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

PO: TBD

October 2020

Prepared for:

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

Prepared by:

environmental engineering
& measurement services, inc.

4577E NW 6th Street Ext
Gainesville, FL 32609

Report Submitted
November 2020

Table of Contents

List of Tables

List of Figures

List of Appendices

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
$\mu g/m^3$	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:
https://www.epa.gov/amtic/national-performance-audit-program-npap-gaseous-monitoring
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) traceable 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 26th, 2020. 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	49C	49C-58192-316
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:

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/ttn/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-traceable gases include cylinders of high concentration CO, low concentration CO, and a multi-blend NO, CO, SO_2 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) 49iQPS 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 Monday October 26th, 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 PM_{10} (first cut point) inlets were removed from the samplers and the EEMS DeltaCal standard was 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 standard. 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.

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. Table 3 provides the approved list of audit levels. The final results of the TTP PE 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

2.3.3 Ozone Monitor Audits

Ozone audit test gas was generated with the ozone generator in the mobile laboratory's dilution system. Where possible, 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 Soddy Daisy glass funnel inlet was bypassed due to excessive moisture from early morning dew at the station.

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. Each station also records data with an ESC 8816 as a backup logger. 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 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:**	**2/10/2020**

Date & Site of Verification	**10/26/2020 East Ridge Partisol 2025 PM-2.5**				
Parameter	**DeltaCal**	**Site Sampler**	**Difference**	**Acceptance Criteria**	**Pass/Fail**
Flow Rate (Lpm)	16.89	16.70	-1.15%	≤ ± 4%	Pass
Design Flow Rate (16.67 Lpm)	16.89		1.34%	≤ ± 4%	Pass
Ambient Temperature (ºC)	24.7	25.6	0.9	≤ ± 2 ºC	Pass
Barometric Pressure (mm Hg)	743.2	742	-1.2	≤ ± 5 mm Hg	Pass
Filter Temperature (ºC)	26.6	27.6	1	≤ ± 2 ºC	Pass
Leak Check			5 mm	≤ 25mm/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:**	**2/10/2020**

Date & Site of Verification	**10/26/2020 Riverside/Siskin Partisol 2025i PM-2.5 POC1**				
Parameter	**DeltaCal**	**Site Sampler**	**Difference**	**Acceptance Criteria**	**Pass/Fail**
Flow Rate (Lpm)	16.48	16.66	1.07%	≤ ± 4%	Pass
Design Flow Rate (16.67 Lpm)	16.48		-1.11%	≤ ± 4%	Pass
Ambient Temperature (ºC)	25.0	24.3	-0.7	≤ ± 2 ºC	Pass
Barometric Pressure (mm Hg)	743.2	742	-1.2	≤ ± 5 mm Hg	Pass
Filter Temperature (ºC)	25.5	25.9	0.4	≤ ± 2 ºC	Pass
Leak Check			15	≤ 25 mm/min	Pass

Date & Site of Verification	**10/26/2020 Riverside/Siskin Partisol 2025i PM-2.5 POC2**				
Parameter	**DeltaCal**	**Site Sampler**	**Difference**	**Acceptance Criteria**	**Pass/Fail**
Flow Rate (Lpm)	16.64	16.68	0.21%	≤ ± 4%	Pass
Design Flow Rate (16.67 Lpm)	16.64		-0.15%	≤ ± 4%	Pass
Ambient Temperature (ºC)	24.7	24.8	0.1	≤ ± 2 ºC	Pass
Barometric Pressure (mm Hg)	743.2	743	-0.2	≤ ± 5 mm Hg	Pass
Filter Temperature (ºC)	25.6	26.1	0.5	≤ ± 2 ºC	Pass
Leak Check			6	≤ 25 mm/min	Pass

The span dust test of the T-640 sampler was slightly above the limit published by the manufacturer. The test was performed with the EEMS span dust and a "zero" filter upstream of the dust to prevent ambient air from entering the dust container and influencing the test.

