



Clean Air Status and Trends Network Quality Assurance Report

EPA Contract No.:	68-D-03-052 (Base Program)
MACTEC Project No.:	6064057000
Reporting Period:	First Quarter 2006 (January - March)

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 first quarter 2006. 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). 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 (SP) used to assess accuracy and for replicate sample (RP) analyses 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, 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 6 presents the relevant sample receipt statistics for first quarter 2006.

Data Quality Indicator (DQI) Results

Figures 1 through 3 present the results of RF, SP, and RP QC sample analyses for first 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. 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.

Blank Results

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

Suspect/Invalid Filter Pack Samples

Five filter pack samples were invalidated due to insufficient flow volume. 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 24 sites during first quarter 2006. 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 First Quarter 2006

Calibration Group*	Months Available	Number of Months	Complete Quarters	Number of Quarters
1	July 2005 – December 2005	6	Quarter 3 2005 – Quarter 4 2005	2
5 [†]	May 2005– October 2005	6	Quarter 3 2005	1

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 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 LYE145, VT
5	May/November	CON186, CA ROM206, CO GTH161, CO	QAK172, OH KEF112, PA LRL117, PA	MKG113, PA 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	0.005	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 Quality Assurance Project Plan, Revision 2.0 (MACTEC, 2003).

Table 5. QC Analysis Count for First Quarter 2006

Filter Type	Parameter	RF Sample Count	SP 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. Filter Pack Receipt Summary

Count of samples received more than 14 days after removal from tower:	18
Count of all samples received:	742
Fraction of samples received within 14 days:	0.976
Average interval in days:	5.5
First receipt date:	1/3/2006
Last receipt date:	3/30/2006

Table 7. Filter Packs Flagged as Suspect or Invalid

Site ID	Sample ID
BEL116, MD	0606001-09
CVL151, MS	0610001-26
KEF112, PA	0607001-46
LRL117, PA	0602001-49
VPI120, VA	0602001-82

Table 8. Field Problems Affecting Data Collection

Days to Resolution	Problem Count
30	114
60	2
90	0
Unresolved by date of publication	28

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)
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

Note: 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). If ozone or flow calibrations fall within 2x the criteria, these data are adjusted per approved protocol described in the CASTNET QAPP, Revision 2.0 (MACTEC, 2003).

Figure 1. Reference Standard Results for First Quarter 2006 (percent difference)

