



Clean Air Status and Trends Network

Third Quarter 2016 Quality Assurance Report

Summary of Quarterly Operations (July through September)

EPA Contract No. EP-W-16-015

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 third quarter 2016. The various QA/QC criteria and policies are documented in the CASTNET Quality Assurance Project Plan (QAPP; Amec Foster Wheeler, 2016). 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

Investigation into the cause of the anomalous sulfur dioxide (SO₂) filter pack concentration measurements for third and fourth quarter 2015 continued. The laboratory had changed to a different supplier of the cellulose filter impregnation solution in April 2015, which continued through October 2015 and affected filter pack samples from mid-May through December 2015. Corrective action was initiated under International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) 17025:2005 management system protocol. Amec Foster Wheeler continued addressing the next steps as outlined in Corrective Action CA_0053 and the Filter Pack SO₂ Issue Summary (versions 4 and 5) during third quarter. Actions outlined by CA_0053 were completed by the end of third quarter.

A new format for the quarterly data summary was used for preparation of the report, which was submitted to EPA on July 29, 2016, and September 29, 2016 (first and second quarter 2016, respectively). Beginning with the Second Quarter 2016 Data Summary, production of the report and the associated data analysis was moved up by one month from the previous quarterly submittal date. Future quarterly summary reports will be submitted at the end of March, June, September, and December each year.

The laboratory began the process of ordering the next year's supply of filters and reagents.

During August, the flagging protocol agreed upon for the May through December 2015 SO₂ data was applied to the data set and evaluated. Evaluation revealed that western sites still showed unreasonably elevated concentrations and require a more rigorous invalidation criterion. An updated criterion will be developed and tested.

Personnel from the North Carolina Department of Environmental Quality (NCDEQ) completed audits of the ozone systems at CASTNET sites within the state and completed checks of the

third-party data collection equipment installed by NCDEQ last year at these ozone sites. One of Amec Foster Wheeler's field subcontractors met NCDEQ at each site. All sites passed the audits. The NCDEQ's goal was to determine if CASTNET data are comparable with the North Carolina ozone network, and they are. It is likely that NCDEQ will regularly perform audits of CASTNET ozone sites in the future.

CASTNET ozone site CNT169, WY failed an independent audit during a visit in July, but the auditor decided to re-audit the site after review of the audit data and metadata. These data indicated possible problems with the pneumatic connections during the audit. The audit of CNT169 was repeated in August, and results passed. Additionally, BFT142, NC failed a National Performance Audit Program (NPAP) audit during the quarter. Review of the audit data and auditor field notes indicated system moisture intrusion was observed during the audit. Amec Foster Wheeler is evaluating possible actions to prevent such issues. EPA Region 4 will schedule a re-audit of this site as their schedule permits.

Safety audits of the BEL116, MD; BVL130, IL; and NPT006, ID sites took place during third quarter 2016. No safety issues were found.

Amec Foster Wheeler received results for sample analyses for proficiency test study 108 for Rain and Soft Waters from the National Laboratory of Environmental Testing, a branch of the National Water Research Institute with Environment Canada that provides QA services. All CASTNET measured parameters received a performance rating of "ideal." However, analyses of conductivity were flagged "high bias" at 2.9 percent. Amec Foster Wheeler's proficiency test plan under the ISO/IEC 7025:2005 accreditation by the American Association for Laboratory Accreditation does not require action for bias below 5 percent for a single parameter unless it is a consecutive finding for that parameter. Amec Foster Wheeler's analytical laboratory continued to be rated, "very good," the highest rating available.

Table 1 lists the quarters of data that were validated to Level 3 during third quarter 2016 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 third quarter 2016.

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 third quarter 2016.

Data Quality Indicator (DQI) Results

Figures 1 through 3 present the results of RF, CCV, and RP QC sample analyses for third quarter 2016. All results were within the criteria listed in Table 3. Results for sulfate nylon filter analyses for one RF sample and one RP sample appear high on the graph but are within criteria per established rounding rules at 105.3 and 20.2 percent respectively.

Table 8 presents summary statistics of critical criteria measurements at ozone sites collected during third quarter 2016. 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. During third quarter 2016, no results exceeded documented criteria.

Table 9 presents summary statistics of critical criteria measurements at trace-level gas monitoring sites collected during third quarter 2016. 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 10 presents observations associated with the shaded cell results in Table 9.

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. The LCS is not required by the CASTNET QA/QC program. 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 third quarter 2016. All recovery values were between 90 percent and 110 percent.

Blank Results

Figures 5 through 7 present the results of MB, LB, and FB QC sample analyses for third quarter 2016. All third 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 third quarter 2016 are listed in Table 11. This table also includes associated site identification and a brief description of the reason the sample was flagged. During third quarter, 24 filter pack samples were invalidated.

Field Problem Count

Table 12 presents counts of field problems affecting continuous data collection for more than one day for third quarter 2016. The problem counts are sorted by a 30-, 60-, or 90-day time period to resolution. A category for unresolved problems is also included. Time to resolution indicates the period taken to implement corrective action. The third quarter table lists an unusually large value for the 30-day category. This is due to Amec Foster Wheeler's utilization of a 1-minute data resolution review tool to evaluate the effects of moisture. During this evaluation, problem tickets were opened when the slightest indication of moisture was observed in order to more closely examine the data for effects.

