Grayson Lake, KY NATTS Network Assessment Review

- Established 2008: Carbonyls, Chromium VI, PAHs, PM_{10} Metals, and VOCs
    - Chromium VI ended in in 2013
- For the NATTS Network Assessment (2008-2018):
    - 17 of 18 Method Quality Objective (MQO) Core HAPs were included in the national trends
        - Chromium VI: Did not have six consecutive years of datasets suitable for trends analysis.
    - 160 of 174 pollutant datasets were suitable for trends analysis
    - Annual Average and 3-Year Rolling Average Concentrations were generally flat over time, with the exception of a few pollutants.
    - 100% Reporting of Datasets
- Method Quality Objectives (MQO): 2008-2018
    - Completeness: Met 85% completeness in 166 of 192 pollutant datasets
    - Method Detection Limits: Met MDL Target Ratio of 1.00 in 182 of 204 pollutant datasets
    - Bias: Met ±25% for 145 of 155 pollutant datasets
    - Overall Method Precision: Met ≤15% CV for 66 of 110 pollutant datasets
    - Analytical Method Precision: Met ≤15% CV for 110 of 124 pollutant datasets
- Analytical Laboratories for 2018

VOC	Carbonyl	PM_{10} Metals	Chromium VI	PAHs
ERG	ERG	ERG	NA	ERG

- Equipment Year Deployed

Equipment Type	VOC	Carbonyl	PM_{10} Metals	Chromium VI	PAHs
Sampler	2012	2012	2010	2008	2008
Analytical	2010	2018	2015	2001	2015
Preconcentrator	2007	NA	NA	NA	NA
Standards Preparation	1985	NA	NA	NA	NA
Canister Cleaning	2011	NA	NA	NA	NA
Extraction	NA	NA	2014	2011	2004

National Summary: NATTS data were collected at 27 locations across the United States, with sites beginning in 2003 or later (Figure 1) for 19 core HAPs. Over 528,000 concentrations (primary, secondary, and replicate) were generated and analyzed for this assessment. Pollutant datasets were scored to assess whether they were suitable for trends analysis. Each pollutant dataset was evaluated against four MQOs: Completeness; Sensitivity; Bias; and Precision. Datasets that were suitable (A- or B-rated) for six consecutive years were used for national trends analysis (Table 1).

National trends were determined by comparing the most recent 3-year blocked averages (e.g., 2013-2015 vs. 2016-2018) to determine if the NATTS Trends DQO was being met:

To be able to detect a a15 percent difference (trend) between the annual mean concentrations of successive 3-year periods within acceptable levels of decision error.

Of the 19 core HAPs. 18 were assessed for the NATTS Trends DQO. Due to sampling and analytical issues, acrolein was not considered for trends analysis (Table 2). This assessment showed that across the network, 15 of those 18 pollutants were decreasing between the 3-year blocks, while two of those pollutants were increasing between the 3-year blocks. One pollutant did not exhibit a trend.

Figure 1. NATTS Site and Year Established

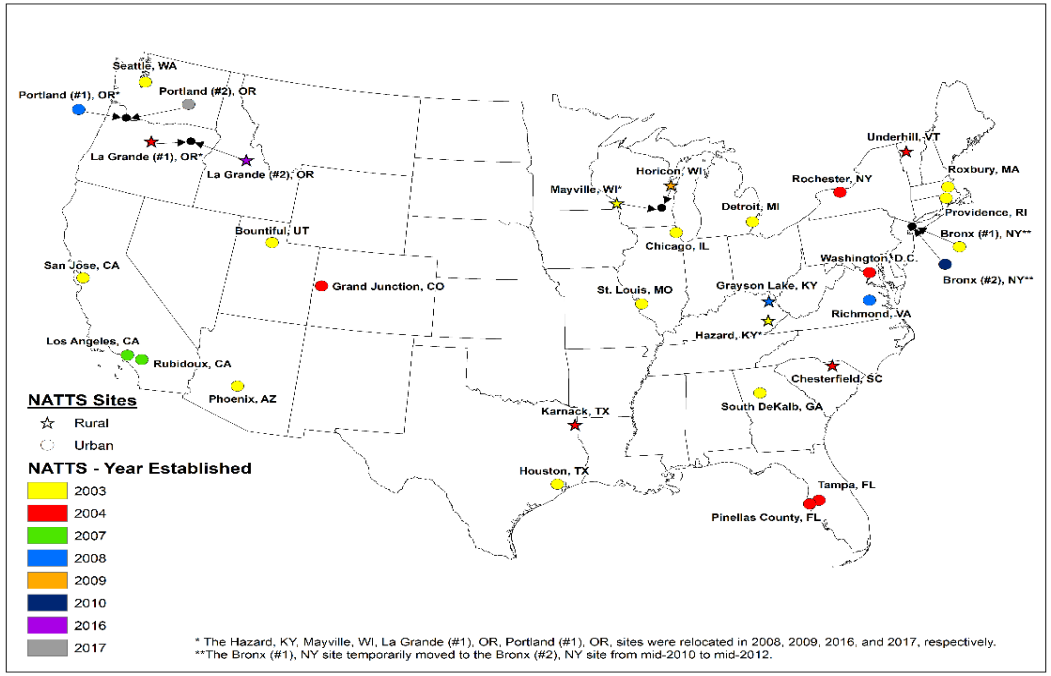


Table 1. NATTS Network Assessment: Count and Percentage of Suitable Datasets by Pollutant Group

Pollutant Group	A-rated		B-rated		Does Not Meet	
	#	%	#	%	#	%
VOCs	1,452	53%	737	27%	555	20%
Carbonyls	523	67%	193	25%	66	8%
PM_{10} Metals	1,418	61%	685	30%	213	9%
Chromium VI	159	74%	29	13%	27	13%
PAHs	410	74%	124	22%	18	3%
Total = 6,609	3,962	60%	1,768	27%	879	13%

Table 2. Three-Year Block Averages for National Trends

Pollutant	Units	# Sites	Block 1	Block 2	% Difference
Acetaldehyde	$\mu g/m^3$	19	1.51	1.39	-7.7%
Arsenic (PM_{10})	ng/m^3	21	0.71	0.68	-3.2%
Benzene	$\mu g/m^3$	19	0.65	0.59	-10.2%
Benzo(a)pyrene	ng/m^3	21	0.113	0.087	-23.2%
Beryllium (PM_{10})	ng/m^3	20	0.012	0.009	-26.4%
Butadiene, 1,3-	$\mu g/m^3$	19	0.071	0.063	-10.9%
Cadmium (PM_{10})	ng/m^3	21	0.170	0.097	-43.0%
Carbon Tetrachloride	$\mu g/m^3$	15	0.59	0.56	-4.7%
Chloroform	$\mu g/m^3$	20	0.256	0.255	-0.4%
Chromium VI	ng/m^3	18	0.029	0.026	-7.7%
Formaldehyde	$\mu g/m^3$	19	2.77	2.68	-3.3%
Lead (PM_{10})	ng/m^3	21	3.08	2.81	-8.9%
Manganese (PM_{10})	ng/m^3	20	8.06	7.93	-1.6%
Naphthalene	ng/m^3	20	66.70	51.08	-23.4%
Nickel (PM_{10})	ng/m^3	19	1.28	1.05	-18.0%
Tetrachloroethylene	$\mu g/m^3$	19	0.149	0.174	17.2%
Trichloroethylene	$\mu g/m^3$	19	0.020	0.022	10.7%
Vinyl Chloride	$\mu g/m^3$	17	0.0051	0.0048	-5.5%

NATTS Monitoring Site Report: Grayson Lake, KY

Site Information

Region	4
NATTS Site Type	Rural
County	Carter
AQS Site Code	21-043-0500
NATTS Operating Agency	KY Dept. of Environmental Protection
Latitude	38.238333
Longitude	-82.988333
AQS Land Use	Residential
AQS Location Setting	Rural
10-Mile Population	27,202

Figure 2. NATTS Site Location

Pollutant Datasets Evaluation: Suitable for Trends (Y=yes; Y(T)=yes, and used for DQO Trends; N=No; "--"=not rated

Final Pollutant Name	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Acetaldehyde	--	--	--	--	--	--	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Arsenic (PM_{10})	--	--	--	--	--	--	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Benzene	--	--	--	--	--	--	N[a]	N[b]	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Benzo(a)pyrene	--	--	--	--	--	--	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Beryllium (PM_{10})	--	--	--	--	--	--	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Butadiene, 1,3-	--	--	--	--	--	--	N[a]	N[b]	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Cadmium (PM_{10})	--	--	--	--	--	--	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Carbon tetrachloride	--	--	--	--	--	--	N[a]	N[b]	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Chloroform	--	--	--	--	--	--	N[a]	N[b]	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Chromium VI	--	--	--	--	--	--	Y	Y	Y	Y	--	--	--	--	--	--
Formaldehyde	--	--	--	--	--	--	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Lead (PM_{10})	--	--	--	--	--	--	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Manganese (PM_{10})	--	--	--	--	--	--	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Naphthalene	--	--	--	--	--	--	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Nickel (PM_{10})	--	--	--	--	--	--	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Tetrachloroethylene	--	--	--	--	--	--	N[a]	N[b]	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Trichloroethylene	--	--	--	--	--	--	N[a]	N[b]	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Vinyl chloride	--	--	--	--	--	--	N[a]	N[b]	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)

[a]: Pollutant was expected, but were invalidated at this site for this year.

[b]: Completeness was less than 75% based on 1-in-6 day sampling

Table 3. NATTS Network Assessment Data (2003-2018) - National Distribution Statistics By Type[a]

Analyte	Units	Site Type	# Data Records	% Detections	Arithmetic Mean[b]	Percentile Value[c]						
						5th	10th	25th	50th	75th	90th	95th
Acetaldehyde	µg/m^3	Urban	15,704	100%	1.77 ± 0.02	0.50	0.66	0.97	1.45	2.19	3.24	4.04
	µg/m^3	Rural	4,930	100%	1.20 ± 0.04	0.36	0.46	0.65	0.93	1.38	2.02	2.76
	µg/m^3	All Sites	20,634	100%	1.63 ± 0.02	0.44	0.58	0.86	1.31	2.00	3.02	3.86
Arsenic (PM_{10})	ng/m^3	Urban	14,968	97%	0.89 ± 0.04	0.10	0.19	0.34	0.58	0.99	1.70	2.41
	ng/m^3	Rural	4,622	96%	0.49 ± 0.02	0.04	0.08	0.17	0.35	0.59	0.94	1.28
	ng/m^3	All Sites	19,590	97%	0.79 ± 0.03	0.06	0.14	0.29	0.52	0.89	1.54	2.19
Benzene	µg/m^3	Urban	15,984	99%	0.86 ± 0.01	0.25	0.30	0.43	0.66	1.05	1.64	2.21
	µg/m^3	Rural	2,494	95%	0.43 ± 0.02	0.04	0.13	0.21	0.33	0.52	0.78	1.01
	µg/m^3	All Sites	18,478	99%	0.81 ± 0.01	0.19	0.26	0.39	0.61	0.98	1.55	2.09
Benzo(a)pyrene	ng/m^3	Urban	12,336	70%	0.096 ± 0.004	ND	ND	ND	0.04	0.11	0.24	0.37
	ng/m^3	Rural	3,179	36%	0.067 ± 0.009	ND	ND	ND	ND	0.02	0.13	0.37
	ng/m^3	All Sites	15,515	63%	0.090 ± 0.004	ND	ND	ND	0.03	0.10	0.23	0.37
Beryllium (PM_{10})	ng/m^3	Urban	15,783	75%	0.051 ± 0.006	ND	ND	0.00003	0.005	0.018	0.050	0.101
	ng/m^3	Rural	4,687	49%	0.023 ± 0.003	ND	ND	ND	ND	0.005	0.017	0.072
	ng/m^3	All Sites	20,470	69%	0.045 ± 0.005	ND	ND	ND	0.003	0.012	0.049	0.100
Butadiene, 1,3-	µg/m^3	Urban	15,388	81%	0.092 ± 0.002	ND	ND	0.025	0.058	0.114	0.215	0.302
	µg/m^3	Rural	2,185	29%	0.012 ± 0.001	ND	ND	ND	ND	0.017	0.046	0.059
	µg/m^3	All Sites	17,573	75%	0.082 ± 0.002	ND	ND	ND	0.049	0.104	0.199	0.287
Cadmium (PM_{10})	ng/m^3	Urban	16,360	92%	0.21 ± 0.02	ND	0.01	0.05	0.09	0.17	0.42	0.63
	ng/m^3	Rural	4,684	87%	0.10 ± 0.01	ND	ND	0.03	0.06	0.11	0.20	0.29
	ng/m^3	All Sites	21,044	91%	0.18 ± 0.01	ND	0.01	0.04	0.08	0.16	0.35	0.56
Carbon Tetrachloride	µg/m^3	Urban	14,713	99%	0.569 ± 0.003	0.361	0.433	0.496	0.562	0.651	0.737	0.798
	µg/m^3	Rural	2,189	92%	0.534 ± 0.016	ND	0.180	0.402	0.537	0.633	0.727	0.798
	µg/m^3	All Sites	16,902	98%	0.565 ± 0.003	0.304	0.408	0.490	0.559	0.649	0.736	0.798
Chloroform	µg/m^3	Urban	16,068	87%	0.265 ± 0.022	ND	ND	0.093	0.132	0.217	0.420	0.668
	µg/m^3	Rural	3,802	43%	0.052 ± 0.003	ND	ND	ND	ND	0.095	0.144	0.230
	µg/m^3	All Sites	19,870	79%	0.224 ± 0.018	ND	ND	0.064	0.113	0.196	0.364	0.586
Chromium VI	ng/m^3	Urban	8,414	74%	0.036 ± 0.002	ND	ND	ND	0.020	0.042	0.081	0.120
	ng/m^3	Rural	2,586	41%	0.018 ± 0.004	ND	ND	ND	ND	0.017	0.031	0.051
	ng/m^3	All Sites	11,000	66%	0.032 ± 0.001	ND	ND	ND	0.016	0.036	0.073	0.114

Table 3. NATTS Network Assessment Data (2003-2018) - National Distribution Statistics By Type[a]

Analyte	Units	Site Type	# Data Records	% Detections	Arithmetic Mean[b]	Percentile Value[c]						
						5th	10th	25th	50th	75th	90th	95th
Formaldehyde	µg/m^3	Urban	16,118	100%	3.11 ± 0.04	0.66	0.99	1.60	2.47	3.84	5.63	7.25
	µg/m^3	Rural	5,002	100%	2.22 ± 0.05	0.53	0.68	1.06	1.69	2.74	4.19	5.45
	µg/m^3	All Sites	21,120	100%	2.90 ± 0.04	0.61	0.86	1.43	2.29	3.59	5.38	6.96
Lead (PM_{10})	ng/m^3	Urban	16,366	100%	4.21 ± 0.13	0.72	0.98	1.55	2.64	4.56	8.35	11.90
	ng/m^3	Rural	4,680	99%	2.10 ± 0.16	0.37	0.50	0.84	1.41	2.37	3.91	5.36
	ng/m^3	All Sites	21,046	99%	3.74 ± 0.11	0.55	0.80	1.31	2.31	4.04	7.41	10.56
Manganese (PM_{10})	ng/m^3	Urban	16,141	100%	9.80 ± 0.32	1.09	1.51	2.52	4.92	10.21	20.10	30.08
	ng/m^3	Rural	4,627	99%	3.96 ± 0.14	0.46	0.73	1.36	2.57	4.75	8.54	12.13
	ng/m^3	All Sites	20,768	100%	8.50 ± 0.25	0.85	1.23	2.15	4.18	8.89	17.98	26.70
Naphthalene	ng/m^3	Urban	12,332	100%	74.63 ± 1.14	15.62	21.27	33.55	55.89	94.64	150.05	196.16
	ng/m^3	Rural	3,301	100%	24.47 ± 1.38	3.74	4.73	7.74	13.86	26.25	50.88	79.17
	ng/m^3	All Sites	15,633	100%	64.04 ± 1.00	6.58	10.92	23.37	45.59	83.31	137.54	181.75
Nickel (PM_{10})	ng/m^3	Urban	16,125	97%	1.85 ± 0.05	0.25	0.41	0.67	1.11	2.00	3.52	5.27
	ng/m^3	Rural	4,623	85%	0.65 ± 0.08	ND	ND	0.10	0.28	0.64	1.15	1.89
	ng/m^3	All Sites	20,748	94%	1.58 ± 0.04	ND	0.15	0.47	0.92	1.73	3.14	4.74
Tetrachloroethylene	µg/m^3	Urban	15,612	86%	0.25 ± 0.01	ND	ND	0.06	0.13	0.25	0.48	0.74
	µg/m^3	Rural	2,272	36%	0.09 ± 0.04	ND	ND	ND	ND	0.04	0.08	0.16
	µg/m^3	All Sites	17,884	79%	0.23 ± 0.01	ND	ND	0.04	0.11	0.22	0.44	0.70
Trichloroethylene	µg/m^3	Urban	15,843	41%	0.040 ± 0.002	ND	ND	ND	ND	0.051	0.107	0.164
	µg/m^3	Rural	3,388	13%	0.021 ± 0.003	ND	ND	ND	ND	ND	0.017	0.250
	µg/m^3	All Sites	19,231	36%	0.037 ± 0.002	ND	ND	ND	ND	0.041	0.105	0.167
Vinyl Chloride	µg/m^3	Urban	14,778	19%	0.0044 ± 0.0003	ND	ND	ND	ND	ND	0.0137	0.0257
	µg/m^3	Rural	2,444	8%	0.0040 ± 0.0009	ND	ND	ND	ND	ND	ND	0.0156
	µg/m^3	All Sites	17,222	17%	0.0043 ± 0.0003	ND	ND	ND	ND	ND	0.0126	0.0254

[a] Statistics presented are from pollutant datasets which were suitable for trends.

[b] The arithmetic mean is the average of all samples results which include actual measured values. If no chemical was registered, then a value of zero is used when calculating the mean.

