

# Clean Air Status and Trends Network (CASTNET) Quarterly Data Summary for Third Quarter 2022 (July through September)

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## Introduction

This quarterly report summarizes the Clean Air Status and Trends Network (CASTNET) data collected during third quarter 2022. Trends in pollutants measured at eastern and western reference sites are shown. Results from the quality assurance/quality control (QA/QC) program are presented for third quarter data and include completeness and precision of filter concentrations and hourly O<sub>3</sub> concentrations. This report also analyzes data for continuous, trace-level NO<sub>y</sub> from the six of eight sites that were operational during third quarter and continuous SO<sub>2</sub> concentrations from three sites. Other QC statistics are given in the CASTNET Third Quarter 2022 Quality Assurance Report (Wood, 2022).

**Figure 1.** Fourth Highest Daily Maximum 8-hour Average O<sub>3</sub> Concentrations (ppb) through Third Quarter 2022



Figure 1 shows fourth highest daily maximum 8-hour average (DM8A) O<sub>3</sub> concentrations measured through third quarter 2022. Five sites exceeded the 0.070 parts per million National Ambient Air Quality Standard for O<sub>3</sub>. Sites that did not meet data completeness are shown as dots with no value. As of May 10, 2022, ozone sampling was discontinued at seven sites due to EPA’s Fiscal Year 2022 budget constraints.

**Trends**

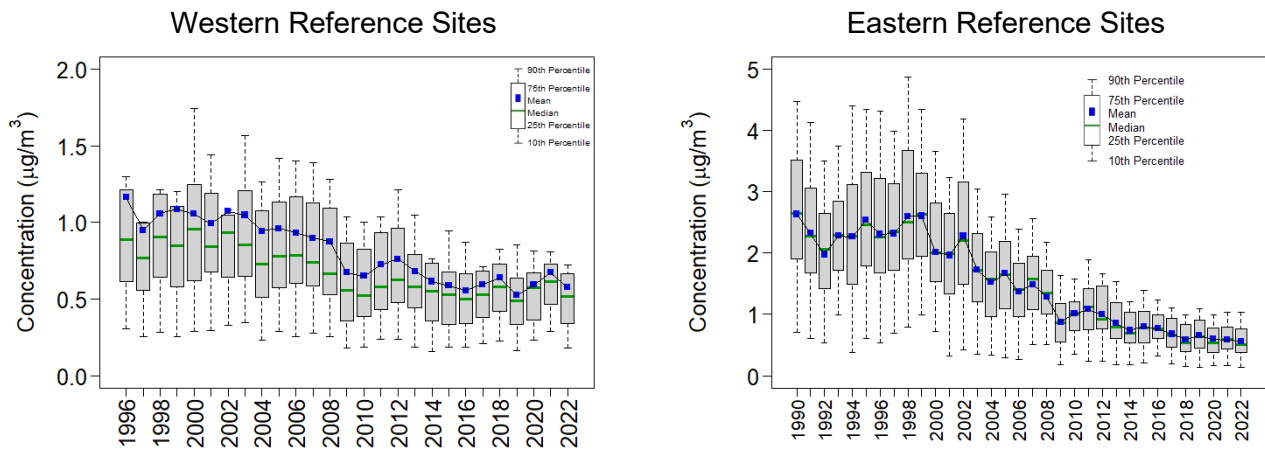
Trend analyses were performed based on filter pack pollutant concentrations measured in micrograms per cubic meter (µg/m<sup>3</sup>) of air at the 34 eastern and 16 western reference sites during third quarter. Trends in quarterly mean filter pack and O<sub>3</sub> concentrations are shown using box plots in Figures 2 through 13.

**Third Quarter Concentrations**

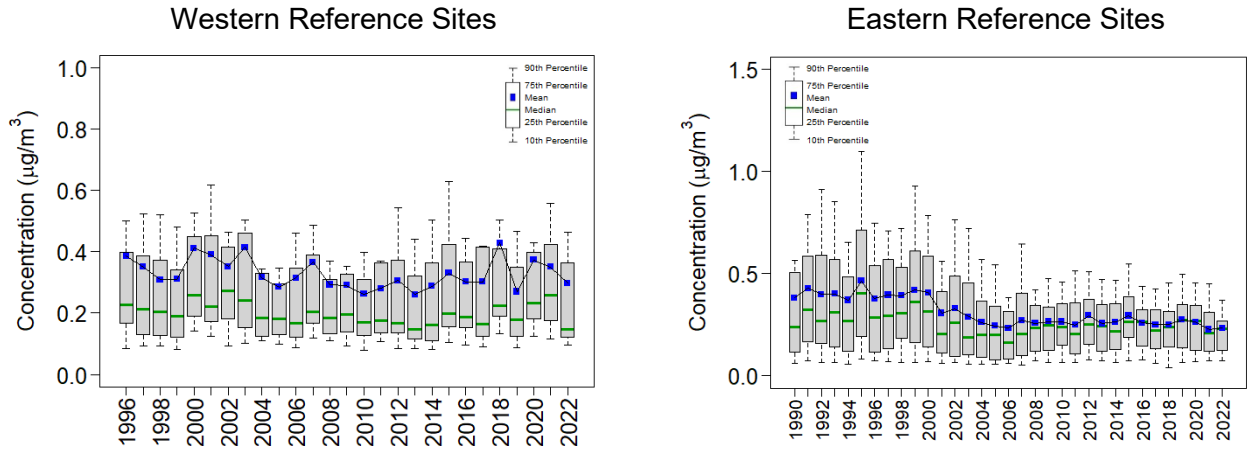
Quarterly mean HNO<sub>3</sub>, NH<sub>4</sub><sup>+</sup>, total NO<sub>3</sub><sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, Cl<sup>-</sup>, Ca<sup>2+</sup>, K<sup>+</sup>, Mg<sup>2+</sup>, and Na<sup>+</sup> concentrations decreased at eastern sites in 2022 while NO<sub>3</sub><sup>-</sup>, and SO<sub>2</sub> concentrations increased. All quarterly mean concentrations decreased at western sites in 2022.

Quarterly O<sub>3</sub> concentrations were analyzed using box plots constructed by averaging all valid hourly O<sub>3</sub> concentrations within third quarter 2022 by site and then averaging those averages for all eastern and western reference sites (Figure 13). The figure shows an overall reduction in quarterly mean O<sub>3</sub> concentrations at eastern sites. Mean O<sub>3</sub> concentrations at western sites show an overall decrease and an increase in third quarter 2022. Quarterly mean concentrations were higher at the western reference sites than at the eastern sites.

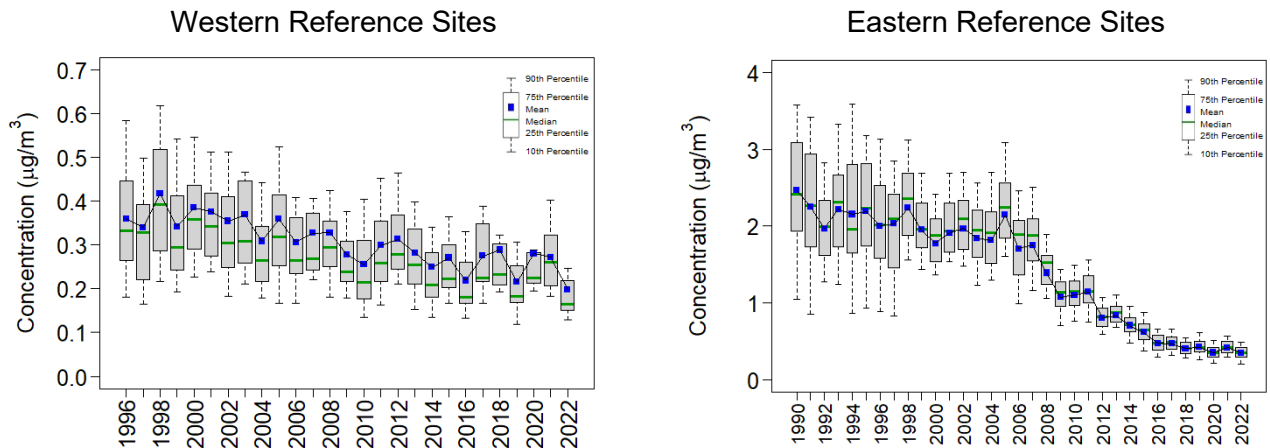
**Figure 2.** Trends in Third Quarter Mean HNO<sub>3</sub> Concentrations



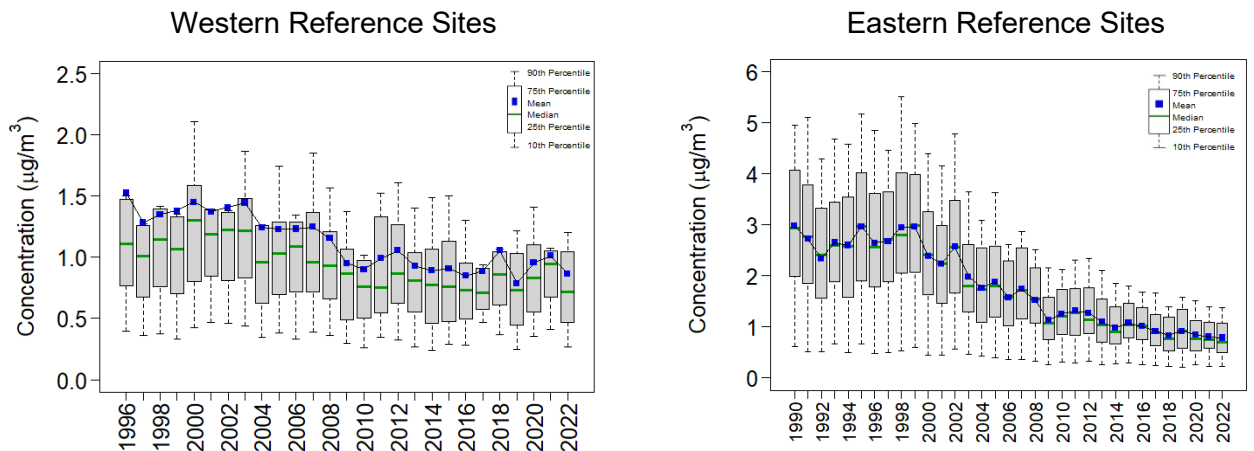
**Figure 3.** Trends in Third Quarter Mean NO<sub>3</sub> Concentrations



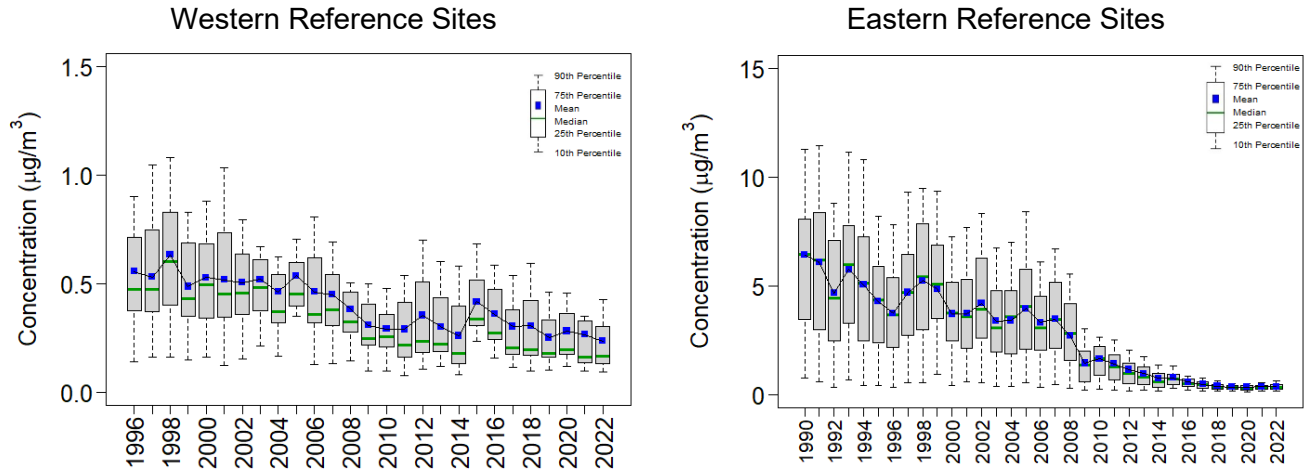
**Figure 4.** Trends in Third Quarter Mean NH<sub>4</sub><sup>+</sup> Concentrations



