Virginia Ambient Air Monitoring 2012 Data Report

Department of Environmental Quality

Commonwealth of Virginia
Department of Environmental Quality

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

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This Ambient Air Monitoring Data Report is for the time period of January 1, 2012 to December 31, 2012.

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Table of Contents

GENERAL INFORMATION:

CRITERIA POLLUTANTS:

Introduction

The 2012 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, the U.S. Department of Agriculture Forest Service, and the National Park Service. Ambient air quality was measured at 45 locations within the Commonwealth during 2012. These monitoring sites were established in accordance with EPA's siting criteria contained in 40 CFR Part 58, Appendices D and E 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. Ambient concentrations of carbon monoxide, nitrogen dioxide, and sulfur dioxide were within the EPA's national ambient air quality standards (NAAQS) in 2012. Virginia continues to experience exceedances of the ozone pollution standard, particularly in Northern Virginia, Richmond, and Hampton Roads. In 2012, Northern Virginia had 15 days when an eight-hour ozone average greater than .075 ppm was recorded at one or more monitoring stations in the area. Richmond had 11 days, Hampton Roads recorded 3 days, Stafford County recorded 4 ozone exceedance days, and Caroline County recorded 4 days that exceeded the 0.075 standard.

Some significant changes that impacted the air quality monitoring network in 2012 are:

- In August of 2012, the Office of Air Quality Monitoring (AQM) relocated the Alexandria City monitoring site from its historical location at 517 N. St. Asaph Street to 3200 Colvin St., Alexandria at the Transportation and Environmental Services facility. This move was performed due to closure of the existing building. As a result of the move, the PM10 monitor was removed and the ozone monitor was designated a special purpose monitor. Revised siting information is located at http://vadeq.tx.sutron.com/cgi-bin/site_info.pl.
- The Science Museum of Virginia Monitoring Site was shut down on December 30, 2012 in anticipation of the development of the Washington Redskins training facility. The Office of Air Quality Monitoring anticipates re-establishing a central Richmond City site but no replacement site has been selected at this time.
- In December 2012, The Office of Air Quality Monitoring received the final approval for installation of the near road monitoring site in the Richmond area. The location selected is in Bryan Park near the Bryan Park interchange. This road segment was selected based on the annual average daily traffic count. This is the first of three near road sites that will be installed as part of the Virginia Air Quality Monitoring network. One near road site is projected for the Tidewater Area and one is projected for the Washington Metropolitan Statistical Area in Northern Virginia.
- December 29, 2012 was the last run date for the PM10 monitors in Front Royal and in Culpeper. These monitors are scheduled to be removed from the monitoring network in early 2013.
- The continuous PM2.5 monitor at the Shenandoah National Park monitoring site failed in August of 2012 resulting in the loss of data for the final 5 months of 2012.

AQM is responsible for seeing that the Virginia ambient air monitoring network is maintained and operated in accordance with state and federal guidelines. Personnel from the Department of Environmental Quality (DEQ) regional offices, the City of Alexandria, the National Park Service, and the U.S. Department of Agriculture Forest Service conduct the daily operations at these sites. One of AQM's primary jobs is to support these people in their air quality monitoring efforts. AQM does this 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 regional operators
- supplying field operators with necessary items so they can perform their job properly
- repairing malfunctioning 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 quality
- 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, lead 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 70 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, Section 6, http://www.epa.gov/ttn/amtic/qalist.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, Section 6, http://www.epa.gov/ttn/amtic/qalist.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 72. EPA has a list of all nonattainment areas in the country at http://www.epa.gov/air/oaqps/greenbk/.

8. **What are the impacts of a 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 formerly been designated nonattainment, but is now recognized by EPA as meeting the NAAQS. A maintenance area must have an approved "maintenance plan" to meet and maintain air quality standards.

10. **What is a design value?**

A design value is a statistic that describes the air quality status of a given area relative to the level of the National Ambient Air Quality Standards (NAAQS). Design values are typically used to classify nonattainment areas, assess progress towards meeting the NAAQS, and develop control strategies. Design values are expressed as concentrations in the ambient air and are calculated according to regulatory specifications to determine the highest monitored concentration in an attainment or non-attainment area.

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 http://vadeq.tx.sutron.com/cgi-bin/aqi_rpt.pl. Summary air quality data PM2.5 can also be found at http://www.deq.virginia.gov/Programs/Air/AirMonitoring/ParticulateMonitoring.aspx. Annual monitoring data reports can be found at http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx. EPA provides monitoring data, as well as maps, on the web at www.epa.gov/airdata and www.epa.gov/air/emissions. Detailed data for monitoring sites in Virginia can also be obtained by contacting the VA DEQ Office of Air Quality Monitoring, or from EPA's AQS Data Mart at www.epa.gov/ttn/airs/aqsdatamart.

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 61 of this report, or visit http://www.deq.virginia.gov/Programs/PollutionResponsePreparedness.aspx.

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.virginia.gov for the health department office in your area or the Division of Health Hazard Control at (804) 864-8182. 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, see www.epa.gov/air/particlepollution.

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 Co., 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. The 3-day monitoring schedule can be found at http://www.epa.gov/ttn/amtic/calendar.html. 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: Speciated PM$_{2.5}$ data are collected at one site in Virginia, the MathScience Innovation Center in Henrico Co., using two co-located samplers that operate simultaneously. One sampler, the MetOne SASS, collects particulate matter on two filters, one nylon and the other Teflon. The second sampler, the URG 3000N carbon sampler, uses a quartz filter to collect particulate matter. The samplers run for 24 hours, on a one-in-three day sampling schedule. After the completion of a sample run, the instrument operator removes the exposed filters and ships them via refrigerated container to RTI, the EPA contract lab in North Carolina. RTI analyzes the filters for the following:

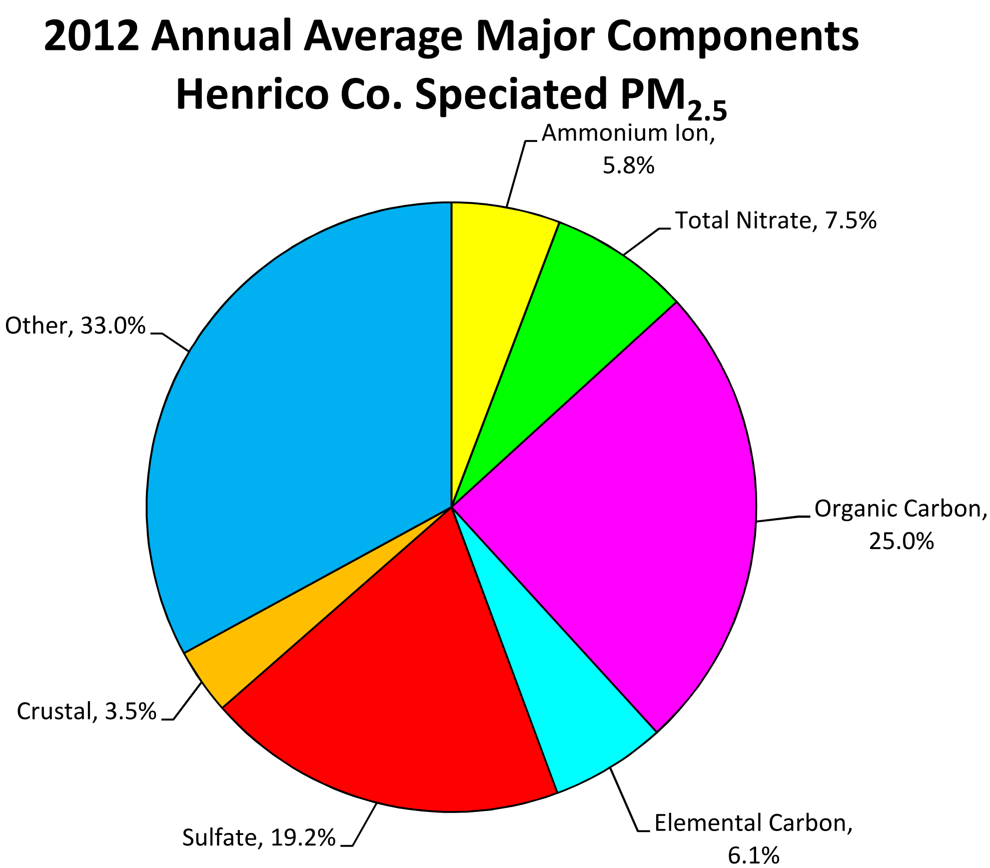
- Teflon filter: total mass loading and thirty-three trace elements including aluminum, antimony, arsenic, bromine, calcium, iron, lead, silicon, titanium, vanadium, and zirconium
- Nylon filter: cations (ammonium, potassium, sodium) and anions (nitrate, sulfate)
- Quartz filter: carbons (carbonate carbon, elemental carbon, organic carbon, total carbon)

The resulting data provide a "chemical fingerprint" of air masses moving through the Richmond area. These data, in conjunction with historical data from other speciation sites, including those outside Virginia, give a representative picture of the constituents of the air samples, which help identify sources of high values and show how the air masses move over a broad area.

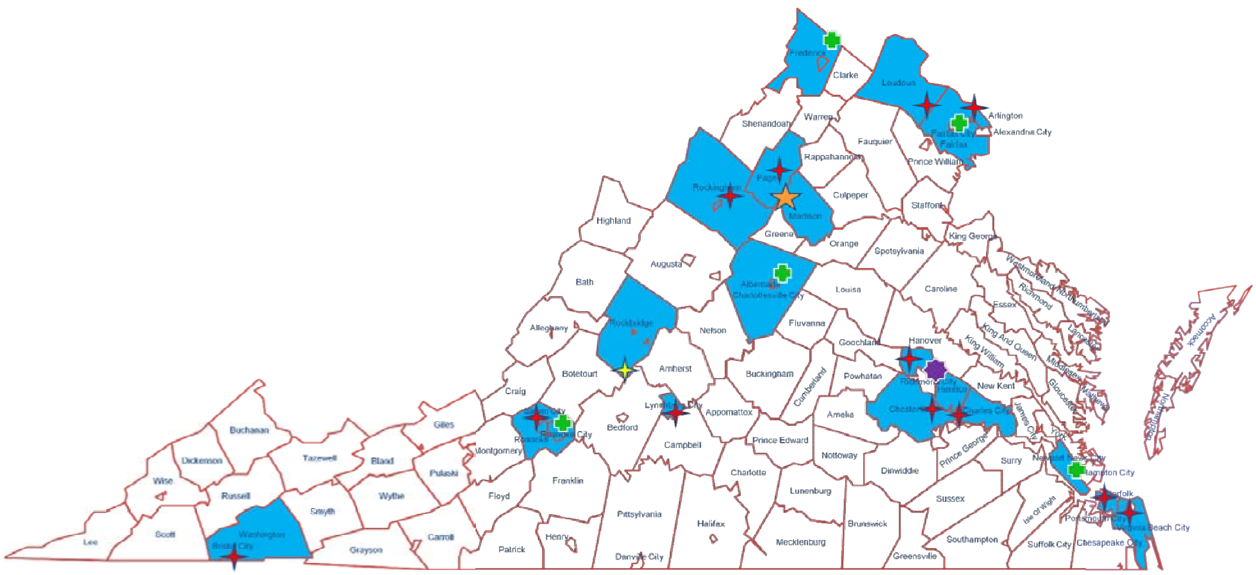
PM$_{2.5}$ Continuous Monitor: This sampler collects particulate samples on a continuous basis, and data are compiled into hourly averages. The sampler utilizes a Tapered Element Oscillating Microbalance (TEOM) in the sampling design. TEOM samplers are operated in Hampton Roads, Henrico Co., Roanoke Co., Fairfax Co., 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, and then posted on the agency website at http://vadeq.tx.sutron.com. 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



FRM Mass Sampler

IMPROVE sampler

FRM Mass and TEOM Samplers

FRM Mass, Speciation, TEOM Sampler

TEOM & IMPROVE sampler, Big Meadows, NPS

National Ambient Air Quality Standards (NAAQS)

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.

2010-2012 $PM_{2.5}$ 24-hour Averages, 98^{th} Percentile Values ($\mu g/m^3$, LC)

Site	2010	2011	2012	3-Year Average
(101-E) **Bristol**	21.1	21.5	16.5	20
(26-F) **Rockingham Co.**	25.2	22.8	17.5	22
(28-J) **Frederick Co.**	24.8	23.8	22.6	24
(29-D) **Page Co.**	24.3	21.2	17.2	21
(33-A) **Albemarle Co.**	19.8	19.2	17.0	19
(109-M) **Roanoke**	22.7	22.4	18.7	21
(110-C) **Salem**	21.5	21.5	16.4*	20
(155-Q) **Lynchburg**	20.4	18.3	15.7	18
(71-D) **Chesterfield Co.**	21.6	22.0	20.0	21
(72-M) **Henrico Co.**	22.4	23.2	19.1	22
(72-N) **Henrico Co.**	21.1	18.6*	18.3	19
(75-B) **Charles City Co.**	20.6	21.6	20.0	21
(179-K) **Hampton**	NA	25.5	20.9	NA
(181-A1) **Norfolk**	21.7	38.8**	21.7	27
(184-J) **Va. Beach**	23.9	25.6	22.7	24
(38-I) **Loudoun Co.**	19.6	20.5	20.6	20
(47-T) **Arlington Co.**	21.8*	21.2*	21.8	22
(46-B9) **Franconia, Fairfax Co.**	23.7	24.1	21.1	23

* Annual value did not meet completeness criteria.
* * Dismal Swamp Wildfire, August 2011.

New annual standard was finalized on January 15, 2013
New standard is 12.0 $\mu g/m^3$.

NAAQS

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 μg/m³. ☞
- 24-Hour concentration – the 3 year average of the 98th percentile of 24-hour concentrations must not exceed 35 μg/m³.

Secondary Standard for $PM_{2.5}$:

- Same as Primary.

2010-2012 $PM_{2.5}$ Weighted Annual Arithmetic Means (μg/m³, LC)				
Site	**2010**	**2011**	**2012**	**3-Year Average**
(101-E) **Bristol**	10.8	9.8	8.8	9.8
(26-F) **Rockingham Co.**	11.2	9.6	8.8	9.9
(28-J) **Frederick Co.**	10.8	10.0	9.8	10.2
(29-D) **Page Co.**	10.2	8.7	8.3	9.1
(33-A) **Albemarle Co.**	9.4	8.5	7.8	8.5
(109-M) **Roanoke**	10.2	10.2	9.1	9.8
(110-C) **Salem**	10.4	9.9	8.9*	9.7*
(155-Q) **Lynchburg**	9.7	8.4	7.6	8.6
(71-D) **Chesterfield Co.**	10.2	9.3	8.9	9.5
(72-M) **Henrico Co.**	9.9	9.5	8.6	9.3
(72-N) **Henrico Co.**	9.7	8.6*	8.3	8.9*
(75-B) **Charles City Co.**	9.4	8.8	8.1	8.8
(179-K) **Hampton**	NA	9.1	7.7	NA
(181-A1) **Norfolk**	10.2	10.5	8.1	9.6
(184-J) **Va. Beach**	9.9	9.6	8.2	9.3
(38-I) **Loudoun Co.**	10.3	9.1	9.0	9.5
(47-T) **Arlington Co.**	10.3*	9.9*	9.4	9.9*
(46-B9) **Franconia, Fairfax Co.**	9.9	9.2	8.7	9.3

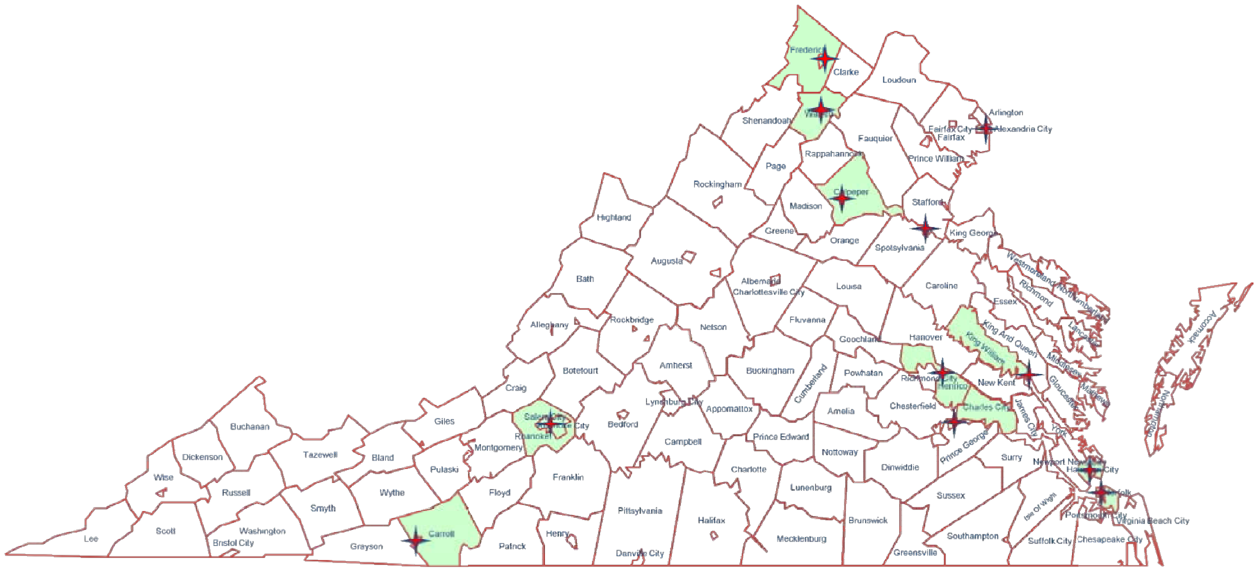
* Annual value did not meet completeness criteria.

☞ New annual standard was finalized on January 15, 2013
New standard is 12.0 μg/m³.

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.

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. The normal sampling schedule is once every sixth day from midnight to midnight. The 6-day monitoring schedule can be found at http://www.epa.gov/ttn/amtic/calendar.html.



VA Department of Environmental Quality

National Ambient Air Quality Standards (NAAQS)

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. An exceedance means a 24-hour average value that is above the level of the 24-hour standard after rounding to the nearest 10 $\mu g/m^3$.

Secondary Standard for PM_{10}:

- Same as Primary.

2010-2012 PM_{10} 24-Hour Average Concentrations (units in $\mu g/m^3$ STD)							
Site	2010		2011		2012		>150 $\mu g/m^3$
	1st Max	2nd Max	1st Max	2nd Max	1st Max	2nd Max	
(23-A) **Carroll Co.**	34	25	31	28	28	26	0
(30-E) **Warren Co.**	42	28	31	31	24	22	0
(134-C) **Winchester**	43	32	35	28	32	28	0
(109-H) **Roanoke**	34	33	65	39	38	31	0
(72-M) **Henrico Co.**	45	31	39	34	31	28	0
(154-M) **Hopewell**	42	30	38	32	31	27	0
(82-C) **King William Co.**	45	31	154*	40	30	29	0
(181-A1) **Norfolk**	45	37	71*	58*	35	32	0
(42-B) **Culpeper Co.**	46	30	32	26	32	28	0
(130-E) **Fredericksburg**	45	40	36	28	34	29	0

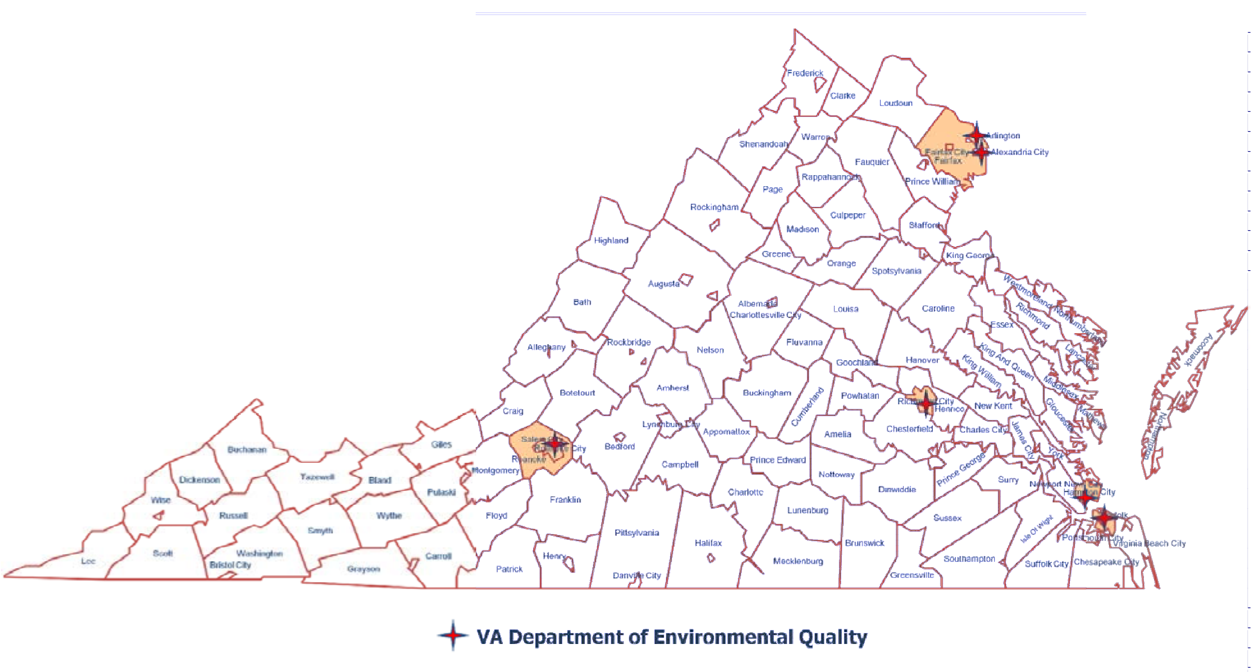
* Dismal Swamp Wildfire, August 2011.

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.



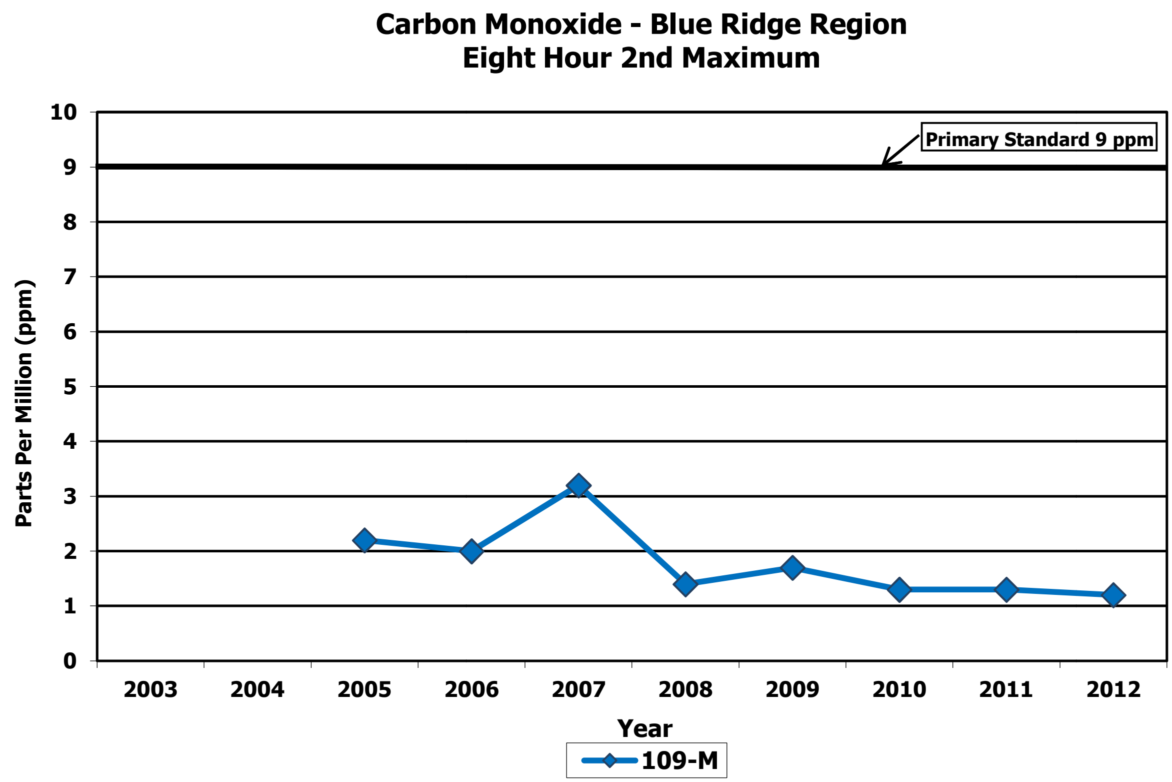
National Ambient Air Quality Standards (NAAQS)

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.

