
**Audit Report for
Nashville Metro Public Health Department
Air Monitoring Network
October 2020**

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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	8
2.3.2 Gaseous Pollutant Monitor Audits	8
2.3.3 Ozone Monitor Audits.....	9
2.3.4 Specific NO ₂ CO and SO ₂ Audit Activities.....	9
3.0 Audit Results	11
3.1 PM Audit Results	11
3.2 TTP Ozone Audit Results	14
3.3 TTP Sulfur Dioxide Audit Results	15
3.4 TTP Carbon Monoxide Audit Results.....	15
3.5 TTP Nitrogen Dioxide Audit Results.....	16

List of Tables

Table 1 Station Locations.....	2
Table 2 Equipment Audited.....	2
Table 3 OAQPS Approved Audit Levels	9
Table 4 Near Road PM Sampler Verification	11
Table 5 Lockeland 1022 and 2025 Samplers Verifications.....	12
Table 6 Lockeland T-640x PM _{2.5} and PM ₁₀ Verifications	13
Table 7 Ozone TTP Audit Results.....	14
Table 8 Sulfur Dioxide TTP Audit Results	15
Table 9 Carbon Monoxide TTP Audit Results	15
Table 10 Nitrogen Dioxide TTP Audit Results.....	16

List of Figures

Figure 1 EEMS Mobile Laboratory..... 5
Figure 2 Near Road Inlet Cover Condition 6
Figure 3 Near Road Audit Line Connection..... 6
Figure 4 Percy Priest Audit Line Connection..... 7

List of Appendices

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

List of Acronyms and Abbreviations

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
MPHD	Metro Public Health Department
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 Nashville Metro Public Health Department to conduct audits of the district's local ambient air quality gaseous and PM pollutant monitoring network. The air quality monitoring network consists of four stations in the greater Nashville, Tennessee Metro Area which are operated by the Metro Public Health Department (MPHD). 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 requirements for independent performance evaluations (PE) 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 PE 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 Through-The-Probe (TTP) gaseous pollutant monitor 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 October 19th through 21st, 2020. The ambient air quality monitors audited were operating at four stations in the network:

1. Lockeland
2. Percy Priest Dam
3. East Health Center
4. Near Road

All stations are in the Nashville Metro area and in Davidson 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

Site	Latitude (°)	Longitude (°)	Elevation (m)	AQS Number
Lockeland	36.176280	-86.738982	161	470370023
Percy Priest Dam	36.150671	-86.623338	157	470370026
East Health Center	36.204696	-86.744816	167	470370011
Near Road	36.142337	-86.734112	159	470370040

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

Table 2 Equipment Audited

Site Location	Parameter	Manufacture	Model	Serial #.
Lockeland POC1	PM _{2.5}	Met One	BAM 1022	T23706
Lockeland POC2	PM _{2.5}	Thermo Environmental	2025i	2025iW20783-1504
Lockeland	PM _{2.5}	T-API	T-640x	991
Lockeland	PM ₁₀	T-API	T-640x	991
Percy Priest Dam	Ozone	Thermo Environmental	49i A2NAB	1322458653
East Health Center	NO _x	Thermo Environmental	42i AZSSDCA	1105247201
East Health Center	Ozone	Thermo Environmental	49i A2NAB	CM09130037
Near Road	NO _x	Thermo Environmental	42i TL-ANMSDAB	1324658812
Near Road	CO	T-API	T300	1360
Near Road	SO ₂	Thermo Environmental	43i QACA	1182890005
Near Road	PM _{2.5}	Met One	BAM 1022	W21428

Additional support materials operated at each of the stations include multi-gas dilution systems, zero air generation systems, and NIST-traceable calibration gases. The sites that measure ozone also have 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/ttn/amtic/npepqa.html>.

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

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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, SO₂ mixture. The mobile laboratory is equipped with its own data acquisition system (DAS).

Two of the three mobile lab systems are verified by the EPA Region 7 Laboratory each year. The NIST-traceable certification from the gas standards supplier is included in Appendix C. 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 photometer is 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 19th, EEMS personnel met MPHD personnel at the Near Road site for the TTP audit of the station's pollutant monitors and PM sampler audits. The CO monitor did not pass the lowest level audit point due to a bias of approximately -0.200ppm at the zero level. The sample inlet cover was somewhat dirty. A photo of the inlet cover is included as Figure 2.

On Tuesday October 20th EEMS personnel met MPHD personnel at the Percy Priest Dam site for the TTP of the ozone monitor. Audit gas was introduced to the station monitor which responded with negative values. The monitor was also somewhat slow to respond to changes in audit gas concentrations. This is an improvement compared to the previous two audits at the station. It was

discussed that the observations may be due to an environmental issue at the site since several troubleshooting actions have been performed, including replacement of the monitor without success.

Following the TTP ozone audit at Percy Priest, both EEMS and MPHD personnel traveled to the Lockeland station for audits of the PM samplers. The samplers at Lockeland have been replaced since the previous audit due to tornado damage which destroyed the existing samplers.

On Wednesday October 21st, EEMS personnel met MPHD personnel at the East Health Center site for TTP audits of the station's pollutant monitors.

Images of some of the sites, samplers, and audit connections are provided in Figures 2 through 4 below.

Figure 2 Near Road Inlet Cover Condition



Figure 3 Near Road Audit Line Connection



Figure 4 Percy Priest Audit Line Connection



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 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 either the EEMS DeltaCal or BIOS dry piston 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 each station audit. At sites that measure ozone, the TTP ozone audit was conducted first. Following the ozone audit, the TTP NO_x, CO, and/or SO₂ audits were performed depending on which parameters were being measured at the site. Audits of gaseous pollutant monitors other than ozone were performed simultaneously by providing audit gas to all monitor inlets using Teflon "tee" connectors or Teflon bag for the Near Road sample inlet.

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. The audit gas was delivered to the station monitor through the station inlet (including all fittings and filters) using a Teflon "tee" to allow the audit gas to vent at the inlet. The audit gas concentration was measured with the level-2 standard photometer in the mobile lab and recorded by the mobile lab DAS. One-minute averages were reported by the site operator from the station monitor and compared to the averages for the same time period from the standard.

2.3.4 Specific NO₂ CO and SO₂ Audit Activities

Prior to beginning the NO_x, CO, and SO₂ audits, the EEMS audit CO analyzer was calibrated using the NIST-traceable CO gases. This was accomplished by supplying the EEMS mobile laboratory CO analyzer with NIST-traceable gas directly from the cylinders and not through the mobile lab dilution system. Data from this "Pre-audit" calibration was entered into the OAQPS audit spreadsheet to be used to calculate the concentration of all audit gases generated during the station audits.

The site audits were accomplished by generating audit test gas using the mobile laboratory dilution system and the NIST-traceable multi-blend gas. The audit gas was delivered to the station monitors at the station sample inlet, through all filters and fittings using Teflon tubing and a Teflon bag or “Tee” to allow the audit gas to vent at the inlet. The generated audit gas CO concentrations were verified with the mobile laboratory CO analyzer. The other audit gas concentrations were then calculated based on the ratio of CO to the other gases in the NIST-traceable multi-blend audit gas cylinder.

Immediately following the station audits, the mobile laboratory CO analyzer was again challenged directly with the NIST-traceable cylinder gases. The results of this “Post-audit” challenge were entered into the OAQPS spreadsheet to correct the audit standard gas concentrations, accounting for any drift of the mobile laboratory CO analyzer. This procedure (Pre-audit CO calibration, multipoint station audits, and Post-audit CO challenge) is the same OAQPS standard procedure used routinely for all NPAP TTP audits.

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 Near Road sampler results are summarized in Table 4 and the results of the three samplers at Lockeland are included in Tables 5 and 6. The span dust test of the T-640x was outside of the manufacture specifications of ± 0.5 . All other parameters for all samplers were within acceptance criteria.

