Clean Air Status and Trends Network
Quality Assurance Report

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MACTEC Project No.:	**6064068000**
Reporting Period:	**Fourth Quarter 2006 (October – December) with 2006 Annual Summary**

Summary of 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 fourth quarter 2006. It also provides an annual summary that includes data from the three previous quarters. 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 reviewed annually and updated as necessary.

Collocated filter pack precision data and completeness data for meteorological measurements are presented for data validated to Level 3 during the quarter/year. Table 1 lists the quarters of data that were validated to Level 3 during 2006 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.

Significant Events for 2006

Beginning in first quarter 2006, Element DataSystem™ began to be used as the laboratory information management system (LIMS) for CASTNET 2006 sampling events. Also in first quarter 2006, The CASTNET QAPP, Revision 3.0 was approved by EPA. During third quarter 2006, statistical analyses to support acceptance testing for the nylon filters was completed. To achieve a 95 percent confidence that an entire box of filters is acceptable, at least four filters per box must be satisfactorily tested. This applies to boxes of both Teflon® and nylon filters. Also during third quarter, use of routine laboratory control sample (LCS) analysis was implemented.

The LCS assists in monitoring for potential sample handling artifacts and is a means to identify possible analyte loss from extraction to extraction, once a baseline is established.

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. Tables 5 through 8 present the number of analyses in each category that were performed during each quarter of 2006.

Sample Receipt Statistics

For the current CASTNET project, which began on July 30, 2003, the Environmental Protection Agency (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 9 presents the relevant sample receipt statistics for each of the four quarters of 2006 together with an annual summary for each category.

Data Quality Indicator (DQI) Results

Figures 1 through 3 present the results of RF, CCV, and RP QC sample analyses for fourth quarter 2006. 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. Table 10 presents the percent recoveries and standard deviations for RF, CCV, and RP QC sample analyses for 2006. The standard deviation of the replicate percent differences for cellulose filter sulfur dioxide RP results give an indication of analytical variability at 5.87 percent. The average was skewed by a few high replicate percent difference results from sample values less than two times the reporting limit obtained during the second quarter of 2006. Quarterly averages are all within criteria.

Table 11 presents quarterly collocated filter pack precision results for data validated to Level 3 during the year. Seven of 11 parameters met the precision acceptance criteria at MCK131/231. The measurements at ROM406/206 indicate that four parameters (NH_4^+, HNO_3, Total NO_3^-, and Cl^-) met the precision criteria. The MARPD results for ROM406/ROM206 are consistent with results from previous reports. The results did not generally meet precision criteria, largely because the concentrations are low in magnitude. MACTEC is evaluating procedures, e.g., sample handling and preparation, in order to improve the precision of filter concentration measurements.

During third quarter 2006, the CASTNET analytical laboratory began processing an LCS to monitor the effects of sample handling. The LCS is a reagent blank spiked with a known concentration of a target analyte and extracted along with a group of field samples. The LCS results through the end of 2006 were within the nominal 80-120 percent limit set for spike recovery with one exception wherein an LCS analysis for chloride showed a 156 percent spiked sample recovery early in the third quarter of 2006. All other QC samples associated with the batch were within criteria. The LCS recovery was investigated and determined to be likely due to isolated sample contamination. The analyst was reminded of the proper techniques to prevent such contamination. Figures and/or tables presenting LCS results will be included in subsequent quarterly QA reports.

Figure 4 presents completeness statistics for continuous measurements validated to Level 3 during the year as compared with the historical average from 1990-2005. All parameters met the 90 percent criterion.

Blank Results

Figures 5 through 7 present the results of MB, LB, and FB QC sample analyses for fourth quarter 2006. All results were within criteria (two times the detection limit) listed in Table 4 with the exception of one cellulose filter FB result. All values were less than three times the detection limit. Table 12 summarizes the record of filter blanks for 2006.

Suspect/Invalid Filter Pack Samples

Filter pack samples that were flagged as suspect or invalid during each of the four quarters of 2006 are listed in Table 13. This table also includes associated site identification and a brief description of the reason the sample was flagged. During fourth quarter, four filter pack samples were invalidated due to insufficient flow volume.

Field Problem Count

Table 14 presents the number of field problems affecting continuous data collection for more than one day for each quarter of 2006. 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

A summary of field calibration failures by parameter for each quarter of 2006 is listed in Table 15. Calibrations were performed at 24 sites during fourth quarter 2006. For fourth quarter,

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 15.

Table 16 presents field accuracy results for 2006 based on instrument challenges performed using independent reference standards during site calibration visits. Each parameter was within its criterion with at least 90 percent frequency with the exception of relative humidity at 73 percent, solar radiation at 88 percent, and north and south wind direction quadrants at 88 and 89 percent, respectively. However, this did not adversely affect data collection because data are not considered invalid unless criteria are exceeded by more than two times the criterion. Using the two-times standard, relative humidity passed with 97 percent frequency solar radiation with 98 percent frequency, and north and south wind direction quadrants with 96 and 94 percent frequency, respectively. During 2006, a portable relative humidity chamber began to be used as the calibration transfer for testing the accuracy of the relative humidity sensors. Using a humidity chamber instead of transfer salts provides a more flexible and user-friendly method to gauge relative humidity sensor performance.

Tables and Figures

Table 1. Level 3 Validated Data Available as of January 2007

Calibration Group*	Months Available	Number of Months	Complete Quarters**	Number of Quarters
1	July 2005 – June 2006	12	Quarter 3 2005 – Quarter 2 2006	4
2	August 2005 – July 2006	12	Quarter 4 2005 – Quarter 2 2006	3
3†	September 2005 – August 2006	12	Quarter 4 2005 – Quarter 2 2006	3
4	October 2005 – September 2006	12	Quarter 4 2005 – Quarter 3 2006	4
5‡	May 2005 – April 2006	12	Quarter 3 2005 – Quarter 1 2006	3

