Clean Air Status and Trends Network
Quality Assurance Report

EPA Contract No.:	**68-D-03-052 (Base Program)**
MACTEC Project No.:	**6064079000**
Reporting Period:	**Third Quarter 2007 (July - September)**

Summary of Quarterly Operations

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 2007. The results presented for filter pack data collection and field calibrations are generated from data extracted from the CASTNET Data Management Center (DMC) database using the CASTNET Data Management System Application (CDMSA). 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 updated annually.

During third quarter 2007, EPA approved the key personnel substitution of William Imbur as the new CASTNET QA Supervisor. Additionally, the CASTNET QA Manager and Field Operations Manager developed an acceptable procedure to extend the timeframe between complete certifications of the transfer standards used for calibration of field equipment. The period between complete certifications was extended from three months to six months and specific pre-deployment checks covering the dynamic range of each transfer standard were added to verify operation between the complete certifications.

Also during third quarter 2007, the CASTNET analytical laboratory implemented the revised reporting limits for analyses using the inductively coupled plasma atomic emission spectrometer (ICP-AES) as listed in the latest revision (Revision 4.0) of the CASTNET QAPP. The reporting limits for calcium and potassium were revised to 0.006 milligrams per liter (mg/L) from 0.003 mg/L and 0.005 mg/L, respectively. The revised reporting limits were not implemented until September 26, 2007, just prior to the end of third quarter. As a result, only the last data point on the QC blank analyses for method blanks and field blanks reflects the new reporting limits. Additionally, the “per box” acceptance testing requirement for Teflon® filters dropped from 7 percent to 4 percent.

Collocated filter pack precision data and completeness data for meteorological measurements are presented for data validated to Level 3 during the quarter. Table 1 lists the quarters of data that were validated to Level 3 during the quarter 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.

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 5 presents the number of analyses in each category that were performed during this quarter.

Sample Receipt Statistics

For the current CASTNET project, which began on July 30, 2003, EPA requires that 95 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 6 presents the relevant sample receipt statistics for third quarter 2007.

Data Quality Indicator (DQI) Results

Figures 1 through 3 present the results of RF, CCV, and RP QC sample analyses for third quarter 2007. All results were within the criteria listed in Table 4 with the exception of several individual RP results. However, these are considered reasonable since higher relative percent differences generally correlate with lower sample concentrations. Quarterly averages are all within criteria.

Figure 4 presents completeness statistics for continuous measurements validated to Level 3 during the quarter. All parameters met the 90 percent criterion with the exception of temperature and delta temperature at 85.9 percent and 89.8 percent, respectively. The low data capture for the temperature parameters is attributable largely to equipment malfunctions.

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 current action limits for

LCS recovery are 80 percent and 120 percent. These limits may change as data are collected and analyzed. Figure 5 presents LCS analysis results for third quarter 2007.

Blank Results

Figures 6 through 8 present the results of MB, LB, and FB QC sample analyses for third quarter 2007. All results were within criteria (two times the detection limit) listed in Table 4 with the exception of a few cellulose filter FB results and one Teflon® filter LB result. All values were less than three times the detection limit with the exception of the Teflon® filter LB result for calcium. The other LB analyzed with the batch was below the reporting limit for calcium and all other QC samples were within established criteria. No systemic problems were indicated upon review.

Suspect/Invalid Filter Pack Samples

Four filter pack samples were invalidated due to insufficient flow volume. Additionally, three samples were invalidated due to data logger problems at the site in Egbert, ON (EGB181). The samples and associated site identification are presented in Table 7.

Field Problem Count

Table 8 presents counts of field problems affecting continuous data collection. 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 time period does not correlate with the quantity of data affected. For example, if a 5-hour block of missing data takes 60 days to replace, it will show up in the 60-day category. By the same token, a site missing 200 hours of data due to the damage caused by a lightning strike will show up in the 30-day category if the site is repaired within 30 days, even though the data cannot be replaced.

Field Calibration Results

Calibrations were performed at 35 sites during third quarter 2007. All sites and parameters were within the criteria listed in Table 3 with the exception of the parameters at the 14 sites that are listed in Table 9.

Tables and Figures

Table 1. Data Validated to Level 3 during Third Quarter 2007

Calibration Group*	Months Available	Number of Months	Complete Quarters	Number of Quarters
5†	November 2006 – April 2007	6	Quarter 1 2007	1
1	January 2007 – June 2007	6	Quarter 1 2007 – Quarter 2 2007	2

Note: * The sites contained in each calibration group are listed in Table 2.
† Contains ROM206 of the ROM406/206 collocated pair

Table 2. Field Calibration Schedule

Calibration Group Number	Months Calibrated	Sites Calibrated			
1	January/July	SND152, AL GAS153, GA CDZ171, KY	BFT142, NC CND125, NC COW137, NC	PNF126, NC ESP127, TN SPD111, TN	PED108, VA VPI120, VA
2	February/August	CAD150, AR IRL141, FL SUM156, FL	BEL116, MD BWR139, MD CVL151, MS	WSP144, NJ CTH110, NY CHE185, OK	ARE128, PA PSU106, PA ALC188, TX
3	March/September	ALH157, IL BVL130, IL STK138, IL	VIN140, IN KNZ184, KS CKT136, KY	MCK131, KY MCK231, KY SAN189, NE	DCP114, OH OXF122, OH PRK134, WI
4	April/October	ABT147, CT SAL133, IN ASH135, ME	HOW132,ME ANA115, MI HOX148, MI	UVL124, MI WST109, NH CAT175, NY	HWF187, NY LYK123, OH EGB181, ON
5	May/November	CON186, CA ROM206, CO GTH161, CO	QAK172, OH KEF112, PA LRL117, PA	MKG113, PA PAL190, TX CDR119, WV	PAR107, WV CNT169, WY PND165, WY