References

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler). 2016. *Clean Air Status and Trends Network (CASTNET) Quality Assurance Project Plan (QAPP) Revision 8.3*. Prepared for U.S. Environmental Protection Agency (EPA), Office of Air and Radiation, Clean Air Markets Division, Washington, DC. Contract No. EP-W-16-015. Gainesville, FL. <https://java.epa.gov/castnet/documents.do>.

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.

U.S. Environmental Protection Agency (EPA). 2015. Appendix A to Part 58 – Quality Assurance Requirements for Monitors used in Evaluations of National Ambient Air Quality Standards. 40 CFR Part 58.

Table 1 Data Validated to Level 3 during Third Quarter 2016

Calibration Group*	Months Available	Number of Months	Complete Quarters	Number of Quarters
E-3/W-10†	November 2015 – April 2016	6	Quarter 1 2016	1
SE-4/MW-6‡	January 2016 – June 2016	6	Quarter 1 2016 – Quarter 2 2016	2

Notes: * The sites contained in each calibration group are listed in Table 2.

† Contains ROM206 of the ROM406/ROM206 collocated pair

‡ Contains MCK131/231 collocated pair

Table 2 Field Calibration Schedule for 2016

Calibration Group	Months Calibrated	Sites Calibrated			
Eastern Sites (24 Total)					
E-1 (8 Sites)	February/August	BEL116, MD ¹ BWR139, MD	WSP144, NJ CTH110, NY	ARE 128, PA PSU106, PA	PED108, VA VPI120, VA
E-2 (11 Sites)	April/October	ABT147, CT ASH135, ME HOW191, ME	WST109, NH CAT175, NY HWF187, NY ²	NIC001, NY WFM007, NY WFM105, 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 (7 Sites)	January/July	SND152, AL GAS153, GA	BFT142, NC CND125, NC	COW005, NC COW137, NC	SPD111, TN
SE-5 (4 Sites)	February/August	CAD150, AR CVL151, MS	IRL141, FL SUM156, FL		
Midwestern Sites (19 Total)					
MW-6 (6 Sites)	January/July	CDZ171, KY CKT136, KY	MCK131, KY MCK231, KY	PNF126, NC ² ESP127, TN	
MW-7 (9 Sites)	March/September	ALH157, IL BVL130, IL ³ 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 (11 Total)					
W-9 (5 Sites)	March/September	KNZ184, KS KIC003, KS	CHE185, OK SAN189, NE	ALC188, TX	
W-10 (6 Sites)	May/November	GTH161, CO ROM206, CO ¹	NPT006, ID CNT169, WY	PND165, WY ¹ PAL190, TX	

Notes: ¹ Trace-level gas calibrations are performed quarterly in February, May, August, and November.

² Trace-level gas calibrations are performed quarterly in January, April, July, and October.

³ Trace-level gas calibrations are performed quarterly in March, June, September, and December.

Table 3 Data Quality Indicators for CASTNET Laboratory Measurements

Analyte	Method	Precision ¹ (MARPD)	Accuracy ² (%)	Nominal Reporting Limits	
				mg/L	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 collocated filter samples and laboratory precision based on replicate samples.

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.

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, (Amec Foster Wheeler, 2016).

Table 4 Ozone Critical Criteria*

Type of Check	Analyzer Response
Zero	Less than ± 1.5 parts per billion (ppb)
Span	Less than or equal to ± 7 percent between supplied and observed concentrations
Single Point QC	Less than or equal to ± 7 percent between supplied and observed concentrations

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, 2015). 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 ± 1.5 ppb	Less than or equal to ± 10 percent between supplied and observed concentrations
NO _y	Less than ± 1.5 ppb	
CO	Less than ± 30 ppb	

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, 2015). 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 E29 (ASTM, 2008).

SO₂ = sulfur dioxide
 NO_y = total reactive oxides of nitrogen
 CO = carbon monoxide
 ppb = parts per billion

Table 6 QC Analysis Count for Third Quarter 2016

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⁻	59	207	87	18	26	91
	NO ₃ ⁻	59	207	87	18	26	91
	NH ₄ ⁺	36	184	86	18	26	91
	Cl ⁻	59	207	87	18	26	91
	Ca ²⁺	38	191	87	19	26	91
	Mg ²⁺	38	191	87	19	26	91
	Na ⁺	38	191	87	19	26	91
	K ⁺	38	191	87	19	26	91
Nylon	SO ₄ ²⁻	55	207	85	17	28	91
	NO ₃ ⁻	55	207	85	17	28	91
Cellulose	SO ₄ ²⁻	69	233	87	18	28	92

Table 7 Filter Pack Receipt Summary for Third Quarter 2016

Count of samples received more than 14 days after removal from tower:	14
Count of all samples received:	817
Fraction of samples received within 14 days:	0.983
Average interval in days:	4.416
First receipt date:	07/01/2016
Last receipt date:	09/29/2016

Table 8 Ozone QC Summary for Third Quarter 2016 (1 of 2)

