

Seattle, WA NATTS Network Assessment Review

- Established 2003: Carbonyls, PM₁₀ Metals, and VOCs
 - Added Chromium VI in 2005, completed in 2013
 - Added PAHs in 2008
- For the NATTS Network Assessment (2003-2018):
 - 18 of 18 Method Quality Objective (MQO) Core HAPs were included in the national trends
 - 238 of 270 pollutant datasets were suitable for trends analysis
 - Annual Average and 3-Year Rolling Average Concentrations were generally decreasing over time.
 - 100% Reporting of Datasets
- Method Quality Objectives (MQO): 2003-2018
 - Completeness: Met 85% completeness in 264 of 282 pollutant datasets
 - Method Detection Limits: Met MDL Target Ratio of 1.00 in 255 of 283 pollutant datasets
 - Bias: Met ±25% for 201 of 223 pollutant datasets
 - Overall Method Precision: Met ≤15% CV for 91 of 116 pollutant datasets
 - Analytical Method Precision: Met ≤15% CV for 166 of 171 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	2016	2003	2014	2005	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 15 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

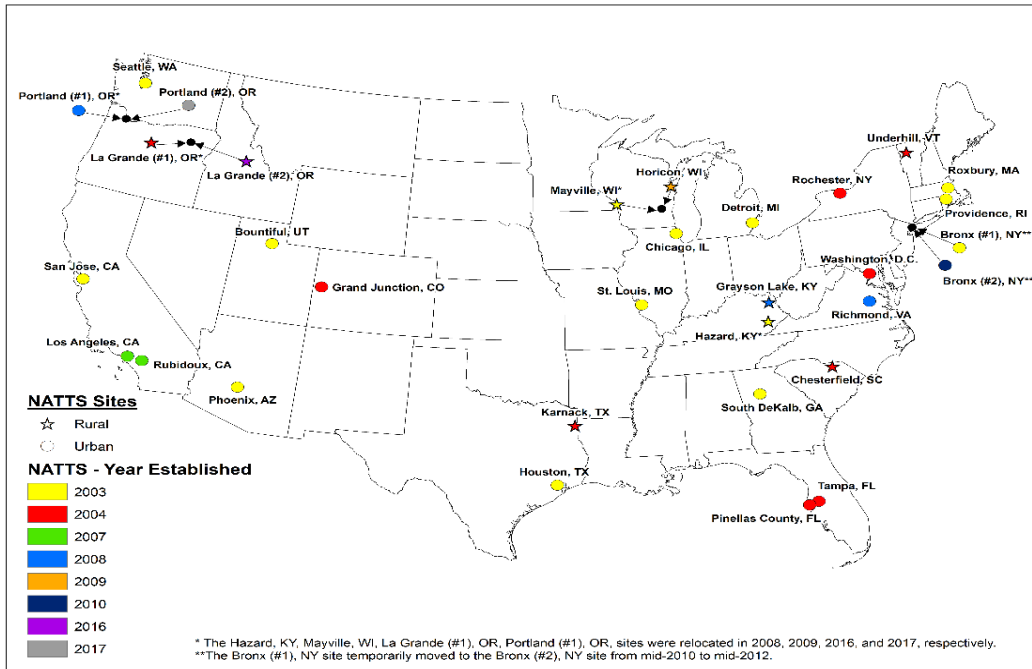


Table 1. NATTS Network Assessment: Count and Percentage of Suitable Datasets by Pollutant Group

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	µg/m ³	19	1.51	1.39	-7.7%
Arsenic (PM ₁₀)	ng/m ³	21	0.71	0.68	-3.2%
Benzene	µg/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-	µg/m ³	19	0.071	0.063	-10.9%
Cadmium (PM ₁₀)	ng/m ³	21	0.170	0.097	-43.0%
Carbon Tetrachloride	µg/m ³	15	0.59	0.56	-4.7%
Chloroform	µg/m ³	20	0.256	0.255	-0.4%
Chromium VI	ng/m ³	18	0.029	0.026	-7.7%
Formaldehyde	µg/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	µg/m ³	19	0.149	0.174	17.2%
Trichloroethylene	µg/m ³	19	0.020	0.022	10.7%
Vinyl Chloride	µg/m ³	17	0.0051	0.0048	-5.5%

NATTS Monitoring Site Report: Seattle, WA

Site Information

Region	10
NATTS Site Type	Urban
County	King
AQS Site Code	53-033-0080
NATTS Operating Agency	WA Department of Ecology
Latitude	47.568333
Longitude	-122.308056
AQS Land Use	Industrial
AQS Location Setting	Suburban
10-Mile Population	2,044,449

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	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Arsenic (PM ₁₀)	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Benzene	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Benzo(a)pyrene	--	--	--	--	--	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Beryllium (PM ₁₀)	N ^a	N ^b	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Butadiene, 1,3-	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Cadmium (PM ₁₀)	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Carbon tetrachloride	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Chloroform	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Chromium VI	--	--	Y	N ^b	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	--	--	--	--	--	--
Formaldehyde	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Lead (PM ₁₀)	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Manganese (PM ₁₀)	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Naphthalene	--	--	--	--	--	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Nickel (PM ₁₀)	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Tetrachloroethylene	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Trichloroethylene	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)
Vinyl chloride	N ^a	Y	Y	N ^b	Y	Y	Y	Y	Y	Y	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)	Y(T)

^a: No MDL reported to EPA.

^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 Seattle, WA

Analyte	Units	# Data Records	% Detection	Arithmetic Mean ^a	Percentile Value ^b						
					5th	10th	25th	50th	75th	90th	95th
Acetaldehyde	µg/m ³	928	100%	1.01 ± 0.05	0.31	0.39	0.53	0.83	1.32	1.83	2.23
Arsenic (PM ₁₀)	ng/m ³	938	100%	0.75 ± 0.04	0.19	0.25	0.37	0.58	0.93	1.47	1.92
Benzene	µg/m ³	926	100%	0.77 ± 0.04	0.23	0.29	0.40	0.61	0.88	1.45	1.82
Benzo(a)pyrene	ng/m ³	641	59%	0.05 ± 0.01	ND	ND	ND	0.01	0.04	0.13	0.24
Beryllium (PM ₁₀)	ng/m ³	923	79%	0.0026 ± 0.0004	ND	ND	0.0003	0.001	0.003	0.006	0.008
Butadiene, 1,3-	µg/m ³	926	93%	0.08 ± 0.01	ND	0.02	0.04	0.06	0.10	0.16	0.23
Cadmium (PM ₁₀)	ng/m ³	938	100%	0.32 ± 0.29	0.02	0.03	0.05	0.08	0.13	0.22	0.30
Carbon Tetrachloride	µg/m ³	926	100%	0.71 ± 0.01	0.56	0.60	0.64	0.69	0.76	0.87	0.95
Chloroform	µg/m ³	926	99%	0.16 ± 0.01	0.08	0.10	0.11	0.13	0.16	0.24	0.38
Chromium VI	ng/m ³	463	86%	0.038 ± 0.004	ND	ND	0.015	0.028	0.050	0.081	0.105
Formaldehyde	µg/m ³	928	100%	1.05 ± 0.12	0.23	0.31	0.46	0.72	1.12	1.72	2.11
Lead (PM ₁₀)	ng/m ³	938	100%	3.40 ± 0.19	0.83	1.11	1.73	2.64	4.02	6.49	8.66
Manganese (PM ₁₀)	ng/m ³	938	100%	7.85 ± 0.59	1.06	1.45	2.54	4.93	9.00	17.72	26.05
Naphthalene	ng/m ³	641	100%	59.86 ± 3.31	17.44	21.61	31.22	47.70	74.84	108.80	146.75
Nickel (PM ₁₀)	ng/m ³	938	100%	1.96 ± 0.14	0.32	0.44	0.66	1.21	2.38	4.58	6.04
Tetrachloroethylene	µg/m ³	926	88%	0.12 ± 0.01	ND	ND	0.06	0.10	0.15	0.28	0.35
Trichloroethylene	µg/m ³	926	30%	0.03 ± 0.01	ND	ND	ND	ND	0.04	0.11	0.17
Vinyl Chloride	µg/m ³	867	3%	0.0005 ± 0.0002	ND	ND	ND	ND	ND	ND	ND

^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.

Table 5. Analytical Labs Supporting this Site

Pollutant Group	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
VOCs	WSU	WSU	WSU	RJ Lee	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG
Carbonyls	WSU	WSU	WSU	RJ Lee	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG
PM ₁₀ Metals	WSU	WSU	WSU	RJ Lee	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG	ERG
Chromium VI	--	--	ERG	ERG	ERG	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.

WSU: Washington State University

RJ Lee: RJ Lee Group Center for Laboratory Sciences

Figure 3. Seattle, WA Annual Average Concentrations

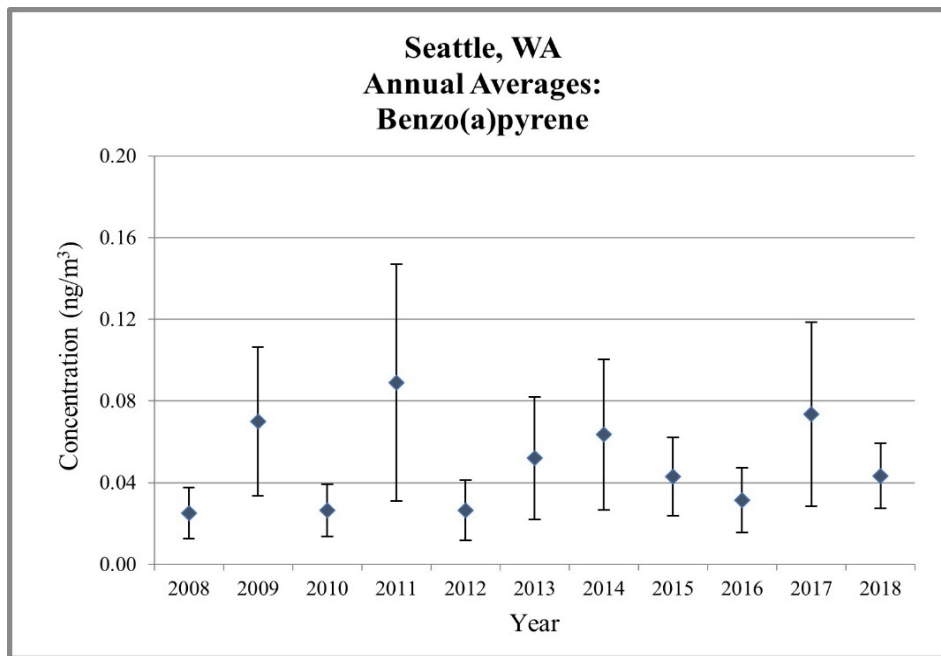
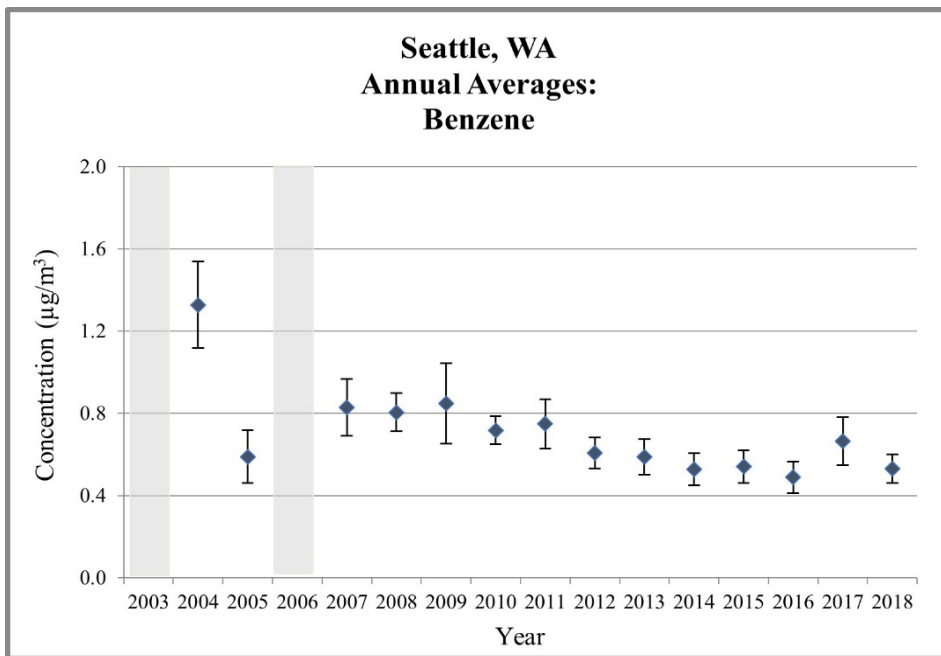
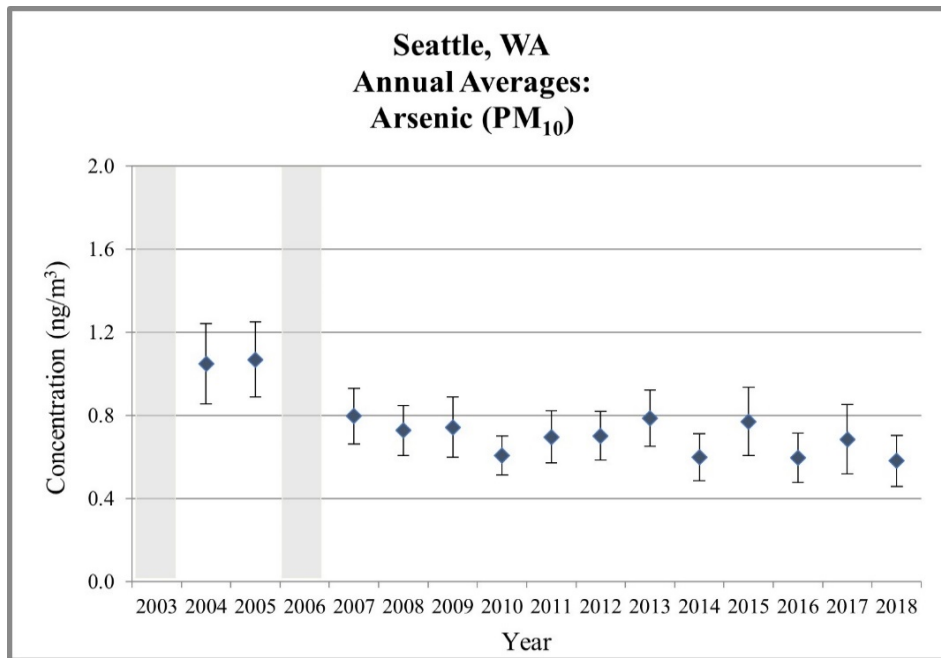
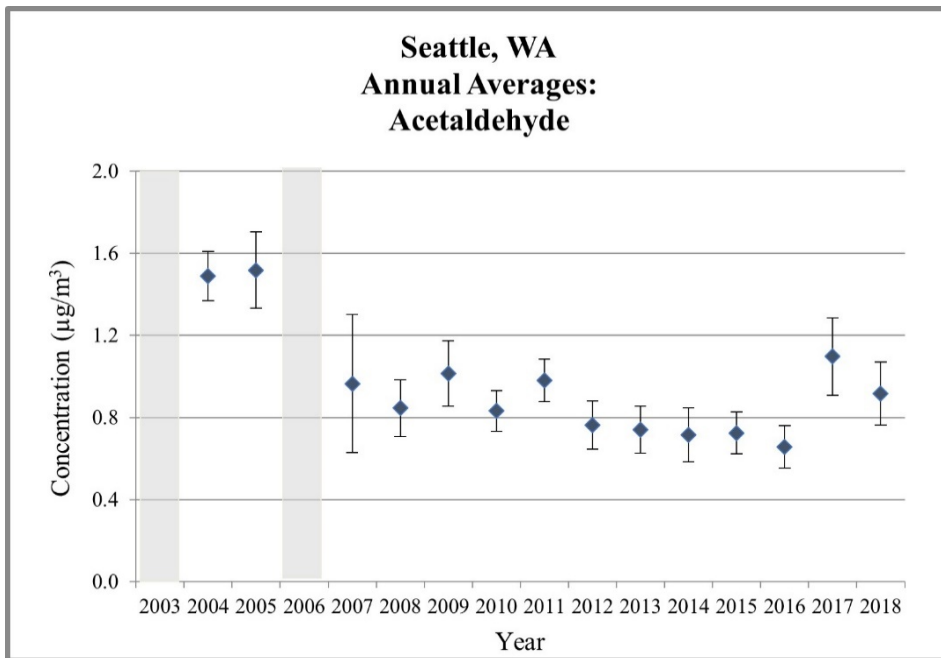