Table 3. Data Quality Indicators for CASTNET Continuous Measurements

Measurement		Criteria*	
Parameter	**Method**	**Precision**	**Accuracy**
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
Relative Humidity	Thin Film Capacitor	± 10% (of full scale)	± 5%, rel. hum. > 85% ± 20%, rel. hum. ≤ 85%
Solar Radiation	Pyranometer	± 10% (of reading taken at local noon)	± 10%
Precipitation	Tipping Bucket Rain Gauge	± 10% (of reading)	± 0.05 inch†
Ambient Temperature	Platinum RTD	± 1.0°C	± 0.5°C
Delta Temperature	Platinum RTD	± 0.5°C	± 0.5°C
O_3	UV Absorbance	± 10% (of reading)	± 10%
Filter Pack Flow	Mass Flow Controller	± 10%	± 5%
Surface Wetness	Conductivity Bridge	Undefined	Undefined

Note:
°C = degrees Celsius
m/s = meters per second
rel. hum. = relative humidity
RTD = resistance-temperature device
UV = ultraviolet

* Precision criteria apply to collocated instruments, and accuracy criteria apply to calibration of instruments
† For target value of 0.50 inch

Table 4. Data Quality Indicators for CASTNET Laboratory Measurements

Analyte	Medium	Method	Precision[1] (MARPD)	Accuracy[2] (%)	Nominal Reporting Limits	
					mg/L	µg/Filter
Ammonium (NH_4^+)	F	AC	10	90 - 110	0.020 *	0.5
Sodium (Na^+)	F	ICP-AES	5	95 - 105	0.005	0.125
Potassium (K^+)	F	ICP-AES	5	95 - 105	0.006	0.125
Magnesium (Mg^{2+})	F	ICP-AES	5	95 - 105	0.003	0.075
Calcium (Ca^{2+})	F	ICP-AES	5	95 - 105	0.006	0.075
Chloride (Cl^-)	F	IC	5	95 - 105	0.020	0.5
Nitrate (NO_3^-)	F	IC	5	95 - 105	0.008 *	0.2
Sulfate (SO_4^{2-})	F	IC	5	95 - 105	0.040	1.0

Note: [1] This column lists precision goals for both network precision calculated from collocated filter samples and laboratory precision based on replicate samples. The goal for the ICP-AES precision RPD criterion changed from 10 percent to 5 percent at the onset of the new contract beginning on July 30, 2003. The precision criterion is applied as described below:

QC conditions: (v1 = initial response; v2 = replicate response; RL = nominal reporting limit)

Condition 1: if (v1 or v2 < RL and the absolute value of (v1 – v2) < RL) = OK

Condition 2: if (v1-v2) < RL and v1 < 5 x RL) = OK

Condition 3: if (v1 > 5*RL and RPD < 5%) = OK

Status: one of the conditions is OK = Precision QC Passes

[2] This column lists laboratory accuracy goals based on reference standards and continuing calibration verification spikes. The goal for the ICP-AES accuracy criterion changed from 90 – 110 percent to 95 – 105 percent for continuing calibration verification spikes at the onset of the new contract beginning on July 30, 2003. The criterion remains 90 – 110 percent for ICP-AES reference standards.

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

For more information on analytical methods and associated precision and accuracy criteria, see the CASTNET QAPP, Revision 4.0 (MACTEC, 2007).

Table 5. QC Analysis Count for Third Quarter 2007

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-}	37	183	84	18	24	84
	NO_3^-	37	183	84	18	24	84
	NH_4^+	36	185	79	18	24	86
	Cl^-	37	183	84	18	24	84
	Ca^{2+}	36	186	83	18	24	84
	Mg^{2+}	36	186	83	18	24	84
	Na^+	36	186	83	18	24	84
	K^+	36	186	83	18	24	84
Nylon	SO_4^{2-}	38	191	87	19	26	87
	NO_3^-	38	191	87	19	26	87
Cellulose	SO_4^{2-}	49	190	72	25	26	87

Table 6. Filter Pack Receipt Summary

Count of samples received more than 14 days after removal from tower:	10
Count of all samples received:	719
Fraction of samples received within 14 days:	0.986
Average interval in days:	5.22
First receipt date:	7/2/2007
Last receipt date:	9/28/2007

Table 7. Filter Packs Flagged as Suspect or Invalid

Site ID	Sample ID
CKT136, KY	07290001-20 07330001-20
EGB181, ON	07290001-30 07300001-30 07320001-30
SUM156, FL	07320001-77 07330001-77

Table 8. Field Problems Affecting Data Collection

Days to Resolution	Problem Count
30	115
60	8
90	0
Unresolved by date of publication	3

Note: Counts were extracted using the problem tracking system (PTS) feature of the CDMSA. Problems requiring corrective action are flagged by field personnel with a ticket number.

Table 9. Field Calibration Failures by Parameter

Site ID	Parameter(s)
ALC188, TX	Wind Direction
BEL116, MD	Relative Humidity
BFT142, NC	Flow Rate
BWR139, MD	Wind Direction
CND125, NC	Precipitation
COW137, NC	Precipitation
CTH110, NY	Wind Direction
GAS153, GA	Ozone Relative Humidity Wind Direction
PNF126, NC	Flow Rate Wind Direction
PSU106, PA	Vector Wind Speed Scalar Wind Speed
SND152, AL	Relative Humidity Wind Direction
SPD111, TN	Delta Temperature Temperature
SUM156, FL	Relative Humidity
WSP144, NJ	Relative Humidity

Note: Per CASTNET project protocols, data are flagged as "suspect" (S) but still considered valid if the calibration criterion is not exceeded by more that its magnitude (i.e., if within 2x the criterion). If ozone or flow calibrations fall within 2x the criteria, these data are adjusted per approved protocol described in the CASTNET QAPP, Revision 4.0 (MACTEC, 2007).