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**	
DeltaCal S/N	**1196**	EEMS # 01451	**DeltaCal Cert Date =**		**2/10/2020**	
Date & Site of Verification	**10/26/2020 Riverside/Siskin T640 PM-2.5**					
Parameter	**BIOS or Std**	**T640**	**Difference**	**Acceptance Criteria**	**Pass/Fail**	
Flow Rate (Lpm)	5.09	4.99	-2.00%	≤ ± 4%	Pass	
Ambient Temperature (ºC)	24.3	24.2	-0.1	≤ ± 2 ºC	Pass	
Shelter Temperature (ºC)			0	≤ ± 2 ºC	Pass	
Barometric Pressure (mm Hg)	743.2	740.7	-2.5	≤ ± 5 mm Hg	Pass	
Dust test	11.1	12	0.9	≤ ± 0.5	Fail	
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 O_3 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	0.10611	0.10540	-0.00071	-0.7	0.10486	-0.00125	-1.2	Pass
Soddy Daisy level 4	0.06888	0.06801	-0.00087	-1.3	0.06778	-0.00110	-1.6	Pass
Soddy Daisy level 3	0.03375	0.03327	-0.00048	-1.4	0.03322	-0.00053	-1.6	Pass
Soddy Daisy level 2	0.01604	0.01584	-0.00020	N/A	0.01585	-0.00019	N/A	Pass
Eastside level 6	0.10149	0.10170	0.00021	0.2	0.10155	0.00006	0.1	Pass
Eastside level 4	0.06915	0.06812	-0.00103	-1.5	0.06803	-0.00112	-1.6	Pass
Eastside level 3	0.02928	0.02937	0.00009	0.3	0.02940	0.00012	0.4	Pass
Eastside level 2	0.01640	0.01612	-0.00028	N/A	0.01612	-0.00028	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-1

Site Name: Eastside Filter Plant - 8816 Audit Date: 10/26/2020

Parameter	NPAP Lab Response (ppm)	Station Response (ppm)	Percent Difference	Actual Difference (ppm)	Pass/Fail	Warning
Ozone						
O3 Audit Level 6	0.10149	0.10155	0.1	0.00006	**Pass**	
O3 Audit Level 4	0.06915	0.06803	-1.6	-0.00112	**Pass**	
O3 Audit Level 3	0.02928	0.02940	0.4	0.00012	**Pass**	
O3 Audit Level 2	0.01640	0.01612	-1.7	-0.00028	**Pass**	
O3 Audit Level 1					**N/A**	
O3 zero	0.00007	-0.00016		-0.00023		
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-1

OZONE REPORT

Site Name:	Eastside Filter Plant - 8816	Airs ID:	470654003
Auditor:	Eric Hebert (EEMS)	Audit Date:	10/26/20
Station Manager:	Kathy Jones (supervisor) / Jim Long (operator)		

MOBILE PE LAB INSTRUMENTS

	Ozone	CO
Instrument:	Ozone	CO
Manufacturer:	Thermo	0
Model:	49iQPS-ANNN	0
Serial Number:	1180930075	0
Calibration Date:	01/14/20	1/0/1900
Slope:	0.9949	0
Intercept (PPM):	0.0003222	0

STATION INSTRUMENT INFORMATION

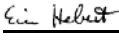
Instrument:	Ozone	
Manufacturer/Model #:	Thermo	49i A1NNA
Property Number:	1435663747	
Calibration Date:	02/26/20	
Slope/Intercept (PPB):	0.0000	0.0000
Indicated Flow (LPM):	0.70 / 0.49	
In-Line Filter Change:	09/14/20	
Manifold Type:	1/4 " Teflon & glass	

FINAL OZONE AUDIT RESULTS

Mobile Lab O3 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.10149	**0.10155**	**0.1**
0.06915	**0.06803**	**-1.6**
0.02928	**0.02940**	**0.4**
0.01640	**0.01612**	**-1.7**
0.00007	**-0.00016**	

	Pass/Fail	Warning
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: Eric Hebert (Print)



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 level 2 audit standard cell A/B pressures, and the site monitor pressures, were measured during the audit and were within acceptable limits.

FINAL SUMMARY AUDIT REPORT
EEMS Van-1

Site Name: Eastside Filter Plant - 8872 Audit Date: 10/26/2020

Parameter	NPAP Lab Response (ppm)	Station Response (ppm)	Percent Difference	Actual Difference (ppm)	Pass/Fail	Warning
Ozone						
O3 Audit Level 6	0.10149	0.10170	0.2	0.00021	**Pass**	
O3 Audit Level 4	0.06915	0.06812	-1.5	-0.00103	**Pass**	
O3 Audit Level 3	0.02928	0.02937	0.3	0.00009	**Pass**	
O3 Audit Level 2	0.01640	0.01612	-1.7	-0.00028	**Pass**	
O3 Audit Level 1					**N/A**	
O3 zero	0.00007	-0.00017		-0.00024		
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-1

OZONE REPORT

Site Name:	Eastside Filter Plant - 8872	Airs ID:	470654003
Auditor:	Eric Hebert (EEMS)	Audit Date:	10/26/20
Station Manager:	Kathy Jones (supervisor) / Jim Long (operator)		