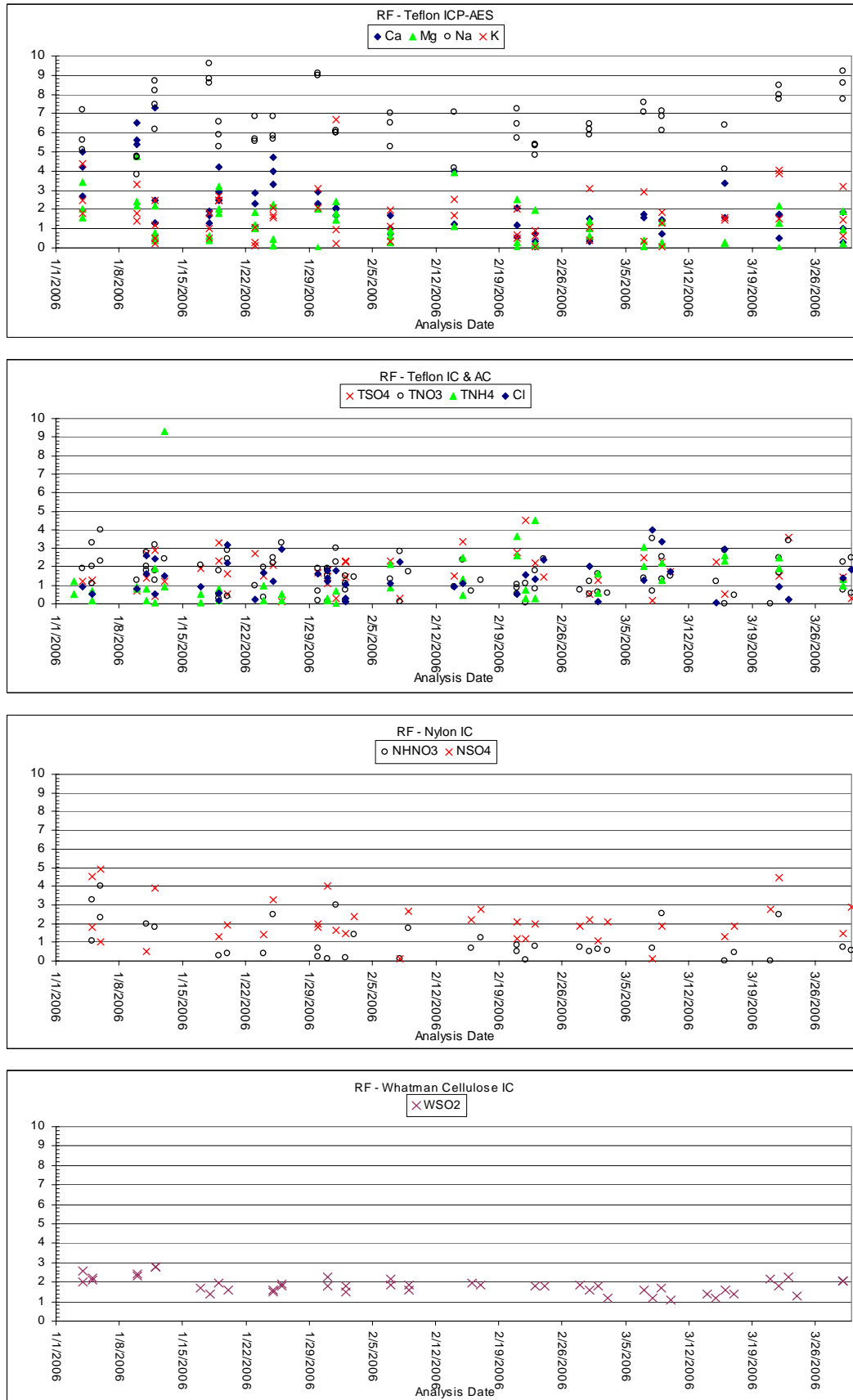


Figure 2. Continuing Calibration Spike Results for First Quarter 2006 (percent recovery)

