
**Audit Report for
Chattanooga Hamilton County Air Pollution
Control Bureau
Ambient Air Monitoring Network**

**PO: 555799
October 2019**

Prepared for:

**Chattanooga Hamilton County Air Pollution Control Bureau
6125 Preservation Drive
Chattanooga, TN 37416**

Prepared by:



**4577E NW 6th Street
Gainesville, FL 32605**

**Report Submitted
October 2019**

Table of Contents

1.0 Introduction.....	1
2.0 Audits of PM Samplers and Gaseous Pollutant Monitors	4
2.1 Audit Methods and Equipment	4
2.1.1 Certification of EEMS Standards	4
2.1.2 EPA Protocol Gas Standards and EEMS Mobile Laboratory	4
2.1.3 Level-2 Ozone Standard.....	4
2.2 Summary of Field Audit Activities	5
2.3 Specific PM Sampler and Gaseous Monitor Audit Activities.....	8
2.3.1 PM Sampler Audits	9
2.3.2 Gaseous Pollutant Monitor Audits	9
2.3.3 Ozone Monitor Audits.....	10
3.0 Audit Results	11
3.1 PM Audit Results	11
3.2 TTP Ozone Audit Results	13
3.3 Recommendations	14

List of Tables

Table 1 Station Locations.....	2
Table 2 Equipment Audited.....	2
Table 3 OAQPS Approved Audit Levels	9
Table 4 East Ridge PM Sampler Verification	11
Table 5 Riverside/Siskin Partisol 2025i PM Samplers Verifications	12
Table 6 Riverside/Siskin T640 PM Sampler Verification.....	13
Table 7 Ozone TTP Audit Results.....	14

List of Figures

Figure 1 EEMS Mobile Laboratory.....	5
Figure 2 Standard Station Sample Inlet.....	6
Figure 3 Soddy Daisy Audit Line Connection	7
Figure 4 Eastside Audit Line Connection.....	8
Figure 5 East Ridge Site.....	8

List of Appendices

- Appendix A** Audit Data Sheets
- Appendix B** Maps of Locations
- Appendix C** Audit Standards Certifications

List of Acronyms and Abbreviations

APCB	Air Pollution Control Bureau
CFR	Code of Federal Regulations
CO	carbon monoxide
DAS	data acquisition system
EEMS	Environmental, Engineering & Measurement Services, Inc.
EPA	Environmental Protection Agency
FRM	Federal Reference Method
lpm	liters per minute
mm Hg	millimeters of mercury
mps	meters per second
NIST	National Institute of Standards and Technology
NO	nitric oxide
NPAP	National Performance Audit Program
OAQPS	Office of Air Quality Planning and Standards
O ₃	Ozone
PE	Performance Evaluation
PM	particulate matter
PM _{2.5}	particulate matter of 2.5 microns in aerodynamic diameter or less
PM ₁₀	particulate matter of 10 microns in aerodynamic diameter or less
ppm	parts per million
PSD	prevention of significant deterioration
QA	quality assurance
rpm	revolutions per minute
S/N	serial number
SLAMS	State or Local Air Monitoring Stations
SO ₂	sulfur dioxide
SOP	standard operating procedure
TBD	To Be Determined
TTP	Through-The-Probe
µg/m ³	micrograms per cubic meter

1.0 Introduction

Environmental, Engineering & Measurement Services, Inc. (EEMS) was contracted by the Chattanooga Hamilton County Air Pollution Control Bureau to conduct audits of the county's local ambient air quality gaseous and PM pollutant monitoring network. The air quality monitoring network consists of four stations in the greater Chattanooga, Tennessee area which are operated by the Air Pollution Control Bureau (APCB). The purpose of this network is to fulfill and comply with specific monitoring requirements for State or Local Air Monitoring Stations (SLAMS) as specified by the EPA in 40 CFR Part 58. The operation of the monitoring stations must meet the requirements in 40 CFR Part 58 Appendix A, which defines the quality assurance (QA) requirements for gaseous and PM pollutant ambient air monitoring. The audits performed by EEMS under this contract fulfilled the requirement for independent audits of all pollutant monitors in the network. The QA requirements can be found at:

http://www.epa.gov/ttnamti1/files/ambient/pm25/qa/appd_validation_template_amtic.pdf.

The trained and certified EEMS field scientist followed the National Performance Audit Program (NPAP) procedures while performing audits of all air quality monitors.

The NPAP is a QA program implemented by the EPA Office of Air Quality Planning and Standards (OAQPS) to conduct audits of gaseous air pollutant monitors by standard methods throughout each region of the U.S. The method includes introduction of National Institute of Standards and Traceability (NIST) audit gases to the station monitors through the ambient sample inlet, including all filters and fittings. This method evaluates the measurement system accuracy including the entire sample train. The audit gas concentrations are also measured and verified with an audit analyzer on-site which is calibrated at the time of the audit.

EEMS performed the NPAP equivalent Through-The-Probe (TTP) audits following EPA's Quality Assurance Guidance Document – *Method Compendium – Field Standard Operating Procedures (SOP) for the Federal PM_{2.5} Performance Evaluation Program and NPAP TTP Audit SOP*. All procedures and guidance documents used to perform these audits can be found at the EPA OAQPS website: <https://www3.epa.gov/ttn/amtic/npepqa.html>

This report includes the results of the TTP and PM sampler audits conducted on October 11th, 2019. The ambient air quality monitors audited were operating at four stations in the network:

1. Soddy Daisy High School
2. Eastside Filter Plant
3. East Ridge
4. Riverside/Siskin

All stations are in the Chattanooga Metro area and in Hamilton County, TN. Map images of the sites are included in Appendix B. The monitoring station locations were obtained during the audit visits with a GPS and are provided in Table 1.

Table 1 Station Locations

Station	Latitude	Longitude	Elevation (meters)	AQS Number
Soddy Daisy	35.233508	-85.181605	281	47-065-1011
Eastside	35.102651	-85.162223	282	47-065-4003
East Ridge	34.994412	-85.242918	219	TBD
Riverside/Siskin	35.050916	-85.293007	218	TBD

The audited monitoring equipment operating at each site is presented in Table 2.

Table 2 Equipment Audited

Station	Parameter	Manufacture	Model	Serial #.
Soddy Daisy	Ozone	Thermo Environmental	49i-A1NAA	1435663748
Eastside	Ozone	Thermo Environmental	49i-A1NAA	1435663747
East Ridge	PM _{2.5}	R & P (Thermo)	2025	2025A 90709
Riverside/Siskin	PM _{2.5}	Thermo Environmental	2025i	2025i-W210841606
Riverside/Siskin	PM _{2.5} (collocated)	Thermo Environmental	2025i	2025i-W211311610
Riverside/Siskin	PM _{2.5}	T-API	T640i	83

Additional support materials operated at each of the gaseous pollutant monitoring stations include zero air generation systems and level 3 certified standard photometers to verify Quality Check (QC) concentrations. Details of the audits are presented in the following sections:

Section 2.0	Audits of PM Samplers and Gaseous Pollutant Monitors
Section 3.0	Audit Results
Appendix A	Audit Data Sheets
Appendix B	Maps of Locations
Appendix C	Audit Standards Certifications

The preparation of this report, and all the activities and tasks described in this report, were performed by an accredited NPAP TTP mobile lab Field Scientist. All procedures followed during the audits were provided by OAQPS and are available at the OAQPS website: <http://www.epa.gov/tn/amtic/npepqa.html>.

Any questions related to this audit or audit report should be addressed to:

Eric Hebert
EEMS Inc.
P.O. Box 357593
Gainesville, FL 32635
Telephone: 352-262-0802
Fax: 352-371-1144
E-mail: eric.hebert@ee-ms.com

2.0 Audits of PM Samplers and Gaseous Pollutant Monitors

2.1 Audit Methods and Equipment

This section describes the steps followed in the performance of these audits. EEMS followed the document referenced above rigorously. Supplemental guidance and excerpts from the method can be found at <http://www.epa.gov/ttn/amtic/npepqa.html>.

2.1.1 Certification of EEMS Standards

All standards owned and maintained by EEMS undergo annual NIST traceable certification. The standards include EPA Protocol Gas standards, digital multi-meters, meteorological sensors and standards, and various flow rate measurement systems including two DeltaCal devices. Copies of the annual certifications of the EEMS standards used for these audits are included in Appendix C.

