Virginia Ambient Air Monitoring 2008 Data Report

Department of Environmental Quality

Commonwealth of Virginia
Department of Environmental Quality

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Office of Air Quality Monitoring
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This Ambient Air Monitoring Data Report is for the time period of January 1, 2008 to December 31, 2008.

On The Cover

We would like to thank Steve and Bobbie Sorensen for their contributions to the front cover.

David K. Paylor, Director
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Acknowledgements:

We would like to thank Chuck Turner, James Dinh, Carolyn Stevens, Dan Salkovitz, Baxter Gilley and Charles (Brian) King.

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2008 Annual Report prepared by:
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Introduction

The 2008 Virginia ambient Air Monitoring Data Report is a compilation of air pollutant measurements made by the Virginia Department of Environmental Quality, the City of Alexandria, Fairfax County, the U.S. Department of Agriculture Forest Service, and the National Park Service. This report satisfies the requirements of the U.S. Environmental Protection Agency (EPA) for the reporting of air quality data as specified in the Code of Federal Regulations (http://www.access.gpo.gov/cgi-bin/cfrassemble.cgi?title=200740), Title 40, Part 58, Appendix F (http://edocket.access.gpo.gov/cfr_2007/julqtr/pdf/40cfr58.61.pdf).

Ambient air quality was measured at 46 locations within the Commonwealth during 2008. These monitoring sites were established in accordance with EPA's siting criteria contained in 40 CFR Part 58, Appendices D and E (http://edocket.access.gpo.gov/cfr_2007/julqtr/pdf/40cfr58.61.pdf), and monitoring network operations conformed to EPA guidance documents and generally accepted air quality monitoring practices. All data reported for these monitoring sites were quality assured in accordance with requirements contained in 40 CFR Part 58, Appendix A (http://edocket.access.gpo.gov/cfr_2007/julqtr/pdf/40cfr58.61.pdf).

Ambient concentrations of carbon monoxide, nitrogen dioxide, and sulfur dioxide were within the EPA's national ambient air quality standards (NAAQS) in 2008. Virginia continues to experience exceedances of the ozone pollution standard, particularly in Northern Virginia, Richmond, and Hampton Roads. In 2008, Northern Virginia had 14 days when an eight-hour ozone average greater than .075 ppm was recorded at one or more monitoring stations in the area. Richmond had 17 days, Hampton Roads recorded 7 days, and Stafford County recorded 1 ozone exceedance day. Caroline County recorded 6 days that exceeded the 0.075 standard and the Charlottesville/Albemarle area recorded 3 days.

In 2008, the Office of Air Quality Monitoring established a new site in Albemarle County. The site, located at Albemarle High School, monitors for ozone and PM2.5 and also maintains a continuous PM2.5 monitor used for forecasting purposes. The PM10 monitor located at Clearbrook in Frederick County was removed at the end of 2008. The PM2.5 monitor located at Raleigh Court Library in Roanoke was relocated to Salem High School at the end of 2008. The new lead NAAQS standard that was promulgated in October of 2008 will require that Virginia DEQ set up and run 2 source specific lead monitors in Southwest Virginia and in the Roanoke area. These monitors will be installed in fall of 2009.

We are responsible for seeing that the Virginia ambient air monitoring network is maintained and operated in accordance with state and federal guidelines. Personnel from DEQ regional offices, the City of Alexandria, Fairfax County Health Department, the National Park Service, and the U.S. Department of Agriculture Forest Service conduct the daily operations at these sites. One of our primary jobs is to support these people in their monitoring efforts. This is done by:

- calibrating air monitoring instrumentation and associated support equipment on a set schedule
- auditing the instrumentation to insure that it is operating within set standards
- troubleshooting instrumentation problems reported by the operators
- supplying field operators with necessary items so they can perform their job properly
- repairing malfuctioning sampling instrumentation and ancillary equipment

Other functions:

- respond to regional and locality requests for special sampling such as emergency response or to answer citizen complaints
- coordinate efforts with the regional offices and localities to determine new air monitoring site locations
- conduct AQM generated special sampling projects to characterize a community's air
- furnish ambient air data to the regional offices, localities, Central Office, EPA and the EPA database
- answer FOIA requests for ambient air sampling data
- work with the regions and the localities to see that area monitoring needs are met
- work with EPA to see that necessary state and federal monitoring needs are met
- support VISTAS (Visibility Improvement State and Tribal Association) and MARAMA (Mid-Atlantic Regional Air Management Association of the Southeast) on routine and special projects

Criteria Pollutant Monitoring:

A portion of the air monitoring network is made up of instruments that sample for the Criteria Pollutants. Sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and particulate matter (PM10 & PM2.5) can injure health, harm the environment and cause property damage. EPA calls these pollutants criteria air pollutants because they have regulated them by first developing health-based criteria (science-based guidelines) as the basis for setting permissible limits. One set of limits (primary standard) protects health; another set of limits (secondary standard) is intended to prevent environmental and property damage

Special Monitoring:

In addition to overseeing the air sampling network for criteria pollutants, AQM conducts routine and short term sampling for VOCs (volatile organic compounds), Carbonyls, Toxic Metals and NOy (total reactive nitrogen). Sampled VOCs are made up of 39 HAPs (Hazardous Air Pollutants) and 56 Hydrocarbon Ozone Precursors.

1. What is the Clean Air Act?

The Clean Air Act is a federal law that provides for the protection of human health and the environment. The original Clean Air Act was passed in 1963, and the 1970 version of the law resulted in the creation of the U.S. Environmental Protection Agency (EPA), which was charged with setting and enforcing ambient air quality standards. The law was amended in 1977, and most recently in 1990. Most of the activities of the Virginia Department of Environmental Quality's Air Division come from mandates of the Clean Air Act, and are overseen by the EPA. More information on the 1990 amendments to the Clean Air Act can be found at: http://www.epa.gov/air/caa/.

2. What is a criteria air pollutant?

The Clean Air Act names six air pollutants that are commonly found in the air throughout the United States, and that can injure humans by causing respiratory and cardiovascular problems, and harm the environment by impairing visibility, and causing damage to animals, crops, vegetation and buildings. EPA has developed health-based criteria for these pollutants through scientific studies, and has established regulations setting permissible levels of these pollutants in the air. The "criteria" pollutants are: carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, particulate matter, and lead, and the limits that have been set for them are the National Ambient Air Quality Standards (NAAQS).

3. What is the difference between a primary and secondary National Ambient Air Quality Standard?

The National Ambient Air Quality Standards are divided into two types. The first type, the primary standard, is designed to protect human health, especially those who are most vulnerable such as children and the elderly, and people suffering from asthma, emphysema, chronic bronchitis, and heart ailments. The second type, the secondary standard, is designed to prevent damage to property and the environment. For a list of the primary and secondary National Ambient Air Quality Standards, see http://www.epa.gov/air/criteria.html or page 67 of this report.

4. How is the location of an air monitoring station decided?

Generally, the deciding factor in all Virginia air monitoring sampling is to determine where the highest pollutant concentrations will occur, and place the sampler as near as possible to that location. A wind rose is typically used to determine the prevailing wind direction for an area and identify the downwind direction from a probable source. A wind rose is a meteorological map showing the frequency and strength of winds from different directions at a specific location.

For typical criteria pollutant monitoring, the federal guidelines on siting an air monitor for measuring maximum concentrations are followed. These guidelines not only encourage siting in areas with free airflow and a minimum amount of obstructions, but they also give the height requirements for the sample inlet and the desired separation distances from obstructions such as tree lines, localized sources such as oil furnace flues, and other influences that can skew the data.

Other determining factors for placing air monitoring stations include:

- security of the site
- safety of the operator
- availability of electric power and communication service
- accessibility of the site

For more specific information, consult EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Part1, Section 6, http://www.epa.gov/ttn/amtic/qabook.html

5. **How large of an area does an air monitoring station represent?**

The sampling area of a monitoring site is dependent on the parameters selected for representation, such as:

- type of pollutants being sampled
- rural vs. urban sampling
- source oriented, population oriented, or background oriented
- sampling for pollution transported from outside the Commonwealth

Many sites are also dependant on topography and meteorology of an area, which play an important role. Federal guidelines spell out the general area of representation. Some examples of varied air sampling sites are:

- A background research site in central Virginia may represent an area with a radius of 50 to 100 kilometers.
- An ozone or fine particulate site in the Shenandoah Valley may represent an elongated area with an axis running with the valley and is a hundred kilometers long but only twenty-five kilometers wide.
- A carbon monoxide sampling site in an urban street canyon setting may represent an area of only a few blocks in radius.
- A source oriented site in south central Virginia may represent an area from 0.5 to 4 kilometers in radius.

For more specific information, consult EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Part1, Section 6, http://www.epa.gov/ttn/amtic/qbook.html

6. **What is a "nonattainment" area?**

A nonattainment area is a geographic area that has been determined by EPA as not meeting the air quality standards for one or more pollutants. Typically, an area is declared nonattainment based on data collected at one or more ambient air monitoring sites within the area. However, sometimes the nonattainment designation can be made based on the use of air quality models that use monitoring data from other areas. In Virginia, nonattainment areas are designated for two of the criteria pollutants, ozone and fine particulate matter ($PM_{2.5}$).

7. **How can I find out if I live in a nonattainment area?**

A list of nonattainment areas in Virginia can be found in this report on page 71. On the web, EPA has a comprehensive list of all nonattainment areas in the country at http://www.epa.gov/air/oaqps/greenbk/.

Frequently Asked Questions

8. **What are the impacts of nonattainment designation?**

To demonstrate how they plan to achieve federal air quality standards, states must draft a "State Implementation Plan," or SIP. This plan lists specific actions that the state will undertake to improve and maintain acceptable air quality, and a time frame for accomplishing these goals. The SIP may require new factories to install the newest and most effective air pollution control technologies. Other actions could be requiring older factories to retrofit their smokestacks with better pollution control devices, requiring an area to sell only reformulated gasoline during the summer months, requiring vapor recovery systems on gasoline pumps, and requiring vehicle exhaust emission checks, to name a few. SIP development is a lengthy process, and involves negotiation between the state and the EPA until it is finalized.

9. **What is a Maintenance Area?**

A maintenance area is an area that has been formally designated nonattainment, but is now recognized by EPA as now meeting the NAAQS. A maintenance area must have an approved "maintenance plan" to meet and maintain air quality standards.

10. **What is an Early Action Compact (EAC) area?**

In April 2004, EPA published a final rule listing areas in the country designated as not attaining the 8-hour ozone ambient air quality standard. A few areas, including two in Virginia, Roanoke and Frederick County/Winchester, entered into Early Action Compacts (EAC) with EPA before the nonattainment designations were published, because they were facing the possibility of being designated nonattainment for ozone. The compacts allowed the participating areas to come up with their own plan for meeting the 8-hour ozone standard, provided they meet certain milestones and they attain the 8-hour ozone standard no later than December 31, 2007. As part of the EAC, EPA agreed to defer the nonattainment designation. The two EAC areas in Virginia were designated attainment as of April 15, 2008.
www.epa.gov/air/oaqps/greenbk/encs2.html#virginia

11. **How can I get current or historical air quality data?**

Current ozone data for Virginia, as well as current AQI and air quality forecasts can be obtained at www.deq.virginia.gov/airquality/homepage.html. Summary air quality data for ozone and PM2.5 can be found on the DEQ website at www.deq.virginia.gov/airquality/homepage.html and www.deq.virginia.gov/airmon/pm25home.html.
Annual monitoring data reports for DEQ from 2001 to the present can be found at http://www.deq.virginia.gov/airmon/publications.html . EPA provides monitoring and emissions data, as well as maps, on the web at http://www.epa.gov/air/data/index.html. Detailed data for monitoring sites in Virginia can also be obtained by contacting the VA DEQ Office of Air Quality Monitoring.

12. **What do I do if I have a complaint about air quality in my neighborhood?**

Contact the DEQ regional office in your area. To see a list of regional offices and phone numbers, see page 58 of this report, or visit www.deq.virginia.gov/prep.

13. **Who can I call about an indoor air quality problem, such as mold or radon gas?**

Your local health department may be able to assist you with some indoor air quality problems. See www.vdh.state.va.us/lhd for the health department office in your area. Other excellent sources of information on indoor air quality can be found on EPA's website at www.epa.gov/iaq/index.html and through the American Lung Association website at www.lungusa.org.

Criteria Pollutants

$PM_{2.5}$ is particulate matter (PM) that is less than or equal to 2.5 micrometers (a micrometer is one millionth of a meter) in aerodynamic diameter. These particles are often called "fine particles" because of their small size. Fine particles originate from a variety of man-made stationary and mobile sources, such as factory smoke stacks and diesel engines, as well as from natural sources, such as forest fires. These particles may be emitted directly into the air, or they may be formed by chemical reaction in the atmosphere from gaseous emissions of sulfur dioxide (SO2), nitrogen oxides (NOx), and volatile organic compounds (VOCs).

Scientific research has linked fine particle pollution to human health problems. The particles are easily inhaled deep into the lungs, and can actually enter the bloodstream. Particle pollution is of particular concern to people with heart or lung disease, such as coronary artery disease, congestive heart failure, asthma, or chronic obstructive pulmonary disease (COPD). Older adults are at risk because they may have underlying, undiagnosed heart or lung problems. Young children are also at risk because their lungs are still developing, they are more likely to have asthma or acute respiratory disease, and they tend to spend longer periods of time at high activity levels, causing them to inhale more particles than someone at rest. Even otherwise healthy people may suffer short-term symptoms such as eye, nose, throat irritation, coughing, and shortness of breath during episodes of high particulate levels.

$PM_{2.5}$ air quality standards were implemented by EPA in 1997 to protect against the health effects of fine particle pollution. In September 2006, EPA announced revisions to the National Ambient Air Quality Standards (NAAQS) for particulate matter. While the long-term $PM_{2.5}$ annual average standard of 15.0 $\mu g/m^3$ remained the same, the short-term 24-hour average $PM_{2.5}$ standard was significantly reduced from 65 $\mu g/m^3$ to 35 $\mu g/m^3$. This was done to better protect public health, based on a large body of scientific evidence which supported the stricter limits. For more information on the revisions to the particulate matter standards, see www.epa.gov/air/particlepollution/pdfs/20060921_factsheet.pdf.

In addition to health problems, fine particle pollution contributes to haze that causes deterioration of visibility in scenic areas, and also deposits harmful compounds on the soil and water. Unlike ozone, which is a seasonal pollutant in most areas of the country, particle pollution can occur year-round, and is monitored throughout the year in Virginia. The Virginia DEQ $PM_{2.5}$ monitoring network uses three different types of samplers to monitor fine particulate in the state:

$PM_{2.5}$ 24-hour Mass Sampler: This Federal Reference Method (FRM) sampler collects particulate matter on a stretched Teflon filter media. Four samplers (Henrico Co., Roanoke, Virginia Beach, and Fairfax Co.) collect 24-hour samples every day. The rest of these samplers collect 24-hour samples on a one-in-three day schedule. Filters are retrieved from the field and shipped via courier to the Virginia Division of Consolidated Laboratory Services (DCLS) in Richmond. At the laboratory, the filters are equilibrated for a minimum of 24 hours prior to the final weighing.

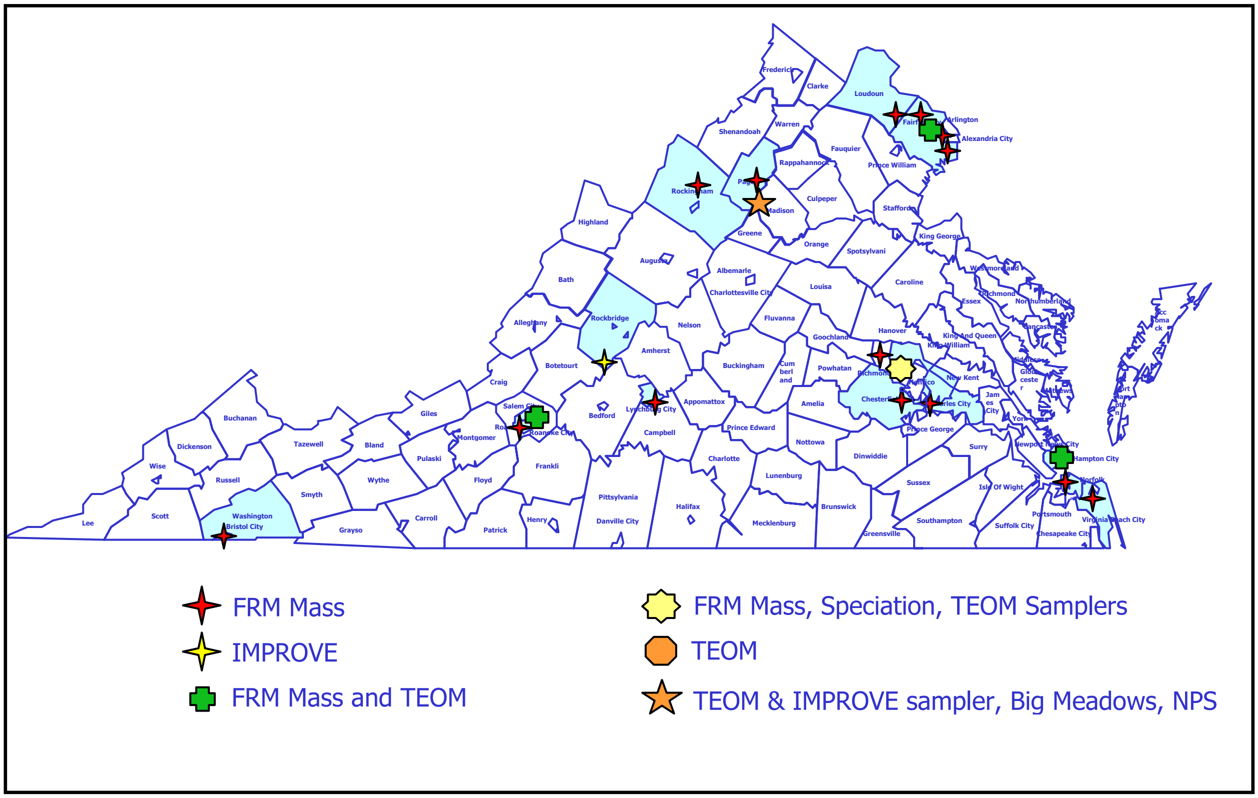
PM$_{2.5}$ 24-hour Speciation Sampler: This sampler collects particulate matter on nylon, Teflon, and quartz filters in three sampling modules. These modules are picked up by the operator after the sampling period, and shipped refrigerated to the EPA contract laboratory. The lab analyzes the filters for mass loading, trace elements (such as aluminum, antimony, arsenic, barium, bromine, and zirconium), cations (ammonium, potassium, sodium), anions (nitrate, sulfate), and carbons (carbonate carbon, elemental carbon, and organic carbon). The speciation network in Virginia consists of one monitor, located in Henrico Co., and this sampler operates on a one in three day sampling schedule.

PM$_{2.5}$ Continuous Monitor: This sampler collects particulate samples on a continuous basis, and data are compiled into hourly averages. The sampler utilizes a Tapered Element Oscillating Microbalance (TEOM) in the sampling design. TEOM samplers are operated in Hampton Roads, Henrico Co., Roanoke, Fairfax Co., and Big Meadows in Shenandoah National Park, Frederick Co., and Albemarle Co.

Each type of PM$_{2.5}$ sampler has a unique function. The FRM samplers collect data that are used to determine if the state is complying with the national ambient air quality standards (NAAQS) for particulate matter. The speciation sampler collects data about the composition of particulate matter in Virginia, and is useful for identifying potential sources of air pollution both within and outside the state boundaries. The FRM and speciation monitors are manual, filter-based methods, and the samples they collect must be transported to a laboratory for processing. Consequently, they are not useful for reporting real-time air quality conditions. The TEOM is a continuous particulate monitor that provides hourly data on fine particulate levels. The data are polled each hour by a central computer at DEQ, and then used to compute the current air quality index, which is posted on the agency website at www.deq.virginia.gov/airquality/homepage.html. The data are also simultaneously sent to EPA's national air quality website at www.airnow.gov.

In addition to the PM$_{2.5}$ network operated by the DEQ, the National Park Service and the USDA Forest Service operate PM$_{2.5}$ samplers at Big Meadows in Shenandoah National Park, and in Rockbridge Co. as part of the IMPROVE (Interagency Monitoring of Protected Visual Environments) network. This network employs different sampling methods than those used by the DEQ. Data for the IMPROVE network can be found on the internet at http://vista.cira.colostate.edu/improve.

PM2.5 Monitoring Network



NAAQS Standards

Primary Standard for $PM_{2.5}$:

- Annual Arithmetic Mean – the 3 year average of the weighted annual mean $PM_{2.5}$ concentration must not exceed 15.0 $\mu g/m^3$.
- 24-Hour concentration – the 3 year average of the 98^{th} percentile of 24-hour concentrations must not exceed 35 $\mu g/m^3$.

Secondary Standard for $PM_{2.5}$:

- Same as Primary.

2006-2008 $PM_{2.5}$ 24-hour Averages, 98^{th} Percentile Values ($\mu g/m^3$)				
Site	**2006**	**2007**	**2008**	**3-Year Average**
(101-E) **Bristol**	30.9	28.0	25.9	28
(29-D) **Page Co.**	28.3	30.0	25.0	28
(109-L) **Roanoke**	29.9	31.9	27.3	30
(155-Q) **Lynchburg**	27.8	30.5	25.4	28
(71-D) **Chesterfield Co.**	31.1	30.7	22.8	28
(72-M) **Henrico Co. ****	30.9	32.0	25.3	29
(72-N) **Henrico Co.**	28.7	30.4	21.9	27
(75-B) **Charles City Co.**	33.7	30.5	22.1	29
(179-C) **Hampton ****	32.0	27.8	27.9	29
(181-A1) **Norfolk**	31.3	27.3	30.3	30
(184-J) **Va. Beach** **	32.0*	28.7	38.6	33
(38-I) **Loudoun Co.** **	32.8	27.7	27.5	29
(47-T) **Arlington Co.**	32.5	29.5	23.4	30
(46-B9) **Franconia, Fairfax Co.**	33.9	31.9	28.4	31
(L-46-A8) **McLean, Fairfax Co.**	32.4	30.9	25.6	30
(L-46-C1) **Annandale, Fairfax Co.**	32.0	29.5	22.7	28

* Incomplete data capture for the year
** The exceptional event package for the 2008 fires has been submitted to EPA, with the final addition sent on 9/25/09. So far, EPA Region III has only concurred on the data from Norfolk (181-A1). We are awaiting a ruling on data from the following sites: 38-I, 179-C, 184-J, and 72-M. If EPA concurres with us, then the 3-year averages (design value) for some of these sites will change as will the 2008 98^{th} percentile values.

NAAQS Standards

Primary Standard for $PM_{2.5}$:

- Annual Arithmetic Mean – the 3 year average of the weighted annual mean $PM_{2.5}$ concentration must not exceed 15.0 $\mu g/m^3$.
- 24-Hour concentration – the 3 year average of the 98th percentile of 24-hour concentrations must not exceed 35 $\mu g/m^3$.

Secondary Standard for $PM_{2.5}$:

- Same as Primary.

2006-2008 $PM_{2.5}$ Weighted Annual Arithmetic Means ($\mu g/m^3$)				
Site	**2006**	**2007**	**2008**	**3-Year Average**
(101-E) **Bristol**	13.5	13.9	10.6	12.7
(29-D) **Page Co.**	12.1	12.5	10.5	11.7
(109-L) **Roanoke**	14.2	14.2	12.0	13.4
(155-Q) **Lynchburg**	12.5	13.1	10.0	11.9
(71-D) **Chesterfield Co.**	13.1	13.0	11.3	12.4
(72-M) **Henrico Co. ****	13.2	12.4	10.7	12.1
(72-N) **Henrico Co.**	12.5	12.4	10.5	11.8
(75-B) **Charles City Co.**	12.0	11.9	10.5	11.5
(179-C) **Hampton ****	12.2	10.9	11.2	11.4
(181-A1) **Norfolk**	12.5	11.4	11.4	11.8
(184-J) **Va. Beach** **	12.6*	11.2	11.8	11.9
(38-I) **Loudoun Co.** **	12.2	12.8	11.5	12.2
(47-T) **Arlington Co.**	12.9	13.8	12.0	12.9
(46-B9) **Franconia, Fairfax Co.**	12.7	12.5	11.1	12.1
(L-46-A8) **McLean, Fairfax Co.**	12.7	13.5	11.8	12.7
(L-46-C1) **Annandale, Fairfax Co.**	12.7	13.3	11.2	12.4

* Incomplete data capture for the year

** Please see previous page

3-Day Monitoring Schedule for PM2.5 2008

January						
Su	M	Tu	W	Th	F	Sa
		1	2	3	**4**	5
6	**7**	8	9	**10**	11	12
13	14	15	**16**	17	18	**19**
20	21	**22**	23	24	**25**	26
27	**28**	29	30	**31**		

February						
Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	**6**	7	8	**9**
10	11	**12**	13	14	**15**	16
17	**18**	19	20	**21**	22	23
24	25	26	**27**	28	29	

March						
Su	M	Tu	W	Th	F	Sa
						1
2	3	**4**	5	6	**7**	8
9	**10**	11	12	**13**	14	15
16	17	18	**19**	20	21	**22**
23	24	**25**	26	27	**28**	29
30	**31**					

April						
Su	M	Tu	W	Th	F	Sa
		1	2	**3**	4	5
6	7	8	**9**	10	11	**12**
13	14	**15**	16	17	**18**	19
20	**21**	22	23	**24**	25	26
27	28	29	**30**			

May						
Su	M	Tu	W	Th	F	Sa
				1	2	**3**
4	5	**6**	7	8	**9**	10
11	**12**	13	14	**15**	16	17
18	19	20	**21**	22	23	**24**
25	26	**27**	28	29	**30**	31

June						
Su	M	Tu	W	Th	F	Sa
1	**2**	3	4	**5**	6	**7**
8	9	10	**11**	12	13	**14**
15	16	**17**	18	19	**20**	21
22	**23**	24	25	**26**	27	28
29	30					

July						
Su	M	Tu	W	Th	F	Sa
		1	**2**	**3**	4	**5**
6	7	**8**	9	10	**11**	12
13	**14**	15	16	**17**	18	19
20	21	22	**23**	24	25	**26**
27	28	**29**	30	31		

August						
Su	M	Tu	W	Th	F	Sa
					1	2
3	**4**	5	6	**7**	8	9
10	11	12	**13**	14	15	**16**
17	18	**19**	20	21	**22**	23
24	**25**	26	27	**28**	29	30
31						

September						
Su	M	Tu	W	Th	F	Sa
	1	2	**3**	4	5	**6**
7	8	**9**	10	11	**12**	13
14	**15**	16	17	**18**	19	20
21	22	23	**24**	25	26	**27**
28	29	**30**				

October						
Su	M	Tu	W	Th	F	Sa
			1	2	**3**	4
5	**6**	7	8	**9**	10	11
12	13	14	**15**	16	17	**18**
19	20	**21**	22	23	**24**	25
26	**27**	28	29	**30**	31	

November						
Su	M	Tu	W	Th	F	Sa
						1
2	3	4	**5**	6	7	**8**
9	10	**11**	12	13	**14**	15
16	**17**	18	19	**20**	21	22
23	24	25	**26**	27	28	**29**
30						

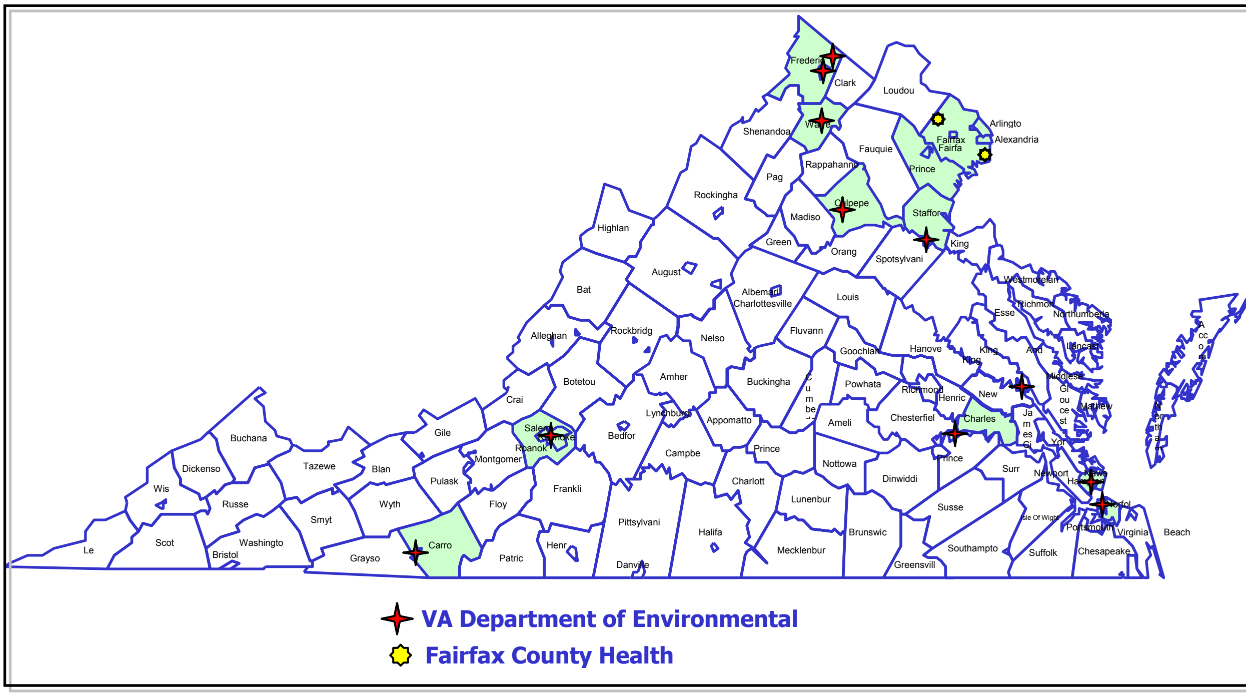
December						
Su	M	Tu	W	Th	F	Sa
	1	**2**	3	4	**5**	6
7	**8**	9	10	**11**	12	13
14	15	16	**17**	18	19	**20**
21	22	**23**	24	25	**26**	27
28	**29**	30	31			

PM_{10} is particulate matter comprised of solid particles or liquid droplets with an aerodynamic diameter of less than or equal to 10 micrometers, and is sometimes referred to as "coarse particles." PM_{10} particles are larger than $PM_{2.5}$, but are still in a size range that can pose health problems because they can be inhaled, and retained in the human respiratory system, causing breathing difficulties, and eye, nose and throat irritation. In addition to the health effects of PM_{10}, these particles can impair visibility, can contribute to climate change, and result in "acidic dry deposition." Acidic dry deposition occurs when particles containing acidic compounds fall to the ground. The acidic particles can corrode surfaces that they settle on, and can increase the acidity of the soil and water.