Figure 1. Reference Standard Results for Third Quarter 2007 (percent recovery)

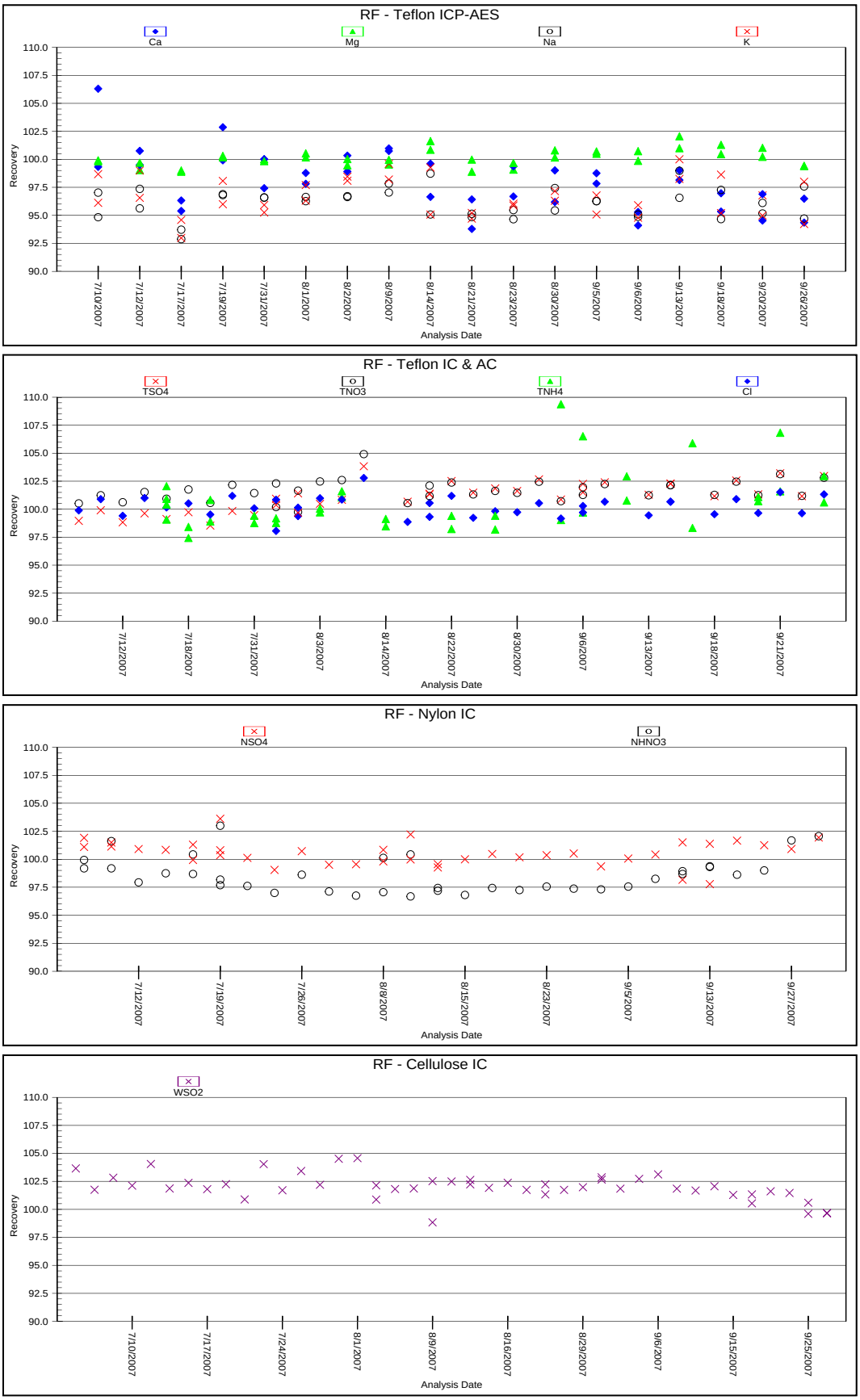
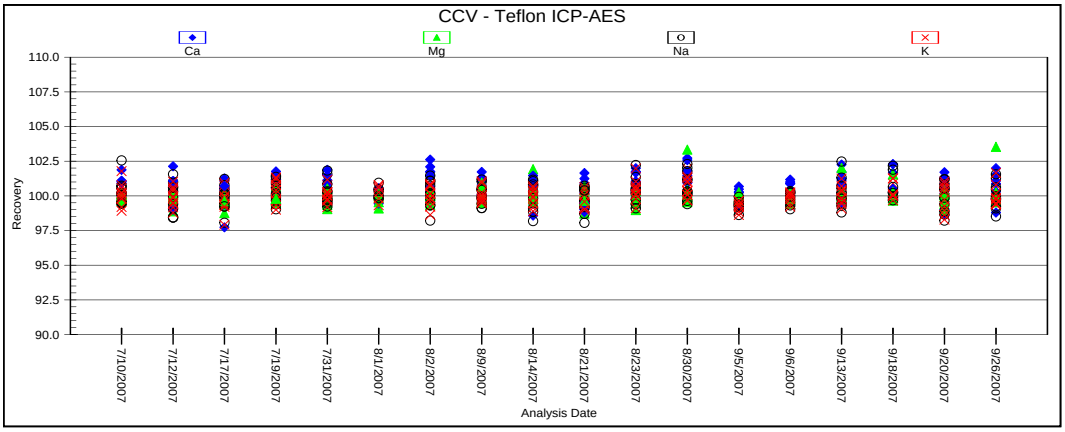
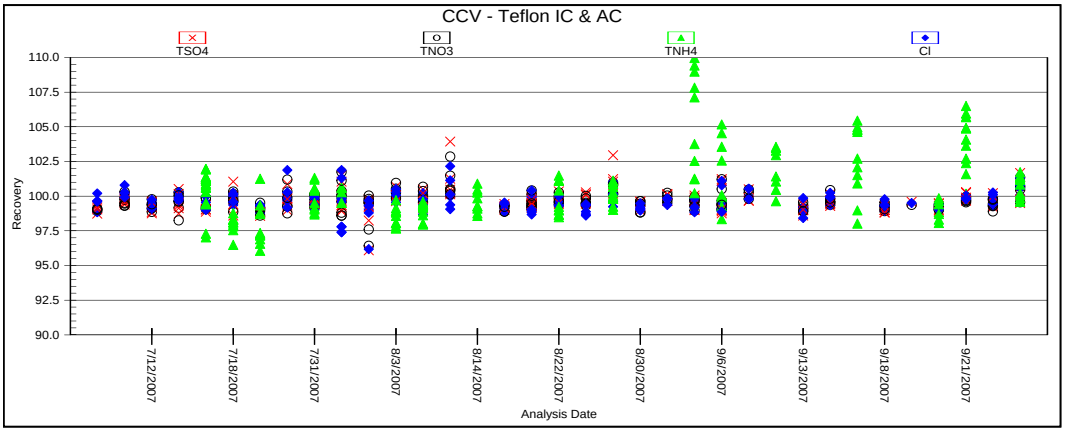
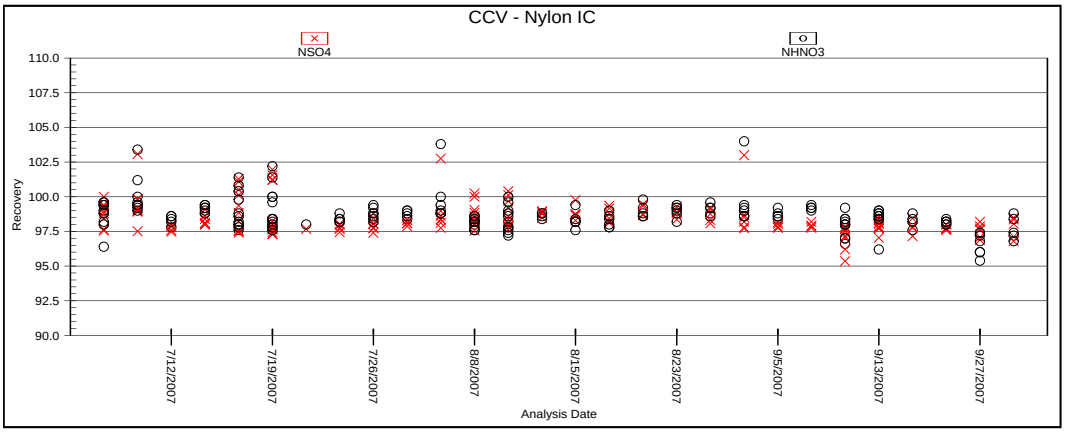