Table 4 Near Road PM Sampler Verification

		Site	Near Road		
Time within one minute of actual	Yes	Met One BAM 1022	PM2.5		
Date verified	Yes	s/n =	W21428		
DeltaCal S/N	1196	EEMS	#	DeltaCal Cert Date:	2/10/2020
			01451		
Date & Site of Verification	10/19/2020 Near Road BAM 1022 PM-2.5				
Parameter	DeltaCal	1022 Site Sampler	Difference	Acceptance Criteria	Pass/Fail
Flow Rate (Lpm)	16.69	16.60	-0.56%	$\leq \pm 4\%$	Pass
Design Flow Rate (16.67 Lpm)	16.69		0.15%	$\leq \pm 4\%$	Pass
Ambient Temperature (°C)	23.1	23.2	0.1	$\leq \pm 2^\circ\text{C}$	Pass
Barometric Pressure (mm Hg)	750.7	749	-1.7	$\leq \pm 10$ mm Hg	Pass
Filter Temperature (°C)			0	$\leq \pm 2^\circ\text{C}$	Pass
Leak Check		flow = 0.9	0.9	≤ 12 mm/min	Pass

Table 5 Lockeland 1022 and 2025 Samplers Verifications

				Site	Lockeland
Time within one minute of actual	Yes			Met One BAM 1022 POC 1	s/n T23706
Time within one minute of actual	Yes			TEI Partisol 2025i POC 2	s/n 2025iW20783-1504
DeltaCal S/N	1196	EEMS	# 01451	DeltaCal Cert Date:	2/10/2020
Date & Site of Verification	10/20/2020 Lockeland BAM 1022 PM-2.5 POC 1				
Parameter	DeltaCal	POC 1 Sampler	Difference	Acceptance Criteria	Pass/Fail
Flow Rate (Lpm)	16.80	16.70	-0.62%	$\leq \pm 4\%$	Pass
Design Flow Rate (16.67 Lpm)	16.80		0.80%	$\leq \pm 4\%$	Pass
Ambient Temperature (°C)	26.2	27.3	1.1	$\leq \pm 2\text{ }^{\circ}\text{C}$	Pass
Barometric Pressure (mm Hg)	750.7	749	-1.7	$\leq \pm 10\text{ mm Hg}$	Pass
Filter Temperature (°C)			0	$\leq \pm 2\text{ }^{\circ}\text{C}$	Pass
Leak Check	start = NA	flow = 0.5		$\leq 5\text{ cm H}_2\text{O}$	Pass
Date & Site of Verification	10/20/2020 Lockeland Partisol PM-2.5 POC 2				
Parameter	DeltaCal	POC 2 Sampler	Difference	Acceptance Criteria	Pass/Fail
Flow Rate (Lpm)	16.53	16.67	0.82%	$\leq \pm 4\%$	Pass
Design Flow Rate (16.67 Lpm)	16.53		-0.81%	$\leq \pm 4\%$	Pass
Ambient Temperature (°C)	27.7	27.4	-0.3	$\leq \pm 2\text{ }^{\circ}\text{C}$	Pass
Barometric Pressure (mm Hg)	750.7	750	-0.7	$\leq \pm 10\text{ mm Hg}$	Pass
Filter Temperature (°C)	29.5	30.0	0.5	$\leq \pm 2\text{ }^{\circ}\text{C}$	Pass
Leak Check	start = NA	flow = N/A	15 mm	$\leq 25\text{ mm H}_2\text{O}$	Pass

Table 6 Lockeland T-640x PM2.5 and PM10 Verifications

		Network :		MPHD - Lockeland		
Time within one minute	Yes	T-640x PM2.5		s/n 991		
Date verified	Yes	T-640x PM10				
DeltaCal S/N	1196	EEMS #	01451	DeltaCal Cert Date:	2/10/2020	
Date & Site of Verification	10/20/2020 Lockeland T-640x PM2.5 & PM10					
Parameter	flow raw	flow corr	T-640	Difference	Acceptance Criteria	Pass/Fail
Total Flow Rate (Lpm)	16.87	16.86	16.60	-1.60%	$\leq \pm 4\%$	Pass
Design Flow Rate (16.67 Lpm)	16.87	16.86		1.20%	$\leq \pm 4\%$	Pass
By-pass Flow Rate (Lpm)	11.75	11.75	11.69	-0.49%	$\leq \pm 5\%$	Pass
Sample Flow Rate (Lpm)	5.20	5.20	5.01	-3.69%	$\leq \pm 5\%$	Pass
Dust Test	11.1		10.1	-1.0	$\leq \pm 0.5$	Fail
Ambient Temperature (°C)	25.8		26.5	0.7	$\leq \pm 2^\circ\text{C}$	Pass
Barometric Pressure (mm Hg)	750.7		748.3	-2.4	$\leq \pm 10 \text{ mm Hg}$	Pass
Leak Check (PM2.5)			0.0		0.2 lpm	Pass
Leak Check (PM10)			0.0		0.2 lpm	Pass
Zero Check (PM2.5)			0.0		0.2 μg	Pass
Zero Check (PM10)			0.0		0.2 μg	Pass

3.2 TTP Ozone Audit Results

The audit results of the ozone monitors in the network were within the acceptance limits of $\pm 10\%$ of any single audit point. The monitor response at the Percy Priest site to ozone-free air was approximately -1.2ppb which accounts for the observed negative bias at the level 2 audit point. The monitor at Percy Priest was very slow to respond to test gas and it was observed to respond with negative measurements when audit gas was introduced. 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 and Audit Level	Audit Value (ppm)	Site Value (ppm)	% Difference	Actual Difference (ppm)	Pass Warning Fail
Percy Priest – level 6	0.10587	0.10610	0.2	0.00023	Pass
Percy Priest – level 4	0.06641	0.06580	-0.9	-0.00061	Pass
Percy Priest – level 3	0.03345	0.03280	-1.9	-0.00065	Pass
Percy Priest – level 2	0.01467	0.01360	N/A	-0.00107	Pass
East - level 6	0.11577	0.11380	-1.7	-0.00197	Pass
East - level 5	0.07123	0.07042	-1.1	-0.00081	Pass
East - level 3	0.03877	0.03810	-1.7	-0.00067	Pass
East - level 2	0.01575	0.01531	N/A	-0.00044	Pass

3.3 TTP Sulfur Dioxide Audit Results

One SO₂ monitor was audited. The results of the SO₂ audits are summarized in Table 8. The field audit forms are included in Appendix A.

Table 8 Sulfur Dioxide TTP Audit Results

Site and Audit Level	Audit Value (ppm)	Site Value (ppm)	% Difference	Actual Difference (ppm)	Pass Warning Fail
Near Road – level 8	0.19023	0.19230	1.1	0.0021	Pass
Near Road – level 6	0.08020	0.08170	1.9	0.0015	Pass
Near Road – level 5	0.03678	0.03800	3.3	0.0012	Pass
Near Road – level 4	0.01383	0.01510	9.2	0.0013	Pass

3.4 TTP Carbon Monoxide Audit Results

There is one CO monitor in the network at the Near Road site. The audit results of that monitor were not within the acceptance limits of $\pm 15\%$ of any single audit point at the lowest of the four points tested. The monitor response to pollutant-free air was approximately -0.200 ppm which accounts for the observed bias. The results of the CO audit are summarized in Table 9. The field audit forms are included in Appendix A.

Table 9 Carbon Monoxide TTP Audit Results

Site and Audit Level	Audit Value (ppm)	Site Value (ppm)	% Difference	Actual Difference (ppm)	Pass Warning Fail
Near Road – level 5	6.3078	6.1100	-3.1	-0.19779	Pass
Near Road – level 4	2.6593	2.4200	-9.0	-0.23930	Pass
Near Road – level 4	1.2196	1.0990	-9.9	-0.12059	Pass
Near Road – level 3	0.4586	0.2810	-38.7	-0.17764	Fail

3.5 TTP Nitrogen Dioxide Audit Results

All audit test points for both NO₂ monitors were within the acceptance limits of $\pm 15\%$ of any single audit point, and within the warning limits of $\pm 10\%$, or 1.5 ppb for level 2. There were no observed problems with the accuracy of the station monitors. The results of the NO₂ audits are summarized in Table 10. The field audit forms are included in Appendix A.

