Clean Air Status and Trends Network
First Quarter 2023 Quality Assurance Report

Summary of Quarterly Operations (January through March)
EPA Contract No. 68HERH21D0006

Introduction

This quarterly report summarizes results from the Clean Air Status and Trends Network (CASTNET) quality assurance/quality control (QA/QC) program for data collected during first quarter 2023. The various QA/QC criteria and policies are documented in the CASTNET Quality Assurance Project Plan (QAPP; WSP, 2022). The QAPP is comprehensive and includes standards and policies for all components of project operation from site selection through final data reporting. It is reviewed annually and updated as warranted.

Quarterly Summary

The assessment required to continue International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) 17025:2017 accreditation by the American Association for Laboratory Accreditation (A2LA) was scheduled for April 3–5, 2023. During first quarter, documentation was reviewed and updated as needed. The CASTNET QA Manager completed the annual review of site operator and site calibrator metrics to track the status of technical training and quality management system training. The QA Manager completed a similar review of analytical laboratory personnel. Additionally, the QA Manager performed a method evaluation of GLM-3180-005 (Inductively Coupled Argon Plasma-Optical Emission Spectrometry: Perkin-Elmer Avio 220 Max (Modified EPA Method 6010-B) for the primary analyst on the new PerkinElmer Avio 220 Max ICP-OES. Preparations were made for the assessor's site visit.

WSP's corporate management purchased a new, inductively coupled plasma-optical emission spectrometer (ICP-OES) for the CASTNET analytical laboratory. The new instrument takes up less bench space than the current version, is easier to use, has the capability to analyze a larger suite of analytes without changing the sample introduction system, and consumes less argon gas. The ICP-OES was installed in the analytical laboratory January 10–11, 2023. In-person training of laboratory personnel by PerkinElmer, the manufacturer, took place on January 18, 2023. Method detection limit results for the new ICP-OES showed some select spectrum peak shifting. The CASTNET Laboratory Operations Manager (LOM) contacted PerkinElmer to advise them of the problem. Replacement parts were shipped to the LOM, and a PerkinElmer technician installed the parts in February 2023. Test results after the parts were replaced did not show any peak shifting, and it never returned during subsequent sample analysis. The standard operating procedure was updated for the new ICP-OES as will related sections of the CASTNET QAPP.

Comparison of ammonium analyses completed on the older Braun+Luebbe AA3 with analyses completed on the SEAL AA500 showed a consistent 5 percent positive bias for analyses on the AA500. WSP contacted SEAL for assistance. SEAL reviewed information provided by WSP and then informed WSP that the method SEAL originally provided was not the correct method. SEAL provided WSP with a different method, which when used with a new set of calibration standards, is providing more reasonable results. WSP plans to continue running comparisons to verify accuracy. New MDL test results will be completed before using the new method for sample analyses. Sample analyses using the AA3 will continue uninterrupted while testing is completed on the AA500.

WSP continued acceptance testing MTL nylon filters and tracking the unidentified peak that is co-eluting with bromide in the chromatogram. Previously, WSP had identified that the co-eluting peak can be correlated to certain MTL filter washing dates. WSP provided data to MTL, and MTL told WSP they would investigate the cause of the unidentified peak. WSP requested a box of unwashed nylon filters from MTL to test if the co-eluting peak is native to the filter or introduced during washing. The unwashed filters did not show the co-eluting peak. MTL is now sending a box of filters that were only rinsed with deionized water. MTL is investigating if the contamination originates in their holding bins since there have been no changes to the washing process. WSP has a good supply of surplus filters that have passed acceptance testing so there will be no disruption in sampling.

During March 2023, WSP received technical direction from EPA to make adjustments to the QC criteria for the CO monitor at the BVL130, IL site to improve data completeness and to meet the requirements in the precursor gas technical assistance guidance. This included adjusting the validation criteria for the zero check to 2.5 percent of full scale (±50 ppb) and adjusting the challenge level of the 1-point precision check to 500 ppb. WSP incorporated these changes, which went into effect beginning March 9, 2023. WSP began reviewing CO data to determine if revalidation using the adjusted criteria will improve data completeness.

Contamination found in method detection limit testing of ammonium analyses on the SEAL AA500 was traced to the air conditioning system. The air vent in the laboratory is close to the instrument. The problem is expected to be resolved by replacing the current minimum efficiency reporting value (MERV) 8 filters in the air handlers serving the laboratory with MERV 13 filters.

On March 27, 2023, WSP received results of analyses for proficiency test (PT) study 121 for Rain and Soft Waters from the Water Science and Technology (WS&T) Directorate, a branch of Environmental Science and Technology Laboratories with ECCC that oversees the PT studies. These PT studies are offered twice a year as part of its quality assurance and proficiency testing services. WSP's overall rating for PT 121 was "Good." WSP had submitted results for the standard suite of CASTNET analyses and additionally included results for pH, specific conductance, and total nitrogen analyses. WSP's analyses for conductivity and total nitrogen for 1 of the 10 samples analyzed were flagged as receiving z-scores that indicated high and low bias, respectively. WSP received no flags for any parameter in the other nine samples analyzed. In PT study 121, WS&T determined that the sample-parameter combinations for RN-06 for ammonia and RN-06 for dissolved organic carbon displayed signs of "insufficient homogeneity" and removed these sample-parameters from scoring (ECCC, 2023). WSP's LOM contacted WS&T for additional information, particularly as to why ammonia was removed from the study scoring but not total nitrogen since ammonia is a component of total nitrogen. WS&T reviewed total nitrogen and found the percent RSD was in line with the others, so it was not excluded from scoring. The W&ST will send a bottle of the RN-06 to WSP for purposes of internal investigation.

Table 1 lists the quarters of data that were validated to Level 3 during first quarter 2023 by site calibration group. Table 2 lists the sites in each calibration group along with the calibration schedule. Table 3 presents the measurement criteria for laboratory filter pack measurements. These criteria apply to the QC samples listed in the following section of this report. Table 4 presents the critical criteria for ozone monitoring. Table 5 presents the critical criteria for trace-level gas monitoring.

Quality Control Analysis Count

The QC sample statistics presented in this report are for reference standards (RF) and continuing calibration verification spikes (CCV) used to assess accuracy and for replicate sample analyses (RP) used to assess "in-run" precision. In addition, laboratory method blanks (MB) containing reagents without a filter; laboratory blanks (LB) containing reagents and a new, unexposed filter; and field blanks (FB) containing reagents and an unexposed filter that was loaded into a filter pack assembly and shipped to and from the monitoring site while remaining in sealed packaging are also included. Table 6 presents the number of analyses in each category that were performed during first quarter 2023.

