



Summary of Quarterly Operations (April – June)

EPA Contract No. EP-W-09-028

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 second quarter 2012. The results presented for filter pack data collection and field calibrations are generated from data extracted from the CASTNET Data Management Center database using the CASTNET Data Management System Application. The various QA/QC criteria and policies are documented in the CASTNET Quality Assurance Project Plan (QAPP). 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.

The CASTNET QAPP Revision 8.0 was approved by EPA during April 2012.

During second quarter 2012, AMEC Environment & Infrastructure, Inc. (AMEC) continued working with the manufacturer of the flow transfer standards used for the network to resolve the measurement errors AMEC discovered in 2011. AMEC and the manufacturer will continue investigating with the goal of quantifying the error and providing users with a measure of uncertainty for affected data. The corrective actions implemented by AMEC include:

- The requirement that all flow standard certification documents produced by the manufacturer for AMEC standards include verification of pressure readings in the range expected at network sites.
- The collection of audit data from both flow standard instruments during all calibrations through the end of 2012.

During second quarter 2012, the CASTNET QA Manager completed an audit of site operator forms for the trace-level gas analyzers at special study sites to verify that the information collected fulfilled each form's purpose, as well as being accurately completed by the site operator. Audit results indicated that the appropriate information is being recorded accurately

and completely. The audit also found that the current system needs an additional requirement to document evaluation of zero/precision/span (ZPS) results by field personnel when the sequence has been manually initiated and recorded by site operators. The CASTNET QA Manager initiated appropriate corrective action by working with the Field and Data Operations managers to establish a routine system for field operations form review and devise a system for electronic archiving.

During first quarter 2012, the CASTNET QA Manager completed an audit of the preparation, use, and return of the calibration and repair kits. The first phase of the audit focused on the procedures and preparation of the calibration and repair kits used by field technicians. Minor findings resulted in recommendations to revise the checklists used when packing the kits to provide additional details for the packers and to evaluate implementing a peer review process. The second phase consisted of an audit of the process and procedures for handling the kits after they are returned to AMEC. To help ensure AMEC's field subcontractors provide complete documentation, it was recommended that the forms be modified to provide reminders. Subsequent follow up during second quarter 2012 verified that findings and recommendations resulting from both phases of the audit were addressed and being implemented.

AMEC continued planning for an on-site technical systems audit (TSA) of AMEC's CASTNET facility. A TSA of the facility is required by EPA since AMEC is the monitoring organization in charge of CASTNET Air Quality System (AQS)-protocol sites. The auditing organization will be RTI International, Inc. (RTI). The auditor will visit two field sites (CND125, NC and BFT142, NC) and AMEC's Gainesville, FL facility during August 2012.

Table 1 lists the quarters of data that were validated to Level 3 during second quarter 2012 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 continuous field measurements. These criteria apply to the instrument challenges performed during site calibrations. Table 4 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 5 presents the critical criteria for ozone monitoring. All EPA-sponsored CASTNET sites that monitor ozone are configured to meet EPA's AQS criteria for QA/QC procedures and are operated in accordance with Part 58 of Title 40 of the Code of Federal Regulations.

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 second quarter 2012.

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 second quarter 2012.

Data Quality Indicator (DQI) Results

Figures 1 through 3 present the results of RF, CCV, and RP QC sample analyses for second quarter 2012. All results were within the criteria listed in Table 4.

Table 8 presents summary statistics of critical criteria measurements at AQS-protocol ozone sites collected during the quarter. All data associated with QC checks that fail to meet the criteria listed in Table 5 will be invalidated. 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.

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. The action limits for LCS recovery are 80 percent and 120 percent. Figure 4 presents LCS analysis results for second quarter 2012. All recovery values were between 95 percent and 110 percent.

Blank Results

Figures 5 through 7 present the results of MB, LB, and FB QC sample analyses for second quarter 2012. All results were within criteria (two times the reporting limit) listed in Table 4.

Suspect/Invalid Filter Pack Samples

Filter pack samples that were flagged as suspect or invalid during second quarter 2012 are listed in Table 10. This table includes associated site identification and a brief description of the reason the sample was flagged. During second quarter, eight filter pack samples were invalidated.

Field Problem Count

Table 11 presents counts of field problems affecting continuous data collection for more than one day during second quarter 2012. 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.

Field Calibration Results

Calibrations were performed at 21 sites during second quarter 2012. All sites and parameters were within the criteria listed in Table 3 with the exception of one parameter at the site listed in Table 12.

Table 1. Data Validated to Level 3 during Second Quarter 2012

Calibration Group*	Months Available	Number of Months	Complete Quarters	Number of Quarters
E-1/SE-5	August 2011 – January 2012	6	Quarter 4 2011	1
MW-7/W-9	September 2011 – February 2012	6	Quarter 4 2011	1
E-2/MW-8	October 2011 – March 2012	6	Quarter 4 2011 – Quarter 1 2012	2