Figure 3. Seattle, WA Annual Average Concentrations

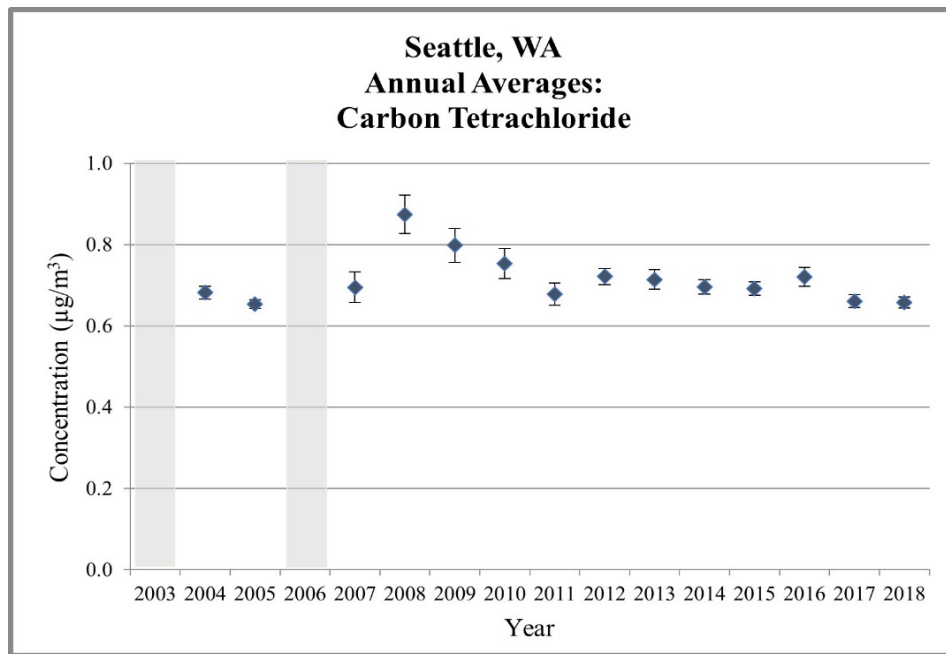
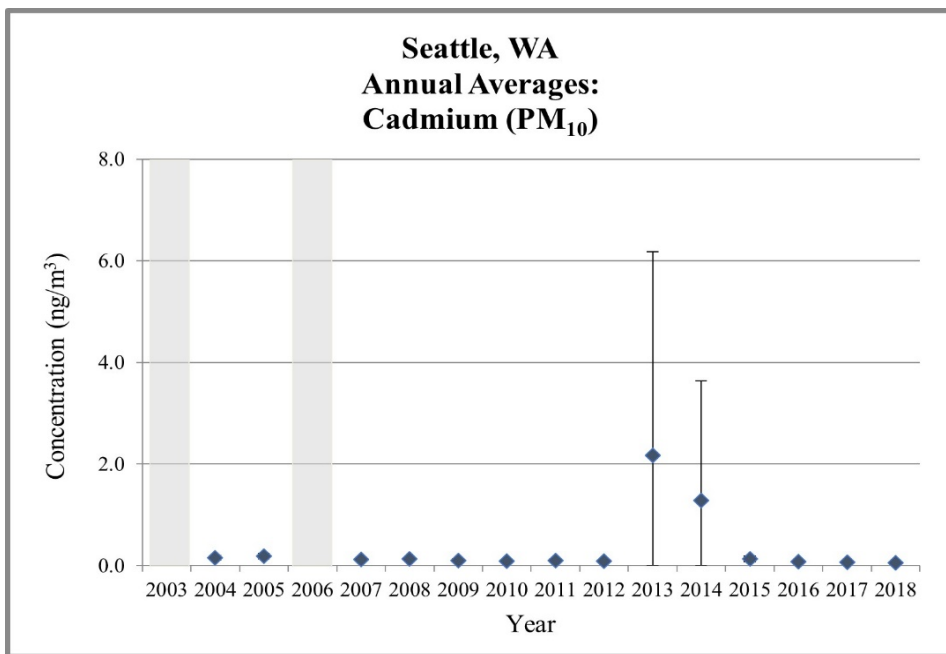
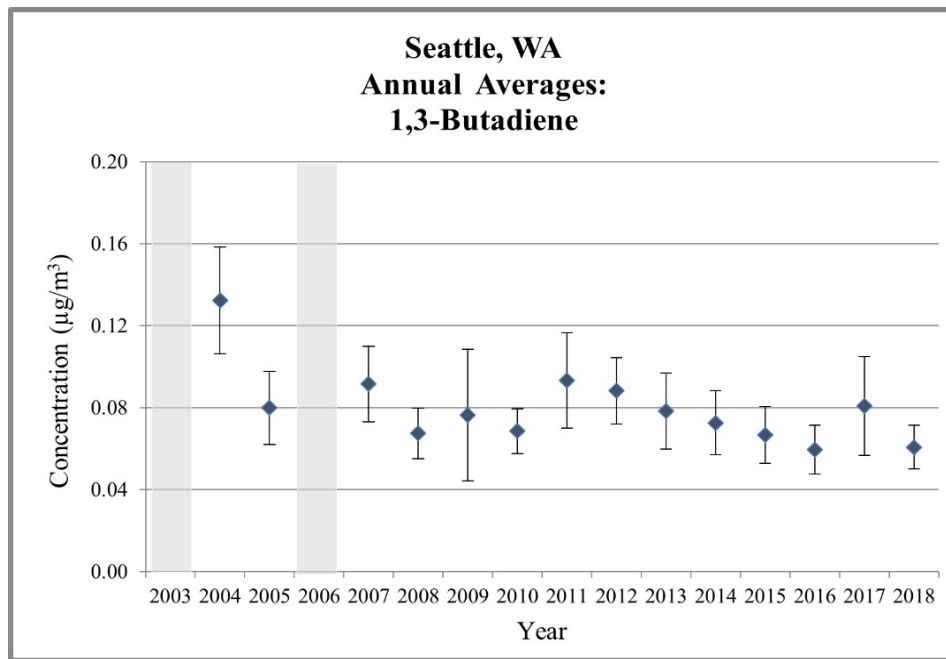
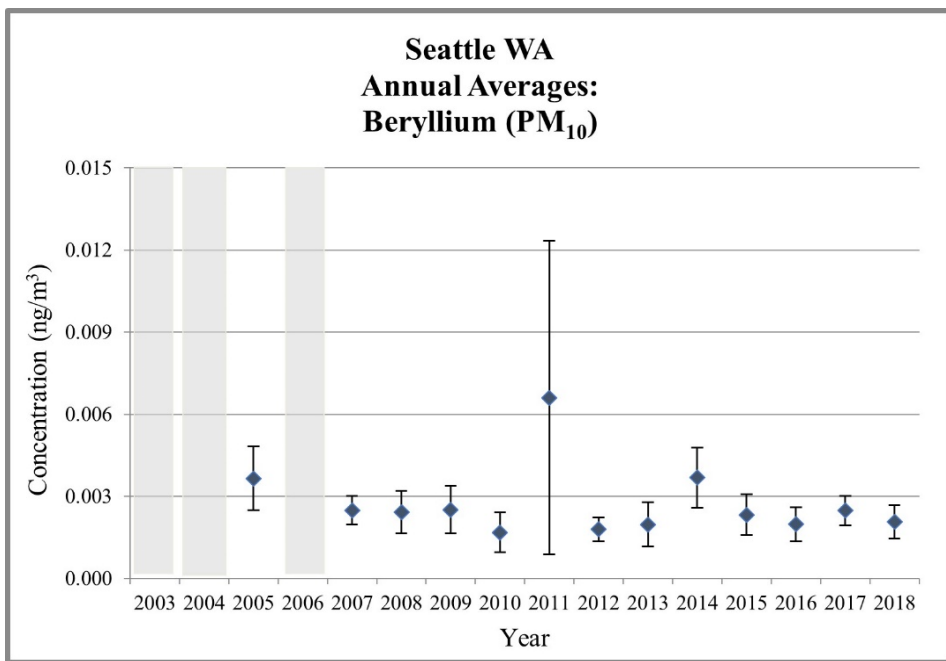


Figure 3. Seattle, WA Annual Average Concentrations

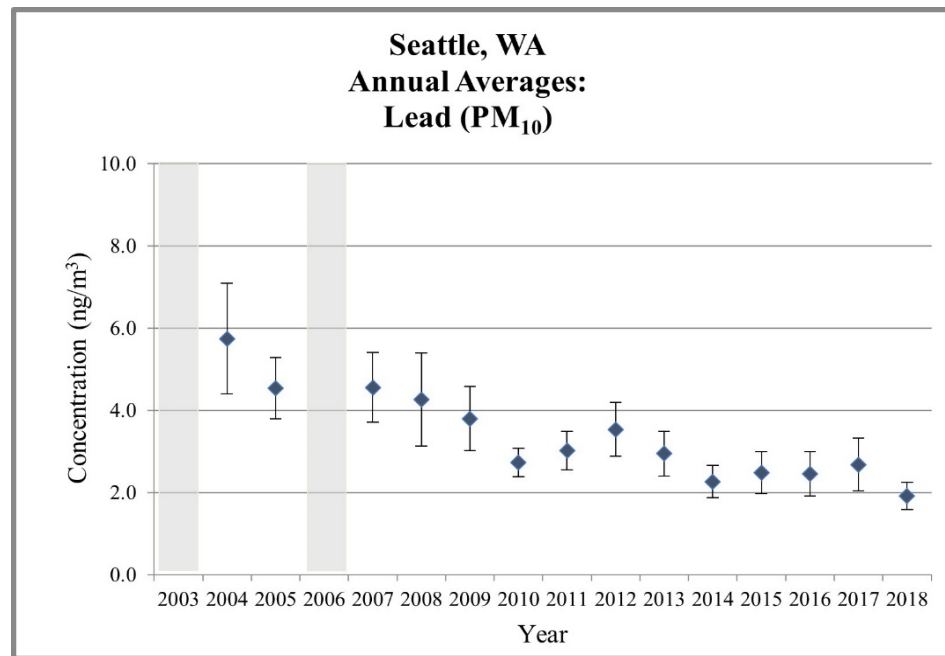
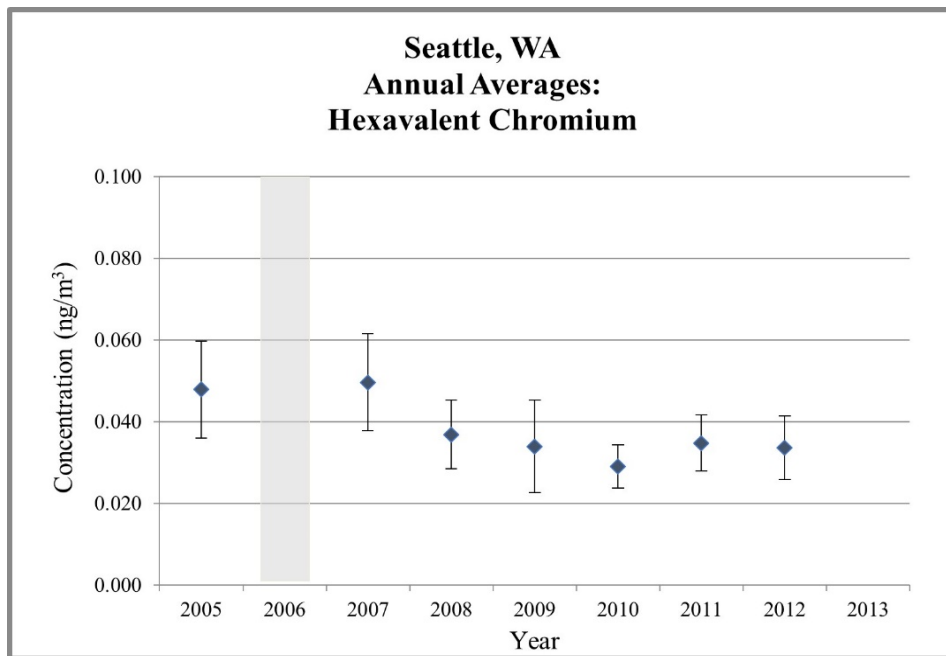
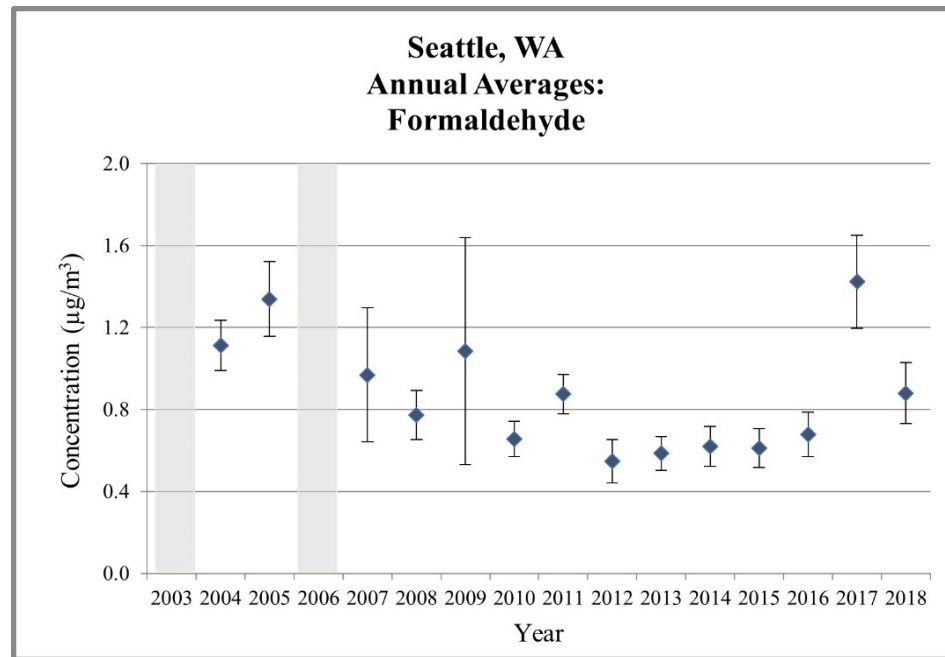
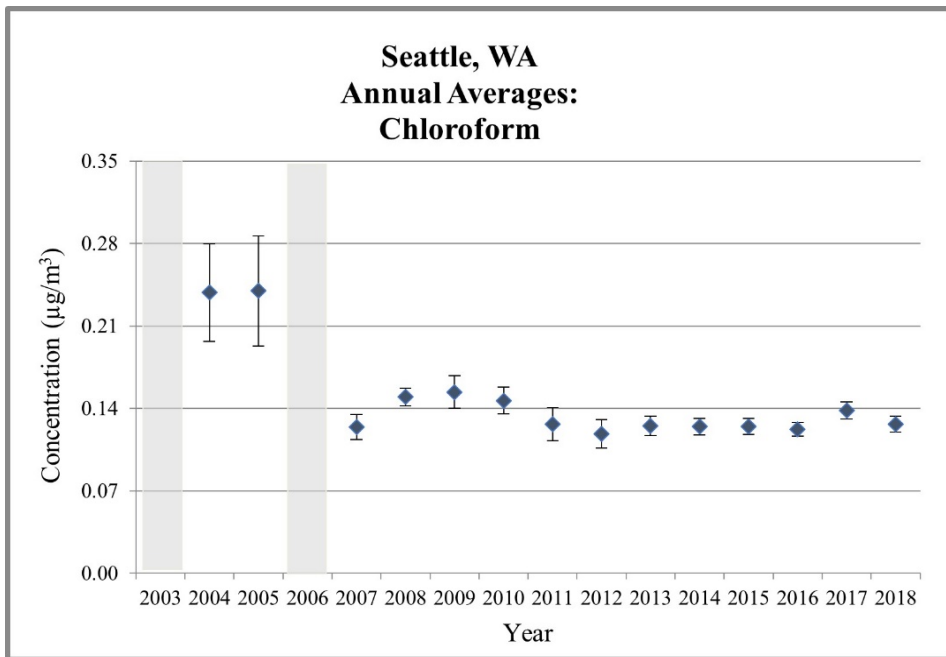