MOBILE PE LAB INSTRUMENTS

Instrument:	Ozone	CO
Manufacturer:	Thermo	0
Model:	49iQPS-ANNN	0
Serial Number:	1180930075	0
Calibration Date:	01/14/20	1/0/1900
Slope:	0.9949	0
Intercept (PPM):	0.0003222	0

STATION INSTRUMENT INFORMATION

Instrument:	Ozone	
Manufacturer/Model #:	Thermo	49i A1NNA
Property Number:	1435663747	
Calibration Date:	02/26/20	
Slope/Intercept (PPB):	0.0000	0.0000
Indicated Flow (LPM):	0.70 / 0.49	
In-Line Filter Change:	09/14/20	
Manifold Type:	1/4 " Teflon & glass	

FINAL OZONE AUDIT RESULTS

Mobile Lab O3 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.10149	**0.10170**	**0.2**
0.06915	**0.06812**	**-1.5**
0.02928	**0.02937**	**0.3**
0.01640	**0.01612**	**-1.7**
0.00007	**-0.00017**	

	Pass/Fail	Warning
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: Eric Hebert (Print)

Eric Hebert (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 level 2 audit standard cell A/B pressures, and the site monitor pressures, were monitored during the audit and were within acceptable limits.

FINAL SUMMARY AUDIT REPORT
EEMS Van-1

Site Name: Soddy Daisy High School - 8816 Audit Date: 10/26/2020

Parameter	NPAP Lab Response (ppm)	Station Response (ppm)	Percent Difference	Actual Difference (ppm)	Pass/Fail	Warning
Ozone						
O3 Audit Level 6	0.10611	0.10486	-1.2	-0.00125	**Pass**	
O3 Audit Level 4	0.06888	0.06778	-1.6	-0.00110	**Pass**	
O3 Audit Level 3	0.03375	0.03322	-1.6	-0.00053	**Pass**	
O3 Audit Level 2	0.01604	0.01585	-1.2	-0.00019	**Pass**	
O3 Audit Level 1					**N/A**	
O3 zero	0.00000	-0.00015		-0.00015		
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**	

FINAL PE THROUGH-THE-PROBE AUDIT REPORT

EEMS Van-1

OZONE REPORT

Site Name:	Soddy Daisy High School - 8816	Airs ID:	470651011
Auditor:	Eric Hebert (EEMS)	Audit Date:	10/26/20
Station Manager:	Kathy Jones (supervisor) / Jim Long (operator)		

MOBILE PE LAB INSTRUMENTS

Instrument:	Ozone	CO
Manufacturer:	Thermo	0
Model:	49iQPS-ANNN	0
Serial Number:	1180930075	0
Calibration Date:	01/14/20	1/0/1900
Slope:	0.9949	0
Intercept (PPM):	0.0003222	0

STATION INSTRUMENT INFORMATION

Instrument:	Ozone	
Manufacturer/Model #:	Thermo	49C
Property Number:	49C-58192-316	
Calibration Date:	03/12/20	
Slope/Intercept (PPB):	0.0000	0.0000
Indicated Flow (LPM):	0.65 / 0.66	
In-Line Filter Change:	09/11/20	
Manifold Type:	1/4 " Teflon & glass	

FINAL OZONE AUDIT RESULTS

Mobile Lab O3 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.10611	**0.10486**	**-1.2**
0.06888	**0.06778**	**-1.6**
0.03375	**0.03322**	**-1.6**
0.01604	**0.01585**	**-1.2**
0.00000	**-0.00015**	

	Pass/Fail	Warning
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: Eric Hebert (Print)

Eric Hebert (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 level 2 audit standard cell A/B pressures and the site monitor pressures were monitored before, during, and after the audit and were within acceptable limits. The glass funnel on the sample inlet was bypassed during the audit due to excessive moisture present from dew.

FINAL SUMMARY AUDIT REPORT
EEMS Van-1

Site Name: Soddy Daisy High School - 8872 Audit Date: 10/26/2020

Parameter	NPAP Lab Response (ppm)	Station Response (ppm)	Percent Difference	Actual Difference (ppm)	Pass/Fail	Warning
Ozone						
O3 Audit Level 6	0.10611	0.10540	-0.7	-0.00071	**Pass**	
O3 Audit Level 4	0.06888	0.06801	-1.3	-0.00087	**Pass**	
O3 Audit Level 3	0.03375	0.03327	-1.4	-0.00048	**Pass**	
O3 Audit Level 2	0.01604	0.01584	-1.2	-0.00020	**Pass**	
O3 Audit Level 1					**N/A**	
O3 zero	0.00000	0.00010		0.00010		
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**	