Note: * The sites contained in each calibration group are listed in Table 2.
** This column does not include Level 3 validated months that comprise only partial calendar quarters. This information is included primarily as a reference for Table 11.
† Contains MCK131/231, KY
‡ 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	BFT142, NC	PNF126, NC	PED108, VA
		GAS153, GA	CND125, NC	ESP127, TN	VPI120, VA
		CDZ171, KY	COW137, NC	SPD111, TN	
2	February/August	CAD150, AR	BEL116, MD	WSP144, NJ	ARE128, PA
		IRL141, FL	BWR139, MD	CTH110, NY	PSU106, PA
		SUM156, FL	CVL151, MS	CHE185, OK	ALC188, TX
3	March/September	ALH157, IL	VIN140, IN	MCK131, KY	DCP114, OH
		BVL130, IL	KNZ184, KS	MCK231, KY	OXF122, OH
		STK138, IL	CKT136, KY	SAN189, NE	PRK134, WI
4	April/October	ABT147, CT	ANA115, MI	CAT175, NY	EGB181, ON
		SAL133, IN	HOX148, MI	HWF187, NY	LYE145, VT
		ASH135, ME	UVL124, MI	LYK123, OH	
		HOW132,ME	WST109, NH		
5	May/November	CON186, CA	QAK172, OH	MKG113, PA	CNT169, WY
		ROM206, CO	KEF112, PA	CDR119, WV	PND165, WY
		GTH161, CO	LRL117, PA	PAR107, WV	

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	0.005	0.125
Magnesium (Mg^{2+})	F	ICP-AES	5	95 - 105	0.003	0.075
Calcium (Ca^{2+})	F	ICP-AES	5	95 - 105	0.003	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 3.0 (MACTEC, 2005).

Table 5. QC Analysis Count for First Quarter 2006

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-}	45	198	50	19	26	42
	NO_3^-	45	198	50	19	26	42
	NH_4^+	48	209	36	24	26	43
	Cl^-	45	198	50	19	26	42
	Ca^{2+}	54	186	49	19	26	42
	Mg^{2+}	54	186	49	19	26	42
	Na^+	54	186	49	19	26	42
	K^+	54	186	49	19	26	42
Nylon	SO_4^{2-}	36	166	50	18	26	42
	NO_3^-	36	166	50	18	26	42
Cellulose	SO_4^{2-}	46	177	46	23	26	69

Table 6. QC Analysis Count for Second Quarter 2006

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-}	35	180	81	17	24	82
	NO_3^-	35	180	81	17	24	82
	NH_4^+	37	176	72	18	24	82
	Cl^-	35	180	81	17	24	82
	Ca^{2+}	50	192	79	17	24	82
	Mg^{2+}	50	192	79	17	24	82
	Na^+	50	192	79	17	24	82
	K^+	50	192	79	17	24	82
Nylon	SO_4^{2-}	32	168	76	16	24	82
	NO_3^-	32	168	76	16	24	82
Cellulose	SO_4^{2-}	42	163	61	21	22	84

Table 7. QC Analysis Count for Third Quarter 2006

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-}	41	198	77	19	28	42
	NO_3^-	41	198	77	19	28	42
	NH_4^+	36	185	67	17	28	42
	Cl^-	41	198	76	19	28	42
	Ca^{2+}	54	207	77	18	28	42
	Mg^{2+}	54	207	77	18	28	42
	Na^+	54	207	77	18	28	42
	K^+	54	207	77	18	28	42
Nylon	SO_4^{2-}	39	180	71	19	26	41
	NO_3^-	39	180	71	19	26	41
Cellulose	SO_4^{2-}	48	177	61	24	24	55

Table 8. QC Analysis Count for Fourth Quarter 2006

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-}	34	171	79	17	28	85
	NO_3^-	34	171	79	17	28	85
	NH_4^+	32	149	62	15	24	85
	Cl^-	34	171	79	17	28	85
	Ca^{2+}	36	178	82	17	28	85
	Mg^{2+}	36	178	82	17	28	85
	Na^+	36	178	82	17	28	85
	K^+	36	178	82	17	28	85
Nylon	SO_4^{2-}	35	170	75	17	26	85
	NO_3^-	35	170	75	17	26	85
Cellulose	SO_4^{2-}	42	165	63	21	26	63

Table 9. Filter Pack Receipt Summary (2006)

Description	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Annual Summary
Count of samples received more than 14 days after removal from tower:	18	12	6	7	42
Count of all samples received:	742	775	747	662	2926
Fraction of samples received within 14 days:	0.976	0.984	0.992	0.989	*0.985
Average interval in days:	5.50	5.00	5.07	6.00	*5.39
First receipt date:	01/03/2006	04/03/2006	07/01/2006	10/02/2006	01/03/2006
Last receipt date:	03/30/2006	06/30/2006	09/29/2006	12/27/2006	12/27/2006

Note: *annual average

Table 10. Filter Pack QC Summary for 2006

Filter Type	Parameter	Reference Sample[1] Recovery (%R)			Continuing Calibration Verification Samples (%R)			In-Run Replicate[2] (RPD)		
		Mean	Std. Dev.	Count[3]	Mean	Std. Dev.	Count[3]	Mean	Std. Dev.	Count[3]
Teflon®	SO_4^{2-}	98.50	1.67	155	99.74	1.21	781	0.48	0.57	322
	NO_3^-	101.81	1.07	155	99.10	1.21	781	1.21	1.48	322
	NH_4^+	100.71	1.73	153	99.48	1.73	751	0.58	0.63	266
	Ca^{2+}	103.02	2.73	194	100.72	1.10	797	1.58	2.34	324
	Mg^{2+}	101.61	1.85	194	99.96	0.74	797	2.48	2.95	324
	Na^+	94.43	1.69	194	100.23	1.00	797	2.38	4.51	324
	K^+	100.79	2.44	194	100.50	0.98	797	3.40	3.29	324
	Cl^-	100.97	1.39	155	99.25	2.41	781	1.17	1.48	319
Nylon	SO_4^{2-}	101.01	1.45	144	99.90	1.99	730	2.12	2.82	305
	NO_3^-	99.95	1.46	144	99.53	1.96	730	0.52	0.88	306
Cellulose	SO_4^{2-}	101.46	0.59	182	99.16	0.80	740	3.75	5.87	257

Note: % R = percent recovery
RPD = relative percent difference

[1] Results of reference sample analyses provide accuracy estimates
[2] Results of replicate analyses provide precision estimates
[3] Number of QC Samples