Figure 3. Seattle, WA Annual Average Concentrations

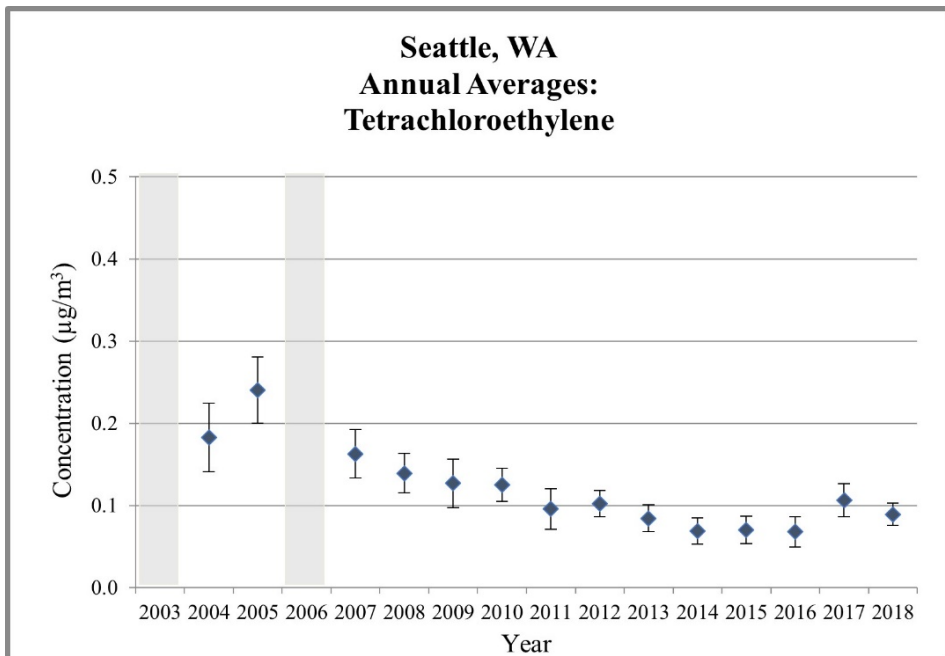
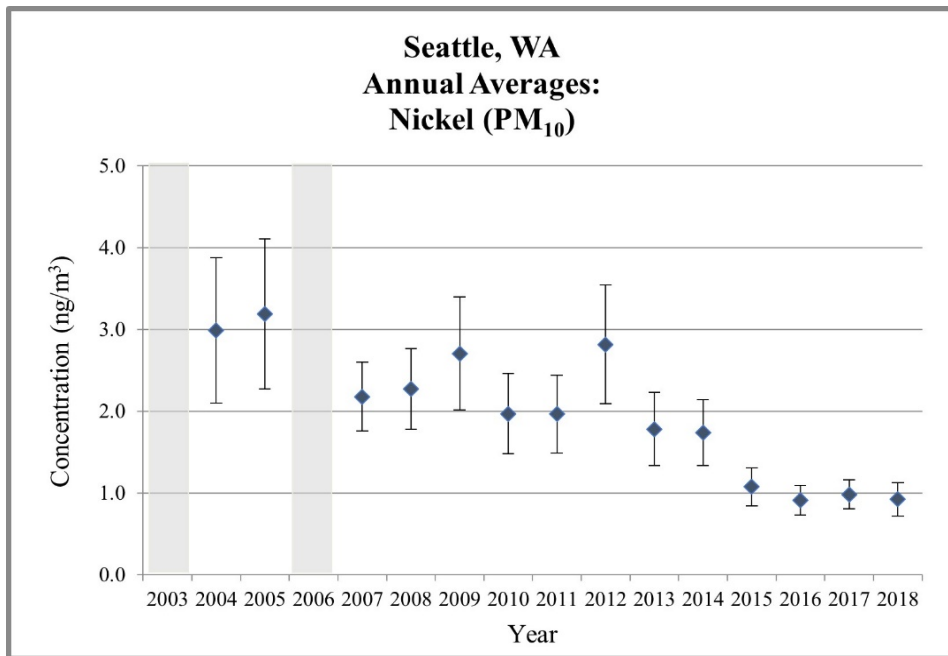
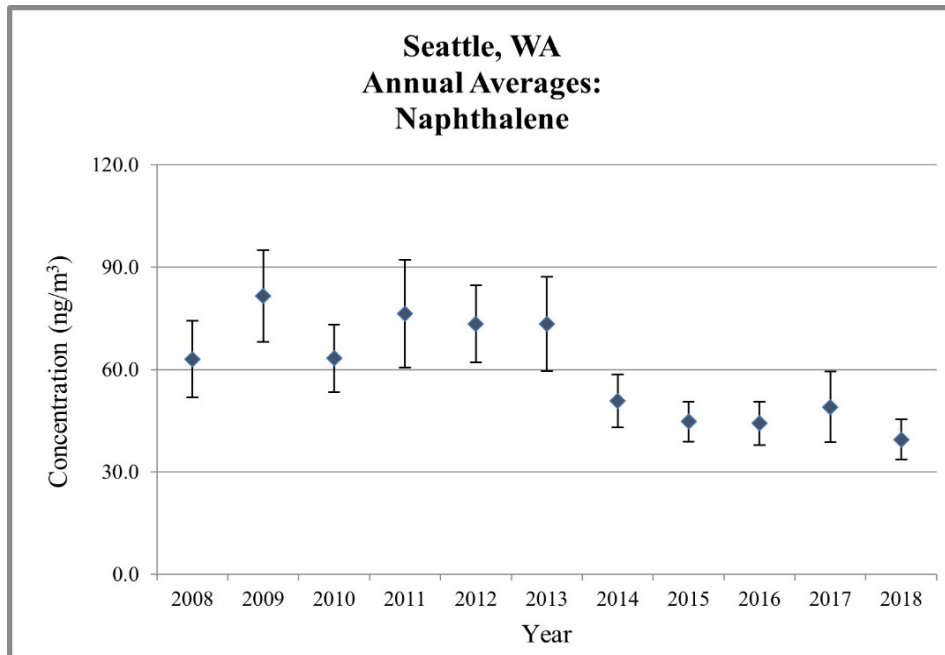
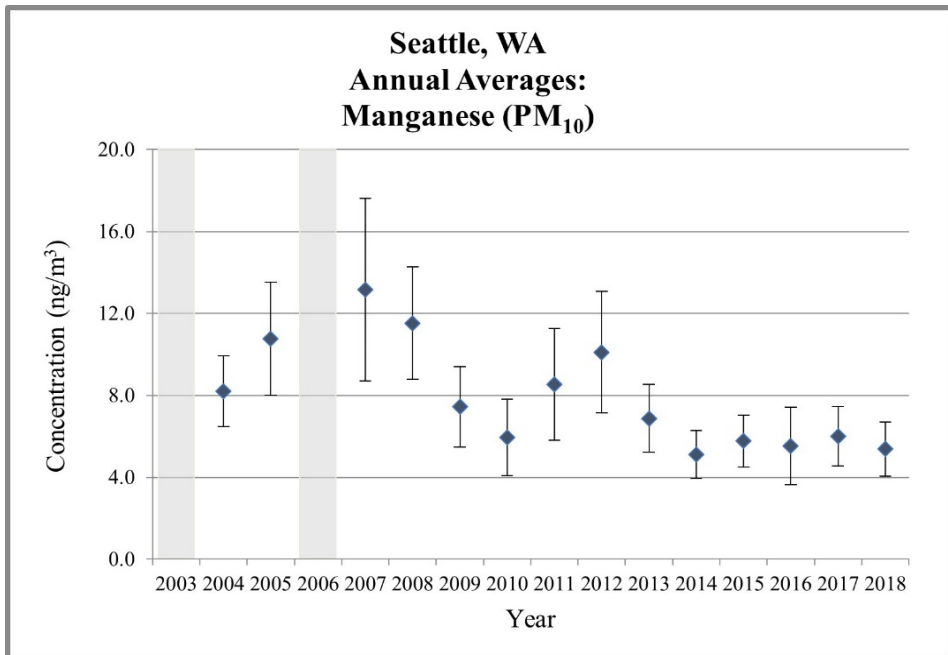
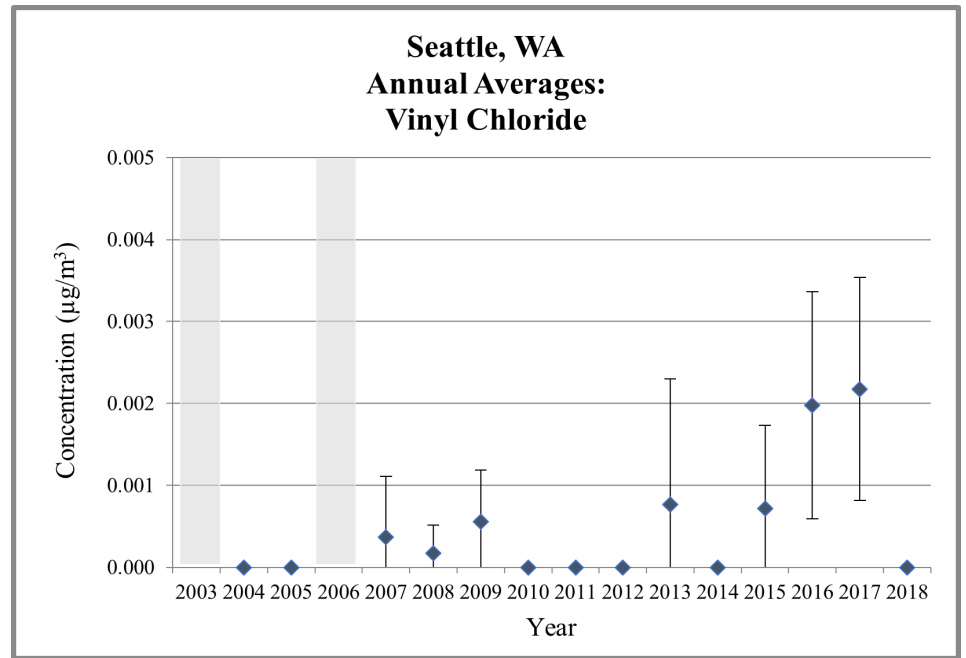
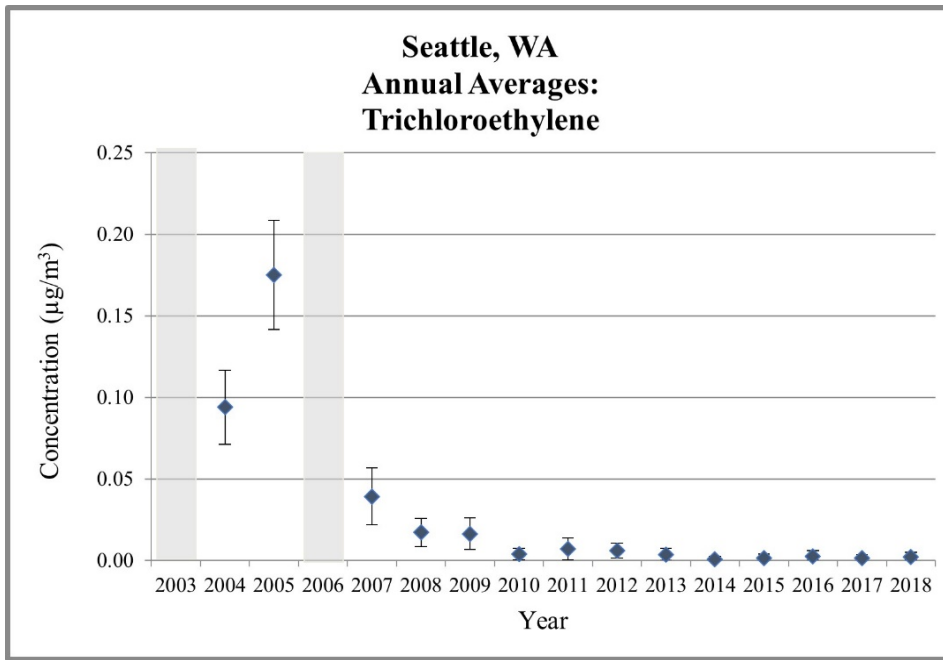


Figure 3. Seattle, WA Annual Average Concentrations



Does not meet MQO

Figure 4. Seattle, WA - 3-Year Rolling Average Concentrations

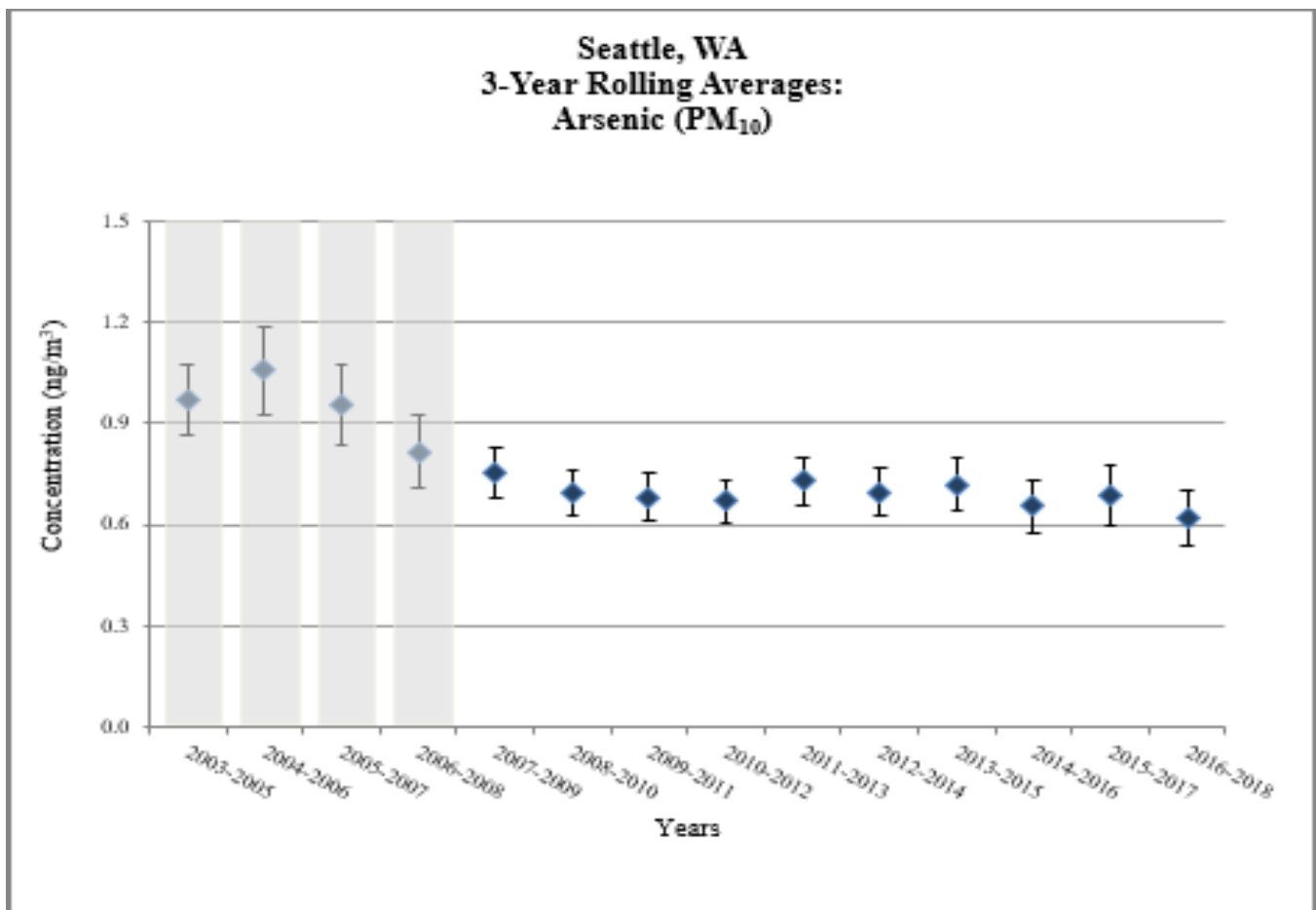
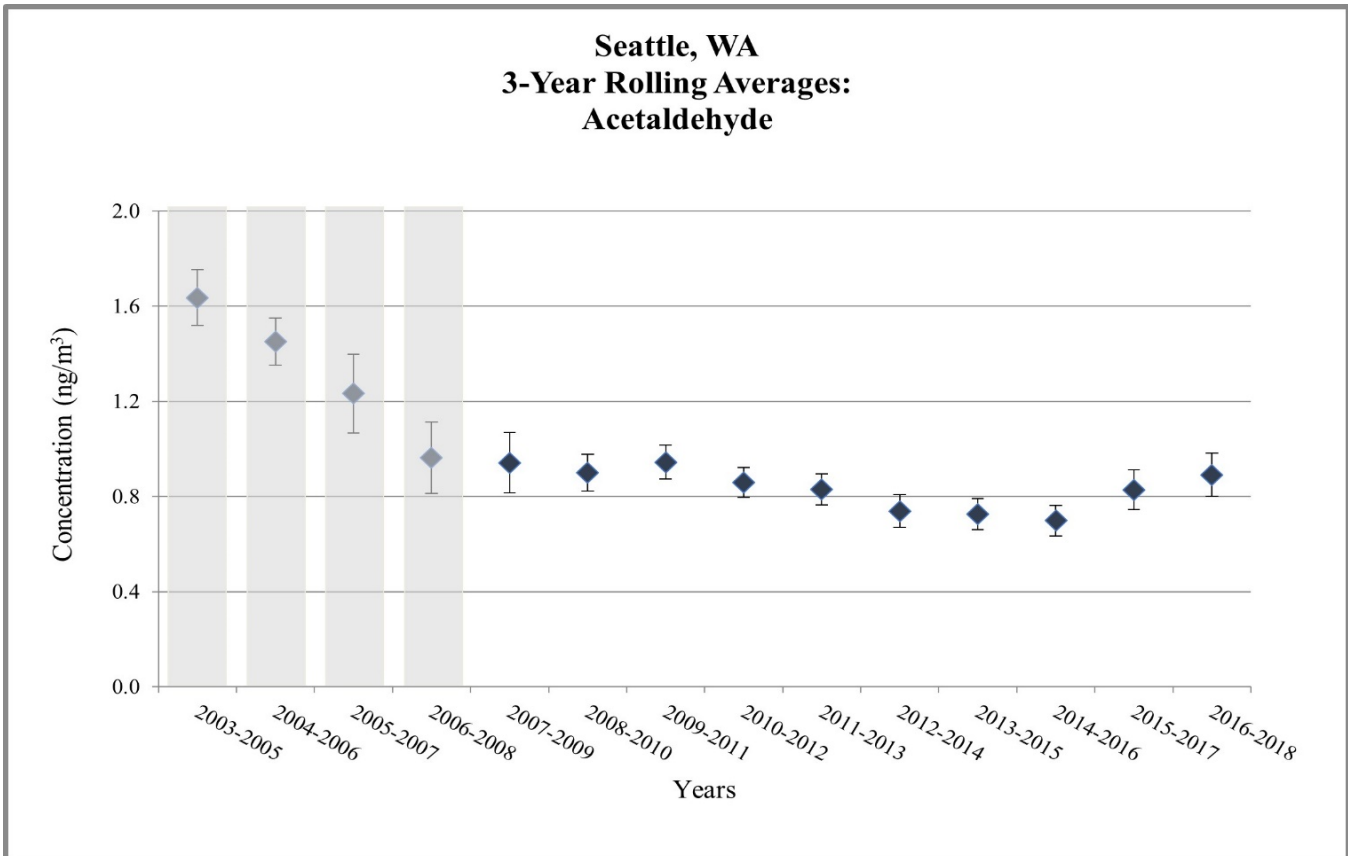