Table 10 Nitrogen Dioxide TTP Audit Results

Site and Audit Level	Audit Value (ppm)	Site Value (ppm)	% Difference	Actual Difference (ppm)	Pass Warning Fail
East – level 6	0.08580	0.08795	2.5	0.00215	Pass
East – level 5	0.04200	0.04344	3.4	0.00144	Pass
East – level 4	0.01780	0.01885	5.9	0.00105	Pass
East – level 2	0.00320	0.00392	N/A	0.00072	Pass
East Converter Efficiency – level 6			99.4%		Pass
East Converter Efficiency – level 5			100.1%		Pass
East Converter Efficiency – level 4			100.0%		Pass
East Converter Efficiency – level 2			101.2%		Pass
Converter Eff calculated by OAQPS Guidance Doc 2.3 February 2002			99.4%		Pass
Near Road – level 7	0.12524	0.12170	-2.8	-0.00354	Pass
Near Road – level 5	0.04229	0.04070	-3.8	-0.00159	Pass
Near Road – level 4	0.01554	0.01490	-4.1	-0.00064	Pass
Near Road – level 2	0.00309	0.00292	N/A	-0.00017	Pass
Near Road Converter Efficiency – level 7			101.2%		Pass
Near Road Converter Efficiency – level 5			100.8%		Pass
Near Road Converter Efficiency – level 4			99.7%		Pass
Near Road Converter Efficiency – level 2			100.3%		Pass
Converter Eff calculated by OAQPS Guidance Doc 2.3 February 2002			101.2%		Pass

APPENDIX A

Audit Data Sheets

FINAL SUMMARY AUDIT REPORT CO BASED
EEMS Van-1

Site Name: Near Road

Audit Date: 10/19/2020

Parameter	NPAP Lab Response (ppm)	Station Response (ppm)	Percent Difference	Actual Difference (ppm)	Pass/Fail	Warning
Ozone						
Pre Zero						
Ozone audit level 6					N/A	
Ozone audit level 5					N/A	
Ozone audit level 4					N/A	
Ozone audit level 3					N/A	
Ozone audit level 2					N/A	
Post Zero						
Carbon Monoxide						
Pre Zero	0.0406	-0.2400		-0.28063	Pass	
CO Audit level 5	6.3078	6.1100	-3.1	-0.19779	Pass	
CO Audit level 4	2.6593	2.4200	-9.0	-0.23930	Pass	
CO Audit level 4	1.2196	1.0990	-9.9	-0.12059	Pass	
CO Audit level 3	0.4586	0.2810	-38.7	-0.17764	Fail	
CO Audit level 1					N/A	
Post Zero	-0.0334	-0.2500		-0.21656	Pass	
Oxides of Nitrogen						
Pre Zero	0.00120	-0.00220		-0.00340	Pass	
NO Audit Point #1	0.18587	0.17870	-3.9	-0.00717	Pass	
NO Audit Point #2	0.07836	0.07390	-5.7	-0.00446	Pass	
NO Audit Point #3	0.03594	0.03290	-8.5	-0.00304	Pass	
NO Audit Point #4	0.01351	0.01180	-12.7	-0.00171	Pass	
NO Audit Point #5					N/A	
Post Zero	-0.00099	-0.00205		-0.00106	Pass	
Pre Zero	0.00120	-0.00220		-0.00340	Pass	
NOx Audit Point #1	0.18587	0.17740	-4.6	-0.00847	Pass	
NOx Audit Point #2	0.07836	0.07319	-6.6	-0.00517	Pass	
NOx Audit Point #3	0.03594	0.03270	-9.0	-0.00324	Pass	
NOx Audit Point #4	0.01351	0.01175	-13.0	-0.00176	Pass	
NOx Audit Point #5					N/A	
Post Zero	-0.00099	-0.00209		-0.00110	Pass	
Pre Zero	0.00000	0.00090		0.00090	Pass	
NO2 Audit level 7	0.12524	0.12170	-2.8	-0.00354	Pass	
NO2 Audit level 5	0.04229	0.04070	-3.8	-0.00159	Pass	
NO2 Audit level 4	0.01554	0.01490	-4.1	-0.00064	Pass	
NO2 Audit level 2	0.00309	0.00292	-5.5	-0.00017	Pass	
Post Zero	0.00000	-0.00002		-0.00002	Pass	
Converter Efficiency NO2 level 7	101.2%				Pass	
Converter Efficiency NO2 level 5	100.8%				Pass	
Converter Efficiency NO2 level 4	99.7%				Pass	
Converter Efficiency NO2 level 2	100.3%				Pass	
Converter Efficiency calculated by OAQPS QA Guidance Doc 2.3 February 2002 =				101.2%	Pass	
Sulfur Dioxide						
Pre Zero	0.00123	0.00050		-0.0007	Pass	
SO2 Audit level 8	0.19023	0.19230	1.1	0.0021	Pass	
SO2 Audit level 6	0.08020	0.08170	1.9	0.0015	Pass	
SO2 Audit level 5	0.03678	0.03800	3.3	0.0012	Pass	
SO2 Audit level 4	0.01383	0.01510	9.2	0.0013	Pass	
SO2 Audit level 1					N/A	
Post Zero	-0.00101	0.00050		0.0015	Pass	

The sample inlet cover is dirty. CO baseline accounts for error with the CO monitor.

FINAL THROUGH-THE-PROBE AUDIT REPORT
EEMS Van-1

CARBON MONOXIDE REPORT

Site Name: Near Road
 Auditor: Eric Hebert (EEMS)
 Station Manager: Gillian Walshe-Langford (MPHD) / Hannah McGinnity (operator)

Airs ID: 470370040
 Audit Date: 10/19/20

MOBILE PE LAB INSTRUMENTS

Instrument:	Ozone	CO
Manufacturer:	Thermo	TEI
Model:	49iQ-PS	48i TLE
Serial Number:	1180930075	1010441506
Calibration Date:	09/14/18	Calibrated
Slope	1.003203	on
Intercept	0.00007166	day of audit

STATION INSTRUMENT INFORMATION

Instrument:	CO	
Manufacturer/Model #:	T-API	T300
Property Number:	1360	
Calibration Date:	09/14/20	
Slope/Intercept:	1.01	0.04
Indicated Flow:	0.8	
In-Line Filter Change:	9/26/2020	
Manifold Type:	0	

FINAL CARBON MONOXIDE AUDIT RESULTS

Audit CO Concentration (ppm)	Site Response (ppm)	Percent Difference
0.0406	-0.240	
6.3078	6.110	-3.1
2.6593	2.420	-9.0
1.2196	1.099	-9.9
0.4586	0.281	-38.7
-0.0334	-0.250	

CO Audit level 5	<u>Pass/Fail</u>	<u>Warning</u>
CO Audit level 4	Pass	
CO Audit level 4	Pass	
CO Audit level 3	Fail	
CO 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% OR difference from actual concentration < 24 hour allowable drift (0.03 ppm)
Fail	Bias > ±15% AND difference from actual concentration > 24 hour allowable drift (0.03 ppm)
Warning	Bias > ±10% AND difference from actual concentration > 0.030 ppm

FINAL THROUGH-THE-PROBE AUDIT REPORT
EEMS Van-1

NITROGEN OXIDES REPORT

Site Name: Near Road
Auditor: Eric Hebert (EEMS)
Station Manager: Gillian Walshe-Langford (MPHD) / Hannah McGinnity (operator)

