increase in quarterly mean O_3 concentrations at eastern and western sites. Quarterly mean concentrations were higher at the western reference sites than at the eastern sites.

Figure 2. Trends in Third Quarter Mean HNO_3 Concentrations

Western Reference Sites



Eastern Reference Sites

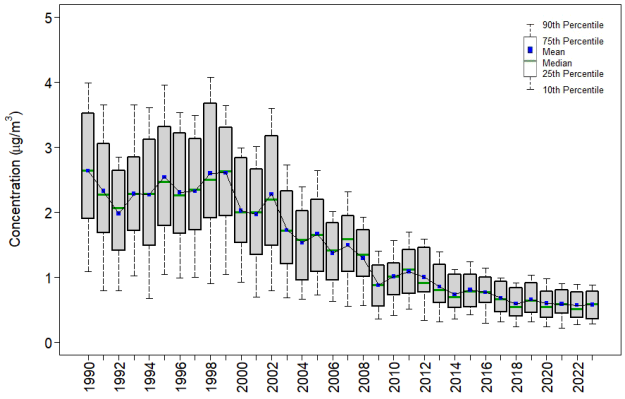
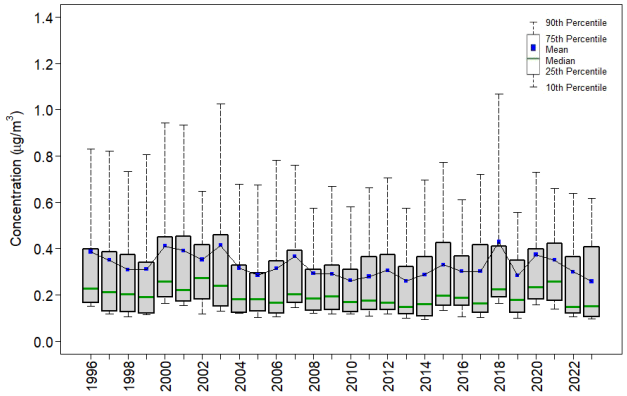


Figure 3. Trends in Third Quarter Mean NO_3^- Concentrations

Western Reference Sites



Eastern Reference Sites

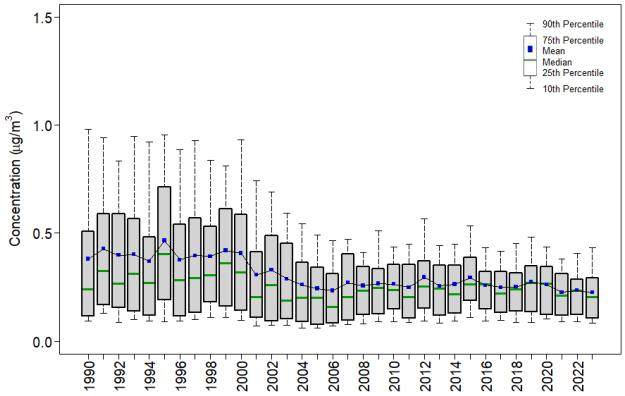
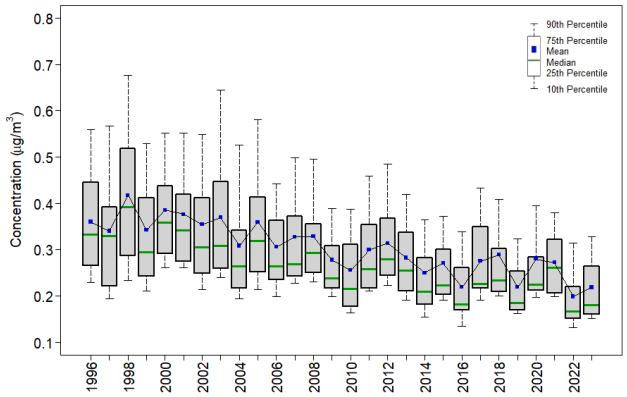


Figure 4. Trends in Third Quarter Mean NH_4^+ Concentrations

Western Reference Sites



Eastern Reference Sites

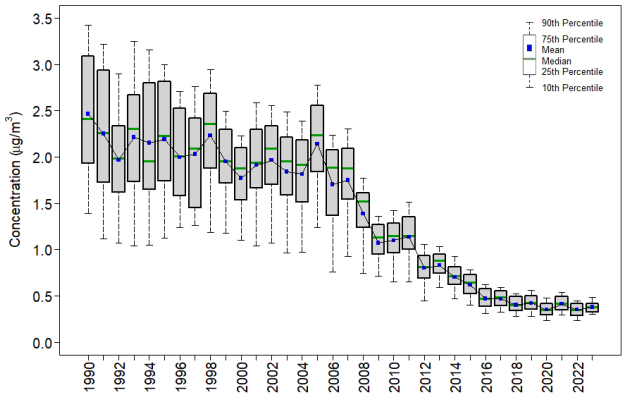
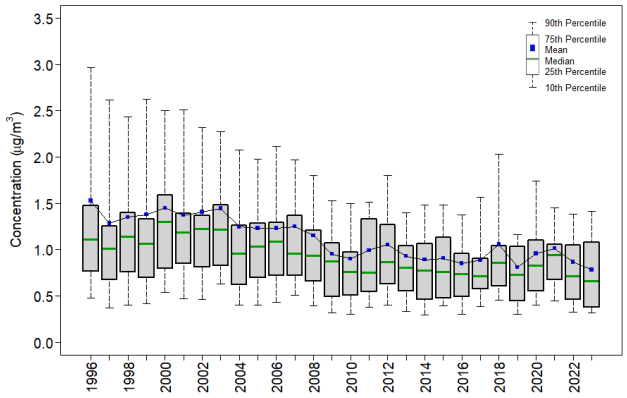


Figure 5. Trends in Third Quarter Mean Total NO_3^- Concentrations

Western Reference Sites



Eastern Reference Sites

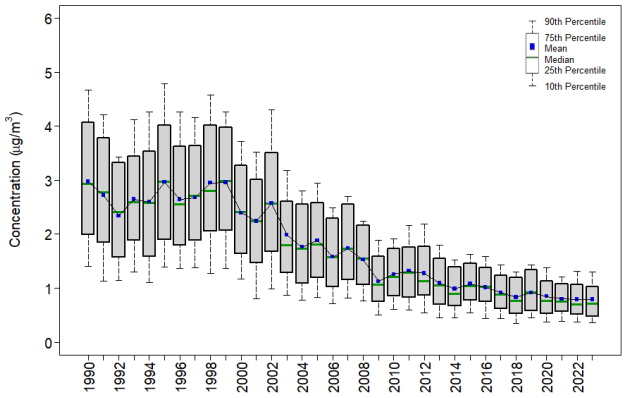
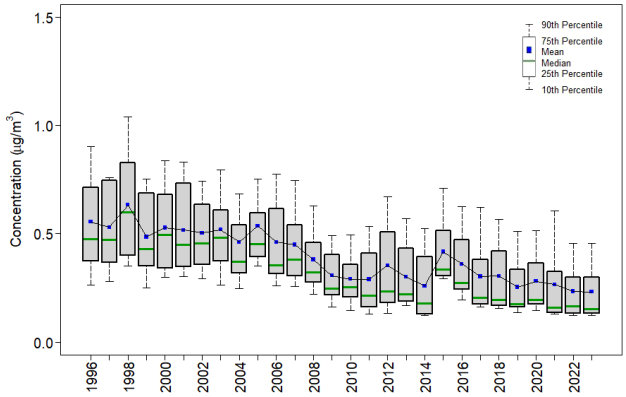


Figure 6. Trends in Third Quarter Mean SO_2 Concentrations

Western Reference Sites



Eastern Reference Sites

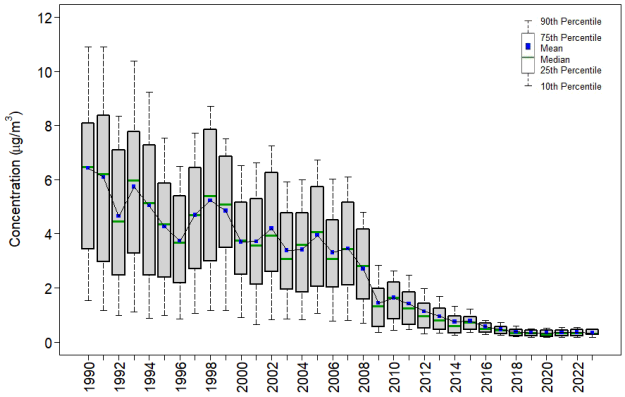
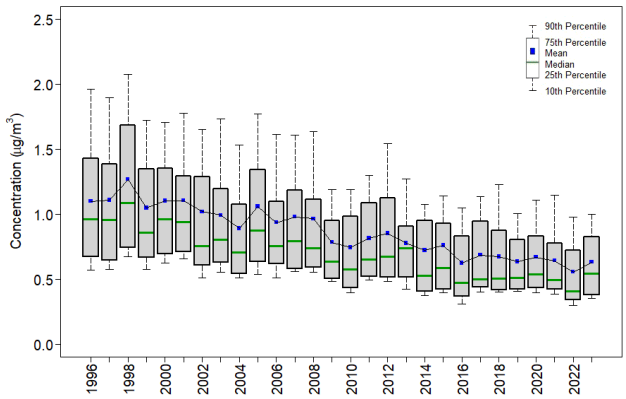


Figure 7. Trends in Third Quarter Mean SO_4^{2-} Concentrations

Western Reference Sites



Eastern Reference Sites

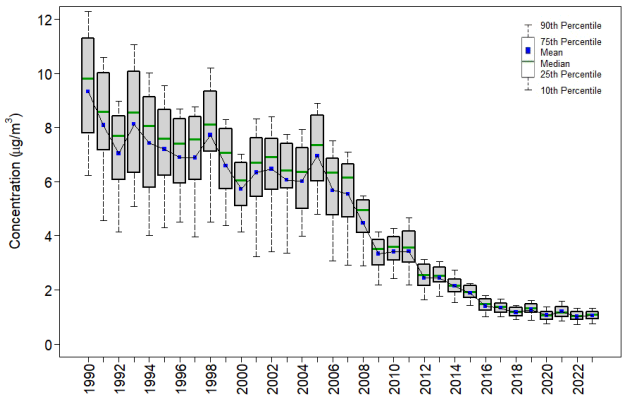
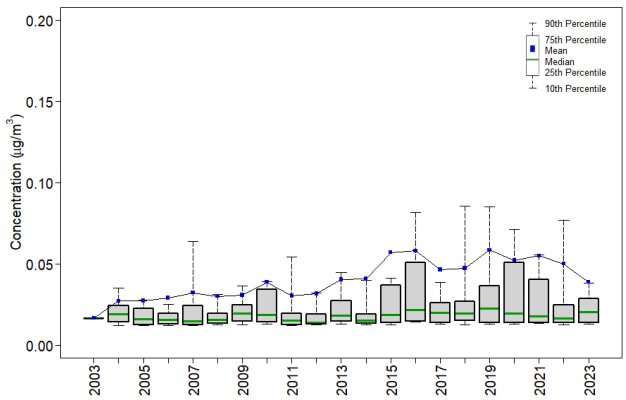