[c] ND: No results of this chemical were registered by the laboratory analytical equipment.

Table 4. Summary Statistics for Grayson Lake, KY

Analyte	Units	# Data Records	% Detection	Arithmetic Mean[a]	Percentile Value[b]						
					5th	10th	25th	50th	75th	90th	95th
Acetaldehyde	µg/m^3	621	100%	0.78 ± 0.03	0.38	0.45	0.56	0.72	0.91	1.20	1.44
Arsenic (PM_{10})	ng/m^3	617	86%	0.48 ± 0.03	ND	ND	0.21	0.43	0.66	0.94	1.15
Benzene	µg/m^3	514	100%	0.46 ± 0.03	0.21	0.23	0.29	0.40	0.55	0.71	0.83
Benzo(a)pyrene	ng/m^3	621	57%	0.04 ± 0.01	ND	ND	ND	0.01	0.05	0.11	0.19
Beryllium (PM_{10})	ng/m^3	617	64%	0.0037 ± 0.0005	ND	ND	ND	0.0020	0.0052	0.0097	0.0110
Butadiene, 1,3-	µg/m^3	514	77%	0.036 ± 0.003	ND	ND	0.016	0.034	0.051	0.066	0.076
Cadmium (PM_{10})	ng/m^3	617	73%	0.07 ± 0.01	ND	ND	ND	0.05	0.08	0.14	0.20
Carbon Tetrachloride	µg/m^3	514	100%	0.64 ± 0.01	0.50	0.53	0.58	0.63	0.70	0.76	0.79
Chloroform	µg/m^3	513	58%	0.06 ± 0.01	ND	ND	ND	0.08	0.11	0.13	0.14
Chromium VI	ng/m^3	304	40%	0.006 ± 0.001	ND	ND	ND	ND	0.013	0.020	0.024
Formaldehyde	µg/m^3	621	100%	1.52 ± 0.07	0.51	0.63	0.86	1.33	1.96	2.76	3.24
Lead (PM_{10})	ng/m^3	617	100%	1.85 ± 0.13	0.50	0.65	0.97	1.41	2.19	3.35	4.24
Manganese (PM_{10})	ng/m^3	617	96%	2.98 ± 0.25	0.29	0.70	1.24	2.08	3.75	5.99	8.24
Naphthalene	ng/m^3	622	100%	17.50 ± 1.16	5.48	6.57	9.33	13.77	21.07	30.39	41.90
Nickel (PM_{10})	ng/m^3	617	75%	0.25 ± 0.02	ND	ND	0.06	0.20	0.32	0.51	0.68
Tetrachloroethylene	µg/m^3	514	47%	0.028 ± 0.003	ND	ND	ND	ND	0.05	0.07	0.09
Trichloroethylene	µg/m^3	514	4%	0.002 ± 0.001	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	µg/m^3	514	9%	0.001 ± 0.000	ND	ND	ND	ND	ND	ND	0.014

[a] :The arithmetic mean is the average of all samples results which included actual measured values. If no chemical was registered, then a value of zero is used.

[b] ND: No results of this chemical were registered by the laboratory analytical equipment.

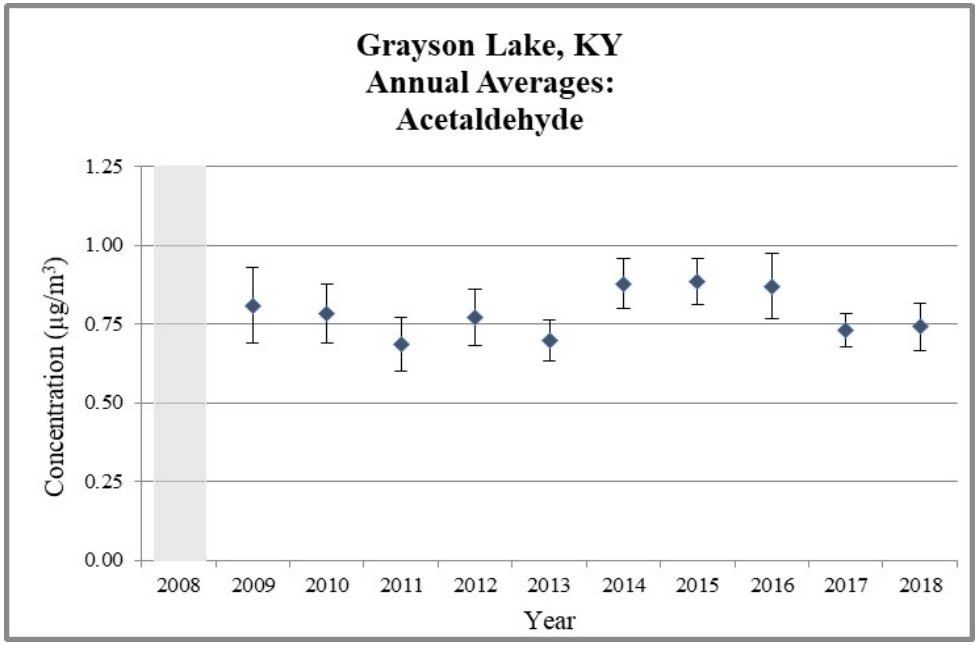
Analytical Labs Supporting this Site

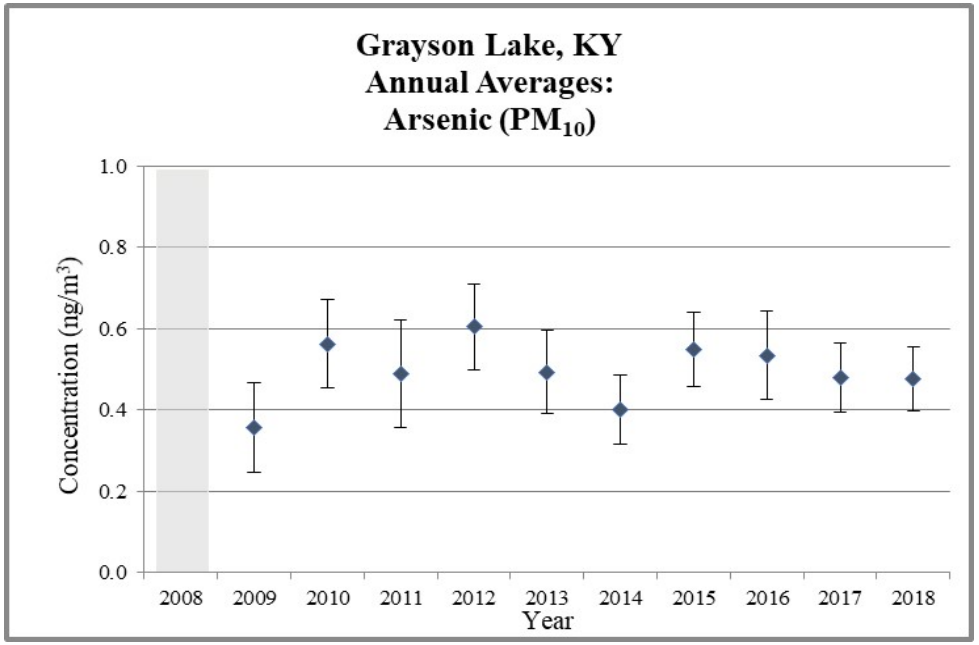
Pollutant Group	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
VOCs	--	--	--	--	--	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG
Carbonyls	--	--	--	--	--	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG
PM_{10} Metals	--	--	--	--	--	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG
Chromium VI	--	--	--	--	--	ERG	ERG	ERG	ERG	ERG	ERG	--	--	--	--	--
PAHs	--	--	--	--	--	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG

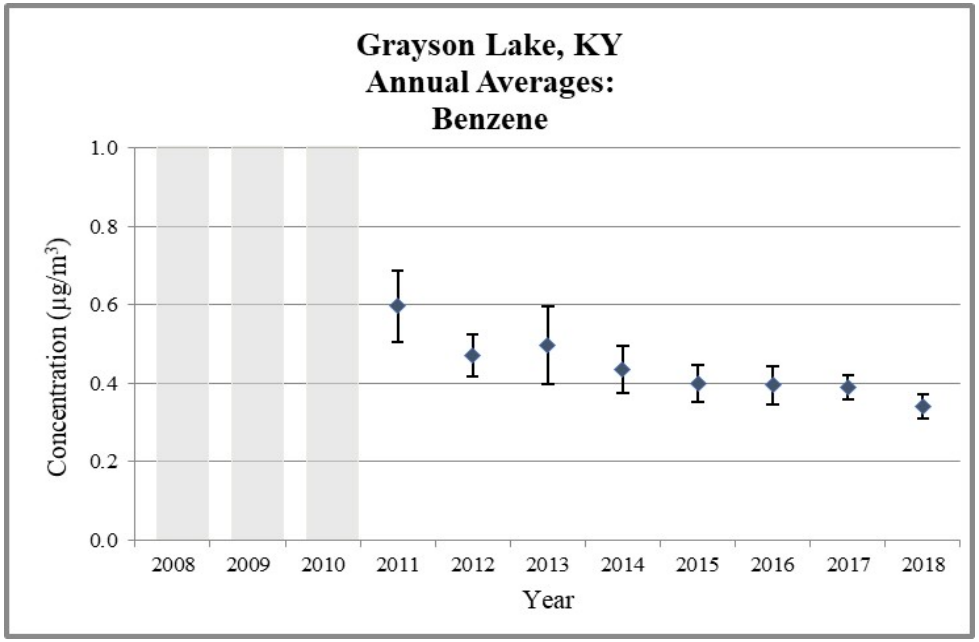
--: Not Applicable

ERG: Eastern Research Group, Inc.

Figure 3. Grayson Lake, KY Annual Average Concentrations







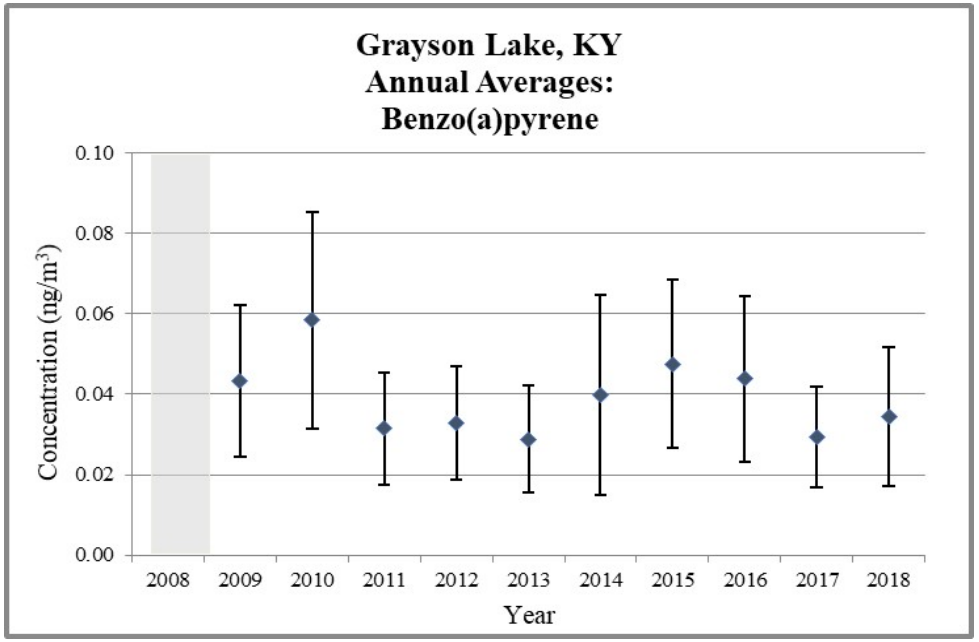
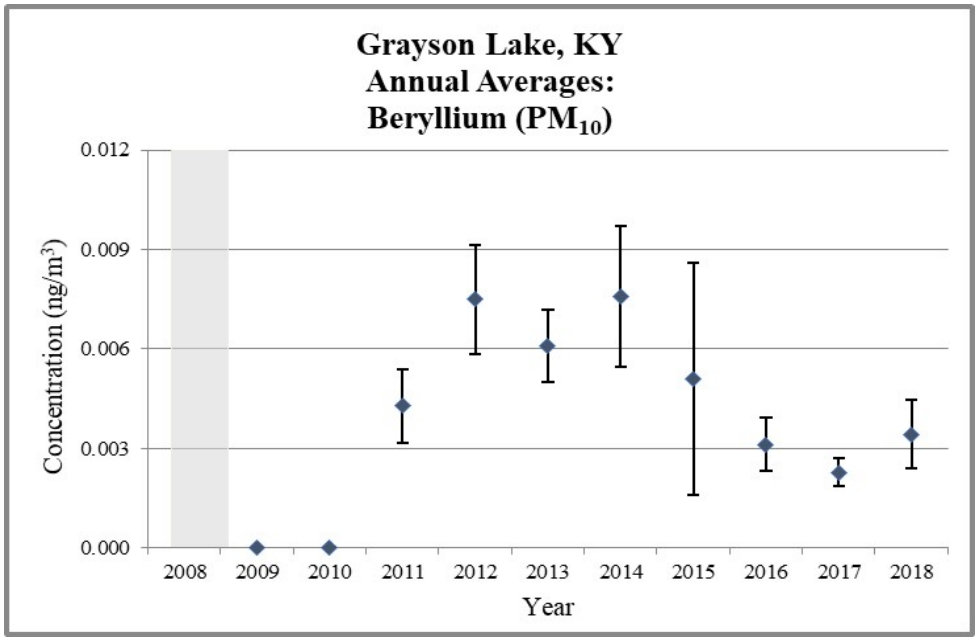
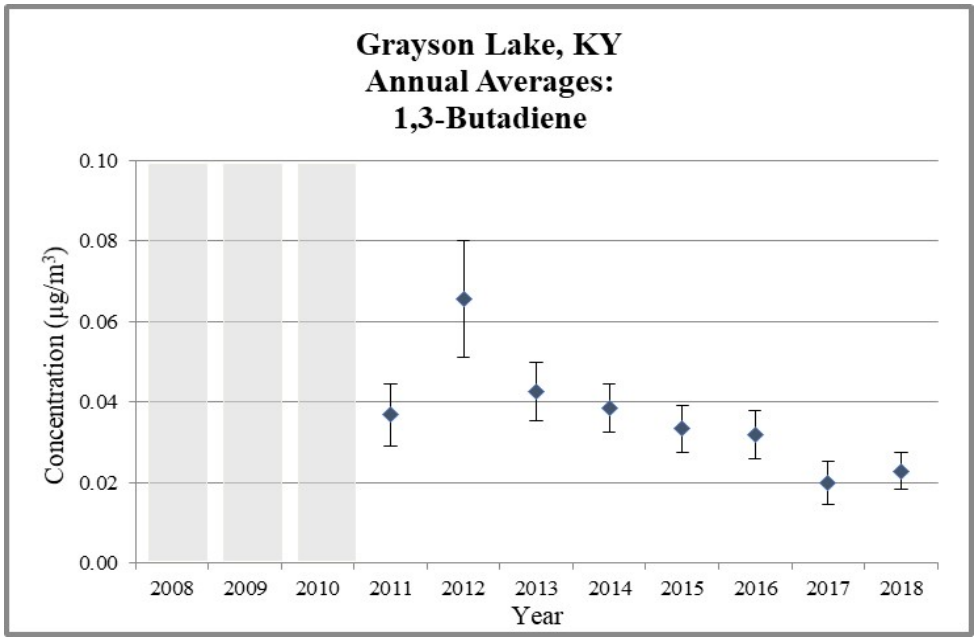
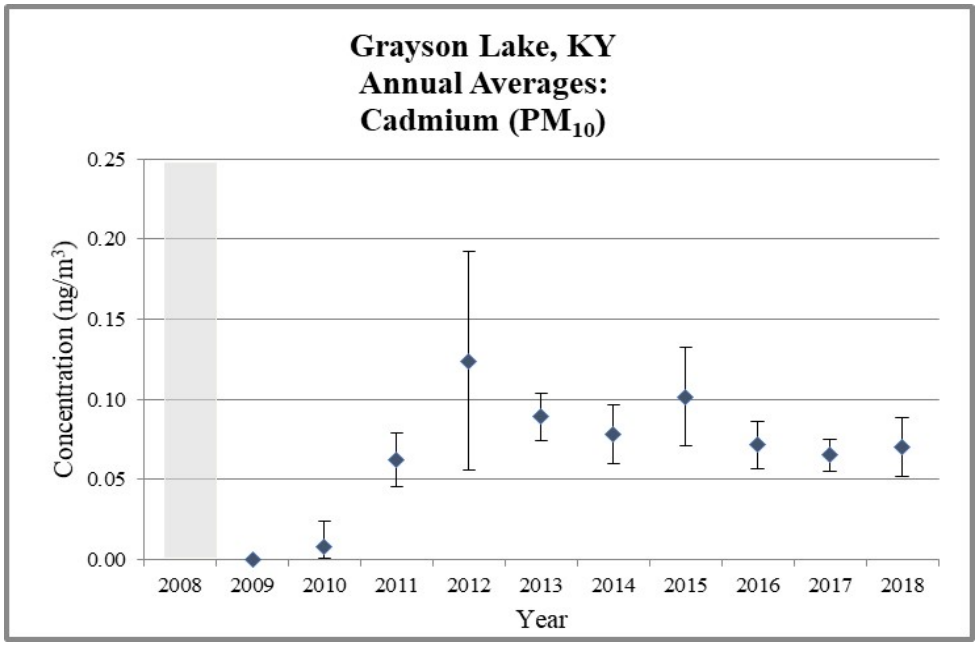