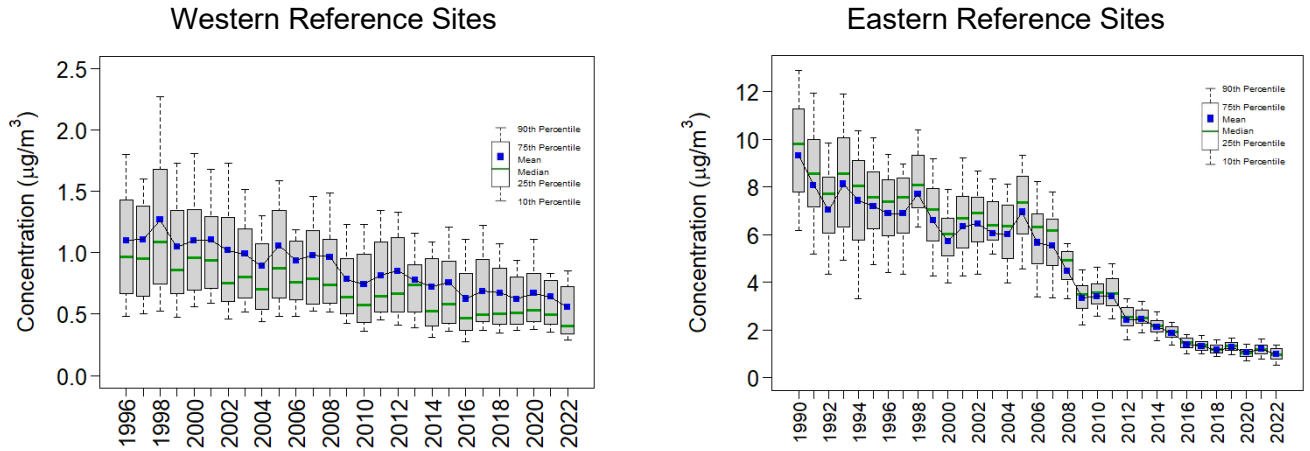
**Figure 5.** Trends in Third Quarter Mean Total NO<sub>3</sub> Concentrations



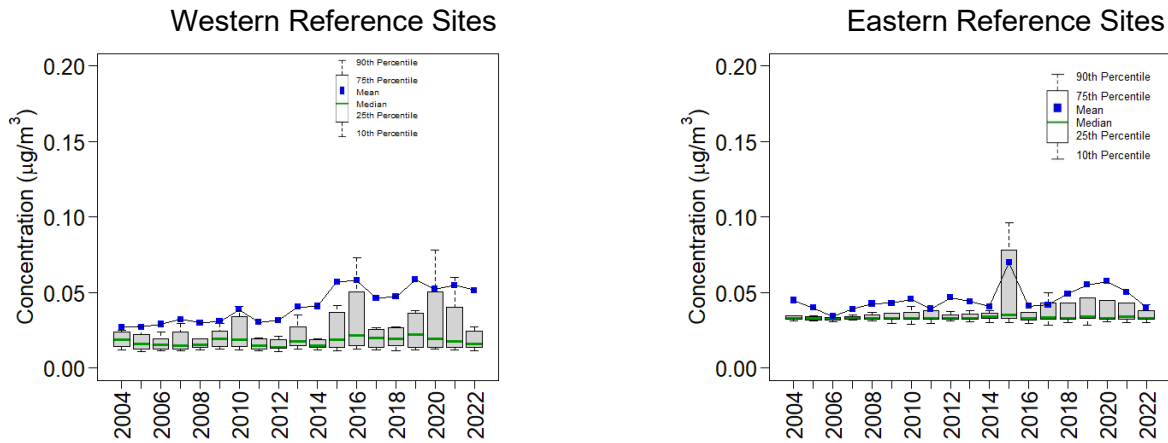
**Figure 6.** Trends in Third Quarter Mean SO<sub>2</sub> Concentrations



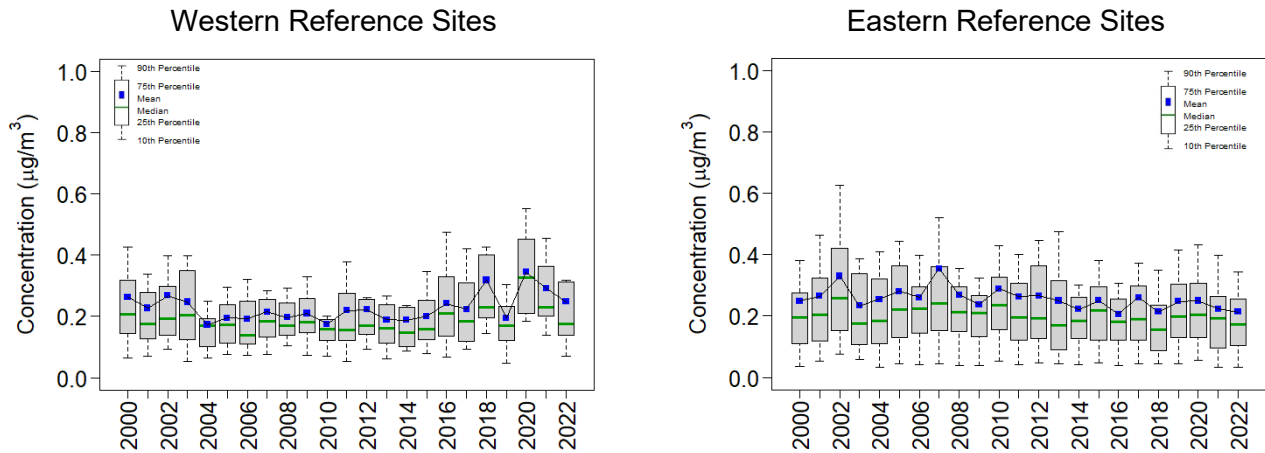
**Figure 7.** Trends in Third Quarter Mean SO<sub>4</sub><sup>2-</sup> Concentrations



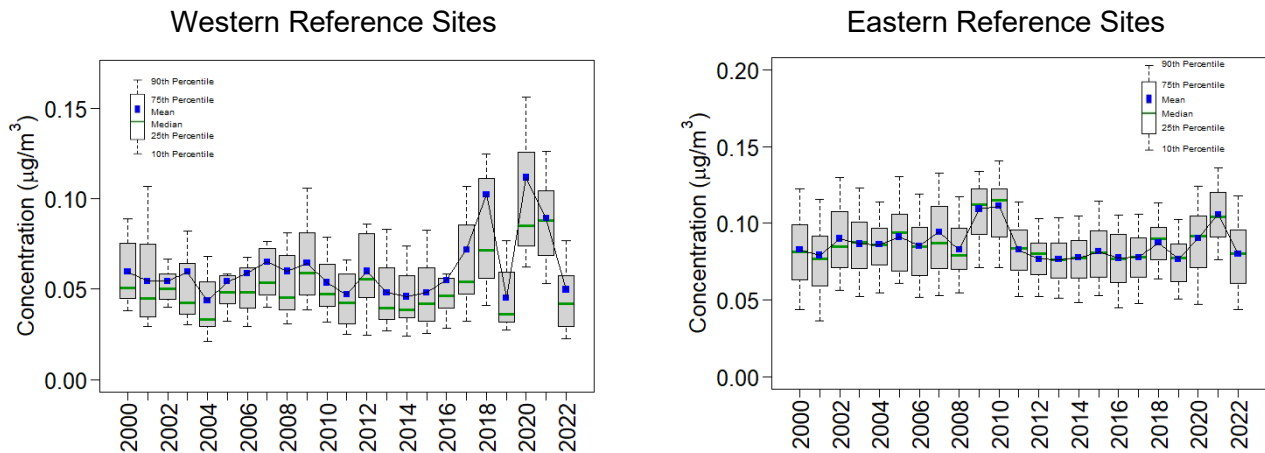
**Figure 8.** Trends in Third Quarter Mean Cl<sup>-</sup> Concentrations



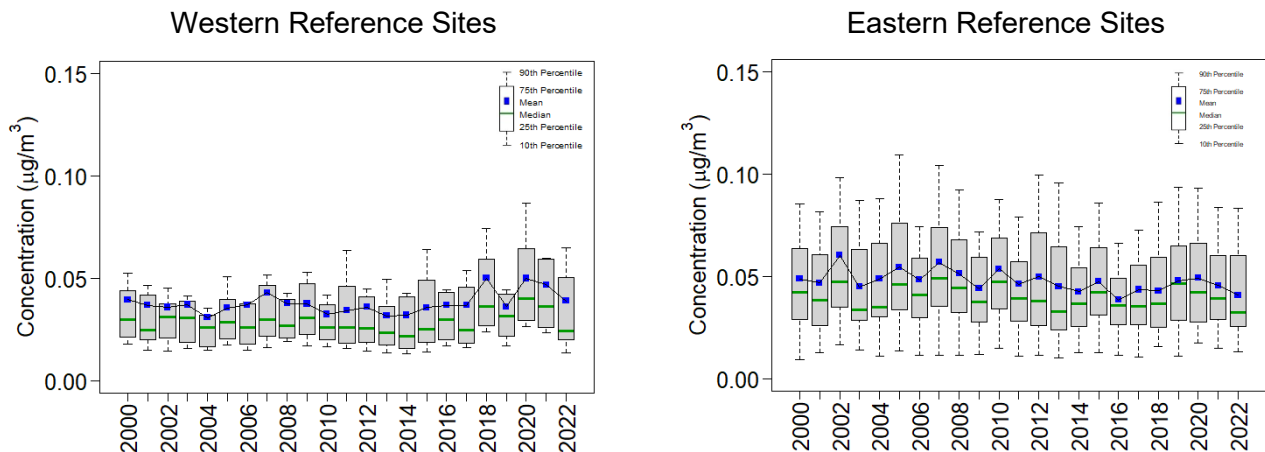
**Figure 9.** Trends in Third Quarter Mean Ca<sup>2+</sup> Concentrations



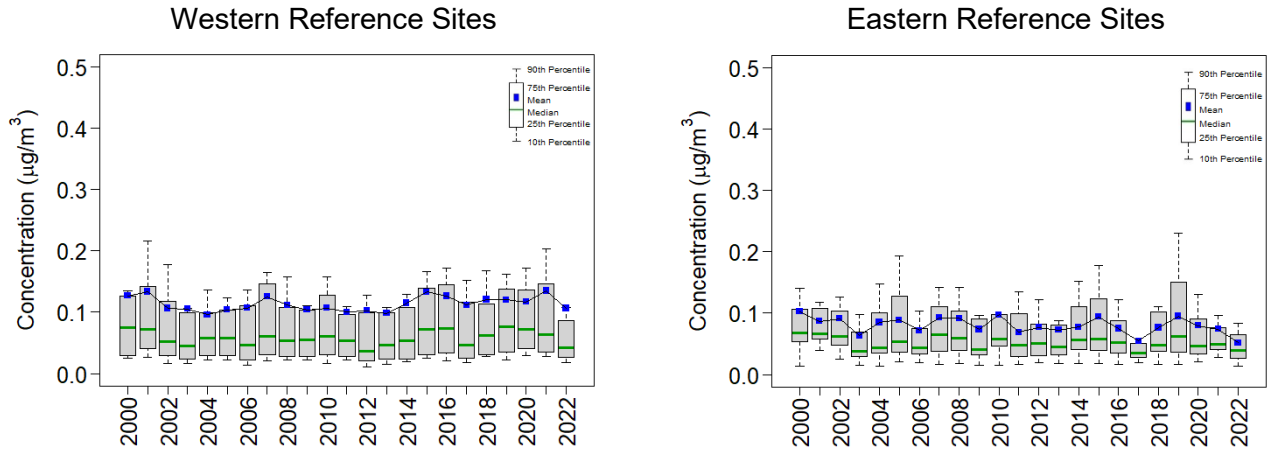
**Figure 10.** Trends in Third Quarter Mean K<sup>+</sup> Concentrations