Figure 8. Trends in Third Quarter Mean Cl^- Concentrations

Western Reference Sites



Eastern Reference Sites

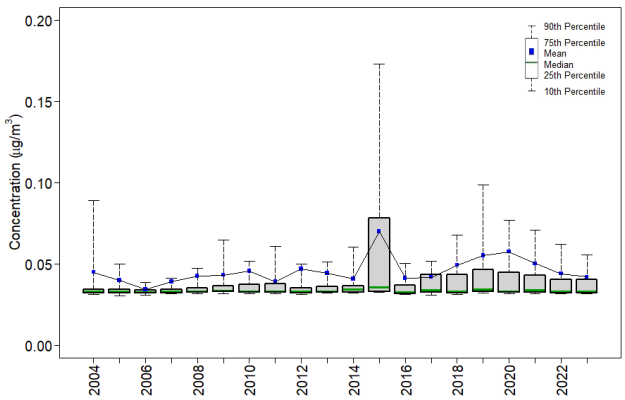
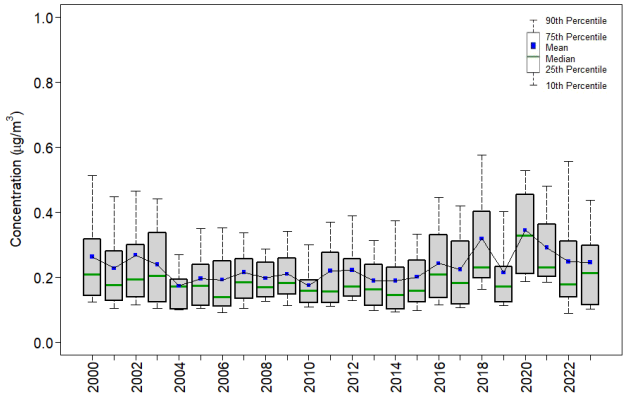


Figure 9. Trends in Third Quarter Mean Ca^{2+} Concentrations

Western Reference Sites



Eastern Reference Sites

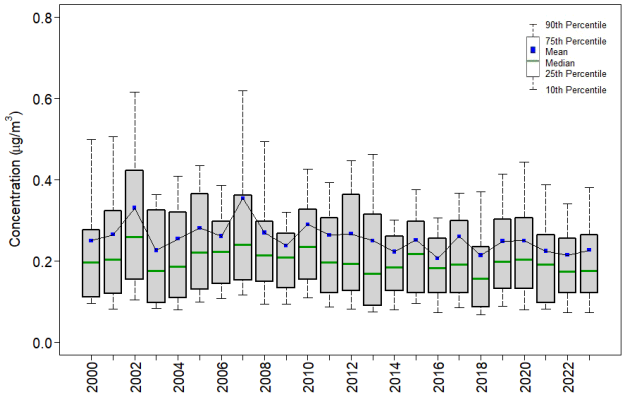
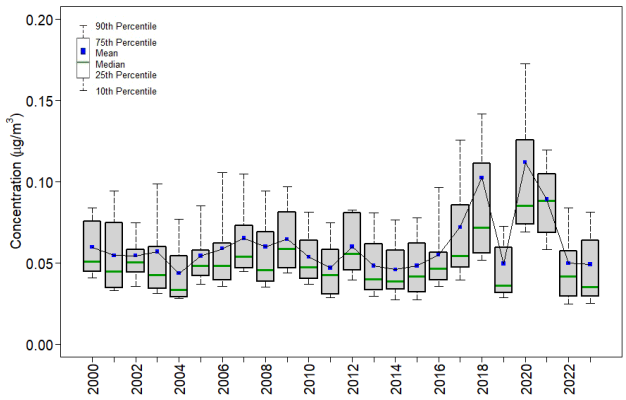


Figure 10. Trends in Third Quarter Mean K^{+} Concentrations

Western Reference Sites



Eastern Reference Sites

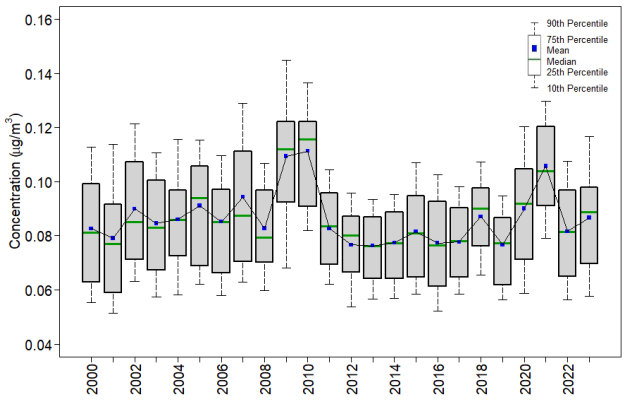
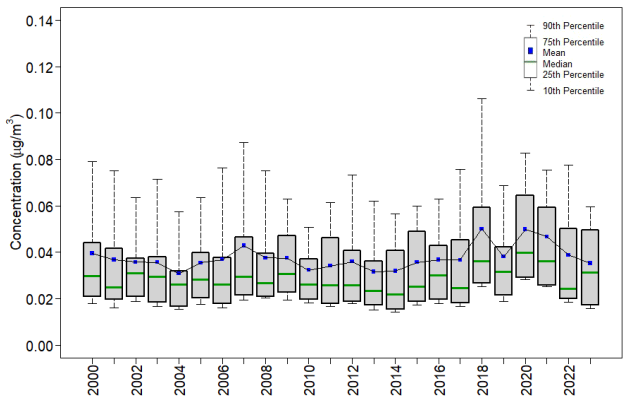


Figure 11. Trends in Third Quarter Mean Mg^{2+} Concentrations

Western Reference Sites



Eastern Reference Sites

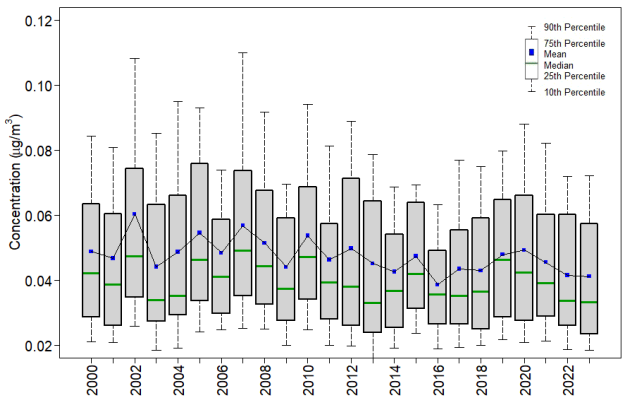
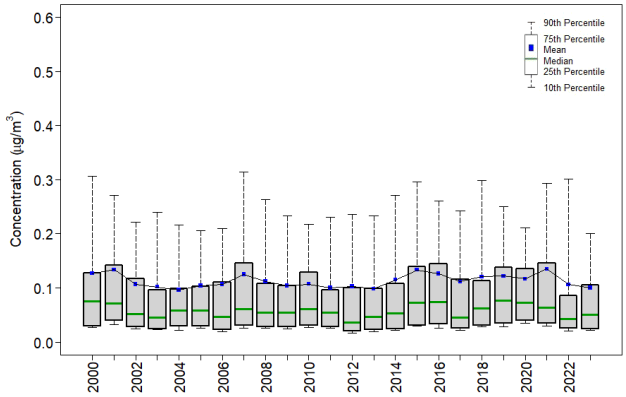


Figure 12. Trends in Third Quarter Mean Na^+ Concentrations

Western Reference Sites



Eastern Reference Sites

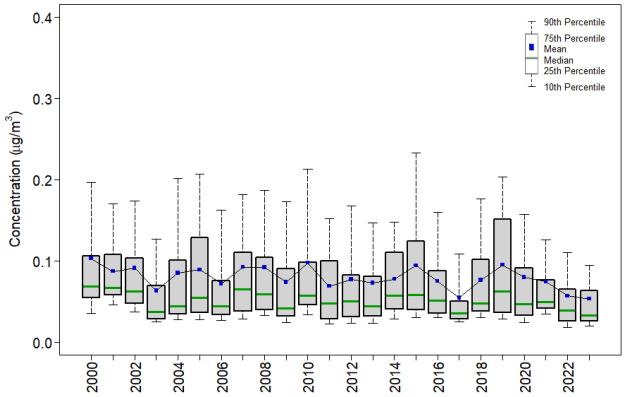
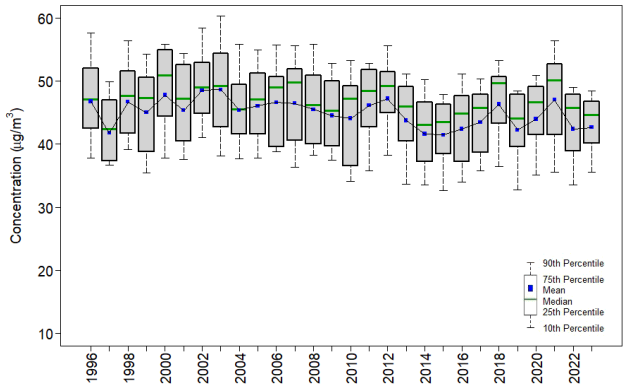
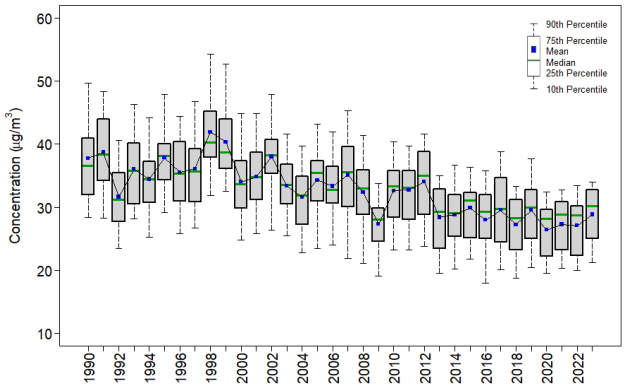