2.1.2 EPA Protocol Gas Standards and EEMS Mobile Laboratory

EEMS owns and maintains a Thermo Environmental Instruments Inc. (TEI) 48i TLE carbon monoxide analyzer which is used to verify standard audit gas concentrations during TTP audits. The CO analyzer is mounted and operated in a climate controlled mobile laboratory with a multi-gas dilution system and NIST traceable EPA Protocol Gas standards. The NIST gases include cylinders of high concentration CO, low concentration CO, and a multi-blend NO, CO, SO₂ mixture. The mobile laboratory is equipped with its own data acquisition system (DAS).

An image of the EEMS mobile laboratory is included in Figure 1.

2.1.3 Level-2 Ozone Standard

EEMS owns and maintains a Thermo Environmental Instruments Inc. (TEI) 49iPS level-2 ozone standard photometer. The standard photometers are mounted and operated in the climate controlled mobile laboratory with a multi-gas dilution system and other standards. The digital output of the standard photometer is monitored and recorded by the mobile laboratory DAS.

The standard photometer is transported to Research Triangle Park (RTP) North Carolina, or one of the EPA regional laboratories for verification at least twice per year. The most recent verification with the Standard Reference Photometer (SRP) from EPA Region 4 is included in Appendix C.

Figure 1 EEMS Mobile Laboratory

2.2 Summary of Field Audit Activities

On Friday October 11th, EEMS personnel met APCB personnel at the Soddy Daisy site for the TTP audit of the station's ozone pollutant monitor. Following the Soddy Daisy site audit, EEMS personnel accompanied APCB personnel to the Eastside station for the TTP audit of the site ozone monitor. While performing the ozone audits the station shelter temperature measurement systems were verified using the EEMS standard Resistance Temperature Detector (RTD). Both shelter temperature systems were within 0.5 degree C accuracy.

After completing the ozone audit at Eastside, both PM monitor sites (East Ridge and Riverside/Siskin) were visited to verify the PM samplers using the EEMS standard. Field activities were completed that afternoon.

Images of some of the sites, samplers, and audit connections are provided in Figures 2 through 5 below.

Figure 2 Standard Station Sample Inlet



Figure 3 Soddy Daisy Audit Line Connection



Figure 4 Eastside Audit Line Connection**Figure 5 East Ridge Site**

2.3 Specific PM Sampler and Gaseous Monitor Audit Activities

This section describes the procedures used for audits of each parameter at all sites. More detailed NPAP TTP audit procedures can be found at: <http://www.epa.gov/ttn/amtic/npepqa.html>.

2.3.1 PM Sampler Audits

The sampler dates and times were verified for all samplers and found to be within 1 minute of the actual time. The PM₁₀ (first cut point) inlets were removed from the samplers and the EEMS DeltaCal or BIOS dry piston standard were installed at the inlet to the sample train. The samplers' operational variables (flow rate, temperature, and pressure) were compared to the variables as measured by the standards. The audit results are included in Section 3.

2.3.2 Gaseous Pollutant Monitor Audits

The EEMS mobile laboratory audit analyzer and systems were allowed to warm-up overnight prior to the station audits. The network stations currently only monitor ambient ozone concentrations. Ozone was the only gaseous pollutant variable audited for the network.

All monitor sample pressures and flow rates were checked prior to, and following the introduction of audit gas to ensure that changes to the routine sampling variables did not occur as a result of the addition of audit gas (test atmosphere) to the sampling inlet.

Audit test gas concentrations were selected from the 40 CFR part 58 approved audit levels which are provided in Table 3. Audit concentrations from at least three audit levels were selected for each monitor audit. The final results of the TTP audits are included in Section 3.0.

Table 3 OAQPS Approved Audit Levels

Audit Level	Concentration Range, ppm			
	O ₃	SO ₂	NO ₂	CO
1	0.004 - 0.0059	0.0003 - 0.0029	0.0003 - 0.0029	0.020 - 0.059
2	0.006 - 0.019	0.0030 - 0.0049	0.0030 - 0.0049	0.060 - 0.199
3	0.020 - 0.039	0.0050 - 0.0079	0.0050 - 0.0079	0.200 - 0.899
4	0.040 - 0.069	0.0080 - 0.0199	0.0080 - 0.0199	0.900 - 2.999
5	0.070 - 0.089	0.0200 - 0.0499	0.0200 - 0.0499	3.000 - 7.999
6	0.090 - 0.119	0.0500 - 0.0999	0.0500 - 0.0999	8.000 - 15.999
7	0.120 - 0.139	0.1000 - 0.1499	0.1000 - 0.2999	16.000 - 30.999
8	0.140 - 0.169	0.1500 - 0.2599	0.3000 - 0.4999	31.000 - 39.999
9	0.170 - 0.189	0.2600 - 0.7999	0.5000 - 0.7999	40.000 - 49.999
10	0.190 - 0.259	0.8000 - 1.000	0.8000 - 1.000	50.000 - 60.000

To be equivalent to the NPAP, a PE requires that the station monitor be challenged (TTP) with audit gas standards of known concentration from at least three approved audit levels, and verified with an audit standard. The NPAP requires challenges at levels 3, 4, and 5, and recommends a challenge at level 1 or 2. The selected audit levels for the PE should be defined in the Quality Assurance Project Plan (QAPP) developed by the Primary Quality Assurance Organization (PQAO) responsible for managing the monitoring network. The QAPP must be approved by the state or federal authority responsible for oversight of the program.

The compliance of audit levels with federal regulations and guidelines should be determined during the routine Technical Systems Audits (TSA) performed by the oversight authority. It is not the responsibility of the EEMS field scientist to select audit levels. The field scientist relies on the station manager to select the audit levels since the station manager is familiar with the QAPP and the concentrations measured at the monitoring station. In general, the audit levels should be representative of the measured ambient concentrations to be equivalent to the federal NPAP.

2.3.3 Ozone Monitor Audits

Ozone audit test gas was generated with the ozone generator in the mobile laboratory's dilution system. The audit gas was delivered to the station monitor through the station inlet (including all fittings and filters) using a Teflon bag over the inlet funnel to allow the audit gas to vent at the inlet. The audit gas concentration was measured with the standard photometer in the mobile lab and recorded by the mobile lab DAS. Averages were reported by the site operator from the station monitor and compared to the averages for the same time period from the standard.

It should be noted that each station utilized two data loggers. The official station concentrations used for the audits were obtained from the Agilare 8872 DAS that is used to report data to AQS. It was observed that the 8872 truncates values to the whole number (ppb), while the backup logger (ESC 8816) reports one additional digit. For some audit points the backup logger values were closer to the audit standard measurement. All loggers at each station were reporting almost identical values. Any reported difference can be attributed to rounding differences in logger setup programs and slight time differences between logger clocks. Results recorded from both loggers at each station are reported in Section 3.0.

3.0 Audit Results

3.1 PM Audit Results

All operational and reporting PM samplers were verified with the EEMS DeltaCal or BIOS dry piston standard. The samplers' date and time and all operational variables were found to be within acceptable limits. The East Ridge sampler results are summarized in Table 4 and the results of the three samplers at Riverside/Siskin are included in Tables 5 and 6.