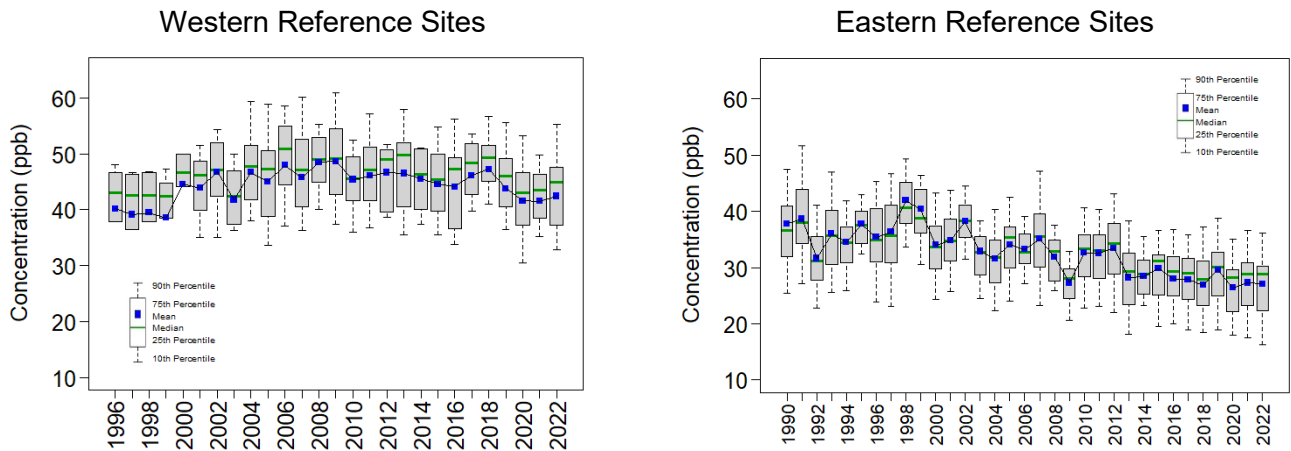
**Figure 11.** Trends in Third Quarter Mean Mg<sup>2+</sup> Concentrations



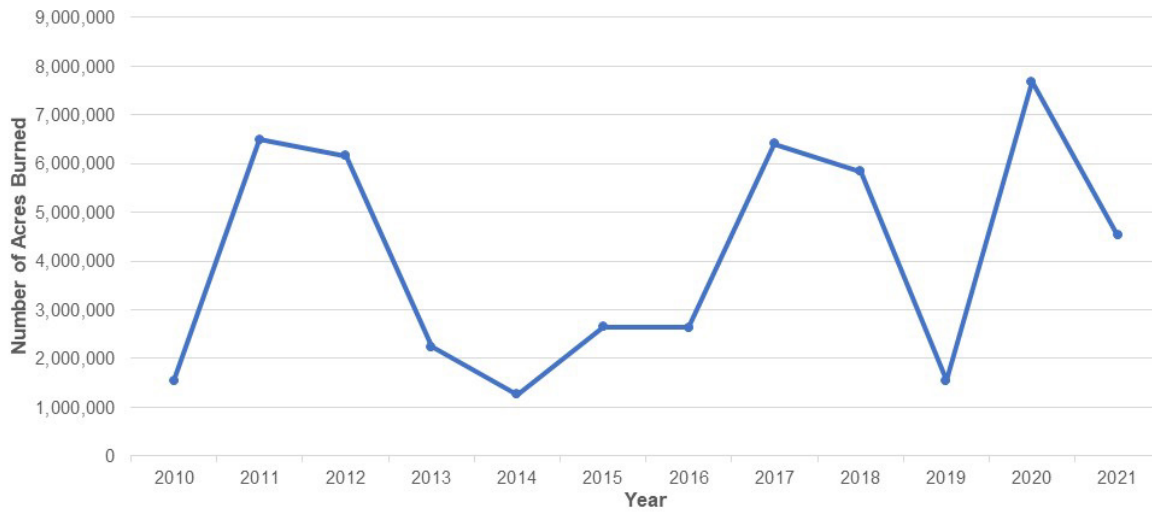
**Figure 12.** Trends in Third Quarter Mean Na<sup>+</sup> Concentrations



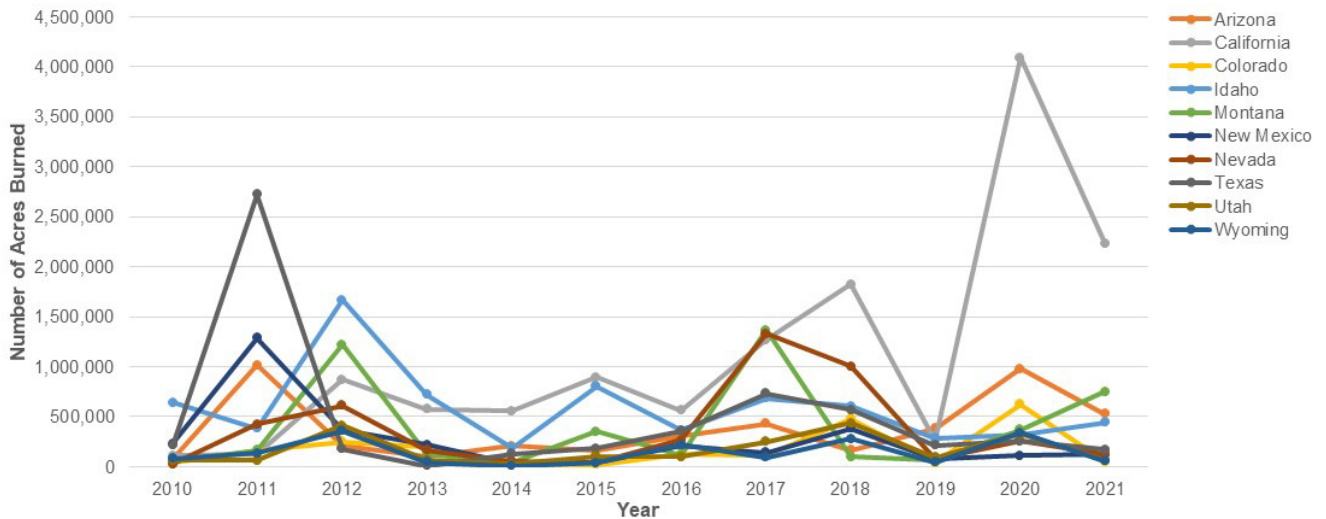
**Figure 13.** Trends in Third Quarter Mean O<sub>3</sub> Concentrations



**Figure 14.** Wildfire Acres Burned in 10 Western States (2010–2021)



**Figure 15.** Wildfire Acres Burned by Western State (2010–2021)



The box plots indicate that cations and nitrogen-based anions in the western United States declined significantly during third quarter 2019 (e.g., the western reference sites shown on the left side of Figures 2–5 and 9–11). Figures 14 and 15 show acres burned by western wildfires over the period 2010 through 2021. The two figures show a lower number of acres burned by wildfires in 2019. Presumably, wildfire emissions were lower during 2019, which resulted in lower pollutant concentrations. The number of acres burned by western wildfires peaked in 2020, and the peak followed by a lower number of acres burned in 2021 are also paralleled by a peak and then declining pollutant concentrations in the box plots.

### Changes in 3-year Average Third Quarter Concentrations

Three-year averages of quarterly mean concentrations of total  $\text{NO}_3^-$ ,  $\text{NH}_4^+$ ,  $\text{SO}_2$ , and  $\text{SO}_4^{2-}$  were reduced over the period 1990–1992 through 2020–2022 for eastern reference sites and 1996–1998 through 2020–2022 for western reference sites. Ozone concentrations decreased at eastern sites and showed minimal reduction at western reference sites. Levels of  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ , and  $\text{Na}^+$  declined at eastern sites from 2004–2006 through 2020–2022 while  $\text{Cl}^-$  and  $\text{K}^+$  values increased. At western sites,  $\text{Cl}^-$  and base cation concentrations increased.

**Table 1.** Eastern Reference Sites: 3-Year Mean  $\text{O}_3$ , Nitrogen, Sulfur, Base Cations, and  $\text{Cl}^-$  Pollutant Concentrations

Parameter	1990–1992 ( $\mu\text{g}/\text{m}^3$ )	2004–2006 ( $\mu\text{g}/\text{m}^3$ )	2020–2022 ( $\mu\text{g}/\text{m}^3$ )	Percent Change
$\text{O}_3$ (ppb)	36		27	-25
Total $\text{NO}_3^-$	2.7		0.8	-70
$\text{NH}_4^+$	2.2		0.4	-83
$\text{SO}_2$	5.7		0.3	-94
$\text{SO}_4^{2-}$	8.1		1.1	-87
$\text{Ca}^{2+}$		0.27	0.23	-14
$\text{K}^+$		0.09	0.09	5
$\text{Mg}^{2+}$		0.05	0.05	-11
$\text{Na}^+$		0.08	0.07	-17
$\text{Cl}^-$		0.04	0.05	24

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

**Table 2.** Western Reference Sites: 3-Year Mean  $\text{O}_3$ , Nitrogen, Sulfur, Base Cations, and  $\text{Cl}^-$  Pollutant Concentrations

Parameter	1996–1998 ( $\mu\text{g}/\text{m}^3$ )	2004–2006 ( $\mu\text{g}/\text{m}^3$ )	2020–2022 ( $\mu\text{g}/\text{m}^3$ )	Percent Change
$\text{O}_3$ (ppb)	45		44	-1
Total $\text{NO}_3^-$	1.4		0.9	-32
$\text{NH}_4^+$	0.4		0.3	-33
$\text{SO}_2$	0.6		0.3	-55
$\text{SO}_4^{2-}$	1.2		0.6	-46
$\text{Ca}^{2+}$		0.19	0.29	58
$\text{K}^+$		0.05	0.08	60
$\text{Mg}^{2+}$		0.03	0.05	31
$\text{Na}^+$		0.10	0.12	17
$\text{Cl}^-$		0.03	0.05	90

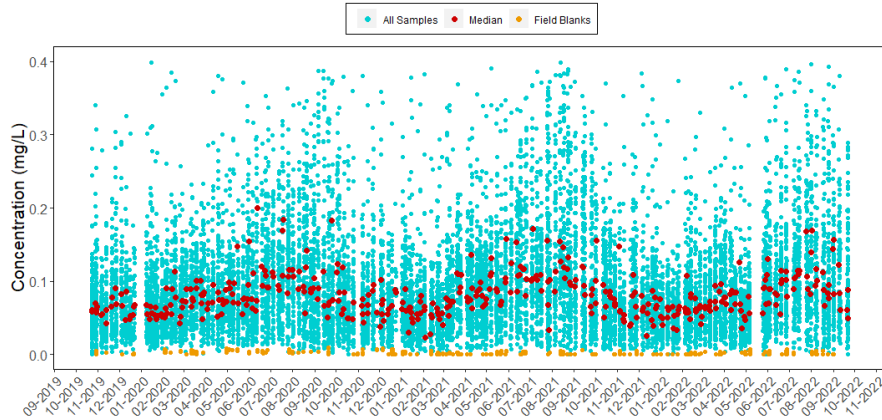
Note: Ozone concentrations are given as ppb. Concentrations for all other parameters are in  $\mu\text{g}/\text{m}^3$ .