Sample Receipt Statistics

Ninety-five percent of field samples from EPA-sponsored sites must be received by the CASTNET laboratory in Gainesville, FL no later than 14 days after removal from the sampling tower. Table 7 presents the relevant sample receipt statistics for first quarter 2023.

Data Quality indicator (DQI) Results

Figures 1 through 3 present the results of RF, CCV, and RP QC sample analyses for first quarter 2023. All results were within the criteria listed in Table 3.

Table 8 presents summary statistics of critical criteria measurements at ozone sites collected during first quarter 2023. The statistics presented contain data validated at Level 2 and Level 3. All data associated with QC checks that fail to meet the criteria listed in Table 4 were or will be invalidated unless the cause of failure has no effect on ambient data collection, and passing results still meet frequency criteria. Results in shaded cells either exceed documented criteria or are otherwise notable. Table 9 presents observations associated with the shaded cell results in Table 8.

Table 10 presents summary statistics of critical criteria measurements at trace-level gas monitoring sites collected during first quarter 2023. The statistics presented contain data validated at Level 2 and Level 3. All data associated with QC checks that fail to meet the criteria listed in Table 5 were or will be invalidated unless the cause of failure has no effect on ambient data collection, and passing results still meet frequency criteria. Results in shaded cells either exceed documented criteria or are otherwise notable. Table 11 presents observations associated with the shaded cell results in Table 10.

Laboratory Control Sample Analysis

The laboratory control sample (LCS) is a reagent blank spiked with the target analytes from the established analytical methods and carried through the same extraction process that field samples must undergo. LCS analyses are performed by the laboratory to monitor for potential sample handling artifacts and provide a means to identify possible analyte loss from extraction to extraction. Figure 4 presents LCS analysis results for first quarter 2023. All recovery values were between 89.6 percent and 106.7 percent.

Blank Results

Figures 5 through 7 present the results of MB, LB, and FB QC sample analyses for first quarter 2023. All first quarter results were within criteria (two times the reporting limit) listed in Table 3.

Suspect/Invalid Filter Pack Samples

Filter pack samples that were flagged as suspect or invalid during first quarter 2023 are listed in Table 12. This table also includes associated site identification and a brief description of the reason the sample was flagged. During first quarter, 15 filter pack samples were invalidated.

Field Problem Count

Table 13 presents counts of field problems affecting continuous data collection for more than one day for first quarter 2023. The problem counts are sorted by a 30-, 60-, or 90-day time period to resolution. A category for unresolved problems is also included.

References

American Society for Testing and Materials (ASTM). 2008. ASTM E29-08, "Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications." ASTM International, West Conshohocken, PA, DOI:10.1520/E0029-08. www.astm.org.

Environment and Climate Change Canada (ECCC). 2023. Rain and Soft Waters PT Study 0121 Report. Environmental Science and Technology Laboratories Division, Water Science and Technology Directorate Proficiency Testing Program, Burlington, Ontario, Canada. Prepared for WSP USA Environment & Infrastructure Inc., Gainesville, FL, USA.

U.S. Environmental Protection Agency (EPA). 2020. Title 40 Code of Federal Regulations Part 58, "Appendix A to Part 58 – Quality Assurance Requirements for Monitors used in Evaluations of National Ambient Air Quality Standards."

WSP USA Environment & Infrastructure Inc. (WSP) formerly known as Wood Environment & Infrastructure Solutions, Inc. 2022. Clean Air Status and Trends Network (CASTNET) Quality Assurance Project Plan (QAPP) Revision 9.5. Prepared for U.S. Environmental Protection Agency (EPA), Office of Air and Radiation, Clean Air Markets Division, Washington, DC. Contract No. 68HERH21D0006. Gainesville, FL. https://java.epa.gov/castnet/documents.do.

Table 1 Data Validated to Level 3 through First Quarter 2023

Calibration Group[*]	Months Available	Number of Months	Complete Quarters	Number of Quarters
E-3/W-10[†]	May 2022– October 2022	6	Quarter 3 2022	1
SE-4/MW-6[‡]	July 2022– December 2022	6	Quarter 3 2022– Quarter 4 2022	2

Notes: [*] The sites contained in each calibration group are listed in Table 2.
         [†] Contains ROM206 of the ROM406/ROM206 co-located pair
         [‡] Contains MCK131/231 co-located pair

Table 2 Field Calibration Schedule for 2023

Calibration Group	Months Calibrated	Sites Calibrated			
Eastern Sites (22 Total)					
E-1 (8 Sites)	February/August	BEL116, MD BWR139, MD	WSP144, NJ CTH110, NY	ARE128, PA PSU106, PA	PED108, VA VPI120, VA
E-2 (9 Sites)	April/October	ABT147, CT ASH135, ME WST109, NH	CAT175, NY HWF187, NY[1] WFM105, NY	NIC001, NY EGB181, ON UND002, VT	
E-3 (5 Sites)	May/November	KEF112, PA MKG113, PA	LRL117, PA PAR107, WV	CDR119, WV	
Southeastern Sites (11 Total)					
SE-4 (6 Sites)	January/July	SND152, AL GAS153, GA	BFT142, NC CND125, NC	COW137, NC SPD111, TN	
SE-5 (5 Sites)	February/August	CAD150, AR IRL141, FL	SUM156, FL CVL151, MS	DUK008, NC3	
Midwestern Sites (18 Total)					
MW-6 (6 Sites)	January/July	CDZ171, KY CKT136, KY	MCK131, KY MCK231, KY	PNF126, NC[1] ESP127, TN	
MW-7 (8 Sites)	March/September	BVL130, IL[2] STK138, IL	VIN140, IN RED004, MN	DCP114, OH OXF122, OH	QAK172, OH PRK134, WI
MW-8 (4 Sites)	April/October	SAL133, IN HOX148, MI	ANA115, MI UVL124, MI		
Western Sites (13 Total)					
W-9 (5 Sites)	March/September	KNZ184, KS KIC003, KS	CHE185, OK SAN189, NE	ALC188, TX	
W-10 (8 Sites)	May/November	LPO010, CA GTH161, CO	ROM206, CO3 NPT006, ID	PAL190, TX UMA009, WA	CNT169, WY PND165, WY3

Notes: [1] Trace-level gas calibrations are performed quarterly in January, April, July, and October.
         [2] Trace-level gas calibrations are performed quarterly in March, June, September, and December.
         [3] Trace-level gas calibrations are performed quarterly in February, May, August, and November.

