OFFICE OF COUNTY MAYOR GLENN JACOBS

Knox County Health Department • 140 Dameron Avenue, Knoxville, TN 37917-6413

Brian Rivera, P.E.
Division Director Air Quality
Knox County Health Department
140 Dameron Ave,
Knoxville, TN 37917-6413

June 7, 2021

Re:Second Quarter Air Monitoring
Audit

Dear Mr. Rivera:
On June 2nd,3rd, and 7th, 2021 the internal quality assurance performance audits were performed on Air Quality's monitoring network. All of the monitors audited were within the acceptable range for critical criteria.

Each physical location was inspected. As noted on the following instrument audit results, many of the instruments were dusty and/or had evidence of cobwebs. The Program Manager and operators were notified of the need for additional cleaning.

The AV Trend software was not collecting data at the Springhill site, however the East Knox site was working as expected.

The laboratory clean room was inspected. The filter preparation area was clean. The PM2.5 storage temperature log was reviewed. Storage temperatures did not exceed 4.1 degrees C when filters were stored.

If there are any questions regarding this audit please email Rebecca.Larocque@knoxcounty.org or call 865-215-5941

Rebecca Larocque

Rebecca Larocque
Environmental Specialist
Knox County Health Department

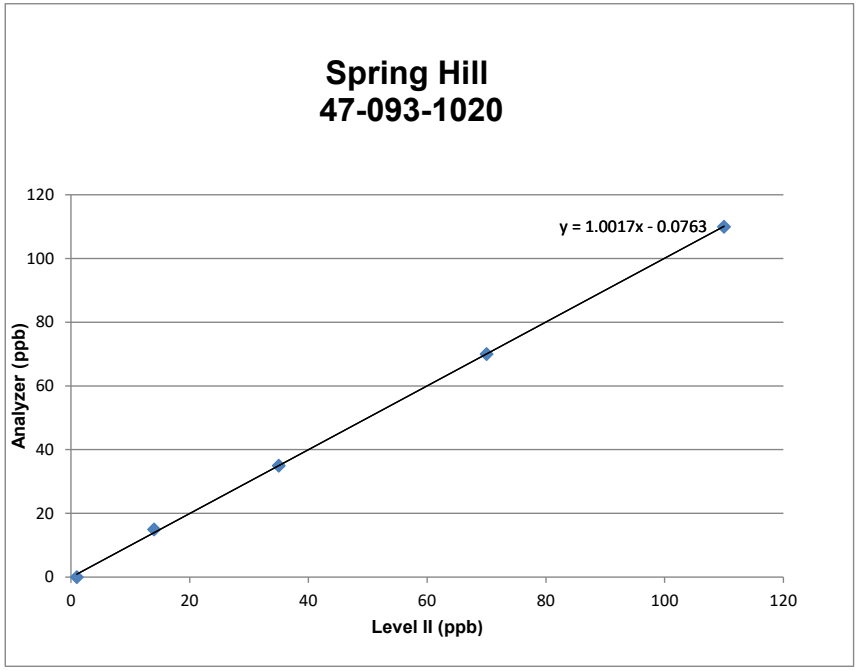
Ozone Audit Calculations

Date: 6/3/2021 Audit SN: 179
Site: Springhill Analyzer SN: 4005

Collection Time	Target	Analyzer	Audit Standard	Difference	% Difference
est	ppb	ppb	ppb	ppb	%
8:07:00 AM	**110**	110	110	0.0	0.00
8:17:00 AM	**70**	70	70	0.0	0.00
8:28:00 AM	**35**	35	35	0.0	0.00
8:39:00 AM	**15**	14	15	-1.0	-6.67
8:50:00 AM	**0**	1	0	1.0	N/A