FINAL PE THROUGH-THE-PROBE AUDIT REPORT

EEMS Van-1

OZONE REPORT

Site Name:	Soddy Daisy High School - 8872	Airs ID:	470651011
Auditor:	Eric Hebert (EEMS)	Audit Date:	10/26/20
Station Manager:	Kathy Jones (supervisor) / Jim Long (operator)		

MOBILE PE LAB INSTRUMENTS

Instrument:	Ozone	CO
Manufacturer:	Thermo	0
Model:	49iQPS-ANNN	0
Serial Number:	1180930075	0
Calibration Date:	01/14/20	1/0/1900
Slope:	0.9949	0
Intercept (PPM):	0.0003222	0

STATION INSTRUMENT INFORMATION

Instrument:	Ozone	
Manufacturer/Model #:	Thermo	49C
Property Number:	49C-58192-316	
Calibration Date:	03/12/20	
Slope/Intercept (PPB):	0.0000	0.0000
Indicated Flow (LPM):	0.65 / 0.66	
In-Line Filter Change:	09/11/20	
Manifold Type:	1/4 " Teflon & glass	

FINAL OZONE AUDIT RESULTS

Mobile Lab O3 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.10611	**0.10540**	**-0.7**
0.06888	**0.06801**	**-1.3**
0.03375	**0.03327**	**-1.4**
0.01604	**0.01584**	**-1.2**
0.00000	**0.00010**	

	Pass/Fail	Warning
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: Eric Hebert (Print)

Eric Hebert (Signature)

EPA person notified in case of audit failure

Audit Limits

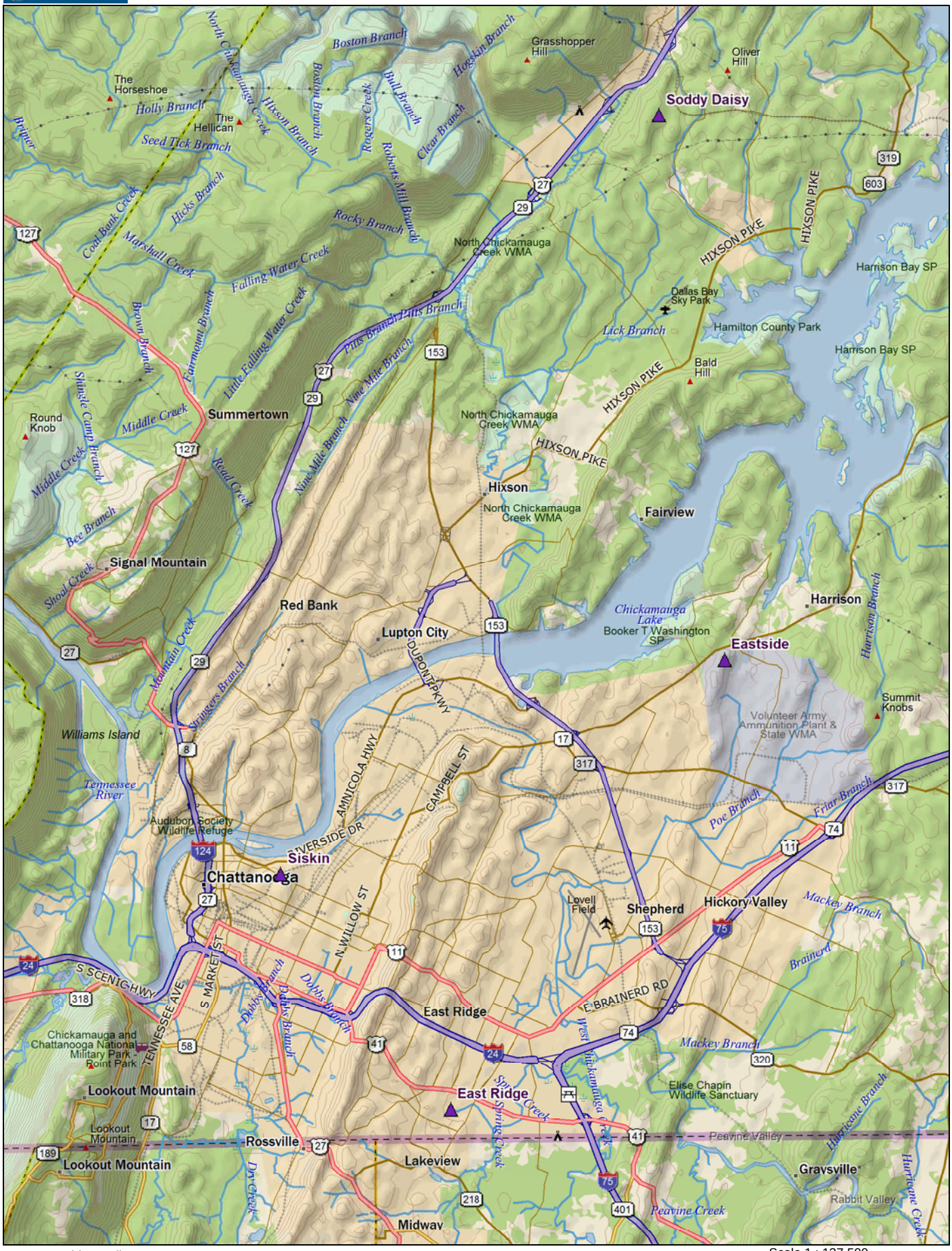
Pass	Bias < ±15.1% OR difference from actual concentration < 24 hour allowable drift (0.003 ppm)
Fail	Bias > ±15.1% AND difference from actual concentration > 24 hour allowable drift (0.003 ppm)
Warning	Bias > ±10% AND difference from actual concentration > 0.0015 ppm