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

Table 2. Field Calibration Schedule

Calibration Group	Months Calibrated	Sites Calibrated			
Eastern Sites (20 Total)					
E-1 (8 Sites)	February/August	BEL116, MD BWR139, MD	WSP144, NJ CTH110, NY	ARE 128, PA PSU106, PA	PED108, VA VPI120, VA
E-2 (7 Sites)	April/October	ABT147, CT WST109, NH	HOW132, ME ASH135, ME	CAT175, NY HWF187, NY	EGB181 ON
E-3 (5 Sites)	May/November	KEF112, PA MKG113, PA	LRL117, PA PAR107, WV	CDR119, WV	
Southeastern Sites (10 Total)					
SE-4 (6 Sites)	January/July	SND152, AL GAS153, GA	BFT142, NC CND125, NC	COW137, NC PNF126, NC	
SE-5 (4 Sites)	February/August	CAD150, AR CVL151, MS	IRL141, FL SUM156, FL		
Midwestern Sites (18 Total)					
MW-6 (6 Sites)	January/July	CDZ171, KY CKT136, KY	MCK131, KY MCK231, KY	ESP127, TN SPD111, TN	
MW-7 (8 Sites)	March/September	ALH157, IL BVL130, IL	STK138, IL VIN140, IN	DCP114, OH OXF122, OH	QAK172, OH PRK134, WI
MW-8 (4 Sites)	April/October	SAL133, IN HOX148, MI	ANA115, MI UVL124, MI		
Western Sites (9 Total)					
W-9 (4 Sites)	March/September	KNZ184, KS CHE185, OK	SAN189, NE ALC188, TX		
W-10 (5 Sites)	May/November	GTH161, CO ROM206, CO	CNT169, WY PND165, WY	PAL190, TX	

Table 3. Data Quality Indicators for CASTNET Continuous Measurements

Measurement		Criteria ¹	
Parameter ²	Method	Precision	Accuracy
Filter pack flow	Mass flow controller	± 10%	± 5%
Ozone ³	UV absorbance	All points within ± 2% of full scale of best fit straight line Linearity error < 5%	
Wind speed	Anemometer	± 0.5 m/s	The greater of ± 0.5 m/s for winds < 5 m/s or ± 5% for winds ≥ 5 m/s
Wind direction	Wind vane	± 5°	± 5°
Sigma theta	Wind vane	Undefined	Undefined
Ambient temperature	Platinum RTD	± 1.0°C	± 0.5°C
Delta temperature	Platinum RTD	± 0.5°C	± 0.5°C
Relative humidity	Thin film capacitor	± 10% (of full scale)	± 10%
Precipitation	Tipping bucket rain gauge	± 10% (of reading)	± 0.05 inch ⁴
Solar radiation	Pyranometer	± 10% (of reading taken at local noon)	± 10%
Surface wetness	Conductivity bridge	Undefined	Undefined

Notes: °C = degrees Celsius
m/s = meters per second
RTD = resistance-temperature device
UV = ultraviolet

¹ Precision criteria apply to collocated instruments, and accuracy criteria apply to calibration of instruments. Collocated precision criteria do not apply to AQS-protocol ozone measurements.

² As of January 2011, meteorological parameters were only measured at four of the EPA-sponsored CASTNET sites: PAL190, TX; CHE185, OK; BVL130, IL; and BEL116, MD.

³ Ozone is not measured at two EPA-sponsored CASTNET sites: EGB181, ON and CAT175, NY.

⁴ For target value of 0.50 inch

Table 4. 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-AES	20	95 - 105	0.005	0.125
Potassium (K ⁺)	ICP-AES	20	95 - 105	0.006	0.15
Magnesium (Mg ²⁺)	ICP-AES	20	95 - 105	0.003	0.075
Calcium (Ca ²⁺)	ICP-AES	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-AES reference standards.

AC = automated colorimetry
 IC = ion chromatography
 ICP-AES = inductively coupled plasma-atomic emission spectrometry
 MARPD = mean absolute relative percent difference
 * = as nitrogen

Values are rounded according to American Society for Testing and Materials (ASTM) (Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications E 29).

For more information on analytical methods and associated precision and accuracy criteria, see the CASTNET QAPP, Revision 8.0 (AMEC, 2012)

Table 5. AQS-Protocol Ozone Critical Criteria *

Type of Check	Analyzer Response
Zero	Less than ± 10 parts per billion (ppb)
Span	Less than or equal to ± 7 percent between supplied and observed concentrations
One Point QC	Less than or equal to ± 7 percent between supplied and observed concentrations

Note: * All EPA-sponsored CASTNET sites that monitor ozone are configured to meet EPA's AQS criteria for QA/QC procedures and are operated in accordance with Part 58 of Title 40 of the Code of Federal Regulations.

Table 6. QC Analysis Count for Second Quarter 2012

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⁻	30	156	68	15	24	44
	NO ₃ ⁻	30	156	76	15	24	44
	NH ₄ ⁺	30	157	81	15	24	44
	Cl ⁻	30	156	66	15	24	42
	Ca ²⁺	31	159	72	15	24	42
	Mg ²⁺	31	159	72	15	24	42
	Na ⁺	31	159	72	15	24	42
	K ⁺	31	159	72	15	24	42
Nylon	SO ₄ ²⁻	29	145	60	14	24	44
	NO ₃ ⁻	29	145	70	14	24	44
Cellulose	SO ₄ ²⁻	36	147	73	18	24	42

Table 7. Filter Pack Receipt Summary for Second Quarter 2012

Count of samples received more than 14 days after removal from tower:	10
Count of all samples received:	1083
Fraction of samples received within 14 days:	0.991
Average interval in days:	3.371
First receipt date:	04/02/2012
Last receipt date:	06/29/2012