Figure 2. Continuing Calibration Spike Results for Third Quarter 2007 (percent recovery)







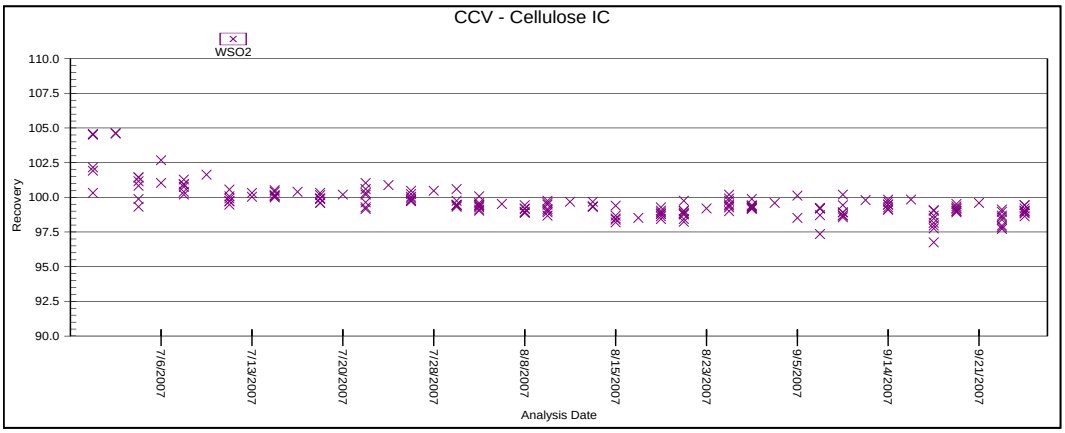


Figure 3. Replicate Sample Analysis Results for Third Quarter 2007 (total micrograms)