Table 3 Data Quality Indicators for CASTNET Laboratory Measurements

Analyte	Method	Precision[1] (MARPD)	Accuracy[2] (%)	Nominal Reporting Limits mg/L	Nominal Reporting Limits µg/Filter
Ammonium (NH_4^+)	AC	20	90-110	0.020*	0.5
Sodium (Na^+)	ICP-OES	20	95-105	0.005	0.125
Potassium (K^+)	ICP-OES	20	95-105	0.006	0.15
Magnesium (Mg^{2+})	ICP-OES	20	95-105	0.003	0.075
Calcium (Ca^{2+})	ICP-OES	20	95-105	0.006	0.15
Chloride (Cl^-)	IC	20	95-105	0.020	0.5
Nitrate (NO_3^-)	IC	20	95-105	0.008*	0.2
Sulfate (SO_4^{2-})	IC	20	95-105	0.040	1.0

Notes: [1] This column lists precision goals for both network precision calculated from co-located filter samples and laboratory precision based on replicate samples for samples > five times the reporting limit. The criterion is ± the reporting limit if the sample is ≤ five times the reporting limit.
[2] This column lists laboratory accuracy goals based on reference standards and continuing calibration verification spikes. The criterion is 90–110 percent for ICP-OES reference standards.
[3] The reporting limit for sulfate on cellulose filters is 0.080 mg/L (2.0 µg/filter).

AC	= automated colorimetry
IC	= ion chromatography
ICP-OES	= inductively coupled plasma-optical emission spectrometry
MARPD	= mean absolute relative percent difference
mg/L	= milligrams per liter
µg/Filter	= micrograms per filter
*	= as nitrogen

Values are rounded according to American Society for Testing and Materials (ASTM) E29-08, "Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications" (ASTM, 2008).

For more information on analytical methods and associated precision and accuracy criteria, see the CASTNET QAPP, (WSP, 2022).

Table 4 Ozone Critical Criteria

Type Check	Analyzer Response
Zero	Less than ± 3.1 parts per billion (ppb)
Span	Less than ± 7.1 percent between supplied and observed concentrations
Single Point QC	Less than ± 7.1 percent between supplied and observed conentrations

Notes: * Applies to CASTNET sites that are configured and operated in accordance with Part 58 of Title 40 of the Code of Federal Regulations (EPA, 2020). The minimum frequency for these checks is once every two weeks.

Values are rounded according to ASTM E29-08, "Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications" (ASTM, 2008).

Table 5 Trace-level Gas Monitoring Critical Criteria

Parameter	Analyzer Response	
	Zero Check	Span Check / Single Point QC Check
SO_2	Less than ± 1.51 ppb	Less than ± 10.1 percent between supplied and observed concentrations
NO_y	Less than ± 1.51 ppb	
*CO	Less than ± 30 ppb	

Notes: *EPA technical direction received March 14, 2023 required WSP to reevaluate CO QC results based on 50 ppb zero check criterion and Level 4 precision challenge at 500 ppb (from 250 ppb) after March 9, 2023 and beyond.

Applies to CASTNET sites that are configured and operated in accordance with Part 58 of Title 40 of the Code of Federal Regulations (EPA, 2020). The minimum frequency for these checks is once every two weeks.

Values are rounded according to ASTM E29-08, "Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications" (ASTM, 2008).

SO_2	=	sulfur dioxide
NO_y	=	total reactive oxides of nitrogen
CO	=	carbon monoxide
ppb	=	parts per billion

Table 6 QC Analysis Count for First Quarter 2023

Filter Type	Parameter	RF Sample Count	CCV Sample Count	RP Sample Count	MB Sample Count	LB Sample Count	FB Sample Count
Teflon	SO_4^{2-}	58	163	69	14	20	48
	NO_3^-	58	163	69	14	20	48
	NH_4^+	29	151	68	14	20	48
	Cl^-	58	163	69	14	20	48
	Ca^{2+}	28	146	69	14	20	48
	Mg^{2+}	28	146	69	14	20	48
	Na^+	28	146	69	14	20	48
	K^+	28	146	69	14	20	48
Nylon	SO_4^{2-}	31	142	68	11	22	57
	NO_3^-	31	142	68	11	22	57
Cellulose	SO_4^{2-}	43	144	64	14	22	82

Table 7 Filter Pack Receipt Summary for First Quarter 2023

Count of samples received more than 14 days after removal from tower:	9
Count of all samples received	602
Fraction of samples received within 14 days:	0.985
Average interval in days:	6.055
First receipt date:	01/03/2023
Last receipt date:	03/21/2023

Note: Sample shipments for the Egbert, Ontario site (EGB181) are in groups of four.
　　　Samples associated with EGB181 are excluded from this statistic.

Table 8 Ozone QC Summary for First Quarter 2023 (1 of 2)

Site ID	% Span Pass[1]	Span [%D][2]	% Single Point QC Pass[1]	% Single Point QC [%D][2]	% Zero Pass[1]	Zero Average (ppb)[2]
ABT147, CT	100.00	4.94	100.00	5.14	100.00	0.23
ALC188, TX	96.67	1.72	96.63	2.31	98.88	0.49
ANA115, MI	100.00	2.31	100.00	1.46	100.00	0.15
ARE128, PA	100.00	0.48	100.00	0.56	100.00	0.28
ASH135, ME[3]	N/A	N/A	N/A	N/A	N/A	N/A
BEL116, MD	100.00	0.45	100.00	0.69	100.00	0.40
BFT142, NC	100.00	3.82	100.00	4.15	100.00	0.25
BVL130, IL	100.00	1.23	100.00	1.75	100.00	0.84
BWR139, MD	100.00	1.36	100.00	1.99	100.00	0.48
CAD150, AR	100.00	1.72	100.00	2.22	100.00	0.31
CDR119, WV[3]	N/A	N/A	N/A	N/A	N/A	N/A
CDZ171, KY[3]	N/A	N/A	N/A	N/A	N/A	N/A
CKT136, KY	100.00	0.29	100.00	0.41	100.00	0.12
CND125, NC	98.75	2.68	98.72	2.79	100.00	0.34
CNT169, WY	100.00	1.28	100.00	1.68	100.00	0.58
COW137, NC	100.00	0.60	100.00	1.09	100.00	0.18
CTH110, NY	100.00	0.77	100.00	0.73	100.00	0.14
CVL151, MS	100.00	0.50	100.00	0.79	100.00	0.24
DCP114, OH[3]	N/A	N/A	N/A	N/A	N/A	N/A
DUK008, NC	100.00	2.88	100.00	1.47	100.00	0.74
ESP127, TN	100.00	2.20	100.00	1.50	100.00	0.33
GAS153, GA	100.00	0.75	98.91	1.59	100.00	0.65
GTH161, CO	91.67	2.22	100.00	1.38	91.49	0.90
HOX148, MI	100.00	0.99	100.00	0.78	100.00	0.19
HWF187, NY[3]	N/A	N/A	N/A	N/A	N/A	N/A
IRL141, IL	100.00	1.67	100.00	2.16	100.00	0.23
KEF112, PA	98.97	1.49	100.00	0.68	100.00	0.60
LPO010, CA	100.00	0.65	100.00	0.82	100.00	0.15
LRL117, PA	100.00	1.16	100.00	0.65	100.00	0.50
MCK131, KY	100.00	0.50	100.00	0.46	100.00	0.17
MCK231, KY	100.00	0.69	100.00	0.56	100.00	0.17
MKG113, PA	100.00	0.46	100.00	0.63	100.00	0.21
NPT006, ID	100.00	1.56	100.00	0.78	100.00	0.11
OXF122, OH	100.00	1.03	100.00	1.08	100.00	0.19
PAL190, TX	100.00	1.07	100.00	1.00	100.00	0.15
PAR107, WV	100.00	0.61	100.00	0.70	100.00	0.20
PED108, PA	100.00	0.64	100.00	0.83	100.00	0.21
PND165, WY	100.00	0.77	100.00	1.09	100.00	0.27
PNF126, NC[3]	N/A	N/A	N/A	N/A	N/A	N/A
PRK134, WI	95.65	5.50	95.65	5.24	100.00	0.13
PSU106, PA	100.00	1.13	100.00	1.30	100.00	0.18
QAK172, OH	100.00	2.23	100.00	2.42	100.00	0.18
ROM206, CO	100.00	1.99	100.00	3.15	100.00	0.20
SAL133, IN	100.00	0.63	100.00	0.47	100.00	0.18

