

# Virginia Ambient Air Monitoring 2013 Data Report



Department of Environmental Quality

Commonwealth of Virginia  
Department of Environmental Quality



Office of Air Quality Monitoring

4949-C Cox Road  
Glen Allen, VA 23060

This Ambient Air Monitoring Data Report is for the time period of January 1, 2013 to December 31, 2013.

David K. Paylor, Director  
Virginia Department of Environmental Quality

Michael Dowd  
Director, Division of Air Quality

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Front Cover: Spring in Shenandoah National Park

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2013 Annual Report prepared by:  
Stacie Carter, Environmental Specialist  
Crystal Sorensen, Environmental Specialist

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The 2013 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 40 locations within the Commonwealth during 2013. These monitoring sites were established in accordance with EPA's siting criteria contained in 40 CFR Part 58, [Appendices D and E](#). Monitoring network operations conformed to EPA guidance documents and 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 for both the hourly and annual standard, sulfur dioxide and PM10 were within the EPA's national ambient air quality standards (NAAQS) in 2013. Virginia experienced a relatively uneventful ozone season in 2013. There were two days in Richmond and one day in Northern Virginia that exceeded the 0.075 ppm ozone standard. For the 3-year period from 2011 through 2013 only Northern Virginia has a design value that exceeds the National Ambient Air Quality Standard (NAAQS) for ozone. For 2013 there was one exceedance of the 35 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) 24 hour standard for PM2.5 (particulate matter less the 2.5 microns). This occurred at the Frederick County site. The 2011 – 2013 design values for all sites in the Commonwealth for both the 24 hour and annual standards for PM2.5 are below the NAAQ standards.

Some significant changes that impacted the air quality monitoring network in 2013 are:

- In March of 2013, the Office of Air Quality Monitoring (AQM) removed the Round Hill monitoring site located in Roanoke City. This site was terminated and removed due to construction that was planned for the elementary school where the site was located including expanding the parking lot to include the location of the monitoring shelter. The carbon monoxide monitor, the continuous PM2.5 (TEOM) monitor and the PM2.5 24-hour monitors were all relocated to the Vinton site in Roanoke County. Revised siting information is located at [http://vadeq.tx.sutron.com/cgi-bin/site\\_info.pl](http://vadeq.tx.sutron.com/cgi-bin/site_info.pl).
- The lead and the PM10 monitors located at Cherry Hill Ct. in the city of Roanoke were shutdown and removed in August of 2013. This removal was precipitated by land use changes in the immediate vicinity of the monitoring site. The replacement site will be operational by the end of 2014.
- In October of 2013, The Office of Air Quality Monitoring began operation of the first Near Road air monitoring site in the Commonwealth of Virginia. The location of this shelter is in Bryan Park near the I-95 & I-64 interchange in the City of Richmond. This road segment was selected based on the annual average daily traffic count. This is the first of three Near Road sites to 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.

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 58 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<sub>2.5</sub>).

## 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](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](http://www.epa.gov/airdata) and [www.epa.gov/air/emissions](http://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](http://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](http://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](http://www.epa.gov/iaq/index.html) and through the American Lung Association website at [www.lungusa.org](http://www.lungusa.org).

# Criteria Pollutants

PM<sub>2.5</sub> 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 (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), 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<sub>2.5</sub> air quality standards were implemented by EPA in 1997 to protect against the health effects of fine particle pollution. On December 14, 2012, EPA strengthened the nation's air quality standards for fine particle pollution to improve public health protection by revising the primary annual PM<sub>2.5</sub> standard to 12.0 µg/m<sup>3</sup> and retaining the 24-hour fine particle standard of 35.0 µg/m<sup>3</sup>. For more information, see [www.epa.gov/airquality/particlepollution/2012/decfsoverview.pdf](http://www.epa.gov/airquality/particlepollution/2012/decfsoverview.pdf).

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

PM<sub>2.5</sub> 24-hour Mass Sampler: This Federal Reference Method (FRM) sampler collects particulate matter on a stretched Teflon filter media. Four samplers (Henrico Co., Vinton, 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<sub>2.5</sub> 24-hour Speciation: Speciated PM<sub>2.5</sub> 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)

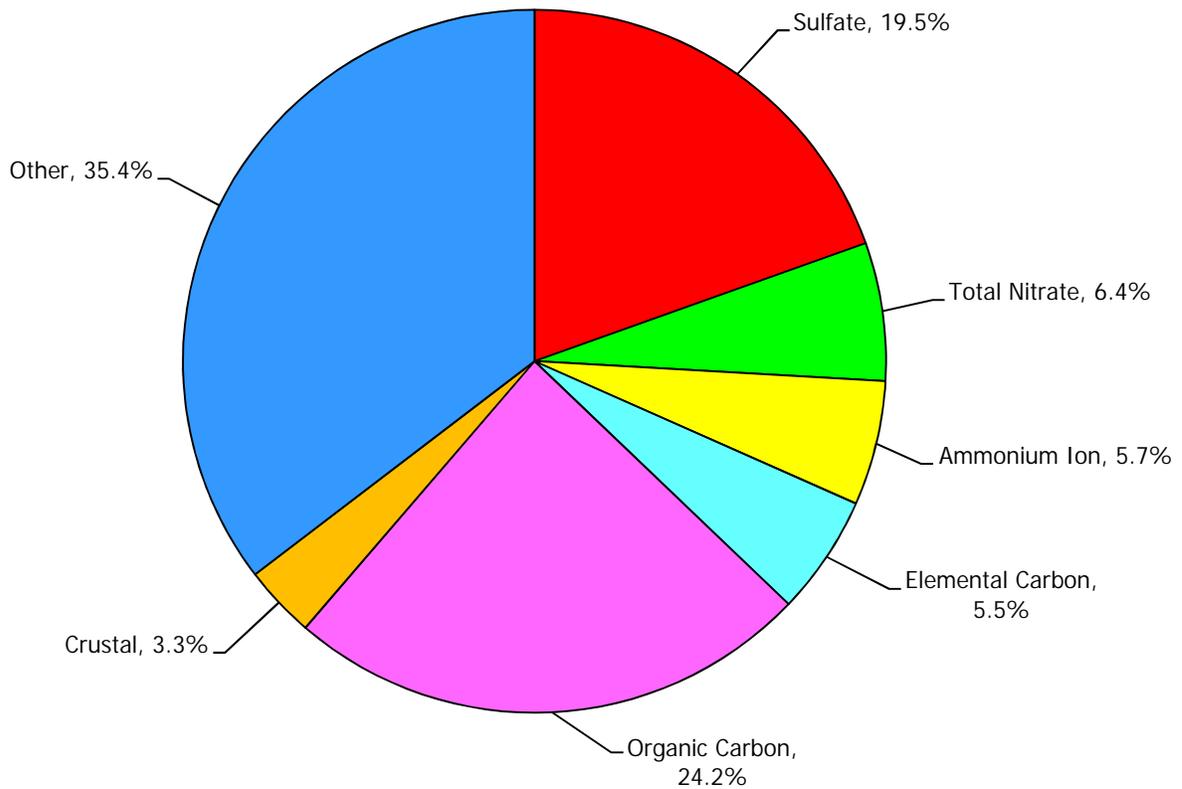
The resulting data provide a “chemical fingerprint” of air masses moving through the Richmond area. These data, in conjunction with historical data from other speciation sites, including those outside Virginia, give a representative picture of the constituents of the air samples, which help identify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

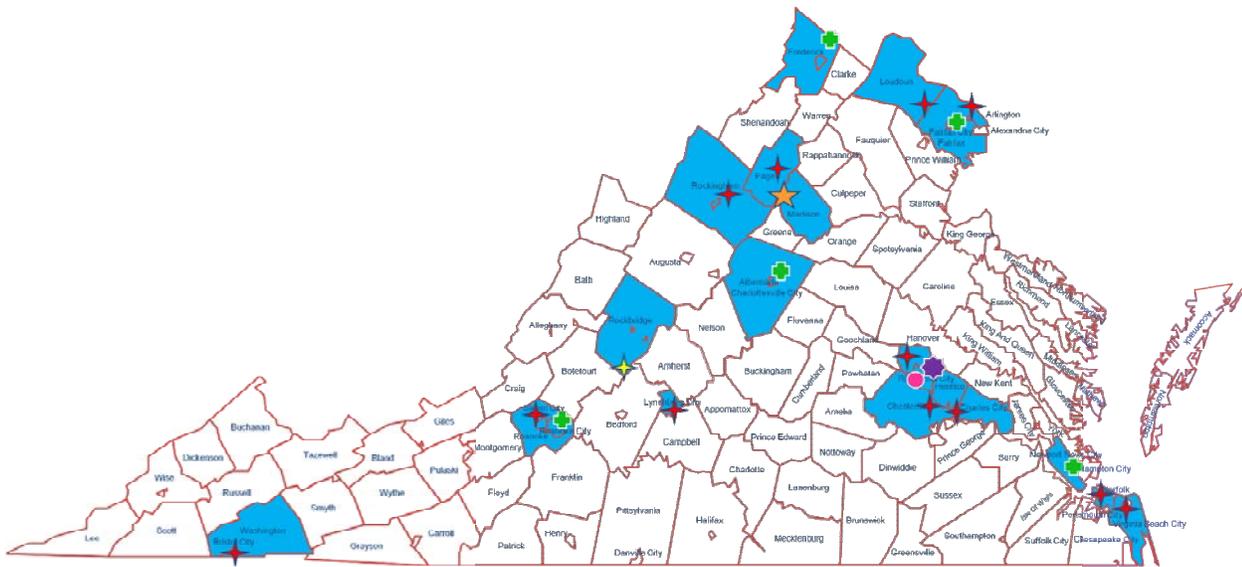
PM<sub>2.5</sub> Continuous: This sampler collects particulate samples on a continuous basis, and data are compiled into hourly averages. PM<sub>2.5</sub> continuous samplers are operated in Hampton Roads, Henrico Co., Roanoke Co., Fairfax Co., Shenandoah National Park, Frederick Co., and Albemarle Co.

Each type of PM<sub>2.5</sub> 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 continuous particulate monitor 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](http://www.airnow.gov).

In addition to the PM<sub>2.5</sub> network operated by the DEQ, the National Park Service and the USDA Forest Service operate PM<sub>2.5</sub> 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>.

**2013 Particulate Components as Determined by Speciation  
Henrico Co.**





-  FRM Mass Sampler
-  IMPROVE sampler
-  FRM Mass and TEOM Samplers
-  FRM Mass, Speciation, TEOM Sampler
-  TEOM & IMPROVE sampler, Big Meadows, NPS
-  Continuous Sampler

# PM2.5 Monitoring Network

## **National Ambient Air Quality Standards (NAAQS)**

Primary Standard for PM<sub>2.5</sub>:

- ➔ Annual Arithmetic Mean – the 3 year average of the weighted annual mean PM<sub>2.5</sub> concentration must not exceed 12.0 µg/m<sup>3</sup>.
- ➔ 24-Hour concentration – the 3 year average of the 98<sup>th</sup> percentile of 24-hour concentrations must not exceed 35 µg/m<sup>3</sup>.

Secondary Standard for PM<sub>2.5</sub>:

- ➔ Annual Arithmetic Mean – the 3 year average of the weighted annual mean PM<sub>2.5</sub> concentration must not exceed 15.0 µg/m<sup>3</sup>.

<b>2011-2013 PM<sub>2.5</sub> 24-hour Averages, 98<sup>th</sup> Percentile Values (µg/m<sup>3</sup>, LC)</b>				
<b>Site</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>3-Year Average</b>
(101-E) <b>Bristol</b>	21.5	16.5	16.2	18
(26-F) <b>Rockingham Co.</b>	22.8	17.5	21.2	21
(28-J) <b>Frederick Co.</b>	23.8	22.6	23.5	23
(29-D) <b>Page Co.</b>	21.2	17.2	19.8	19
(33-A) <b>Albemarle Co.</b>	19.2	17.0	18.9	18
(110-C) <b>Salem</b>	21.5	16.4*	18.7*	19
(155-Q) <b>Lynchburg</b>	18.3	15.7	18.2	17
(71-D) <b>Chesterfield Co.</b>	22.0	20.0	20.4*	21
(72-M) <b>Henrico Co.</b>	23.2	19.1	19.3	21
(72-N) <b>Henrico Co.</b>	18.6*	18.3	18.5	18
(75-B) <b>Charles City Co.</b>	21.6	20.0	18.2	20
(179-K) <b>Hampton</b>	25.0	20.9	15.9	21
(181-A1) <b>Norfolk</b>	24.7	21.7	15.8	21
(184-J) <b>Va. Beach</b>	25.6	22.7	18.0	22
(38-I) <b>Loudoun Co.</b>	20.5	20.6	19.9	20
(47-T) <b>Arlington Co.</b>	21.2*	21.8	21.2	21
(46-B9) <b>Franconia, Fairfax Co.</b>	24.1	21.1	21.0	22

\* Annual value did not meet completeness criteria

**NAAQS**

Primary Standard for PM<sub>2.5</sub>:

- ➔ Annual Arithmetic Mean – the 3 year average of the weighted annual mean PM<sub>2.5</sub> concentration must not exceed 12.0 µg/m<sup>3</sup>.
- ➔ 24-Hour concentration – the 3 year average of the 98<sup>th</sup> percentile of 24-hour concentrations must not exceed 35 µg/m<sup>3</sup>.

Secondary Standard for PM<sub>2.5</sub>:

- ➔ Annual Arithmetic Mean – the 3 year average of the weighted annual mean PM<sub>2.5</sub> concentration must not exceed 15.0 µg/m<sup>3</sup>.

<b>2011-2013 PM<sub>2.5</sub> Weighted Annual Arithmetic Means (µg/m<sup>3</sup>, LC)</b>				
<b>Site</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>3-Year Average</b>
(101-E) <b>Bristol</b>	9.8	8.8	8.5	9.0
(26-F) <b>Rockingham Co.</b>	9.6	8.8	8.4	8.9
(28-J) <b>Frederick Co.</b>	10.0	9.8	8.8	9.5
(29-D) <b>Page Co.</b>	8.7	8.3	7.2	8.1
(33-A) <b>Albemarle Co.</b>	8.5	7.8	7.6	7.9
(110-C) <b>Salem</b>	9.9	8.9*	8.6*	9.1
(155-Q) <b>Lynchburg</b>	8.4	7.6	7.4	7.8
(71-D) <b>Chesterfield Co.</b>	9.3	8.9	8.2*	8.8
(72-M) <b>Henrico Co.</b>	9.5	8.6	8.1	8.7
(72-N) <b>Henrico Co.</b>	8.6*	8.3	7.8	8.3
(75-B) <b>Charles City Co.</b>	8.8	8.1	7.6	8.2
(179-K) <b>Hampton</b>	8.8	7.7	7.1	7.9
(181-A1) <b>Norfolk</b>	10.5	8.1	7.5	8.7
(184-J) <b>Va. Beach</b>	9.6	8.2	7.7	8.5
(38-I) <b>Loudoun Co.</b>	9.1	9.0	8.5	8.9
(47-T) <b>Arlington Co.</b>	9.9*	9.4	8.9	9.4
(46-B9) <b>Franconia, Fairfax Co.</b>	9.2	8.7	8.3	8.8

\* Annual value did not meet completeness criteria.

[PM<sub>10</sub>](#) 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<sub>10</sub> particles are larger than PM<sub>2.5</sub>, 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<sub>10</sub>, 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<sub>10</sub> 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<sub>10</sub> 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](http://www.epa.gov/air/particlepollution).

To measure PM<sub>10</sub>, 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<sub>10</sub> concentration is determined by dividing the change in filter mass by the volume of sampled air. The resulting PM<sub>10</sub> concentration is reported as micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ). 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>.



PM10 Monitoring Sites

**National Ambient Air Quality Standards (NAAQS)**

Primary Standard for PM<sub>10</sub>:

- 24- hour concentration not to exceed 150 µg/m<sup>3</sup> 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 µg/m<sup>3</sup>.

Secondary Standard for PM<sub>10</sub>:

- Same as Primary.

2011-2013 PM <sub>10</sub> 24-Hour Average Concentrations (units in µg/m <sup>3</sup> STD)							
Site	2011		2012		2013		>150 µg/m <sup>3</sup>
	1 <sup>st</sup> Max	2 <sup>nd</sup> Max	1 <sup>st</sup> Max	2 <sup>nd</sup> Max	1 <sup>st</sup> Max	2 <sup>nd</sup> Max	
(23-A) <b>Carroll Co.</b>	31	28	28	26	34	22	0
(134-C) <b>Winchester</b>	35	28	32	28	21	19	0
(109-H) <b>Roanoke**</b>	65	39	38	31	62	45	0
(72-M) <b>Henrico Co.</b>	39	34	31	28	26	22	0
(154-M) <b>Hopewell</b>	38	32	31	27	23	19	0
(82-C) <b>King William Co.</b>	154*	40	30	29	27	22	0
(179-K) <b>Hampton</b>	67	35	34	32	22	19	0
(181-A1) <b>Norfolk</b>	71*	58*	35	32	29	21	0
(130-E) <b>Fredericksburg</b>	36	28	34	29	29	21	0

\* Dismal Swamp Wildfire, August 2011.

\*\* Did not meet completeness criteria.



**National Ambient Air Quality Standards (NAAQS)**

Primary Standard for CO:

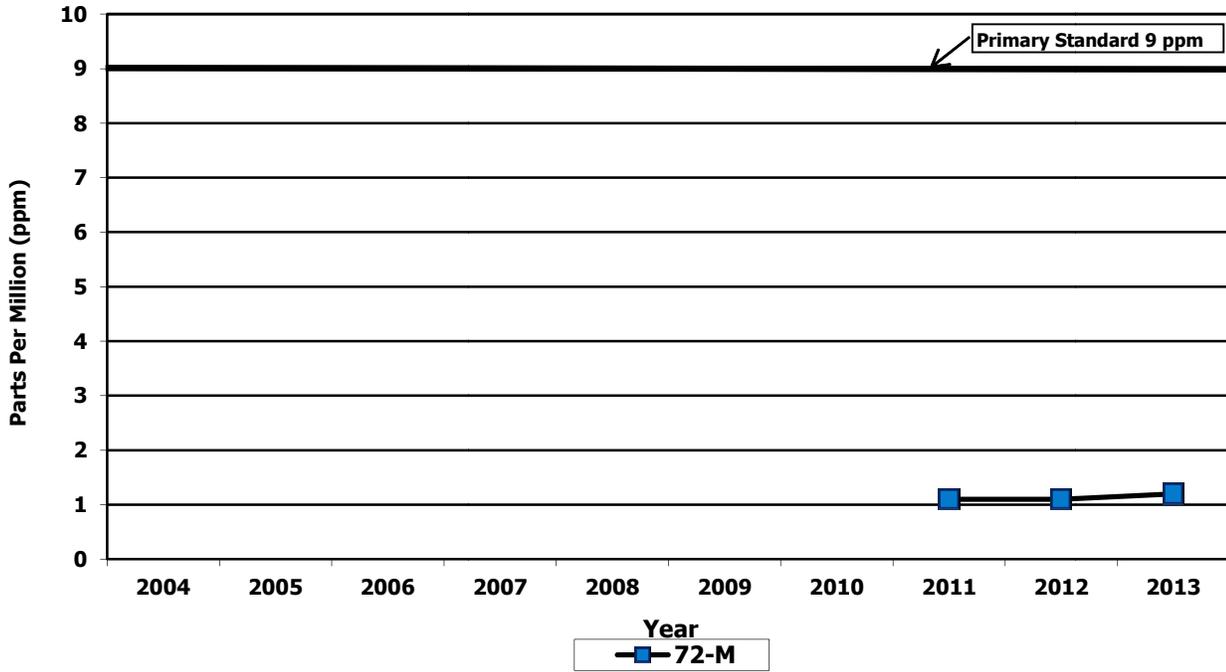
- 8-hour average not to exceed 9 ppm (10 mg/m<sup>3</sup>) more than once per year.
- 1-hour average not to exceed 35 ppm (40 mg/m<sup>3</sup>) more than once per year.