Table 8. AQS-Protocol Ozone QC Summary (1 of 2)

Site ID	% Span Pass ¹	Span %D ²	% One Point QC Pass ¹	One Point QC %D ²	One Point QC CL ³	% Zero Pass ¹	Zero Average (ppb) ²
ABT147, CT	100.00	0.59	100.00	0.87	0.17	100.00	0.46
ALC188, TX	100.00	1.01	96.74	1.79	0.53	94.57	2.65
ALH157, IL	98.72	1.81	98.72	1.43	0.81	98.72	1.05
ANA115, MI	100.00	1.15	100.00	1.01	0.12	100.00	0.44
ARE128, PA	98.88	0.40	97.75	0.74	0.21	100.00	0.57
ASH135, ME	100.00	4.47	100.00	4.38	0.12	100.00	0.34
BEL116, MD	90.24	10.62	89.87	10.47	4.81	92.77	1.89
BFT142, NC	96.55	2.77	93.10	3.66	2.16	96.55	3.65
BVL130, IL	69.44	18.48	66.67	13.70	3.85	100.00	0.85
BWR139, MD	100.00	0.98	98.90	1.26	0.36	95.60	3.29
CAD150, AR	98.90	1.18	100.00	1.25	0.11	98.90	0.57
CDR119, WV	100.00	1.00	100.00	0.93	0.08	100.00	0.91
CDZ171, KY	100.00	0.35	100.00	0.32	0.06	100.00	0.25
CKT136, KY	95.65	4.14	96.74	3.76	2.18	96.74	2.80
CND125, NC	91.40	8.01	91.40	7.59	3.89	91.40	3.24
CNT169, WY	100.00	1.10	98.82	2.87	0.31	100.00	0.34
COW137, NC	100.00	0.96	100.00	0.76	0.09	100.00	0.29
CTH110, NY	97.83	3.63	97.83	2.19	1.19	97.83	1.26
CVL151, MS	96.77	4.69	94.62	5.85	2.40	95.70	3.05
DCP114, OH	93.55	4.10	93.55	4.37	1.84	100.00	0.51
ESP127, TN	100.00	0.22	100.00	0.34	0.05	98.90	2.45
GAS153, GA	100.00	0.58	100.00	0.74	0.07	100.00	1.28
GTH161, CO	100.00	1.34	100.00	1.45	0.20	100.00	0.18
HOW132, ME	100.00	1.44	100.00	1.38	0.17	100.00	0.66
HOX148, MI	98.92	0.58	100.00	0.44	0.07	100.00	0.16
HWF187, NY	97.85	4.33	97.85	3.83	1.65	97.85	1.17
IRL141, FL	100.00	0.44	100.00	0.69	0.11	100.00	3.75
KEF112, PA	100.00	0.68	100.00	0.70	0.08	98.91	0.78
KNZ184, KS	100.00	0.46	100.00	0.59	0.09	98.90	2.38
LRL117, PA	100.00	2.33	100.00	1.73	0.13	100.00	0.57
MCK131, KY	100.00	1.97	100.00	2.09	0.11	100.00	0.56
MCK231, KY	100.00	1.86	100.00	1.77	0.07	98.91	1.46

Table 8. AQS-Protocol Ozone QC Summary (2 of 2)

Site ID	% Span Pass ¹	Span %D ²	% One Point QC Pass ¹	One Point QC %D ²	One Point QC CL ³	% Zero Pass ¹	Zero Average (ppb) ²
MKG113, PA	100.00	0.69	100.00	0.71	0.08	100.00	0.40
OXF122, OH	100.00	1.06	98.75	2.37	2.03	100.00	0.96
PAL190, TX	100.00	1.16	100.00	0.84	0.07	100.00	0.41
PAR107, WV	100.00	1.09	100.00	0.92	0.22	100.00	0.91
PED108, VA	100.00	0.66	100.00	0.53	0.13	100.00	0.69
PND165, WY	98.25	3.17	98.25	1.81	1.43	98.25	1.28
PNF126, NC	100.00	0.52	100.00	0.47	0.07	100.00	0.30
PRK134, WI	100.00	0.76	100.00	0.58	0.08	100.00	0.99
PSU106, PA	96.67	4.06	96.70	3.47	2.28	96.67	1.26
QAK172, OH	100.00	1.89	100.00	2.51	0.10	98.89	0.95
ROM206, CO	100.00	2.07	100.00	2.48	0.09	100.00	0.49
SAL133, IN	100.00	0.79	100.00	0.95	0.09	100.00	0.65
SAN189, NE	100.00	0.75	100.00	0.57	0.07	100.00	0.78
SND152, AL	100.00	1.53	100.00	1.31	0.07	98.90	0.44
SPD111, TN	96.74	2.07	98.91	0.93	0.25	100.00	0.44
STK138, IL	100.00	3.23	100.00	3.62	0.05	100.00	0.55
SUM156, FL	100.00	0.40	100.00	0.48	0.08	98.88	0.73
UVL124, MI	100.00	1.34	100.00	1.37	0.15	100.00	0.22
VIN140, IN	100.00	0.55	100.00	0.72	0.07	100.00	0.25
VPI120, VA	96.10	4.53	96.10	4.50	3.02	96.10	2.37
WSP144, NJ	93.48	1.15	95.65	1.41	0.31	98.91	0.88
WST109, NH	100.00	3.45	100.00	3.93	0.18	100.00	0.79

Notes: ¹ Percentage of comparisons that pass the criteria listed in Table 5. 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 5 are addressed in Table 9.