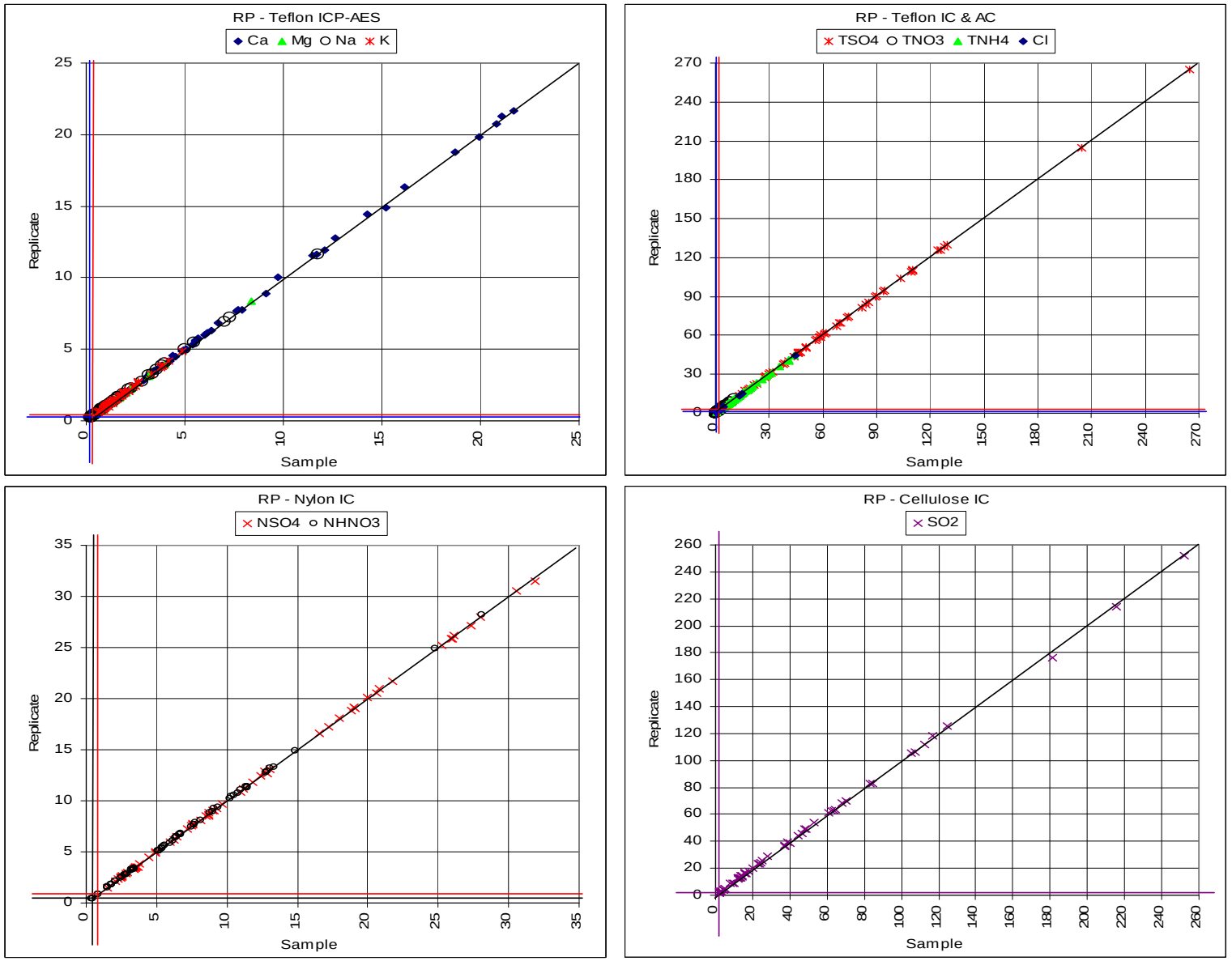
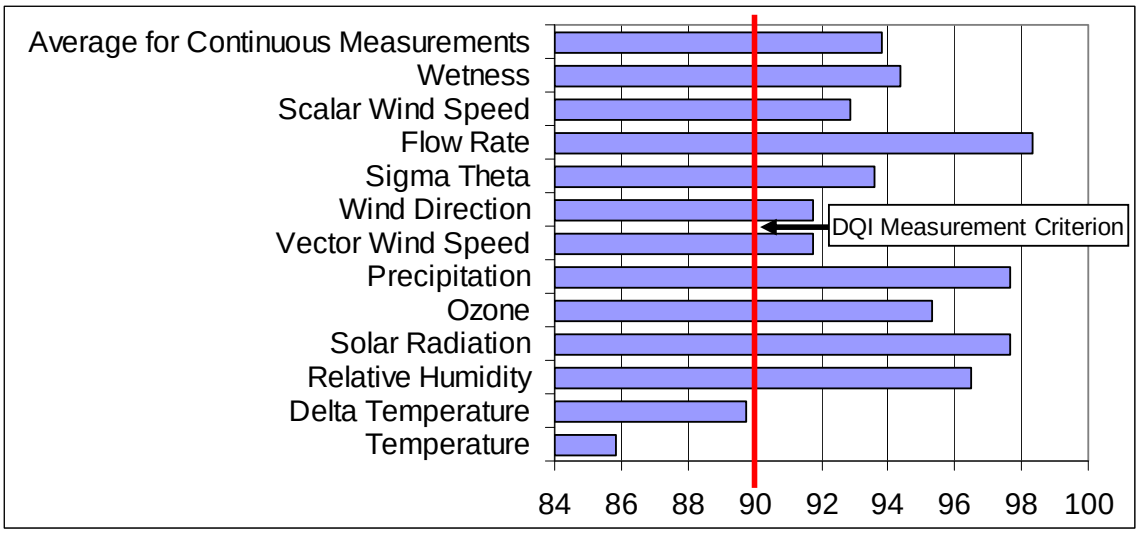
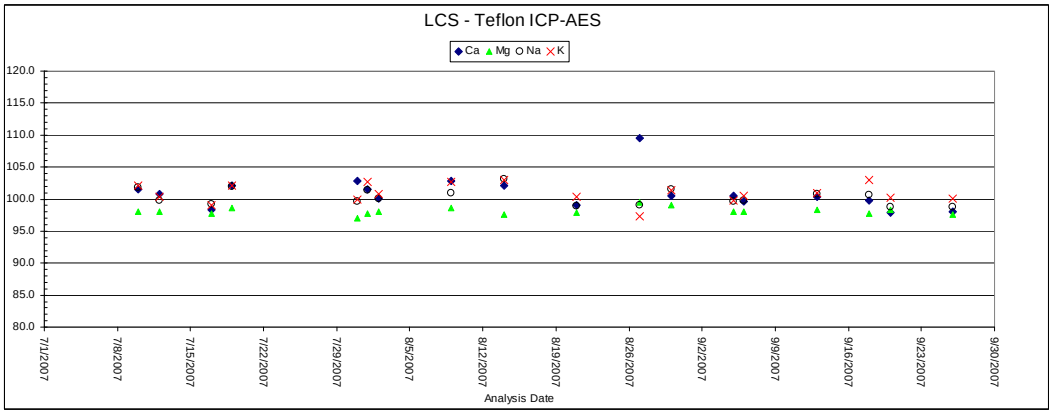