Figure 13. Trends in Third Quarter Mean O_3 Concentrations

Western Reference Sites



Eastern Reference Sites



Changes in 3-Year Average Third Quarter Concentrations

As shown in Table 1 and Table 2, three-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 decreased at eastern sites and showed almost no change at western reference sites. Ca^{2+}, Mg^{2+}, and Na^+ levels declined at eastern sites from 2004–2006 through 2021–2023. Cl^- and K^+ values increased. At western sites, Cl^- and 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	36	2.7	2.2	5.7	8.1					
2004–2006						0.27	0.09	0.05	0.08	0.04
2021–2023	28	0.8	0.4	0.3	1.1	0.22	0.09	0.04	0.06	0.05
Percent Change	-23	-70	-83	-94	-87	-17	4	-15	-25	14

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)

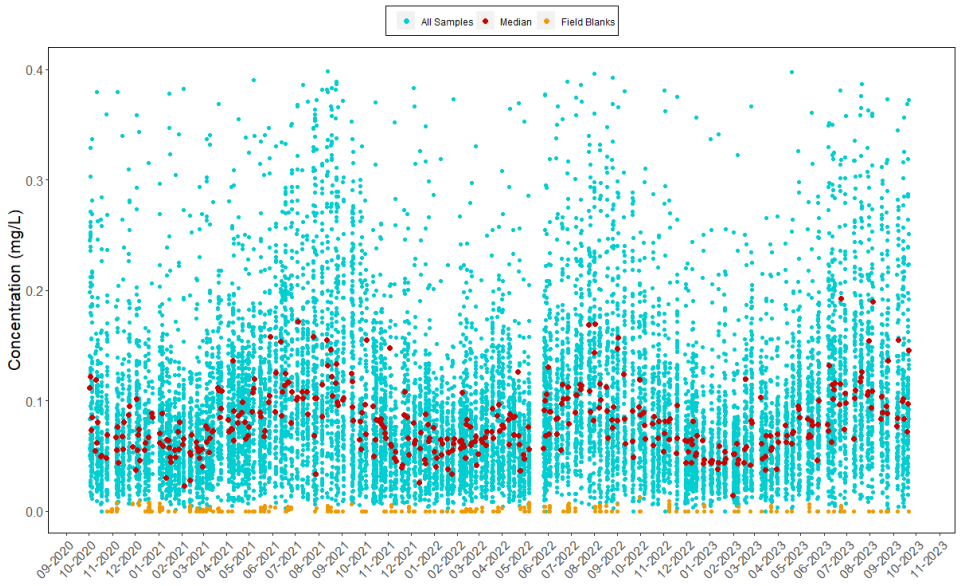
Parameter	O_3 (ppb)	Total NO_3^-	NH_4^+	SO_2	SO_4^{2-}	Ca^{2+}	K^+	Mg^{2+}	Na^+	Cl^-
1996–1998	45	1.4	0.4	0.6	1.2					
2004–2006						0.19	0.05	0.03	0.10	0.03
2021–2023	44	0.9	0.2	0.2	0.6	0.26	0.06	0.04	0.11	0.05
Percent Change	-2	-36	-38	-57	-47	40	20	17	11	72

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

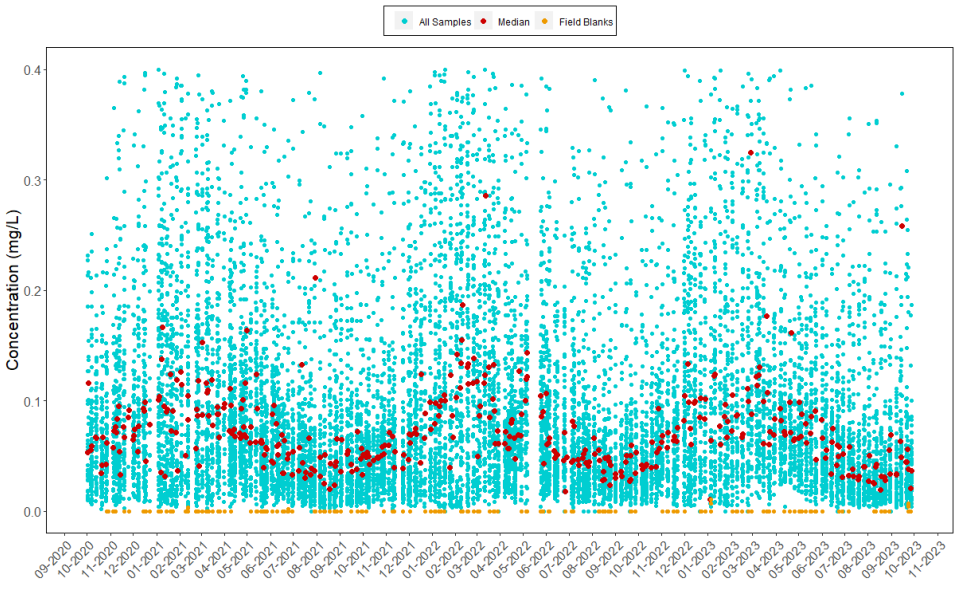
Figures 14 through 24 give time series of laboratory-analyzed concentrations of field samples and field blanks in milligrams per liter (mg/L) of 11 parameters from fourth quarter 2020 through third quarter 2023. These figures provide indications of potential issues with concentration measurements relative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

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



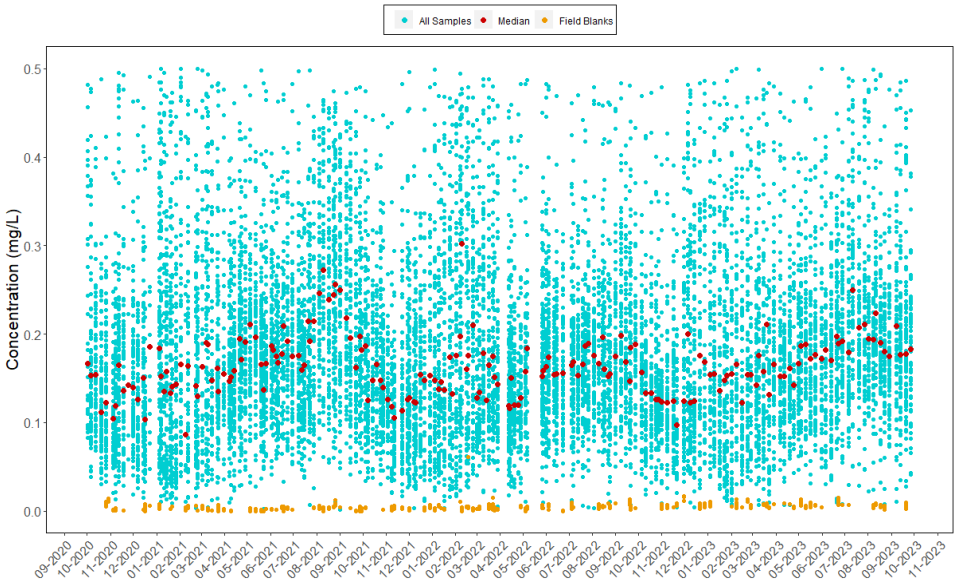
Note: Nominal reporting limit is 0.008 mg/L

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



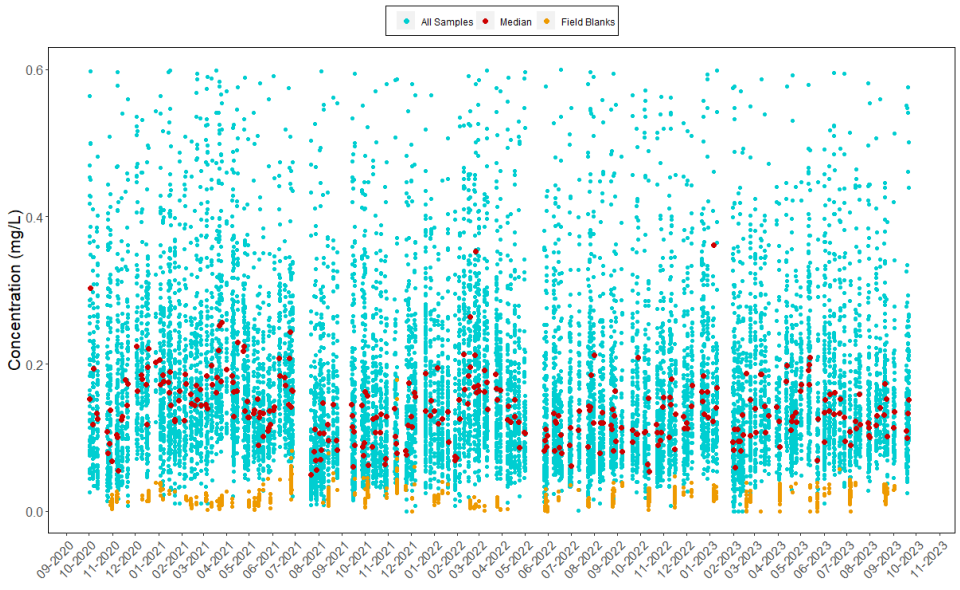
Note: Nominal reporting limit is 0.008 mg/L

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



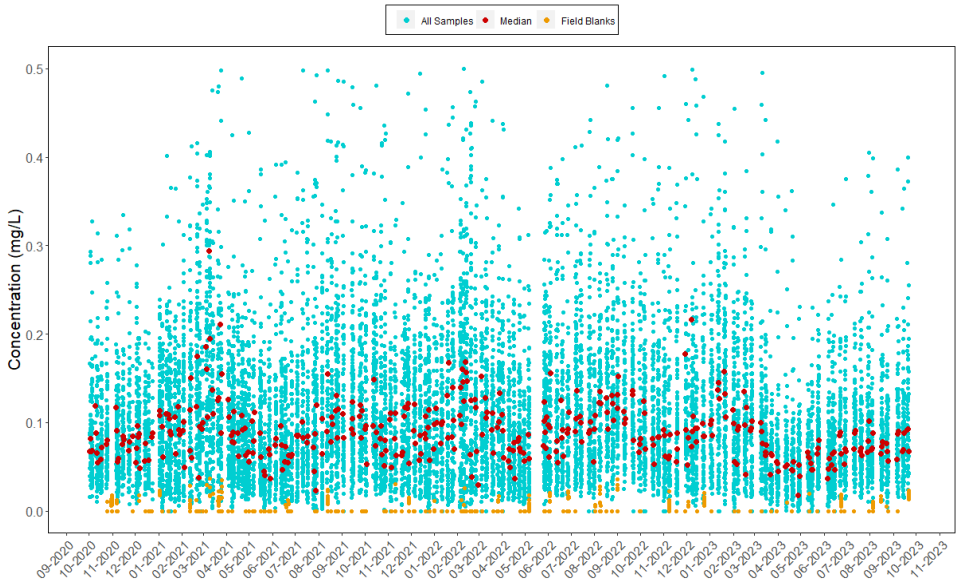
Note: Nominal reporting limit is 0.020 mg/L