Airs ID: 470370040
Audit Date: 10/19/20

MOBILE PE LAB INSTRUMENTS			STATION INSTRUMENT INFORMATION		
Instrument:	Ozone	CO	Instrument:	NO/NOX	
Manufacturer:	Thermo	TEI	Manufacturer/Model #:	TEI	42iTL
Model:	49iQ-PS	48i TLE	Property Number:	1324658812	
Serial Number:	1180930075	1010441506	Calibration Date:	10/12/20	
Calibration Date:	09/14/18	Calibrated	Slope/Intercept:	0.985	-0.002
Slope	1.003203	on	Indicated Flow:	1.5	
Intercept	0.00007166	day of audit	In-Line Filter Change:	9/30/2020	
			Manifold Type:	0	

FINAL NO AUDIT RESULTS		
Audit NO Concentration (ppm)	Site Response (ppm)	Percent Difference
0.00120	-0.0022	
0.18587	0.1787	-3.9
0.07836	0.0739	-5.7
0.03594	0.0329	-8.5
0.01351	0.0118	-12.7
-0.00099	-0.0021	
	<u>Pass/Fail</u>	<u>Warning</u>
NO Audit Point #1	Pass	
NO Audit Point #2	Pass	
NO Audit Point #3	Pass	
NO Audit Point #4	Pass	Warning
NO Audit Point #5	N/A	

FINAL NOx AUDIT RESULTS		
Audit NOx CONCENTRATION (ppm)	SITE RESPONSE (ppm)	Percent Difference
0.00120	-0.0022	
0.18587	0.1774	-4.6
0.07836	0.0732	-6.6
0.03594	0.0327	-9.0
0.01351	0.0118	-13.0
-0.00099	-0.0021	
	<u>Pass/Fail</u>	<u>Warning</u>
NOx Audit Point #1	Pass	
NOx Audit Point #2	Pass	
NOx Audit Point #3	Pass	
NOx Audit Point #4	Pass	Warning
NOx Audit Point #5	N/A	

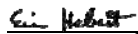
FINAL NO ₂ AUDIT RESULTS			
Audit NO ₂ Concentration (ppm)	Site Response (ppm)	Percent Difference	Converter Efficiency
0.00000	-0.0012		
0.12524	0.1217	-2.8	101.2%
0.04229	0.0407	-3.8	100.8%
0.01554	0.0149	-4.1	99.7%
0.00309	0.0029	-5.5	100.3%
0.00000	0.0000	0.0	

Audit Limits
 Pass Bias < ±15% OR difference from actual concentration < 24 hour
 Fail Bias > ±15% AND difference from actual concentration > 24 ho
 Warning Bias > ±10% AND difference from actual concentration > 0.001

Converter Efficiency Audit Limits
 Pass Between 96% and 104%
 Fail <96% or >104%
 Warning Between 96%-97% or 103%-104%

	<u>Pass/Fail</u>	<u>Warning</u>
NO ₂ Audit level 7	Pass	
NO ₂ Audit level 5	Pass	
NO ₂ Audit level 4	Pass	
NO ₂ Audit level 2	Pass	
Converter Efficiency NO ₂ level 7	Pass	
Converter Efficiency NO ₂ level 5	Pass	
Converter Efficiency NO ₂ level 4	Pass	
Converter Efficiency NO ₂ level 2	Pass	
Converter Efficiency by slope =	Pass	

Conv eff by slope = 101.2%

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

FINAL THROUGH-THE-PROBE AUDIT REPORT
EEMS Van-1

SULFUR DIOXIDE REPORT

Site Name: Near Road
 Auditor: Eric Hebert (EEMS)
 Station Manager: Gillian Walshe-Langford (MPHD) / Hannah McGinnity (operator)

Airs ID: 470370040
 Audit Date: 10/19/20

MOBILE PE LAB INSTRUMENTS

Instrument:	Ozone	CO
Manufacturer:	Thermo	TEI
Model:	49iQ-PS	48i TLE
Serial Number:	1180930075	1010441506
Calibration Date:	09/14/18	Calibrated
Slope	1.003203	on
Intercept	0.00007166	day of audit

STATION INSTRUMENT INFORMATION

Instrument:	SO2	
Manufacturer/Model #:	TEI	43iQ
Property Number:	1182890005	
Calibration Date:	10/03/20	
Slope/Intercept:	0.998	0.000
Indicated Flow:	0.6	
In-Line Filter Change:	10/13/2020	
Manifold Type:	0	

FINAL SULFUR DIOXIDE AUDIT RESULTS

Audit SO2 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.00123	0.0005	
0.19023	0.1923	1.1
0.08020	0.0817	1.9
0.03678	0.0380	3.3
0.01383	0.0151	9.2
-0.00101	0.0005	

SO ₂ Audit level 8	<u>Pass/Fail</u>	<u>Warning</u>
SO ₂ Audit level 6	Pass	
SO ₂ Audit level 5	Pass	
SO ₂ Audit level 4	Pass	
SO ₂ 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% OR difference from actual concentration < 24 hour allowable drift (0.0015 ppm)
Fail	Bias > ±15% AND difference from actual concentration > 24 hour allowable drift (0.0015 ppm)
Warning	Bias > ±10% AND difference from actual concentration > 0.0015 ppm

FINAL SUMMARY AUDIT REPORT
EEMS Van-1

Site Name: Percy Priest

Audit Date: 10/20/2020

Parameter	NPAP Lab Response (ppm)	Station Response (ppm)	Percent Difference	Actual Difference (ppm)	Pass/Fail	Warning
Ozone						
O3 Audit Level 6	0.10587	0.10610	0.2	0.00023	Pass	
O3 Audit Level 4	0.06641	0.06580	-0.9	-0.00061	Pass	
O3 Audit Level 3	0.03345	0.03280	-1.9	-0.00065	Pass	
O3 Audit Level 2	0.01467	0.01360	-7.3	-0.00107	Pass	
O3 Audit Level 1					N/A	
O3 zero	-0.00021	-0.00120		-0.00099		
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: Percy Priest
 Auditor: Eric Hebert (EEMS)
 Station Manager: Gillian Walshe-Langford (MPHD) / Greg Lowery (operator)

Airs ID: 470370026
 Audit Date: 10/20/20

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:	1322458653	
Calibration Date:	08/12/20	
Slope/Intercept (PPB):	1.0076	0.0000
Indicated Flow (LPM):	0.73 / 0.75	
In-Line Filter Change:	09/30/20	
Manifold Type:	1/4 " Teflon	

FINAL OZONE AUDIT RESULTS

Mobile Lab O3 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.10587	0.10610	0.2
0.06641	0.06580	-0.9
0.03345	0.03280	-1.9
0.01467	0.01360	-7.3
-0.00021	-0.00120	

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
	<u>Tim Sharac</u>
	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:

Although much improved from the audit performed last year, the ozone monitor at Percy Priest is still somewhat slow to respond. It also responds with negative values when ozone is first added to the inlet. The monitor response to ozone-free air was approximately -1 ppb. Since several troubleshooting activities have been implemented, including replacement of the monitor, it may indicate an environmental issue at the site. This was discussed with the operator and manager.