### Time Series of Laboratory Analysis Parameters for All Sites

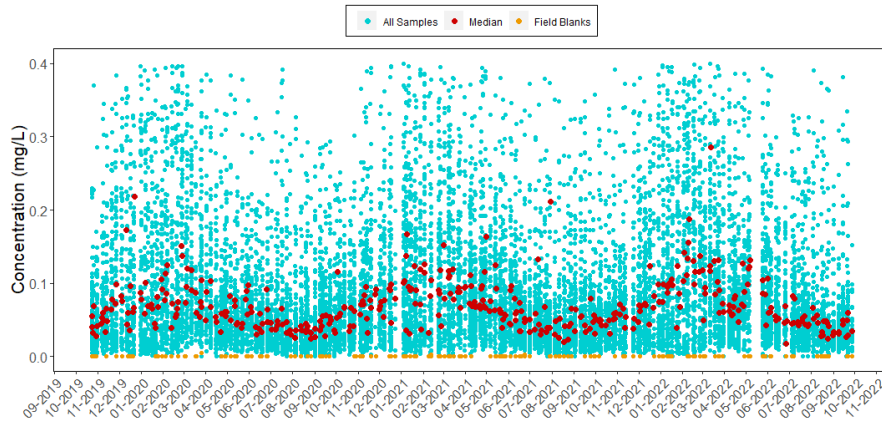
Figures 16 through 26 give time series of laboratory-analyzed concentrations of field samples and field blanks in milligrams per liter (mg/L) of 11 parameters from September 2019 through third quarter 2022. These figures provide indications of potential issues with concentration measurements relative to detection and reporting limits.

**Figure 16.** Concentrations of NO<sub>3</sub><sup>-</sup> (as N) from Nylon Filters



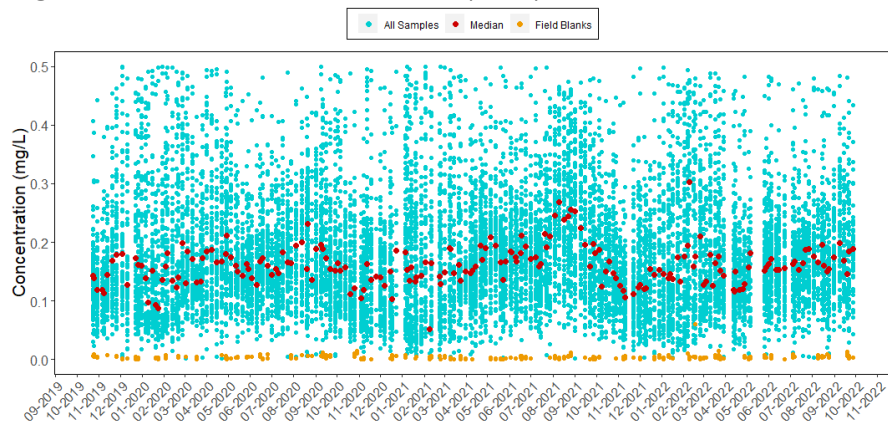
Note: Nominal reporting limit is 0.008 mg/L.

**Figure 17.** Concentrations of NO<sub>3</sub><sup>-</sup> (as N) from Teflon Filters



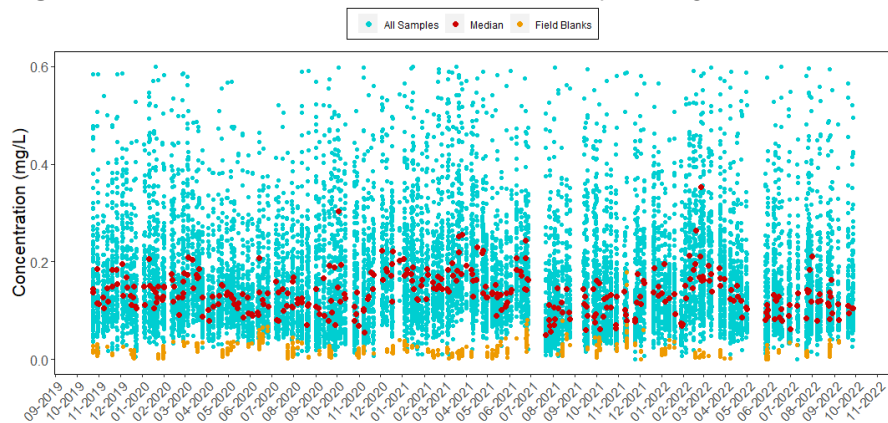
Note: Nominal reporting limit is 0.008 mg/L.

**Figure 18.** Concentrations of  $\text{NH}_4^+$  (as N) from Teflon Filters



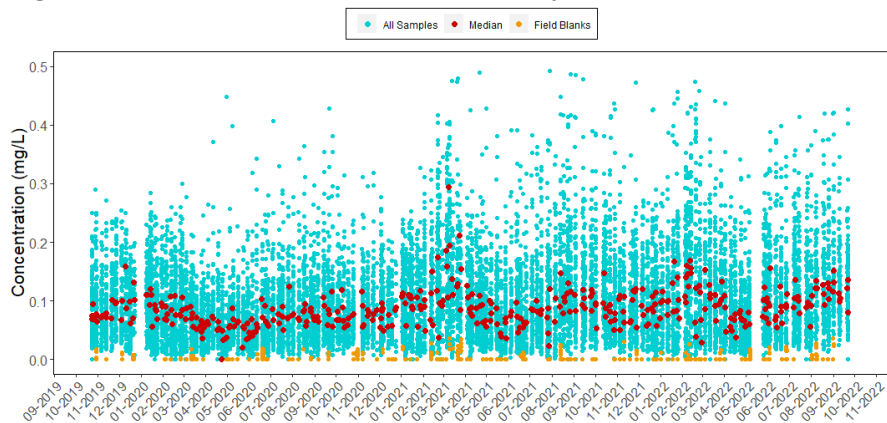
Note: Nominal reporting limit is 0.020 mg/L.

**Figure 19.** Concentrations of  $\text{SO}_2$  from  $\text{K}_2\text{CO}_3$ -impregnated Cellulose Filters



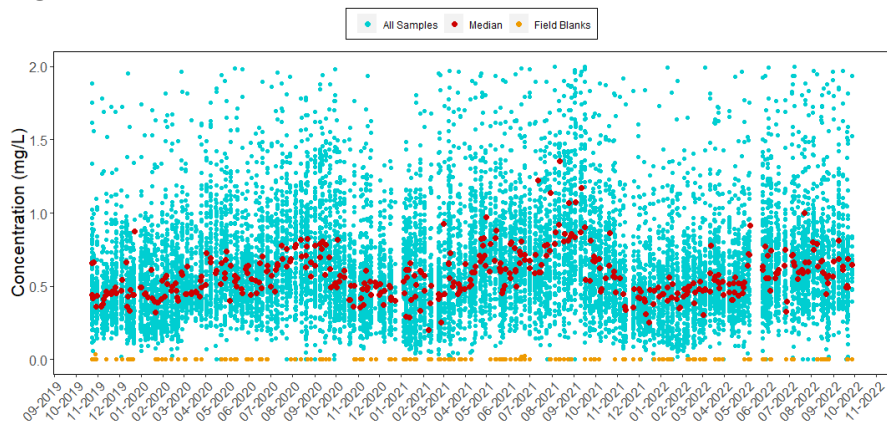
Note: Nominal reporting limit is 0.040 mg/L.

**Figure 20.** Concentrations of SO<sub>4</sub><sup>2-</sup> from Nylon Filters



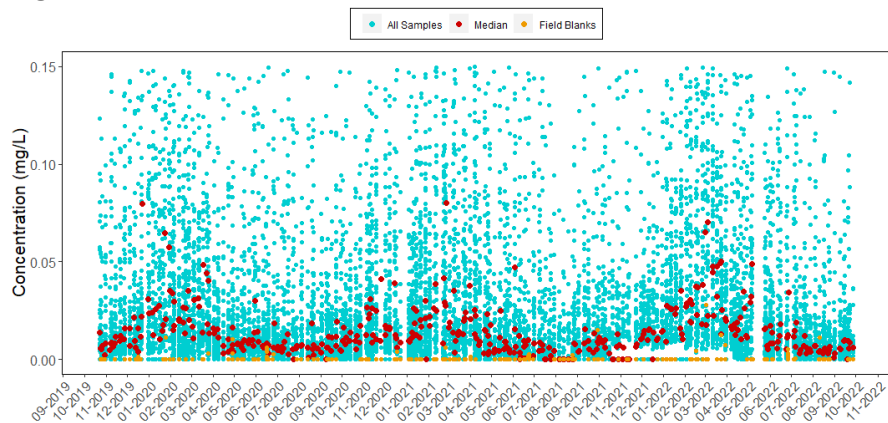
Note: Nominal reporting limit is 0.040 mg/L.

**Figure 21.** Concentrations of SO<sub>4</sub><sup>2-</sup> from Teflon Filters



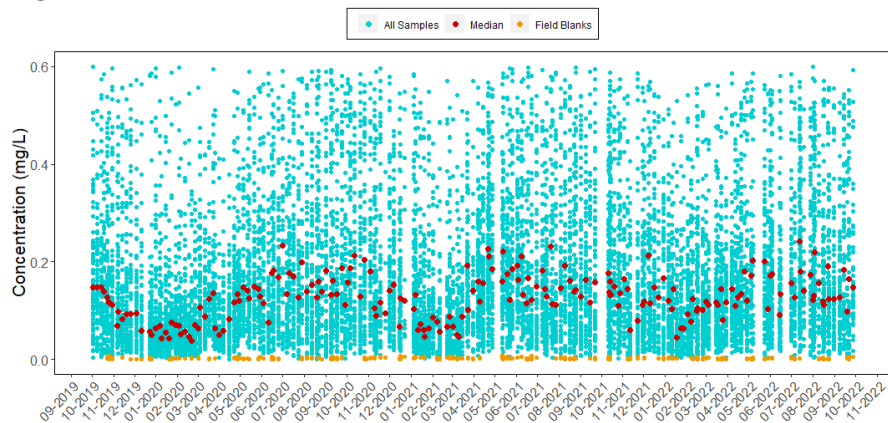
Note: Nominal reporting limit is 0.040 mg/L.

**Figure 22.** Concentrations of Cl<sup>-</sup> from Teflon Filters



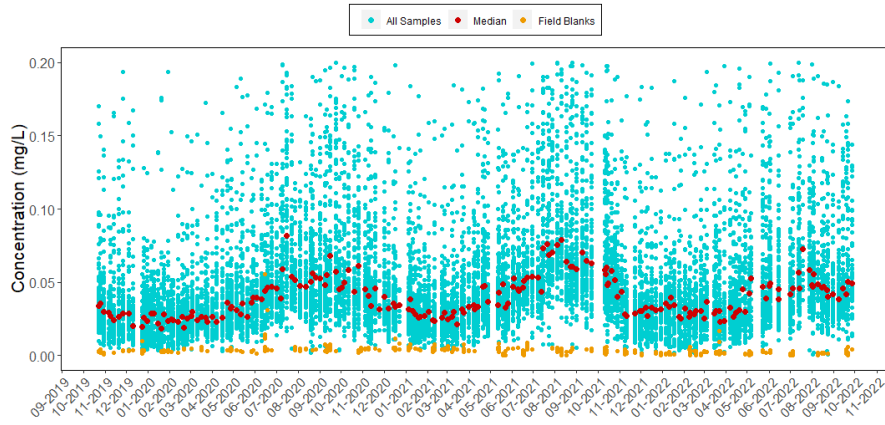
Note: Nominal reporting limit is 0.020 mg/L.

