National Atmospheric Deposition Program
Site Survey Program
Annual Report

Prepared for:

U.S. Environmental Protection Agency
Office of Atmospheric Programs

Prepared by:

8010 SW 17th Place
Gainesville, FL 32607

Contract No.: EP-W-07-061

September 2008

Table of Contents

List of Appendices

List of Tables

List of Acronyms and Abbreviations

AIRMoN	Atmospheric Integrated Research Monitoring Network
CAL	Central Analytical Laboratory
CASTNET	Clean Air Status and Trends Network
DVM	Digital multi-meters
DQI	Data Quality Indicator
EEMS	Environmental, Engineering & Measurement Services, Inc.
EPA	U.S. Environmental Protection Agency
FSSD	Field Site Survey Database
MDN	Mercury Deposition Network
NADP	National Atmospheric Deposition Program
NIST	National Institute of Standards and Technology
NOS	Network Operations Subcommittee
NTN	National Trends Network
PO	Program Office
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
SOP	Standard Operating Procedures

Executive Summary

Under US EPA contract number EPW-07061, Support for Conducting Systems and Performance Surveys of National Atmospheric Monitoring Stations, Environmental, Engineering & Measurement Services, Inc. (EEMS) has initiated an independent evaluation and assessment site survey program for the purpose maintaining the quality assurance of the networks of the National Atmospheric Deposition Program (NADP). The NADP is a cooperative, multi-agency network, which measures precipitation chemistry and estimates atmospheric deposition for various pollutant ions and mercury. The three inter-related NADP networks are, the National Trends Network (NTN), the Atmospheric Integrated Research Monitoring Network (AIRMoN), and the Mercury Deposition Network (MDN). EPA has provided long-standing support for the operation of NADP including operational support for four US Forest Service monitoring sites, and recurring funding for the chemical analysis and coordination for 31 other wet deposition sites, in addition to the support for the survey and quality assurance programs of the NADP atmospheric deposition site networks.

To understand the impact of emissions reductions on the environment, scientists and policy makers use data collected from long-term national monitoring networks such as the Clean Air Status and Trends Network (CASTNET) and the NADP. These networks are complementary in many ways and provide information on a variety of indicators necessary for tracking temporal and spatial trends in regional air quality and atmospheric deposition.

Work performed under this contract includes the survey of sites associated with the NADP. Site surveys include:

- Graphical representation of the site instruments with respect to each other and the site surroundings.
- Evaluation of site operator proficiency and technique.
- Reinforcement of NADP protocols and training.
- Maintenance, evaluation, and quality assurance assessment of site instruments.

Site surveys afford the necessary checks and balances for site operations and serve to validate data provided by the sites in the network.

The results of those surveys performed during the reporting period are presented in this report.

1.0 Introduction / Background

The National Atmospheric Deposition Program (NADP) Site Survey Program is a means to establish an independent and unbiased Quality Assurance (QA) program of systems and performance surveys to assess and document the conditions and operations of the collective sites of the NADP. The conditions and operations pertain to the siting, sample collection and handling, equipment operation and maintenance, recordkeeping, reports, and field laboratory procedures.

Ongoing QA programs are an essential part of, and add credence to, any long-term monitoring network. The external evaluations provided by this program verify, and support, the established procedures and criteria of the NADP and its networks, and ensure they are maintained. The site survey program provides a higher level of confidence for NADP reported data.

Quality assurance and quality control (QC) activities for these networks improve overall data quality and ensures field measurements remain accurate and precise. Stringent QA and QC are essential for obtaining unbiased and representative atmospheric deposition measurements and for maintaining the integrity of the sample during collection, handling, and analysis. These activities strengthen the reliability and overall quality of the data the Agency uses for policy decisions and for measures of accountability.

Essentially, NADP site surveys are accomplished by visiting each site, observing the site operator while performing the routine site activities, providing technical and training support, checking the operation of the site instrumentation, performing routine repairs and maintenance, and reporting the results. More details of the activities are provided in the following key tasks.

1. Scheduling sites to be surveyed. This task is coordinated with the EPA Project Officer, the NADP PO, network liaisons, site operators, supervisors, and sponsors. Approximately 90 NADP sites are scheduled for surveys during each contract period. The schedule is developed based on the elapsed time since the previous site survey (longest time between visits first), and consideration for efficient and cost effective travel.

2. Preparing for field site surveys. During survey preparation, available site data are compiled and reviewed creating the site file. The necessary materials and standards for each site survey are checked and shipped if necessary. The site operators scheduled for surveys are contacted to finalize the survey arrangements.

3. Performing site surveys. During each site survey a comprehensive qualitative and quantitative assessment is performed. The site assessment consists of:
    - Verifying the NADP collector location using a WAAS GPS.

- Qualitatively evaluating the site regarding the current NADP siting criteria.
- Verifying, or creating the site plan view. The site plan view identifies all equipment and major features within a 30 meter radius.
- Qualitatively assessing the site surroundings regarding obstructions to wind and precipitation which could impact data collection and quality. Documenting the site surroundings with at least 8 digital photographs taken in the cardinal directions of N, NE, E, SE, S, SW, W, and NW. The photographs should be taken within 5 -10 meters of the NADP collector with the direction referenced.
- Qualitatively assessing the instruments and equipment with regard to function, maintenance, and condition. Documenting equipment malfunctions and signs of wear on the survey forms and with photographs as necessary.
- Qualitatively evaluating the site personnel regarding the methods and procedures used for sample handling, field analytical analysis (AIRMoN), calibrations, cleaning, maintenance, recordkeeping, reporting, and material storage. Reviewing on-site documentation (rain gauge charts, logs, forms) for legibility, accuracy and completeness. Confirming that the current versions of NADP manuals/documentation are present.
- Quantitatively assessing the accuracy of the NADP instrumentation responses to QA standards. These include standard weights for rain gauge tests and mass determinations, and analytical standards for pH and conductivity meter and cell tests (AIRMoN sites only).
- Recording all data on the hard copy forms provided in the site file. Printing any additional forms from the database if required in order to record all data. Comparing the observations to the pre-populated values, verifying and correcting any discrepancies, and confirming with the site personnel as needed.

4. Performing minor repairs, maintenance, adjustments, and guidance. With the consent of the site personnel and the approval of the appropriate liaison
    - Perform any necessary minor repair, maintenance, adjustment, and calibration to restore proper function in accordance with the Network Operations Subcommittee (NOS) procedures. These tasks can include leveling and stabilizing the instrument, and correcting the orientation. Record all actions on the appropriate survey form.
    - Provide technical assistance, instruction, and training regarding the maintenance of the site and equipment, sample collection and handling, and site operation procedures, consistent with the NADP Quality Assurance Project Plan (QAPP), and SOP specific to the network.

5. Transferring observations from survey forms to survey database. Enter the survey information obtained in the steps above into the survey database and review for significant differences using the automated verification feature, and entry/exit rules.

6. Conducting an exit interview with the site personnel. This task includes the preparation and delivery of an exit/spot report summarizing any equipment deficiencies or failures, survey results, activities, adjustments, and any aspects that are, or could potentially affect data quality. The report is provided to the site operator, supervisor, NADP PO Quality Assurance Manager, and the EPA Project Officer. The report is then included in the site file with the appropriate document control number.

7. Providing a Site Performance Survey Report, with the survey data set. The final site survey data set is considered to be the final site survey report. The data set is delivered to the NADP Program Office QA Manager and the EPA Contracting Officer Representative (COR) each month and contains data obtained during site surveys conducted the previous month. The data set for each site consists of:
    - Survey results that have been subjected to duplicate entry and internal QA review.
    - Edited and scanned site plan view (or site sketch).
    - Digital photographs.
    - Scanned raingage chart.
    - Any additional pertinent supporting information.

2.0 Status of Sites Surveyed

2.1 Sites Surveyed

This is the first annual report for this project which began in June of 2007. Approximately six months of preparation were required to develop the survey procedures and database, and acquire the materials to perform the surveys. The contract requires delivery of this report prior to the annual springtime NADP meeting. Therefore, the report covers the sites surveyed during the months of December, 2007 through March, 2008. A total of 37 sites were visited during this period, these include 12 MDN sites and 25 NTN sites. No AIRMoN sites were surveyed. Table 3-1 is a list of the sites surveyed and includes the network, site name, survey date, and equipment found.

2.2 General Status of Sites Surveyed

Overall the sites surveyed during the reporting period were found in good condition and collecting data meeting NADP quality objectives. All of the sites visited were operating Belfort mechanical raingages as the primary raingage. Due to the age of the gages, most were found to have some operational problem. Most problems were minor and were corrected during the site survey. Since the survey data indicates that a large percentage of gages required attention, it is likely that the mechanical gages have reached, or in some cases exceeded, their useful life-expectancy.

The qualitative evaluation of the site personnel with respect to their ability to follow NADP protocols and operate the site instrumentation, found them all to be capable, knowledgeable, and committed to maintaining quality throughout the sample and data collection process. They demonstrated both enthusiasm and conscientiousness concerning the operation of their sites by their willingness to receive instruction from the survey team regarding improvements to their sample handling technique and equipment maintenance.

Specific survey findings that are, or could, impact data quality are discussed in section 3.0.