Figure 4. Seattle, WA - 3-Year Rolling Average Concentrations

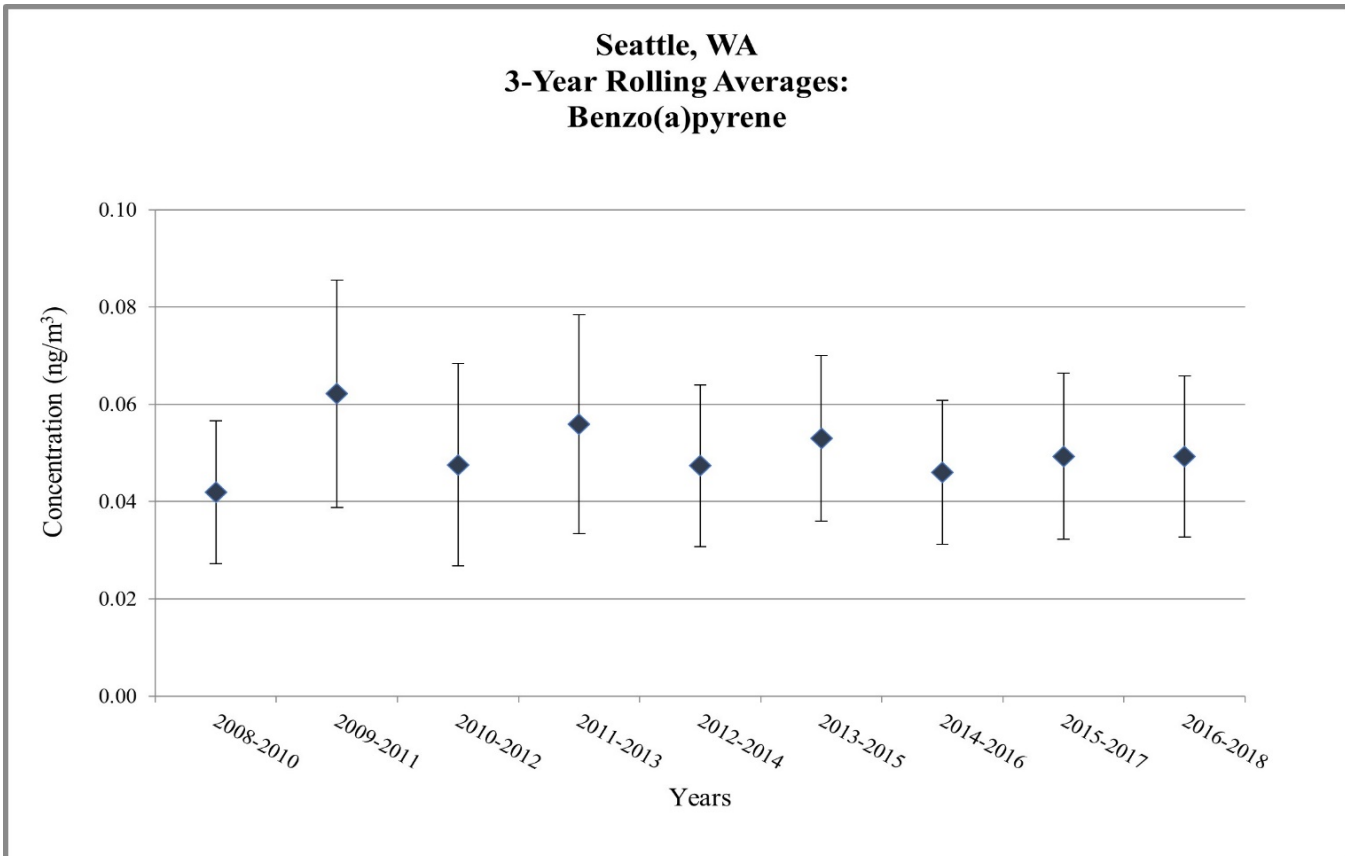
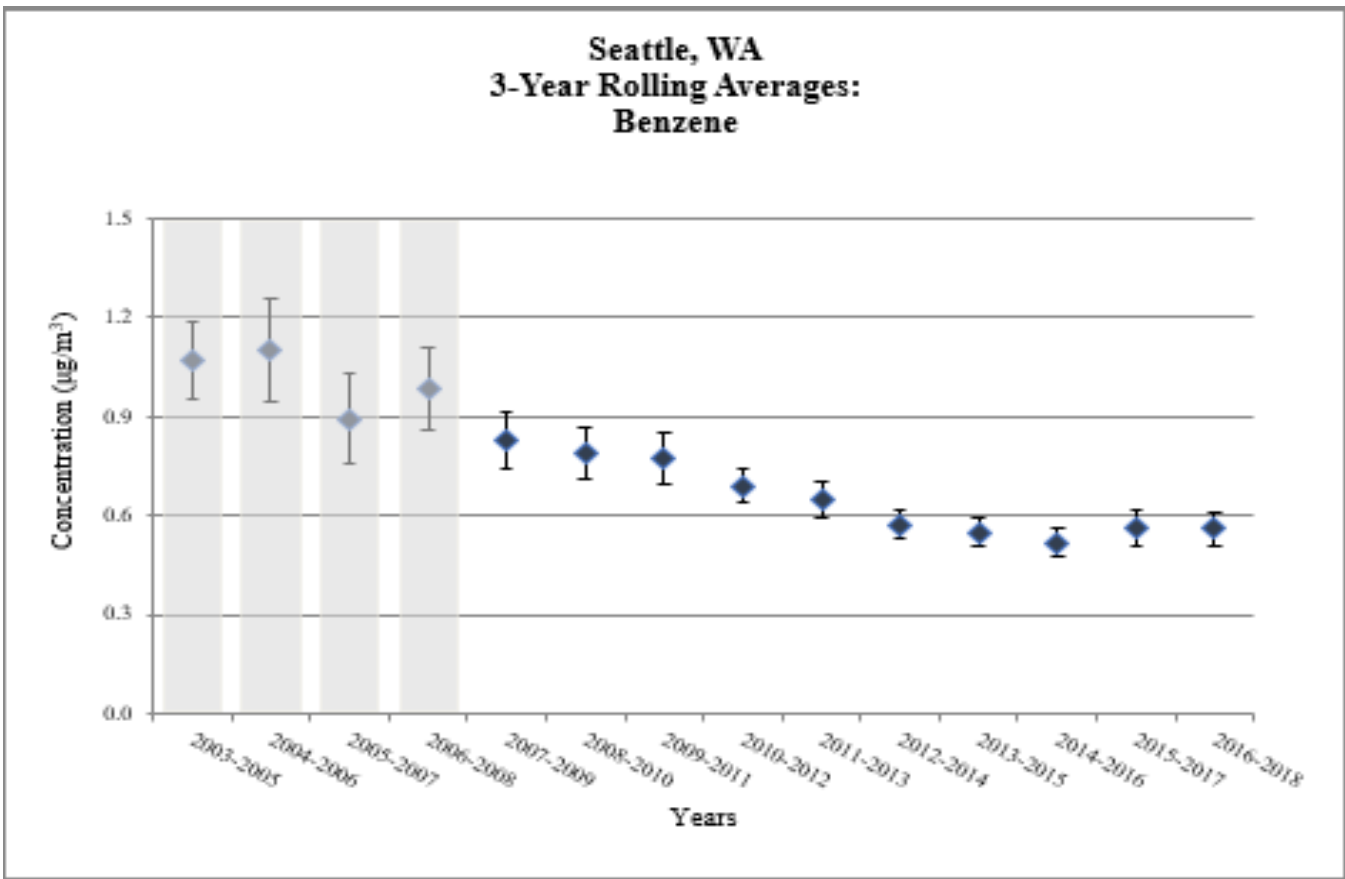


Figure 4. Seattle, WA - 3-Year Rolling Average Concentrations

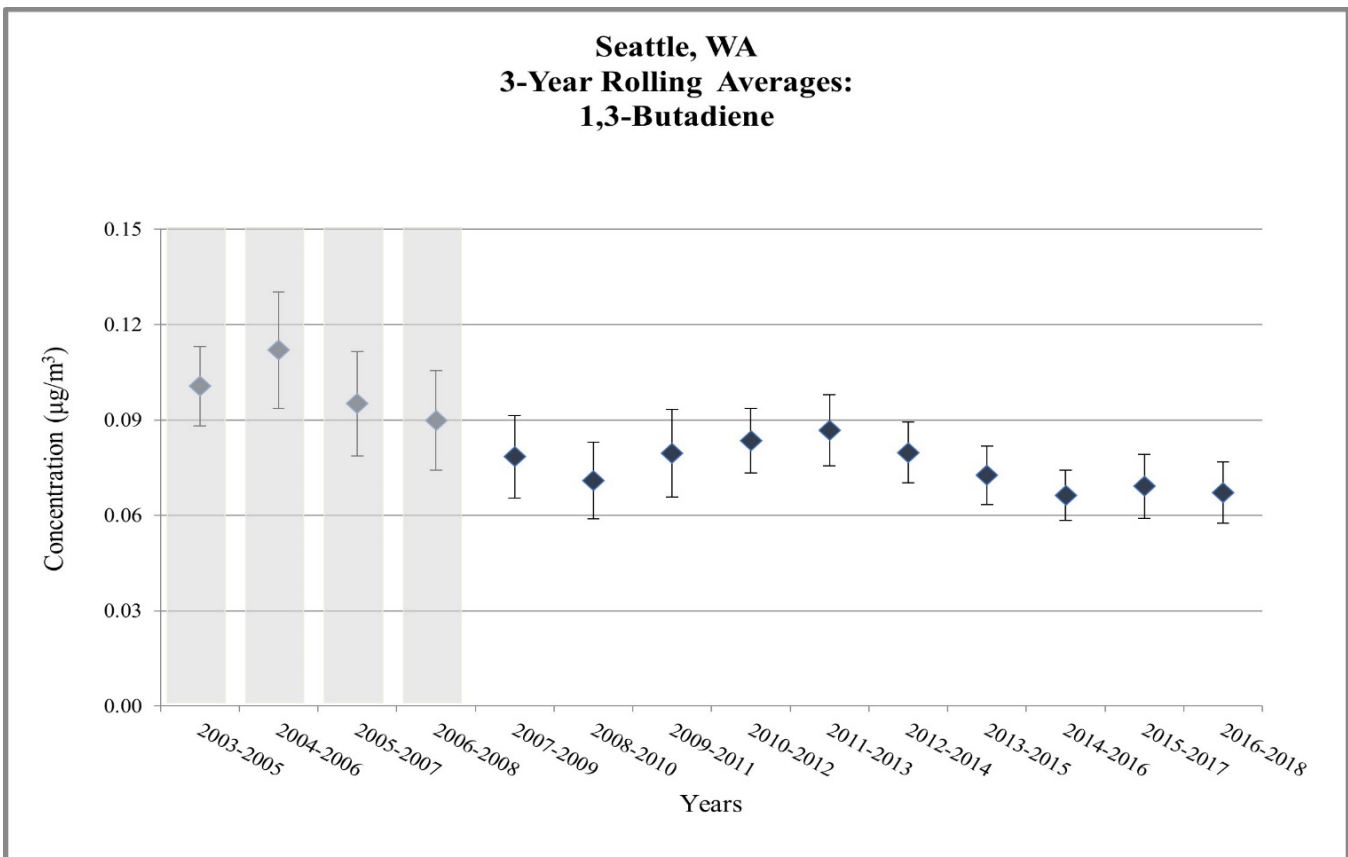
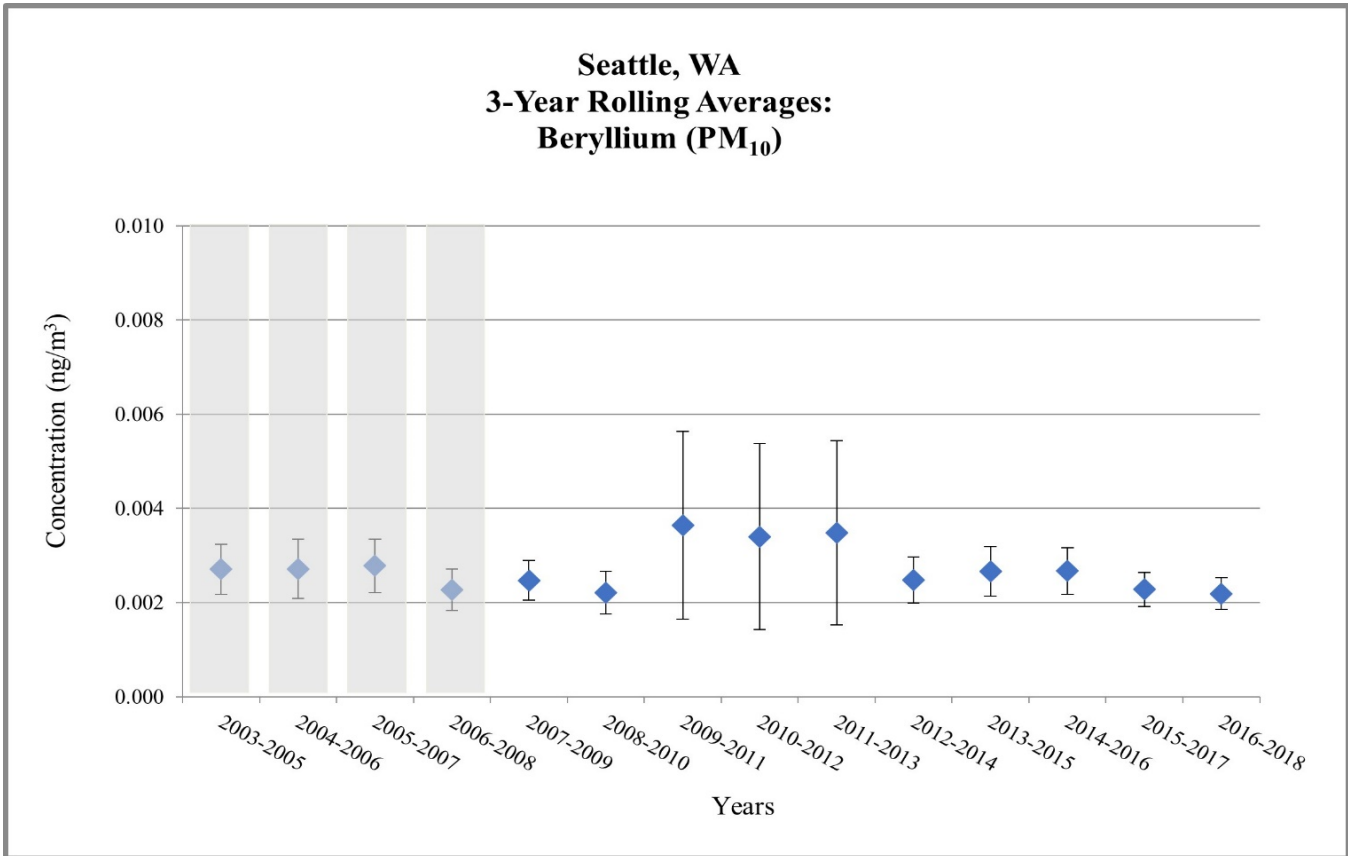