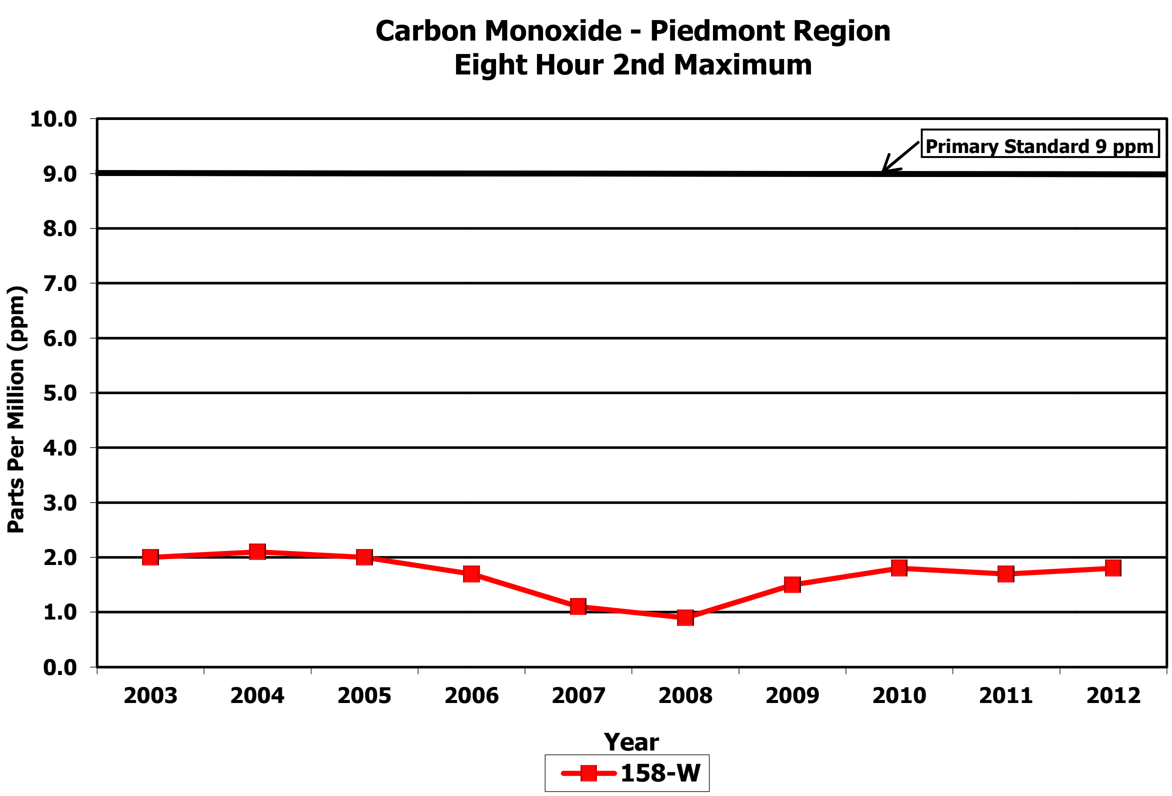
There are no Secondary Standards for CO because it does not harm vegetation or buildings.

Site	2012			
	1-Hour Avg. (ppm)		8-Hour Avg. (ppm)	
	1st Max.	2nd Max.	1st Max.	2nd Max.
(109-M) **Roanoke**	1.6	1.5	1.3	1.2
(158-W) **Richmond**	2.4	2.2	2.0	1.8
(179-K) **Hampton**	1.2	1.1	1.0	.9
(181-A1) **Norfolk**	1.6	1.5	1.1	1.0
(47-T) **Arlington Co.**	1.7	1.6	1.6	1.4
(L-126-C) **Alexandria***	1.4	1.4	1.1	1.0

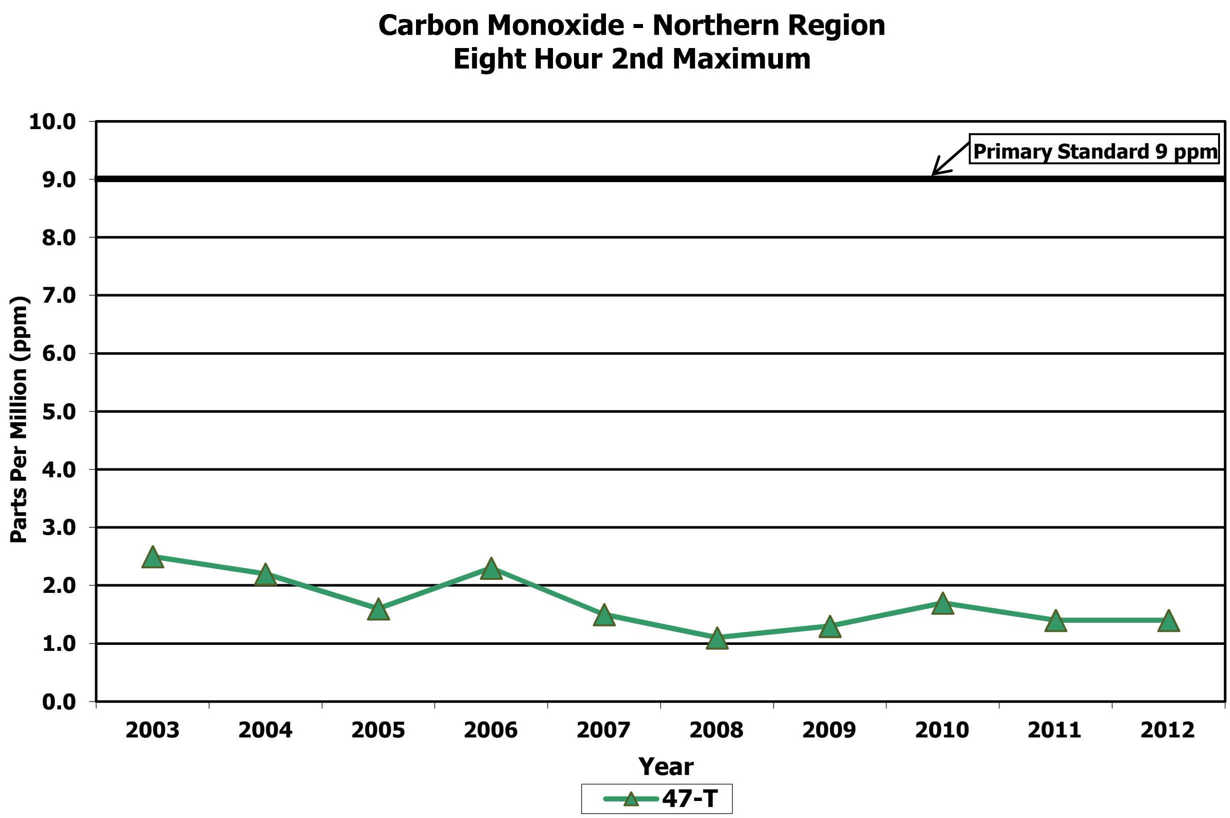
Eight Hour Averages stated as Ending Hour
* Site relocated in the 3rd Qtr.



Carbon Monoxide - Blue Ridge Region
Eight Hour 2nd Maximum
Primary Standard 9 ppm
Parts Per Million (ppm)
10
9
8
7
6
5
4
3
2
1
0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
109-M



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
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
158-W

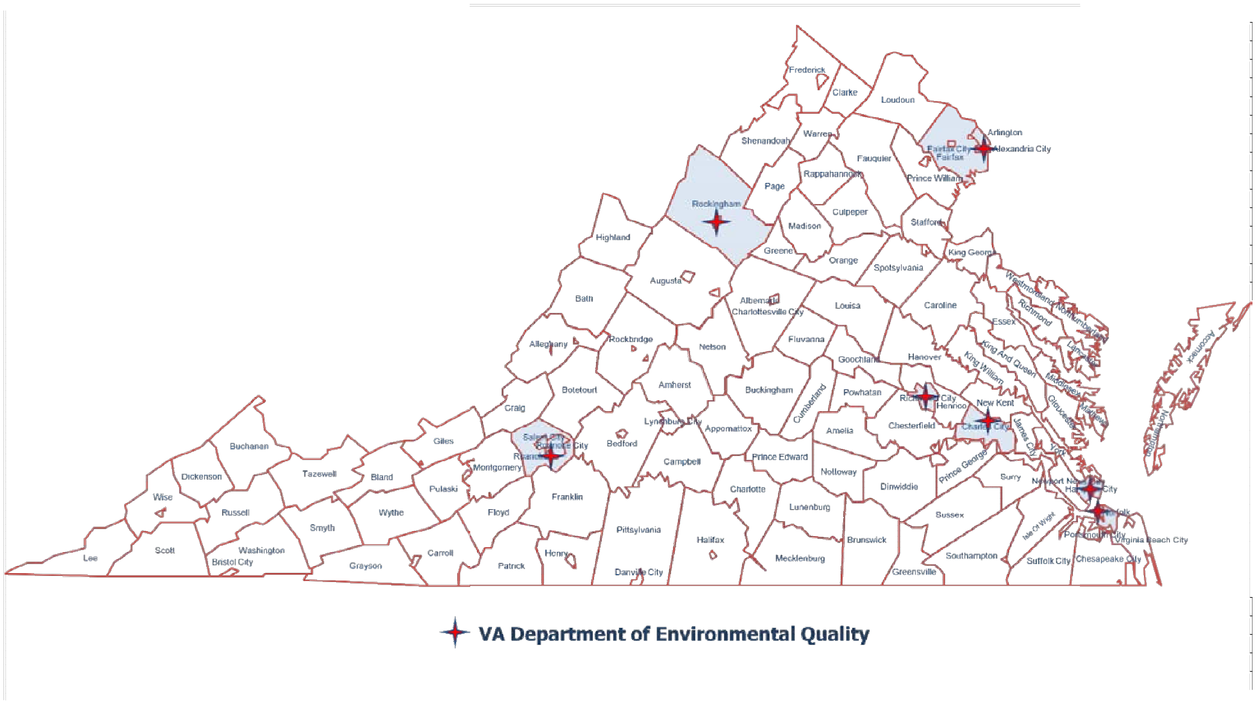

Carbon Monoxide - Northern Region
Eight Hour 2nd Maximum
Primary Standard 9 ppm
Parts Per Million (ppm)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
47-T

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.



National Ambient Air Quality Standards (NAAQS)

Primary Standards for SO_2:

- 3-year average of the 99th percentile 1-hour daily maximum values not to exceed 75 ppb.

Secondary Standard for SO_2:

- 3-Hour concentration not to exceed 0.5 ppm (500 ppb) more than once per year.

Sulfur Dioxide 99th Percentile 1-Hour Daily Maximum Values (ppb)												
State ID	City/County	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	3-Yr Avg Design Value 2010-2012
26-F	Rockingham Co.		Inc	19	14	11	11	13	8	6	4	6
19-A6	Roanoke Co.	17	16	15	22	Inc	12	10	10	9	5	8
72-M	Henrico Co.								Inc	21	8	NA
75-B	Charles City Co.	84	79	94	78	94	58	47	44	38	21	34
158-W	Richmond	93	50	79	54	53	38	39	39	27	9	25
179-K	Hampton								Inc	39	33	NA
181-A1	Norfolk									54	56	NA
L126-C	Alexandria*	103	71	78	46	42	31	36	17	14	17*	NA

Inc - Incomplete
NA – Not available
* Site relocated in the 3rd Qtr. / did not meet completeness criteria

National Ambient Air Quality Standards (NAAQS)

Primary Standards for SO_2:

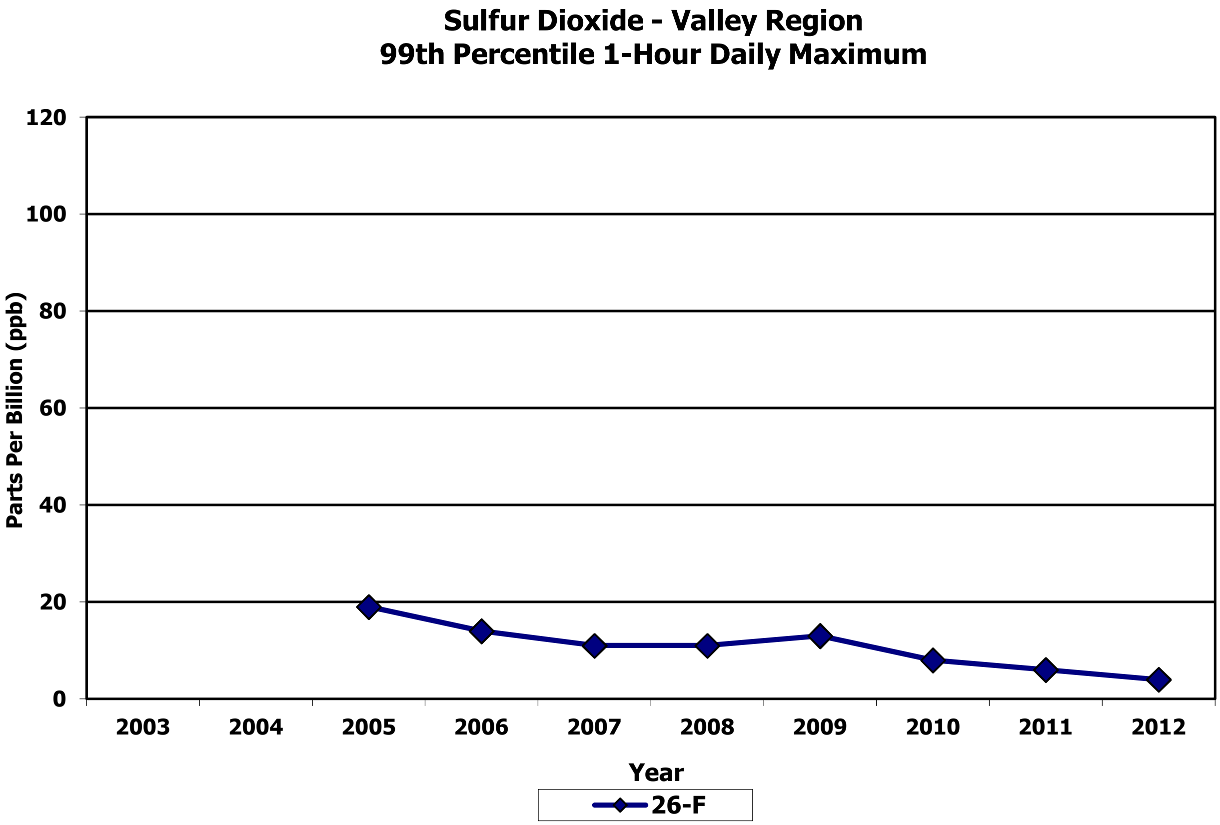
- 3-year average of the 99th percentile 1-hour daily maximum values not to exceed 75 ppb.

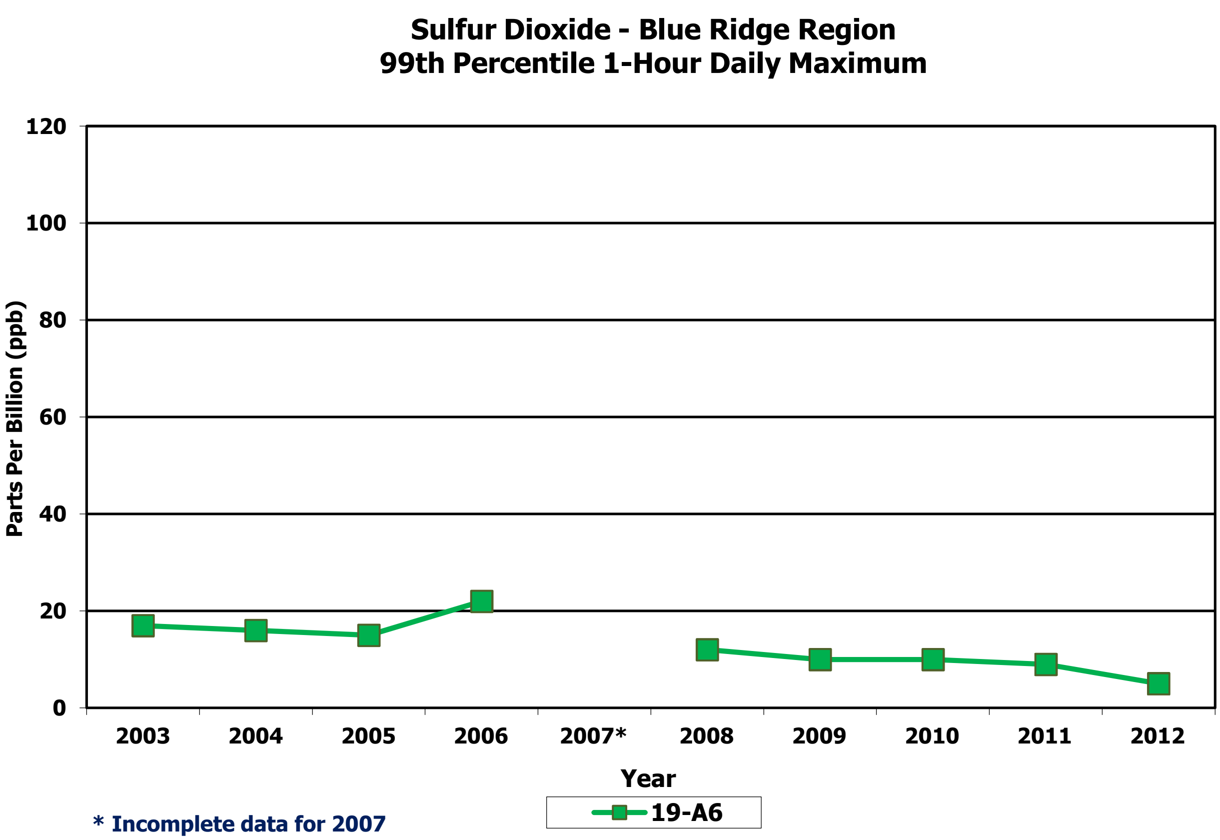
Secondary Standard for SO_2:

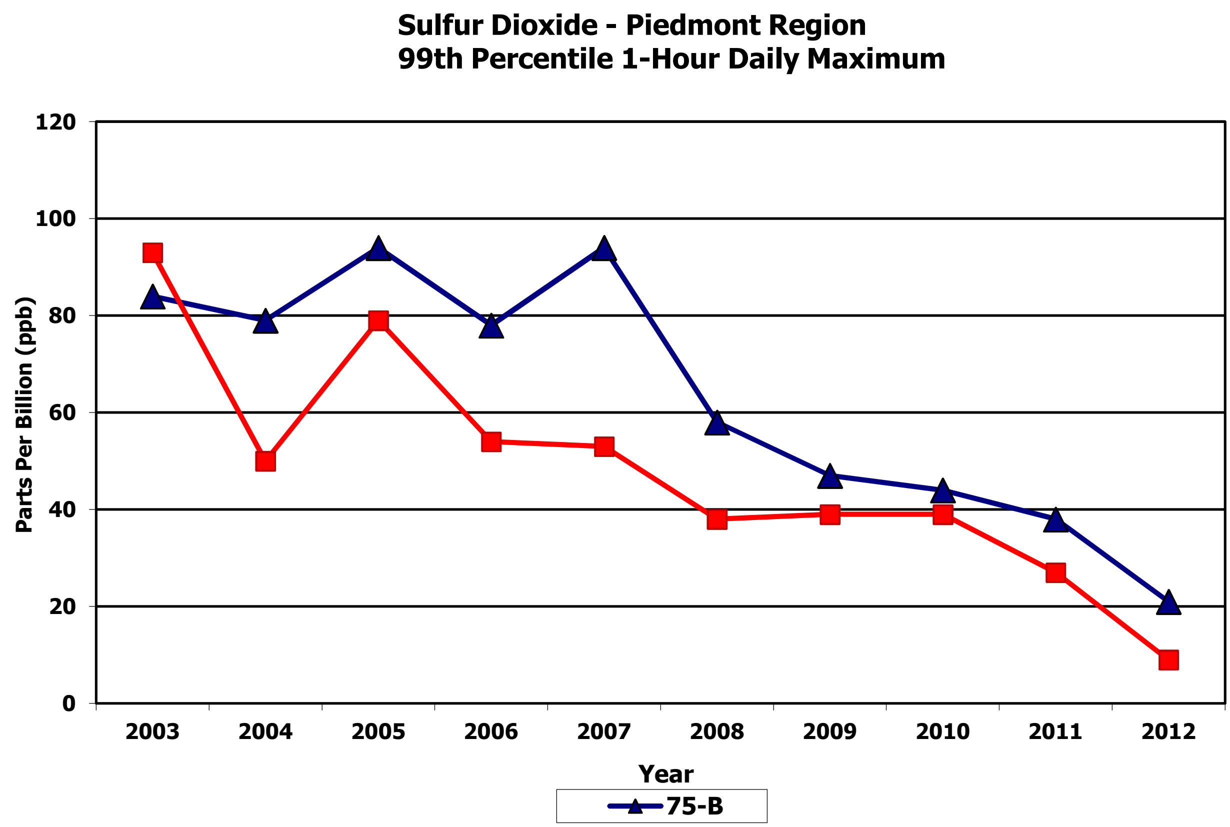
- 3-Hour concentration not to exceed 0.5 ppm (500 ppb) more than once per year.