Table 11. Precision Results for Third Quarter 2005 through Second Quarter 2006

Site Pairs	SO_4^{2-}	NO_3^-	NH_4^+	Ca^{2+}	Mg^{2+}	Na^+	K^+	Cl^-	HNO_3	SO_2	Total NO_3^-
MCK 131/231, KY											
2005 Q4	3.68	8.93	3.30	7.62	11.16	5.31	5.77	7.58	4.06	3.16	5.24
2006 Q1	3.22	8.71	3.86	12.17	10.49	6.40	10.30	3.46	2.90	2.98	4.74
2006 Q2	0.96	7.49	1.70	4.79	5.20	4.28	11.16	2.06	3.90	1.81	3.83
Average	2.62	8.38	2.95	8.19	8.95	5.33	9.08	4.37	3.62	2.65	4.60
ROM 406/206, CO											
2005 Q3	6.65	14.60	6.65	10.17	10.62	7.56	13.01	2.27	2.27	6.42	2.70
2005 Q4	5.44	12.74	5.45	12.36	9.14	7.70	21.22	5.13	5.32	8.81	4.84
2006 Q1	4.75	3.93	2.51	7.68	8.72	6.68	9.05	1.33	4.84	7.86	2.78
Average	5.61	10.42	4.87	10.07	9.49	7.31	14.43	2.91	4.14	7.70	3.44

Note: 30 site-quarter-parameters were outside criterion

Table 12. Summary of Filter Blanks for 2006 (page 1 of 2)

Parameter Name	Detection Limit Total µg	Total Number	Number > Detection Limit	Average Total µg	Average Absolute Deviation	Maximum Total µg
FIELD BLANKS						
Teflon®-NH_4^+-N	0.500	334	6	0.501	0.001	0.555
Teflon®- NO_3^--N	0.200	335	14	0.202	0.005	0.375
Teflon®- SO_4^{2-}	1.000	335	0	1.000	0.000	1.000
Cl^-	0.500	335	0	0.500	0.000	0.500
Ca^{2+}	0.075	335	10	0.077	0.004	0.435
Mg^{2+}	0.075	335	0	0.075	0.000	0.075
Na^+	0.125	335	5	0.131	0.012	0.751
K^+	0.125	335	7	0.128	0.006	0.628
Nylon- NO_3^--N	0.200	335	0	0.200	0.000	0.200
Nylon - SO_4^{2-}	1.000	335	1	1.000	0.000	1.075
Cellulose - SO_4^{2-}	2.000	311	100	2.246	0.344	4.350
LABORATORY BLANKS						
Teflon®-NH_4^+-N	0.500	104	1	0.500	0.001	0.533
Teflon®- NO_3^--N	0.200	108	0	0.200	0.000	0.200
Teflon®- SO_4^{2-}	1.000	108	0	1.000	0.000	1.000
Cl^-	0.500	108	0	0.500	0.000	0.500
Ca^{2+}	0.075	108	3	0.085	0.019	0.500
Mg^{2+}	0.075	108	0	0.075	0.000	0.075
Na^+	0.125	108	1	0.135	0.020	1.228
K^+	0.125	108	0	0.125	0.000	0.125
Nylon- NO_3^--N	0.200	106	0	0.200	0.000	0.200
Nylon -SO_4^{2-}	1.000	106	1	1.003	0.005	1.275
Cellulose -SO_4^{2-}	2.000	102	14	2.053	0.092	3.000
METHOD BLANKS						
Teflon®-NH_4^+-N	0.500	74	0	0.500	0.000	0.500
Teflon®- NO_3^--N	0.200	72	0	0.200	0.000	0.200
Teflon®- SO_4^{2-}	1.000	72	0	1.000	0.000	1.000
Cl^-	0.500	72	0	0.500	0.000	0.500
Ca^{2+}	0.075	71	0	0.075	0.000	0.075
Mg^{2+}	0.075	71	0	0.075	0.000	0.075
Na^+	0.125	71	0	0.125	0.000	0.125
K^+	0.125	71	0	0.125	0.000	0.125
Nylon- NO_3^--N	0.200	71	0	0.200	0.000	0.200
Nylon -SO_4^{2-}	1.000	71	1	1.006	0.000	1.400
Cellulose -SO_4^{2-}	2.000	91	0	2.000	0.000	2.000

Table 12. Summary of Filter Blanks for 2006 (page 2 of 2)

Parameter Name	Detection Limit Total µg	Total Number	Number > Detection Limit	Average Total µg	Average Absolute Deviation	Maximum Total µg
ACCEPTANCE TEST VALUES						
Teflon®-NH_4^+-N	0.500	455	0	0.500	0.000	0.500
Teflon®- NO_3^--N	0.200	455	9	0.204	0.000	0.668
Teflon®- SO_4^{2-}	1.000	455	0	1.000	0.000	1.000
Cl^-	0.500	455	0	0.500	0.000	0.500
Ca^{2+}	0.075	455	3	0.076	0.000	0.602
Mg^{2+}	0.075	455	0	0.075	0.000	0.075
Na^+	0.125	455	4	0.127	0.000	0.723
K^+	0.125	455	0	0.125	0.000	0.125
Nylon- NO_3^--N	0.200	250	0	0.200	0.000	0.200
Nylon -SO_4^{2-}	1.000	250	0	1.000	0.000	1.000
Cellulose -SO_4^{2-}	2.000	306	0	2.000	0.000	2.000

Note: Cellulose filters are not analyzed for ambient NO_3^-. The blank results are used only for QC.
µg = microgram