Site ID	% Span Pass ¹	Span %D ²	% Single Point QC Pass ¹	Single Point QC %D ²	Single Point QC CL ³	% Zero Pass ¹	Zero Average (ppb) ²
ABT147, CT	100.00	1.55	100.00	1.63	0.12	95.65	0.48
ALC188, TX	94.44	2.73	100.00	1.94	0.12	100.00	0.23
ALH157, IL	100.00	1.29	100.00	0.95	0.16	100.00	0.13
ANA115, MI	100.00	1.06	100.00	0.91	0.22	100.00	0.13
ARE128, PA	100.00	0.93	100.00	0.98	0.12	100.00	0.26
ASH135, ME	100.00	0.85	100.00	0.70	0.09	100.00	0.14
BEL116, MD	98.90	1.86	98.90	1.47	0.34	95.60	0.40
BFT142, NC	96.88	1.73	100.00	1.38	0.21	98.96	0.21
BVL130, IL	100.00	0.90	98.92	1.41	0.22	100.00	0.36
BWR139, MD	100.00	1.66	97.78	2.20	0.31	92.39	0.61
CAD150, AR	100.00	1.28	97.73	1.51	0.41	93.18	0.53
CDR119, WV	100.00	2.58	100.00	2.64	0.17	100.00	0.34
CDZ171, KY	98.96	0.80	97.92	0.69	0.24	96.88	0.29
CKT136, KY	100.00	0.66	100.00	0.56	0.07	100.00	0.15
CND125, NC	100.00	2.64	100.00	2.41	0.19	100.00	0.36
CNT169, WY	100.00	2.22	100.00	0.99	0.18	100.00	0.66
COW137, NC	100.00	1.09	100.00	1.55	0.11	100.00	0.23
CTH110, NY	100.00	0.92	100.00	0.94	0.11	100.00	0.29
CVL151, MS	100.00	1.06	100.00	0.66	0.09	100.00	0.26
DCP114, OH	100.00	1.88	100.00	1.33	0.17	97.75	0.21
ESP127, TN	100.00	1.16	100.00	0.92	0.16	100.00	0.17
GAS153, GA	100.00	0.35	100.00	0.42	0.05	100.00	0.34
GTH161, CO	100.00	4.38	100.00	4.38	0.24	100.00	0.13

Table 8 Ozone QC Summary for Third Quarter 2016 (2 of 2)

Site ID	% Span Pass ¹	Span %D ²	% Single Point QC Pass ¹	Single Point QC %D ²	Single Point QC CL ³	% Zero Pass ¹	Zero Average (ppb) ²
HOX148, MI	100.00	1.72	100.00	1.73	0.23	100.00	0.66
HWF187, NY	100.00	0.62	100.00	0.97	0.16	97.62	0.33
IRL141, FL	100.00	1.01	100.00	1.35	0.14	100.00	0.18
KEF112, PA	100.00	0.78	95.56	1.73	0.63	98.89	0.25
LRL117, PA	93.75	6.56	95.24	4.16	3.39	95.24	0.81
MCK131, KY	98.92	1.53	100.00	0.88	0.12	98.92	0.34
MCK231, KY	100.00	1.50	100.00	1.69	0.18	100.00	0.31
MKG113, PA	100.00	0.76	98.75	0.88	0.25	91.25	0.45
OXF122, OH	100.00	2.03	98.88	2.83	0.22	98.88	0.87
PAL190, TX	97.14	1.26	98.51	1.23	0.29	97.01	0.48
PAR107, WV	98.95	2.35	100.00	1.74	0.22	97.89	0.23
PED108, VA	100.00	1.97	100.00	1.87	0.24	100.00	0.20
PND165, WY	97.89	2.68	97.89	3.22	0.85	97.89	1.37
PNF126, NC	100.00	1.35	98.90	1.72	0.17	100.00	0.28
PRK134, WI	100.00	2.58	98.89	2.36	0.30	98.89	0.38
PSU106, PA	100.00	0.71	100.00	0.50	0.12	97.87	0.43
QAK172, OH	97.83	3.21	97.85	3.12	1.88	97.85	1.06
ROM206, CO	100.00	1.04	100.00	0.90	0.12	100.00	0.16
SAL133, IN	98.91	1.50	100.00	1.21	0.19	95.65	0.53
SAN189, NE	100.00	0.95	100.00	0.89	0.11	100.00	0.15
SND152, AL	100.00	1.25	100.00	1.25	0.09	100.00	0.29
SPD111, TN	100.00	1.00	96.51	1.75	0.49	97.67	0.55
STK138, IL	97.87	1.76	100.00	0.85	0.16	100.00	0.44
SUM156, FL	96.91	1.81	100.00	1.17	0.09	100.00	0.39
UVL124, MI	100.00	0.80	100.00	0.67	0.12	97.87	0.23
VIN140, IN	100.00	2.38	98.96	2.43	0.18	100.00	0.30
VPI120, VA	100.00	0.93	100.00	1.05	0.18	100.00	0.29
WSP144, NJ	100.00	1.65	98.95	2.08	0.34	96.84	0.90
WST109, NH	100.00	0.95	98.92	1.30	0.26	98.92	0.27

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 90 percent confidence limit of the coefficient of variation. This should be less than or equal to the 7 percent single point QC check critical criterion. Values exceeding this criterion are addressed in Table 9.