**Figure 23.** Concentrations of Ca<sup>2+</sup> from Teflon Filters



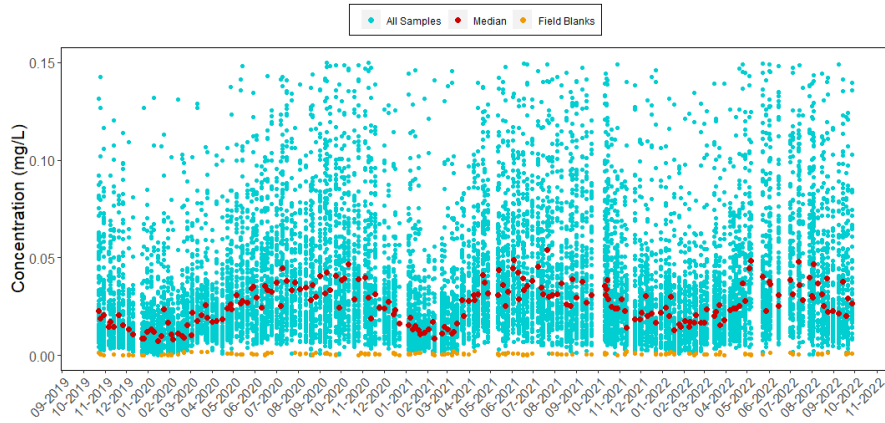
Note: Nominal reporting limit is 0.006 mg/L.

**Figure 24.** Concentrations of  $K^+$  from Teflon Filters



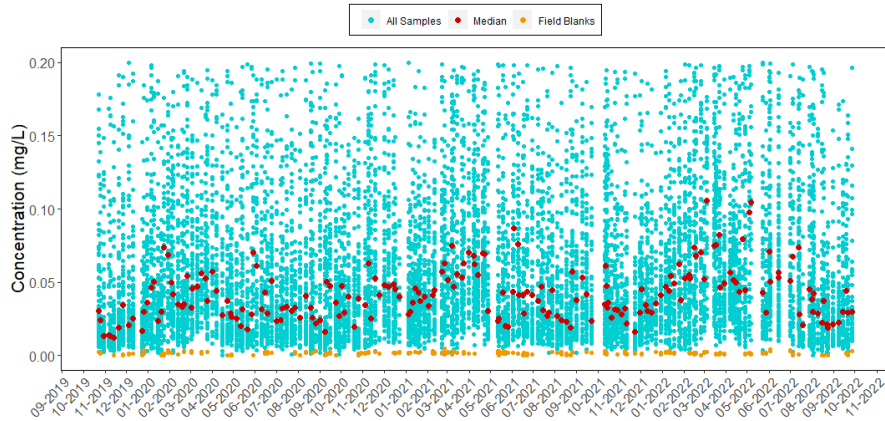
Note: Nominal reporting limit is 0.006 mg/L.

**Figure 25.** Concentrations of  $Mg^{2+}$  from Teflon Filters



Note: Nominal reporting limit is 0.003 mg/L.

**Figure 26.** Concentrations of Na<sup>+</sup> from Teflon Filters

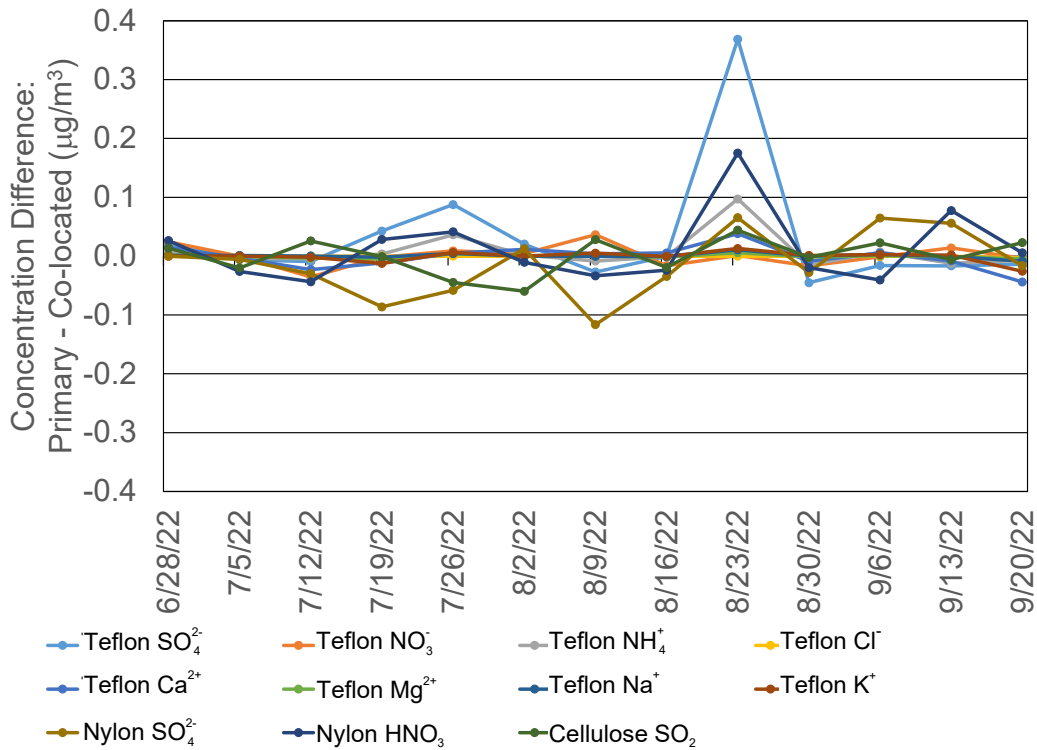


Note: Nominal reporting limit is 0.005 mg/L.

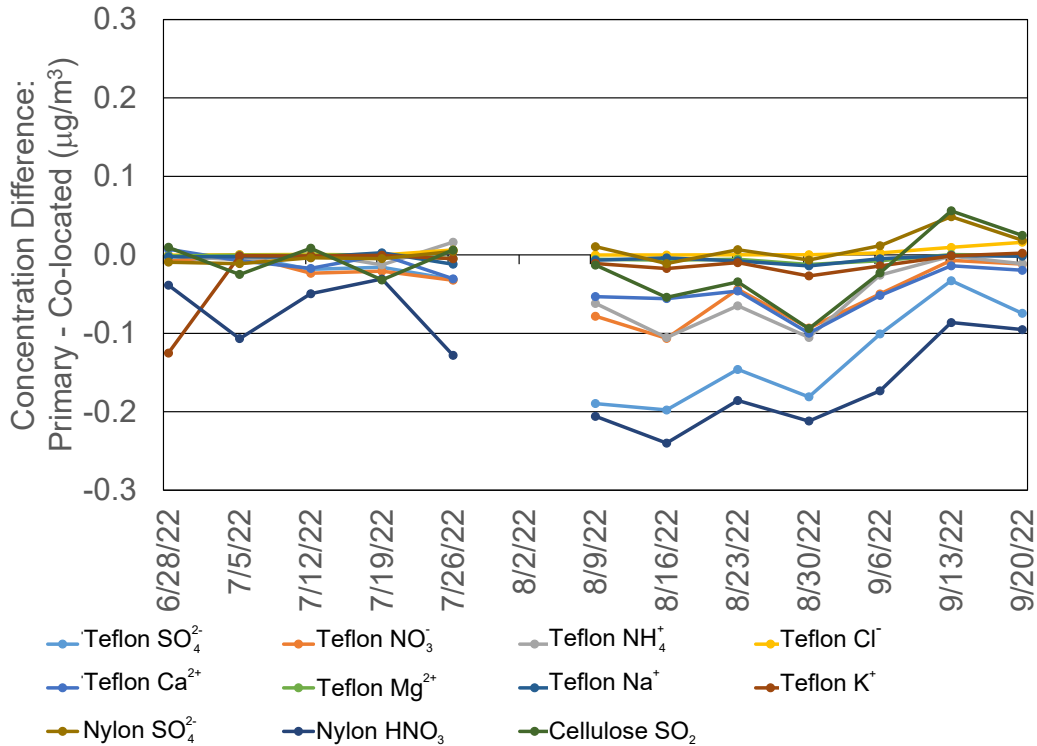
**Time Series of Concentration Differences from Co-located Sites**

Figures 27 and 28 show times series of concentration differences between the two sets of co-located sites. Figure 27 shows a disparity in co-located concentrations at the MCK131/231 site during the week of 8/23/22 (week 34). Project scientists are reviewing these data further. The disparity in concentrations at ROM406/206 was caused by flow problems at ROM406.

**Figure 27.** Time Series of Filter Concentration Differences between MCK131 and MCK231, KY



**Figure 28.** 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 2022. The MARPD values at MCK131/231 met the 20 percent criterion. The ROM406/206 values did not because of problems with the ROM406 flow system.

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

	Total NO <sub>3</sub> <sup>-</sup>	HNO <sub>3</sub>	NO <sub>3</sub> <sup>-</sup>	NH <sub>4</sub> <sup>+</sup>	SO <sub>2</sub>	SO <sub>4</sub> <sup>2-</sup>	Ca <sup>2+</sup>	Mg <sup>2+</sup>	Na <sup>+</sup>	K <sup>+</sup>	Cl <sup>-</sup>
<b>MCK131/231, KY</b>											
$\bar{X}$ (µg/m <sup>3</sup> )	1.08	0.28	0.40	0.26	0.04	0.04	0.08	0.03	0.67	0.37	0.94
$\bar{Y}$ (µg/m <sup>3</sup> )	1.05	0.28	0.39	0.27	0.04	0.03	0.08	0.03	0.66	0.38	0.93
MAD	0.05	0.01	0.02	0.02	0.00	0.00	0.01	0.00	0.04	0.04	0.05
MARPD	4.39	4.30	3.88	6.21	6.25	11.17	7.62	1.14	6.04	13.56	4.74
<b>ROM406/206, CO</b>											
$\bar{X}$ (µg/m <sup>3</sup> )	0.39	0.15	0.18	0.13	0.02	0.02	0.03	0.02	0.41	0.17	0.56
$\bar{Y}$ (µg/m <sup>3</sup> )	0.52	0.21	0.23	0.17	0.02	0.03	0.04	0.02	0.59	0.19	0.79
MAD	0.12	0.06	0.05	0.05	0.01	0.01	0.01	0.00	0.18	0.05	0.23
MARPD	29.07	32.25	24.25	34.02	27.68	33.63	28.22	19.72	38.08	25.11	36.37

### 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 2022 (1 of 2)

Site ID	Teflon SO <sub>4</sub> <sup>2-</sup>	Teflon NO <sub>3</sub>	Teflon NH <sub>4</sub> <sup>+</sup>	Teflon Minor Cations	Teflon Cl <sup>-</sup>	Nylon HNO <sub>3</sub>	Nylon SO <sub>4</sub> <sup>2-</sup>	Cellulose SO <sub>2</sub>	Comment
ALC188, TX	85	85	85	85	85	85	85	85	There were two 2-week samples during the quarter.
ANA115, MI	0	0	0	0	0	0	0	0	Site was mothballed due to EPA's FY2022 budget.
ASH135, ME	0	0	0	0	0	0	0	0	Site was mothballed due to EPA's FY2022 budget.
BBE401, TX	85	85	85	85	85	85	85	85	The site operator left the flow pump off for one sample, and flow was missing or invalid for an extended period during another sampling week.
BEL116, MD	69	69	69	69	69	69	69	69	The mass flow controller malfunctioned and affected three samples. It was subsequently replaced. Another sample was affected by a power failure.
BWR139, MD	77	77	77	77	77	77	77	77	There were three 2-week samples during the quarter.
CDR119, WV	0	0	0	0	0	0	0	0	Site was mothballed due to EPA's FY2022 budget.
CDZ171, KY	0	0	0	0	0	0	0	0	Site was mothballed due to EPA's FY2022 budget.
DCP114, OH	0	0	0	0	0	0	0	0	Site was mothballed due to EPA's FY2022 budget.
EGB181, ON	0	0	0	0	0	0	0	0	Site was mothballed due to EPA's FY2022 budget.
FOR605, WY	77	77	77	77	77	77	77	77	Flow data were missing for three samples.
HWF187, NY	0	0	0	0	0	0	0	0	Site was mothballed due to EPA's FY2022 budget.
LAV410, CA	85	85	85	85	85	85	85	85	The flow pump failed, affecting one sample. A power failure affected another sample.