Table 4 East Ridge PM Sampler Verification

Delta Cal Version	N/A		Site	East Ridge	
Time Verified	Yes		R&P Partisol 2025	PM2.5	
Date Verified	Yes		s/n =	2025 90709	
DeltaCal S/N	1196	EEMS # 01451	DeltaCal Cert Date:	2/15/2019	
Date & Site of Verification	10/11/2019 East Ridge Partisol 2025 PM-2.5				
Parameter	DeltaCal	Site Sampler	Difference	Acceptance Criteria	Pass/Fail
Flow Rate (Lpm)	16.90	16.70	-1.19%	$\leq \pm 4\%$	Pass
Design Flow Rate (16.67 Lpm)	16.90		1.39%	$\leq \pm 4\%$	Pass
Ambient Temperature (°C)	31.0	30.3	-0.7	$\leq \pm 2^\circ\text{C}$	Pass
Barometric Pressure (mm Hg)	741.5	742	0.5	$\leq \pm 5 \text{ mm Hg}$	Pass
Filter Temperature (°C)	30.8	31.2	0.4	$\leq \pm 2^\circ\text{C}$	Pass
Leak Check			3 mm	$\leq 25\text{mm}/\text{min}$	Pass

Table 5 Riverside/Siskin Partisol 2025i PM Samplers Verifications

Delta Cal Version	N/A		Site		Riverside/Siskin
Date/Time verified	Yes	POC1	PM-2.5	Partisol 2025i Primary	s/n= 2025iW210841606
Date/Time verified	Yes	POC2	PM-2.5	Partisol 2025i colo	s/n= 2025iW211311610
DeltaCal S/N	1196	EEMS # 01451	DeltaCal Cert Date:		2/15/2019
Date & Site of Verification	10/11/2019 Riverside/Siskin Partisol 2025i PM-2.5 POC1				
Parameter	DeltaCal	Site Sampler	Difference	Acceptance Criteria	Pass/Fail
Flow Rate (Lpm)	16.59	16.68	0.53%	$\leq \pm 4\%$	Pass
Design Flow Rate (16.67 Lpm)	16.59		-0.47%	$\leq \pm 4\%$	Pass
Ambient Temperature (°C)	26.3	26.6	0.3	$\leq \pm 2^\circ\text{C}$	Pass
Barometric Pressure (mm Hg)	743.0	743	0	$\leq \pm 5$ mm Hg	Pass
Filter Temperature (°C)	27.7	28.1	0.4	$\leq \pm 2^\circ\text{C}$	Pass
Leak Check			4	≤ 25 mm/min	Pass
Date & Site of Verification	10/11/2019 Riverside/Siskin Partisol 2025i PM-2.5 POC2				
Parameter	DeltaCal	Site Sampler	Difference	Acceptance Criteria	Pass/Fail
Flow Rate (Lpm)	16.32	16.67	2.13%	$\leq \pm 4\%$	Pass
Design Flow Rate (16.67 Lpm)	16.32		-2.08%	$\leq \pm 4\%$	Pass
Ambient Temperature (°C)	27.2	27.3	0.1	$\leq \pm 2^\circ\text{C}$	Pass
Barometric Pressure (mm Hg)	743.0	743	0	$\leq \pm 5$ mm Hg	Pass
Filter Temperature (°C)	28.4	28.5	0.1	$\leq \pm 2^\circ\text{C}$	Pass
Leak Check			6	≤ 25 mm/min	Pass

Table 6 Riverside/Siskin T640 PM Sampler Verification

Delta Cal Version	N/A	Site			Riverside/Siskin
Date & Time verified	Yes	PM-2.5	T-API T640	s/n= 83	
BIOS Definer S/N	159956	EEMS # 01414	BIOS Definer Cert Date:		2/8/2019
Date & Site of Verification	10/11/2019 Riverside/Siskin T640 PM-2.5				
Parameter	BIOS or Std	T640	Difference	Acceptance Criteria	Pass/Fail
Flow Rate (Lpm)	4.79	4.99	4.12%	4.75 – 5.25	Pass
Ambient Temperature (°C)	26.7	26.4	-0.3	≤ ± 2 °C	Pass
Shelter Temperature (°C)	28.5	28.4	-0.1	≤ ± 2 °C	Pass
Barometric Pressure (mm Hg)	742	741.4	-0.6	≤ ± 5 mm Hg	Pass
Dust test	11.1	11.3	0.2	≤ ± 0.5	Pass
Zero test	0.0	0.0			Pass

3.2 TTP Ozone Audit Results

The audit results of the two ozone monitors in the network were within the acceptance limit of ±10% of any single audit point and within the warning limit of ± 7% (± 1.5 ppb for level 2). The results of the O₃ audits are summarized in Table 7. The field audit forms are included in Appendix A.

Table 7 Ozone TTP Audit Results

Site & Audit Level	Audit Value ppm	Primary Logger 8872			Backup Logger 8816			Pass Warning Fail 8872 Logger
		ppm	Difference		ppm	Difference		
			Actual	%		Actual	%	
Soddy Daisy level 6	0.10651	0.108	0.0015	1.4	0.10820	0.0017	1.6	Pass
Soddy Daisy level 4	0.06874	0.069	0.0003	0.4	0.06970	0.0010	1.4	Pass
Soddy Daisy level 3	0.03629	0.036	-0.0003	-0.8	0.03669	0.0004	1.1	Pass
Soddy Daisy level 2	0.01494	0.014	-0.0009	N/A	0.01482	-0.0001	N/A	Pass
Eastside level 6	0.11215	0.112	-0.0001	-0.1	0.11150	-0.0006	-0.6	Pass
Eastside level 4	0.06842	0.068	-0.0004	-0.6	0.06843	0.0000	0.0	Pass
Eastside level 3	0.03830	0.038	-0.0003	-0.8	0.03806	-0.0002	-0.6	Pass
Eastside level 2	0.01556	0.015	-0.0006	N/A	0.01556	0.000	N/A	Pass

3.3 Recommendations

The stations in the Chattanooga Hamilton County monitoring network are in good condition and very well maintained and operated. The site operators are knowledgeable and maintain the site monitors in very good working order. Operation of the network may benefit by training additional personnel for backup capacity and to fill in during absence of the regular site operators.

APPENDIX A

Audit Data Sheets

FINAL SUMMARY AUDIT REPORT
EEMS Van-3

Site Name: Soddy Daisy High School - 8872

Audit Date: 10/11/2019

Parameter	NPAP Lab Response (ppm)	Station Response (ppm)	Percent Difference	Actual Difference (ppm)	Pass/Fail	Warning
Ozone						
O3 Audit Level 6	0.10651	0.10800	1.4	0.0015	Pass	
O3 Audit Level 4	0.06874	0.06900	0.4	0.0003	Pass	
O3 Audit Level 3	0.03629	0.03600	-0.8	-0.0003	Pass	
O3 Audit Level 2	0.01494	0.01400	-6.3	-0.0009	Pass	
O3 Audit Level 1					N/A	
Carbon Monoxide						
CO Audit Point #1					N/A	
CO Audit Point #2					N/A	
CO Audit Point #3					N/A	
CO Audit Point #4					N/A	
CO Audit Point #5					N/A	
Oxides of Nitrogen						
NO Audit Point #1					N/A	
NO Audit Point #2					N/A	
NO Audit Point #3					N/A	
NO Audit Point #4					N/A	
NO Audit Point #5					N/A	
NOx Audit Point #1					N/A	
NOx Audit Point #2					N/A	
NOx Audit Point #3					N/A	
NOx Audit Point #4					N/A	
NOx Audit Point #5					N/A	
NO2 Audit Point #1					N/A	
NO2 Audit Point #2					N/A	
NO2 Audit Point #3					N/A	
NO2 Audit Point #4					N/A	
Converter Efficiency NO2 Audit Point #1					N/A	
Converter Efficiency NO2 Audit Point #2					N/A	
Converter Efficiency NO2 Audit Point #3					N/A	
Converter Efficiency NO2 Audit Point #4					N/A	
Sulfur Dioxide						
SO2 Audit Point #1					N/A	
SO2 Audit Point #2					N/A	
SO2 Audit Point #3					N/A	
SO2 Audit Point #4					N/A	
SO2 Audit Point #5					N/A	

* = CFR Appendix A Audit Levels

FINAL PE THROUGH-THE-PROBE AUDIT REPORT

EEMS Van-3

OZONE REPORT

Site Name: Soddy Daisy High School - 8872
 Auditor: Eric Hebert (EEMS)
 Station Manager: Kathy Jones (supervisor) / Jim Long (operator)

Airs ID: 470651011
 Audit Date: 10/11/19

MOBILE PE LAB INSTRUMENTS

Instrument:	Ozone	CO	-
Manufacturer:	Thermo	0	
Model:	49i-A1ZCA	0	
Serial Number:	1180030022	0	
Calibration Date:	06/12/19	1/0/1900	
Slope:	0.9984	0	
Intercept (PPM):	0.0002709	0	

STATION INSTRUMENT INFORMATION

Instrument:	Ozone	
Manufacturer/Model #:	TEI	49i-A1NAA
Property Number:	1435663748	
Calibration Date:	04/15/19	
Slope/Intercept (PPB):	LOGGER =	8872
Indicated Flow (LPM):	1.00 / 0.63	
In-Line Filter Change:	09/24/19	
Manifold Type:	1/4 " Teflon & GLASS	