Figure 4. Seattle, WA - 3-Year Rolling Average Concentrations

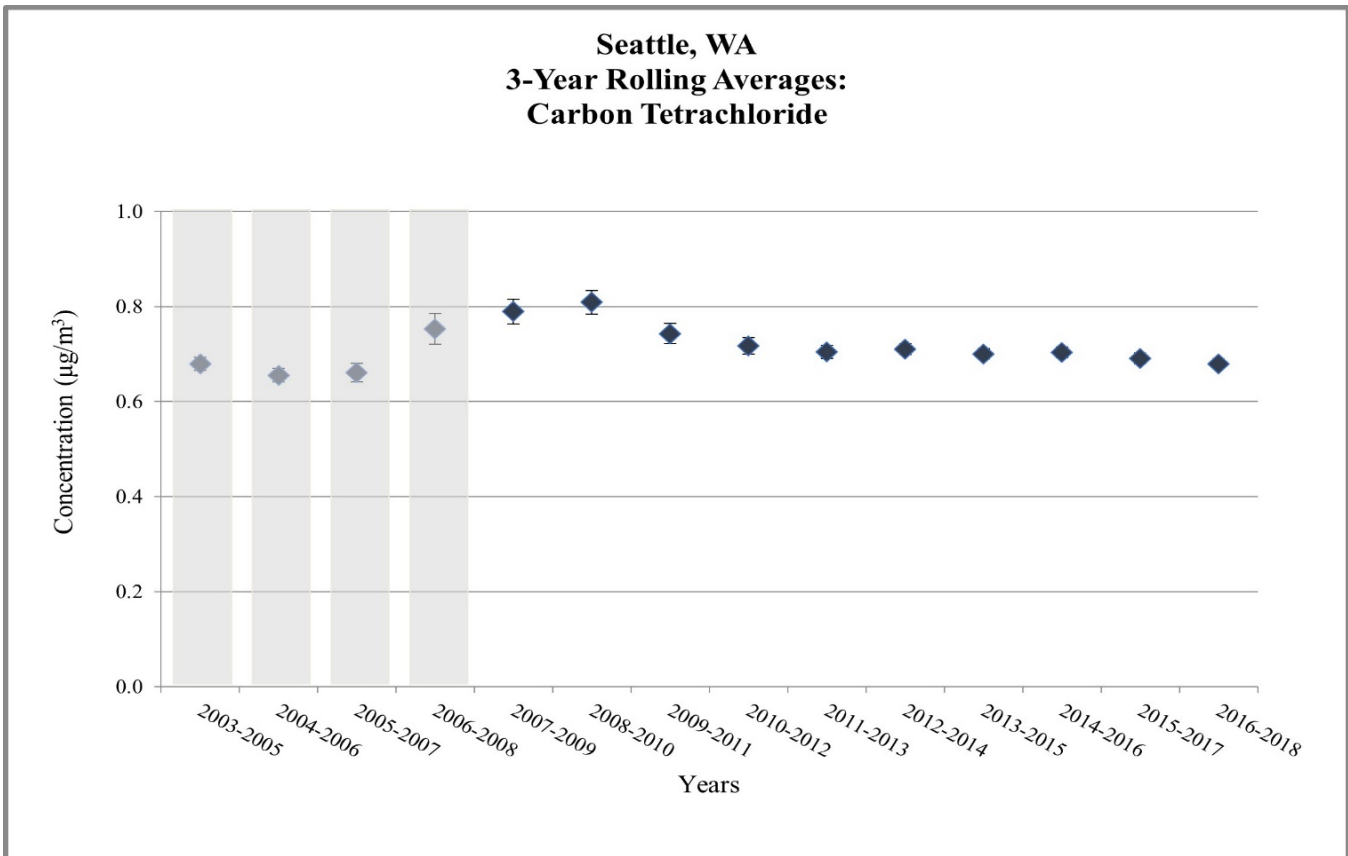
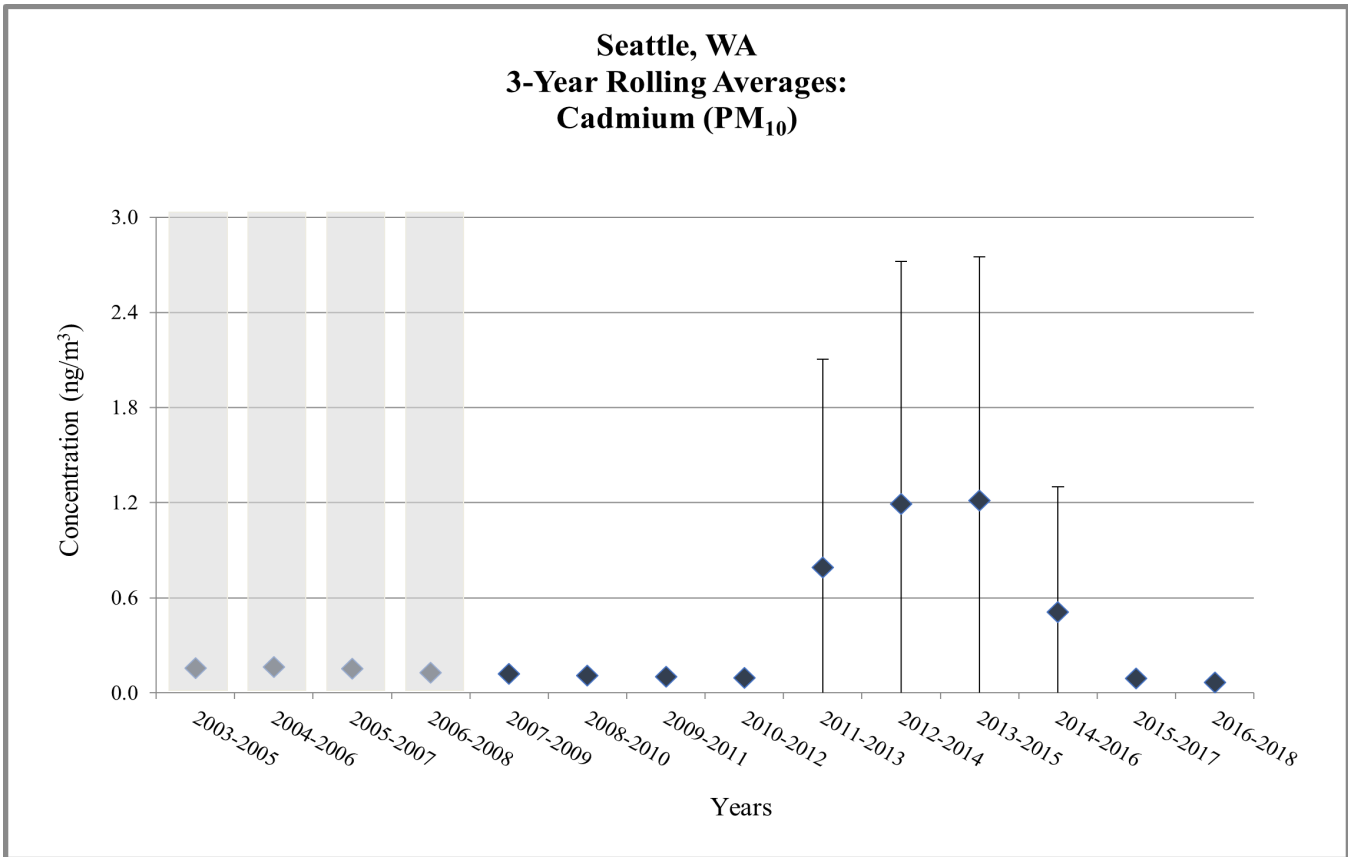


Figure 4. Seattle, WA - 3-Year Rolling Average Concentrations

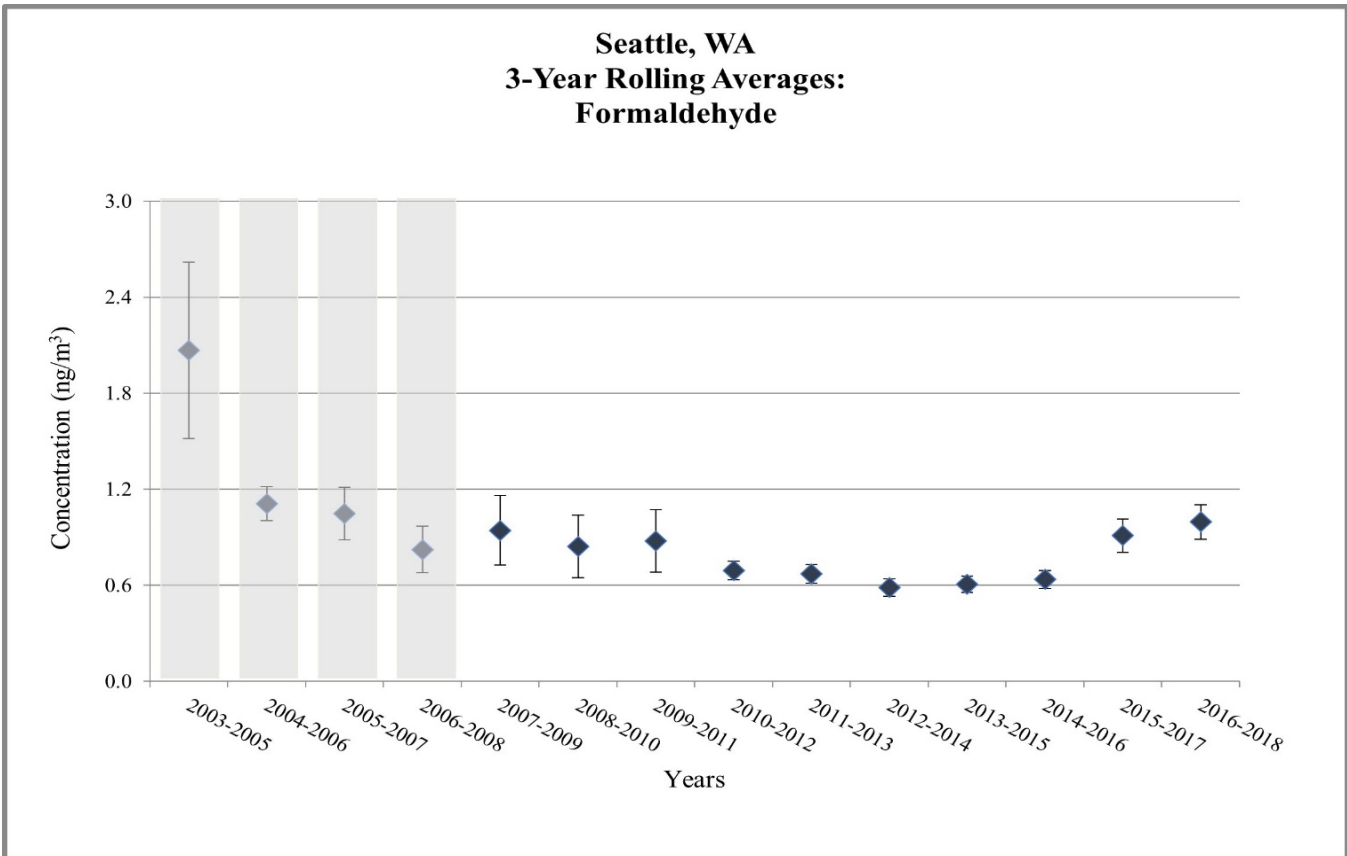
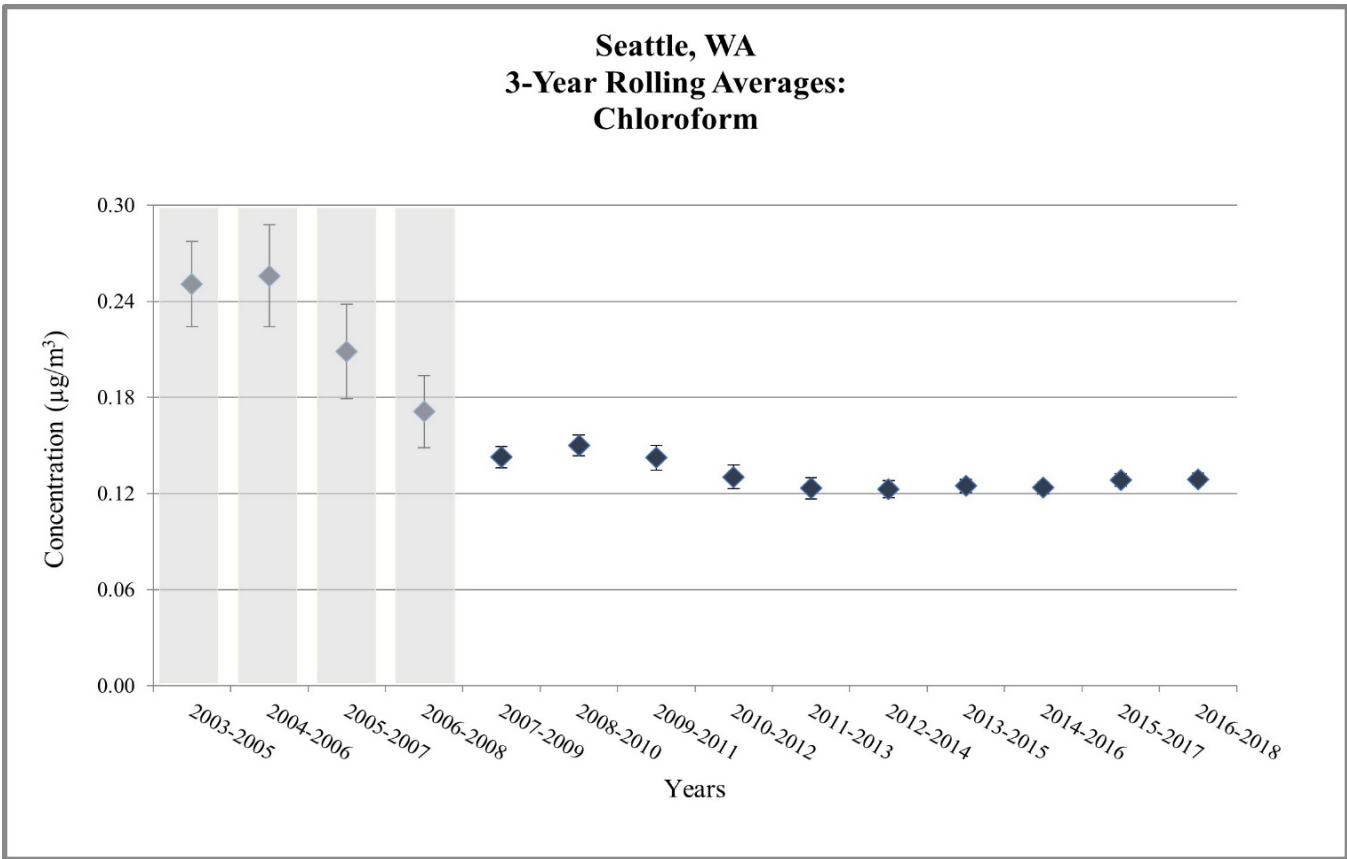