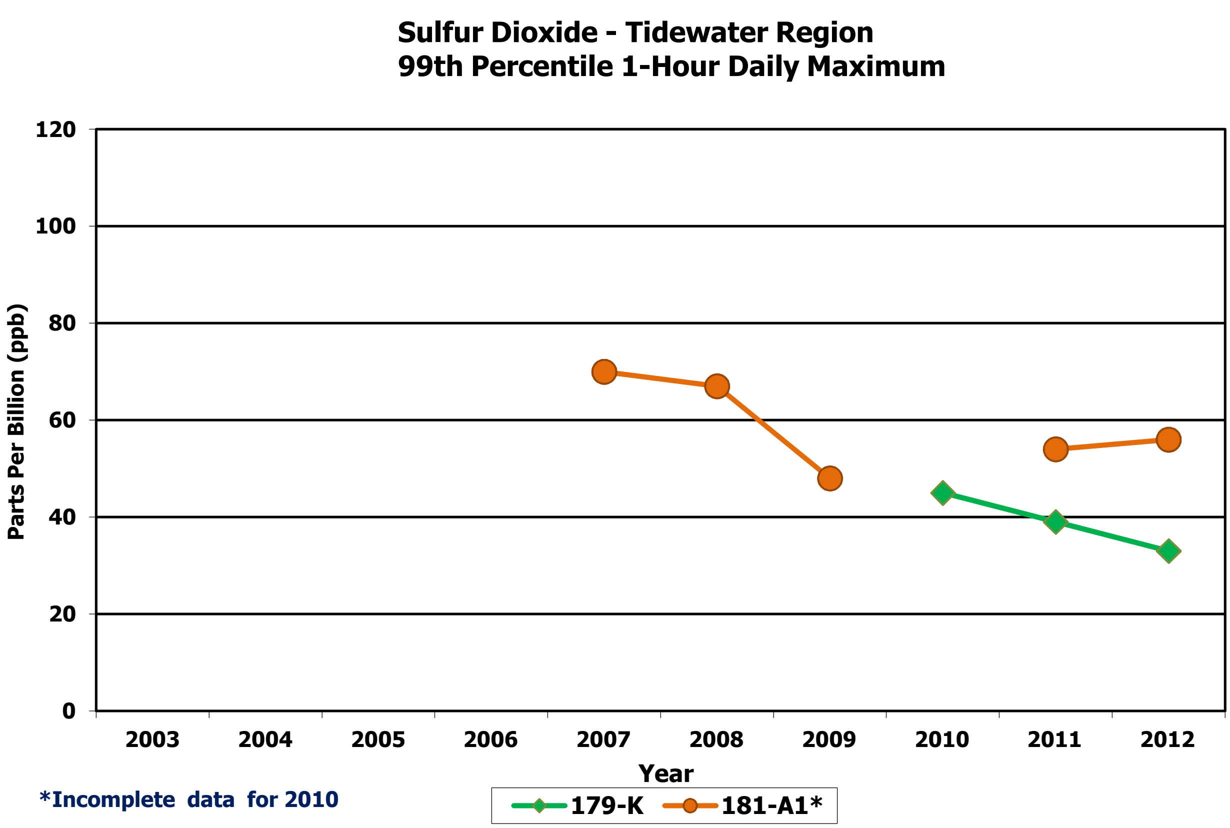
Sulfur Dioxide 3-Hour Block Average Maximum Values (ppb)												
State ID	**City/County**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Number Obs. > 500 ppb**
26-F	Rockingham Co.		Inc	21	20	16	14	16	9	6	5	0
19-A6	Roanoke Co.	17	22	23	23	Inc	14	14	14	8	5	0
75-B	Charles City Co.	110	70	66	75	68	41	67	37	26	18	0
158-W	Richmond	79	48	54	42	38	27	32	40	23	8	0
179-K	Hampton									22	56	0
181-A1	Norfolk	41	48	44	61	58	63			40	36	0
L126-C	Alexandria*	113	61	77	67	48	42	55	17	36	14*	0

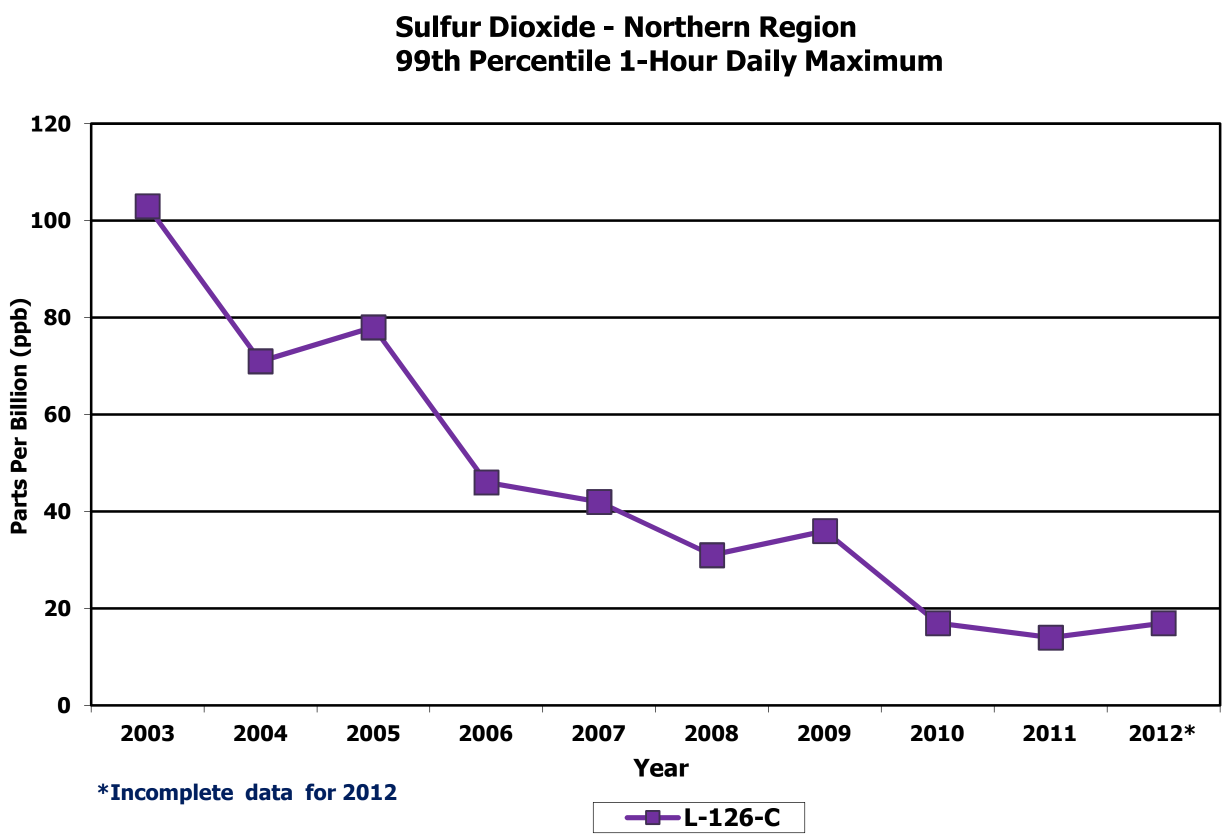
Inc - Incomplete
NA – Not available
* Site relocated in 3rd Qtr. / did not meet completeness criteria


Sulfur Dioxide - Valley Region
99th Percentile 1-Hour Daily Maximum
Parts Per Billion (ppb)
120
100
80
60
40
20
0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
26-F


Sulfur Dioxide - Blue Ridge Region
99th Percentile 1-Hour Daily Maximum
Parts Per Billion (ppb)
120
100
80
60
40
20
0
2003
2004
2005
2006
2007*
2008
2009
2010
2011
2012
Year
* Incomplete data for 2007
19-A6


Sulfur Dioxide - Piedmont Region
99th Percentile 1-Hour Daily Maximum
120
100
80
60
40
20
0
Parts Per Billion (ppb)
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
75-B


Sulfur Dioxide - Tidewater Region
99th Percentile 1-Hour Daily Maximum
120
100
80
60
40
20
0
Parts Per Billion (ppb)
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
*Incomplete data for 2010
179-K
181-A1*

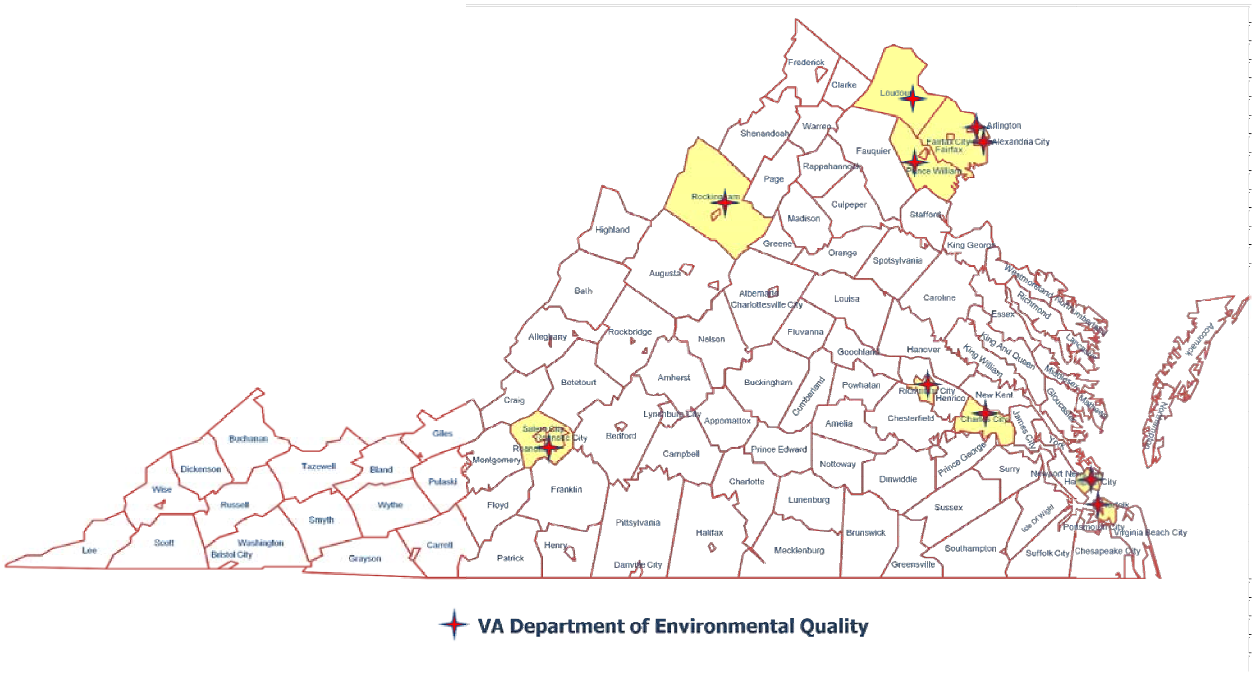

Sulfur Dioxide - Northern Region
99th Percentile 1-Hour Daily Maximum
120
100
80
60
40
20
0
Parts Per Billion (ppb)
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012*
Year
*Incomplete data for 2012
L-126-C

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 chemiluminescence 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 NOx and NO concentrations.



National Ambient Air Quality Standards (NAAQS)

Primary Standard for NO_2:

- 3-year average of the 98^{th} percentile 1-hour daily maximum values not to exceed 100 ppb.
- Annual Arithmetic Mean not to exceed 53 ppb (100 $\mu g/m^3$).

Secondary Standard for NO_2:

- Same as primary.

Nitrogen Dioxide 98^{th} Percentile 1-Hour Daily Maximum Values (ppb)				
Site City/County	**2010**	**2011**	**2012**	**3-Yr Avg. Design Value 2010-2012**
(26-F) **Rockingham Co.**	44	36	35*	39*
(19-A6) **Roanoke Co.**	41	38	37	39
(75-B) **Charles City Co.**	56	55	46	52
(158-W) **Richmond**	57	46	51	51
(179-K) **Hampton**		31	28	NA
(181-A1) **Norfolk**		43	41	NA
(38-I) **Loudoun Co.**	44	38	36	39
(45-L) **Prince William Co.**	30	29	25	28
(47-T) **Arlington Co.**	52	46	44	47
(L-126-C) **Alexandria****	57	47	44**	49**

NA – Not available

* Did not meet completeness criteria

** Site relocated in 3^{rd} Qtr. / did not meet completeness criteria

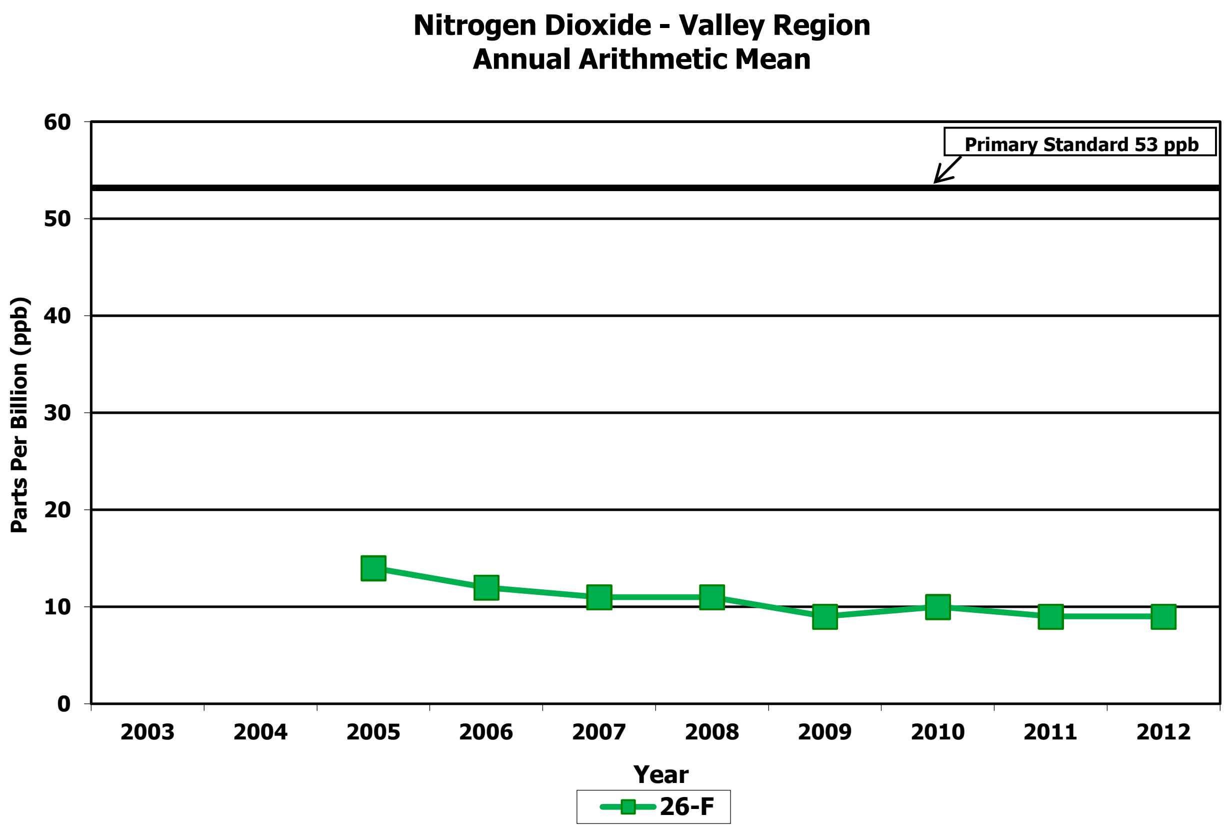
National Ambient Air Quality Standards (NAAQS)

Primary Standard for NO_2:
- 3-year average of the 98th percentile 1-hour daily maximum values not to exceed 100 ppb.
- Annual Arithmetic Mean not to exceed 53 ppb (100 $\mu g/m^3$).

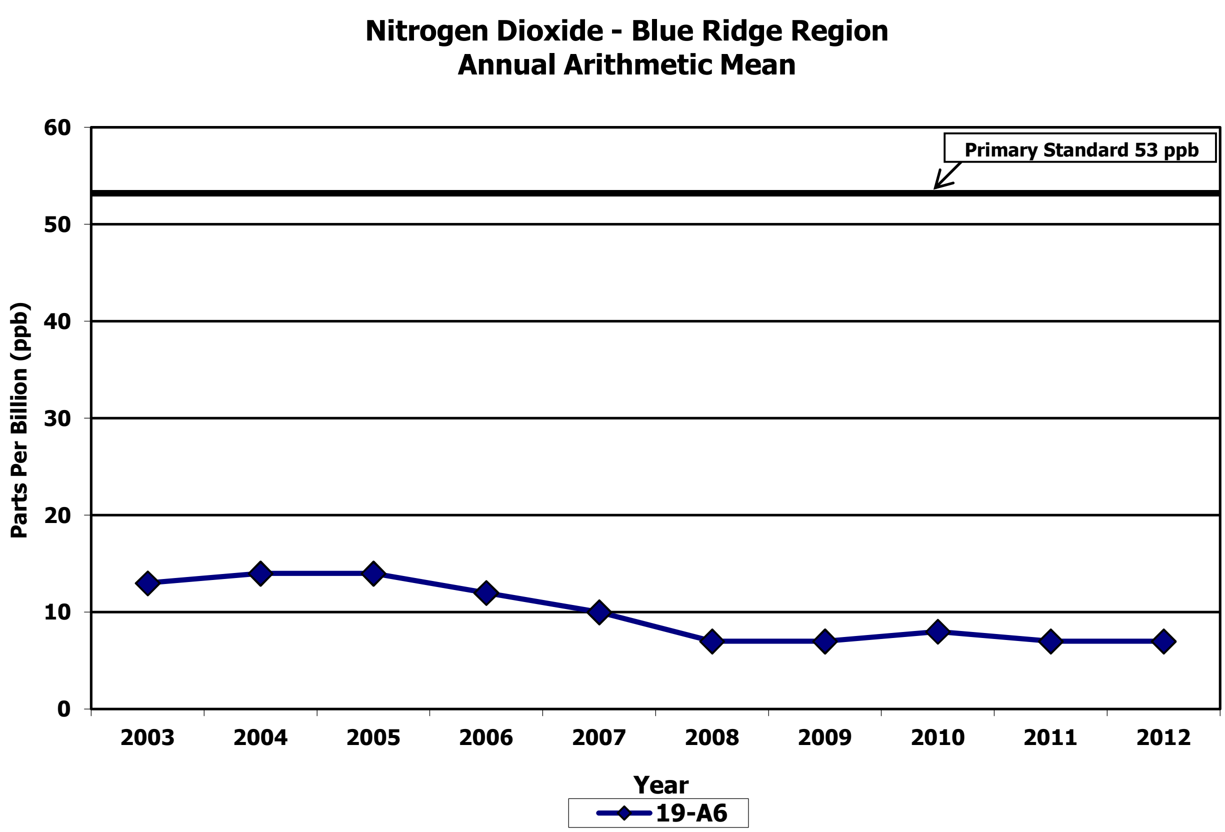
Secondary Standard for NO_2:
- Same as primary.

Site	Annual Arithmetic Mean (ppb)									
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
(26-F) **Rockingham Co.**		Inc	14	12	11	11	9	10	9	9*
(19-A6) **Roanoke Co.**	13	14	14	12	10	7	7	8	7	7
(75-B) **Charles City Co.**	10	10	10	10	7	6	5	5	6	5
(158-W) **Richmond**	16	15	16	16	14	12	11	12	10	10
(179-K) **Hampton**									5	5
(181-A1) **Norfolk**					12	10	Inc	NA	10	8
(38-I) **Loudoun Co.**	16	15	14	13	11	8	7	8	8	7
(45-L) **Prince William Co.**	12	10	9	7	7	6	5	5	6	5
(47-T) **Arlington Co.**	26	22	21	18	16	13	13	13	12	12
(L-126-C) **Alexandria****	23	24	24	20	18	16	15	16	13	12**

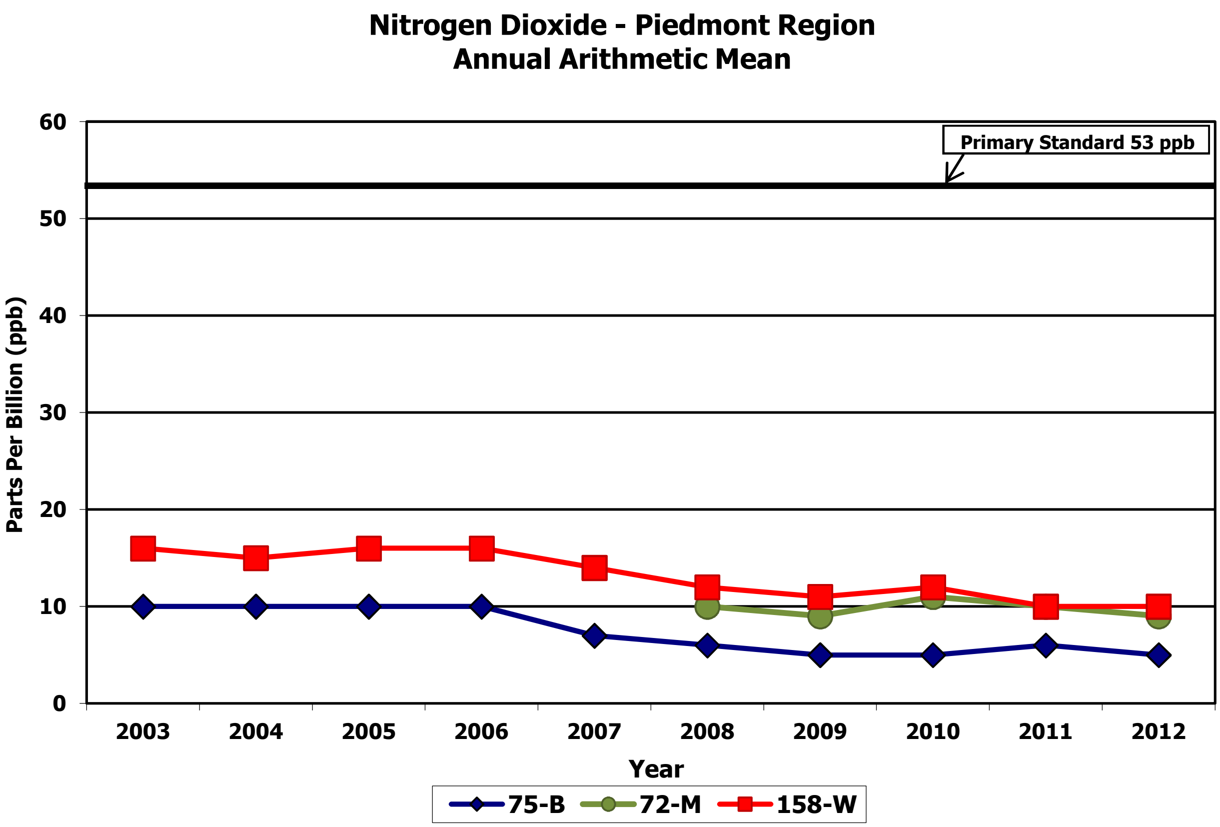
Inc – Incomplete
NA – Not available
* Did not meet completeness criteria
** Site relocated in 3rd Qtr. / did not meet completeness criteria

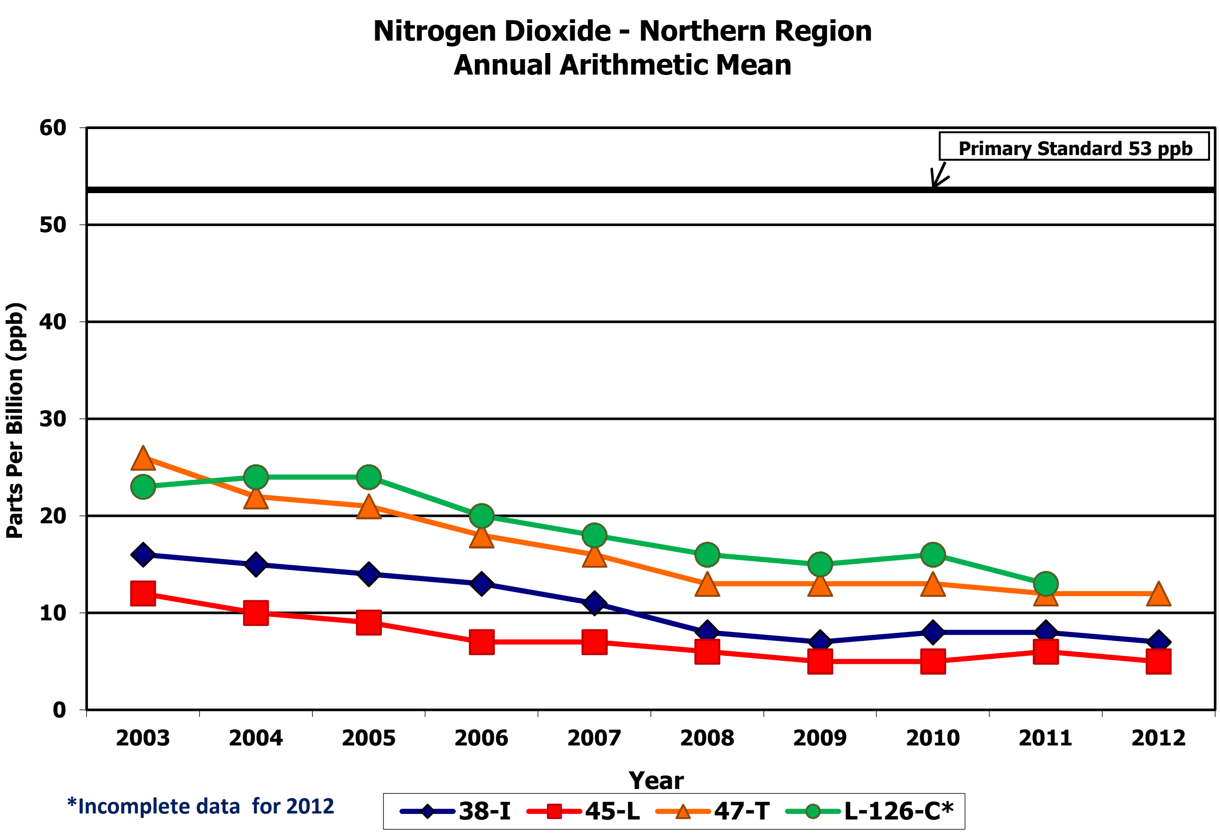


Nitrogen Dioxide - Valley Region
Annual Arithmetic Mean
Primary Standard 53 ppb
Parts Per Billion (ppb)
0
10
20
30
40
50
60
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
26-F



Nitrogen Dioxide - Blue Ridge Region
Annual Arithmetic Mean
Primary Standard 53 ppb
Parts Per Billion (ppb)
0
10
20
30
40
50
60
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
19-A6


Nitrogen Dioxide - Piedmont Region
Annual Arithmetic Mean
Primary Standard 53 ppb
Parts Per Billion (ppb)
60
50
40
30
20
10
0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
75-B
72-M
158-W


Nitrogen Dioxide - Northern Region
Annual Arithmetic Mean
Primary Standard 53 ppb
Parts Per Billion (ppb)
60
50
40
30
20
10
0
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
*Incomplete data for 2012
38-I
45-L
47-T
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 is a gas that occurs both in the Earth's upper atmosphere and at ground level. Ozone can be "good" or "bad" for people's health and for the environment, 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 people, 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.