FINAL 8872 LOGGER OZONE AUDIT RESULTS

Mobile Lab O3 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.10651	0.10800	1.4
0.06874	0.06900	0.4
0.03629	0.03600	-0.8
0.01494	0.01400	-6.3
-0.00016	0.00000	

	<u>Pass/Fail</u>	<u>Warning</u>
O3 Audit Level 6	Pass	
O3 Audit Level 4	Pass	
O3 Audit Level 3	Pass	
O3 Audit Level 2	Pass	
O3 Audit Level 1	N/A	

Auditor	<u>Eric Hebert</u>
	Print
	<i>Eric Hebert</i>
	Signature
EPA person notified in case of audit failure	

Audit Limits

Pass	Bias < ±15.1% OR difference from actual concentration < 24 hour allowable drift (0.003 ppm)
Fail	Bias > ±15.1% AND difference from actual concentration > 24 hour allowable drift (0.003 ppm)
Warning	Bias > ±10% AND difference from actual concentration > 0.0015 ppm

Comments:

The site monitor and level-2 audit standard pressures were monitored throughout the audit to ensure they were within acceptable limits. The 8872 logger truncates ozone data which can result in greater differences from the audit standard concentrations.

FINAL SUMMARY AUDIT REPORT
EEMS Van-3

Site Name: Soddy Daisy High School - 8816

Audit Date: 10/11/2019

Parameter	NPAP Lab Response (ppm)	Station Response (ppm)	Percent Difference	Actual Difference (ppm)	Pass/Fail	Warning
Ozone						
O3 Audit Level 6	0.10651	0.10820	1.6	0.0017	Pass	
O3 Audit Level 4	0.06874	0.06970	1.4	0.0010	Pass	
O3 Audit Level 3	0.03629	0.03669	1.1	0.0004	Pass	
O3 Audit Level 2	0.01494	0.01482	-0.8	-0.0001	Pass	
O3 Audit Level 1					N/A	
Carbon Monoxide						
CO Audit Point #1					N/A	
CO Audit Point #2					N/A	
CO Audit Point #3					N/A	
CO Audit Point #4					N/A	
CO Audit Point #5					N/A	
Oxides of Nitrogen						
NO Audit Point #1					N/A	
NO Audit Point #2					N/A	
NO Audit Point #3					N/A	
NO Audit Point #4					N/A	
NO Audit Point #5					N/A	
NOx Audit Point #1					N/A	
NOx Audit Point #2					N/A	
NOx Audit Point #3					N/A	
NOx Audit Point #4					N/A	
NOx Audit Point #5					N/A	
NO2 Audit Point #1					N/A	
NO2 Audit Point #2					N/A	
NO2 Audit Point #3					N/A	
NO2 Audit Point #4					N/A	
Converter Efficiency NO2 Audit Point #1					N/A	
Converter Efficiency NO2 Audit Point #2					N/A	
Converter Efficiency NO2 Audit Point #3					N/A	
Converter Efficiency NO2 Audit Point #4					N/A	
Sulfur Dioxide						
SO2 Audit Point #1					N/A	
SO2 Audit Point #2					N/A	
SO2 Audit Point #3					N/A	
SO2 Audit Point #4					N/A	
SO2 Audit Point #5					N/A	

* = CFR Appendix A Audit Levels

FINAL PE THROUGH-THE-PROBE AUDIT REPORT

EEMS Van-3

OZONE REPORT

Site Name: Soddy Daisy High School - 8816
 Auditor: Eric Hebert (EEMS)
 Station Manager: Kathy Jones (supervisor) / Jim Long (operator)

Airs ID: 470651011
 Audit Date: 10/11/19

MOBILE PE LAB INSTRUMENTS

Instrument:	Ozone	CO
Manufacturer:	Thermo	0
Model:	49i-A1ZCA	0
Serial Number:	1180030022	0
Calibration Date:	06/12/19	1/0/1900
Slope:	0.9984	0
Intercept (PPM):	0.0002709	0

STATION INSTRUMENT INFORMATION

Instrument:	Ozone	
Manufacturer/Model #:	TEI	49i-A1NAA
Property Number:	1435663748	
Calibration Date:	04/15/19	
Slope/Intercept (PPB):	LOGGER =	8816
Indicated Flow (LPM):	1.00 / 0.63	
In-Line Filter Change:	09/24/19	
Manifold Type:	1/4 " Teflon & GLASS	

FINAL 8816 OZONE AUDIT RESULTS

Mobile Lab O3 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.10651	0.10820	1.6
0.06874	0.06970	1.4
0.03629	0.03669	1.1
0.01494	0.01482	-0.8
-0.00016	-0.00030	

	<u>Pass/Fail</u>	<u>Warning</u>
O3 Audit Level 6	Pass	
O3 Audit Level 4	Pass	
O3 Audit Level 3	Pass	
O3 Audit Level 2	Pass	
O3 Audit Level 1	N/A	

Auditor	<u>Eric Hebert</u>
	Print
	<i>Eric Hebert</i>
	Signature
EPA person notified in case of audit failure	

Audit Limits

Pass	Bias < ±15.1% OR difference from actual concentration < 24 hour allowable drift (0.003 ppm)
Fail	Bias > ±15.1% AND difference from actual concentration > 24 hour allowable drift (0.003 ppm)
Warning	Bias > ±10% AND difference from actual concentration > 0.0015 ppm

Comments:

The site monitor and level-2 audit standard pressures were monitored throughout the audit to ensure they were within acceptable limits.

FINAL SUMMARY AUDIT REPORT
EEMS Van-3

Site Name: Eastside Filter Plant - 8872

Audit Date: 10/11/2019

Parameter	NPAP Lab Response (ppm)	Station Response (ppm)	Percent Difference	Actual Difference (ppm)	Pass/Fail	Warning
Ozone						
O3 Audit Level 6	0.11215	0.11200	-0.1	-0.0001	Pass	
O3 Audit Level 4	0.06842	0.06800	-0.6	-0.0004	Pass	
O3 Audit Level 3	0.03830	0.03800	-0.8	-0.0003	Pass	
O3 Audit Level 2	0.01556	0.01500	-3.6	-0.0006	Pass	
O3 Audit Level 1					N/A	
Carbon Monoxide						
CO Audit Point #1					N/A	
CO Audit Point #2					N/A	
CO Audit Point #3					N/A	
CO Audit Point #4					N/A	
CO Audit Point #5					N/A	
Oxides of Nitrogen						
NO Audit Point #1					N/A	
NO Audit Point #2					N/A	
NO Audit Point #3					N/A	
NO Audit Point #4					N/A	
NO Audit Point #5					N/A	
NOx Audit Point #1					N/A	
NOx Audit Point #2					N/A	
NOx Audit Point #3					N/A	
NOx Audit Point #4					N/A	
NOx Audit Point #5					N/A	
NO2 Audit Point #1					N/A	
NO2 Audit Point #2					N/A	
NO2 Audit Point #3					N/A	
NO2 Audit Point #4					N/A	
Converter Efficiency NO2 Audit Point #1					N/A	
Converter Efficiency NO2 Audit Point #2					N/A	
Converter Efficiency NO2 Audit Point #3					N/A	
Converter Efficiency NO2 Audit Point #4					N/A	
Sulfur Dioxide						
SO2 Audit Point #1					N/A	
SO2 Audit Point #2					N/A	
SO2 Audit Point #3					N/A	
SO2 Audit Point #4					N/A	

FINAL PE THROUGH-THE-PROBE AUDIT REPORT

EEMS Van-3

OZONE REPORT

Site Name: Eastside Filter Plant - 8872
 Auditor: Eric Hebert (EEMS)
 Station Manager: Kathy Jones (supervisor) / Jim Long (operator)

Airs ID: 470654003
 Audit Date: 10/11/19

MOBILE PE LAB INSTRUMENTS

Instrument:	Ozone	CO	-
Manufacturer:	Thermo	0	
Model:	49i-A1ZCA	0	
Serial Number:	1180030022	0	
Calibration Date:	06/12/19	1/0/1900	
Slope:	0.9984	0	
Intercept (PPM):	0.0002709	0	