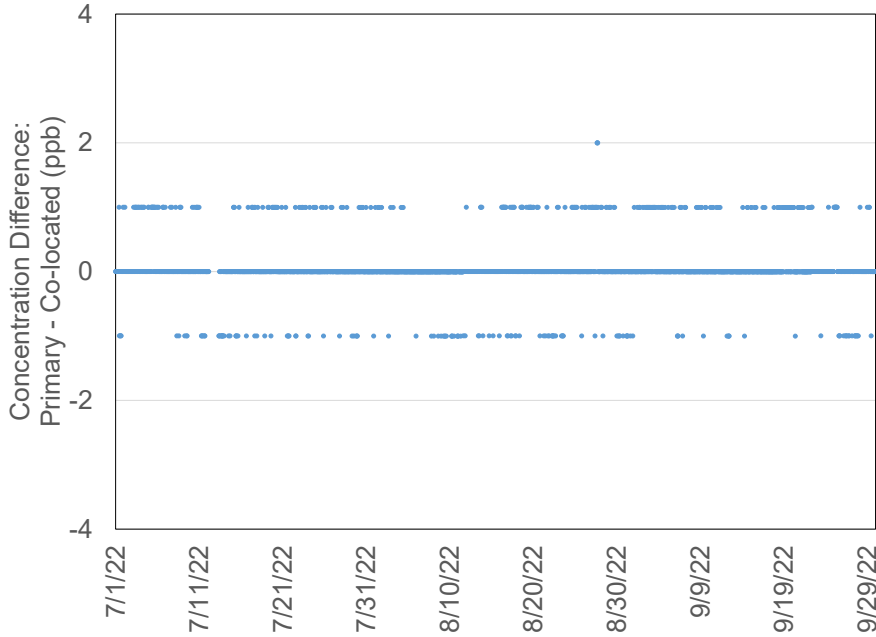
**Table 4.** Sites with less than 90 Percent Data Completeness for Filter Concentrations for Third Quarter 2022 (2 of 2)

Site ID	Teflon SO <sub>4</sub> <sup>2-</sup>	Teflon NO <sub>3</sub> <sup>-</sup>	Teflon NH <sub>4</sub> <sup>+</sup>	Teflon Minor Cations	Teflon Cl <sup>-</sup>	Nylon HNO <sub>3</sub>	Nylon SO <sub>4</sub> <sup>2-</sup>	Cellulose SO <sub>2</sub>	Comment
PNF126, NC	0	0	0	0	0	0	0	0	Site was mothballed due to EPA's FY2022 budget.
PSU106, PA	0	0	0	0	0	0	0	0	Site was mothballed due to EPA's FY2022 budget.
SAN189, NE	0	0	0	0	0	0	0	0	Tribal partner paused filter pack sampling in second quarter until October 1, 2022.
SUM156, FL	69	69	69	69	69	69	69	69	Four samples were affected by a flow system calibration failure.
UND002, VT	0	0	0	0	0	0	0	0	Site was mothballed due to EPA's FY2022 budget.
WST109, NH	0	0	0	0	0	0	0	0	Site was mothballed due to EPA's FY2022 budget.

### Precision of Ozone Concentrations

Time series of co-located hourly O<sub>3</sub> concentration differences for third quarter 2022 are provided in Figures 29 and 30 for MCK131/231 and ROM406/206, respectively. The figures indicate no consistent bias between the co-located analyzers at these site locations.

**Figure 29.** Time Series of the Differences in Co-located O<sub>3</sub> Concentrations for MCK131/231, KY



**Figure 30.** Time Series of the Differences in Co-located O<sub>3</sub> Concentrations for ROM406/206, CO

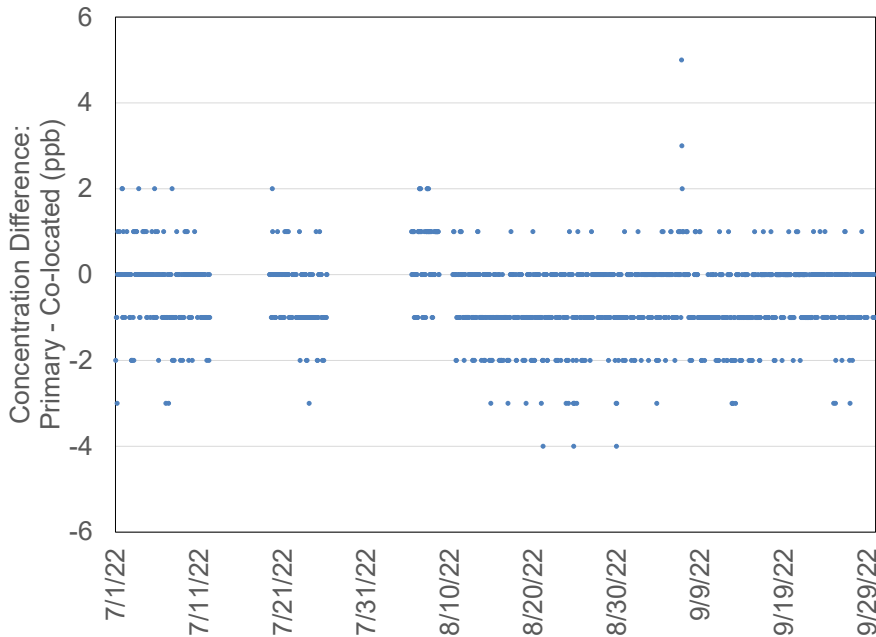


Table 5 gives MARPD data for O<sub>3</sub> data measured at the two co-located sites.

**Table 5.** Quarterly Precision (MARPD) for Co-located O<sub>3</sub> Concentrations

Site Pair	Quarter	Start Date	MARPD	Records
MCK131/231, KY				
	4	10/1/21	1.0	2086
	1	1/1/22	1.1	2046
	2	4/1/22	0.6	2066
	3	7/1/22	0.8	2058
ROM406/206, CO				
	4	10/1/21	1.7	2075
	1	1/1/22	2.0	1970
	2	4/1/22	1.5	1932
	3	7/1/22	1.8	1638

### Completeness for O<sub>3</sub> Concentrations

Calculation of an annual O<sub>3</sub> 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<sub>3</sub> concentrations. Comments are provided for these sites.

**Table 6.** Sites with less than 90 Percent Data Completeness for DM8A Concentrations during Third Quarter 2022 (1 of 2)

Site ID	Percent Completeness	Comments
ASH135, ME	0	Site was mothballed due to EPA's FY2022 budget.
HWF187, NY	0	Site was mothballed due to EPA's FY2022 budget.
WST109, NH	0	Site was mothballed due to EPA's FY2022 budget.
PNF126, NC	0	Site was mothballed due to EPA's FY2022 budget.
CDZ171, KY	0	Site was mothballed due to EPA's FY2022 budget.
DCP114, OH	0	Site was mothballed due to EPA's FY2022 budget.
CDR119, WV	0	Site was mothballed due to EPA's FY2022 budget.
OXF122, OH	75	Occasional high shelter temperatures resulted in invalid data during August. The shelter air conditioning unit was replaced September 2.
ROM406, CO	76	Sample pump failures affected data mid-July and again in late July.
CVL151, MS	83	The site analyzer malfunctioned in late August and was replaced in September.
VIN140, IN	86	Occasional high shelter temperatures resulted in invalid data during July. The shelter air conditioning unit was replaced July 22.
DEN417, AK	86	Sample pump failures affected data from early to mid-September.

**Table 6.** Sites with less than 90 Percent Data Completeness for DM8A Concentrations during Third Quarter 2022 (2 of 2)

Site ID	Percent Completeness	Comments
BBE401, TX	86	A combination of QC check failures and a power outage affected data in late August. Data were affected in mid-September due to a data logger malfunction.
BEL116, MD	88	Intermittent power failures in July and August caused some data loss.
CAV436, NM	88	Elevated shelter temperatures resulted in data invalidation intermittently during the quarter.
ALC188, TX	88	The site analyzer malfunctioned and was replaced in September.
VOY413, MN	89	Power outage affected data from mid- to late September.
GAS153, GA	89	The site analyzer malfunctioned and was replaced in July.

Table 7 shows CASTNET sites with less than 90 percent completeness for hourly O<sub>3</sub> 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<sub>3</sub> Concentrations

Site ID	Q3 2022	Q4 2021– Q3 2022	Comments
ASH135, ME	0	56	Site was mothballed due to EPA's FY2022 budget.
CDR119, WV	0	56	Site was mothballed due to EPA's FY2022 budget.
CDZ171, KY	0	60	Site was mothballed due to EPA's FY2022 budget.
DCP114, OH	0	60	Site was mothballed due to EPA's FY2022 budget.
HWF187, NY	0	59	Site was mothballed due to EPA's FY2022 budget.
PNF126, NC	0	60	Site was mothballed due to EPA's FY2022 budget.
WST109, NH	0	60	Site was mothballed due to EPA's FY2022 budget.
ROM406, CO	78	92	Sample pump failures affected data mid-July and again in late July.
OXF122, OH	80	93	Occasional high shelter temperatures resulted in invalid data during August. The shelter air conditioning unit was replaced September 2.
DEN417, AK	86	96	Sample pump failures affected data from early to mid-September.
ALC188, TX	88	96	The site analyzer malfunctioned and was replaced in September.
CVL151, MS	89	95	The analyzer malfunctioned in late August and was replaced in September.

### Filter Pack Total Nitrate and Continuous Trace-level NO<sub>y</sub> Concentrations at CASTNET Sites

Figures 31 through 38 show a comparison of weekly average continuous NO<sub>y</sub> measurements with weekly filter pack total NO<sub>3</sub><sup>-</sup> concentrations collected at the six of eight sites with NO<sub>y</sub> measurements. No data are available from HWF187 and PNF126 for third quarter 2022. The sites were mothballed due to EPA's Fiscal Year 2022 budget constraints. The NO<sub>y</sub> concentrations were consistently higher than the total NO<sub>3</sub><sup>-</sup> levels at all sites. The average weekly NO<sub>y</sub> levels, the weekly total NO<sub>3</sub><sup>-</sup> concentrations, and their ratios for the six sites with available data are shown in Table 8. Ratios of NO<sub>y</sub> to total NO<sub>3</sub><sup>-</sup> varied from 4.58 at GRS420 to 5.77 at DUK008.

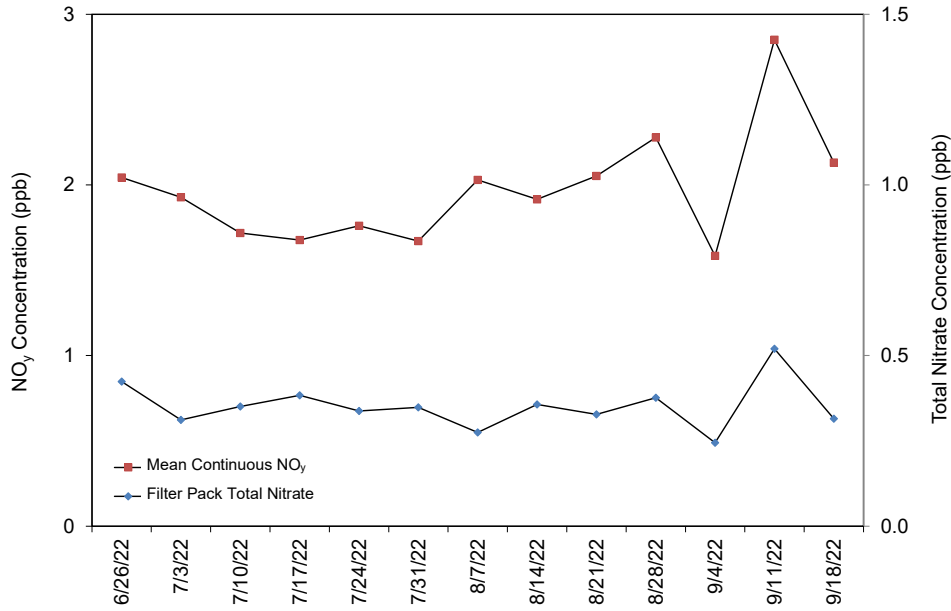
**Table 8.** Summary of Total NO<sub>3</sub><sup>-</sup> and NO<sub>y</sub> Measurements for Third Quarter 2022