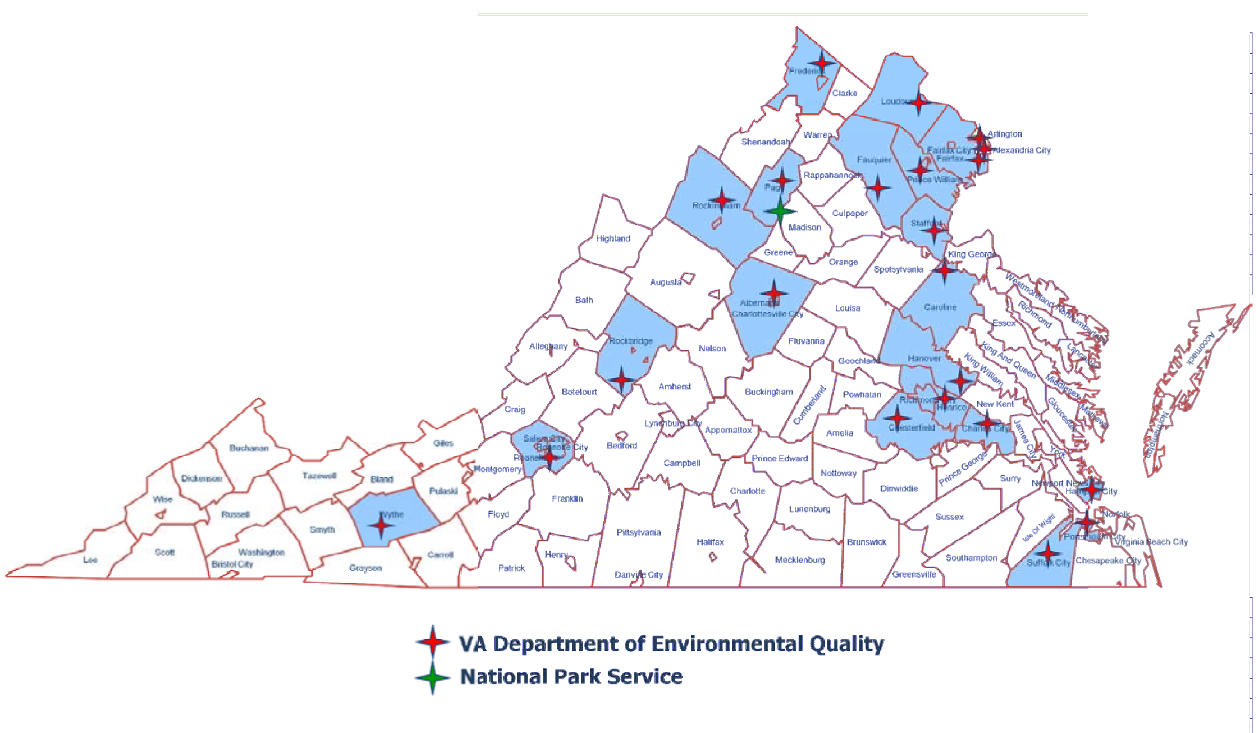
Ground-level ozone is a seasonal pollutant, and the length of the ozone season varies across the country. In some areas, the season may last most of the year, but in Virginia it is usually only a problem during the late spring to summer months when the sunlight is most intense. For 2012, Virginia was required to operate its ozone monitors from the months of April to October. 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://vadeq.tx.sutron.com/cgi-bin/aqi_rpt.pl. 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 2011. 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/monhistory.aspx.



National Ambient Air Quality Standards (NAAQS)

Primary Standard for O_3:

- Maximum 8-hour average concentration of 0.075 ppm (157 µg/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

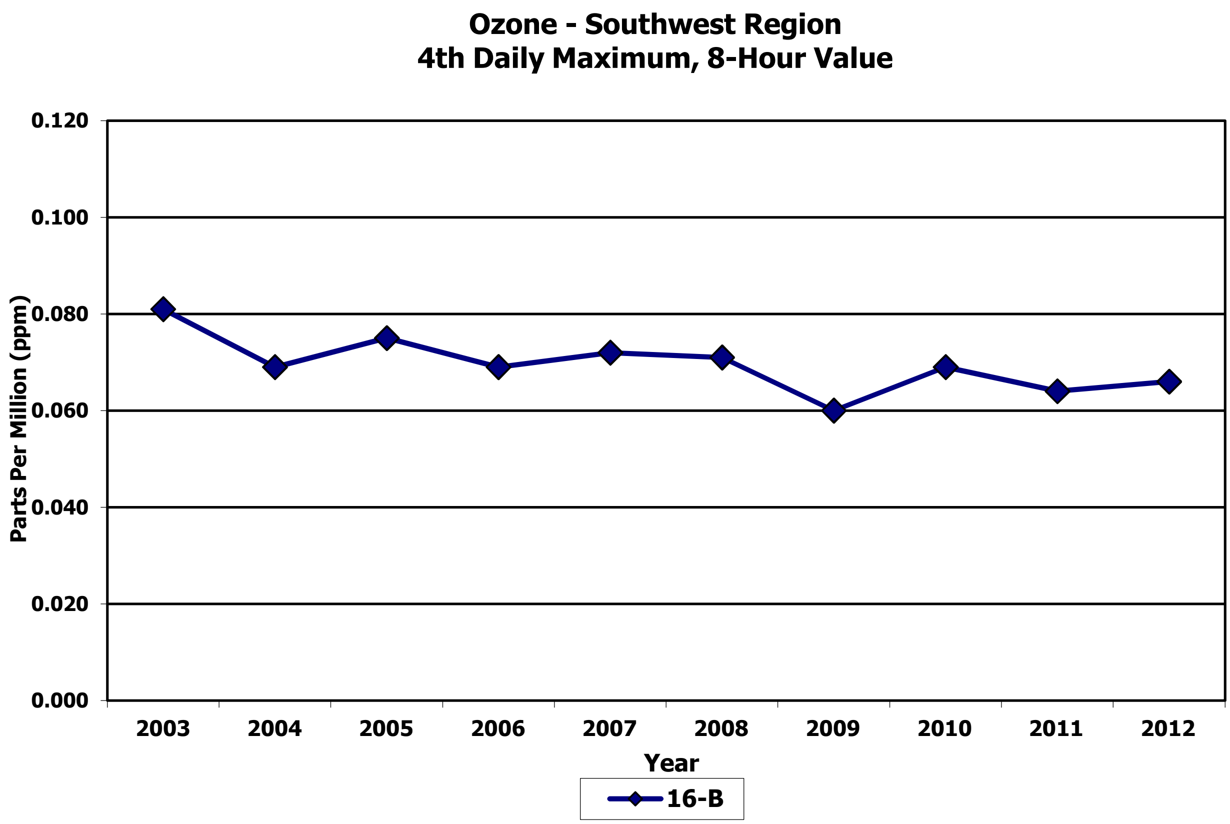
The standard is attained at a monitoring site when the 3-year average of the fourth highest daily maximum 8-hour average for each of the three most recent years is less than or equal to 0.075 ppm.

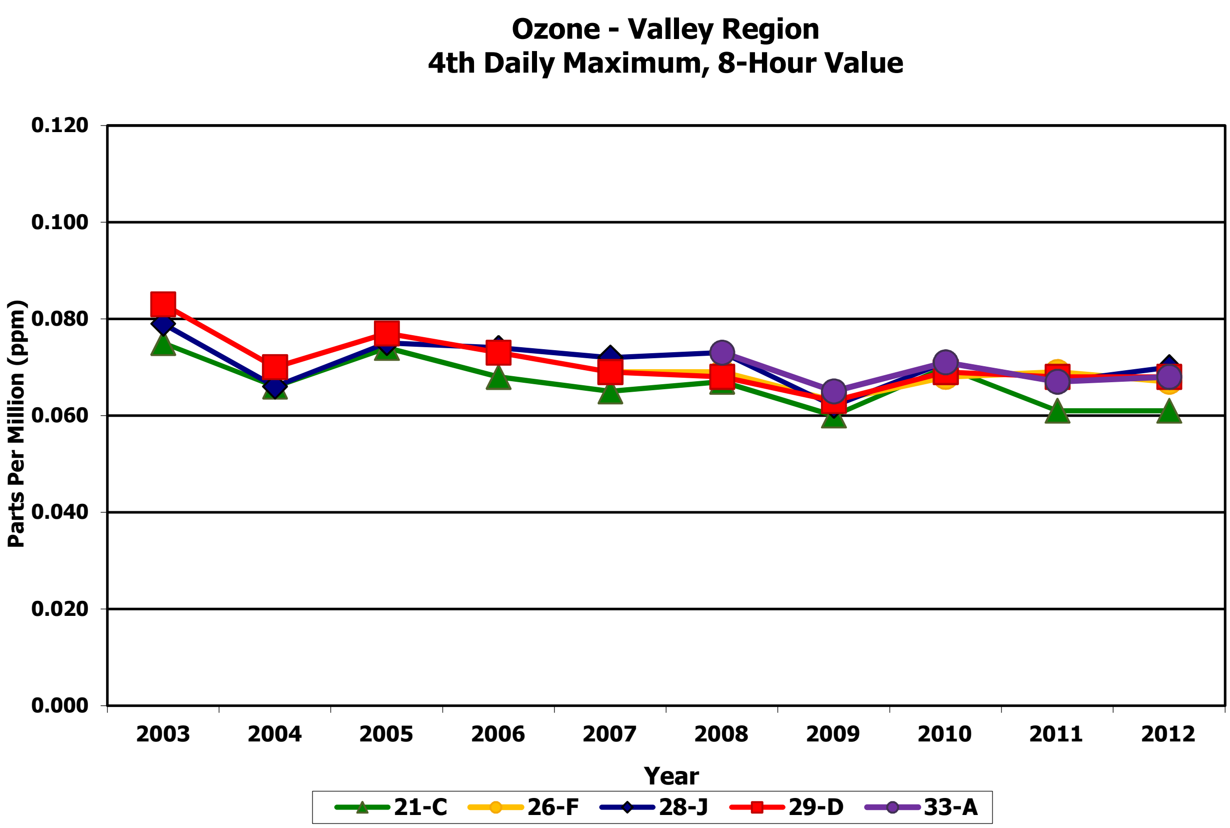
Site	Days Exceeded 0.075 ppm	2012 Highest Daily Maximum 8-Hour Avg.			
		1st Max.	2nd Max.	3rd Max.	4th Max.
(16-B) **Wythe Co.**	1	.080	.075	.075	.066
(26-F) **Rockingham Co.**	0	.075	.069	.068	.067
(28-J) **Frederick Co.**	1	.076	.073	.071	.070
(29-D) **Page Co.**	0	.073	.071	.069	.068
(33-A) **Albemarle Co.**	1	.076	.071	.069	.068
(19-A6) **Roanoke Co.**	1	.077	.072	.071	.070
(21-C) **Rockbridge Co.**	0	.064	.062	.061	.061
(71-H) **Chesterfield Co.**	3	.080	.077	.076	.074
(72-M) **Henrico Co.**	5	.097	.092	.086	.078
(73-E) **Hanover Co.**	4	.093	.087	.084	.076
(75-B) **Charles City Co.**	5	.095	.081	.080	.076
(179-K) **Hampton**	2	.101	.079	.075	.074
(183-E) **Suffolk**	2	.079	.078	.071	.071
(183-F) **Suffolk**	1	.077	.073	.069	.067
(37-B) **Fauquier Co.**	0	.068	.063	.062	.061
(38-I) **Loudoun Co.**	2	.079	.077	.073	.073
(44-A) **Stafford Co.**	4	.082	.081	.079	.076
(45-L) **Prince William Co.**	2	.082	.078	.075	.072
(46-B9) **Fairfax Co.**	12	.106	.097	.096	.084
(47-T) **Arlington Co.**	12	.094	.093	.088	.084
(48-A) **Caroline Co.**	4	.080	.077	.077	.076
(L-126-C) **Alexandria**	7	.098	.096	.089	.086

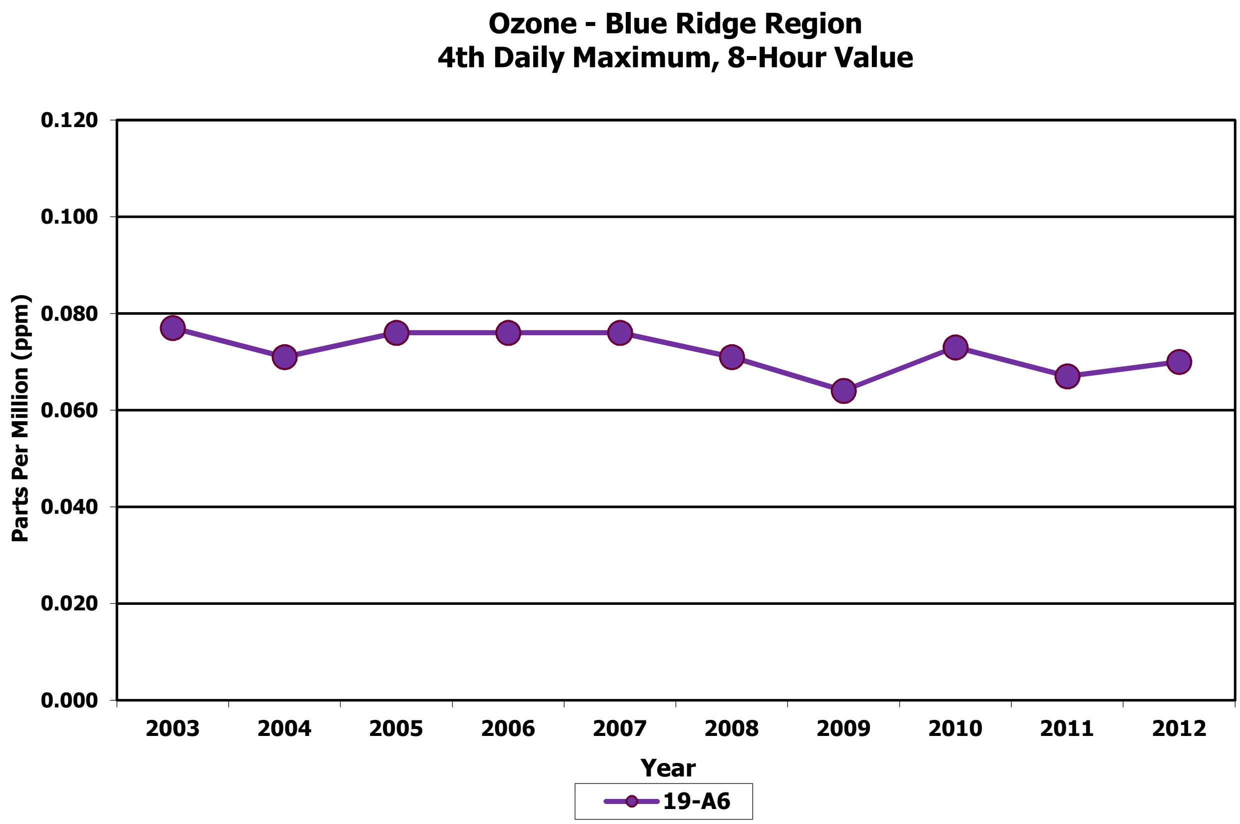
2010-2012 Fourth-Highest Daily Maximum 8-Hour Ozone Averages (units parts per million)					
	Monitor Location (County/City)	**2010**	**2011**	**2012**	**3-Year Average (NAAQS = .075 ppm)**
Richmond Maintenance Area	Chesterfield Co.	.081	.071	.074	.075
	Henrico Co.	**.079**	**.078**	**.078**	.078
	Hanover Co.	**.078**	**.076**	**.076**	.076
	Charles City Co.	**.078**	**.084**	**.076**	.079
Hampton Roads Maintenance Area	Hampton City	**.078**	**.076**	**.074**	.076
	Suffolk City (TCC)	.072	.076	.071	.073
	Suffolk City (Holland)	.075	.073	.067	.071
Fredericksburg Maintenance Area	**Stafford Co.**	**.078**	**.074**	**.076**	.076
Northern Virginia Nonattainment Area	Loudoun Co.	.078	.075	.073	.075
	Prince William Co.	.073	.071	.072	.072
	Arlington Co.	**.087**	**.087**	**.084**	.086
	Alexandria City	**.081**	**.084**	**.086**	.083
	Fairfax Co. (Lee Park)	**.089**	**.087**	**.084**	.086
Shenandoah National Park Maintenance Area	Madison Co. (Big Meadows)	.074	.072	.072	.072
Areas Currently Designated Attainment	Wythe Co.	.069	.064	.066	.066
	Rockbridge Co.	.070	.061	.061	.064
	Rockingham Co.	.068	.069	.067	.068
	Frederick Co.	.071	.067	.070	.069
	Page Co.	.069	.068	.068	.068
	Albemarle Co.	.071	.067	.068	.068
	Roanoke Co.	.073	.067	.070	.070
	Fauquier Co.	.066	.063	.061	.063
	Caroline Co.	.074	.072	.076	.074

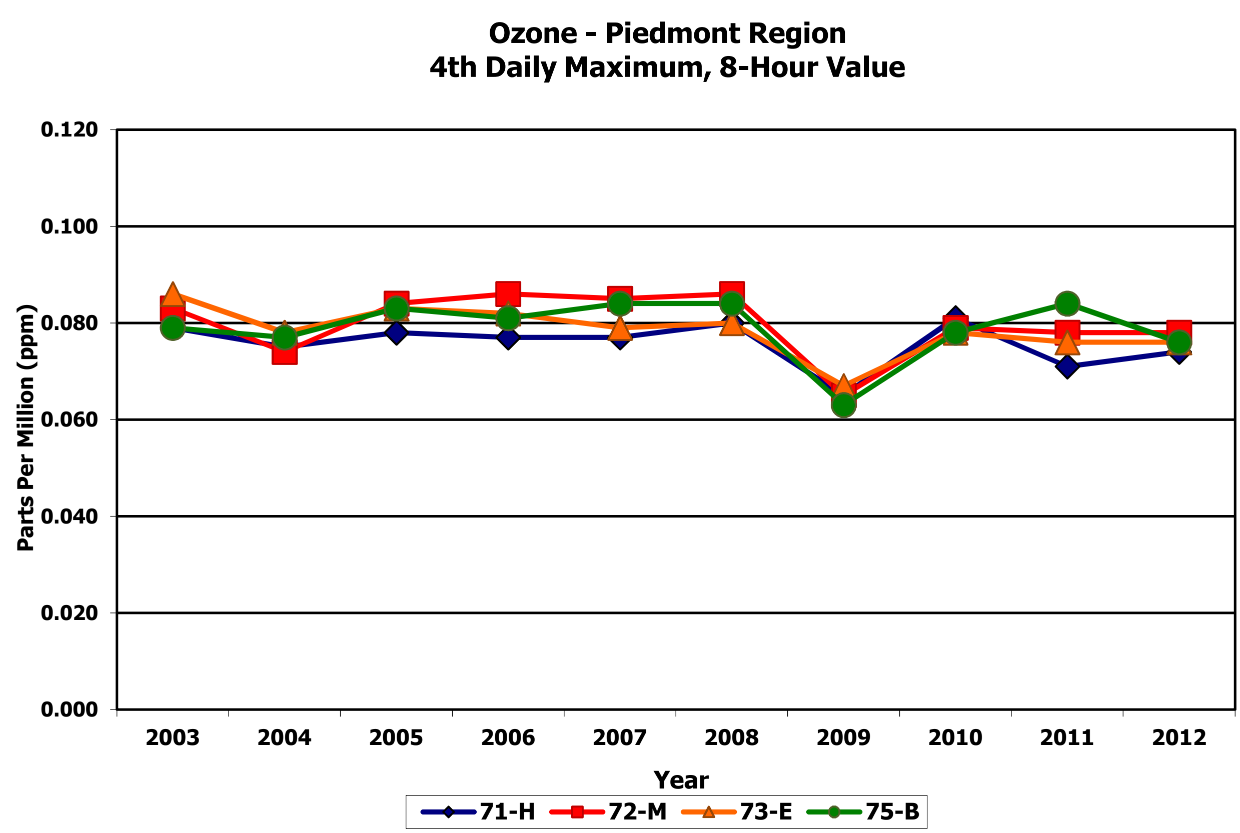
Ozone Monitoring Network

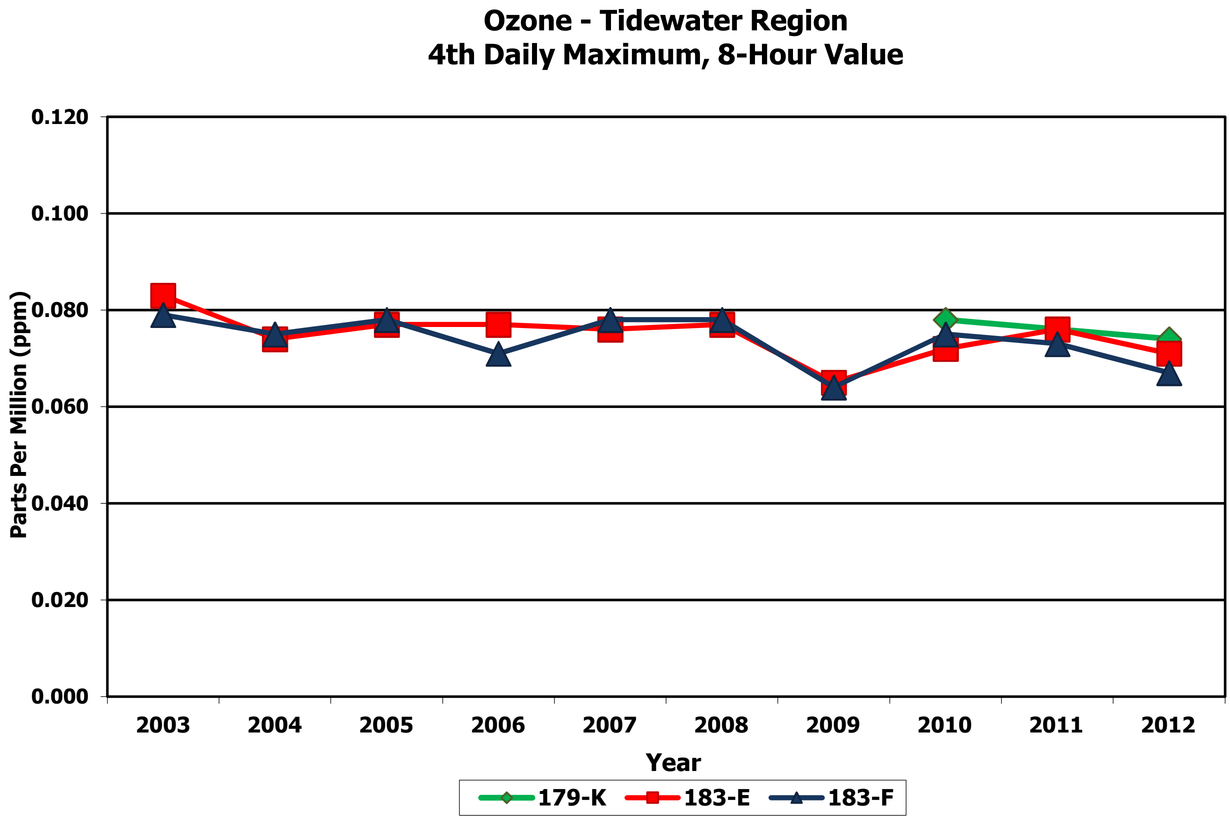
A 3-year average of .075 ppm or above exceeds the 8-hour NAAQS for ozone. For the period from 2010-2012, Charles City, Hanover, Henrico, Hampton, Stafford, the counties of Fairfax, Arlington, and the city of Alexandria exceeded the ozone air quality standards.