³ 90% confidence limit of the coefficient of variation. This should be less than or equal to the 7% one 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. AQS-Protocol Ozone QC Observations

Site ID	QC Criterion	Comments
BEL116, MD	Span %D ; Single Point QC %D	The zero air system tubing was disconnected for one week. Ambient data collection was not affected.
BVL130, IL	%Span Pass; Span %D ; % Single Point QC Pass; Single Point QC %D	The site analyzer failed during the last week in May. Associated ambient data were invalidated. Additionally, the site transfer standard failed mid-June and was replaced at the end of the month. Ambient data were not directly affected but the frequency criterion was not met.
CND125, NC	Span %D ; Single Point QC %D	The zero air system tubing was disconnected for one week. Ambient data collection was not affected.

Notes: %D = percent difference

Table 10. Filter Packs Flagged as Suspect or Invalid

Site ID	Sample No.	Reason
CAT175, NY	1217001-15	“Calibrator Onsite” data logger status left as true for the latter half of the week
CHE185, OK	1215001-19	Polling problems
GRB411, NV	1214001-33 1215001-33 1216001-33	Invalidated due to suspect data
HOW132, ME	1217001-37 1220001-37	Power failures
WNC429, SD	1222001-80	Data logger channel down

Table 11. Field Problems Affecting Data Collection

Days to Resolution	Problem Count
30	100
60	10
90	0
Unresolved by End of Quarter	7

Table 12. Field Calibration Failures by Parameter

Site ID	Parameter(s)
CNT169, WY	Temperature

Note: Per CASTNET project protocols, data for all parameters except flow are flagged as “suspect” (S) but still considered valid if the calibration criterion is not exceeded by more than its magnitude (i.e., if within 2x the criterion). If flow calibrations fall within 2x the criteria, these data are adjusted per approved protocol described in the CASTNET QAPP, Revision 8.0 (AMEC, 2012). Please refer to Table 8 for documentation of the QC failures affecting the validity of AQS-protocol ozone data.

Figure 1. Reference Standard Results for Second Quarter 2012 (percent recovery)