%D = percent difference

CL = confidence limit

ppb = parts per billion

Table 9 Trace-level Gas QC Summary for Third Quarter 2016

Parameter	% Span Pass ¹	Span %D ²	% Single Point QC Pass ¹	Single Point QC %D ²	Single Point QC CL ³	% Zero Pass ¹	Zero Average (ppb) ²
BEL116, MD							
SO ₂	100.00	1.40	100.00	1.28	0.31	100.00	1.15
NO _y	100.00	2.32	100.00	2.89	0.51	100.00	0.17
BVL130, IL							
SO ₂	100.00	1.57	100.00	2.50	0.34	100.00	0.42
NO _y	100.00	4.00	100.00	1.89	0.43	100.00	0.91
CO	100.00	0.52	91.11	5.29	1.17	88.89	18.23
HWF187, NY							
NO _y	100.00	1.02	100.00	2.67	0.39	100.00	0.39
PND165, WY							
NO _y	100.00	1.85	100.00	4.36	0.57	100.00	0.08
PNF126, NC							
NO _y	100.00	1.45	100.00	2.52	0.47	100.00	0.81
ROM206, CO							
NO _y	100.00	1.18	100.00	1.40	0.26	96.43	0.72

Notes: ¹ Percentage of comparisons that pass the criteria listed in Table 5. Values falling below 90 percent are addressed in Table 10.

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 10.

³ 90 percent confidence limit of the coefficient of variation. This should be less than or equal to the 10 percent single point QC check critical criterion. Values exceeding this criterion are addressed in Table 10.

%D = percent difference

CL = confidence limit

ppb = parts per billion

Table 10 Trace-level Gas QC Observations for Third Quarter 2016

Site ID	Parameter	QC Criterion	Comments
BVL130, IL	CO	% Zero Pass	Several QC check failures occurred throughout the quarter, most likely due to an elevated baseline resulting from an erroneous zero point auto-reference by the analyzer.

Table 11 Filter Packs Flagged as Suspect or Invalid during Third Quarter 2016

Site ID	Sample No.	Reason
BAS601, WY	1628005-01 1630008-01	Insufficient flow volume
BBE401, TX	1635004-02	The mass flow controller malfunctioned and was replaced.
BEL116, MD	1635003-06	Power failure
BUF603, WY	1629006-02	Power failure
CAN407, UT	1636005-03	Insufficient flow volume
CDR119, WV	1628001-12 1630005-12	Data logger malfunction
CHA467, AZ	1629004-04	Insufficient flow volume
CHE185, OK	1629005-02 1631005-02 1633005-02 1634005-02	There were telemetry and data logger issues. Data recovery is underway.
CNT169, WY	1638003-16	Flow data are missing due to a polling error.
DIN431, UT	1634004-06	Insufficient flow volume
KIC003, KS	1629005-03 1630007-03 1631005-03 1632005-03	Leaks in the flow system and a malfunctioning flow pump
MEV405, CO	1636005-15	Flow system malfunction
PAL190, TX	1628001-38	Data logger malfunction
PED108, VA	1635003-40	Flow data are missing due to a polling error.
UND002, VT	1630005-52 1637003-52	Intermittent power fluctuations resulted in problems with site telemetry.

Table 12 Field Problems Affecting Data Collection

Days to Resolution	Problem Count
30	544
60	14
90	0
Unresolved by End of Quarter	20

Figure 1 Reference Standard Results for Third Quarter 2016 (percent recovery)