Slope **0.998094** **correlation** **0.999874**

Intercept **0.09** **R2** **0.999749**



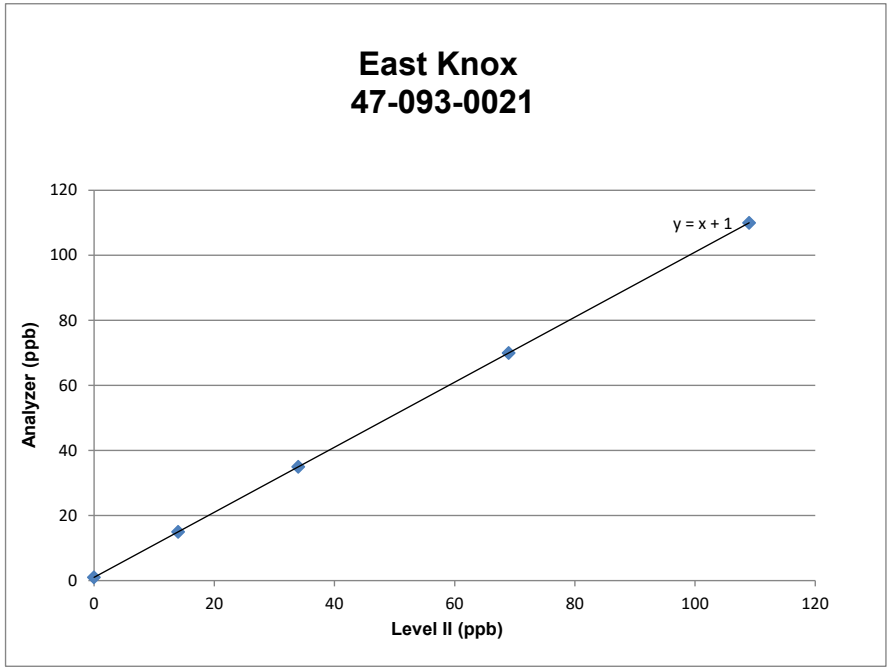
Power blinked @8:42 est during zero, instruments remained on, restarted external pump and solinoid swapped for a brief moment. AV Trend Not working

Date: 6/2/2021 Audit SN: 179
Site: East Knox Analyzer SN: 4006

Collection Time	Target	Analyzer	Audit Standard	Difference	% Difference
est	ppb	ppb	ppb	ppb	%
8:11:00 AM	**110**	109	110	-1.0	-0.91
8:22:00 AM	**70**	69	70	-1.0	-1.43
8:32:00 AM	**35**	34	35	-1.0	-2.86
8:44:00 AM	**15**	14	15	-1.0	-6.67
8:54:00 AM	**0**	0	1	-1.0	NA

Slope **1.000000** **correlation** **1.000000**

Intercept **-1.00** **R2** **1.000000**



Cobwebs near Hvac exhaust, suggest sweep/ vaccuum shelter. Reminder to inspect fire extinguisher

Reference device used for Audit: **SLP** Serial number : HL-190706

Date of Certification: Jun-20

Date: 6/1/2021
Site: Air Lab Monitor Serial number: B225760909

Thermo 2025

	units	System Value	Reference Value	Difference (S-R)	%	Acceptance Criteria
Time	hh:mm:ss	8:44:13 AM	8:44:32 AM	0:00:19		+/- 1 Min.
Filter T	°C	22.7	23	-0.3		+/- 2º C
Ambient T	°C	21.5	21.1	0.4		+/- 2º C
Pressure	mmHg	738	742	-4		+/- 10 mmHg
Flow Rate	lpm	16.71	16.98	-0.27	-1.59%	+/- 4%

Notes: LC Passed 2 mmHg PM 10 head was dirty, operator replaced with clean

Date: 6/1/2021
Site: Rule Monitor Serial number: W2909512601

Thermo 2025

	units	System Value	Reference Value	Difference (S-A)	%	Acceptance Criteria
Time	hh:mm:ss	10:21:00 AM	10:21:00 AM	0:00:00		+/- 1 Min.
Filter T	°C	25.7	26.7	-1		+/- 2º C
Ambient T	°C	24.4	24.4	0		+/- 2º C
Pressure	mmHg	740	739	1		+/- 10 mmHg
Flow Rate	lpm	16.68	16.93	-0.25	-1.48%	+/- 4%

Notes: LC passed 6mmHG

Date: 6/1/2021
Site: AirLab Monitor Serial number: 192

T640 X

	Units	System	Reference	Difference	%	Criteria
Time	hh:mm:ss	9:13:54 AM	9:13:53 AM	0:00:01		+/- 1 Min.
Shelter T	°C	30	28	2		+/- 2º C
Amb T	°C	24.4	24.8	-0.4		+/- 2º C
Pressure	mmHg	739.3	741.3	-2		+/- 10mmHg
Total Flow	lpm	16.8	16.9	-0.1	-0.59%	+/- 4 %
MainFlow	lpm	4.9	4.95	-0.05	-1.01%	+/- 4 %

Notes: LC Passed shelter T serial # 140793699, Very dusty (pollen) and dirty inside shelter, evidence older cobwebs