3.0 Specific Problems Encountered and Frequency

Each site survey consists of assessing, and entering into a database, information as it relates to the siting criteria, performance and condition of the equipment found (collector and primary gage), status of supplies, site operator's performance, and other information that relates to the site. Since EEMS has not surveyed any of the AIRMoN sites thus far, the following analysis only applies to the NTN and MDN networks.

3.1 Equipment Encountered During the Site Surveys

The breakdown of equipment found at the 37 sites surveyed through March 2008 is shown in Table 3.1.

Table 3-1. Sites Surveyed through March 2008 and Equipment Found at the Sites

Site ID	Site Name	Network	Survey Date	Collector Type	Raingage Type	Backup Raingage Type
AL02	Delta Elementary	MDN	3/5/2008	ACM-type	Belfort	
AL02	Delta Elementary	NTN	3/5/2008	ACM-type	Belfort	
AL03	Centreville	MDN	3/6/2008	ACM-type	Belfort	NOAH IV
AL10	Black Belt Research & Extension Center	NTN	3/6/2008	ACM-type	Belfort	Stick Gage
AL24	Bay Road	MDN	3/5/2008	ACM-type	Belfort	Tipping Bucket
AL24	Bay Road	NTN	3/5/2008	ACM-type	Belfort	
AL99	Sand Mountain Research & Extension Center	NTN	2/28/2008	ACM-type	Belfort	Tipping Bucket
AZ06	Organ Pipe Cactus NP	NTN	2/15/2008	ACM-type	Belfort	
AZ98	Chiricahua NM	NTN	2/20/2008	ACM-type	Belfort	Tipping Bucket
AZ99	Oliver Knoll	NTN	2/14/2008	ACM-type	Belfort	Stick Gage
GA09	Okefenokee National Wildlife Refuge	MDN	1/30/2008	ACM-type	Belfort	Stick Gage
GA09	Okefenokee National Wildlife Refuge	NTN	1/30/2008	ACM-type	Belfort	Stick Gage
GA33	Sapelo Island	MDN	2/19/2008	N-CON	Belfort	
GA33	Sapelo Island	NTN	2/19/2008	ACM-type	Belfort	
GA40	Yorkville	MDN	3/11/2008	ACM-type	Belfort	NOAH IV
GA41	Georgia Station	NTN	2/27/2008	ACM-type	Belfort	Tipping Bucket
GA99	Chula	NTN	1/30/2008	ACM-type	Belfort	Stick Gage
IN26	Fort Harrison State Park	MDN	12/20/2007	ACM-type	Belfort	OTT
IN41	Agronomy Center for Research and Extension	NTN	12/21/2007	ACM-type	Belfort	
MS10	Clinton	NTN	3/19/2008	ACM-type	Belfort	
MS19	Newton	NTN	3/19/2008	ACM-type	Belfort	

Site ID	Site Name	Network	Survey Date	Collector Type	Raingage Type	Backup Raingage Type
MS22	Oak Grove	MDN	3/19/2008	ACM-type	Belfort	NOAH IV
MS30	Coffeeville	NTN	3/1/2008	ACM-type	Belfort	Tipping Bucket
NC26	Candor	MDN	1/8/2008	ACM-type	Belfort	Tipping Bucket
SC05	Cape Romain National Wildlife Refuge	MDN	2/12/2008	ACM-type	Belfort	
SC05	Cape Romain National Wildlife Refuge	NTN	2/12/2008	ACM-type	Belfort	
SC06	Santee National Wildlife Refuge	NTN	2/22/2008	ACM-type	Belfort	
SC11	North Inlet-Winyah Bay National Estuarine Research Reserve	NTN	2/13/2008	ACM-type	Belfort	
SC19	Congaree Swamp	MDN	2/14/2008	ACM-type	Belfort	NOAH IV
TX03	Beeville	NTN	2/8/2008	ACM-type	Belfort	
TX04	Big Bend Nat'l Park-K-B	NTN	2/10/2008	ACM-type	Belfort	
TX10	APC NWR	NTN	2/7/2008	ACM-type	Belfort	Stick Gage
TX16	Sonora	NTN	2/9/2008	ACM-type	Belfort	
TX21	Longview	MDN	2/6/2008	ACM-type	Belfort	
TX21	Longview	NTN	2/6/2008	ACM-type	Belfort	
TX22	Guadalupe Mnt. NP	NTN	2/12/2008	ACM-type	Belfort	
TX56	LBJ Grassland	NTN	2/25/2008	ACM-type	Belfort	

Of the 37 sites surveyed, only one, GA33-MDN, has a collector other than an ACM-type collector, and all the sites included in this report operate a Belfort raingage as the primary gage. A wider variety of backup gages was found, and altogether, 17 sites have backup gages. The site survey only takes into account the siting criteria of the backup gage, not the performance of the gage itself. The questionnaire used during the performance survey of a typical NTN site (i.e., Belfort raingage and AMC-type collector) contains of 249 entries, and the one used for the typical MDN site is comprised of 250 entries. This includes the "as found test" and calibration points for the primary gage and scale.

3.2 Findings Likely to Impact Data Quality

The assessments considered by EEMS to impact data quality are categorized by element, as collector, siting criteria, or raingage assessments. Of the 37 sites included in this report, 16 sites were in accordance with all collector assessments, 13 sites were in accordance with all raingage assessments, and 10 sites conformed to all siting criteria assessments.

Of the 31 siting criteria assessments, 13 assessments were found in conformity at all sites. Of the 12 assessments concerning collectors, 4 assessments were found in conformity at all sites.

Additionally, all site operators followed NADP instructions and guidelines regarding maintaining sample media quality.

Appendix A contains the list of current survey assessments that EEMS considers could directly impact data quality. The following section and tables focus on the survey data that describes the assessments at sites that ***did not*** meet NADP criteria for those assessments.

Table 3-2 presents the non-compliant survey data for MDN sites and Table 3-3 presents non-compliant findings at NTN sites.

One notable observation of the results in Table 3-3 concerns the NTN collector lid liner condition. One field team member may have misinterpreted the intent of the survey question and entered "not applicable" for each response. This is discussed further in Section 6.0 of this report.

Table 3-2. Percent of Non-compliant Findings - MDN

	Number of Assessments	Found Non-Compliant	Percent Non-Compliant
Siting Criteria Assessments			
45 degree rule met (raingage)	12	3	25.0
No objects > 1 m height inside 5 m radius (raingage)	12	5	41.7
No fences > 1 m height inside 2 m radius (raingage)	12	1	8.3
No vegetation height > 0.6 m within 5 m radius (raingage)	12	1	8.3
45 degree rule met (collector)	12	3	25.0
No objects > 1 m height within 5 m radius (collector)	12	2	16.7
No fences > 1 m height inside 5 m radius (collector)	12	2	16.7
No vegetation height > 0.6 m within 5 m radius (collector)	12	1	8.3
No treated lumber inside 5 m radius (collector)	12	3	25.0
No galvanized metal inside 5 m radius collector	12	3	25.0
No herbicides and fertilizers used within 20 m radius	12	1	8.3
ACM-type Collector Assessments			
Dry side bucket is clean	11	1	9.1
Does lid seal properly	11	1	9.1
Lid liner in good condition	11	1	9.1
Collector temperature control	10	2	20.0
ACM sensor operates properly	11	1	9.1
Belfort Raingage Assessments			
Was the 'as found' turnover set properly	12	8	66.7

Table 3-3. Percent of Non-compliant Findings - NTN

	Number of Assessments	Found Non-Compliant	Percent Non-Compliant
Siting Criteria Assessments			
45 degree rule met (raingage)	25	3	12.0
No objects > 1 m height inside 5 m radius (raingage)	25	8	32.0
No fences > 1 m height inside 2 m radius (raingage)	25	2	8.0
No vegetation height > 0.6 m within 5 m radius (raingage)	25	1	4.0
45 degree rule met (collector)	25	3	12.0
No objects > 1 m height within 5 m radius (collector)	25	9	36.0
No fences > 1 m height inside 5 m radius (collector)	25	5	20.0
No vegetation height > 0.6 m within 5 m radius (collector)	25	1	4.0
No treated lumber inside 5 m radius (collector)	25	6	24.0
No pastures and ag. activity within 20 m radius	25	1	4.0
No herbicides and fertilizers used within 20 m radius	25	1	4.0
ACM-type Collector Assessments			
Dry side bucket is clean	25	7	28.0
Lid liner in good condition	25	Missing	
ACM sensor operates properly	25	3	12.0
Motorbox operates within acceptable limits	25	2	8.0
Belfort Raingage Assessments			
Was the 'as found' turnover set properly	25	16	64.0

In order to better understand the problems noted with the Belfort raingages some additional description of the gage is necessary. The gage is a dual-traverse mechanical weighing precipitation gage designed to measure the amount of precipitation which falls during a seven day period. The precipitation is captured through an eight inch opening and funneled into a bucket. The bucket rests on a mechanical scale that moves an ink pen as weight (precipitation) is added to the bucket. The pen trace is recorded on a paper chart attached to a rotating drum which completes one rotation during a seven day period. The chart is marked both vertically and horizontally so both time and precipitation can be determined from the pen trace.