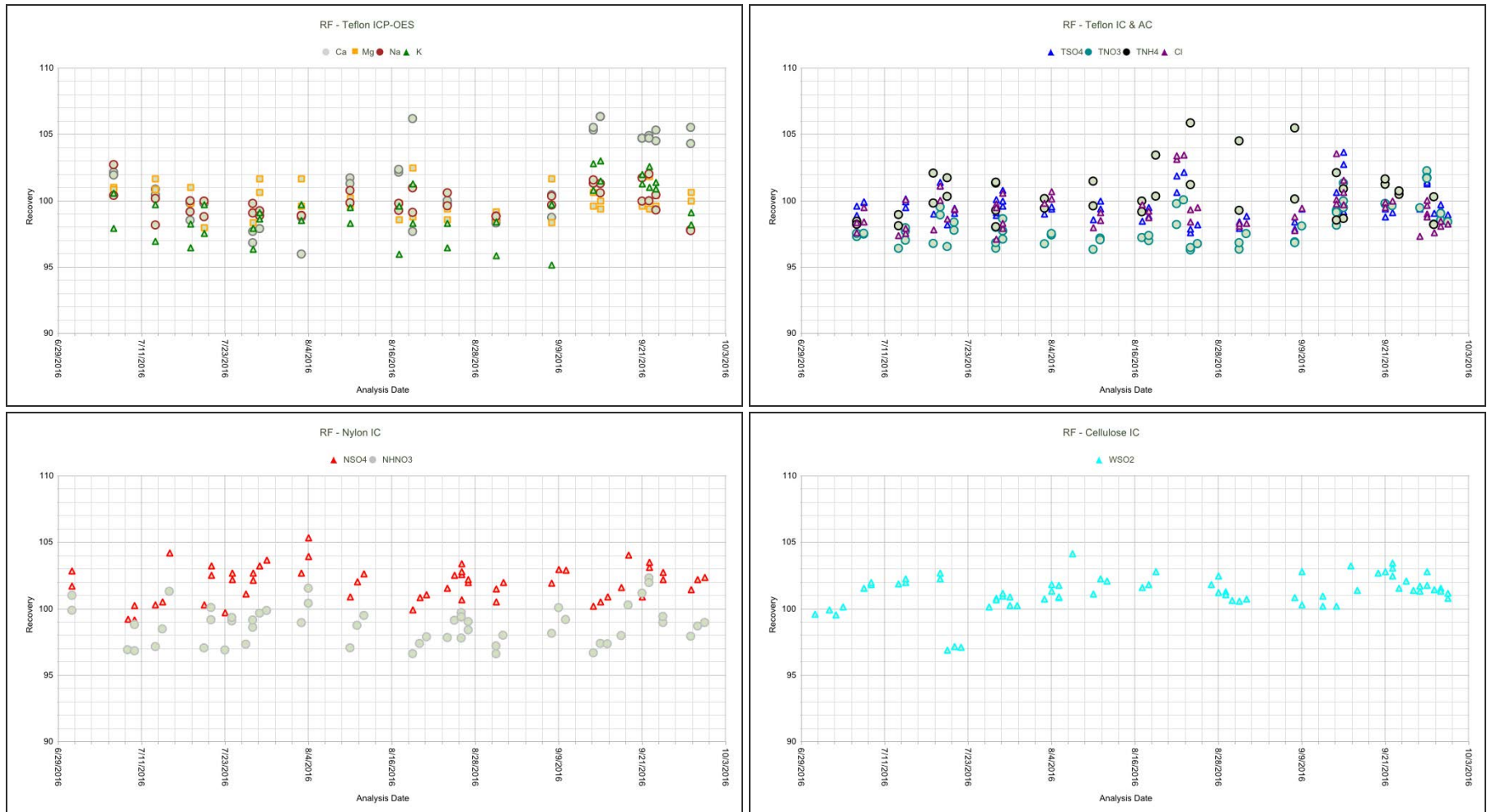


Figure 2 Continuing Calibration Spike Results for Third Quarter 2016 (percent recovery)

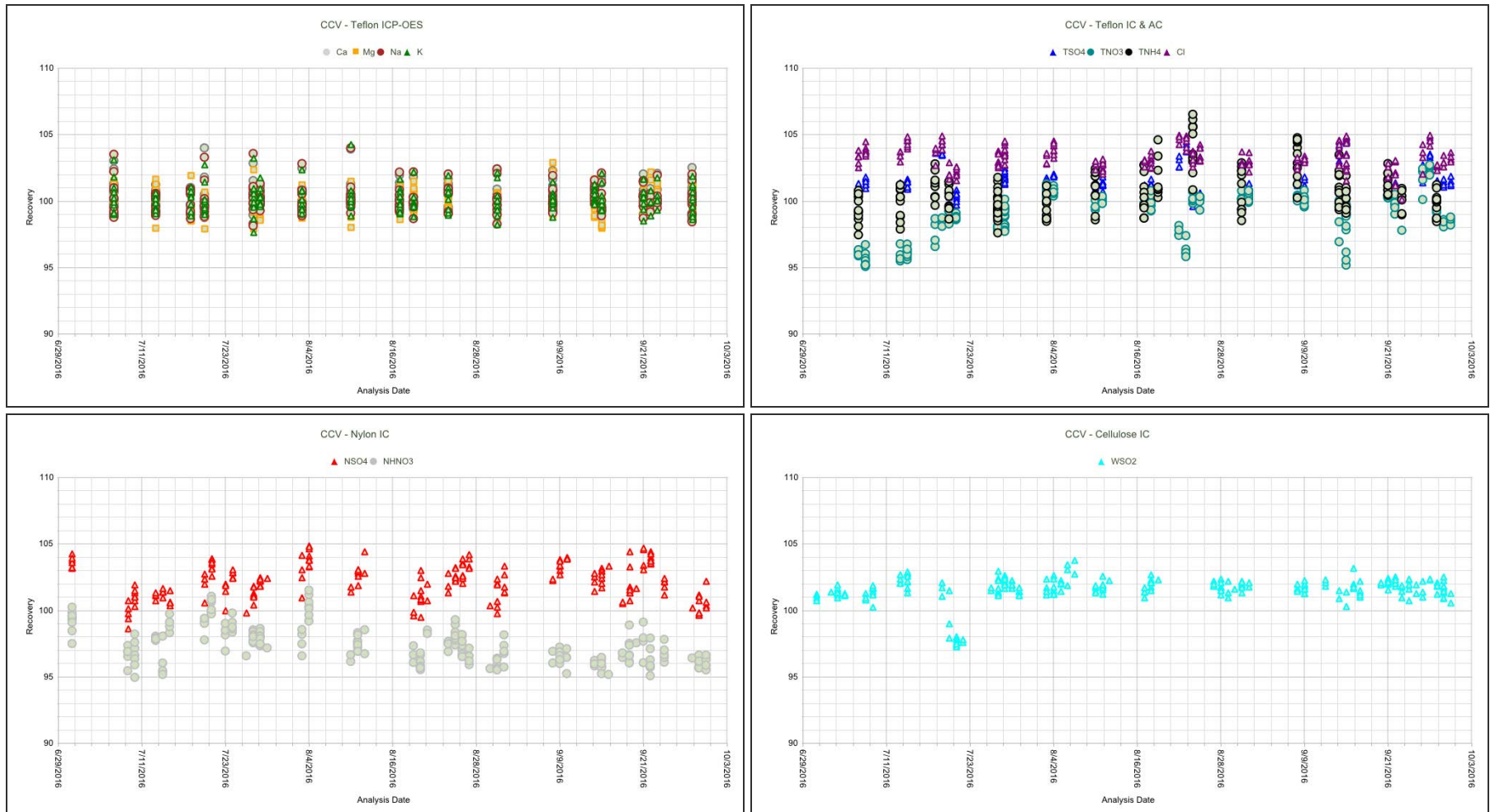


Figure 3 Replicate Sample Analysis Results for Third Quarter 2016 (percent difference)