The National Ambient Air Quality Standards, or NAAQS, for particulate matter were revised in September 2006. EPA changed the existing standards for PM_{10} by revoking the annual standard of 50 micrograms per cubic meter, because current scientific evidence did not support a link between long-term exposure to coarse particles and health problems. However, the 24-hour PM_{10} standard was retained to protect citizens from effects of short-term exposures. For additional information on the revised particulate matter standards, see www.epa.gov/air/particlepollution/pdfs/20060921_factsheet.pdf.

To measure $PM_{10,}$ ambient air is drawn into a sampler that uses a particle size discrimination inlet. The inlet is designed so that particles in the size range of 10 micrometers (also called microns) or below stay suspended in the air stream, while larger particles settle out. The sample air flows across an 8 x 10 inch micro-quartz filter at a rate of 40 cubic feet per minute for a 24-hour period. The particles are captured on the filter, which is weighed before and after sampling, and the PM_{10} concentration is determined by dividing the change in filter mass by the volume of sampled air. The resulting PM_{10} concentration is reported as micrograms per cubic meter ($\mu g/m^3$). The filters are processed at the DEQ Office of Air Quality Monitoring, except for the samples collected by Fairfax County, which performs their own analyses. The normal sampling schedule is once every sixth day from midnight to midnight.

PM_{10} Monitoring Sites



NAAQS Standards

Primary Standard for PM_{10}:

- 24-Hour concentration not to exceed 150 $\mu g/m^3$ more than once per year averaged over three years.

Secondary Standard for PM_{10}:

- Same as Primary.

2006-2008 PM_{10} 24-Hour Average Concentrations (units in $\mu g/m^3$)							
Site	**2006**		**2007**		**2008**		**>150 $\mu g/m^3$**
	1st Max	**2nd Max**	**1st Max**	**2nd Max**	**1st Max**	**2nd Max**	
(23-A) **Carroll Co.**	41	36	39	37	29	28	0
(28-L) **Frederick Co.**	78	64	78	67	88	76	0
(30-E) **Warren Co.**	36	36	46	32	38	36	0
(134-C) **Winchester**	40	38	51	45	36	36	0
(109-H) **Roanoke**	60	57	75	58	68	61	0
(154-N) **Hopewell**	--	--	42	39	41	38	0
(82-C) **King William Co.**	52	44	41	36	36	35	0
(179-C) **Hampton**	--	--	38	37	33	31	0
(181-A1) **Norfolk**	48	39	39	36	88	69	0
(42-B) **Culpeper Co.**	44	41	50	36	39	33	0
(130-E) **Fredericksburg**	48	48	50	39	40	39	0
(L-46-B3) **Fairfax Co.**	42	40	35	33	44	41	0
(L-46-F) **Fairfax Co.**	41	40	54	52	42	39	0

6-Day Monitoring Schedule for PM10 2008

January

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5
6	**7**	8	9	10	11	12
13	14	15	16	17	18	**19**
20	21	22	23	24	**25**	26
27	28	29	30	**31**		

February

Su	M	Tu	W	Th	F	Sa
					1	2
3	4	5	**6**	7	8	9
10	11	**12**	13	14	15	16
17	**18**	19	20	21	22	23
24	25	26	27	28	29	

March

Su	M	Tu	W	Th	F	Sa
						1
2	3	4	5	6	**7**	8
9	10	11	12	**13**	14	15
16	17	18	**19**	20	21	22
23	24	**25**	26	27	28	**29**
30	**31**					

April

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	5
6	7	8	9	10	11	**12**
13	14	15	16	17	**18**	19
20	21	22	23	**24**	25	26
27	28	29	**30**			

May

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	**6**	7	8	9	10
11	**12**	13	14	15	16	17
18	19	20	21	22	23	**24**
25	26	27	28	29	**30**	31

June

Su	M	Tu	W	Th	F	Sa
1	2	3	4	**5**	6	7
8	9	10	**11**	12	13	14
15	16	**17**	18	19	20	21
22	**23**	24	25	26	27	28
29	30					

July

Su	M	Tu	W	Th	F	Sa
		1	2	3	4	**5**
6	7	8	9	10	**11**	12
13	14	15	16	**17**	18	19
20	21	22	**23**	24	25	26
27	28	**29**	30	31		

August

Su	M	Tu	W	Th	F	Sa
					1	2
3	**4**	5	6	7	8	9
10	11	12	13	14	15	**16**
17	18	19	20	21	**22**	23
24	25	26	27	**28**	29	30
31						

September

Su	M	Tu	W	Th	F	Sa
	1	2	**3**	4	5	6
7	8	**9**	10	11	12	13
14	**15**	16	17	18	19	20
21	22	23	24	25	26	**27**
28	29	30				

October

Su	M	Tu	W	Th	F	Sa
			1	2	**3**	4
5	6	7	8	**9**	10	11
12	13	14	**15**	16	17	18
19	20	**21**	22	23	24	25
26	**27**	28	29	30	31	

November

Su	M	Tu	W	Th	F	Sa
						1
2	3	4	5	6	7	**8**
9	10	11	12	13	**14**	15
16	17	18	19	**20**	21	22
23	24	25	**26**	27	28	29
30						

December

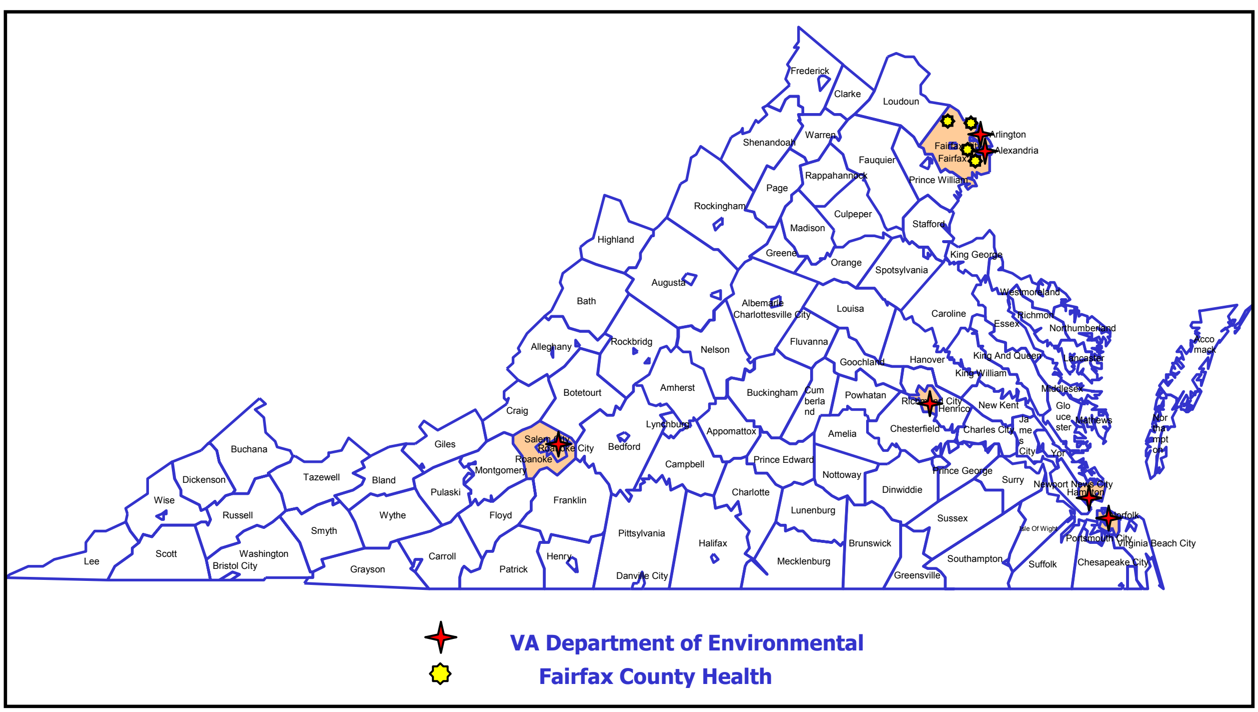
Su	M	Tu	W	Th	F	Sa
	1	**2**	3	4	5	6
7	**8**	9	10	11	12	13
14	15	16	17	18	19	**20**
21	22	23	24	25	**26**	27
28	29	30	31			

Carbon monoxide (CO) is a colorless, odorless gas that is produced by incomplete burning of carbon compounds in fossil fuels (gasoline, natural gas, coal, oil, etc.). Over half of the CO emissions in the country come from motor vehicle exhaust. Other sources include construction equipment, boats, lawnmowers, woodstoves, forest fires, and industrial manufacturing processes.

CO concentrations are higher in the vicinity of heavily traveled highways, and drop rapidly the further the distance from the road. Ambient levels of carbon monoxide tend to be higher in the colder months due to "thermal inversions" that trap pollutants close to the ground. A thermal inversion occurs when the temperature of the air next to the ground is colder than air above it. When this happens, the air resists vertical mixing that can help the pollutants to disperse, forming a layer of smog close to the ground.

Carbon monoxide is harmful because it reacts in the bloodstream, reducing the amount of oxygen that is supplied to the heart and brain. CO can be harmful at lower levels to people who suffer from cardiovascular disease, like angina, arteriosclerosis, or congestive heart failure. At high levels, CO can impair brain function, causing vision problems, reduce manual dexterity, and reduce ability to perform complicated tasks. At very high levels, carbon monoxide can be deadly.

Carbon monoxide in the ambient air is measured continuously with an electronic instrument that uses NDIR, "non-dispersive infrared" photometry. The instrument has a pump that continuously draws air through a sample chamber that contains an infrared light source and a detector. Any CO molecules that are present in the sample air absorb some of the infrared light, reducing the intensity of the light reaching the detector. The portion of the infrared light absorbed by the CO molecules is converted into an electrical signal corresponding to the CO concentration, and stored in the instrument computer.



NAAQS Standards

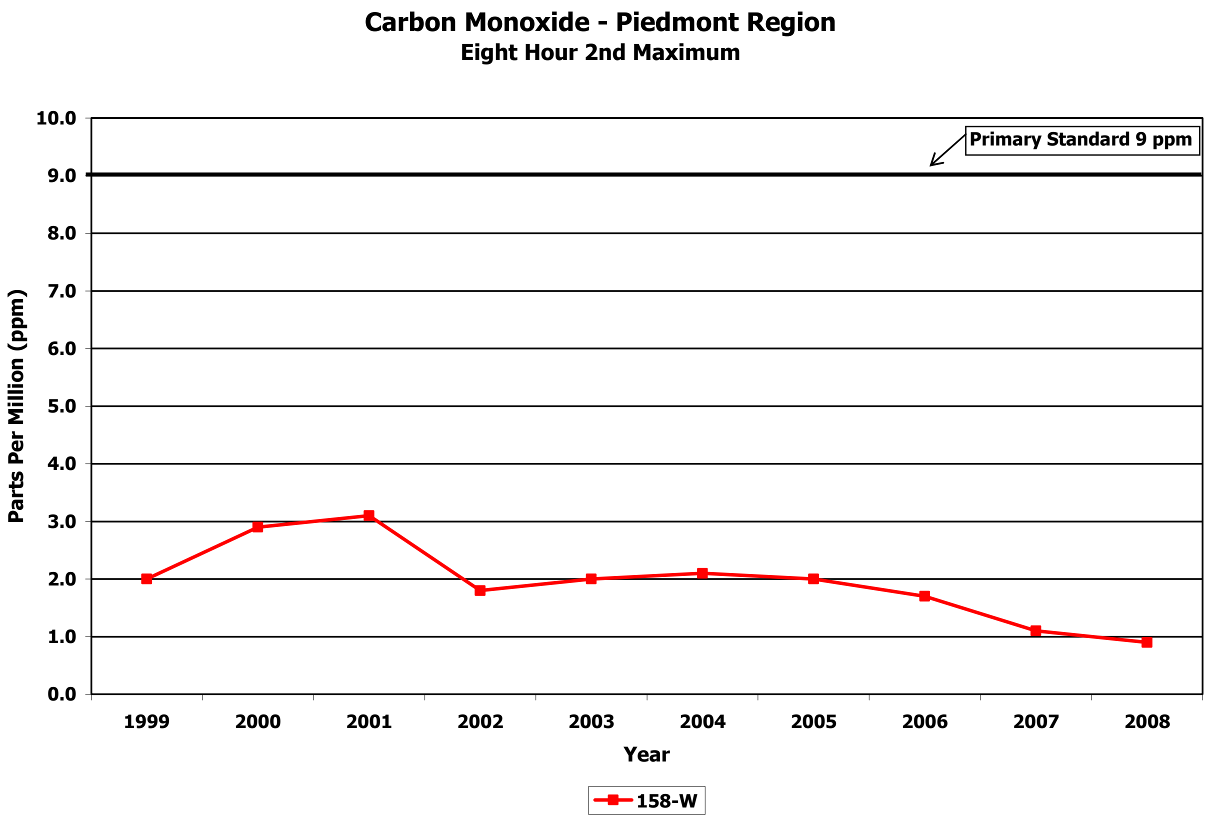
Primary Standard for CO:

- 8-hour average not to exceed 9 ppm (10 mg/m^3) more than once per year.
- 1-hour average not to exceed 35 ppm (40 mg/m^3) more than once per year.

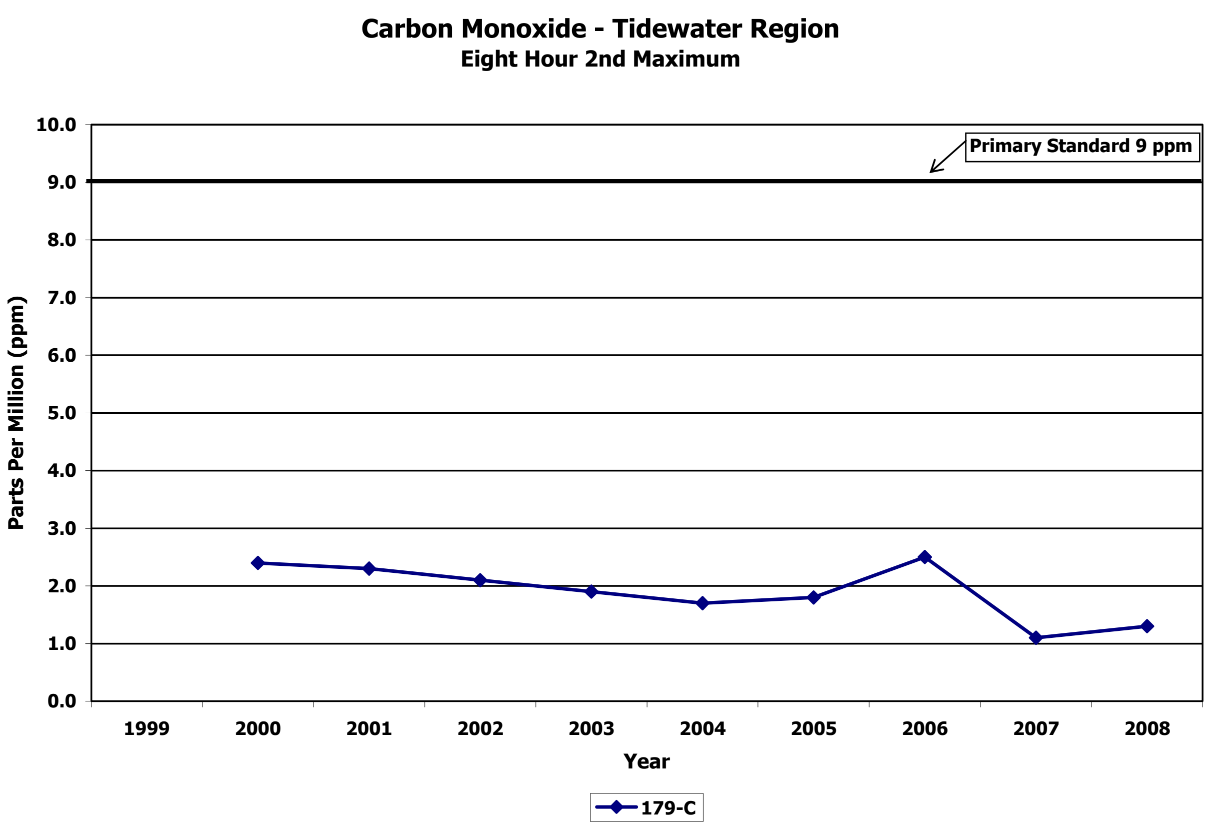
There are no Secondary Standards for CO because it does not harm vegetation or buildings.

Site	2008			
	1-Hour Avg. (ppm)		8-Hour Avg. (ppm)	
	1st Max.	2nd Max.	1st Max.	2nd Max.
(109-M) **Roanoke**	2.0	2.0	1.5	1.4
(158-W) **Richmond**	1.4	1.4	1.0	0.9
(179-C) **Hampton**	4.2	4.1	1.6	1.3
(181-A1) **Norfolk**	4.7	4.5	2.2	1.9
(46-B9) **Fairfax Co.**	1.9	1.9	1.9	1.8
(47-T) **Arlington Co.**	1.7	1.6	1.2	1.1
(L-46-A8) **Fairfax Co.**	2.1	2.0	1.5	1.5
(L-46-C1) **Fairfax Co.**	1.2	1.1	1.0	0.9
(L-46-F) **Fairfax Co.**	1.4	1.4	1.2	1.0
(L-126-C) **Alexandria**	1.9	1.9	1.3	1.2

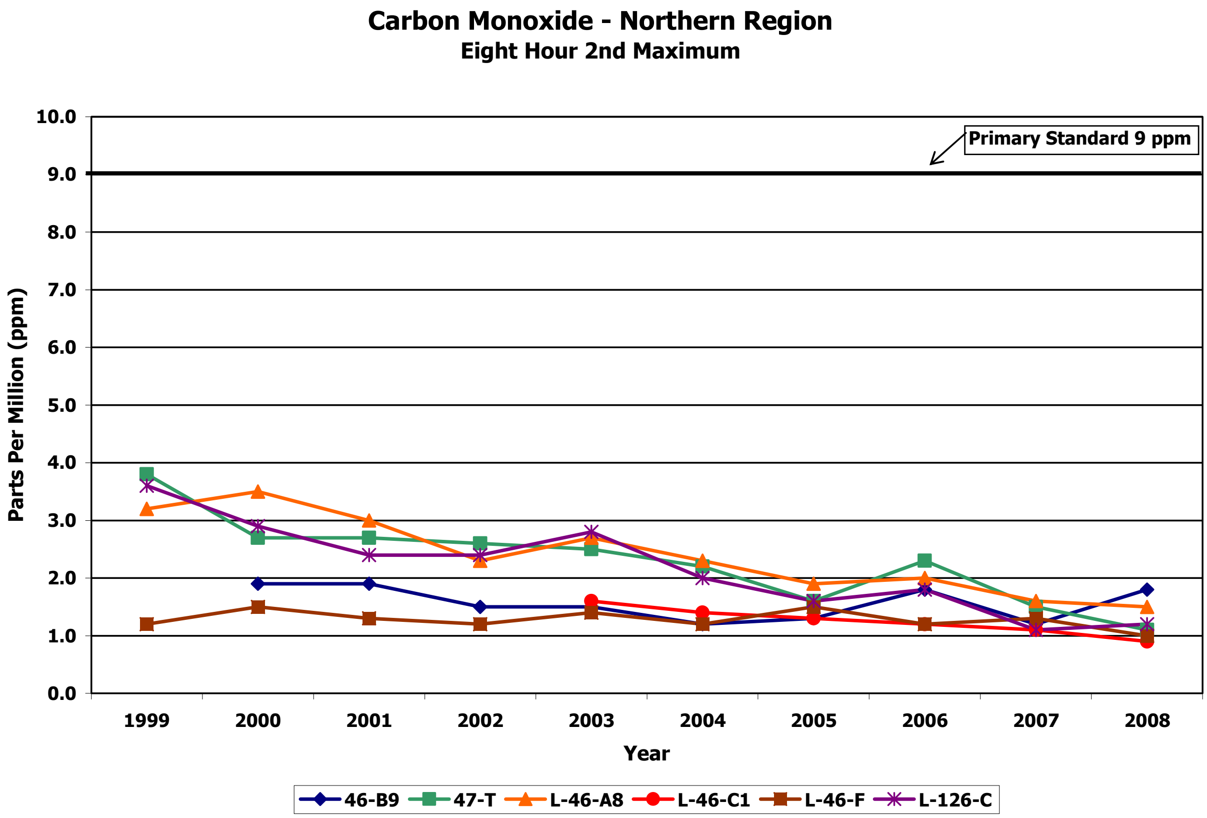
* Eight Hour Averages stated as Ending Hour



Carbon Monoxide - Piedmont Region
Eight Hour 2nd Maximum
Primary Standard 9 ppm
Parts Per Million (ppm)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
158-W



Carbon Monoxide - Tidewater Region
Eight Hour 2nd Maximum
Primary Standard 9 ppm
Parts Per Million (ppm)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
179-C

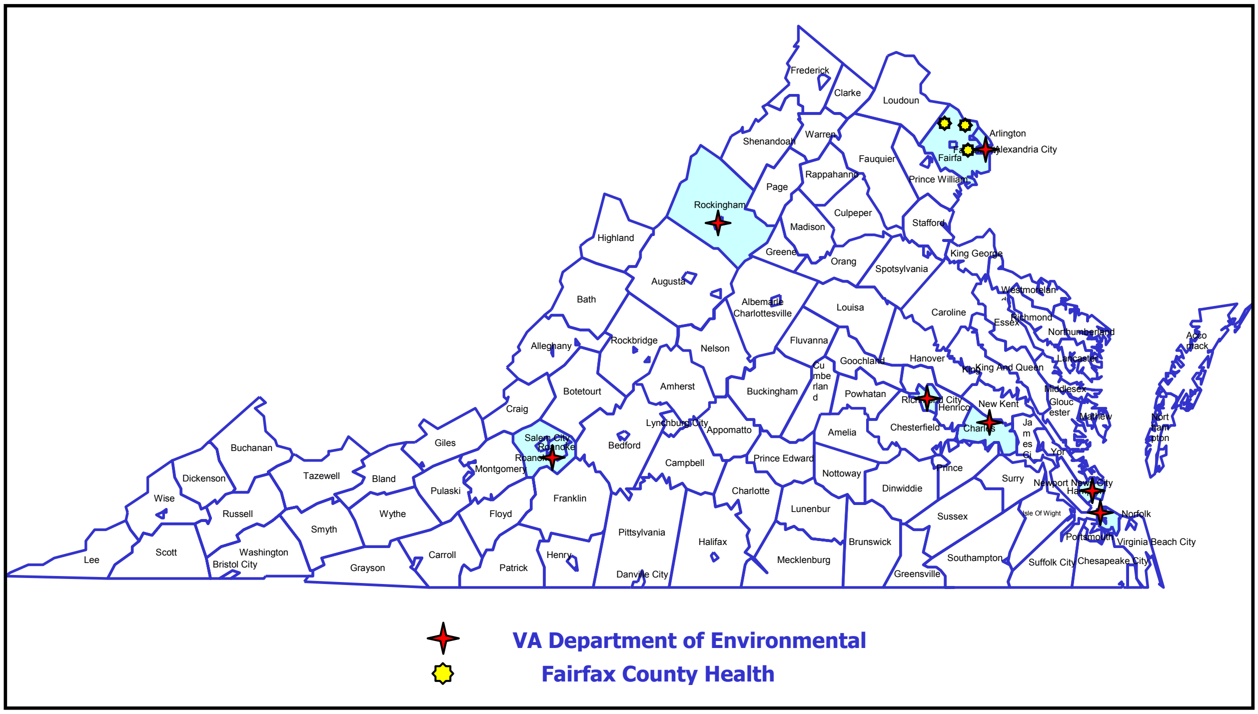

Carbon Monoxide - Northern Region
Eight Hour 2nd Maximum
Primary Standard 9 ppm
Parts Per Million (ppm)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
46-B9
47-T
L-46-A8
L-46-C1
L-46-F
L-126-C

Sulfur Dioxide (SO_2) is a colorless gas that has a strong odor. It results from burning of fuels containing sulfur (such as coal and oil), petroleum refining, and smelting (extracting metals from ore), and it also occurs naturally from volcanic eruptions. SO_2 can dissolve in water vapor to produce sulfuric acid, and it can also interact with other gases and particles in the air to produce sulfate aerosols that are capable of traveling long distances in the atmosphere.