Table 8 Ozone QC Summary for First Quarter 2023 (2 of 2)

Site ID	% Span Pass[1]	Span [%D][2]	% Single Point QC Pass[1]	% Single Point QC [%D][2]	% Zero Pass[1]	Zero Average (ppb)[2]
SAN189, NE	78.43	22.34	78.43	22.82	100.00	0.61
SND152, AL	100.00	0.93	100.00	1.00	100.00	0.22
SPD111, TN	100.00	1.12	100.00	1.44	100.00	0.41
STK138, IL	100.00	1.05	100.00	1.05	100.00	0.25
SUM156, FL	100.00	1.59	100.00	0.93	100.00	0.18
UMA009, WA	100.00	0.27	100.00	0.59	100.00	0.45
UVL124, MI	100.00	1.85	98.91	1.40	100.00	0.49
VIN140, IN	96.77	3.94	100.00	1.11	100.00	0.12
VPI120, VA	100.00	0.81	100.00	0.99	100.00	0.27
WSP144, NJ	100.00	1.00	100.00	1.03	100.00	0.17
WST109, NH[3]	N/A	N/A	N/A	N/A	N/A	N/A

Notes: [1]Percentage of comparisons that pass the criteria listed in Table 4. Values falling below 90 percent are addressed in Table 9.
[2]Absolute value of the average percent differences between the on-site transfer standard and the site monitor. Values exceeding the criteria listed in Table 4 are addressed in Table 9.
[3]Site mothballed due to EPA budget constraints.

%D   =   percent difference
ppb   =   parts per billion

Table 9 Ozone QC Observations for First Quarter 2023

Site ID	QC Criterion	Comments
SAN189, NE	% Span Pass Span |%D| % Single Point QC Pass Single Point QC |%D|	The analyzer sample pump failed in late February and was replaced.

Note: %D = percent difference

Table 10 Trace-level Gas QC Summary for First Quarter 2023

Parameter	% Span Pass[1]	Span [%D][2]	% Single Point QC Pass[1]	% Single Point QC [%D][2]	% Zero Pass[1]	Zero Average (ppb)[2]
BVL130, IL						
SO_2	100.00	1.53	100.00	3.47	100.00	0.77
NO_y	100.00	1.32	100.00	1.52	100.00	0.12
CO	98.28	2.73	72.41	9.91	50.85	53.11
DUK008, NC						
NO_y	100.00	1.83	100.00	2.24	100.00	0.42
HWF187, NY						
NO_y	NA	NA	NA	NA	NA	NA
PND126, NC						
NO_y	100.00	4.04	100.00	6.02	100.00	0.26
PNF126, NC						
NO_y	NA	NA	NA	NA	NA	NA
ROM206, CO						
NO_y	100.00	3.14	100.00	1.47	100.00	0.12

Notes: [1]Percentage of comparisons that pass the criteria listed in Table 5. Values falling below 90 percent are addressed in Table 11.
[2]Absolute value of the average percent differences between the supplied and observed concentrations. Values exceeding the criteria listed in Table 5 are addressed in Table 11.

%D = percent difference
ppb = parts per billion

Table 11 Trace-level Gas QC Observations for First Quarter 2023

Site ID	Parameter	QC Criterion	Comments
BVL130, IL	CO	% Single Point QC Pass % Zero Pass Zero Average	Failures were due to calibration drift.

Table 12 Filter Packs Flagged as Suspect or Invalid During First Quarter 2023

Site ID	Sample No.	Reason
ACA416, ME	2303003-01	Power failure
CNT169, WY	2307001-15	The flow pump failed.
DEN417, AK	2301003-05 2302003-05	Data are suspect. The filter pack appears to be unexposed.
EGB181, ON	2307001-21	Site data are missing.
FOR605, WY	2305005-03	Flow data are missing.
GLR468, MT	2307003-08 2309003-08	Power failure
GRS420, TN	2304003-11	Data are suspect. The filter pack appears to be unexposed.
GTH161, CO	2301001-24 2303001-24	Data are suspect. The filter pack appears to be unexposed.
JOT403, CA	2305003-12	Flow data are missing.
MCK231, KY	2304001-32	There was an obstruction in flow system.
MKG113, PA	2302001-33	The mass flow controller malfunctioned and was replaced.
SAN189, NE	2304004-07	The data logger flow channel was left down.