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

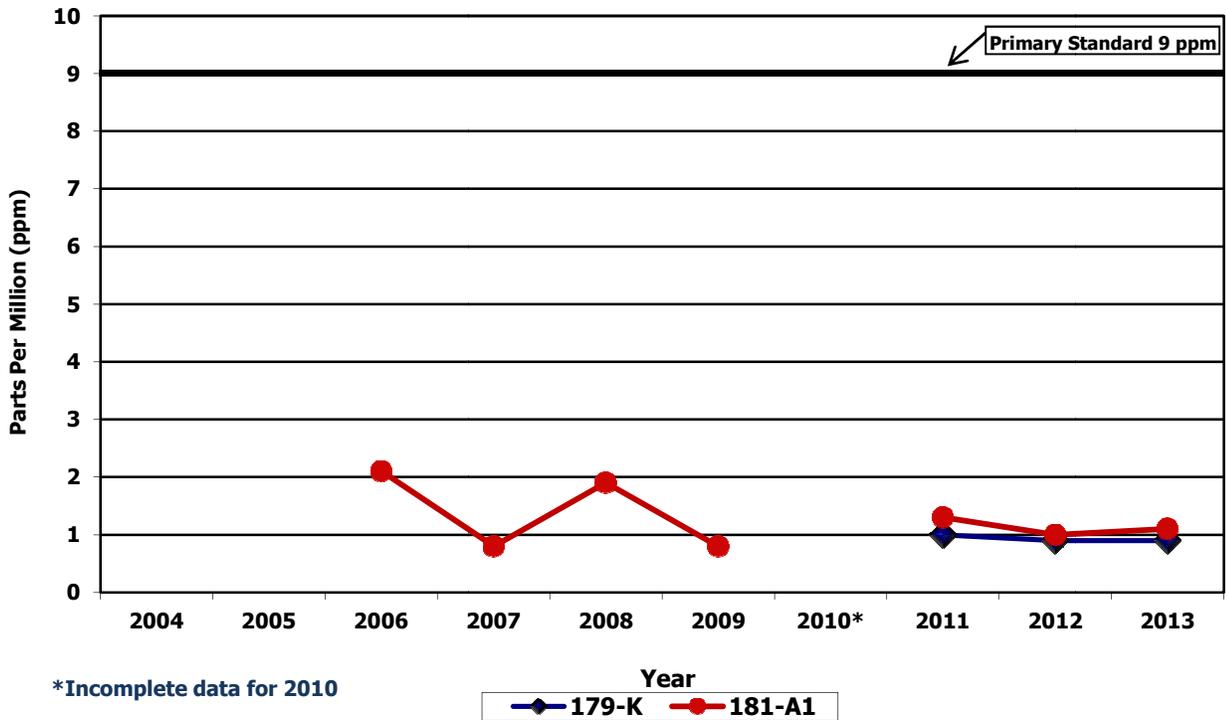
Site	2013			
	1-Hour Avg. (ppm)		8-Hour Avg. (ppm)	
	1 <sup>st</sup> Max.	2 <sup>nd</sup> Max.	1 <sup>st</sup> Max.	2 <sup>nd</sup> Max.
(19-A6) <b>Vinton</b>	1.0	1.0	.9	.8
(72-M) <b>Henrico</b>	1.9	1.5	1.4	1.2
(158-X) <b>Richmond</b>	1.8	1.4	1.2	1.1
(179-K) <b>Hampton</b>	1.2	1.1	.9	.9
(181-A1) <b>Norfolk</b>	2.1	2.0	1.5	1.1
(47-T) <b>Arlington Co.</b>	1.2	1.2	1.1	1.0
(L-126-I) <b>Alexandria</b>	5.7	4.9	4.1	3.1

Eight Hour Averages stated as Ending Hour

### Carbon Monoxide - Piedmont Region Eight Hour 2nd Maximum

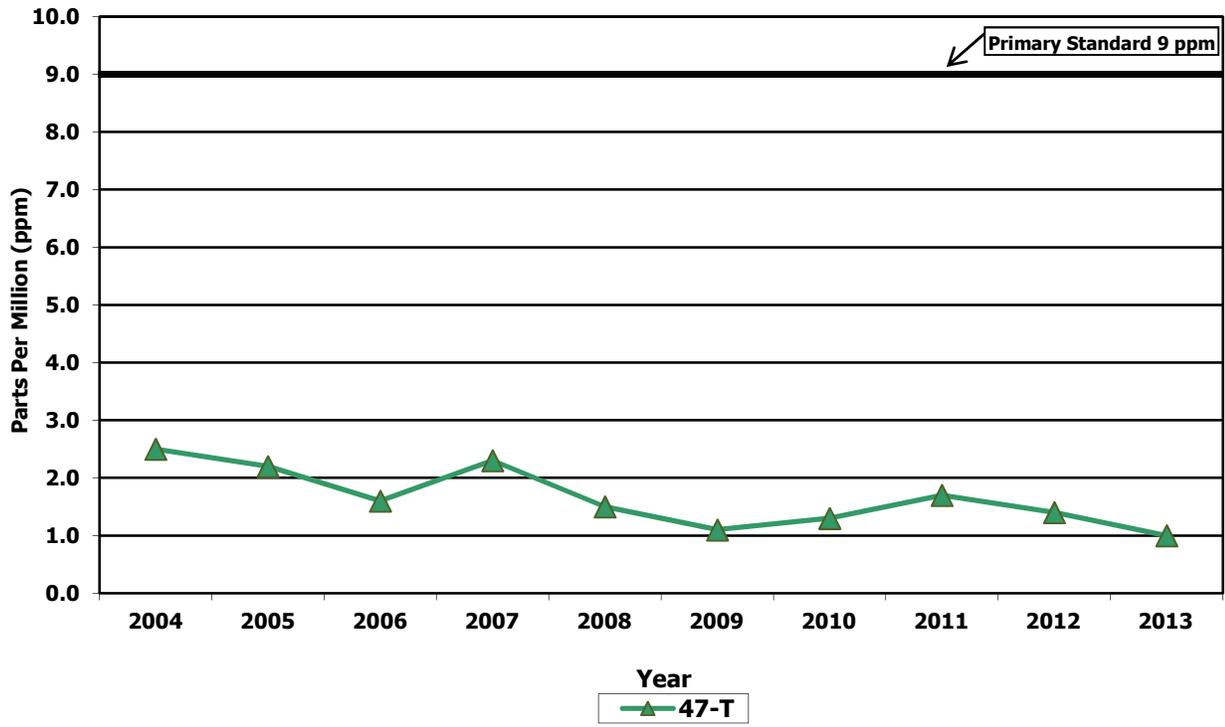


### Carbon Monoxide - Tidewater Region Eight Hour 2nd Maximum



\*Incomplete data for 2010

### Carbon Monoxide - Northern Region Eight Hour 2nd Maximum

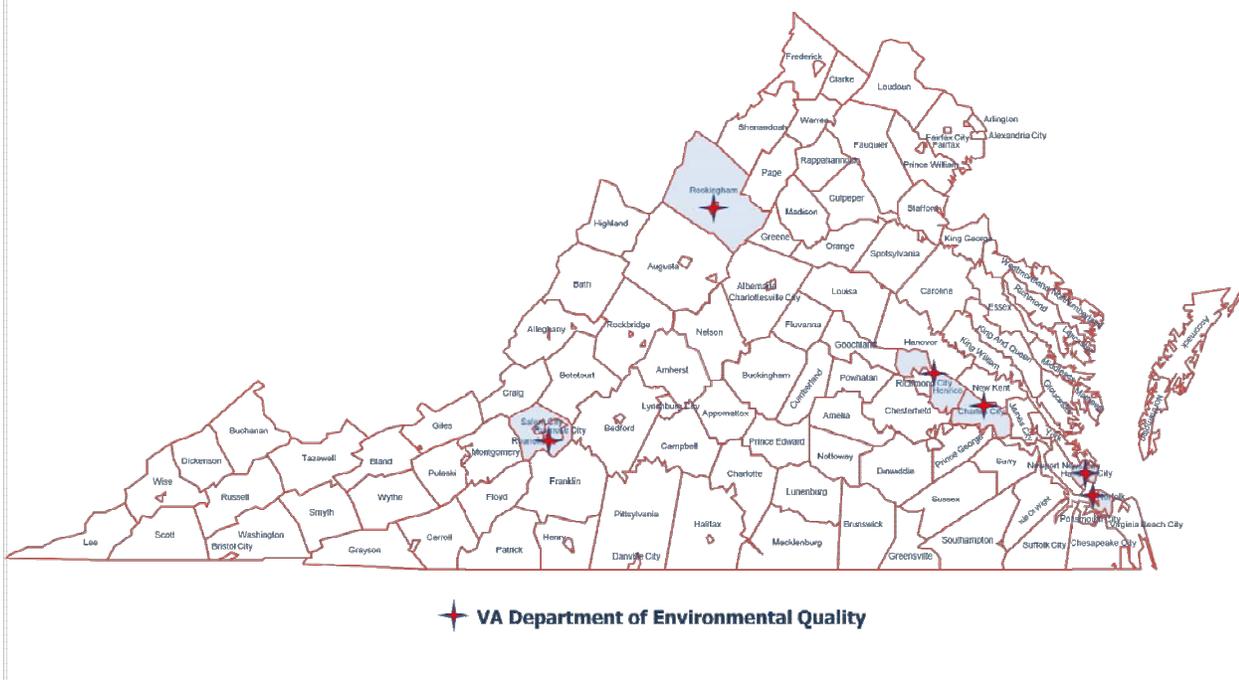


[Sulfur](#) Dioxide (SO<sub>2</sub>) is a colorless gas that has a strong odor. It results from burning of fuels containing sulfur (such as coal and oil), petroleum refining, and smelting (extracting metals from ore), and it also occurs naturally from volcanic eruptions. SO<sub>2</sub> can dissolve in 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<sub>2</sub>. 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> molecules in the sample air absorb some of the UV light, become excited, and then fluoresce, releasing light characteristic of SO<sub>2</sub>. 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<sub>2</sub> in the sample, is converted to an SO<sub>2</sub> concentration by the instrument computer.



**SO2 Monitoring Network**

**National Ambient Air Quality Standards (NAAQS)**

Primary Standards for SO<sub>2</sub>:

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

Secondary Standard for SO<sub>2</sub>:

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

<b>Sulfur Dioxide 99<sup>th</sup> Percentile 1-Hour Daily Maximum Values (ppb)</b>					
<b>Site ID</b>	<b>City/County</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>3-Yr Avg Design Value 2011-2013</b>
26-F	Rockingham Co.	6	4	4	5
19-A6	Roanoke Co.	9	5	6*	6
72-M	Henrico Co.	21	8	6	11
75-B	Charles City Co.	38	21	30	29
179-K	Hampton	39	33	38	37
181-A1	Norfolk	54	56	52	54

\* Did not meet completeness criteria

**National Ambient Air Quality Standards (NAAQS)**

Primary Standards for SO<sub>2</sub>:

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

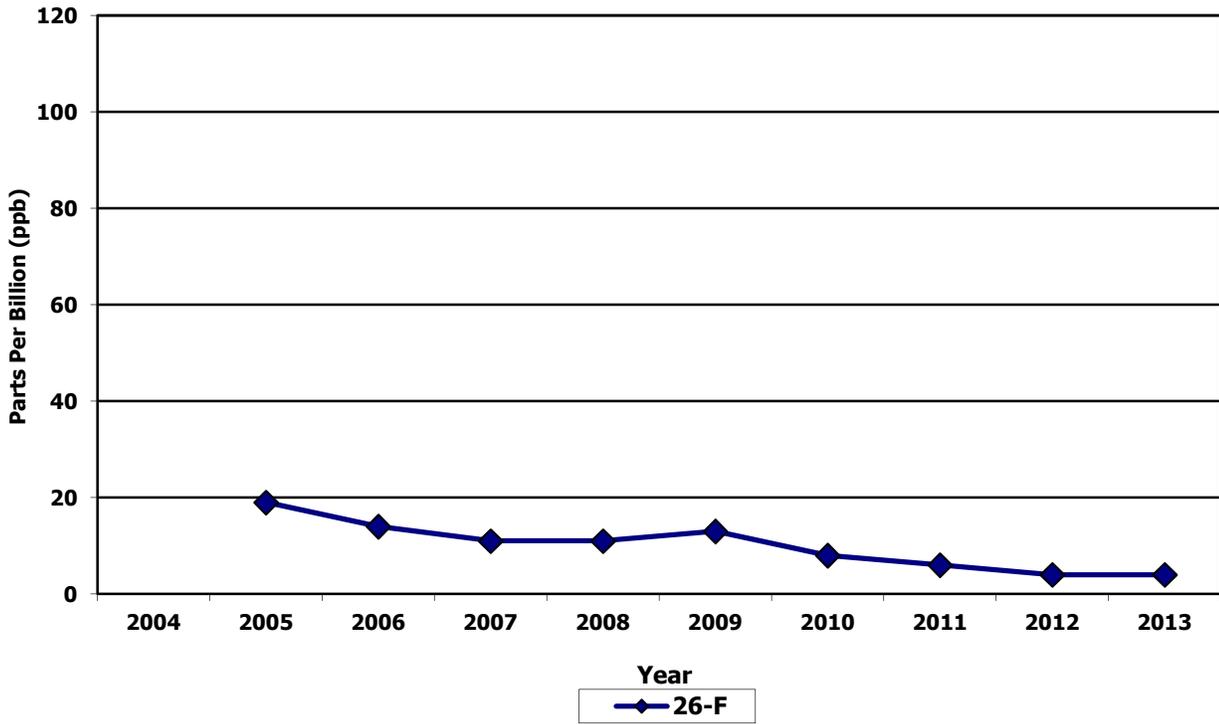
Secondary Standard for SO<sub>2</sub>:

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

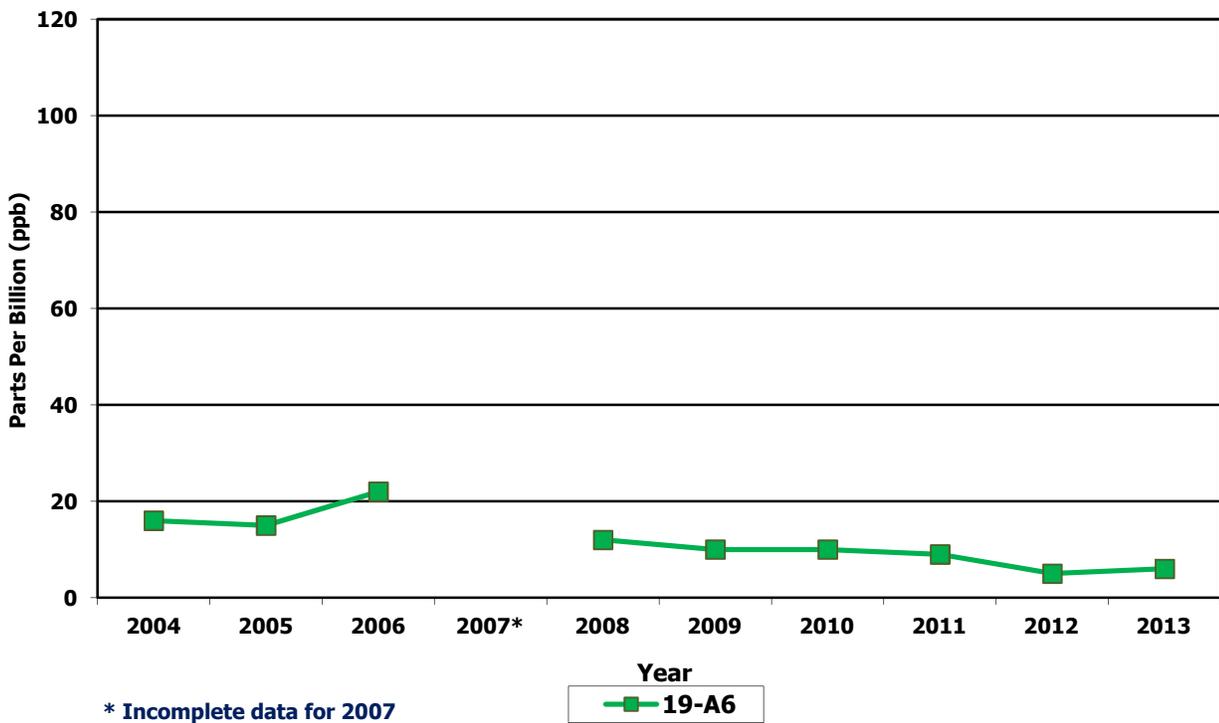
<b>Sulfur Dioxide 3-Hour Block Average Maximum Values (ppb)</b>					
<b>Site ID</b>	<b>City/County</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>Number Obs. &gt; 500 ppb</b>
26-F	Rockingham Co.	6	5	6	0
19-A6	Roanoke Co.	8	5	6	0
72-M	Henrico	22	9	5	0
75-B	Charles City Co.	26	18	23	0
179-K	Hampton	22	56	37	0
181-A1	Norfolk	40	36	51	0

**SO<sub>2</sub> Monitoring Network**

### Sulfur Dioxide - Valley Region 99th Percentile 1-Hour Daily Maximum

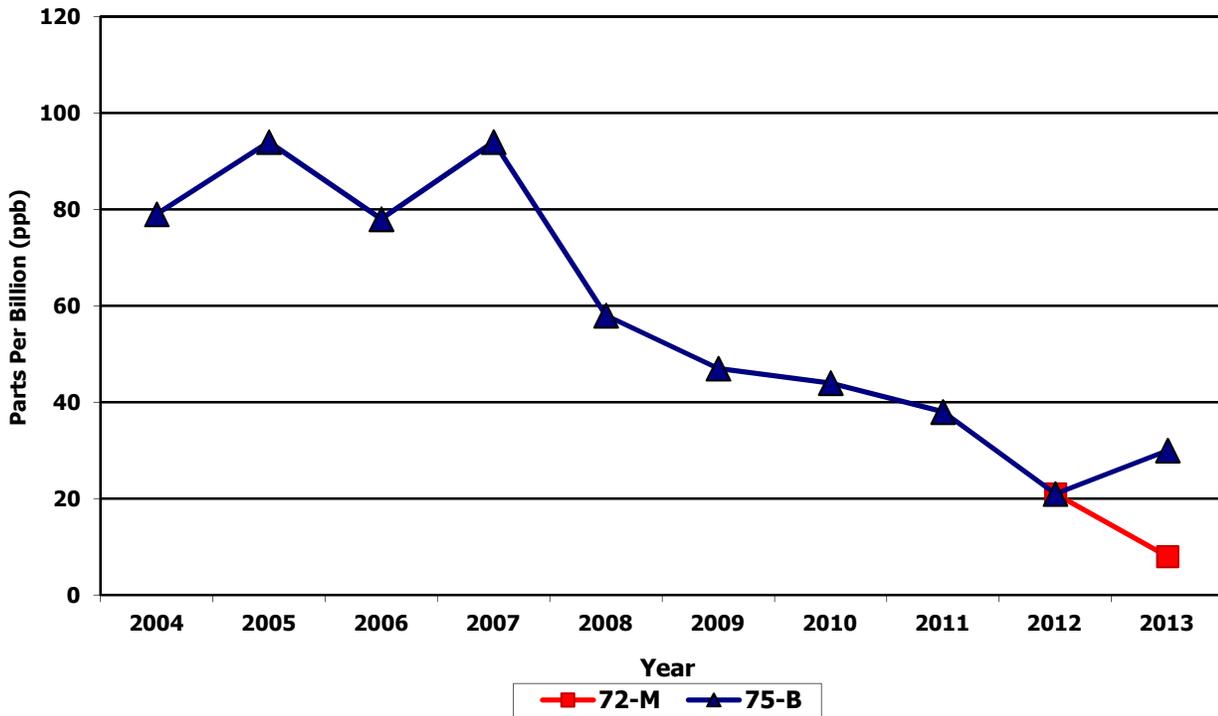


### Sulfur Dioxide - Blue Ridge Region 99th Percentile 1-Hour Daily Maximum

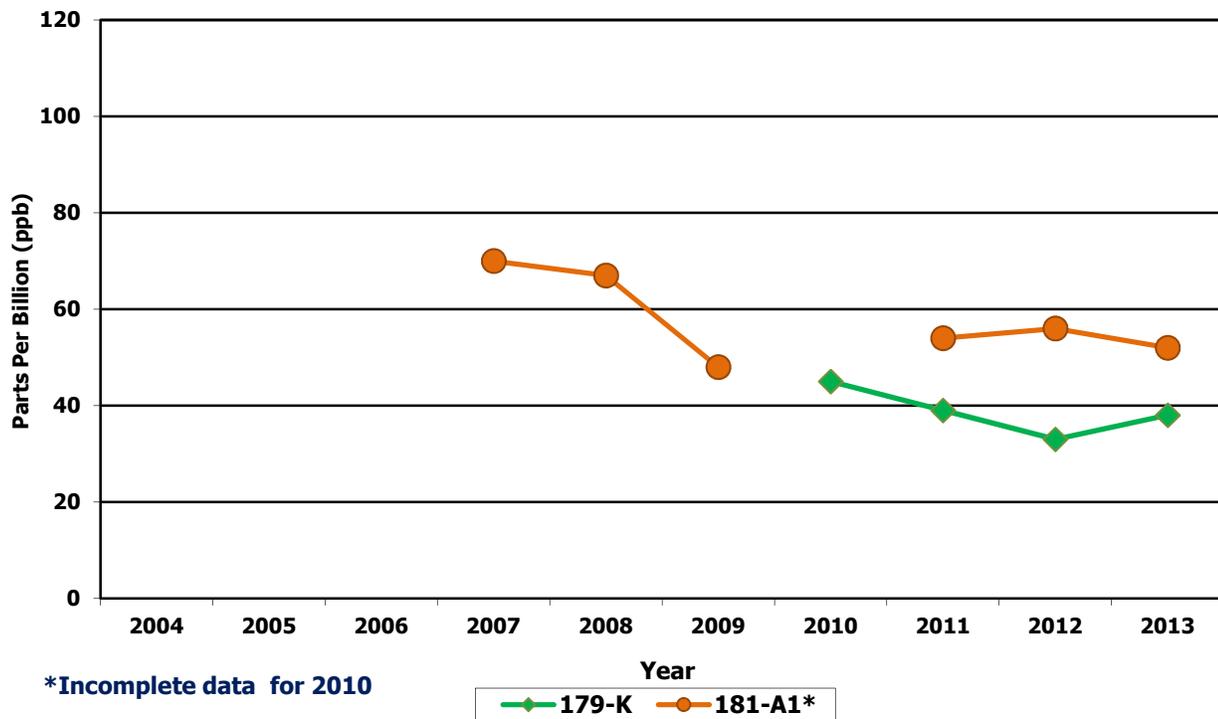


\* Incomplete data for 2007

### Sulfur Dioxide - Piedmont Region 99th Percentile 1-Hour Daily Maximum



### Sulfur Dioxide - Tidewater Region 99th Percentile 1-Hour Daily Maximum



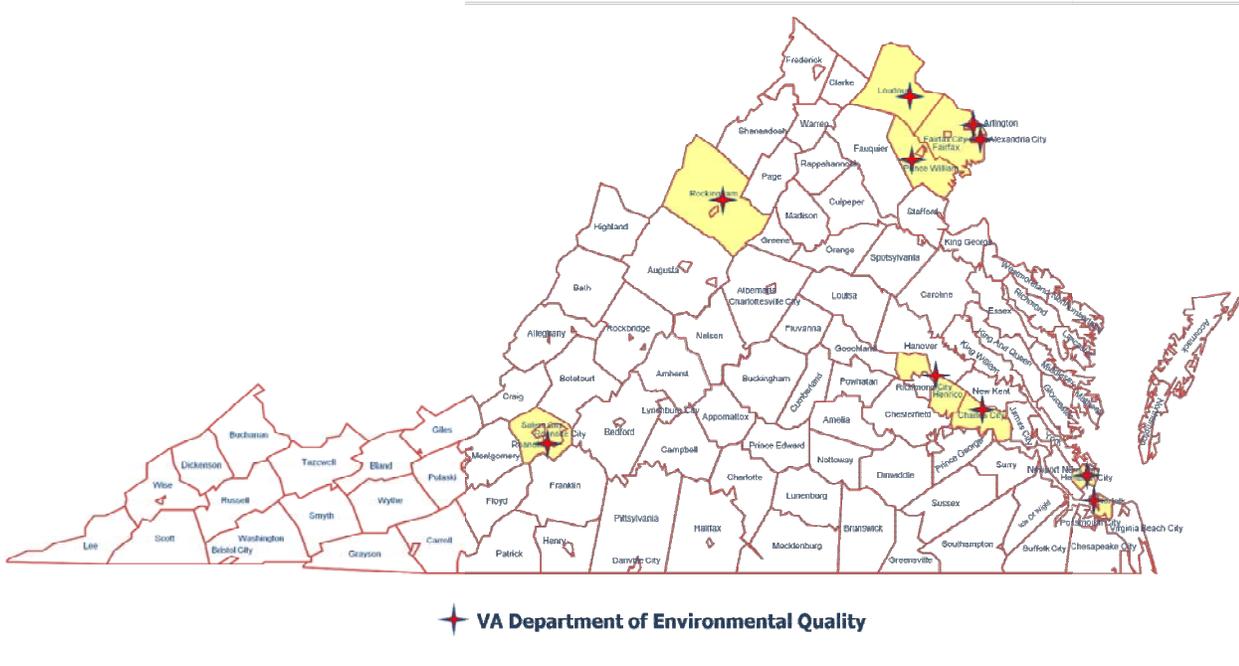
\*Incomplete data for 2010

[Nitrogen](#) dioxide (NO<sub>2</sub>) is one in a group of gases referred to as oxides of nitrogen (NO<sub>x</sub>). Nitrogen dioxide, which is characterized by a reddish-brown color and pungent odor, along with the other NO<sub>x</sub> gases, results from high-temperature burning of fossil fuels in automobiles, power plants, and other industrial, commercial, and residential sources. NO<sub>x</sub> can occur naturally from lightning, forest fires, and bacterial processes that take place in soil.