EPA has developed primary and secondary air quality standards for SO_2. The primary standards are designed to protect people from the health effects of sulfur dioxide gas, which include respiratory problems for people with asthma and for those who are active outdoors. Long-term exposure to high concentrations of sulfur dioxide gas can cause respiratory illness and aggravate existing heart conditions. Sulfate particles that are formed from SO_2 gas can be inhaled, and are associated with increased respiratory symptoms and disease.

Secondary standards for sulfur dioxide protect against damage to vegetation and buildings, and against decreased visibility. The acids that can form from SO_2 and water vapor contribute to acid deposition (commonly called "acid rain") which causes damage to the leaves of plants and trees, making them vulnerable to disease, and can increase the acidity of lakes and streams, making them unsuitable for aquatic life. Acid deposition also causes deterioration of materials on buildings, monuments, and sculptures. Finally, small sulfate particles, formed when SO_2 gas reacts with other gases and particles in the air, contribute to haze that causes decreased visibility in many areas of the country.

Sulfur dioxide is monitored continuously with an electronic instrument using ultraviolet fluorescence detection. The instrument has a pump that pulls outside air into a sample chamber containing a high intensity ultraviolet (UV) light. Any SO_2 molecules in the sample air absorb some of the UV light, become excited, and then fluoresce, releasing light characteristic of SO_2. The fluorescence is detected with a photomultiplier tube (a tube that detects very small amounts of light and multiplies the signal many times), and the resulting signal, which corresponds to the amount of SO_2 in the sample, is converted to an SO_2 concentration by the instrument computer.



NAAQS Standards

Primary Standards for SO_2:

- Annual Arithmetic Mean not to exceed 0.03 ppm (80 $\mu g/m^3$).
- 24-Hour concentration not to exceed 0.14 ppm (365 $\mu g/m^3$) more than once per year.

Secondary Standard for SO_2:

- 3-Hour concentration not to exceed 0.5 ppm (1300 $\mu g/m^3$) more than once per year.

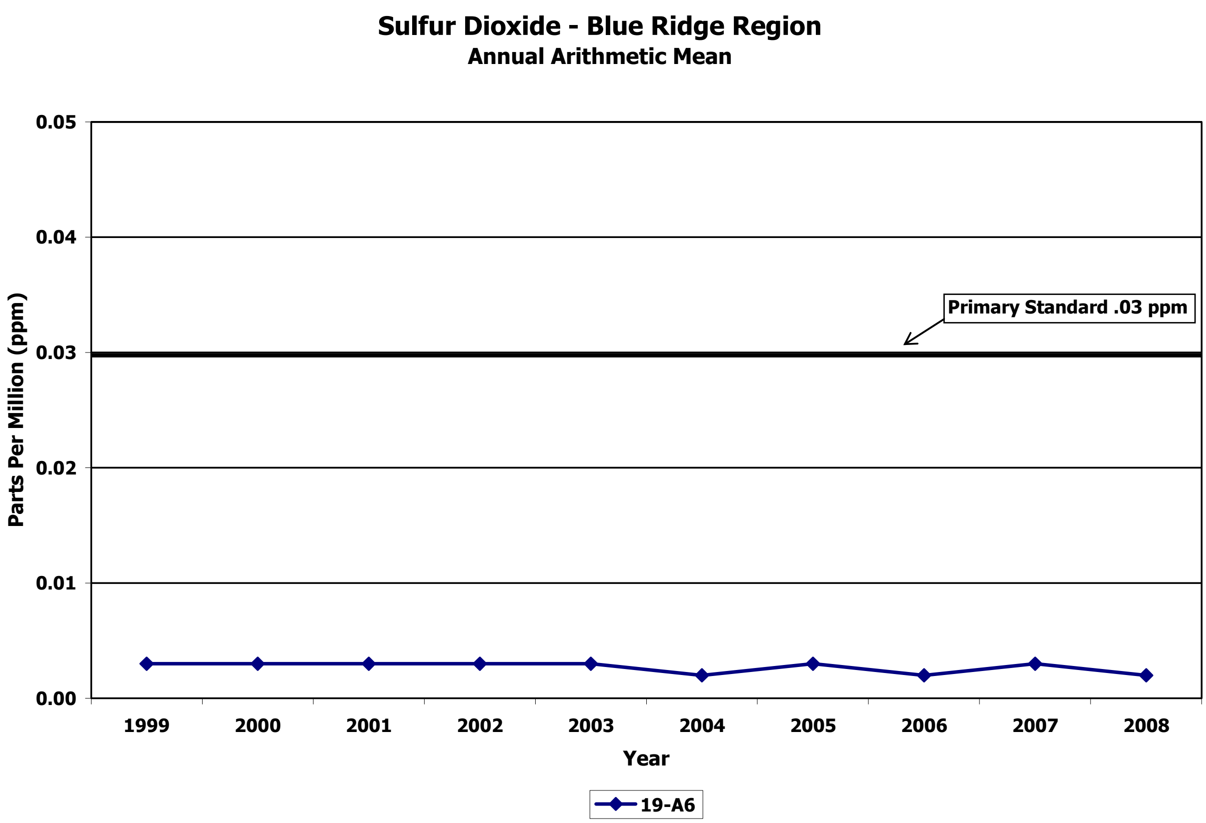
Site	2008			
	24-Hour Avg. (ppm)		3-Hour Avg. (ppm)	
	1st Max.	2nd Max.	1st Max.	2nd Max.
(26-F) **Rockingham Co.**	.007	.004	.014	.012
(19-A6) **Roanoke Co.**	.008	.007	.014	.010
(75-B) **Charles City Co.**	.014	.013	.041	.040
(158-W) **Richmond**	.011	.010	.026	.024
(179-C) **Hampton**	.013	.011	.062	.033
(181-A1) **Norfolk**	.016	.014	.055	.052
(L-46-A8) **Fairfax Co.**	.021	.016	.044	.029
(L-46-C1) **Fairfax Co.**	.017	.015	.028	.026
(L-46-F) **Fairfax Co.**	.012	.009	.019	.018
(L-126-C) **Alexandria**	.015	.012	.041	.025

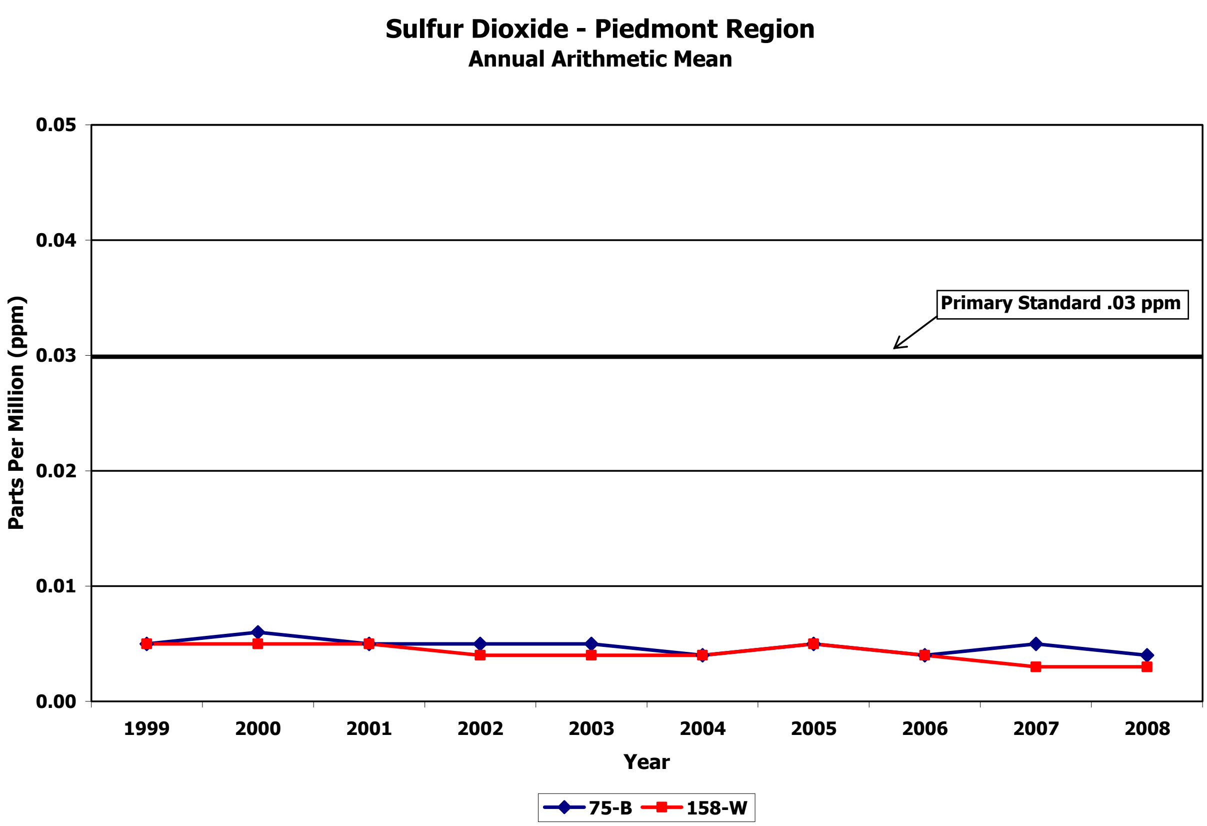
NAAQS Standards

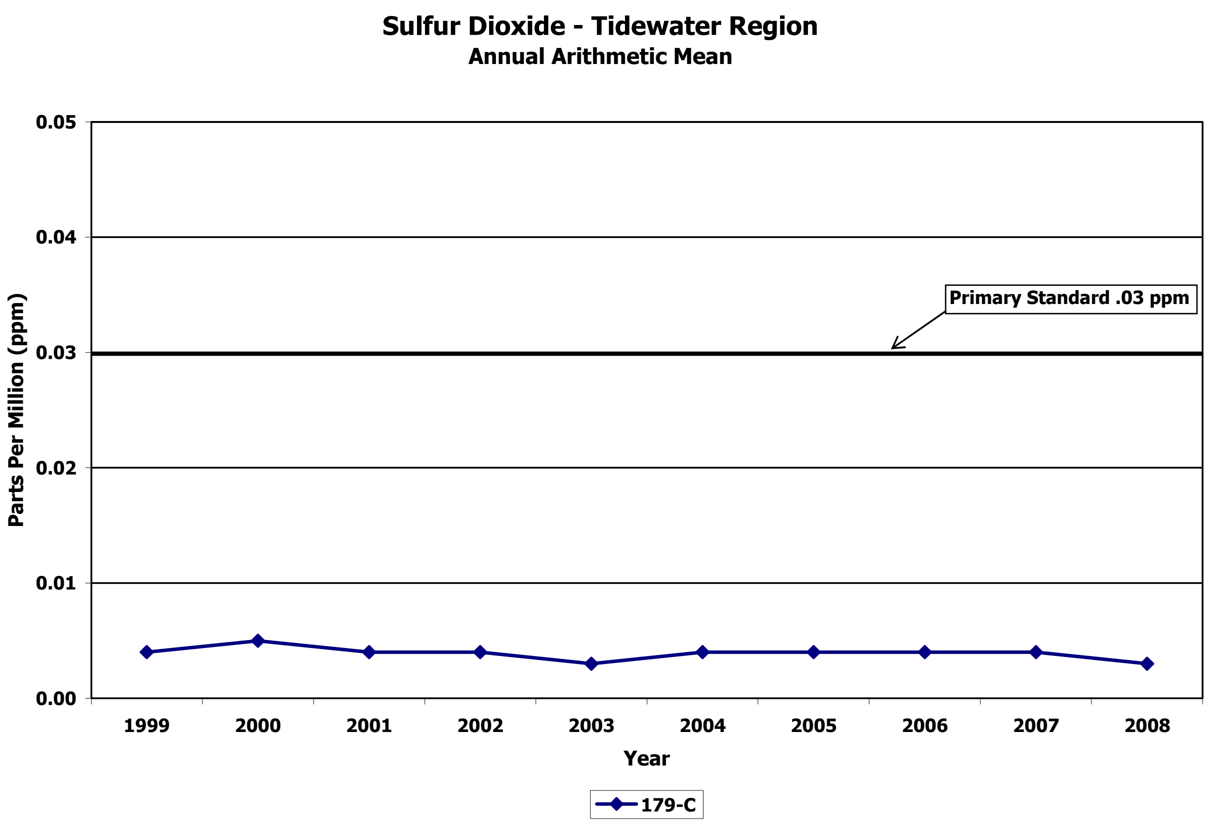
Primary Standards for SO_2:
- Annual Arithmetic Mean not to exceed 0.03 ppm (80 μg/m^3).
- 24-Hour concentration not to exceed 0.14 ppm (365 μg/m^3) more than once per year.

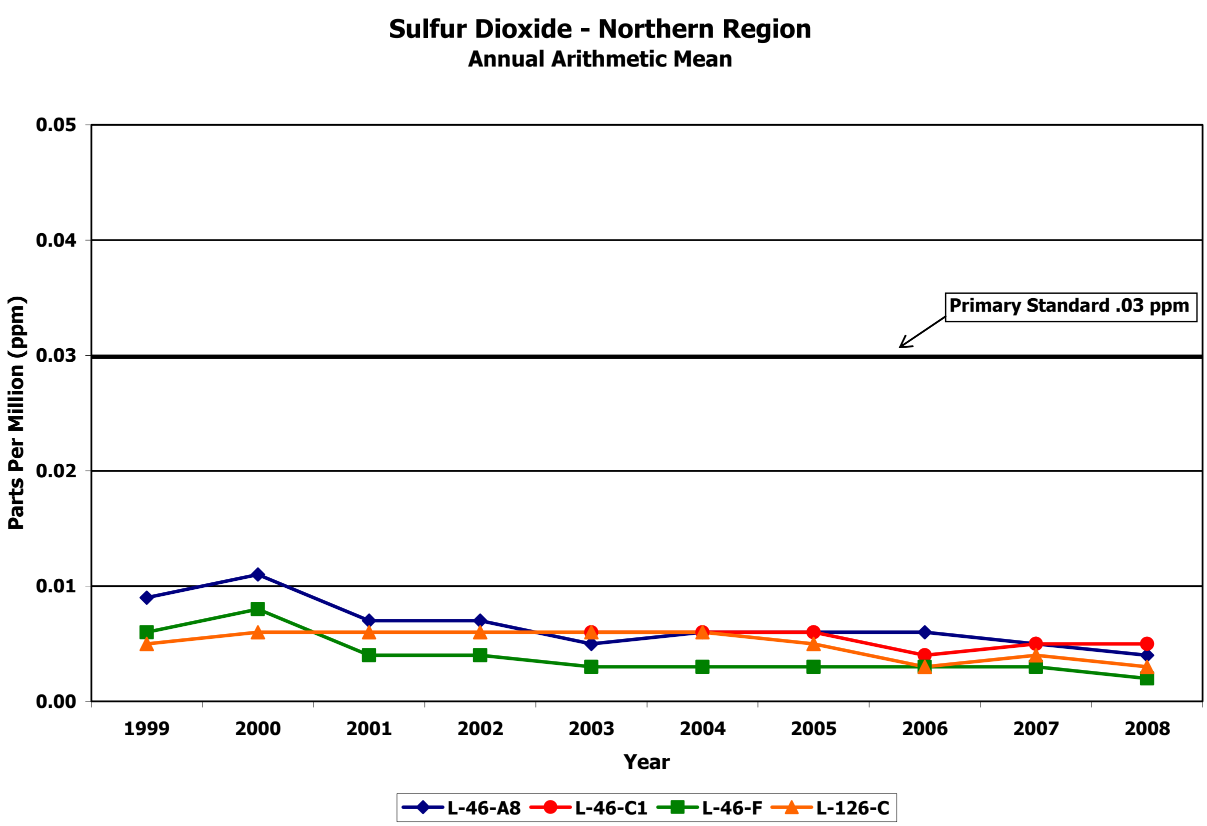
Secondary Standard for SO_2:
- 3-Hour concentration not to exceed 0.5 ppm (1300 μg/m^3) more than once per year.

Site	Annual Arithmetic Mean (ppm)									
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
(26-F) **Rockingham Co.**	--	--	--	--	--	--	.002	.002	.001	.001
(19-A6) **Roanoke Co.**	.003	.003	.003	.003	.003	.002	.003	.002	.003	.002
(75-B) **Charles City Co.**	.005	.006	.005	.005	.005	.004	.005	.004	.005	.004
(158-W) **Richmond**	.005	.005	.005	.004	.004	.004	.005	.004	.003	.003
(179-C) **Hampton**	.004	.005	.004	.004	.003	.004	.004	.004	.004	.003
(181-A1) **Norfolk**	--	--	--	--	--	--	--	--	.005	.004
(L-46-A8) **Fairfax Co.**	.009	.011	.007	.007	.005	.006	.006	.006	.005	.004
(L-46-C1) **Fairfax Co.**	--	--	--	--	.006	.006	.006	.004	.005	.005
(L-46-F) **Fairfax Co.**	.006	.008	.004	.004	.003	.003	.003	.003	.003	.002
(L-126-C) **Alexandria**	.005	.006	.006	.006	.006	.006	.005	.003	.004	.003


Sulfur Dioxide - Blue Ridge Region
Annual Arithmetic Mean
Parts Per Million (ppm)
0.05
0.04
0.03
0.02
0.01
0.00
Primary Standard .03 ppm
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
19-A6


Sulfur Dioxide - Piedmont Region
Annual Arithmetic Mean
Parts Per Million (ppm)
0.05
0.04
0.03
0.02
0.01
0.00
Primary Standard .03 ppm
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
75-B
158-W


Sulfur Dioxide - Tidewater Region
Annual Arithmetic Mean
Parts Per Million (ppm)
0.05
0.04
0.03
0.02
0.01
0.00
Primary Standard .03 ppm
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
179-C

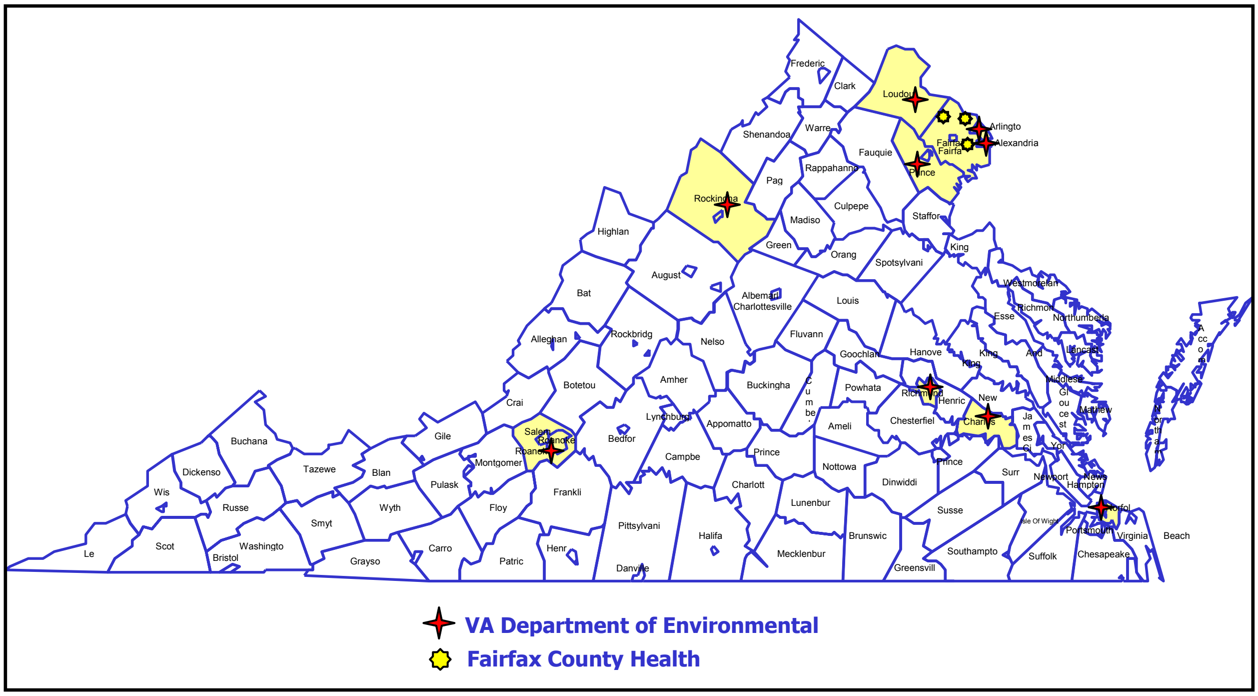

Sulfur Dioxide - Northern Region
Annual Arithmetic Mean
Parts Per Million (ppm)
0.05
0.04
0.03
0.02
0.01
0.00
Primary Standard .03 ppm
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
L-46-A8
L-46-C1
L-46-F
L-126-C

Nitrogen dioxide (NO_2) is one in a group of gases referred to as oxides of nitrogen (NO_X). Nitrogen dioxide, which is characterized by a reddish-brown color and pungent odor, along with the other NO_X gases, results from high-temperature burning of fossil fuels in automobiles, power plants, and other industrial, commercial, and residential sources. NO_X can occur naturally from lightning, forest fires, and bacterial processes that take place in soil.

NO_X pollution contributes to a wide range of problems in the environment. Ground-level ozone, a major component of "smog", forms when NO_X and volatile organic compounds (VOCs) react in the presence of sunlight. NO_X also reacts with other gases and particles in the air to form acids that contribute to acid deposition, and to form small particles that can be inhaled into the lungs. NO_X contributes to water quality deterioration by depositing nitrogen into water bodies, upsetting the nutrient balance and causing oxygen depletion in the water so that fish and other aquatic life cannot survive. Nitrate particles and nitrogen dioxide also contribute to visibility impairment by blocking light transmission.

EPA has established primary and secondary air quality standards for NO_2 because it can cause lung irritation and respiratory problems in humans. Small particles formed from reaction of NO_X gases with other compounds can be inhaled deep into the lungs and cause or worsen respiratory conditions such as emphysema and bronchitis, and can aggravate existing heart conditions.

Nitrogen oxides are measured continuously with electronic instruments using the "gas phase chemiluminescence" method. The instrument has a pump that draws ambient air into a reaction chamber. Inside the chamber, the air is mixed with a high concentration of ozone (O_3). Any nitric oxide (NO) present in the sample air reacts with O_3 to produce NO_2. The NO_2 molecules created by the reaction are in an excited state, and emit light characteristic of NO_2 – this is called "chemiluminescence." The light produced in the reaction is detected with a photomultiplier tube, and the resulting signal is converted to a number reflecting the concentration of NO in the ambient air by the instrument computer. The instrument then activates a valve that diverts incoming ambient air into a "converter", which converts any NO_2 in the ambient air to NO by reduction reaction. After the air passes through the converter, it is sent to the reaction chamber where the NO and O_3 react to produce NO_2. The chemilumiscence produced by the reaction is converted to a signal that reflects the concentration of NO_X in the ambient air. The instrument then calculates the NO_2 concentration using the difference between the measured NO and NO_X concentrations.



NAACS Standards

Primary Standard for NO_2:

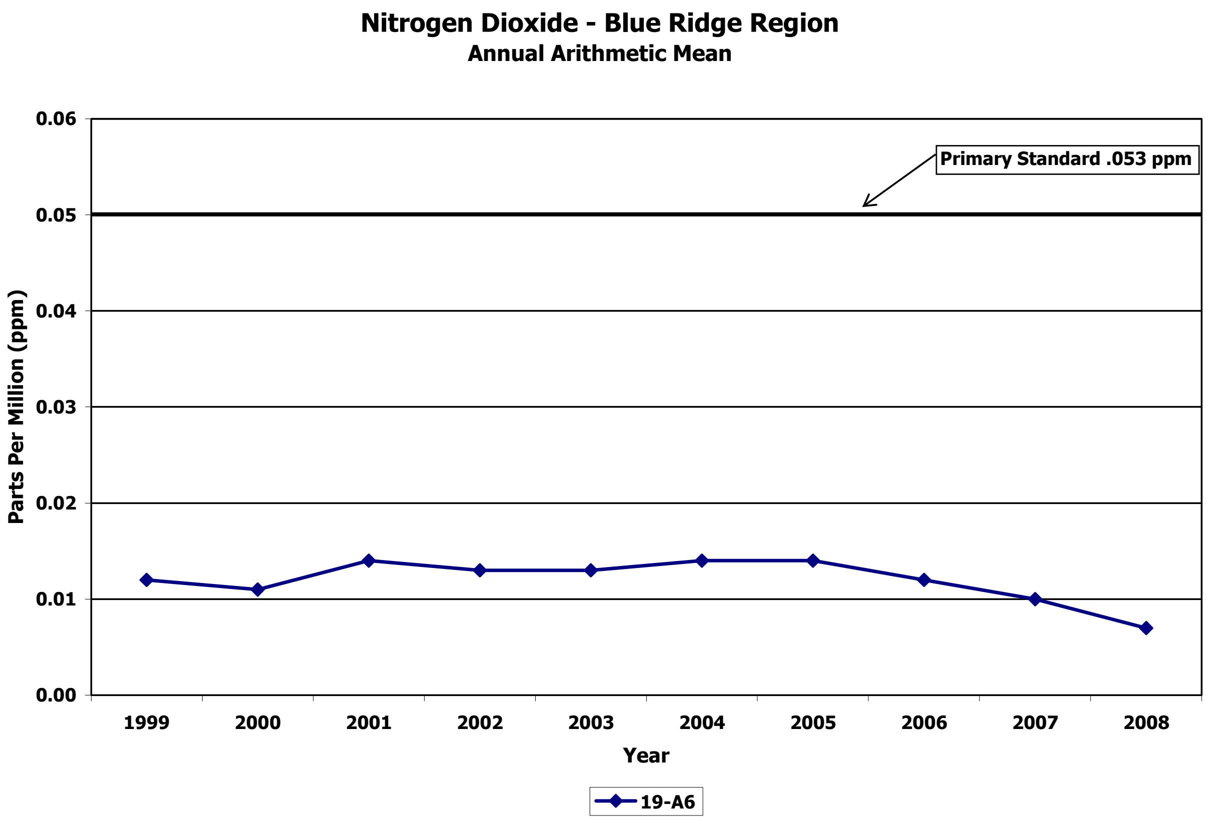
- Annual Arithmetic Mean not to exceed 0.053 ppm (100 μg/m^3).