The bottom of the chart begins at zero precipitation and the top of the chart corresponds to six inches of precipitation. The dual-traverse gage is designed to measure from zero to twelve inches of precipitation. This is accomplished by the fist, or upward traverse of the pen from zero to six inches, and then as weight is added to the bucket the pen “turns over” and begins a second or downward traverse from six to twelve inches of precipitation. Proper function of the gage requires that the pen moves within ± 0.10 inches of the distance corresponding to the weight of the precipitation amount and that it turns over at the top of the chart.

Tables 3-4, and 3-5 present EEMS's findings regarding the assessments of siting criteria, raingage and collector condition, and site operator proficiency (assessed as "sampling media quality maintained") which are considered to be the areas that may most impact data quality. As described in survey task #3, the assessment of site operator proficiency includes the qualitative evaluation of the site personnel regarding the methods and procedures used for sample handling, recordkeeping, reporting, equipment cleaning, maintenance, and material storage. Additionally, on-site documentation (rain gauge charts, logs, forms) was also assessed for legibility, accuracy and completeness.

The data indicate that most of the non-compliant findings are related to the 45 degree rules and those rules related to the collector and gage immediate surroundings. The other most prevalent issues are the calibration and turn over adjustment of the Belfort gage.

Tables 3-4 and 3-5 also contain "N/A" for the lid liner assessments at some sites, as noted in Table 3-3 due to misinterpretation of the survey questionnaire by the surveyor. Some survey assessments for pastures and agricultural activity siting criteria are also reported as "missing" in Table 3-4. This is due to a mistake on the survey questionnaire indicating that this criterion is only applicable to NTN and AIRMoN sites and not MDN sites. Corrections and improvements to the survey questionnaire are discussed further in Section 6.0.

Table 3-4. Findings Most Likely to Impact Data Quality - MDN

Site ID	AL02	AL03	AL24	GA09	GA33	GA40	IN26	MS22	NC26	SC05	SC19	TX21
Is sampling media quality maintained? (operator proficiency)												
45 degree rule met (raingage)		X		X						X		
No objects > 1 m height inside 5 m radius (raingage)	X	X			X			X	X			
No fences > 1 m height inside 2 m radius (raingage)	X											
No vegetation height > 0.6 m within 5 m radius (raingage)					X							
Collector and sensor oriented properly												
45 degree rule met (collector)	X	X		X								
No objects > 1 m height within 5 m radius (collector)	X										X	
No fences > 1 m height inside 5 m radius (collector)	X										X	
No vegetation height > 0.6 m within 5 m radius (collector)					X							
No treated lumber inside 5 m radius (collector)	X	X					X					
No galvanized metal inside 5 m radius collector	X	X									X	
No pastures and ag. activity within 20 m radius				missing		missing	missing	missing	missing			
No herbicides and fertilizers used within 20 m radius												X
Combustion sources meet NADP siting criteria												
Parking lots and maintenance areas meet NADP siting criteria												
Storage areas (fertilizers, road salt, manure, etc) meet NADP siting criteria								missing				
Metalworking operations meet NADP siting criteria												
Dry side bucket is clean					N/A				X			N/A
Does lid seal properly					N/A			X				
Lid liner in good condition					N/A				X			
Collector temperature control				X	N/A	X	U to T					
ACM sensor operates properly			X		N/A							
Motorbox operates within acceptable limits					N/A							
Was the 'as found' turn over set properly			X			X	X	X	X	X	X	X

Table 3-5. Findings Most Likely to Impact Data Quality - NTN

Site ID	AL02	AL10	AL24	AL99	AZ06	AZ98	AZ99	GA09	GA33	GA41	GA99	IN41	MS10
Is sampling media quality maintained? (operator proficiency)													
45 degree rule met (raingage)								X					
No objects > 1 m height inside 5 m radius (raingage)	X	X				X			X				
No fences > 1 m height inside 2 m radius (raingage)	X												
No vegetation height > 0.6 m within 5 m radius (raingage)									X				
Collector and sensor oriented properly													
45 degree rule met (collector)	X							X					
No objects > 1 m height within 5 m radius (collector)	X					X	X		X			X	
No fences > 1 m height inside 5 m radius (collector)	X					X	X						
No vegetation height > 0.6 m within 5 m radius (collector)									X				
No treated lumber inside 5 m radius (collector)	X						X			X		X	
No pastures and ag. activity within 20 m radius		X											
No herbicides and fertilizers used within 20 m radius													
Parking lots and maintenance areas meet NADP siting criteria													
Storage areas (fertilizers, road salt, manure, etc) meet NADP siting criteria													
Dry side bucket is clean			X		X					X		X	X
Does lid seal properly													
Lid liner in good condition					N/A	N/A	N/A						
ACM sensor operates properly					X		X						
Motorbox operates within acceptable limits	X												
Was the 'as found' turn over set properly			X			X	X			X	X	X	

Table 3-5. Findings Most Likely to Impact Data Quality – NTN (continued)

Site ID	MS19	MS30	SC05	SC06	SC11	TX03	TX04	TX10	TX16	TX21	TX22	TX56
Is sampling media quality maintained? (operator proficiency)												
45 degree rule met (raingage)		X	X									
No objects > 1 m height inside 5 m radius (raingage)								X	X		X	X
No fences > 1 m height inside 2 m radius (raingage)								X				
No vegetation height > 0.6 m within 5 m radius (raingage)												
Collector and sensor oriented properly												
45 degree rule met (collector)		X										
No objects > 1 m height within 5 m radius (collector)								X	X		X	X
No fences > 1 m height inside 5 m radius (collector)								X	X			
No vegetation height > 0.6 m within 5 m radius (collector)												
No treated lumber inside 5 m radius (collector)					X			X				
No pastures and ag. activity within 20 m radius												
No herbicides and fertilizers used within 20 m radius										X		
Parking lots and maintenance areas meet NADP siting criteria												
Storage areas (fertilizers, road salt, manure, etc) meet NADP siting criteria												
Dry side bucket is clean	X			X								
Does lid seal properly												
Lid liner in good condition							N/A		N/A		N/A	N/A
ACM sensor operates properly								X				
Motorbox operates within acceptable limits								X				
Was the 'as found' turn over set properly	X	X	X	X	X	X		X		X	X	X

N/A = Not applicable to the site

X = Non-compliant finding U to T = Unable to test

4.0 Recommendations to the NADP Program Office

The following subsections provide recommendations that, in the opinion of EEMS, would help to improve the operation of the sites and quality of data collected by the NADP.

As a measure of the site survey program's effectiveness as a QA tool, EEMS intends to plot the number of problem sites per year, and those sites with significant improvements from previous visits. As surveys are completed and the survey database is populated, tracking of site conditions and improvements will be captured and reported on the three-year site survey rotation schedule.

4.1 Documentation

Although most sites surveyed have been operating for a very long time, and most site operators are experienced and knowledgeable of the procedures and duties they are required to perform, some of the documentation of those procedures is outdated. It is important to modify and update site operation reference documentation and distribute that documentation to the operators, supervisors, and data users.

The NADP website is a valuable tool for providing both data and documentation for data users, but it is sometimes not utilized by site operation personnel. Changes to procedures that are distributed via direct mailing to operators, and are intended to append or replace pages in the current documentation are not always retained onsite. Some site operators suggested a revised QAPP be distributed, and subsequent revisions and updates be supplied and tracked electronically.

4.2 Procedure Recommendations

Analysis of the survey data obtained from the sites surveyed during the reporting period suggests that an additional raingage operation and maintenance procedure may benefit data quality. The most common problems observed with the Belfort raingages include improper turnover adjustment and dirty linkage. Dirty linkage causes sticky or poor pen response to changes in weight.

Measured precipitation would be affected by incorrect pen turnover when large amounts of precipitation occurred during the sample period, or when the gage is winterized which raises the pen baseline and allows precipitation to accumulate for multiple weeks. Both cases are more likely to cause the pen to turnover and begin the downward transverse. In most cases where the gage turnover was an issue, a minor adjustment corrected the second transverse (six to twelve inch) response.

Two solutions that are easily implemented and could help to eliminate inaccuracies in precipitation measurement due to turnover problems are:

- Reduce the amount of antifreeze used during the winter and have the site operator empty the bucket and replace the antifreeze more frequently during the winter to avoid reaching the second transverse.
- Have the site operator check and adjust the turnover on a regular schedule.

The first suggestion may not be practical at all site locations due to both the amount of precipitation that falls during one week and the logistics involved with winterization of the gage.

The second solution requires removing the gage cover and making an adjustment to a linkage. There is always a potential for undesired results when adjustments are made to the mechanical linkage of the gage, therefore training should be provided and proper care should be exercised if implementing this approach. It has been our experience however, that the turnover adjustment is relatively straightforward and easily accomplished. Most site operators would be able to perform this adjustment with proper instruction received during the annual training classes provided by the CAL and/or on site training provided during the site surveys.

It is further suggested that if the second approach (check and adjust the turnover) is to be performed, it should be done during good weather just prior to winterizing the gage.