Figure 3. Grayson Lake, KY Annual Average Concentrations







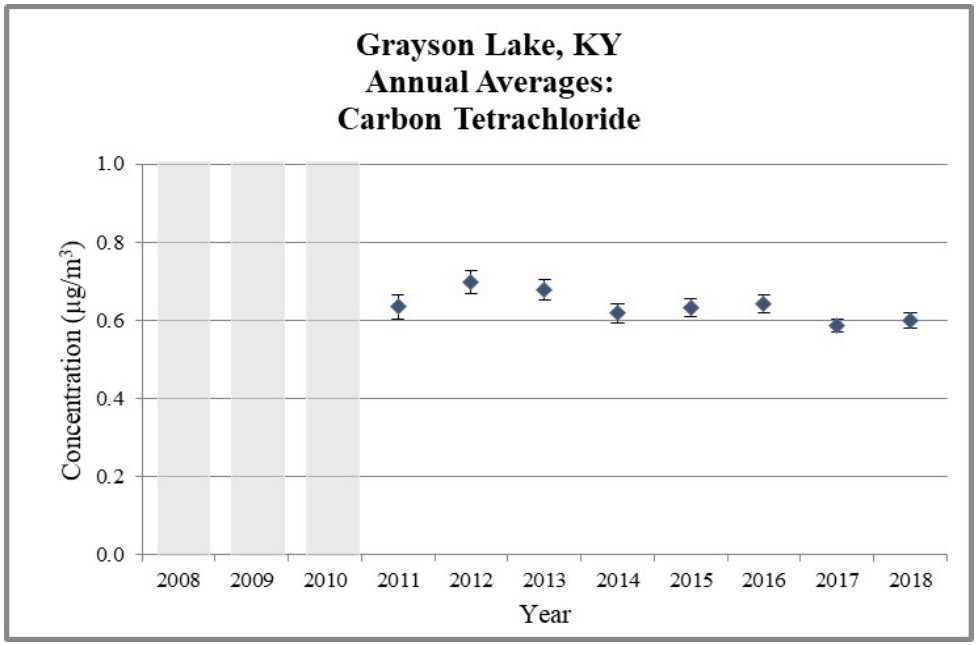
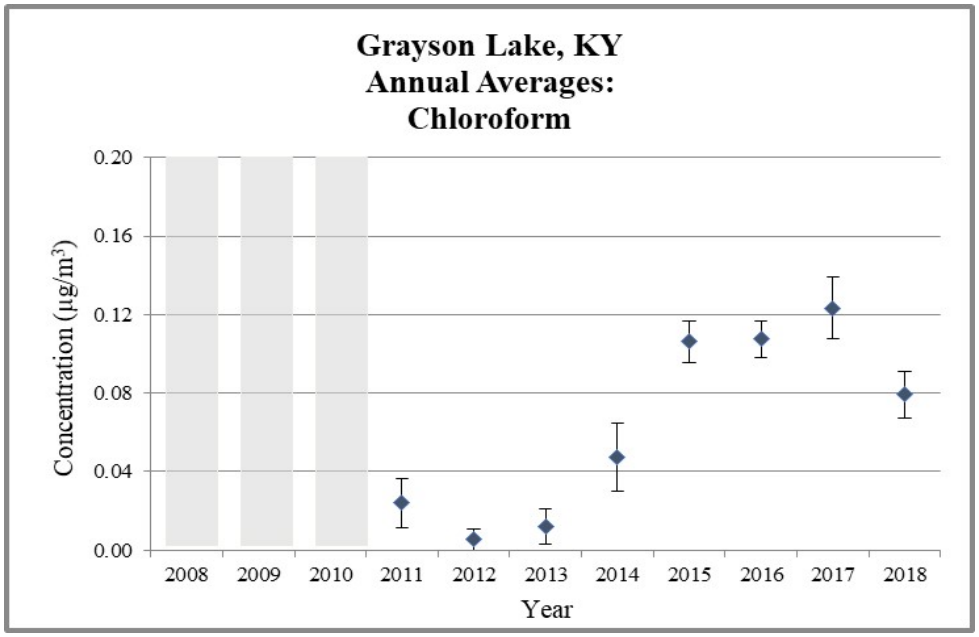
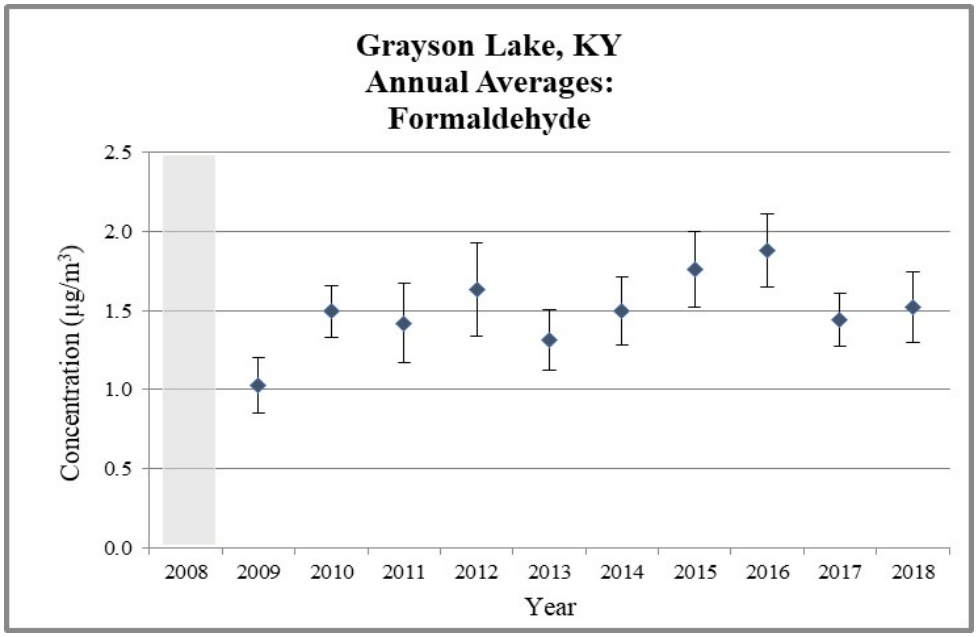
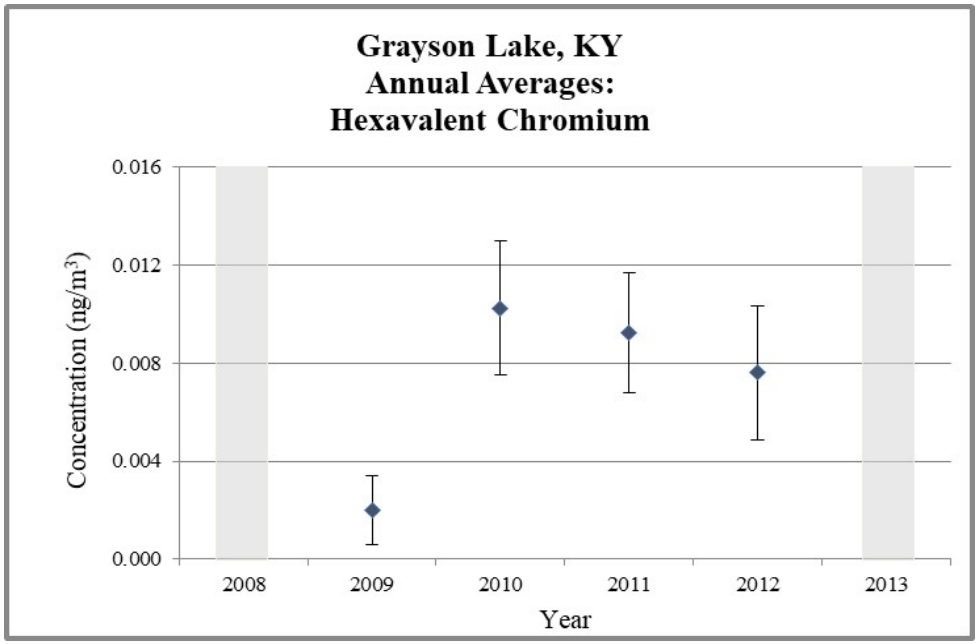


Figure 3. Grayson Lake, KY Annual Average Concentrations







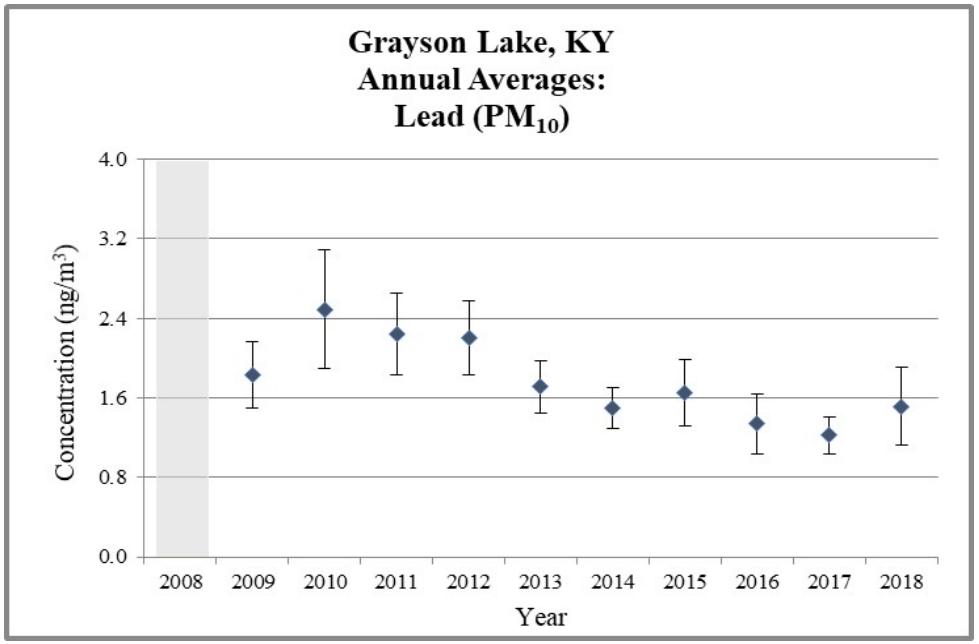
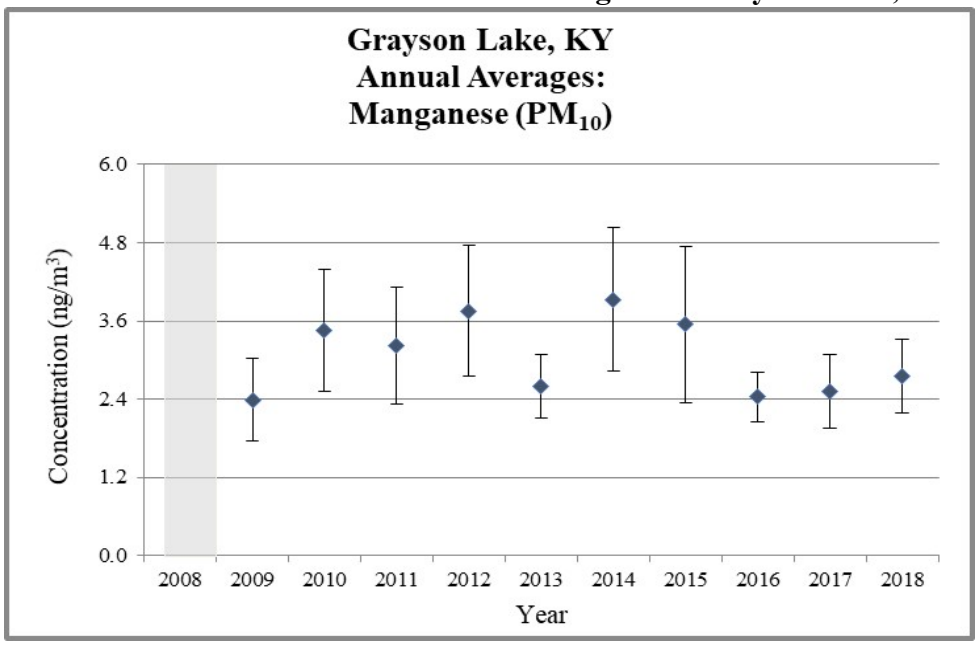
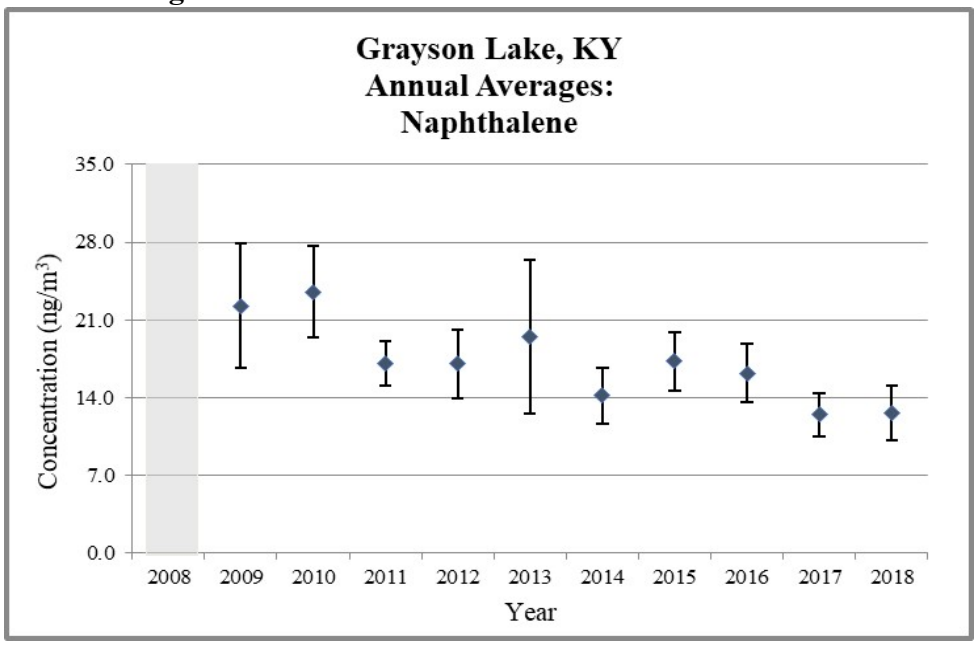
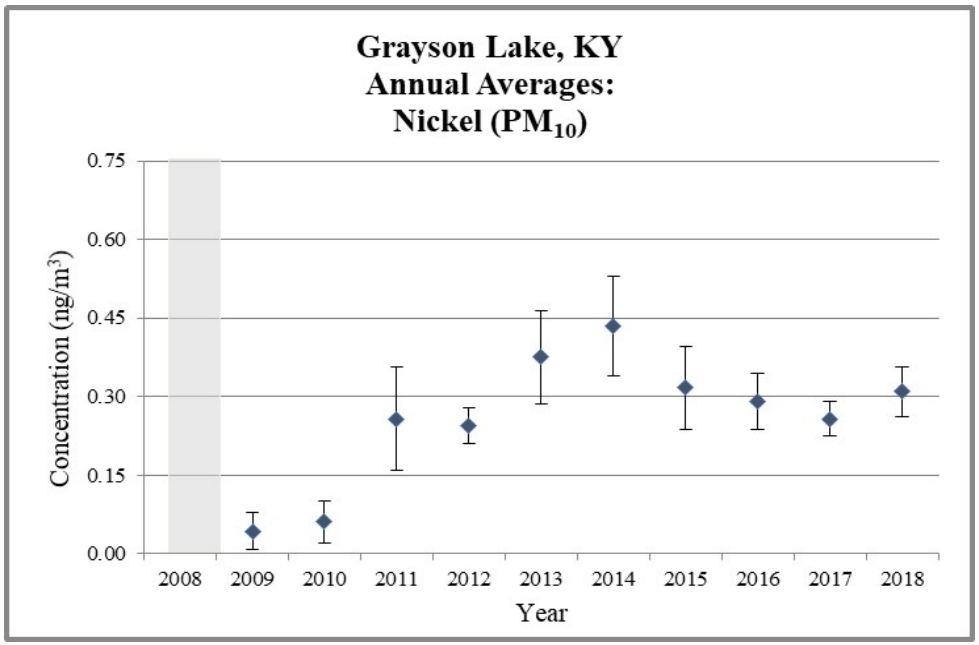