NO<sub>x</sub> pollution contributes to a wide range of problems in the environment. Ground-level ozone, a major component of “smog”, forms when NO<sub>x</sub> and volatile organic compounds (VOCs) react in the presence of sunlight. NO<sub>x</sub> 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<sub>x</sub> 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<sub>2</sub> because it can cause lung irritation and respiratory problems in humans. Small particles formed from reaction of NO<sub>x</sub> 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<sub>3</sub>). Any nitric oxide (NO) present in the sample air reacts with O<sub>3</sub> to produce NO<sub>2</sub>. The NO<sub>2</sub> molecules created by the reaction are in an excited state, and emit light characteristic of NO<sub>2</sub> – 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<sub>2</sub> 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<sub>3</sub> react to produce NO<sub>2</sub>. The chemiluminescence produced by the reaction is converted to a signal that reflects the concentration of NO<sub>x</sub> in the ambient air. The instrument then calculates the NO<sub>2</sub> concentration using the difference between the measured NO<sub>x</sub> and NO concentrations.



**NO2 Monitoring Network**

**National Ambient Air Quality Standards (NAAQS)**

Primary Standard for NO<sub>2</sub>:

- 3-year average of the 98<sup>th</sup> percentile 1-hour daily maximum values not to exceed 100 ppb.
- Annual Arithmetic Mean not to exceed 53 ppb (100 µg/m<sup>3</sup>).

Secondary Standard for NO<sub>2</sub>:

- Same as primary.

<b>Nitrogen Dioxide 98<sup>th</sup> Percentile 1-Hour Daily Maximum Values (ppb)</b>				
<b>Site City/County</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>3-Yr Avg. Design Value 2011-2013</b>
(26-F) <b>Rockingham Co.</b>	36	35*	40	37
(19-A6) <b>Roanoke Co.</b>	38	37	35	36
(72-M) <b>Henrico Co.</b>	38	39	38	38
(75-B) <b>Charles City Co.</b>	55	46	41	47
(179-K) <b>Hampton</b>	31	28	28	29
(181-A1) <b>Norfolk</b>	43	41	41	42
(38-I) <b>Loudoun Co.</b>	38	36	37	37
(45-L) <b>Prince William Co.</b>	29	25	29	28
(47-T) <b>Arlington Co.</b>	46	44	43*	44
(L-126-I) <b>Alexandria</b>			64	NA

\* Did not meet completeness criteria

## **National Ambient Air Quality Standards (NAAQS)**

Primary Standard for NO<sub>2</sub>:

- 3-year average of the 98<sup>th</sup> percentile 1-hour daily maximum values not to exceed 100 ppb.
- Annual Arithmetic Mean not to exceed 53 ppb (100 µg/m<sup>3</sup>).

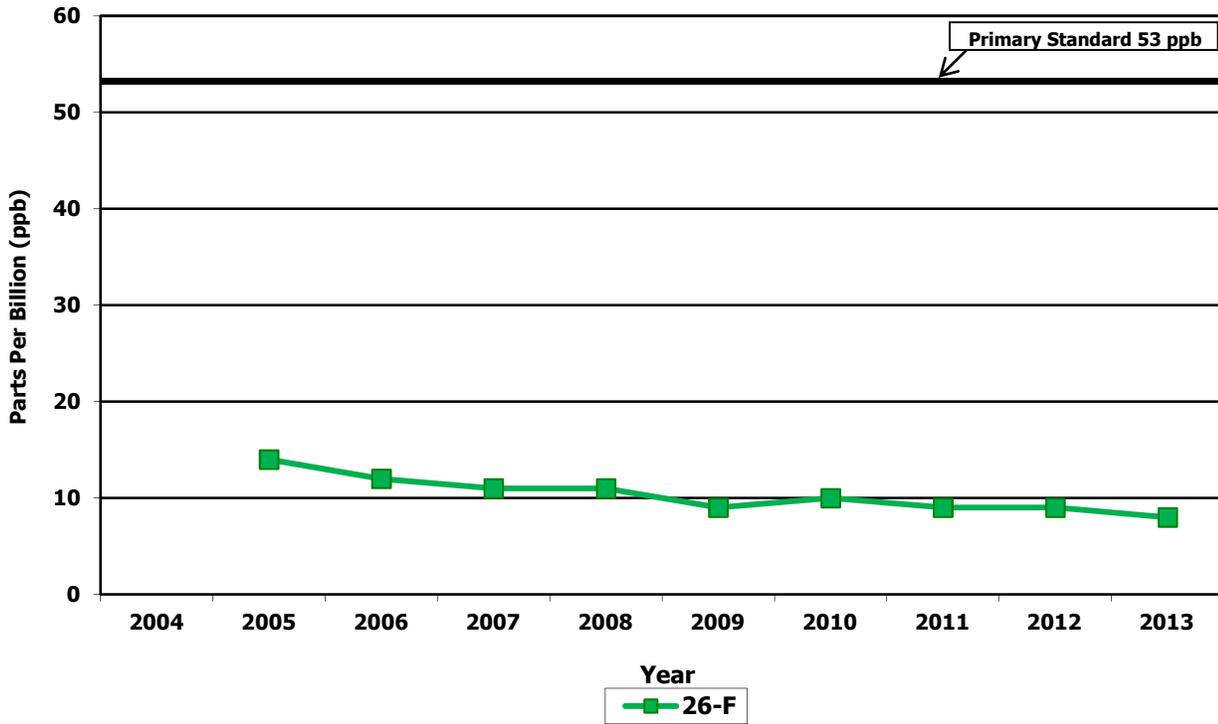
Secondary Standard for NO<sub>2</sub>:

- Same as primary.

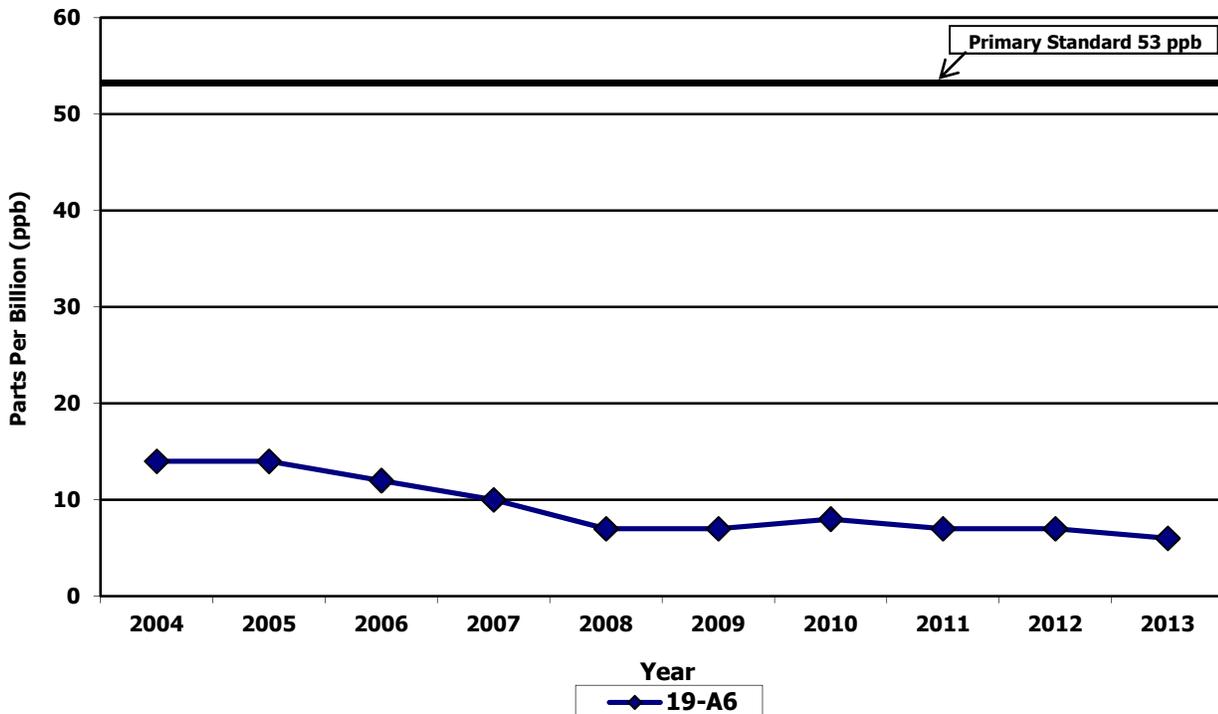
Site	Annual Arithmetic Mean (ppb)		
	2011	2012	2013
(26-F) <b>Rockingham Co.</b>	9	9*	8
(19-A6) <b>Roanoke Co.</b>	7	7	6
(72-M) <b>Henrico Co.</b>	10	9	8
(75-B) <b>Charles City Co.</b>	6	5	4
(179-K) <b>Hampton</b>	5	5	4
(181-A1) <b>Norfolk</b>	10	8	8
(38-I) <b>Loudoun Co.</b>	8	7	7
(45-L) <b>Prince William Co.</b>	6	5	5
(47-T) <b>Arlington Co.</b>	12	12	11*
(L-126-I) <b>Alexandria</b>			13

\* Did not meet completeness criteria

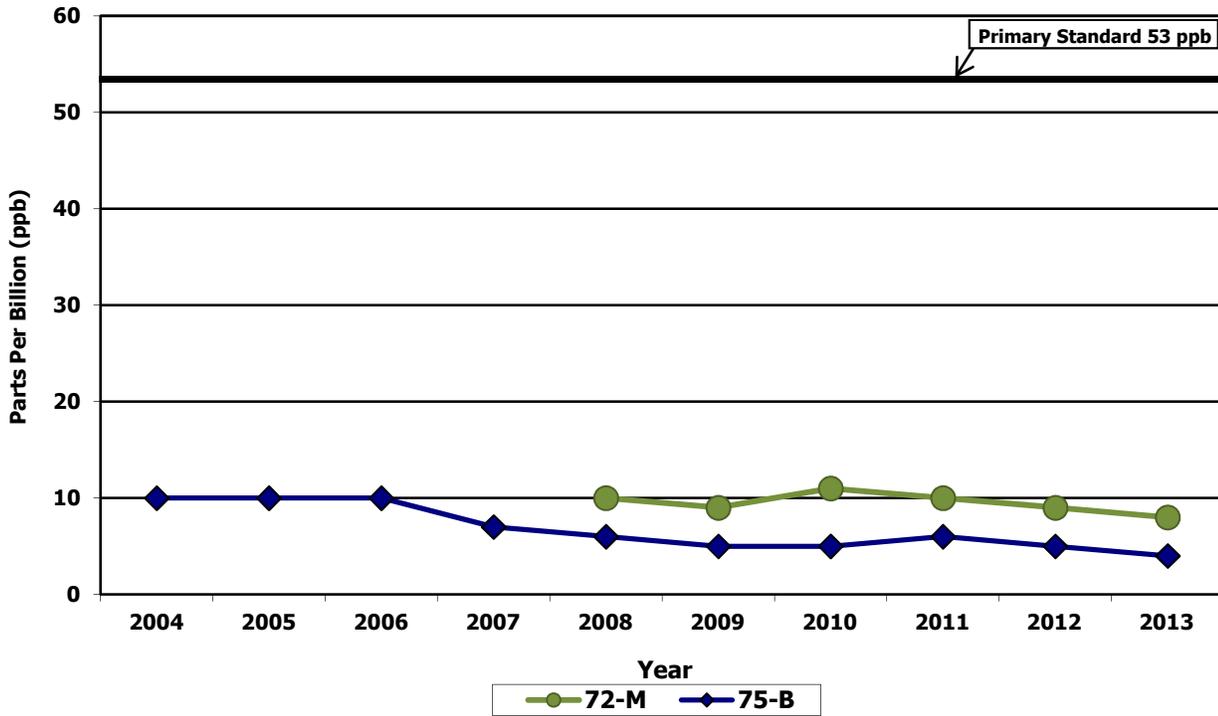
### Nitrogen Dioxide - Valley Region Annual Arithmetic Mean



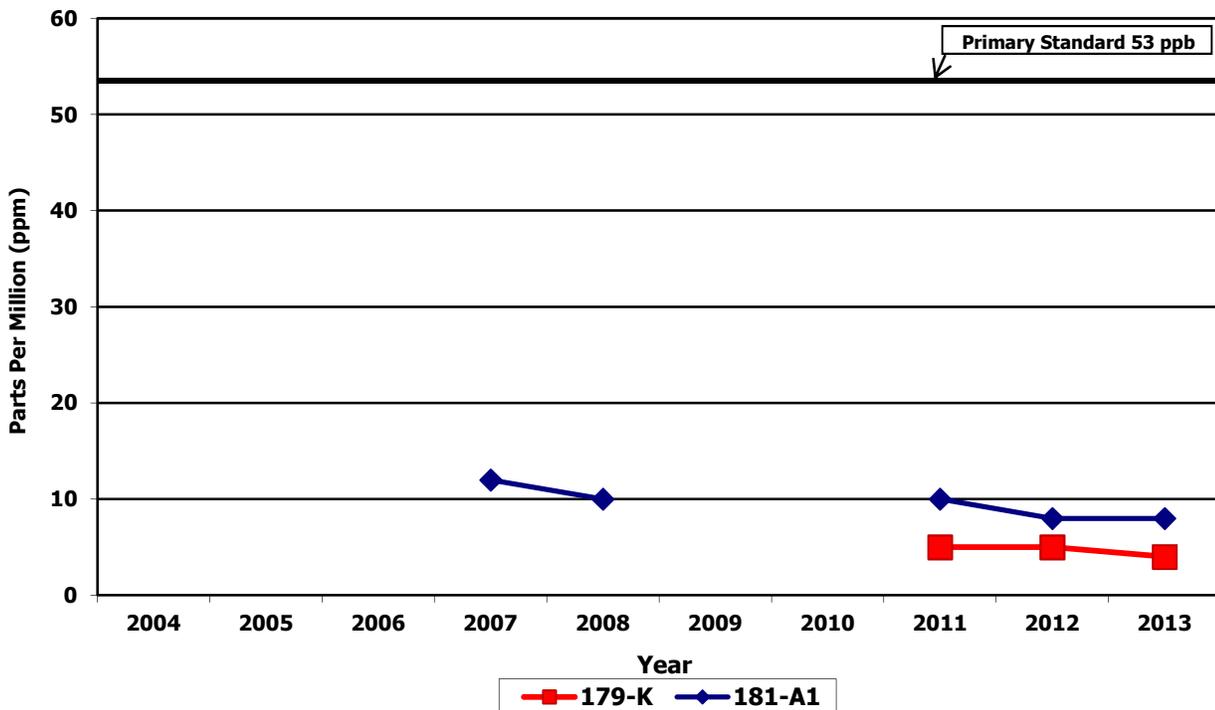
### Nitrogen Dioxide - Blue Ridge Region Annual Arithmetic Mean



### Nitrogen Dioxide - Piedmont Region Annual Arithmetic Mean

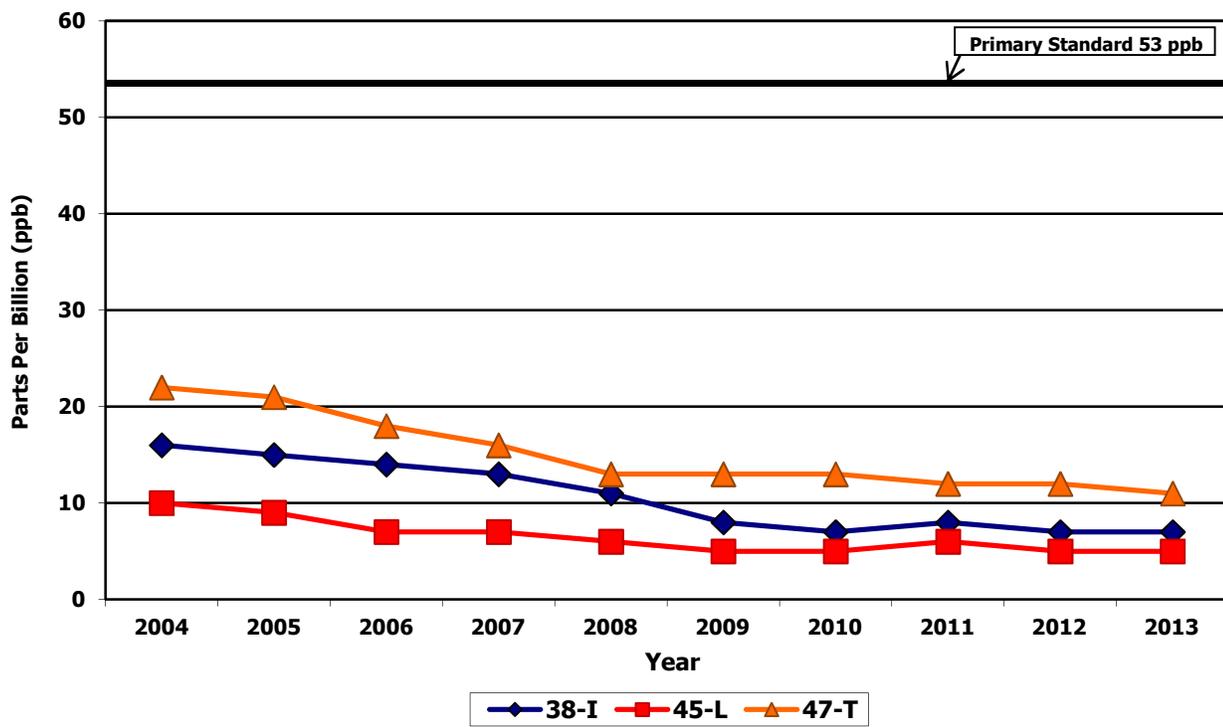


### Nitrogen Dioxide - Tidewater Region Annual Arithmetic Mean



\*Incomplete data in 2009 & 2010

### Nitrogen Dioxide - Northern Region Annual Arithmetic Mean



Ozone (O<sub>3</sub>) 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<sub>2</sub>).

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, NO<sub>x</sub> 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 NO<sub>x</sub> and VOCs, or "ozone precursors," that are necessary for ozone production.