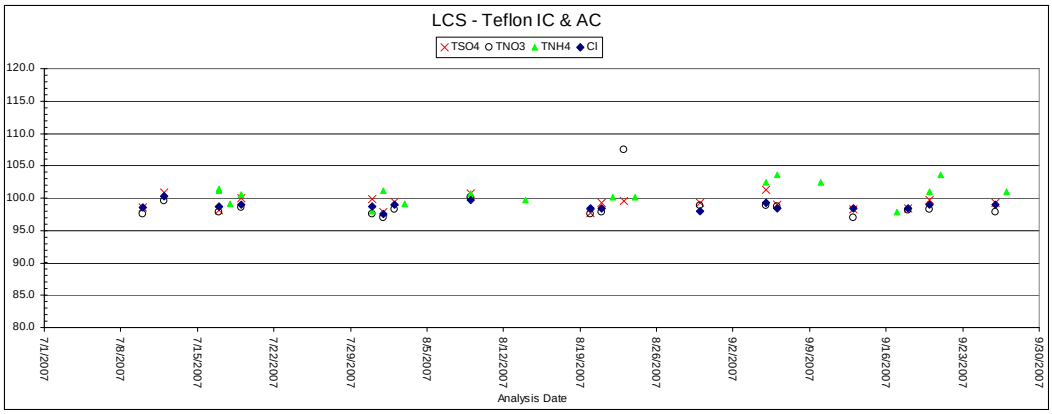
Figure 4. Percent Completeness of Measurements for Fourth Quarter 2006 through Third Quarter 2007*

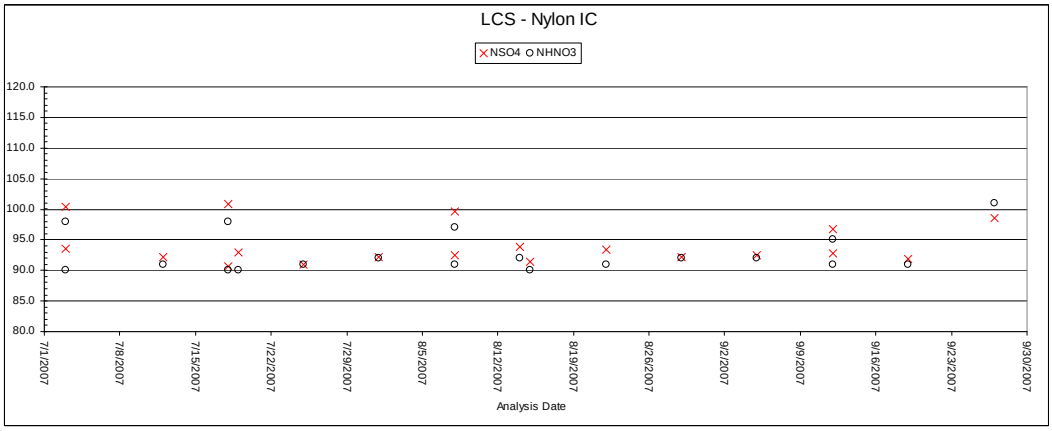


Note: *Presents Level 3 data available during the third quarter of 2007.

Figure 5. Laboratory Control Sample Results for Third Quarter 2007 (percent recovery)