Figure 3. Grayson Lake, KY Annual Average Concentrations







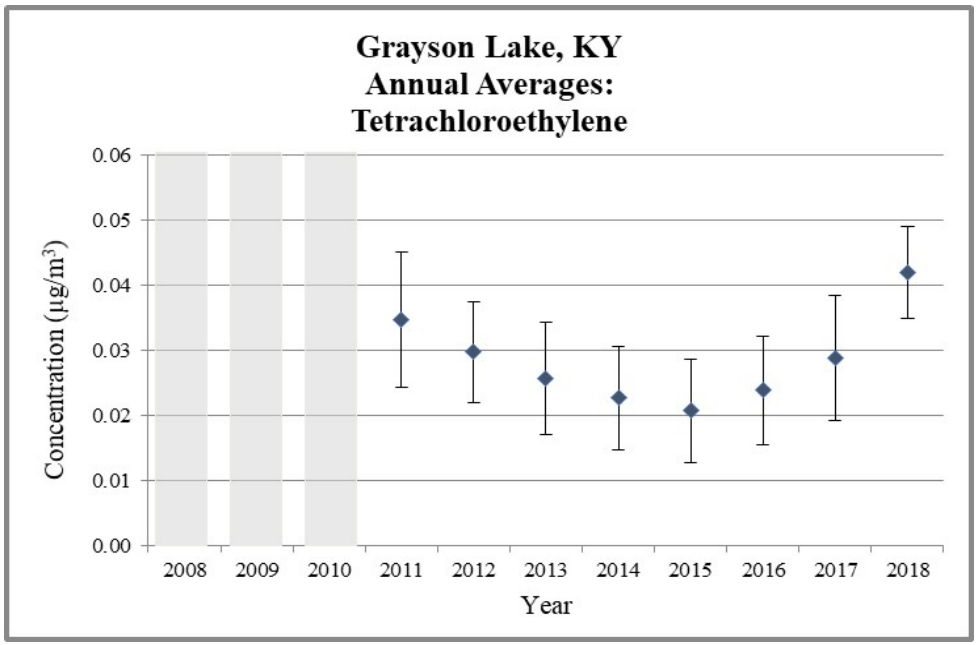
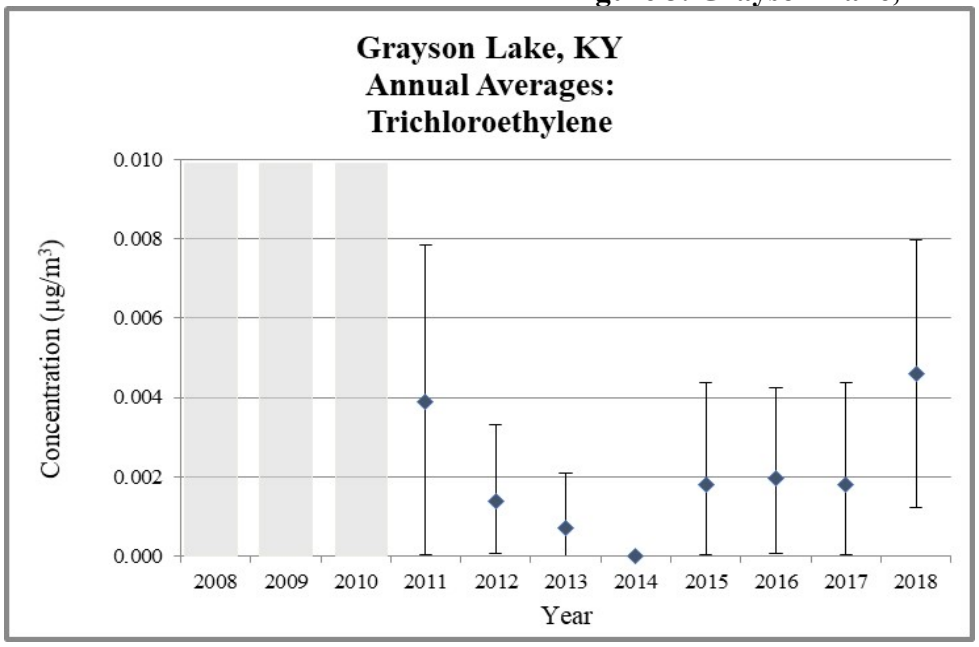
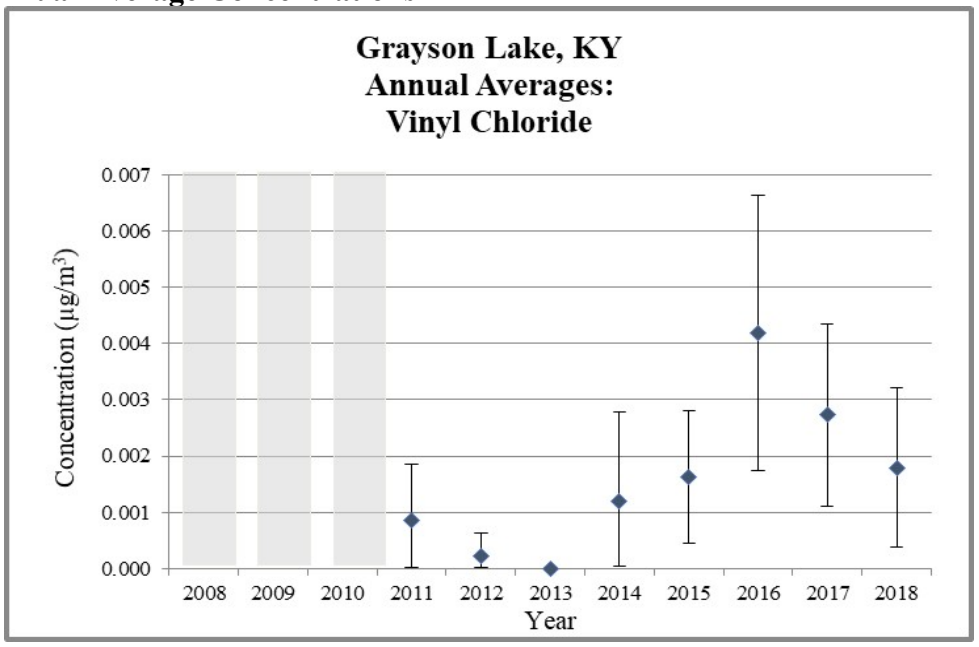


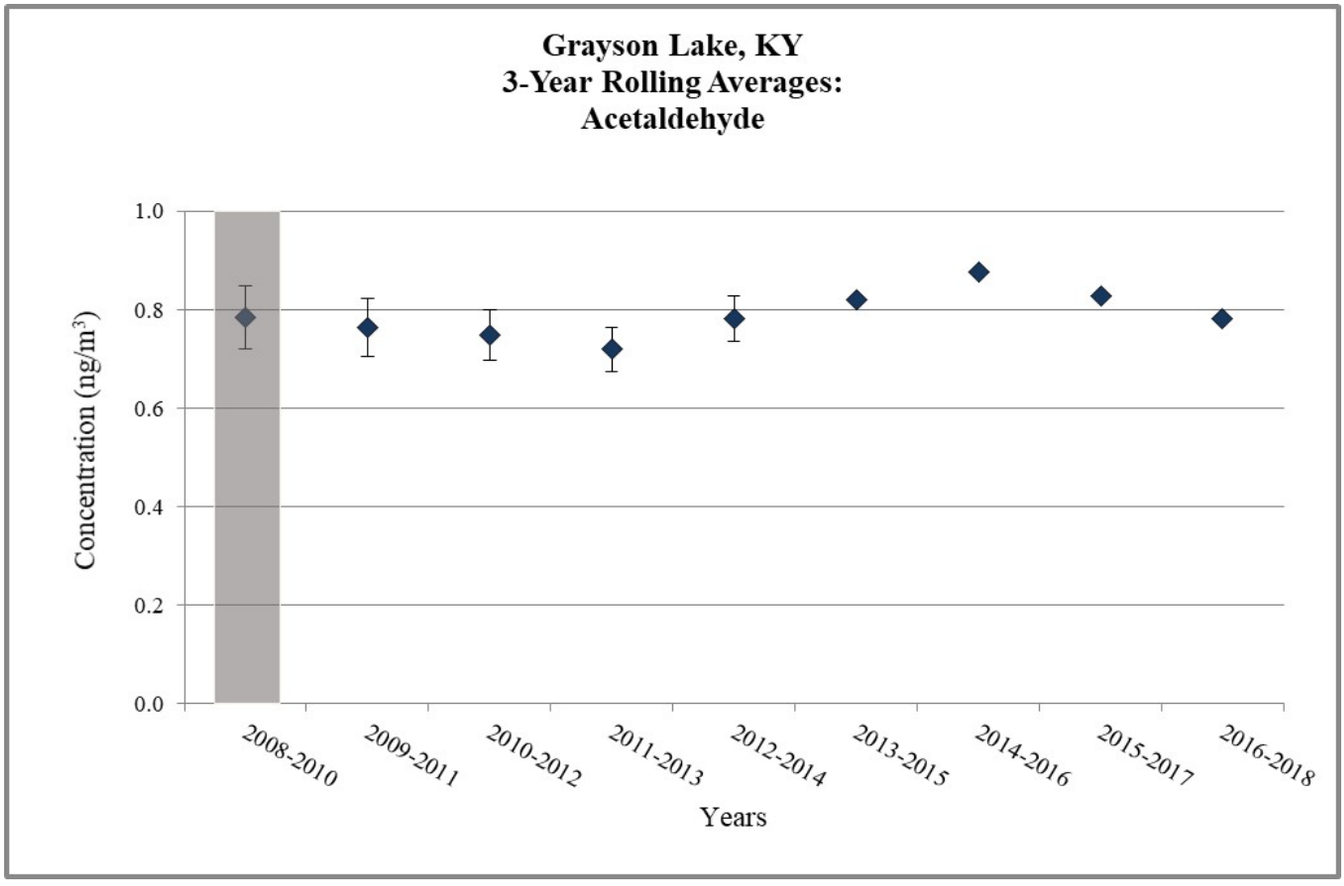
Figure 3. Grayson Lake, KY Annual Average Concentrations





Does not meet MQO

Figure 4. Grayson Lake, KY - 3-Year Rolling Average Concentrations



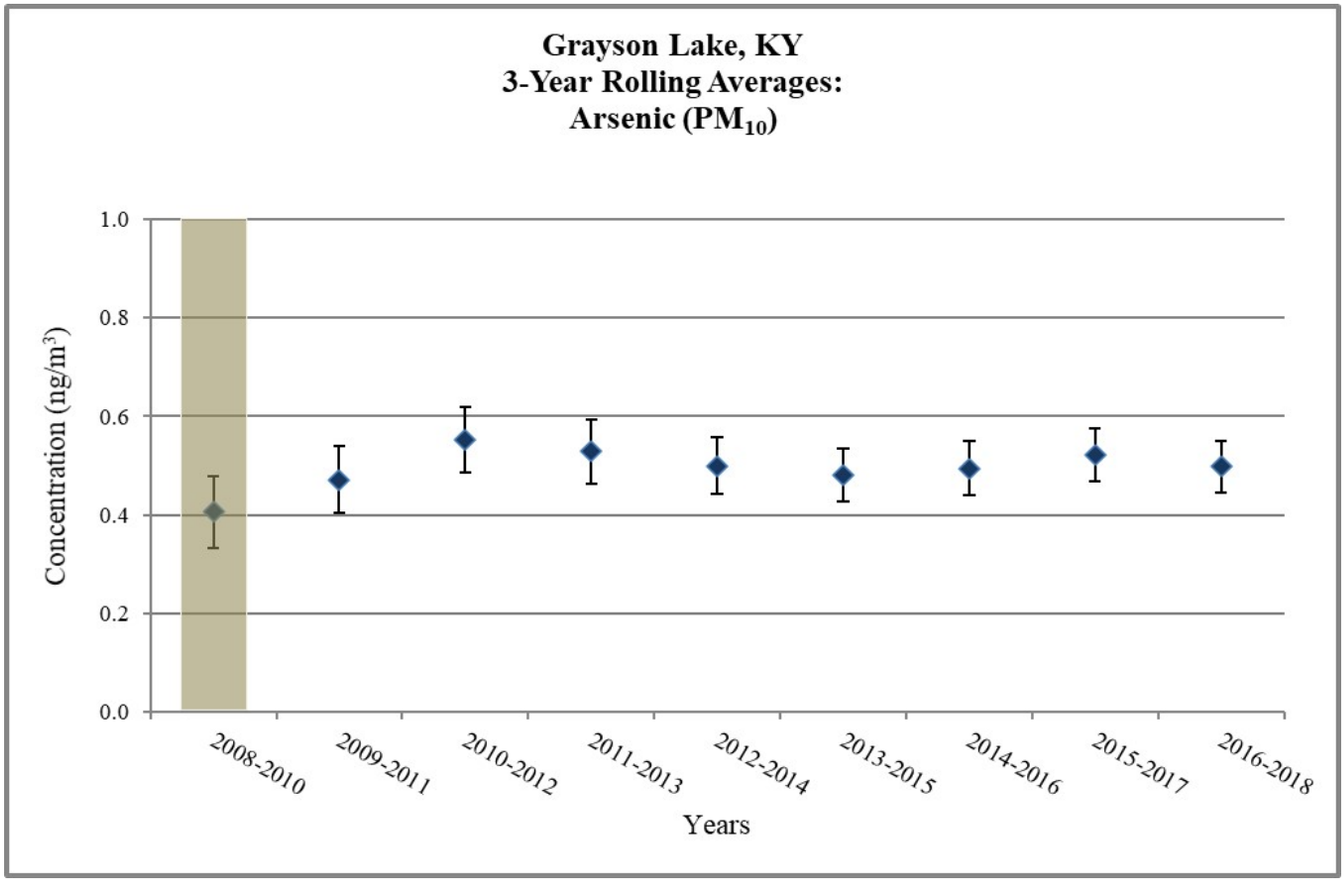
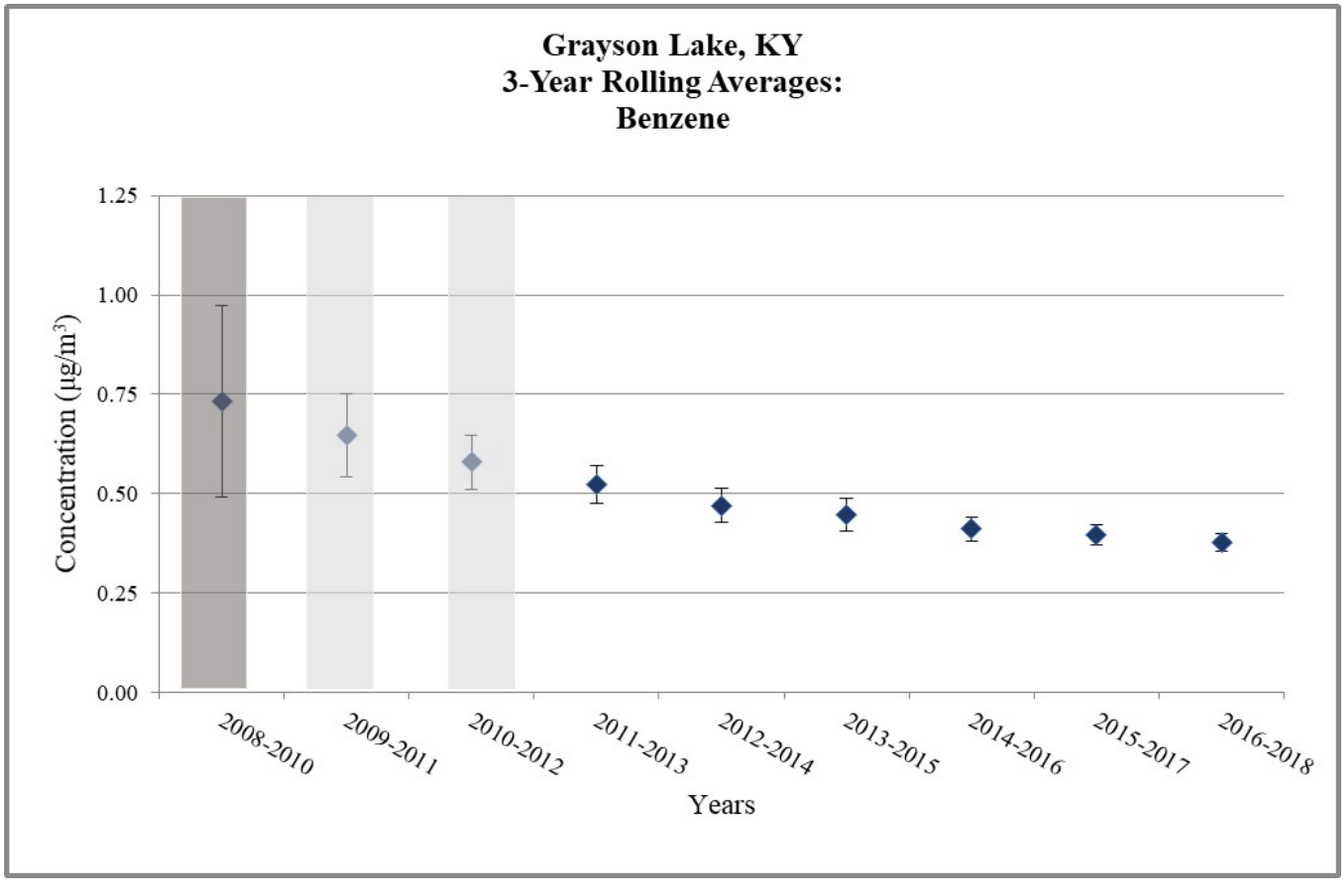
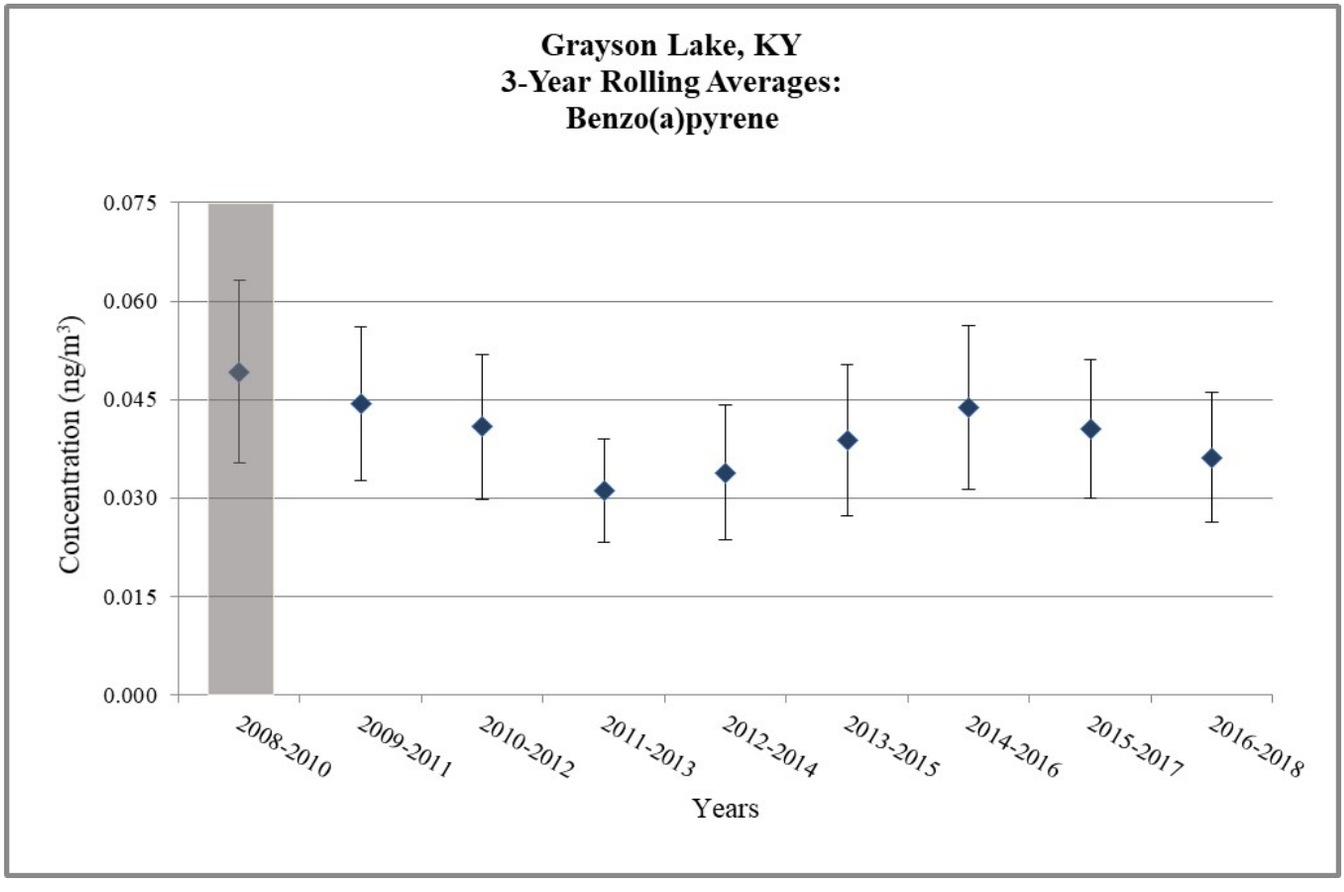