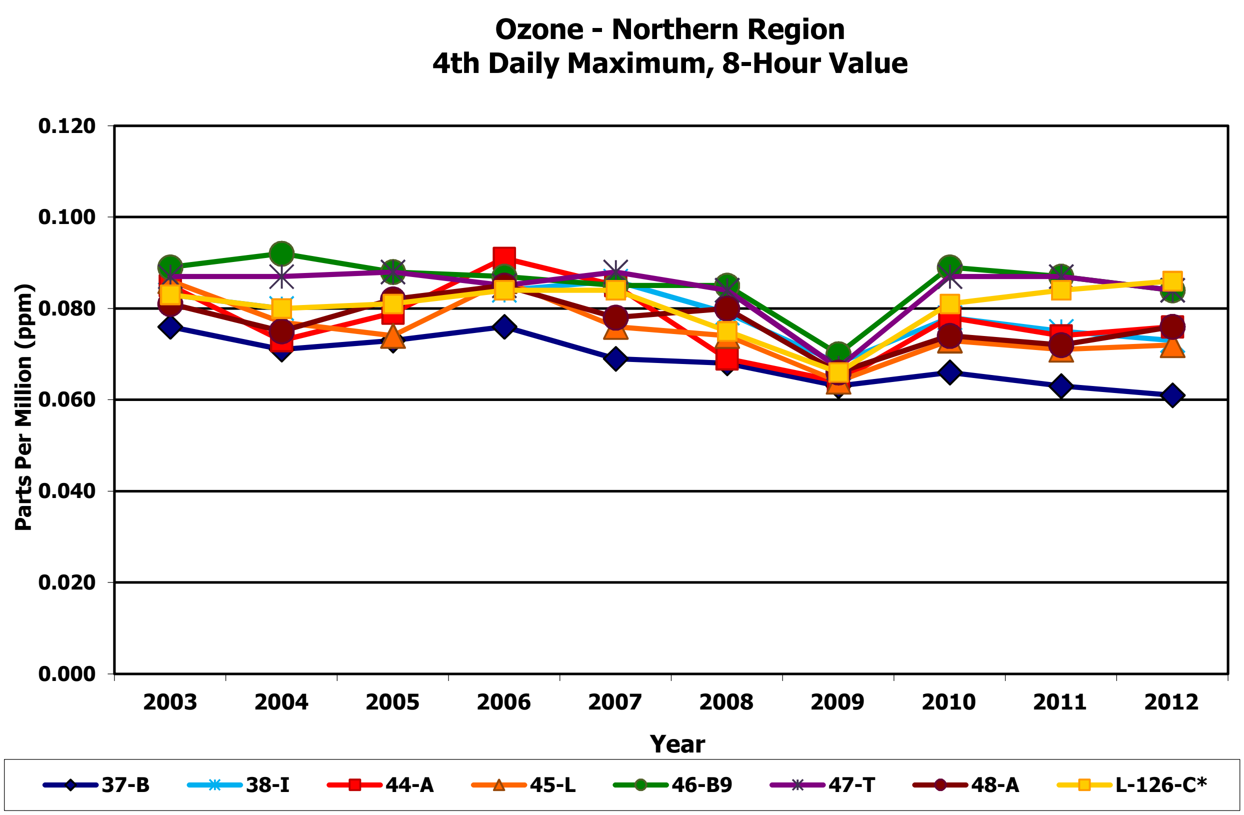

Ozone - Southwest Region
4th Daily Maximum, 8-Hour Value
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Parts Per Million (ppm)
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
16-B


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)
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
21-C
26-F
28-J
29-D
33-A


Ozone - Blue Ridge Region
4th Daily Maximum, 8-Hour Value
Parts Per Million (ppm)
0.120
0.100
0.080
0.060
0.040
0.020
0.000
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
19-A6


Ozone - Piedmont Region
4th Daily Maximum, 8-Hour Value
Parts Per Million (ppm)
0.120
0.100
0.080
0.060
0.040
0.020
0.000
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
71-H
72-M
73-E
75-B


Ozone - Tidewater Region
4th Daily Maximum, 8-Hour Value
Parts Per Million (ppm)
0.120
0.100
0.080
0.060
0.040
0.020
0.000
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
179-K
183-E
183-F


Ozone - Northern Region
4th Daily Maximum, 8-Hour Value
Parts Per Million (ppm)
0.120
0.100
0.080
0.060
0.040
0.020
0.000
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
37-B
38-I
44-A
45-L
46-B9
47-T
48-A
L-126-C*

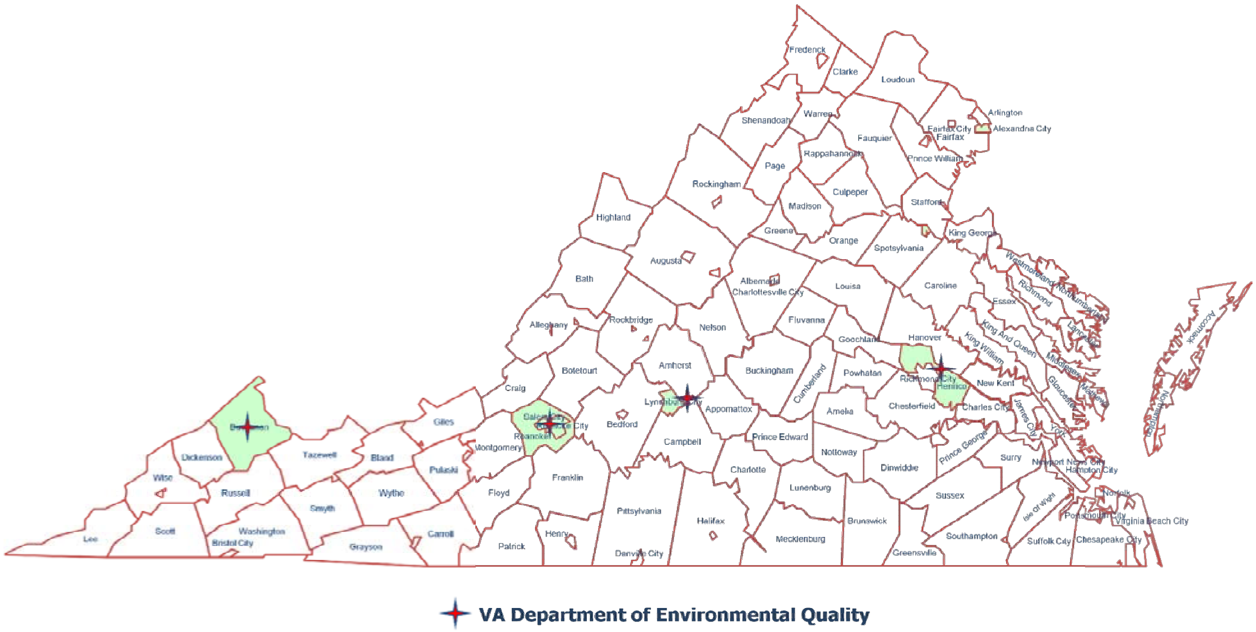
Lead (Pb) is a metal found naturally in the environment as well as in manufactured products. In the past, emissions from cars and trucks using leaded gasoline were the primary sources of lead in the atmosphere. Efforts by EPA to remove lead from motor vehicle gasoline resulted in dramatic reductions of lead in the ambient air from 1980 to 1999. Now the major sources of lead in the air are ore and metals processing and piston-engine aircraft operating on leaded aviation gasoline.

Particles containing lead can be inhaled, or lead can be ingested from drinking water or through contaminated food as a result of deposition of leaded particles onto the ground or in the water. In the body, lead can accumulate in the bones; affect the nervous system, kidney function, immune system, reproductive and developmental systems and the cardiovascular system. Young children are particularly vulnerable to the effects of lead, where it can contribute to behavioral problems, learning deficits and lowered IQ. Lead can stay in the environment for a long time, causing adverse effects to plants and animals.

The National Ambient Air Quality Standards, or NAAQS, for lead were revised in October 2008. At that time, EPA reduced the level of the standard from 1.5 micrograms per cubic meter to 0.15 micrograms per cubic meter. The secondary standard was also reduced to the level of the new primary standard. Virginia DEQ received a waiver from EPA in 1997 to discontinue lead monitoring because Virginia had no major lead sources. However, when the new standards were promulgated, the emission threshold that agencies were required to use for determining if a lead monitor was needed near a source also changed. As a result, Virginia had to resume monitoring for lead in a few areas, and AQM began installing the lead monitors in late 2009 and completed installation in October 2010. For additional information on the revised lead standards, see http://www.epa.gov/ttn/naaqs/standards/pb/s_pb_index.html.

To measure lead, ambient air is drawn into a high volume sampler. The sample air flows across an 8 x 10 inch glass fiber filter at a rate of 39-60 cubic feet per minute for a 24-hour period. The filter is sent to the Division of Consolidated Laboratories, where a small portion of it is analyzed using inductively coupled plasma – mass spectrometry (ICP-MS). The resulting lead concentration is reported as micrograms per cubic meter ($\mu g/m^3$). The normal sampling schedule is once every sixth day from midnight to midnight. The lead sampling schedule for 2012 can be found at http://www.epa.gov/ttn/amtic/calendar.html.

Lead Monitoring Sites



National Ambient Air Quality Standards (NAAQS)

Primary Standard for Pb:

- 0.15 µg/m³ three-month rolling average

Secondary Standard for Pb:

- Same as Primary

2012 Pb 3-Month Averages (units in µg/m³, LC)				
Site	**No. 24-Hour Observations**	**1st Max**	**2nd Max**	**>0.15 µg/m³**
(4-G) **Buchanan Co.**	59	0.01	0.01	0
(109-H) **Roanoke**	60	0.05	0.03	0
(53-G) **Amherst Co.**	57	0.01	0.01	0
(72-M) **Henrico Co.**	53	0.01	0.01	0

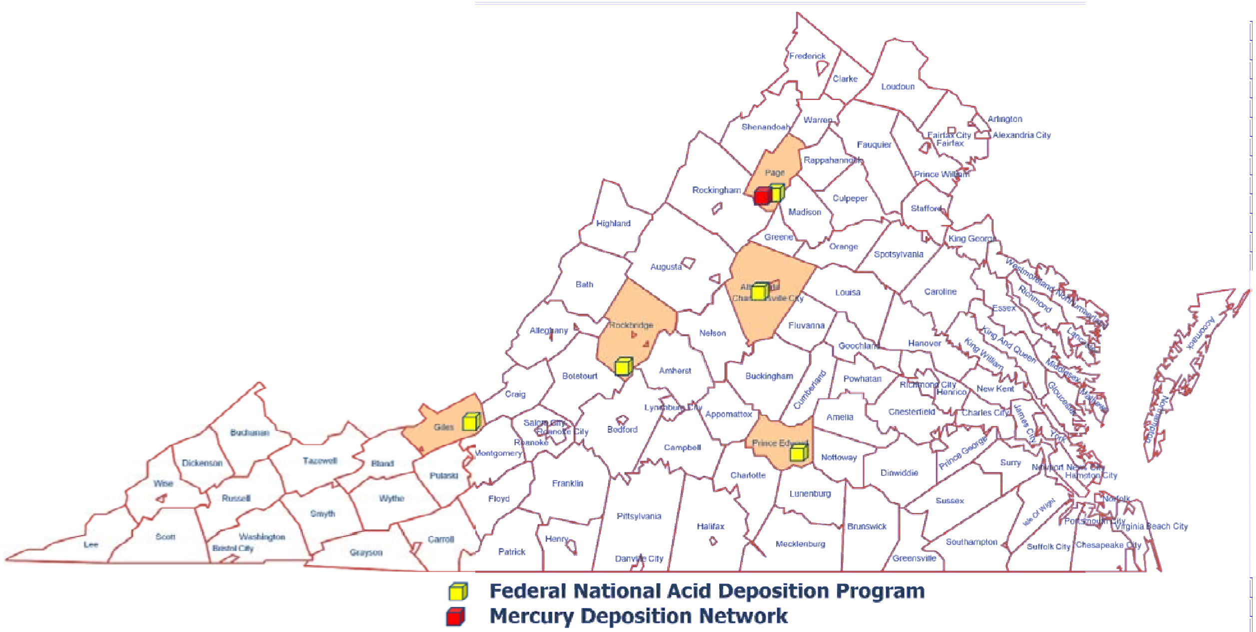
Acid Deposition Program

Photochemical Assessment Monitoring Stations

Air Toxics Monitoring Network

The National Acid Deposition Program (NADP) had five monitoring sites in Virginia in 2012: Big Meadows (Shenandoah National Park), Hortons Station (Giles County), Charlottesville, Prince Edward County, and Natural Bridge Station (Rockbridge County). NADP site information and data are available on-line at http://nadp.sws.uiuc.edu/ntn in the NTN (National Trends Network) section.

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



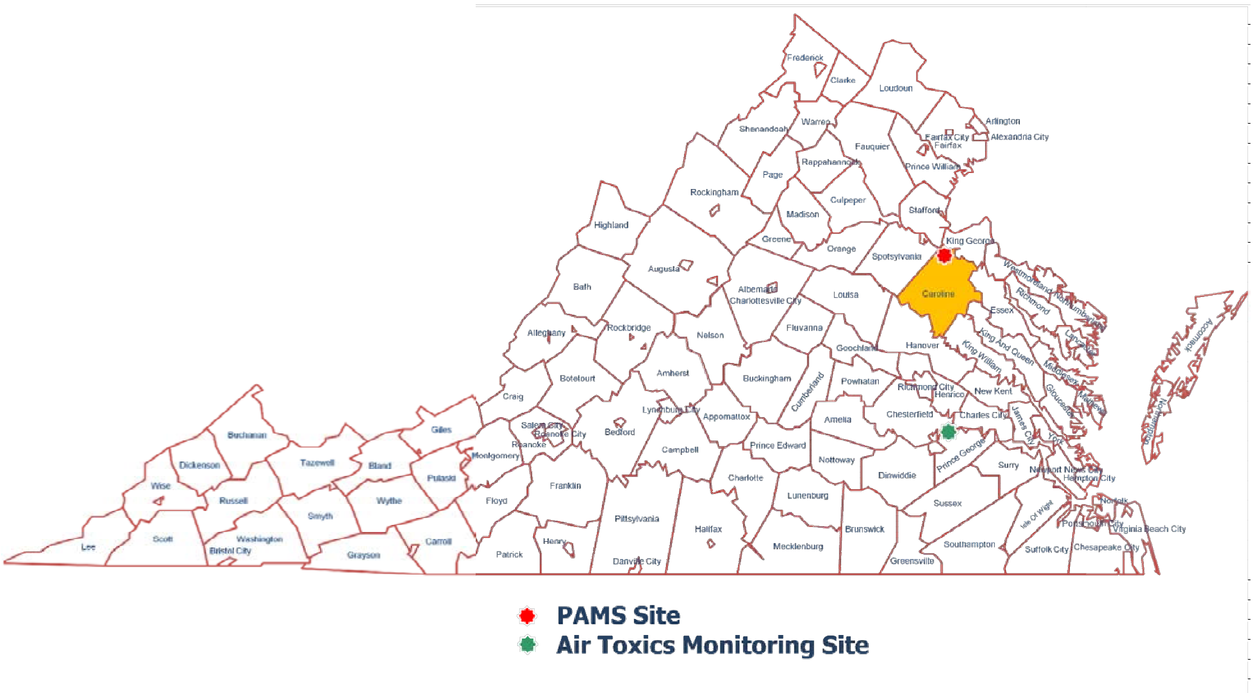
In 2012, the Office of Air Quality Monitoring (AQM) program of the Department of Environmental Quality operated one Photochemical Assessment Monitoring station (PAMS) at the Fredericksburg Geomagnetic Center at Corbin in Caroline County. Additionally, 24-hour PAMS Volatile Organic Compounds (VOC) samples were collected from one core Air Toxics Monitoring Network (ATMN) site located at Carter G. Woodson Middle School (Woodson) in the City of Hopewell, using a one-in-six day sampling schedule.

The Corbin site is considered at Type I PAMS site. A Type I site measures background ozone precursor concentrations at a location that is considered an upwind site for an ozone non-attainment area. Corbin collected 24-hour VOC samples on an every six day schedule all year long. Hourly samples were collected using an Automatic Gas Chromatograph (Auto GC) during the peak ozone season which is considered to be the 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} or Silco^{T} canisters and RMESI (RM Environmental Systems, Inc.) air samplers. Each VOC sample from Corbin was analyzed by the Division of Consolidated Laboratory Services (DCLS) using a Gas Chromatograph/Flame Ionization Detector (FID) designated as TO-12. Samples from Woodson were analyzed by the Maryland Department of the Environment, Air and Radiation Management Administration, using a Gas Chromatograph/Flame Ionization Detector (FID) designated as TO-12. 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



2012 Average Concentration of Detectable Volatile Ozone Precursors Photochemical Assessment Monitoring Station (PAMS) Type I - Corbin

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	57	0.00	2.82	0.00	0.106	0.465
43202	Ethane	57	0.00	7.37	3.34	3.212	2.423
43203	Ethylene	57	0.35	2.46	0.74	0.857	0.430
43204	Propane	57	0.74	6.23	3.04	3.223	1.435
43205	Propylene	57	0.16	1.76	0.37	0.412	0.245
43206	Acetylene	57	0.00	9.84	0.96	2.312	2.647
43212	n-butane	57	0.28	4.15	1.25	1.448	0.836
43214	Isobutane	57	0.21	1.59	0.69	0.768	0.364
43216	t-2-butene	57	0.00	2.98	0.00	0.232	0.568
43217	c-2-butene	57	0.00	3.78	0.00	0.107	0.533
43220	n-pentane	57	0.15	3.82	0.74	0.885	0.606
43221	Isopentane	57	0.24	8.67	0.98	1.172	1.134
43224	1-pentene	57	0.00	1.63	0.08	0.234	0.409
43226	t-2-pentene	57	0.00	0.41	0.00	0.020	0.066
43227	c-2-pentene	57	0.00	0.28	0.00	0.015	0.049
43230	3-methylpentane	57	0.00	2.56	0.21	0.315	0.374
43231	n-hexane	57	0.00	1.51	0.29	0.347	0.220
43232	n-heptane	57	0.00	0.50	0.19	0.192	0.107
43233	n-octane	57	0.00	0.32	0.00	0.072	0.090
43235	n-nonane	57	0.00	0.35	0.00	0.053	0.098
43238	n-decane	57	0.00	0.79	0.00	0.099	0.175
43242	Cyclopentane	57	0.00	1.23	0.00	0.052	0.171
43243	Isoprene	57	0.00	41.86	0.60	5.346	9.278
43244	2,2-dimethylbutane	57	0.00	0.28	0.00	0.049	0.079
43245	1-Hexene	57	0.00	2.68	0.10	0.182	0.378
43247	2,4-dimethylpentane	57	0.00	0.14	0.00	0.009	0.028
43248	Cyclohexane	57	0.00	1.28	0.00	0.089	0.185
43249	3-methylhexane	57	0.00	1.69	0.21	0.372	0.376
43250	2,2,4-trimethylpentane	57	0.00	0.53	0.20	0.209	0.139
43252	2,3,4-trimethylpentane	57	0.00	0.23	0.00	0.029	0.060
43253	3-methylheptane	57	0.00	0.11	0.00	0.002	0.015
43261	Methylcyclohexane	57	0.00	0.27	0.00	0.055	0.083
43262	Methylcyclopentane	57	0.00	0.35	0.12	0.120	0.084
43263	2-methylhexane	57	0.00	0.45	0.15	0.144	0.112
43280	1-butene	57	0.00	2.05	0.25	0.302	0.319
43284	2,3-dimethylbutane	57	0.00	0.42	0.00	0.064	0.099
43285	2-methylpentane	57	0.00	0.96	0.28	0.341	0.222
43291	2,3-dimethylpentane	57	0.00	0.32	0.00	0.045	0.077
43954	n-undecane	57	0.00	0.90	0.00	0.100	0.204
43960	2-methylheptane	57	0.00	0.17	0.00	0.013	0.044
45109	m/p-xylene	57	0.00	0.53	0.00	0.137	0.179
45201	Benzene	57	0.19	2.36	0.57	0.722	0.442
45202	Toluene	57	0.12	1.88	0.77	0.768	0.353
45203	Ethylbenzene	57	0.00	0.43	0.00	0.063	0.106
45204	o-xylene	57	0.00	3.20	0.00	0.273	0.715
45207	1,3,5-trimethylbenzene	57	0.00	0.00	0.00	0.000	0.000
45208	1,2,4-trimethylbenzene	57	0.00	14.15	0.15	0.686	1.917
45209	n-propylbenzene	57	0.00	0.91	0.00	0.101	0.216
45210	Isopropylbenzene	57	0.00	0.00	0.00	0.000	0.000
45211	o-ethyltoluene	57	0.00	0.74	0.00	0.035	0.124
45212	m-ethyltoluene	57	0.00	0.46	0.00	0.055	0.119
45213	p-ethyltoluene	57	0.00	2.28	0.33	0.504	0.608
45218	m-diethylbenzene	57	0.00	0.26	0.00	0.019	0.064
45219	p-diethylbenzene	57	0.00	0.73	0.00	0.078	0.178
45220	Styrene	57	0.00	3.56	0.33	0.567	0.729
45225	1,2,3-trimethylbenzene	57	0.00	1.16	0.00	0.143	0.261
43000	**PAMHC**	57	8.26	75.46	25.45	27.470	12.042
43102	**TNMOC**	57	9.09	135.67	39.72	43.821	21.670

2012 Average Concentration of Detectable Volatile Ozone Precursors
Photochemical Assessment Monitoring Station Additional VOC PAMS Sampling - Carter G. Woodson Middle School, Hopewell

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	56	0.07	1.29	0.20	0.253	0.221
43202	Ethane	56	1.99	142.08	6.30	15.300	27.171
43203	Ethylene	56	0.49	7.30	1.69	2.071	1.433
43204	Propane	56	1.15	39.39	4.57	6.929	6.916
43205	Propylene	56	0.20	3.16	0.57	0.754	0.548
43206	Acetylene	56	0.44	20.40	2.60	4.030	4.050
43212	n-butane	56	0.58	15.24	2.22	3.611	3.111
43214	Isobutane	56	0.27	6.29	1.29	1.690	1.344
43216	t-2-butene	56	0.04	2.35	0.09	0.157	0.307
43217	c-2-butene	56	0.00	3.24	0.10	0.175	0.426
43220	n-pentane	56	0.60	6.09	1.82	2.171	1.234
43221	Isopentane	56	0.73	8.16	2.77	3.113	1.916
43224	1-pentene	56	0.10	2.50	0.21	0.272	0.318
43226	t-2-pentene	56	0.04	2.66	0.26	0.313	0.361
43227	c-2-pentene	56	0.03	3.10	0.12	0.194	0.405
43230	3-methylpentane	56	0.18	4.80	0.62	0.770	0.674
43231	n-hexane	56	0.17	4.26	0.69	0.853	0.666
43232	n-heptane	56	0.13	3.03	0.42	0.501	0.444
43233	n-octane	56	0.10	3.23	0.21	0.299	0.418
43235	n-nonane	56	0.12	2.62	0.24	0.312	0.336
43238	n-decane	56	0.00	2.56	0.24	0.311	0.357
43242	Cyclopentane	56	0.10	2.21	0.36	0.441	0.336
43243	Isoprene	56	0.04	36.44	1.13	3.636	6.260
43244	2,2-dimethylbutane	56	0.09	4.06	0.21	0.307	0.525
43245	1-Hexene	56	0.02	5.19	0.08	0.188	0.688
43247	2,4-dimethylpentane	56	0.05	3.84	0.20	0.282	0.498
43248	Cyclohexane	56	0.00	4.26	0.16	0.262	0.560
43249	3-methylhexane	56	0.20	1.54	0.40	0.456	0.229
43250	2,2,4-trimethylpentane	56	0.19	4.22	0.68	0.886	0.695
43252	2,3,4-trimethylpentane	56	0.13	2.85	0.41	0.471	0.392
43253	3-methylheptane	56	0.05	2.59	0.15	0.208	0.336
43261	Methylcyclohexane	56	0.00	3.38	0.28	0.353	0.448
43262	Methylcyclopentane	56	0.18	3.17	0.54	0.593	0.425
43263	2-methylhexane	56	0.10	3.07	0.54	0.613	0.444
43280	1-butene	56	0.05	2.97	0.14	0.220	0.390
43284	2,3-dimethylbutane	56	0.06	5.18	0.26	0.412	0.677
43285	2-methylpentane	56	0.44	3.71	1.55	1.508	0.790
43291	2,3-dimethylpentane	56	0.00	5.13	0.27	0.375	0.664
43954	n-undecane	56	0.06	1.72	0.15	0.216	0.238
43960	2-methylheptane	56	0.09	2.63	0.22	0.280	0.337
45109	m/p-xylene	56	0.36	4.36	1.05	1.150	0.689
45201	Benzene	56	0.28	3.89	0.79	0.998	0.690
45202	Toluene	56	0.55	6.53	1.77	2.015	1.204
45203	Ethylbenzene	56	0.00	2.39	0.34	0.417	0.343
45204	o-xylene	56	0.15	2.64	0.43	0.548	0.411
45207	1,3,5-trimethylbenzene	56	0.05	2.14	0.21	0.273	0.287
45208	1,2,4-trimethylbenzene	56	0.16	2.84	0.61	0.702	0.461
45209	n-propylbenzene	56	0.05	2.67	0.19	0.305	0.418
45210	Isopropylbenzene	56	0.00	3.38	0.11	0.201	0.452
45211	o-ethyltoluene	56	0.03	1.15	0.15	0.192	0.176
45212	m-ethyltoluene	56	0.13	2.28	0.40	0.464	0.354
45213	p-ethyltoluene	56	0.08	2.80	0.42	0.518	0.466
45218	m-diethylbenzene	56	0.02	2.26	0.05	0.155	0.344
45219	p-diethylbenzene	56	0.03	1.71	0.07	0.154	0.276
45220	Styrene	56	0.00	1.42	0.42	0.469	0.276
45225	1,2,3-trimethylbenzene	56	0.03	1.66	0.14	0.213	0.252
43000	**PAMHC**	56	18.10	256.41	51.35	64.558	49.527
43102	**TNMOC**	56	40.11	284.98	94.59	103.487	52.289