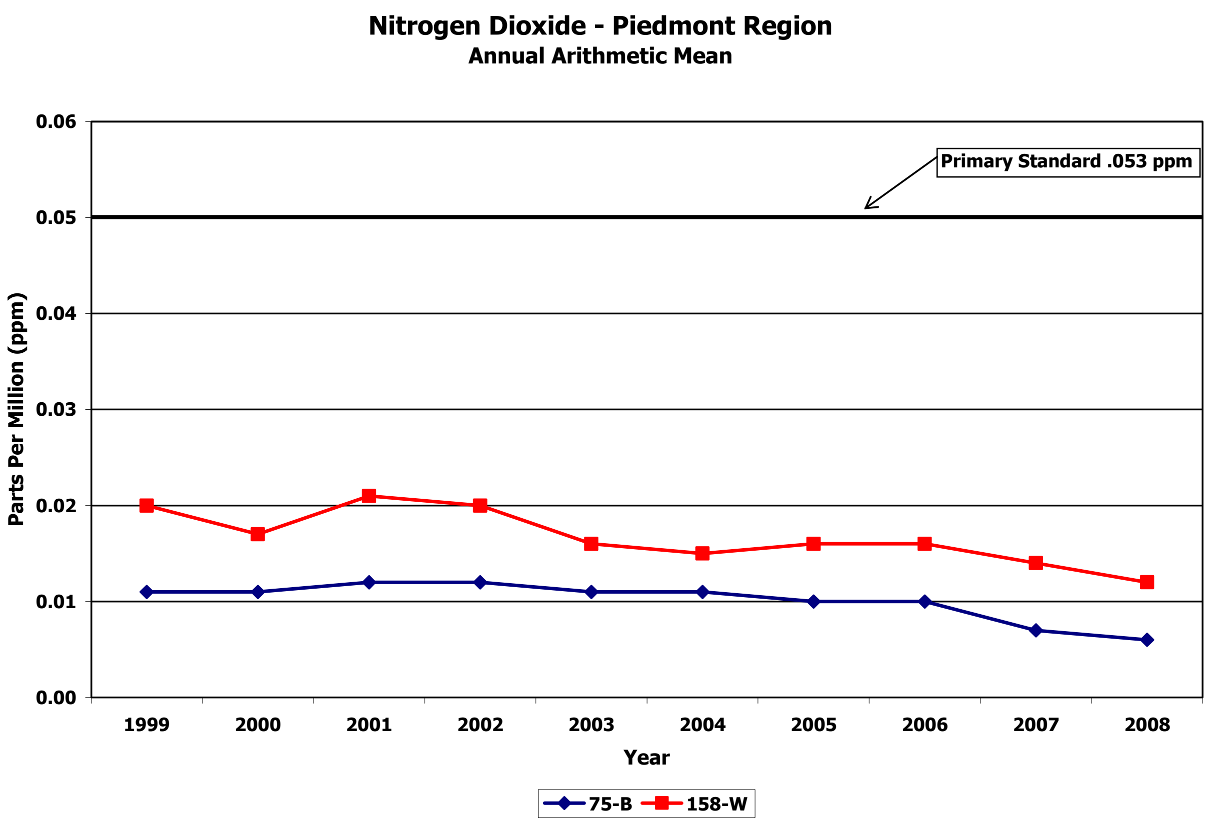
Secondary Standard for NO_2:

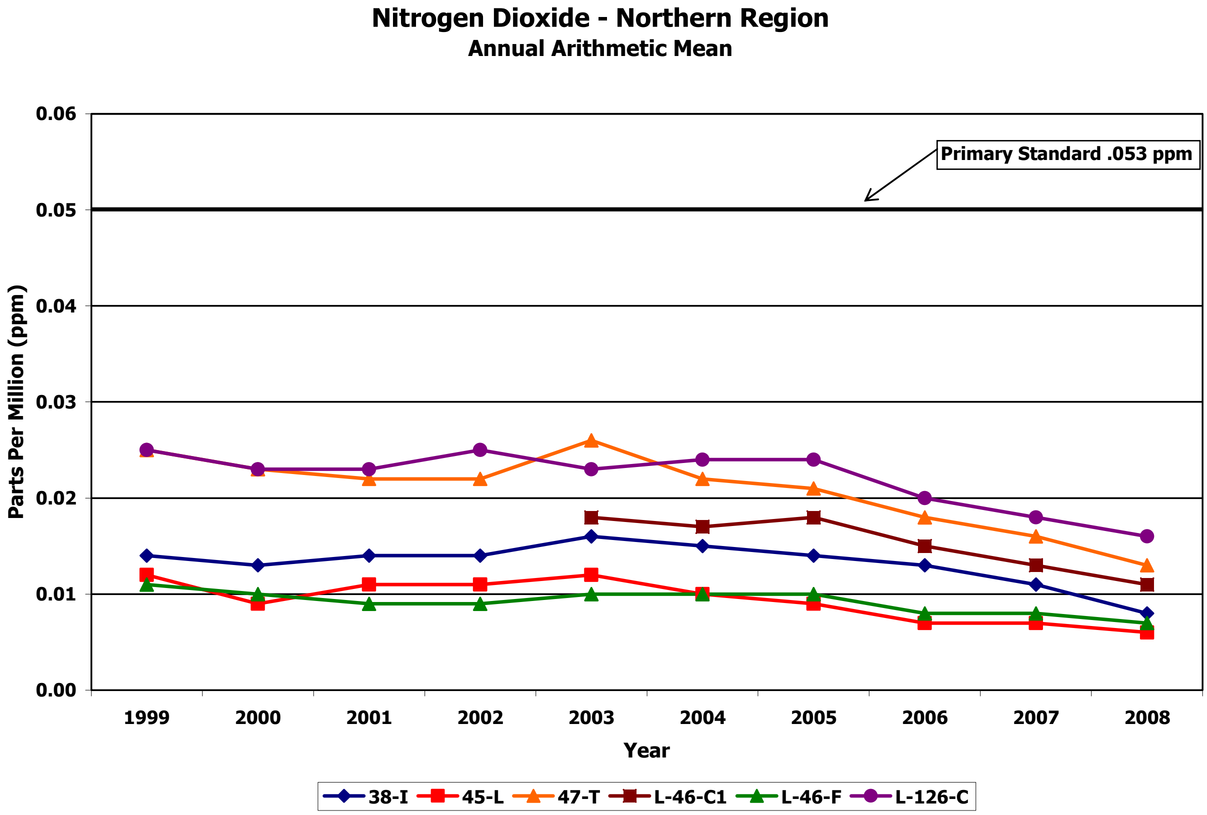
- Same as primary.

Site	Annual Arithmetic Mean (ppm)									
	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
(26-F) **Rockingham Co.**	--	--	--	--	--	--	.014	.012	.011	.011
(19-A6) **Roanoke Co.**	.012	.011	.014	.013	.013	.014	.014	.012	.010	.007
(75-B) **Charles City Co.**	.011	.011	.012	.012	.011	.011	.010	.010	.007	.006
(158-W) **Richmond**	.020	.017	.021	.020	.016	.015	.016	.016	.014	.012
(181-A1) **Norfolk**	--	--	--	--	--	--	--	--	.012	.010
(38-I) **Loudoun Co.**	.014	.013	.014	.014	.016	.015	.014	.013	.011	.008
(45-L) **Prince William Co.**	.012	.009	.011	.011	.012	.010	.009	.007	.007	.006
(47-T) **Arlington Co.**	.025	.023	.022	.022	.026	.022	.021	.018	.016	.013
(L-46-A8) **Fairfax Co.**	.020	.021	.020	**	**	.018	.017	.015	.014	.013
(L-46-C1) **Fairfax Co.**	--	--	--	--	.018	.017	.018	.015	.013	.011
(L-46-F) **Fairfax Co.**	.011	.010	.009	.009	.010	.010	.010	.008	.008	.007
(L-126-C) **Alexandria**	.025	.023	.023	.025	.023	.024	.024	.020	.018	.016

** Did not meet EPA's minimum requirements for data capture


Nitrogen Dioxide - Blue Ridge Region
Annual Arithmetic Mean
Primary Standard .053 ppm
Parts Per Million (ppm)
0.06
0.05
0.04
0.03
0.02
0.01
0.00
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
19-A6


Nitrogen Dioxide - Piedmont Region
Annual Arithmetic Mean
Primary Standard .053 ppm
Parts Per Million (ppm)
0.06
0.05
0.04
0.03
0.02
0.01
0.00
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
75-B
158-W


Nitrogen Dioxide - Northern Region
Annual Arithmetic Mean
Primary Standard .053 ppm
Parts Per Million (ppm)
0.06
0.05
0.04
0.03
0.02
0.01
0.00
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
38-I
45-L
47-T
L-46-C1
L-46-F
L-126-C

Ozone (O_3) is a gas comprised of three oxygen atoms. It is unstable, and a strong oxidizing agent, and will react readily with other compounds to decay to the more stable diatomic oxygen (O_2).

Ozone can be good or bad, depending on its location in the atmosphere. "Good" ozone occurs naturally in the stratosphere, about 10-30 miles above the earth's surface, where it forms a layer that filters the sun's ultraviolet rays before they reach the surface where they can cause harm to animals and plants. "Bad" ozone, or ground-level ozone, occurs when chemicals found in the atmosphere at earth's surface react in the presence of intense sunlight. Ozone at ground level is harmful because it can cause a variety of health problems, as well as damage to plants and materials. Since ground-level ozone is not emitted directly, it is called a "secondary" pollutant. The chemicals needed to form ozone, NOx and hydrocarbons (also called volatile organic compounds, or VOCs), can come from motor vehicle exhaust, power plants, industrial emissions, gasoline vapors, chemical solvents, as well as natural sources such as lightning, forest fires, and plant decomposition. Ozone, and the chemicals that produce ozone, can travel hundreds of miles from their sources, so that even rural areas with few pollutant emissions can occasionally experience high ozone levels. Efforts to control ground-level ozone involve limiting emissions of NOx and VOCs, or "ozone precursors," that are necessary for ozone production.

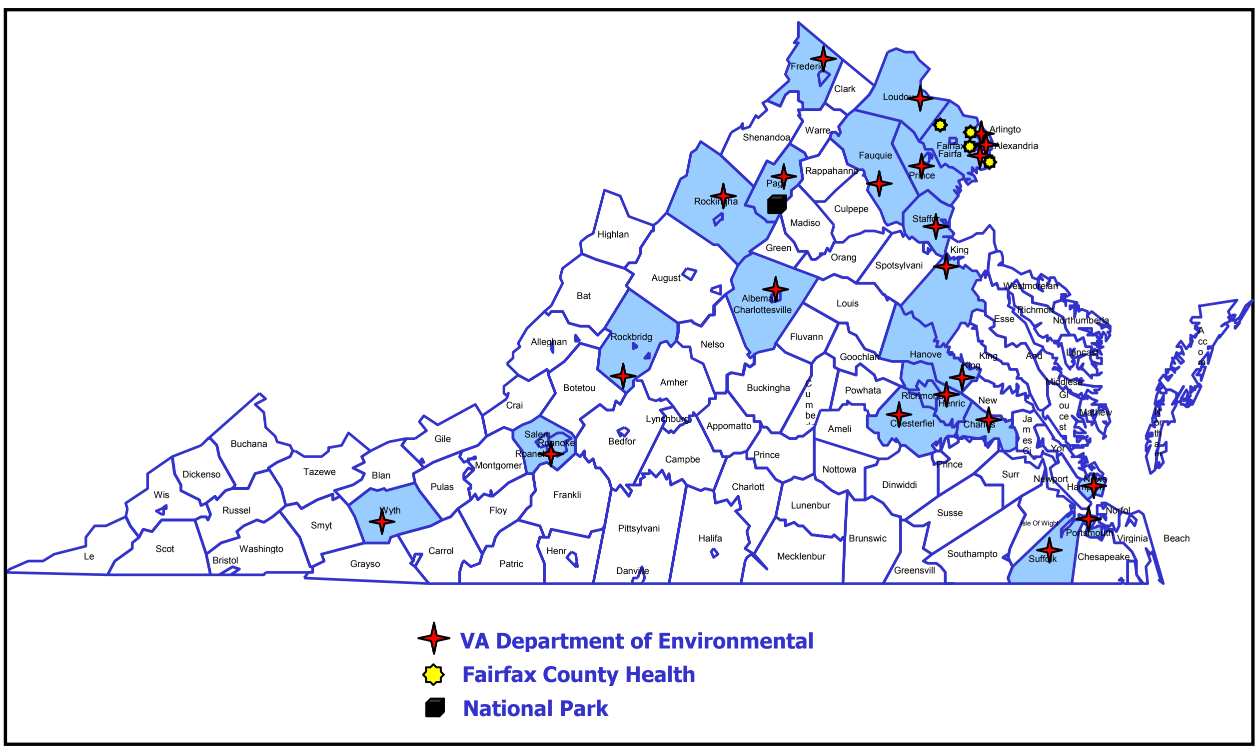
Ground-level ozone is a seasonal pollutant, and the length of the ozone season varies across the country. In some areas, the season may last most of the year, but in Virginia it is usually only a problem during the late spring to summer months when the sunlight is most intense. Virginia is only required to operate its ozone monitors from the months of April to October, although a few sites operate year-round. In addition to the seasonal pattern, ozone also has a strong diurnal (daily) pattern at low altitudes, so that it is usually depressed at night, but begins to build during the day after the sun rises.

EPA has created primary and secondary air quality standards for ground-level ozone because of its adverse affects on public health and welfare. In humans, ozone can irritate lung airways, causing sunburn-like inflammation, and can induce symptoms such as wheezing, coughing, and pain when taking a deep breath. Although people with existing respiratory problems, such as asthma and emphysema, are most vulnerable, young children and otherwise healthy people can also suffer respiratory problems from ozone exposure. Scientific studies have shown that even at low levels, ozone can trigger breathing problems for sensitive individuals. In addition to human health problems, ozone can damage the leaves of plants and trees, making them susceptible to disease, insects, and harsh weather. Ozone can also cause rubber to harden and crack, and some painted surfaces to fade more quickly.

Ozone is measured continuously with electronic instruments using "ultraviolet (UV) absorption photometry." The method is based on the principle that ozone strongly absorbs UV light at 254 nanometers (a nanometer is equal to a distance of one billionth of a meter). The ozone monitor has a sample pump that draws ambient air into it and splits the air into two gas streams. In one stream, the air passes through an "ozone scrubber", which cleanses the sample air of any ozone. Then the clean air passes through a sample cell that contains a UV light source and a detector. The detector measures the intensity of the light in the sample cell, providing a zero reference. The second air stream is sent straight into the sample cell, bypassing the scrubber. Any ozone present in the incoming air will absorb some of the UV light in the sample cell, reducing the amount of light reaching the detector. The instrument then calculates the ozone concentration of the ambient air from the difference in the light intensities measured between the scrubbed, or "zero" air, and the unscrubbed air.

Daily ozone forecasts for selected metropolitan areas and hourly ozone values for all Virginia ozone monitoring sites can be viewed for the months of April to October on the DEQ web page at http://www.deq.virginia.gov/airquality/homepage. In addition, animated ozone maps for Virginia and other parts of the United States are available at http://www.airnow.gov/ .

The National Park Service operated one ozone monitor at Big Meadows in Shenandoah National Park in 2008. Daily data from this site are available at the DEQ website, and historical data may be obtained from the National Park Service, or by internet at http://12.45.109.6/.



NAAQS Standards

Primary Standard for O_3:

- Maximum 8-hour average concentration of 0.075 ppm (157 $\mu g/m^3$), effective May 27, 2008, based on 3-year average of the annual fourth highest daily maximum 8-hour averages.

Secondary Standard for O_3:
Same as primary

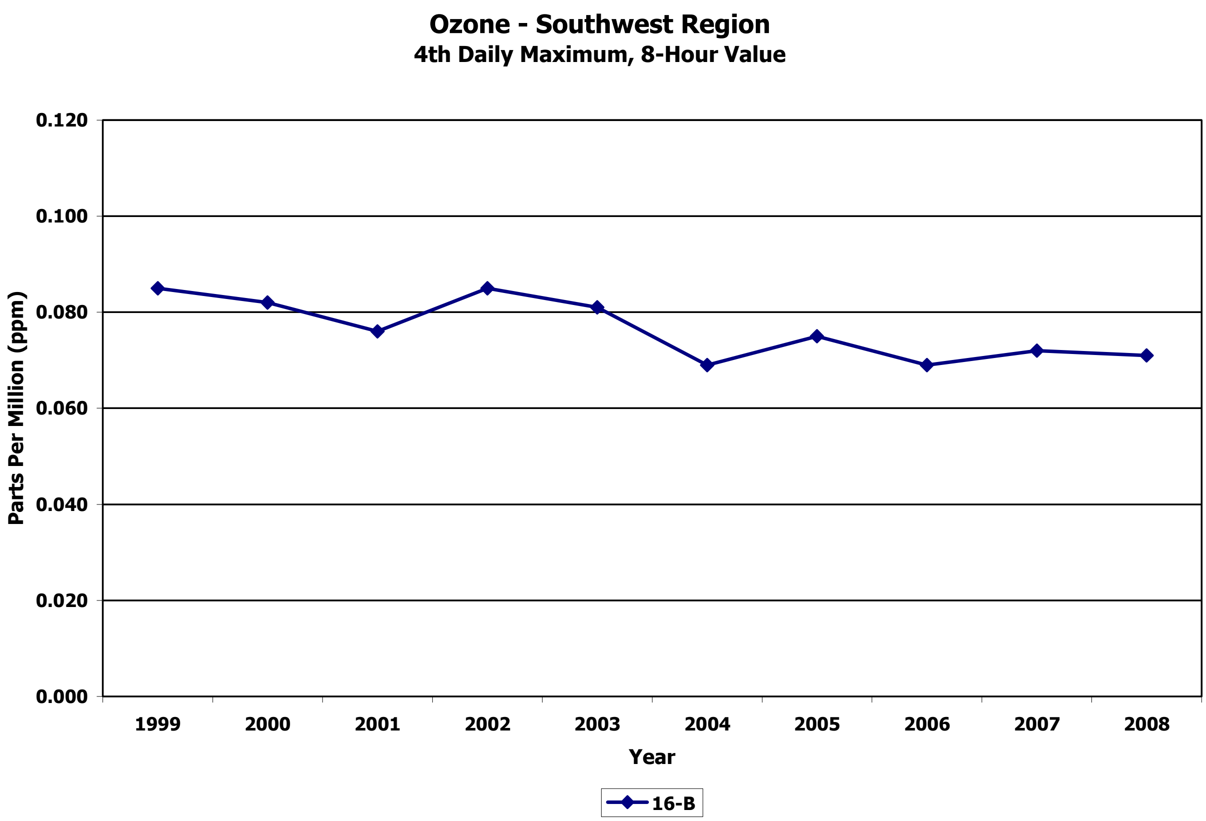
The 8-hour standard is set at 0.075 ppm and is exceeded when an average level of ozone over an 8-hour period is 0.075 ppm. The standard is attained if the fourth highest daily maximum 8-hour average for each of the three most recent years at a monitoring site are averaged, yielding an average less than or equal to 0.075 ppm.

Site	Days Exceeded 0.075 ppm	2008 Highest Daily Maximum 8-Hour Avg.			
		1st Max.	2nd Max.	3rd Max.	4th Max.
(16-B) **Wythe Co.**	1	.076	.073	.073	.071
(26-F) **Rockingham Co.**	0	.071	.070	.070	.069
(28-J) **Frederick Co.**	2	.081	.079	.073	.073
(29-D) **Page Co.**	0	.075	.073	.073	.068
(33-A) **Albemarle Co. ****	3	.082	.078	.077	.073
(19-A6) **Roanoke Co.**	1	.081	.074	.074	.071
(21-C) **Rockbridge Co.**	1	.077	.070	.067	.067
(71-H) **Chesterfield Co.**	7	.099	.097	.089	.080
(72-M) **Henrico Co.**	10	.110	.095	.087	.086
(73-E) **Hanover Co.**	8	.089	.083	.081	.080
(75-B) **Charles City Co.**	11	.089	.089	.085	.084
(179-C) **Hampton**	4	.088	.082	.079	.079
(183-E) **Suffolk**	6	.085	.079	.078	.077
(183-F) **Suffolk**	4	.095	.095	.079	.078
(37-B) **Fauquier Co.**	1	.078	.072	.069	.068
(38-I) **Loudoun Co.**	8	.100	.089	.080	.079
(44-A) **Stafford Co.**	1	.085	.071	.070	.069
(45-L) **Prince William Co.**	2	.082	.076	.075	.074
(46-B9) **Fairfax Co.**	6	.095	.088	.085	.085
(47-T) **Arlington Co.**	8	.104	.093	.089	.084
(48-A) **Caroline Co.**	6	.090	.085	.081	.080
(L-46-A8) **Fairfax Co.**	6	.102	.090	.081	.080
(L-46-B3) **Fairfax Co.**	7	.095	.092	.085	.085
(L-46-C1) **Fairfax Co.**	10	.102	.088	.082	.082
(L-46-F) **Fairfax Co.**	5	.098	.080	.079	.078
(L-126-C) **Alexandria**	3	.090	.077	.077	.075

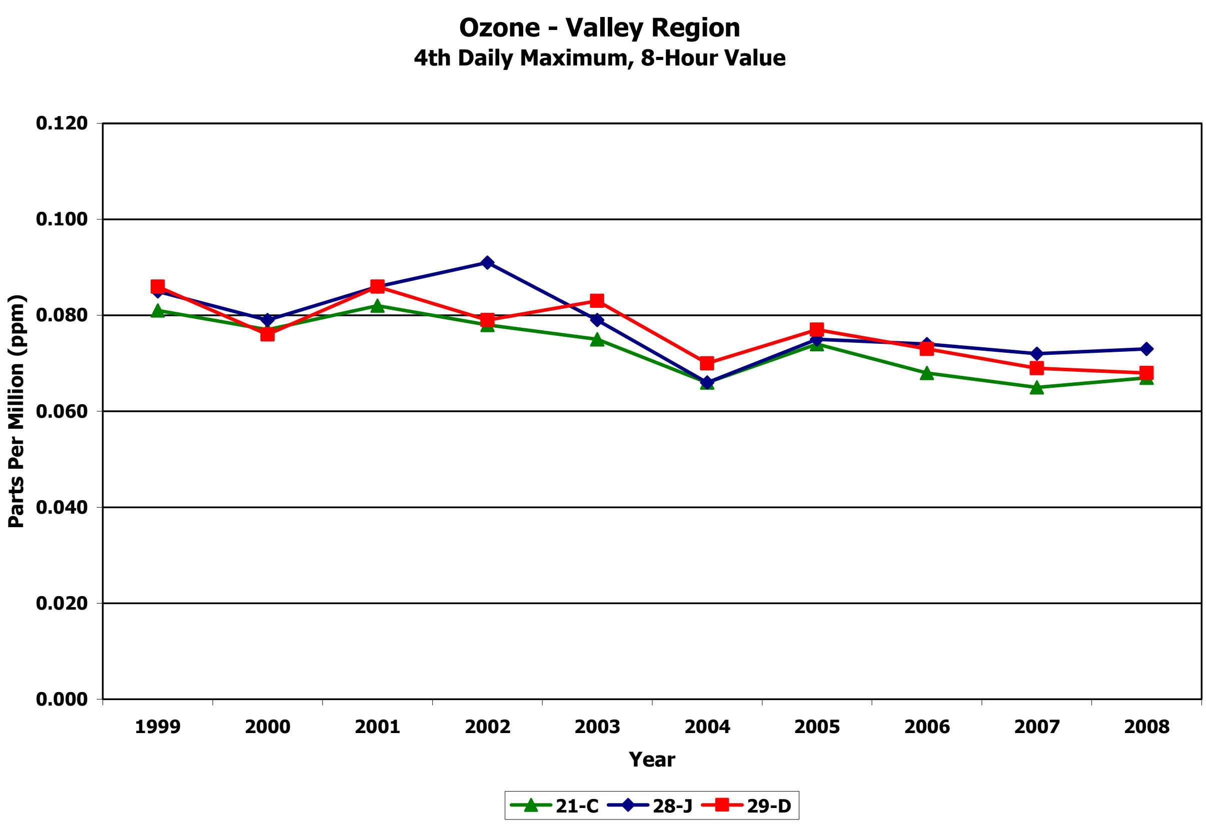
** New Site

2006-2008 Fourth-Highest Daily Maximum 8-Hour Ozone Averages (units parts per million)					
	Monitor Location (County/City)	2006	2007	2008	3-Year Average (NAAQS = .075 ppm)
Roanoke EAC Area	Roanoke Co.	.076	.076	.071	.074
Richmond Maintenance Area	Chesterfield Co.	.077	.077	.080	.078
	Henrico Co.	.086	.085	.086	.085
	Hanover Co.	.082	.079	.080	.080
	Charles City Co.	.081	.084	.084	.083
Hampton Roads Maintenance Area	Hampton City	.076	.076	.079	.077
	Suffolk City (TCC)	.077	.076	.077	.076
	Suffolk City (Holland)	.071	.078	.078	.075
Winchester EAC Area	Frederick Co.	.074	.072	.073	.073
Fredericksburg Maintenance Area	Stafford Co.	.091	.085	.069	.081
Northern Virginia Nonattainment Area	Loudoun Co.	.084	.086	.079	.083
	Prince William Co.	.086	.076	.074	.078
	Arlington Co.	.085	.088	.084	.085
	Alexandria City	.084	.084	.075	.081
	Fairfax Co. (Lee Park)	.087	.085	.085	.085
	Fairfax Co. (McLean)	.088	.083	.080	.083
	Fairfax Co. (Chantilly)	.081	.078	.078	.079
	Fairfax Co. (Annandale)	.085	.084	.082	.083
	Fairfax Co. (Mt. Vernon)	.088	.088	.085	.087
Shenandoah National Park Maintenance Area	Madison Co. (Big Meadows)	.076	.073	.078	.075
Areas Currently Designated Attainment	Wythe Co.	.069	.072	.071	.070
	Rockbridge Co.	.068	.065	.067	.066
	Page Co.	.073	.069	.068	.070
	Fauquier Co.	.076	.069	.068	.071
	Caroline Co.	.085	.078	.080	.081

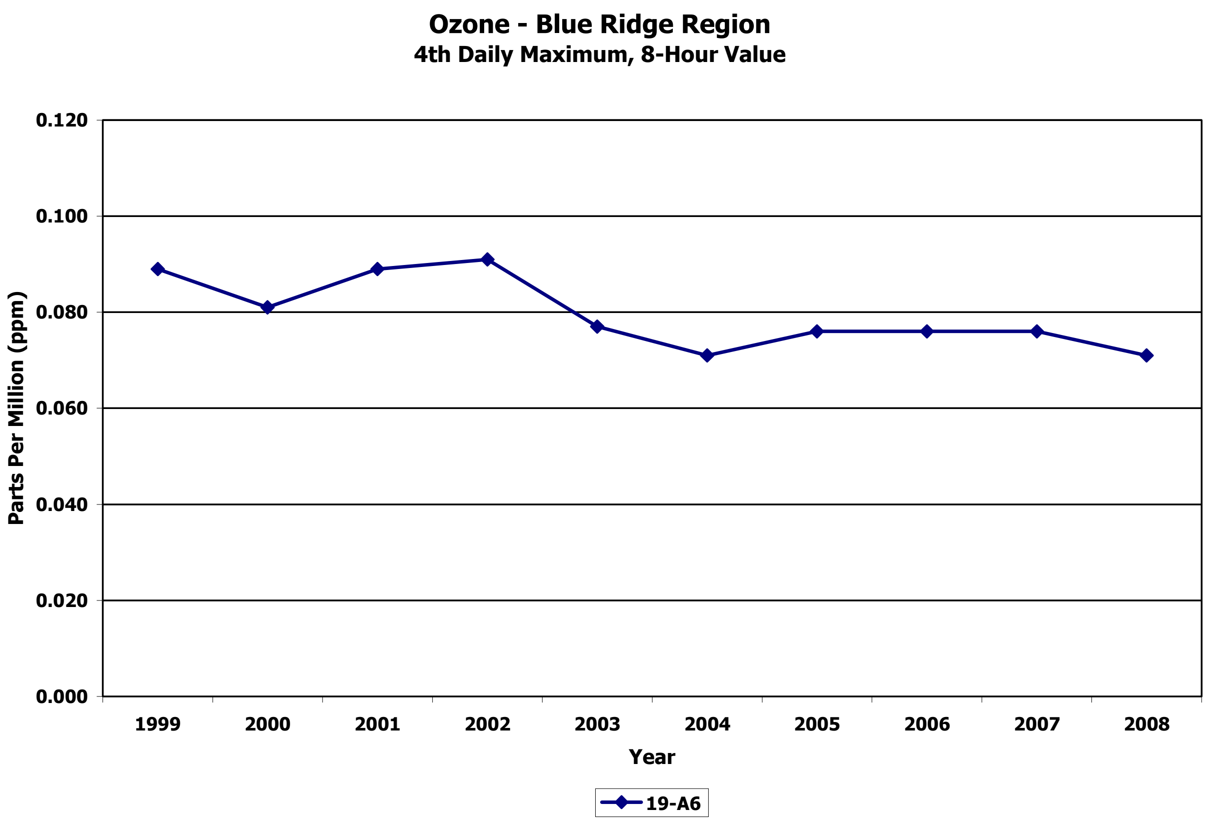
A 3-year average greater than .075 ppm exceeds the 8-hour NAAQS for ozone