Comments:

The level 2 audit standard cell A/B and the site monitor pressures, were monitored during the audit and were within acceptable limits.
The glass funnel on the sample inlet was bypassed due to excessive moisture from dew.

APPENDIX B

Maps of Locations

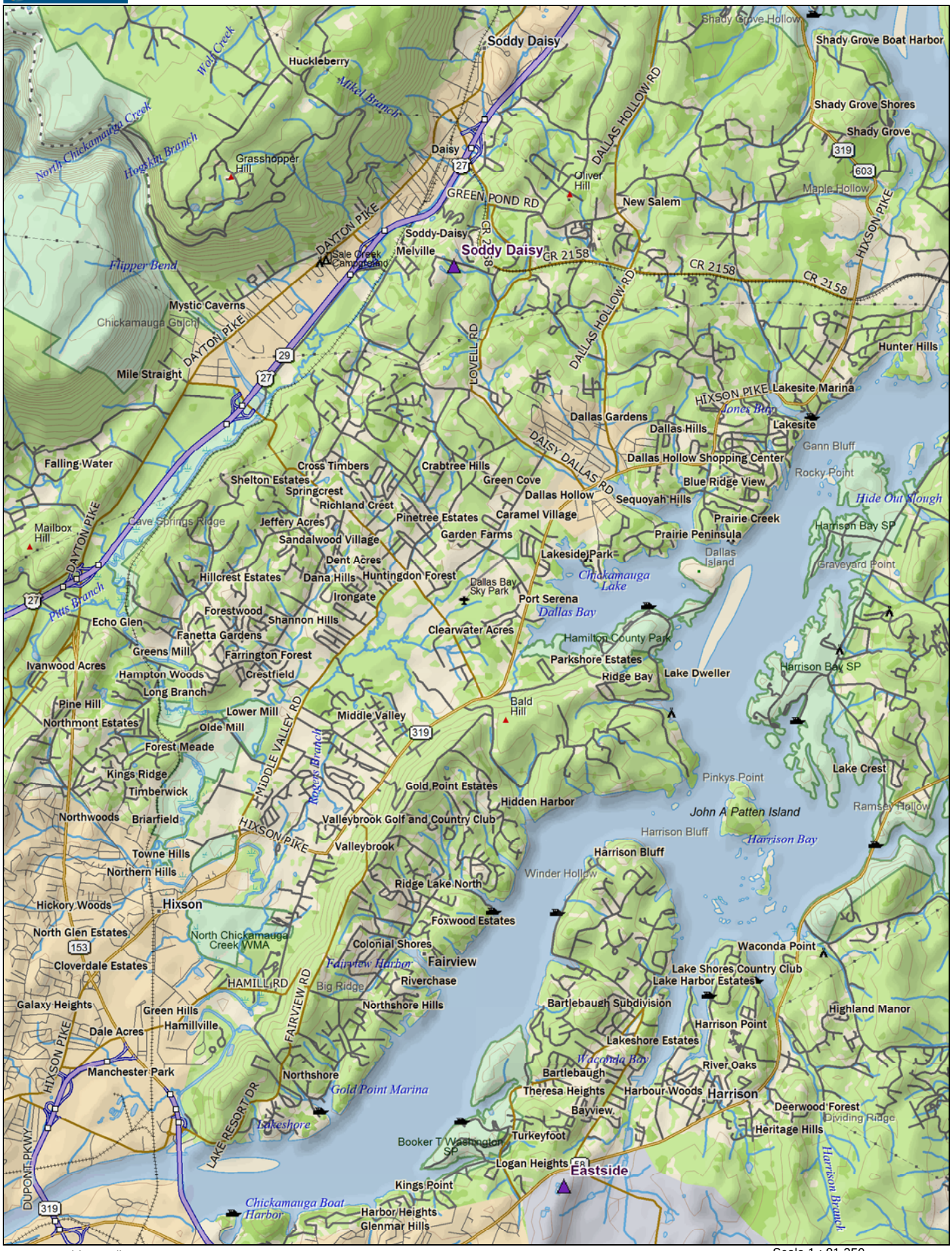


TN
MN (4.9°W)