Table 13. Filter Packs Flagged as Suspect or Invalid

Site ID	Sample	Flag	Reason
First Quarter 2006			
BEL116, MD	0606001-09	Invalid	Insufficient flow volume
CVL151, MS	0610001-26	Invalid	Insufficient flow volume
KEF112, PA	0607001-46	Invalid	Insufficient flow volume
LRL117, PA	0602001-49	Invalid	Insufficient flow volume
VPI120, VA	0602001-82	Invalid	Insufficient flow volume
Second Quarter 2006			
DCP114, OH	0619001-27	Invalid	Insufficient flow volume
BEL116, MD	0614001-09	Invalid	Insufficient flow volume
	0615001-09	Invalid	Insufficient flow volume
ALH157, IL	0616001-04	Invalid	Insufficient flow volume
	0617001-04	Invalid	Insufficient flow volume
	0618001-04	Invalid	Insufficient flow volume
ROM206, CO	0618001-69	Invalid	Insufficient flow volume
WSP144, NJ	0614001-84	Invalid	Insufficient flow volume
Third Quarter 2006			
BEL116, MD	0627001-09	Invalid	Insufficient flow volume
CKT136, KY	0633001-20	Invalid	Insufficient flow volume
ESP127, TN	0629001-33	Invalid	Insufficient flow volume
OXF122, OH	0630001-59	Invalid	Insufficient flow volume
STK138, IL	0630001-76	Invalid	Insufficient flow volume
Fourth Quarter 2006			
HOX149, MI	0642001-42	Invalid	Insufficient flow volume
HWF187, NY	0643001-43	Invalid	Insufficient flow volume
LRL117, PA	0642001-49	Invalid	Insufficient flow volume
WST109, NH	0642001-85	Invalid	Insufficient flow volume

Table 14. Field Problems Affecting Data Collection

Days to Resolution	Problem Count
First Quarter 2006	
30	114
60	2
90	0
Unresolved by End of Quarter	28
Second Quarter 2006	
30	20
60	11
90	0
Unresolved by End of Quarter	9
Third Quarter 2006	
30	18
60	0
90	0
Unresolved by End of Quarter	53
Fourth Quarter 2006	
30	16
60	13
90	12
Unresolved by Date of Publication	13

Table 15. Field Calibration Failures by Parameter (page 1 of 2)

Site ID	Parameter(s)
First Quarter 2006	
ARE128, PA	Wind Direction
BEL116, MD	Relative Humidity
BFT142, NC	Relative Humidity
BWR139, MD	Wind Direction
CDZ171, KY	Relative Humidity
CTH110, NY	Flow Rate
CVL151, MS	Solar Radiation
ESP127, TN	Solar Radiation
IRL141, FL	Relative Humidity
PAR107, WV	Solar Radiation
PED108, VA	Relative Humidity
PSU106, PA	Solar Radiation
SPD111, TN	Flow Rate
WSP144, NJ	Relative Humidity
Second Quarter 2006	
ANA115, MI	Temperature Relative Humidity Wind Direction
ASH135, ME	Wind Direction
CAT175, NY	Delta Temperature Wind Direction Precipitation
CDR119, WV	Solar Radiation
CKT136, KY	Wind Direction
CNT169, WY	Wind Direction
CON186, CA	Relative Humidity
DCP114, OH	Wind Direction
GTH161, CO	Wind Direction
HOW132, ME	Wind Speed
HOX148, MI	Wind Direction
LRL117, PA	Relative Humidity
LYE145, VT	Temperature Relative Humidity
PND165, WY	Relative Humidity
ROM206, CO	Wind Direction Precipitation
SAL133, IN	Relative Humidity
SND152, AL	Wind Direction
WSP144, NJ	Wind Direction

Table 15. Field Calibration Failures by Parameter (page 2 of 2)

Site ID	Parameter(s)
Third Quarter 2006	
ALC188, TX	Relative Humidity
BWR139, MD	Relative Humidity
CTH110, NY	Wind Direction
ESP127, TN	Wind Direction
IRL141, FL	Wind Direction
PNF126, NC	Relative Humidity Temperature
PSU106, PA	Solar Radiation
SND152, AL	Relative Humidity
SPD111, TN	Solar Radiation Flow Rate
STK138, IL	Wind Speed
VPI120, VA	Temperature
Fourth Quarter 2006	
ABT147, CT	Wind Direction
ANA115, MI	Relative Humidity
CAT175, NY	Temperature Delta Temperature
CNT169, WY	Wind Direction
CON186, CA	Relative Humidity
HOW132, ME	Wind Direction
HOX148, MI	Relative Humidity
LYK123, OH	Relative Humidity Solar Radiation
PND165, WY	Relative Humidity
QAK172, OH	Solar Radiation
ROM206, CO	Temperature
SAL133, IN	Relative Humidity
UVL124, MI	Relative Humidity
WST109, NH	Relative Humidity

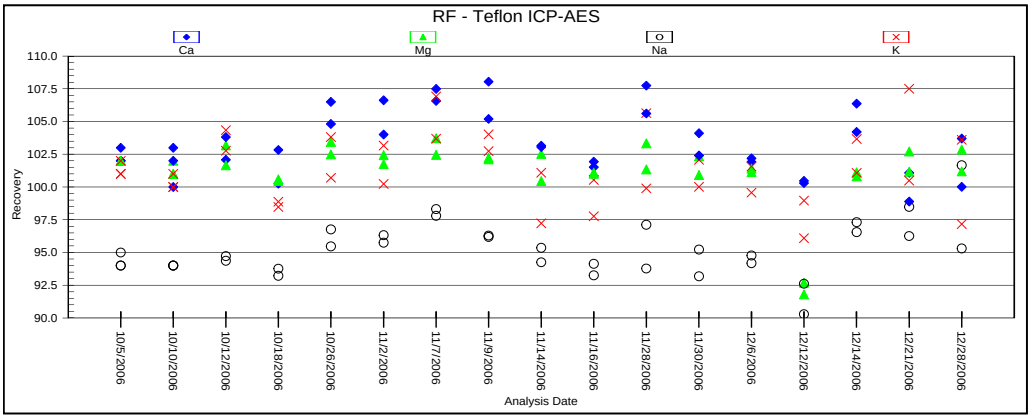
Note: Per CASTNET project protocols, data are flagged as "suspect" (S) but still considered valid if the calibration criterion is not exceeded by more that its magnitude (i.e., if within 2x the criterion). If ozone or flow calibrations fall within 2x the criteria, these data are adjusted per approved protocol described in the CASTNET QAPP, Revision 3.0 (MACTEC, 2005).