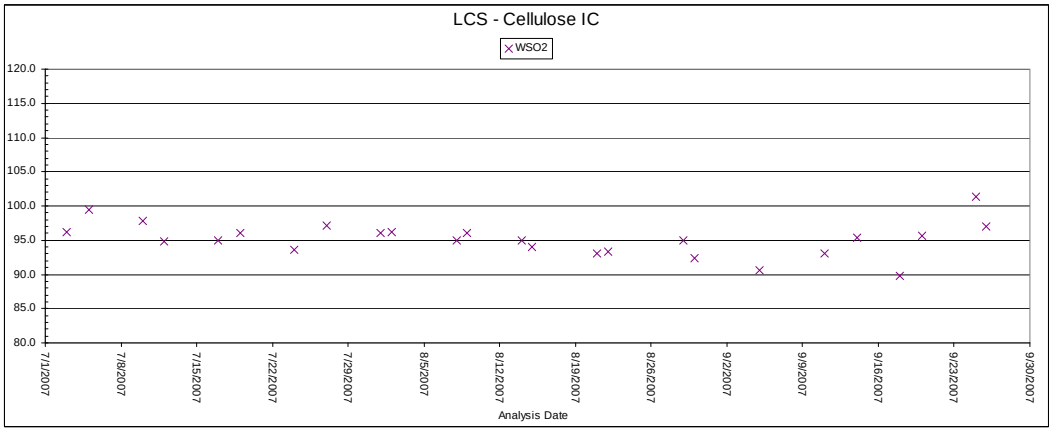
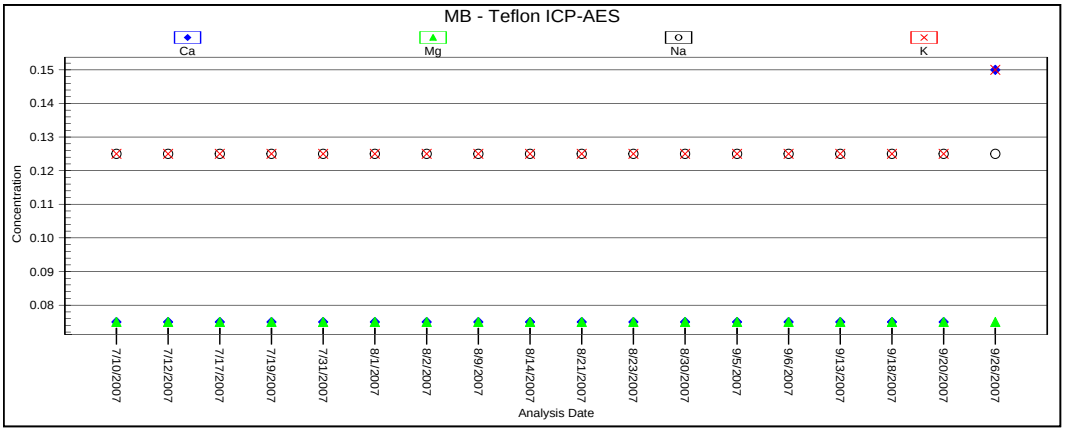
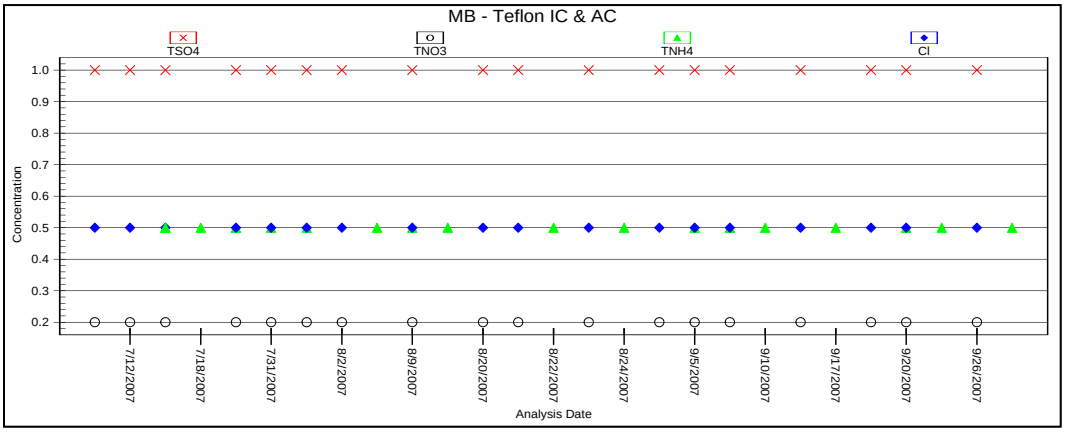
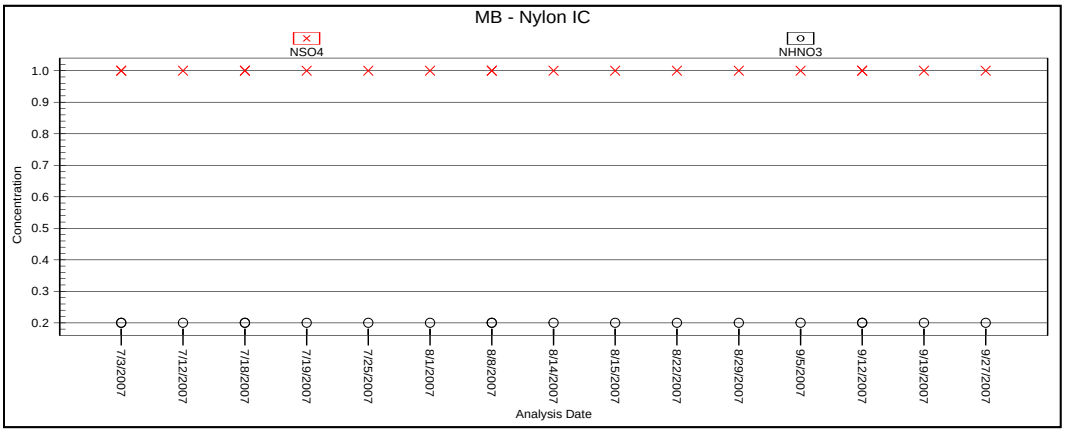


Figure 6. Method Blank Analysis Results for Third Quarter 2007 (total micrograms)