Site ID	Elevation	Total NO <sub>3</sub> <sup>-</sup> (ppb)	NO <sub>y</sub> (ppb)	Ratio
DUK008, NC	164*	0.35	1.97	5.77
BVL130, IL	213	0.70	4.66	5.19
MAC426, KY	243	0.35	1.82	5.26
HWF187, NY <sup>φ</sup>	497	-	-	-
GRS420, TN	793	0.27	1.21	4.58
PNF126, NC <sup>φ</sup>	1216	-	-	-
PND165, WY	2386	0.21	1.16	5.73
ROM206, CO	2742	0.24	1.23	5.26

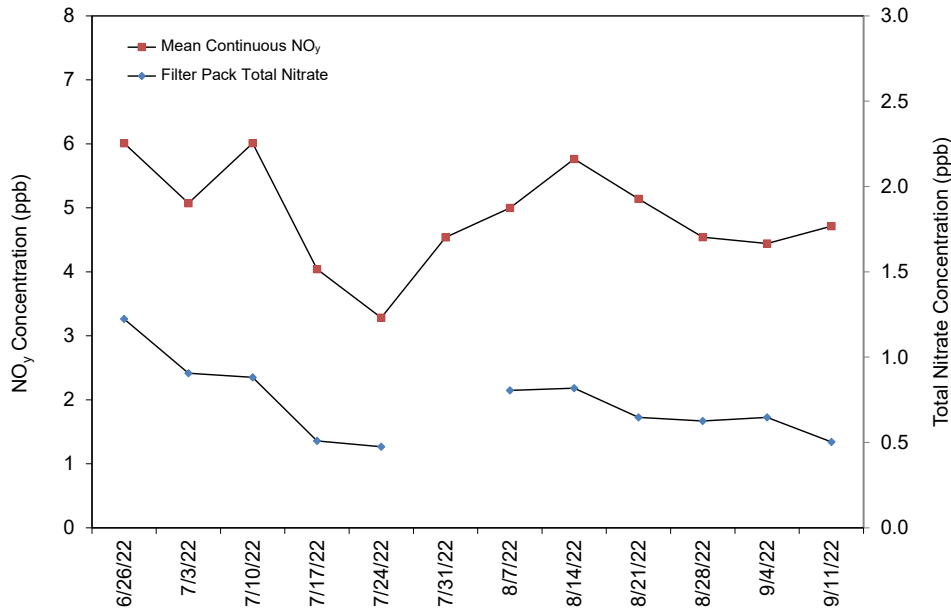
Note: \* The inlet of the enhanced NO<sub>y</sub> monitor is located at the top of the 30-meter tower.

<sup>φ</sup> The site was mothballed in second quarter 2022 due to EPA's FY2022 budget. No measurements were recorded during third quarter 2022.

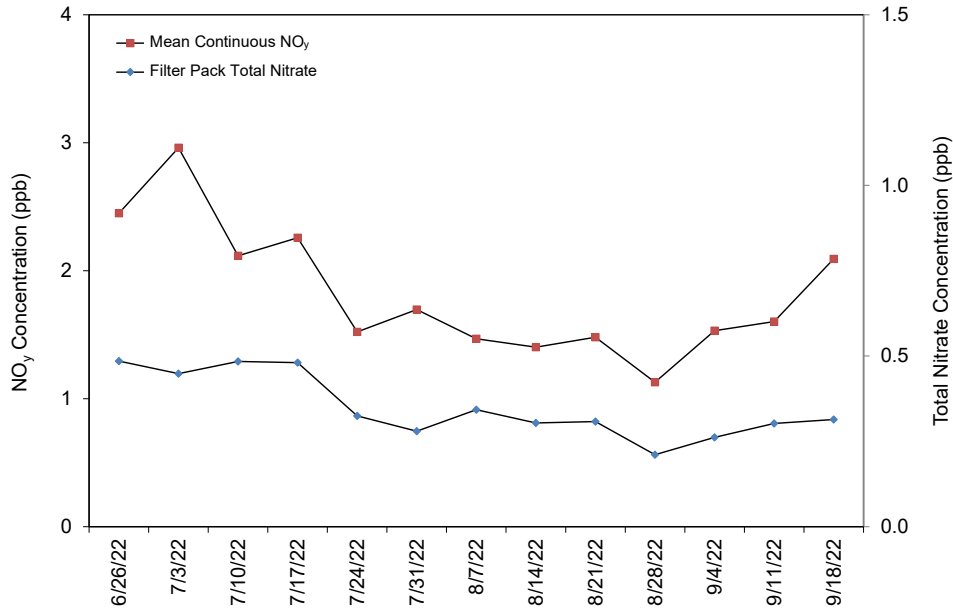
**Figure 31.** Comparison of DUK008 Weekly Mean NO<sub>y</sub> and Total NO<sub>3</sub><sup>-</sup> Concentrations



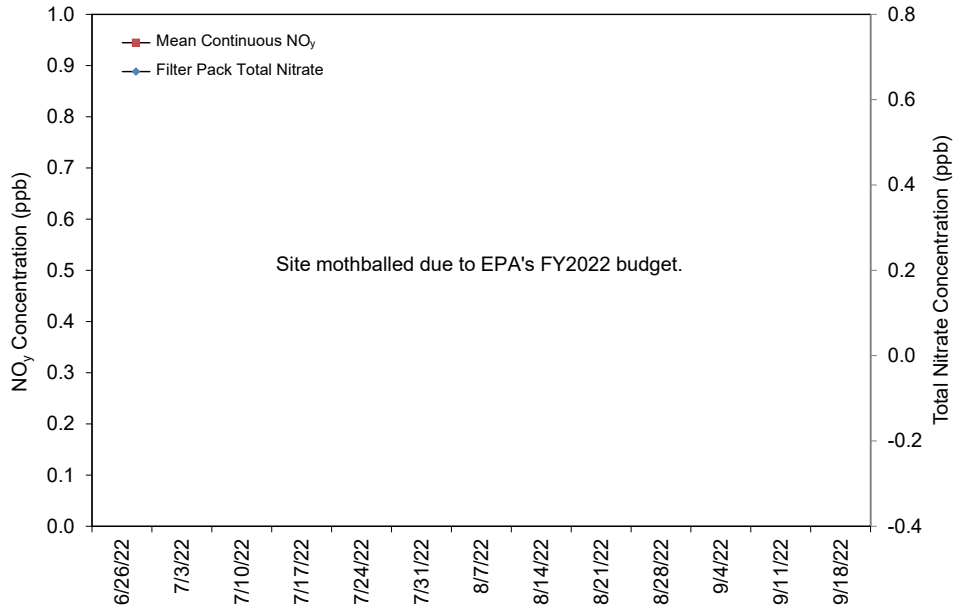
**Figure 32.** Comparison of BVL130 Weekly Mean NO<sub>y</sub> and Total NO<sub>3</sub><sup>-</sup> Concentrations



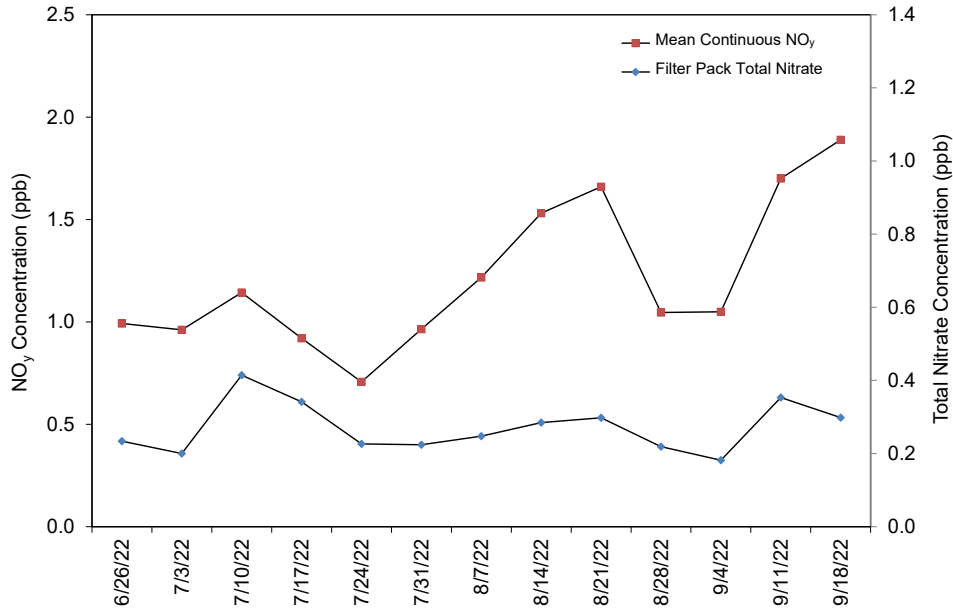
**Figure 33.** Comparison of MAC426 Weekly Mean  $\text{NO}_y$  and Total  $\text{NO}_3^-$  Concentrations



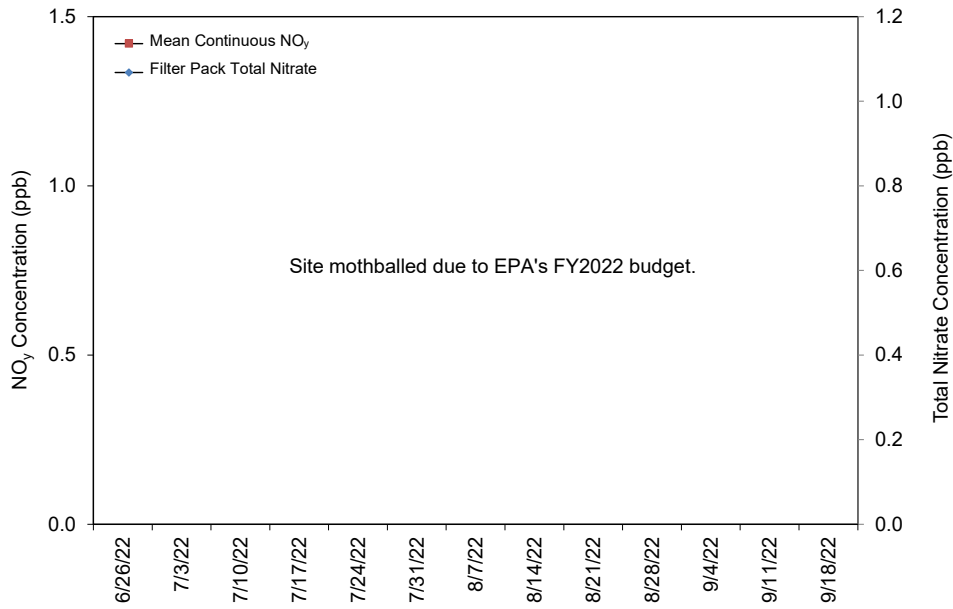
**Figure 34.** Comparison of HWF187 Weekly Mean  $\text{NO}_y$  and Total  $\text{NO}_3^-$  Concentrations