The second problem affecting the gages surveyed was the accumulation of dirt on the internal moving linkages. In most cases cleaning the linkages restored proper function of the gage. Therefore it is suggested that the site operators be instructed to clean the gages regularly at least once per year. The best time to clean the gage would vary from site to site based on the local weather patterns. For example, gages in the southwest should be cleaned following the spring windstorms when they are likely to receive the most wind-blown dust. This would also ensure that they are clean and working well prior to the season most likely for precipitation.

It would also be advisable to clean the gage when performing the turnover adjustment, and check the turnover when cleaning the gage, since both procedures require removing the gage cover.

5.0 Site and Field Laboratory Survey Results and Discussion

The site survey results have been presented and discussed in other sections of this report. Current field laboratory procedures are limited to sample weighing and decanting at NTN sites. AIRMoN sites still require pH and conductivity measurements; however no AIRMoN sites were assessed during the reporting period. Therefore this section will focus on weighing and decanting the NTN samples.

All site operators were observed to be proficient with sample weighing and decanting procedures. During the surveys, training procedures were reinforced regarding not mixing the sample prior to decanting. One suggestion that may be of value would be to move the field lab as close to the sample site as possible to help eliminate sample loss or mixing while transporting the sample to the lab. This is most practical at sites collocated with CASTNET sites, since there is usually space available for the lab equipment.

There are some site scales used for sample weighing that require attention. Although very accurate and easy to use, electronic scales require routine and regular maintenance. This is usually provided by a service contractor that visits the lab and certifies the scale. It may be possible to rotate scales from sites to the Central Analytical Laboratory (CAL) on an annual basis to be serviced. This approach may be cost prohibitive or not possible due to contractual issues. At a minimum scales that are determined to be functioning poorly during the site surveys should be identified as action items and require some follow-up from the CAL. This could include replacing the scale with a surplus instrument.

6.0 Data Quality Information

Several procedures are in place to help ensure survey data quality. Foremost, a comprehensive QAPP has been developed prior to collecting survey data. Field survey team training has been provided to ensure consistency of methods. Duplicate entry of survey data has been implemented to help detect and correct typographic errors. Ongoing review of results for accuracy and consistency is provided by the EEMS' QA Manager, who is not involved with the field data collection.

6.1 Quality Assurance Project Plan

Many changes and revisions to the site survey database have occurred during the first nine months of the program. This requires a revision to the QAPP to address the specific procedures for data entry and reporting. The target delivery date for the completion of the QAPP revision 1 is December, 2008. This revision will include updated data entry screens and site data reporting, filing, and archiving procedures.

6.2 Field Team Training

Field survey team training was conducted at two sites in Indiana during site surveys in December 2007. All team members were present. Due to the level of experience of survey personnel, no additional training has been scheduled. Survey team members routinely share experiences through regular communication. This process will continue thereby expanding the knowledge base of the team and maintaining consistency of methods.

Following completion of the revised QAPP, the QA Manager will observe at least one survey team member at a site while performing a survey. A report of the survey will be provided by the QA Manager following the visit.

6.3 Duplicate Data Entry

A routine procedure utilized as part of the QA program for survey data, is duplicate data entry. Field personnel entry survey data results into the Field Site Survey Database (FSSD) after completing the survey. An initial spot report is generated using that data. After completing three surveys, the database is sent electronically to the EEMS office, and the original hardcopy field forms are sent via FedEx.

Once the files are received and logged at the EEMS office, a second set of data tables are populated independently using the original hardcopy forms. The QA Manager then compares the two sets of tables. Discrepancies are identified and investigated to determine the intended entry. In some cases this requires contacting the field personnel to verify or confirm a result. If necessary, after the QA process and acceptance by the QA Manager, a revised spot report is generated from the set of tables populated at the office. This preserves the original set of tables

populated in the field, and provides review, tracking, and edit documentation for the survey results and reports.

6.4 Document Review

During the review process described above, during the reporting period, several problems were identified, and are discussed in the subsections that follow.

6.4.1 Site Survey Questionnaire

Although considerable effort was expended by both EEMS and by the NADP PO, some of the questions contained in the Site Survey Questionnaire are somewhat ambiguous. This has led to some field personnel interpreting some questions one way, while another team member might interpret the same question differently. An example of this occurrence was shown in the data presented in Section 3.0 regarding lid liner condition.

As cases are discovered during review of the survey reports, additional clarification is requested from the PO as to the intent of the question. This information is then shared with the team to eliminate confusion and maintain consistency. Subsequent versions of the questionnaire and database will be provided with clarifications.

A meeting has been scheduled to review the questionnaire and address the specific issues. Following the meeting (scheduled for late April) any necessary edits to data fields will be performed and the database will be resubmitted.

The QA Manager identified some problems with the files received from the first several site surveys. The problems were generally a result of poor recordkeeping on the part of the survey team. Issues included fields not legible or not complete, individual equipment forms not completed, site sketches not notated, inconsistent file naming, and delays in providing survey information. The issues were addressed by providing a corrective action memo to the survey team. Subsequent survey files and reports have improved considerably.

Files and reports will continue to be reviewed and monitored to improve consistency and quality.

6.5 Survey Equipment Certification

The instruments used by the survey team are maintained and certified by the EEMS QA Manager. Most undergo annual certification by various sources. Digital multi-meters (DVM) are certified National Institute of Standards and Technology (NIST) traceable by the manufacturer. The DVMs are used to measure temperature with a thermocouple input which is certified with a NIST traceable thermometer.

The weights used to challenge the weighing raingages and site scales are certified on a NIST traceable electronic scale.

The compass used to determine the azimuth of objects near the collector is certified as NIST traceable annually by a third party.

All certification documentation is provided in Appendix B. Of the three compass/transits used for the surveys, two were purchased just prior to beginning the surveys and therefore were not certified this year. All three will be certified in 2008. The thermocouples used for temperature determination are certified to the standard RTD, however that documentation is not available. The thermocouples will be checked and recertified in 2008 and any unadjusted findings that may have affected past survey results will be reported in the 2008 annual report.

APPENDIX A

Assessments Determined to Impact Data Quality

Assessments Determined to Impact Data Quality

Field Entry	NTN	MDN
Is sampling media quality maintained?	✓	✓
Is the orifice of the collector +/- .3 m of raingage (elevation)	✓	✓
45 degree rule met (raingage)	✓	✓
30 degree rule for trees met (raingage)	✓	✓
30 degree rule for buildings met (raingage)	✓	✓
No objects > 1 m height inside 5 m radius (raingage)	✓	✓
No fences > 1 m height inside 2 m radius (raingage)	✓	✓
No vegetation height > 0.6 m within 5 m radius (raingage)	✓	✓
Does NADP require a raingage wind shield at this site	✓	✓
If raingage wind shield present, is it installed correctly	✓	✓
Collector ground cover, 30 m radius	✓	✓
Collector and sensor oriented properly	✓	✓
45 degree rule met (collector)	✓	✓
30 degree rule for trees met (collector)	✓	✓
30 degree rule for buildings met (collector)	✓	✓
No objects > 1 m height within 5 m radius (collector)	✓	✓
No fences > 1 m height inside 5 m radius (collector)	✓	✓
No vegetation height > 0.6 m within 5 m radius (collector)	✓	✓
No sources of treated lumber inside 5 m radius (collector)	✓	✓
No sources of galvanized metal inside 5 m radius collector (MDN)	N/A	✓
No pastures and ag. activity within 20 m radius (NTN/AIRMoN)	✓	N/A
No herbicides and fertilizers used within 20 m radius (NTN AIRMoN)	✓	N/A
Roads meet NADP siting criteria	✓	✓
Waterways meet NADP siting criteria	✓	✓
Airports meet NADP siting criteria	✓	✓
Animal operations meet NADP siting criteria (NTN and AIRMoN)	✓	N/A
Combustion sources meet NADP siting criteria (MDN only)	N/A	✓
Parking lots and maintenance areas meet NADP siting criteria	✓	✓
Storage areas (fertilizers, road salt, manure, etc) meet NADP siting criteria	✓	N/A
Metalworking operations meet NADP siting criteria (MDN only)	N/A	✓
No significant changes to local site conditions within 500 meters of the collector since previous survey	✓	✓
Dry side bucket is clean	✓	✓
Does lid seal properly	✓	✓
Lid liner in good condition	✓	✓
Fan in good condition	N/A	✓
Cooling fan thermostat in good condition	N/A	✓
Heater in good condition	N/A	✓

Field Entry	NTN	MDN
Heater thermostat in good condition	N/A	✓
Has flush wall filter mount been installed	N/A	✓
Filter in good condition	N/A	✓
Max / min thermometer in acceptable limits	N/A	✓
ACM sensor operates properly	✓	✓
Motorbox operates within acceptable limits	✓	✓
Was the 'as found' turn over set properly	✓	✓

APPENDIX B

Transfer Standard Instrument Certifications

TROEMNER
Henry Troemner LLC

Traceable Certificate

201 Wolf Drive • P.O. Box 87 • Thorofare, NJ 08086-0087 • Phone:856-686-1600 • Fax: 856-686-1601 • www.troemner.com • e-mail: troemner@troemner.com

Weight

Serial Number	26677
Order Number	X5-322286
Certificate Number	427745
Date of Calibration	05-NOV-2007

ITIN Scale Co.
4802 Glenwood Road
Brooklyn, NY 11224

Description of Weights: Troemner Weight Set

Material	Assumed Density at 20°C	Range
Brass	8.39 g/cm3	1kg-1g

Tested with Reference Standards Traceable to the National Institute of Standards & Technology through NIST Test Number 822/272103-05.