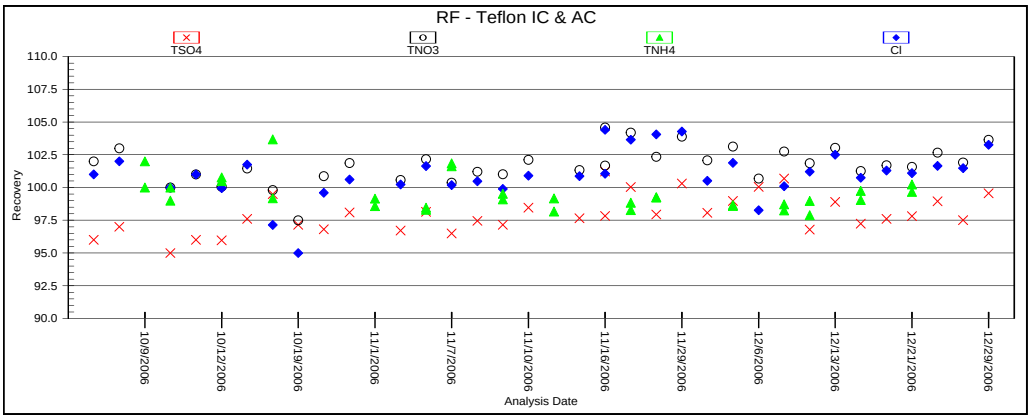
Table 16. Accuracy Results for 2006 Field Measurements

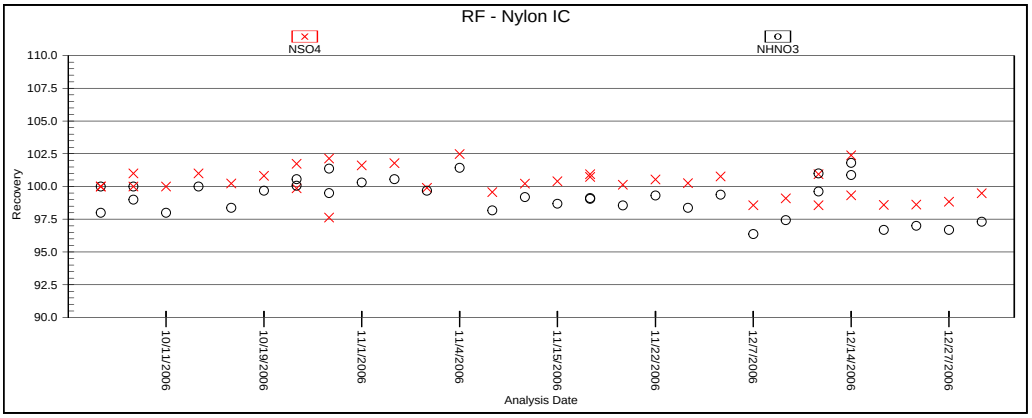
Parameter	Percent Within Criterion
Temperature (0°C)	99 percent
Temperature (ambient)	98 percent
Delta Temperature (0°C)	100 percent
Delta Temperature (ambient)	97 percent
*Relative Humidity > 85%	73 percent
Relative Humidity ≤ 50%	94 percent
*Solar Radiation	88 percent
*Wind Direction North	88 percent
*Wind Direction South	89 percent
Wind Speed < 5 m/s	100 percent
Wind Speed ≥ 5 m/s	95 percent
Precipitation	99 percent
Wetness (w/in 0.5 volts)	100 percent
Ozone Slope	97 percent
Ozone Intercept	100 percent
Flow Rate	97 percent

Note: °C = degrees Celsius.
m/s = meters per second.
* = Per CASTNET project protocols, data 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). The percent within 2x criterion for these parameters ranged from 92.6 percent to 98 percent.

Figure 1. Reference Standard Results for Fourth Quarter 2006 (percent recovery)







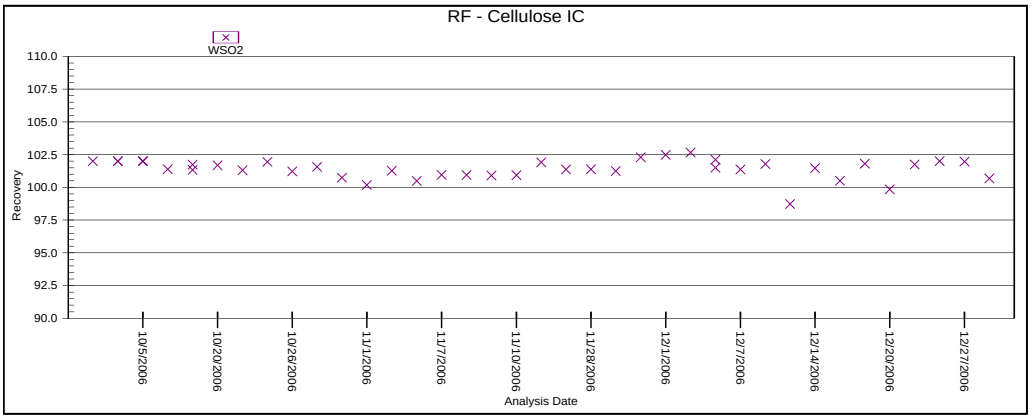


Figure 2. Continuing Calibration Verification Spike Results for Fourth Quarter 2006 (percent recovery)