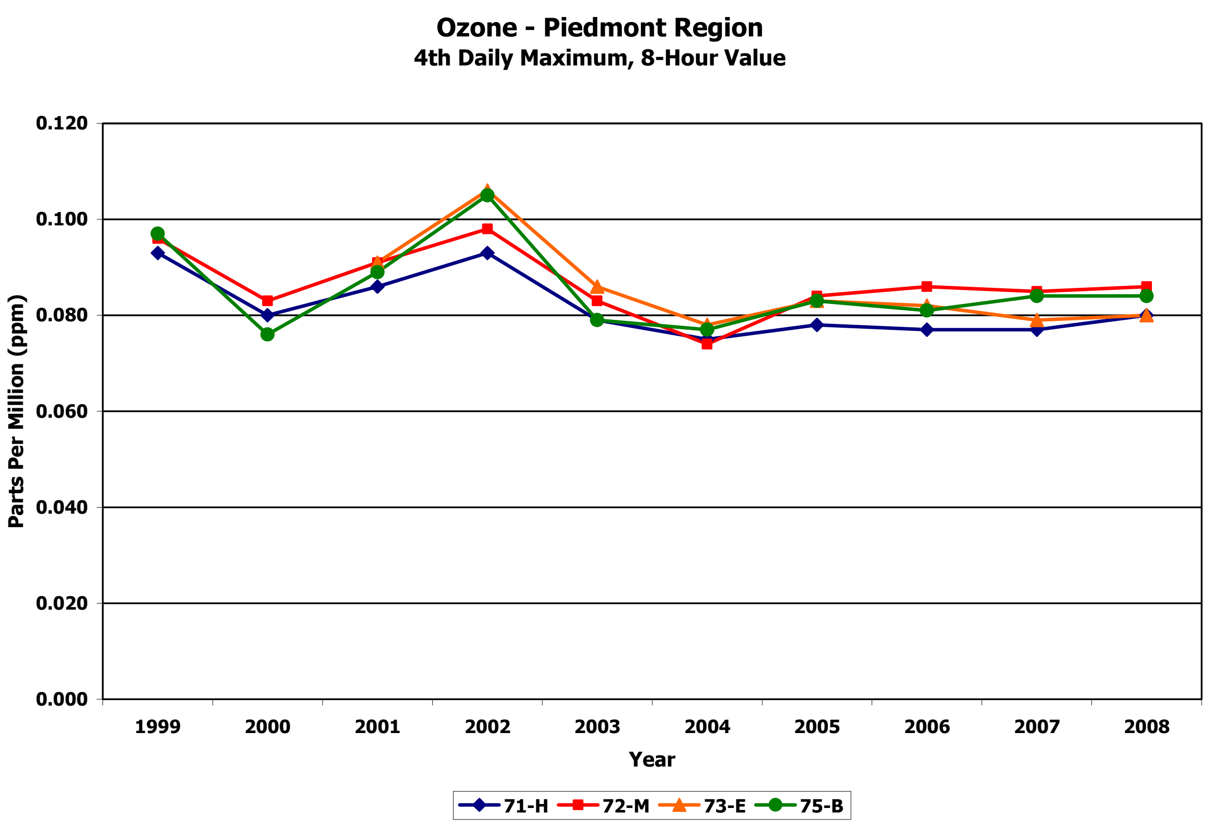


Ozone - Southwest Region
4th Daily Maximum, 8-Hour Value
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Parts Per Million (ppm)
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
16-B

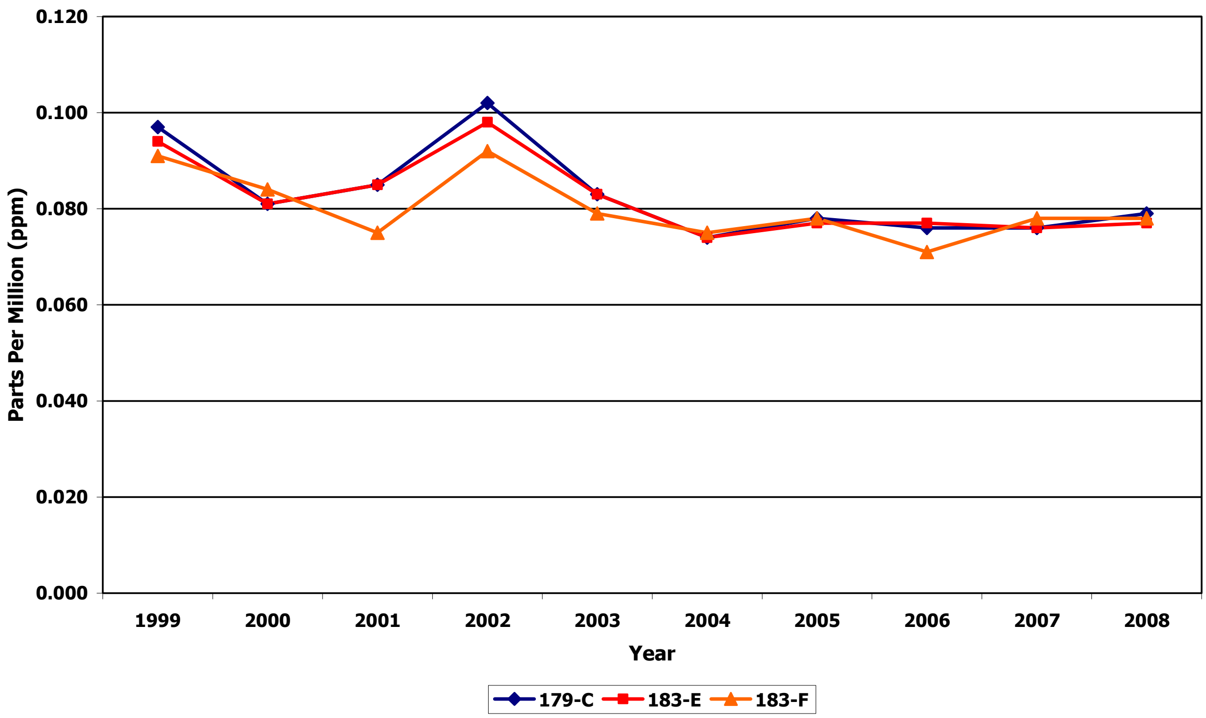


Ozone - Valley Region
4th Daily Maximum, 8-Hour Value
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Parts Per Million (ppm)
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
21-C
28-J
29-D

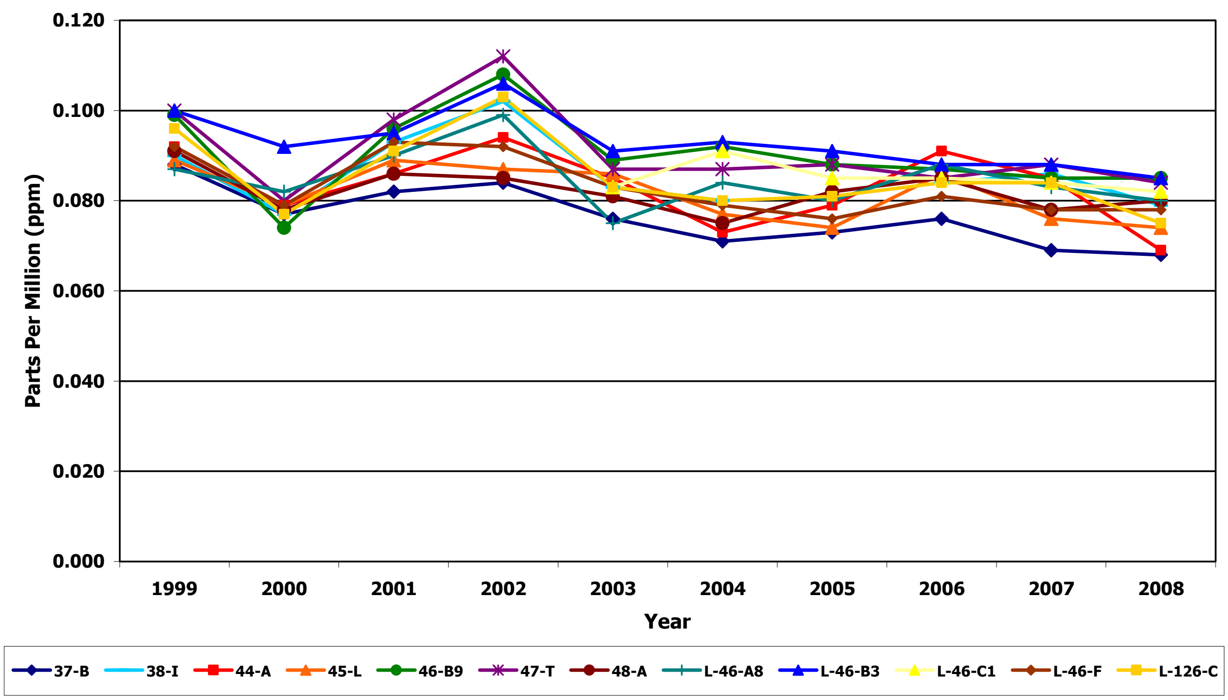

Ozone - Blue Ridge Region
4th Daily Maximum, 8-Hour Value
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Parts Per Million (ppm)
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
19-A6


Ozone - Piedmont Region
4th Daily Maximum, 8-Hour Value
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Parts Per Million (ppm)
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year
71-H
72-M
73-E
75-B

Ozone - Tidewater Region
4th Daily Maximum, 8-Hour Value



Ozone - Northern Region
4th Daily Maximum, 8-Hour Value



Acid Deposition Program

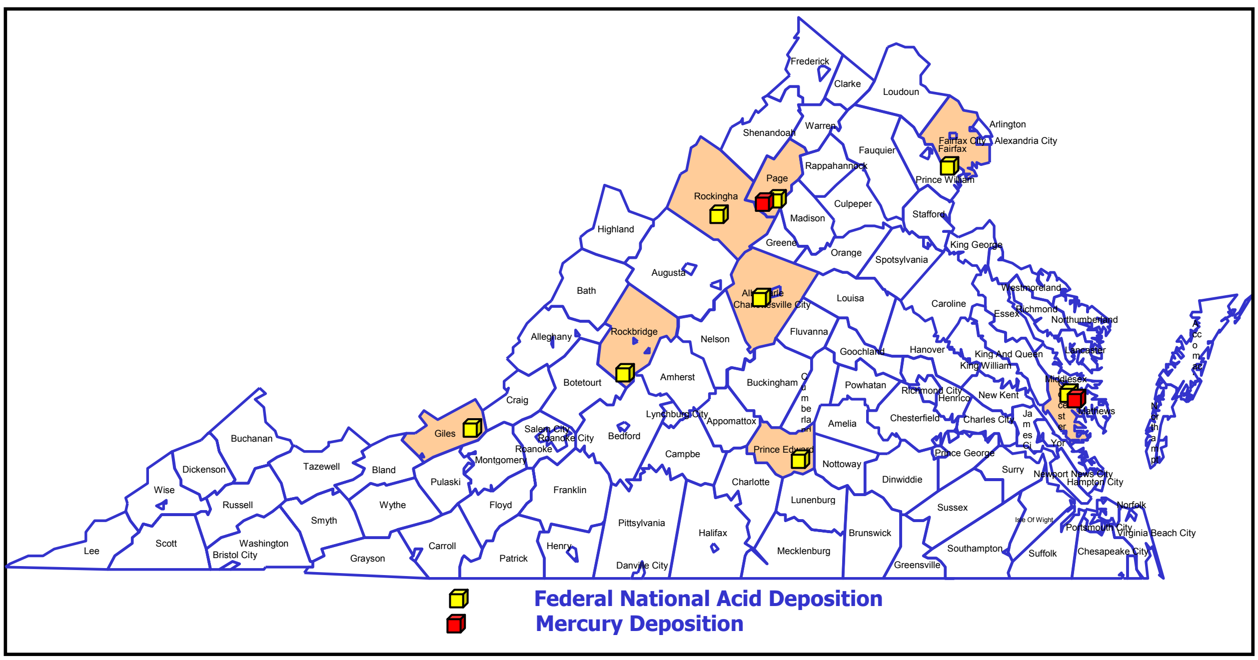
Photochemical Assessment Monitoring Stations

Air Toxics Monitoring Network

The Virginia Department of Environmental Quality sponsored two National Acid Deposition Program (NADP) sites in 2008: Harcum in Gloucester County and Mason Neck in Fairfax County.

The NADP has eight monitoring sites in Virginia: Big Meadows (Shenandoah National Park), Hortons Station (Giles County), Charlottesville, Prince Edward County, Harcum (Gloucester County), Harrisonburg (Rockingham County), Natural Bridge Station (Rockbridge County), and Mason Neck (Fairfax County). NADP site information and data are available on-line at http://nadp.sws.uiuc.edu.

In addition to the eight acid deposition monitors, there are two NADP Mercury Deposition Network (MDN) sites in Virginia: Harcum (Gloucester County), and Big Meadows (Shenandoah National Park). MDN site information and data are available on-line at http://nadp.sws.uiuc.edu/mdn.



In 2008, the Office of Air Quality Monitoring (AQM) program of the Department of Environmental Quality operated two Photochemical Assessment Monitoring stations (PAMS) at Corbin in Caroline County, and the MathScience Innovation Center (MSIC) in Henrico County. Additionally, 24-hour PAMS Volatile Organic Compounds (VOC) samples were collected from two core Air Toxics Monitoring Network (ATMN) sites located on the property of the DEQ Tidewater Regional Office (TRO) in Virginia Beach, and Lee District Park in Fairfax County, using a one in six day sampling schedule.

Corbin was operated all year as a PAMS Type I site, collecting 24-hour VOC samples every six days. A Type I site measures upwind background ozone precursor concentrations. In addition, 3-hour episodic sampling was conducted on days forecasted to be high ozone alert days for the Washington-Baltimore area during the period of June to August in the summer.

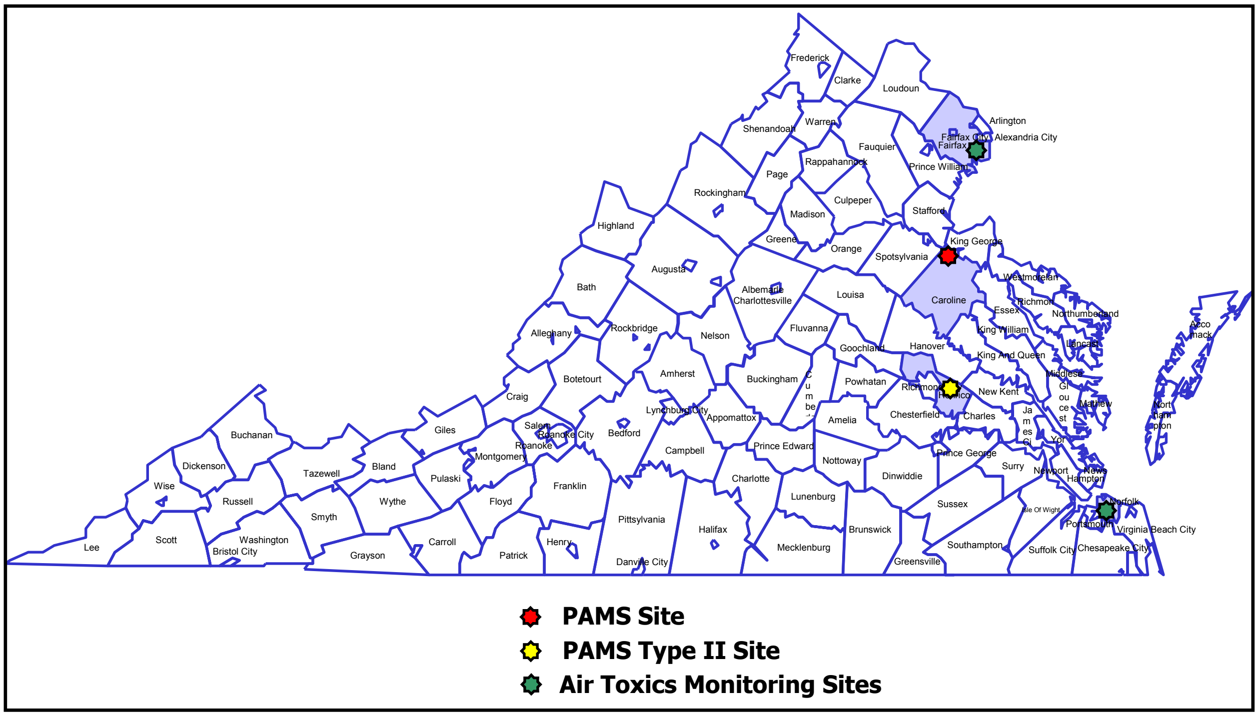
The MathScience Innovation Center monitoring station was operated as a revised PAMS Type II site during the 2008 season, collecting one 24-hour VOC canister sample every six days until June 30th when the MSIC was discontinued as an Air Toxics Monitoring Network site. A Type II site measures maximum ozone precursor concentrations in the primary downwind direction on days conducive to ozone formation. Hourly samples were collected using an Auto Gas Chromatograph during peak ozone season (months of June, July and August).

AQM used the manual method for collecting ambient air samples. This method involves the collection of integrated, whole samples by using evacuated Summa[T] canisters and RMESI (RM Environmental Systems, Inc.) air samplers. Each VOC sample from Corbin was analyzed by the Division of Consolidated Laboratory Services using a Gas Chromatograph/Flame Ionization Detector. Samples from MathScience Innovation Center, Lee District Park, and TRO were analyzed by the Maryland Department of the Environment, Air and Radiation Management Administration, using a Gas Chromatograph/Flame Ionization Detector.

All VOC samples were analyzed for the presence of fifty-six target volatile organic precursors, and the measured concentration of Total Nonmethane Organic Compounds (TNMOC).

Detailed PAMS data are available upon written request to the Virginia Department of Environmental Quality, Office of Air Quality Monitoring.

Photochemical Assessment Monitoring Network



2008 Average Concentration of Detectable Volatile Ozone Precursors
Photochemical Assessment Monitoring Station (PAMS) Type I - Corbin, VA

Concentrations are in ppbC

(non detects are counted as zeros for statistical purposes)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
43141	n-dodecane	59	0.00	16.54	0.11	0.513	2.156
43202	Ethane	59	0.42	13.88	4.48	5.065	3.160
43203	Ethylene	59	0.00	13.19	0.63	1.312	2.404
43204	Propane	59	0.56	9.06	3.08	3.701	2.112
43205	Propylene	59	0.00	1.33	0.30	0.341	0.268
43206	Acetylene	59	0.00	22.60	2.41	3.459	3.814
43212	n-butane	59	0.12	5.83	1.53	1.853	1.407
43214	Isobutane	59	0.00	1.54	0.23	0.273	0.230
43216	t-2-butene	59	0.00	1.67	0.01	0.109	0.337
43217	c-2-butene	59	0.00	1.43	0.00	0.165	0.408
43220	n-pentane	59	0.00	2.17	1.16	1.105	0.572
43221	Isopentane	59	0.00	4.14	0.79	1.056	0.862
43224	1-pentene	59	0.00	4.85	0.41	0.968	1.360
43226	t-2-pentene	59	0.00	2.80	0.00	0.111	0.377
43227	c-2-pentene	59	0.00	3.21	0.00	0.111	0.430
43230	3-methylpentane	59	0.00	1.73	0.21	0.292	0.321
43231	n-hexane	59	0.00	0.68	0.13	0.135	0.128
43232	n-heptane	59	0.00	0.58	0.24	0.231	0.174
43233	n-octane	59	0.00	0.38	0.00	0.102	0.128
43235	n-nonane	59	0.00	0.83	0.35	0.323	0.269
43238	n-decane	59	0.00	2.65	0.45	0.600	0.490
43242	Cyclopentane	59	0.00	0.52	0.02	0.063	0.102
43243	Isoprene	59	0.00	22.25	1.14	3.345	5.145
43244	2,2-dimethylbutane	59	0.00	0.45	0.05	0.093	0.125
43245	1-hexene	59	0.00	2.65	0.16	0.357	0.482
43247	2,4-dimethylpentane	59	0.00	0.46	0.12	0.118	0.128
43248	Cyclohexane	59	0.00	2.10	0.69	0.808	0.447
43249	3-methylhexane	59	0.00	1.88	0.30	0.506	0.479
43250	2,2,4-trimethylpentane	59	0.00	0.66	0.26	0.245	0.152
43252	2,3,4-trimethylpentane	59	0.00	0.21	0.00	0.013	0.042
43253	3-methylheptane	59	0.00	1.01	0.07	0.152	0.206
43261	Methylcyclohexane	59	0.00	0.38	0.00	0.029	0.072
43262	Methylcyclopentane	59	0.00	0.91	0.25	0.262	0.205
43263	2-methylhexane	59	0.00	0.92	0.08	0.144	0.181
43280	1-butene	59	0.00	3.09	0.63	0.840	0.652
43284	2,3-dimethylbutane	59	0.00	0.35	0.05	0.083	0.093
43285	2-methylpentane	59	0.00	0.94	0.27	0.275	0.199
43291	2,3-dimethylpentane	59	0.00	0.36	0.03	0.057	0.076
43954	n-undecane	59	0.00	1.66	0.00	0.124	0.244
43960	2-methylheptane	59	0.00	0.58	0.00	0.049	0.116
45109	m/p-xylene	59	0.00	1.32	0.30	0.371	0.300
45201	Benzene	59	0.00	0.17	0.00	0.021	0.046
45202	Toluene	59	0.19	2.59	0.79	0.868	0.517
45203	Ethylbenzene	59	0.00	0.46	0.06	0.106	0.127
45204	o-xylene	59	0.00	2.55	0.67	0.749	0.527
45207	1,3,5-trimethylbenzene	59	0.00	0.25	0.00	0.020	0.045
45208	1,2,4-trimethylbenzene	59	0.00	1.56	0.10	0.165	0.265
45209	n-propylbenzene	59	0.00	0.53	0.00	0.055	0.100
45210	Isopropylbenzene	59	0.00	0.19	0.00	0.007	0.033
45211	o-ethyltoluene	59	0.00	2.17	0.29	0.355	0.381
45212	m-ethyltoluene	59	0.00	2.23	0.63	0.678	0.454
45213	p-ethyltoluene	59	0.00	0.57	0.12	0.154	0.156
45218	m-diethylbenzene	59	0.00	0.71	0.00	0.145	0.211
45219	p-diethylbenzene	59	0.00	1.11	0.00	0.053	0.157
45220	Styrene	59	0.00	1.05	0.09	0.179	0.247
45225	1,2,3-trimethylbenzene	59	0.00	5.83	1.59	1.744	1.276
43000	**PAMHC**	59	12.89	74.47	31.72	34.187	12.608
43102	**TNMOC**	59	20.41	105.79	51.44	52.905	16.174

2008 Average Concentration of Detectable Volatile Ozone Precursors Photochemical Assessment Monitoring Station (PAMS) Type II – MathScience Innovation Ctr. (Concentrations are in ppbC)

(non detects are counted as zeros for statistical purposes)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
43141	n-dodecane	31	0.03	1.94	0.17	0.394	0.505
43202	Ethane	31	3.44	21.97	7.53	9.010	4.984
43203	Ethylene	31	0.82	4.69	1.42	1.806	0.997
43204	Propane	31	2.65	15.24	5.36	6.550	3.440
43205	Propylene	31	0.38	2.05	0.71	0.803	0.346
43206	Acetylene	31	0.66	3.55	1.52	1.568	0.735
43212	n-butane	31	0.86	12.83	3.56	4.056	2.877
43214	Isobutane	31	0.64	4.07	1.17	1.543	0.851
43216	t-2-butene	31	0.03	0.25	0.06	0.084	0.055
43217	c-2-butene	31	0.02	0.20	0.06	0.077	0.045
43220	n-pentane	31	0.95	4.43	1.56	1.782	0.780
43221	Isopentane	31	1.24	8.65	2.23	2.820	1.593
43224	1-pentene	31	0.13	0.59	0.21	0.226	0.095
43226	t-2-pentene	31	0.08	0.79	0.18	0.236	0.166
43227	c-2-pentene	31	0.03	0.28	0.07	0.091	0.060
43230	3-methylpentane	31	0.31	2.37	0.57	0.662	0.402
43231	n-hexane	31	0.35	2.96	0.75	0.818	0.508
43232	n-heptane	31	0.17	1.35	0.33	0.398	0.233
43233	n-octane	31	0.09	0.64	0.16	0.208	0.135
43235	n-nonane	31	0.08	0.64	0.16	0.213	0.122
43238	n-decane	31	0.07	0.89	0.19	0.247	0.186
43242	Cyclopentane	31	0.07	0.51	0.13	0.159	0.103
43243	Isoprene	31	0.03	8.56	0.12	1.349	2.475
43244	2,2-dimethylbutane	31	0.09	0.46	0.16	0.175	0.073
43245	1-Hexene	31	0.05	0.17	0.08	0.085	0.031
43247	2,4-dimethylpentane	31	0.06	0.60	0.11	0.146	0.108
43248	Cyclohexane	31	0.06	0.61	0.14	0.159	0.102
43249	3-methylhexane	31	0.26	1.23	0.66	0.644	0.283
43250	2,2,4-trimethylpentane	31	0.29	3.61	0.64	0.832	0.683
43252	2,3,4-trimethylpentane	31	0.11	1.41	0.23	0.315	0.260
43253	3-methylheptane	31	0.00	0.48	0.10	0.132	0.103
43261	Methylcyclohexane	31	0.09	0.78	0.19	0.222	0.132
43262	Methylcyclopentane	31	0.23	1.89	0.50	0.564	0.317
43263	2-methylhexane	31	0.31	1.90	0.51	0.647	0.321
43280	1-butene	31	0.10	0.31	0.14	0.165	0.061
43284	2,3-dimethylbutane	31	0.00	1.03	0.20	0.265	0.190
43285	2-methylpentane	31	0.58	4.35	1.33	1.615	0.824
43291	2,3-dimethylpentane	31	0.07	0.71	0.16	0.194	0.125
43954	n-undecane	31	0.06	0.78	0.15	0.216	0.152
43960	2-methylheptane	31	0.08	0.57	0.15	0.193	0.116
45109	m/p-xylene	31	0.36	3.38	0.85	0.980	0.606
45201	Benzene	31	0.70	2.83	1.13	1.301	0.456
45202	Toluene	31	1.02	7.90	2.14	2.472	1.621
45203	Ethylbenzene	31	0.13	1.18	0.31	0.355	0.207
45204	o-xylene	31	0.13	1.21	0.29	0.347	0.218
45207	1,3,5-trimethylbenzene	31	0.06	0.75	0.15	0.202	0.141
45208	1,2,4-trimethylbenzene	31	0.17	1.63	0.37	0.486	0.305
45209	n-propylbenzene	31	0.04	0.45	0.13	0.151	0.092
45210	Isopropylbenzene	31	0.02	0.21	0.04	0.050	0.041
45211	o-ethyltoluene	31	0.02	0.42	0.05	0.086	0.085
45212	m-ethyltoluene	31	0.10	1.15	0.26	0.315	0.208
45213	p-ethyltoluene	31	0.07	0.78	0.21	0.272	0.175
45218	m-diethylbenzene	31	0.00	0.35	0.07	0.082	0.064
45219	p-diethylbenzene	31	0.02	0.44	0.10	0.111	0.083
45220	Styrene	31	0.00	0.72	0.16	0.176	0.140
45225	1,2,3-trimethylbenzene	31	0.04	0.53	0.12	0.133	0.095
43000	**PAMHC**	31	25.63	131.64	43.33	49.189	22.064
43102	**TNMOC**	31	44.59	210.30	75.33	82.977	34.187