We certify that the weights listed are calibrated to ASTM E617-97 Class 6 tolerances.

The calibration of these weights is based on apparent mass vs material of density 8.0g/cm3.

Nominal Mass Value	Serial Number	Correction *	Tolerance (+ or -)	Uncertainty (+ or -)
1 kg		+48.1508 mg	100.000 mg	5.0 mg
500 g		+15.5984 mg	50.000 mg	2.5 mg
200 g		+2.3109 mg	20.000 mg	1.0 mg
100 g		+0.5676 mg	10.000 mg	0.5 mg
100 g *		+4.8182 mg	10.000 mg	0.5 mg
50 g		+1.0397 mg	7.000 mg	0.30 mg
20 g		+1.0779 mg	3.000 mg	0.15 mg
10 g		+0.6285 mg	2.000 mg	0.10 mg
10 g *		+0.9736 mg	2.000 mg	0.10 mg
5 g		+0.1272 mg	2.000 mg	0.05 mg
2 g		+1.3898 mg	2.000 mg	0.05 mg
2 g *		+0.2646 mg	2.000 mg	0.05 mg
1 g		+0.7252 mg	2.000 mg	0.05 mg

* Correction is defined as the difference between the mass value of a weight and its nominal value. A positive correction indicates that the mass value is greater than the nominal value by the amount of the correction.

Joseph Moran, Metrology Manager, Approved Signatory

* Denotes weight is marked with a dot

Weight / Balance Calibration Log

Date	Balance SN#	Weight SN#	Cal Type	Std. (g)	Act. (g)	Calibrator	Notes
12/13/2007	8028481064	N/A	Initial	0.00	0.00	CKH	Initial Calibration of Balance
12/13/2007	8028481064	26677	Initial	1000.00	1000.02		
12/13/2007	8028481064	26677	Initial	500.00	500.00		
12/13/2007	8028481064	26677	Initial	200.00	199.99		
12/13/2007	8028481064	26677	Initial	100.00	99.99		
12/13/2007	8028481064	26677	Initial	50.00	49.99		
12/13/2007	8028481064	26677	Initial	20.00	20.00		
12/13/2007	8028481064	26677	Initial	10.00	10.00		
12/13/2007	8028481064	26677	Initial	5.00	5.00		
12/13/2007	8028481064	26677	Initial	2.00	2.00		
12/13/2007	8028481064	26677	Initial	1.00	1.00		
12/13/2007	8028481064	N/A		0.00	0.00		Belfort Field Set #1
12/13/2007	8028481064	1-1		N/A	824.20		
12/13/2007	8028481064	1-2		N/A	824.64		
12/13/2007	8028481064	1-3		N/A	823.75		
12/13/2007	8028481064	1-4		N/A	823.07		
12/13/2007	8028481064	1-5		N/A	823.34		
12/13/2007	8028481064	1-6		N/A	824.89		
			Mid Check				
12/13/2007	8028481064	N/A		0.00	0.00		
12/13/2007	8028481064	26677		1000.00	1000.03		
12/13/2007	8028481064	26677		500.00	500.00		
12/13/2007	8028481064	1-7			824.49		Belfort Field Set #1
12/13/2007	8028481064	1-8			823.72		
12/13/2007	8028481064	1-9			824.40		
12/13/2007	8028481064	1-10			822.87		
12/13/2007	8028481064	1-11			824.72		
12/13/2007	8028481064	1-12			824.78		
12/13/2007	8028481064	N/A	Final	0.00	0.00		
12/13/2007	8028481064	N/A		1.00	1.00		
12/13/2007	8028481064	N/A		2.00	2.00		
12/13/2007	8028481064	N/A		5.00	5.00		
12/13/2007	8028481064	N/A		10.00	10.00		
12/13/2007	8028481064	N/A		20.00	20.00		
12/13/2007	8028481064	N/A		50.00	49.99		
12/13/2007	8028481064	N/A		100.00	99.99		
12/13/2007	8028481064	N/A		200.00	200.00		
12/13/2007	8028481064	N/A		500.00	500.00		
12/13/2007	8028481064	N/A		1000.00	1000.01		
12/13/2007	8028481064	N/A		0.00	0.00		

Calibrator Signature: _____ Date: 12/13/07

Reviewer Signature: _____ Date: _____

Weight / Balance Calibration Log

Date	Balance SN#	Weight SN#	Cal Type	Std. (g)	Act. (g)	Calibrator	Notes
12/28/2007	8028481064	N/A	Initial	0.00	0.00	CKH	Initial Calibration of Balance
12/28/2007	8028481064	26677	Initial	1000.00	1000.02	CKH	Initial Calibration of Balance
12/28/2007	8028481064	26677	Initial	500.00	500.00	CKH	Initial Calibration of Balance
12/28/2007	8028481064	26677	Initial	200.00	200.01	CKH	Initial Calibration of Balance
12/28/2007	8028481064	26677	Initial	100.00	100.00	CKH	Initial Calibration of Balance
12/28/2007	8028481064	26677	Initial	50.00	50.00	CKH	Initial Calibration of Balance
12/28/2007	8028481064	26677	Initial	20.00	20.00	CKH	Initial Calibration of Balance
12/28/2007	8028481064	26677	Initial	10.00	10.00	CKH	Initial Calibration of Balance
12/28/2007	8028481064	26677	Initial	5.00	5.00	CKH	Initial Calibration of Balance
12/28/2007	8028481064	26677	Initial	2.00	2.00	CKH	Initial Calibration of Balance
12/28/2007	8028481064	26677	Initial	1.00	1.00	CKH	Initial Calibration of Balance
12/28/2007	8028481064	N/A	Initial	0.00	0.00	CKH	Initial Calibration of Balance
12/28/2007							
12/28/2007	8028481064	1-0		N/A	1034.55		Bucket Equiv. Weight Set #1
12/28/2007	8028481064	2-1		N/A	824.24		Belfort Field Set #2
12/28/2007	8028481064	2-2		N/A	823.47		
12/28/2007	8028481064	2-3		N/A	825.30		
12/28/2007	8028481064	2-4		N/A	823.82		
12/28/2007	8028481064	2-5		N/A	823.87		
12/28/2007	8028481064	2-6		N/A	824.62		
12/28/2007							
12/28/2007	8028481064	N/A	Mid-Check	0.00	0.00		Mid-Check
12/28/2007	8028481064	26677		200.00	200.00		
12/28/2007	8028481064	26677		500.00	500.01		
12/28/2007	8028481064	26677		1000.00	1000.04		
12/28/2007	8028481064	N/A		0.00	0.00		
12/28/2007							
12/28/2007	8028481064	2-7			825.05		Belfort Field Set #2
12/28/2007	8028481064	2-8			824.90		
12/28/2007	8028481064	2-9			824.31		
12/28/2007	8028481064	2-10			823.85		
12/28/2007	8028481064	2-11			824.00		
12/28/2007	8028481064	2-12			823.49		
12/28/2007							
12/28/2007	8028481064	N/A	Final	0.00	0.00		
12/28/2007	8028481064	26677		1.00	1.01		
12/28/2007	8028481064	26677		2.00	2.00		
12/28/2007	8028481064	26677		5.00	5.01		
12/28/2007	8028481064	26677		10.00	10.00		
12/28/2007	8028481064	26677		20.00	20.00		
12/28/2007	8028481064	26677		50.00	50.00		
12/28/2007	8028481064	26677		100.00	100.00		
12/28/2007	8028481064	26677		200.00	199.99		
12/28/2007	8028481064	26677		500.00	500.01		
12/28/2007	8028481064	26677		1000.00	1000.04		

Calibrator Signature: _____ Date: 12/28/07

Reviewer Signature: _____ Date: _____

Weight / Balance Calibration Log

Date	Balance SN#	Weight SN#	Cal Type	Std. (g)	Act. (g)	Calibrator	Notes
1/28/2008	8028481064	N/A	Initial	0.00	0.00	CKH	Initial Calibration of Balance
1/28/2008	8028481064	26677	Initial	1000.00	1000.03	CKH	Initial Calibration of Balance
1/28/2008	8028481064	26677	Initial	500.00	500.00	CKH	Initial Calibration of Balance
1/28/2008	8028481064	26677	Initial	200.00	200.00	CKH	Initial Calibration of Balance
1/28/2008	8028481064	26677	Initial	100.00	100.00	CKH	Initial Calibration of Balance
1/28/2008	8028481064	26677	Initial	50.00	50.00	CKH	Initial Calibration of Balance
1/28/2008	8028481064	26677	Initial	20.00	20.00	CKH	Initial Calibration of Balance
1/28/2008	8028481064	26677	Initial	10.00	9.99	CKH	Initial Calibration of Balance
1/28/2008	8028481064	26677	Initial	5.00	5.01	CKH	Initial Calibration of Balance
1/28/2008	8028481064	26677	Initial	2.00	2.00	CKH	Initial Calibration of Balance
1/28/2008	8028481064	26677	Initial	1.00	1.00	CKH	Initial Calibration of Balance
1/28/2008	8028481064	N/A	Initial	0.00	0.00	CKH	Initial Calibration of Balance
1/28/2008	8028481064	0-#2			1000.48	CKH	Bucket Equivalent Wt. Set #2
1/28/2008	8028481064	N/A	Final	0.00	0.00		Final Calibration of Balance
1/28/2008	8028481064	26677		1.00	1.00		Final Calibration of Balance
1/28/2008	8028481064	26677		2.00	2.00		Final Calibration of Balance
1/28/2008	8028481064	26677		5.00	5.00		Final Calibration of Balance
1/28/2008	8028481064	26677		10.00	10.00		Final Calibration of Balance
1/28/2008	8028481064	26677		20.00	20.00		Final Calibration of Balance
1/28/2008	8028481064	26677		50.00	50.00		Final Calibration of Balance
1/28/2008	8028481064	26677		100.00	100.00		Final Calibration of Balance
1/28/2008	8028481064	26677		200.00	200.00		Final Calibration of Balance
1/28/2008	8028481064	26677		500.00	500.01		Final Calibration of Balance
1/28/2008	8028481064	26677		1000.00	1000.03		Final Calibration of Balance
1/28/2008	8028481064	26677		0.00	0.00		Final Calibration of Balance