**FINAL SUMMARY AUDIT REPORT CO BASED
EEMS Van-1**

Site Name: East

Audit Date: 10/21/2020

Parameter	NPAP Lab Response (ppm)	Station Response (ppm)	Percent Difference	Actual Difference (ppm)	Pass/Fail	Warning
Ozone						
Pre Zero						
Ozone Audit Level 6	0.11577	0.11380	-1.7	-0.00197	Pass	
Ozone Audit Level 5	0.07123	0.07042	-1.1	-0.00081	Pass	
Ozone Audit Level 3	0.03877	0.03810	-1.7	-0.00067	Pass	
Ozone Audit Level 2	0.01575	0.01531	-2.8	-0.00044	Pass	
Ozone Audit Level 1					N/A	
Post Zero	-0.00013	-0.00050		-0.00037	Pass	
Carbon Monoxide						
Pre Zero	0.0134					
CO Audit level 5	4.8872				N/A	
CO Audit level 4	2.4708				N/A	
CO Audit level 3	1.3639				N/A	
CO Audit level 3	0.6336				N/A	
CO Audit level 2					N/A	
Post Zero	-0.0217					
Oxides of Nitrogen						
Pre Zero	0.00039	-0.0002		-0.00059	Pass	
NO Audit Point #1	0.14401	0.1484	3.0	0.00439	Pass	
NO Audit Point #2	0.07280	0.0745	2.3	0.00170	Pass	
NO Audit Point #3	0.04019	0.0403	0.1	0.00006	Pass	
NO Audit Point #4	0.01867	0.0189	1.0	0.00018	Pass	
NO Audit Point #5					N/A	
Post Zero	-0.00064	-0.0003		0.00034	Pass	
Pre Zero	0.00039	-0.0002		-0.00059	Pass	
NOx Audit Point #1	0.14401	0.1483	3.0	0.00429	Pass	
NOx Audit Point #2	0.07280	0.0745	2.3	0.00170	Pass	
NOx Audit Point #3	0.04019	0.0407	1.2	0.00050	Pass	
NOx Audit Point #4	0.01867	0.0194	4.1	0.00077	Pass	
NOx Audit Point #5					N/A	
Post Zero	-0.00064	0.0002		0.00084	Pass	
Pre Zero	0.00000	0.00010		0.00010	Pass	
NO2 Audit level 6	0.08580	0.08795	2.5	0.00215	Pass	
NO2 Audit level 5	0.04200	0.04344	3.4	0.00144	Pass	
NO2 Audit level 4	0.01780	0.01885	5.9	0.00105	Pass	
NO2 Audit level 2	0.00320	0.00392	22.5	0.00072	Pass	
Post Zero	0.00000	0.00050		0.00050	Pass	
Converter Efficiency NO2 level 6	99.4%				Pass	
Converter Efficiency NO2 level 5	100.1%				Pass	
Converter Efficiency NO2 level 4	100.0%				Pass	
Converter Efficiency NO2 level 2	101.2%				Pass	
Converter Efficiency calculated by OAQPS QA Guidance Doc 2.3 February 2002 =				99.4%	Pass	
Sulfur Dioxide						
Pre Zero	0.00040					
SO2 Audit level 7	0.14739				N/A	
SO2 Audit level 6	0.07451				N/A	
SO2 Audit level 5	0.04113				N/A	
SO2 Audit level 4	0.01911				N/A	
SO2 Audit level 2					N/A	
Post Zero	-0.00065					

FINAL THROUGH-THE-PROBE AUDIT REPORT
EEMS Van-1

OZONE REPORT

Site Name: East
 Auditor: Eric Hebert
 Station Manager: Gillian Walshe-Langford (MPHD) / Hannah McGinnity (operator)

Airs ID: 470370011
 Audit Date: 10/21/20

MOBILE PE LAB INSTRUMENTS

Instrument:	Ozone	CO
Manufacturer:	Thermo	TEI
Model:	49iQ-PS	48i TLE
Serial Number:	1180930075	1010441506
Calibration Date:	01/14/20	Calibrated
Slope	0.9949	on
Intercept	0.0003222	day of audit

STATION INSTRUMENT INFORMATION

Instrument:	Ozone	
Manufacturer/Model #:	Thermo	49i-A2NAB
Property Number:	CM09130037	
Calibration Date:	09/15/20	
Slope/Intercept:	0.9979	-0.0005
Indicated Flow:	0.79 / 0.79	
In-Line Filter Change:	10/16/20	
Manifold Type:	1/4 " Teflon	

FINAL OZONE AUDIT RESULTS

Audit O3 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.11577	0.11380	-1.7
0.07123	0.07042	-1.1
0.03877	0.03810	-1.7
0.01575	0.01531	-2.8
-0.00013	-0.00050	

Ozone Audit Level 6
 Ozone Audit Level 5
 Ozone Audit Level 3
 Ozone Audit Level 2
 Ozone Audit Level 1

<u>Pass/Fail</u>	<u>Warning</u>
Pass	
Pass	
Pass	
Pass	
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% OR difference from actual concentration < 24 hour allowable drift (0.0015 ppm)
Fail	Bias > ±15% AND difference from actual concentration > 24 hour allowable drift (0.0015 ppm)
Warning	Bias > ±10% AND difference from actual concentration > 0.0015 ppm

Comments:

NITROGEN OXIDES REPORT

Site Name: East
 Auditor: Eric Hebert
 Station Manager: Gillian Walshe-Langford (MPHD) / Hannah McGinnity (operator)

Airs ID: 470370011
 Audit Date: 10/21/20

MOBILE PE LAB INSTRUMENTS

Instrument:	Ozone	CO
Manufacturer:	Thermo	TEI
Model:	49iQ-PS	48i TLE
Serial Number:	1180930075	1010441506
Calibration Date:	01/14/20	Calibrated
Slope	0.9949	on
Intercept	0.0003222	day of audit

STATION INSTRUMENT INFORMATION

Instrument:	NO/NOX
Manufacturer/Model #:	Thermo #2i-AZSSDCA
Property Number:	1105247201
Calibration Date:	09/11/20
Slope/Intercept:	0.995 -0.004
Indicated Flow:	0.72 L/min
In-Line Filter Change:	10/13/2020
Manifold Type:	1/4" Teflon

FINAL PE NO AUDIT RESULTS

Mobile Lab NO Concentration (ppm)	Site Response (ppm)	Percent Difference
0.0004	-0.0002	
0.1440	0.1484	3.0
0.0728	0.0745	2.3
0.0402	0.0403	0.1
0.0187	0.0189	1.0
-0.0006	-0.0003	

	<u>Pass/Fail</u>	<u>Warning</u>
NO Audit Point #1	Pass	
NO Audit Point #2	Pass	
NO Audit Point #3	Pass	
NO Audit Point #4	Pass	
NO Audit Point #5	N/A	

FINAL PE NOx AUDIT RESULTS

Mobile Lab NOx CONCENTRATION (ppm)	SITE RESPONSE (ppm)	Percent Difference
0.0004	-0.0002	
0.1440	0.1483	3.0
0.0728	0.0745	2.3
0.0402	0.0407	1.2
0.0187	0.0194	4.1
-0.0006	0.0002	

	<u>Pass/Fail</u>	<u>Warning</u>
NOx Audit Point #1	Pass	
NOx Audit Point #2	Pass	
NOx Audit Point #3	Pass	
NOx Audit Point #4	Pass	
NOx Audit Point #5	N/A	

FINAL PE NO₂ AUDIT RESULTS

Mobile Lab NO ₂ Concentration (ppm)	Site Response (ppm)	Percent Difference	Converter Efficiency
0.0000	-0.0001		
0.0858	0.0880	2.5	99.4%
0.0420	0.0434	3.4	100.1%
0.0178	0.0189	5.9	100.0%
0.0032	0.0039	22.5	101.2%

Audit Limits

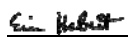
Pass	Bias < ±15% Levels 3 and above
Fail	Bias > ±15% OR > ± 1.5 ppb Levels 1 & 2
Warning	Bias > ±10% Levels 3 and above

Converter Efficiency Audit Limits

Pass	Between 96% and 104%
Fail	<96% or >104%
Warning	Between 96%-97% or 103%-104%

	<u>Pass/Fail</u>	<u>Warning</u>
NO ₂ Audit level 6	Pass	
NO ₂ Audit level 5	Pass	
NO ₂ Audit level 4	Pass	
NO ₂ Audit level 2	Pass	
Converter Efficiency NO2 level 6	Pass	
Converter Efficiency NO2 level 5	Pass	
Converter Efficiency NO2 level 4	Pass	
Converter Efficiency NO2 level 2	Pass	
Converter Efficiency by slope =	Pass	