Table 13 Field Problems Affecting Data Collection

Days to Resolution	Problem Count
30	159
60	7
90	1
Unresolved by end of quarter	3

Figure 1 Reference Standard Results for First Quarter 2023 (percent recovery)
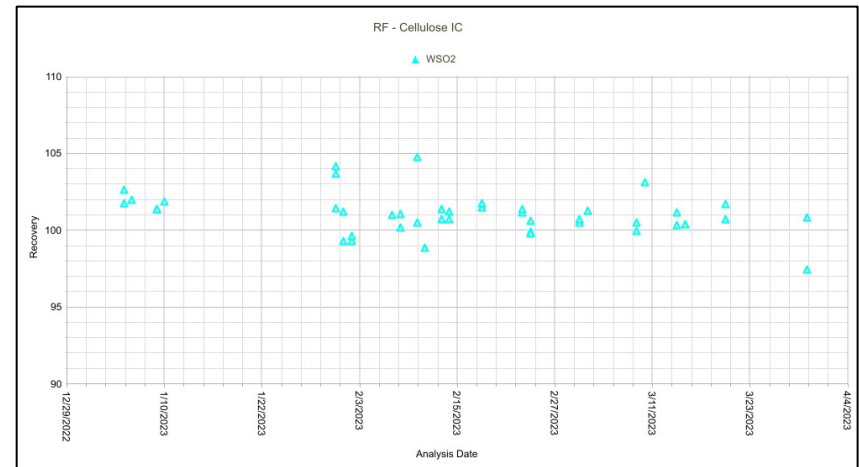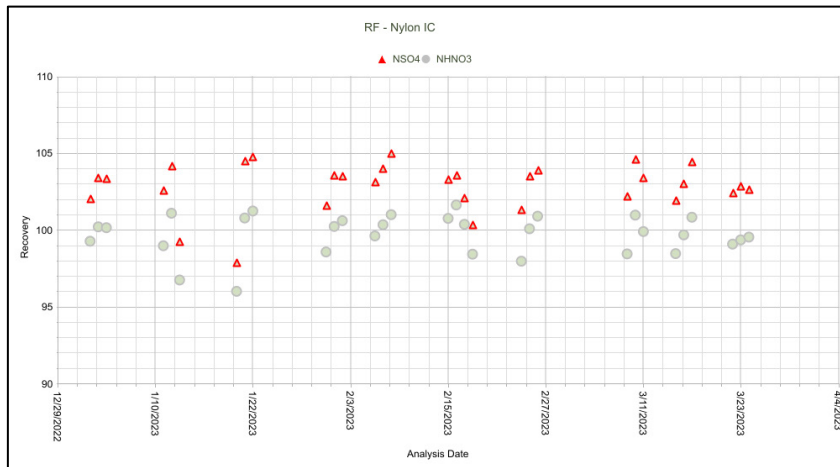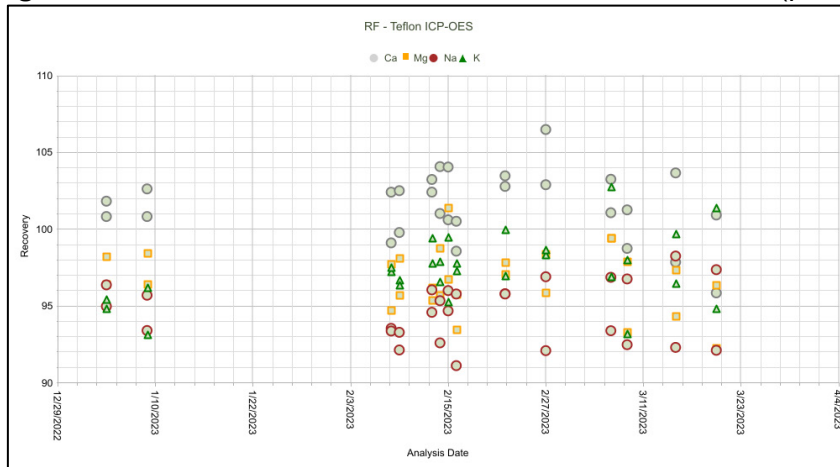
Figure 2 Continuing Calibration Spike Results for First Quarter 2023 (percent recovery)