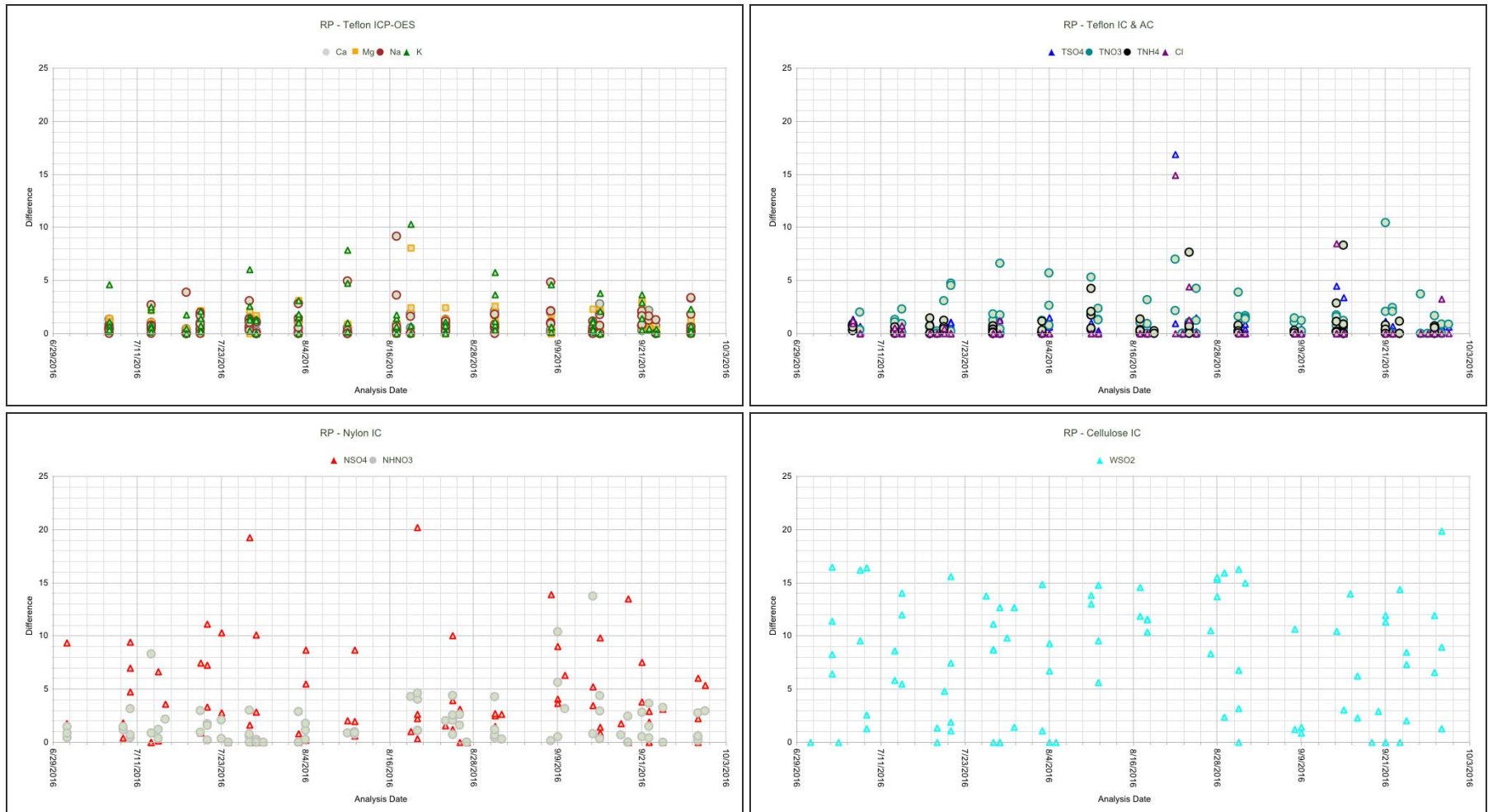


Figure 4 Laboratory Control Sample Results for Third Quarter 2016 (percent recovery)