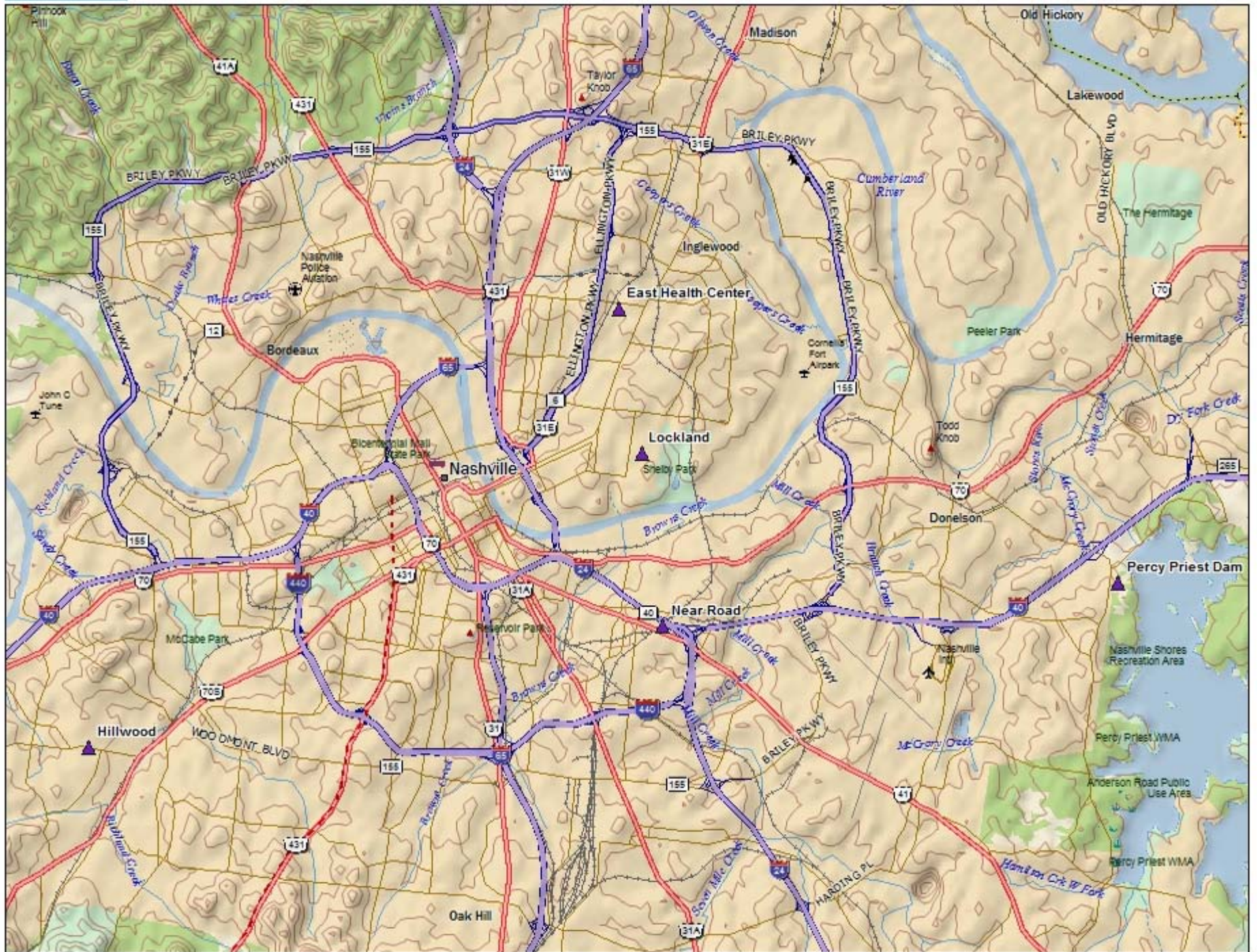
Conv eff by slope
99.4%

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

Comments:

APPENDIX B

Maps of Locations



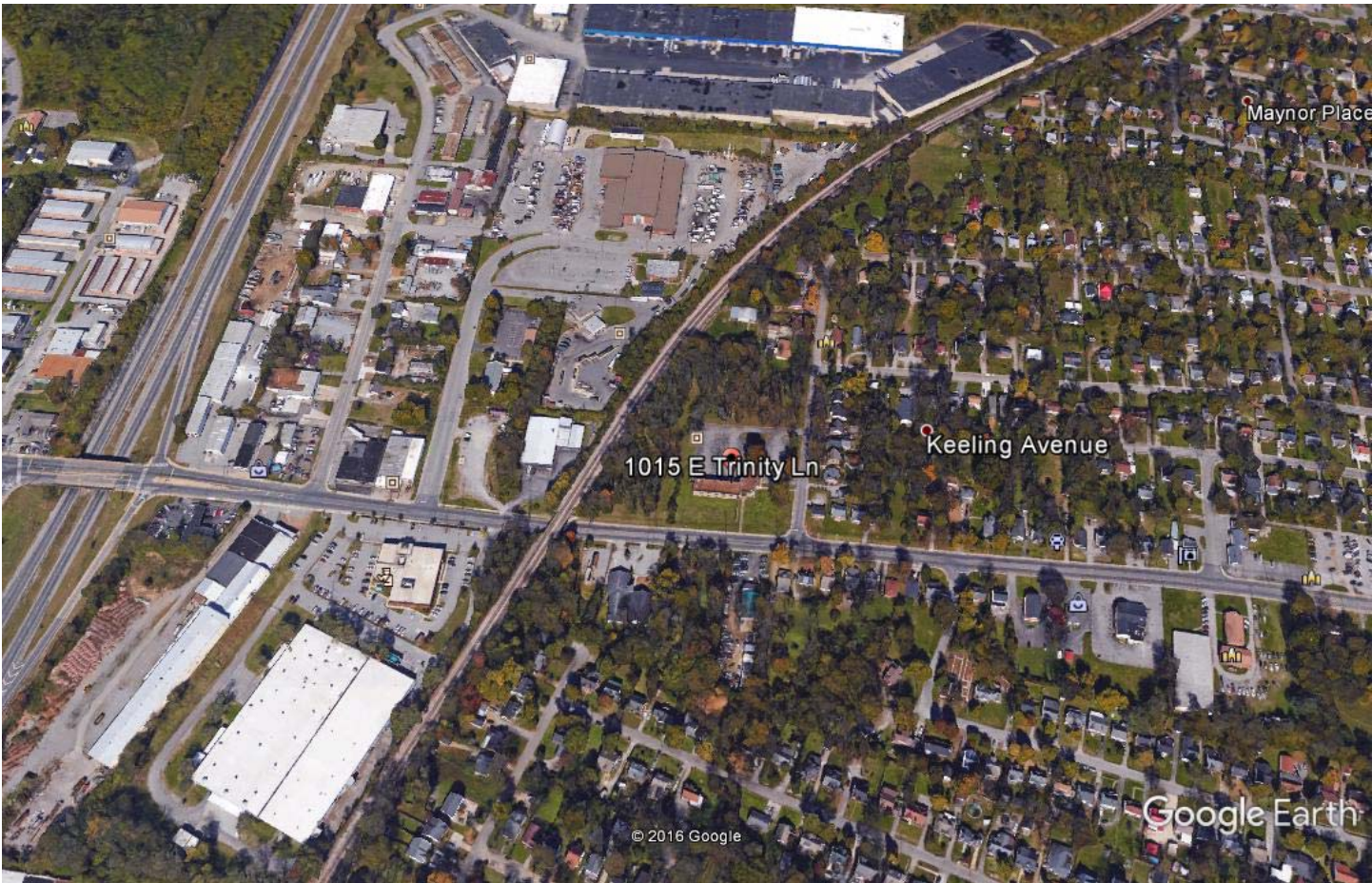
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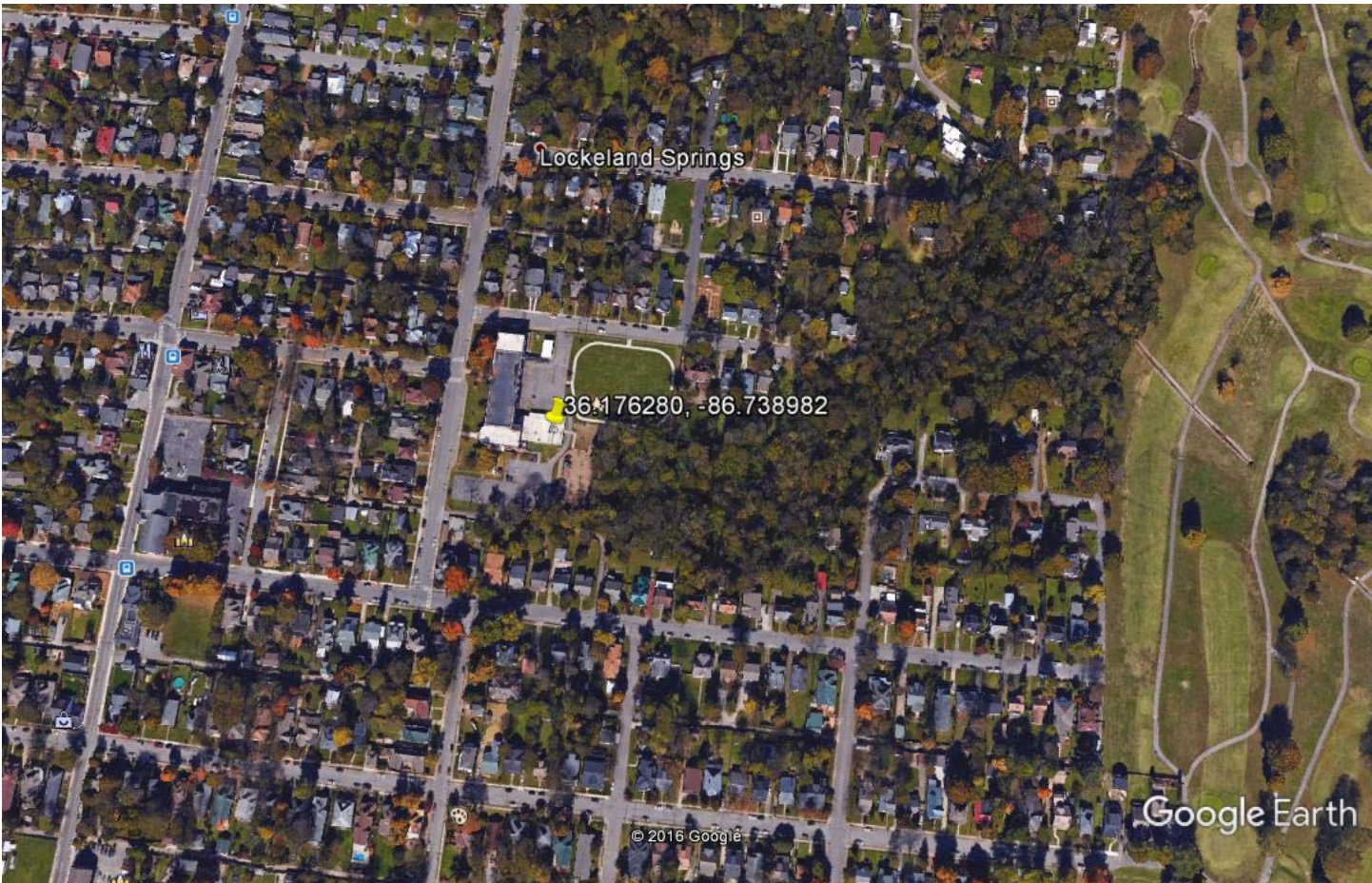