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



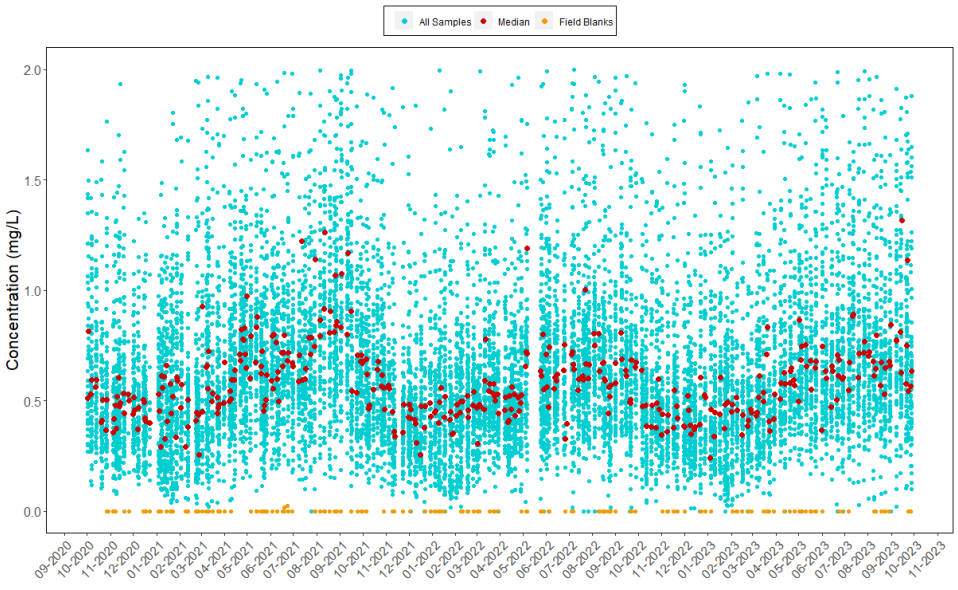
Note: Nominal reporting limit is 0.040 mg/L

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



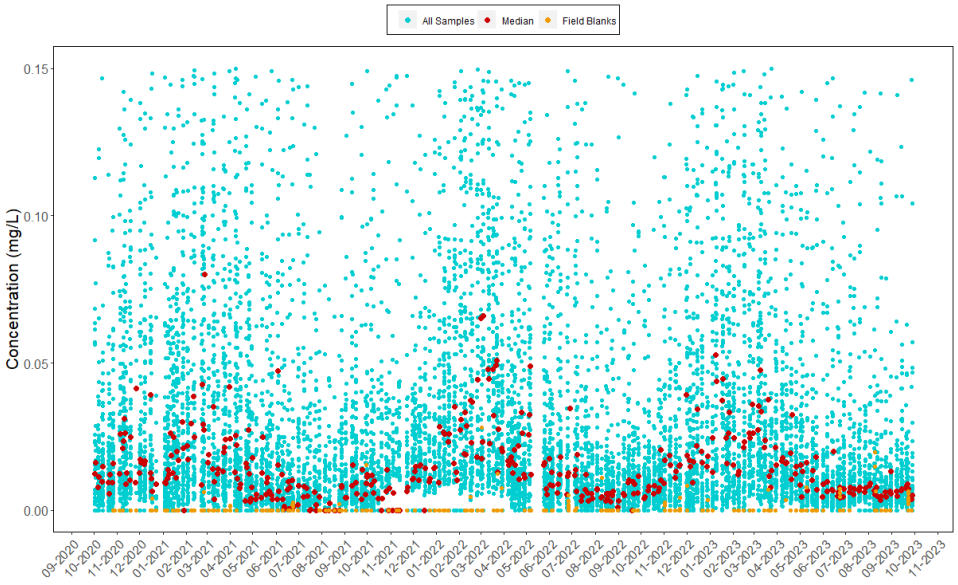
Note: Nominal reporting limit is 0.040 mg/L

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



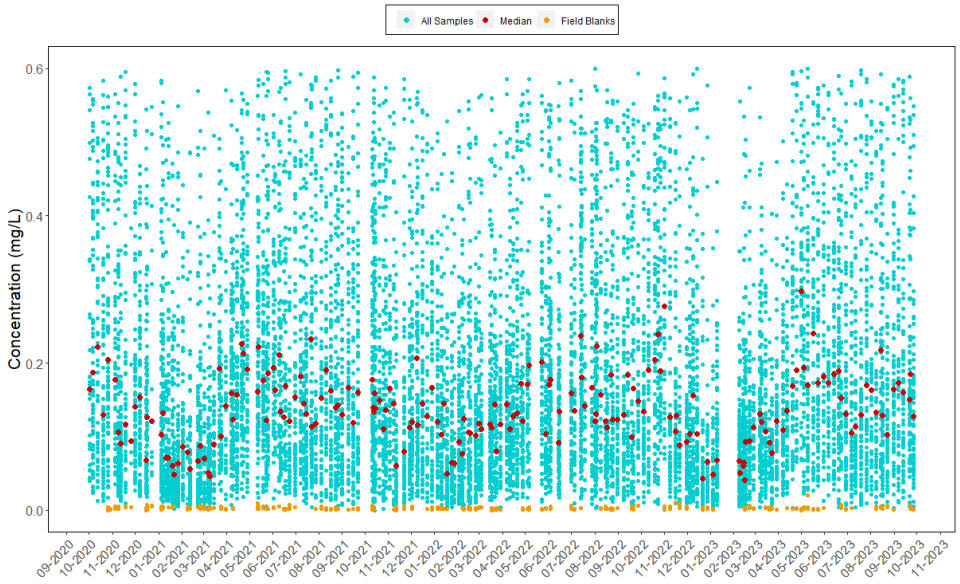
Note: Nominal reporting limit is 0.040 mg/L

Figure 20. Concentrations of Cl^- from Teflon Filters



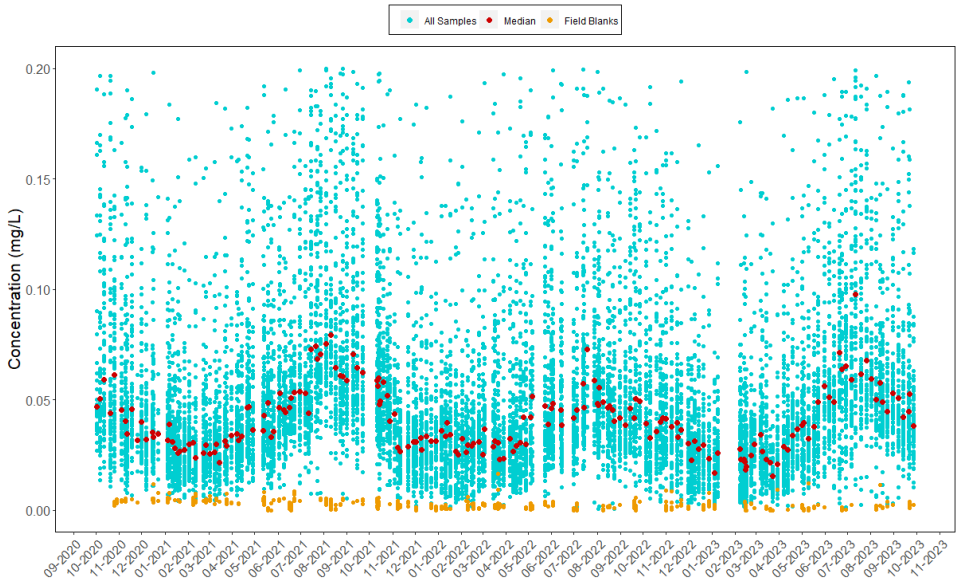
Note: Nominal reporting limit is 0.020 mg/L

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



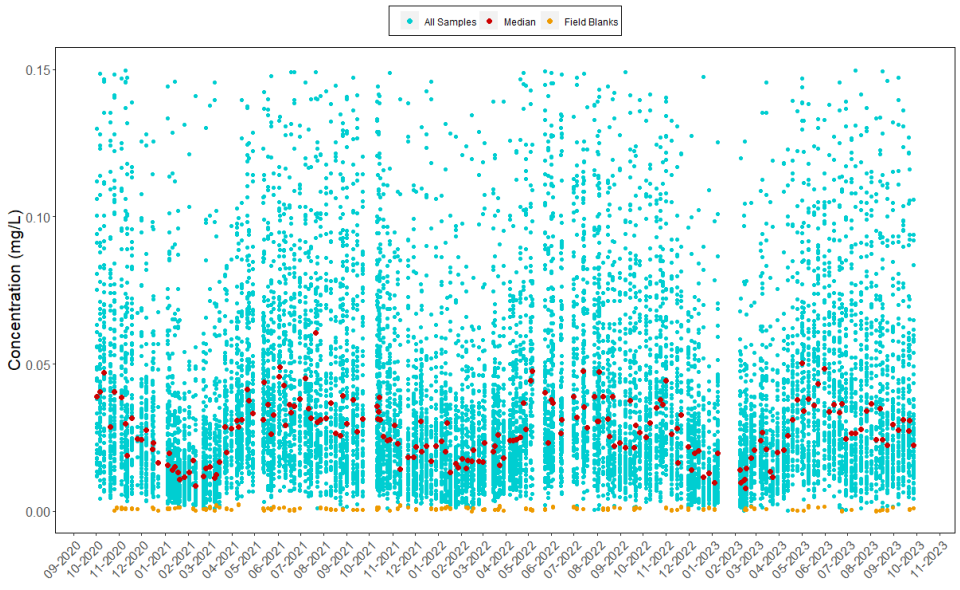
Note: Nominal reporting limit is 0.006 mg/L