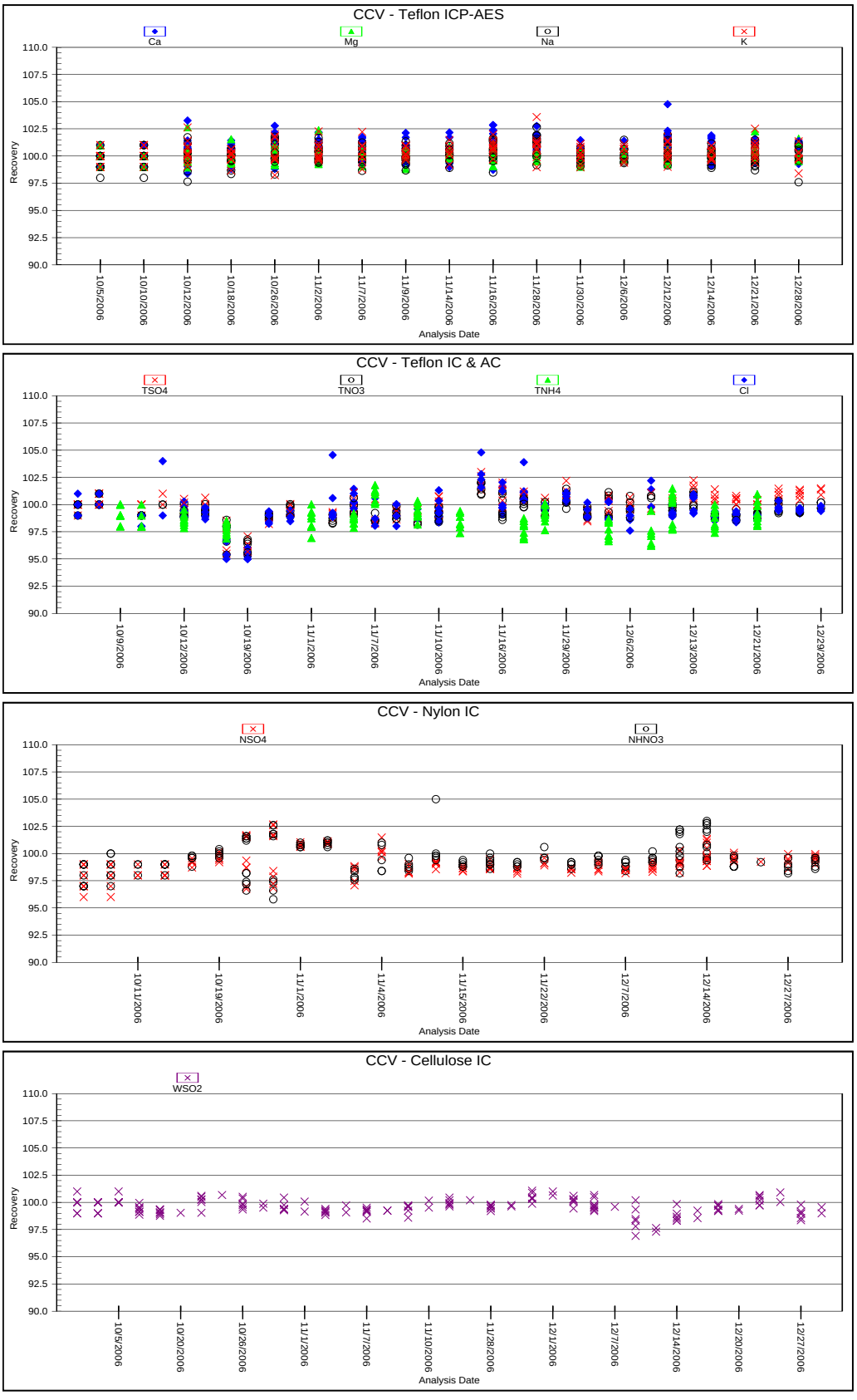


Figure 3. Replicate Sample Analysis Results for Fourth Quarter 2006 (total micrograms)

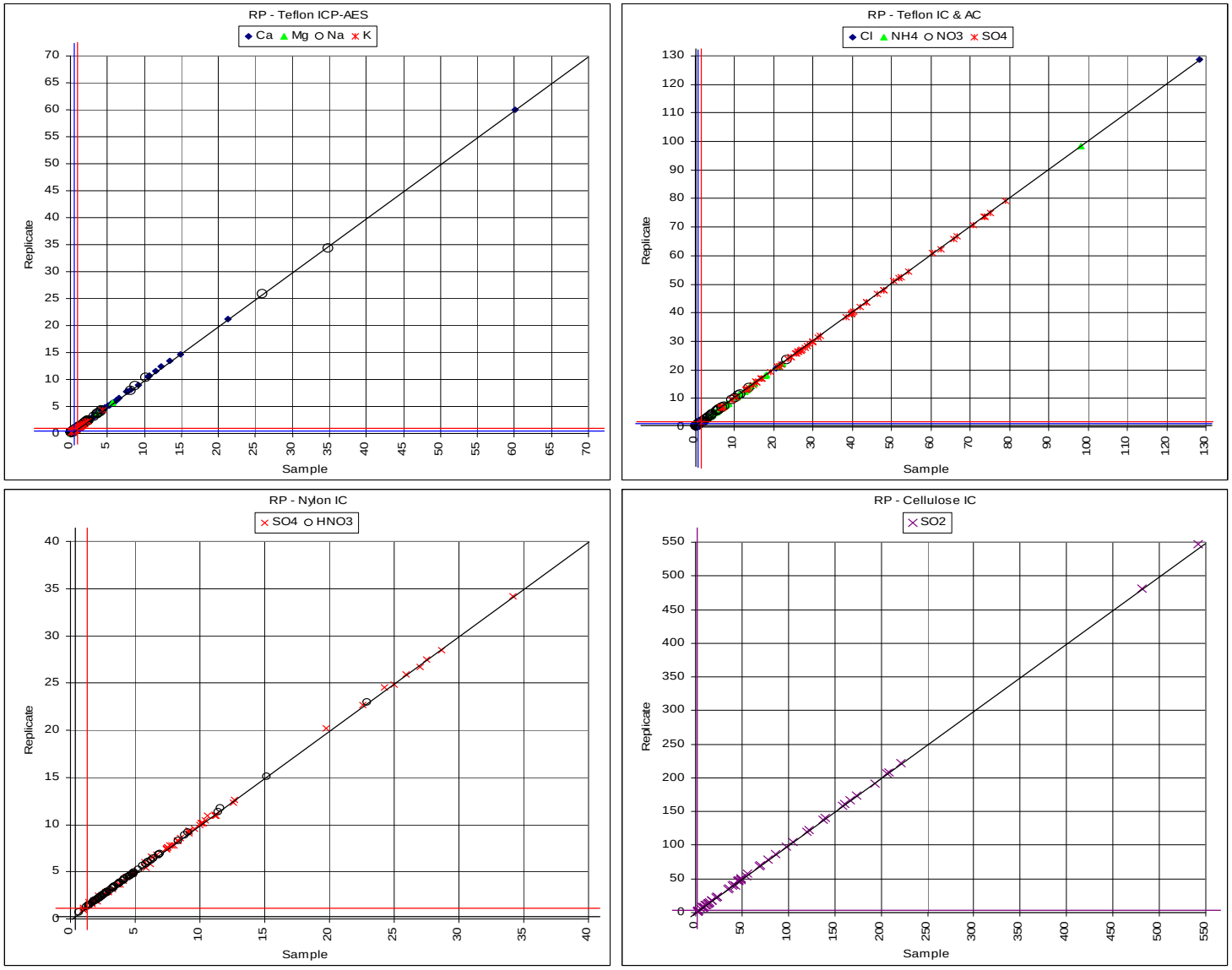
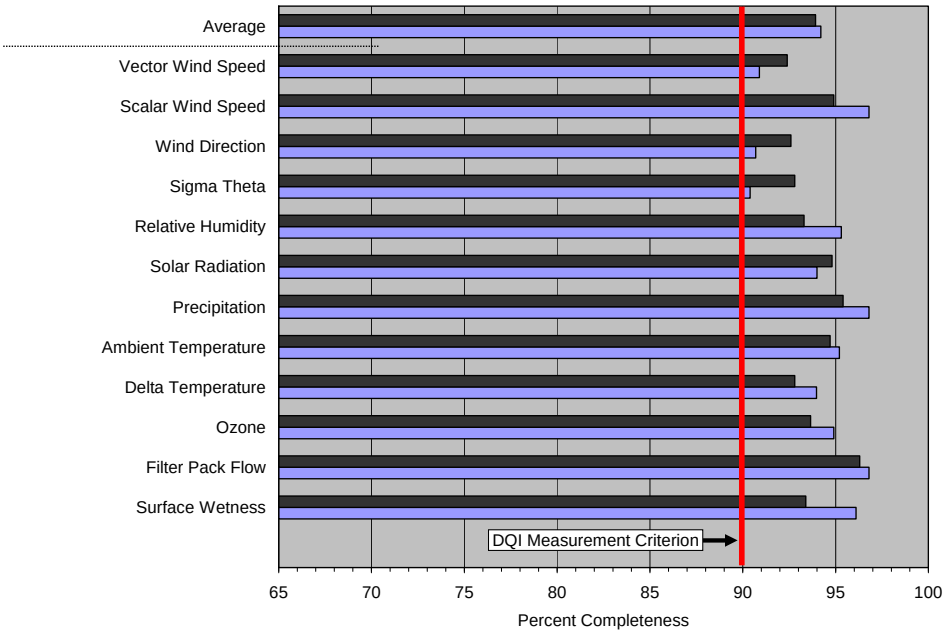