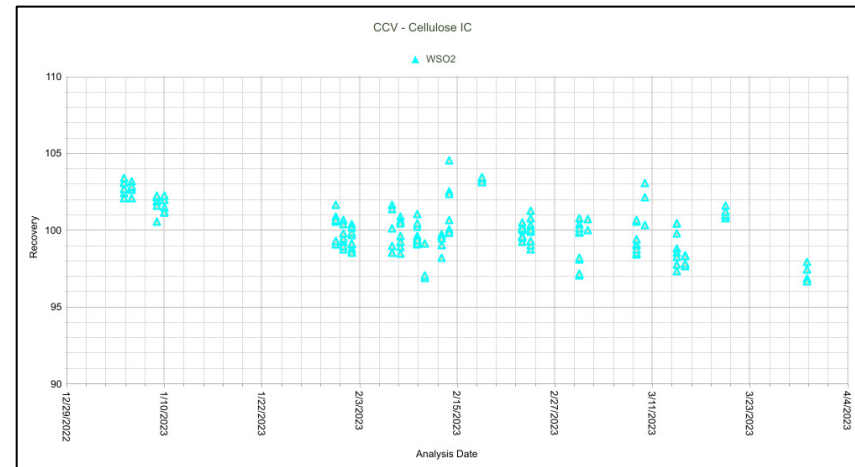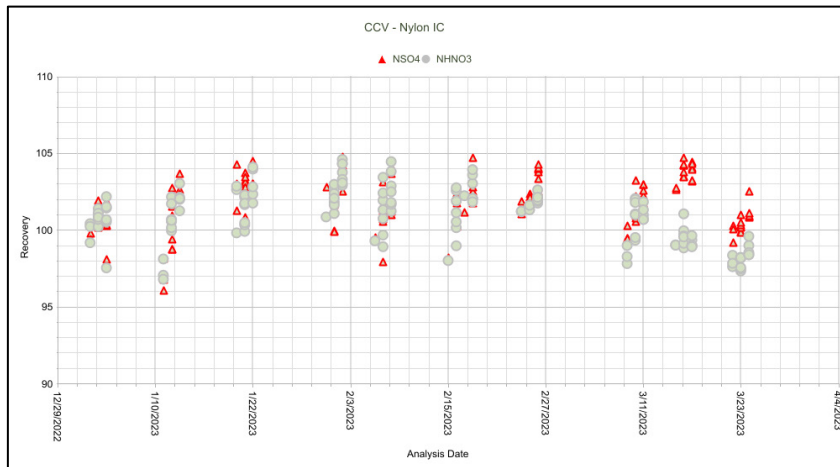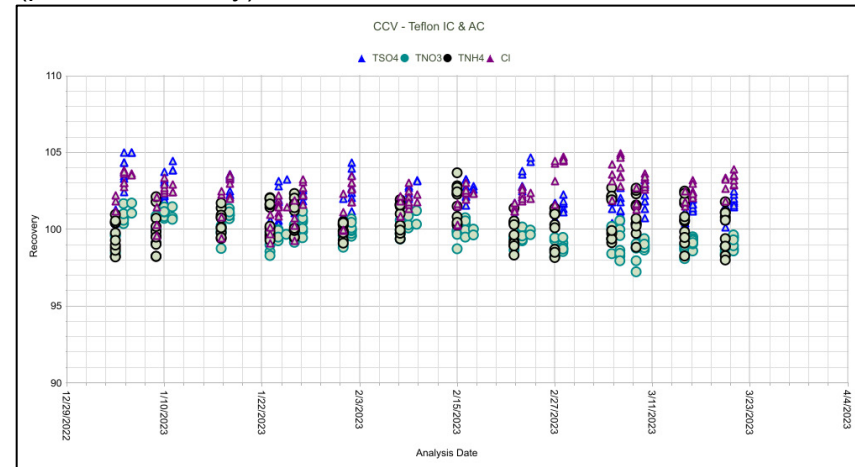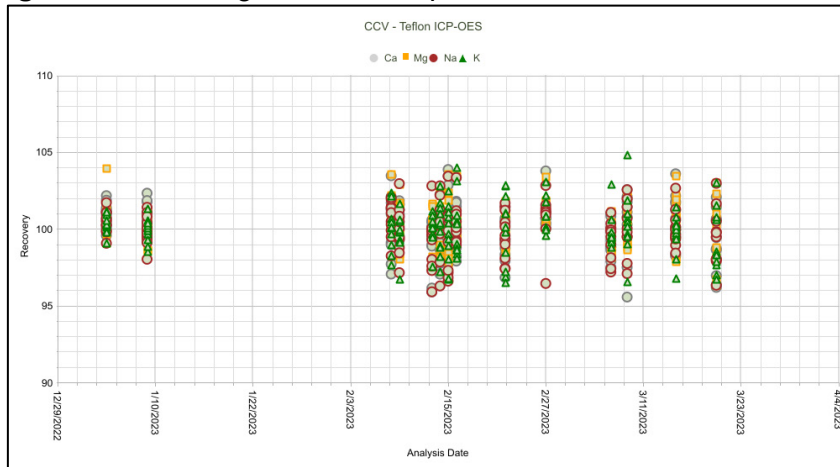
Figure 3 Replicate Sample Analysis Results for First Quarter 2023 (percent difference)
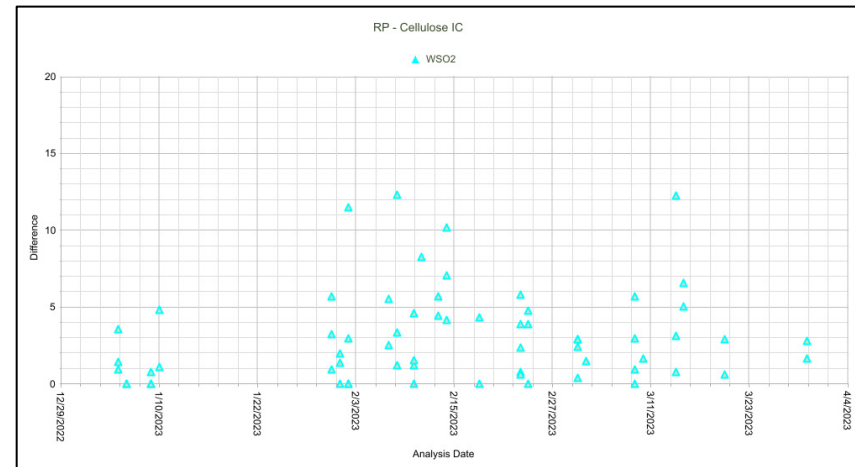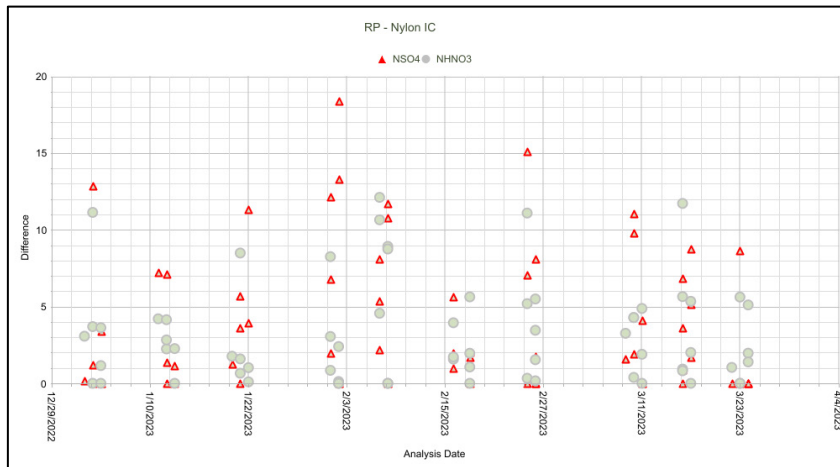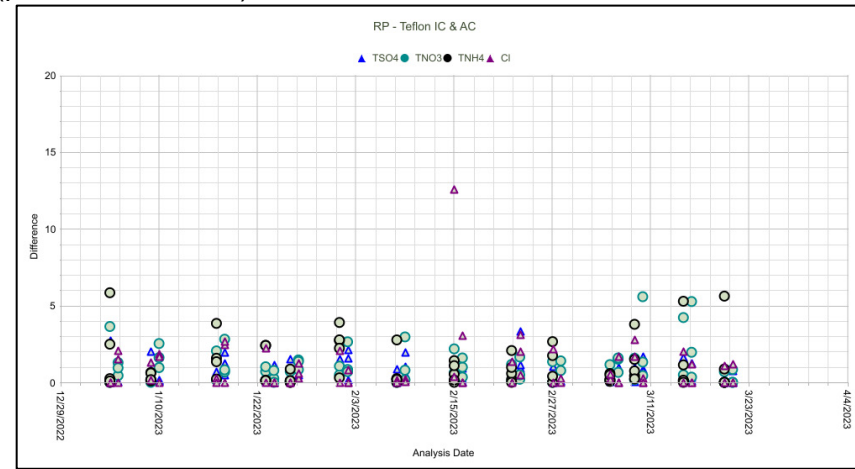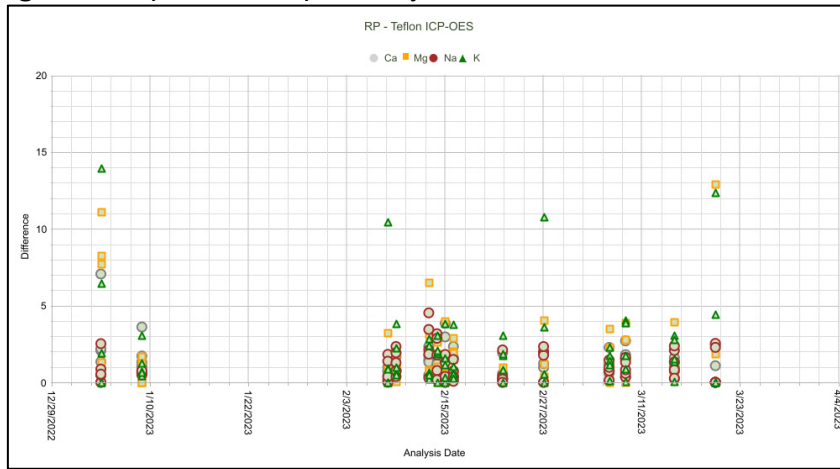