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



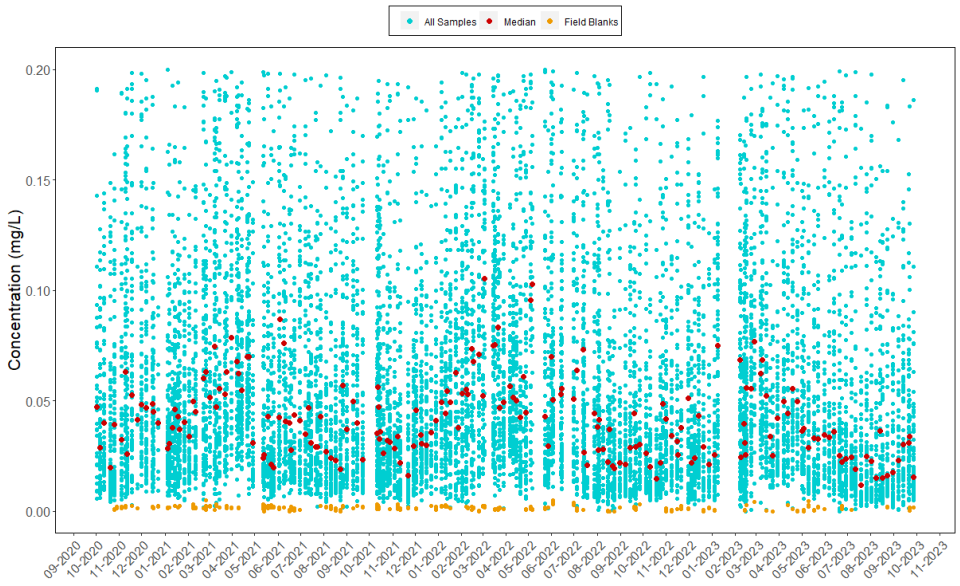
Note: Nominal reporting limit is 0.006 mg/L

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 time 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

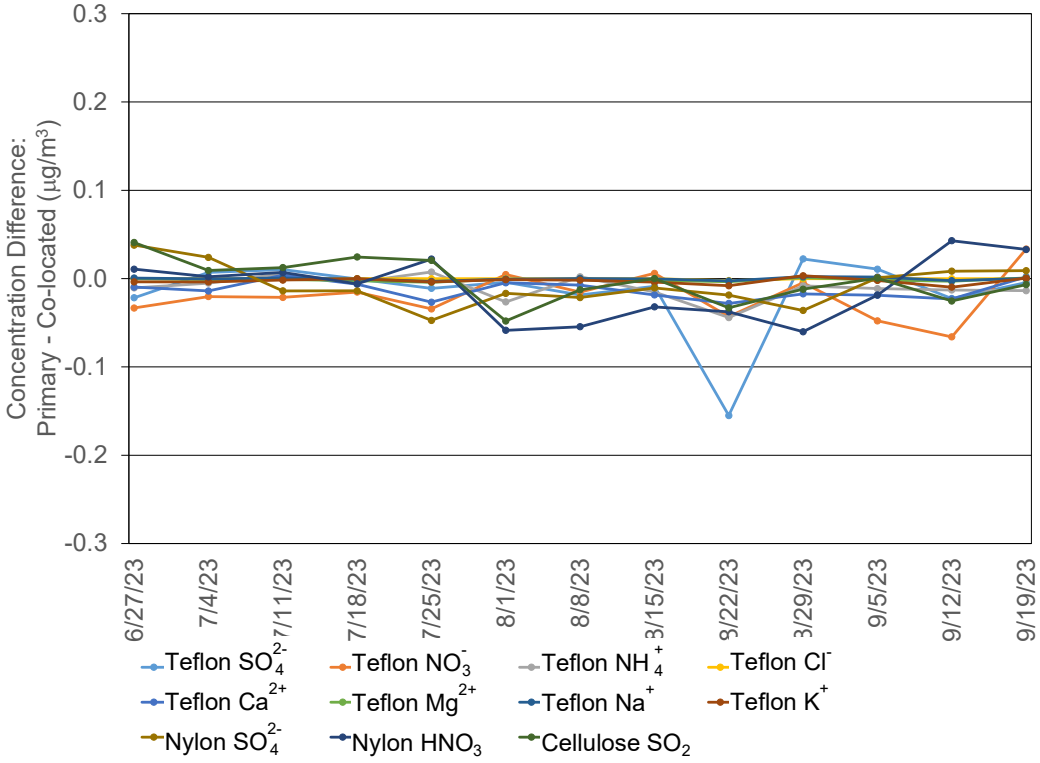
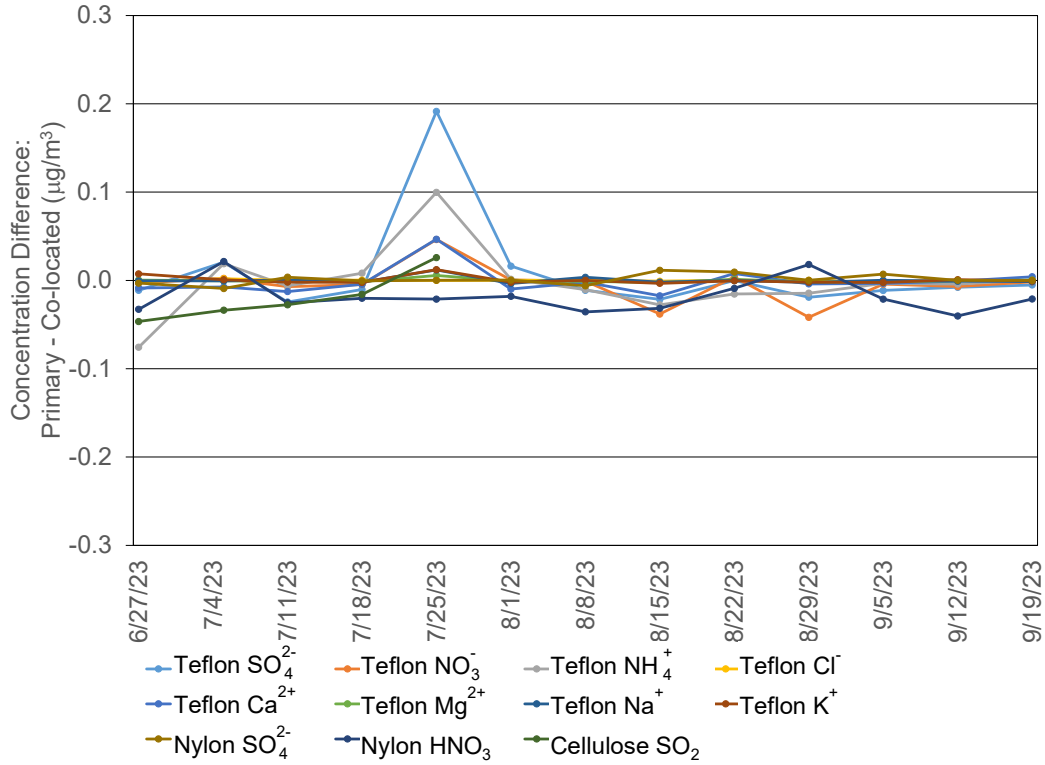


Figure 26. Time Series of Filter Concentration Differences between ROM406 and ROM206, CO



Precision of Filter Pack Concentrations

Table 3 shows mean absolute relative percent differences (MARPD) for concentrations measured at MCK131/231 and ROM406/206 during third quarter 2023. The MARPD values met the 20 percent criterion. Note that SO_2 measurements were discontinued at ROM206.

Table 3. Precision (MARPD) for Co-located Filter Pack Data during Third 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											
$\overline{X}$ (µg/m^3)	1.07	0.82	0.26	0.50	0.37	1.31	0.26	0.04	0.03	0.09	0.03
$\overline{Y}$ (µg/m^3)	1.10	0.83	0.28	0.52	0.37	1.33	0.27	0.04	0.03	0.10	0.03
MAD	0.04	0.03	0.03	0.01	0.03	0.02	0.01	0.00	0.00	0.00	0.00
MARPD	4.17	4.09	10.28	2.46	7.24	1.39	5.31	4.40	5.05	3.80	0.92
ROM406/206, CO											
$\overline{X}$ (µg/m^3)	0.61	0.46	0.16	0.22		0.53	0.16	0.02	0.03	0.04	0.02
$\overline{Y}$ (µg/m^3)	0.64	0.48	0.16	0.22	0.17	0.52	0.16	0.02	0.03	0.04	0.02
MAD	0.04	0.03	0.02	0.03		0.04	0.01	0.00	0.00	0.00	0.00
MARPD	6.72	7.55	10.78	13.83		7.21	8.77	9.76	11.57	8.68	4.73

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 Third 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
ALB801, AB	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	Two weeks were not sampled due to field issues.
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.
BEL116, MD	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	Power failure affected two samples.
BWR139, MD	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	There were three 2-week samples during the quarter.
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.
CND125, NC	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	The site had data logger issues due to low voltage from the battery pack. These affected three samples
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	76.9	76.9	76.9	76.9	76.9	76.9	76.9	30.8	Power failure affected three samples along with August cessation of SO_2 analyses for NPS sponsored sites.
KIC003, KS	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	This site collected two samples during the quarter before being decommissioned.
NIC001, NY	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	There were two 2-week samples during the quarter. Another sample was invalidated for suspect data.
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.
SHE604, WY	46.2	46.2	46.2	46.2	46.2	46.2	46.2	46.2	The flow pump and the mass flow controller failed. Both were replaced. Seven samples were affected.
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.
VIN140, IN	84.6	84.6	84.6	84.6	84.6	84.6	84.6	84.6	The mass flow controller malfunctioned and was replaced. Two samples were affected.

Table 4. Sites with less than 90 Percent Data Completeness for Filter Concentrations for Third 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
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.
YOS404, CA	53.8	53.8	53.8	53.8	53.8	53.8	53.8	30.8	The mass flow controller malfunctioned and was replaced. Six samples were affected. SO_2 analyses were suspended for NPS sponsored sites beginning in August.