STATION INSTRUMENT INFORMATION

Instrument:	Ozone	
Manufacturer/Model #:	TEI	49i-A1NAA
Property Number:	1435663747	
Calibration Date:	02/21/19	
Slope/Intercept (PPB):	LOGGER =	8872
Indicated Flow (LPM):	0.66 / 0.52	
In-Line Filter Change:	09/23/19	
Manifold Type:	1/4 " Teflon & GLASS	

FINAL 8872 OZONE AUDIT RESULTS

Mobile Lab O3 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.11215	0.11200	-0.1
0.06842	0.06800	-0.6
0.03830	0.03800	-0.8
0.01556	0.01500	-3.6
0.00025	0.00000	

	<u>Pass/Fail</u>	<u>Warning</u>
O3 Audit Level 6	Pass	
O3 Audit Level 4	Pass	
O3 Audit Level 3	Pass	
O3 Audit Level 2	Pass	
O3 Audit Level 1	N/A	

Auditor	<u>Eric Hebert</u>	Print
	<i>Eric Hebert</i>	Signature
EPA person notified in case of audit failure		

Audit Limits

Pass	Bias < ±15.1% OR difference from actual concentration < 24 hour allowable drift (0.003 ppm)
Fail	Bias > ±15.1% AND difference from actual concentration > 24 hour allowable drift (0.003 ppm)
Warning	Bias > ±10% AND difference from actual concentration > 0.0015 ppm

Comments:

The site monitor and level-2 audit standard pressures were monitored throughout the audit to ensure they were within acceptable limits. The 8872 logger truncates ozone data which can result in greater differences from the audit standard concentrations.

FINAL SUMMARY AUDIT REPORT
EEMS Van-3

Site Name: Eastside Filter Plant - 8816

Audit Date: 10/11/2019

Parameter	NPAP Lab Response (ppm)	Station Response (ppm)	Percent Difference	Actual Difference (ppm)	Pass/Fail	Warning
Ozone						
O3 Audit Level 6	0.11215	0.11150	-0.6	-0.0006	Pass	
O3 Audit Level 4	0.06842	0.06843	0.0	0.0000	Pass	
O3 Audit Level 3	0.03830	0.03806	-0.6	-0.0002	Pass	
O3 Audit Level 2	0.01556	0.01556	0.0	0.0000	Pass	
O3 Audit Level 1					N/A	
Carbon Monoxide						
CO Audit Point #1					N/A	
CO Audit Point #2					N/A	
CO Audit Point #3					N/A	
CO Audit Point #4					N/A	
CO Audit Point #5					N/A	
Oxides of Nitrogen						
NO Audit Point #1					N/A	
NO Audit Point #2					N/A	
NO Audit Point #3					N/A	
NO Audit Point #4					N/A	
NO Audit Point #5					N/A	
NOx Audit Point #1					N/A	
NOx Audit Point #2					N/A	
NOx Audit Point #3					N/A	
NOx Audit Point #4					N/A	
NOx Audit Point #5					N/A	
NO2 Audit Point #1					N/A	
NO2 Audit Point #2					N/A	
NO2 Audit Point #3					N/A	
NO2 Audit Point #4					N/A	
Converter Efficiency NO2 Audit Point #1					N/A	
Converter Efficiency NO2 Audit Point #2					N/A	
Converter Efficiency NO2 Audit Point #3					N/A	
Converter Efficiency NO2 Audit Point #4					N/A	
Sulfur Dioxide						
SO2 Audit Point #1					N/A	
SO2 Audit Point #2					N/A	
SO2 Audit Point #3					N/A	
SO2 Audit Point #4					N/A	

FINAL PE THROUGH-THE-PROBE AUDIT REPORT

EEMS Van-3

OZONE REPORT

Site Name: Eastside Filter Plant - 8816
 Auditor: Eric Hebert (EEMS)
 Station Manager: Kathy Jones (supervisor) / Jim Long (operator)

Airs ID: 470654003
 Audit Date: 10/11/19

MOBILE PE LAB INSTRUMENTS

Instrument:	Ozone	CO
Manufacturer:	Thermo	0
Model:	49i-A1ZCA	0
Serial Number:	1180030022	0
Calibration Date:	06/12/19	1/0/1900
Slope:	0.9984	0
Intercept (PPM):	0.0002709	0

STATION INSTRUMENT INFORMATION

Instrument:	Ozone	
Manufacturer/Model #:	TEI	49i-A1NAA
Property Number:	1435663747	
Calibration Date:	02/21/19	
Slope/Intercept (PPB):	LOGGER =	8816
Indicated Flow (LPM):	0.66 / 0.52	
In-Line Filter Change:	09/23/19	
Manifold Type:	1/4 " Teflon & GLASS	

FINAL 8816 OZONE AUDIT RESULTS

Mobile Lab O3 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.11215	0.11150	-0.6
0.06842	0.06843	0.0
0.03830	0.03806	-0.6
0.01556	0.01556	0.0
0.00025	0.00000	

O3 Audit Level 6
 O3 Audit Level 4
 O3 Audit Level 3
 O3 Audit Level 2
 O3 Audit Level 1

Pass/Fail
Pass
Pass
Pass
Pass
N/A

Warning

Auditor	<u>Eric Hebert</u>
	Print
	<i>Eric Hebert</i>
	Signature
EPA person notified in case of audit failure	

Audit Limits

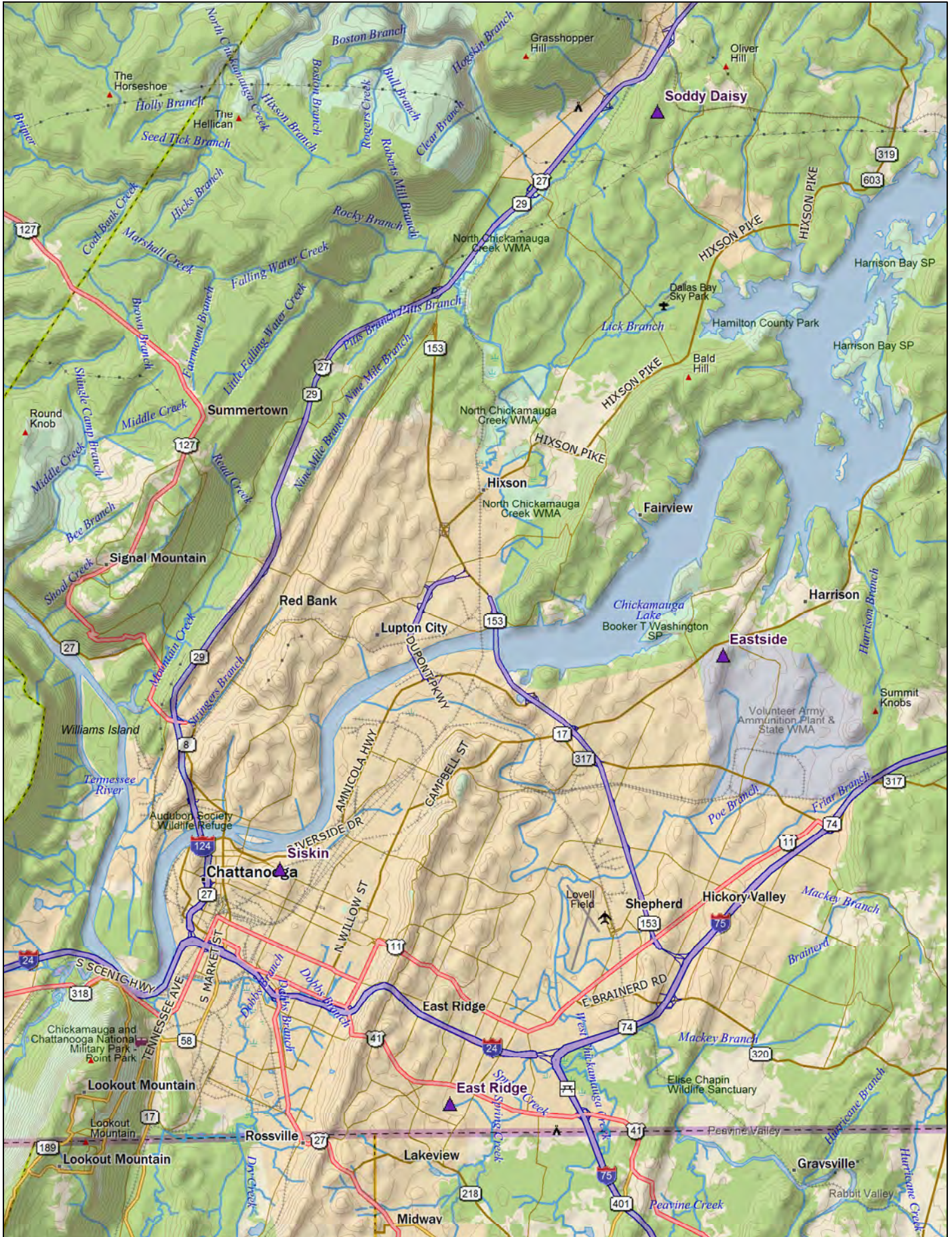
Pass	Bias < ±15.1% OR difference from actual concentration < 24 hour allowable drift (0.003 ppm)
Fail	Bias > ±15.1% AND difference from actual concentration > 24 hour allowable drift (0.003 ppm)
Warning	Bias > ±10% AND difference from actual concentration > 0.0015 ppm

Comments:

The site monitor and level-2 audit standard pressures were monitored throughout the audit to ensure they were within acceptable limits.

