



January 12, 2021

Gillian Walshe-Langford, Ph.D.  
Air Monitoring Program  
Metro Public Health Department  
2500 Charlotte Avenue  
Nashville, Tennessee 37209  
Reference: Fourth Quarter 2020 TDEC / Performance Audits

Dear Dr. Walshe-Langford:

This report contains the results of performance audits conducted by personnel from Tennessee's Air Quality Assurance Program on October 13, 2020, October 15, 2020, December 1, 2020, and December 3, 2020. The audits were performed on various instruments at multiple monitoring locations throughout Metropolitan Davidson County air monitoring network, including gaseous analyzers for O<sub>3</sub>, SO<sub>2</sub>, NO<sub>2</sub>, CO, and particle samplers for PM 10 and PM 2.5. The sites audited include Near Road, East Health Center, Percy Priest Dam, and Lockeland School.

During the fourth quarter Quality Assurance Performance Audits (QAPA), Tennessee Air Quality Assurance personnel audited Percy Priest and East Health Center ozone analyzers with a level three standard (Teledyne 750U multi-gas calibrator) to determine the accuracy of the analyzer. For non-ozone gas audits, certified gas concentrations were delivered from the Teledyne 750U's verified mass flow controllers to determine the accuracy of SO<sub>2</sub>, NO<sub>2</sub> and CO analyzers. Times were verified by [www.time.gov](http://www.time.gov), and temperatures were verified using a transfer standard (Streamline Pro). The flow rate of each low volume particle sampler was checked against a specified design flow rate and a transfer standard (Streamline Pro). All TDEC QA equipment is verified against a certified standard to ensure its accuracy. These audits were conducted to ensure that each air monitor within the Metropolitan Davidson County network was operating within accepted criteria established by federal regulations and guidance documents. Acceptable limits of these performance audits are published in 40 Code of Federal Regulations (CFR) Part 58 and QA Handbook Volume II, which establish federal standards for Quality Assurance and Quality Control practices for ambient air monitoring. These acceptable limits should be considered in conjunction with your last approved Quality Assurance Plan.

Results from the fourth quarter, 2020 QAPAs, demonstrate that the Davidson County air monitoring network was operating within acceptable limits of federal regulations and quality assurance guidelines **except for the CO monitor at Near Road**. All QAPA results were noted in the instrument log books and summarized in the following pages of this report.

If we can be of any further assistance or should there be questions regarding this audit, please email me at [Ben.Hartsfield@tn.gov](mailto:Ben.Hartsfield@tn.gov) or call (615) 532-0597.

Sincerely,

A handwritten signature in blue ink that reads "Ben Hartsfield".

Ben Hartsfield  
Environmental Consultant 1  
Quality Assurance Section

Reviewed by Michelle Oakes   
Michelle Oakes (Jan 11, 2021 11:01 CST)

cc: A. Pratt, APC; M. Oakes, APC; R. Brawner, APC; G. Walshe-Langford, Davidson County

*Air Pollution Control Division  
Quality Assurance Performance Audit*

Site: Near Road CO  
 Audit Quarter: 4Q 2020  
 AQS #: 47-037-0040  
 Auditor: Ben Hartsfield  
 Date of Audit: 12/1/2020

Instrument Model: <b>Teledyne T300</b> Serial Number: <b>1360</b> Data Logger Model: <b>ESC 8832</b> Data Logger Serial Number: <b>A4689K</b>			<u>Audit Equipment:</u> Teledyne T750U SN 71 Teledyne 751H SN 183 Praxair FA02370 CO 201.7 PPM 6/26/2022 Streamline Pro SN 150306 <a href="http://www.time.gov">www.time.gov</a>			
<u>Measured Parameter sccm/LPM</u>	<u>Audit Value ppm</u>	<u>Monitor Response ppm</u>	<u>Difference</u>	<u>Acceptable Range</u>	<u>Level *</u>	
0cc/5L	0	-0.280		<±0.41 ppm	Zero	
180cc/10L	3.566	3.328	-6.7%	<±15.1%	5	
90cc/10L	1.799	1.521	-15.5%	<±15.1%	4	
30cc/10L	0.603	0.363	-39.8%	<±15.1%	3	
0cc/10L	0	-0.260		<±0.41 ppm	Zero	
Data Logger Time	11:20:05	11:20:00	00:00:05	<±00:01:00*		
Data Logger Temperature	26.3	27.1	0.8	<±2.1°C		