Figure 4. Grayson Lake, KY - 3-Year Rolling Average Concentrations





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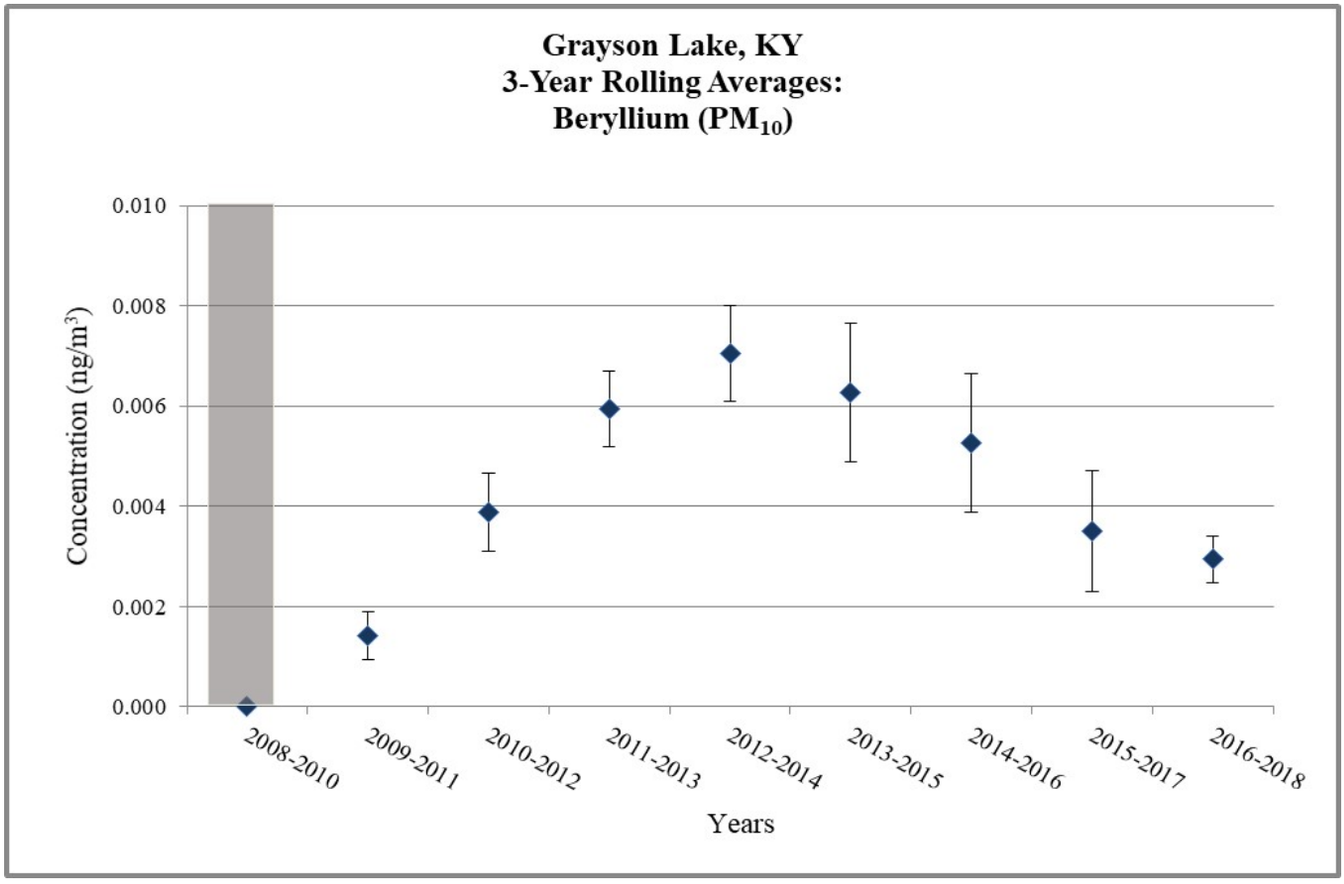

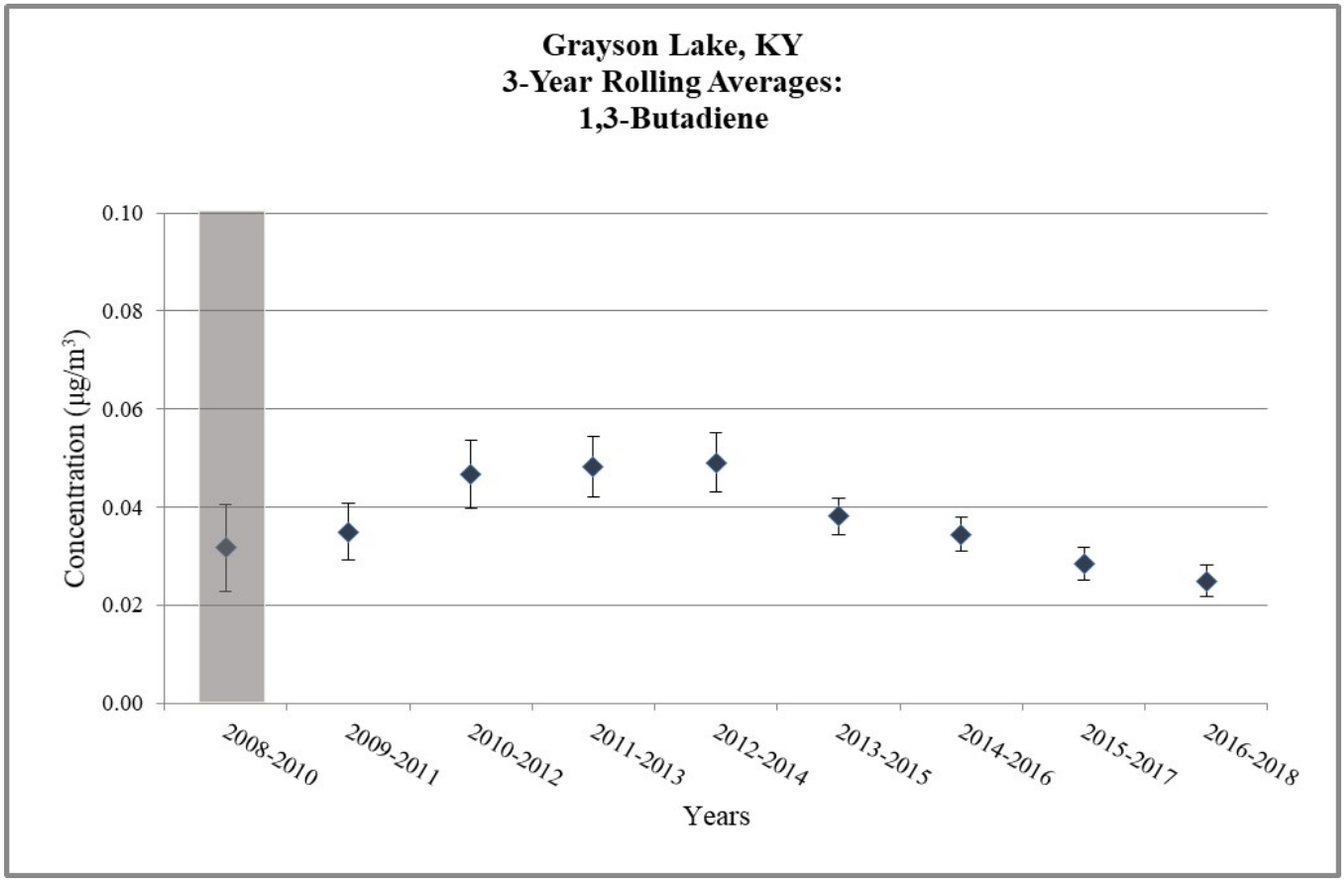

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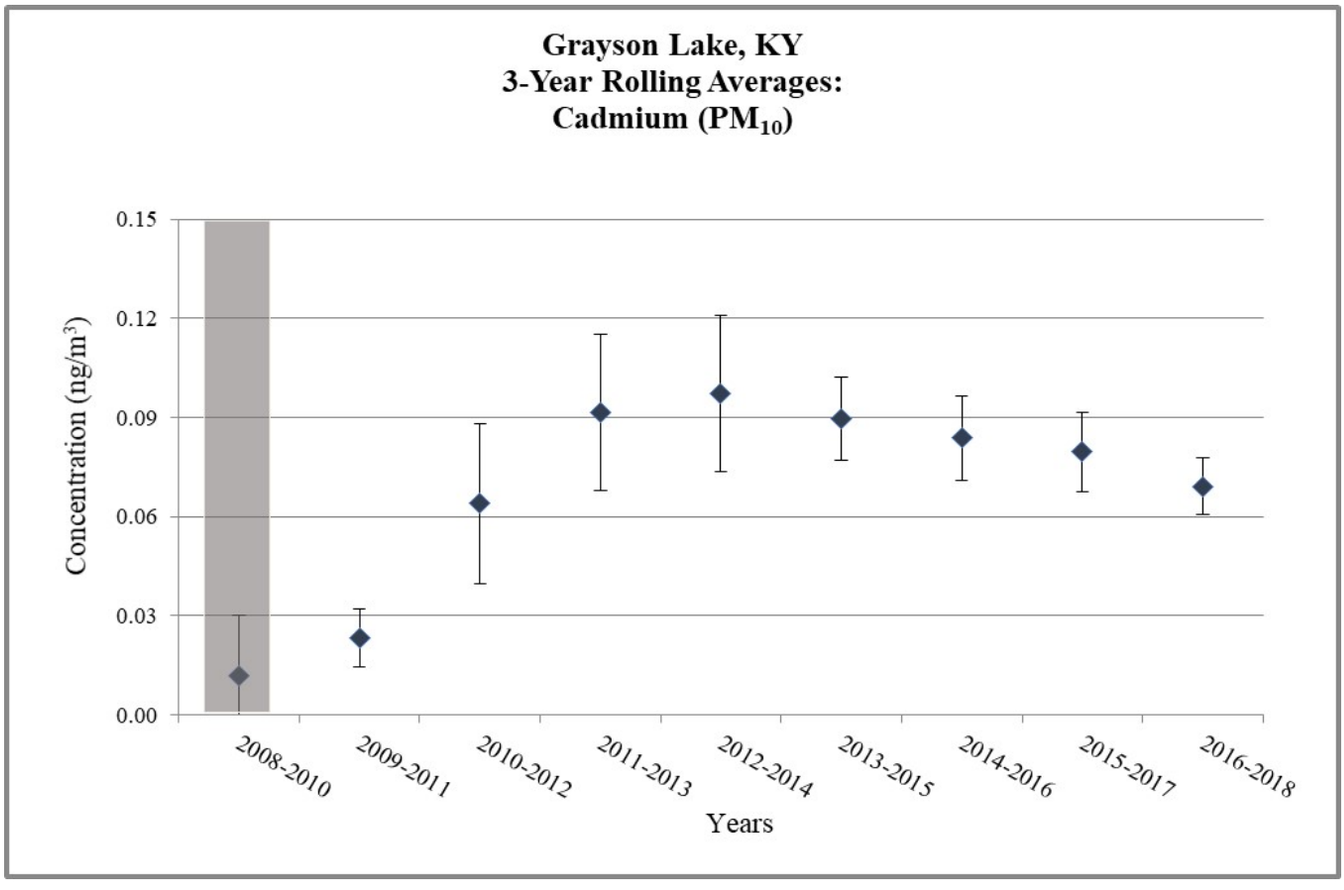

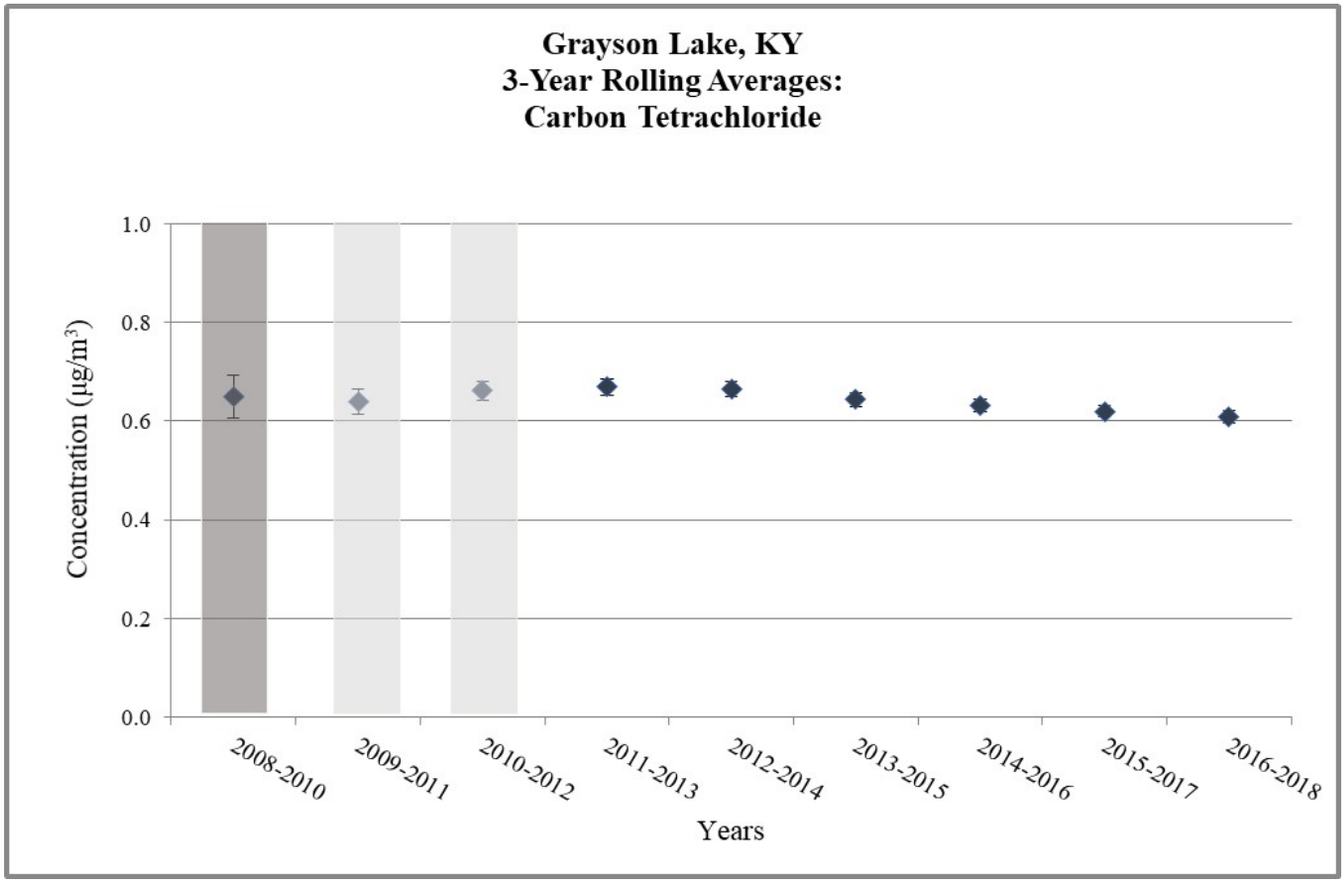

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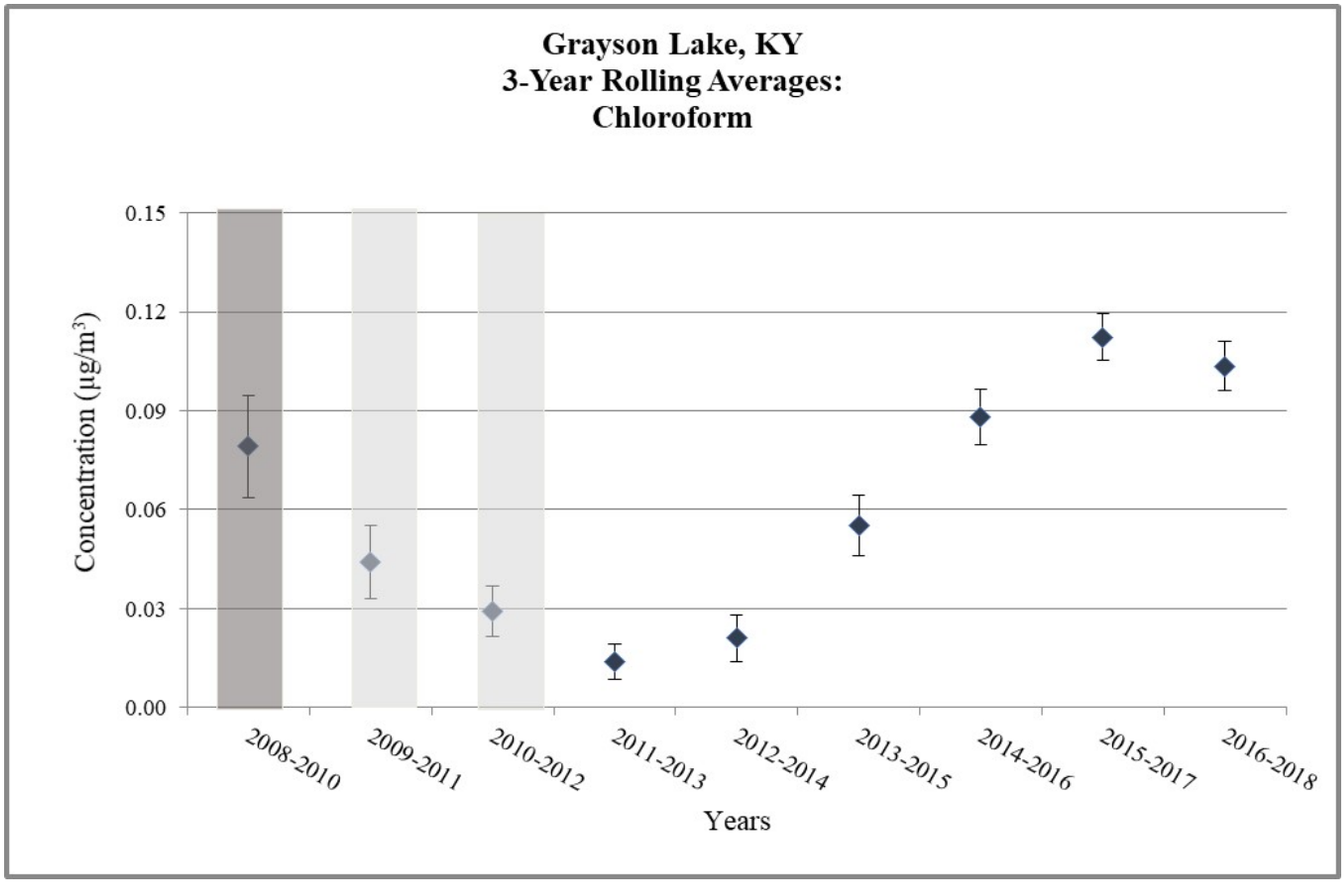