**Figure 35.** Comparison of GRS420 Weekly Mean NO<sub>y</sub> and Total NO<sub>3</sub> Concentrations

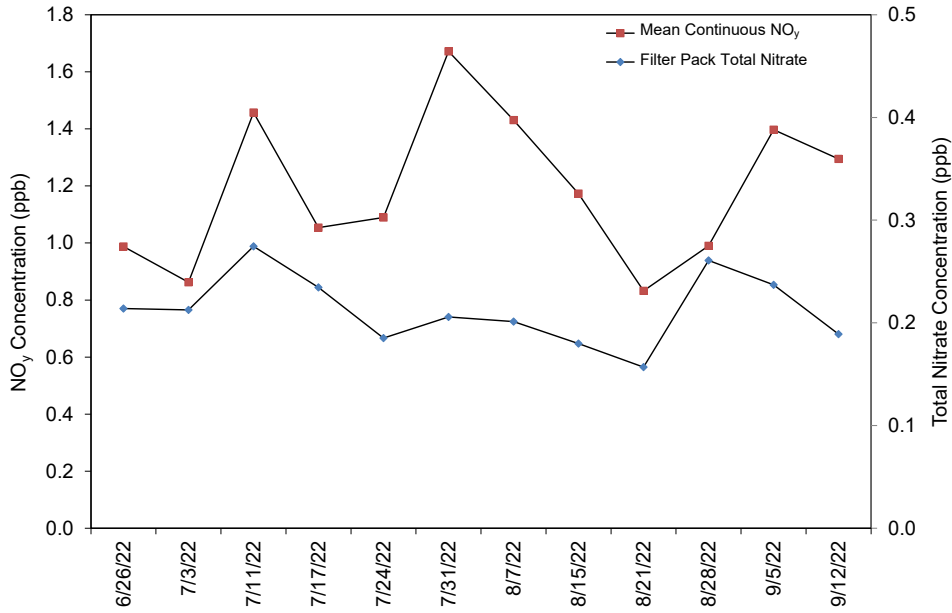


**Figure 36.** Comparison of PNF126 Weekly Mean NO<sub>y</sub> and Total NO<sub>3</sub> Concentrations

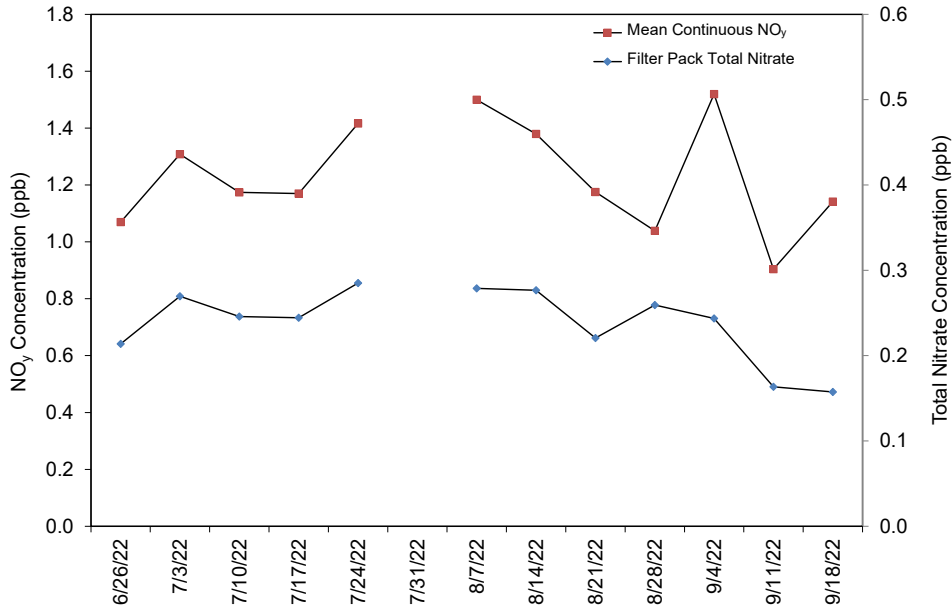




**Figure 37.** Comparison of PND165 Weekly Mean NO<sub>y</sub> and Total NO<sub>3</sub><sup>-</sup> Concentrations



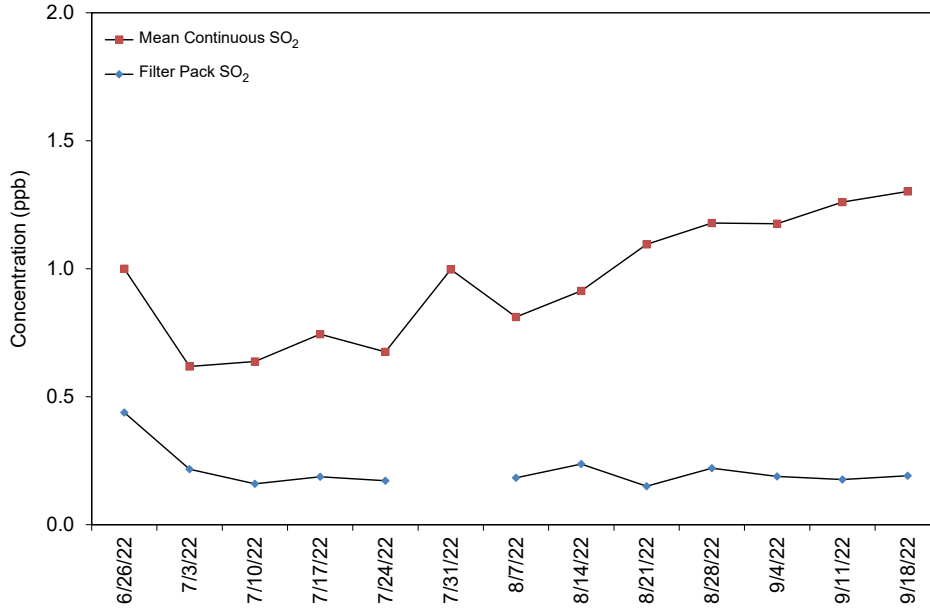
**Figure 38.** Comparison of ROM206 Weekly Mean NO<sub>y</sub> and Total NO<sub>3</sub><sup>-</sup> Concentrations



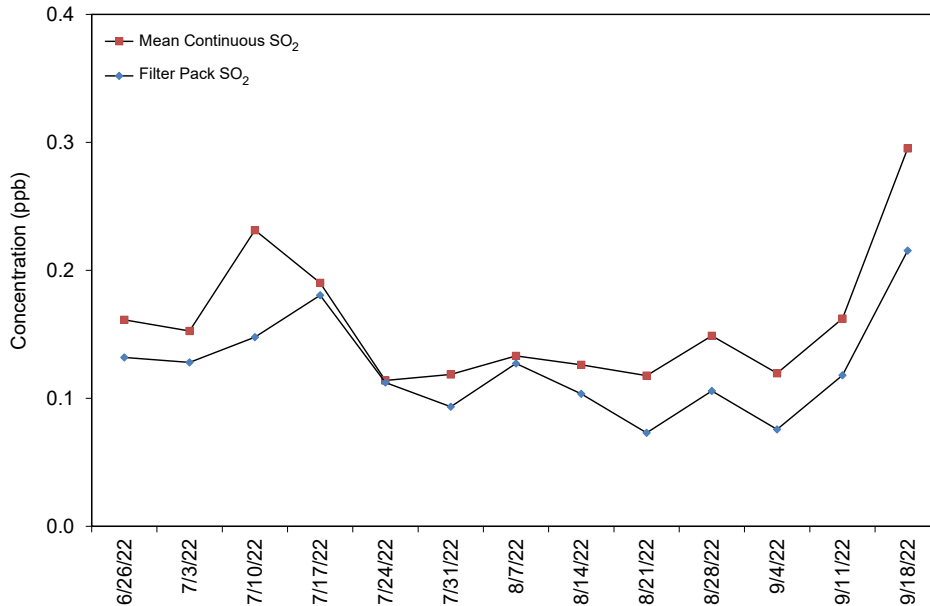
### Filter Pack and Continuous Trace-level Gas Sulfur Dioxide Concentrations

Figures 39 through 41 provide diagrams that compare weekly filter pack SO<sub>2</sub> 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. The SO<sub>2</sub> concentrations measured at GRS420 were comparable except for one week when the analyzer was not operating and during three weeks when the instrument was sampling incorrectly.

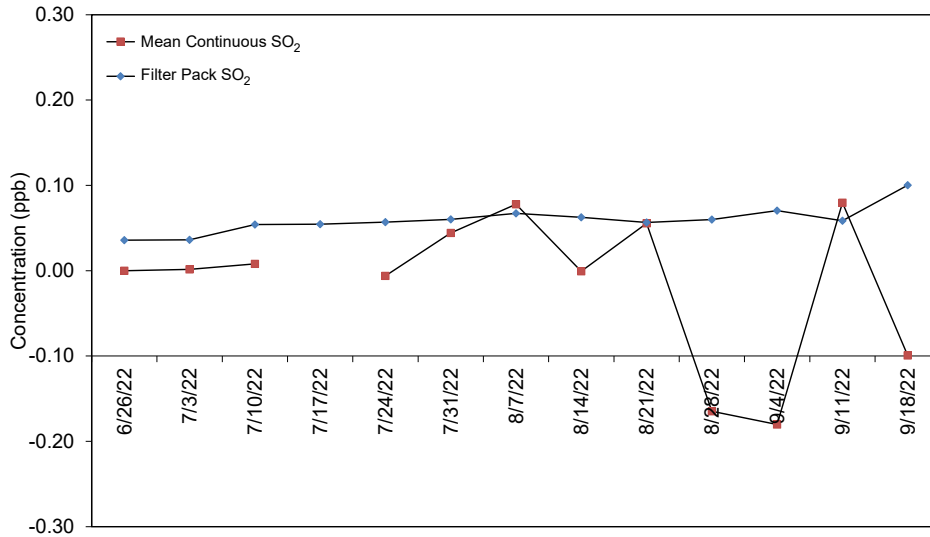
**Figure 39.** Comparison of BVL130 Weekly Mean SO<sub>2</sub> Concentrations



**Figure 40.** Comparison of MAC426 Weekly Mean SO<sub>2</sub> Concentrations



**Figure 41.** Comparison of GRS420 Weekly Mean SO<sub>2</sub> 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 2022. The average for fourth quarter 2021 through third quarter 2022 for each of the sites is included for reference. Shading indicates sites with percent completeness less than 90 percent.

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

Site ID	Parameter*	Q3 2022	Q4 2021– Q3 2022	Comments for Third Quarter Results
BVL130, IL	CO	53	46	There were QC check failures in July and August due to a loose Ethernet cable.
	NO	90	89	
	NOY	90	93	
	NOYDIF	90	89	
	SO2_GA	88	90	The site operator left the channel down.
CHC432, NM	NO	97	97	
	NOX	97	97	
	NOXDIF	97	97	
DUK008, NC	HNO3	89		<ul style="list-style-type: none"> <li>♦ Monitoring restarted August 2021, but QC activities were not fully operational until December 2021. As a result, the average for Q4 2021 through Q3 2022 was not calculated.</li> <li>♦ The QC check runs for NH3 result in three to six hours of invalid data every two days for all parameters.</li> <li>♦ Data for all parameters were invalidated for 8/27/22 to 8/30/22 due to calibration activities.</li> <li>♦ Additionally, NH3 and TNX had lower completeness due to a system leak in the TNX channel.</li> </ul>
	NH3	43		
	NO	89		
	NO2_TRUE	89		
	NOX_TRUE	89		
	NOY	89		
	NOY_MINUS	89		
	NOYDIF	89		
TNX	53			
GRS420, TN	CO	78	82	Sample pump failure affected data from early to mid-September
	NO	91	87	
	NOY	91	87	
	NOYDIF	91	87	
	SO2_GA	87	85	Sample pump failure affected data in late July.
HWF187, NY	NO	0	56	Site was mothballed due to FY2022 budget.
	NOY	0	55	
	NOYDIF	0	55	
MAC426, KY	CO	95	95	
	NO	98	97	
	NOY	98	97	
	NOYDIF	98	97	
	SO2_GA	98	97	
PND165, WY	NO	91	85	
	NOY	91	84	
	NOYDIF	91	84	

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

Site ID	Parameter*	Q3 2022	Q4 2021– Q3 2022	Comments for Third Quarter Results
PNF126, NC	NO	0	55	Site was mothballed due to FY2022 budget.
	NOY	0	55	
	NOYDIF	0	55	
ROM206, CO	NO	95	95	
	NOY	95	95	
	NOYDIF	95	95	

Note: \* See Table 10

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

**Table 10.** CASTNET Trace-level Gas Measurements

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

## References

Wood Environment & Infrastructure Solutions, Inc. 2022. *Clean Air Status and Trends Network (CASTNET) Third Quarter 2022 Quality Assurance Report.*

<https://java.epa.gov/castnet/documents.do>