Site: Near Road NO<sub>2</sub>  
 Audit Quarter: 4Q 2020  
 AQS #: 47-037-0040  
 Auditor: Ben Hartsfield  
 Date of Audit: 12/1/2020

Instrument Model: <b>Thermo 42i TL NO<sub>2</sub></b> Serial Number: <b>1324658812</b> Data Logger Model: <b>ESC 8832</b> Data Logger Serial Number: <b>A4689K</b>			<u>Audit Equipment:</u> Teledyne T750U SN 71 Teledyne 751H SN 183 Praxair FA02370 NO/NO <sub>x</sub> 10.99 PPM 6/26/2022 Streamline Pro SN 150306 <a href="http://www.time.gov">www.time.gov</a>			
<u>Measured Parameter sccm/LPM</u>	<u>Audit Value ppb</u>	<u>Monitor Response ppb</u>	<u>Difference</u>	<u>Acceptable Range</u>	<u>Level *</u>	
0cc/10L	0	0	0.0	<±3.1 ppb	Zero	
1400mv-150cc/10L	126	119	-5.6%	<±15.1%	7	
1100mv-50cc/10L	73	68	-6.8%	<±15.1%	6	
970mv-30cc/10L	47	45	-4.3%	<±15.1%	5	
0cc/10L	0	0	0.0	<±3.1 ppb	Zero	

**Site: Near Road NO<sub>x</sub>**  
**Audit Quarter: 4Q 2020**  
**AQS #: 47-037-0040**  
**Auditor: Ben Hartsfield**  
**Date of Audit: 12/1/2020**

Instrument Model: <b>Thermo 42i NO<sub>x</sub></b> Serial Number: <b>1324658812</b> Data Logger Model: <b>ESC 8832</b> Data Logger Serial Number: <b>A4689K</b>		<b>Audit Equipment:</b> Teledyne T750U SN 71 Teledyne 751H SN 183 Praxair FA02370 NO/NO <sub>x</sub> 10.99 PPM 6/26/2022 Streamline Pro SN 150306 <a href="http://www.time.gov">www.time.gov</a>			
<u>Measured Parameter sccm/LPM</u>	<u>Audit Value ppb</u>	<u>Monitor Response ppb</u>	<u>Difference</u>	<u>Acceptable Range</u>	<u>Level *</u>
0cc/10L	0	-2.0	0.0	<±3.1 ppb	Zero
150cc/10L	162	158	-2.5%	<±15.1%	
100cc/10L	108	105	-2.8%	<±15.1%	
60cc/10L	65	62	-4.6%	<±15.1%	
20cc/10L	21	19	-9.5%	<±15.1%	
0cc/10L	0	0	0.0	<±3.1 ppb	Zero

**Site: Near Road NO**  
**Audit Quarter: 4Q 2020**  
**AQS #: 47-037-0040**  
**Auditor: Ben Hartsfield**  
**Date of Audit: 12/1/2020**

Instrument Model: <b>Thermo 42i NO</b> Serial Number: <b>1324658812</b> Data Logger Model: <b>ESC 8832</b> Data Logger Serial Number: <b>A4689K</b>		<b>Audit Equipment:</b> Teledyne T750U SN 71 Teledyne 751H SN 183 Praxair FA02370 NO/NO <sub>x</sub> 10.99 PPM 6/26/2022 Streamline Pro SN 150306 <a href="http://www.time.gov">www.time.gov</a>			
<u>Measured Parameter sccm/LPM</u>	<u>Audit Value ppb</u>	<u>Monitor Response ppb</u>	<u>Difference</u>	<u>Acceptable Range</u>	<u>Level *</u>
0cc/10L	0	0	0.0	<±3.1 ppb	Zero
150cc/10L	162	159	-1.9%	<±15.1%	
100cc/10L	108	105	-2.8%	<±15.1%	
60cc/10L	65	62	-4.6%	<±15.1%	
20cc/10L	21	19	-9.5%	<±15.1%	
0cc/10L	0	0	0.0	<±3.1 ppb	Zero