Figure 4. Seattle, WA - 3-Year Rolling Average Concentrations

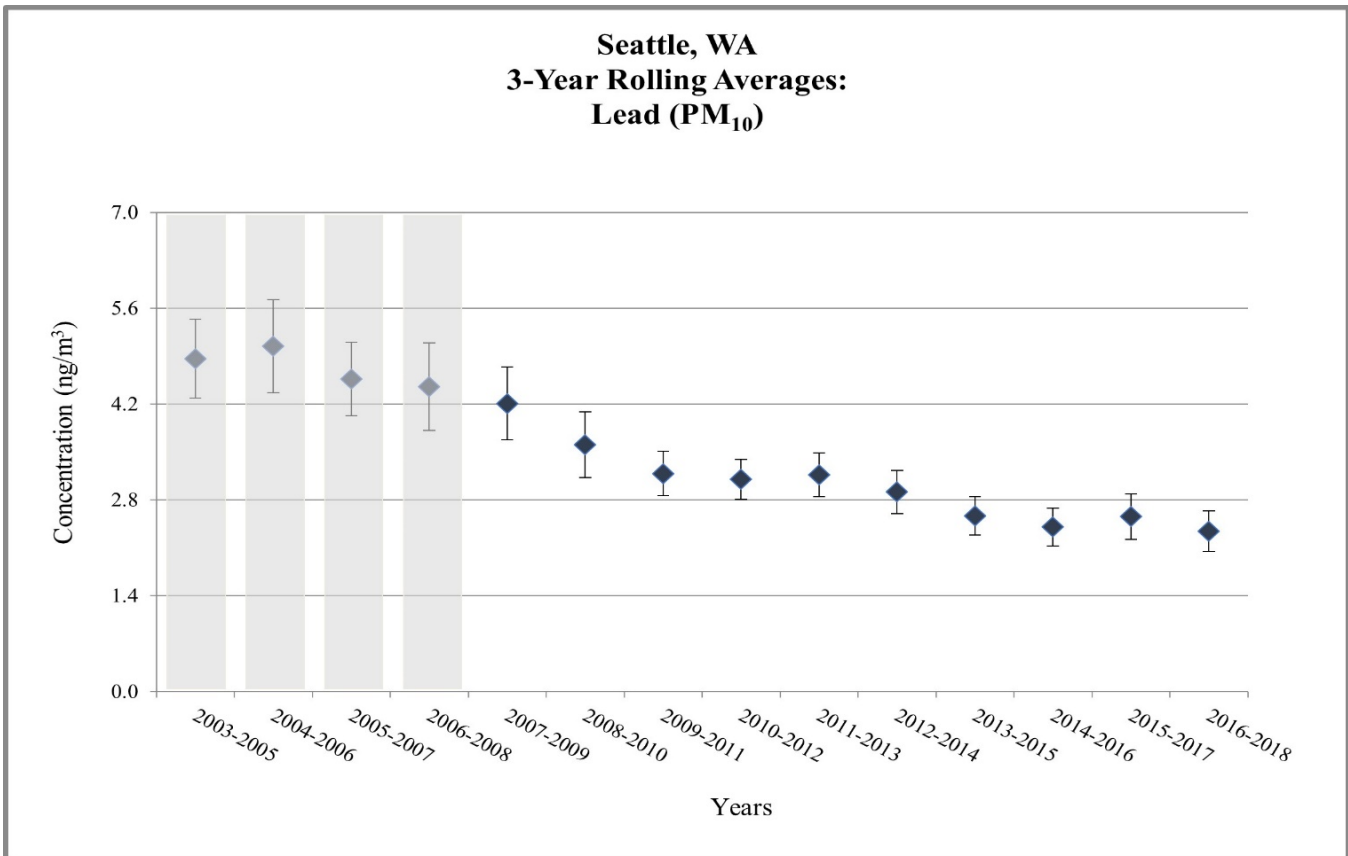
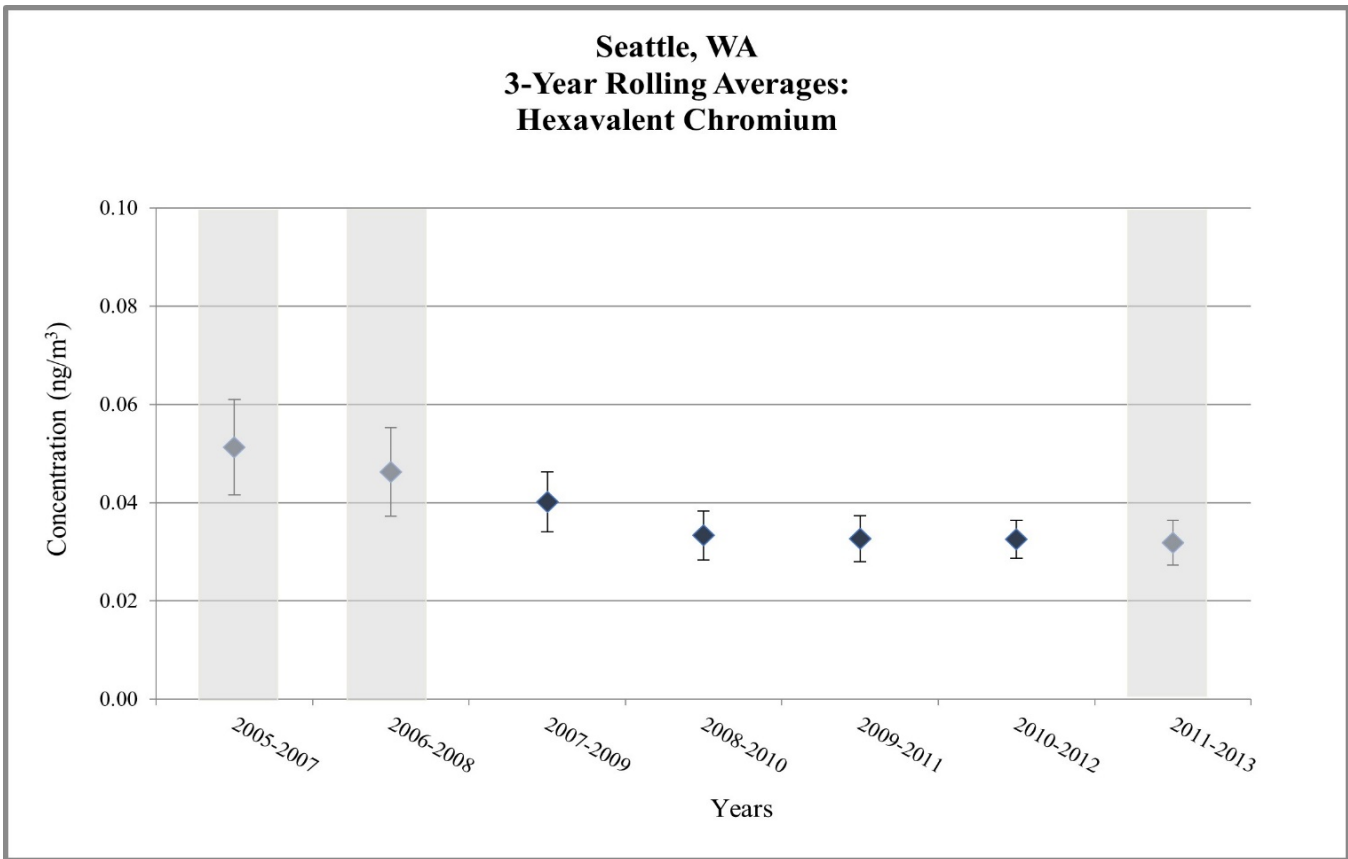


Figure 4. Seattle, WA - 3-Year Rolling Average Concentrations

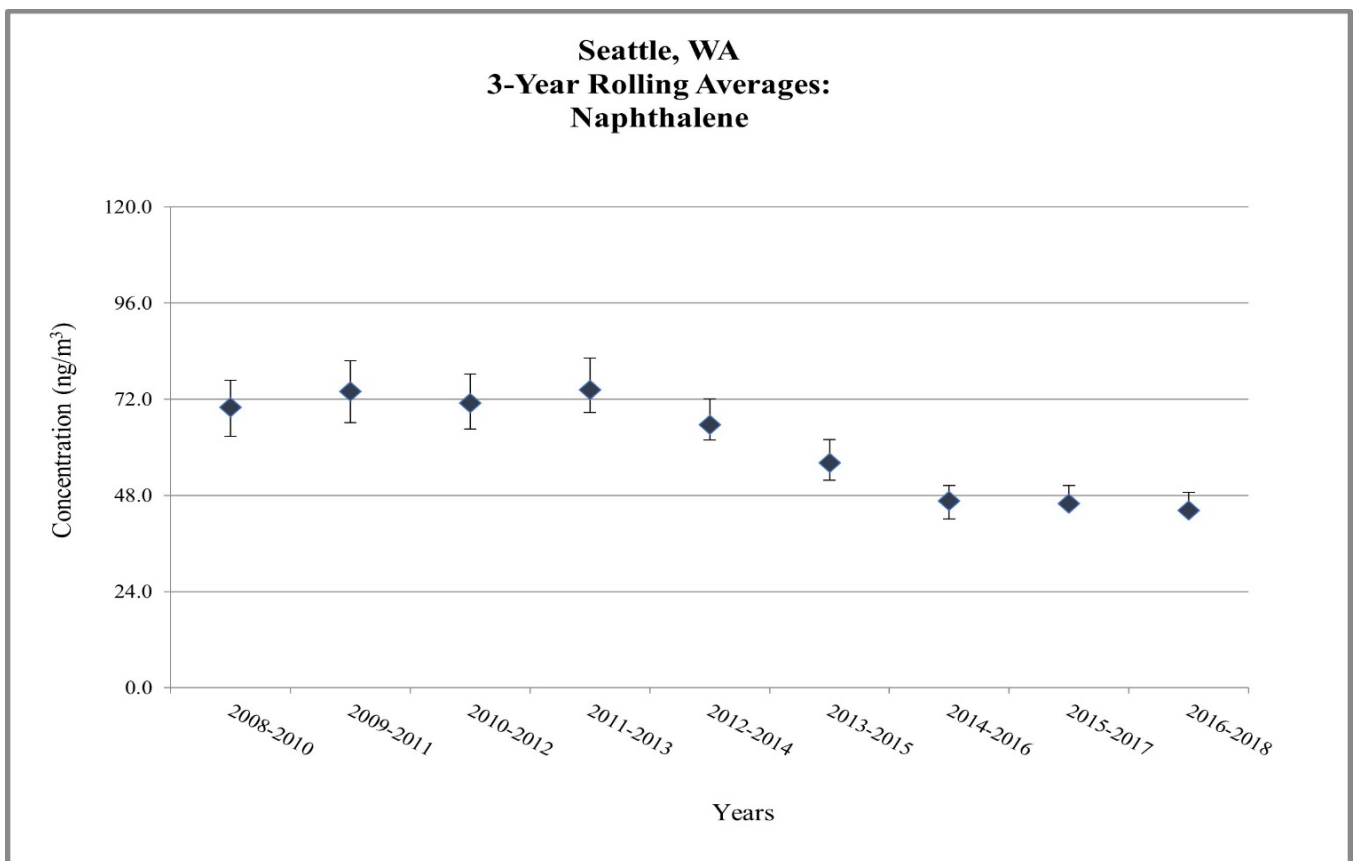
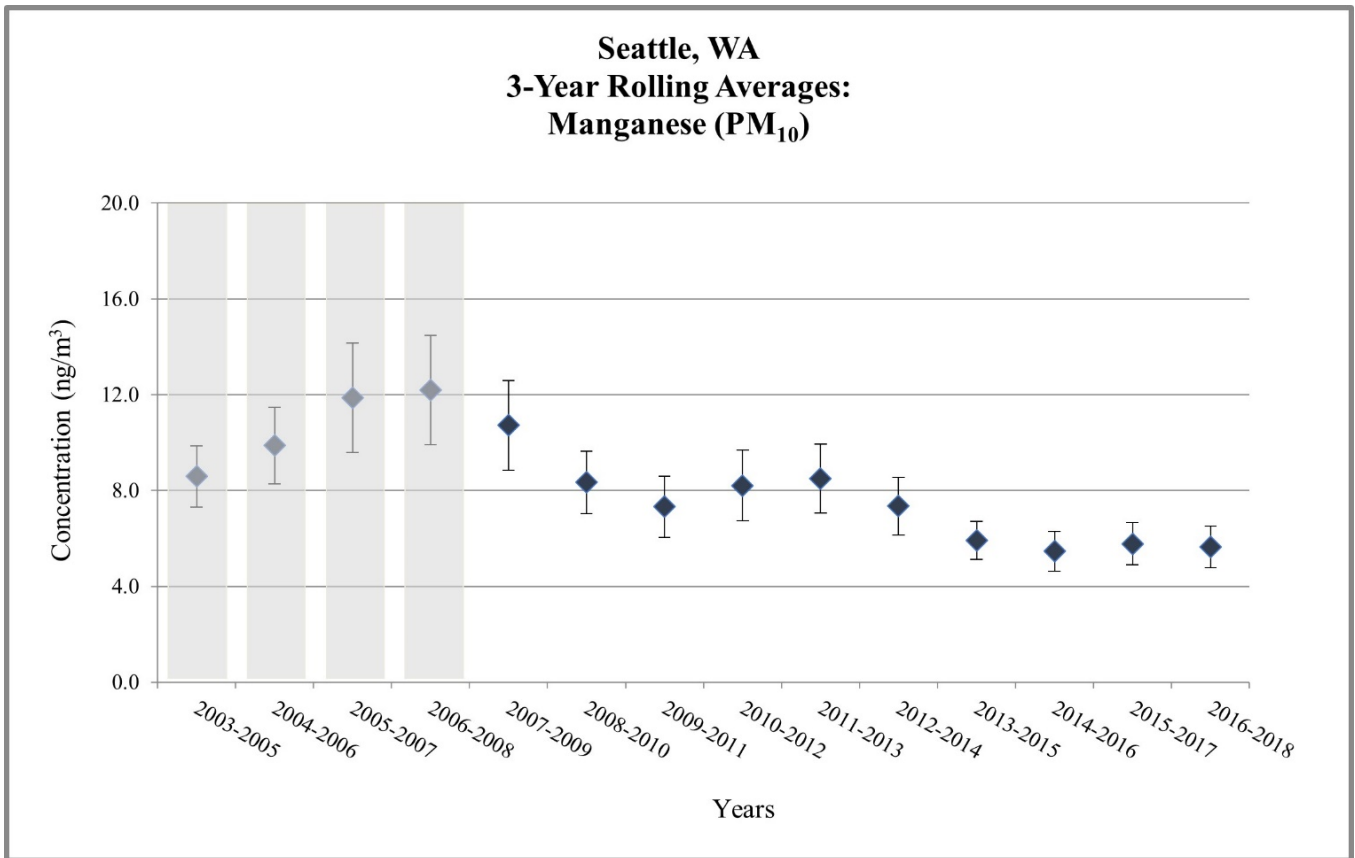


