

QUALITY ASSURANCE AUDIT REPORT

**Midlothian, Texas
Ambient Air Collection and Chemical Analysis
Midlothian, TX**

**Conducted:
May 4, 2009**

Prepared by:

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May 27, 2009

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EXECUTIVE SUMMARY

On May 4, 2009, Darrin Barton of URS Corporation conducted performance and technical system audits of the Midlothian, Texas ambient air collection and chemical analysis monitoring program in Midlothian, Texas. The audits provided an independent assessment of the monitoring program.

There are five (5) monitoring locations involved in this program, identified as Sites 1, 2, 3c, 4, and 5. Each location contains specific monitoring equipment and measurement systems as part of a network designed to document air quality. All monitoring equipment and measurement systems associated with the network were found to be in operation at the time of the audit and were subsequently audited. Performance audit results indicate acceptable responses for measurement systems and monitoring equipment with the following exception:

- The rain gauge at site 5 was found to be biased high forty percent. With an audit input of 0.10 inches the site sensor yielded a response of 0.14 inches.

Performance audit results are presented in this report. Any identified concerns or observations, were reported to the URS project team via a corrective action report (CAR) at the conclusion of the audit. For each issued CAR, the project team will initiate measures to resolve the identified area in a timely manner and a follow up concerning any CAR's will be conducted during the next audit.

1.0 Introduction

On May 4, 2009, Darrin Barton of URS Corporation conducted performance and audits of the Midlothian, Texas ambient air collection and chemical analysis monitoring program in Midlothian, Texas. This report, along with the attached appendices, documents the audit procedures, performance audit results, and identified concerns and observations. Where applicable, recommendations are offered to improve overall operations and quality control. At the conclusion of the audit, the auditor met with the project staff to discuss all results, identified concerns and observations.

1.1 Purpose

This audit was conducted as part of an independent URS quality assurance program for the Midlothian Ambient Air Collection and Chemical Analysis monitoring project. The objectives of the audit were to provide an assessment of the performance for air quality and meteorological monitoring equipment and to evaluate the technical systems employed.

1.2 Scope

The monitoring program for the Midlothian Ambient Air Collection and Chemical Analysis monitoring project consists of a network of five (5) monitoring locations with the following monitoring measurement systems:

- Sites 1, 2, 3c, 4, and 5.
 - Meteorological monitoring systems measuring wind direction, wind speed, temperature, barometric pressure and precipitation;
- Sites 1, 2, 3c, 4, and 5.
 - High-volume time-integrated PM₁₀ air monitors to collect particulate samples for the determination of metals other than Cr⁶⁺. Low-volume time-integrated air monitors to collect particulate samples for Cr⁶⁺.

1.3 Audit Procedures

Performance audits were conducted by comparing field measurements to an audit standard of known quality or through artificial field tests in which the instrument response is predicted. In each case, results were obtained and compared to the audit criteria for accuracy. Audit criteria used to assess each measured parameter are derived from the following:

- Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Specific Methods, Section 2.11, EPA/600/R-94/038b, revised April 1994;
- Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements, EPA/600/R-94/038d, revised April 1994; and
- Quality Assurance Project Plan (QAPP) for Midlothian, Texas Ambient Air Collection and Chemical Analysis.

Performance audit results for each measurement are summarized in this report, with detailed documentation provided in the appendix. Specific procedures and methods employed for the audit are described in the subsections below.

1.3.1 High-Volume PM₁₀ Sampler

Each PM₁₀ sampler was audited using a certified Volumetric Flow Control (VFC) orifice comparing the calculated audit flow rate to the sampler calibration flow rate and the designed (ideal) flow rate.

1.3.2 Cr⁶⁺ Sampler

The TEOM unit was audited for flow rate accuracy for the main flow. Flow rate accuracy was tested using a NIST-traceable volumetric flow meter for each portion of the flow system.

1.3.3 Wind Direction

Wind direction was audited for two independent characteristics: alignment of the sensor with respect to true north and output linearity. Alignment was tested using a certified compass transit by comparing the response of the sensor to the known magnetic declination. Output linearity was tested in 30-degree increments using a linearity device in both the clockwise and counterclockwise directions. These results were used to determine the maximum total error over the range of the sensor. Additionally, the condition of each sensor's bearings was inspected.

1.3.4 Horizontal Wind Speed

Wind speed was audited using a constant velocity motor drive unit for which several specific rates of revolution correspond to known wind speeds. In addition, the condition of each sensor's bearings was checked to ensure that the starting threshold (i.e., lowest detectable wind speed) was within manufacturer's specification.

1.3.5 Temperature

Temperature was audited by comparing the measured response against a collocated NIST-traceable digital thermometer over several time intervals.

1.3.6 Barometric Pressure

Barometric pressure was audited by comparing the measured response against a collocated NIST-traceable barometer over several time intervals.

1.3.7 Precipitation

Precipitation was audited by introducing a known amount of water into the gauge bucket and testing against the predicted response.

2.0 Audit Results

The following tables contain a summary of the performance audit results by measurement parameter. Detailed performance audit data are contained in the field audit data sheets section (Appendix A).

Table 2-1. PM₁₀ Audit Results

Site Number	Sampler Serial Number	Calculated Audit Flow (m ³ /min)	Sampler Flow (m ³ /min)	Audit Flow Rate Difference (%) (Criteria ± 7%)	Design Flow Rate Difference (%) (Criteria ± 10%)	Pass / Fail
1	580	1.075	1.124	4.6	-4.9	Pass
	675	1.075	1.103	2.6	-4.9	Pass
2	641	1.081	1.113	3.0	-4.3	Pass
	582	1.100	1.091	-0.8	-2.7	Pass
	726	1.100	1.126	2.4	-2.7	Pass
3c	6673	1.104	1.094	-0.9	-2.3	Pass
	6671	1.104	1.111	0.6	-2.3	Pass
4	6670	1.126	1.111	-1.3	-0.3	Pass
	6672	1.126	1.117	-0.8	-0.3	Pass
5	583	1.090	1.119	2.6	-3.5	Pass
	584	1.094	1.129	3.5	-3.5	Pass

Table 2-2. Cr⁶⁺ Flow Rate Audit Results

Site Number	Channel	Expected Flow Rate (LPM)	Measured Flow Rate (LPM)	Measurement Error (%) (Criteria ± 10%)	Pass / Fail
1	1	15.0	16.1	7.3	Pass
	2	15.0	16.3	8.7	Pass
2	1	15.0	16.3	8.7	Pass
	2	15.0	16.4	9.3	Pass
	1d	15.0	16.0	6.5	Pass
3c	1	15.0	15.3	2.0	Pass
	2	15.0	16.4	9.3	Pass
4	1	15.0	15.7	4.7	Pass
	2	15.0	16.2	8.0	Pass
5	1	15.0	16.4	9.3	Pass
	2	15.0	16.2	8.0	Pass

Table 2-3. Wind Direction Audit Results

Site Number	Sensor Height (meters)	Alignment Error (°) (Criteria ± 2°)	Max Linearity Error (°) (Criteria ± 3°)	Max Total Error (°) (Criteria ± 5°)	Pass / Fail
1	10	-0.90	-1.6	-2.5	Pass
2	10	0.60	-1.17	1.43	Pass
3c	10	-1.40	-2.58	-3.98	Pass
4	10	-0.40	-2.25	-2.65	Pass
5	10	-0.40	2.25	-1.50	Pass

Table 2-4. Horizontal Wind Speed Audit Results

Site Number	Sensor Height (Meters)	Audit Input Value (mph)	Sensor Measurement (mph)	Measurement Error (mph) (Criteria ± 0.4 mph)	Pass / Fail
1	10	0.6	0.6	0.0	Pass
		4.2	4.2	0.0	Pass
		10.1	10.1	0.0	Pass
		18.5	18.5	0.0	Pass
		36.4	36.4	0.0	Pass
		54.3	54.3	0.0	Pass
2	10	0.6	0.6	0.0	Pass
		4.2	4.2	0.0	Pass
		10.1	10.1	0.0	Pass
		18.5	18.5	0.0	Pass
		36.4	36.4	0.0	Pass
		54.3	54.3	0.0	Pass
3c	10	0.6	0.6	0.0	Pass
		4.2	4.2	0.0	Pass
		10.1	10.1	0.0	Pass
		18.5	18.5	0.0	Pass
		36.4	36.4	0.0	Pass
		54.3	54.3	0.0	Pass
4	10	0.6	0.6	0.0	Pass
		4.2	4.2	0.0	Pass
		10.1	10.1	0.0	Pass
		18.5	18.5	0.0	Pass
		36.4	36.4	0.0	Pass
		54.3	54.3	0.0	Pass
5	10	0.6	0.6	0.0	Pass
		4.2	4.2	0.0	Pass
		10.1	10.1	0.0	Pass
		18.5	18.5	0.0	Pass
		36.4	36.4	0.0	Pass
		54.3	54.3	0.0	Pass

Table 2-6. Temperature Audit Results

Site Number	Sensor Height (Meters)	Reference Temperature (°C)	Sensor Reading (°C)	Measurement Error (°C) (Criteria ± 1.0° C)	Pass / Fail
1	1.1	17.0	16.8	-0.2	Pass
		17.3	16.8	-0.5	Pass
2	1.1	19.3	18.5	-0.8	Pass
		19.9	19.1	-0.8	Pass
3c	1.1	19.5	19.9	0.4	Pass
4	1.1	21.7	21.2	-0.5	Pass
5	1.1	20.3	20.4	0.1	Pass
		22.5	21.9	-0.6	Pass