**Converter Efficiency: 97.6%**

**Site: Near Road SO<sub>2</sub>**  
**Audit Quarter: 4Q 2020**  
**AQS #: 47-037-0040**  
**Auditor: Ben Hartsfield**  
**Date of Audit: 12/01/2020**

Instrument Model: <b>Thermo 43i SO<sub>2</sub></b> Serial Number: <b>1182890005</b> Data Logger Model: <b>ESC 8832</b> Data Logger Serial Number: <b>A4689K</b>		<b>Audit Equipment:</b> Teledyne T750U SN 71 Teledyne 751H SN 183 Praxair FA02370 SO <sub>2</sub> 13.16 PPM 6/26/2022 Streamline Pro SN 150306 <a href="http://www.time.gov">www.time.gov</a>				
<u>Measured Parameter sccm/LPM</u>	<u>Audit Value ppb</u>	<u>Monitor Response ppb</u>	<u>Difference</u>	<u>Acceptable Range</u>	<u>Level *</u>	
0cc/10L	0	1	1	<±3.1 ppb	Zero	
150cc/10L	194	204	5.2%	<±15.1%	8	
100cc/10L	130	136	4.6%	<±15.1%	7	
60cc/10L	78	81	3.8%	<±15.1%	6	
20cc/10L	26	28	7.6%	<±15.1%	5	
0cc/10L	0	1	1	<±3.1 ppb	Zero	
Data Logger Time	11:20:05	11:20:00	00:00:05	<±00:01:00*		
Data Logger Temperature	26.3	27.1	0.8	<±2.1°C		

**Audit Notes:**

1. The monitors audited showed satisfactory correlation with our audit standard except for the CO monitor.
2. It is believed that if the CO monitor read zero closer to actual zero, the monitor would have showed satisfactory correlation.
3. The results were noted in the instrument logbooks and listed in this report.
4. \*The data logger acceptable range of <±00:01:00 is a State recommendation.

**Recommendation:**

1. Re-zero the CO monitor.

**Site: Near Road**  
**Audit Quarter: 4Q 2020**  
**AQS #: 47-037-0040**  
**Auditor: Ben Hartsfield**  
**Date of Audit: 12/01/2020**

Instrument Model: <b>BAM</b> Serial Number: <b>W21428</b>		<u>Audit Equipment:</u> Streamline Pro SN C150306 www.time.gov		
<u>Measured Parameter</u>	<u>Audit Value</u>	<u>Monitor Response</u>	<u>Difference</u>	<u>Acceptable Range</u>
Sample Flow: LPM	16.60	16.7	0.6%	+/-4.1% (5.1%)
Barometric Pressure: mmHg	750.6	750	- 0.6 mm	+/-10.1 mmHg
Ambient Temperature: °C	2.6	2.4	- 0.2°C	+/-2.1°C
External Leak Check:	AF:1.0	AL: 1.0		≤25 mmHg
Monitor Time:	11:49:45	11:49:36	-0:00:09	+/-00:05:00

**Audit Notes:**

1. The monitors audited showed satisfactory correlation with our audit standard.
2. The results were noted in the instrument logbooks and listed in this report.
3. \*The data logger time acceptable range of <math>\pm 00:01:00</math> is a State recommendation.

**Recommendations**

1. None.

Any questions concerning the audits, or any comments made in connection with the audits may be addressed to me at (615) 532-0597 or at Ben.Hartsfield@tn.gov.