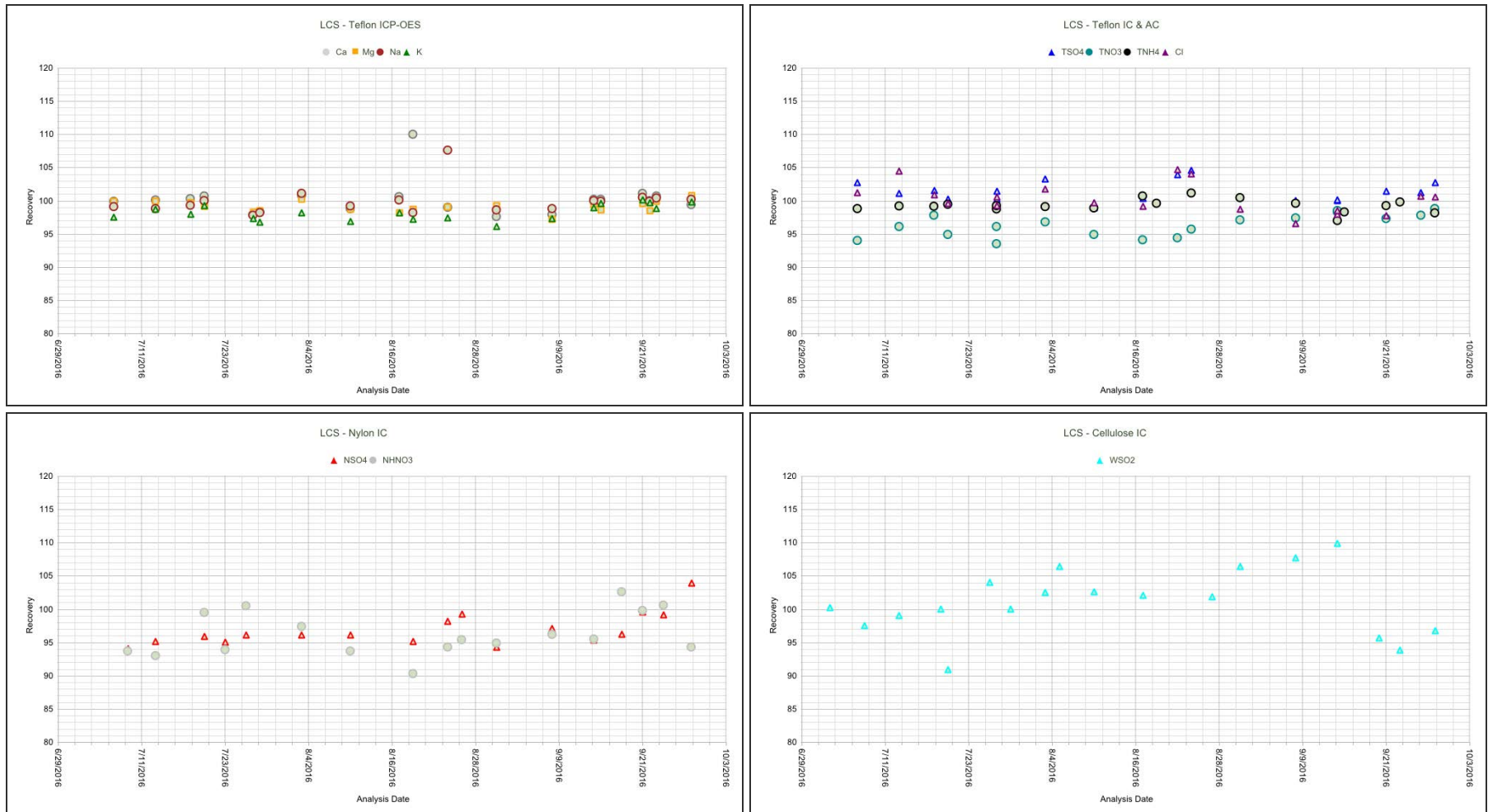


Figure 5 Method Blank Analysis Results for Third Quarter 2016 (total micrograms)