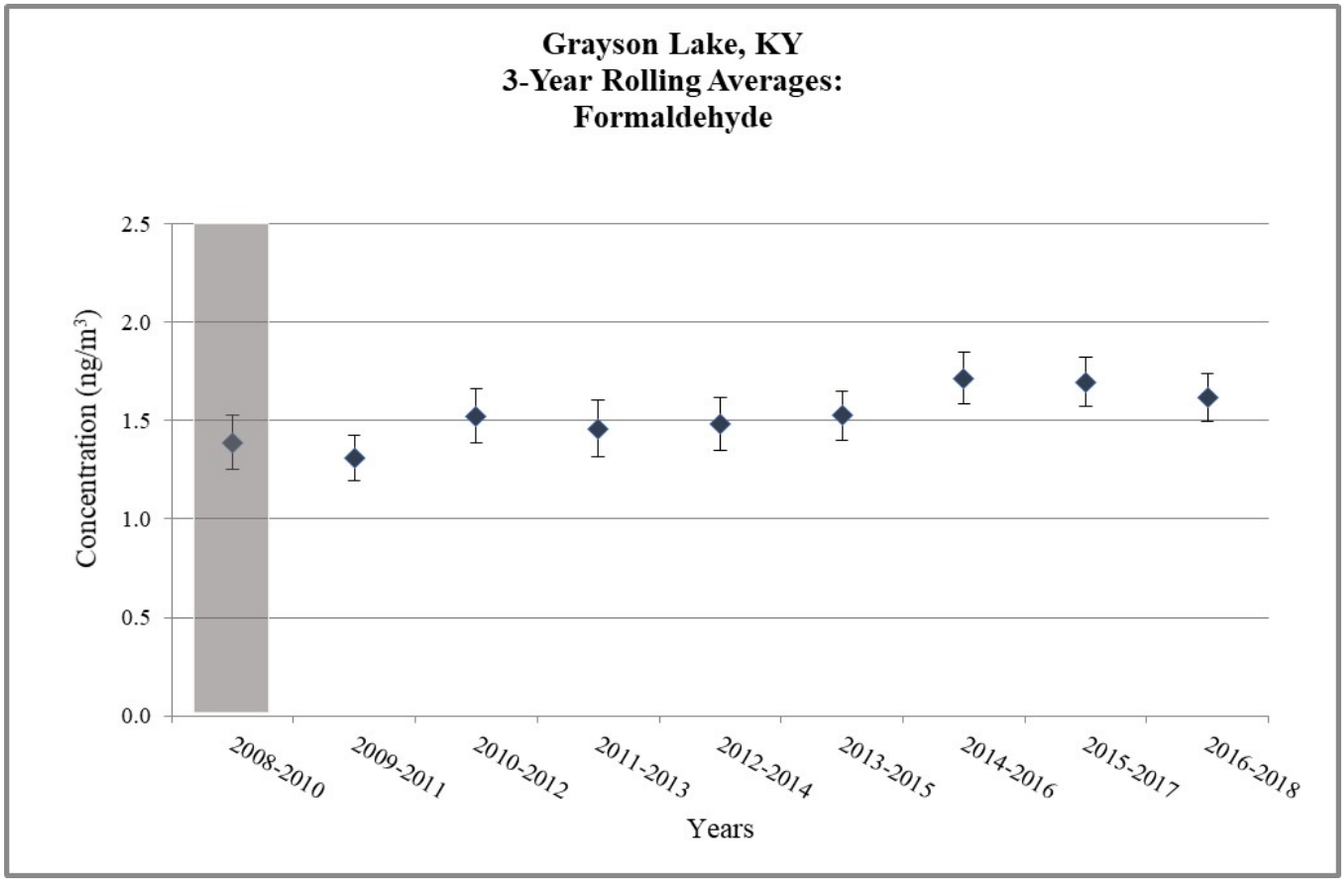
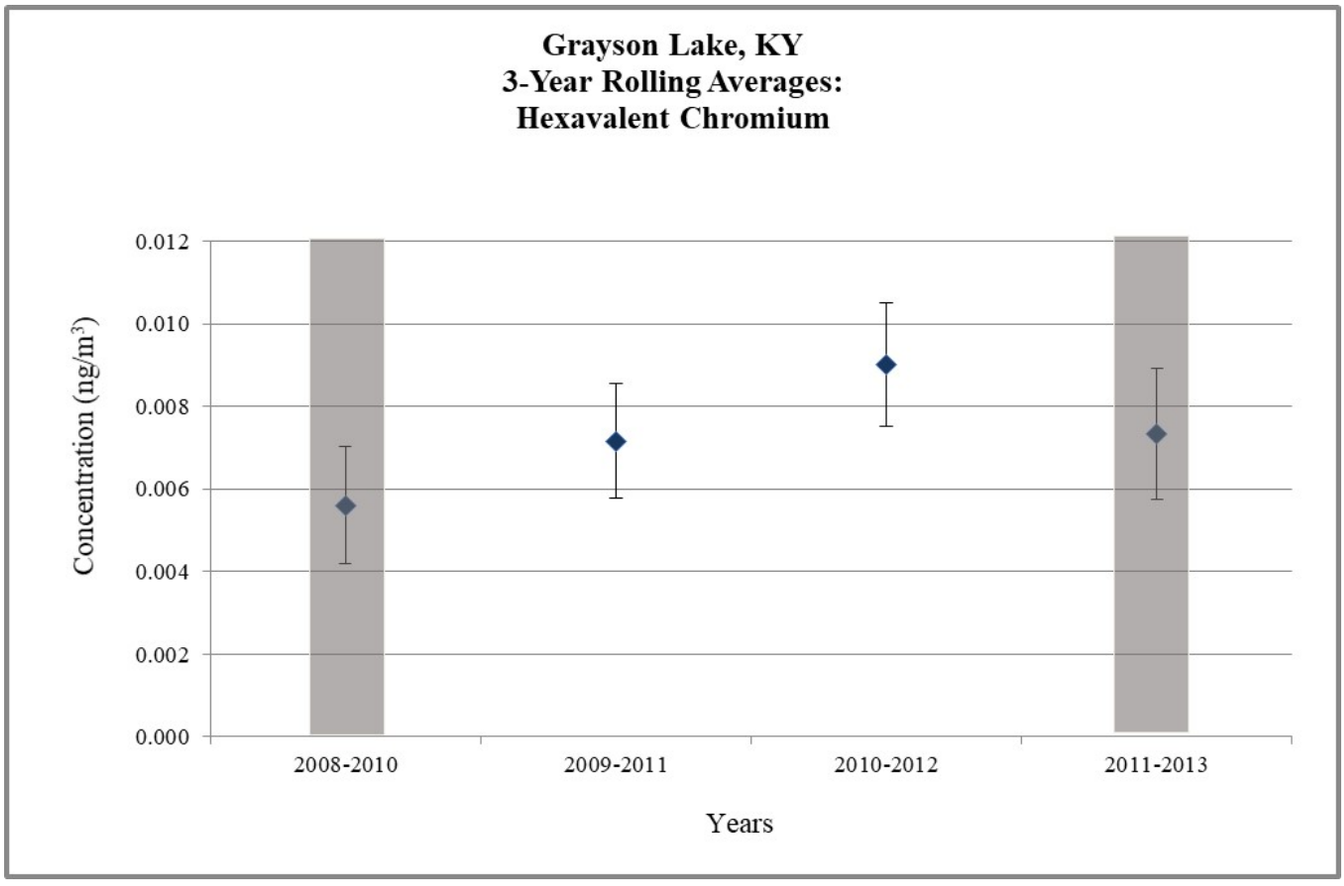


Figure 4. Grayson Lake, KY - 3-Year Rolling Average Concentrations



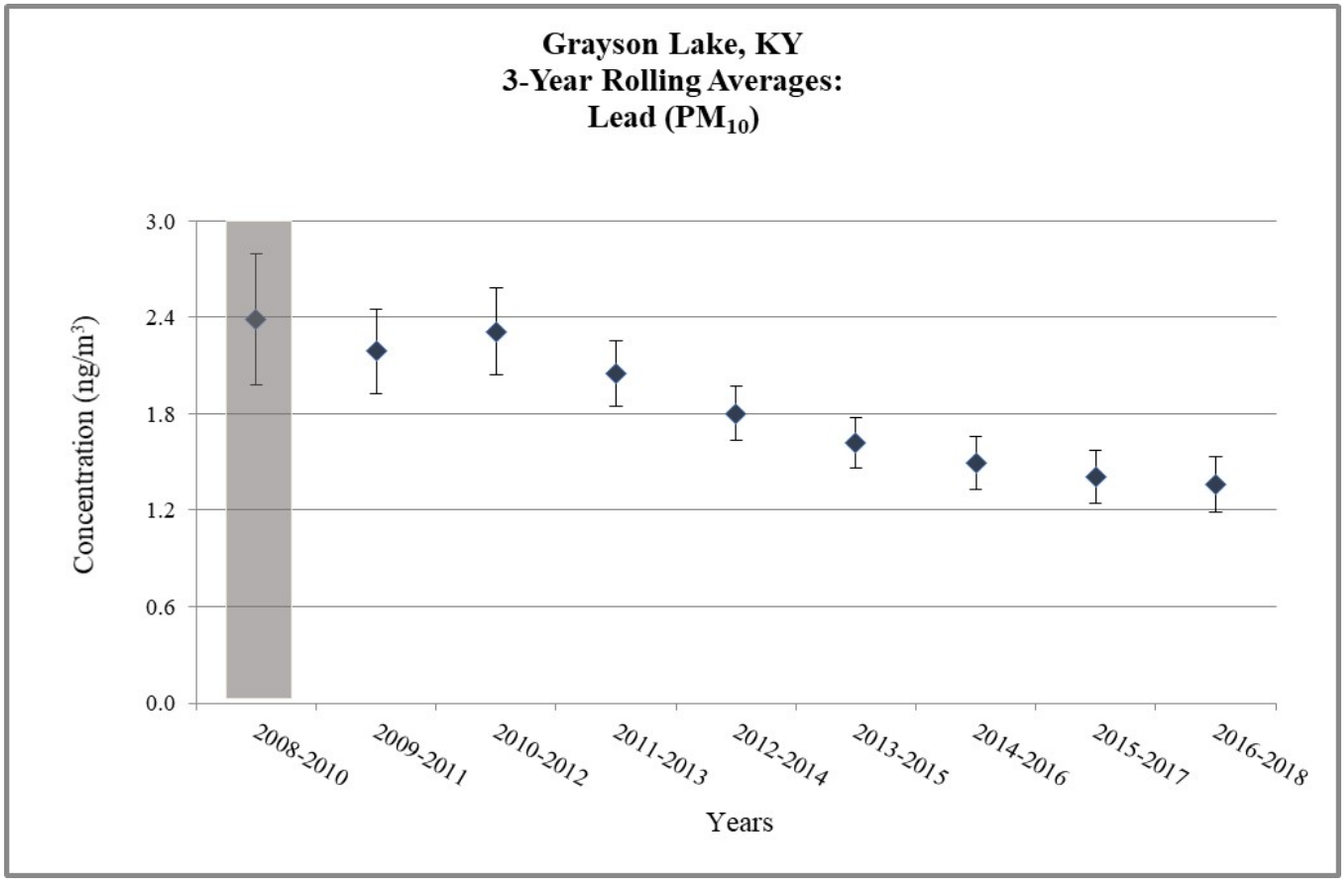
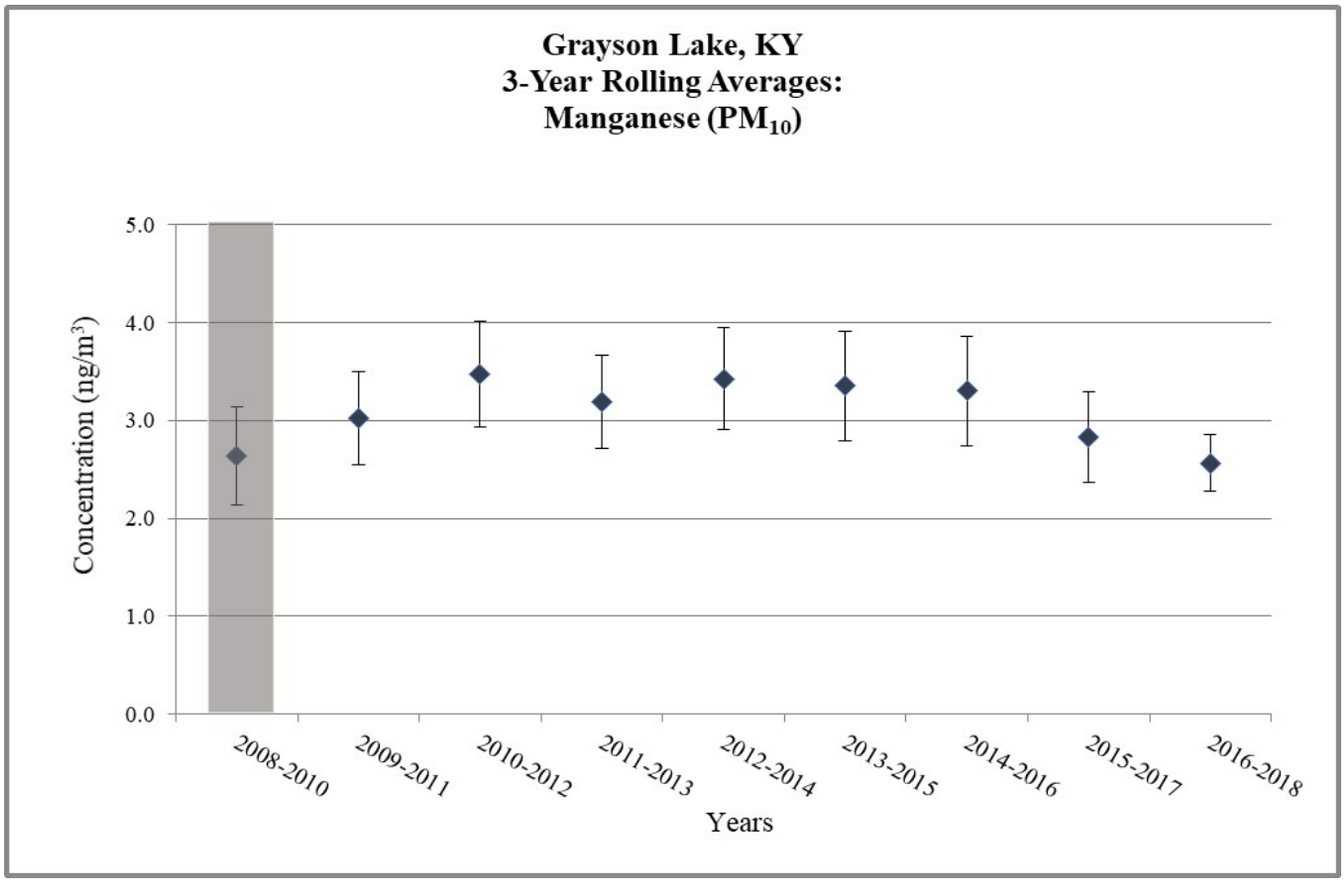
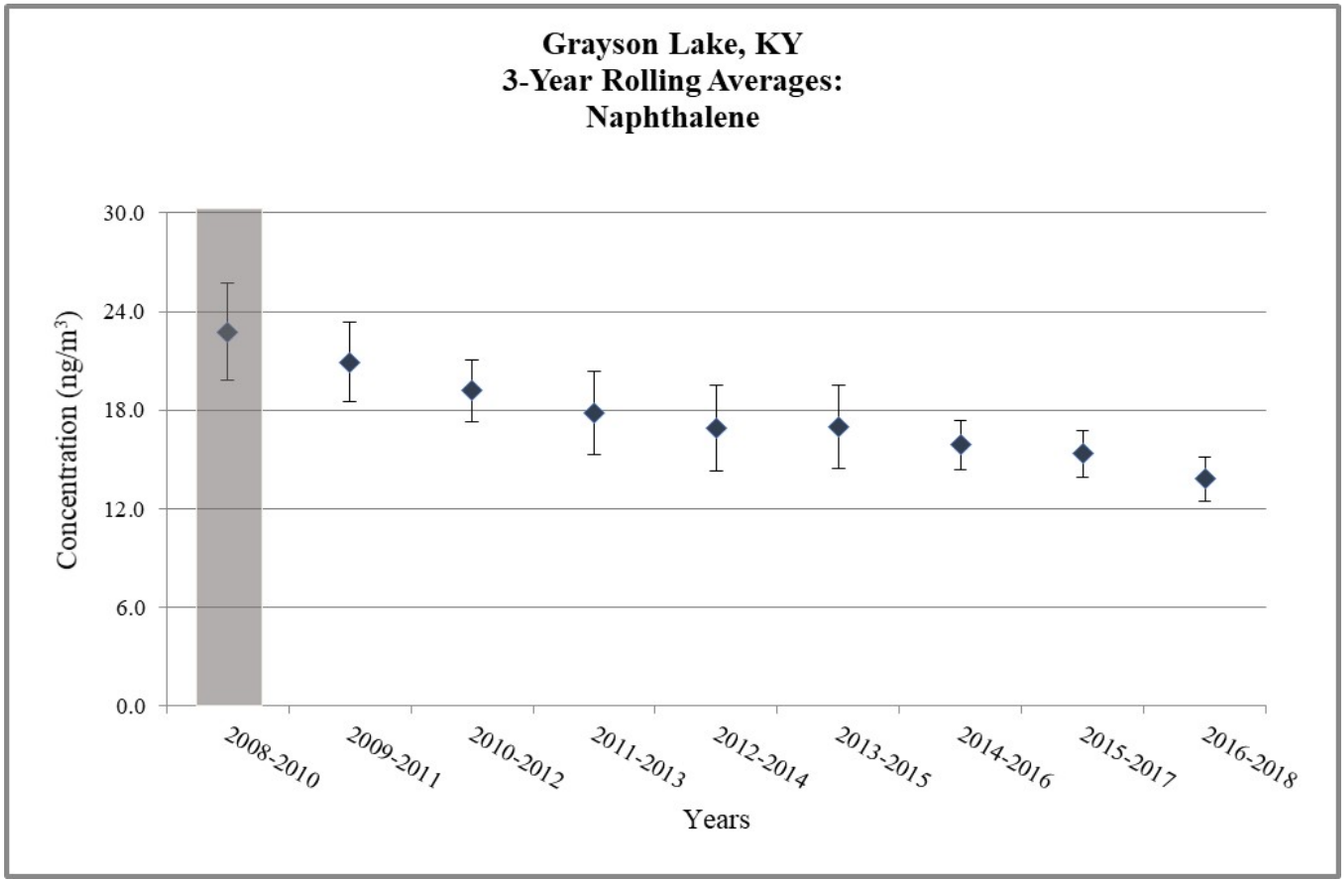