Sincerely,



Ben Hartsfield  
 Environmental Consultant 1  
 Quality Assurance Program

*Air Pollution Control Division  
Quality Assurance Performance Audit*

**Site: Percy Priest Dam Ozone**  
**Audit Quarter: 4Q 2020**  
**AQS #: 47-037-0026**  
**Auditor: Ben Hartsfield**  
**Date of Audit: 10/13/2020**

Instrument Model: <b>Thermo 49i O3</b> Serial Number: <b>1322458652</b> Data Logger Model: <b>ESC 8832</b>		<u>Audit Equipment:</u> Teledyne T750U SN 153 Teledyne 751H SN 183 Streamline Pro C150306 www.time.gov			
<u>Measured Parameter O3 ppb/LPM</u>	<u>Audit Value ppb</u>	<u>Monitor Response ppb</u>	<u>Difference</u>	<u>Acceptable Range</u>	<u>Level *</u>
0ppb/5L	0	0	0	<±3.1 ppb	Zero
85ppb/5L	85	84	-1.2%	<±15.1%	5
65ppb/5L	65	64	-1.5%	<±15.1%	4
35ppb/5L	35	34	-2.9%	<±15.1%	3
15ppb/5L	15	14	-6.7%	<±1.5 ppb or <±15.1%, whichever is less stringent	2
0ppb/5L	0	0	-0	<±3.1 ppb	Zero
Data Logger Time	09:10:00	09:09:02	00:00:58	+/-00:01:00*	
Data Logger Temperature	24.8	25.0	0.2	±2.1 °C	

**Audit Notes:**

1. The monitor audited showed satisfactory correlation with our audit standard.
2. The results were noted in the instrument log books and listed in this report.
3. \*The data logger time acceptable range of <±00:01:00 is a State recommendation.

**Recommendations :**

1. None.

Any questions concerning the audits or any comments made in connection with the audits may be addressed to me at (615) 687-7048 or at Ben.Hartsfield@tn.gov.

Sincerely,



Ben Hartsfield  
 Environmental Consultant 1  
 Quality Assurance Program

*Air Pollution Control Division  
Quality Assurance Performance Audit*

**Site: East Health Center NO<sub>2</sub>**  
**Audit Quarter: 4Q 2020**  
**AQS #: 47-037-0011**  
**Auditor: Ben Hartsfield**  
**Date of Audit: 10/15/2020**

Instrument Model: <b>Thermo 42i NO<sub>2</sub></b> Serial Number: <b>1105247201</b> Data Logger Model: <b>ESC 8832</b> Data Logger Serial Number: <b>A4721K</b>			<u>Audit Equipment:</u> Teledyne T750U SN 153 Teledyne 751H SN 183 Praxair FA02370 NO/NO <sub>x</sub> 10.99 PPM 6/26/2022 Streamline Pro SN 150306 <a href="http://www.time.gov">www.time.gov</a>			
<u>Measured Parameter sccm/LPM</u>	<u>Audit Value ppb</u>	<u>Monitor Response ppb</u>	<u>Difference</u>	<u>Acceptable Range</u>	<u>Level *</u>	
0cc/10L	0	0	0.0	<±3.1 ppb	Zero	
1400mv-150cc/10L	127	129	1.6%	<±15.1%	7	
1150mv-100cc/10L	76	76	0.0%	<±15.1%	6	
970mv-60cc/10L	50	50	0.0%	<±15.1%	5	
0cc/10L	0	0	0.0	<±3.1 ppb	Zero	

**Site: East Health Center NO<sub>x</sub>**  
**Audit Quarter: 4Q 2020**  
**AQS #: 47-037-0011**  
**Auditor: Ben Hartsfield**  
**Date of Audit: 10/15/2020**