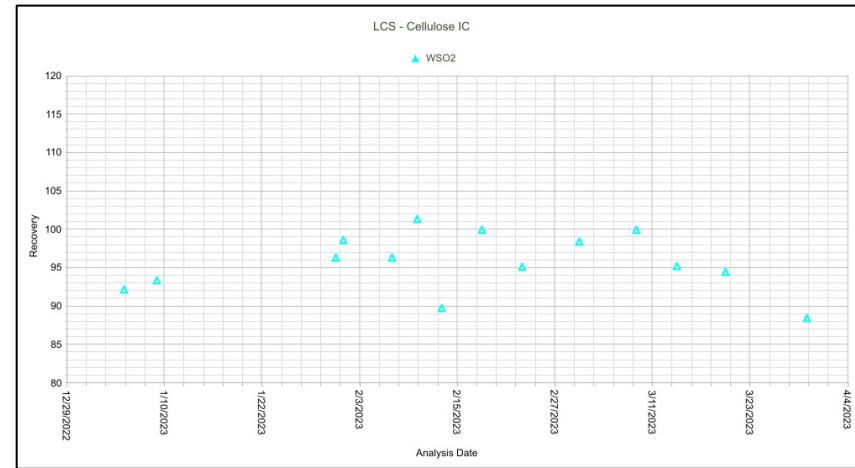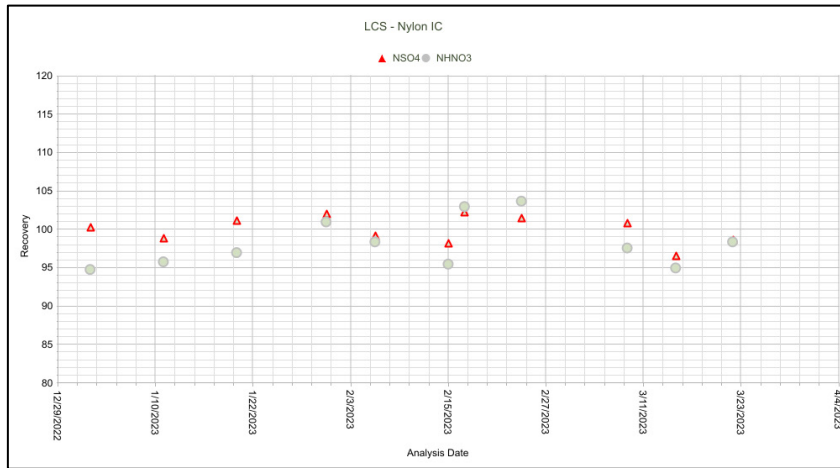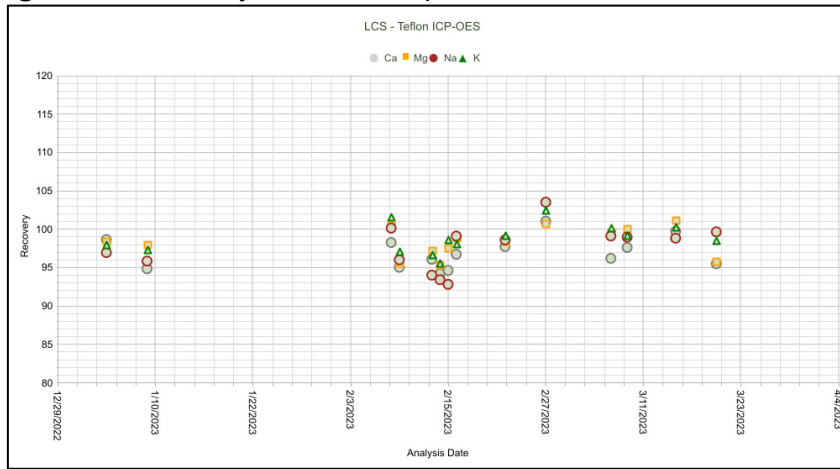**Figure 4** Laboratory Control Sample Results for First Quarter 2023 (percent recovery)
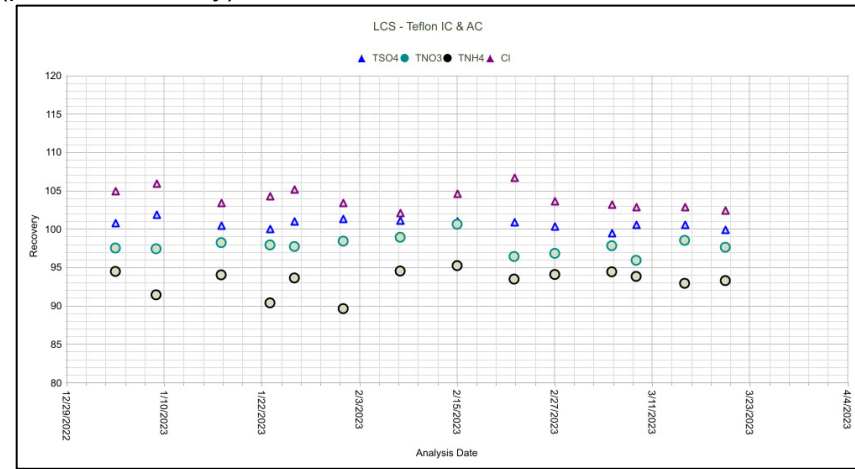
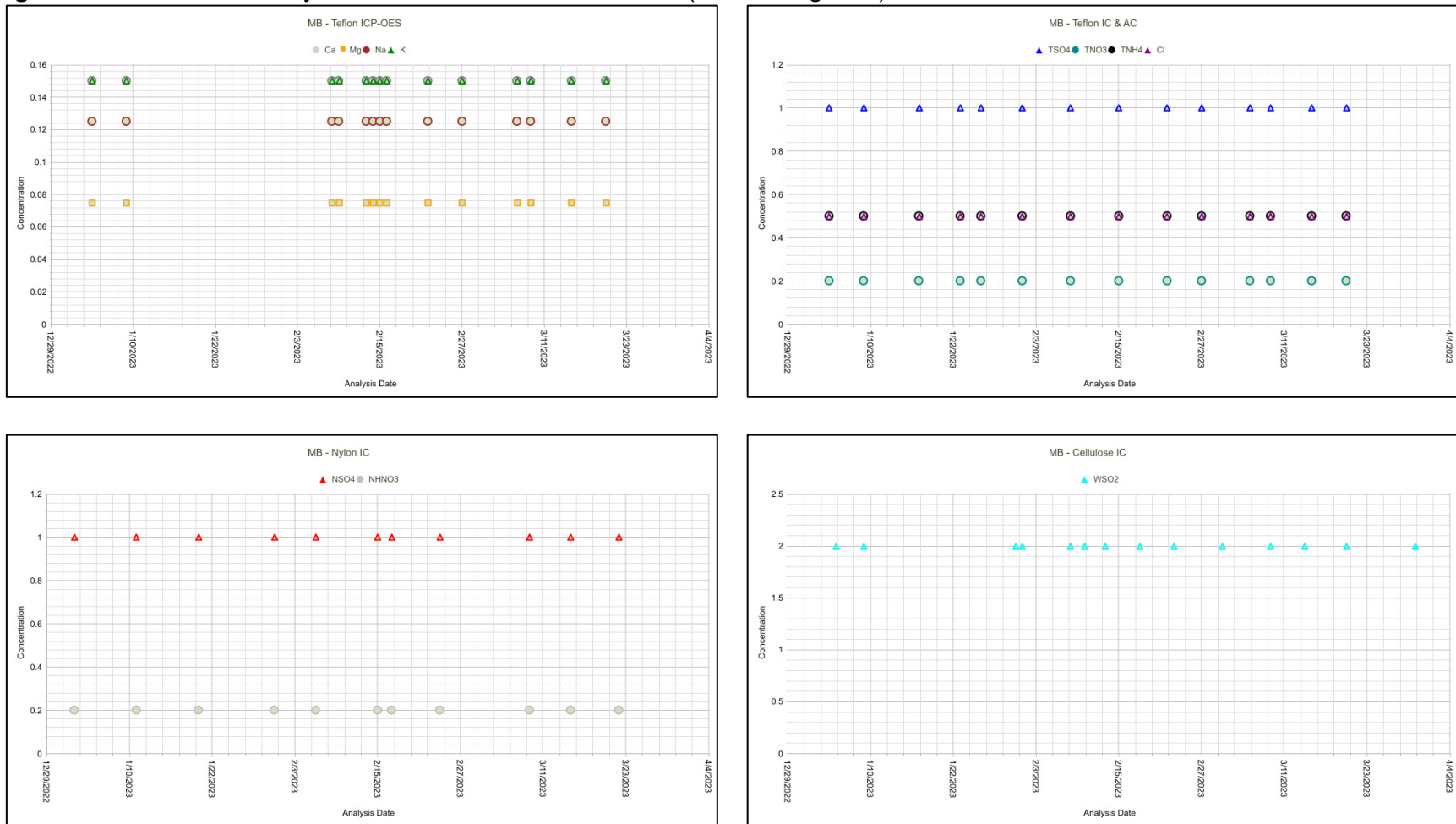**Figure 5** Method Blank Analysis Results for First Quarter 2023 (total micrograms)