2008 Average Concentration of Detectable Volatile Ozone Precursors
Lee District Park

Concentrations are in ppbC
(non detects are counted as zeros for statistical purposes)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
43141	n-dodecane	59	0.03	0.41	0.13	0.140	0.075
43202	Ethane	59	2.20	21.27	5.98	7.278	4.011
43203	Ethylene	59	0.67	6.23	1.28	1.610	0.995
43204	Propane	59	1.68	13.01	4.59	5.031	2.607
43205	Propylene	59	0.30	2.14	0.61	0.727	0.366
43206	Acetylene	59	0.51	5.41	1.11	1.455	0.910
43212	n-butane	59	0.51	9.03	2.11	2.692	1.818
43214	Isobutane	59	0.38	4.15	1.10	1.288	0.778
43216	t-2-butene	59	0.00	0.19	0.04	0.055	0.038
43217	c-2-butene	59	0.03	0.19	0.04	0.056	0.035
43220	n-pentane	59	0.47	4.50	1.45	1.600	0.813
43221	Isopentane	59	0.69	4.79	1.82	2.041	0.924
43224	1-pentene	59	0.10	0.36	0.17	0.186	0.059
43226	t-2-pentene	59	0.05	0.43	0.10	0.123	0.070
43227	c-2-pentene	59	0.02	0.19	0.05	0.057	0.032
43230	3-methylpentane	59	0.22	1.32	0.50	0.542	0.237
43231	n-hexane	59	0.24	1.81	0.63	0.706	0.329
43232	n-heptane	59	0.14	0.74	0.31	0.356	0.158
43233	n-octane	59	0.05	0.45	0.14	0.165	0.078
43235	n-nonane	59	0.05	0.44	0.15	0.163	0.076
43238	n-decane	59	0.04	0.54	0.15	0.183	0.101
43242	Cyclopentane	59	0.03	0.26	0.11	0.113	0.052
43243	Isoprene	59	0.02	29.87	0.17	3.061	5.725
43244	2,2-dimethylbutane	59	0.06	0.36	0.14	0.150	0.065
43245	1-Hexene	59	0.04	0.17	0.07	0.074	0.027
43247	2,4-dimethylpentane	59	0.05	0.39	0.11	0.126	0.067
43248	Cyclohexane	59	0.05	0.36	0.11	0.128	0.065
43249	3-methylhexane	59	0.24	1.04	0.41	0.451	0.170
43250	2,2,4-trimethylpentane	59	0.18	1.72	0.60	0.651	0.332
43252	2,3,4-trimethylpentane	59	0.07	0.59	0.23	0.248	0.118
43253	3-methylheptane	59	0.00	0.25	0.09	0.097	0.051
43261	Methylcyclohexane	59	0.07	0.46	0.18	0.195	0.091
43262	Methylcyclopentane	59	0.20	1.08	0.41	0.444	0.173
43263	2-methylhexane	59	0.11	0.92	0.46	0.491	0.193
43280	1-butene	59	0.04	0.43	0.12	0.144	0.079
43284	2,3-dimethylbutane	59	0.08	0.52	0.19	0.208	0.100
43285	2-methylpentane	59	0.33	2.56	1.23	1.295	0.513
43291	2,3-dimethylpentane	59	0.06	0.45	0.15	0.175	0.083
43954	n-undecane	59	0.12	0.65	0.28	0.293	0.132
43960	2-methylheptane	59	0.07	0.33	0.14	0.152	0.059
45109	m/p-xylene	59	0.22	2.27	0.79	0.882	0.436
45201	Benzene	59	0.52	3.10	0.94	1.095	0.487
45202	Toluene	59	0.66	5.25	1.95	2.090	0.960
45203	Ethylbenzene	59	0.09	0.76	0.28	0.304	0.138
45204	o-xylene	59	0.08	0.84	0.28	0.301	0.150
45207	1,3,5-trimethylbenzene	59	0.00	0.43	0.14	0.158	0.084
45208	1,2,4-trimethylbenzene	59	0.11	1.02	0.34	0.382	0.189
45209	n-propylbenzene	59	0.03	0.26	0.09	0.101	0.044
45210	Isopropylbenzene	59	0.00	0.19	0.04	0.049	0.028
45211	o-ethyltoluene	59	0.02	0.42	0.06	0.092	0.089
45212	m-ethyltoluene	59	0.07	0.67	0.25	0.275	0.139
45213	p-ethyltoluene	59	0.05	0.79	0.21	0.254	0.148
45218	m-diethylbenzene	59	0.03	0.15	0.05	0.060	0.027
45219	p-diethylbenzene	59	0.03	0.23	0.08	0.088	0.042
45220	Styrene	59	0.07	0.71	0.16	0.184	0.107
45225	1,2,3-trimethylbenzene	59	0.03	0.34	0.10	0.117	0.058
43000	**PAMHC**	59	17.08	102.18	36.54	41.381	16.838
43102	**TNMOC**	59	34.83	169.64	66.57	69.174	24.720

2008 Average Concentration of Detectable Volatile Ozone Precursors Photochemical Assessment Monitoring Station Additional VOC PAMS Sampling - Tidewater Regional Office (TRO)

Concentrations are in ppbC

(non detects are counted as zeros for statistical purposes)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
43141	n-dodecane	60	0.03	0.77	0.12	0.189	0.158
43202	Ethane	60	1.56	17.22	6.45	6.873	3.392
43203	Ethylene	60	0.48	8.13	1.73	2.035	1.384
43204	Propane	60	0.85	51.21	6.77	8.803	7.854
43205	Propylene	60	0.25	3.65	0.93	1.096	0.763
43206	Acetylene	60	0.44	5.93	1.31	1.575	0.982
43212	n-butane	60	0.49	11.28	2.54	3.411	2.301
43214	Isobutane	60	0.30	5.59	1.54	1.718	1.098
43216	t-2-butene	60	0.03	0.63	0.10	0.139	0.120
43217	c-2-butene	60	0.03	0.54	0.09	0.125	0.103
43220	n-pentane	60	0.61	5.45	1.88	2.139	1.133
43221	Isopentane	60	1.09	10.02	2.98	3.590	2.085
43224	1-pentene	60	0.10	1.27	0.33	0.369	0.230
43226	t-2-pentene	60	0.08	1.06	0.29	0.342	0.197
43227	c-2-pentene	60	0.03	0.52	0.10	0.131	0.099
43230	3-methylpentane	60	0.21	2.43	0.65	0.799	0.467
43231	n-hexane	60	0.23	3.47	0.96	1.117	0.656
43232	n-heptane	60	0.12	1.61	0.51	0.547	0.300
43233	n-octane	60	0.07	0.92	0.23	0.264	0.174
43235	n-nonane	60	0.06	0.77	0.20	0.237	0.153
43238	n-decane	60	0.06	0.84	0.20	0.247	0.167
43242	Cyclopentane	60	0.00	0.54	0.15	0.184	0.115
43243	Isoprene	60	0.02	7.84	0.28	1.261	1.705
43244	2,2-dimethylbutane	60	0.06	0.58	0.17	0.196	0.105
43245	1-Hexene	60	0.03	0.81	0.09	0.125	0.135
43247	2,4-dimethylpentane	60	0.00	0.60	0.14	0.189	0.126
43248	Cyclohexane	60	0.05	0.63	0.19	0.224	0.138
43249	3-methylhexane	60	0.24	1.45	0.59	0.623	0.247
43250	2,2,4-trimethylpentane	60	0.19	3.25	0.71	0.935	0.614
43252	2,3,4-trimethylpentane	60	0.08	1.17	0.26	0.333	0.213
43253	3-methylheptane	60	0.00	0.48	0.11	0.150	0.092
43261	Methylcyclohexane	60	0.00	0.86	0.25	0.289	0.172
43262	Methylcyclopentane	60	0.23	1.88	0.61	0.668	0.354
43263	2-methylhexane	60	0.14	2.33	0.68	0.767	0.383
43280	1-butene	60	0.07	0.79	0.22	0.268	0.177
43284	2,3-dimethylbutane	60	0.08	0.98	0.25	0.329	0.206
43285	2-methylpentane	60	0.62	4.94	1.72	1.874	0.899
43291	2,3-dimethylpentane	60	0.05	0.82	0.22	0.272	0.165
43954	n-undecane	60	0.05	1.17	0.30	0.371	0.241
43960	2-methylheptane	60	0.07	0.63	0.20	0.218	0.112
45109	m/p-xylene	60	0.22	5.31	1.21	1.412	0.871
45201	Benzene	60	0.45	6.39	1.37	1.563	1.036
45202	Toluene	60	0.78	10.00	2.90	3.324	1.887
45203	Ethylbenzene	60	0.10	1.59	0.41	0.464	0.273
45204	o-xylene	60	0.09	1.69	0.39	0.472	0.288
45207	1,3,5-trimethylbenzene	60	0.07	0.74	0.18	0.220	0.135
45208	1,2,4-trimethylbenzene	60	0.11	2.06	0.52	0.580	0.360
45209	n-propylbenzene	60	0.04	0.45	0.14	0.156	0.082
45210	Isopropylbenzene	60	0.02	0.52	0.05	0.063	0.065
45211	o-ethyltoluene	60	0.03	0.23	0.07	0.084	0.051
45212	m-ethyltoluene	60	0.10	1.23	0.33	0.389	0.227
45213	p-ethyltoluene	60	0.06	0.88	0.29	0.320	0.197
45218	m-diethylbenzene	60	0.02	0.67	0.09	0.094	0.087
45219	p-diethylbenzene	60	0.03	0.46	0.12	0.126	0.073
45220	Styrene	60	0.04	0.98	0.24	0.249	0.149
45225	1,2,3-trimethylbenzene	60	0.03	0.56	0.14	0.175	0.116
43000	**PAMHC**	60	19.08	120.54	52.50	54.710	25.248
43102	**TNMOC**	60	38.45	201.66	94.13	90.701	37.506

In 2008, the Office of Air Quality Monitoring (AQM) of the Department of Environmental Quality (DEQ) operated three Air Toxics Monitoring Network (ATMN) stations. These sites were located at the MathScience Innovation Center (MSIC) in Henrico County, DEQ Tidewater Regional Office (TRO) in Virginia Beach, and Lee District Park in Fairfax County. Sampling at these sites consisted of Volatile Organic Compounds (VOC), Carbonyls, and Metals. The ATMN program at the MSIC site was discontinued as of June 30th of this year in order to allow the site to be converted into a National Air Toxics Trends Site (NATTS).

The ATMN sites had a sampling schedule consisting of 24-hour samples collected every 6th day. Data from these sites will be used to characterize air toxics concentrations in the respective urban areas.

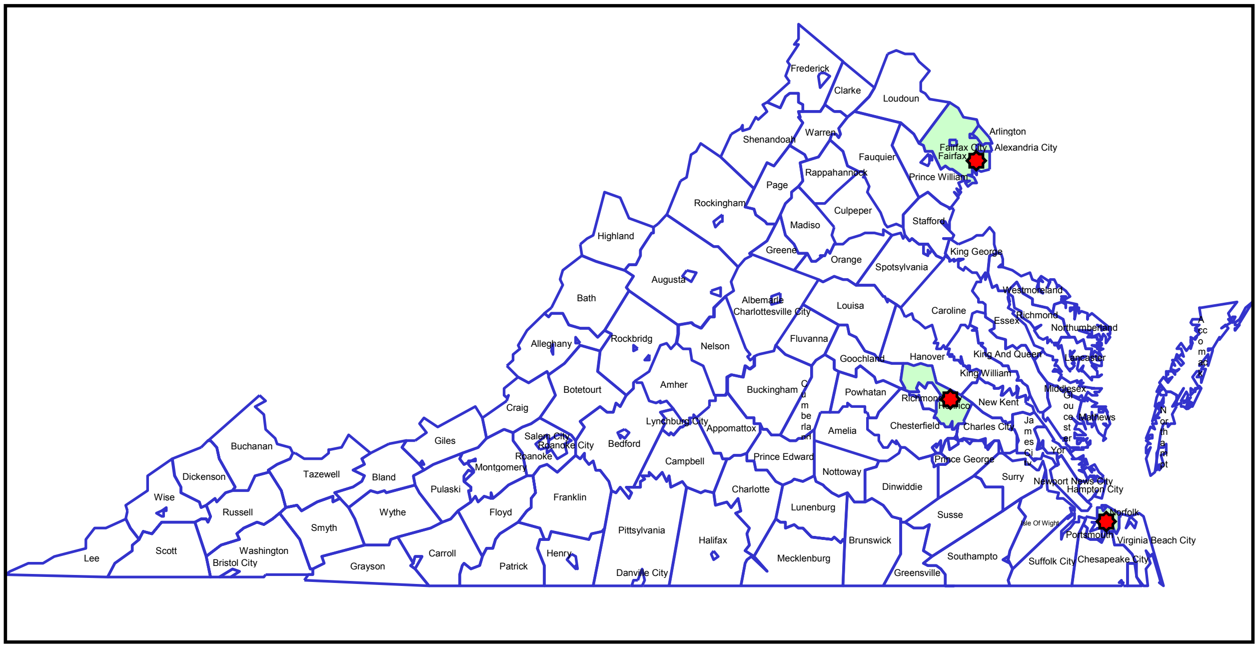
AQM used the manual method for collecting ambient air samples for VOC analysis. Whole air samples were collected using evacuated SilcoT canisters and RMESI (RM Environmental Systems, Inc.) air samplers. Each sample was analyzed by the Maryland Department of the Environment, Air and Radiation Management Administration, using a Gas Chromatograph equipped with a Mass Selective Detector, using method TO15.

Carbonyls were collected on DNPH (2,4-Dinitrophenylhydrazine) treated sorbent tubes using ATEC 8000 cartridge samplers. Samples were analyzed by the Philadelphia Health Department using a Liquid Chromatographic procedure, using method TO11A.

The Metals were collected using a high volume Total Suspended Particulate (TSP) sampler. Samples were analyzed by the Division of Consolidated Laboratory Services (DCLS). Analysis utilized inductively coupled plasma mass spectrometry (ICP-MS) using method IO-3.1 and IO-3.5.

Detailed data collected at these sites in 2008 are available upon written request to the Virginia Department of Environmental Quality, Office of Air Quality Monitoring.

Air Toxics Monitoring Network



Detectable VOC in 24-Hour Canister Samples
GC/MSD - MathScience Innovation Center - Henrico County, VA
January 1 to June 30, 2008- Concentrations are in ppbV

(non detects are counted as zeros for statistical purposes)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
42153	Carbon Disulfide	31	0.01	0.92	0.04	0.107	0.184
43207	Freon 113	31	0.08	0.11	0.09	0.091	0.008
43208	Freon 114	31	0.01	0.03	0.02	0.020	0.003
43209	Ethyl Acetate	31	0.00	0.24	0.01	0.042	0.062
43218	1,3-Butadiene	31	0.00	0.11	0.03	0.035	0.028
43231	Hexane	31	0.04	0.44	0.09	0.109	0.076
43232	Heptane	31	0.02	0.22	0.04	0.053	0.040
43248	Cyclohexane	31	0.00	0.07	0.02	0.022	0.019
43312	Isopropyl Alcohol	31	0.00	1.50	0.41	0.469	0.313
43372	2-Methoxy-2-Methyl-Propane	31	0.00	0.03	0.01	0.007	0.007
43505	Acrolein	31	0.00	0.40	0.20	0.183	0.099
43551	Acetone	31	1.87	8.63	3.85	4.137	1.851
43552	Methyl ethyl Ketone (2-butanone)	31	0.20	1.10	0.38	0.434	0.184
43559	Methyl butyl Ketone (2-hexanone)	31	0.00	0.07	0.03	0.030	0.021
43560	Methyl isobutyl Ketone	31	0.00	0.14	0.00	0.012	0.027
43801	Chloromethane	31	0.60	0.80	0.66	0.666	0.050
43802	Dichloromethane	31	0.06	0.30	0.08	0.095	0.046
43803	Chloroform	31	0.01	0.03	0.02	0.017	0.006
43804	Carbon Tetrachloride	31	0.08	0.11	0.09	0.092	0.009
43806	Bromoform (Tribromomethane)	31	0.00	0.00	0.00	0.000	0.000
43811	Trichlorofluoromethane	31	0.24	0.42	0.27	0.280	0.035
43812	Chloroethane	31	0.00	0.04	0.01	0.014	0.012
43813	1,1-Dichloroethane	31	0.00	0.01	0.00	0.000	0.002
43814	Methyl chloroform	31	0.01	0.02	0.01	0.011	0.003
43815	Ethylene dichloride	31	0.01	0.02	0.01	0.011	0.003
43817	Tetrachloroethylene	31	0.00	0.13	0.02	0.025	0.022
43818	1,1,2,2-Tetrachloroethane	31	0.00	0.00	0.00	0.000	0.000
43819	Bromomethane	31	0.00	0.02	0.01	0.010	0.008
43820	1,1,2-Trichloroethane	31	0.00	0.01	0.00	0.000	0.002
43823	Dichlorodifluoromethane	31	0.53	0.70	0.59	0.589	0.038
43824	Trichloroethylene	31	0.00	0.01	0.00	0.002	0.004
43826	1,1-Dichloroethylene	31	0.00	0.01	0.00	0.000	0.002
43828	Bromodichloromethane	31	0.00	0.01	0.00	0.001	0.002
43829	1,2-Dichloropropane	31	0.00	0.01	0.00	0.000	0.002
43830	trans-1,3-Dichlopropylene	31	0.00	0.01	0.00	0.000	0.002
43831	cis-1,3-Dichlopropylene	31	0.00	0.02	0.00	0.001	0.004
43832	Dibrochloromethane	31	0.00	0.00	0.00	0.000	0.000
43838	Trans-1,2-Dichlotoethene	31	0.00	0.00	0.00	0.000	0.000
43839	cis-1,2-Dichloroethene	31	0.00	0.00	0.00	0.000	0.000
43843	Ethylene Dibromide	31	0.00	0.00	0.00	0.000	0.000
43844	Hexachlorobutadiene	31	0.00	0.01	0.00	0.002	0.004
43860	Vinyl Chloride	31	0.00	0.01	0.00	0.000	0.002
45109	m/p-Xylene	31	0.03	0.38	0.07	0.085	0.066
45201	Benzene	31	0.08	0.37	0.17	0.188	0.080
45202	Toluene	31	0.12	0.99	0.25	0.295	0.192
45203	Ethylbenzene	31	0.01	0.16	0.03	0.040	0.027
45204	o-Xylene	31	0.01	0.16	0.03	0.035	0.028
45207	1,3,5-Trimethylbenzene	31	0.00	0.05	0.01	0.013	0.011
45208	1,2,4-Trimethylbenzene	31	0.00	0.19	0.03	0.044	0.034
45213	p-Ethyltoluene	31	0.00	0.13	0.02	0.020	0.023
45220	Styrene	31	0.00	0.09	0.02	0.021	0.017
45801	Chlorobenzene	31	0.00	0.01	0.00	0.001	0.003
45805	1,2-Dichlorobenzene	31	0.00	0.01	0.00	0.001	0.003
45806	1,3-Dichlorobenzene	31	0.00	0.01	0.00	0.001	0.003
45807	1,4-Dichlorobenzene	31	0.00	0.06	0.01	0.016	0.015
45809	Benzyl Chloride	31	0.00	0.02	0.01	0.007	0.007
45810	1,2,4-Trichlorobenzene	31	0.00	0.04	0.00	0.004	0.009
46401	Tetrahydrofuran	31	0.00	0.34	0.00	0.028	0.066

Detectable VOC in 24-Hour Canister Samples
GC/MSD - Lee District Park - Fairfax County, VA
January 1 to December 31, 2008 - Concentrations are in ppbV

(non detects are counted as zeros for statistical purposes)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
42153	Carbon Disulfide	59	0.00	0.35	0.01	0.035	0.057
43207	Freon 113	59	0.08	0.11	0.09	0.091	0.007
43208	Freon 114	59	0.01	0.02	0.02	0.020	0.001
43209	Ethyl Acetate	59	0.00	0.12	0.01	0.016	0.022
43218	1,3-Butadiene	59	0.00	0.08	0.02	0.027	0.022
43231	Hexane	59	0.03	0.26	0.09	0.094	0.046
43232	Heptane	59	0.00	0.10	0.03	0.038	0.020
43248	Cyclohexane	59	0.00	0.07	0.01	0.016	0.016
43312	Isopropyl Alcohol	59	0.09	11.33	0.22	0.476	1.459
43372	2-Methoxy-2-Methyl-Propane	59	0.00	0.02	0.00	0.005	0.006
43505	Acrolein	59	0.00	0.31	0.16	0.162	0.065
43551	Acetone	59	1.38	6.84	2.81	3.267	1.340
43552	Methyl ethyl Ketone (2-butanone)	59	0.03	0.80	0.27	0.310	0.141
43559	Methyl butyl Ketone (2-hexanone)	59	0.00	0.06	0.01	0.008	0.011
43560	Methyl isobutyl Ketone	59	0.00	0.02	0.00	0.001	0.004
43801	Chloromethane	59	0.52	0.70	0.62	0.619	0.040
43802	Dichloromethane	59	0.06	0.16	0.09	0.091	0.023
43803	Chloroform	59	0.01	0.04	0.02	0.021	0.008
43804	Carbon Tetrachloride	59	0.07	0.12	0.09	0.092	0.010
43806	Bromoform (Tribromomethane)	59	0.00	0.01	0.00	0.001	0.002
43811	Trichlorofluoromethane	59	0.24	0.40	0.28	0.282	0.026
43812	Chloroethane	59	0.00	0.05	0.00	0.007	0.011
43813	1,1-Dichloroethane	59	0.00	0.01	0.00	0.000	0.001
43814	Methyl chloroform	59	0.00	0.02	0.01	0.011	0.003
43815	Ethylene dichloride	59	0.00	0.02	0.01	0.010	0.005
43817	Tetrachloroethylene	59	0.01	0.08	0.03	0.031	0.017
43818	1,1,2,2-Tetrachloroethane	59	0.00	0.01	0.00	0.000	0.002
43819	Bromomethane	59	0.00	0.02	0.01	0.007	0.006
43820	1,1,2-Trichloroethane	59	0.00	0.00	0.00	0.000	0.000
43823	Dichlorodifluoromethane	59	0.53	0.69	0.60	0.600	0.037
43824	Trichloroethylene	59	0.00	0.02	0.00	0.006	0.006
43826	1,1-Dichloroethylene	59	0.00	0.06	0.00	0.002	0.009
43828	Bromodichloromethane	59	0.00	0.01	0.00	0.000	0.002
43829	1,2-Dichloropropane	59	0.00	0.01	0.00	0.001	0.003
43830	trans-1,3-Dichlopropylene	59	0.00	0.00	0.00	0.000	0.000
43831	cis-1,3-Dichlopropylene	59	0.00	0.00	0.00	0.000	0.000
43832	Dibrochloromethane	59	0.00	0.00	0.00	0.000	0.000
43838	Trans-1,2-Dichlotoethene	59	0.00	0.01	0.00	0.000	0.001
43839	cis-1,2-Dichloroethene	59	0.00	0.00	0.00	0.000	0.000
43843	Ethylene Dibromide	59	0.00	0.00	0.00	0.000	0.000
43844	Hexachlorobutadiene	59	0.00	0.01	0.00	0.001	0.003
43860	Vinyl Chloride	59	0.00	0.01	0.00	0.000	0.001
45109	m/p-Xylene	59	0.02	0.22	0.06	0.066	0.036
45201	Benzene	59	0.06	0.42	0.16	0.168	0.077
45202	Toluene	59	0.11	0.58	0.22	0.238	0.102
45203	Ethylbenzene	59	0.01	0.08	0.03	0.033	0.014
45204	o-Xylene	59	0.01	0.09	0.02	0.027	0.015
45207	1,3,5-Trimethylbenzene	59	0.00	0.03	0.01	0.007	0.006
45208	1,2,4-Trimethylbenzene	59	0.00	0.09	0.03	0.031	0.017
45213	p-Ethyltoluene	59	0.00	0.04	0.01	0.013	0.009
45220	Styrene	59	0.00	0.05	0.02	0.016	0.009
45801	Chlorobenzene	59	0.00	0.01	0.00	0.001	0.003
45805	1,2-Dichlorobenzene	59	0.00	0.01	0.00	0.001	0.002
45806	1,3-Dichlorobenzene	59	0.00	0.01	0.00	0.000	0.002
45807	1,4-Dichlorobenzene	59	0.00	0.03	0.01	0.007	0.008
45809	Benzyl Chloride	59	0.00	0.02	0.00	0.006	0.007
45810	1,2,4-Trichlorobenzene	59	0.00	0.02	0.00	0.002	0.004
46401	Tetrahydrofuran	59	0.00	0.07	0.00	0.004	0.010

Detectable VOC in 24-Hour Canister Samples
GC/MSD - Tidewater Regional Office (TRO) – Va. Beach, VA
January 1 to December 31, 2008– Concentrations are in ppbV