Instrument Model: <b>Thermo 42i NO<sub>x</sub></b> Serial Number: <b>110547201</b> Data Logger Model: <b>ESC 8832</b> Data Logger Serial Number: <b>A4721K</b>			<u>Audit Equipment:</u> Teledyne T750U SN 153 Teledyne 751H SN 183 Praxair FA02370 NO/NO <sub>x</sub> 10.99 PPM 6/26/2022 Streamline Pro SN 060504 <a href="http://www.time.gov">www.time.gov</a>			
<u>Measured Parameter sccm/LPM</u>	<u>Audit Value ppb</u>	<u>Monitor Response ppb</u>	<u>Difference</u>	<u>Acceptable Range</u>	<u>Level *</u>	
0cc/10L	0	0	0	<±3.1 ppb	Zero	
150cc/10L	162	170	4.9%	<±15.1%		
100cc/10L	108	114	5.6%	<±15.1%		
60cc/10L	65	68	4.6%	<±15.1%		
20cc/11L	22	22	0.0%	<±15.1%		
0cc/10L	0	0	0	<±3.1 ppb	Zero	

Site: East Health Center NO

Audit Quarter: 4Q 2020

AQS #: 47-037-0011

Auditor: Ben Hartsfield

Date of Audit: 10/15/2020

Instrument Model: <b>Thermo 42i NO</b> Serial Number: <b>1105247201</b> Data Logger Model: <b>ESC 8832</b> Data Logger Serial Number: <b>A4721K</b>			<u>Audit Equipment:</u> Teledyne T750U SN 153 Teledyne 751H SN 183 Praxair FA02370 NO/NO <sub>x</sub> 10.99 PPM 6/26/2022 Streamline Pro SN 150306 www.time.gov			
<u>Measured Parameter sccm/LPM</u>	<u>Audit Value ppb</u>	<u>Monitor Response ppb</u>	<u>Difference</u>	<u>Acceptable Range</u>	<u>Level *</u>	
0cc/10L	0	0	0.0	<±3.1 ppb	Zero	
150cc/10L	162	169	4.3%	<±15.1%		
100cc/10L	108	114	5.6%	<±15.1%		
60cc/10L	65	68	4.6%	<±15.1%		
20cc/10L	22	22	0.0%	<±15.1%		
0cc/10L	0	0	0.0	<±3.1 ppb	Zero	

Converter Efficiency: 97.9%

Audit Notes:

1. The monitor audited showed satisfactory correlation with our audit standard.

Recommendations:

1. None



**Site: East Health Center O3**  
**Audit Quarter: 4Q 2020**  
**AQS #: 47-037-0011**  
**Auditor: Ben Hartsfield**  
**Date of Audit: 10/15/2020**

Instrument Model: <b>Thermo 49i O3</b> Serial Number: <b>CM09130037</b> Data Logger Model: <b>ESC 8832</b> Data Logger Serial Number: <b>A4721K</b>			<b>Audit Equipment:</b> Teledyne T750U SN 153 Teledyne 751H SN 183 Praxair FA02370 CO 201.7 PPM 6/26/2022 Streamline Pro SN 150306 <a href="http://www.time.gov">www.time.gov</a>			
<u>Measured Parameter sccm/LPM</u>	<u>Audit Value ppb</u>	<u>Monitor Response ppb</u>	<u>Difference</u>	<u>Acceptable Range</u>	<u>Level *</u>	
0ppb/5L	0	1	1	<±3.1 ppb	Zero	
85ppb/5L	85	82	-3.5%	<±15.1%	8	
65ppb/5L	65	62	-4.6%	<±15.1%	7	
35ppb/5L	35	33	-5.7%	<±15.1%	6	
15ppb/5L	15	14	-6.7%	<±15.1%	5	
0ppb/5L	0	1	1	<±3.1 ppb	Zero	
Data Logger Time	10:55:30	10:55:00	00:00:30	<±00:01:00		
Data Logger Temperature	24.5	24.0	0.5	<±2.1°C		

**Audit Notes:**

1. The monitor audited showed satisfactory correlation with our audit standard
2. The data Logger time acceptable range of <+ 00:01:00 is a state recommendation.

**Recommendations:**

1. None

Any questions concerning the audits or any comments made in connection with the audits may be addressed to me at (615) 687-7048 or at Ben.Hartsfield@tn.gov.