Scale 1 : 137,500

1 cm = 1.38 km

Data Zoom 10-5

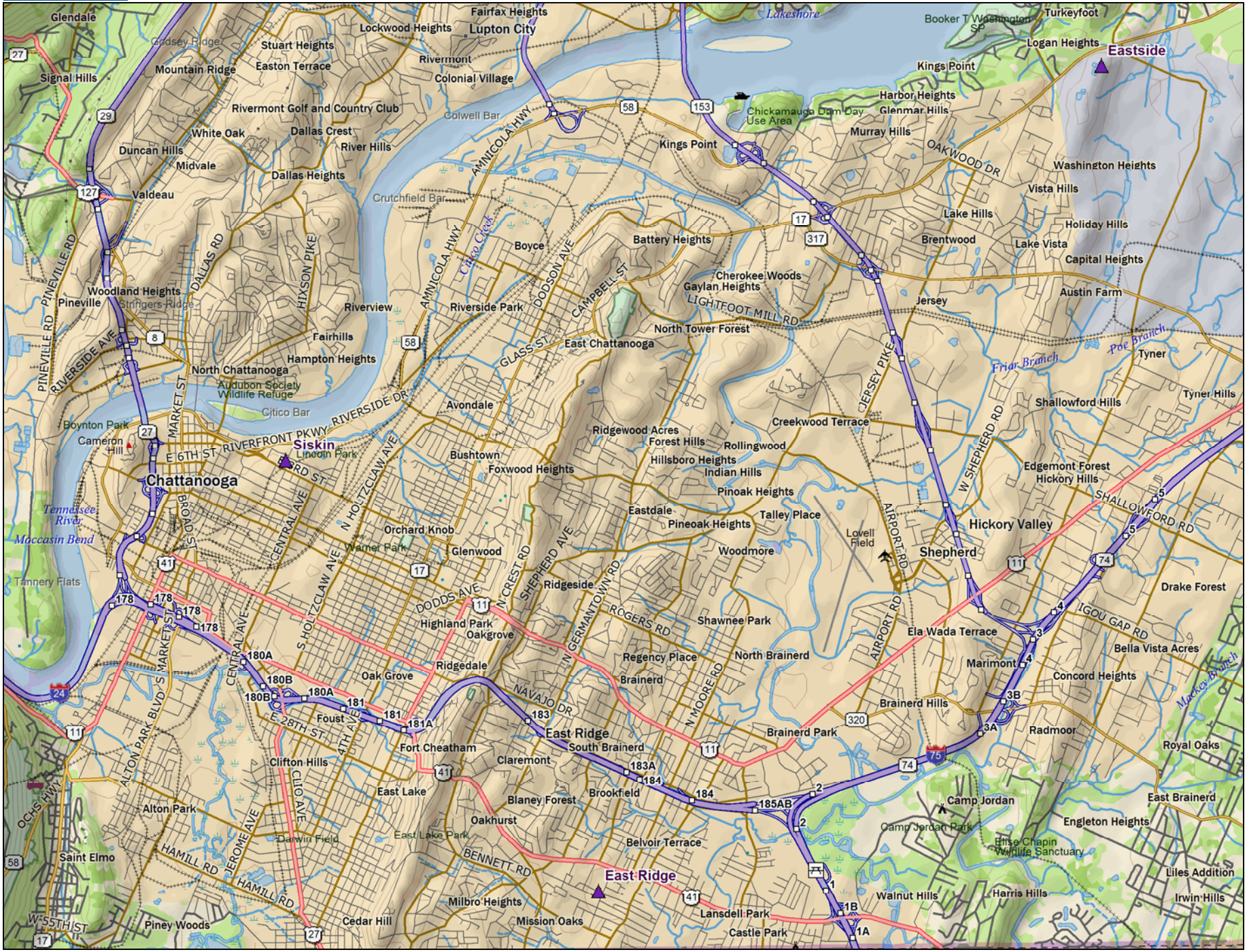


TN
MN (5.0°W)

Scale 1 : 81,250

1 cm = 812.5 m

Data Zoom 11-3



TN

MN (4.9°W)