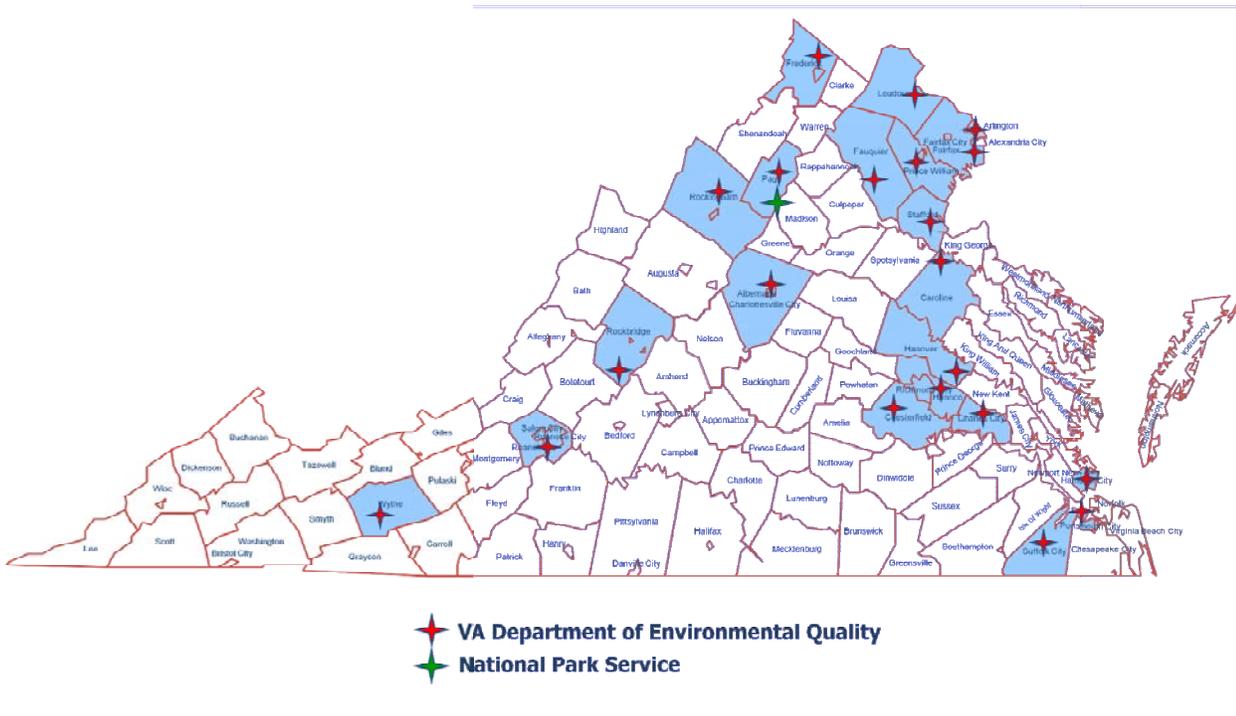
Ground-level ozone is a seasonal pollutant, and the length of the ozone season varies across the country. In some areas, the season may last most of the year, but in Virginia it is usually only a problem during the late spring to summer months when the sunlight is most intense. For 2013, Virginia was 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/ajq\\_rpt.pl](http://vadeq.tx.sutron.com/cgi-bin/ajq_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 2013. 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://ard-request.air-resource.com>.



## **National Ambient Air Quality Standards (NAAQS)**

Primary Standard for O<sub>3</sub>:

- Maximum 8-hour average concentration of 0.075 ppm (157 µg/m<sup>3</sup>), effective May 27, 2008, based on 3-year average of the annual fourth highest daily maximum 8-hour averages.

Secondary Standard for O<sub>3</sub>:

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.

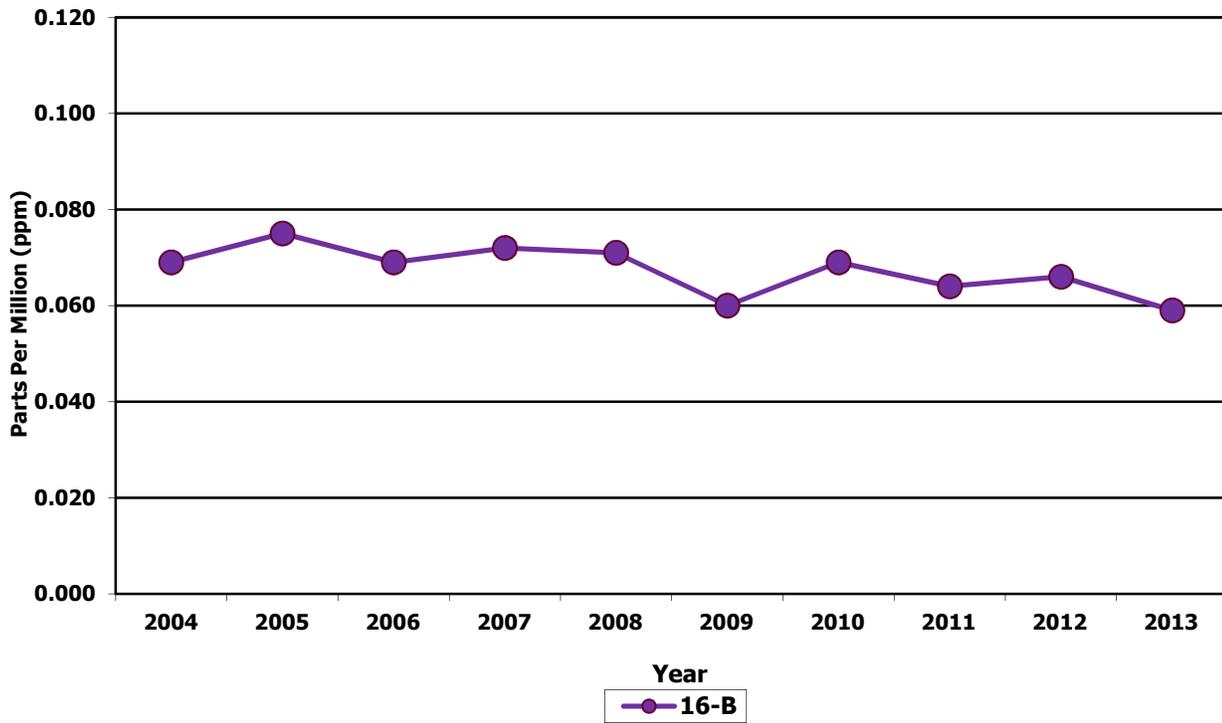
Site	Days Exceeded 0.075 ppm	2013			
		Highest Daily Maximum 8-Hour Avg.			
		1 <sup>st</sup> Max.	2 <sup>nd</sup> Max.	3 <sup>rd</sup> Max.	4 <sup>th</sup> Max.
(16-B) <b>Wythe Co.</b>	0	.066	.063	.059	.059
(26-F) <b>Rockingham Co.</b>	0	.062	.062	.060	.058
(28-J) <b>Frederick Co.</b>	0	.066	.065	.060	.060
(29-D) <b>Page Co.</b>	0	.063	.062	.061	.060
(33-A) <b>Albemarle Co.</b>	0	.062	.062	.060	.060
(19-A6) <b>Roanoke Co.</b>	0	.064	.058	.058	.057
(21-C) <b>Rockbridge Co.</b>	0	.061	.060	.058	.058
(71-H) <b>Chesterfield Co.</b>	0	.066	.065	.064	.063
(72-M) <b>Henrico Co.</b>	0	.070	.066	.066	.065
(73-E) <b>Hanover Co.</b>	1	.082	.067	.067	.066
(75-B) <b>Charles City Co.</b>	1	.085	.065	.064	.061
(179-K) <b>Hampton</b>	0	.072	.072	.069	.068
(183-E) <b>Suffolk</b>	0	.075	.067	.066	.065
(183-F) <b>Suffolk</b>	0	.068	.066	.066	.065
(37-B) <b>Fauquier Co.</b>	0	.064	.060	.059	.059
(38-I) <b>Loudoun Co.</b>	0	.075	.071	.069	.066
(44-A) <b>Stafford Co.</b>	0	.071	.065	.064	.064
(45-L) <b>Prince William Co.</b>	0	.070	.067	.066	.066
(46-B9) <b>Fairfax Co.</b>	1	.076	.068	.067	.067
(47-T) <b>Arlington Co.</b>	0	.075	.070	.067	.067
(48-A) <b>Caroline Co.</b>	0	.067	.066	.066	.065

<b>2011-2013 Fourth-Highest Daily Maximum 8-Hour Ozone Averages (units parts per million)</b>					
	<b>Monitor Location (County/City)</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>3-Year Average (NAAQS = .075 ppm)</b>
<b>Richmond Maintenance Area</b>	Chesterfield Co.	.071	.074	.063	.069
	Henrico Co.	.078	.078	.065	.073
	Hanover Co.	.076	.076	.066	.072
	Charles City Co.	.084	.076	.061	.073
<b>Hampton Roads Maintenance Area</b>	Hampton City	.076	.074	.068	.072
	Suffolk City (TCC)	.076	.071	.065	.070
	Suffolk City (Holland)	.073	.067	.065	.068
<b>Fredericksburg Maintenance Area</b>	Stafford Co.	.074	.076	.064	.071
<b>Northern Virginia Nonattainment Area</b>	Loudoun Co.	.075	.073	.066	.071
	Prince William Co.	.071	.072	.066	.069
	Arlington Co.	.087	.084	.067	.079
	Fairfax Co. (Lee Park)	.087	.084	.067	.079
<b>Shenandoah National Park Maintenance Area</b>	Madison Co. (Big Meadows)	.072	.072	.063	.069
<b>Areas Currently Designated Attainment</b>	Wythe Co.	.064	.066	.059	.063
	Rockbridge Co.	.061	.061	.058	.060
	Rockingham Co.	.069	.067	.058	.064
	Frederick Co.	.067	.070	.060	.065
	Page Co.	.068	.068	.060	.065
	Albemarle Co.	.067	.068	.060	.065
	Roanoke Co.	.067	.070	.057	.064
	Fauquier Co.	.063	.061	.059	.061
Caroline Co.	.072	.076	.065	.071	

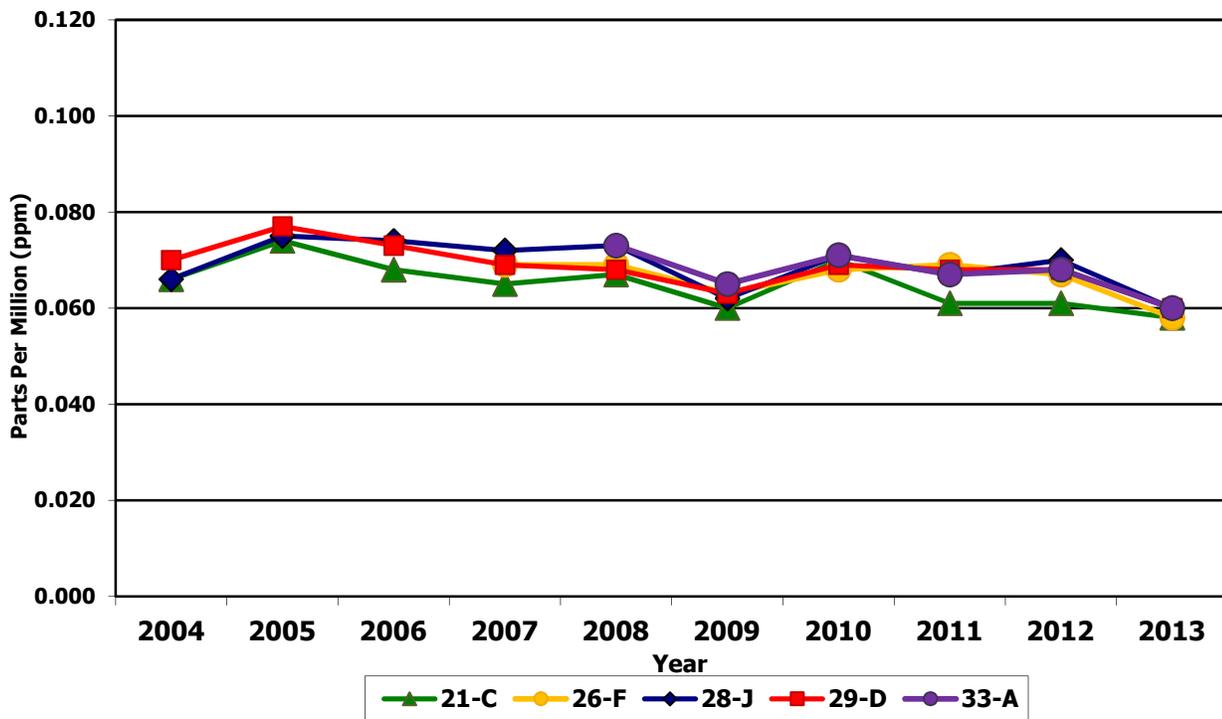
Ozone Monitoring Network

*A 3-year average of .075 ppm or above exceeds the 8-hour NAAQS for ozone. For the period from 2011-2013, the counties of Fairfax, and Arlington exceeded the ozone air quality standards.*

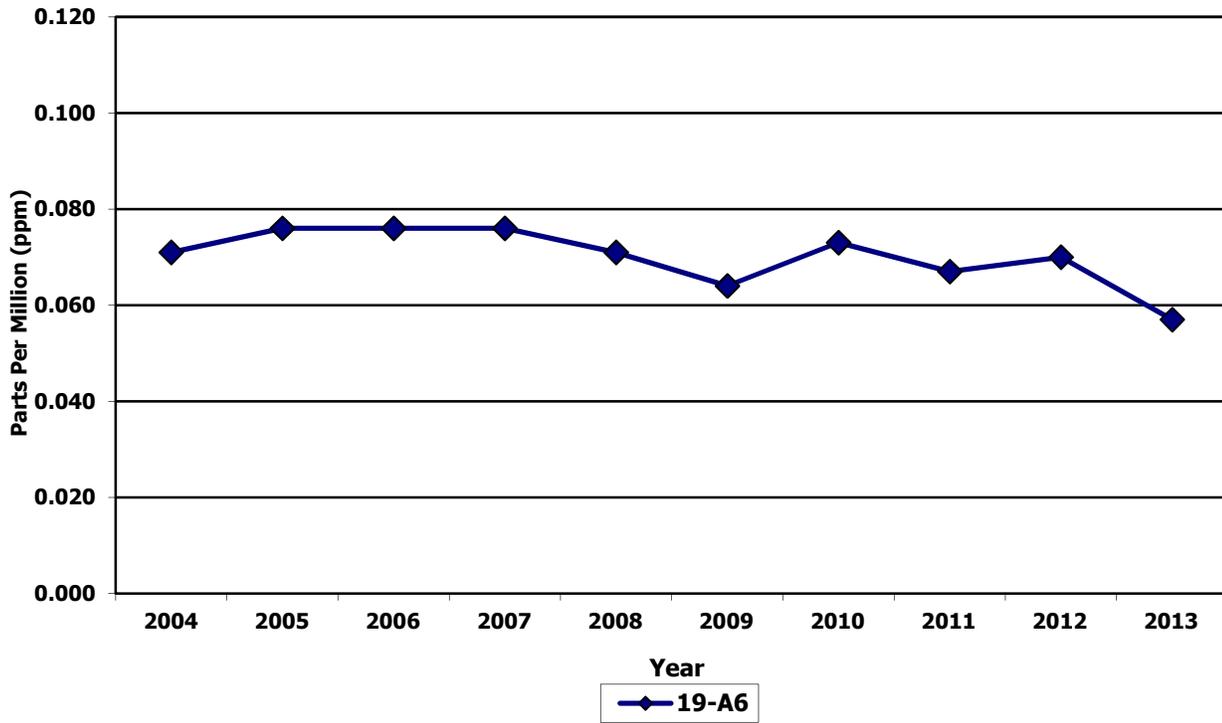
### Ozone - Southwest Region 4th Daily Maximum, 8-Hour Value



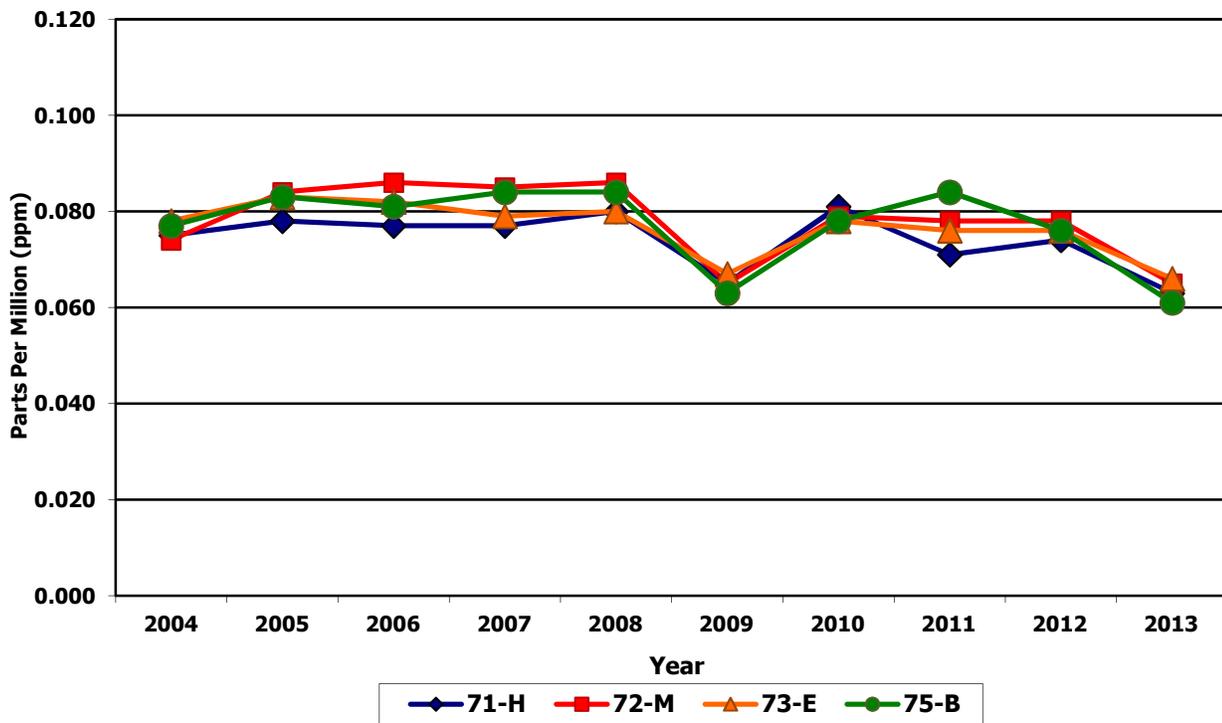
### Ozone - Valley Region 4th Daily Maximum, 8-Hour Value



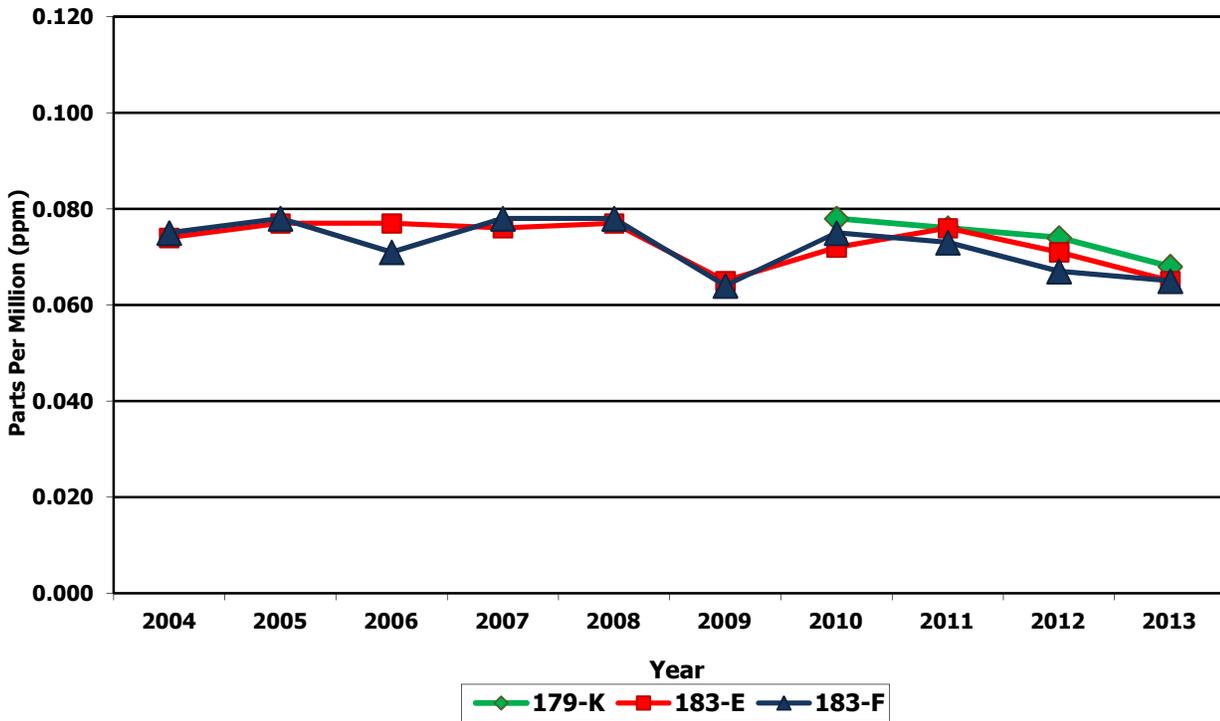
### Ozone - Blue Ridge Region 4th Daily Maximum, 8-Hour Value



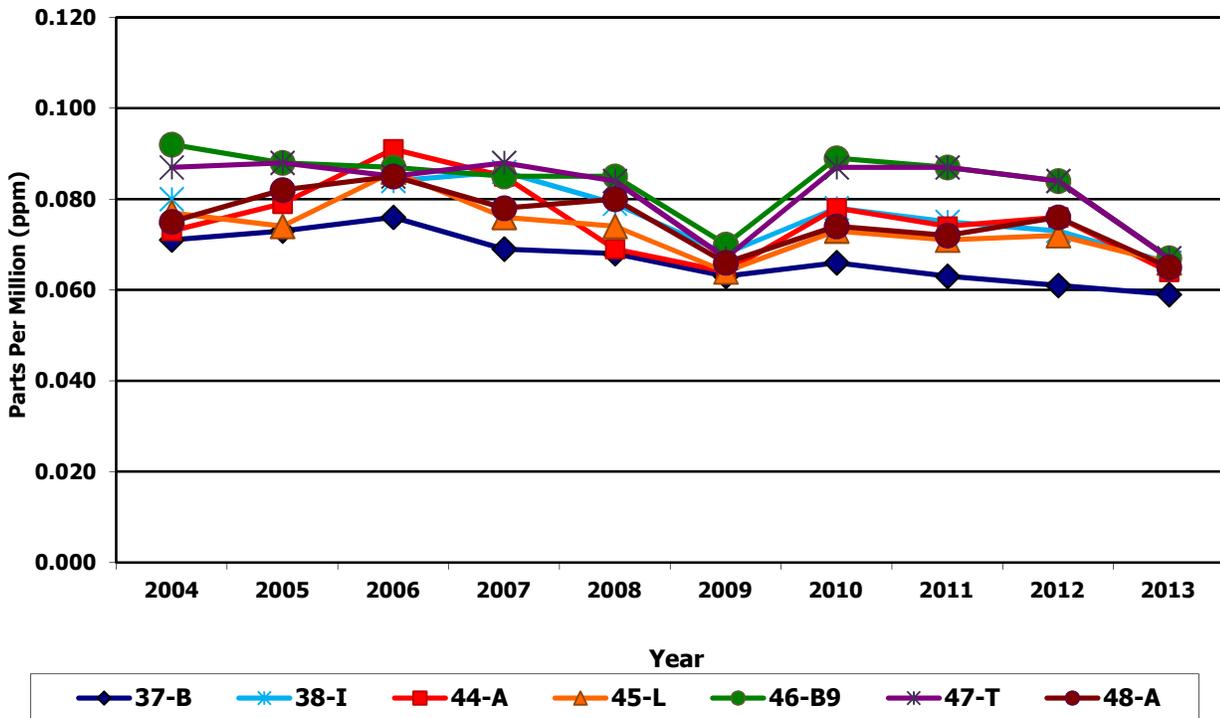
### Ozone - Piedmont Region 4th Daily Maximum, 8-Hour Value



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



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



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](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 ( $\mu\text{g}/\text{m}^3$ ). The normal sampling schedule is once every sixth day from midnight to midnight. The lead sampling schedule for 2013 can be found at <http://www.epa.gov/ttn/amtic/calendar.html>.