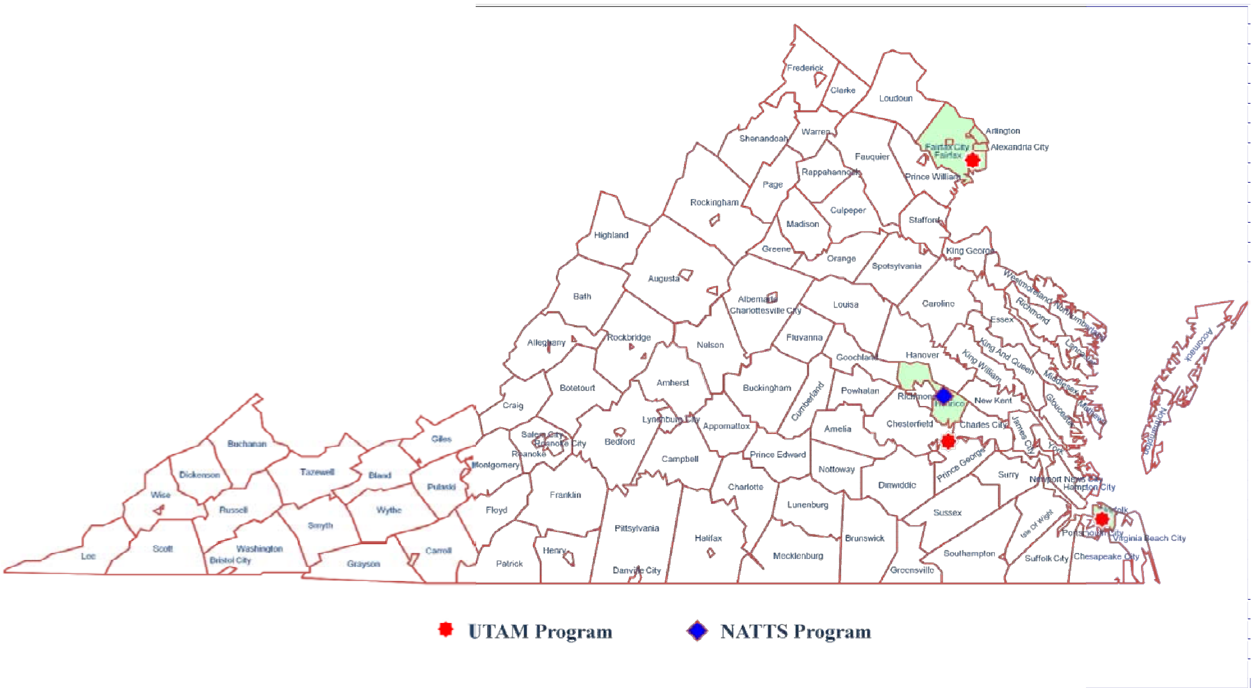
In 2012, the Office of Air Quality Monitoring (AQM) of the Department of Environmental Quality (DEQ) operated an Air Toxics Monitoring Network (ATMN). The ATMN consists of three separate monitoring programs. The Urban Air Toxics Monitoring Program (UATM), The National Air Toxics Trend Stations Program (NATTS), and The Community Air Toxics Assessment Monitoring Program (CAMP).

The UATM program consisted of three sites that were located at: the Carter G. Woodson Middle School in Hopewell; 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 Total Suspended Particulate (TSP) Metals. Each of the UATM 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 Silco™ or SUMMA™ canisters and RMESI (RM Environmental Systems, Inc.) air samplers. Each sample was analyzed by the Division of Consolidated Laboratory Services (DCLS), 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 taken from January through June 2012 were analyzed by the Philadelphia Health Department and the samples taken from July through December 2012 were analyzed by DCLS, using a Liquid Chromatographic procedure designated as method TO11A. Metals samples were collected using a high volume Total Suspended Particulate (TSP) sampler and were analyzed by the DCLS. Analysis utilized inductively coupled plasma mass spectrometry (ICP-MS) using method IO-3.1 and IO-3.5.

The NATTS program operated one station located at the MathScience Innovation Center (MSIC) in Henrico County. The NATTS site had a sampling schedule consisting of 24-hour samples collected every 6th day. Data from this site will be evaluated along with data from all of the NATTS sites nationally. AQM used the manual method for collecting ambient air samples for VOC analysis. Whole air samples were collected using evacuated Silco™ canisters and RMESI (RM Environmental Systems, Inc.) air samplers. Each sample was analyzed by the DCLS, using a Gas Chromatograph equipped with a Mass Selective Detector, utilizing method TO15. Carbonyls were collected on DNPH (2,4-Dinitrophenylhydrazine) treated sorbent tubes using ATEC 8000 cartridge samplers. Samples were analyzed by DCLS using a Liquid Chromatographic procedure, and the TO11A method. The Metals samples were collected using a high volume 10 micron Particulate Matter (PM10) sampler and analyzed by the DCLS. Analysis utilized Inductively Coupled Plasma Mass Spectrometry (ICP-MS) using method IO-3.1 and IO-3.5.

Air Toxics Monitoring Network



Detectable VOC in 24-Hour Canister Samples
GC/MSD - MathScience Innovation Center (NATTS Site), Henrico County, VA
January 1 to December 31, 2012- Concentrations are in ppbV

(non detects are counted as zeros for statistical purposes)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
43205	Propylene	58	0.00	0.00	0.00	0.000	0.000
43207	Freon 113	58	0.06	0.13	0.08	0.083	0.014
43208	Freon 114	58	0.00	0.00	0.00	0.000	0.000
43209	Ethyl Acetate	58	0.00	1.05	0.00	0.023	0.141
43218	1,3-Butadiene	58	0.00	0.12	0.00	0.003	0.018
43231	Hexane	58	0.00	0.61	0.09	0.111	0.111
43232	Heptane	58	0.00	0.21	0.00	0.035	0.051
43248	Cyclohexane	58	0.00	0.00	0.00	0.000	0.000
43372	MTBE	58	0.00	0.00	0.00	0.000	0.000
43441	Methyl Methacrylate	58	0.00	0.05	0.00	0.001	0.007
43505	Acrolein	58	0.00	1.54	0.00	0.104	0.252
43702	Acetonitrile	58	0.00	48.58	0.00	2.737	10.295
43704	Acrylonitrile	58	0.00	0.00	0.00	0.000	0.000
43801	Chloromethane	58	0.39	0.81	0.58	0.589	0.095
43802	Dichloromethane	58	0.00	6.25	0.10	0.325	0.959
43803	Chloroform	58	0.00	0.02	0.00	0.001	0.004
43804	Carbon Tetrachloride	58	0.06	0.13	0.08	0.082	0.013
43806	Bromoform (Tribromomethane)	58	0.00	0.07	0.00	0.002	0.012
43811	Trichlorofluoromethane	58	0.17	0.48	0.25	0.263	0.060
43812	Chloroethane	58	0.00	0.00	0.00	0.000	0.000
43813	1,1-Dichloroethane	58	0.00	0.00	0.00	0.000	0.000
43814	Methyl chloroform	58	0.00	0.00	0.00	0.000	0.000
43815	Ethylene dichloride	58	0.00	0.00	0.00	0.000	0.000
43817	Tetrachloroethylene	58	0.00	0.12	0.00	0.009	0.022
43818	1,1,2,2-Tetrachloroethane	58	0.00	0.00	0.00	0.000	0.000
43819	Bromomethane	58	0.00	0.00	0.00	0.000	0.000
43820	1,1,2-Trichloroethane	58	0.00	0.00	0.00	0.000	0.000
43823	Dichlorodifluoromethane	58	0.00	0.66	0.41	0.359	0.222
43824	Trichloroethylene	58	0.00	0.00	0.00	0.000	0.000
43826	1,1-Dichloroethylene	58	0.00	0.00	0.00	0.000	0.000
43828	Bromodichloromethane	58	0.00	0.00	0.00	0.000	0.000
43829	1,2-Dichloropropane	58	0.00	0.00	0.00	0.000	0.000
43830	trans-1,3-Dichlopropylene	58	0.00	0.00	0.00	0.000	0.000
43831	cis-1,3-Dichlopropylene	58	0.00	0.00	0.00	0.000	0.000
43832	Dibromochloromethane	58	0.00	0.00	0.00	0.000	0.000
43838	Trans-1,2-Dichloroethene	58	0.00	0.00	0.00	0.000	0.000
43839	cis-1,2-Dichloroethene	58	0.00	0.00	0.00	0.000	0.000
43843	Ethylene Dibromide	58	0.00	0.00	0.00	0.000	0.000
43844	Hexachlorobutadiene	58	0.00	0.00	0.00	0.000	0.000
43860	Vinyl Chloride	58	0.00	0.00	0.00	0.000	0.000
45109	m/p-Xylene	58	0.00	0.36	0.08	0.095	0.076
45201	Benzene	58	0.00	0.57	0.13	0.169	0.105
45202	Toluene	58	0.06	0.86	0.22	0.267	0.164
45203	Ethylbenzene	58	0.00	0.46	0.00	0.045	0.084
45204	o-Xylene	58	0.00	0.13	0.03	0.033	0.037
45207	1,3,5-Trimethylbenzene	58	0.00	0.05	0.00	0.002	0.009
45208	1,2,4-Trimethylbenzene	58	0.00	0.19	0.00	0.029	0.050
45213	p-Ethyltoluene	58	0.00	0.08	0.00	0.008	0.019
45220	Styrene	58	0.00	0.91	0.00	0.054	0.157
45801	Chlorobenzene	58	0.00	0.03	0.00	0.001	0.005
45805	1,2-Dichlorobenzene	58	0.00	0.16	0.00	0.013	0.031
45806	1,3-Dichlorobenzene	58	0.00	0.15	0.00	0.016	0.031
45807	1,4-Dichlorobenzene	58	0.00	0.22	0.00	0.026	0.043
45810	1,2,4-Trichlorobenzene	58	0.00	0.44	0.00	0.026	0.070
46401	Tetrahydrofuran	58	0.00	0.00	0.00	0.000	0.000

Detectable VOC in 24-Hour Canister Samples
GC/MSD - Carter G. Woodson Middle School (UTAM Site), Hopewell, VA
January 1 to December 31, 2012 - 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	0.01	0.08	0.02	0.023	0.015
43207	Freon 113	59	0.03	0.31	0.07	0.080	0.036
43208	Freon 114	59	0.00	0.02	0.01	0.013	0.008
43218	1,3-Butadiene	59	0.00	0.18	0.03	0.045	0.043
43231	N-Hexane	59	0.00	0.44	0.08	0.099	0.087
43232	N-Heptane	59	0.02	0.35	0.07	0.101	0.075
43248	Cyclohexane	59	0.00	0.15	0.03	0.044	0.033
43372	Methyl Tert-Butyl Ether	59	0.00	0.08	0.00	0.008	0.016
43505	Acrolein	59	0.04	0.46	0.15	0.178	0.096
43551	Acetone	59	0.71	7.60	2.89	3.097	1.299
43702	Acetonitrile	59	0.26	8.17	2.28	2.554	1.521
43704	Acrylonitrile	59	0.00	0.37	0.01	0.019	0.049
43801	Chloromethane	59	0.39	0.75	0.55	0.547	0.075
43802	Dichloromethane	59	0.03	0.50	0.07	0.092	0.068
43803	Chloroform	59	0.01	0.03	0.02	0.018	0.006
43804	Carbon Tetrachloride	59	0.06	0.10	0.08	0.078	0.007
43811	Trichlorofluoromethane	59	0.11	0.30	0.23	0.230	0.026
43814	Methyl Chloroform	59	0.00	0.04	0.01	0.009	0.012
43815	Ethylene Dichloride	59	0.00	0.02	0.01	0.011	0.003
43817	Tetrachloroethylene	59	0.00	0.09	0.02	0.022	0.019
43818	1,1,2,2-Tetrachloroethane	59	0.00	0.01	0.00	0.000	0.002
43819	Bromomethane	59	0.00	0.02	0.00	0.006	0.007
43820	1,1,2-Trichloroethane	59	0.00	0.01	0.00	0.000	0.001
43823	Dichlorodifluoromethane	59	0.38	0.59	0.45	0.447	0.036
43824	Trichloroethylene	59	0.00	0.02	0.00	0.002	0.004
43829	1,2-Dichloropropane	59	0.00	0.02	0.00	0.001	0.003
43830	Trans-1,3-Dichloropropylene	59	0.00	0.03	0.00	0.001	0.004
43831	Cis-1,3-Dichloropropylene	59	0.00	0.02	0.00	0.001	0.003
43843	Ethylene Dibromide	59	0.00	0.02	0.00	0.001	0.003
43844	Hexachlorobutadiene	59	0.00	0.03	0.00	0.002	0.005
43860	Vinyl Chloride	59	0.00	0.05	0.00	0.006	0.014
45109	M/P Xylene	59	0.02	0.30	0.06	0.078	0.055
45201	Benzene	59	0.04	0.67	0.14	0.180	0.121
45202	Toluene	59	0.06	0.80	0.18	0.227	0.141
45203	Ethylbenzene	59	0.01	0.12	0.02	0.031	0.023
45204	O-Xylene	59	0.01	0.09	0.02	0.030	0.020
45207	1,3,5-Trimethylbenzene	59	0.00	0.03	0.01	0.006	0.007
45208	1,2,4-Trimethylbenzene	59	0.00	0.08	0.02	0.021	0.016
45213	P-Ethyltoluene	59	0.00	0.18	0.01	0.020	0.028
45220	Styrene	59	0.00	0.15	0.02	0.026	0.028
45801	Chlorobenzene	59	0.00	0.33	0.00	0.014	0.057
45807	1,4-Dichlorobenzene	59	0.00	0.11	0.00	0.008	0.019
45809	Benzyl Chloride	59	0.00	0.02	0.00	0.001	0.004
46401	Furan, Tetrahydro-	59	0.00	0.05	0.02	0.024	0.015

Detectable VOC in 24-Hour Canister Samples
GC/MSD - Tidewater Regional Office (UTAM Site), Va. Beach, VA
January 1 to December 31, 2012 – 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	0.19	0.02	0.031	0.029
43207	Freon 113	60	0.06	0.08	0.07	0.068	0.006
43208	Freon 114	60	0.00	0.02	0.02	0.016	0.006
43218	1,3-Butadiene	60	0.00	0.24	0.06	0.063	0.050
43231	N-Hexane	60	0.00	0.32	0.09	0.103	0.084
43232	N-Heptane	60	0.00	0.30	0.08	0.108	0.078
43248	Cyclohexane	60	0.01	0.13	0.04	0.049	0.030
43372	Methyl Tert-Butyl Ether	60	0.00	0.01	0.00	0.000	0.002
43505	Acrolein	60	0.05	0.89	0.20	0.221	0.119
43551	Acetone	60	1.64	7.52	3.21	3.399	1.165
43702	Acetonitrile	60	0.01	1.13	0.25	0.296	0.178
43704	Acrylonitrile	60	0.00	0.16	0.01	0.015	0.027
43801	Chloromethane	60	0.39	0.70	0.58	0.568	0.071
43802	Dichloromethane	60	0.04	0.35	0.07	0.090	0.046
43803	Chloroform	60	0.01	0.05	0.02	0.018	0.008
43804	Carbon Tetrachloride	60	0.02	0.09	0.07	0.071	0.013
43811	Trichlorofluoromethane	60	0.19	0.27	0.23	0.232	0.016
43814	Methyl Chloroform	60	0.00	0.05	0.00	0.005	0.012
43815	Ethylene Dichloride	60	0.00	0.02	0.01	0.009	0.004
43817	Tetrachloroethylene	60	0.00	1.78	0.07	0.174	0.296
43818	1,1,2,2-Tetrachloroethane	60	0.00	0.00	0.00	0.000	0.000
43819	Bromomethane	60	0.00	0.02	0.00	0.004	0.006
43820	1,1,2-Trichloroethane	60	0.00	0.01	0.00	0.000	0.001
43823	Dichlorodifluoromethane	60	0.33	0.53	0.46	0.454	0.038
43824	Trichloroethylene	60	0.00	0.01	0.00	0.001	0.003
43829	1,2-Dichloropropane	60	0.00	0.01	0.00	0.001	0.002
43830	Trans-1,3-Dichloropropylene	60	0.00	0.09	0.00	0.002	0.012
43831	Cis-1,3-Dichloropropylene	60	0.00	0.01	0.00	0.000	0.001
43843	Ethylene Dibromide	60	0.00	0.00	0.00	0.000	0.000
43844	Hexachlorobutadiene	60	0.00	0.03	0.00	0.002	0.006
43860	Vinyl Chloride	60	0.00	0.07	0.00	0.003	0.011
45109	M/P Xylene	60	0.02	0.34	0.08	0.095	0.063
45201	Benzene	60	0.04	0.52	0.16	0.180	0.104
45202	Toluene	60	0.06	0.89	0.24	0.285	0.179
45203	Ethylbenzene	60	0.01	0.11	0.03	0.033	0.020
45204	O-Xylene	60	0.01	0.11	0.03	0.036	0.022
45207	1,3,5-Trimethylbenzene	60	0.00	0.04	0.01	0.010	0.010
45208	1,2,4-Trimethylbenzene	60	0.01	0.10	0.02	0.031	0.023
45213	P-Ethyltoluene	60	0.00	0.08	0.02	0.023	0.019
45220	Styrene	60	0.00	0.27	0.03	0.036	0.040
45801	Chlorobenzene	60	0.00	0.35	0.00	0.016	0.071
45807	1,4-Dichlorobenzene	60	0.00	0.01	0.00	0.003	0.005
45809	Benzyl Chloride	60	0.00	0.00	0.00	0.000	0.000
46401	Furan, Tetrahydro-	60	0.00	0.07	0.02	0.021	0.013

Detectable VOC in 24-Hour Canister Samples
GC/MSD - Lee District Park (UTAM Site), Fairfax County, VA
January 1 to December 31, 2012 - 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	57	0.02	0.25	0.04	0.060	0.052
43207	Freon 113	57	0.05	0.09	0.07	0.068	0.006
43208	Freon 114	57	0.00	0.02	0.02	0.015	0.007
43218	1,3-Butadiene	57	0.00	0.14	0.05	0.048	0.034
43231	N-Hexane	57	0.00	0.23	0.06	0.069	0.062
43232	N-Heptane	57	0.00	0.30	0.05	0.074	0.061
43248	Cyclohexane	57	0.00	0.09	0.03	0.038	0.026
43372	Methyl Tert-Butyl Ether	57	0.00	0.01	0.00	0.000	0.001
43505	Acrolein	57	0.00	0.36	0.18	0.196	0.082
43551	Acetone	57	1.23	9.44	3.59	3.526	1.456
43702	Acetonitrile	57	0.10	0.65	0.29	0.300	0.105
43704	Acrylonitrile	57	0.00	0.52	0.00	0.023	0.073
43801	Chloromethane	57	0.39	0.99	0.55	0.556	0.104
43802	Dichloromethane	57	0.03	0.24	0.07	0.081	0.035
43803	Chloroform	57	0.01	0.05	0.02	0.019	0.009
43804	Carbon Tetrachloride	57	0.03	0.09	0.07	0.067	0.012
43811	Trichlorofluoromethane	57	0.10	0.29	0.23	0.229	0.025
43814	Methyl Chloroform	57	0.01	0.04	0.02	0.020	0.008
43815	Ethylene Dichloride	57	0.00	0.02	0.01	0.011	0.003
43817	Tetrachloroethylene	57	0.00	0.11	0.02	0.028	0.024
43818	1,1,2,2-Tetrachloroethane	57	0.00	0.00	0.00	0.000	0.000
43819	Bromomethane	57	0.00	0.11	0.00	0.008	0.016
43820	1,1,2-Trichloroethane	57	0.00	0.00	0.00	0.000	0.000
43823	Dichlorodifluoromethane	57	0.39	0.70	0.46	0.463	0.047
43824	Trichloroethylene	57	0.00	0.04	0.01	0.007	0.007
43829	1,2-Dichloropropane	57	0.00	0.00	0.00	0.000	0.000
43830	Trans-1,3-Dichloropropylene	57	0.00	0.07	0.00	0.001	0.009
43831	Cis-1,3-Dichloropropylene	57	0.00	0.01	0.00	0.000	0.002
43843	Ethylene Dibromide	57	0.00	0.00	0.00	0.000	0.000
43844	Hexachlorobutadiene	57	0.00	0.04	0.00	0.002	0.007
43860	Vinyl Chloride	57	0.00	0.06	0.00	0.004	0.010
45109	M/P Xylene	57	0.02	0.16	0.05	0.052	0.028
45201	Benzene	57	0.05	0.34	0.13	0.152	0.076
45202	Toluene	57	0.07	0.40	0.18	0.185	0.076
45203	Ethylbenzene	57	0.01	0.05	0.02	0.021	0.010
45204	O-Xylene	57	0.01	0.06	0.02	0.021	0.011
45207	1,3,5-Trimethylbenzene	57	0.00	0.04	0.00	0.005	0.008
45208	1,2,4-Trimethylbenzene	57	0.00	0.16	0.01	0.021	0.029
45213	P-Ethyltoluene	57	0.00	0.08	0.01	0.012	0.016
45220	Styrene	57	0.00	0.06	0.01	0.015	0.013
45801	Chlorobenzene	57	0.00	0.34	0.00	0.007	0.045
45807	1,4-Dichlorobenzene	57	0.00	0.01	0.00	0.002	0.004
45809	Benzyl Chloride	57	0.00	0.00	0.00	0.000	0.000
46401	Furan, Tetrahydro-	57	0.00	0.15	0.02	0.021	0.022

24 Hour Carbonyl Sampling 2012 Summary Statistical Analysis

Concentrations are in ug/m^3

(non detects are counted as zeros for statistical purposes)

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Carter G. Woodson Middle School	43502	Formaldehyde	59	0.11	12.80	2.43	2.874	1.950
	43503	Acetaldehyde	59	0.24	3.00	1.43	1.425	0.642
	43504	Propionaldehyde	59	0.00	0.59	0.13	0.186	0.200
	43551	Acetone	59	0.00	10.00	3.80	3.838	2.181
	43552	Methyl Ethyl Ketone	59	0.00	1.30	0.59	0.549	0.357
	43560	Methyl Isobutyl Ketone	59	0.00	0.00	0.00	0.000	0.000

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Tidewater Regional Office	43502	Formaldehyde	57	0.05	6.53	2.36	2.586	1.233
	43503	Acetaldehyde	57	0.00	5.45	1.32	1.341	0.801
	43504	Propionaldehyde	57	0.00	11.82	0.00	0.372	1.554
	43551	Acetone	57	0.00	10.77	3.20	3.065	2.340
	43552	Methyl Ethyl Ketone	57	0.00	3.77	0.50	0.530	0.535
	43560	Methyl Isobutyl Ketone	57	0.00	0.48	0.00	0.030	0.085