Scale 1 : 75,000

1 cm = 750.0 m

Data Zoom 11-4

APPENDIX C

Audit Standards Certifications

Ozone Transfer Standard Verification Summary Report

U. S. Environmental Protection Agency
Region 4 Laboratory Services & Applied Science Division
Quality Assurance and Program Services Branch
Quality Assurance Section
980 College Station Rd.
Athens, GA 30605

	EPA Standard	GUEST Instrument
Agency:	EPA Region 4	EEMS
Contact:	Keith Harris	Eric Hebert
Make:	NIST	Thermo
Model:	SRP	49 iQps
S/N:	10	1180930075
Guest Test Status:		PASS
Guest Known Offset:		0

EEMS 01115
Van 1

SESD Project #: 20-0156
Test #: # 1
"as left"

Level 2	Slope	Intercept	R^2	High O_3	Lower O_3
Averages:	0.9949	0.3222	0.9999944	422	0
Upper Tolerance:	1.0300	3.0000			
LowerTolerance:	0.9700	-3.0000			

Cycle Start Date / Time	File Name	Slope	Intercept	R^2	Upper Range (ppb O_3)	Lower Range (ppb O_3)
1/13/20 4:45 PM	Cal20011300.xls	0.9988	0.0863	0.9999931	422	0.00
1/13/20 6:25 PM	Cal20011301.xls	0.9885	0.3766	0.9999991	423	-0.05
1/13/20 8:05 PM	Cal20011302.xls	0.9902	0.3919	0.9999979	423	-0.01
1/13/20 9:45 PM	Cal20011303.xls	0.9941	0.5503	0.9999843	423	0.02
1/13/20 11:25 PM	Cal20011304.xls	1.0007	0.0943	0.9999991	423	0.06
1/14/20 1:05 AM	Cal20011400.xls	1.0000	0.2294	0.9999891	422	-0.06
1/14/20 2:45 AM	Cal20011401.xls	0.9922	0.5266	0.9999982	421	0.04

Comments: Prior to test one instrument was adjusted to more closely match the SRP.

Ozone calibration factors at time of test: O3 BKG: 1.2 ppb O3 COEF: 0.998

Verification Expires on: January 14, 2021

Keith Harris Date 01/14/20

Mesa Labs 10 Park Place Butler, NJ 07405
NIST Traceable Calibration Facility, ISO 9001:2008 Registered

MesaLabs

EEMS 01457

CERTIFICATE OF CALIBRATION - NIST TRACEABILITY

(Refer to instruction manual for further details of calibration)

DeltaCal Serial Number: S/N 1196 **Date:** 10-Feb-20

Calibration Technician : Jan Oviedo

Van 3

Critical Venturi Flow Meter:	Max Uncertainity = 0.346%
Serial Number:	1A CEESI NVLAP NIST Data File 07BGI-0001
Serial Number:	2A CEESI NVLAP NIST Data File 07BGI-0003
Serial Number:	5C COX Nist Data File CCAL33222 - 5 C
Serial Number:	4A CEESI NVLAP NIST Data File 07BGI-0002
Serial Number:	3A CEESI NVLAP NIST Data File 07BGI-0004

Room Temperature: +- 0.03°C from -5°C - 70°C **Room Temperature:** 23.90 °C

Brand: Telatemp **Serial Number:** 358921

Std Cal Date: 1-May-19 **Std Cal Due Date:** 30-Apr-20

DeltaCal :

Ambient Temperature (set): 23.90 °C

Aux (filter) Temperature (set): 23.90 °C

Barometric Pressure and Absolute Pressure

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

Serial Number: C4310002

Std Cal Date: 13-Mar-19 **Std Cal Due Date:** 12-Mar-20

DeltaCal :

Barometric pressure (set): 753 mm of Hg

Results of Venturi Calibration

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

Q= 3.92011 ΔP ^ 0.51866 Overall Uncertainty: 0.35%

Q= 3.80631 ΔP ^ 0.53708 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)

Mesa Labs 10 Park Place Butler, NJ 07405

NIST Traceable Calibration Facility, ISO 9001:2008 Registered

To Check a DeltaCal
1.5-19.5

VER 4.00P

Date	Technician
2/10/2020	Jan Oviedo

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

Serial No. 1196

BP= 753 mm of Hg

	Reading Abs. P Crit. Vent. mm of Hg	Room Temp	CV Qa Flow Lpm	Qa deltaCal Indicated	% Error
# 2	139.16	23.90	1.568	1.563	-0.32
	227.43	23.90	2.593	2.597	0.14
	313.82	23.90	3.597	3.596	-0.02
	393.04	23.90	4.517	4.495	-0.49
	481.48	23.90	5.544	5.549	0.09
	532.20	23.90	6.133	6.127	-0.10
#1	174.90	24.00	6.944	6.966	0.31
	255.67	24.00	10.222	10.210	-0.11
	332.96	24.00	13.358	13.349	-0.07
	414.15	24.00	16.652	16.670	0.11
	482.22	24.00	19.414	19.466	0.27
				Average %	-0.02