VA Department of Environmental Quality

# Lead Monitoring Sites

## National Ambient Air Quality Standards (NAAQS)

Primary Standard for Pb:

➔ 0.15  $\mu\text{g}/\text{m}^3$  three-month rolling average

Secondary Standard for Pb:

➔ Same as Primary

2013 Pb 3-Month Averages (units in $\mu\text{g}/\text{m}^3$ , LC)				
Site	No. 24-Hour Observations	1 <sup>st</sup> Max	2 <sup>nd</sup> Max	>0.15 $\mu\text{g}/\text{m}^3$
(4-G) Buchanan Co.	59	0.01	0.01	0
(109-H) Roanoke*	36	0.11	0.11	0
(53-G) Amherst Co.	59	0.01	0.01	0
(72-M) Henrico Co.	59	0.00	0.00	0

\* Incomplete data for 2013

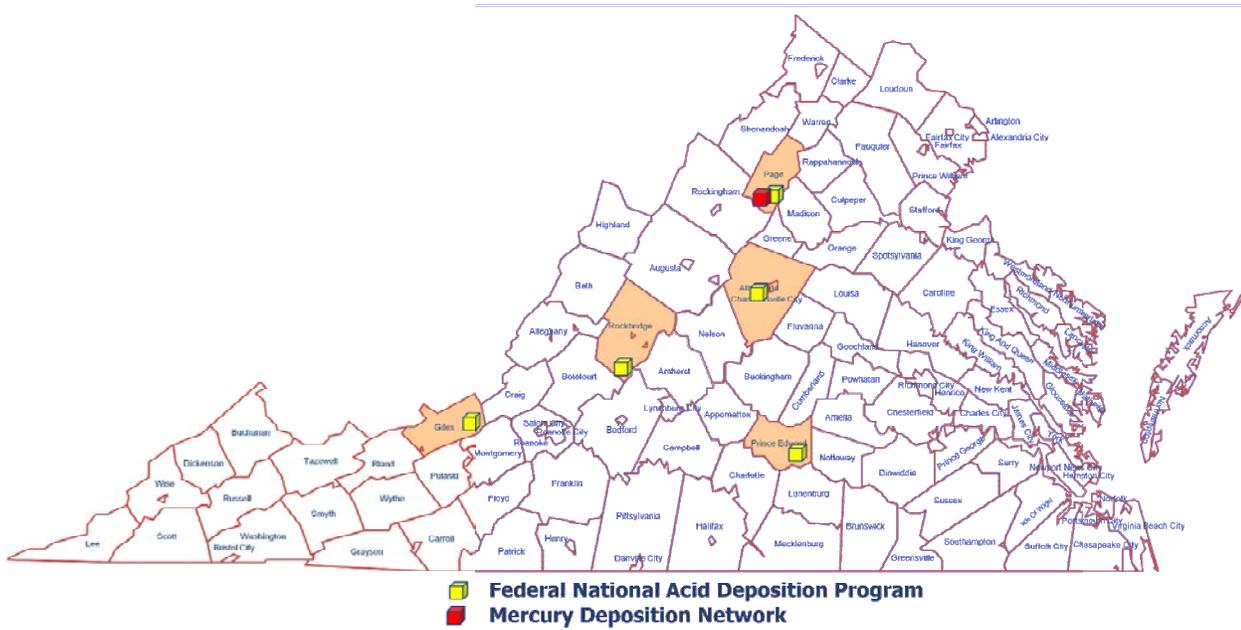
**Acid Deposition Program**

**Photochemical Assessment  
Monitoring Stations**

**Air Toxics Monitoring Network**

The National Acid Deposition Program (NADP) had five monitoring sites in Virginia in 2013: 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/>.



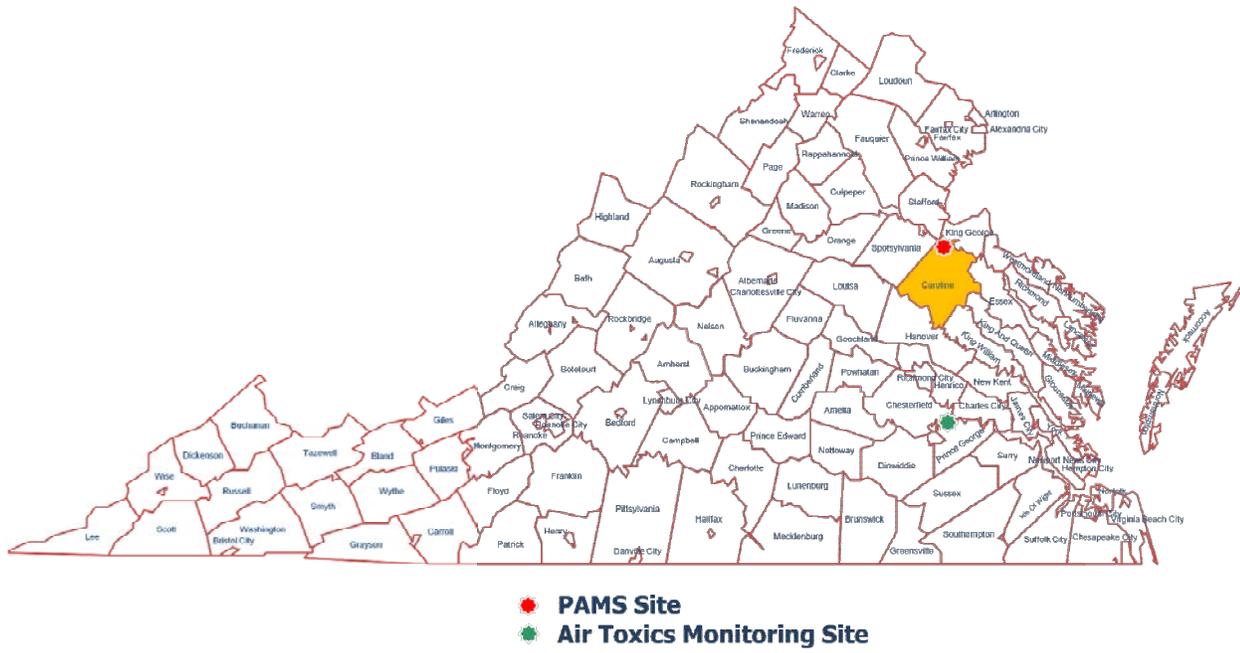
In 2013, the Office of Air Quality Monitoring (AQM) program of the Department of Environmental Quality operated one Photochemical Assessment Monitoring (PAMS) station at the Fredericksburg Geomagnetic Center at Corbin in Caroline County from January 1<sup>st</sup> to May 31<sup>st</sup>. This station was moved to the MathScience Innovation Center (MSIC) in Henrico 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 a 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 from January 1<sup>st</sup> to May 31<sup>st</sup> in 2013.

VADEQ moved the Photochemical Assessment Monitoring station to the MSIC site on June 1<sup>st</sup>. The MSIC site is considered a Type II PAMS site. A type II site measures maximum ozone precursor concentrations in the primary downwind direction for the Richmond area. MSIC collected 24-hour VOC samples on an every six day schedule from June 1<sup>st</sup> through the remainder of the year.

AQM used the manual method for collecting ambient air samples. This method involves the collection of integrated, whole samples by using evacuated Summa<sup>T</sup> or Silco<sup>T</sup> canisters and Xonteck, Inc. air samplers. Each VOC sample from Corbin and MSIC 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

**2013 Average Concentration of Detectable Volatile Ozone Precursors  
Photochemical Assessment Monitoring Station (PAMS) Type I - Corbin  
January 1 to May 31, 2013 - 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	24	0.00	1.20	0.00	0.10	0.27
43202	Ethane	24	2.71	9.97	6.61	6.19	2.04
43203	Ethylene	24	0.74	6.60	1.01	1.43	1.22
43204	Propane	24	1.21	9.34	4.40	4.53	2.23
43205	Propylene	24	0.19	2.80	0.42	0.54	0.52
43206	Acetylene	24	0.43	4.22	1.52	1.60	0.94
43212	n-butane	24	0.37	4.26	2.11	2.11	1.15
43214	Isobutane	24	0.35	2.70	1.04	1.13	0.64
43216	t-2-butene	24	0.00	0.00	0.00	0.00	0.00
43217	c-2-butene	24	0.00	0.00	0.00	0.00	0.00
43220	n-pentane	24	0.22	2.16	0.99	0.96	0.49
43221	Isopentane	24	0.28	2.54	0.99	1.04	0.53
43224	1-pentene	24	0.00	2.34	0.00	0.19	0.55
43226	t-2-pentene	24	0.00	0.00	0.00	0.00	0.00
43227	c-2-pentene	24	0.00	0.29	0.00	0.02	0.07
43230	3-methylpentane	24	0.00	0.51	0.20	0.18	0.18
43231	n-hexane	24	0.00	0.90	0.41	0.41	0.27
43232	n-heptane	24	0.00	0.60	0.32	0.31	0.14
43233	n-octane	24	0.00	0.40	0.00	0.11	0.14
43235	n-nonane	24	0.00	0.54	0.00	0.12	0.18
43238	n-decane	24	0.00	1.43	0.00	0.21	0.36
43242	Cyclopentane	24	0.00	0.29	0.00	0.01	0.06
43243	Isoprene	24	0.00	8.10	0.00	0.87	2.19
43244	2,2-dimethylbutane	24	0.00	0.00	0.00	0.00	0.00
43245	1-Hexene	24	0.00	1.29	0.00	0.20	0.30
43247	2,4-dimethylpentane	24	0.00	0.63	0.00	0.06	0.16
43248	Cyclohexane	24	0.00	2.96	0.30	0.39	0.61
43249	3-methylhexane	24	0.00	1.28	0.31	0.38	0.41
43250	2,2,4-trimethylpentane	24	0.00	0.41	0.00	0.09	0.14
43252	2,3,4-trimethylpentane	24	0.00	0.00	0.00	0.00	0.00
43253	3-methylheptane	24	0.00	0.52	0.00	0.08	0.15
43261	Methylcyclohexane	24	0.00	0.79	0.00	0.06	0.18
43262	Methylcyclopentane	24	0.00	0.81	0.22	0.24	0.23
43263	2-methylhexane	24	0.00	0.40	0.00	0.10	0.14
43280	1-butene	24	0.00	3.44	0.32	0.62	0.84
43284	2,3-dimethylbutane	24	0.00	0.26	0.00	0.05	0.09
43285	2-methylpentane	24	0.00	0.74	0.30	0.31	0.16
43291	2,3-dimethylpentane	24	0.00	0.24	0.00	0.01	0.05
43954	n-undecane	24	0.00	0.93	0.00	0.14	0.25
43960	2-methylheptane	24	0.00	0.59	0.00	0.05	0.15
45109	m/p-xylene	24	0.00	2.65	0.35	0.50	0.63
45201	Benzene	24	0.00	2.45	0.65	0.77	0.49
45202	Toluene	24	0.00	2.18	0.81	0.95	0.52
45203	Ethylbenzene	24	0.00	0.78	0.00	0.19	0.27
45204	o-xylene	24	0.00	1.10	0.00	0.22	0.31
45207	1,3,5-trimethylbenzene	24	0.00	0.55	0.00	0.10	0.19
45208	1,2,4-trimethylbenzene	24	0.00	2.37	0.17	0.35	0.54
45209	n-propylbenzene	24	0.00	0.70	0.00	0.13	0.25
45210	Isopropylbenzene	24	0.00	0.31	0.00	0.02	0.08
45211	o-ethyltoluene	24	0.00	1.46	0.00	0.22	0.35
45212	m-ethyltoluene	24	0.00	1.29	0.00	0.23	0.38
45213	p-ethyltoluene	24	0.00	1.11	0.12	0.30	0.36
45218	m-diethylbenzene	24	0.00	0.61	0.00	0.04	0.14
45219	p-diethylbenzene	24	0.00	0.55	0.00	0.07	0.17
45220	Styrene	24	0.00	2.86	0.36	0.54	0.73
45225	1,2,3-trimethylbenzene	24	0.00	3.79	0.00	0.50	0.97
<b>43000</b>	<b>PAMHC</b>	24	15.49	46.32	26.84	29.68	7.86
<b>43102</b>	<b>TNMOC</b>	24	24.74	77.67	40.78	43.23	14.44

**2013 Average Concentration of Detectable Volatile Ozone Precursors  
Photochemical Assessment Monitoring Station (PAMS) Type II –  
MathScience Innovation Center**

**June 1 to December 31, 2013** -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	33	0.00	0.42	0.00	0.07	0.12
43202	Ethane	33	2.39	25.98	8.44	9.80	5.62
43203	Ethylene	33	0.50	3.56	1.50	1.65	0.70
43204	Propane	33	1.62	14.64	4.30	4.95	2.95
43205	Propylene	33	0.21	1.50	0.58	0.65	0.31
43206	Acetylene	33	0.43	10.25	1.11	2.02	2.43
43212	n-butane	33	0.68	6.79	2.21	2.92	1.85
43214	Isobutane	33	0.46	3.41	1.35	1.47	0.75
43216	t-2-butene	33	0.00	0.00	0.00	0.00	0.00
43217	c-2-butene	33	0.00	0.16	0.00	0.00	0.03
43220	n-pentane	33	0.00	4.34	1.85	1.80	1.00
43221	Isopentane	33	0.69	7.86	3.01	3.15	1.54
43224	1-pentene	33	0.00	1.34	0.00	0.16	0.28
43226	t-2-pentene	33	0.00	0.50	0.00	0.08	0.13
43227	c-2-pentene	33	0.00	1.13	0.00	0.10	0.21
43230	3-methylpentane	33	0.00	2.08	0.71	0.73	0.45
43231	n-hexane	33	0.00	2.54	0.79	0.79	0.48
43232	n-heptane	33	0.00	1.21	0.41	0.43	0.25
43233	n-octane	33	0.00	0.45	0.14	0.14	0.15
43235	n-nonane	33	0.00	0.43	0.00	0.12	0.13
43238	n-decane	33	0.00	1.30	0.17	0.20	0.27
43242	Cyclopentane	33	0.00	0.82	0.18	0.18	0.19
43243	Isoprene	33	0.00	9.46	2.20	2.41	2.39
43244	2,2-dimethylbutane	33	0.00	0.58	0.19	0.16	0.15
43245	1-Hexene	33	0.00	0.58	0.00	0.07	0.15
43247	2,4-dimethylpentane	33	0.00	0.82	0.23	0.22	0.21
43248	Cyclohexane	33	0.00	1.24	0.22	0.27	0.29
43249	3-methylhexane	33	0.00	1.75	0.57	0.55	0.35
43250	2,2,4-trimethylpentane	33	0.00	3.79	1.11	1.22	0.81
43252	2,3,4-trimethylpentane	33	0.00	1.43	0.38	0.42	0.29
43253	3-methylheptane	33	0.00	0.39	0.00	0.11	0.13
43261	Methylcyclohexane	33	0.00	0.71	0.26	0.28	0.16
43262	Methylcyclopentane	33	0.00	1.42	0.47	0.54	0.29
43263	2-methylhexane	33	0.00	1.62	0.46	0.49	0.32
43280	1-butene	33	0.00	0.82	0.29	0.32	0.19
43284	2,3-dimethylbutane	33	0.00	1.18	0.41	0.41	0.31
43285	2-methylpentane	33	0.00	3.07	1.12	1.10	0.61
43291	2,3-dimethylpentane	33	0.00	0.80	0.24	0.23	0.19
43954	n-undecane	33	0.00	0.56	0.00	0.13	0.18
43960	2-methylheptane	33	0.00	0.25	0.00	0.07	0.09
45109	m/p-xylene	33	0.00	2.11	0.58	0.67	0.49
45201	Benzene	33	0.17	1.66	0.76	0.79	0.35
45202	Toluene	33	0.41	7.11	2.41	2.48	1.40
45203	Ethylbenzene	33	0.00	0.89	0.31	0.29	0.23
45204	o-xylene	33	0.00	1.01	0.27	0.27	0.24
45207	1,3,5-trimethylbenzene	33	0.00	0.70	0.00	0.08	0.19
45208	1,2,4-trimethylbenzene	33	0.00	1.40	0.45	0.47	0.30
45209	n-propylbenzene	33	0.00	0.92	0.00	0.09	0.23
45210	Isopropylbenzene	33	0.00	0.40	0.00	0.03	0.09
45211	o-ethyltoluene	33	0.00	1.07	0.34	0.37	0.33
45212	m-ethyltoluene	33	0.00	0.93	0.33	0.34	0.26
45213	p-ethyltoluene	33	0.00	0.71	0.00	0.10	0.19
45218	m-diethylbenzene	33	0.00	0.00	0.00	0.00	0.00
45219	p-diethylbenzene	33	0.00	0.30	0.00	0.02	0.07
45220	Styrene	33	0.00	1.33	0.00	0.22	0.32
45225	1,2,3-trimethylbenzene	33	0.00	0.84	0.00	0.05	0.16
<b>43000</b>	<b>PAMHC</b>	33	9.35	94.45	47.40	46.53	20.96
<b>43102</b>	<b>TNMOC</b>	33	12.63	151.28	55.57	58.45	28.98