Calibrator Signature: _____ Date: 1/28/08

Reviewer Signature: Nancy J Hallbrook Date: 1/28/08

Weight / Balance Calibration Log

Date	Balance SN#	Weight SN#	Cal Type	Std. (g)	Act. (g)	Calibrator	Notes
2/24/2008	8028481064	N/A	Initial	0.00	0.00	CKH	Initial Calibration of Balance
2/24/2008	8028481064	26677	Initial	1000.00	1000.01	CKH	Initial Calibration of Balance
2/24/2008	8028481064	26677	Initial	500.00	499.99	CKH	Initial Calibration of Balance
2/24/2008	8028481064	26677	Initial	200.00	200.00	CKH	Initial Calibration of Balance
2/24/2008	8028481064	26677	Initial	100.00	100.00	CKH	Initial Calibration of Balance
2/24/2008	8028481064	26677	Initial	50.00	49.99	CKH	Initial Calibration of Balance
2/24/2008	8028481064	26677	Initial	20.00	20.00	CKH	Initial Calibration of Balance
2/24/2008	8028481064	26677	Initial	10.00	10.00	CKH	Initial Calibration of Balance
2/24/2008	8028481064	26677	Initial	5.00	5.01	CKH	Initial Calibration of Balance
2/24/2008	8028481064	26677	Initial	2.00	2.01	CKH	Initial Calibration of Balance
2/24/2008	8028481064	26677	Initial	1.00	1.00	CKH	Initial Calibration of Balance
2/24/2008	8028481064	N/A	Initial	0.00	0.00	CKH	Initial Calibration of Balance
2/24/2008	8028481064						
2/24/2008	8028481064	3-1		N/A	823.33		Belfort Field Set #3
2/24/2008	8028481064	3-2		N/A	823.18		
2/24/2008	8028481064	3-3		N/A	824.63		
2/24/2008	8028481064	3-4		N/A	824.50		
2/24/2008	8028481064	3-5		N/A	824.81		
2/24/2008	8028481064	3-6		N/A	822.93		
2/24/2008	8028481064	N/A	Mid-Check	0.00	0.00		Mid-Check
2/24/2008	8028481064	26677		200.00	200.00		
2/24/2008	8028481064	26677		500.00	500.00		
2/24/2008	8028481064	26677		1000.00	1000.03		
2/24/2008	8028481064	N/A		0.00	0.00		
2/24/2008	8028481064	3-7			823.78		Belfort Field Set #3
2/24/2008	8028481064	3-8			823.43		
2/24/2008	8028481064	3-9			822.99		
2/24/2008	8028481064	3-10			823.50		
2/24/2008	8028481064	3-11			823.78		
2/24/2008	8028481064	3-12			833.76		
2/24/2008	8028481064	N/A	Final	0.00	0.00		
2/24/2008	8028481064	26677		1.00	0.99		
2/24/2008	8028481064	26677		2.00	2.01		
2/24/2008	8028481064	26677		5.00	5.00		
2/24/2008	8028481064	26677		10.00	10.00		
2/24/2008	8028481064	26677		20.00	20.00		
2/24/2008	8028481064	26677		50.00	49.99		
2/24/2008	8028481064	26677		100.00	99.99		
2/24/2008	8028481064	26677		200.00	200.00		
2/24/2008	8028481064	26677		500.00	500.01		
2/24/2008	8028481064	26677		1000.00	1000.03		
2/24/2008	8028481064	26677		0.00	0.00		

Calibrator Signature: _____ Date: 2/24/08

Reviewer Signature: Nancy J Halbrook Date: 2/24/08

Fluke Corporation
Instrument Test Certificate and Statement of Calibration Practices

The Fluke Corporation, ISO Certification No. U0018, hereby certifies that your product was calibrated in accordance with applicable Fluke calibration procedures during the manufacturing process. These processes are ISO-9001 controlled and are designed to assure that the instrument will meet its published specification.

The Fluke Corporation further certifies that the measurement standards and instruments used during the calibration of this meter are traceable to the United States National Institute of Standards and Technology (NIST). At planned intervals, Fluke's measurement standards are calibrated by comparison to or measurement against the standards of NIST.

Fluke guarantees that at the time of test your instrument met its published specifications. Detailed specifications are available in the User Manual and Specification Supplement. A certificate of traceability can be obtained by sending the meter to any Fluke Technical Service Center. A nominal fee is charged for this service.

Quality Assurance Manager

QUALITY MANAGEMENT SYSTEM
FLUKE.
ISO 9001
CERTIFIED TO MEET ISO 9001

For Customer use only:

Because we use different delivery channels, you may have received a meter with a test certificate that is several weeks old. Our experience indicates the calibration of this product is not affected by storage prior to its initial receipt by the customer. Therefore, the recalibration of this unit should be based on when the product is put into service, plus the recommended calibration interval.

The recommended calibration interval for this instrument is 12 months and begins on the date of receipt by the customer For recalibration, please use our calibration services. Locations are listed at the WWW address below.

Please fill in appropriate dates as indicated:

Date Instrument Received: 12/17/2007

Date Calibration Due: 12/17/2008

P/N 1589971 Rev. 1 6/2005

Fluke Corporation
PO Box 9090 Everett WA 98206.9090 USA

Telephone 425.347.6100
Facsimile 425.446.5116
Email http://www.fluke.com

Production Verification Test Data

Model: 287 Serial Number: 95740135 Date: 17-DEC-2007

Function	Applied Stimulus	Response	Low Limit	High Limit	Units
LoZ	120 V @ 60 Hz	120.2	113.6	126.4	(V)
VAC	0.5 V @ 8 kHz	0.4975	0.4945	0.5055	(V)
VAC	45 V @ 75 kHz	15.025	14.435	15.565	(V)
VAC	1000 V @ 10 kHz	998.9	993.5	1006.5	(V)
mVAC	5 mV @ 20 Hz	0.004999	0.004865	0.005135	(V)
mVAC	500 mV @ 45 Hz	0.49945	0.49825	0.50175	(V)
VDC	0.5 V	0.4999	0.4977	0.5023	(V)
VDC	600.0 V	600.0	599.6	600.4	(V)
mVDC	0.025 mV	0.000024	0.000005	0.000045	(V)
mVDC	500 mV	0.50000	0.49986	0.50015	(V)
Ohms	500 Ohms	500.01	499.65	500.35	(Ohms)
Ohms	300 M Ohms	299000000.0	275800000.0	324200000.0	(Ohms)
Cap	5 nFarad	0.00000000501	0.00000000490	0.00000000510	(F)
AAC	5 A @ 1 kHz	5.0024	4.8460	5.1540	(A)
mAAC	0.004 A @ 1 kHz	0.003997	0.003956	0.004044	(A)
uAAC	500 uA @ 60 Hz	0.00050007	0.00049680	0.00050320	(A)
ADC	5 A	5.0004	4.9840	5.0160	(A)
mADC	50 mA	0.049999	0.049965	0.050035	(A)
mADC	400 mA	0.40000	0.39938	0.40062	(A)
uADC	500 uA	0.00049996	0.00049943	0.00050058	(A)
uADC	5000 uA	0.005000	0.004996	0.005004	(A)
LoOhm	0.2 Ohms	0.198	0.180	0.220	(Ohms)

EEMS # 01311

Fluke Corporation
Instrument Test Certificate and Statement of Calibration Practices

The Fluke Corporation, ISO Certification No. U0018, hereby certifies that your product was calibrated in accordance with applicable Fluke calibration procedures during the manufacturing process. These processes are ISO-9001 controlled and are designed to assure that the instrument will meet its published specification.

The Fluke Corporation further certifies that the measurement standards and instruments used during the calibration of this meter are traceable to the United States National Institute of Standards and Technology (NIST). At planned intervals, Fluke's measurement standards are calibrated by comparison to or measurement against the standards of NIST.

Fluke guarantees that at the time of test your instrument met its published specifications. Detailed specifications are available in the User Manual and Specification Supplement. A certificate of traceability can be obtained by sending the meter to any Fluke Technical Service Center. A nominal fee is charged for this service.