(non detects are counted as zeros for statistical purposes)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
42153	Carbon Disulfide	60	0.01	0.49	0.05	0.081	0.104
43207	Freon 113	60	0.08	0.13	0.09	0.096	0.010
43208	Freon 114	60	0.01	0.03	0.02	0.020	0.003
43209	Ethyl Acetate	60	0.00	0.14	0.01	0.029	0.035
43218	1,3-Butadiene	60	0.00	0.24	0.04	0.049	0.045
43231	Hexane	60	0.03	0.53	0.13	0.159	0.108
43232	Heptane	60	0.01	0.17	0.05	0.062	0.037
43248	Cyclohexane	60	0.00	0.09	0.02	0.027	0.020
43312	Isopropyl Alcohol	60	0.09	5.66	0.24	0.378	0.711
43372	2-Methoxy-2-Methyl-Propane	60	0.00	0.02	0.01	0.008	0.007
43505	Acrolein	60	0.00	0.53	0.15	0.162	0.092
43551	Acetone	60	1.64	9.42	3.63	4.238	2.091
43552	Methyl ethyl Ketone (2-butanone)	60	0.09	0.82	0.30	0.353	0.181
43559	Methyl butyl Ketone (2-hexanone)	60	0.00	0.08	0.01	0.014	0.019
43560	Methyl isobutyl Ketone	60	0.00	0.19	0.00	0.010	0.026
43801	Chloromethane	60	0.53	1.09	0.67	0.697	0.103
43802	Dichloromethane	60	0.06	0.18	0.10	0.099	0.029
43803	Chloroform	60	0.01	0.06	0.02	0.023	0.011
43804	Carbon Tetrachloride	60	0.08	0.13	0.10	0.098	0.011
43806	Bromoform (Tribromomethane)	60	0.00	0.01	0.00	0.001	0.003
43811	Trichlorofluoromethane	60	0.24	0.38	0.28	0.287	0.031
43812	Chloroethane	60	0.00	0.04	0.01	0.010	0.012
43813	1,1-Dichloroethane	60	0.00	0.01	0.00	0.001	0.003
43814	Methyl chloroform	60	0.01	0.02	0.01	0.012	0.004
43815	Ethylene dichloride	60	0.00	0.02	0.01	0.011	0.005
43817	Tetrachloroethylene	60	0.01	0.74	0.07	0.126	0.147
43818	1,1,2,2-Tetrachloroethane	60	0.00	0.01	0.00	0.001	0.003
43819	Bromomethane	60	0.00	0.03	0.01	0.011	0.009
43820	1,1,2-Trichloroethane	60	0.00	0.01	0.00	0.000	0.001
43823	Dichlorodifluoromethane	60	0.53	0.84	0.61	0.609	0.051
43824	Trichloroethylene	60	0.00	0.01	0.00	0.004	0.005
43826	1,1-Dichloroethylene	60	0.00	0.02	0.00	0.002	0.005
43828	Bromodichloromethane	60	0.00	0.01	0.00	0.001	0.003
43829	1,2-Dichloropropane	60	0.00	0.01	0.00	0.001	0.003
43830	trans-1,3-Dichlopropylene	60	0.00	0.00	0.00	0.000	0.000
43831	cis-1,3-Dichlopropylene	60	0.00	0.01	0.00	0.000	0.001
43832	Dibrochloromethane	60	0.00	0.01	0.00	0.001	0.002
43838	Trans-1,2-Dichlotoethene	60	0.00	0.01	0.00	0.000	0.001
43839	cis-1,2-Dichloroethene	60	0.00	0.01	0.00	0.000	0.001
43843	Ethylene Dibromide	60	0.00	0.00	0.00	0.000	0.001
43844	Hexachlorobutadiene	60	0.00	0.01	0.00	0.002	0.004
43860	Vinyl Chloride	60	0.00	0.01	0.00	0.001	0.002
45109	m/p-Xylene	60	0.02	0.46	0.09	0.114	0.079
45201	Benzene	60	0.07	0.99	0.22	0.246	0.166
45202	Toluene	60	0.09	1.11	0.36	0.404	0.232
45203	Ethylbenzene	60	0.01	0.15	0.05	0.050	0.028
45204	o-Xylene	60	0.01	0.16	0.04	0.045	0.029
45207	1,3,5-Trimethylbenzene	60	0.00	0.06	0.01	0.013	0.010
45208	1,2,4-Trimethylbenzene	60	0.01	0.19	0.04	0.049	0.033
45213	p-Ethyltoluene	60	0.00	0.07	0.02	0.020	0.014
45220	Styrene	60	0.00	0.11	0.03	0.029	0.017
45801	Chlorobenzene	60	0.00	0.01	0.00	0.002	0.004
45805	1,2-Dichlorobenzene	60	0.00	0.01	0.00	0.001	0.003
45806	1,3-Dichlorobenzene	60	0.00	0.01	0.00	0.000	0.001
45807	1,4-Dichlorobenzene	60	0.00	0.03	0.01	0.009	0.007
45809	Benzyl Chloride	60	0.00	0.02	0.01	0.008	0.007
45810	1,2,4-Trichlorobenzene	60	0.00	0.02	0.00	0.002	0.004
46401	Tetrahydrofuran	60	0.00	0.05	0.01	0.004	0.010

24 Hour Carbonyl Sampling 2008 Summary Statistical Analysis

Concentrations are in ppbV

(non detects are counted as zeros for statistical purposes)

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Lee Park	43502	Formaldehyde	60	0.13	7.78	1.81	2.228	1.582
	43503	Acetaldehyde	60	0.05	2.23	1.01	1.065	0.482
	43504	Propionaldehyde	60	0.01	1.01	0.19	0.260	0.198
	43551	Acetone	60	0.09	3.57	1.39	1.555	0.648
	43552	Methyl Ethyl Ketone	60	0.04	0.45	0.23	0.239	0.089
	43560	Methyl Isobutyl Ketone	60	0.00	0.02	0.00	0.003	0.005

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
MathScience Innovation Center	43502	Formaldehyde	30	1.23	6.45	2.41	2.782	1.400
	43503	Acetaldehyde	30	0.51	2.63	0.93	1.036	0.393
	43504	Propionaldehyde	30	0.08	0.43	0.13	0.151	0.069
	43551	Acetone	30	0.87	5.53	1.61	1.887	0.952
	43552	Methyl Ethyl Ketone	30	0.12	0.82	0.24	0.269	0.130
	43560	Methyl Isobutyl Ketone	30	0.00	0.11	0.00	0.008	0.024

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Tidewater Regional Office	43502	Formaldehyde	58	1.06	7.21	2.77	2.969	1.326
	43503	Acetaldehyde	58	0.40	2.30	0.93	1.041	0.440
	43504	Proipionaldehyde	58	0.06	0.35	0.14	0.158	0.072
	43551	Acetone	58	0.53	3.82	1.51	1.664	0.753
	43552	Methyl Ethyl Ketone	58	0.09	0.52	0.23	0.237	0.097
	43560	Methyl Isobutyl Ketone	58	0.00	0.14	0.00	0.009	0.026

TSP Metals Sampling 2008 Summary Statistical Analysis

Concentrations are in ng/m^3

(non detects are counted as zeros for statistical purposes)

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
MathScience Innovation Center	12103	Arsenic	31	0.19	1.75	0.74	0.890	0.415
	12105	Beryllium	31	0.00	0.03	0.01	0.008	0.007
	12110	Cadmium	31	0.00	0.40	0.14	0.148	0.093
	12112	Chromium	31	1.36	2.68	1.82	1.892	0.339
	12128	Lead	31	1.03	12.13	4.08	4.437	2.162
	12132	Manganese	31	1.07	24.27	7.18	9.075	5.521
	12136	Nickel	31	0.65	3.05	1.15	1.249	0.482

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Lee Park	12103	Arsenic	57	0.30	2.84	0.85	0.947	0.458
	12105	Beryllium	57	0.00	0.04	0.00	0.005	0.008
	12110	Cadmium	57	0.03	1.08	0.17	0.223	0.205
	12112	Chromium	57	1.22	3.92	2.01	2.060	0.479
	12128	Lead	57	0.98	6.68	2.83	3.157	1.478
	12132	Manganese	57	2.11	25.27	5.67	6.587	4.238
	12136	Nickel	57	0.63	2.99	1.27	1.329	0.497

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Tidewater Regional Office	12103	Arsenic	60	0.47	16.66	1.14	1.738	2.241
	12105	Beryllium	60	0.00	0.05	0.00	0.006	0.009
	12110	Cadmium	60	0.00	0.38	0.10	0.122	0.072
	12112	Chromium	60	1.31	3.36	2.11	2.190	0.511
	12128	Lead	60	0.92	8.57	3.28	3.697	1.820
	12132	Manganese	60	1.31	16.92	6.35	6.683	3.566
	12136	Nickel	60	0.82	4.12	1.62	1.707	0.682

AQI (Air Quality Index)

What is the AQI?

The air quality index (AQI) is a measurement designed to indicate how clean or polluted the air is in an area, and it also provides information about health effects associated with air pollution. The index is reported daily, or in some cases continuously, and calculated from measured concentrations of five major pollutants regulated by the Clean Air Act: ground-level ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide. EPA has established national ambient air quality standards (NAAQS) for each of these pollutants to protect public health, and the index is derived from the NAAQS. State and local agencies are required to report the AQI in areas where the population is 350,000 or more, although it is often reported in additional areas as a public service.

How does the AQI work?

The AQI range is from 0 to 500, with the low numbers representing good air quality and the high numbers indicating unhealthy, or even hazardous air quality. The index is divided into six categories with coordinating color codes. In addition, each category has a health-related message associated with it, to inform the public of possible health effects that may arise as a result of breathing polluted air.

Generally, an index of 100 corresponds to the national air quality standard for the pollutant, which is the level that EPA has established to protect public health. Levels below 100 are considered satisfactory, while numbers above 100 are considered unhealthy, first for sensitive groups, and then for the general public as the index value increases.

How is the AQI calculated?

The AQI is calculated from air pollution measurements collected at monitoring sites across the country. The reporting agency must calculate an index for each pollutant from the measured concentrations at all monitoring sites in an area using a standard formula developed by EPA. The pollutant with the highest index is reported as the "primary pollutant", and the highest index is reported as the AQI for the area. If the AQI is above 100, then the agency must report which groups may be sensitive to the primary pollutant. If two or more pollutants have indexes above 100, then the agency must report all groups that may be affected by those pollutants.

In Virginia, as well as most of the nation, the pollutants of greatest concern are ground-level ozone, and airborne particulate matter. Currently, the AQI is only reported for those two pollutants in Virginia.

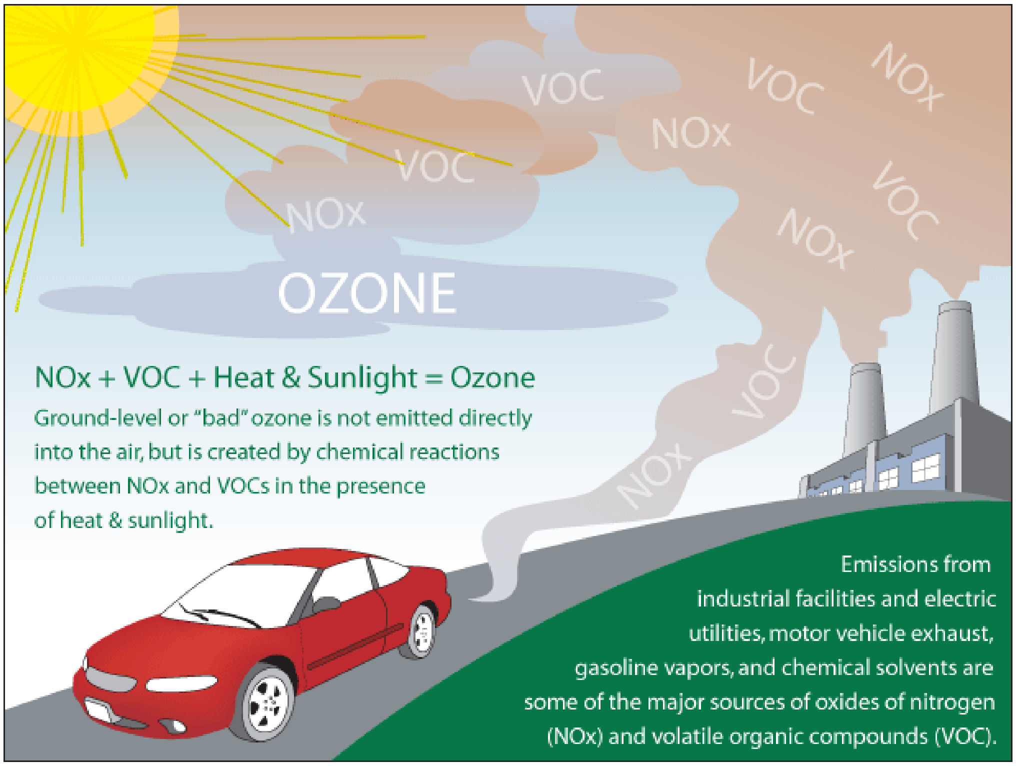
How do I find the AQI for my area?

DEQ reports the air quality index for Roanoke, Winchester, Richmond, Hampton Roads, and Northern Virginia for ozone and particulate matter on the internet at www.deq.virginia.gov/airquality/homepage.html. The AQI for particulate matter is reported year-round and the AQI for ozone is reported during the months of April to October, which is ozone season in Virginia. Air quality forecasts and current ozone data can be obtained at the DEQ site, as well as links to other air quality websites. EPA also reports air quality conditions for the United States at www.airnow.gov.

In addition to the internet, current and forecasted AQI levels are broadcast on local television and radio weather reports in many areas, as well as printed in newspapers. By reaching out to the public using these different media, individuals can plan their activities to reduce exposure during episodes of poor air quality, and they can also take steps to reduce pollution.

For detailed information about the AQI, and on health effects of the pollutants that are included in the AQI, visit www.airnow.gov .

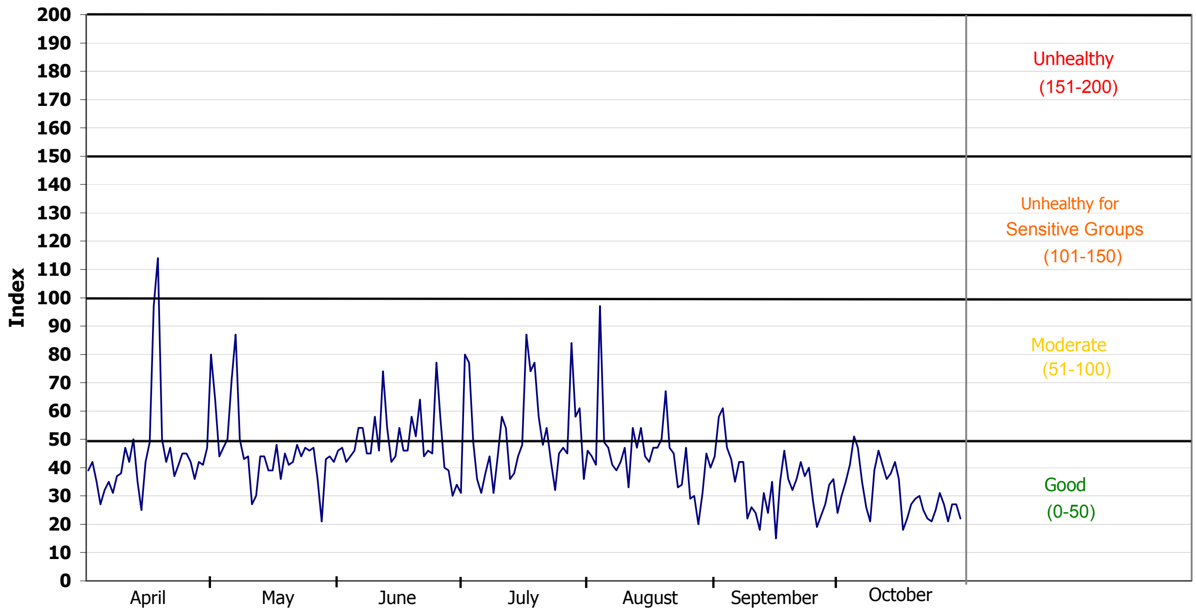
Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0-50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51-100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101-150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151-200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201-300	Health alert: everyone may experience more serious health effects.
Hazardous	> 300	Health warnings of emergency conditions. The entire population is more likely to be affected.



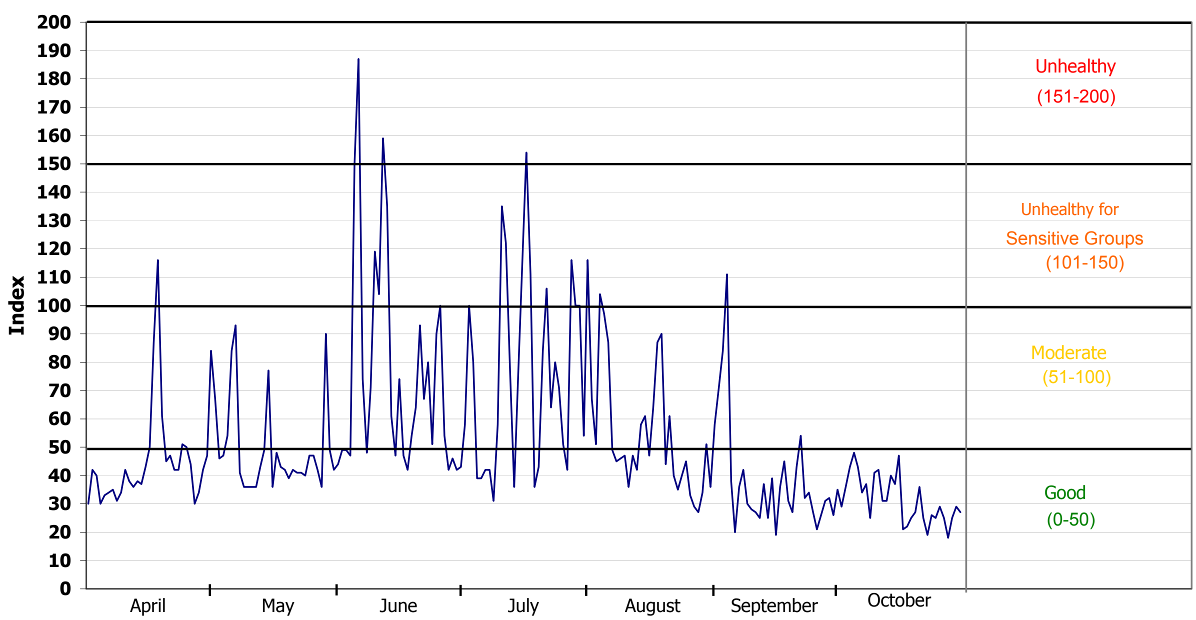
Every day tips:	**Ozone Action Day tips:**
Conserve energy—at home, at work, everywhere.	Conserve electricity and set your air conditioner at a higher temperature.
Defer use of gasoline-powered lawn and garden equipment. Follow gasoline refueling instructions for efficient vapor recovery. Be careful not to spill fuel and always tighten your gas cap securely.	Choose a cleaner commute—share a ride to work or use public transportation. Bicycle or walk to errands when possible.
Keep car, boat, and other engines tuned up according to manufacturers' specification.	Defer use of gasoline-powered lawn and garden equipment.
Be sure your tires are properly inflated.	Refuel cars and trucks after dusk.
Carpool, use public transportation, bike, or walk whenever possible.	Combine errands and reduce trips.
Use environmentally safe paints and cleaning products whenever possible.	Limit engine idling.
Some products that you use at your home or office are made with smog-forming chemicals that can evaporate into the air when you use them. Follow manufacturers' recommendations for use and properly seal cleaners, paints, and other chemicals to prevent evaporation into the air.	Use household, workshop, and garden chemicals in ways that keep evaporation to a minimum, or try to delay using them when poor air quality is forecast.

For more information, please visit these sites:
http://www.epa.gov/otaq/consumer/18-youdo.pdf
www.airnow.gov/index.cfm?action=resources.whatyoucando

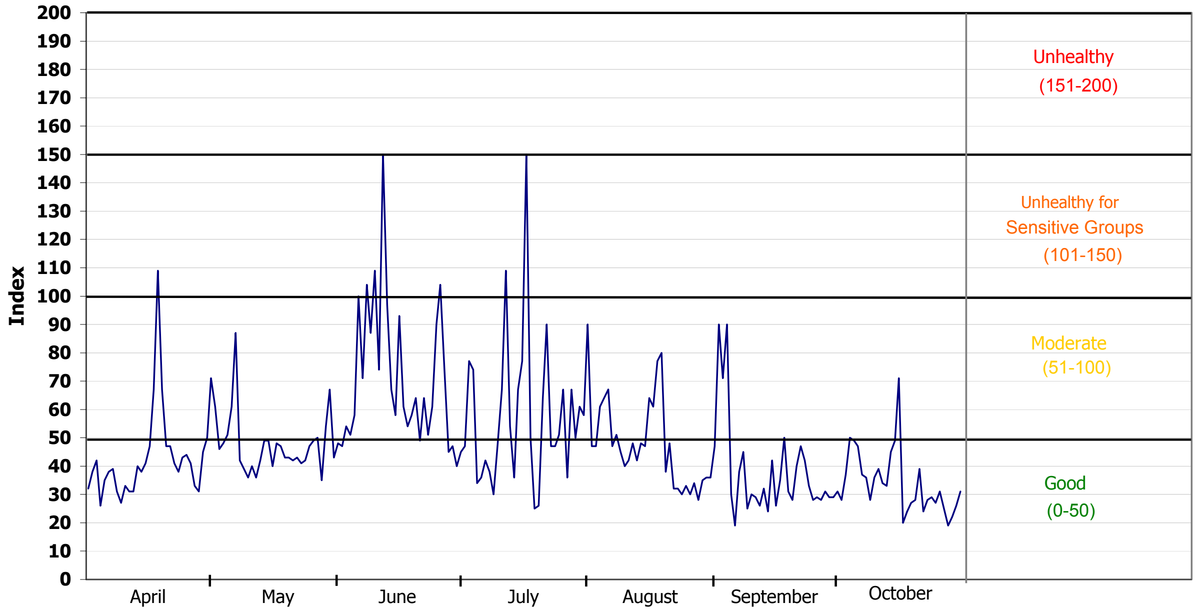
Ozone Air Quality Index
Roanoke Area
2008



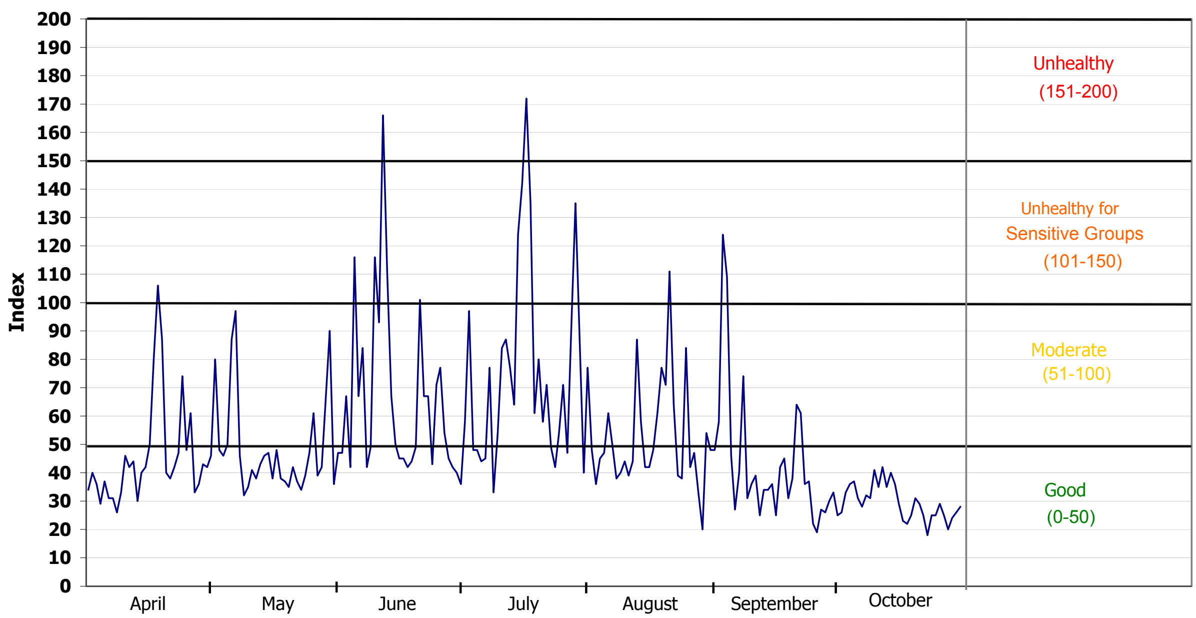
Ozone Air Quality Index
Richmond - Petersburg Areas
2008



Ozone Air Quality Index
Norfolk - Virginia Beach - Newport News Areas
2008



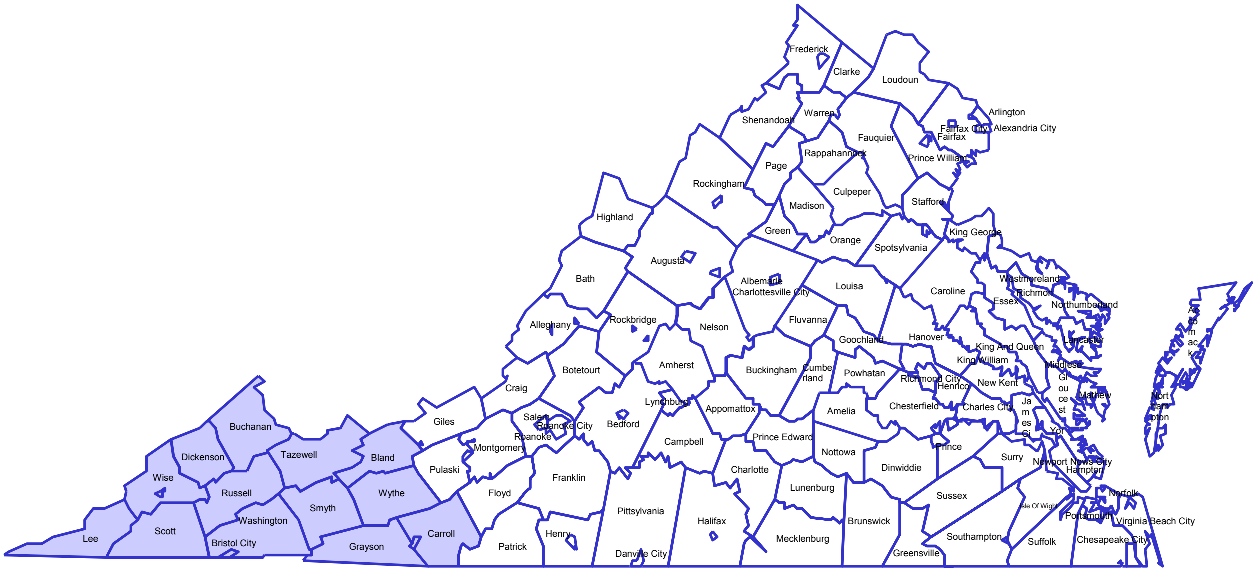
Ozone Air Quality Index
Washington, DC Area
2008



Appendix A

Abbreviation Table

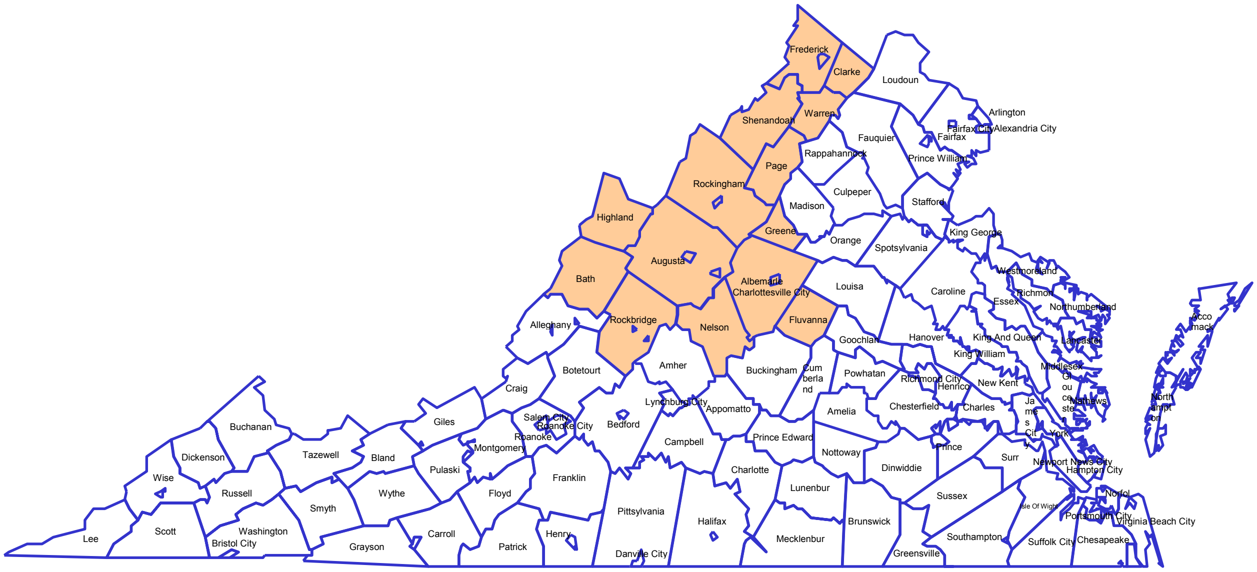
AQM	Air Quality Monitoring
AQCR	Air Quality Control Region
ATMN	Air Toxics Monitoring Network
Avg.	Average
CO	Carbon Monoxide
DEQ	Department of Environmental Quality
EAC	Early Action Compacts
EPA	Environmental Protection Agency
IMPROVE	Interagency Monitoring of Protected Visual Environments
LAT	Latitude
LONG	Longitude
MARAMA	Mid-Atlantic Regional Air Management Association
MET.	Meteorological Instrumentation
MSA	Metropolitan Statistical Area
NA	Not Available
NAMS	National Air Monitoring Stations
NMOC	Non-Methane Organic Compounds
NO_2	Nitrogen Dioxide
NUM	Number of Samples
O_3	Ozone
PAMHC	Total PAMS Hydrocarbon
PAMS	Photochemical Assessment Monitoring Station
PM_{10}	Particulate Matter with an aerodynamic diameter less than or equal to 10 microns
$PM_{2.5}$	Particulate Matter with an aerodynamic diameter less than or equal to 2.5 microns
POLLUT.	Pollutant
ppbC	Part Per Billion of Carbon
ppbv	Part Per Billion by volume
ppm	Part Per Million
SLAMS	State and Local Air Monitoring Station
SO_2	Sulfur Dioxide
STD	Standard
STDEV	Standard Deviation
TEOM	Tapered Element Oscillating Microbalance (a method for continuously measuring $PM_{2.5}$ in ambient air)
TNMOC	Total Nonmethane Organic Compound
ug/m^3	Micrograms per cubic meter
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VOC	Volatile Organic Compounds