Date: 6/1/2021
Site: Rule Monitor Serial number: 675

T640

	Units	System	Reference	Difference	%	Criteria
Time	hh:mm:ss	10:42:10 AM	10:42:12 AM	0:00:02		+/- 1 Min.
Shelter T	°C	29.5	27.5	2		+/- 2º C
Amb T	°C	25.2	25	0.2		+/- 2º C
Pressure	mmHg	736.1	738.9	-2.8		+/- 10mmHg
Flow Rate	lpm	5	5.07	-0.07	-1.38%	+/- 4 %

Notes: Logbook, maintenance stickies in place but not utlized. Shelter thermometer SN200638909

Date: 6/2/2021
Site: Springhill Monitor Serial number: 910

T640

	Units	System	Reference	Difference	%	Criteria
Time	hh:mm:ss	10:25:00 AM	10:25:03 AM	0:00:03		+/- 1 Min.
Shelter T	°C	28	26	2		+/- 2º C
Amb T	°C	24.3	24.7	-0.4		+/- 2º C
Pressure	mmHg	735	736.1	-1.1		+/- 10mmHg
Flow Rate	lpm	4.95	5.12	-0.17	-3.32%	+/- 4 %

Notes: Extremely dusty in shelter, shelter thermometer SN99287906

Speciation Audit Calculations

Reference device used for Audit: **SLP**

Serial number : HL190706

Date of Certification: Jun-20

Leak Test

	Pass	Fail
URG 3000	47	
SASS Channel 1	0	
SASS Channel 2	0.1	

Pressure {Ambient}

	System	Reference	Difference
URG 3000N	734.2	736.2	-2.00
SASS	736	736	0.00

Flow Rate

	System	Reference	% Difference
URG 3000N	21.97	22.25	-1.26%
SASS channel 1	6.7	6.9	-2.90%
SASS Channel 2	6.6	6.8	-2.94%

Temperature

	System	Reference	Difference
URG 3000N Ambient	22.9	23.8	-0.90
SASS ambient	23.7	23.5	0.20
SASS filter channel 1	24.5	24.8	-0.30
SASSfilter Channel 2	24	24	0.00

KNOX COUNTY TENNESSEE
HEALTH DEPARTMENT

TSP 1-point Flow Verification

Site: Ameristeel **Operator's Orifice** Z87 Audit Stnd: 91004702 **Date:** 6/7/2021
manometers: 91022312

Technician: Rebecca Larocque

Monitor:
Model: Andersen/GMW Hi-Vol
VFC SN: P-04304

slope (m) 1.561 (TS Orifice calibration curve)
Intercept (b) 0.006

Sec 2.7.2, Step 4

	obs		conv
T_a =	23.9 ºC	=	296.9 º K
P_a =	739.1 mm Hg	=	29.1 in Hg

P_{std}/T_{std} = 0.1004

T_{std}/P_{std} = 9.959893

Pass Leak Test? Yes No

Sec 2.7.2, Step 7

ΔH_2O =	3.0 in H_20		**With Orifice and Filter**
ΔP_{stag} =	25.9 in H_20 =	48.4 mmHg	

With Orifice and Filter

$Q_a = (y-b)/m$

Q_{std} orif (calc)= 1.0924 m^3/min = 1.092 m3/min cfm

$y = \sqrt{[\Delta H_2O \times (P_{std}/T_{std})\ T_a/P_a]}$

$Q_a = \dfrac{(\sqrt{[\Delta H_2O \times (P_{std}/T_{std})\ T_a/P_a]}) - b}{m}$

P_o/P_a = 0.9345

Q_a orf (tab)= 1.1420 m^3/min

$P_o/P_a = 1-(\Delta P_{stag}/P_a)$ =
Absolute Stagnation Pressure Ratio

Q_{std} orif (tab)= Q_{std} (P_a/T_a) (T_{std}/P_{std}) = Q_{std} (T_a/P_a)(9.9599)

Q_{std} orif (tab)= 1.1148 m^3/min

Use the Absolute Stagantion Pressure Ratio (P_o/P_a)
and the temperature (T_a) to find the actual flowrate (Q_a)in the
monitor's look up table.