Figure 4. Historical (1990–2005) and Third Quarter 2005 through Third Quarter 2006 Percent Completeness of Measurements *



Note: Black bars represent 1990-2005 data.
* Presents Level 3 data available during the 2006 calendar year.

Figure 5. Method Blank Analysis Results for Fourth Quarter 2006 (total micrograms)

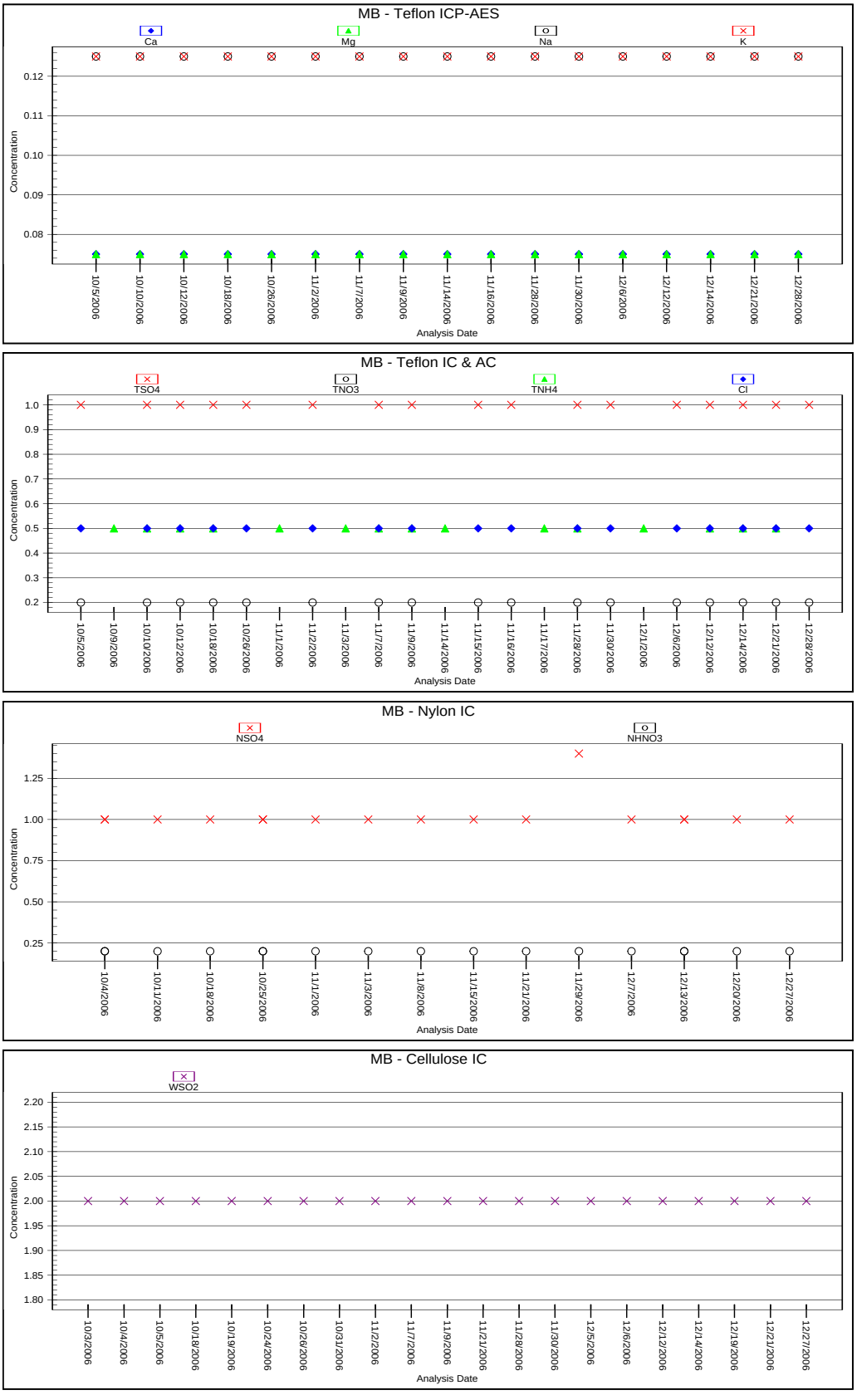