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Lee Park	43502	Formaldehyde	60	0.81	12.00	2.66	3.271	2.238
	43503	Acetaldehyde	60	0.49	3.79	1.63	1.708	0.591
	43504	Propionaldehyde	60	0.00	0.64	0.23	0.209	0.198
	43551	Acetone	60	1.51	10.80	3.90	3.926	1.751
	43552	Methyl Ethyl Ketone	60	0.00	1.32	0.62	0.598	0.241
	43560	Methyl Isobutyl Ketone	60	0.00	0.00	0.00	0.000	0.000

NATTS Carbonyl Sampling 2011 Summary Statistical Analysis

Concentrations are in ug/m^3

(non detects are counted as zeros for statistical purposes)

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
MathScience Innovation Center	43502	Formaldehyde	61	0.93	11.40	2.11	2.768	2.129
	43503	Acetaldehyde	61	0.64	3.49	1.29	1.457	0.562
	43504	Propionaldehyde	61	0.00	0.74	0.00	0.086	0.183
	43551	Acetone	61	1.32	11.00	3.76	4.042	1.719
	43552	Methyl Ethyl Ketone	61	0.00	1.38	0.48	0.504	0.247
	43560	Methyl Isobutyl Ketone	61	0.00	0.00	0.00	0.000	0.000

TSP Metals Sampling 2012 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
Carter G. Woodson Middle School	12103	Arsenic	57	0.18	20.79	0.64	1.121	2.690
	12105	Beryllium	57	0.00	0.05	0.00	0.004	0.010
	12110	Cadmium	57	0.02	0.29	0.08	0.092	0.052
	12112	Chromium	57	2.11	3.51	2.67	2.663	0.332
	12128	Lead	57	0.64	11.17	2.41	2.661	1.565
	12132	Manganese	57	1.83	28.04	6.59	8.033	5.220
	12136	Nickel	57	0.33	2.48	0.76	0.857	0.414

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Tidewater Regional Office	12103	Arsenic	57	0.18	5.31	0.93	1.149	0.833
	12105	Beryllium	57	0.00	0.02	0.00	0.002	0.003
	12110	Cadmium	57	0.00	0.22	0.07	0.072	0.045
	12112	Chromium	57	2.08	4.90	2.69	2.782	0.483
	12128	Lead	57	0.42	16.67	2.17	2.524	2.159
	12132	Manganese	57	1.26	19.58	4.71	5.896	3.720
	12136	Nickel	57	0.46	4.08	1.03	1.281	0.709

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Lee Park	12103	Arsenic	59	0.24	2.39	0.65	0.812	0.483
	12105	Beryllium	59	0.00	0.06	0.00	0.003	0.009
	12110	Cadmium	59	0.01	0.22	0.08	0.092	0.051
	12112	Chromium	59	2.14	4.16	2.55	2.605	0.363
	12128	Lead	59	0.56	5.56	2.11	2.250	1.112
	12132	Manganese	59	1.52	23.54	5.02	6.165	4.142
	12136	Nickel	59	0.36	2.73	0.81	0.928	0.502

NATTS PM10 Metals Sampling 2012 Summary Statistical Analysis

Concentrations are in ng/m^3

(non detects and negative values are counted as zeros for statistical purposes)

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
MathScience Innovation Center	82103	Arsenic	60	0.21	3.60	0.75	0.844	0.529
	82105	Beryllium	60	0.00	0.05	0.00	0.002	0.008
	82110	Cadmium	60	0.05	0.84	0.11	0.152	0.134
	82112	Chromium	60	2.35	4.32	2.88	2.915	0.289
	82128	Lead	60	0.38	12.61	2.20	2.790	2.369
	82132	Manganese	60	0.90	7.94	2.82	3.049	1.438
	82136	Nickel	60	0.38	1.57	0.74	0.748	0.297

AQI (Air Quality Index)

What is the AQI?

The air quality index (AQI) is a measurement designed to indicate how clean 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.

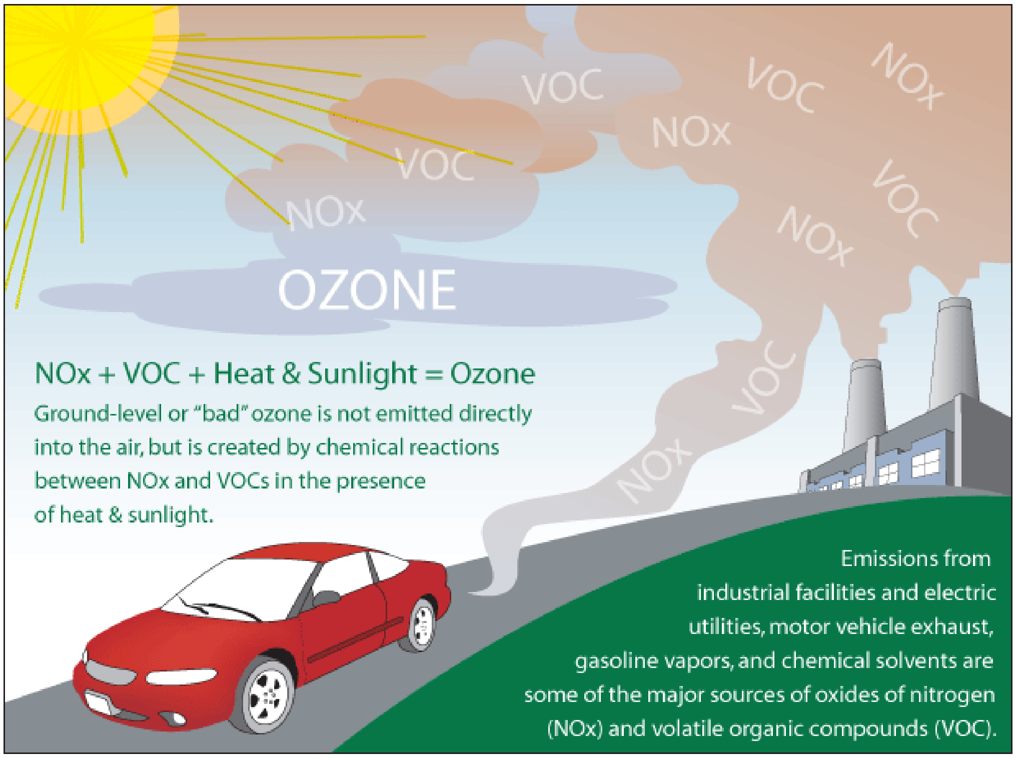
How do I find the AQI for my area?

DEQ reports the air quality index for Roanoke, Winchester, Richmond, Hampton Roads, and Northern Virginia on the internet at http://vadeq.ipsmtx.com/cgi-bin/air_quality_forecast.pl. Air quality forecasts and current air quality 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.

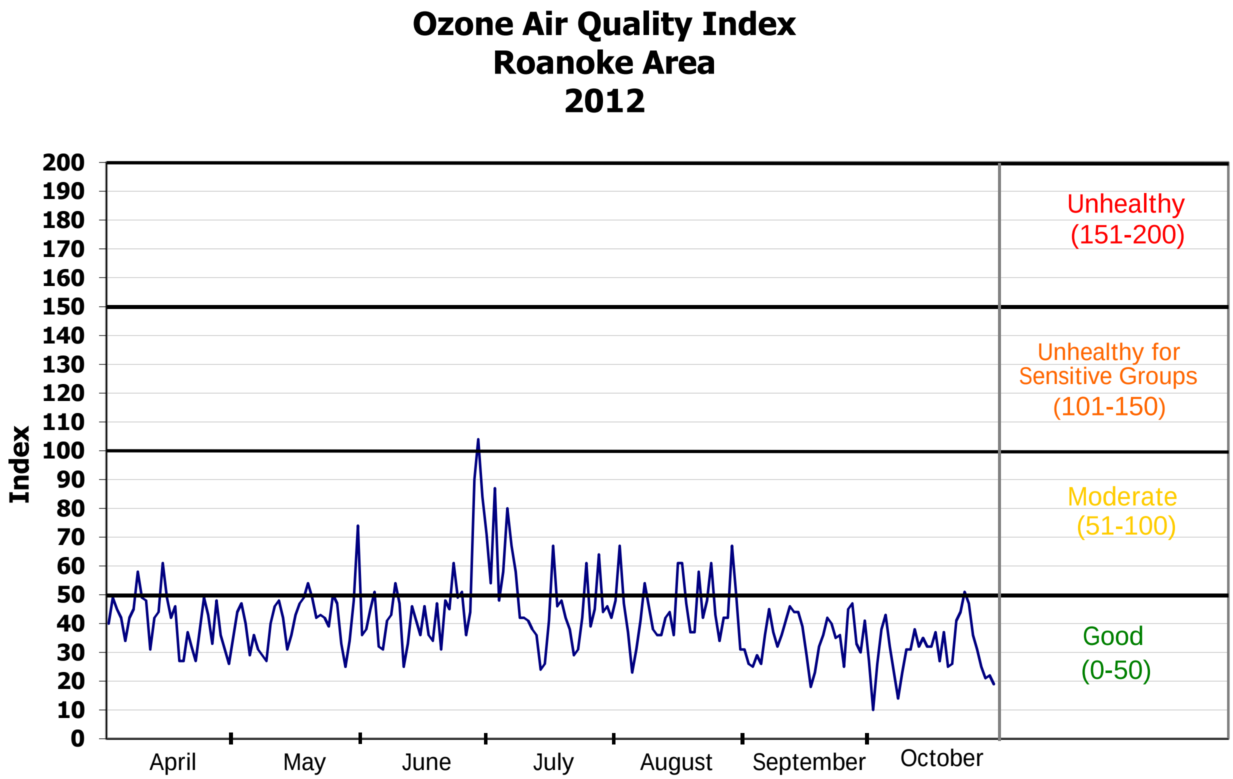
For detailed information about the AQI, and on health effects of the pollutants that are included in the AQI, visit www.airnow.gov .

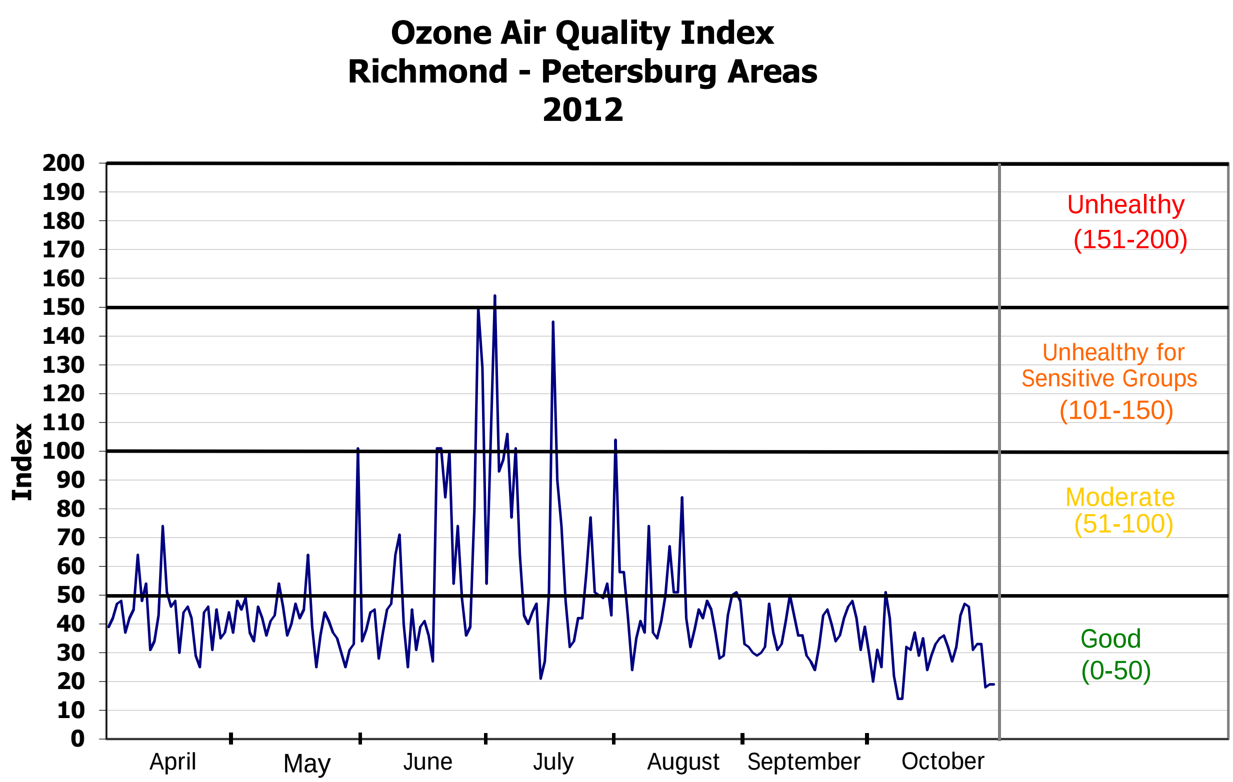
Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0-50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51-100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people 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. • 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. • Keep car, boat, and other engines tuned up according to manufacturers' specification. • Be sure your tires are properly inflated. • Carpool, use public transportation, bike, or walk whenever possible. • Use environmentally safe paints and cleaning products whenever possible. • 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.	• Conserve electricity and set your air conditioner at a higher temperature. • Choose a cleaner commute—share a ride to work or use public transportation. Bicycle or walk to errands when possible. • Defer use of gasoline-powered lawn and garden equipment. • Refuel cars and trucks after dusk. • Combine errands and reduce trips. • Limit engine idling. • 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/actions.htm
www.airnow.gov/index.cfm?action=resources.whatyoucando


Ozone Air Quality Index
Roanoke Area
2012
Index
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
April
May
June
July
August
September
October
Unhealthy
(151-200)
Unhealthy for
Sensitive Groups
(101-150)
Moderate
(51-100)
Good
(0-50)


Ozone Air Quality Index
Richmond - Petersburg Areas
2012
Index
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10
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April
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June
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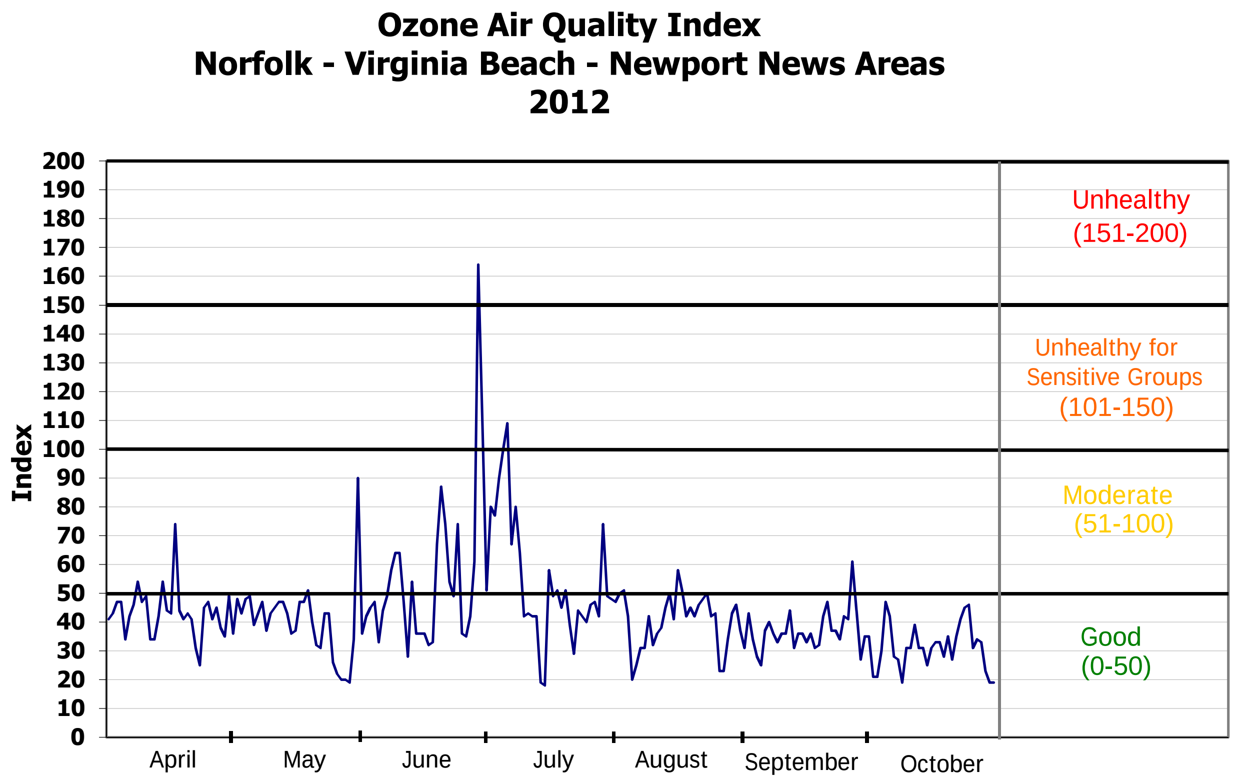
Unhealthy
(151-200)
Unhealthy for
Sensitive Groups
(101-150)
Moderate
(51-100)
Good
(0-50)


Ozone Air Quality Index
Norfolk - Virginia Beach - Newport News Areas
2012
Index
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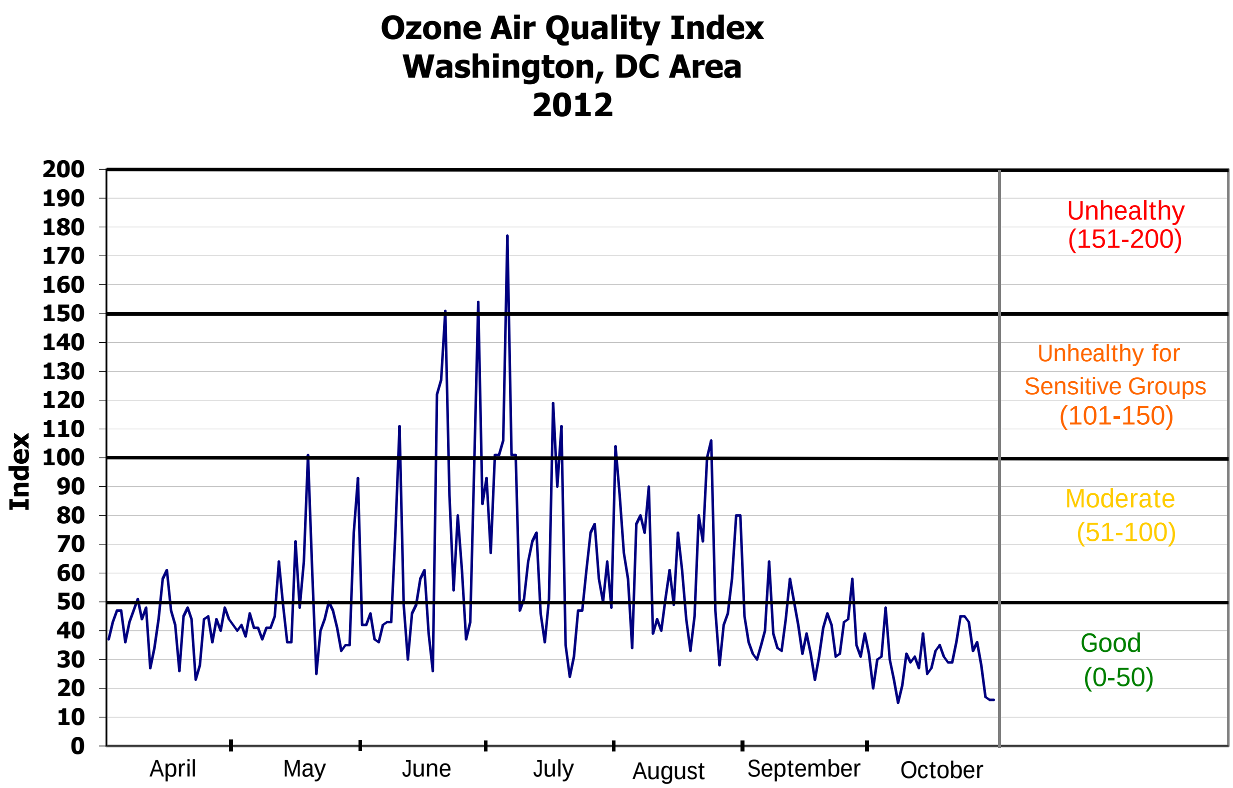
Unhealthy
(151-200)
Unhealthy for
Sensitive Groups
(101-150)
Moderate
(51-100)
Good
(0-50)


Ozone Air Quality Index
Washington, DC Area
2012
Index
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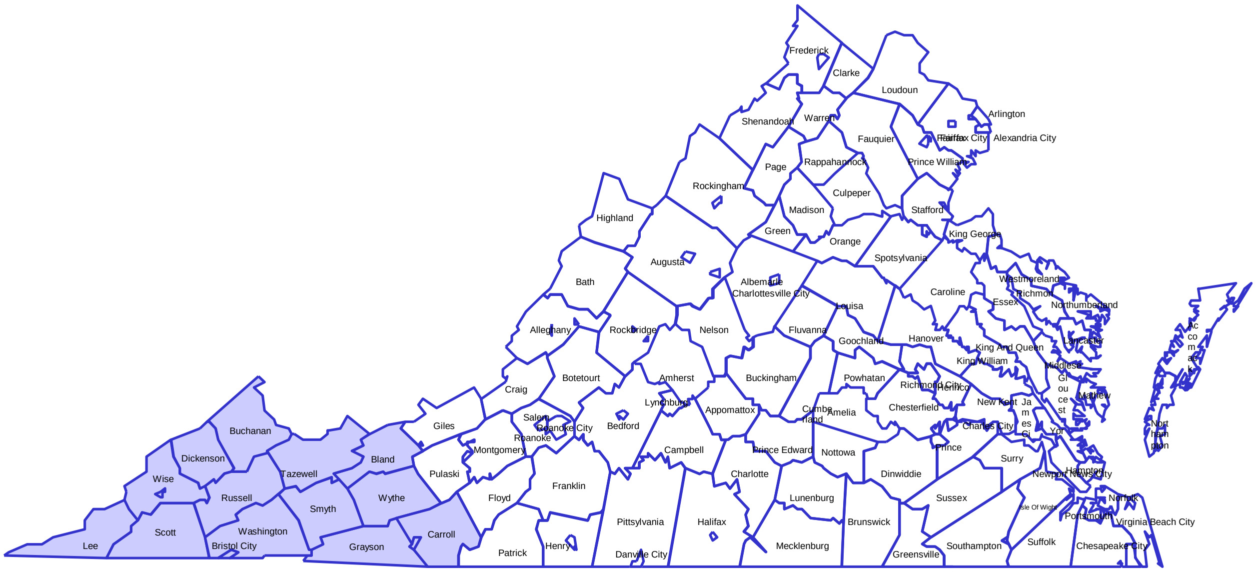
10
0
April
May
June
July
August
September
October
Unhealthy
(151-200)
Unhealthy for
Sensitive Groups
(101-150)
Moderate
(51-100)
Good
(0-50)