APPENDIX B

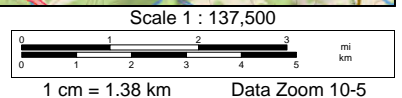
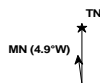
Maps of Locations

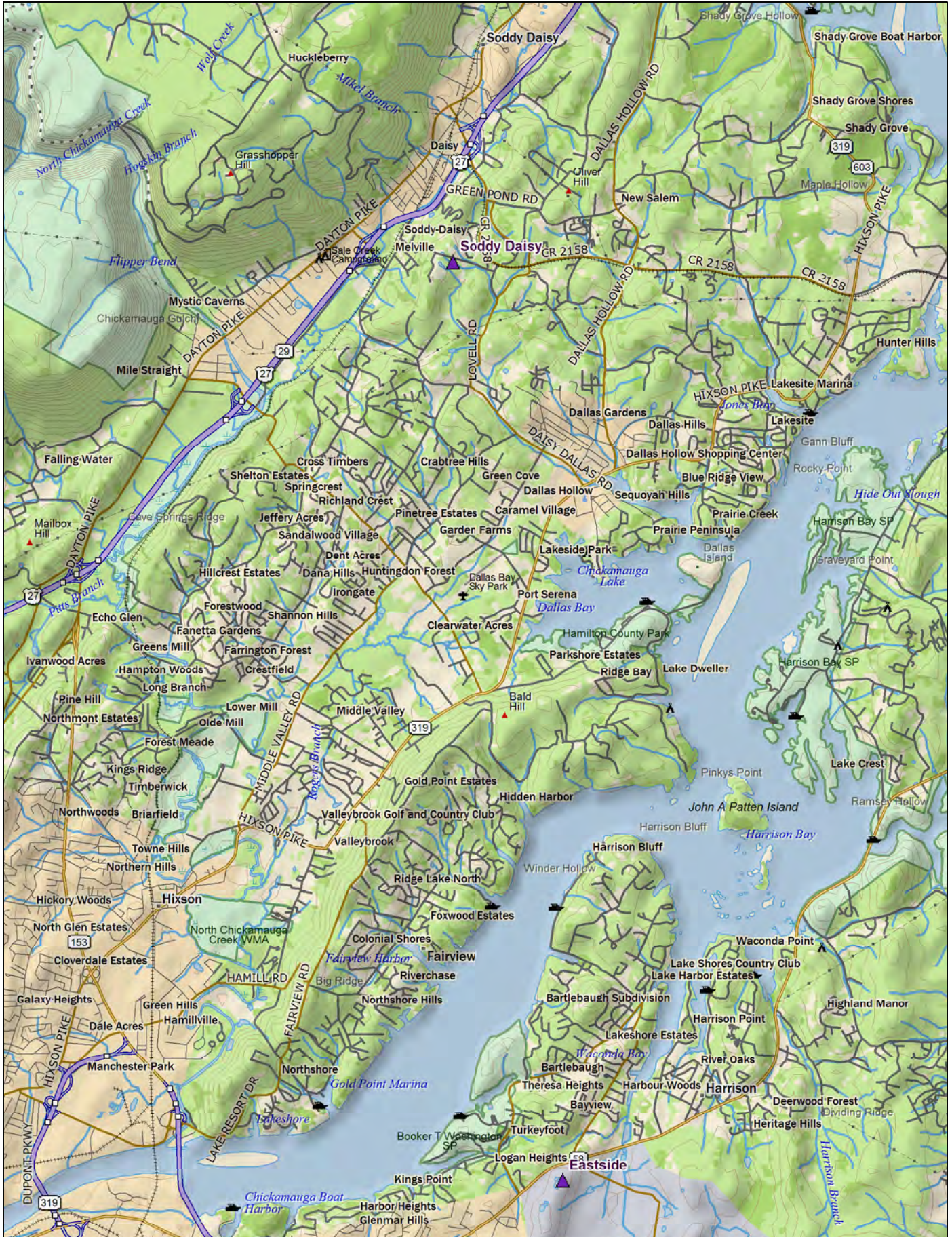


Data use subject to license.

© DeLorme. Topo North America™ 10.

www.delorme.com





Data use subject to license.

© DeLorme. Topo North America™ 10.

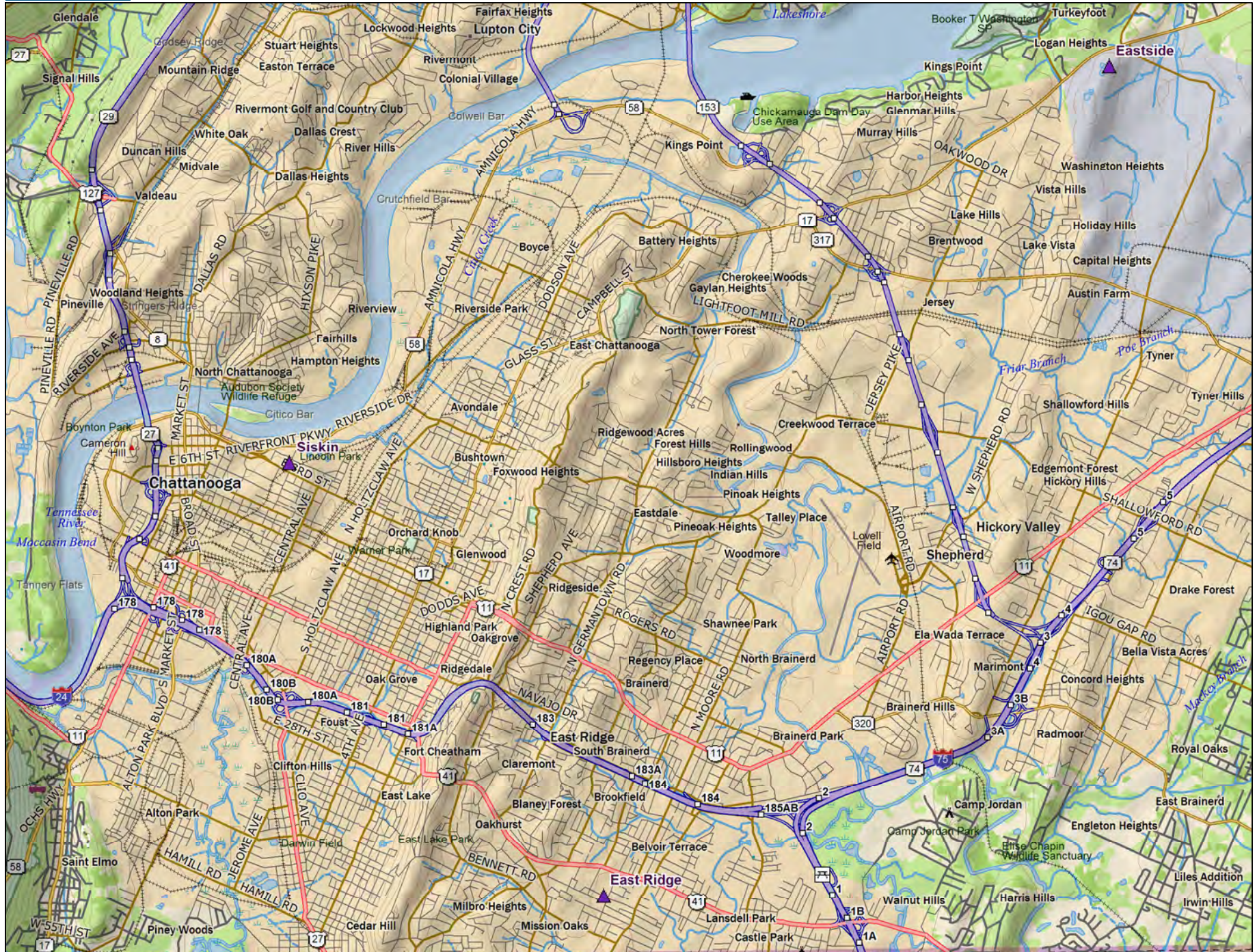
www.delorme.com



Scale 1 : 81,250



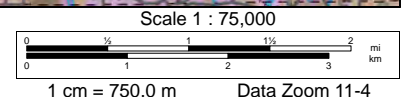
1 cm = 812.5 m Data Zoom 11-3



Data use subject to license.