Table 2-7. Barometric Pressure Audit Results

Site Number	Sensor Height (Meters)	Reference Pressure (mm/Hg)	Sensor Reading (mm/Hg)	Measurement Error (mm/Hg) (Criteria ± 7.6 mm/Hg)	Pass / Fail
1	1.1	745.5	744.3	-1.2	Pass
		745.5	744.2	-1.3	Pass
2	1.1	746.5	744.3	-2.2	Pass
		746.5	744.6	-2.0	Pass
3c	1.1	740.3	739.6	-0.7	Pass
4	1.1	741.1	739.6	-1.5	Pass
5	1.1	741.2	740.1	-1.1	Pass
		740.7	739.8	-0.9	Pass

Table 2-8. Precipitation Audit Results

Site Number	Sensor Height (Meters)	Input Volume (Inches)	Sensor Reading (Inches)	Measurement Error (%) (Criteria $\pm 10\%$)	Pass / Fail
1	0.6	.10	.09	-10.0	Pass
2	0.6	.10	.09	-10.0	Pass
3c	0.6	.10	.09	-10.0	Pass
4	0.6	.10	.09	-10.0	Pass
5	0.6	.10	.14	40.0	Failed

3.0 Discussions and Recommendations

This section focuses on concerns identified during the audit. An audit concern can be a performance audit results that does not meet the criteria, or a technical systems audit result of any condition that may adversely affect quality. Three categories are used to rank the audit concerns critical, major and minor. Each level of concern is defined in the following paragraphs, along with an explanation of any audit issues that are so categorized. General recommendations for corrective actions are listed at the end of the section, where applicable. Appended to this report are the field data worksheets (Appendix A), audit equipment traceability (Appendix B) and corrective action reports (Appendix C).

3.1 Critical Concerns

Critical concerns are situations that will adversely impact data quality and have a significant effect on successful project operations. Nonconforming audit results that indicate measurements out of quality control requirements are classified as critical concerns. These concerns require immediate action to ensure that the measurement quality will return to in-control conditions. Critical concerns must be addressed and corrective action documented and reported to the project team. Based on the results of this audit, no critical concerns were identified.

3.2 Major Concerns

Major concerns may not immediately affect successful project operations, but may potentially impact data quality and could lead to data invalidation. Measurement systems outside the audit objective are usually classified as major concerns. A written response normally is required for major concerns so that acknowledgment of the problem and a corrective action plan can be communicated and implemented effectively. Based on the results of this audit, no major concerns were identified.

3.3 Minor Concerns

Minor concerns are typically based on observed inconsistencies in implementation of procedures, or performance audit results that indicate potential for future problems. Data validity is not compromised, but a degree of inefficiency or the beginning of a larger problem could result from these situations. Based on the results of this audit, one minor concern was identified as discussed below.

During the audit of the rain gauge at site 5 it was observed that the responses were biased high forty percent. With a known input of 0.10 inches the rain gauge yielded a response of 0.14

inches. The rain gauge has a dual chambered tipping mechanism that pours when one side is full and produces a signal response for the measured amount. It was observed during the audit that when tipped, one of the chambers would bounce producing a second erroneous response thus contributing to the bias. The Midlothian monitoring program QAPP doesn't specify measurement criteria for rainfall amount only for rainfall duration. Therefore no corrective action report was generated for this finding.

4.0 Response Requirements

As project manager, Al Hendler is responsible for coordinating a response to this audit report. Any critical and major concerns, if identified, require a specific written response detailing action taken or planned to resolve the concern and prevent reoccurrence. A written response should include specific action taken or planned to resolve the concern and prevent reoccurrence. Each written response enables the auditor to document the resolution of any concern and close the audit.

APPENDIX A

Field Data Worksheets



Wind Direction Audit Data Sheet (360 Sensor)

Site ID: Midlothian CAMS 52(Site 1)
 Date: May 4, 2009
 Time: 945-1045 CDT
 Sensor ID: Met One 020 C
 Serial #: C3624

Tower Height: 10 Meters
 Sensor Level: yes
 Vane Condition: good
 Bearing Condition: good
 Last Field Calibration: n/a

Audit Device: Compass Transit
 Model: Lietz 115
 Serial #: 32100
 Cert. Expiration: November 18, 2009
 Linearity Device: Met One Degree Wheel
 Serial #: 1

Reference Angle (deg)	Sensor Rotation	Sensor Response (deg)	Measurement Error (deg)	Hysteresis Error (deg)	Normalized Linearity Error (deg)	Average Error (deg)	Total Error (deg)
0	cw	360.00	0.00		0.40		
30	cw	28.00	-2.00		-1.60		
60	cw	58.00	-2.00		-1.60		
90	cw	89.00	-1.00		-0.60		
120	cw	119.00	-1.00		-0.60		
150	cw	150.00	0.00		0.40		
180	cw	180.00	0.00		0.40		
210	cw	211.00	1.00		1.40		
240	cw	240.00	0.00		0.40		
270	cw	270.00	0.00		0.40		
300	cw	300.00	0.00		0.40		
330	cw	330.00	0.00		0.40		
360	ccw	0.40	0.40	0.40	0.80	0.60	-0.30
330	ccw	330.00	0.00	0.00	0.40	0.40	-0.50
300	ccw	300.00	0.00	0.00	0.40	0.40	-0.50
270	ccw	270.00	0.00	0.00	0.40	0.40	-0.50
240	ccw	240.00	0.00	0.00	0.40	0.40	-0.50
210	ccw	211.00	1.00	0.00	1.40	1.40	0.50
180	ccw	180.00	0.00	0.00	0.40	0.40	-0.50
150	ccw	150.00	0.00	0.00	0.40	0.40	-0.50
120	ccw	119.00	-1.00	0.00	-0.60	-0.60	-1.50
90	ccw	89.00	-1.00	0.00	-0.60	-0.60	-1.50
60	ccw	58.00	-2.00	0.00	-1.60	-1.60	-2.50
30	ccw	28.00	-2.00	0.00	-1.60	-1.60	-2.50
Mean:			-0.40	0.03			
Maximum Hysteresis Error :				0.40			
Maximum Normalized Linearity Error :					-1.60		
	<i>Specification : +/- 3 degrees</i>						
Maximum Total Error :							-2.50
	<i>Specification : +/- 5 degrees</i>						

True North Alignment	
Known Declination:	4.4 EMD
Expected Magnetic Compass Reading for True North:	355.6 Degrees
Actual Magnetic Compass Reading w/ Vane Aligned to 180/360:	356.5 Degrees
Alignment Error:	-0.90 Degrees
Data Correction:	None
Alignment Correction:	None
Action Taken	
Alignment meets specification. No action required.	

Specification : +/- 2 degrees

Auditor : Darrin Barton

Notes :

Horizontal Wind Speed Audit Data Sheet

Site ID: Midlothian CAMS 52(Site 1)
Date: May 4, 2009
Time: 945-1045 CDT
Sensor ID: Met One 010 C
Serial #: A1796

Tower Height: 10 Meters
Sensor Level: yes
Cup Condition: good
Bearing Check:

0.2 g-cm CCW
 0.2 g-cm CW

Audit Device: Anemometer Drive
Model: RM Young 18811
Serial #: 10501
Cert. Expiration: June 18, 2009
Torque Device: RM Young Torque Disc
Serial #: 1

Last Field Calibration: n/a

Audit Input CCW (rpm)	Known Input Value (m/h)	Sensor Response (m/h)	Measurement Error (m/h)	Audit Input CW (rpm)	Known Input Value (m/h)	Sensor Response (m/h)	Measurement Error (m/h)
0	0.6	0.6	0.0	0	0.6	0.6	0.0
60	4.2	4.2	0.0	60	4.2	4.2	0.0
160	10.1	10.1	0.0	160	10.1	10.1	0.0
300	18.5	18.5	0.0	300	18.5	18.5	0.0
600	36.4	36.4	0.0	600	36.4	36.4	0.0
900	54.3	54.3	0.0	900	54.3	54.3	0.0

Specification: +/- 0.4

Specification: +/- 0.4

Auditor: Darrin Barton

Notes:

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Temperature Audit Data Sheet

Site ID: Midlothian CAMS 52(Site 1)
Date: May 4, 2009
Time: 930-940 CDT
Sensor ID: Met One 060A-2
Serial #: G3468

Sensor Height: 3.5'
Sensor Condition: good
Sensor Level: yes
Aspirator Condition: working
Last Field Calibration: n/a

Audit Device: Digital Thermometer
Model: VWR
Serial #: 230058352
Cert. Expiration: July 29, 2009

Time of the Audit	Type of Comparison	Audit Reference Temperature (deg C)	Station Probe Temperature (deg C)	Measurement Error (deg C)
930	Collocated Measurement	17.00	16.8	-0.2
940	Collocated Measurement	17.3	16.8	-0.5

Specification: +/- 1.0

Auditor: Darrin Barton

Notes:

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Barometric Pressure Audit Data Sheet

Site ID: Midlothian CAMS 52(Site 1)
Date: May 4, 2009
Time: 930-940 CDT
Sensor ID: Vaisala
Serial #: unknown

Sensor Height: 3.5'
Sensor Condition: good
Sensor Level: yes
Last Field Calibration: n/a

Audit Device: Barometer/Altimeter
Model: Airs-Vaisala
Serial #: OF1475
Cert. Expiration: May 1, 2009

Time of the Audit	Type of Comparison	Audit Reference Barometric Pressure (mmHg)	Site Sensor Barometric Pressure (mmHg)	Measurement Error (mmHg)
930	Collocated Measurement	745.5	744.3	-1.2
940	Collocated Measurement	745.5	744.2	-1.3

Specification: +/- 7.6

Auditor: Darrin Barton

Notes:

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Precipitation Audit Data Sheet

Site ID: Midlothian CAMS 52(Site 1)
Date: May 4, 2009
Time: 935 CDT
Sensor ID: Met One
Serial #: X6391