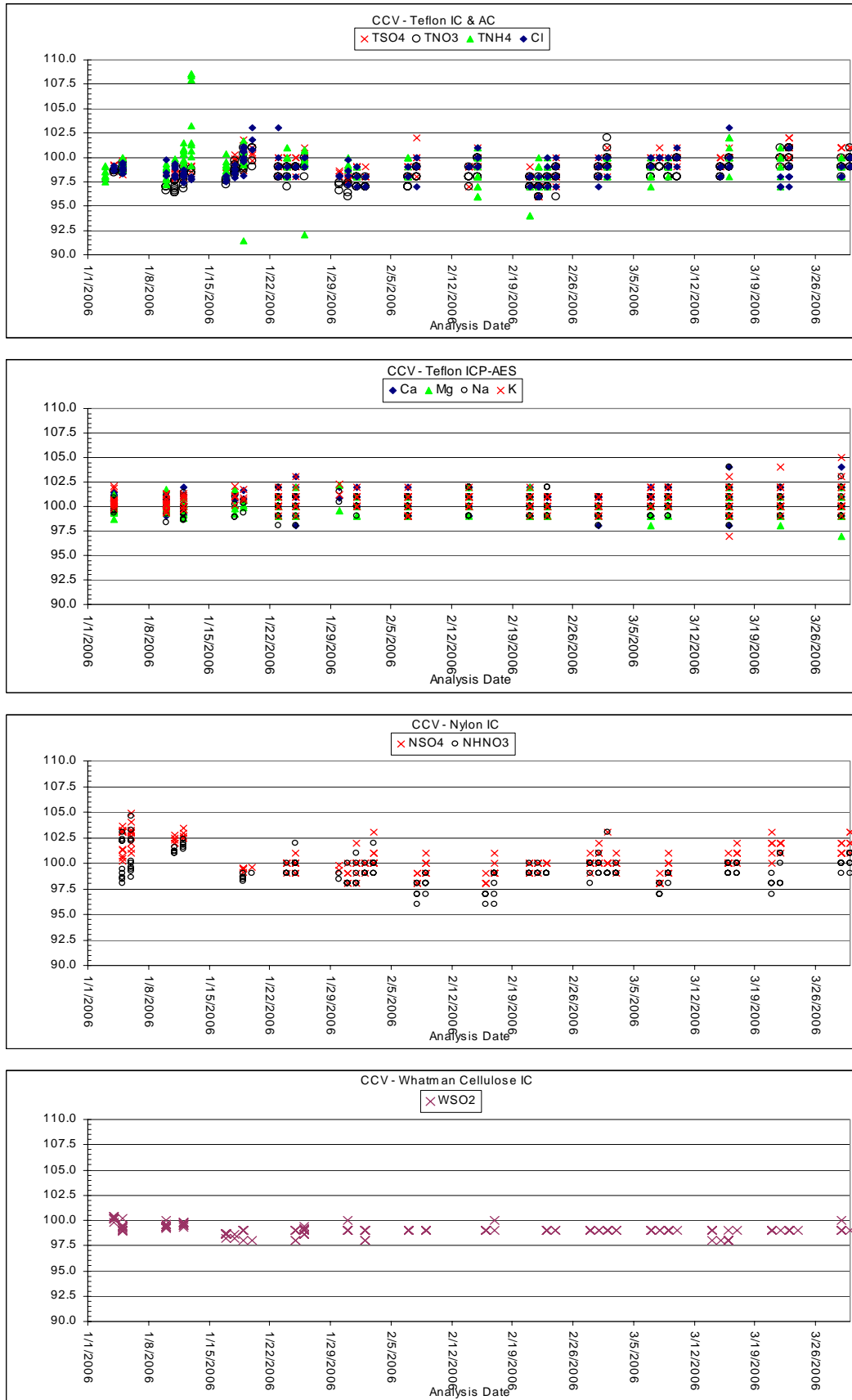


Figure 3. Replicate Sample Analysis Results for First Quarter 2006 (total micrograms)