Figure 4. Grayson Lake, KY - 3-Year Rolling Average Concentrations





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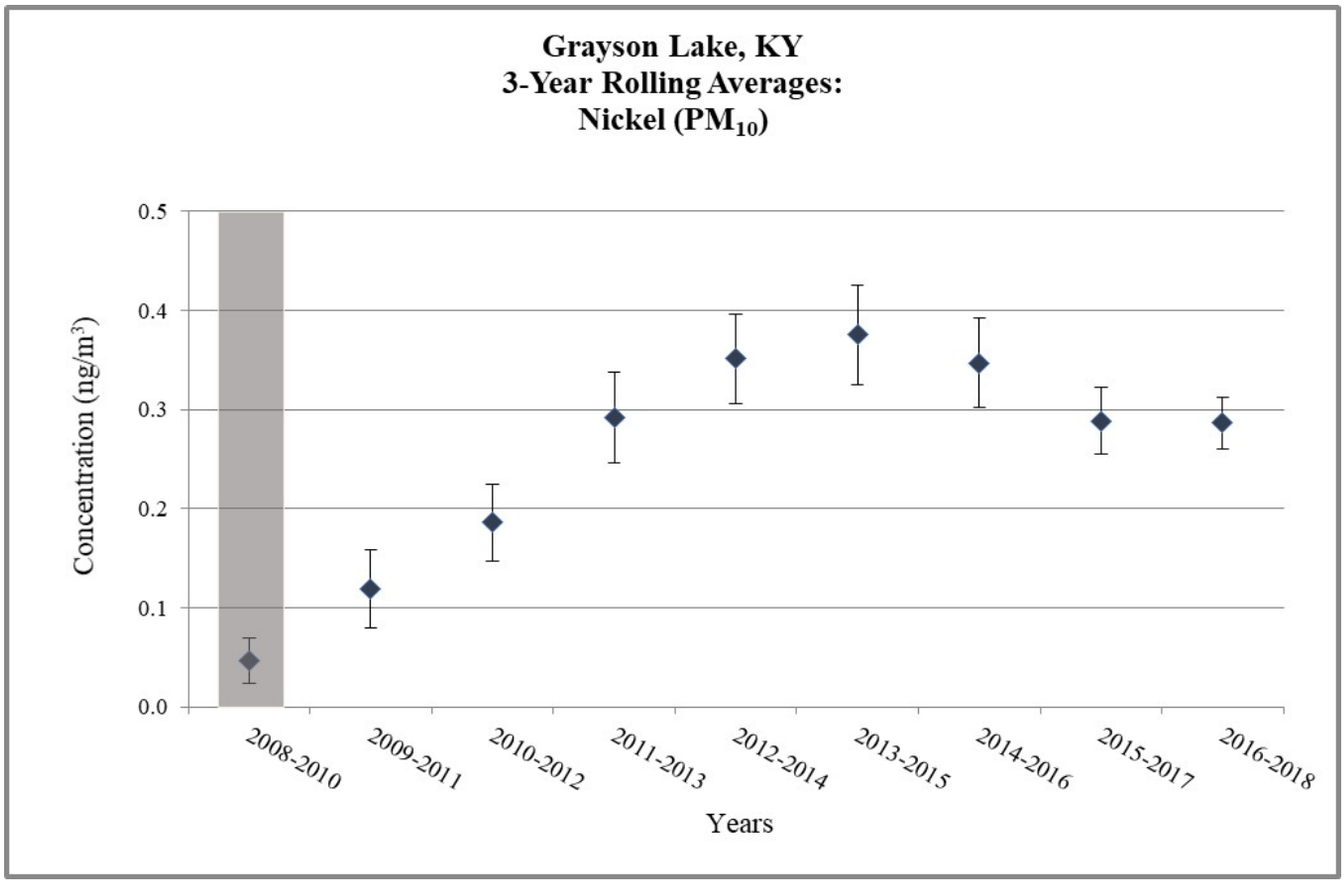

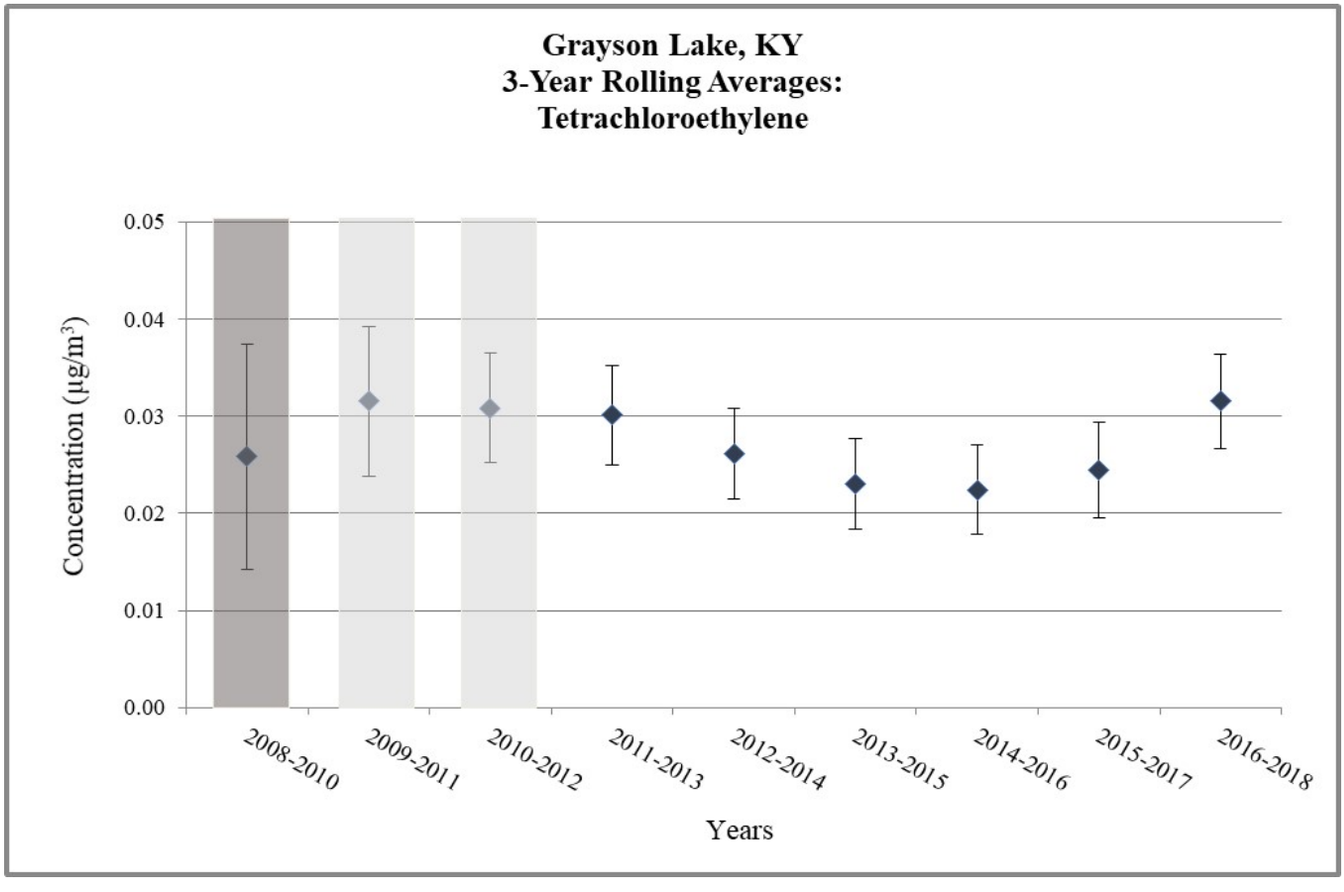

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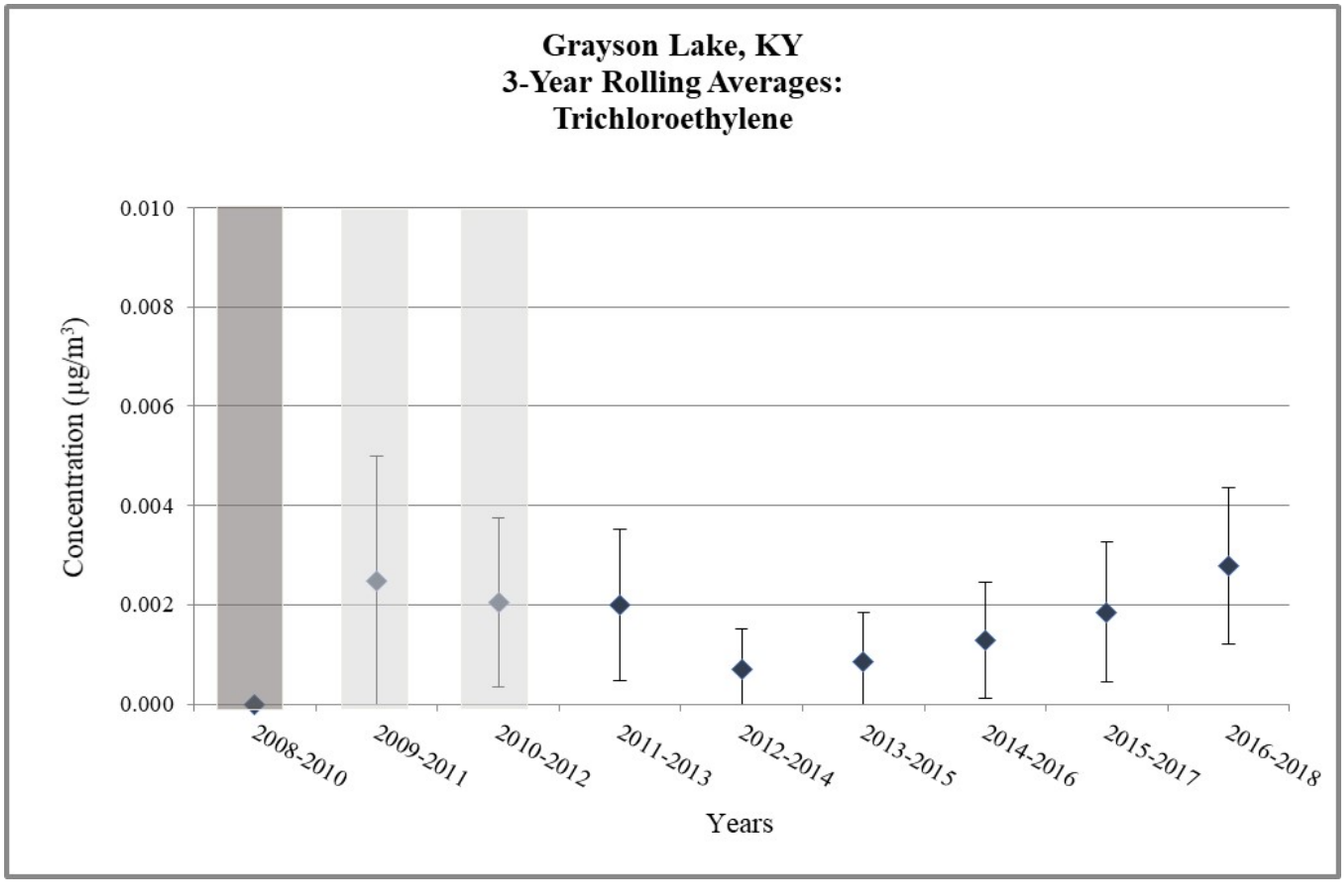

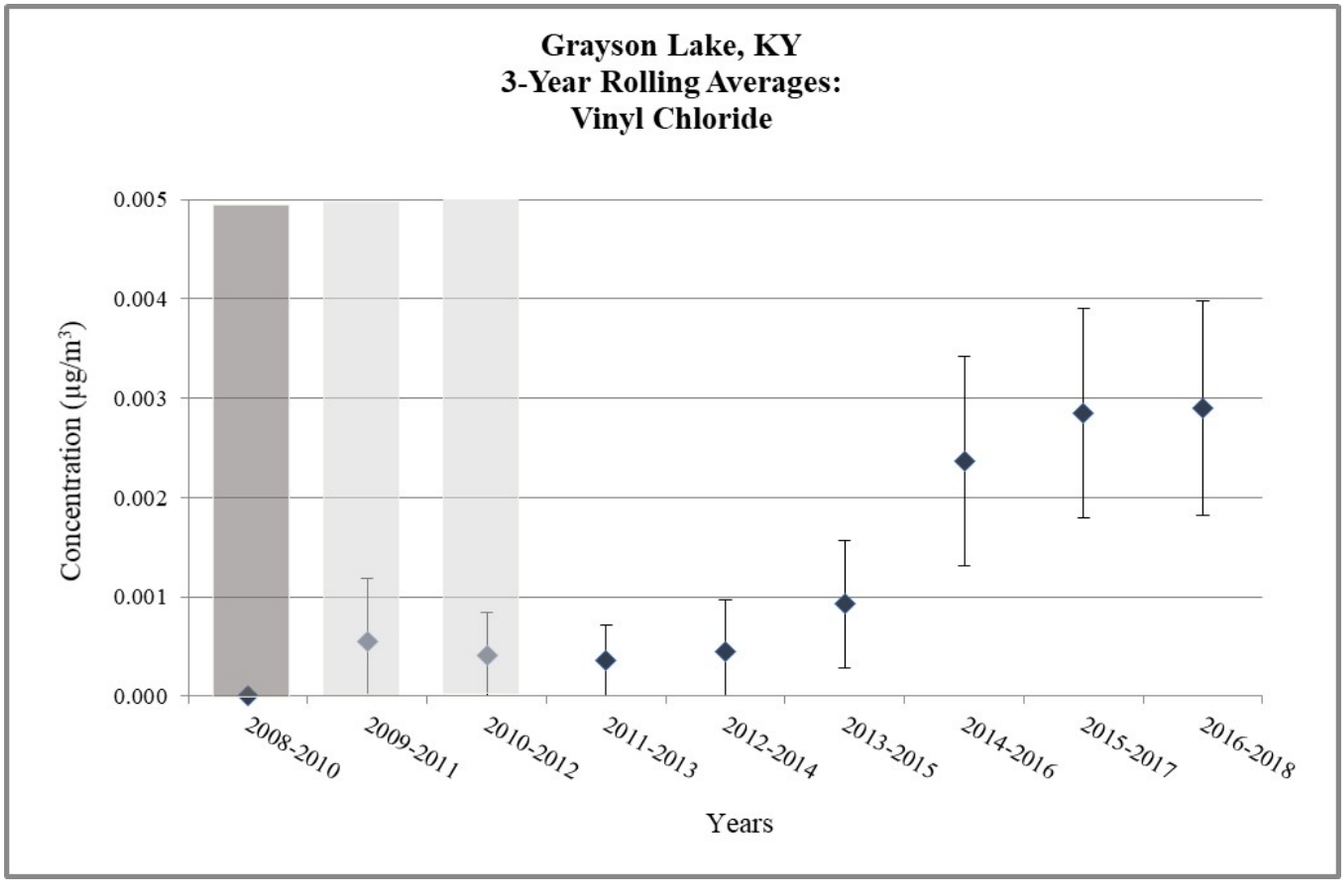

Does not meet MQO **Concentrations not included in Analysis**

Table 6. NATTS Network Assessment: MQO#1 - Completeness Percentage at Grayson Lake, KY

Pollutant Group	Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbonyl	Acetaldehyde	a	100	98	84	100	100	100	100	100	98	95
Carbonyl	Formaldehyde	a	100	98	84	100	100	100	100	100	98	95
Chromium VI	Chromium VI	a	100	100	100	100	b	--	--	--	--	--
PAH	Benzo(a)pyrene	a	100	98	100	100	95	95	98	100	92	92
PAH	Naphthalene	a	100	98	100	100	95	95	98	100	92	93
PM_{10} Metals	Arsenic (PM_{10})	a	98	100	98	97	97	97	97	97	92	95
PM_{10} Metals	Beryllium (PM_{10})	a	98	100	98	97	97	97	97	97	92	95
PM_{10} Metals	Cadmium (PM_{10})	a	98	100	98	97	97	97	97	97	92	95
PM_{10} Metals	Lead (PM_{10})	a	98	100	98	97	97	97	97	97	92	95
PM_{10} Metals	Manganese (PM_{10})	a	98	100	98	97	97	97	97	97	92	95
PM_{10} Metals	Nickel (PM_{10})	a	98	100	98	97	97	97	97	97	92	95
VOC	Benzene	c	c	d	100	98	100	92	100	100	98	98
VOC	Butadiene, 1,3-	c	c	d	100	98	100	92	100	100	98	98
VOC	Carbon tetrachloride	c	c	d	100	98	100	92	100	100	98	98
VOC	Chloroform	c	c	d	100	98	100	92	100	100	98	97
VOC	Tetrachloroethylene	c	c	d	100	98	100	92	100	100	98	98
VOC	Trichloroethylene	c	c	d	100	98	100	92	100	100	98	98
VOC	Vinyl chloride	c	c	d	100	98	100	92	100	100	98	98

	A-rated: ≥85%
	B-rated: Between 75% to 85%
	Does not meet: ≤75%
--	No data available

[a]: Due to site logistical issues, sampling ended at the Hazard, KY site in May 2008. The site relocated to Grayson Lake, KY and sampling resumed in October 2008.