Sensor Height: 2 inches
Sensor Condition: good
Sensor Level: yes
Sensor Clean: yes
Last Field Calibration: n/a

Audit Device: Acrylic Buret
Model: Cole Parmer
Serial #: 2
Cert. Expiration: none

Time of the Audit	Input Volume (mL)	Gauge Input (inches)	Response (inches)	Measurement Error (%)
935	80.0	0.10	0.09	-10.0%

Specification: +/- 10.0

Auditor : Darrin Barton

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Notes:

**PM₁₀ / VOLUMETRIC FLOW CONTROL (VFC)
PERFORMANCE AUDIT DATA**

Site ID: Midlothian CAMS 52(Site 1)
 Date: May 4, 2009
 Time: 1000 CDT
 Pressure (P_a) (mm Hg): 745.6
 Temperature (T_a) (F): 61.4
 Temperature (T_a) (C): 16.3

Audit Device: Variable Orifice
 Serial #: W-90
 Slope: 0.96956
 Intercept: 0.00007
 Correlation: 0.99996
 Cert. Exp. Date: September 30, 2009

PM ₁₀ AUDIT DATA						
Sampler ID#	Audit Pressure Drop (ΔH) ("H ₂ O)	Stagnation Pressure (ΔP _{STG}) ("H ₂ O)	Audit Flow (Q _a) (m ³ /min)	Sampler Flow ¹ (Q _s) (m ³ /min)	Percent Difference ² (Sampler vs. Audit)	Percent Difference ³ (Audit vs. Design)
580	2.80	19.3	1.075	1.124	4.6%	-4.9%
675	2.80	19.6	1.075	1.103	2.6%	-4.9%

1. From Sampler Look-Up Table or Calibration Data
2. Acceptance Criteria: ±7%
3. Acceptance Criteria: ±10%

SAMPLER CALIBRATION DATA					
Sampler ID#	Pressure Ratio (P _i /P _a) (mm Hg)	Calibration Date	Sampler Slope	Sampler Intercept	Sampler Correlation
580	0.9517	11/19/08	12.2996	0.1387	1.0000
675	0.9509	11/19/08	12.0731	0.1683	1.0000

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Notes:

**Cr⁶⁺ Sampler
PERFORMANCE AUDIT DATA**

Site ID: Midlothian CAMS 52(Site 1)
 Date: May 4, 2009
 Time: 1005 CDT
 ANALYZER ID: ERG CR6-15
 Serial #: 15.0

Audit Flow Meter : BGI
 Model No : deltaCal
 Serial No : 579
 Cert. Exp. Date : 9/5/2009

Sample Inlet Flow Audit Data		
Designed Flow Rate (LPM)	Measured Flow Rate (LPM)	Percent Difference ₂
15	16.1	7.33%
15	16.3	8.67%

2. Acceptance Criteria: ± 10%

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Notes:

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Wind Direction Audit Data Sheet (360 Sensor)

Site ID: Midlothian Old CAMS 302(Site 2)
 Date: May 4, 2009
 Time: 1100-1145 CDT
 Sensor ID: Met One 020 B
 Serial #: J3045

Tower Height: 10 Meters
 Sensor Level: yes
 Vane Condition: good
 Bearing Condition: good
 Last Field Calibration: n/a

Audit Device: Compass Transit
 Model: Lietz 115
 Serial #: 32100
 Cert. Expiration: November 18, 2009
 Linearity Device: Met One Degree Wheel
 Serial #: 1

Reference Angle (deg)	Sensor Rotation	Sensor Response (deg)	Measurement Error (deg)	Hysteresis Error (deg)	Normalized Linearity Error (deg)	Average Error (deg)	Total Error (deg)
0	cw	358.00	-2.00		-1.17		
30	cw	29.00	-1.00		-0.17		
60	cw	59.00	-1.00		-0.17		
90	cw	90.00	0.00		0.83		
120	cw	120.00	0.00		0.83		
150	cw	149.00	-1.00		-0.17		
180	cw	180.00	0.00		0.83		
210	cw	210.00	0.00		0.83		
240	cw	240.00	0.00		0.83		
270	cw	269.00	-1.00		-0.17		
300	cw	299.00	-1.00		-0.17		
330	cw	328.00	-2.00		-1.17		
360	ccw	358.00	-2.00	0.00	-1.17	-1.17	-0.57
330	ccw	328.00	-2.00	0.00	-1.17	-1.17	-0.57
300	ccw	299.00	-1.00	0.00	-0.17	-0.17	0.43
270	ccw	269.00	-1.00	0.00	-0.17	-0.17	0.43
240	ccw	240.00	0.00	0.00	0.83	0.83	1.43
210	ccw	210.00	0.00	0.00	0.83	0.83	1.43
180	ccw	180.00	0.00	0.00	0.83	0.83	1.43
150	ccw	149.00	-1.00	0.00	-0.17	-0.17	0.43
120	ccw	119.00	-1.00	1.00	-0.17	0.33	0.93
90	ccw	89.00	-1.00	1.00	-0.17	0.33	0.93
60	ccw	59.00	-1.00	0.00	-0.17	-0.17	0.43
30	ccw	29.00	-1.00	0.00	-0.17	-0.17	0.43
Mean:			-0.83	0.17			
Maximum Hysteresis Error :				1.00			
Maximum Normalized Linearity Error :					-1.17		
	<i>Specification : +/- 3 degrees</i>						
Maximum Total Error :							1.43
	<i>Specification : +/- 5 degrees</i>						

True North Alignment	
Known Declination:	4.4 EMD
Expected Magnetic Compass Reading for True North:	355.6 Degrees
Actual Magnetic Compass Reading w/ Vane Aligned to 180/360:	355 Degrees
Alignment Error:	0.60 Degrees
Data Correction:	None
Alignment Correction:	None
Action Taken	
Alignment meets specification. No action required.	

Specification : +/- 2 degrees

Auditor : Darrin Barton

Notes :



Rev. 8.7 (3/08)

Horizontal Wind Speed Audit Data Sheet

Site ID: Midlothian Old CAMS 302(Site 2)
Date: May 4, 2009
Time: 1100-1145 CST
Sensor ID: Met One 010 B
Serial #: P1085

Tower Height: 10 Meters
Sensor Level: yes
Cup Condition: good
Bearing Check:
 0.2 g-cm CCW
 0.2 g-cm CW
Last Field Calibration: n/a

Audit Device: Anemometer Drive
Model: RM Young 18811
Serial #: 10501
Cert. Expiration: June 18, 2009
Torque Device: RM Young Torque Disc
Serial #: 1

Audit Input CCW (rpm)	Known Input Value (m/h)	Sensor Response (m/h)	Measurement Error (m/h)	Audit Input CW (rpm)	Known Input Value (m/h)	Sensor Response (m/h)	Measurement Error (m/h)
0	0.6	0.6	0.0	0	0.6	0.6	0.0
60	4.2	4.2	0.0	60	4.2	4.2	0.0
160	10.1	10.1	0.0	160	10.1	10.1	0.0
300	18.5	18.5	0.0	300	18.5	18.5	0.0
600	36.4	36.4	0.0	600	36.4	36.4	0.0
900	54.3	54.3	0.0	900	54.3	54.3	0.0

Specification: +/- 0.4

Specification: +/- 0.4

Auditor: Darrin Barton

Notes:

URS
 Rev. 8.7 (3/08)

Temperature Audit Data Sheet

Site ID: Midlothian Old CAMS 302(Site 2)
Date: May 4, 2009
Time: 1115-1135 CDT
Sensor ID: Met One 060A-2
Serial #: unknown

Sensor Height: 3.5'
Sensor Condition: good
Sensor Level: yes
Aspirator Condition: working
Last Field Calibration: n/a

Audit Device: Digital Thermometer
Model: VWR
Serial #: 230058352
Cert. Expiration: July 29, 2009

Time of the Audit	Type of Comparison	Audit Reference Temperature (deg C)	Station Probe Temperature (deg C)	Measurement Error (deg C)
11:15	Collocated Measurement	18.5	19.3	0.8
11:35	Collocated Measurement	19.9	19.1	-0.8

Specification: +/- 1.0

Auditor: Darrin Barton

Notes:

URS

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Barometric Pressure Audit Data Sheet

Site ID: Midlothian Old CAMS 302(Site 2)
Date: May 4, 2009
Time: 1115-1135 CDT
Sensor ID: Vaisala
Serial #: unknown

Sensor Height: 3.5'
Sensor Condition: good
Sensor Level: yes
Last Field Calibration: n/a

Audit Device: Barometer/Altimeter
Model: Airs-Vaisala
Serial #: OF1475
Cert. Expiration: May 1, 2009

Time of the Audit	Type of Comparison	Audit Reference Barometric Pressure (mmHg)	Site Sensor Barometric Pressure (mmHg)	Measurement Error (mmHg)
1115	Collocated Measurement	746.5	744.3	-2.2
1135	Collocated Measurement	746.6	744.6	-2.0

Specification: +/- 7.6

Auditor: Darrin Barton

Notes:

URS

Rev. 8.7 (3/08)

Precipitation Audit Data Sheet

Site ID: Midlothian Old CAMS 302(Site 2)
Date: February 25, 2009
Time: 1220 CDT
Sensor ID: Met One
Serial #: unknown

Sensor Height: 2 inches
Sensor Condition: good
Sensor Level: yes
Sensor Clean: yes
Last Field Calibration: n/a

Audit Device: Acrylic Buret
Model: Cole Parmer
Serial #: 2
Cert. Expiration: none

Time of the Audit	Input Volume (mL)	Gauge Input (inches)	Response (inches)	Measurement Error (%)
1220	80.0	0.10	0.09	-10.0%