EEMS # 01451

S/N 1196 Van 3

(EJ) 2/13/20

m = 1.000669

b = −0.00536

r2 = 1.00000

Certificate Number
A3483085
Issue Date: 01/29/20

Certificate of Calibration

EEMS
Van-2

Customer: ENVIRONMENTAL ENGINEERING & MEASUREMENT SERVICES
4577 E NW 6TH STREET
GAINESVILLE, FL 36209
352-262-0802

P.O. Number:

ID Number: EEMS 01229

Description:	DIGITAL STIK THERMOMETER	Calibration Date:	01/29/2020
Manufacturer:	FLUKE	Calibration Due:	01/29/2021
Model Number:	1551A EX	Procedure:	FLUKE 1551A EX,52A EX Rev: 11/1/2010
Serial Number:	3275143	Temperature:	71 °F
Technician:	STEVE TORRES	Humidity:	36 % RH
On-Site Calibration: ☐		**As Found Condition:**	**IN TOLERANCE**
Comments:		**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.

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

WALLY GYNN, BRANCH MANAGER

Scott Chamberlain, QUALITY MANAGER

Calibration Standards

Asset Number	Manufacturer	Model Number	Date Calibrated	Cal Due
05535	FLUKE	5609-12-D	7/17/2019	7/17/2020
660TL18010015	ADDITEL CORPORATION	ADT875PC-155	6/4/2019	6/4/2020
A88072	FLUKE/HART	1502A	11/5/2019	2/28/2020

TMI 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 Number
A3483085
Issue Date: 01/29/20

Certificate of Calibration

Data Sheet

Parameter	Nominal	Minimum	Maximum	As Found	As Left	Unit	ADJ/FAIL
Temperature Accuracy	-25.00	-25.05	-24.95	-25.05	-25.05	°C	
Temperature Accuracy	0.00	-0.05	0.05	0.01	0.01	°C	
Temperature Accuracy	100.00	99.95	100.05	100.02	100.02	°C	
Temperature Accuracy	150.00	149.95	150.05	150.01	150.01	°C	

FEMS # 01229

Van-2

$m = 1.0002595$

$b = -0.017099$

$r^2 = 1.0000$

1/30/2020

TMI 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

Date

2/14/2020 - - Calibration and verification of three RTD meters with most recent certification of EEMS RTD

TMI Cert data -- 1/29/2020

	TMI STD	EEMS RTD 01229	diff	corrected
Cert #	A3483085			
	-25.00	-25.05	0.050	-25.026
	0.00	0.01	-0.010	0.027
	100.00	100.02	-0.020	100.011
	150.00	150.01	-0.010	149.988

RTD 01229

2020 correction: slope= 1.00025954

intercept= -0.0170992

corr= 1.0000000

Eric Hebert 2/14/2020

At EEMS	Date 2/14/2020 RTD 01229 raw	corrected	RTD 01230 / 01231 EEMS AER raw	corrected	RTD 01227 / 1 EEMS van3 raw	corrected	RTD 01228 / 2 EEMS van1 raw	corrected
	0.08	0.10	0.11	0.09	0.21	0.08	-0.05	0.08
	11.06	11.07	11.09	11.08	11.29	10.82	11.04	11.32
	20.88	20.89	20.90	20.90	21.22	20.67	20.96	21.17
	30.65	30.66	30.65	30.66	31.01	30.64	30.78	30.65
	39.36	39.37	39.35	39.37	39.83	39.39	39.59	39.39
	50.87	50.87	50.83	50.86	51.39	50.86	51.15	50.85
	25.25	25.26	25.26	25.26	25.60	25.27	25.35	25.27
slope =			**0.998854**		**1.007968**		**1.008426**	
intercept =			**0.024392**		**0.129496**		**-0.12932**	
correlation =			**1.0000**		**1.0000**		**1.0000**	

EPA United States Environmental Protection Agency

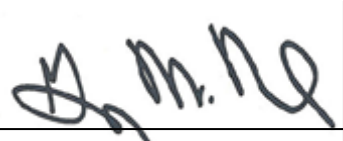
Field Scientist Certification

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: October 2-4, 2019



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