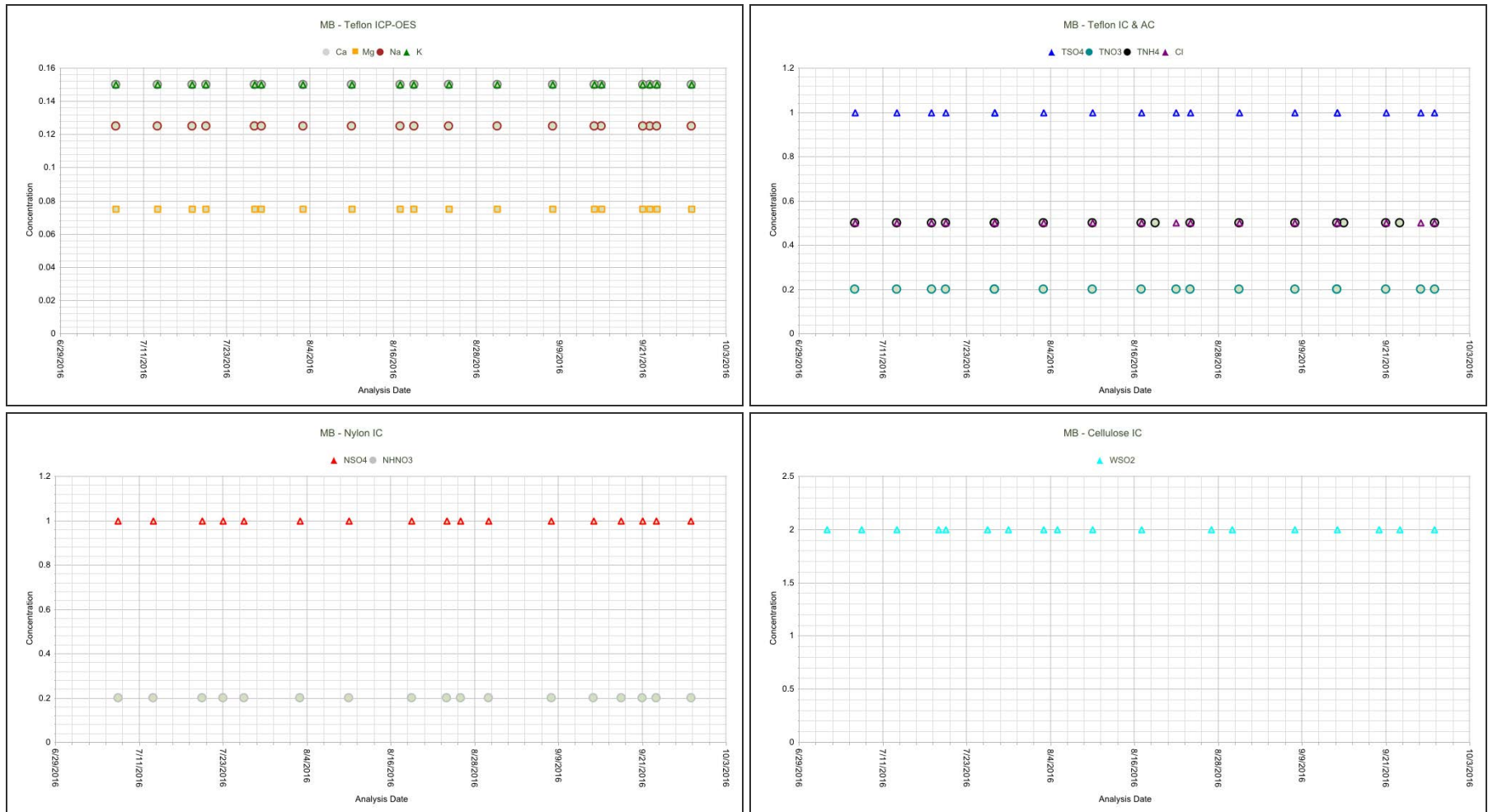


Figure 6 Laboratory Blank Analysis Results for Third Quarter 2016 (total micrograms)

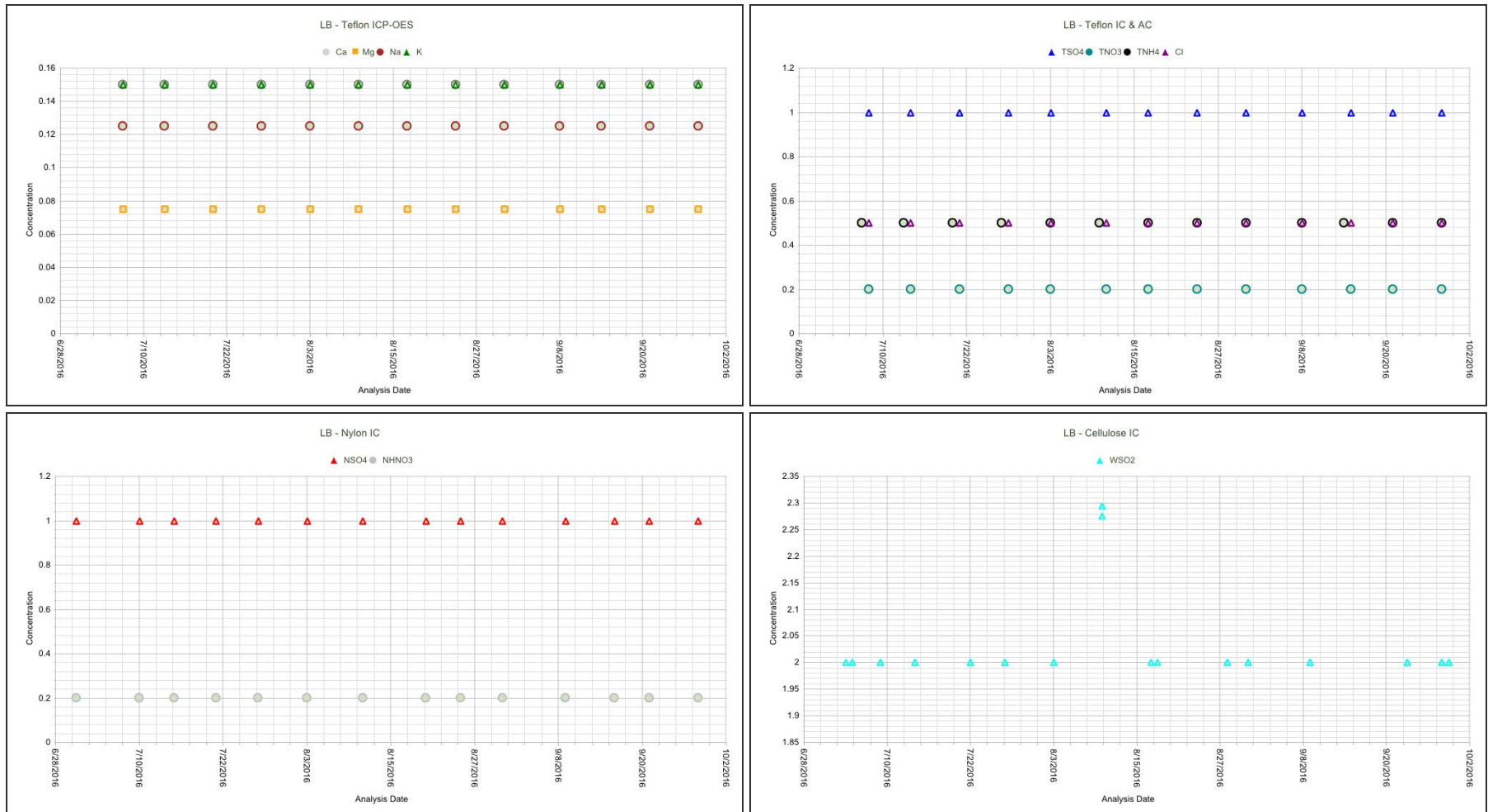


Figure 7 Field Blank Analysis Results for Third Quarter 2016 (total micrograms)