Specification: +/- 10.0

Auditor : Darrin Barton

URS

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Notes:

**PM₁₀ / VOLUMETRIC FLOW CONTROL (VFC)
PERFORMANCE AUDIT DATA**

Site ID: Midlothian Old CAMS 302(Site 2)
 Date: May 4, 2009
 Time: 1200-1205 CDT
 Pressure (P_a) (mm Hg): 746.6
 Temperature (T_a) (F): 67.8
 Temperature (T_a) (C): 19.9

Audit Device: Variable Orifice
 Serial #: W-90
 Slope: 0.96956
 Intercept: 0.00007
 Correlation: 0.99996
 Cert. Exp. Date: September 30, 2009

PM ₁₀ AUDIT DATA						
Sampler ID#	Audit Pressure Drop (ΔH) ("H ₂ O)	Stagnation Pressure (ΔP _{STG}) ("H ₂ O)	Audit Flow (Q _a) (m ³ /min)	Sampler Flow ¹ (Q _a) (m ³ /min)	Percent Difference ² (Sampler vs. Audit)	Percent Difference ³ (Audit vs. Design)
641	2.80	19.5	1.081	1.113	3.0%	-4.3%
582	2.90	20.1	1.100	1.091	-0.8%	-2.7%

1. From Sampler Look-Up Table or Calibration Data
2. Acceptance Criteria: ±7%
3. Acceptance Criteria: ±10%

SAMPLER CALIBRATION DATA					
Sampler ID#	Pressure Ratio (P _f /P _a) (mm Hg)	Calibration Date	Sampler Slope	Sampler Intercept	Sampler Correlation
641	0.9512	02/25/09	12.1374	0.1619	1.0000
582	0.9497	03/09/09	11.8857	0.1920	1.0000

AUDITOR: Darrin Barton

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Notes:

**PM₁₀ / VOLUMETRIC FLOW CONTROL (VFC)
PERFORMANCE AUDIT DATA**

Site ID: Midlothian Old CAMS 302(Site 2)
 Date: May 4, 2009
 Time: 11:55 CDT
 Pressure (P_a) (mm Hg): 746.6
 Temperature (T_a) (F): 67.8
 Temperature (T_a) (C): 19.9

Audit Device: Variable Orifice
 Serial #: W-90
 Slope: 0.96956
 Intercept: 0.00007
 Correlation: 0.99996
 Cert. Exp. Date: September 30, 2009

PM ₁₀ AUDIT DATA						
Sampler ID#	Audit Pressure Drop (ΔH) ("H ₂ O)	Stagnation Pressure (ΔP _{STG}) ("H ₂ O)	Audit Flow (Q _a) (m ³ /min)	Sampler Flow ¹ (Q _s) (m ³ /min)	Percent Difference ² (Sampler vs. Audit)	Percent Difference ³ (Audit vs. Design)
726	2.90	19.8	1.100	1.126	2.4%	-2.7%

1. From Sampler Look-Up Table or Calibration Data
2. Acceptance Criteria: ±7%
3. Acceptance Criteria: ±10%

SAMPLER CALIBRATION DATA					
Sampler ID#	Pressure Ratio (P _i /P _a) (mm Hg)	Calibration Date	Sampler Slope	Sampler Intercept	Sampler Correlation
726	0.9505	02/25/09	12.2874	0.1419	1.0000

AUDITOR: Darrin Barton

Notes:

Cr⁶⁺ Sampler PERFORMANCE AUDIT DATA

Site ID: Midlothian Old CAMS 302(Site 2)
Date: May 4, 2009
Time: 1225 CDT
ANALYZER ID: ERG CR6
Serial #: s/n 1 and s/n 24

Audit Flow Meter : BGI
Model No : deltaCal
Serial No : 579
Cert. Exp. Date : 9/5/2009

Sample Inlet Flow Audit Data		
Designed Flow Rate (LPM)	Measured Flow Rate (LPM)	Percent Difference ₂
15	16.3	8.67%
15	16.4	9.33%
15	15.98	6.53%

2. Acceptance Criteria: ± 10%

AUDITOR: Darrin Barton

Notes:

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 Rev. 8.7 (3/08)

Wind Direction Audit Data Sheet (360 Sensor)

Site ID: Vitovsky Elementary (Site 3c)
 Date: May 4, 2009
 Time: 1630-1730 CDT
 Sensor ID: Met One 020 C
 Serial #: Y2145

Tower Height: 10 Meters
 Sensor Level: yes
 Vane Condition: good
 Bearing Condition: good
 Last Field Calibration: n/a

Audit Device: Compass Transit
 Model: Lietz 115
 Serial #: 32100
 Cert. Expiration: November 18, 2009
 Linearity Device: Met One Degree Wheel
 Serial #: 1

Reference Angle (deg)	Sensor Rotation	Sensor Response (deg)	Measurement Error (deg)	Hysteresis Error (deg)	Normalized Linearity Error (deg)	Average Error (deg)	Total Error (deg)
0	CW	359.00	-1.00		-0.58		
30	CW	27.00	-3.00		-2.58		
60	CW	57.00	-3.00		-2.58		
90	CW	88.00	-2.00		-1.58		
120	CW	119.00	-1.00		-0.58		
150	CW	150.00	0.00		0.42		
180	CW	180.00	0.00		0.42		
210	CW	211.00	1.00		1.42		
240	CW	241.00	1.00		1.42		
270	CW	271.00	1.00		1.42		
300	CW	301.00	1.00		1.42		
330	CW	331.00	1.00		1.42		
360	CCW	359.00	-1.00	0.00	-0.58	-0.58	-1.98
330	CCW	331.00	1.00	0.00	1.42	1.42	0.02
300	CCW	301.00	1.00	0.00	1.42	1.42	0.02
270	CCW	271.00	1.00	0.00	1.42	1.42	0.02
240	CCW	241.00	1.00	0.00	1.42	1.42	0.02
210	CCW	211.00	1.00	0.00	1.42	1.42	0.02
180	CCW	180.00	0.00	0.00	0.42	0.42	-0.98
150	CCW	150.00	0.00	0.00	0.42	0.42	-0.98
120	CCW	119.00	-1.00	0.00	-0.58	-0.58	-1.98
90	CCW	88.00	-2.00	0.00	-1.58	-1.58	-2.98
60	CCW	57.00	-3.00	0.00	-2.58	-2.58	-3.98
30	CCW	27.00	-3.00	0.00	-2.58	-2.58	-3.98
Mean:			-0.42	0.00			
Maximum Hysteresis Error :				0.00			
Maximum Normalized Linearity Error :					-2.58		
	<i>Specification : +/- 3 degrees</i>						
Maximum Total Error :							-3.98
	<i>Specification : +/- 5 degrees</i>						

True North Alignment	
Known Declination:	4.4 EMD
Expected Magnetic Compass Reading for True North:	355.6 Degrees
Actual Magnetic Compass Reading w/ Vane Aligned to 180/360:	357 Degrees
Alignment Error:	-1.40 Degrees
Data Correction:	None
Alignment Correction:	None
Action Taken	
Alignment meets specification. No action required.	

Specification : +/- 2 degrees

Auditor : Darrin Barton

Notes :

Horizontal Wind Speed Audit Data Sheet

Site ID: Vitovsky Elementary (Site 3c)
Date: May 4, 2009
Time: 1630-1730 CDT
Sensor ID: Met One 010 C
Serial #: C3636

Tower Height: 10 Meters
Sensor Level: yes
Cup Condition: good
Bearing Check:

0.2 g-cm CCW
 0.2 g-cm CW

Last Field Calibration: n/a

Audit Device: Anemometer Drive
Model: RM Young 18811
Serial #: 10501
Cert. Expiration: June 18, 2009
Torque Device: RM Young Torque Disc
Serial #: 1

Audit Input CCW (rpm)	Known Input Value (m/h)	Sensor Response (m/h)	Measurement Error (m/h)	Audit Input CW (rpm)	Known Input Value (m/h)	Sensor Response (m/h)	Measurement Error (m/h)
0	0.6	0.6	0.0	0	0.6	0.6	0.0
60	4.2	4.2	0.0	60	4.2	4.2	0.0
160	10.1	10.1	0.0	160	10.1	10.1	0.0
300	18.5	18.5	0.0	300	18.5	18.5	0.0
600	36.4	36.4	0.0	600	36.4	36.4	0.0
900	54.3	54.3	0.0	900	54.3	54.3	0.0

Specification: +/- 0.4

Specification: +/- 0.4

Auditor: Darrin Barton

Notes:

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Temperature Audit Data Sheet

Site ID: Vitovsky Elementary (Site 3c)
Date: May 4, 2009
Time: 1740 CDT
Sensor ID: Met One 060A-2
Serial #: G7946

Sensor Height: 3.5'
Sensor Condition: good
Sensor Level: yes
Aspirator Condition: working
Last Field Calibration: n/a

Audit Device: Digital Thermometer
Model: VWR
Serial #: 230058352
Cert. Expiration: July 29, 2009

Time of the Audit	Type of Comparison	Audit Reference Temperature (deg C)	Station Probe Temperature (deg C)	Measurement Error (deg C)
1740	Collocated Measurement	19.5	19.9	0.4

Specification: +/- 1.0

Auditor: Darrin Barton

Notes:

URS

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Barometric Pressure Audit Data Sheet

Site ID: Vitovsky Elementary (Site 3c)
Date: May 4, 2009
Time: 1740 CDT
Sensor ID: Vaisala
Serial #: unknown

Sensor Height: 3.5'
Sensor Condition: good
Sensor Level: yes
Last Field Calibration: n/a

Audit Device: Barometer/Altimeter
Model: Airs-Vaisala
Serial #: OF1475
Cert. Expiration: May 1, 2009