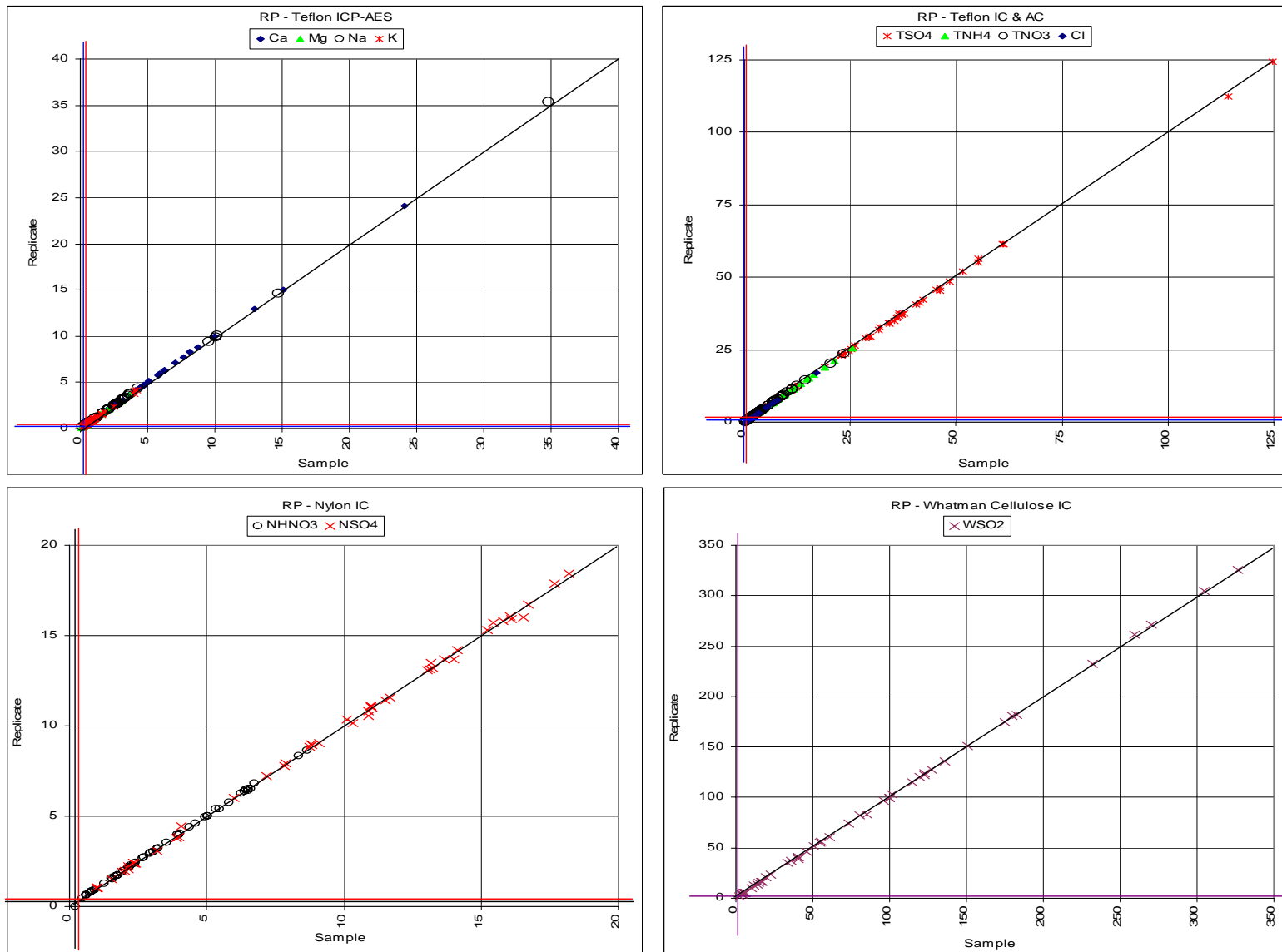
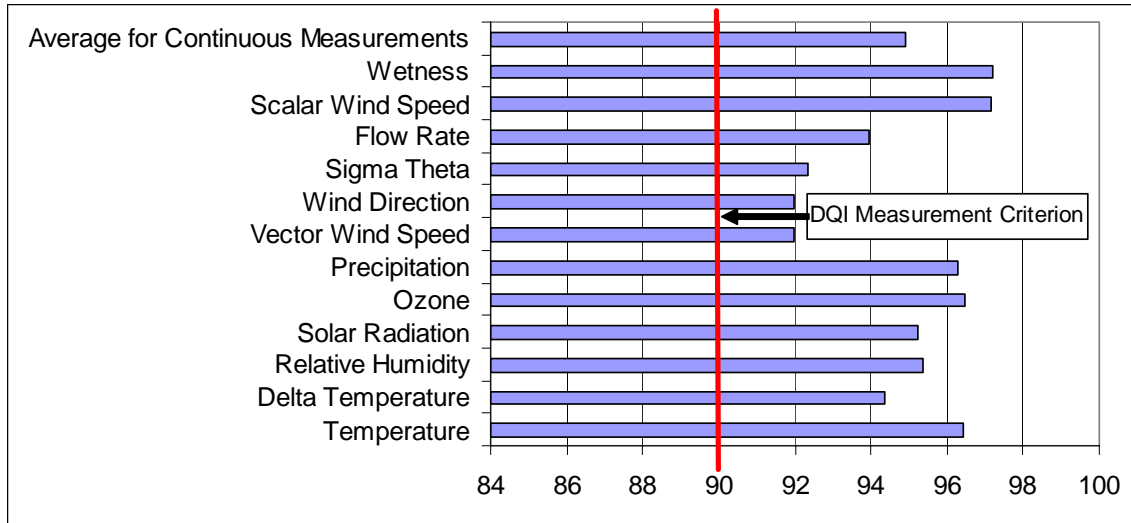


Figure 4. Percent Completeness of Measurements for Third Quarter 2005 through Fourth Quarter 2005*



Note: *Presents Level 3 data available during the first quarter of 2006.