Precision of Ozone Concentrations

Time series of co-located hourly O_3 concentration differences for third 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

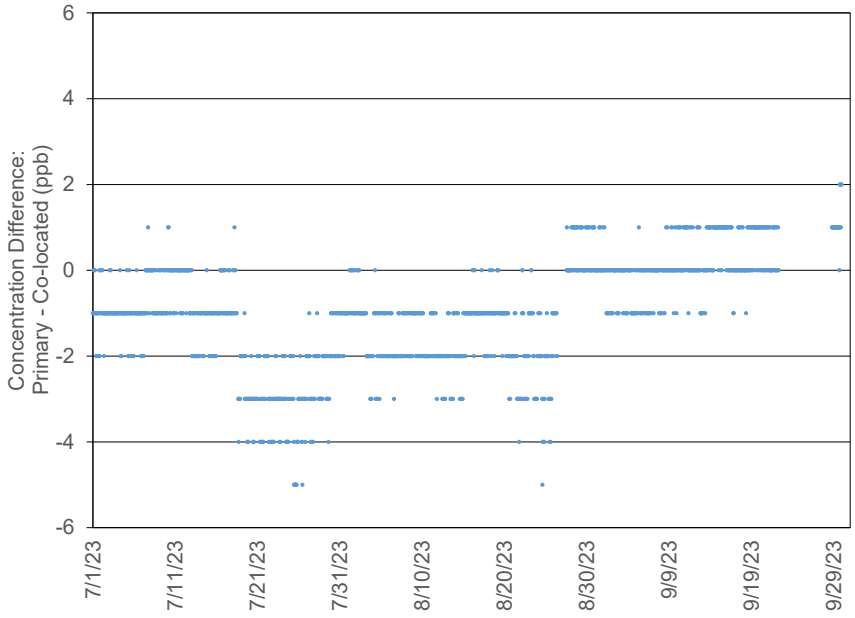


Figure 28. Time Series of the Difference in Co-located O_3 Concentrations for ROM406/206, CO

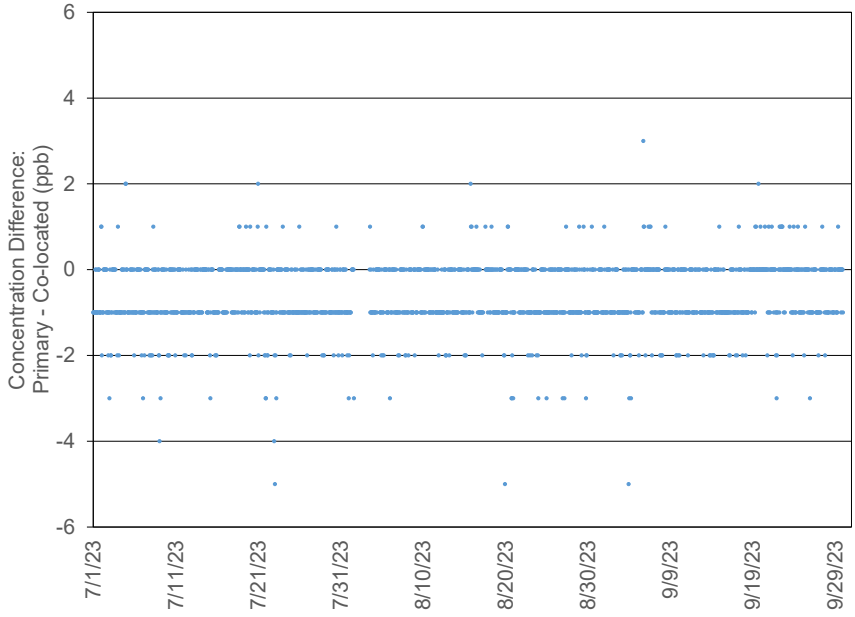


Table 5 gives MARPD data for O_3 data measured at the two co-located sites.

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

Site Pair	Quarter	Start Date	MARPD	Records
MCK131/231, KY				
	4	10/1/22	0.6	2098
	1	1/1/23	0.9	2040
	2	4/1/23	1.7	2036
	3	7/1/23	3.6	1912
ROM406/206, CO				
	4	10/1/22	1.5	1531
	1	1/1/23	1.2	2046
	2	4/1/23	1.6	2052
	3	7/1/23	1.6	2038

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 Third Quarter 2023

Site ID	Percent Completeness	Comments
ASH135, ME	0	Site mothballed due to EPA's FY2022 budget.
BEL116, MD	85	No power at the site from mid to late September.
BFT142, NC	85	Communications issues occurred in late August. The pressure transducer malfunctioned mid-September and was replaced.
CAV436, NM	84	Calibration checks were outside of data acceptance criteria from late June through mid-July
CDR119, WV	0	Site mothballed due to EPA's FY2022 budget.
CDZ171, KY	0	Site mothballed due to EPA's FY2022 budget.
CND125, NC	66	High bench temperatures were measured late July to late August due to issues with site air conditioning. Repairs were completed August 25.
CVL151, MS	87	Ozone data collection was interrupted from early to mid-August due to data logger issues. Data collection resumed following data logger reboot.
DCP114, OH	0	Site mothballed due to EPA's FY2022 budget.
ESP127, TN	87	The data logger required resetting on four separate occasions during the quarter.
HWF187, NY	0	Site mothballed due to EPA's FY2022 budget.
JOT403, CA	83	Power was down at the site from mid-September through early November
MCK231, KY	88	The ozone dryer was broken on 9/22/2023, and the Nafion dryer was bypassed on 9/29/2023.
NEC602, WY	83	Data were invalid from late July 25 through early August due to an instrument malfunction
NPT006, ID	86	There were communications issues in mid-September and a power failure in late September.
PND165, WY	87	High bench temperatures occurred mid to late September.
PNF126, NC	0	Site mothballed due to EPA's FY2022 budget.
SHN418, VA	86	Calibration checks were outside data acceptance criteria from late June through mid-July
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	Q3 2023	Q4 2022 – Q3 2023	Comments
ASH135, ME	0	0	Site mothballed due to EPA's FY2022 budget.
BEL116, MD	88	96	No power at the site from mid to late September.
BFT142, NC	88	96	Communications issues occurred in late August. The pressure transducer malfunctioned mid-September and was replaced.
CAV436, NM	84	93	Calibration checks were outside data acceptance criteria from late June through mid-July
CDR119, WV	0	0	Site mothballed due to EPA's FY2022 budget.
CDZ171, KY	0	0	Site mothballed due to EPA's FY2022 budget.
CND125, NC	69	89	High bench temperatures occurred late July to late August due to issues with site air conditioning. Repairs were completed August 25.
CVL151, MS	88	93	Ozone data collection was interrupted from early to mid-August due to data logger issues. Data collection resumed following data logger reboot.
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	81	94	Power was down at the site from mid-September through early November
NEC602, WY	84	95	Data were invalid from late July 25 through early August due to an instrument malfunction
NPT006, ID	88	94	There were communications issues in mid-September and a power failure in late September.
PNF126, NC	0	0	Site mothballed due to EPA's FY2022 budget.
SHN418, VA	87	90	Calibration checks were outside data acceptance criteria from late June through mid-July
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 six of the eight 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 2.98 at GRS420 to 6.32 at PND165. No data were available from HWF187 and PNF126 for third quarter 2023. These sites were mothballed in May 2022 due to EPA's budget constraints.

Table 8. Summary of Total NO_3^-/NO_y Measurements for Q3 2023

Site ID	Elevation	Total NO_3^- (ppb)	NO_y (ppb)	Ratio
DUK008, NC	164*	0.34	2.01	5.92
BVL130, IL	213	0.65	2.57	4.00
MAC426, KY	243	0.36	1.81	4.42
HWF187, NYϕ	497	Site mothballed due to EPA's FY2022 budget.		
GRS420, TN	793	0.34	1.01	2.98
PNF126, NCϕ	1216	Site mothballed due to EPA's FY2022 budget.		
PND165, WY	2386	0.15	0.87	6.32
ROM206, CO	2742	0.19	1.04	5.65

Note: *The inlet of the enhanced NO_y monitor is located at the top of the 30-meter tower.
ϕThe site was mothballed in second quarter 2022 due to EPA's FY2022 budget. No measurements were recorded during third quarter 2023.