Time of the Audit	Type of Comparison	Audit Reference Barometric Pressure (mmHg)	Site Sensor Barometric Pressure (mmHg)	Measurement Error (mmHg)
1740	Collocated Measurement	740.3	739.6	-0.7

Specification: +/- 7.6

Auditor: Darrin Barton

Notes:

URS

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Precipitation Audit Data Sheet

Site ID: Vitovsky Elementary (Site 3c)
Date: May 4, 2009
Time: 1750 CDT
Sensor ID: Met One
Serial #: B2029

Sensor Height: 2 inches
Sensor Condition: good
Sensor Level: yes
Sensor Clean: yes
Last Field Calibration: n/a

Audit Device: Acrylic Buret
Model: Cole Parmer
Serial #: 2
Cert. Expiration: none

Time of the Audit	Input Volume (mL)	Gauge Input (inches)	Response (inches)	Measurement Error (%)
1750	80.0	0.10	0.09	-10.0%

Specification: +/- 10.0

Auditor : Darrin Barton

URS

Rev. 8.7 (3/08)

Notes:

**PM₁₀ / VOLUMETRIC FLOW CONTROL (VFC)
PERFORMANCE AUDIT DATA**

Site ID: Vitovsky Elementary (Site 3c)
 Date: May 4, 2009
 Time: 1755-1805 CDT
 Pressure (P_a) (mm Hg): 740.3
 Temperature (T_a) (F): 67.1
 Temperature (T_a) (C): 19.5

Audit Device: Variable Orifice
 Serial #: W-90
 Slope: 0.96956
 Intercept: 0.00007
 Correlation: 0.99996
 Cert. Exp. Date: September 30, 2009

PM ₁₀ AUDIT DATA						
Sampler ID#	Audit Pressure Drop (ΔH) ("H ₂ O)	Stagnation Pressure (ΔP _{STG}) ("H ₂ O)	Audit Flow (Q _a) (m ³ /min)	Sampler Flow ¹ (Q _s) (m ³ /min)	Percent Difference ² (Sampler vs. Audit)	Percent Difference ³ (Audit vs. Design)
6673	2.90	19.3	1.104	1.094	-0.9%	-2.3%
6671	2.90	18.6	1.104	1.111	0.6%	-2.3%

1. From Sampler Look-Up Table or Calibration Data
2. Acceptance Criteria: ±7%
3. Acceptance Criteria: ±10%

SAMPLER CALIBRATION DATA					
Sampler ID#	Pressure Ratio (P ₁ /P _a) (mm Hg)	Calibration Date	Sampler Slope	Sampler Intercept	Sampler Correlation
6673	0.9513	11/20/08	11.9097	0.1892	1.0000
6671	0.9531	11/20/08	12.0629	0.1696	1.0000

AUDITOR: Darrin Barton

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Notes:

Cr⁶⁺ Sampler
PERFORMANCE AUDIT DATA

Site ID: Vitovsky Elementary (Site 3c)
Date: May 4, 2009
Time: 1605-1615
ANALYZER ID: ERG CR6
Serial #: 9.0

Audit Flow Meter : BGI
Model No : deltaCal
Serial No : 579
Cert. Exp. Date : 9/5/2009

Sample Inlet Flow Audit Data		
Designed Flow Rate (LPM)	Measured Flow Rate (LPM)	Percent Difference ₂
15	15.3	2.00%
15	16.4	9.33%

2. Acceptance Criteria: ± 10%

AUDITOR: Darrin Barton

Notes:

URS
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Wind Direction Audit Data Sheet (360 Sensor)

Site ID: Midlothian Jaycee Park (Site 4)
 Date: May 4, 2009
 Time: 1505-1535 CDT
 Sensor ID: Met One 020 B
 Serial #: H7308

Tower Height: 10 Meters
 Sensor Level: yes
 Vane Condition: good
 Bearing Condition: good
 Last Field Calibration: n/a

Audit Device: Compass Transit
 Model: Lietz 115
 Serial #: 32100
 Cert. Expiration: November 18, 2009
 Linearity Device: Met One Degree Wheel
 Serial #: 1

Reference Angle (deg)	Sensor Rotation	Sensor Response (deg)	Measurement Error (deg)	Hysteresis Error (deg)	Normalized Linearity Error (deg)	Average Error (deg)	Total Error (deg)
0	CW	360.00	0.00		0.75		
30	CW	27.00	-3.00		-2.25		
60	CW	57.00	-3.00		-2.25		
90	CW	87.00	-3.00		-2.25		
120	CW	118.00	-2.00		-1.25		
150	CW	149.00	-1.00		-0.25		
180	CW	180.00	0.00		0.75		
210	CW	211.00	1.00		1.75		
240	CW	241.00	1.00		1.75		
270	CW	271.00	1.00		1.75		
300	CW	300.00	0.00		0.75		
330	CW	330.00	0.00		0.75		
360	CCW	360.00	0.00	0.00	0.75	0.75	0.35
330	CCW	330.00	0.00	0.00	0.75	0.75	0.35
300	CCW	300.00	0.00	0.00	0.75	0.75	0.35
270	CCW	271.00	1.00	0.00	1.75	1.75	1.35
240	CCW	241.00	1.00	0.00	1.75	1.75	1.35
210	CCW	211.00	1.00	0.00	1.75	1.75	1.35
180	CCW	180.00	0.00	0.00	0.75	0.75	0.35
150	CCW	149.00	-1.00	0.00	-0.25	-0.25	-0.65
120	CCW	118.00	-2.00	0.00	-1.25	-1.25	-1.65
90	CCW	87.00	-3.00	0.00	-2.25	-2.25	-2.65
60	CCW	57.00	-3.00	0.00	-2.25	-2.25	-2.65
30	CCW	27.00	-3.00	0.00	-2.25	-2.25	-2.65
Mean:			-0.75	0.00			
Maximum Hysteresis Error :				0.00			
Maximum Normalized Linearity Error :					-2.25		
Specification : +/- 3 degrees							
Maximum Total Error :							-2.65
Specification : +/- 5 degrees							

True North Alignment	
Known Declination:	4.4 EMD
Expected Magnetic Compass Reading for True North:	355.6 Degrees
Actual Magnetic Compass Reading w/ Vane Aligned to 180/360:	356 Degrees
Alignment Error:	-0.40 Degrees
Data Correction:	None
Alignment Correction:	None
Action Taken	
Alignment meets specification. No action required.	

Specification : +/- 2 degrees

Auditor : Darrin Barton

Notes :



Rev. 8.7 (3/08)

Horizontal Wind Speed Audit Data Sheet

Site ID: Midlothian Jaycee Park (Site 4)
Date: May 4, 2009
Time: 1505-1535 CDT
Sensor ID: Met One 010 B
Serial #: unknown

Tower Height: 10 Meters
Sensor Level: yes
Cup Condition: good
Bearing Check:

0.2 g-cm CCW
 0.2 g-cm CW

Last Field Calibration: n/a

Audit Device: Anemometer Drive
Model: RM Young 18811
Serial #: 10501
Cert. Expiration: June 18, 2009
Torque Device: RM Young Torque Disc
Serial #: 1

Audit Input CCW (rpm)	Known Input Value (m/h)	Sensor Response (m/h)	Measurement Error (m/h)	Audit Input CW (rpm)	Known Input Value (m/h)	Sensor Response (m/h)	Measurement Error (m/h)
0	0.6	0.6	0.0	0	0.6	0.6	0.0
60	4.2	4.2	0.0	60	4.2	4.2	0.0
160	10.1	10.1	0.0	160	10.1	10.1	0.0
300	18.5	18.5	0.0	300	18.5	18.5	0.0
600	36.4	36.4	0.0	600	36.4	36.4	0.0
900	54.3	54.3	0.0	900	54.3	54.3	0.0

Specification: +/- 0.4

Specification: +/- 0.4

Auditor: Darrin Barton

Notes:

URS
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Temperature Audit Data Sheet

Site ID: Midlothian Jaycee Park (Site 4)
Date: May 4, 2009
Time: 1505 CDT
Sensor ID: Met One 060A-2
Serial #: unknown

Sensor Height: 3.5'
Sensor Condition: good
Sensor Level: yes
Aspirator Condition: working
Last Field Calibration: n/a

Audit Device: Digital Thermometer
Model: VWR
Serial #: 230058352
Cert. Expiration: July 29, 2009

Time of the Audit	Type of Comparison	Audit Reference Temperature (deg C)	Station Probe Temperature (deg C)	Measurement Error (deg C)
1505	Collocated Measurement	21.7	21.2	-0.5

Specification: +/- 1.0

Auditor: Darrin Barton

Notes:

URS

Rev. 8.7 (3/08)

Barometric Pressure Audit Data Sheet

Site ID: Midlothian Jaycee Park (Site 4)
Date: May 4, 2009
Time: 1510 CDT
Sensor ID: Vaisala
Serial #: unknown

Sensor Height: 3.5'
Sensor Condition: good
Sensor Level: yes
Last Field Calibration: n/a

Audit Device: Barometer/Altimeter
Model: Airt-Vaisala
Serial #: OF1475
Cert. Expiration: May 1, 2009

Time of the Audit	Type of Comparison	Audit Reference Barometric Pressure (mmHg)	Site Sensor Barometric Pressure (mmHg)	Measurement Error (mmHg)
1510	Collocated Measurement	741.1	739.6	-1.5

Specification: +/- 7.6

Auditor: Darrin Barton

Notes:

URS
Rev. 8.7 (3/08)

Precipitation Audit Data Sheet

Site ID: Midlothian Jaycee Park (Site 4)
Date: May 4, 2009
Time: 1510 CDT
Sensor ID: Met One
Serial #: unknown