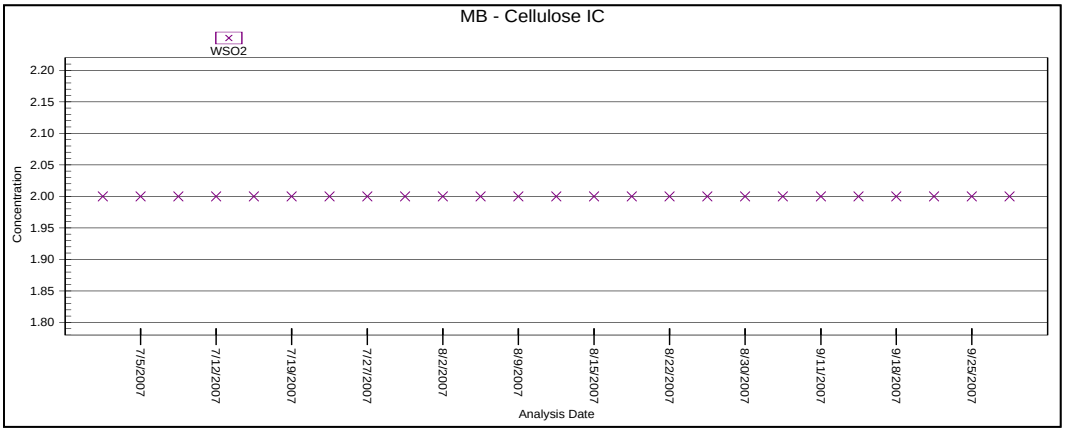


Figure 7. Laboratory Blank Analysis Results for Third Quarter 2007 (total micrograms)

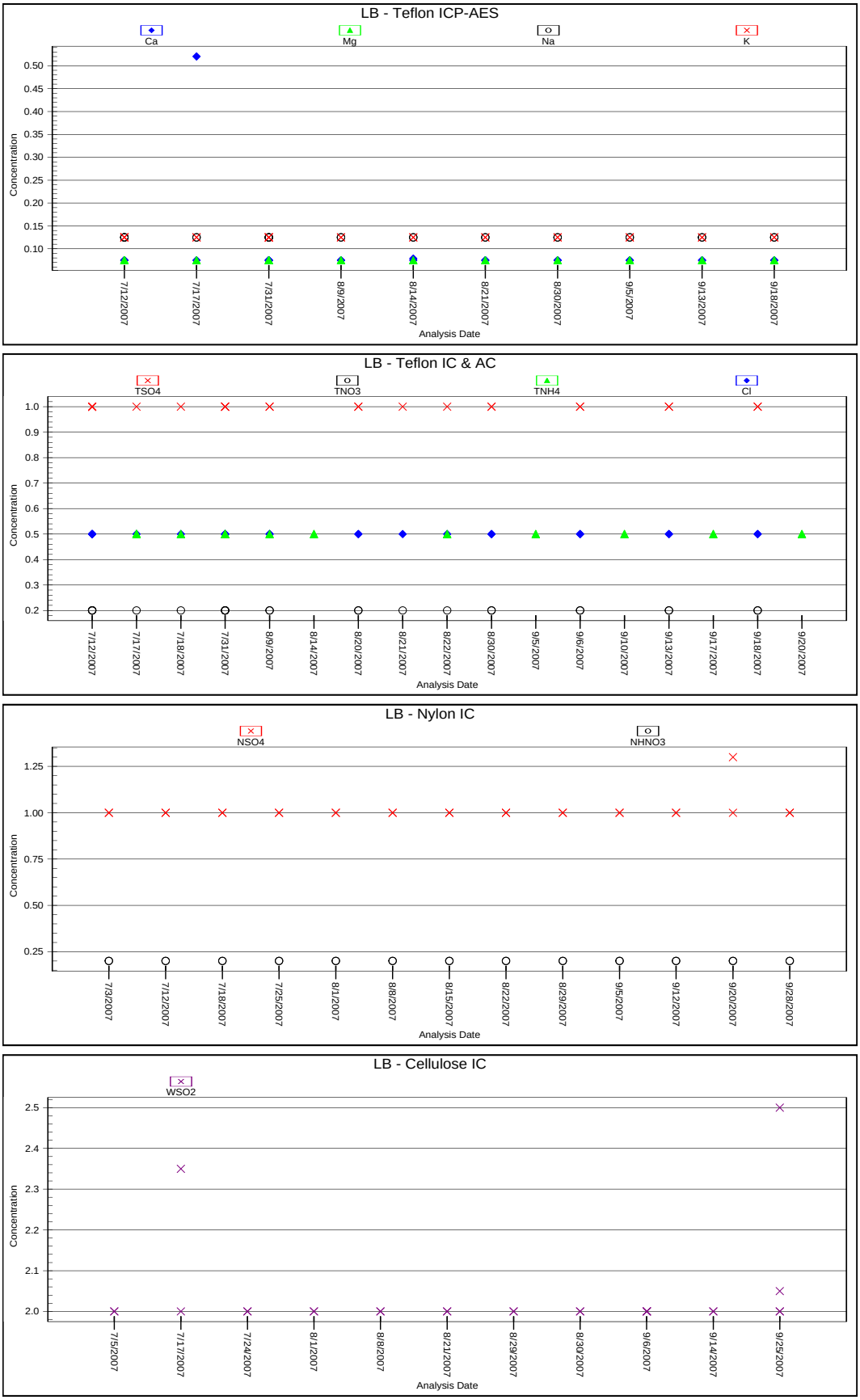


Figure 8. Field Blank Analysis Results for Third Quarter 2007 (total micrograms)