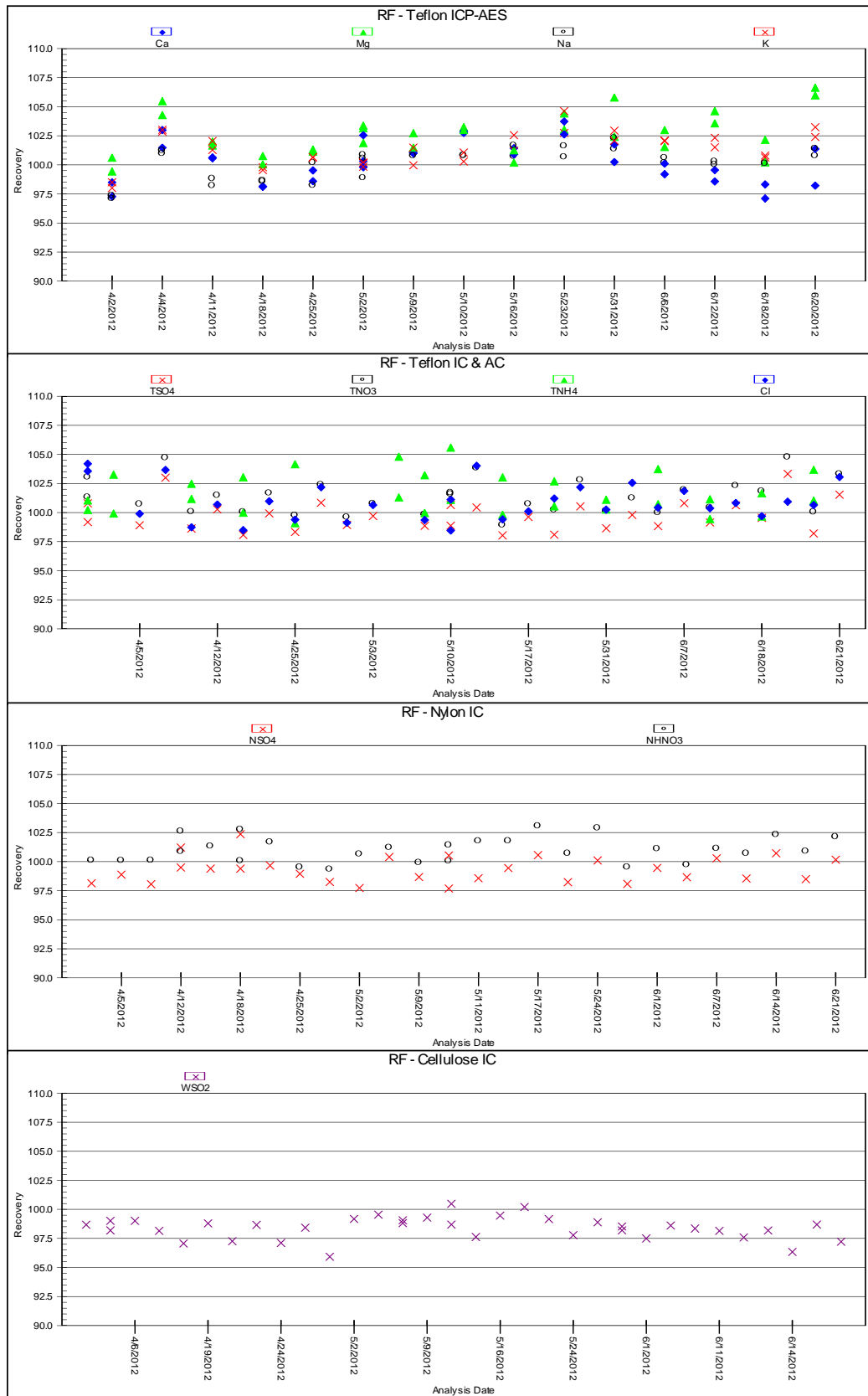


Figure 2. Continuing Calibration Spike Results for Second Quarter 2012 (percent recovery)

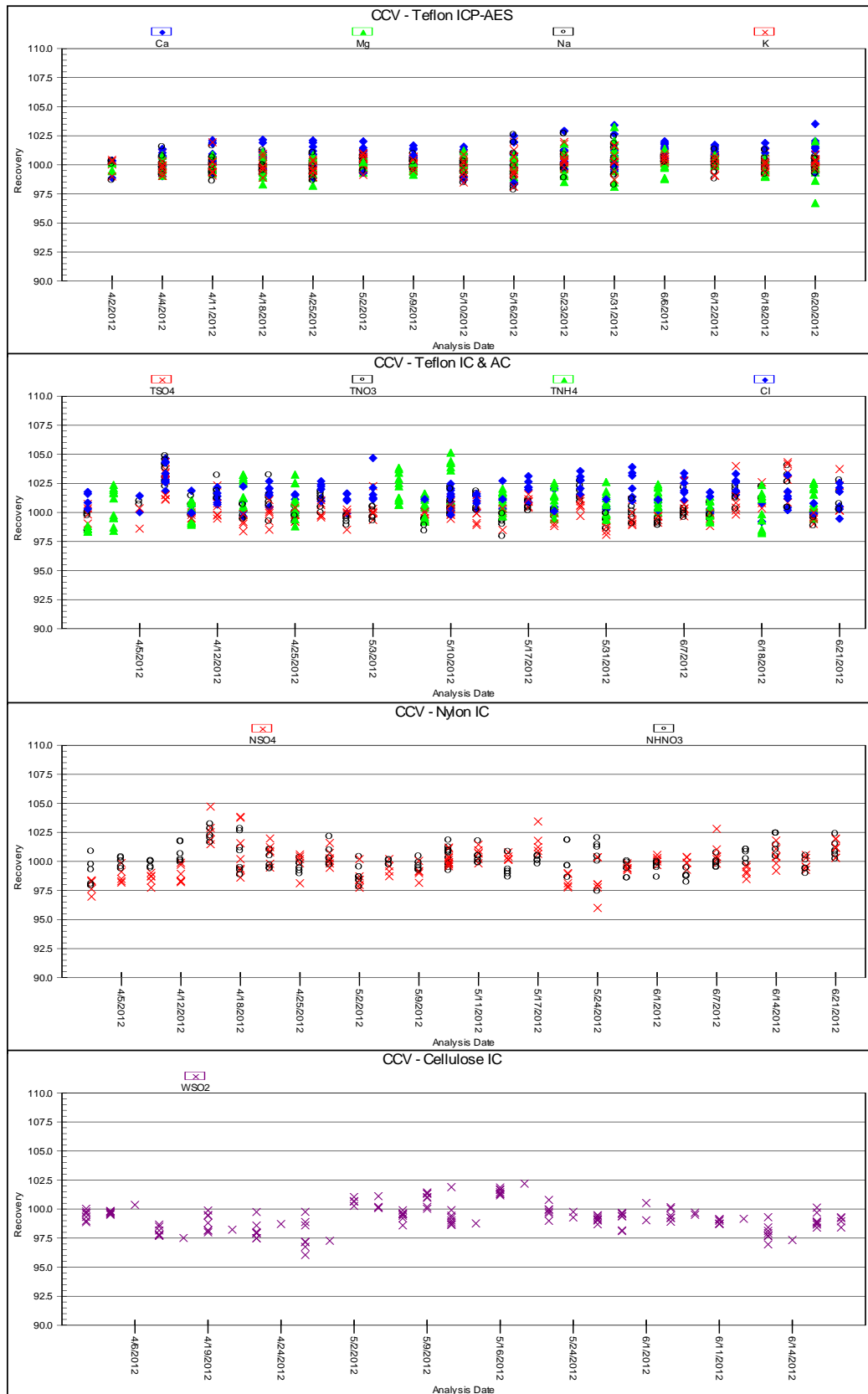


Figure 3. Replicate Sample Analysis Results for Second Quarter 2012 (percent difference)