Quality Assurance Manager

For Customer use only:
Because we use different delivery channels, you may have received a meter with a test certificate that is several weeks old. Our experience indicates the calibration of this product is not affected by storage prior to its initial receipt by the customer. Therefore, the recalibration of this unit should be based on when the product is put into service, plus the recommended calibration interval.

The recommended calibration interval for this instrument is 12 months and begins on the date of receipt by the customer For recalibration, please use our calibration services. Locations are listed at the WWW address below.

Please fill in appropriate dates as indicated:

Date Instrument Received: 12/17/07

Date Calibration Due: 12/17/2008

P/N 1589971 Rev. 1 6/2006

Fluke Corporation
PO Box 9090 Everett WA 98206.9090 USA

Telephone 425.347.6100
Facsimile 425.446.5116
Email http://www.fluke.com

Production Verification Test Data

Model: 287 Serial Number: 95740243 Date: 17-DEC-2007

Function	Applied Stimulus	Response	Low Limit	High Limit	Units
LoZ	120 V @ 60 Hz	120.2	113.6	126.4	(V)
VAC	0.5 V @ 8 kHz	0.4975	0.4945	0.5055	(V)
VAC	45 V @ 75 kHz	15.025	14.435	15.565	(V)
VAC	1000 V @ 10 kHz	999.1	993.5	1006.5	(V)
mVAC	5 mV @ 20 Hz	0.005001	0.004865	0.005135	(V)
mVAC	500 mV @ 45 Hz	0.49939	0.49825	0.50175	(V)
VDC	0.5 V	0.5000	0.4977	0.5023	(V)
VDC	600.0 V	600.0	599.6	600.4	(V)
mVDC	0.025 mV	0.000023	0.000005	0.000045	(V)
mVDC	500 mV	0.50000	0.49986	0.50015	(V)
Ohms	500 Ohms	500.01	499.65	500.35	(Ohms)
Ohms	300 M Ohms	299600000.0	275800000.0	324200000.0	(Ohms)
Cap	5 nFarad	0.00000000501	0.00000000490	0.00000000510	(F)
AAC	5 A @ 1 kHz	5.0024	4.8460	5.1540	(A)
mAAC	0.004 A @ 1 kHz	0.003997	0.003956	0.004044	(A)
uAAC	500 uA @ 60 Hz	0.00049994	0.00049680	0.00050320	(A)
ADC	5 A	5.0004	4.9840	5.0160	(A)
mADC	50 mA	0.050002	0.049965	0.050035	(A)
mADC	400 mA	0.40004	0.39938	0.40062	(A)
uADC	500 uA	0.00050001	0.00049943	0.00050058	(A)
uADC	5000 uA	0.005000	0.004996	0.005004	(A)
LoOhm	0.2 Ohms	0.198	0.180	0.220	(Ohms)

EEMS # 01312

FLUKE ® Everett Service Center
1420 75th St. SW
Everett, Washington 98203
USA

NQA ISO 9001: 2000 Certified

Calibration Certificate

Description:	TRUE RMS MULTIMETER	**Certificate Number:**	**1567749-86590148:1202391220**
Manufacturer:	FLUKE	**Date of Calibration:**	07 February 2008
Model:	187	**Date of Certificate:**	07 February 2008
Serial Number:	86590148	**Date Due:**	07 February 2009
Customer Name:		**Procedure Name:**	
ENVIRONMENTAL ENGINEERING & MEASUREMENT SE		FLUKE 187: (1 YEAR) ACAL VER RS-232 /5520	
City, State:	GAINESVILLE, FL	**Procedure Revision:**	2.0
Customer Item ID:	86590148	**Data Type:**	FOUND-LEFT
PO Number:	HALBROOK CCS	**Temperature:**	23 ± 3.0 °Celsius
RMA Number:	3889556	**Relative Humidity:**	25% ≤ RH ≤ 60%
		Test Result:	PASS

The Fluke Corporation, NQA ISO 9001:2000 ISO Certification No. 10100/2, certifies that the instrument identified above was calibrated in accordance with applicable Fluke calibration procedures. Its calibration processes are ISO-9001 controlled and are designed to certify that the instrument was within its published specifications at the time of calibration.

The measurement standards and instruments used during the calibration of this instrument are traceable to the United States National Institute of Standards and Technology (NIST), other reputable National Institutes, natural physical constants, consensus standards, or by ratio type measurements.

This certificate applies to only the item identified and shall not be reproduced other than in full, without the specific written approval by Fluke Corporation. The user is obliged to have the in object recalibrated at appropriate intervals. Calibration Certificates without signature are not valid.

The Data type that could be found in this certificate is interpreted as follows:

- As Found — The unit needed adjustment and/or repair.
- As Left — The unit was adjusted and/or repaired.
- As Found/ As Left — The unit was calibrated without any adjustment and/or repair performed.

Comments:

Helene Heng
Metrology Technician

ICL CALIBRATION LABORATORIES, INC.

ACCREDITED
Certificate 526.01

ISO/IEC 17025 and ANSI/NCSL Z540-1 accredited
The specialists in ASTM and laboratory thermometers & hydrometers
Members: **ASTM API NCSLI ASQ NCWM**

Setting new standards in calibration excellence!

1501 Decker Avenue Suite 118 Stuart, FL 34994 USA
Tel: 772 286 7710 **1-800-713-6647**
Fax: 772 286 8737 E-mail: sales@iclcalibration.com
Internet: www.iclcalibration.com

Field office: Cagues, PR Tel: 787 286 7448

CALIBRATION REPORT FOR DIGITAL THERMOMETER

THIS REPORT OF CALIBRATION SHALL DOCUMENT THAT THE INSTRUMENT DESCRIBED HEREIN WAS EXAMINED AND TESTED IN ICL'S ISO/IEC 17025 ACCREDITED CALIBRATION LABORATORY, AGAINST NIST TRACEABLE REFERENCE STANDARDS, IN ACCORDANCE WITH ICL'S ISO/IEC 17025 CALIBRATION PROCEDURE REFERENCED BELOW. THIS CALIBRATION MEETS THE REQUIREMENTS OF ISO/IEC 17025, ANSI/NCSL Z540-1-1994, (WHICH SUPERSEDED AND REPLACED MIL-STD 45662A), AND THE ISO-9000 AND QS-9000 SERIES OF QUALITY STANDARDS.

CUSTOMER INFORMATION:

EEMS
8010 SW 17TH PLACE
GAINESVILLE, FL 32607

PURCHASE ORDER NUMBER: NOT AVAILABLE

SUBMITTED BY: EEMS

INSTRUMENT INFORMATION:

DATE RECEIVED FOR CALIBRATION: 01-28-2008 DATE REPORT ISSUED: 02-13-2008

DIGITAL THERMOMETER MODEL NUMBER: 4600-1.2.5

SERIAL NUMBER: 01D102193 & 01H0060 EEMS 01230 & 01231 INSCRIPTION: EUTECHNICS

ENGINEERING UNITS: degrees Celsius RANGE: -40/150C DIVISIONS: .001 °C

IMMERSION: PROBE S/N 01H0060

ACCURACY TOLERANCE: +/- 0.025C (per manufacturer)

RESULTS OF PHYSICAL EXAMINATION:

THIS INSTRUMENT WAS RECEIVED IN OPERABLE CONDITION, UNLESS OTHERWISE NOTED.

NOTE: The three decimal place display may be observed using the 'check cal' function accessible from the mode switch.
NOTE: THE INDICATION OF THIS THERMOMETER IS BEYOND TOLERANCE LIMITS AND IT CANNOT BE ADJUSTED BY ICL!
NOTE: IT MUST BE SENT TO ALPHA EUTECHNICS FOR ANY REPAIRS.

CALIBRATION PROCEDURE USED: *ICL Procedure 01, which is based upon ASTM E 77, NBS Monograph 150 & NIST SP 250-23*

RESULTS OF CALIBRATION:

'AS FOUND'

TEST TEMP	READING	CORRECTION	TOLERANCE	IN TOL?	UNCERTAINTY
0.000°C	0.008°C	-0.008°C	0.0250°C	YES	0.006°C
10.005°C	10.015°C	-0.010°C	0.0250°C	YES*	0.015°C
20.001°C	20.007°C	-0.006°C	0.0250°C	YES	0.015°C
30.005°C	30.002°C	+0.003°C	0.0250°C	YES	0.015°C
40.005°C	39.988°C	+0.017°C	0.0250°C	YES*	0.015°C
50.003°C	49.976°C	+0.027°C	0.0250°C	NO!*	0.015°C

NO ADJUSTMENTS WERE MADE TO THIS INSTRUMENT.

'AS LEFT'

TEST TEMP	READING	CORRECTION	TOLERANCE	IN TOL?	UNCERTAINTY
0.000°C	0.008°C	-0.008°C	0.0250°C	YES	0.006°C
10.005°C	10.015°C	-0.010°C	0.0250°C	YES*	0.015°C
20.001°C	20.007°C	-0.006°C	0.0250°C	YES	0.015°C
30.005°C	30.002°C	+0.003°C	0.0250°C	YES	0.015°C
40.005°C	39.988°C	+0.017°C	0.0250°C	YES*	0.015°C
50.003°C	49.976°C	+0.027°C	0.0250°C	NO!*	0.015°C

THIS INSTRUMENT FAILED TO MEET THE ACCURACY TOLERANCE AT ONE OR MORE OF THE POINTS TESTED.