**2013 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)

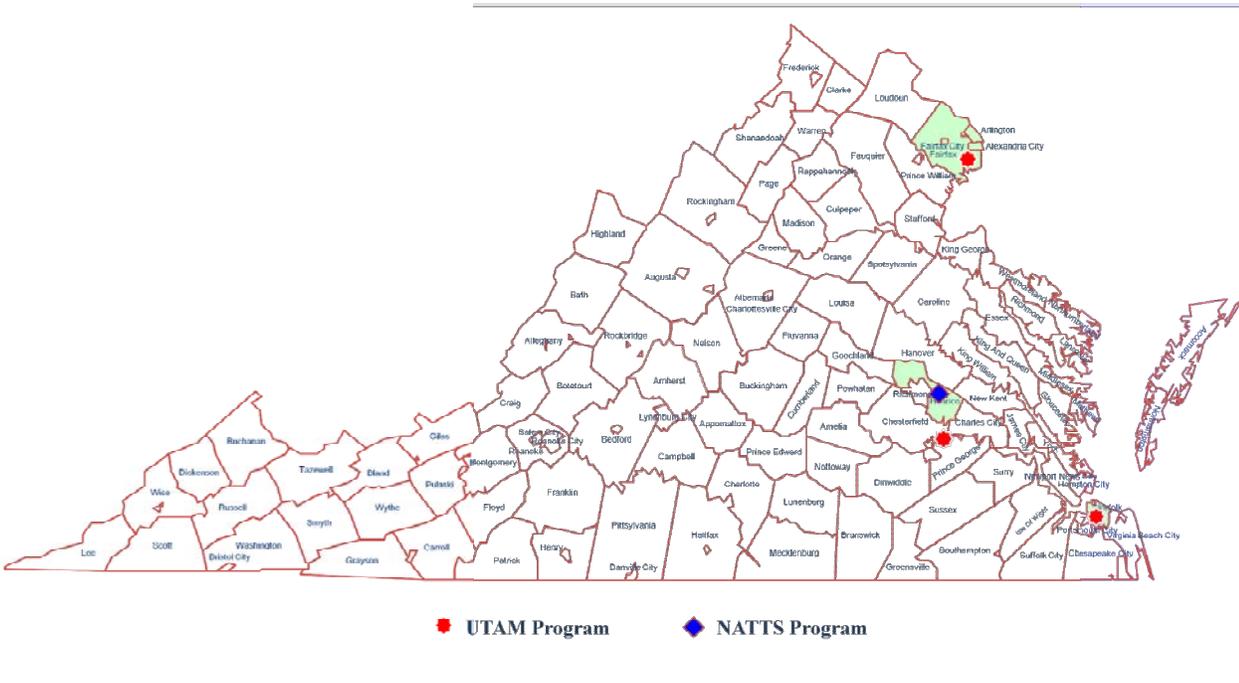
Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
43141	n-dodecane	59	0.00	1.35	0.17	0.24	0.23
43202	Ethane	59	2.25	49.44	6.87	8.61	7.14
43203	Ethylene	59	0.31	7.19	1.39	2.13	1.84
43204	Propane	59	1.11	31.31	4.40	6.17	5.23
43205	Propylene	59	0.11	3.83	0.51	0.72	0.63
43206	Acetylene	59	0.43	10.77	1.51	2.67	2.57
43212	n-butane	59	0.32	14.34	2.43	3.36	3.03
43214	Isobutane	59	0.16	10.24	1.18	1.45	1.44
43216	t-2-butene	59	0.02	0.56	0.06	0.09	0.09
43217	c-2-butene	59	0.02	0.33	0.06	0.09	0.07
43220	n-pentane	59	0.26	11.44	1.54	2.05	1.66
43221	Isopentane	59	0.32	16.99	2.15	2.93	2.59
43224	1-pentene	59	0.08	1.73	0.18	0.23	0.22
43226	t-2-pentene	59	0.02	1.57	0.18	0.25	0.25
43227	c-2-pentene	59	0.01	0.85	0.08	0.12	0.13
43230	3-methylpentane	59	0.08	2.63	0.60	0.73	0.55
43231	n-hexane	59	0.10	5.74	0.67	0.88	0.86
43232	n-heptane	59	0.10	1.88	0.39	0.53	0.38
43233	n-octane	59	0.08	1.10	0.20	0.25	0.17
43235	n-nonane	59	0.06	1.10	0.18	0.21	0.15
43238	n-decane	59	0.05	1.42	0.16	0.23	0.21
43242	Cyclopentane	59	0.07	1.14	0.21	0.25	0.16
43243	Isoprene	59	0.02	17.50	0.35	3.14	4.46
43244	2,2-dimethylbutane	59	0.03	0.65	0.19	0.22	0.14
43245	1-Hexene	59	0.02	0.44	0.06	0.09	0.08
43247	2,4-dimethylpentane	59	0.00	0.82	0.22	0.25	0.18
43248	Cyclohexane	59	0.00	1.12	0.17	0.23	0.20
43249	3-methylhexane	59	0.17	1.59	0.51	0.54	0.28
43250	2,2,4-trimethylpentane	59	0.10	4.10	0.72	1.01	0.85
43252	2,3,4-trimethylpentane	59	0.07	1.83	0.41	0.50	0.37
43253	3-methylheptane	59	0.04	0.59	0.12	0.16	0.12
43261	Methylcyclohexane	59	0.00	1.21	0.26	0.31	0.23
43262	Methylcyclopentane	59	0.12	2.28	0.62	0.70	0.41
43263	2-methylhexane	59	0.07	2.26	0.63	0.70	0.46
43280	1-butene	59	0.00	0.63	0.12	0.16	0.12
43284	2,3-dimethylbutane	59	0.05	1.15	0.27	0.33	0.27
43285	2-methylpentane	59	0.08	4.47	1.27	1.46	0.95
43291	2,3-dimethylpentane	59	0.00	1.05	0.26	0.32	0.22
43954	n-undecane	59	0.06	1.36	0.19	0.26	0.21
43960	2-methylheptane	59	0.06	0.65	0.20	0.23	0.14
45109	m/p-xylene	59	0.21	6.63	1.03	1.32	1.00
45201	Benzene	59	0.29	2.68	0.85	1.02	0.58
45202	Toluene	59	0.43	12.59	1.92	2.49	1.95
45203	Ethylbenzene	59	0.04	2.03	0.38	0.46	0.33
45204	o-xylene	59	0.06	2.15	0.46	0.53	0.36
45207	1,3,5-trimethylbenzene	59	0.03	0.86	0.15	0.18	0.15
45208	1,2,4-trimethylbenzene	59	0.09	1.95	0.40	0.49	0.37
45209	n-propylbenzene	59	0.04	0.48	0.13	0.15	0.09
45210	Isopropylbenzene	59	0.00	0.27	0.05	0.07	0.05
45211	o-ethyltoluene	59	0.00	0.62	0.10	0.15	0.13
45212	m-ethyltoluene	59	0.05	1.30	0.36	0.39	0.26
45213	p-ethyltoluene	59	0.05	1.89	0.20	0.27	0.29
45218	m-diethylbenzene	59	0.02	0.44	0.05	0.08	0.07
45219	p-diethylbenzene	59	0.02	0.45	0.08	0.10	0.08
45220	Styrene	59	0.00	1.88	0.32	0.45	0.38
45225	1,2,3-trimethylbenzene	59	0.02	0.54	0.10	0.12	0.10
<b>43000</b>	<b>PAMHC</b>	59	11.75	224.06	43.22	53.06	34.09
<b>43102</b>	<b>TNMOC</b>	59	31.01	469.75	88.58	99.53	68.75

In 2013, 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 6<sup>th</sup> 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<sup>T</sup> or SUMMA<sup>T</sup> canisters and RMESI (RM Environmental Systems, Inc.) air samplers. Each sample was analyzed by the Maryland Department of the Environment, Air and Radiation Management Administration, using a Gas Chromatograph equipped with a Mass Selective Detector, using method TO15. Carbonyls were collected on DNPH (2,4-Dinitrophenylhydrazine) treated sorbent tubes using ATEC 8000 cartridge samplers. Samples taken by the Division of Consolidated Laboratory Services (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 6<sup>th</sup> 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<sup>T</sup> 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, 2013-** 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	0.03	0.12	0.09	0.086	0.014
43208	Freon 114	58	0.00	0.03	0.00	0.002	0.006
43209	Ethyl Acetate	58	0.00	0.01	0.00	0.000	0.001
43218	1,3-Butadiene	58	0.00	0.00	0.00	0.000	0.000
43231	Hexane	58	0.00	0.40	0.11	0.116	0.087
43232	Heptane	58	0.00	0.19	0.04	0.052	0.060
43248	Cyclohexane	58	0.00	0.07	0.00	0.005	0.015
43372	MTBE	58	0.00	0.00	0.00	0.000	0.000
43441	Methyl Methacrylate	58	0.00	0.00	0.00	0.000	0.000
43505	Acrolein	58	0.00	0.57	0.00	0.060	0.136
43702	Acetonitrile	58	0.00	0.27	0.00	0.008	0.045
43704	Acrylonitrile	58	0.00	0.00	0.00	0.000	0.000
43801	Chloromethane	58	0.26	0.80	0.61	0.604	0.104
43802	Dichloromethane	58	0.06	1.74	0.18	0.248	0.248
43803	Chloroform	58	0.00	0.04	0.02	0.013	0.013
43804	Carbon Tetrachloride	58	0.03	0.28	0.09	0.093	0.029
43806	Bromoform (Tribromomethane)	58	0.00	0.03	0.00	0.001	0.004
43811	Trichlorofluoromethane	58	0.09	0.36	0.26	0.266	0.047
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	0.01	0.00	0.000	0.001
43815	Ethylene dichloride	58	0.00	0.03	0.00	0.007	0.011
43817	Tetrachloroethylene	58	0.00	0.08	0.02	0.016	0.017
43818	1,1,2,2-Tetrachloroethane	58	0.00	0.02	0.00	0.000	0.003
43819	Bromomethane	58	0.00	0.02	0.00	0.000	0.003
43820	1,1,2-Trichloroethane	58	0.00	0.00	0.00	0.000	0.000
43823	Dichlorodifluoromethane	58	0.00	1.24	0.55	0.544	0.252
43824	Trichloroethylene	58	0.00	0.99	0.00	0.018	0.130
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	0.06	0.00	0.002	0.010
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	0.32	0.09	0.106	0.066
45201	Benzene	58	0.06	0.42	0.15	0.169	0.082
45202	Toluene	58	0.05	1.75	0.23	0.278	0.239
45203	Ethylbenzene	58	0.00	0.11	0.03	0.035	0.025
45204	o-Xylene	58	0.00	0.11	0.04	0.040	0.028
45207	1,3,5-Trimethylbenzene	58	0.00	0.06	0.00	0.008	0.015
45208	1,2,4-Trimethylbenzene	58	0.00	0.08	0.00	0.005	0.017
45213	p-Ethyltoluene	58	0.00	0.11	0.00	0.007	0.019
45220	Styrene	58	0.00	0.28	0.00	0.026	0.049
45801	Chlorobenzene	58	0.00	0.09	0.00	0.003	0.014
45805	1,2-Dichlorobenzene	58	0.00	0.31	0.00	0.020	0.048
45806	1,3-Dichlorobenzene	58	0.00	0.57	0.00	0.027	0.080
45807	1,4-Dichlorobenzene	58	0.00	1.13	0.00	0.045	0.151
45810	1,2,4-Trichlorobenzene	58	0.00	2.14	0.00	0.051	0.283
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, 2013** - Concentrations are in ppbV  
(non detects are counted as zeros for statistical purposes)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
42153	Carbon Disulfide	59	0.00	0.32	0.03	0.046	0.052
43207	Freon 113	59	0.04	0.19	0.07	0.079	0.020
43208	Freon 114	59	0.01	0.04	0.02	0.020	0.005
43218	1,3-Butadiene	59	0.00	0.13	0.02	0.033	0.030
43231	N-Hexane	59	0.00	0.71	0.06	0.089	0.105
43232	N-Heptane	59	0.00	0.16	0.04	0.053	0.038
43248	Cyclohexane	59	0.00	0.14	0.02	0.035	0.035
43372	Methyl Tert-Butyl Ether	59	0.00	0.05	0.00	0.002	0.008
43505	Acrolein	59	0.00	2.33	0.20	0.256	0.321
43551	Acetone	59	1.31	18.15	3.78	4.248	2.807
43702	Acetonitrile	59	0.09	4.49	0.70	0.921	0.805
43704	Acrylonitrile	59	0.00	0.06	0.01	0.012	0.011
43801	Chloromethane	59	0.36	0.90	0.58	0.594	0.077
43802	Dichloromethane	59	0.00	4.23	0.11	0.259	0.606
43803	Chloroform	59	0.00	0.03	0.02	0.019	0.007
43804	Carbon Tetrachloride	59	0.06	0.14	0.08	0.084	0.014
43811	Trichlorofluoromethane	59	0.07	0.38	0.23	0.223	0.038
43814	Methyl Chloroform	59	0.00	0.04	0.01	0.007	0.009
43815	Ethylene Dichloride	59	0.00	0.14	0.00	0.007	0.022
43817	Tetrachloroethylene	59	0.00	0.07	0.01	0.017	0.018
43818	1,1,2,2-Tetrachloroethane	59	0.00	0.08	0.00	0.002	0.011
43819	Bromomethane	59	0.00	0.05	0.01	0.011	0.011
43820	1,1,2-Trichloroethane	59	0.00	0.09	0.00	0.002	0.012
43823	Dichlorodifluoromethane	59	0.27	0.89	0.43	0.449	0.090
43824	Trichloroethylene	59	0.00	0.09	0.00	0.005	0.017
43829	1,2-Dichloropropane	59	0.00	0.03	0.00	0.004	0.007
43830	Trans-1,3-Dichloropropylene	59	0.00	0.09	0.00	0.003	0.016
43831	Cis-1,3-Dichloropropylene	59	0.00	0.06	0.00	0.002	0.010
43843	Ethylene Dibromide	59	0.00	0.27	0.00	0.006	0.037
43844	Hexachlorobutadiene	59	0.00	0.02	0.00	0.001	0.003
43860	Vinyl Chloride	59	0.00	0.06	0.00	0.007	0.014
45109	M/P Xylene	59	0.00	0.52	0.07	0.092	0.095
45201	Benzene	59	0.06	0.45	0.17	0.188	0.103
45202	Toluene	59	0.04	2.27	0.18	0.285	0.356
45203	Ethylbenzene	59	0.00	0.17	0.03	0.043	0.035
45204	O-Xylene	59	0.00	0.16	0.03	0.036	0.033
45207	1,3,5-Trimethylbenzene	59	0.00	0.09	0.01	0.009	0.015
45208	1,2,4-Trimethylbenzene	59	0.00	0.17	0.02	0.035	0.036
45213	P-Ethyltoluene	59	0.00	0.22	0.01	0.016	0.030
45220	Styrene	59	0.00	0.42	0.02	0.043	0.072
45801	Chlorobenzene	59	0.00	0.33	0.00	0.010	0.045
45807	1,4-Dichlorobenzene	59	0.00	0.33	0.01	0.014	0.045
45809	Benzyl Chloride	59	0.00	0.11	0.00	0.006	0.017
46401	Furan, Tetrahydro-	59	0.00	0.08	0.02	0.021	0.017

**Detectable VOC in 24-Hour Canister Samples**  
**GC/MSD - Tidewater Regional Office (UTAM Site), Va. Beach, VA**  
**January 1 to December 31, 2013** – 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	61	0.00	1.37	0.03	0.091	0.202
43207	Freon 113	61	0.06	0.10	0.07	0.070	0.006
43208	Freon 114	61	0.01	0.03	0.02	0.020	0.003
43218	1,3-Butadiene	61	0.00	0.18	0.03	0.054	0.049
43231	N-Hexane	61	0.00	0.52	0.07	0.100	0.098
43232	N-Heptane	61	0.00	0.21	0.04	0.055	0.041
43248	Cyclohexane	61	0.00	0.12	0.02	0.033	0.027
43372	Methyl Tert-Butyl Ether	61	0.00	0.01	0.00	0.001	0.002
43505	Acrolein	61	0.00	0.53	0.19	0.198	0.114
43551	Acetone	61	1.67	9.66	3.79	3.890	1.529
43702	Acetonitrile	61	0.00	1.70	0.26	0.309	0.259
43704	Acrylonitrile	61	0.00	0.13	0.01	0.017	0.020
43801	Chloromethane	61	0.50	0.84	0.64	0.650	0.065
43802	Dichloromethane	61	0.00	0.32	0.12	0.106	0.067
43803	Chloroform	61	0.00	0.06	0.02	0.020	0.010
43804	Carbon Tetrachloride	61	0.02	0.12	0.08	0.078	0.017
43811	Trichlorofluoromethane	61	0.07	0.29	0.23	0.227	0.039
43814	Methyl Chloroform	61	0.00	0.05	0.01	0.007	0.008
43815	Ethylene Dichloride	61	0.00	0.20	0.00	0.021	0.049
43817	Tetrachloroethylene	61	0.00	2.32	0.06	0.193	0.348
43818	1,1,2,2-Tetrachloroethane	61	0.00	0.01	0.00	0.000	0.001
43819	Bromomethane	61	0.00	0.03	0.01	0.010	0.008
43820	1,1,2-Trichloroethane	61	0.00	0.01	0.00	0.000	0.001
43823	Dichlorodifluoromethane	61	0.37	0.79	0.47	0.491	0.094
43824	Trichloroethylene	61	0.00	0.02	0.00	0.003	0.005
43829	1,2-Dichloropropane	61	0.00	0.01	0.00	0.001	0.003
43830	Trans-1,3-Dichloropropylene	61	0.00	0.01	0.00	0.000	0.001
43831	Cis-1,3-Dichloropropylene	61	0.00	0.01	0.00	0.000	0.001
43843	Ethylene Dibromide	61	0.00	0.01	0.00	0.000	0.001
43844	Hexachlorobutadiene	61	0.00	0.01	0.00	0.000	0.002
43860	Vinyl Chloride	61	0.00	0.12	0.00	0.005	0.017
45109	M/P Xylene	61	0.00	0.29	0.07	0.079	0.056
45201	Benzene	61	0.06	0.41	0.17	0.196	0.096
45202	Toluene	61	0.05	0.86	0.18	0.266	0.176
45203	Ethylbenzene	61	0.00	0.10	0.03	0.036	0.020
45204	O-Xylene	61	0.00	0.15	0.03	0.034	0.027
45207	1,3,5-Trimethylbenzene	61	0.00	0.04	0.01	0.011	0.009
45208	1,2,4-Trimethylbenzene	61	0.00	0.21	0.04	0.052	0.048
45213	P-Ethyltoluene	61	0.00	0.10	0.01	0.016	0.018
45220	Styrene	61	0.00	0.12	0.03	0.031	0.024
45801	Chlorobenzene	61	0.00	0.03	0.01	0.007	0.006
45807	1,4-Dichlorobenzene	61	0.00	0.04	0.00	0.006	0.008
45809	Benzyl Chloride	61	0.00	0.03	0.00	0.004	0.006
46401	Furan, Tetrahydro-	61	0.00	0.06	0.02	0.016	0.013

**Detectable VOC in 24-Hour Canister Samples**  
**GC/MSD - Lee District Park (UTAM Site), Fairfax County, VA**  
**January 1 to December 31, 2013 - Concentrations are in ppbV**  
(non detects are counted as zeros for statistical purposes)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
42153	Carbon Disulfide	59	0.00	0.61	0.02	0.042	0.082
43207	Freon 113	59	0.06	0.08	0.07	0.070	0.004
43208	Freon 114	59	0.00	0.03	0.02	0.019	0.004
43218	1,3-Butadiene	59	0.00	0.13	0.02	0.031	0.027
43231	N-Hexane	59	0.00	3.40	0.04	0.099	0.438
43232	N-Heptane	59	0.00	0.38	0.02	0.032	0.049
43248	Cyclohexane	59	0.00	0.09	0.01	0.021	0.020
43372	Methyl Tert-Butyl Ether	59	0.00	0.00	0.00	0.000	0.000
43505	Acrolein	59	0.00	0.69	0.14	0.167	0.125
43551	Acetone	59	1.14	10.89	2.93	3.402	1.758
43702	Acetonitrile	59	0.04	3.92	0.25	0.322	0.486
43704	Acrylonitrile	59	0.00	0.03	0.01	0.012	0.009
43801	Chloromethane	59	0.48	0.78	0.61	0.611	0.059
43802	Dichloromethane	59	0.00	0.19	0.11	0.094	0.052
43803	Chloroform	59	0.00	0.04	0.02	0.018	0.008
43804	Carbon Tetrachloride	59	0.01	0.11	0.08	0.072	0.022
43811	Trichlorofluoromethane	59	0.06	0.27	0.24	0.228	0.034
43814	Methyl Chloroform	59	0.00	0.03	0.01	0.012	0.006
43815	Ethylene Dichloride	59	0.00	0.12	0.00	0.007	0.017
43817	Tetrachloroethylene	59	0.00	0.11	0.02	0.024	0.021
43818	1,1,2,2-Tetrachloroethane	59	0.00	0.00	0.00	0.000	0.000
43819	Bromomethane	59	0.00	0.05	0.01	0.011	0.009
43820	1,1,2-Trichloroethane	59	0.00	0.00	0.00	0.000	0.000
43823	Dichlorodifluoromethane	59	0.35	0.79	0.47	0.485	0.075
43824	Trichloroethylene	59	0.00	0.01	0.00	0.005	0.005
43829	1,2-Dichloropropane	59	0.00	0.01	0.00	0.001	0.003
43830	Trans-1,3-Dichloropropylene	59	0.00	0.00	0.00	0.000	0.000
43831	Cis-1,3-Dichloropropylene	59	0.00	0.00	0.00	0.000	0.000
43843	Ethylene Dibromide	59	0.00	0.00	0.00	0.000	0.000
43844	Hexachlorobutadiene	59	0.00	0.01	0.00	0.000	0.002
43860	Vinyl Chloride	59	0.00	0.06	0.00	0.008	0.014
45109	M/P Xylene	59	0.00	0.29	0.03	0.043	0.044
45201	Benzene	59	0.04	0.32	0.13	0.149	0.064
45202	Toluene	59	0.03	0.54	0.11	0.139	0.086
45203	Ethylbenzene	59	0.00	0.08	0.02	0.022	0.014
45204	O-Xylene	59	0.00	0.11	0.01	0.017	0.017
45207	1,3,5-Trimethylbenzene	59	0.00	0.05	0.00	0.006	0.010
45208	1,2,4-Trimethylbenzene	59	0.00	0.27	0.02	0.028	0.045
45213	P-Ethyltoluene	59	0.00	0.05	0.01	0.007	0.010
45220	Styrene	59	0.00	0.11	0.02	0.024	0.018
45801	Chlorobenzene	59	0.00	0.01	0.00	0.001	0.003
45807	1,4-Dichlorobenzene	59	0.00	0.03	0.00	0.003	0.006
45809	Benzyl Chloride	59	0.00	0.01	0.00	0.002	0.004
46401	Furan, Tetrahydro-	59	0.00	0.07	0.01	0.010	0.012

## 24 Hour Carbonyl Sampling 2013 Summary Statistical Analysis

Concentrations are in  $\mu\text{g}/\text{m}^3$   
(non detects are counted as zeros for statistical purposes)