Data Zoom 10-7



Google Earth





Google Earth

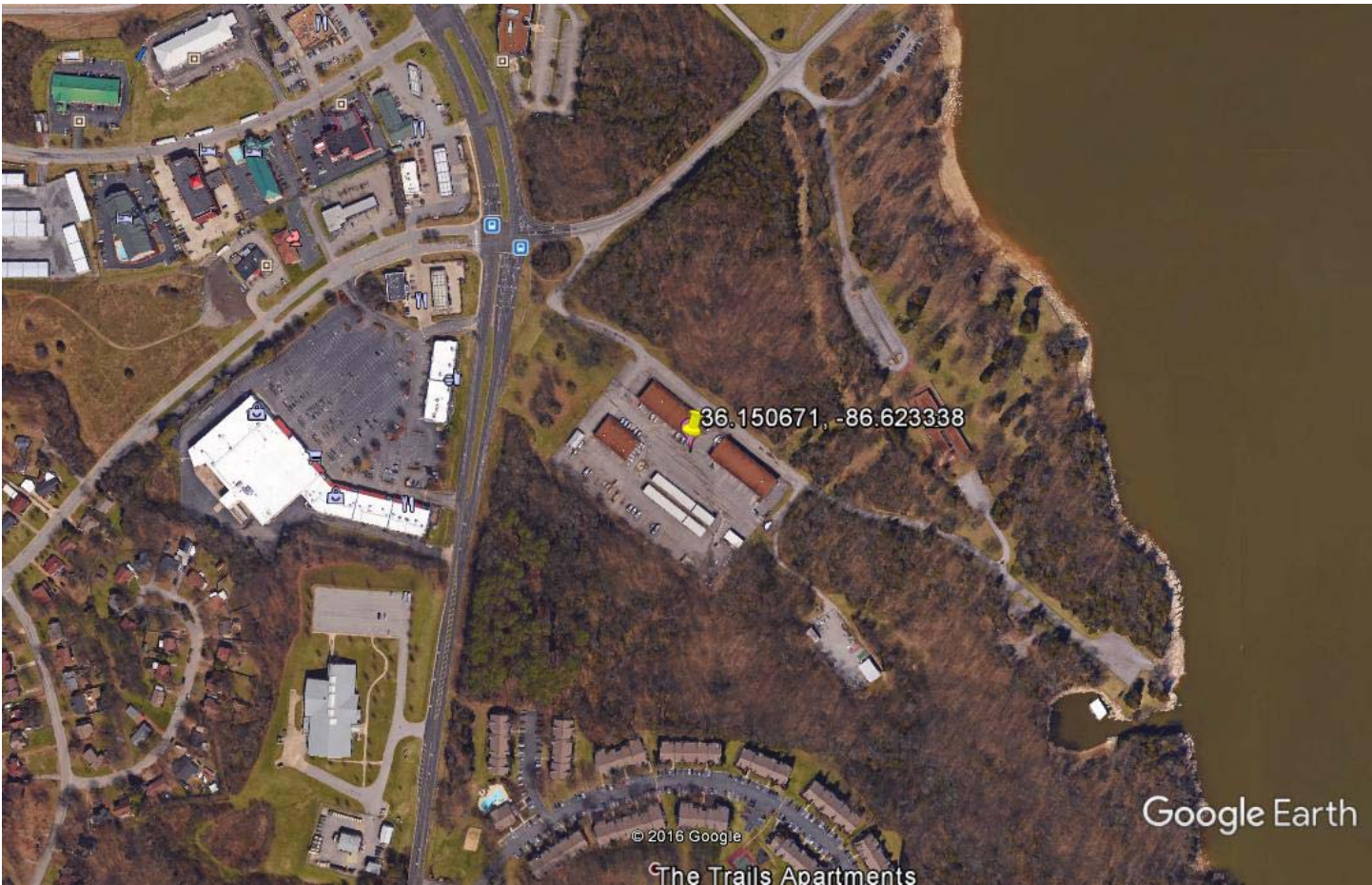




Google Earth

feet
meters





Google Earth



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			
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)
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

Challenge Cylinder #1 Certificate

EPA Protocol Gas Verification Program

Date of Assay: 26-Feb-19

Cylinder under Test: Scott Marrin
JB03450

Pollutant Gas: Carbon Monoxide
Balance Gas: Air
Cylinder Pressure After Assay: 850 psig