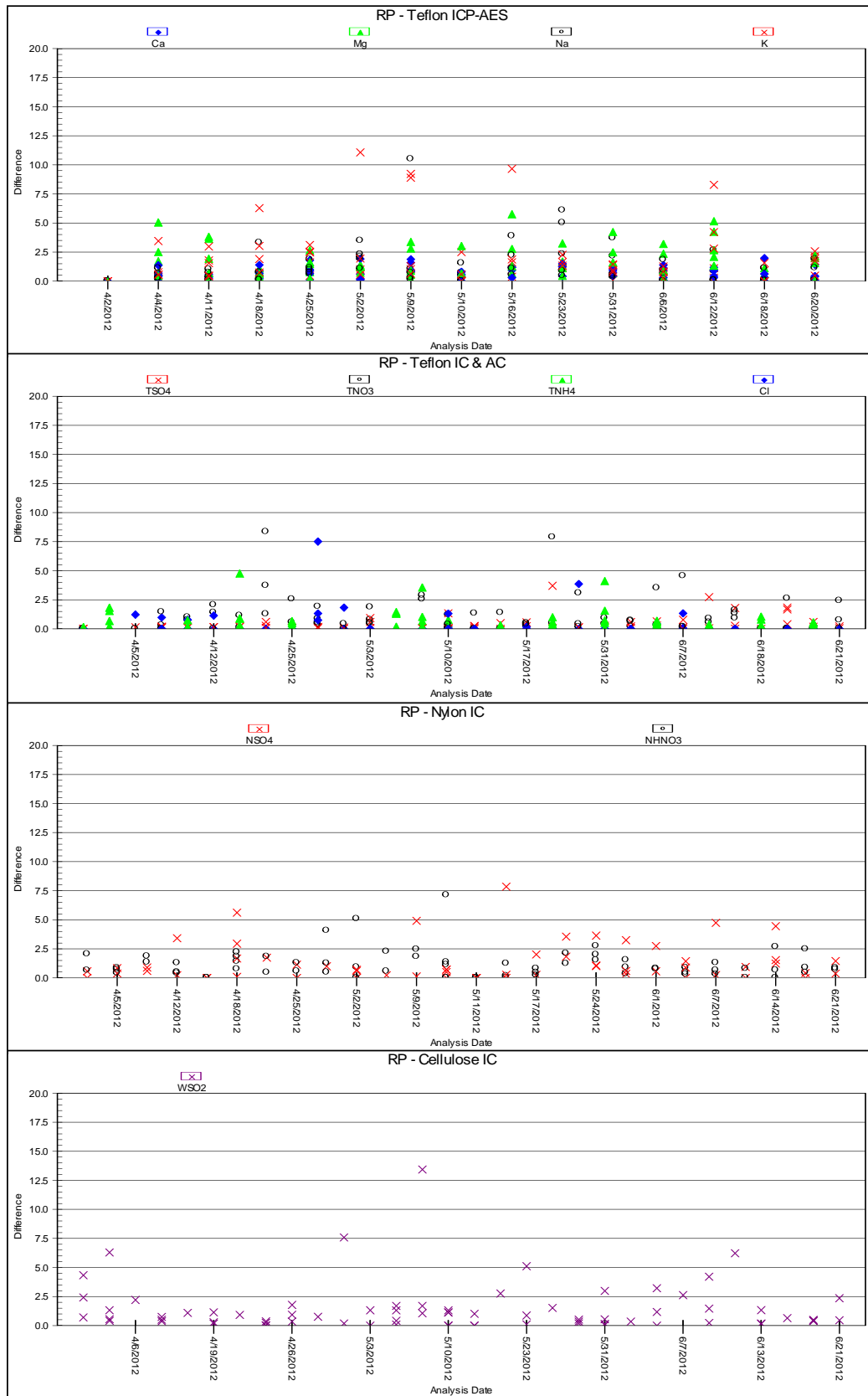


Figure 4. Laboratory Control Sample Results for Second Quarter 2012 (percent recovery)