% difference between orifice flow rate and sampler flow rate
With Orifice and Filter

QC % difference = 100 X $\dfrac{Q_{std}\text{ orf (tab)} - Q_{std}\text{ orif (calc)}}{Q_{std}\text{ orif (calc)}}$ = 2.04 %

Is this value ≤ 7.1% ? Yes No

if yes, continue
If no, investigate

Without orifice. Filter in a cassette only

$P_o/P_a = 1-(\Delta P_{stag}/P_a)$ = Absolute Stagnation Pressure Ratio

ΔP_{stag} =	27 in H_20 =	50.4 mmHg	**Without Orifice. Filter in cassette only**

P_o/P_a = 0.9317

Q_a samp = 1.139 m^3/min

Use the Absolute Stagantion Pressure Ratio (P_o/P_a)
and the temperature (T_a) to find the actual flowrate (Q_a)in the
monitor's look up table.

Qstd = Qa * (Pa/Ta) * Tstd/Pstd = Qa (Pa/Ta) * 9.9599

Qstd = 1.111828981 m3/min 39.2639 cfm

Q_a correct
Without Orifice. Filter Only

Q_a correct = $\dfrac{Q_a\text{ samp X (100 - \% diff)}}{100}$ = 1.0891 m^3/min

% difference between Q_a correct and Q_a design

% difference = 100 X $\dfrac{Q_a\text{ correct} - 1.130}{1.130}$ = -3.62 %

Is this ≤ 10%? Yes No

if yes, flow check has been passed
if no, investigate

Note: Design flow rate = 1.13 m^3/min

Note: If % diff is ≥ 6 % notifiy site operator.

Reference Method 2.2 "Determination of Suspended Particulates in the Atmosphere (High-Volume Method)

KNOX COUNTY TENNESSEE
HEALTH DEPARTMENT

TSP 1-point Flow Verification

Site: Burnside **Operator's Orifice** Z87 Audit Stnd: 91004702 **Date:** 6/7/2021
manometers: 91022312

Technician: Rebecca Larocque

Monitor:
Model: Andersen/GMW Hi-Vol
VFC SN: P-02875

slope (m) 1.561 (TS Orifice calibration curve)
Intercept (b) 0.006

Sec 2.7.2, Step 4

	obs		conv
T_a =	22.7 ºC	=	295.7 º K
P_a =	739 mm Hg	=	29.1 in Hg

P_{std}/T_{std} = 0.1004

T_{std}/P_{std} = 9.959893

Pass Leak Test? Yes No

ΔH_2O =	3.2 in H_20		**With Orifice and Filter**
ΔP_{stag} =	25.6 in H_20 =	47.8 mmHg	

Sec 2.7.2, Step 7

With Orifice and Filter

$Q_a = (y-b)/m$

Q_{std} orif (calc)= 1.1306 m^3/min = 1.131 m3/min cfm

$y = \sqrt{[\Delta H_2O \times (P_{std}/T_{std})\ T_a/P_a]}$

$Q_a = \dfrac{(\sqrt{[\Delta H_2O \times (P_{std}/T_{std})\ T_a/P_a]}) - b}{m}$

P_o/P_a = 0.9353

Q_a orf (tab)= 1.1260 m^3/min

$P_o/P_a = 1-(\Delta P_{stag}/P_a)$ =
Absolute Stagnation Pressure Ratio

Q_{std} orif (tab)= Q_{std} (P_a/T_a) (T_{std}/P_{std}) = Q_{std} (T_a/P_a)(9.9599)

Q_{std} orif (tab)= 1.1034 m^3/min

Use the Absolute Stagantion Pressure Ratio (P_o/P_a)
and the temperature (T_a) to find the actual flowrate (Q_a)in the
monitor's look up table.

% difference between orifice flow rate and sampler flow rate
With Orifice and Filter

QC % difference = 100 X $\dfrac{Q_{std}\text{ orf (tab)} - Q_{std}\text{ orif (calc)}}{Q_{std}\text{ orif (calc)}}$ = -2.40 %

Is this value ≤ 7.1% ? Yes No

if yes, continue
If no, investigate

Without orifice. Filter in a cassette only

$P_o/P_a = 1-(\Delta P_{stag}/P_a)$ = Absolute Stagnation Pressure Ratio

ΔP_{stag} =	19.2 in H_20 =	35.9 mmHg	**Without Orifice. Filter in cassette only**

P_o/P_a = 0.9515

Q_a samp = 1.148 m^3/min

Use the Absolute Stagantion Pressure Ratio (P_o/P_a)
and the temperature (T_a) to find the actual flowrate (Q_a)in the
monitor's look up table.