© DeLorme. Topo North America™ 10.

www.delorme.com



APPENDIX C

Audit Standards Certifications

Ozone Transfer Standard Verification Summary Report



U. S. Environmental Protection Agency
 Region 4 Science and Ecosystem Support Division
 Enforcement and Investigations Branch
 Superfund and Air Section
 980 College Station Rd.
 Athens, GA 30605

EEMS
01114
(van 3)

	EPA Standard	GUEST Instrument
Agency:	EPA Region 4	EEMS
Contact:	Mike Crowe	Eric Hebert
Make:	NIST	Thermo
Model:	SRP	49i
S/N:	10	1180030022
Guest Test Status:		PASS
Guest Known Offset:		0

SESD Project #:
Test #:

#1
 "as found"
 and "as left"

Level 2	Slope	Intercept	R ²	High O ₃	Lower O ₃
Averages:	0.9984	0.2709	0.9999986	363	0
Upper Tolerance:	1.0300	3.0000			
Lower Tolerance:	0.9700	-3.0000			

Cycle Start Date / Time	File Name	Slope	Intercept	R ²	Upper Range (ppb O ₃)	Lower Range (ppb O ₃)
6/11/19 5:01 PM	Cal19061101.xls	0.9984	0.2057	0.9999981	360	0.24
6/11/19 6:37 PM	Cal19061102.xls	0.9975	0.3485	0.9999992	363	-0.02
6/11/19 8:13 PM	Cal19061103.xls	0.9992	0.1985	0.9999984	363	0.12
6/11/19 9:50 PM	Cal19061104.xls	0.9980	0.3826	0.9999987	364	-0.14
6/11/19 11:26 PM	Cal19061105.xls	0.9991	0.0000	0.9999981	364	-0.13
6/12/19 1:02 AM	Cal19061200.xls	0.9983	0.3572	0.9999990	365	0.12
6/12/19 2:39 AM	Cal19061201.xls	0.9986	0.4040	0.9999988	365	-0.05

Comments:

Instrument tested as found.
 Ozone calibration factors at time of test: O3 BKG: -0.4 ppb O3 COEF: 0.990

Instrument within tolerance

Verification Expires on: **June 12, 2020**
September 12, 2019 (For NPAP use)

Mike Crowe *Mike Crowe* Date *6/12/19*



CERTIFICATE OF CALIBRATION - NIST TRACEABILITY

(Refer to instruction manual for further details of calibration)

deltaCal Serial Number: 1196

DATE: 15-Feb-2019

Calibration Operator: E. Albuja

EEEMS # 01451

Critical Venturi Flow Meter: Max Uncertainty = 0.346%

Serial Number: 1 CEESI NVLAP NIST Data File 04BGI151

Serial Number: 2 CEESI NVLAP NIST Data File 04BGI152

Serial Number: 3 CEESI NVLAP NIST Data File 04BGI153

Serial Number: 4 CEESI NVLAP NIST Data File 02BGI004

Room Temperature: +/- 0.03°C from -5°C - 70°C Room Temp: 22.2 °C

Brand: Telatemp Serial Number: 358654
Std Cal Date: 30-Oct-18 Std Cal Due Date: 30-Oct-19

deltaCal:

Ambient Temperature (set): 22.2 °C

Aux (filter) Temperature (set): 22.2 °C

Barometric Pressure and Absolute Pressure

Vaisala Model PTB330(50-1100) Digital Accuracy: 0.03371%

Serial Number: C4310002
Std Cal Date: 26-Mar-18 Std Cal Due Date: 26-Mar-19

deltaCal:

Barometric pressure (set): 745 mm of Hg

Results of Venturi Calibration

Flow Rate (Q) vs. Pressure Drop (ΔP). Where: Q=Lpm, ΔP = Cm of H2O

Q= 3.79391 ΔP ^ 0.53886 Overall Uncertainty: 0.35%

Q= 3.87818 ΔP ^ 0.52196 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: March 2016
Cal102-01T1 Rev D

To Check a deltaCal E. Albuja

Date 15-Feb-2019 Pre recert

1.5-19.5 VER 4.00

BP= 749.5 mm of Hg

Maximum allowable error at any flow rate is .75%.

Serial No. 1196

EEMS # 01451

As found

	Reading	Room Temp	CV	Qa	Qa	% Error
	Abs. P		Flow	deltaCal	Indicated	
	Crit. Vent.	Temp	Lpm			
	mm of Hg					
# 2	135.40	24.50	1.519	1.803	18.71	
	194.50	24.50	2.203	2.432	10.40	
	238.45	24.50	2.712	3.336	23.03	
	342.79	24.50	3.919	4.078	4.05	
	489.21	24.50	5.614	5.672	1.04	
# 1	154.50	24.50	6.070	6.094	0.39	
	238.46	24.50	9.478	9.583	1.11	
	307.59	24.50	12.284	12.360	0.62	} Range used
	362.12	24.50	14.497	14.558	0.42	
	470.76	24.50	18.907	18.345	-2.97	
Average %					5.68	

To Check a deltaCal

E. Albuja

Date 15-Feb-2019

1.5-19.5 VER 4.00

BP= 745 mm of Hg

Maximum allowable error at any flow rate is .75%.

Serial No. 1196

EEMS # 01451

	Reading Abs. P Crit. Vent. mm of Hg	Room Temp	CV Qa Flow Lpm	Qa deltaCal Indicated	% Error
# 2	138.54	22.20	1.553	1.558	0.35
	233.86	22.20	2.654	2.668	0.53
	272.06	22.20	3.095	3.093	-0.07
	374.35	22.20	4.277	4.297	0.47
	476.76	22.20	5.460	5.470	0.18
# 1	174.04	22.30	6.854	6.901	0.69
	252.66	22.30	10.040	10.050	0.10
	341.62	22.30	13.646	13.662	0.12
	410.84	22.30	16.452	16.481	0.18
	481.71	22.30	19.324	19.384	0.31
			Average %	0.28	

$m = 1.002038$

$b = 0.003911$

$r^2 = 1.000000$

(1pm)

Ⓢ 3/7/19



MesaLabs

Page 2 of 2

EEMS# 01414



NVLAP Lab Code 200661-0 Calibration

2/8/2019

As Shipped Calibration Data

Certificate No 281466
Technician Lilianna Malinowska

Lab. Pressure 748 mmHg
Lab. Temperature 21.3 °C

Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Shipped
25344 sccm	25183 sccm	0.64%	1.00%	In Tolerance
5017.9 sccm	5000.8 sccm	0.34%	1.00%	In Tolerance
1508.4 sccm	1501.65 sccm	0.45%	1.00%	In Tolerance
21.3 °C	21.3 °C	-	± 0.8°C	In Tolerance
748 mmHg	748 mmHg	-	± 3.5 mmHg	In Tolerance

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-800-44	101897	01-May-2018	01-May-2019
Precision Thermometer	305460	02-Oct-2018	02-Oct-2019
Precision Barometer	2981392	18-Jul-2018	18-Jul-2019

Calibration Notes

The expanded uncertainty of flow, temperature, and pressure measurements all have a coverage factor of k = 2 for a confidence interval of approximately 95%.