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
<b>Carter G. Woodson Middle School</b>	43502	Formaldehyde	61	1.06	5.88	2.43	2.818	1.184
	43503	Acetaldehyde	61	0.64	2.49	1.22	1.260	0.381
	43504	Propionaldehyde	61	0.00	0.67	0.00	0.048	0.150
	43551	Acetone	61	1.09	8.82	3.49	3.820	1.804
	43552	Methyl Ethyl Ketone	61	0.00	1.46	0.56	0.549	0.246
	43560	Methyl Isobutyl Ketone	61	0.00	0.00	0.00	0.000	0.000

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
<b>Tidewater Regional Office</b>	43502	Formaldehyde	61	0.93	6.46	2.36	2.386	0.903
	43503	Acetaldehyde	61	0.22	3.04	1.32	1.400	0.495
	43504	Propionaldehyde	61	0.00	0.83	0.00	0.149	0.249
	43551	Acetone	61	0.33	10.50	3.22	3.506	1.958
	43552	Methyl Ethyl Ketone	61	0.00	1.46	0.55	0.540	0.300
	43560	Methyl Isobutyl Ketone	61	0.00	0.00	0.00	0.000	0.000

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
<b>Lee Park</b>	43502	Formaldehyde	61	0.75	5.61	1.81	2.285	1.144
	43503	Acetaldehyde	61	0.52	2.30	1.31	1.302	0.402
	43504	Propionaldehyde	61	0.00	0.64	0.00	0.042	0.142
	43551	Acetone	61	1.12	7.36	3.13	3.485	1.432
	43552	Methyl Ethyl Ketone	61	0.00	1.16	0.56	0.552	0.223
	43560	Methyl Isobutyl Ketone	61	0.00	0.00	0.00	0.000	0.000

## NATTS Carbonyl Sampling 2013 Summary Statistical Analysis

Concentrations are in  $\mu\text{g}/\text{m}^3$   
(non detects are counted as zeros for statistical purposes)

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
<b>MathScience Innovation Center</b>	43502	Formaldehyde	61	0.63	6.03	2.26	2.718	1.259
	43503	Acetaldehyde	61	0.67	2.32	1.31	1.304	0.375
	43504	Propionaldehyde	61	0.00	0.58	0.00	0.031	0.120
	43551	Acetone	61	1.39	7.41	3.49	3.806	1.495
	43552	Methyl Ethyl Ketone	61	0.00	1.28	0.59	0.582	0.199
	43560	Methyl Isobutyl Ketone	61	0.00	0.00	0.00	0.000	0.000

## TSP Metals Sampling 2013 Summary Statistical Analysis

Concentrations are in ng/m<sup>3</sup>  
(non detects are counted as zeros for statistical purposes)

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
<b>Carter G. Woodson Middle School</b>	12103	Arsenic	58	0.25	1.86	0.66	0.749	0.383
	12105	Beryllium	58	0.00	0.04	0.00	0.003	0.007
	12110	Cadmium	58	0.00	0.31	0.07	0.085	0.056
	12112	Chromium	58	1.30	3.97	2.10	2.137	0.442
	12128	Lead	58	0.54	13.21	2.06	2.329	1.754
	12132	Manganese	58	1.02	25.82	6.11	7.299	5.043
	12136	Nickel	58	0.43	2.68	0.75	0.877	0.474

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
<b>Tidewater Regional Office</b>	12103	Arsenic	60	0.21	5.79	0.96	1.400	1.191
	12105	Beryllium	60	0.00	0.05	0.00	0.005	0.009
	12110	Cadmium	60	0.00	0.21	0.08	0.083	0.047
	12112	Chromium	60	1.50	3.15	2.28	2.355	0.407
	12128	Lead	60	0.58	6.53	1.93	2.303	1.375
	12132	Manganese	60	0.87	25.01	4.71	6.440	4.804
	12136	Nickel	60	0.52	4.51	1.07	1.262	0.723

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
<b>Lee Park</b>	12103	Arsenic	61	0.14	2.05	0.70	0.755	0.400
	12105	Beryllium	61	0.00	0.04	0.00	0.002	0.006
	12110	Cadmium	61	0.01	0.31	0.08	0.082	0.052
	12112	Chromium	61	1.46	3.66	2.07	2.129	0.388
	12128	Lead	61	0.55	3.95	1.92	2.012	0.856
	12132	Manganese	61	1.15	21.42	4.79	5.769	3.835
	12136	Nickel	61	0.43	2.74	0.79	0.885	0.447

## NATTS PM10 Metals Sampling 2013 Summary Statistical Analysis

Concentrations are in ng/m<sup>3</sup>  
(non detects and negative values are counted as zeros for statistical purposes)

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
<b>MathScience Innovation Center</b>	82103	Arsenic	60	0.17	2.50	0.64	0.739	0.423
	82105	Beryllium	60	0.00	0.04	0.00	0.003	0.009
	82110	Cadmium	60	0.02	0.40	0.12	0.140	0.083
	82112	Chromium	60	1.57	3.22	2.22	2.245	0.362
	82128	Lead	60	0.11	4.17	1.60	1.823	1.011
	82132	Manganese	60	0.30	5.76	2.21	2.329	1.214
	82136	Nickel	60	0.37	1.18	0.65	0.694	0.196

# 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?**

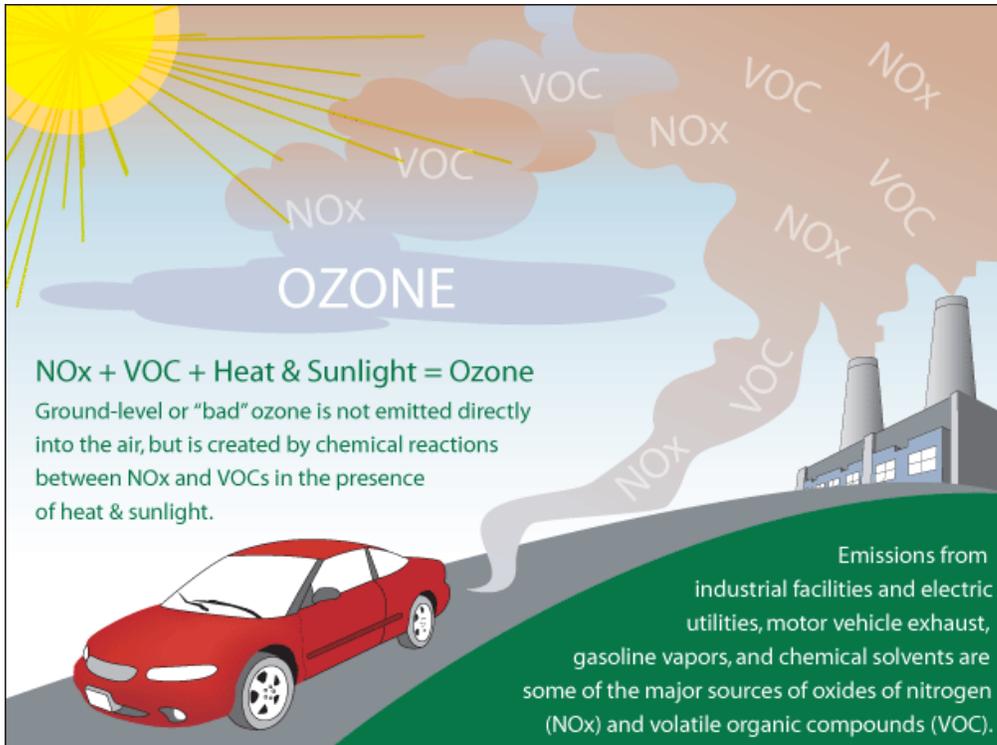
DEQ reports the air quality index for Roanoke, Winchester, Richmond, Hampton Roads, and Northern Virginia on the internet at

[http://vadeq.ipsmtx.com/cgi-bin/air\\_quality\\_forecast.pl](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](http://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](http://www.airnow.gov).

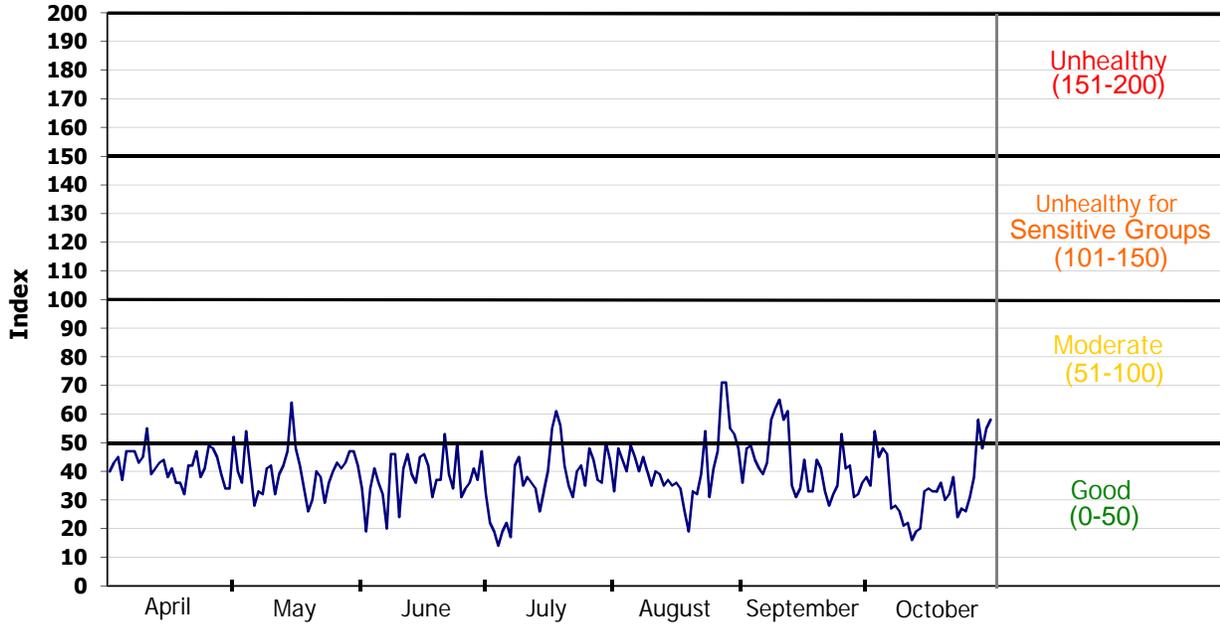
<b>Air Quality Index Levels of Health Concern</b>	<b>Numerical Value</b>	<b>Meaning</b>
Good	0-50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51-100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very 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.



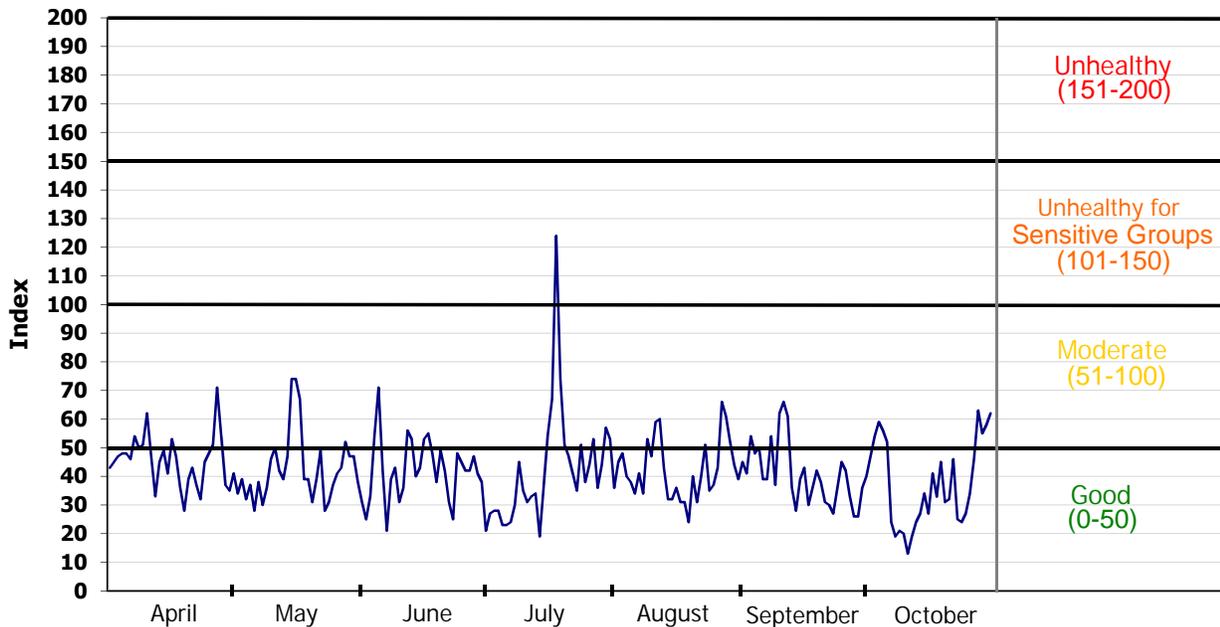
Every day tips:	Ozone Action Day tips:
<ul style="list-style-type: none"> <li>✚ Conserve energy—at home, at work, everywhere.</li> <li>✚ Defer use of gasoline-powered lawn and garden equipment. Follow gasoline refueling instructions for efficient vapor recovery. Be careful not to spill fuel and always tighten your gas cap securely.</li> <li>✚ Keep car, boat, and other engines tuned up according to manufacturers' specification.</li> <li>✚ Be sure your tires are properly inflated.</li> <li>✚ Carpool, use public transportation, bike, or walk whenever possible.</li> <li>✚ Use environmentally safe paints and cleaning products whenever possible.</li> <li>✚ 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.</li> </ul>	<ul style="list-style-type: none"> <li>✚ Conserve electricity and set your air conditioner at a higher temperature.</li> <li>✚ Choose a cleaner commute—share a ride to work or use public transportation. Bicycle or walk to errands when possible.</li> <li>✚ Defer use of gasoline-powered lawn and garden equipment.</li> <li>✚ Refuel cars and trucks after dusk.</li> <li>✚ Combine errands and reduce trips.</li> <li>✚ Limit engine idling.</li> <li>✚ 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.</li> </ul>

For more information, please visit these sites:  
<http://www.epa.gov/otaq/actions.htm>  
[www.airnow.gov/index.cfm?action=resources.whatyoucando](http://www.airnow.gov/index.cfm?action=resources.whatyoucando)

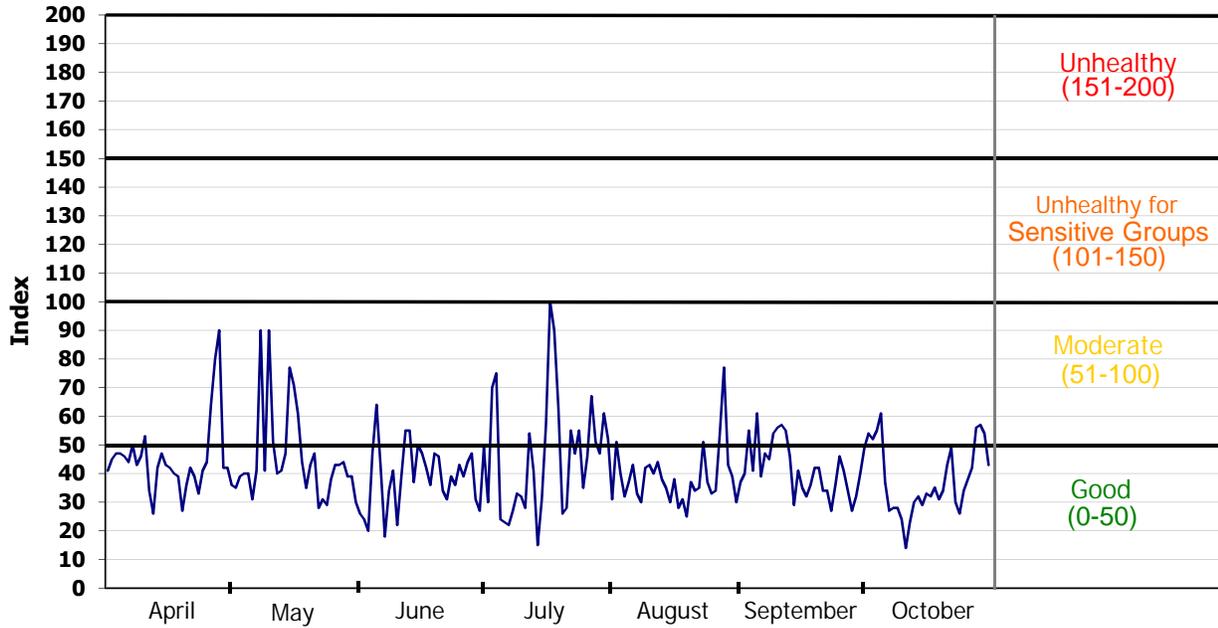
### Ozone Air Quality Index Roanoke Area 2013



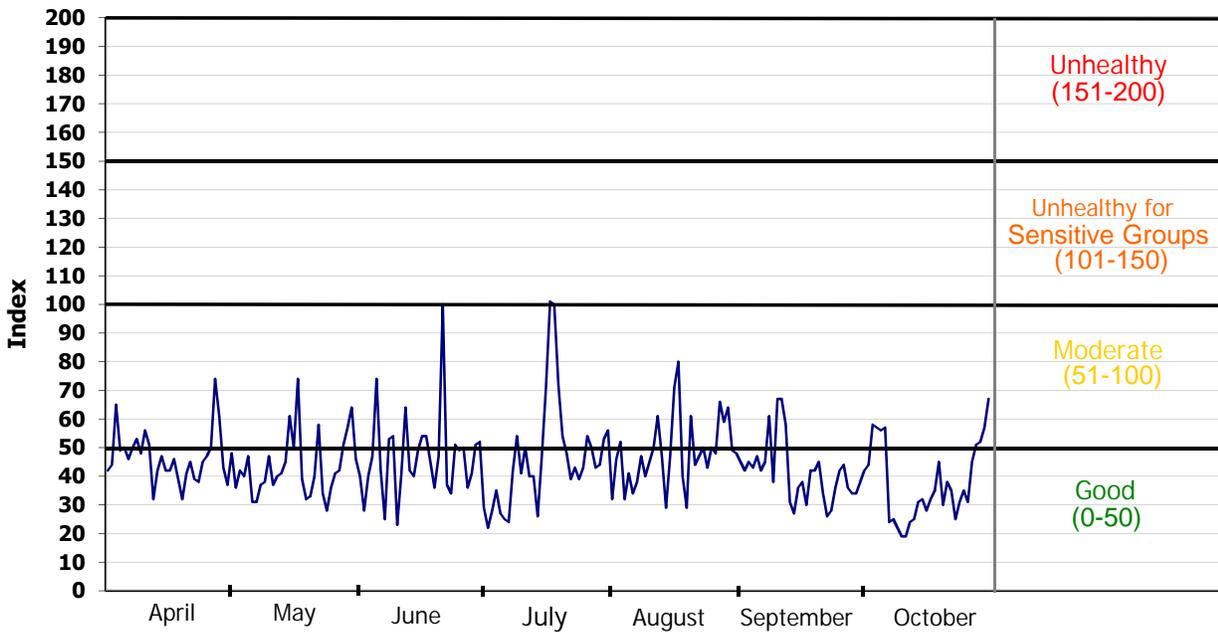
### Ozone Air Quality Index Richmond - Petersburg Areas 2013



### Ozone Air Quality Index Norfolk - Virginia Beach - Newport News Areas 2013



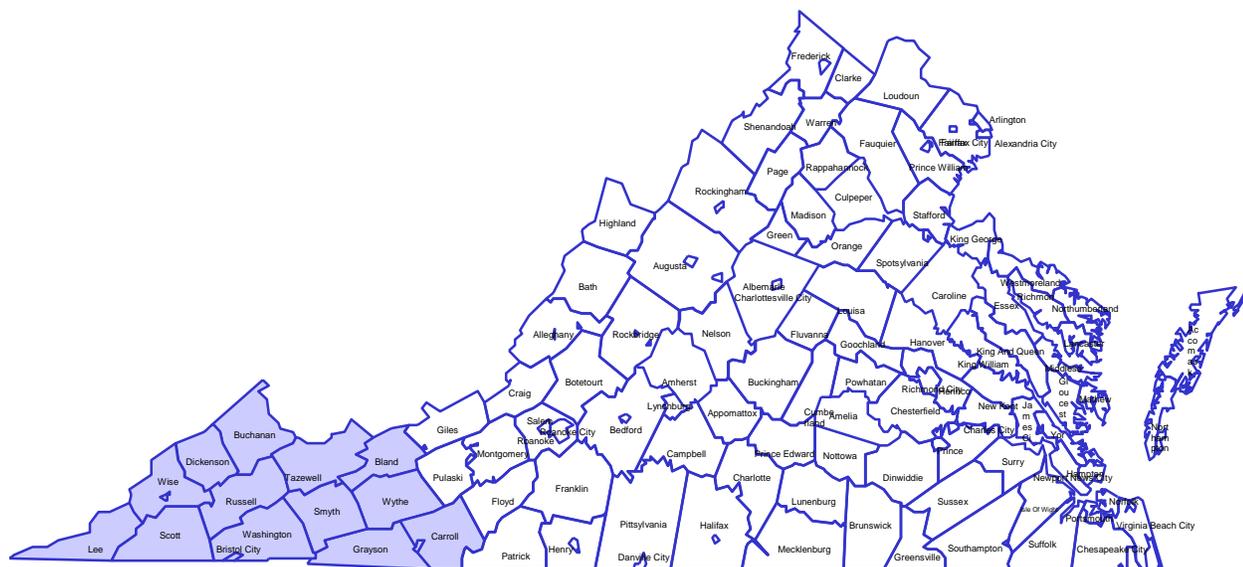
### Ozone Air Quality Index Washington, DC Area 2013