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

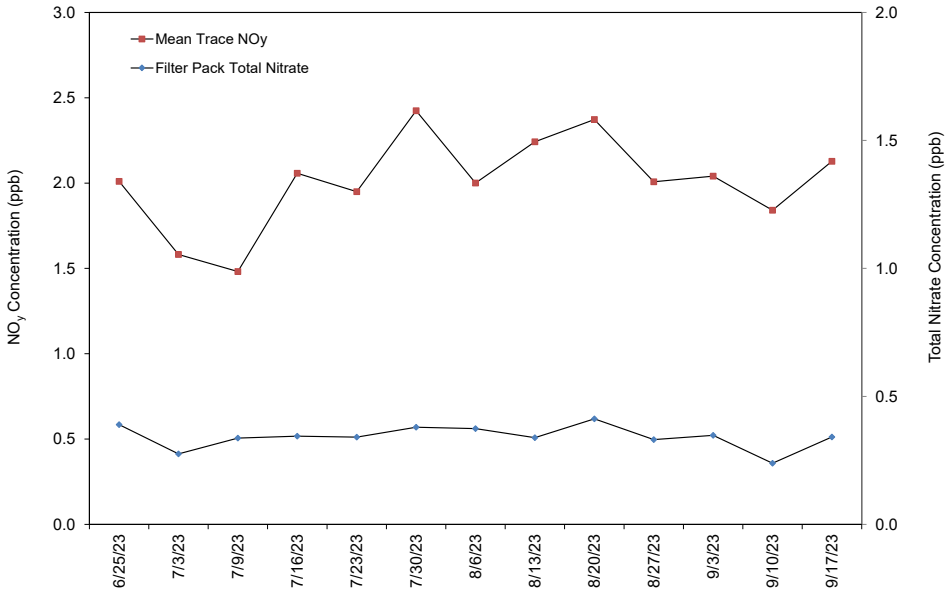


Figure 30. Comparison of BVL130 Weekly Mean NO_y and Total NO_3^- Concentrations

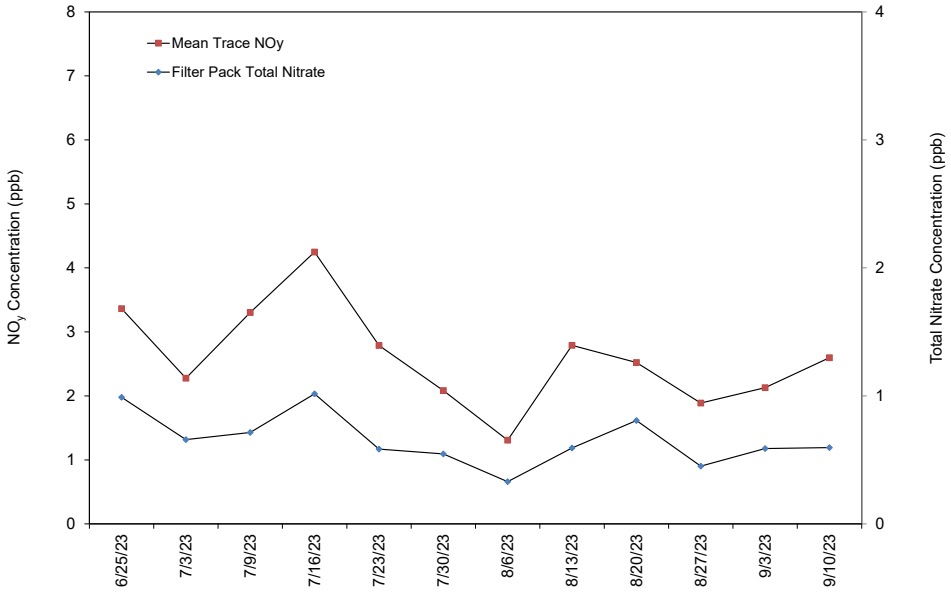


Figure 31. Comparison of MAC426 Weekly Mean NO_y and Total NO_3^- Concentrations

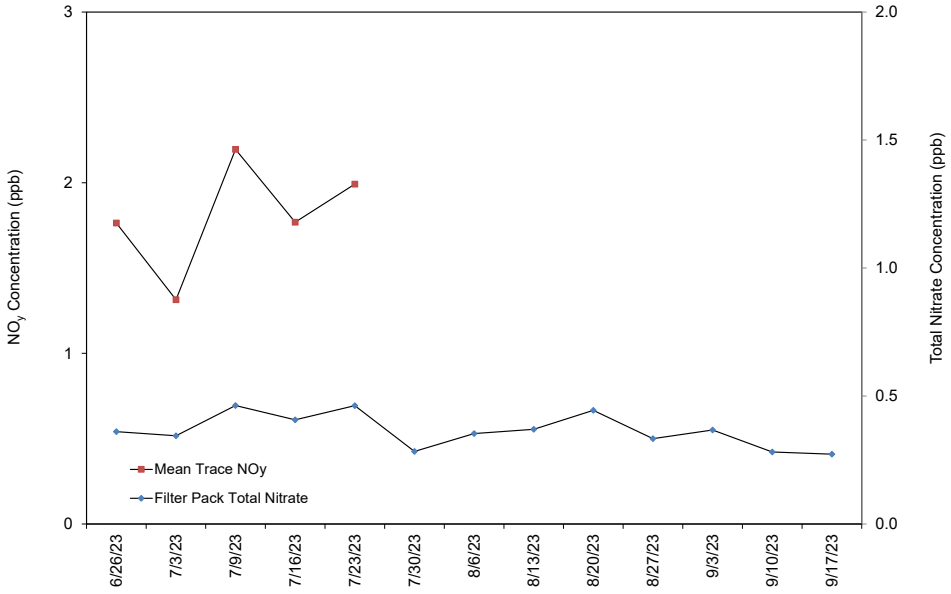


Figure 32. Comparison of HWF187 Weekly Mean NO_y and Total NO_3^- Concentrations

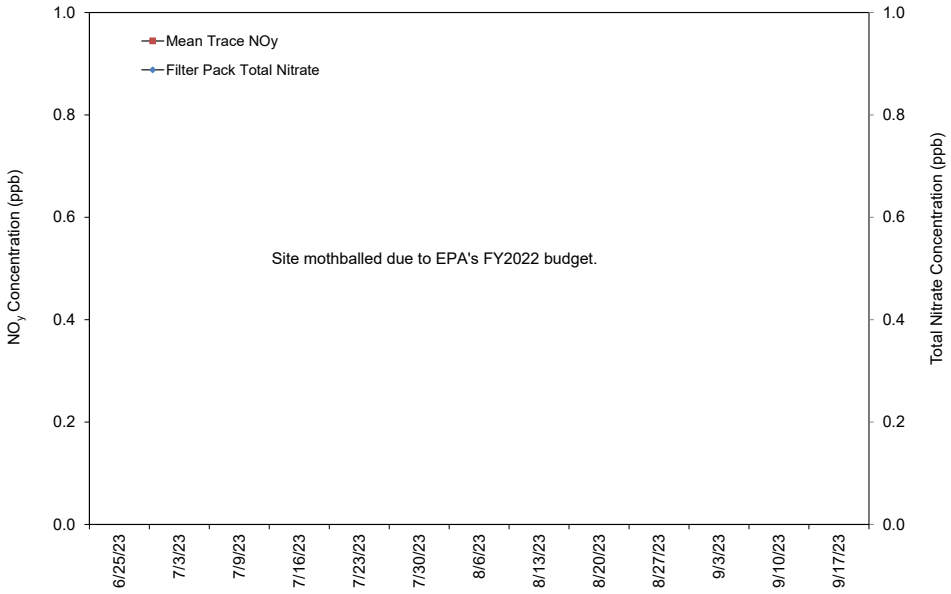


Figure 33. Comparison of GRS420 Weekly Mean NO_y and Total NO_3^- Concentrations

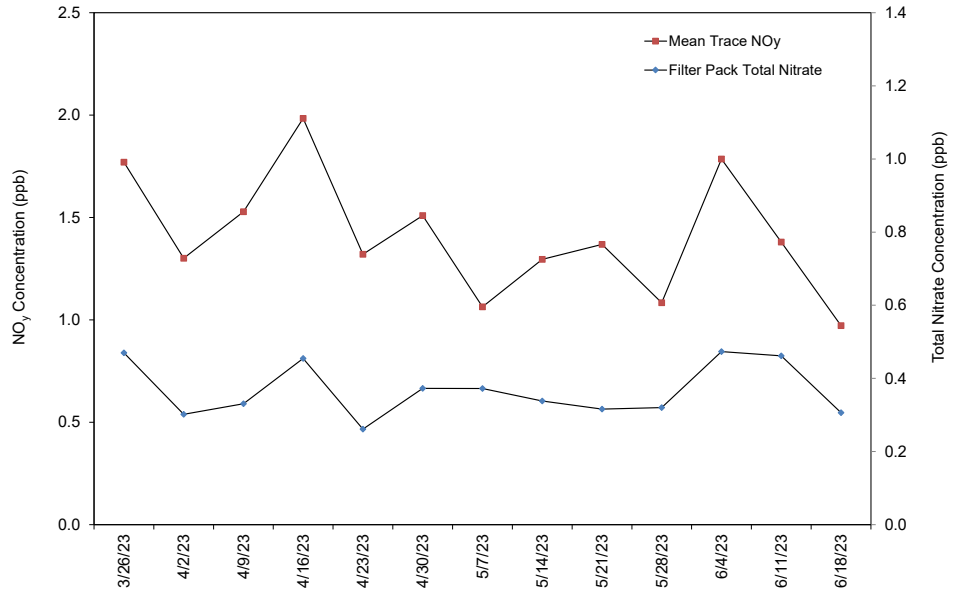


Figure 34. Comparison of PNF126 Weekly Mean NO_y and Total NO_3^- Concentrations

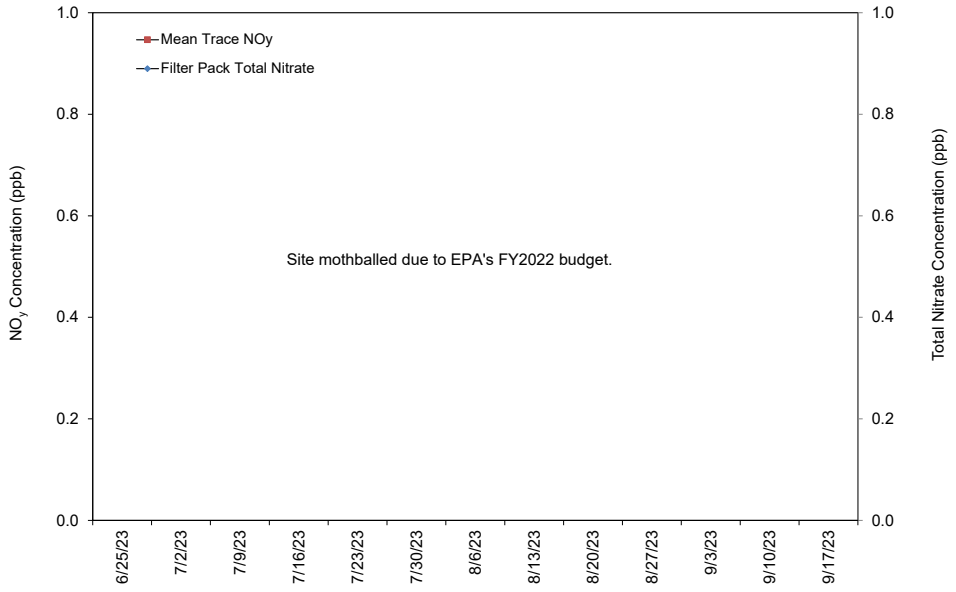


Figure 35. Comparison of PND165 Weekly Mean NO_y and Total NO_3^- Concentrations

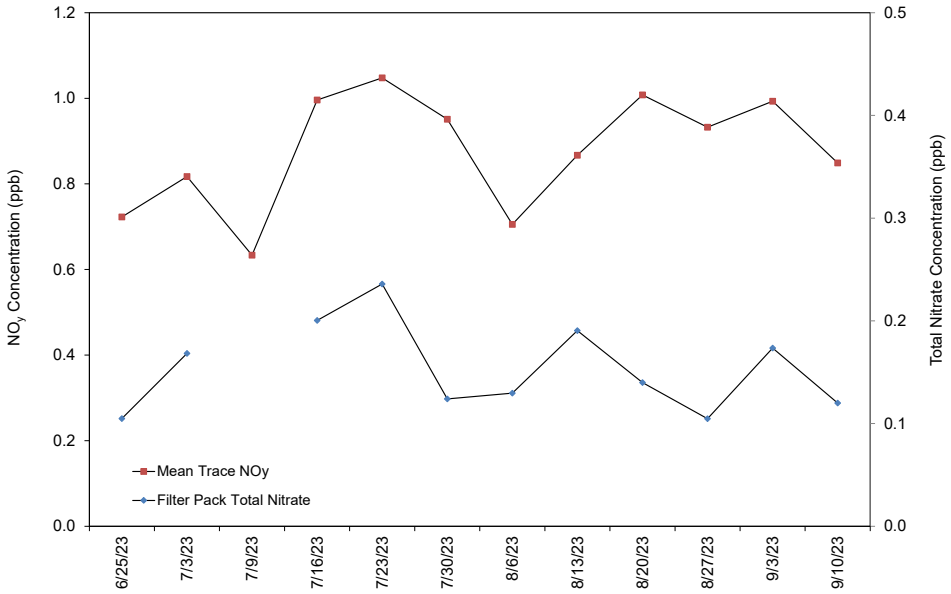
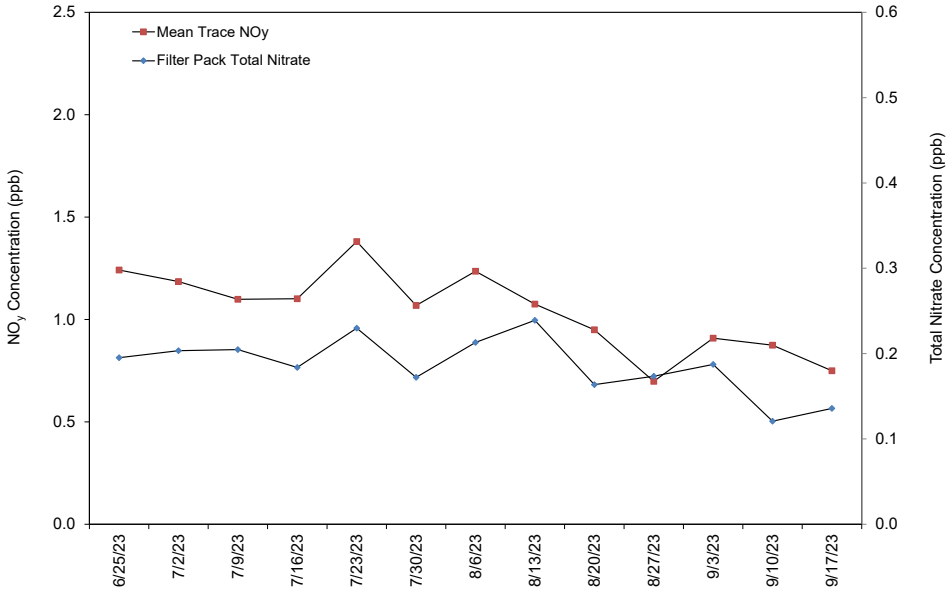