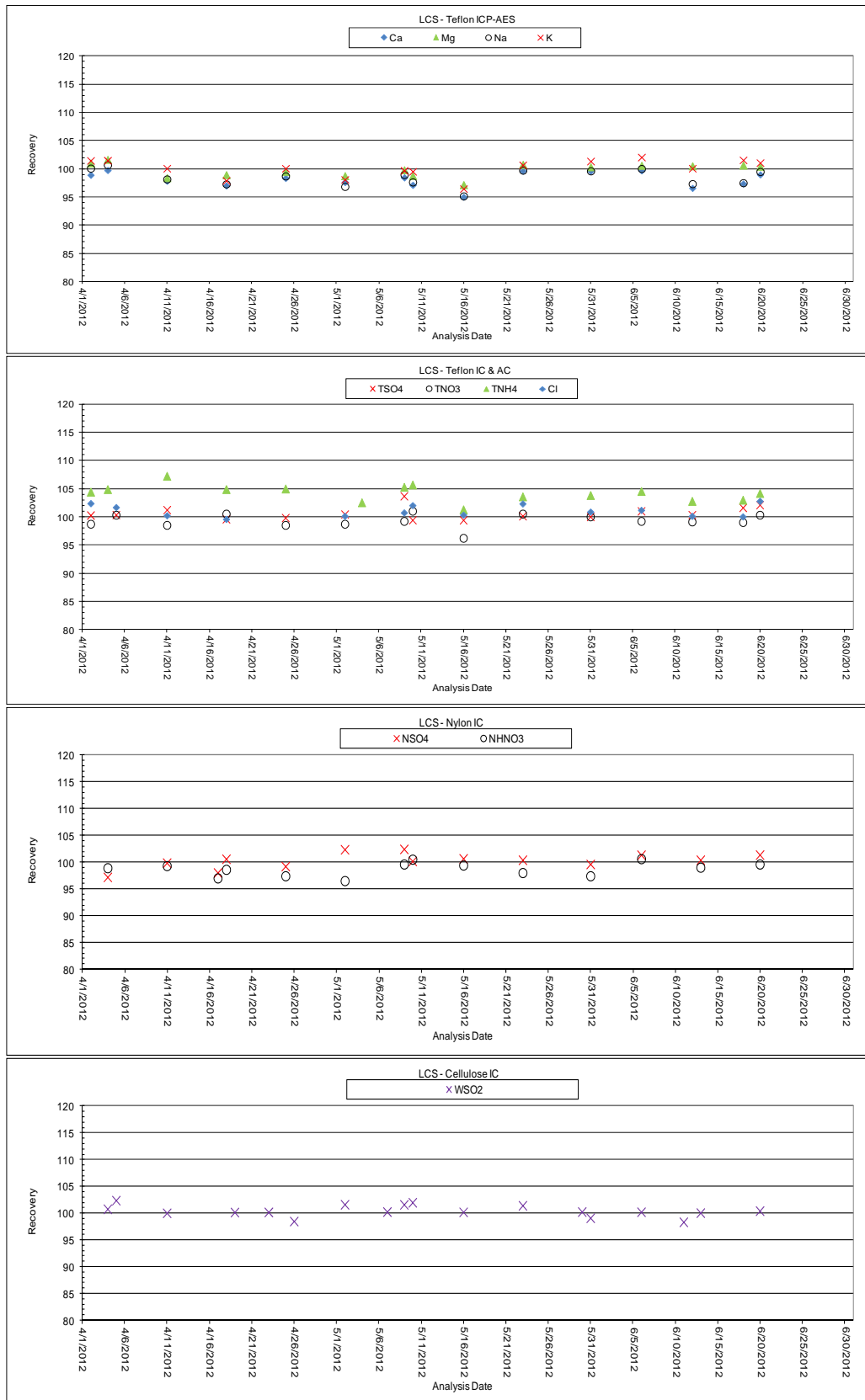


Figure 5. Method Blank Analysis Results for Second Quarter 2012 (total micrograms)