Sensor Height: 2 inches
Sensor Condition: good
Sensor Level: yes
Sensor Clean: yes
Last Field Calibration: n/a

Audit Device: Acrylic Buret
Model: Cole Parmer
Serial #: 2
Cert. Expiration: none

Time of the Audit	Input Volume (mL)	Gauge Input (inches)	Response (inches)	Measurement Error (%)
1510	80.0	0.10	0.09	-10.0%

Specification: +/- 10.0

Auditor : Darrin Barton

URS
Rev. 8.7 (3/08)

Notes:

**PM₁₀ / VOLUMETRIC FLOW CONTROL (VFC)
PERFORMANCE AUDIT DATA**

Site ID: Midlothian Jaycee Park (Site 4)
 Date: May 4, 2009
 Time: 1535-1545 CDT
 Pressure (P_a) (mm Hg): 741.1
 Temperature (T_a) (F): 71.0
 Temperature (T_a) (C): 21.7

Audit Device: Variable Orifice
 Serial #: W-90
 Slope: 0.96956
 Intercept: 0.00007
 Correlation: 0.99996
 Cert. Exp. Date: September 30, 2009

PM ₁₀ AUDIT DATA						
Sampler ID#	Audit Pressure Drop (ΔH) ("H ₂ O)	Stagnation Pressure (ΔP _{STG}) ("H ₂ O)	Audit Flow (Q _a) (m ³ /min)	Sampler Flow ¹ (Q _s) (m ³ /min)	Percent Difference ² (Sampler vs. Audit)	Percent Difference ³ (Audit vs. Design)
6670	3.00	19.6	1.126	1.111	-1.3%	-0.3%
6672	3.00	19.9	1.126	1.117	-0.8%	-0.3%

1. From Sampler Look-Up Table or Calibration Data
2. Acceptance Criteria: ±7%
3. Acceptance Criteria: ±10%

SAMPLER CALIBRATION DATA					
Sampler ID#	Pressure Ratio (P _i /P _a) (mm Hg)	Calibration Date	Sampler Slope	Sampler Intercept	Sampler Correlation
6670	0.9506	11/20/08	12.0629	0.1696	1.0000
6672	0.9498	11/20/08	12.1388	0.1598	1.0000

AUDITOR: Darrin Barton

Notes:

URS
Rev. 8.7 (3/08)

Cr⁶⁺ Sampler
PERFORMANCE AUDIT DATA

Site ID: Midlothian Jaycee Park (Site 4)
 Date: February 25, 2009
 Time: 1550-1600 CDT
 ANALYZER ID: ERG CR6
 Serial #: 16.0

Audit Flow Meter : BGI
 Model No : deltaCal
 Serial No : 579
 Cert. Exp. Date : 9/5/2009

Sample Inlet Flow Audit Data		
Designed Flow Rate (LPM)	Measured Flow Rate (LPM)	Percent Difference ₂
15	15.7	4.67%
15	16.2	8.00%

2. Acceptance Criteria: ± 10%

AUDITOR: Darrin Barton

Notes:

URS
Rev. 8.7 (3/08)

Wind Direction Audit Data Sheet (360 Sensor)

Site ID: Midlothian Water Treatment Plant(Site 5)
 Date: May 4, 2009
 Time: 1320-1400
 Sensor ID: Met One 020 B
 Serial #: K3069

CDT

Tower Height: 10 Meters
 Sensor Level: yes
 Vane Condition: good
 Bearing Condition: good
 Last Field Calibration: n/a

Audit Device: Compass Transit
 Model: Lietz 115
 Serial #: 32100
 Cert. Expiration: November 18, 2009
 Linearity Device: Met One Degree Wheel
 Serial #: 1

Reference Angle (deg)	Sensor Rotation	Sensor Response (deg)	Measurement Error (deg)	Hysteresis Error (deg)	Normalized Linearity Error (deg)	Average Error (deg)	Total Error (deg)
0	CW	1.00	1.00		-0.75		
30	CW	29.60	-0.40		-2.15		
60	CW	62.00	2.00		0.25		
90	CW	92.00	2.00		0.25		
120	CW	121.00	1.00		-0.75		
150	CW	151.00	1.00		-0.75		
180	CW	181.00	1.00		-0.75		
210	CW	211.00	1.00		-0.75		
240	CW	242.00	2.00		0.25		
270	CW	270.00	0.00		-1.75		
300	CW	300.00	0.00		-1.75		
330	CW	331.00	1.00		-0.75		
360	CCW	0.30	0.30	0.70	-1.45	-1.10	-1.50
330	CCW	332.00	2.00	1.00	0.25	-0.25	-0.65
300	CCW	302.00	2.00	2.00	0.25	-0.75	-1.15
270	CCW	272.00	2.00	2.00	0.25	-0.75	-1.15
240	CCW	243.00	3.00	1.00	1.25	0.75	0.35
210	CCW	213.00	3.00	2.00	1.25	0.25	-0.15
180	CCW	184.00	4.00	3.00	2.25	0.75	0.35
150	CCW	153.00	3.00	2.00	1.25	0.25	-0.15
120	CCW	124.00	4.00	3.00	2.25	0.75	0.35
90	CCW	93.00	3.00	1.00	1.25	0.75	0.35
60	CCW	62.00	2.00	0.00	0.25	0.25	-0.15
30	CCW	32.00	2.00	1.60	0.25	-0.95	-1.35
Mean:			1.75	1.61			
Maximum Hysteresis Error :				3.00			
Maximum Normalized Linearity Error :					2.25		
	<i>Specification : +/- 3</i>	<i>degrees</i>					
Maximum Total Error :							-1.50
	<i>Specification : +/- 5</i>	<i>degrees</i>					

True North Alignment	
Known Declination:	4.4 EMD
Expected Magnetic Compass Reading for True North:	355.6 Degrees
Actual Magnetic Compass Reading w/ Vane Aligned to 180/360:	356 Degrees
Alignment Error:	-0.40 Degrees
Data Correction:	None
Alignment Correction:	None
Action Taken	
Alignment meets specification. No action required.	

Specification : +/- 2 degrees

Auditor : Darrin Barton

Notes :



Rev. 8.7 (3/08)

Horizontal Wind Speed Audit Data Sheet

Site ID: Midlothian Water Treatment Plant(Site 5)
Date: May 4, 2009
Time: 1320-1400 CDT
Sensor ID: Met One 010 B
Serial #: G1380

Tower Height: 10 Meters
Sensor Level: yes
Cup Condition: good
Bearing Check:

0.2 g-cm CCW
 0.2 g-cm CW

Last Field Calibration: n/a

Audit Device: Anemometer Drive
Model: RM Young 18811
Serial #: 10501
Cert. Expiration: June 18, 2009
Torque Device: RM Young Torque Disc
Serial #: 1

Audit Input CCW (rpm)	Known Input Value (m/h)	Sensor Response (m/h)	Measurement Error (m/h)	Audit Input CW (rpm)	Known Input Value (m/h)	Sensor Response (m/h)	Measurement Error (m/h)
0	0.6	0.6	0.0	0	0.6	0.6	0.0
60	4.2	4.2	0.0	60	4.2	4.2	0.0
160	10.1	10.1	0.0	160	10.1	10.1	0.0
300	18.5	18.5	0.0	300	18.5	18.5	0.0
600	36.4	36.4	0.0	600	36.4	36.4	0.0
900	54.3	54.3	0.0	900	54.3	54.3	0.0

Specification: +/- 0.4

Specification: +/- 0.4

Auditor: Darrin Barton

Notes:

URS
 Rev. 8.7 (3/08)

Temperature Audit Data Sheet

Site ID: Midlothian Water Treatment Plant(Site 5)
Date: May 4, 2009
Time: 1325-1400 CDT
Sensor ID: Met One 060A-2
Serial #: unknown

Sensor Height: 3.5'
Sensor Condition: good
Sensor Level: yes
Aspirator Condition: working
Last Field Calibration: n/a

Audit Device: Digital Thermometer
Model: VWR
Serial #: 230058352
Cert. Expiration: July 29, 2009

Time of the Audit	Type of Comparison	Audit Reference Temperature (deg C)	Station Probe Temperature (deg C)	Measurement Error (deg C)
1325	Collocated Measurement	20.3	20.4	0.1
1400	Collocated Measurement	22.5	21.9	-0.6

Specification: +/- 1.0

Auditor: Darrin Barton

Notes:

URS

Rev. 8.7 (3/08)

Barometric Pressure Audit Data Sheet

Site ID: Midlothian Water Treatment Plant(Site 5) Sensor Height: 3.5'
Date: May 4, 2009 Sensor Condition: good
Time: 1325-1400 CDT Sensor Level: yes
Sensor ID: Vaisala Last Field Calibration: n/a
Serial #: unknown

Audit Device: Barometer/Altimeter
Model: Airs-Vaisala
Serial #: OF1475
Cert. Expiration: May 1, 2009

Time of the Audit	Type of Comparison	Audit Reference Barometric Pressure (mmHg)	Site Sensor Barometric Pressure (mmHg)	Measurement Error (mmHg)
1325	Collocated Measurement	741.2	740.1	-1.1
1400	Collocated Measurement	740.7	739.8	-0.9

Specification: +/- 7.6

Auditor: Darrin Barton

Notes:

URS

Rev. 8.7 (3/08)

Precipitation Audit Data Sheet

Site ID: Midlothian Water Treatment Plant(Site 5)
Date: May 4, 2009
Time: 1420 CDT
Sensor ID: Met One
Serial #: unknown

Sensor Height: 2 inches
Sensor Condition: good
Sensor Level: yes
Sensor Clean: yes
Last Field Calibration: n/a

Audit Device: Acrylic Buret
Model: Cole Parmer
Serial #: 2
Cert. Expiration: none

Time of the Audit	Input Volume (mL)	Gauge Input (inches)	Response (inches)	Measurement Error (%)
1420	80.0	0.10	0.14	40.0%

Specification: +/- 10.0

Auditor : Darrin Barton

URS

Rev. 8.7 (3/08)

Notes: One side of the tipping bucket would bounce twice when full, thus biasing the reading by .01" when tipped on that side of the rain gauge.