Figure 36. Comparison of ROM206 Weekly Mean NO_y and Total NO_3^- Concentrations



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 generally higher than filter pack concentrations at BVL130. Data completeness was insufficient at MAC426 and GRS420. Quarter 3 is the last quarter with reported continuous SO_2 concentrations, as the National Park Service (NPS) is discontinuing the measurements.

Figure 37. Comparison of BVL130 Weekly Mean SO_2 Concentrations

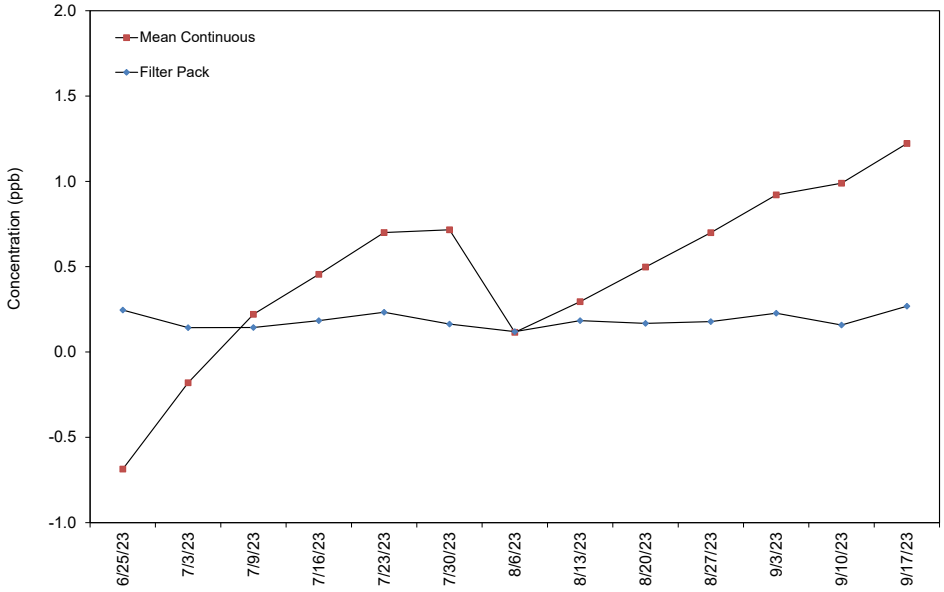


Figure 38. Comparison of MAC426 Weekly Mean SO_2 Concentrations

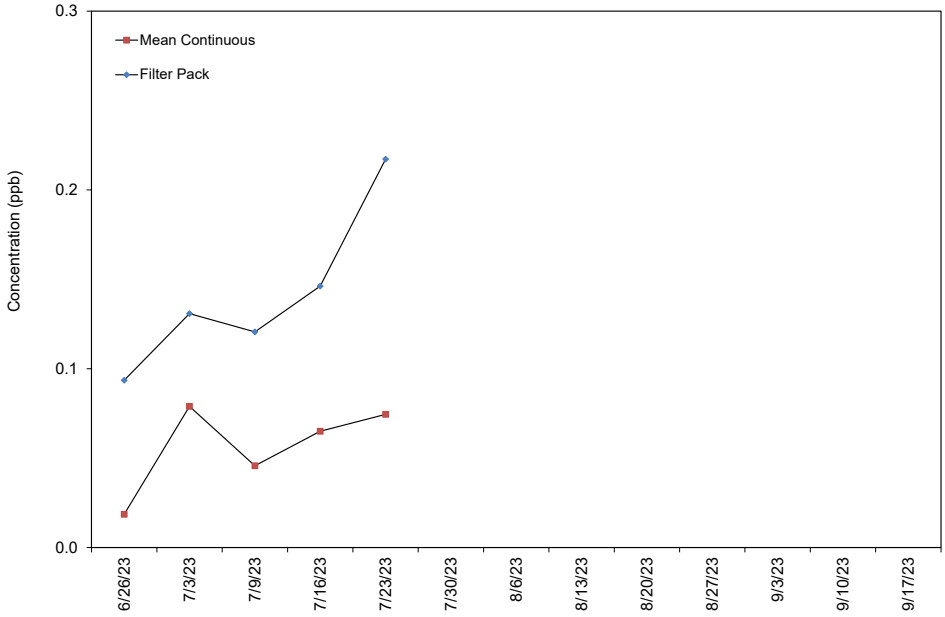
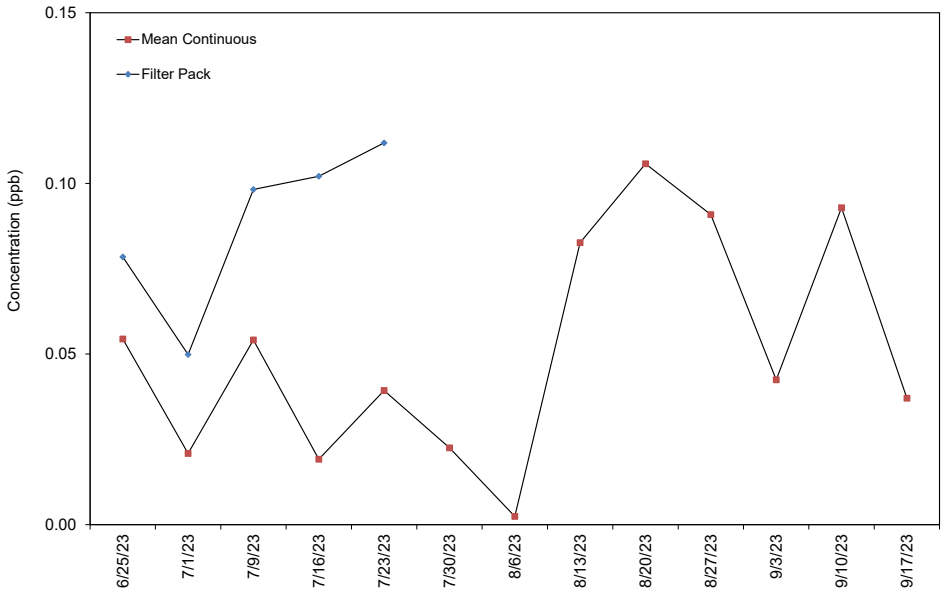


Figure 39. Comparison of GRS420 Weekly Mean SO_2 Concentrations



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 third quarter 2023. The average for fourth quarter 2022 through third 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	Q3 2023	Q4 2022–Q3 2023	Comments
BVL130, IL	CO	90	56	
	NO	85	81	Data logger communication issue affected data in late July. Suspect data were invalidated in mid-August. Analyzer flow was restricted mid-September due to the erroneous inclusion of an extra internal filter during routine maintenance.
	NOY	85	75	
	NOYDIF	85	75	
	SO2_GA	80	84	Calibration drift occurred early August. Analyzer was recalibrated mid-August.
CHC432, NM	NO	92	96	
	NOX	92	96	
	NOXDIF	92	96	
DUK008, NC	HNO3	88	71	Calibration performed over several days in late July resulted in invalid data during those activities. In addition, data were invalidated during each ZPS (NH_3 and NO_y).
	NH3	88	80	
	NO	88	82	
	NO2_TRUE	88	82	
	NOX_TRUE	88	82	
	NOY	88	82	
	NOY_MINUS	88	71	
	NOYDIF	88	82	
	TNX	88	80	

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

Site ID	Parameter	Q3 2023	Q4 2022–Q3 2023	Comments
GRS420, TN	CO	83	91	All gaseous data were invalid in late July because the network switch failed. CO data were invalid because precision checks were outside data acceptance criteria in early August. NO/NO_y data were invalid early to mid-September due to calibration checks that were outside data acceptance criteria. SO_2 data were invalid early September because the analyzer locked up.
	NO	82	92	
	NOY	82	92	
	NOYDIF	82	91	
	SO2_GA	85	72	
HWF187, NY	NO	0	0	Site mothballed due to EPA's FY2022 budget.
	NOY	0	0	
	NOYDIF	0	0	
MAC426, KY	CO	32	74	Monitoring for enhanced gaseous parameters ended at this site on July 31, 2023.
	NO	33	80	
	NOY	33	80	
	NOYDIF	33	80	
	SO2_GA	33	75	
PND165, WY	NO	88	92	The analyzer malfunctioned in early July. In addition, shelter temperature criteria were exceeded frequently from mid to late September due to a failing air conditioner. The unit was replaced in late September.
	NOY	88	91	
	NOYDIF	88	91	
PNF126, NC	NO	0	0	Site mothballed due to EPA's FY2022 budget.
	NOY	0	0	
	NOYDIF	0	0	
ROM206, CO	NO	94	93	
	NOY	94	93	
	NOYDIF	94	93	

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) Third Quarter 2023 Quality Assurance Report. https://java.epa.gov/castnet/documents.do