Sincerely,



Ben Hartsfield  
 Environmental Consultant 1  
 Quality Assurance Program

**Site: Lockeland**  
**Audit Quarter: 4Q 2020**  
**AQS #: 47-037-0023**  
**Auditor: Ben Hartsfield**  
**Date of Audit: 12/03/2020**

Instrument Model: <b>T640</b> Serial Number: <b>1405A231091503</b>		<u>Audit Equipment:</u> Streamline Pro SN C150306 www.time.gov		
<u>Measured Parameter</u>	<u>Audit Value</u>	<u>Monitor Response</u>	<u>Difference</u>	<u>Acceptable Range</u>
Sample Flow: LPM	5.14	5.00	-2.7%	+/-4.1% (5.1%)
Bypass Flow: LPM	11.64	11.67	0.3%	+/-4.1% (5.1%)
Total Flow: LPM	16.78	16.67	-0.7%	+/-4.1% (5.1%)
Barometric Pressure: mmHg	752.5	752.4	-0.1mm	+/-10.1 mmHg
Ambient Temperature: °C	9.0	8.2	-0.8°C	+/-2.1°C
Monitor Time:	10:39:00	10:40:50	00:01:50	+/-00:05:00
Leak Check Main:	0.1			
Leak Check Bypass	0.1			

**Site: Lockeland**  
**Audit Quarter: 4Q 2019**  
**AQS #: 47-037-0023 POC1**  
**Auditor: Ben Hartsfield**  
**Date of Audit: 12/03/2020**

Instrument Model: <b>BAM POC 1</b> Serial Number: <b>W21431</b>		<u>Audit Equipment:</u> Streamline Pro SN C150306 www.time.gov		
<u>Measured Parameter</u>	<u>Audit Value</u>	<u>Monitor Response</u>	<u>Difference</u>	<u>Acceptable Range</u>
Sample Flow: LPM	16.63	16.7	0.4%	+/-4.1% (5.1%)
Barometric Pressure: mmHg	754.2	753	-1.2mm	+/-10.1 mmHg
Ambient Temperature: °C	7.9	6.2	-1.7°C	+/-2.1°C
External Leak Check: As Found mmHg		0.7		≤25 mmHg
External Leak Check: As Left mmHg		0.6		≤25 mmHg
Monitor Time:	10:10:30	10:10:20	-0:00:10	+/-00:05:00

**Site: Lockeland**  
**Audit Quarter: 4Q 2020**  
**AQS #: 47-037-0023 POC 2**  
**Auditor: Ben Hartsfield**  
**Date of Audit: 12/03/2020**

Instrument Model: <b>2025i PM2.5</b> Serial Number: <b>2025I202241204</b>		Audit Equipment: Streamline Pro SN C150306 www.time.gov		
<u>Measured Parameter</u>	<u>Audit Value</u>	<u>Monitor Response</u>	<u>Difference</u>	<u>Acceptable Range</u>
Sample Flow: LPM	16.64	16.69	0.3%	+/-4.1% (5.1%)
Barometric Pressure: mmHg	753.8	757	3.2mm	+/-10.1 mmHg
Ambient Temperature: °C	7.6	7.8	0.2°C	+/-2.1°C
Filter Temperature: °C	9.0	9.7	0.7°C	+/-2.1°C
External Leak Check: As Found mmHg		5		≤25 mmHg
External Leak Check: As Left mmHg		2		≤25 mmHg
Monitor Time:	10:24:23	10:24:00	-0:00:23	+/-00:05:00

**Audit Notes:**

1. The monitors audited showed satisfactory correlation with our audit standard.
2. The results were noted in the instrument log books and listed in this report.

**Recommendations**

1. None

Any questions concerning the audits or any comments made in connection with the audits may be addressed to me at (615) 687-7048 or at Ben.Hartsfield@tn.gov.

Sincerely,



Ben Hartsfield  
 Environmental Consultant 1  
 Quality Assurance Program