**PM₁₀ / VOLUMETRIC FLOW CONTROL (VFC)
PERFORMANCE AUDIT DATA**

Site ID: Midlothian Water Treatment Plant(Site 5)
 Date: May 4, 2009
 Time: 1430-1440 CDT
 Pressure (P_a) (mm Hg): 740.7
 Temperature (T_a) (F): 72.5
 Temperature (T_a) (C): 22.5

Audit Device: Variable Orifice
 Serial #: W-90
 Slope: 0.96956
 Intercept: 0.00007
 Correlation: 0.99996
 Cert. Exp. Date: September 30, 2009

PM ₁₀ AUDIT DATA						
Sampler ID#	Audit Pressure Drop (ΔH) ("H ₂ O)	Stagnation Pressure (ΔP _{STG}) ("H ₂ O)	Audit Flow (Q _a) (m ³ /min)	Sampler Flow ¹ (Q _s) (m ³ /min)	Percent Difference ² (Sampler vs. Audit)	Percent Difference ³ (Audit vs. Design)
583	2.80	19.9	1.090	1.119	2.6%	-3.5%
584	2.80	19.4	1.090	1.129	3.5%	-3.5%

1. From Sampler Look-Up Table or Calibration Data
2. Acceptance Criteria: ±7%
3. Acceptance Criteria: ±10%

SAMPLER CALIBRATION DATA					
Sampler ID#	Pressure Ratio (P _i /P _a) (mm Hg)	Calibration Date	Sampler Slope	Sampler Intercept	Sampler Correlation
583	0.9498	11/02/08	12.2892	0.1501	1.0000
584	0.9511	11/20/08	12.2246	0.1485	1.0000

AUDITOR: Darrin Barton

Notes:

URS
Rev. 8.7 (3/08)

Cr⁶⁺ Sampler PERFORMANCE AUDIT DATA

Site ID: Midlothian Water Treatment Plant(Site 5)
Date: May 4, 2009
Time: 1430-1440 CDT
ANALYZER ID: ERG CR6
Serial #: 14.0

Audit Flow Meter : BGI
Model No : deltaCal
Serial No : 579
Cert. Exp. Date : 9/5/2009

Sample Inlet Flow Audit Data		
Designed Flow Rate (LPM)	Measured Flow Rate (LPM)	Percent Difference ₂
15	16.4	9.33%
15	16.2	8.00%

2. Acceptance Criteria: ± 10%

AUDITOR: Darrin Barton

Notes:

URS
 Rev. 8.7 (3/08)

APPENDIX B

Audit Standards Traceability Documentation



501 W. 6th St.
Austin, TX 78701
512/478-8793

10713 Metric Blvd.
Austin, TX 78758
512/837-8991

106 W. Nakoma St.
San Antonio, TX 78216
210/681-4280

G4 SPATIAL TECHNOLOGIES

November 18, 2008

Mr. Darrin Barton
URS, Inc.
9400 Amberglenn
Austin, TX 78729

Dear Mr. Barton,

This letter certifies that your Lietz Sokkisha Model 115 transit, serial number 32100, has been examined and found to be operating within normal parameters. Inasmuch as this is a manual instrument using vernier scales, accuracy is highly dependent on the care and skill of the operator. However, when used properly, the instrument will generate one minute precision in both vertical and horizontal readings. A complete calibration of the instrument was preformed and all features are functioning to within factory specifications.

Please let me know if I can be of further assistance.

Thank you,
Neal Hagood

A handwritten signature in cursive script that reads "Neal Hagood".



CALIBRATION PROCEDURE
18801/18810 ANEMOMETER DRIVE

DWG: CP18801(A)

REV: C101107 PAGE: 3 of 3
 BY: TJT DATE: 10/11/07
 CHK: JC W.C. GAS-12

CERTIFICATE OF CALIBRATION AND TESTING

MODEL: 18810 (Comprised of Models 18820 Control Unit & 18831 Motor Assembly)
 SERIAL NUMBER: 10501

R. M. Young Company certifies that the above equipment was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating the measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

Nominal Motor Rpm	Output Frequency Hz (1)	Calculated Rpm (2)	Indicated Rpm (3)
60	320	60	60
120	640	120	120
240	1280	240	240
420	2240	420	420
600	3200	600	600
810	4320	810	810
990	5280	990	990

Clockwise and Counterclockwise rotation verified

- (1) Measured at the optical encoder output.
- (2) Frequency output produces 320 pulses per revolution of motor shaft.
- (3) Indicated on the Control Unit LCD display. Note: Divide indicated rpm by 10 to calculate actual motor rpm.

* Indicates out of tolerance

No Calibration Adjustments Required As Found As Left

Traceable frequency meter used in calibration Model: DPS740 SN: 4863

Date of inspection 6/18/08
 Inspection Interval One Year

Tested By RP



Calibration
Certificate No. 1750.01

Calibration complies with ISO 9001
ISO/IEC 17025 AND ANSI/NCSL Z540-1



Cert. No.: 4000-1939847

Traceable® Certificate of Calibration for Digital Thermometer

Instrument Identification:

URS Corp., 9400 Amberglan Blvd., Attn: James Clarke, Austin, TX 78729 U.S.A. (RMA:944141)

Model: 61220-601 S/N: 230058352 Manufacturer : Control Company
Model: 61220-604 S/N: 230058318

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC191	A79341		
Thermistor Module	A27129	10/17/08	1000228266
Temperature Probe	3039	10/26/08	A7710039-4
Temperature Probe	149	3/06/09	A82225037-3
Thermistor Module	A17118	8/30/08	A7831032
Temperature Calibration Bath TC218	A73332		

Certificate Information:

Technician: 68 Procedure: CAL-06 Cal Date: 7/29/08 Cal Due: 7/29/09
Test Conditions: 23.0°C 49.0 %RH 1014 mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±uc	TUR
°C	0.001	-0.003	Y	0.001	-0.003	Y	-0.049	0.051	0.013	3.8:1
°C	25.001	24.998	Y	25.001	24.998	Y	24.951	25.051	0.013	3.8:1
°C	60.001	59.995	Y	60.001	59.995	Y	59.951	60.051	0.013	2.8:1
°C	100.001	100.008	Y	100.001	100.008	Y	99.951	100.051	0.013	3.8:1

This Instrument was calibrated using instruments traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±uc=Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=k(Max-Min)/2; Date=MM/DD/YY

Wallace Berry
Wallace Berry, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Digital Thermometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Thermometers change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Control Company is an ISO 17025:2005 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.
Control Company is ISO 9001:2000 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-AQ-HOU.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

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Vernon Hills, Illinois

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NIST Traceable Calibration Report

URS Corp
9400 Amberglenn Blvd
Austin, TX 78729



Reference Number: 15405

PO Number: 94684



Manufacturer: AIR Inc.
Model Number: AIR-HB-1A
Description: Pressure, Barometer, Digital
Asset Number: 17414-12
Serial Number: OF1475

Calibration Date: 05/01/2008
Calibration Due Date: 05/01/2009
Calibration Interval: 12 Months
Condition As Found: Out of Tolerance
Condition As Left: In Tolerance, No adjustment
Procedure: NAVAIR 17-20MP-216

Remarks:

Performed calibration traceable to NIST. The barometer was outside of the manufacturer's accuracy "As Found" for barometric pressure. Applied -0.97 mBar correction prior to performing "As Left" data. Performed "As Left" documentation. Barometer is now within manufacturer's accuracy and in good working order. The calibration was performed at Latitude 42.233603 Longitude -87.948128 at an elevation of 737' above sea level. Received State-Meter was returned with a dead battery. "As Found" data was performed with zero correction applied as when the battery is replaced the correction needs to be manually re-entered via holding down the Set/Zero Key along with the Mode key, arrow down or up to the correction desired, release keys. The "As Left" data was collected after inputting the -0.97 mBar correction which was noted on the previous NIST certificate # 19600.

Standards Utilized

Asset No.	Manufacturer	Model No.	Description	Cal. Date	Due Date
CP05020	DH INSTRUMENTS INC	RPM4 BA100KS	Calibrator, Reference Pressure Monitor	12/03/2007	12/03/2008

Calibration Data

FUNCTION TESTED	Nominal Value	As Found	As Left	Out of Tolerance	CALIBRATION TOLERANCE
Ambient Pressure	990.0 mbar	991.53	990.06	X	989.5 to 990.5 mbar [TUR 4.0:1] [EMU 0.12 mbar]
Decreasing Barometric Pressure Test	1030.0 mbar	1031.5	1030.1	X	1029.5 to 1030.5 mbar [TUR 3.9:1] [EMU 0.13 mbar]
	950.0 mbar	951.6	950.0	X	949.5 to 950.5 mbar [TUR 4.2:1] [EMU 0.12 mbar]
	805.0 mbar	806.3	804.8	X	804.5 to 805.5 mbar [TUR 4.7:1] [EMU 0.11 mbar]
	610.0 mbar	611.3	609.9	X	609.5 to 610.5 mbar [TUR 5.6:1] [EMU 0.089 mbar]
Increasing Barometric Pressure Test	805.0 mbar	806.3	804.8	X	804.5 to 805.5 mbar [TUR 4.7:1] [EMU 0.11 mbar]
	950.0 mbar	951.6	950.0	X	949.5 to 950.5 mbar [TUR 4.2:1] [EMU 0.12 mbar]
	1030.0 mbar	1031.5	1030.1	X	1029.5 to 1030.5 mbar [TUR 3.9:1] [EMU 0.13 mbar]

Temperature: 22° C
Humidity: 50% RH
Test No.: 27567

Calibration Performed By:			Quality Reviewer:	
Ziegler, Jeff	Metrologist	847-327-5335	Collins, Bob	5/1/2008
Name	Title	Phone	Name	Date

This report may not be reproduced, except in full, without written permission of InnoCal. The results stated in this report relate only to the items tested or calibrated. Measurements reported herein are traceable to SI units via national standards maintained by NIST and were performed in compliance with MIL-STD-45662A, ANSI/NCSL Z540-1-1994, 10CFR50, Appendix B, ISO 9002-94, and ISO 17025:2005. The estimated measurement uncertainty (EMU) reported on this certificate is being reported at a confidence level of 95% or K=2 unless otherwise noted in the remarks section.