Figure 6 Laboratory Blank Analysis results for First Quarter 2023 (total micrograms)
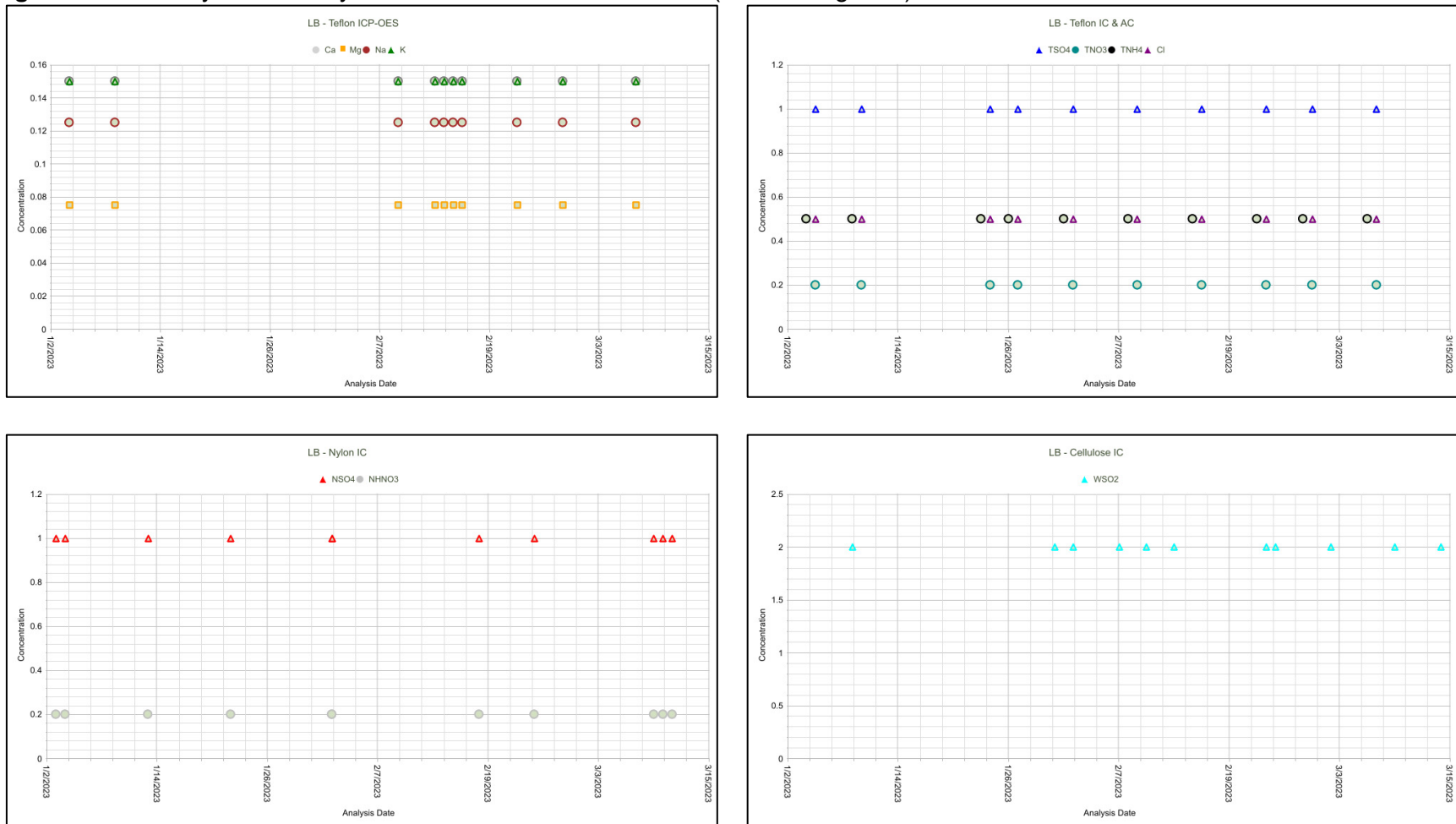
Figure 7 Field Blank Analysis Results for First Quarter 2023 (total micrograms)