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
16-B	O_3	Sewage Disposal Plant	51-197-0002	Rural Retreat Wythe Co.	36° 53′ 35″ -81° 15′ 18″
23-A	PM_{10}	Gladeville Elementary School	51-035-0001	Galax Carroll Co.	36° 42′ 09″ -80° 52′ 48″
101-E	$PM_{2.5}$	Highland View Elementary School	51-520-0006	Bristol	36° 36′ 28″ -82° 09′ 52″

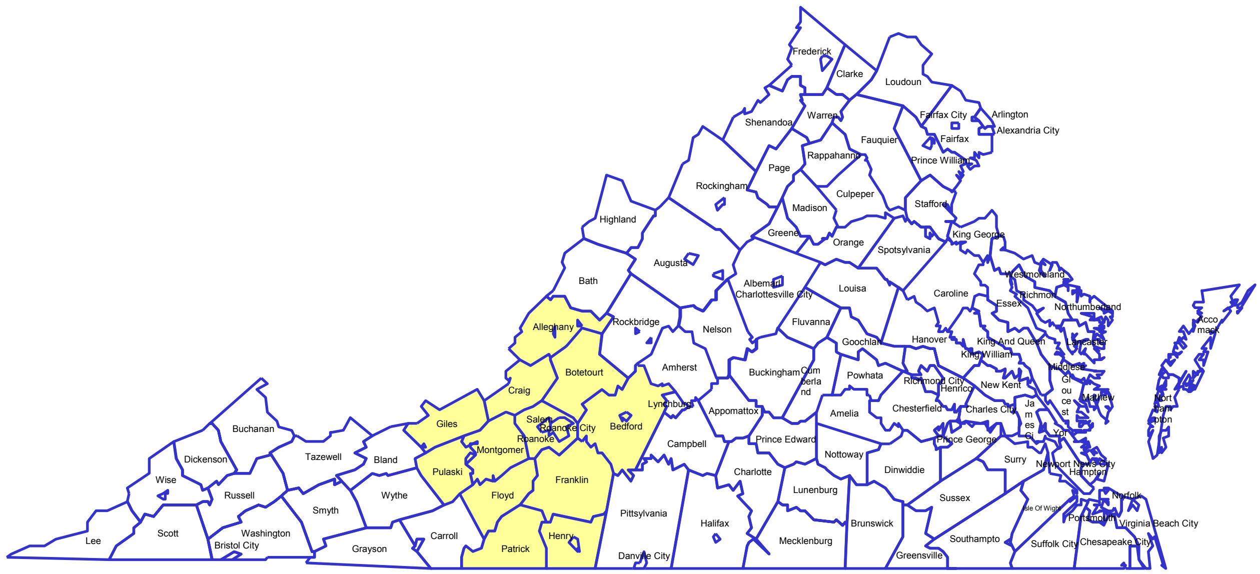
Contact Information for this Region:
Southwest Regional Office
Dallas Sizemore, Director
P.O. Box 1688
355 Deadmore Street
Abingdon, VA 24212
(276) 676-4800

Valley Monitoring Network 2008



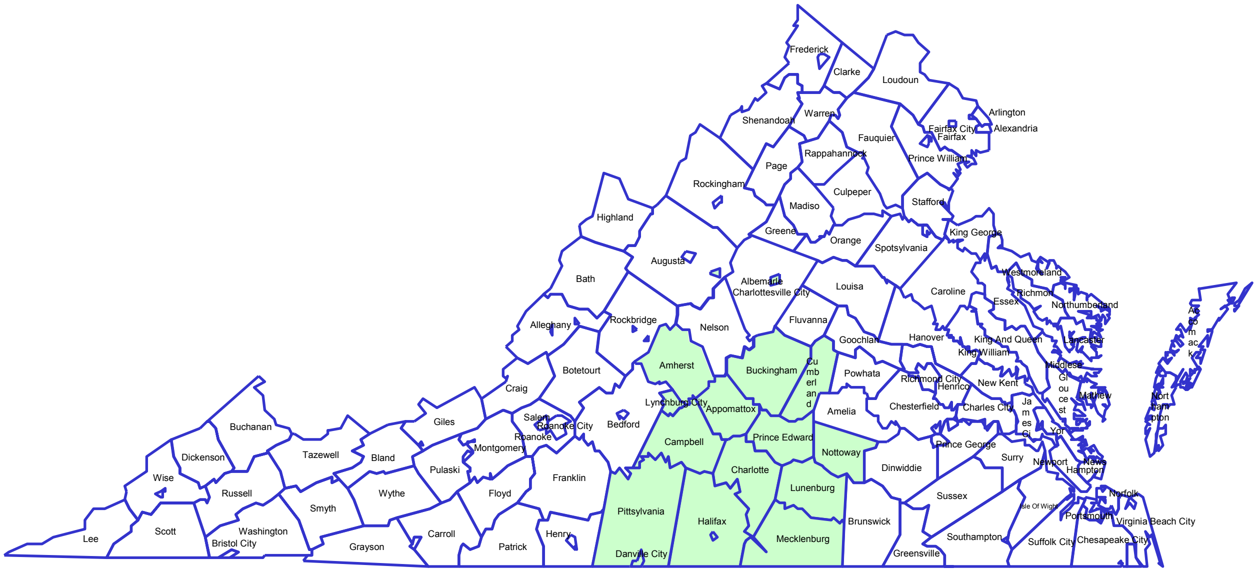
STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
21-C	O_3, IMPROVE	Natural Bridge Ranger Station	51-163-0003	Rockbridge Co.	37° 37′ 34″ -79° 30′ 47″
26-F	$PM_{2.5}$, SO_2, NO_2,O_3	Rockingham VDOT	51-165-0003	Harrisonburg Rockingham Co.	38° 28′ 38″ -78° 49′ 09″
28-J	O_3	Woodbine Road Lester Building Systems	51-069-0010	Rest Frederick Co.	39° 16′ 58″ -78° 04′ 53″
28-L	PM_{10}	Clearbrook 1256 Brucetown Road	51-069-0012	Rest Frederick Co.	39° 16′ 58″ -78° 04′ 53″
29-D	O_3, $PM_{2.5}$	Luray Caverns Airport	51-139-0004	Page Co.	39° 15′ 24″ -78° 05′ 25″
33-A	O_3, $PM_{2.5}$	Albemarle High School	51-003-0001	Albermarle Co.	38° 04′ 35″ -78° 30′ 14″
30-E	PM_{10}	Warren Co. Memorial Hospital 1000 Shenandoah Avenue	51-187-0004	Front Royal Warren Co.	38° 55′ 58″ -78° 11′ 54″
134-C	PM_{10}	Winchester Courts Building	51-840-0002	Winchester	39° 11′ 08″ -78° 09′ 47″

Contact information for this Region:
Valley Regional Office
Amy T. Owens, Director
P.O. Box 3000
4411 Early Road
Harrisonburg, VA 22801
(540) 574-7800



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
19-A6	SO_2, NO_2, O_3	East Vinton Elementary School Ruddell Road	51-161-1004	Vinton Roanoke Co.	37° 17′ 08″ -81° 15′ 18″
109-H	PM_{10}	101 Cherry Hill Circle	51-770-0011	Roanoke	37° 16′ 33″ -79° 59′ 58″
109-L	$PM_{2.5}$	Raleigh Court Library	51-770-0014	Roanoke	37° 15′ 22″ -79° 59′ 06″
109-M	CO, TEOM $PM_{2.5}$	2020 Oakland Blvd.	51-770-0015	Roanoke	37° 17′ 48″ -79° 57′ 20″

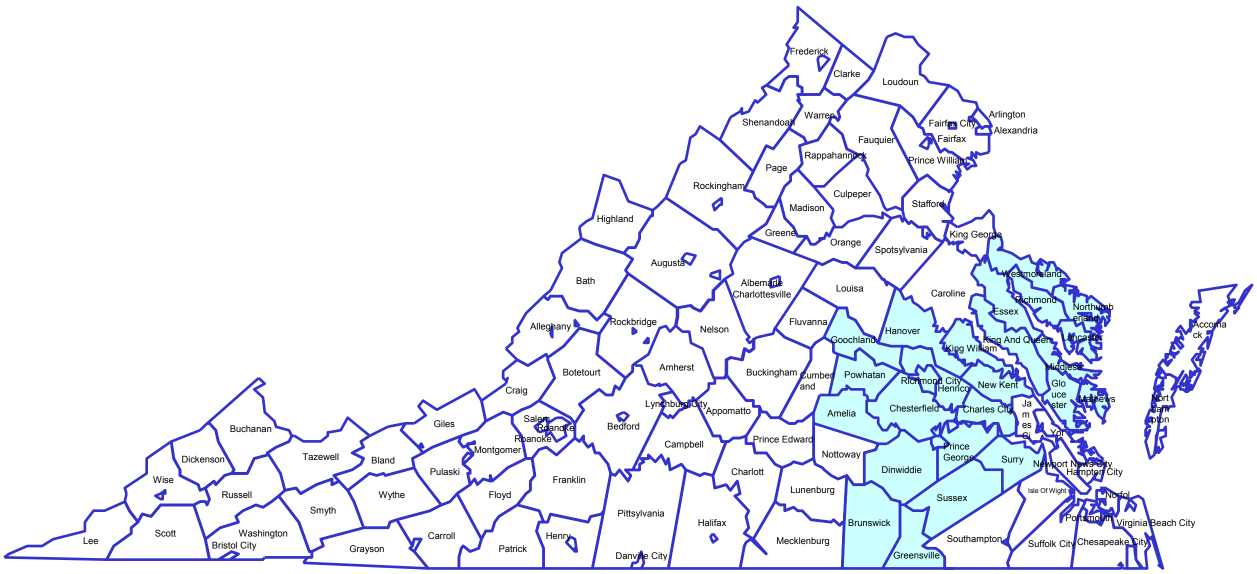
Contact information for this Region:
Blueridge Regional Office
Steven Dietrich, Director
3019 Peters Creek Road
Roanoke, VA 24019
(540) 562-6700



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
155-Q	$PM_{2.5}$	Leesville Hwy. & Greystone Dr.	51-680-0015	Lynchburg	37^{o} 33′ 18″ -79^{o} 21′ 45″

Contact information for this Region:
South Central Regional Office
David Miles, Deputy Director
7705 Timberlake Road
Lynchburg, VA 24502
(434) 582-5120

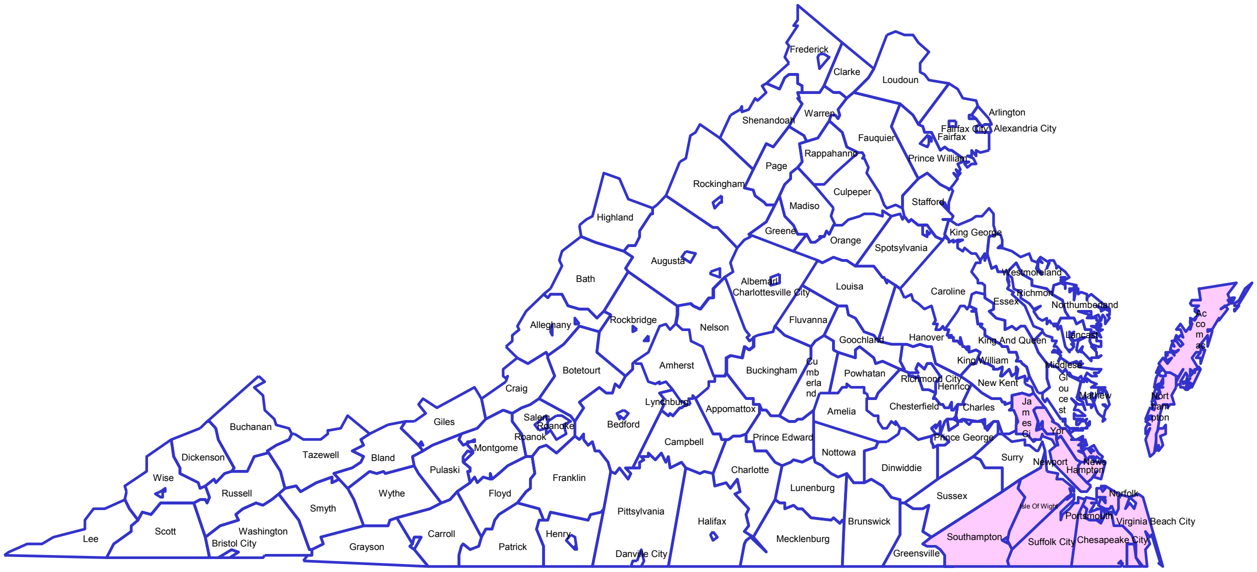
Piedmont Monitoring Network 2008



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
71-D	$PM_{2.5}$	Bensley Armory	51-041-003	Chesterfield Co.	37° 26′ 10″ -77° 27′ 03″
71-H	O_3	Beach Road Highway Shop	51-041-0004	Chesterfield Co.	37° 21′ 32″ -77° 35′ 37″
72-M	O_3, VOC, $PM_{2.5}$, TEOM, Speciation Toxics	MathScience Innovation Center 2401 Hartman Street	51-087-0014	Henrico Co.	37° 33′ 30″ -77° 34′ 01″
72-N	$PM_{2.5}$	DEQ-Piedmont Regional Office 4949-A Cox Road	51-087-0015	Henrico Co.	37° 40′ 13″ -77° 34′ 03″
73-E	O_3	McClellan Road	51-085-0003	Hanover Co.	37° 36′ 21″ -77° 13′ 07″
75-B	O_3, NO_2, SO_2, $PM_{2.5}$	Charles City County Route 608	51-036-0002	Charles City Co.	37° 20′ 31″ -77° 15′ 39″
82-C	PM_{10}	West Point Elementary School Thompson Ave. & Chelsea Rd.	51-101-0003	West Point King William Co.	37° 33′ 34″ -76° 47′ 43″
154-M	PM_{10}	Spruance St. and Pierce St.	51-670-0011	Hopewell	37° 18′ 43″ -77° 16′ 23″
158-W	CO, SO2, NO2	Science Museum of Virginia DMV and Leigh Street	51-760-0024	Richmond	37° 33′ 45″ -77° 27′ 55″

Contact Information for this Region:
Piedmont Regional Office
Richard Weeks, Director
4949-A Cox Road
Glen Allen, VA 23060
(804) 527-5020

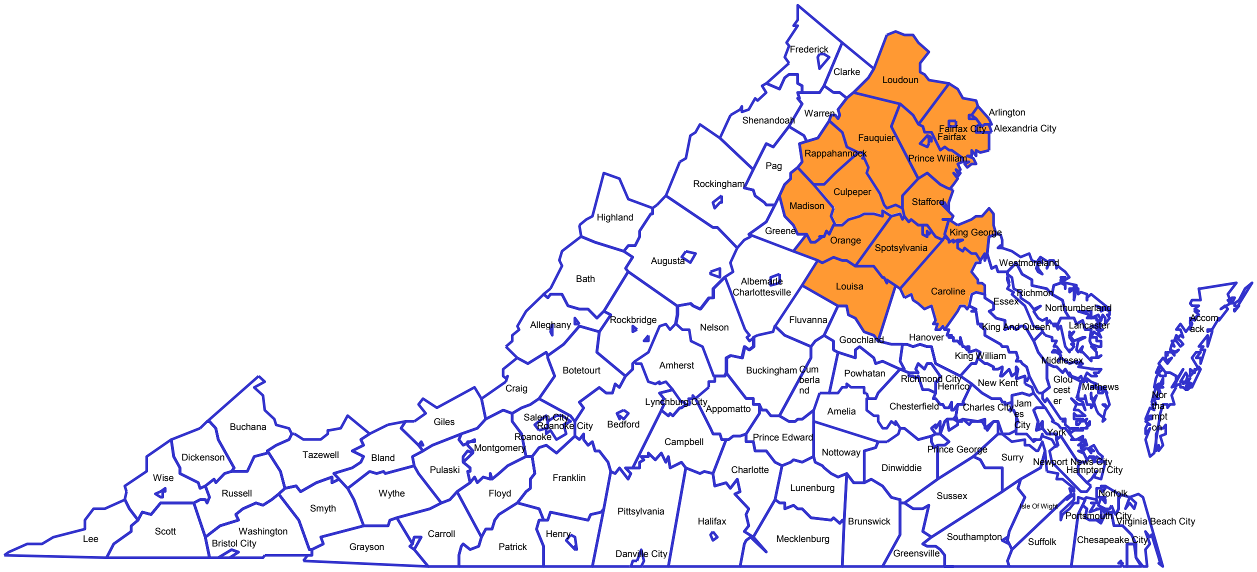
Tidewater Monitoring Network 2008



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
179-C	CO, SO_2, O_3, $PM_{2.5}$, PM_{10}, TEOM	Virginia School for the Deaf & Blind 700 Shell Road	51-650-0004	Hampton	37° 00′ 12″ -76° 23′ 57″
181-A1	CO, SO_2, NO_2, PM_{10}, $PM_{2.5}$	NOAA Property 2nd and Woodis Avenue	51-710-0024	Norfolk	36° 51′ 28″ -76° 18′ 06″
183-E	O_3	Tidewater Community College Frederick Campus	51-800-0004	Suffolk	36° 54′ 12″ -76° 43′ 53″
183-F	O_3	Tidewater Research Station	51-800-0005	Suffolk	36° 40′ 03″ -76° 43′ 53″
184-J	$PM_{2.5}$, Toxics	DEQ – Tidewater Regional Office 5636 Southern Blvd.	51-810-0008	Va. Beach	36° 50′ 28″ -76° 10′ 53″

Contact information for this Region:
Francis L. Daniel, Director
5636 Southern Blvd.
Virginia Beach, VA 23462
(757) 518-2000

Northern Monitoring Network 2008



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
37-B	O_3	Phelps Wildlife Area Route 651	51-061-0002	Sumerduck Fauquier Co.	38° 28′ 30″ -77° 46′ 04″
38-I	O_3, NO_2, $PM_{2.5}$	Broad Run High School Route 641	51-107-1005	Ashburn Loudoun Co.	39° 01′ 28″ -77° 29′ 24″
42-B	PM_{10}	Farmington Elementary School Sunset Lane	51-047-0002	Culpeper Culpeper Co.	38° 27′ 26″ -78° 00′ 40″
44-A	O_3	Widewater Elementary School Den Rich Road	51-179-0001	Widewater Stafford Co.	38° 28′ 59″ -77° 22′ 13″
45-L	O_3, NO_2	Long Park Route 15	51-153-0009	Prince William Co.	38° 51′ 19″ -77° 38′ 08″
46-B9	O_3, CO, $PM_{2.5}$	Lee District Park Telegraph Road	51-059-0030	Franconia Fairfax Co.	38° 46′ 22″ -77° 06′ 20″
47-T	CO, NO_2, O_3, $PM_{2.5}$	Aurora Hills Visitors Center 18^{th} and Hayes Streets	51-013-0020	Arlington Co.	38° 51′ 27″ -77° 03′ 33″
48-A	O_3, NO_y, VOC	U.S.G.S. Geomagnetic Center	51-033-0001	Corbin Caroline Co.	38° 12′ 03″ -77° 22′ 38″
130-E	PM_{10}	Hugh Mercer Elementary School 2100 Cowan Boulevard	51-630-0004	Fredericksburg	38° 18′ 17″ -77° 29′ 11″

STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
L-46-A8	CO, SO_2, O_3, NO_2, $PM_{2.5}$	McLean Governmental Center 1437 Balls Hill Road	51-059-5001	McLean Fairfax Co.	38° 55′ 55″ -77° 11′ 56″
L-46-B3	O_3, PM_{10}	Mt. Vernon Fire Station 2675 Sherwood Hall Lane	51-059-0018	Mount Vernon Fairfax Co.	38° 44′ 33″ -77° 04′ 39″
L-46-F	CO, SO_2, O_3, NO_2, PM_{10}	Upper Cub Run Drive	51-059-0005	Chantilly Fairfax Co.	38° 53′ 38″ -77° 27′ 55″
L-46-C1	CO, SO_2, O_3, NO_2, $PM_{2.5}$, TEOM	Mason Governmental Center 6507 Columbia Pike	51-059-1005	Annandale Fairfax Co.	38° 50′ 15″ -77° 09′ 47″
L-126-C	CO, SO_2, O_3, NO_2	Alexandria Health Department 517 North Saint Asaph Street	51-510-0009	Alexandria	38° 48′ 38″ -77° 02′ 40″
N-35-A	O_3, TEOM, IMPROVE,	Big Meadows, National Park Service	51-113-0003	Madison Co.	38° 31′ 19″ -78° 26′ 10″

Contact Information for this Region:
Northern Regional Office
Thomas Faha, Director
13901 Crown Court
Woodbridge, VA 22193
(703) 583-3800

Minimum Number of Observations	
3-Hour Average	3 Consecutive Hourly Observations
8-Hour	6 Hourly Observations
24-Hour	18 Hourly Observations
Quarterly Averages ($PM_{2.5}$, PM_{10})	75% of Scheduled Samples
Yearly Averages (Continuous Instruments)	75% of Total Possible Observations
Yearly Averages ($PM_{2.5}$, PM_{10})	Four Complete Quarterly Averages

POLLUTANT	PRIMARY STANDARD $\mu g/m^3$	PRIMARY STANDARD ppm	SECONDARD STANDARD $\mu g/m^3$	SECONDARD STANDARD ppm
CARBON MONOXIDE				
8-hour concentration	10,000[a]	9[a]	None	None
1-hour concentration	40,000[a]	35[a]		
SULFUR DIOXIDE				
Annual arithmetic mean	80	0.03		
24-hour concentration	365[a]	0.14[a]		
3-hour concentration			1300[a]	0.5[a]
NITROGEN DIOXIDE				
Annual arithmetic mean	100	0.053	Same as primary	
OZONE				
8-hour concentration	157[b]	0.075[b]	Same as primary	
1-hour concentration**				
LEAD				
Quarterly arithmetic mean	1.5		Same as primary	
(October 2008)				
3-month rolling average	0.15			
PARTICULATE MATTER				
$PM_{2.5}$				
Annual arithmetic mean	15.0[e]			
24-hour concentration	35[d]			
PM_{10}			Same as primary	
24-hour concentration	150[e]			

[a] Not to be exceeded more than once a year
[b] 3-year average of the 4th highest 8-hour concentration may not exceed 0.075 ppm
[c] Based on a 3-year average of annual arithmetic mean PM2.5 concentrations
[d] Based on a 3-year average of 98th percentile of 24-hour PM2.5 concentrations
[e] Not to be exceeded more than once per year on average over 3 years

*** Please see www.epa.gov/air/criteria.html for additional information concerning NAAQS.*

NAMS/SLAMS 2008

REGION	$PM_{2.5}$	PM_{10}	CO	SO_2	NO_2	O_3	TOTAL
Southwest	1	1	---	---	---	1	3
Valley	3	3	---	1	1	4	13
Blue Ridge	3	1	1	1	1	1	8
Piedmont	4	4	1	2	2	4	17
Tidewater	3	2	2	2	1	3	13
***Northern**	5	4	6	4	7	13	39
TOTAL	**18**	**16**	**10**	**10**	**12**	**26**	**92**

* *This region's sites are operated by DEQ, Fairfax Co., and Alexandria*

As of October 2009, the nonattainment areas in Virginia are confined to the Northern Region

Northern Virginia
Arlington County
Fairfax County
Loudoun County
Prince William County
City of Alexandria
City of Fairfax
City of Falls Church
City of Manassas
City of Manassas Park

$PM_{2.5}$ Nonattainment Area Designations

Northern Virginia
Arlington County
Fairfax County
Loudoun County
Prince William County
City of Alexandria
City of Fairfax
City of Falls Church
City of Manassas
City of Manassas Park

The following are Maintenance Areas (Previously Nonattainment Areas)

Fredericksburg
Spotsylvania County
Stafford County
City of Fredericksburg

Richmond
Charles City County
Chesterfield County
Hanover County
Henrico County
Prince George County
City of Colonial Heights
City of Hopewell
City of Petersburg
City of Richmond

The following are Maintenance Areas (cont.)

Norfolk-Va. Beach-Newport News
Gloucester County
Isle of Wright
James City County
York County
City of Chesapeake
City of Hampton
City of Newport News
City of Norfolk
City of Poquoson
City of Portsmouth
City of Suffolk
City of Virginia Beach
City of Williamsburg

Shenandoah National Park
Page
Madison Counties

Appendix B

AIRSData – Access to national and state air pollution concentrations and emissions data
http://www.epa.gov/air/data

Air Explorer – Collection of user-friendly visualization tools for air quality monitoring
http://www.epa.gov/airexplorer

Air Now – Ozone mapping, AQI, and real time data
http://www.airnow.gov

Air Now – Air Quality Index Information
http://www.airnow.gov/index.cfm?action=aqibasics.aqi

American Lung Association:
http://www.lungusa.org/

Department of Environmental Quality link:
http://www.deq.virginia.gov/

Education for teachers and children:
http://www.epa.gov/kids

IMPROVE
http://vista.cira.colostate.edu/improve

MARAMA
http://www.marama.org/index.html

Nonattainment area descriptions:
http://epa.gov/oar/oaqps/greenbk

U.S. EPA:
http://www.epa.gov

VISTAS:
http://www.vistas-sesarm.org

2008 3-Day Monitoring Schedule for PM2.5 and 6-Day Monitoring Schedule for PM10:
http://www.epa.gov/ttn/amtic/calendar.html

EPA's Technology Transfer Network (TTN) – Ambient Monitoring Technology Information Center (AMTC)
http://www.epa.gov/ttn/amtic

References

Code of Federal Regulations – 40 CFR 50 & 58

Virginia Ambient Air Monitoring Data Reports

DEQ Monthly/Quarterly Reports 1999 – 2008

Air Quality System (AQS)