TISCH ENVIRONMENTAL, INC.
 145 SOUTH MIAMI AVE.
 VILLAGE OF CLEVELAND, OH 45002
 513.467.9000
 877.263.7610 TOLL FREE
 513.467.9009 FAX
 WWW.TISCH-ENV.COM

AIR POLLUTION MONITORING EQUIPMENT

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Sep 30, 2008 Roots-meter S/N 9833620 Ta (K) - 295
 Operator Tisch Orifice I.D. - W90 Pa (mm) - 749.3

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.2580	4.3	1.50
2	NA	NA	1.00	0.9670	7.2	2.50
3	NA	NA	1.00	0.8800	8.6	3.00
4	NA	NA	1.00	0.8150	10.0	3.50
5	NA	NA	1.00	0.6170	17.1	6.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
0.9902	0.7871	1.2223	0.9942	0.7903	0.7685
0.9863	1.0200	1.5779	0.9904	1.0242	0.9921
0.9845	1.1187	1.7285	0.9885	1.1233	1.0868
0.9826	1.2057	1.8670	0.9866	1.2106	1.1739
0.9732	1.5773	2.4445	0.9771	1.5837	1.5369
Qstd slope (m) = 1.54836			Qa slope (m) = 0.96956		
intercept (b) = 0.00011			intercept (b) = 0.00007		
coefficient (r) = 0.99996			coefficient (r) = 0.99996		
y axis = SQRT[H2O(Pa/760)(298/Ta)]			y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

$$Vstd = \text{Diff. Vol} [(Pa - \text{Diff. Hg}) / 760] (298/Ta)$$

$$Qstd = Vstd / \text{Time}$$

$$Va = \text{Diff Vol} [(Pa - \text{Diff Hg}) / Pa]$$

$$Qa = Va / \text{Time}$$

For subsequent flow rate calculations:

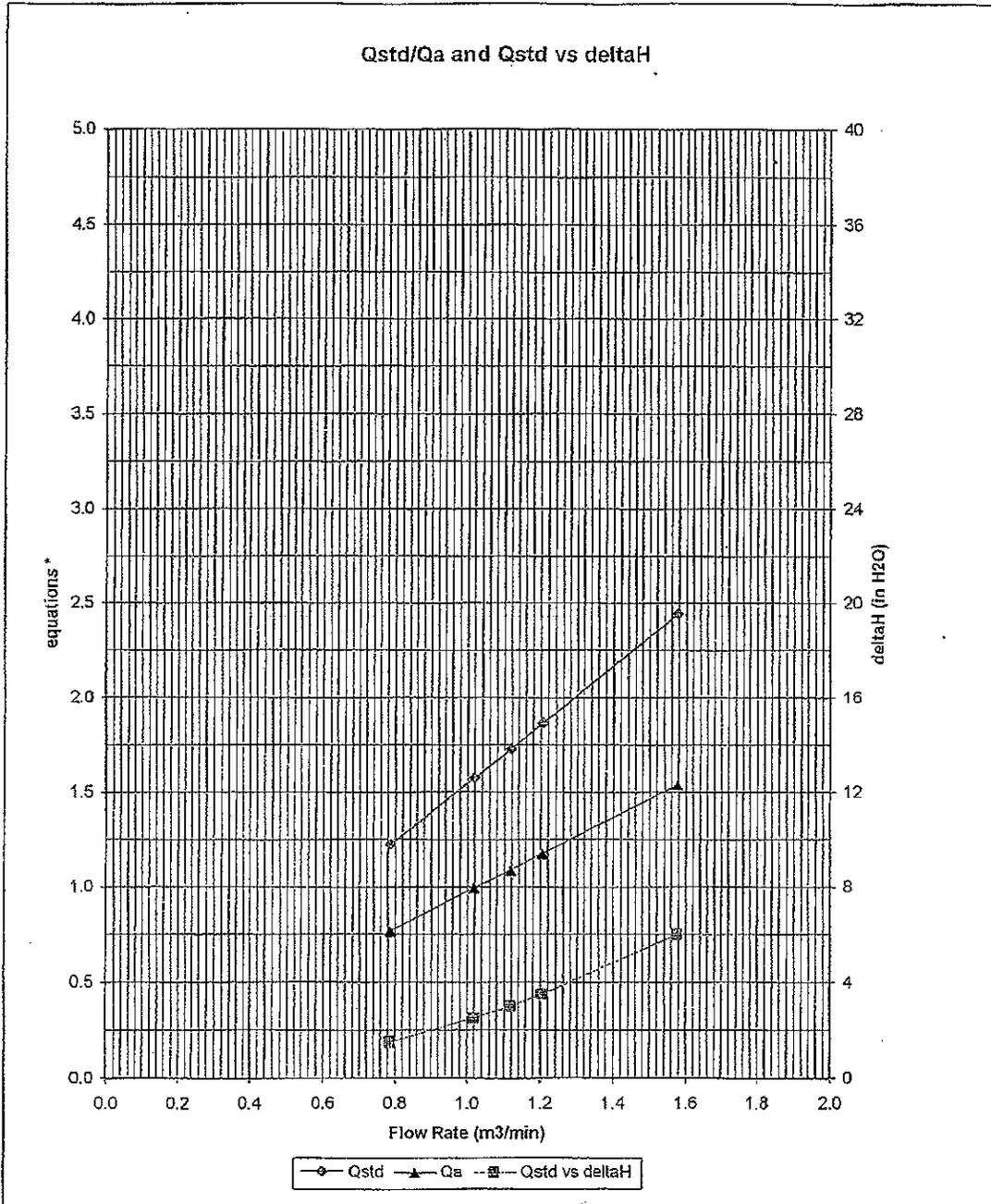
$$Qstd = 1/m \{ [\text{SQRT} (H2O (Pa/760) (298/Ta))] - b \}$$

$$Qa = 1/m \{ [\text{SQRT} H2O (Ta/Pa)] - b \}$$



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 WWW.TISCH-ENV.COM

AIR POLLUTION MONITORING EQUIPMENT



* y-axis equations:

Qstd series:
$$\sqrt{\Delta H \left(\frac{P_a}{P_{std}} \right) \left(\frac{T_{std}}{T_a} \right)}$$

Qa series:
$$\sqrt{\Delta H (T_a / P_a)}$$

#W90

BGI INCORPORATED 58 GUINAN STREET WALTHAM, MA 02451
NIST Traceable Calibration Facility, Registered ISO 9002:2000



CERTIFICATE OF CALIBRATION - NIST TRACEABILITY

(Refer to instruction manual for further details of calibration)

deltaCal Serial Number: 000579

DATE 5-SEPT-08

Calibration Operator: Brian DeVoe

Critical Venturi Flow Meter: Max Uncertainty = 0.346%
Serial Number: 1A *CEESI NVLAP NIST Data File 07BGI-0001*
Serial Number: 2A *CEESI NVLAP NIST Data File 07BGI-0003*
Serial Number: 4A *CEESI NVLAP NIST Data File 07BGI-0002*

Room Temperature : Uncertainty = 0.071% Room Temperature: 23.6 C
Brand: *Ertco* Serial Number: 9216
NIST Traceability No. 516837

deltaCal:

Ambient Temperature (set): 23.6 C

Aux (filter) Temperature (set): 23.6 C

Barometric Pressure and Absolute Pressure

Merriam Model 355-A10900 Accuracy: 0.020%
S/N 953100-A1
NIST Traceable Meriam Procedure A35924

deltaCal:

Barometric Pressure (set): 761.97 mm of Hg

Results of Venturi Calibration

Flow Rate (Q) vs. Pressure Drop (ΔP).

Where: Q=Lpm, ΔP = Cm of H₂O

$$Q = 3.58950 \Delta P^{0.52278}$$

Overall Uncertainty: 0.35%

Date Placed In Service _____
(To be filled in by operator upon receipt)

Recommended Recalibration Date _____
(12 months from date placed in service)

Revised: July 2007

To Check a deltaCal

5-Sep-08 BD

1.5-19.5 VER 2.56

Mbar= 1015.87

mm of Hg 761.97

Maximum allowable error at any flow rate is .75%. Room Temp= 23.6 C

Serial No. 579

Venturi	Reading Abs. P Crit. Vent. MB	Reading Abs. P Crit. Vent. mm of Hg	Crit. Vent. Temp	TRUE Flow Lpm	A True Flow Lpm	deltaCal Indicated	% Error
# 2	291.94	219.0	23.20	2.44	2.45	2.44	-0.40
	523.84	392.9	23.20	4.42	4.43	4.42	-0.30
# 1	348.17	261.1	23.20	10.21	10.25	10.18	-0.69
	532.84	399.7	23.20	15.70	15.77	15.74	-0.17
	645.42	484.1	23.20	19.05	19.13	19.18	0.26
Average %						-0.26	