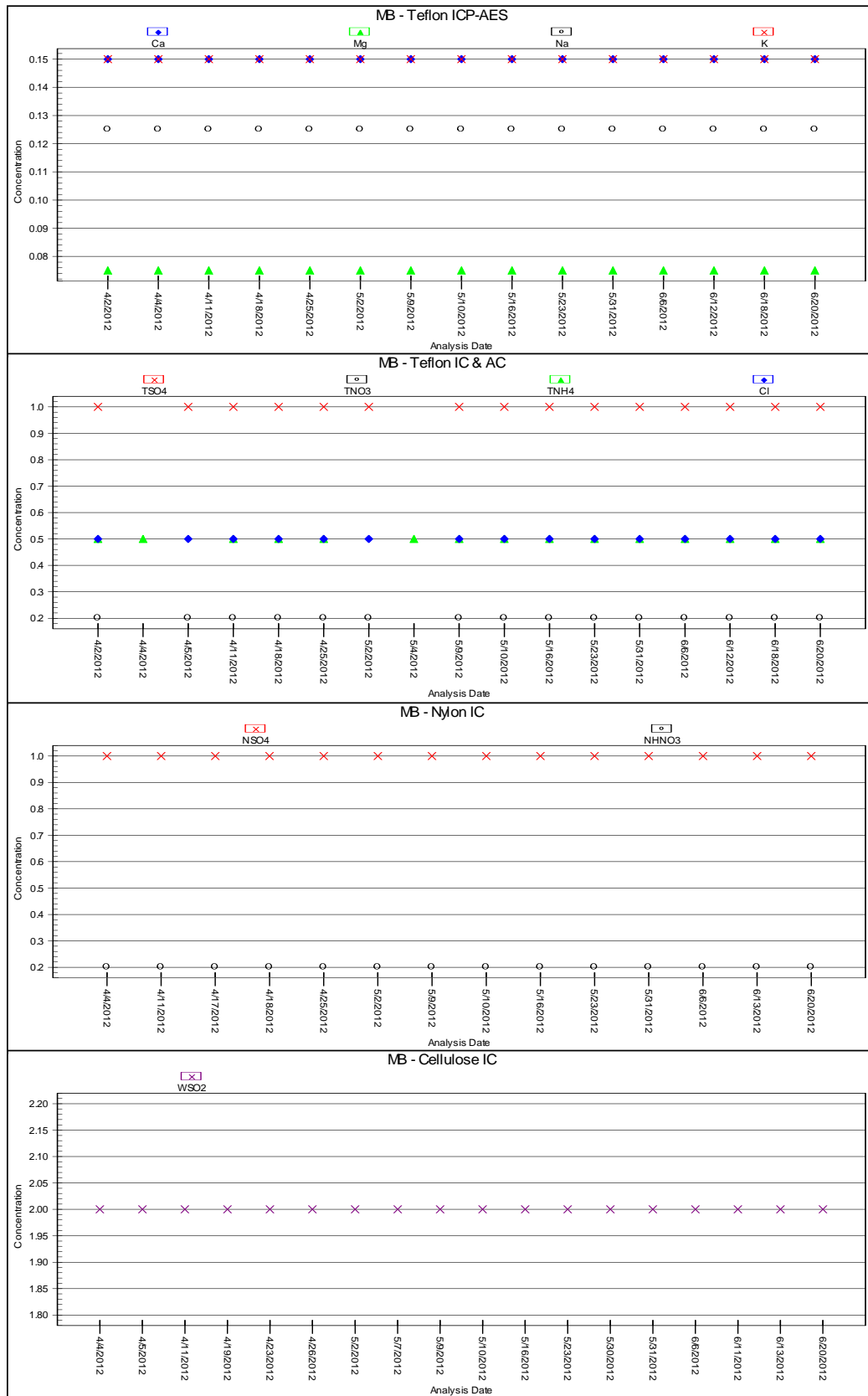


Figure 6. Laboratory Blank Analysis Results for Second Quarter 2012 (total micrograms)

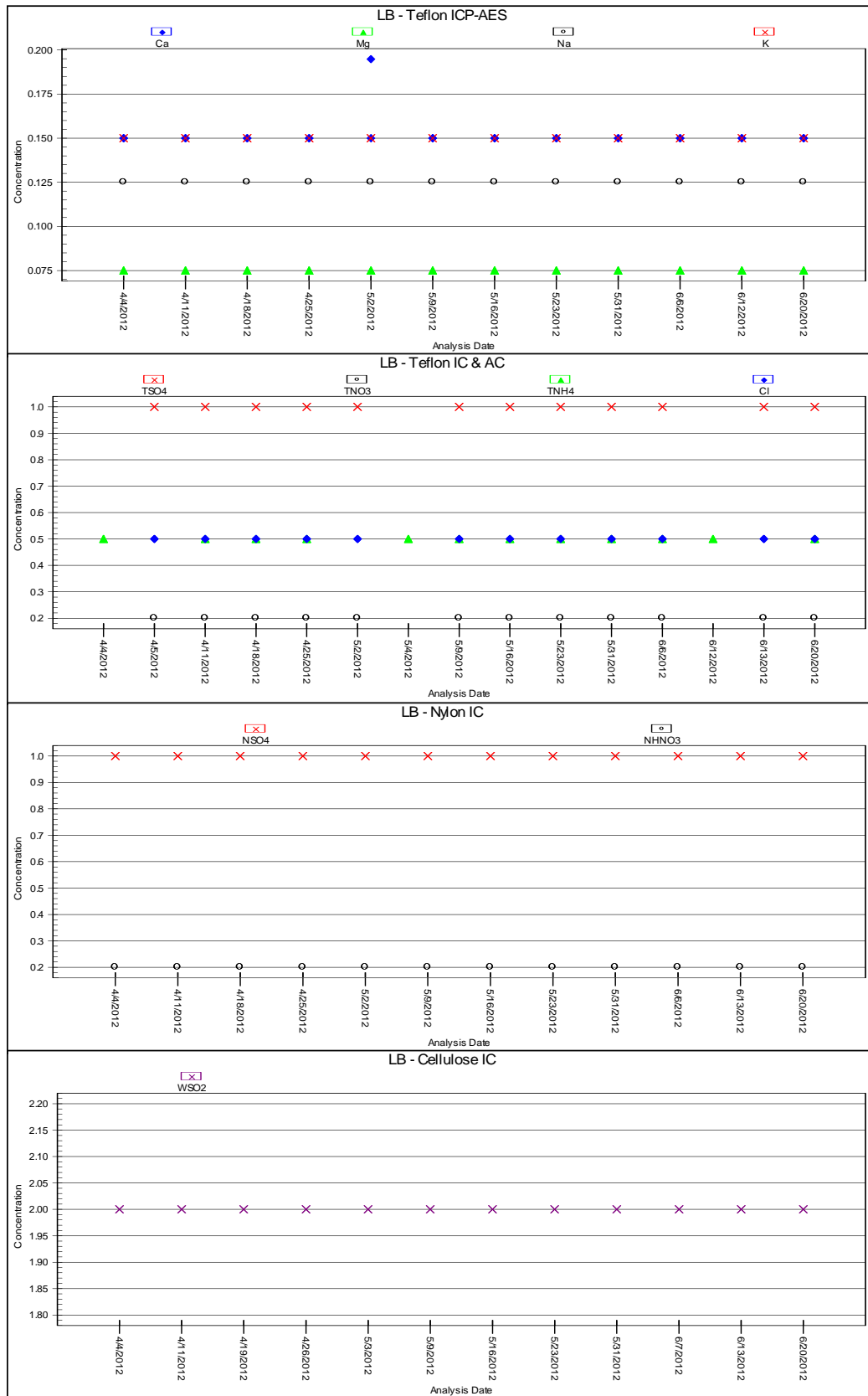


Figure 7. Field Blank Analysis Results for Second Quarter 2012 (total micrograms)