Qstd = Qa * (Pa/Ta) * Tstd/Pstd = Qa (Pa/Ta) * 9.9599

Qstd = 1.12500969 m3/min 39.7293 cfm

Q_a correct
Without Orifice. Filter Only

Q_a correct = $\dfrac{Q_a\text{ samp X (100 - \% diff)}}{100}$ = 1.1520 m^3/min

% difference between Q_a correct and Q_a design

% difference = 100 X $\dfrac{Q_a\text{ correct} - 1.130}{1.130}$ = 1.95 %

Is this ≤ 10%? Yes No

if yes, flow check has been passed
if no, investigate

Note: Design flow rate = 1.13 m^3/min

Note: If % diff is ≥ 6 % notifiy site operator.

Reference Method 2.2 "Determination of Suspended Particulates in the Atmosphere (High-Volume Method)

KNOX COUNTY TENNESSEE
HEALTH DEPARTMENT

TSP 1-point Flow Verification

Site: Burnside Collocated **Operator's Orifice** Z87 Audit Stnd: 91004702 **Date:** 6/7/2021
manometers: 91022312

Technician: Rebecca Larocque

Monitor:
Model: Andersen/GMW Hi-Vol
VFC SN: P-04302

slope (m) 1.561 (TS Orifice calibration curve)
Intercept (b) 0.006

Sec 2.7.2, Step 4

	obs		conv
T_a =	22.7 ºC	=	295.7 º K
P_a =	739 mm Hg	=	29.1 in Hg

P_{std}/T_{std} = 0.1004

T_{std}/P_{std} = 9.959893

Pass Leak Test? Yes No

ΔH_2O =	3.1 in H_20		**With Orifice and Filter**
ΔP_{stag} =	25.8 in H_20 =	48.2 mmHg	

Sec 2.7.2, Step 7

With Orifice and Filter

$Q_a = (y-b)/m$

Q_{std} orif (calc)= 1.1127 m^3/min = 1.113 m3/min cfm

$y = \sqrt{[\Delta H_2O \times (P_{std}/T_{std})\ T_a/P_a]}$

$Q_a = \dfrac{(\sqrt{[\Delta H_2O \times (P_{std}/T_{std})\ T_a/P_a]}) - b}{m}$

P_o/P_a = 0.9348

Q_a orf (tab)= 1.1300 m^3/min

$P_o/P_a = 1-(\Delta P_{stag}/P_a)$ =
Absolute Stagnation Pressure Ratio

Q_{std} orif (tab)= Q_{std} (P_a/T_a) (T_{std}/P_{std}) = Q_{std} (T_a/P_a)(9.9599)

Q_{std} orif (tab)= 1.1074 m^3/min

Use the Absolute Stagantion Pressure Ratio (P_o/P_a)
and the temperature (T_a) to find the actual flowrate (Q_a)in the
monitor's look up table.

% difference between orifice flow rate and sampler flow rate
With Orifice and Filter

QC % difference = 100 X $\dfrac{Q_{std}\text{ orf (tab)} - Q_{std}\text{ orif (calc)}}{Q_{std}\text{ orif (calc)}}$ = -0.48 %

Is this value ≤ 7.1% ? Yes No

if yes, continue
If no, investigate

Without orifice. Filter in a cassette only

$P_o/P_a = 1-(\Delta P_{stag}/P_a)$ = Absolute Stagnation Pressure Ratio

ΔP_{stag} =	20.1 in H_20 =	37.6 mmHg	**Without Orifice. Filter in cassette only**

P_o/P_a = 0.9492

Q_a samp = 1.148 m^3/min

Use the Absolute Stagantion Pressure Ratio (P_o/P_a)
and the temperature (T_a) to find the actual flowrate (Q_a)in the
monitor's look up table.

Qstd = Qa * (Pa/Ta) * Tstd/Pstd = Qa (Pa/Ta) * 9.9599

Qstd = 1.12500969 m3/min 39.7293 cfm

Q_a correct
Without Orifice. Filter Only

Q_a correct = $\dfrac{Q_a\text{ samp X (100 - \% diff)}}{100}$ = 1.1304 m^3/min

% difference between Q_a correct and Q_a design

% difference = 100 X $\dfrac{Q_a\text{ correct} - 1.130}{1.130}$ = 0.04 %

Is this ≤ 10%? Yes No

if yes, flow check has been passed
if no, investigate

Note: Design flow rate = 1.13 m^3/min

Note: If % diff is ≥ 6 % notifiy site operator.

Reference Method 2.2 "Determination of Suspended Particulates in the Atmosphere (High-Volume Method)