Figure 4. Seattle, WA - 3-Year Rolling Average Concentrations

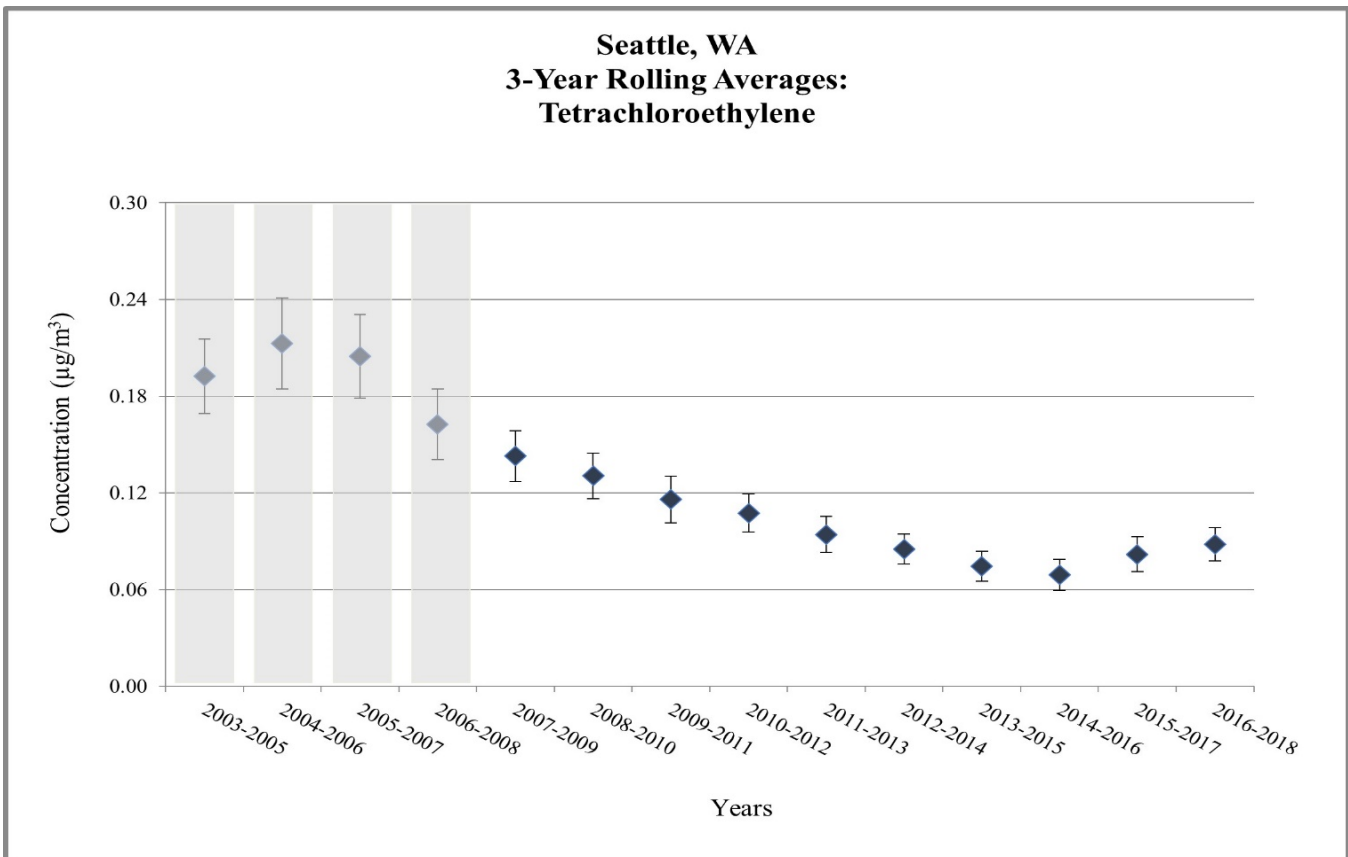
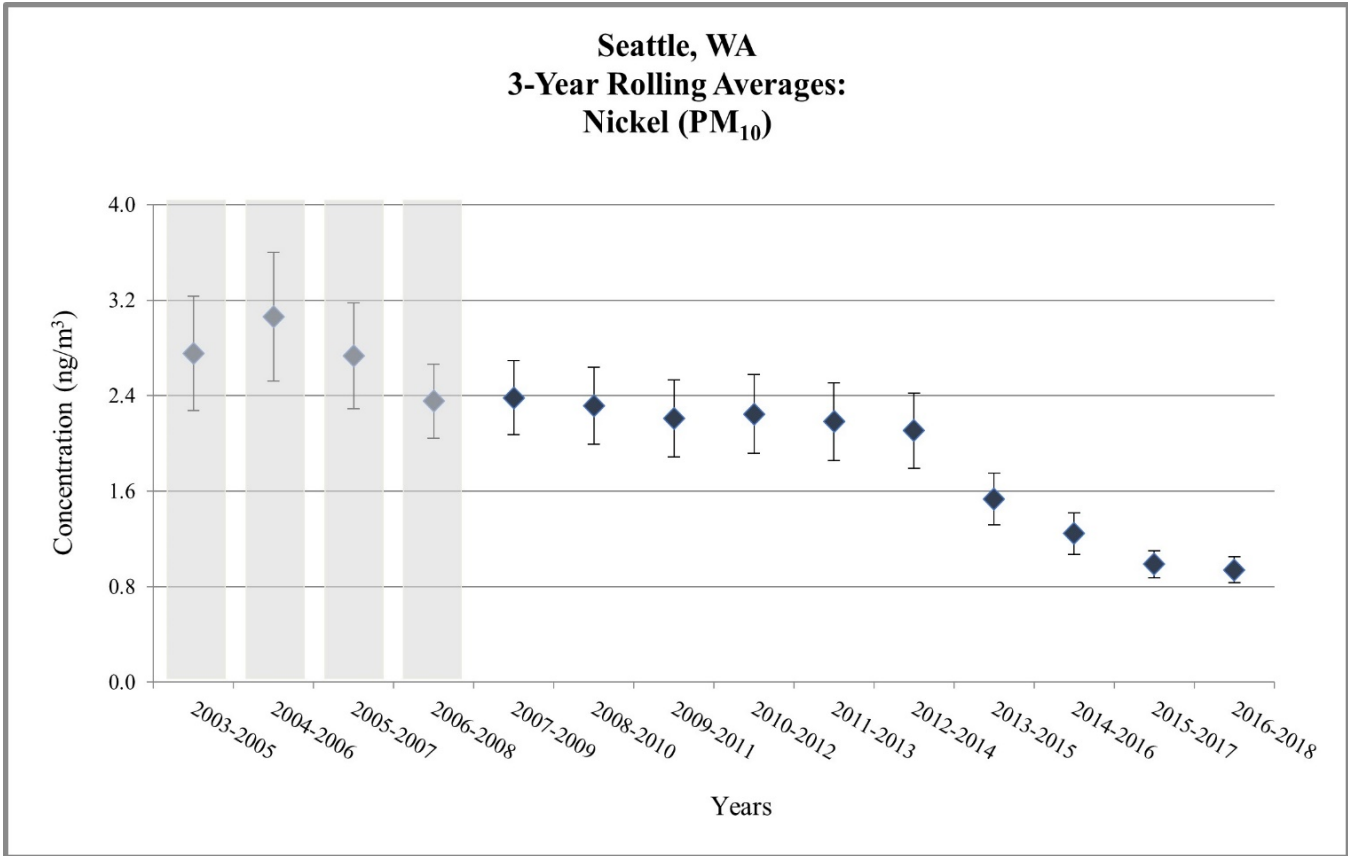
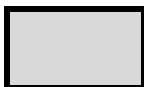
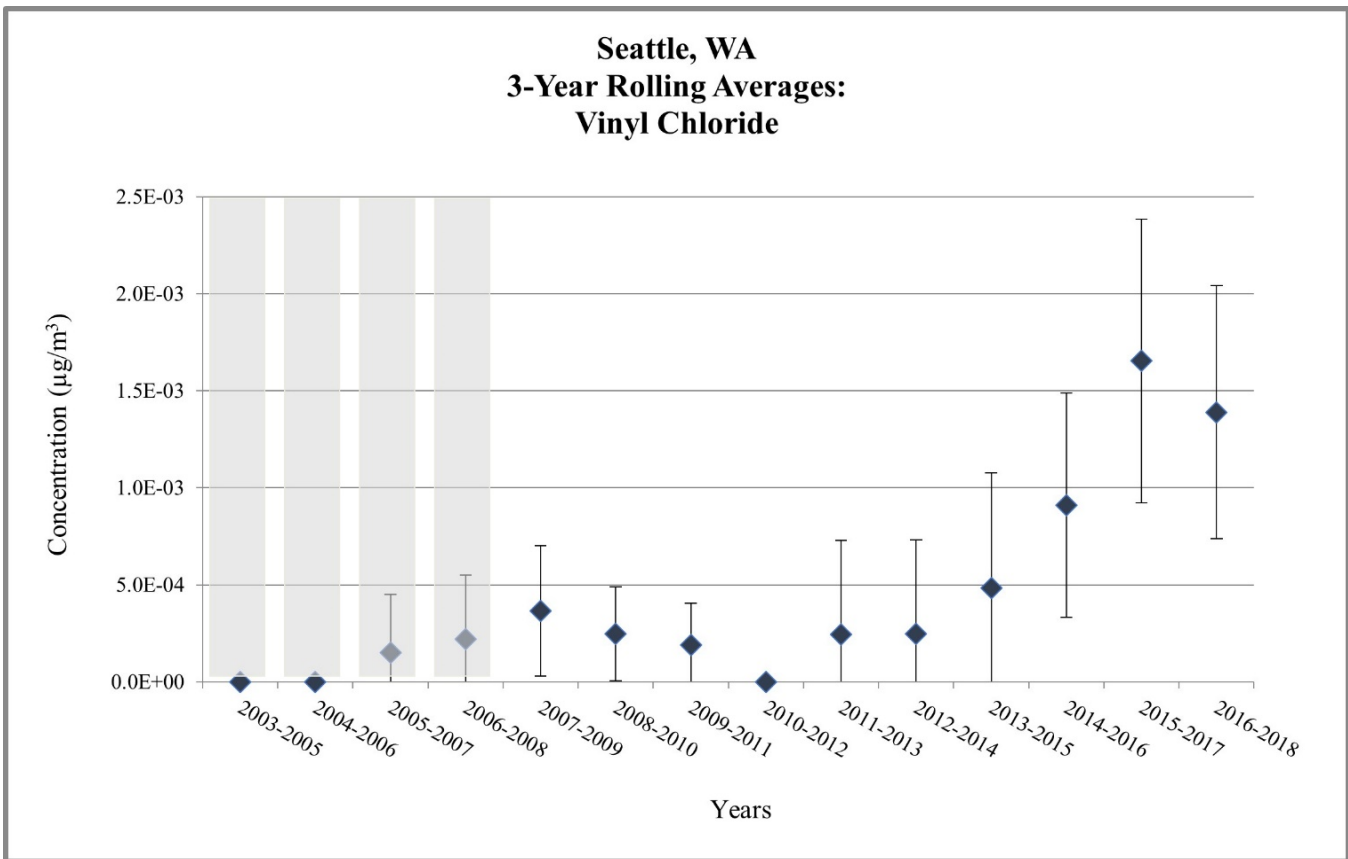
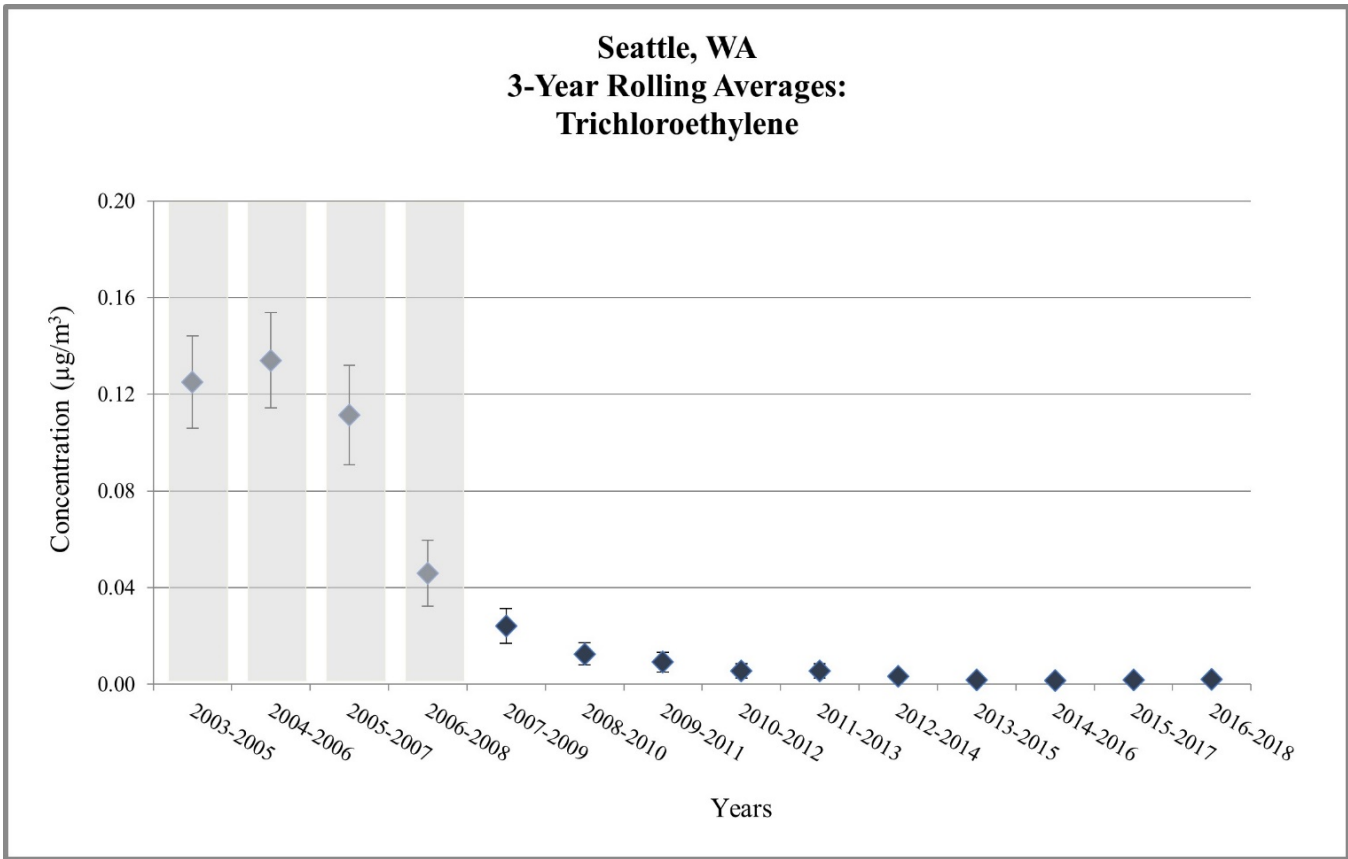


Figure 4. Seattle, WA - 3-Year Rolling Average Concentrations



Does not meet MQO or wasn't able to collect enough samples

Table 6. NATTS Network Assessment: MQO#1 - Completeness Percentage at Seattle, WA

Pollutant Group	Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbonyl	Acetaldehyde	100	97	92	44	98	102	105	97	98	98	93	100	98	100	102	100
Carbonyl	Formaldehyde	100	97	92	44	98	102	105	97	98	98	93	100	98	100	102	100
Chromium VI	Chromium VI	--	--	97	21	100	100	100	97	100	98	a	--	--	--	--	--
PAH	Benzo(a)pyrene	--	--	--	--	--	96	100	95	98	97	93	100	95	100	98	98
PAH	Naphthalene	--	--	--	--	--	96	100	95	98	97	93	100	95	100	98	98
PM ₁₀ Metals	Arsenic (PM ₁₀)	96	97	100	44	100	98	97	95	100	97	98	98	97	95	123	125
PM ₁₀ Metals	Beryllium (PM ₁₀)	96	72	100	44	100	98	97	95	100	97	98	98	97	95	123	125
PM ₁₀ Metals	Cadmium (PM ₁₀)	96	97	100	44	100	98	97	95	100	97	98	98	97	95	123	125
PM ₁₀ Metals	Lead (PM ₁₀)	96	97	100	44	100	98	97	95	100	97	98	98	97	95	123	125
PM ₁₀ Metals	Manganese (PM ₁₀)	96	97	100	44	100	98	97	95	100	97	98	98	97	95	123	125
PM ₁₀ Metals	Nickel (PM ₁₀)	96	97	100	44	100	98	97	95	100	97	98	98	97	95	123	125
VOC	Benzene	100	98	98	41	100	100	102	97	100	98	93	98	93	100	102	100
VOC	Butadiene, 1,3-	100	98	98	41	100	100	102	97	100	98	93	98	93	100	102	100
VOC	Carbon tetrachloride	100	98	98	41	100	100	102	97	100	98	93	98	93	100	102	100
VOC	Chloroform	100	98	98	41	100	100	102	97	100	98	93	98	93	100	102	100
VOC	Tetrachloroethylene	100	98	98	41	100	100	102	97	100	98	93	98	93	100	102	100
VOC	Trichloroethylene	100	98	98	41	100	100	102	97	100	98	93	98	93	100	102	100
VOC	Vinyl chloride	b	100	98	43	100	100	102	97	100	98	93	98	93	100	102	100

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

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

^b: Vinyl chloride was not reported at the Seattle, WA site, although the other VOCs were reported for the year.