Flow testing is in accordance with our test number PR18-13 with an expanded uncertainty of 0.18% using high-purity nitrogen or filtered laboratory air. Flow readings in sccm are performed at STP of 21.1°C and 760 mmHg.

Pressure testing is in accordance with our test number PR18-11 with an expanded uncertainty of 0.16 mmHg.

Temperature testing is in accordance with our test number PR18-12 with an expanded uncertainty of 0.04 °C.

Traceability to the International System of Units (SI) is verified by accreditation to ISO/IEC 17025 by NVLAP under NVLAP Code 200661-0.

Technician Notes:

By:

Mohammed Aziz
Director of Engineering
Mesa Laboratories, Inc., Butler, NJ

m = 0.99331937
b = 0.0093545 (Lpm)
r² = 0.99999

Ⓢ 2/15/19



NVLAP Lab Code 200661-0
Calibration

Calibration Certificate

CertificateNo. 281466

Sold To:

Environmental Engineering & Measurement
Services
8010 SW 17th Place
Gainesville, FL 32607
US

Product 200-530+ High Defender 530+ High Flow

Serial No. 159956

EEMS# 01414

Cal. Date 08-Feb-2019

All calibrations are performed at Mesa Laboratories, Inc., 10 Park Place, Butler, NJ, 07405, an ISO 17025:2005 accredited laboratory through NVLAP of NIST. This report shall not be reproduced except in full without the written approval of the laboratory. Results only relate to the items calibrated. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

As Received Calibration Data

Technician	Lilianna Malinowska		Lab. Pressure	757 mmHg
			Lab. Temperature	21.3 °C
Instrument Reading	Lab Standard Reading	Deviation	Allowable Deviation	As Received
25880 sccm	25126 sccm	3.0%	1.00%	Out of Tolerance
5145.1 sccm	5000.7 sccm	2.89%	1.00%	Out of Tolerance
1542.4 sccm	1500.35 sccm	2.8%	1.00%	Out of Tolerance
22.4 °C	22.6 °C	-	± 0.8°C	In Tolerance
756 mmHg	757 mmHg	-	± 3.5 mmHg	In Tolerance

Mesa Laboratories Standards Used

Description	Standard Serial Number	Calibration Date	Calibration Due Date
ML-800-44	103521	11-Jun-2018	11-Jun-2019
Precision Thermometer	305460	02-Oct-2018	02-Oct-2019
Precision Barometer	2981392	20-Jul-2018	20-Jul-2019

Certificate of Calibration

Customer: ENVIRONMENTAL ENGINEERING & MEASUREMENT SERVICES

1128 NW 39TH DRIVE
GAINESVILLE, FL 32605
FEDEX

P.O. Number:

ID Number: **EEMS 01229**



Description: DIGITAL STIK THERMOMETER

Manufacturer: FLUKE

Model Number: 1551A EX

Serial Number: 3275143

Technician: STEVE TORRES

On-Site Calibration:

Comments: TUR is 2 to 1

Calibration Date: 01/23/2019

Calibration Due: 01/23/2020

Procedure: FLUKE 1551A EX,52A EX
Rev: 11/1/2010

Temperature: 71 F

Humidity: 43 % RH

As Found Condition: IN TOLERANCE

Calibration Results: IN TOLERANCE

Limiting Attribute:

This instrument has been calibrated using standards traceable to the SI units through the National Institute of Standards and Technology (NIST) or other National Metrological Institute (NMI). The method of calibration is direct comparison to a known standard, derived from natural physical constants, ratio measurements or compared to consensus standards.

Reported uncertainties are expressed as expanded uncertainty values at an approximately 95% confidence level using a coverage factor of k=2. Statements of compliance are based on test results falling within specified limits with no reduction by the uncertainty of the measurement.

TMI's Quality System is accredited to ISO/IEC 17025:2017 and ANSI/NCSL Z540-1-1994. ISO/IEC 17025:2017 is written in a language relevant to laboratory operations, meeting the principles of ISO 9001 and aligned with its pertinent requirements. This calibration complies with all the requirements of ANSI/NCSL Z540-1-1994 and TMI's Quality Manual, QM-1.

Results contained in this document relate only to the item calibrated. Calibration due dates appearing on the certificate or label are determined by the client for administrative purposes and do not imply continued conformance to specifications.

This certificate shall not be reproduced, except in full, without the written permission of Technical Maintenance, Inc.

Measurements not currently on TMI's Scope of Accreditation are identified with an asterisk.

FRANK BAHMANN, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

<u>Asset Number</u>	<u>Manufacturer</u>	<u>Model Number</u>	<u>Date Calibrated</u>	<u>Cal Due</u>
05535	FLUKE	5609-12-D	7/3/2018	7/3/2019
660TL18010015	ADDITEL	ADT875PC-155	6/1/2018	6/1/2019
A88072	FLUKE/HART	1502A	12/17/2018	4/2/2019



Technical Maintenance, Inc.

12530 TELECOM DRIVE, TEMPLE TERRACE, FL 33637

Phone: 813-978-3054 Fax 813-978-3758

www.tmicalibration.com

ANSI/NCSL Z540-1-1994

Certificate of Calibration

Data Sheet

<u>Parameter</u>	<u>Nominal</u>	<u>Minimum</u>	<u>Maximum</u>	<u>As Found</u>	<u>As Left</u>	<u>Unit</u>	<u>ADJ/FAIL</u>
Temperature Accuracy	-25.00	-25.05	-24.95	-25.02	-25.02	°C	
Temperature Accuracy	0.00	-0.05	0.05	0.01	0.01	°C	
Temperature Accuracy	100.00	99.95	100.05	99.99	99.99	°C	
Temperature Accuracy	150.00	149.95	150.05	149.97	149.97	°C	

EEMS # 01229

$$m = 0.999893$$

$$b = -0.006489$$

$$r^2 = 1.00000$$



Technical Maintenance, Inc.

12530 TELECOM DRIVE, TEMPLE TERRACE, FL 33637

Phone: 813-978-3054 Fax 813-978-3758

www.tmiclibration.com

ANSI/NCSL Z540-1-1994

Date

2/12/2019 - - Calibration and verification of three RTD meters with most recent certification of EEMS RTD

TMI Cert data -- 1/23/2019				
	TMI STD	EEMS RTD		
Cert #	A2380069	01229		
			diff	corrected
	-25.00	-25.02	0.020	-25.016
	0.00	0.01	-0.010	0.016
	100.00	99.99	0.010	100.007
	150.00	149.97	0.030	149.993
RTD 01229				
2019 correction: slope= 0.99989313				
intercept= -0.0064885				
corr= 1.0000000				

Ein Hebert

2/12/2019

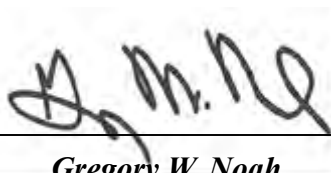
At	Date	RTD 01230 / 01231		RTD 01227 / 1		RTD 01228 / 2	
EEMS	2/12/2019	EEMS AER		EEMS van3		EEMS van1	
RTD	01229	raw	corrected	raw	corrected	raw	corrected
raw	corrected						
0.02	0.03	0.04	0.01	0.15	0.00	-0.09	0.02
10.32	10.33	10.35	10.34	10.56	10.09	10.31	10.57
21.10	21.11	21.12	21.12	21.43	20.89	21.19	21.35
30.30	30.31	30.32	30.33	30.67	30.30	30.47	30.30
40.00	40.01	39.98	40.00	40.46	40.02	40.28	40.03
47.91	47.92	47.89	47.92	48.40	47.90	48.23	47.90
25.00	25.01	25.00	25.00	25.34	25.01	25.14	25.02
		slope = 0.998872		1.007333		1.009092	
		intercept = 0.026147		0.144973		-0.11036	
		correlation = 1.0000		1.0000		1.0000	

Field Scientist Certification

Eric Hebert

*Has satisfactorily completed
The US Environmental Protection Agency's
“National Performance Audit Program (NPAP)
Field Scientist Re-certification Course”*

**Office of Air Quality Planning and Standards
Research Triangle Park, NC
Course Dates: April 13-14, 2017**



Gregory W. Noah
**NPAP National Coordinator
USEPA, OAQPS, AAMG**