**DECISION RULE: Unless otherwise instructed, ICL uses the following decision rule: if indications are perceived to reside within the tolerance limits, the indications are considered as 'In-Tolerance'; any indications perceived to reside outside the tolerance limits are considered to be 'Out-of-Tolerance'. The measurement uncertainty is not considered in this declaration.*

An asterik (*) alongside the 'Yes' or 'No' in the 'IN TOL?' column in the table of corrections above should alert the user that the amount by which the device is either In-Tolerance or Out-of-Tolerance is smaller than the measurement uncertainty associated with that calibration result.

Our best measurement capabilities are: at Liquid Nitrogen (approximately -196C), +/- 0.0062C; from -80 to 0C, +/- 0.0089C; at 0C, +/- 0.0039C; at 0.01C (TPW), +/- 0.0019C; from 0.01 to 100C, +/- 0.0085C; from 100 to 200C, +/- 0.0094C; from 200 to 300C, +/- 0.0098C; from 300 to 420C, +/- 0.014C; from 420 to 500C, +/- 0.034C; from 500 to 700C, +/- 0.26C; from 700 to 1000C,

+/- 0.86C. These uncertainties have been calculated utilizing the methods recommended in NIST Technical Note 1297 and the ANSI-NCSL document Z-540-2 entitled 'Guide to the Expression of Uncertainty in Measurement'. A coverage factor of 2 sigma (k = 2) has been applied to the standard uncertainty in order to express the expanded uncertainty at approximately a 95% confidence level.

THE UNCERTAINTIES PRESENTED ABOVE IN THE 'RESULTS' TABLE ARE LARGER THAN OUR BEST MEASUREMENT CAPABILITIES, AS THE RESOLUTION OF THIS INSTRUMENT, ESTIMATED TO BE 0.001 °C, AND OTHER CONTRIBUTIONS HAVE BEEN FACTORED INTO THE CALCULATION.

THE EXPANDED UNCERTAINTIES (K = 2) REPORTED HERE DO NOT CONTAIN ESTIMATES FOR (1) ANY EFFECTS THAT MAY BE INTRODUCED BY TRANSPORTATION OF THE INSTRUMENT BETWEEN ICL AND THE USER'S LABORATORY, (2) DRIFT OF THE INSTRUMENT, (3) HYSTERESIS OF THE INSTRUMENT, OR (4) ANY MEASUREMENT UNCERTAINTIES INTRODUCED BY THE USER.

LABORATORY ENVIRONMENTAL CONDITIONS: TEMPERATURE: 23°C +/- 2°C RELATIVE HUMIDITY: BETWEEN 40% AND 60%

ALL TEMPERATURES GIVEN IN THIS REPORT ARE THOSE DEFINED BY THE INTERNATIONAL TEMPERATURE SCALE OF 1990 (ITS-90)

IMPORTANT NOTE: THE CORRECT OPERATION OF DIGITAL ELECTRONIC THERMOMETERS IS DEPENDENT ON ALL COMPONENTS FUNCTIONING PROPERLY. CORRECT TEMPERATURE INDICATION MAY BE IMPEDED BY PHYSICAL DAMAGE TO THE PROBE OR CABLE ASSEMBLY, CONTAMINATION OF ELECTRICAL CONTACTS WITH WATER, OIL, OR OTHER MATERIAL, OR BY LESS OBVIOUS CAUSES SUCH AS LOW BATTERY LEVEL OR FAILURE OF INTERNAL COMPONENTS. ACCORDINGLY, ICL CALIBRATION LABORATORIES, INC. REPRESENTS THAT THE VALUES INDICATED ABOVE WERE THOSE OBSERVED DURING THE PERFORMANCE OF THIS TEST HOWEVER CANNOT BE RESPONSIBLE FOR INACCURATE READINGS WHICH MAY BE EXPERIENCED IN FUTURE USES DUE TO CONDITIONS WHICH ARE BEYOND OUR CONTROL.

THIS CALIBRATION WAS PERFORMED BY: DEBORAH M. WEBER

THE CALIBRATION PERFORMED AND DOCUMENTED BY THIS REPORT OF TEST IS A LIMITED CALIBRATION AND ACCORDINGLY, LIMITATIONS OF USE ARE IMPOSED AS FOLLOWS:

THIS INSTRUMENT CAN BE USED WITH CONFIDENCE ONLY WITHIN THE RANGE BRACKETED BY THE TEST POINTS AND/OR IMMEDIATELY AROUND THE TEST POINTS.

TRACEABILITY INFORMATION

This calibration is traceable to NIST through an unbroken chain of comparisons. The reference standard is used to calibrate the transfer standard, which in turn is used to calibrate the client's instrument. Each step in the chain is fully documented, and measurement uncertainty at each step has been calculated.

Our NIST primary reference thermometer from -196 to 420C is a Rosemount model 162CE 25.5 Ohm SPRT, serial no. 5058, calibrated by NIST on May 15, 2006. NIST GMP-11 recommends a 36 month calibration cycle for SPRTs. PRT transfer standards and ASTM liquid-in-glass transfer standards are calibrated annually against this SPRT, per NIST GMP-11 recommendations.

Our primary reference thermometer for temperatures from 500 to 1000C is a Hart Scientific model 5624 PRT sensor, serial #0105, calibrated by Hart Scientific. PRT and noble metal thermocouple transfer standards are calibrated annually against this reference sensor, per NIST GMP-11 recommendations.

Test Point	Comparator	MTE#	Manufacturer	Transfer Standard	MTE#	Manufacturer	Next Due
0.000°C	Ice bath	000	Lab Glass	Ice bath	222	Lab Glass	10/08/08
10.005°C	9510 glycol bath	002	PolyScience	5614 PRT 576776	130	Hart Scientific	06/03/08
20.001°C	9601 glycol bath	008	Polyscience	5614 PRT 597010	135	Hart Scientific	06/03/08
30.005°C	7310 water bath	012	Polyscience	5614 PRT 576776	130	Hart Scientific	06/03/08
40.005°C	7012 water bath	223	Hart Scientific	5614 PRT 524105	127	Hart Scientific	06/03/08
50.003°C	6022 water bath	041	Hart Scientific	5614 PRT 524105	127	Hart Scientific	06/03/08

ICL CALIBRATION LABORATORIES, INC.

An ISO/IEC 17025 & ANSI/NCSL Z-540-1 accredited laboratory - American Association for Laboratory Accreditation Certificate #526.01

J. JEFF KELLY, TECHNICAL DIRECTOR
DEBORAH M. WEBER, A.S.C.P. ACCREDITED TECHNOLOGIST This document prepared by LORI PARR and reviewed by KAREN ALLEBORN

DATE REPORT ISSUED: 02-13-2008 RECALIBRATION DATE SPECIFIED BY CLIENT: February 13, 2009

NIST GMP-11 (Mar '03), 'Good Measurement Practice for Assignment and Adjustment of Calibration Intervals for Standards' states that, 'Temperature standards are dynamic with use. Shock, contamination and other factors can cause drift from accepted values'. Table 4 of GMP-11 recommends recalibration of liquid-in-glass thermometers, standard thermistors and PRTs at 12 month intervals. Liquid-in-glass thermometers used for 'Temperature Critical Parameters' should be recalibrated at 6 month intervals. NIST GMP-11 is available for download in Adobe .pdf format on our website at www.icllabs.com Follow the link for 'Downloads'.

The API 'Manual of Petroleum Measurement Standards', Chapter 7, June, 2001, specifies a 12 month recalibration interval for liquid-in-glass thermometers (see section 8.3) and for portable electronic thermometers (PETs). See section 8.2

The user should be aware that any number of factors may cause this instrument to drift out of calibration before the specified calibration interval has expired.

This calibration report applies only to the item calibrated. This calibration report shall not be used to claim product endorsement by the A2LA.

Warren-Knight Instrument Company
2045 Bennett Road
Philadelphia, PA 19116
Phone: 215-464-9300; Fax: 215-464-9303
Web: http://www.warrenind.com

CERTIFICATION OF CALIBRATION AND CONFORMANCE

We hereby certify that the equipment below has been manufactured and/or inspected by standards traceable to NIST. Calibration of the specified instrument has been performed in compliance with ANSI Z540-1 requirements. It is warranted that the equipment has been calibrated to be in full conformance with the drawings and specifications of the instrument. Calibration tests were performed on the material specified below and were in accordance with all applicable quality assurance requirements with data on file at our facility.

Customer Name:	EEMS
Purchase Order #:	
Instrument:	USHIKATA COMPASS S-25
Serial Number:	190037
Quantity:	1
Calibration Due:	FEBRUARY 2008

John Noga

John Noga, Quality Control

FEBRUARY 12, 2007

Measurement Standards:
Theodolite: Wild T-3 S/N 18801/CAL 5/14/97 NIST# 738/229329-83 738/223398
Optical Wedge: K&E 71-7020 S/N 5167/CAL 4/19/01 NIST# 731/244084-89