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

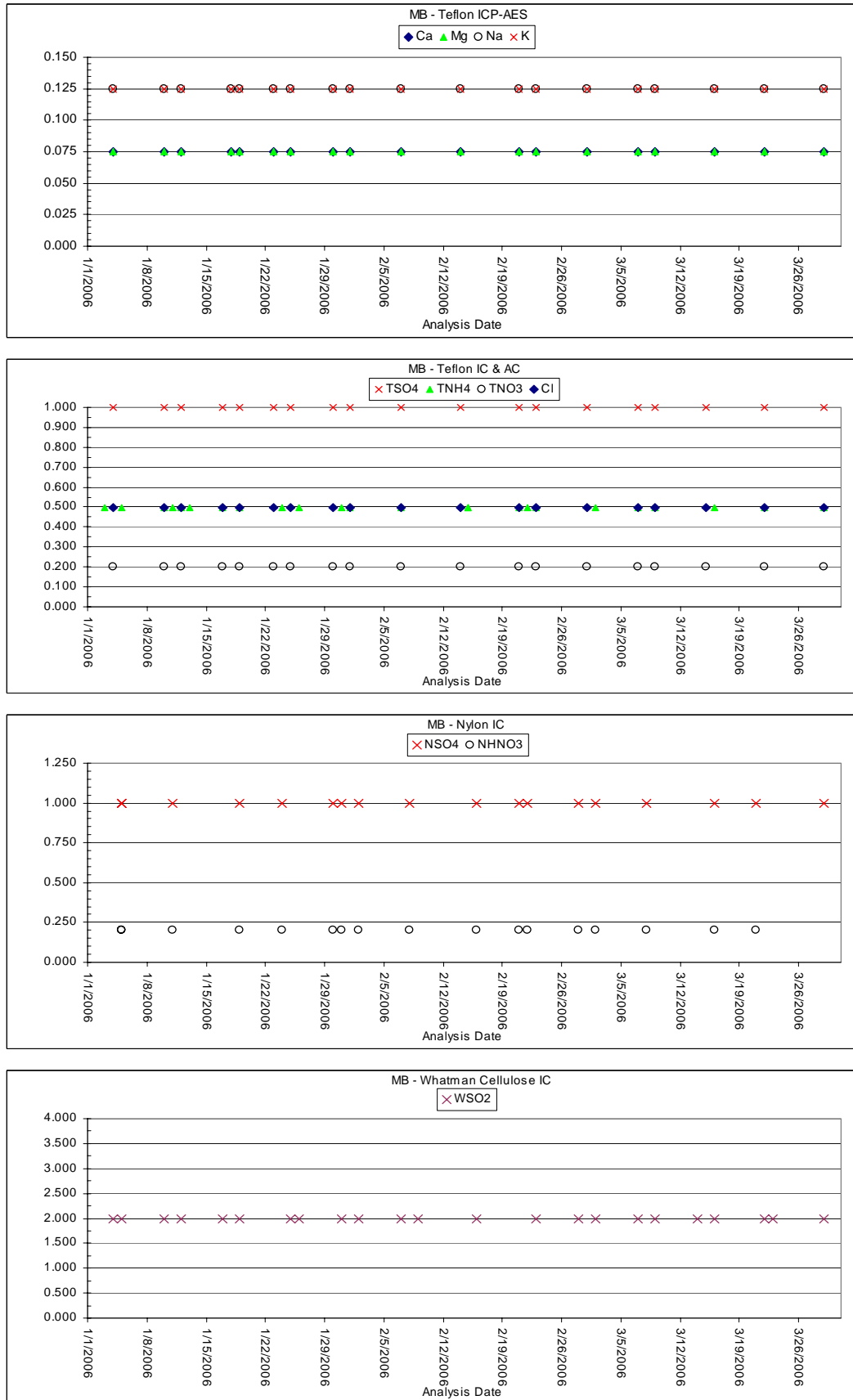


Figure 6. Laboratory Blank Analysis Results for First Quarter 2006 (total micrograms)