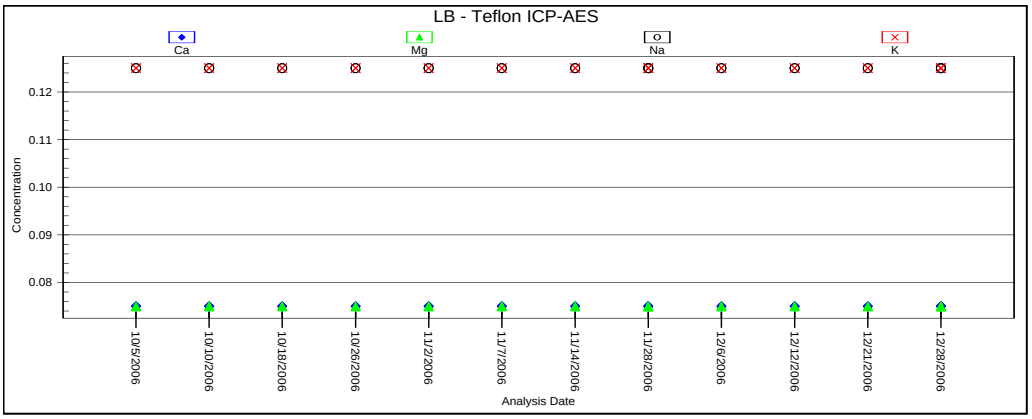
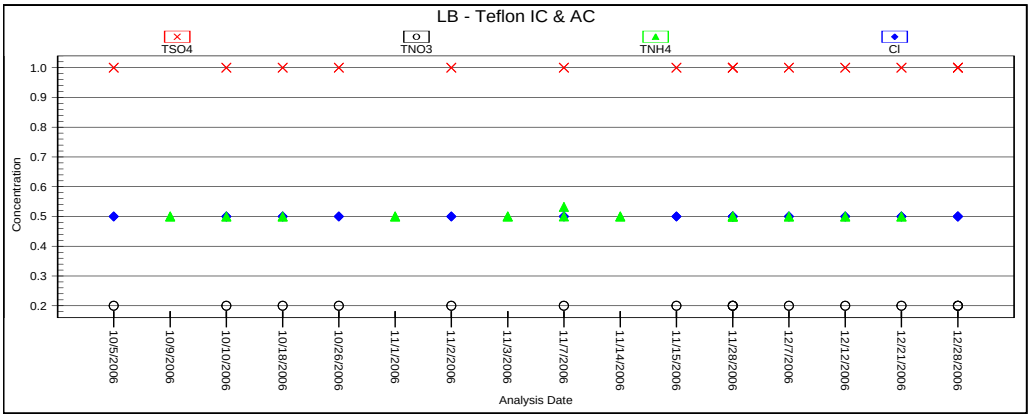
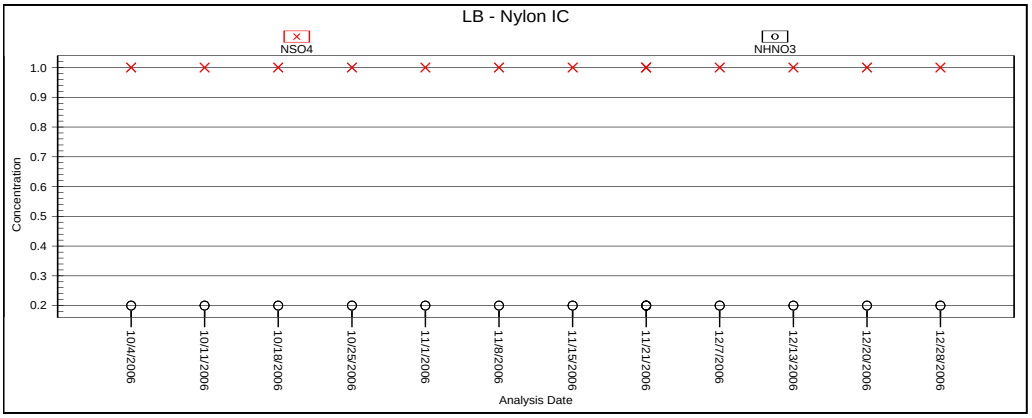


Figure 6. Laboratory Blank Analysis Results for Fourth Quarter 2006 (total micrograms)







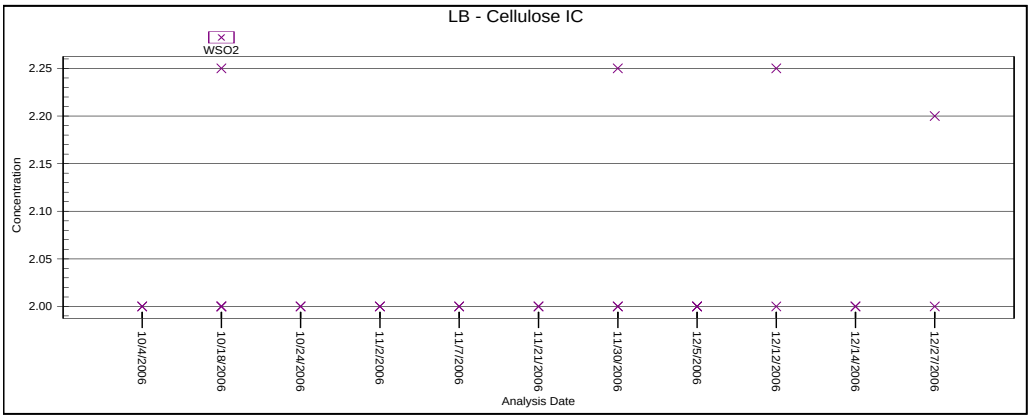


Figure 7. Field Blank Analysis Results for Fourth Quarter 2006 (total micrograms)