Assayed CO Concentration =	9.384
Vendor Certified CO Concentration =	9.440
% bias =	-0.60%
95% uncertainty of analysis =	0.07%

Reference Gas: SRM 1681b
FF20781

Expiration Date: 26-Sep-21

Analyst: T. Bui/ L. Sena

Analytical Facility: EPA Region 7 Ambient Air Standards Laboratory,
Kansas City, KS

Challenge Cylinder #1 Certificate

EPA Protocol Gas Verification Program

Date of Assay: 26-Feb-19

Cylinder under Test: Scott Marrin
JB03465

Pollutant Gas: Carbon Monoxide
Balance Gas: Air
Cylinder Pressure After Assay: 525 psig

Assayed CO Concentration =	4.509
Vendor Certified CO Concentration =	4.490
% bias =	0.42%
95% uncertainty of analysis =	0.27%

Reference Gas: SRM 1680b
CAL018075

Expiration Date: 20-Sep-21

Analyst: T. Bui/ L. Sena

Analytical Facility: EPA Region 7 Ambient Air Standards Laboratory,
Kansas City, KS

Challenge Cylinder #1 Certificate

EPA Protocol Gas Verification Program

Date of Assay: 5-Mar-19

Cylinder under Test: Scott Marrin
JB03443

Pollutant Gas: Carbon Monoxide
Balance Gas: Air
Cylinder Pressure After Assay: 1450 psig

Assayed CO Concentration =	0.521
Vendor Certified CO Concentration =	0.502
% bias =	3.77%
95% uncertainty of analysis =	0.80%

Reference Gas: SRM 1680b
CAL018075

Expiration Date: 20-Sep-21

Analyst: T. Bui/ L. Sena

Analytical Facility: EPA Region 7 Ambient Air Standards Laboratory,
Kansas City, KS

Challenge Cylinder #1 Certificate

EPA Protocol Gas Verification Program

Date of Assay: 27-Feb-19

Cylinder under Test:

Scott Marrin
JB03389

Pollutant Gas:

Carbon Monoxide

Balance Gas:

Nitrogen

Cylinder Pressure After Assay:

1325 psig

Assayed CO Concentration = 504.8

Vendor Certified CO Concentration = 506.0

% bias = -0.24%

95% uncertainty of analysis = 0.21%

Reference Gas: SRM 1680b
CAL018075

Expiration Date: 20-Sep-21

Analyst: T. Bui/ L. Sena

Analytical Facility: EPA Region 7 Ambient Air Standards Laboratory,
Kansas City, KS

Challenge Cylinder #1 Certificate

EPA Protocol Gas Verification Program

Date of Assay: 1-Mar-19

Cylinder under Test: Scott Marrin
JB03389

Pollutant Gas: Sulfur Dioxide
Balance Gas: Nitrogen
Cylinder Pressure After Assay: 1350 psig

Assayed SO ₂ Concentration =	15.22
Vendor Certified SO ₂ Concentration =	15.26
% bias =	-0.27%
95% uncertainty of analysis =	0.23%

Reference Gas: SRM 1693a
CAL015195

Expiration Date: 22-Mar-19

Analyst: T. Bui/L. Sena

Analytical Facility: EPA Region 7 Ambient Air Standards Laboratory,
Kansas City, KS

Challenge Cylinder #1 Certificate

EPA Protocol Gas Verification Program

Date of Assay: 6-Mar-19

Cylinder under Test: Scott Marrin
JB03389

Pollutant Gas: Nitric Oxide
Balance Gas: Nitrogen
Cylinder Pressure After Assay: 1325 psig

Assayed NO Concentration = 15.06

Vendor Certified NO Concentration = 14.91

% bias = 0.98%

95% Uncertainty of Analysis = 0.38%

Assayed NO_x Concentration = 15.05

Vendor Certified NO_x Concentration = 14.91

% bias = 0.91%

95% Uncertainty of Analysis = 0.41%

Reference Gas: SRM 1683b
CAL018181

Expiration Date: 25-Mar-19

Analyst: T. Bui/L. Sena

Analytical Facility: EPA Region 7 Ambient Air Standards Laboratory,
Kansas City, KS



Report Of Analysis EPA Protocol Gas Mixtures

EEMS01
TO: Environmental, Engineering & Measurement
Svcs Inc
1128 NW 39th Drive
Gainesville, FL 32605
(352) 262-0802

REPORT NO: 69075-01
REPORT DATE: March 13, 2017
CUSTOMER PO NO: E HEBERT

CYLINDER NUMBER: **JB03389**

CYLINDER SIZE: 50A (52 std cu ft)
CYLINDER PRESSURE: 2000 psig

COMPONENT	CONCENTRATION (v/v) ± EPA UNCERTAINTY	REFERENCE STANDARD	ANALYZER MAKE, MODEL, S/N, DETECTION	REPLICATE ANALYSIS DATA
Carbon monoxide	506 ± 2 ppm	GMIS	SRM 1680b	<u>3/3/2017</u> <u>3/13/2017</u>
			Samp#: 2-I-23	505 ppm 506 ppm
		Cyl#: CC323	Cyl#: CAL015763	505 ppm 506 ppm
		588 ± 2 ppm	496.7 ± 1.6 ppmv	505 ppm 507 ppm
		Exp: 10/7/2024	Exp: 2/20/2017	LAST CAL DATE: 3/7/2017 \bar{x} : 505 ppm 506 ppm
Nitric oxide	14.91 ± 0.16 ppm	GMIS	SRM 2629a	<u>3/3/2017</u> <u>3/10/2017</u>
			Samp#: 50-G-90	14.92 ppm 14.96 ppm
NOx	14.91 ppm	Cyl#: CC28468	Cyl#: FF31693	14.93 ppm 14.90 ppm
Nitrogen dioxide	< 0.15 ppm	20.34 ± 0.21 ppm	18.96 ± 0.19 ppm	14.86 ppm 14.92 ppm
		Exp: 12/20/2019	Exp: 6/30/2017	LAST CAL DATE: 3/7/2017 \bar{x} : 14.90 ppm 14.93 ppm
Sulfur dioxide	15.26 ± 0.22 ppm	GMIS	SRM 1689	<u>3/3/2017</u> <u>3/10/2017</u>
			Samp#: 98-A-33	15.28 ppm 15.23 ppm
		Cyl#: CA03167	Cyl#: FF40537	15.24 ppm 15.30 ppm
		10.22 ± 0.11 ppm	4.813 ± 0.05 ppm	15.29 ppm 15.18 ppm
		Exp: 10/7/2020	Exp: 1/8/2017	LAST CAL DATE: 2/20/2017 \bar{x} : 15.27 ppm 15.24 ppm

O2-free Nitrogen Balance

CERTIFICATION DATE: March 10, 2017

EPA EXPIRATION DATE: March 11, 2020

ppm = μmole/mole % = mole-% \bar{x} = EPA weighted mean

The above analyses were performed in accordance with Procedure G1 of the EPA Traceability Protocol, Report Number EPA600/R-12/531, dated May 2012.

The above analyses should not be used if the cylinder pressure is less than 100 psig.

ANALYST: Mark Monson
M.J. Monson

APPROVED: J. T. Marrin
J. T. Marrin



EEMS
01457

CERTIFICATE OF CALIBRATION - NIST TRACEABILITY

(Refer to instruction manual for further details of calibration)

DeltaCal Serial Number: S/w 1196

Date: 10-Feb-20

Calibration Technician : Jan Oviedo

Van 3

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: 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

	Reading Abs. P Crit. Vent. mm of Hg	Room Temp	CV Qa Flow Lpm	BP= 753 mm of Hg 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

2/13/20

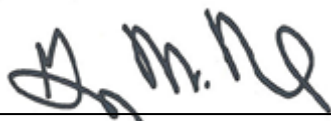
m = 1.000269
b = -0.00536
r2 = 1.00000

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