# Appendix A

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 <sub>2</sub>	Nitrogen Dioxide
NUM	Number of Samples
O <sub>3</sub>	Ozone
PAMHC	Total PAMS Hydrocarbon
PAMS	Photochemical Assessment Monitoring Station
PM <sub>10</sub>	Particulate Matter with an aerodynamic diameter less than or equal to 10 microns
PM <sub>2.5</sub>	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 <sub>2</sub>	Sulfur Dioxide
STD	Standard
STDEV	Standard Deviation
TEOM	Tapered Element Oscillating Microbalance (a method for continuously measuring PM <sub>2.5</sub> in ambient air)
TNMOC	Total Nonmethane Organic Compound
UATM	Urban Air Toxics Monitoring Program
ug/m <sup>3</sup>	Micrograms per cubic meter
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VOC	Volatile Organic Compounds

# Abbreviation Table

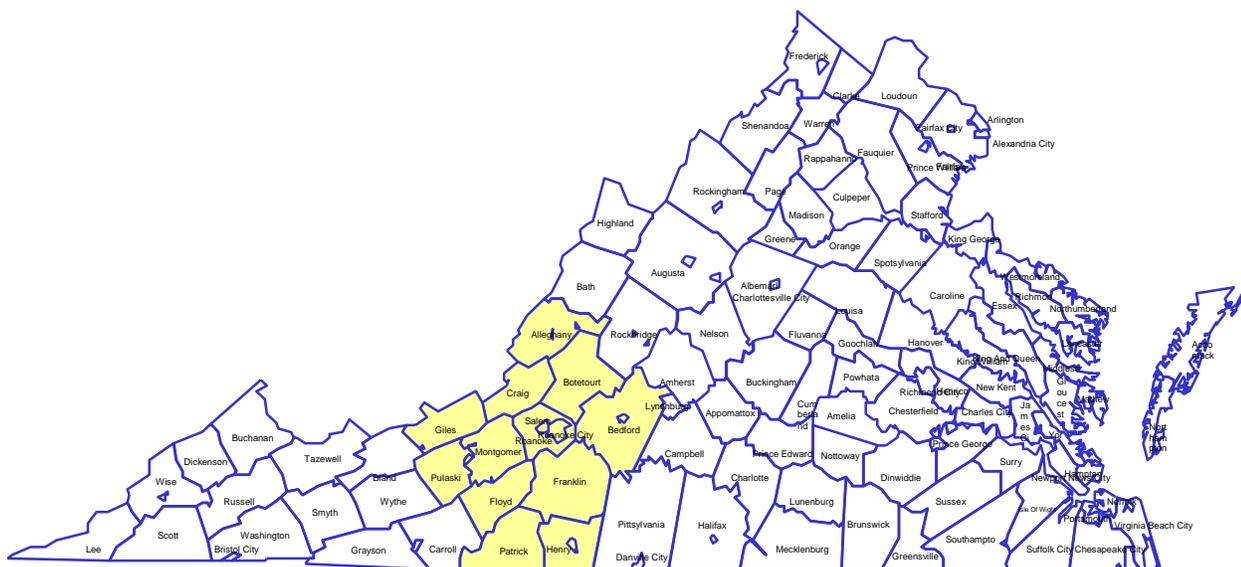


# Southwest Monitoring Network 2013

STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
4-G	Lead	VP-1 Upper Stock Pile Area	51-027-0006	Buchanan Co.	37.24778 -82.01806
16-B	O <sub>3</sub>	Sewage Disposal Plant	51-197-0002	Rural Retreat Wythe Co.	36.89117 -81.25423
23-A	PM <sub>10</sub>	Gladeville Elementary School	51-035-0001	Galax Carroll Co.	36.70067 -80.87978
101-E	PM <sub>2.5</sub>	Highland View Elementary School	51-520-0006	Bristol	36.60800 -82.16410

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

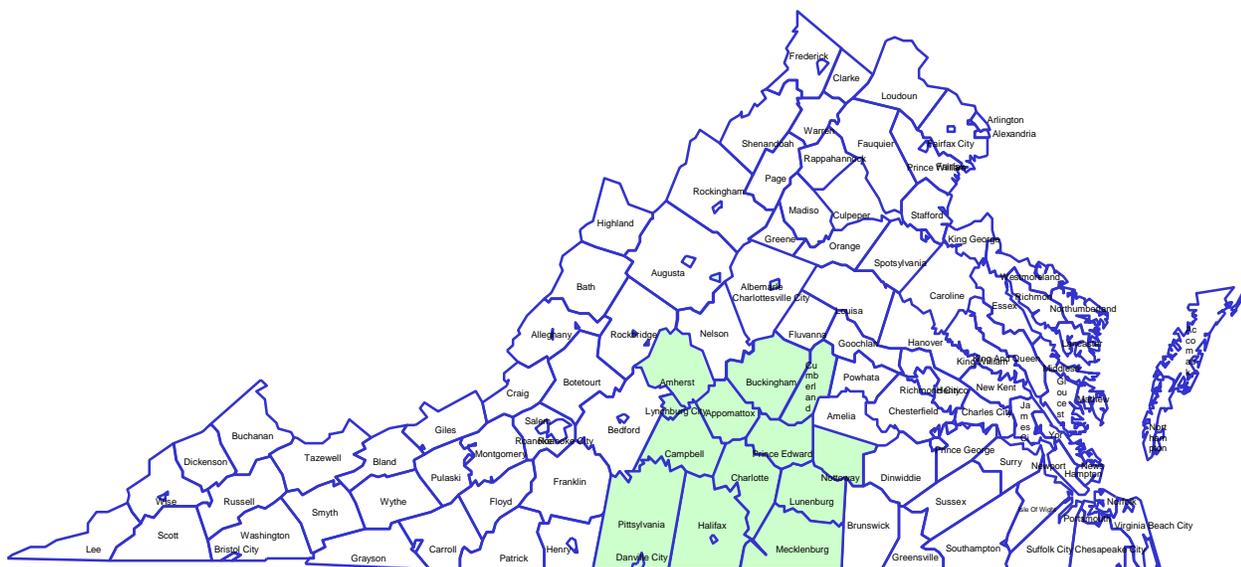




# Blue Ridge Monitoring Network 2013

STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
19-A6	CO, SO <sub>2</sub> , NO <sub>2</sub> , O <sub>3</sub> , PM <sub>2.5</sub>	East Vinton Elementary School Ruddell Road	51-161-1004	Vinton Roanoke Co.	37.28342 -79.88452
109-H	PM <sub>10</sub> , Lead	101 Cherry Hill Circle	51-770-0011	Roanoke	37.27399 -79.99945
110-C	PM <sub>2.5</sub>	Salem High School	51-775-0011	Salem	37.29788 -80.08102

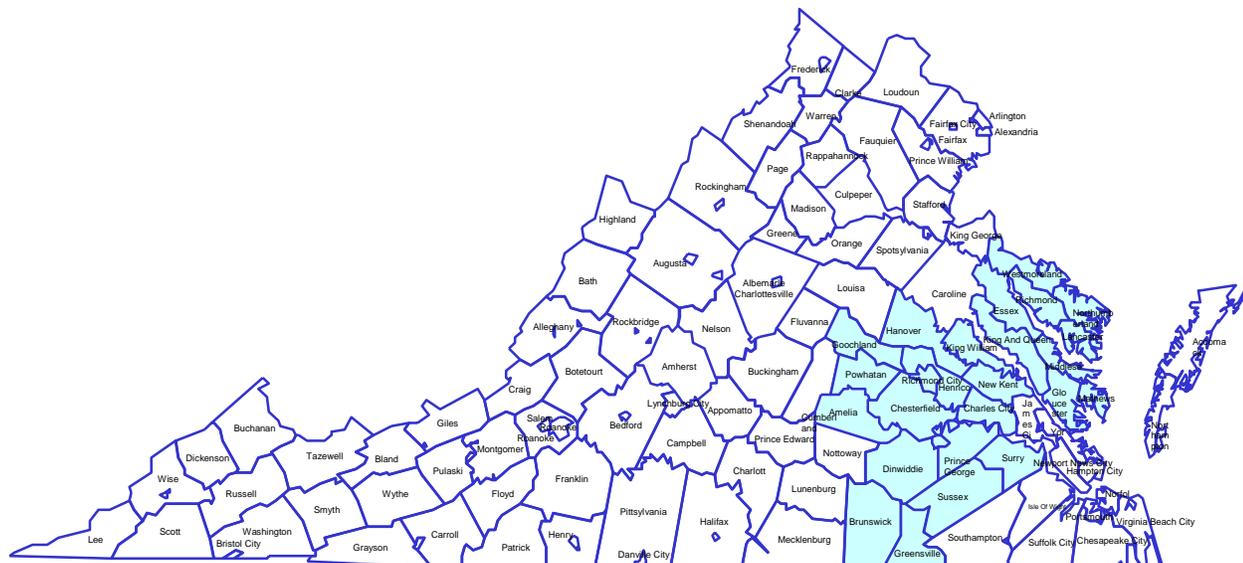
Contact information for this Region:  
 Blue Ridge Regional Office  
 Robert Weld, Director  
 3019 Peters Creek Road  
 Roanoke, VA 24019  
 (540) 562-6700



# Blue Ridge Monitoring Network 2013

STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
155-Q	PM <sub>2.5</sub>	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

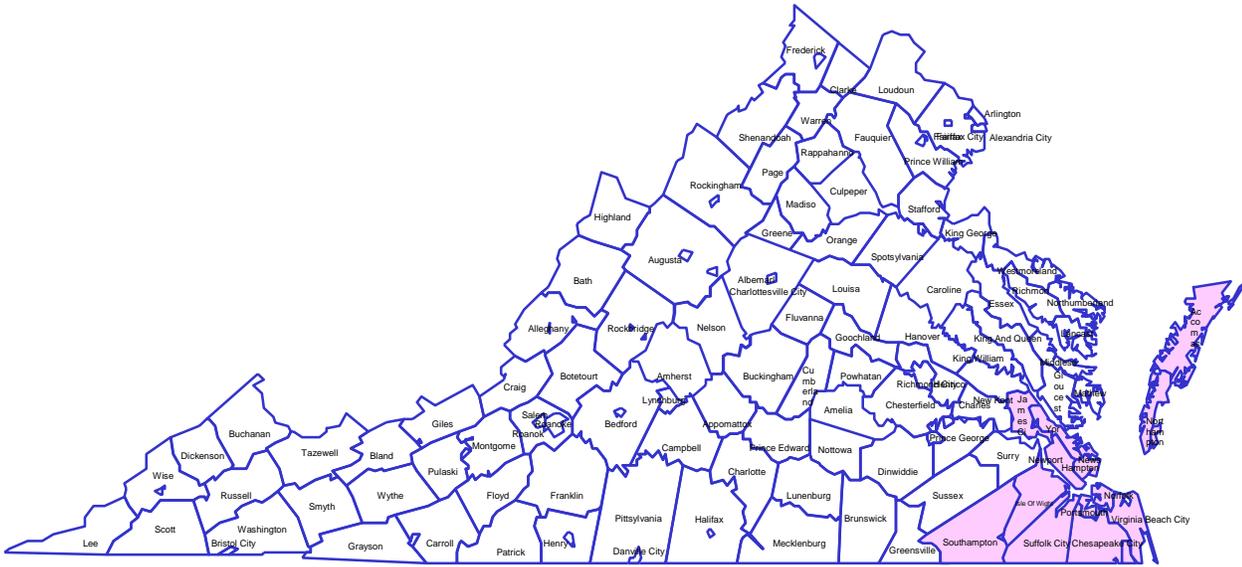


# Piedmont Monitoring Network 2013

STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
71-D	PM <sub>2.5</sub>	Bensley Armory	51-041-0003	Chesterfield Co.	37.43467 -77.45118
71-H	O <sub>3</sub>	Beach Road Highway Shop	51-041-0004	Chesterfield Co.	37.35748 -77.59355
72-M	O <sub>3</sub> , VOC, PM <sub>2.5</sub> , 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 <sub>2.5</sub>	DEQ-Piedmont Regional Office 4949-A Cox Road	51-087-0015	Henrico Co.	37.67132 -77.56640
73-E	O <sub>3</sub>	McClellan Road	51-085-0003	Hanover Co.	37.60613 -77.21880
75-B	O <sub>3</sub> , NO <sub>2</sub> , SO <sub>2</sub> , PM <sub>2.5</sub>	Charles City County Route 608	51-036-0002	Charles City Co.	37.34438 -77.25925
82-C	PM <sub>10</sub>	West Point Elementary School Thompson Ave. & Chelsea Rd.	51-101-0003	West Point King William Co.	37.55793 -76.79540
154-M	PM <sub>10</sub> , Toxics	Carter G. Woodson Middle School 1000 Winston Churchill Dr.	51-670-0010	Hopewell	37.28962 -77.29182
158-X	CO, NO <sub>2</sub>	Joseph Bryan Park	51-760-0025	Richmond	37.0 -77.00

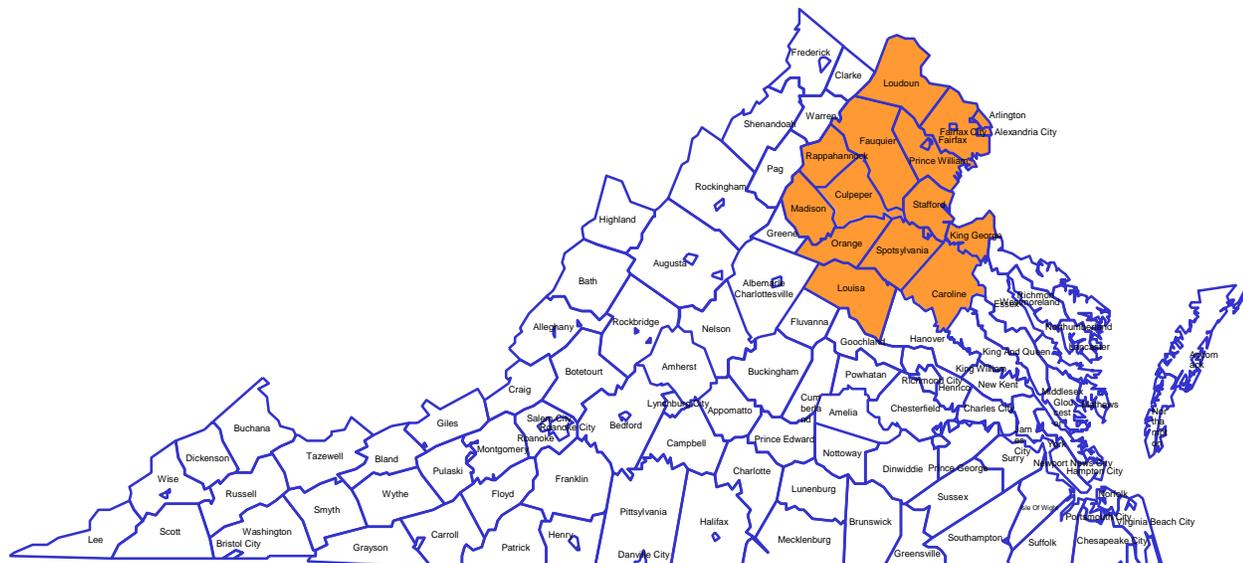
Contact Information for this Region:  
 Piedmont Regional Office  
 Michael Murphy, Director  
 4949-A Cox Road  
 Glen Allen, VA 23060  
 (804) 527-5020

# Tidewater Monitoring Network 2013



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
179-K	CO, SO <sub>2</sub> , NO <sub>2</sub> , O <sub>3</sub> , PM <sub>2.5</sub> , PM <sub>10</sub> , TEOM	NASA Langley Research Center	51-650-0008	Hampton	37.10373 -76.38702
181-A1	CO, SO <sub>2</sub> , NO <sub>2</sub> , PM <sub>10</sub> , PM <sub>2.5</sub>	NOAA Property 2 <sup>nd</sup> and Woodis Avenue	51-710-0024	Norfolk	36.85555 -76.30135
183-E	O <sub>3</sub>	Tidewater Community College Frederick Campus	51-800-0004	Suffolk	36.90118 -76.43808
183-F	O <sub>3</sub>	Tidewater Research Station	51-800-0005	Suffolk	36.66525 -76.73078
184-J	PM <sub>2.5</sub> , 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 2013

STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
37-B	O <sub>3</sub>	Phelps Wildlife Area Route 651	51-061-0002	Sumerduck Fauquier Co.	38.47367 -77.76772
38-I	O <sub>3</sub> , NO <sub>2</sub> , PM <sub>2.5</sub>	Broad Run High School Route 641	51-107-1005	Ashburn Loudoun Co.	39.02473 -77.48925
44-A	O <sub>3</sub>	Widewater Elementary School Den Rich Road	51-179-0001	Widewater Stafford Co.	38.48123 -77.37040
45-L	O <sub>3</sub> , NO <sub>2</sub>	Long Park Route 15	51-153-0009	Prince William Co.	38.85287 -77.63462
46-B9	O <sub>3</sub> , CO, PM <sub>2.5</sub> , Toxics	Lee District Park Telegraph Road	51-059-0030	Franconia Fairfax Co.	38.77335 -77.10468
47-T	CO, NO <sub>2</sub> , O <sub>3</sub> , PM <sub>2.5</sub>	Aurora Hills Visitors Center 18 <sup>th</sup> and Hayes Streets	51-013-0020	Arlington Co.	38.85770 -77.05922
48-A	O <sub>3</sub>	U.S.G.S. Geomagnetic Center	51-033-0001	Corbin Caroline Co.	38.20087 -77.37742
130-E	PM <sub>10</sub>	Hugh Mercer Elementary School 2100 Cowan Boulevard	51-630-0004	Fredericksburg	38.30225 -77.48712
L-126-I	CO, SO <sub>2</sub> , O <sub>3</sub> , NO <sub>2</sub>	Alexandria T&ES 3200 Colvin Street	51-510-0021	Alexandria	38.80650 -77.08640
L-126-H	PM <sub>10</sub>	435 Ferdinand Day Drive	51-510-0020	Alexandria	38.80493 -77.12687
N-35-A	O <sub>3</sub> , TEOM, IMPROVE,	Big Meadows, National Park Service	51-113-0003	Madison Co.	38.52280 -78.43487

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

# Data Capture Criteria

<b>Minimum Number of Observations</b>	
3-Hour Average	3 Consecutive Hourly Observations
8-Hour	6 Hourly Observations
24-Hour	18 Hourly Observations
Quarterly Averages & 3-month Averages	75% of Scheduled Samples
Yearly Averages	75% of Total Possible Observations
Annual Weighted Means	Four Complete Quarterly Averages

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
<b>Carbon Monoxide</b>		Primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
<b>Lead</b>		Primary and Secondary	Rolling 3 month average	0.15 µg/m <sup>3</sup> (a)	Not to be exceeded
<b>Nitrogen Dioxide</b>		Primary	1-hour	100 ppb	98 <sup>th</sup> percentile, averaged over 3 years
		Primary and Secondary	Annual	53 ppb (b)	Annual Mean
<b>Ozone</b>		Primary and Secondary	8-hour	0.075 ppm (c)	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
<b>Particle Pollution</b>	<b>PM<sub>2.5</sub></b>	Primary	Annual	12 µg/m <sup>3</sup>	Annual Mean, averaged over 3 years
		Secondary	Annual	15 µg/m <sup>3</sup>	Annual Mean, averaged over 3 years
		Primary and Secondary	24-hour	35 µg/m <sup>3</sup>	Annual Mean, averaged over 3 years
	<b>PM<sub>10</sub></b>	Primary and Secondary	24-hour	150 µg/m <sup>3</sup>	Not to be exceeded more than once per year on average over 3 years
<b>Sulfur Dioxide</b>		Primary	1-hour	75 ppb (d)	99 <sup>th</sup> percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

(a) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m<sup>3</sup> as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

(b) The official level of the annual NO<sub>2</sub> standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(c) Final rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard ("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.

(d) Final rule signed June 2, 2010. The 1971 annual and 24-hour SO<sub>2</sub> standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

Please see [www.epa.gov/air/criteria.html](http://www.epa.gov/air/criteria.html) for additional information concerning NAAQS.

**NCore/SLAMS 2013**

<b>REGION</b>	<b>PM<sub>2.5</sub></b>	<b>PM<sub>10</sub></b>	<b>Pb</b>	<b>CO</b>	<b>SO<sub>2</sub></b>	<b>NO<sub>2</sub></b>	<b>O<sub>3</sub></b>	<b>TOTAL</b>
<b>Southwest</b>	1	1	1	---	---	---	1	4
<b>Valley</b>	5	1	---	---	1	1	5	13
<b>Blue Ridge</b>	3	---	2	1	1	1	1	9
<b>Piedmont</b>	4	3	1	1	2	3	4	18
<b>Tidewater</b>	3	2	---	2	2	2	3	14
<b>*Northern</b>	4	2	---	2	1	4	8	21
<b>TOTAL</b>	<b>20</b>	<b>9</b>	<b>4</b>	<b>6</b>	<b>7</b>	<b>11</b>	<b>22</b>	<b>79</b>

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

**Number of Criteria Pollutant Monitoring Sites**

**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<sub>2.5</sub> 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)

**Ozone & PM<sub>2.5</sub> Nonattainment Area Designations**

# 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/homepage>

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

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

VISTAS:  
<http://www.metro4-sesarm.org/index.asp>

2013 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 (AMTIC)  
<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