Appendix A

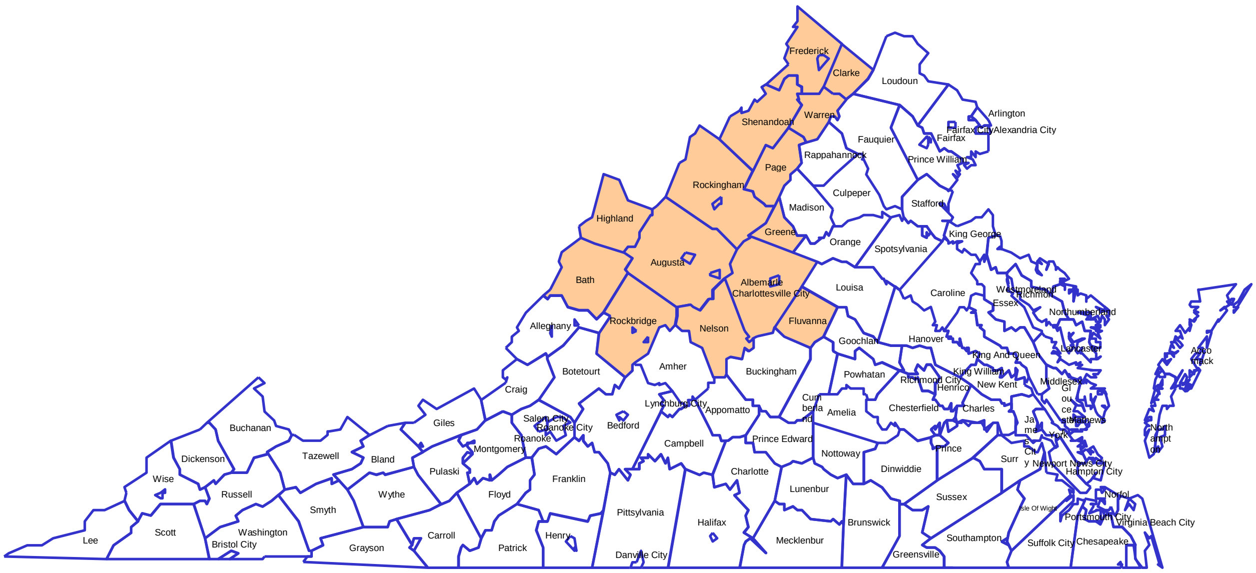
Abbreviation Table

AQM	Air Quality Monitoring
AQCR	Air Quality Control Region
ATMN	Air Toxics Monitoring Network
Avg.	Average
CAMP	Community Air Toxics Assessment Monitoring Program
CO	Carbon Monoxide
DEQ	Department of Environmental Quality
EPA	Environmental Protection Agency
IMPROVE	Interagency Monitoring of Protected Visual Environments
LAT	Latitude
LC	Local Conditions
LONG	Longitude
MARAMA	Mid-Atlantic Regional Air Management Association
MET.	Meteorological Instrumentation
MSA	Metropolitan Statistical Area
NA	Not Available
NAMS	National Air Monitoring Stations
NATTS	National Air Toxics Trend 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
UATM	Urban Air Toxics Monitoring Program
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.	36.89117 -81.25423
23-A	PM_{10}	Gladeville Elementary School	51-035-0001	Galax Carroll Co.	36.70067 -80.87978
101-E	$PM_{2.5}$	Highland View Elementary School	51-520-0006	Bristol	36.60800 -82.16410
4-G	Lead	VP-1 Upper Stock Pile Area	51-027-0006	Buchanan Co.	37.24778 -82.01806

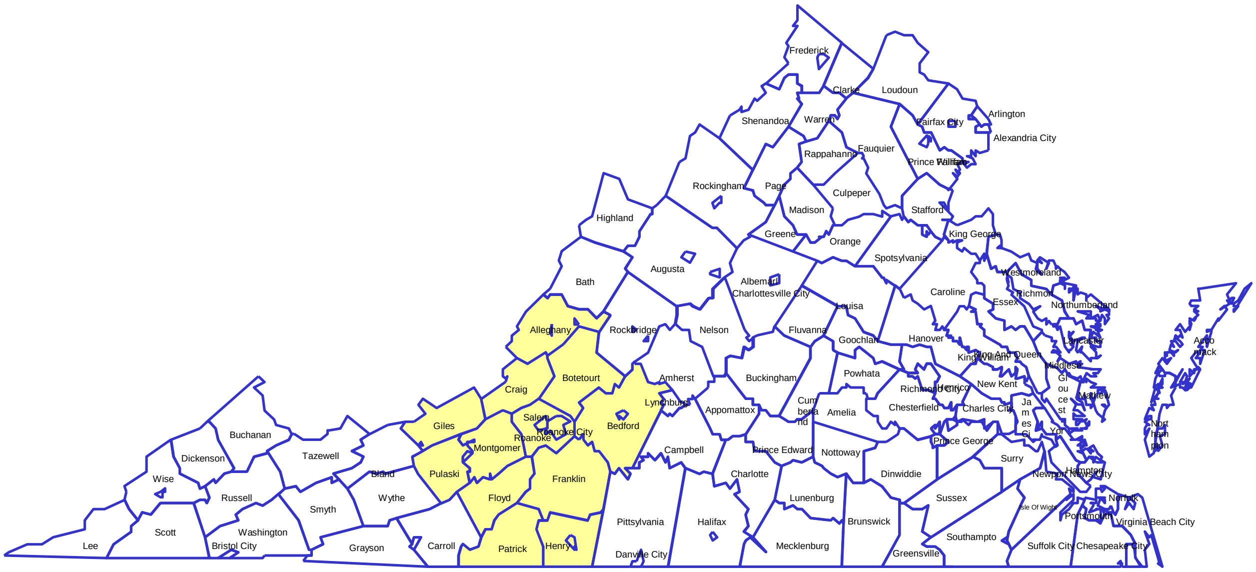
Contact Information for this Region:
Southwest Regional Office
Dallas Sizemore, Director
P.O. Box 1688
355 Deadmore Street
Abingdon, VA 24212
(276) 676-4800



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
21-C	O_3, IMPROVE	Natural Bridge Ranger Station	51-163-0003	Rockbridge Co.	37.62668 -79.51257
26-F	$PM_{2.5}$, SO_2, NO_2,O_3	Rockingham VDOT	51-165-0003	Harrisonburg Rockingham Co.	38.47753 -78.81952
28-J	O_3, $PM_{2.5}$, TEOM	Woodbine Road Lester Building Systems	51-069-0010	Rest Frederick Co.	39.28102 -78.08157
29-D	O_3, $PM_{2.5}$	Luray Caverns Airport	51-139-0004	Page Co.	38.66373 -78.50442
33-A	O_3, $PM_{2.5}$, TEOM	Albemarle High School	51-003-0001	Albemarle Co.	38.07657 -78.50397
30-E	PM_{10}	Warren Co. Memorial Hospital 1000 Shenandoah Avenue	51-187-0004	Front Royal Warren Co.	38.93095 -78.19847
134-C	PM_{10}	Winchester Courts Building	51-840-0002	Winchester	39.18397 -78.16308

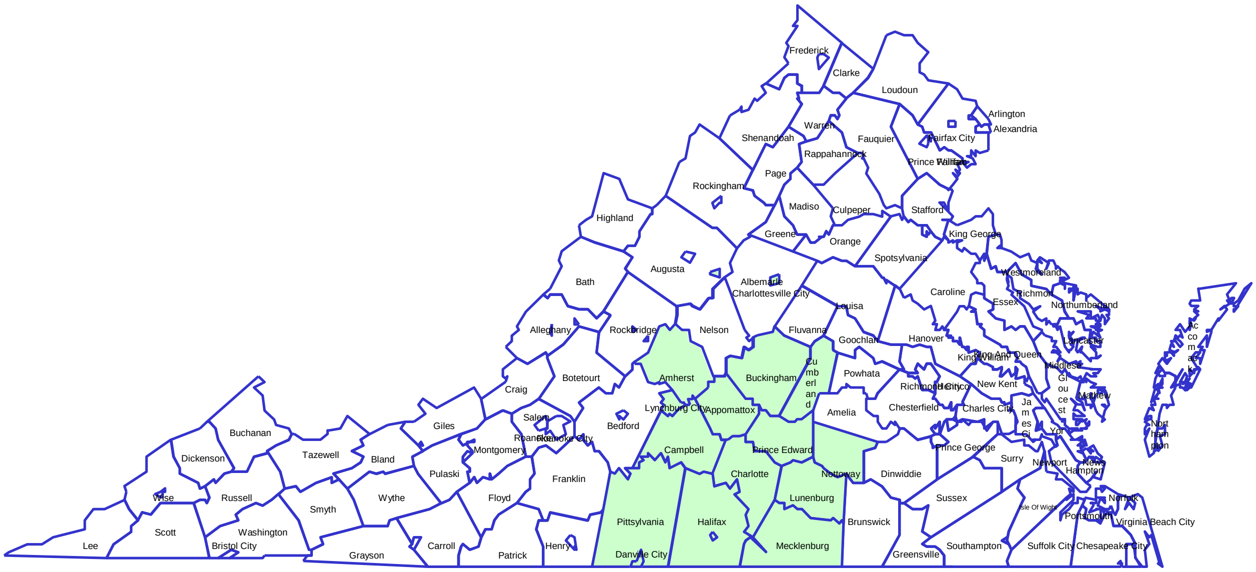
Contact information for this Region:
Valley Regional Office
Amy T. Owens, Director
P.O. Box 3000
4411 Early Road
Harrisonburg, VA 22801
(540) 574-7800

Blue Ridge Monitoring Network 2012



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.	37.28342 -79.88452
109-H	PM_{10}, Lead	101 Cherry Hill Circle	51-770-0011	Roanoke	37.27399 -79.99945
109-M	CO, TEOM $PM_{2.5}$	2020 Oakland Blvd.	51-770-0015	Roanoke	37.29717 -79.95573
110-C	$PM_{2.5}$	Salem High School	51-775-0011	Salem	37.29788 -80.08102

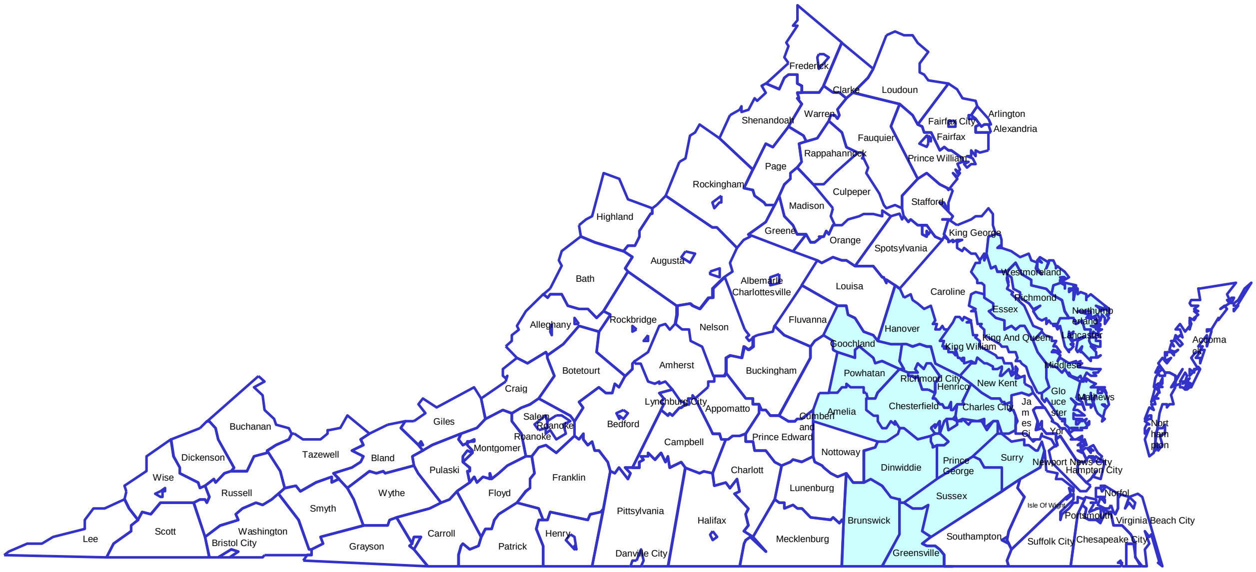
Contact information for this Region:
Blue Ridge Regional Office
Robert Weld, Director
3019 Peters Creek Road
Roanoke, VA 24019
(540) 562-6700



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
155-Q	$PM_{2.5}$	Leesville Hwy. & Greystone Dr.	51-680-0015	Lynchburg	37.33175 -79.21478
53-G	Lead	Central Virginia Training Center	51-009-0007	Madison Heights, Amherst County	37.41222 -79.11623

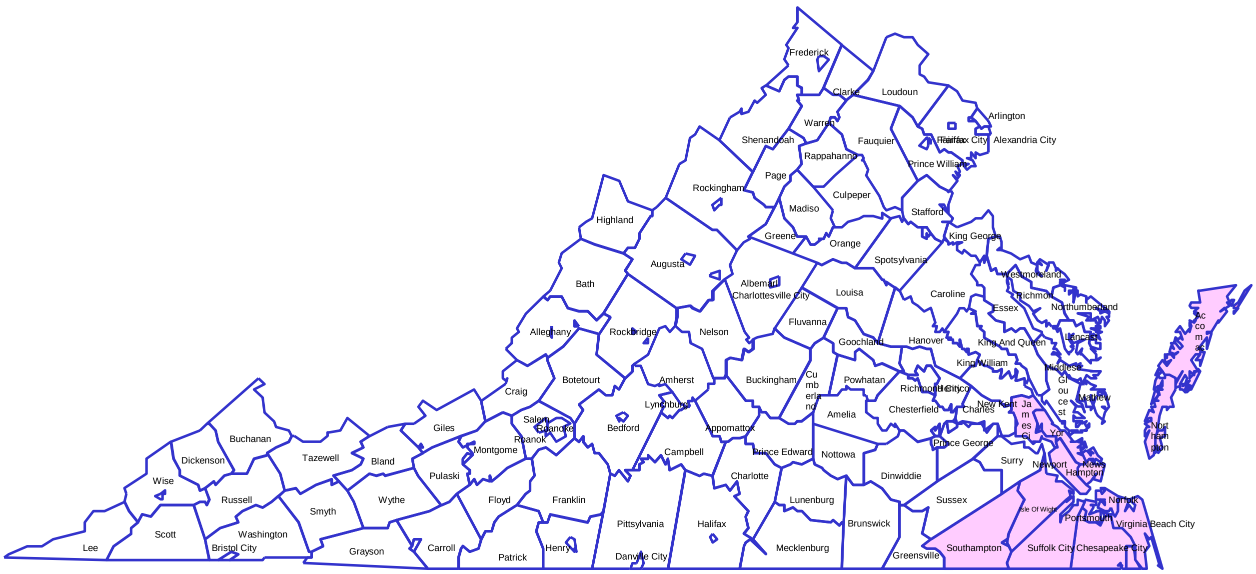
Contact information for this Region:
South Central Regional Office
Robert Weld, Director
7705 Timberlake Road
Lynchburg, VA 24502
(434) 582-5120

Piedmont Monitoring Network 2012



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
71-D	$PM_{2.5}$	Bensley Armory	51-041-0003	Chesterfield Co.	37.43467 -77.45118
71-H	O_3	Beach Road Highway Shop	51-041-0004	Chesterfield Co.	37.35748 -77.59355
72-M	O_3, VOC, $PM_{2.5}$, TEOM, Speciation, Toxics, Lead, Met, NCore, NATTS	MathScience Innovation Center 2401 Hartman Street	51-087-0014	Henrico Co.	37.55652 -77.40027
72-N	$PM_{2.5}$	DEQ-Piedmont Regional Office 4949-A Cox Road	51-087-0015	Henrico Co.	37.67132 -77.56640
73-E	O_3	McClellan Road	51-085-0003	Hanover Co.	37.60613 -77.21880
75-B	O_3, NO_2, SO_2, $PM_{2.5}$	Charles City County Route 608	51-036-0002	Charles City Co.	37.34438 -77.25925
82-C	PM_{10}	West Point Elementary School Thompson Ave. & Chelsea Rd.	51-101-0003	West Point King William Co.	37.55793 -76.79540
154-M	PM_{10}, Toxics	Carter G. Woodson Middle School 1000 Winston Churchill Dr.	51-670-0010	Hopewell	37.28962 -77.29182
158-W	CO, SO2, NO2	Science Museum of Virginia DMV and Leigh Street	51-760-0024	Richmond	37.56260 -77.46500

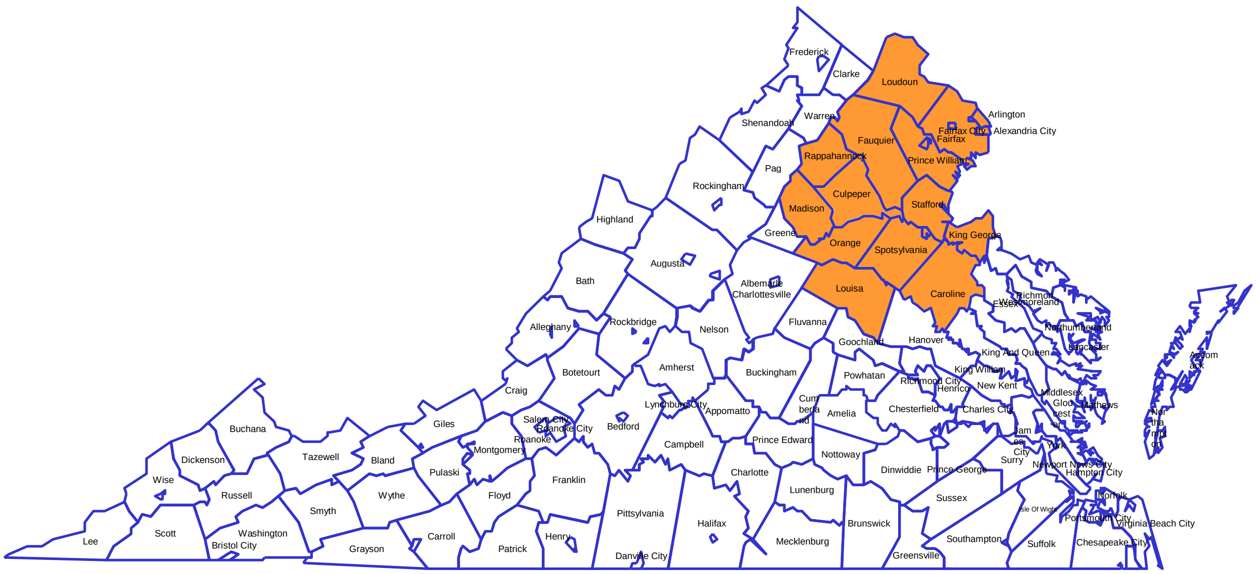
Contact Information for this Region:
Piedmont Regional Office
Michael Murphy, Director
4949-A Cox Road
Glen Allen, VA 23060
(804) 527-5020



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
179-K	CO, SO_2, NO_2, O_3, $PM_{2.5}$, PM_{10}, TEOM	NASA Langley Research Center	51-650-0008	Hampton	37.10373 -76.38702
181-A1	CO, SO_2, NO_2, PM_{10}, $PM_{2.5}$	NOAA Property 2nd and Woodis Avenue	51-710-0024	Norfolk	36.85555 -76.30135
183-E	O_3	Tidewater Community College Frederick Campus	51-800-0004	Suffolk	36.90118 -76.43808
183-F	O_3	Tidewater Research Station	51-800-0005	Suffolk	36.66525 -76.73078
184-J	$PM_{2.5}$, Toxics	DEQ – Tidewater Regional Office 5636 Southern Blvd.	51-810-0008	Va. Beach	36.84188 -76.18123

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

Northern Monitoring Network 2012



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.	38.47367 -77.76772
38-I	O_3, NO_2, $PM_{2.5}$	Broad Run High School Route 641	51-107-1005	Ashburn Loudoun Co.	39.02473 -77.48925
42-B	PM_{10}	Farmington Elementary School Sunset Lane	51-047-0002	Culpeper Culpeper Co.	38.45552 -78.01120
44-A	O_3	Widewater Elementary School Den Rich Road	51-179-0001	Widewater Stafford Co.	38.48123 -77.37040
45-L	O_3, NO_2	Long Park Route 15	51-153-0009	Prince William Co.	38.85287 -77.63462
46-B9	O_3, CO, $PM_{2.5}$, Toxics	Lee District Park Telegraph Road	51-059-0030	Franconia Fairfax Co.	38.77335 -77.10468
47-T	CO, NO_2, O_3, $PM_{2.5}$	Aurora Hills Visitors Center 18th and Hayes Streets	51-013-0020	Arlington Co.	38.85770 -77.05922
48-A	O_3, NO_y, VOC, PAMS	U.S.G.S. Geomagnetic Center	51-033-0001	Corbin Caroline Co.	38.20087 -77.37742
130-E	PM_{10}	Hugh Mercer Elementary School 2100 Cowan Boulevard	51-630-0004	Fredericksburg	38.30225 -77.48712

STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
L-126-C*	CO, SO_2, O_3, NO_2, PM_{10}, $PM_{2.5}$	Alexandria Health Dept. 517 North Saint Asaph Street	51-510-0009	Alexandria	38.81040 -77.04435
L-126-I**	CO, SO_2, O_3, NO_2	Alexandria T&ES 3200 Colvin Street	51-510-0021	Alexandria	38.80650 -77.08640
L-126-H	PM_{10}	435 Ferdinand Day Drive	51-510-0020	Alexandria	38.80493 -77.12687
N-35-A	O_3, TEOM, IMPROVE,	Big Meadows, National Park Service	51-113-0003	Madison Co.	38.52280 -78.43487

* Site relocated in August 2012
** New site installed in August 2012

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

National Ambient Air Quality Standards

POLLUTANT	PRIMARY STANDARD		SECONDARY STANDARD	
	Concentration	**Averaging Time**	**Concentration**	**Averaging Time**
CARBON MONOXIDE	9 ppm	8-hour[a]	None	None
	35 ppm	1-hour[a]		
SULFUR DIOXIDE	0.03 ppm (1971 std)[b]	Annual arithmetic mean	0.5 ppm	3-hour[a]
	0.14 ppm (1971 std)[b]	24-hour[a]		
	75 ppb	1-hour[c]		
NITROGEN DIOXIDE	.053 ppm	Annual arithmetic mean	Same as primary	
	100 ppb	1-hour[d]	None	
OZONE	0.075 ppm (2008 std)	8-hour[e]	Same as primary	
	.08 ppm (1997 std)	8-hour[f]	Same as primary	
LEAD	0.15 µg/m^3 (2008 std)	3-month rolling average	Same as primary	
	1.5 µg/m^3 (1978 std)[g]	Quarterly average	Same as primary	
PARTICULATE MATTER $PM_{2.5}$	15.0 µg/m^3	Weighted annual arithmetic mean[h]	Same as primary	
	35 µg/m^3	24-hour[i]	Same as primary	
PARTICULATE MATTER PM_{10}	150 µg/m^3	24-hour[j]	Same as primary	

[a] Not to be exceeded more than once a year

[b] The 1971 SO_2 standards remain in effect until 1 year after an area is designated for the 2010 1-hour standard

[c] 3-year average of 99th percentile of daily maximum 1-hour averages may not exceed 75 ppb

[d] 3-year average of 98th percentile of daily maximum 1-hour averages may not exceed 100 ppb

[e] 3-year average of the 4th highest daily maximum 8-hour concentration may not exceed 0.075 ppm (EPA is in the process of reconsidering these standards)

[f] 3-year average of the 4th highest daily maximum 8-hour concentration may not exceed .08 ppm (the 1997 standard and the implementation rules for that standard will remain in place as EPA addresses the transition from the 1997 to the 2008 ozone standard).

[g] The 1978 lead standard (1.5 µg/m^3 quarterly avg.) remains in effect until 1 year after an area is designated for the 2008 standard.

[h] 3-year average of the weighted annual mean $PM_{2.5}$ concentration may not exceed 15.0 µg/m^3

[i] 3-year average of the 98th percentile of 24-hour $PM_{2.5}$ concentrations may not exceed 35 µg/m^3

[j] 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.

NCore/SLAMS 2012

REGION	$PM_{2.5}$	PM_{10}	Pb	CO	SO_2	NO_2	O_3	TOTAL
Southwest	1	1	1	---	---	---	1	4
Valley	4	2	---	---	1	1	5	13
Blue Ridge	3	1	2	1	1	1	1	10
Piedmont	4	3	1	2	3	3	4	20
Tidewater	3	2	---	2	2	2	3	14
***Northern**	3	3	---	2	1	4	9	22
TOTAL	**18**	**12**	**4**	**7**	**8**	**11**	**23**	**83**

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

8-Hour Ozone Nonattainment Area (1997 Std.)

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 (1997 Std.)

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-Petersburg
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.)

Hampton Roads
Gloucester County
Isle of Wright County
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 County
Madison County*
(* the portions in SNP)

Appendix B

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

Air Emission Sources
http://www.epa.gov/air/emissions

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/

AQS Data Mart (AQS data for the scientific and technical community):
http://www.epa.gov/ttn/airs/aqsdatamart

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

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

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

2012 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

Code of Federal Regulations – 40 CFR 50 & 58
http://www.gpoaccess.gov/cfr/index.html

Virginia Ambient Air Monitoring Data Reports
http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx

Air Quality System (AQS)
http://www.epa.gov/ttn/airs/airsaqs

References