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

Pollutant Group	Pollutant Name	Target MDL	Units	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbonyl	Acetaldehyde	0.45	µg/m ³	b	0.04	0.04	0.02	0.02	0.02	0.03	0.01	0.03	0.02	0.04	0.03	0.03	0.03	0.13	0.08
Carbonyl	Formaldehyde	0.98/0.08 ^a	µg/m ³	b	0.02	0.02	0.01	0.01	0.02	0.01	0.004	0.02	0.01	0.26	0.21	0.26	0.21	1.07	0.72
Chromium VI	Chromium VI	0.08	ng/m ³	--	--	0.20	0.14	0.10	0.09	0.06	0.01	0.05	0.04	0.05	--	--	--	--	--
PAH	Benzo(a)pyrene	0.91	ng/m ³	--	--	--	--	--	0.07	0.06	0.04	0.04	0.05	0.05	0.02	0.10	0.05	0.02	0.01
PAH	Naphthalene	29.00	ng/m ³	--	--	--	--	--	0.015	0.008	0.008	0.003	0.004	0.006	0.010	0.004	0.018	0.048	0.042
PM ₁₀ Metals	Arsenic (PM ₁₀)	0.23	ng/m ³	b	0.03	0.03	0.029	0.04	0.04	0.04	0.05	0.23	0.28	0.79	0.88	0.06	0.16	0.14	0.14
PM ₁₀ Metals	Beryllium (PM ₁₀)	0.42	ng/m ³	b	0.01	0.01	0.008	0.05	0.03	0.00	0.00	0.00	0.01	0.04	0.04	0.002	0.002	0.002	0.003
PM ₁₀ Metals	Cadmium (PM ₁₀)	0.56	ng/m ³	b	0.00	0.00	0.005	0.01	0.01	0.01	0.14	0.01	0.01	0.02	0.02	0.013	0.003	0.003	0.008
PM ₁₀ Metals	Lead (PM ₁₀)	15.0	ng/m ³	b	0.00	0.00	0.0025	0.001	0.001	0.004	0.054	0.006	0.009	0.006	0.002	0.002	0.002	0.002	0.004
PM ₁₀ Metals	Manganese (PM ₁₀)	5.0	ng/m ³	b	0.02	0.02	0.011	0.00	0.00	0.00	0.067	0.02	0.07	0.03	0.03	0.02	0.02	0.02	0.04
PM ₁₀ Metals	Nickel (PM ₁₀)	2.1	ng/m ³	b	0.04	0.04	0.028	0.04	0.04	0.05	0.795	0.17	0.22	0.11	0.08	0.11	0.09	0.10	0.51
VOC	Benzene	0.13	µg/m ³	b	0.23	0.23	0.58	0.59	0.25	0.15	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	0.40	0.40	0.44	0.40	0.11	0.07	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	0.35	0.35	0.25	0.56	0.15	0.07	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	0.20	0.08	0.17	0.07	0.02	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	0.41	0.41	0.49	0.44	0.24	0.12	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	0.10	0.10	0.11	0.19	0.04	0.02	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	c	1.18	1.18	b	0.56	0.12	0.05	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.

Table 8. NATTS Network Assessment: MQO#3 - Bias Percent Difference at Seattle, WA

Pollutant Group	Pollutant Name	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbonyls	Acetaldehyde	13.7	5.5	32.6	-1.9	24.6	-10.1	0.7	3.0	a	0.1	-4.3	a	-5.4	3.6	-8.7
Carbonyls	Formaldehyde	3.2	12.5	22.9	-3.2	14.4	-7.8	-2.8	-3.4	a	-0.5	-2.2	a	-19.1	-5.3	-3.7
Chromium VI	Chromium VI	--	--	--	--	--	-5.6 ^b	10.5 ^b	--	19.5	-6.5	--	--	--	--	--
PAH	Benzo(a)pyrene	--	--	--	--	--	-1.7	-2.3	-2.1	25.2	-5.7	-16.3	-14.2	-10.5	-22.4	-14.8
PAH	Naphthalene	--	--	--	--	--	-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)	c	-27.8	1.5	11.5	8.4	-14.8	7.3	1.4	15.7	-3.0	1.9	a	-2.3	-1.4	-3.4
PM ₁₀ Metals	Beryllium (PM ₁₀)	c	-16.5	18.9	18.9	4.8	-5.5	11.2	-8.2	17.5	-2.0	d	a	-0.4	3.7	0.5
PM ₁₀ Metals	Cadmium (PM ₁₀)	c	-30.6	-3.2	5.3	5.1	-16.2	4.9	-5.7	16.6	1.4	d	a	3.9	2.8	3.0
PM ₁₀ Metals	Lead (PM ₁₀)	c	-26.7	-0.4	-1.5	4.7	-30.6	-3.5	-6.3	19.9	0.1	2.2	a	-1.6	-0.4	-1.9
PM ₁₀ Metals	Manganese (PM ₁₀)	c	-28.8	0.8	-13.8	-25.3	-37.7	0.6	-3.8	21.5	-6.2	13.2	a	3.9	1.3	2.6
PM ₁₀ Metals	Nickel (PM ₁₀)	c	-25.9	-0.2	-8.5	8.6	-28.9	4.7	-6.8	11.4	-1.2	e	a	26.5	21.2	10.6
VOC	Benzene	-13.5	1.5	-28.3	-5.8	-1.5	6.2	-13.2	10.2	a	-3.3	18.1	-5.3	5.2	14.6	-11.8
VOC	Butadiene, 1,3-	-40.1	14.5	35.1	2.5	7.8	-0.5	-3.7	10.9	a	0.6	-8.1	-22.0	-10.1	3.9	-6.6
VOC	Carbon tetrachloride	15.5	21.9	-1.8	10.4	16.5	1.9	31.6	25.4	a	13.3	24.2	40.2	53.5	26.5	0
VOC	Chloroform	-15.1	12.5	5.5	9.1	4.3	5.4	1.0	-9.7	a	-2.4	8.5	10.3	8.1	9.2	-7.5
VOC	Tetrachloroethylene	-6.6	-4.4	-12.1	-3.7	0	1.1	-16.1	0.8	a	-9.5	-1.8	-14.6	-5.5	13.0	-3.8
VOC	Trichloroethylene	-11.3	4.9	0.7	5.5	5.3	2.7	-6.4	-8.3	a	3.0	-0.3	-10.0	-9.5	9.6	-14.6
VOC	Vinyl chloride	-20.6	-7.3	36.6	1.1	-14.1	-0.1	-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: Pollutant was sampled at this site and year, but no bias data were reported

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

^e: 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.

Table 9. NATTS Network Assessment: MQO#4 - Overall Method Precision %CV at Seattle, WA

Pollutant Group	Pollutant Name	Overall Method precision % CV															
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbonyls	Acetaldehyde	--	--	--	--	3.1	23.9	2.7	2.4	1.8	1.7	1.9	5.2	--	--	1.9	2.1
Carbonyls	Formaldehyde	--	--	--	--	8.0	13.3	5.7	5.2	4.0	3.1	5.7	3.7	--	--	2.2	4.3
Chromium VI	Chromium VI	--	--	39.2	39.1	17.4	15.9	16.8	10.0	11.0	8.6	0.1	--	--	--	--	--
PAH	Benzo(a)pyrene	--	--	--	--	--	a	5.9	1.7	12.7	12.6	4.9	46.5	0.6	a	4.0	6.0
PAH	Naphthalene	--	--	--	--	--	10.6	13.2	30.9	6.0	4.6	4.5	8.4	5.0	5.4	6.2	2.5
PM ₁₀ Metals	Arsenic (PM ₁₀)	--	--	--	--	2.4	--	--	--	--	--	--	--	--	--	--	--
PM ₁₀ Metals	Beryllium (PM ₁₀)	--	--	--	--	a	--	--	--	--	--	--	--	--	--	--	--
PM ₁₀ Metals	Cadmium (PM ₁₀)	--	--	--	--	6.3	--	--	--	--	--	--	--	--	--	--	--
PM ₁₀ Metals	Lead (PM ₁₀)	--	--	--	--	0.6	--	--	--	--	--	--	--	--	--	--	--
PM ₁₀ Metals	Manganese (PM ₁₀)	--	--	--	--	0.8	--	--	--	--	--	--	--	--	--	--	--
PM ₁₀ Metals	Nickel (PM ₁₀)	--	--	--	--	7.0	--	--	--	--	--	--	--	--	--	--	--
VOC	Benzene	--	--	--	--	9.7	6.5	9.8	5.3	4.6	6.3	3.8	4.7	--	--	8.1	5.0
VOC	Butadiene, 1,3-	--	--	--	--	10.4	6.5	4.5	10.0	5.0	3.5	5.6	6.8	--	--	12.4	6.7
VOC	Carbon tetrachloride	--	--	--	--	7.6	2.4	5.3	6.9	13.1	8.3	4.9	2.7	--	--	8.1	3.3
VOC	Chloroform	--	--	--	--	27.4	9.9	32.6	17.7	16.6	14.1	9.6	22.5	--	--	7.7	2.9
VOC	Tetrachloroethylene	--	--	--	--	3.6	11.0	5.2	5.9	0.9	2.3	6.4	3.2	--	--	a	15.5
VOC	Trichloroethylene	--	--	--	--	21.8	31.2	9.4	a	5.4	--	a	a	--	--	a	a
VOC	Vinyl chloride	--	--	--	--	a	a	a	a	a	--	--	a	--	a	a	a

	A-rated: ≤ 15% CV
	B-rated: Between 15%CV to 25% 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 Seattle, WA

Pollutant Group	Pollutant Name	Analytical Method precision % CV															
		2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Carbonyls	Acetaldehyde	--	--	--	--	1.3	0.6	0.9	0.4	1.3	1.8	1.2	1.9	9.5	5.5	0.8	0.6
Carbonyls	Formaldehyde	--	--	--	--	1.9	1.3	0.6	0.4	0.7	0.6	2.2	1.4	5.4	4.9	0.9	1.3
Chromium VI	Chromium VI	--	--	--	--	6.9	2.4	4.3	5.3	4.8	3.3	5.5	--	--	--	--	--
PAH	Benzo(a)pyrene	--	--	--	--	--	0.0	1.7	2.4	8.1	4.3	1.1	2.4	1.9	a	2.2	1.3
PAH	Naphthalene	--	--	--	--	--	1.6	2.1	2.6	1.7	2.8	3.6	2.6	4.1	4.6	1.7	2.9
PM ₁₀ Metals	Arsenic (PM ₁₀)	--	--	--	--	0.5	--	--	--	--	1.2	22.1	12.5	15.3	4.7	2.2	1.5
PM ₁₀ Metals	Beryllium (PM ₁₀)	--	--	--	--	a	--	--	--	--	a	a	a	0	3.3	20.0	5.5
PM ₁₀ Metals	Cadmium (PM ₁₀)	--	--	--	--	2.7	--	--	--	--	3.3	7.6	9.0	4.0	3.0	1.2	5.6
PM ₁₀ Metals	Lead (PM ₁₀)	--	--	--	--	0.2	--	--	--	--	1.7	1.7	1.0	0.7	0.5	1.4	0.6
PM ₁₀ Metals	Manganese (PM ₁₀)	--	--	--	--	2.0	--	--	--	--	1.8	1.2	0.8	1.0	0.4	0.6	1.3
PM ₁₀ Metals	Nickel (PM ₁₀)	--	--	--	--	0.2	--	--	--	--	1.2	2.7	1.5	2.4	1.0	2.4	1.3
VOC	Benzene	--	--	--	--	6.7	6.2	3.7	2.8	2.3	8.2	3.1	5.0	3.6	7.9	3.0	3.5
VOC	Butadiene, 1,3-	--	--	--	--	7.8	6.2	9.0	2.2	6.0	6.6	6.4	6.3	11.9	4.8	7.0	4.0
VOC	Carbon tetrachloride	--	--	--	--	3.8	5.7	5.9	3.1	2.7	9.2	3.7	4.5	4.8	6.5	4.4	2.9
VOC	Chloroform	--	--	--	--	7.1	9.5	11.8	3.6	7.4	3.8	5.1	3.7	7.7	8.5	6.9	3.0
VOC	Tetrachloroethylene	--	--	--	--	7.3	3.5	5.6	1.5	10.0	2.3	3.3	6.3	4.3	7.4	a	3.2
VOC	Trichloroethylene	--	--	--	--	3.6	6.6	0	--	5.4	a	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 to 25% 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

Pollutant Type	Year(s)	Manufacturer/Model, Extraction Type, and Year
<i>Sampling Equipment</i>		
Carbonyls	2003-2018	Xontech 925 Carbonyls Sampler (Year Deployed: <2006)
Chormium VI	2005-2013	ERG Chromium VI sampler (Year Deployed: 2000)
PAHs	2008-2018	Tisch Environmental Hi-Vol PAHs Sampler (Year Deployed: 2005)
PM ₁₀ Metals	2003-2004	Andersen GMW PM10 Hi-Vol Sampler (Year Deployed: 2002)
	2005-2014	Andersen GMW PM10 Hi-Vol Sampler (Year Deployed: <1994)
	2014-2018	Thermo 2025 (Year Deployed: 2014)
VOCs	2003-2015	Xontech 910PC Sampler (Year Deployed: 2005)
	2016-2018	Xontech 901 Sampler (Year Deployed: 2016)
<i>Analytical Equipment</i>		
Carbonyls	2003-2005	HP/Agilent HPLC 1100 with variable wavelength detection (Year Deployed: unknown)
	2006	HPLC with Waters 996 PDA detection (Year Deployed: unknown)
	2007-2017	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	2003-2004	unknown (Year Deployed: unknown)
	2005-2006	PE Sciex ELAN DRC ICP-MS (Year Deployed: unknown)
	2007-2014	PE ELAN 9000 ICP-MS (Year Deployed: 2003)
	2015-2018	Thermo iCAP Q ICP-MS (Year Deployed: 2015)
VOCs	2003-2004	HP/Agilent 6890 GC/FID (Year Deployed: unknown)
	2005	HP/Agilent model 5890 GC/FID (Year Deployed: unknown)
	2006	HP/Agilent 6890/5973 GC/MS (Year Deployed: 2001)
	2007-2009	HP/Agilent 6890/5973 GC/MS (Year Deployed: 2006)
	2010	HP/Agilent 5890/5971 GC/MS (Year Deployed: 2008)
	2011-2018	HP/Agilent 6890/5975 GC/MS (Year Deployed: 2010)
<i>Preconcentrator Equipment</i>		
VOCs	2003-2004	unknown (Year Deployed: unknown)
	2005-2006	Custom-built (Year Deployed: unknown)
	2007	Entech 7000, Entech 7100A (Year Deployed: 2003/2007)
	2008-2018	Entech 7100A (Year Deployed: 2003)
<i>Standards Preparation Equipment</i>		
VOCs	2003-2006	UNKNOWN (Year Deployed: UNKNOWN)
	2007-2018	Custom-built (dynamic dilution) (Year Deployed: 1985)

Appendix A. Equipment Inventory

Pollutant Type	Year(s)	Manufacturer/Model, Extraction Type, and Year
<i>Canister Cleaning Equipment</i>		
VOCs	2003-2004	UNKNOWN (Year Deployed: UNKNOWN)
	2005-2006	Custom-built (Year Deployed: unknown)
	2007-2010	Custom-built (Cold) (Year Deployed: 2003)
	2011-2018	Wasson-ECE TO Clean (Hot) (Year Deployed: 2010)
<i>PM₁₀ Extraction Equipment</i>		
PM ₁₀ Metals	2003-2004	unknown (Year Deployed: unknown)
	2005-2006	unknown (Hotblock) (Year Deployed: unknown)
	2007-2013	Branson 8510 (Sonicator) (Year Deployed: 2004)
	2014-2018	Environmental Express (Hotblock) (Year Deployed: 2014)
<i>Chromium VI Extraction Equipment</i>		
Chromium VI	2005-2010	Branson 8510 (Sonicator) (Year Deployed: 2001)
	2011	Branson 8510 Sonicator/ Branson Shaker (Year Deployed: 2011)
	2012-2013	Branson Shaker (Year Deployed: 2011)
<i>PAHs Extraction Equipment</i>		
PAHs	2008-2018	Dionex -300 (ASE) (Year Deployed: 2004)