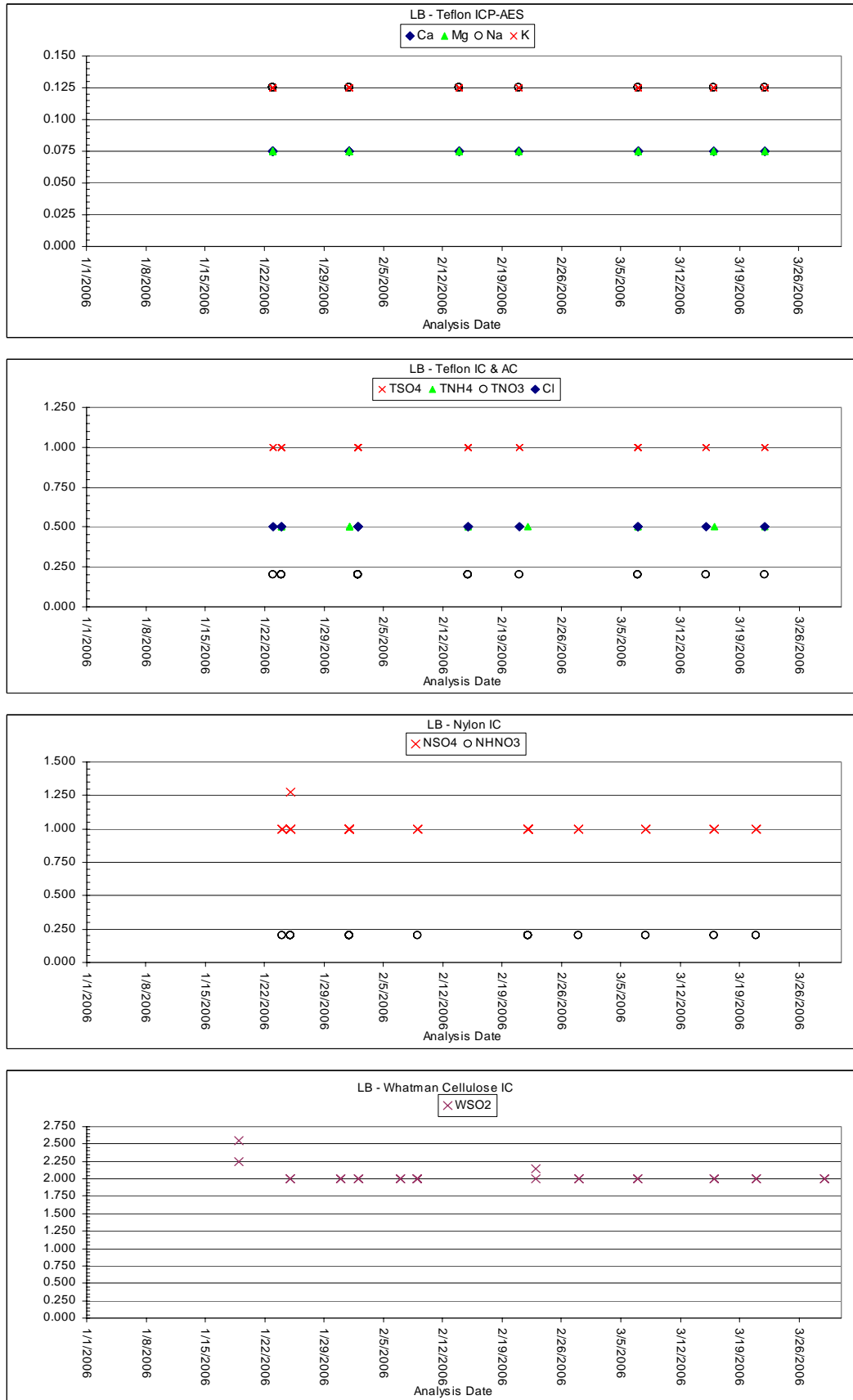


Figure 7. Field Blank Analysis Results for First Quarter 2006 (total micrograms)