[b]: Scheduled sampling ended midway through the year, thus, the site did not have the opportunity to collect enough samples to meet the 85% MQO.

[c]: Pollutant was expected, but results were invalidated at this site for this year.

[d]: Analysis of VOCs were switched to the National Monitoring Program lab in summer 2010.

Table 7. NATTS Network Assessment: MQO#2 - Reported Method Detection Limits (MDLs) at Grayson Lake, KY

Pollutant Group	Pollutant Name	Target MDL	Units	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbonyl	Acetaldehyde	0.45	µg/m^3	0.18	0.04	0.04	0.02	0.02	0.02	0.01	0.02	0.02	0.06	0.06
Carbonyl	Formaldehyde	0.98/0.08[a]	µg/m^3	0.03	0.01	0.01	0.01	0.01	0.12	0.11	0.12	0.11	0.54	0.54
Chromium VI	Chromium VI	0.08	ng/m^3	0.08	0.05	0.01	0.05	0.04	0.05	--	--	--	--	--
PAH	Benzo(a)pyrene	0.91	ng/m^3	0.07	0.06	0.03	0.04	0.05	0.05	0.03	0.13	0.06	0.02	0.01
PAH	Naphthalene	29.00	ng/m^3	0.015	0.007	0.009	0.003	0.004	0.006	0.011	0.005	0.023	0.063	0.056
PM_{10} Metals	Arsenic (PM_{10})	0.23	ng/m^3	0.45	0.45	0.56	0.68	0.74	0.87	0.96	0.06	0.17	0.16	0.15
PM_{10} Metals	Beryllium (PM_{10})	0.42	ng/m^3	0.26	0.20	0.20	0.02	0.05	0.05	0.05	0.002	0.002	0.002	0.003
PM_{10} Metals	Cadmium (PM_{10})	0.56	ng/m^3	0.17	0.17	0.19	0.02	0.02	0.02	0.02	0.014	0.004	0.004	0.009
PM_{10} Metals	Lead (PM_{10})	15.0	ng/m^3	0.013	0.013	0.007	0.001	0.005	0.007	0.003	0.002	0.002	0.002	0.004
PM_{10} Metals	Manganese (PM_{10})	5.0	ng/m^3	0.02	0.02	0.024	0.03	0.06	0.03	0.03	0.02	0.02	0.02	0.04
PM_{10} Metals	Nickel (PM_{10})	2.1	ng/m^3	0.05	0.05	0.078	0.08	0.19	0.12	0.09	0.11	0.10	0.11	0.56
VOC	Benzene	0.13	µg/m^3	b	0.98	0.47	0.71	1.50	0.47	0.37	0.96	0.52	0.64	0.36
VOC	Butadiene, 1,3-	0.10	µg/m^3	b	b	0.22	0.15	0.24	0.24	0.29	0.31	0.58	0.44	0.43
VOC	Carbon tetrachloride	0.17	µg/m^3	b	b	0.89	0.89	0.89	0.59	0.63	0.37	0.59	0.85	0.49
VOC	Chloroform	0.50	µg/m^3	b	0.20	0.17	0.09	0.14	0.15	0.14	0.16	0.12	0.19	0.13
VOC	Tetrachloroethylene	0.17	µg/m^3	b	b	0.44	0.72	0.80	0.56	0.52	0.56	0.64	1.24	0.58
VOC	Trichloroethylene	0.5/0.2[a]	µg/m^3	b	0.22	0.18	0.27	0.24	0.43	0.46	0.46	0.43	0.94	0.40
VOC	Vinyl chloride	0.11	µg/m^3	b	b	0.30	0.19	0.26	0.26	0.28	0.19	0.74	0.40	0.30

A-rated: MDL to Target MDL ratio ≤ 1

B-rated" MDL to Target MDL ratio between 1 and 2

Does Not Meet MDL to Target MDL ratio>2

-- No data available

[a]: For the 2012 sampling year, the Target MDL for this pollutant was reduced.

[b]: Pollutant was expected, but results were invalidated at this site for this year.

Table 8. NATTS Network Assessment: MQO#3 - Bias Percent Difference at Grayson Lake, KY

Pollutant Group	Pollutant Name	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbonyls	Acetaldehyde	2.9	-20.0	0.7	3.0	a	0.1	-4.3	a	-5.4	3.6	-8.7
Carbonyls	Formaldehyde	9.6	-13.7	-2.8	-3.4	a	-0.5	-2.2	a	-19.1	-5.3	-3.7
Chromium VI	Chromium VI	a	-5.6[b]	10.5[b]	a	19.5	-6.5	--	--	--	--	--
PAH	Benzo(a)pyrene	a	-1.7	-2.3	-2.1	25.2	-5.7	-16.3	-14.2	-10.5	-22.4	-14.8
PAH	Naphthalene	a	-7.7	-17.1	-13.9	21.4	25.5	0.7	-11.4	-9.5	-11.6	-20.7
PM_{10} Metals	Arsenic (PM_{10})	7.6	12.0	7.3	1.4	15.7	-3.0	1.9	a	-2.3	-1.4	-3.4
PM_{10} Metals	Beryllium (PM_{10})	2.5	32.0	11.2	-8.2	17.5	-2.0	c	a	-0.4	3.7	0.5
PM_{10} Metals	Cadmium (PM_{10})	4.3	17.2	4.9	-5.7	16.6	1.4	c	a	3.9	2.8	3.0
PM_{10} Metals	Lead (PM_{10})	-3.7	-6.2	-3.5	-6.3	19.9	0.1	2.2	a	-1.6	-0.4	-1.9
PM_{10} Metals	Manganese (PM_{10})	1.9	-4.8	0.6	-3.8	21.5	-6.2	13.2	a	3.9	1.3	2.6
PM_{10} Metals	Nickel (PM_{10})	29.4	4.9	4.7	-6.8	11.4	-1.2	d	a	26.5	21.2	10.6
VOC	Benzene	e	e	-13.2	10.2	a	-3.3	18.1	-5.3	5.2	14.6	-11.8
VOC	Butadiene, 1,3-	e	e	-3.7	10.9	a	0.6	-8.1	-22.0	-10.1	3.9	-6.6
VOC	Carbon tetrachloride	e	e	31.6	25.4	a	13.3	24.2	40.2	53.5	26.5	0
VOC	Chloroform	e	e	1.0	-9.7	a	-2.4	8.5	10.3	8.1	9.2	-7.5
VOC	Tetrachloroethylene	e	e	-16.1	0.8	a	-9.5	-1.8	-14.6	-5.5	13.0	-3.8
VOC	Trichloroethylene	e	e	-6.4	-8.3	a	3.0	-0.3	-10.0	-9.5	9.6	-14.6
VOC	Vinyl chloride	e	e	-14.1	0.3	a	-8.1	10.0	-7.1	1.5	-3.3	-2.7

	A-rated:±25%
	B-rated: Between 25% to 35% or between -25% to -35%
	Does not meet:>35% or <35%
--	No data available

[a]: No Proficiency Test samples were sent for this pollutant and year.

[b]: Proficiency Test results are from the National Contract Lab for EPA's School Air Toxics Monitoring Program. The %Difference was -5.55% in 2009 and 10.53% in 2010.

[c]: The Proficiency Test sample for this pollutant was 0; the site reported a concentration as "<MDL", rather than 0. EPA accepted this result.

[d]: Although a Proficiency Test sample was sent to the lab supporting this site and year, the results were nullified by EPA due to QA issues.

[e]: Pollutant was expected, but results were invalidated at this site for this year.

Table 9. NATTS Network Assessment: MQO#4 - Overall Method Precision %CV at Grayson Lake, KY

Pollutant Group	Pollutant Name	Overall Method precision % CV										
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbonyls	Acetaldehyde	5.8	15.2	11.7	6.5	1.6	1.1	1.1	--	--	1.0	0.9
Carbonyls	Formaldehyde	4.2	15.4	12.8	6.6	2.1	2.3	0.6	--	--	1.2	1.0
Chromium VI	Chromium VI	a	9.4	7.1	20.4	5.2	a	--	--	--	--	--
PAH	Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--	--
PAH	Naphthalene	--	--	--	--	--	--	--	--	--	--	--
PM_{10} Metals	Arsenic (PM_{10})	6.9	6.6	10.7	20.3	16.9	13.4	17.3	15.8	8.0	4.1	3.3
PM_{10} Metals	Beryllium (PM_{10})	a	a	a	0	a	a	0	18.0	30.3	15.9	14.5
PM_{10} Metals	Cadmium (PM_{10})	a	a	a	20.6	29.6	35.7	27.4	15.9	7.5	3.4	2.8
PM_{10} Metals	Lead (PM_{10})	28.4	6.8	5.5	15.1	4.1	18.5	23.5	13.4	8.3	2.4	1.5
PM_{10} Metals	Manganese (PM_{10})	60.5	43.7	49.4	26.7	3.4	17.7	12.6	9.0	6.1	3.7	5.0
PM_{10} Metals	Nickel (PM_{10})	a	44.9	6.9	35.6	1.2	27.0	37.8	25.3	22.3	8.8	a
VOC	Benzene	--	--	66.7	6.1	10.5	6.6	6.4	--	--	13.2	6.7
VOC	Butadiene, 1,3-	--	--	16.8	20.1	8.2	7.4	15.8	--	--	a	a
VOC	Carbon tetrachloride	--	--	33.9	4.3	7.2	7.2	22.3	--	--	4.4	5.1
VOC	Chloroform	--	--	0	4.8	21.1	--	3.0	--	--	38.6	8.9
VOC	Tetrachloroethylene	--	--	a	a	a	a	a	--	--	a	a
VOC	Trichloroethylene	--	--	a	a	a	--	a	--	--	a	a
VOC	Vinyl chloride	--	--	a	a	a	--	a	--	a	a	a

A-rated:≤ 15% CV

B-rated: Between 15%CV to25% CV

Does Not Meet: >25% CV or did not report Precision (required in the NATTS Workplan Template since 2012)

-- No data available

[a]: Although both primary and secondary data were reported, both sets of values were less than the MDL. Thus no %CV was calculated.

Table 10. NATTS Network Assessment: MQO#4 - Analytical Precision %CV at Grayson Lake, KY

Pollutant Group	Pollutant Name	Analytical Method precision % CV										
		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbonyls	Acetaldehyde	--	--	--	0.4	0.7	1.4	0.7	3.0	0.7	0.8	1.6
Carbonyls	Formaldehyde	--	--	--	0.9	1.0	1.3	1.0	1.2	0.5	0.8	1.6
Chromium VI	Chromium VI	--	6.7	6.4	5.8	4.8	12.1	--	--	--	--	--
PAH	Benzo(a)pyrene	--	--	--	--	2.0	6.0	6.9	a	1.7	2.0	3.0
PAH	Naphthalene	--	--	--	--	2.7	2.1	2.6	4.5	0.5	1.2	0.8
PM_{10} Metals	Arsenic (PM_{10})	--	--	--	7.5	12.7	18.1	15.3	8.8	2.9	2.7	2.1
PM_{10} Metals	Beryllium (PM_{10})	--	--	--	0	0	0	24.6	12.1	24.2	14.2	12.7
PM_{10} Metals	Cadmium (PM_{10})	--	--	--	5.1	12.0	10.4	10.9	12.7	3.6	1.6	2.3
PM_{10} Metals	Lead (PM_{10})	--	--	--	0.9	0.8	1.8	1.6	1.3	1.3	0.9	0.3
PM_{10} Metals	Manganese (PM_{10})	--	--	--	0.4	1.4	1.3	1.0	2.3	2.8	0.9	1.2
PM_{10} Metals	Nickel (PM_{10})	--	--	--	46.7	1.7	18.9	22.2	7.6	7.3	0.9	a
VOC	Benzene	--	--	4.5	8.3	6.5	4.6	4.8	29.6	30.6	5.5	5.2
VOC	Butadiene, 1,3-	--	--	6.7	6.7	6.8	5.7	12.0	a	0	a	9.8
VOC	Carbon tetrachloride	--	--	1.9	5.8	7.4	6.1	1.2	6.7	4.9	11.1	5.6
VOC	Chloroform	--	--	3.0	7.4	17.2	a	5.1	14.5	19.5	7.5	9.5
VOC	Tetrachloroethylene	--	--	a	a	a	a	a	a	a	a	a
VOC	Trichloroethylene	--	--	--	--	a	a	a	a	a	a	a
VOC	Vinyl chloride	--	--	--	20.2	a	a	a	a	a	a	a

A-rated:≤ 15% CV

B-rated: Between 15%CV to25% CV

Does Not Meet: >25% CV or did not report Precision (required in the NATTS Workplan Template since 2012)

-- No data available

[a]: The primary and/or replicate value were less than the MDL, so no calculation could be made.

Appendix A. Equipment Inventory

Method	Year(s)	Manufacturer/Model, Extraction Type, and Year
Sampling Equipment		
Carbonyls	2008-2010	ATEC 2200 Toxic Air Sampler (Year Deployed: 2008)
	2011-2011	ATEC 2200 Toxic Air Sampler (2 units) (Year Deployed: 2008)
	2012-2018	ATEC 2200 Toxic Air Sampler (2 units) (Year Deployed: 2012)
Chormium VI	2008-2013	URG Model 3000 (Year Deployed: 2008)
PAHs	2008-2018	Tisch Environmental TE-1000 PUF Sampler (Year Deployed: 2008)
PM_{10} Metals	2008-2010	Thermo R&P Parisol-FRM 2000 Air Sampler (Year Deployed: 2000)
	2011-2018	Thermo R&P Parisol-FRM 2000 Air Sampler (2 units) (Year Deployed: 2010)
VOCs	2008-2011	ATEC 2200 Toxic Air Sampler (Year Deployed: 2008)
	2012-2018	ATEC 2200 Toxic Air Sampler (Year Deployed: 2012)
Analytical Equipment		
Carbonyls	2008-2017	Waters Alliance 2695 HPLC /model 2487 Dual Absorbance (Year Deployed: 2003)
	2018	Waters Alliance e2695 HPLC /model 2489 Dual Absorbance (Year Deployed: 2018)
Chromium VI	2005-2013	Dionex 300 ion chromatography system (Year Deployed: 2001)
PAHs	2008-2014	HP/Agilent 5890/5971 GC/MS (Year Deployed: 2008)
	2015-2018	HP/Agilent 7890B/5975C GC/MS (Year Deployed: 2015)
PM_{10} Metals	2008-2014	PE ELAN 9000 ICP-MS (Year Deployed: 2003)
	2015-2018	Thermo iCAP Q ICP-MS (Year Deployed: 2015)
VOCs	2008-2009	HP/Agilent 6890/5973 GC/MS (Year Deployed: 2005)
	2010	HP/Agilent 5890/5971 GC/MS (Year Deployed: 2008)
	2011-2018	HP/Agilent 6890/5975 GC/MS (Year Deployed: 2010)
Preconcentrator Equipment		
VOCs	2008-2018	Entech 7100A (Year Deployed: 2007)
Standards Preparation Equipment		
VOCs	2008-2018	Custom-built (dynamic dilution) (Year Deployed: 1985)
Canister Cleaning Equipment		
VOCs	2008-2010	Custom-built (Cold) (Year Deployed: 2003)
	2011-2018	Wasson-ECE TO Clean (Hot) (Year Deployed: 2010)
PM_{10} Extraction Equipment		
PM_{10} Metals	2003	Branson 8510 (Sonicator) (Year Deployed: unknown)
	2004-2013	Branson 8510 (Sonicator) (Year Deployed: 2004)
	2014-2018	Environmental Express (Hotblock) (Year Deployed: 2014)

Appendix A. Equipment Inventory

Method	Year(s)	Manufacturer/Model, Extraction Type, and Year
Chromium VI Extraction Equipment		
Chromium VI	2008-2010	Branson 8510 (Sonicator) (Year Deployed: 2001)
	2011	Branson 8510 Sonicator/ Branson Shaker (Year Deployed: 2001/2011)
	2012-2014	Branson Shaker (Year Deployed: 2011)
PAHs Extraction Equipment		
PAHs	2008-2018	Dionex -300 (ASE) (Year Deployed: 2004)