Virginia Ambient Air Monitoring 2018 Data Report

Department of Environmental Quality

Commonwealth of Virginia
Department of Environmental Quality

Office of Air Quality Monitoring

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This Ambient Air Monitoring Data Report is for the time period of January 1, 2018 to December 31, 2018.

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Acknowledgements:

We would like to thank Chuck Turner, Carolyn Stevens, Peter Effertz, Dan Salkovitz, Baxter Gilley and Namita Verma.

Published, October 2019

2018 Annual Report prepared by:
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TABLE OF CONTENTS

INTRODUCTION

The 2018 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 38 locations within the Commonwealth during 2018. Included in this total are three sulfur dioxide monitoring sites that are maintained by three industrial sources that were identified in the recent EPA SO_2 Data Requirements Rule. All 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, sulfur dioxide and particulate matter, and lead were within the EPA's national ambient air quality standards (NAAQS) in 2018. For ozone, there were two days in the Richmond area and four days in Northern Virginia where the standard of 0.070 ppm was exceeded. There was also an exceedance recorded at the ozone site in Stafford County in 2018. For the 3-year period from 2016 through 2018, all ozone sites demonstrated compliance with the 0.070 ppm National Ambient Air Quality Standard (NAAQS) for ozone. There were no exceedances of the 35 micrograms per cubic meter ($\mu g/m^3$) 24-hour standard for $PM_{2.5}$ (particulate matter less than 2.5 microns) and the 2016 – 2018 design values for all $PM_{2.5}$ sites in the Commonwealth for both the 24-hour and annual standard were below the NAAQ standard.

Some significant changes that impacted the air quality monitoring network in 2018 are:

- Due to turnover at the USDA Forest Service, there were no on-site personnel to monitor the Natural Bridge (51-163-0003, JARI1) ozone site at the end of 2018. This situation has lasted into the 2019 ozone season so DEQ is now performing all QA and routine maintenance at this site.

- The Urban Air Toxics suite of pollutants that was monitored at the site located at the DEQ Tidewater Regional Office (51-810-0008) was limited to only metals analysis following the end of calendar year 2018. The volatile organic compounds and carbonyl pollutants samplers were removed from this site due to financial constraints on the Office of Air Quality Monitoring analytical budget. These samplers were installed in 2005 and were originally placed at this location to meet the Clean Air Act requirements for the monitoring of air toxic pollutants in urban environments.

- The Office of Air Quality monitoring has received all equipment needed to complete the installation of the PAMS (Photochemical Assessment Monitoring Station) site at the MathScience Innovation Center (51-087-0014). AQM will collect the hourly VOC measurements using an Automated Gas Chromatograph. As of December 31, 2018, the Auto GC is installed but not yet running.

OFFICE OF AIR QUALITY MONITORING

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 SESARM (Southeastern States Air Resource Managers, Inc.) 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.

FREQUENTLY ASKED QUESTIONS

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: Clean Air Act.

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 NAAQS table or page 72 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*, EPA's Quality Assurance Handbook

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 dependent 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*, EPA's Quality Assurance Handbook

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 ozone.

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 74. EPA has a list of all nonattainment areas in the country at Green Book National Area and County-Level Multi-Pollutant Information.

FREQUENTLY ASKED QUESTIONS

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 AQI and air quality forecasts can be obtained from EPA's AirNow website. Summary air quality data for PM2.5 can also be found at Air Monitoring Particulate summary. Prior annual monitoring data reports can be found at Air Monitoring Publications. EPA also provides monitoring and emissions data, as well as maps, on the web at their AirData and Air Emissions Inventories webpages. 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.

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

Contact the DEQ regional office in your area by phone, or make a report online. For a list of regional offices and phone numbers, see page 63 of this report, or visit DEQ's locations.

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 Virginia Department of Health Local Districts for the health department office in your area or the Division of Environmental Epidemiology at (804) 864-8182. The DEQ has an Indoor Air Quality webpage with links to websites that provide information regarding specific indoor air quality problems. Other excellent sources of information on indoor air quality can be found on EPA's Indoor Air Quality website and through the American Lung Association website at LungUSA.

CRITERIA POLLUTANTS

PM2.5 Monitoring Network

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

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

$PM_{2.5}$ air quality standards were implemented by EPA in 1997 to protect against the health effects of fine particle pollution. 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 PM2.5 standard to 12.0 $\mu g/m^3$ and retaining the 24-hour fine particle standard of 35 $\mu g/m^3$. For more information, see EPA's Revisions to the AQ Standards for Particulate Matter.

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

$PM_{2.5}$ 24-hour Mass Sampler: This Federal Reference Method (FRM) sampler collects particulate matter on a stretched Teflon filter media. The samplers collect 24-hour samples on a one-in-three day schedule, except for one in Fairfax County, which collects samples every day. The 3-day monitoring schedule can be found at PM2.5 Monitoring Calendar. The 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.

PM2.5 Monitoring Network

PM$_{2.5}$ 24-hour Speciation: Speciated PM$_{2.5}$ data are collected at one site in Virginia, the MathScience Innovation Center in Henrico Co., using two co-located samplers that operate simultaneously. One sampler, the MetOne SASS, collects particulate matter on two filters, one nylon and the other Teflon. The second sampler, the URG 3000N carbon sampler, uses a quartz filter to collect particulate matter. The samplers run for 24 hours, on a one-in-three day sampling schedule. After the completion of a sample run, the instrument operator removes the exposed filters and ships them via refrigerated container to an EPA contract lab, where the filters are analyzed for the following:

- Teflon filter: 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 chloride)
- Quartz filter: carbons (elemental carbon, organic carbon, total carbon)

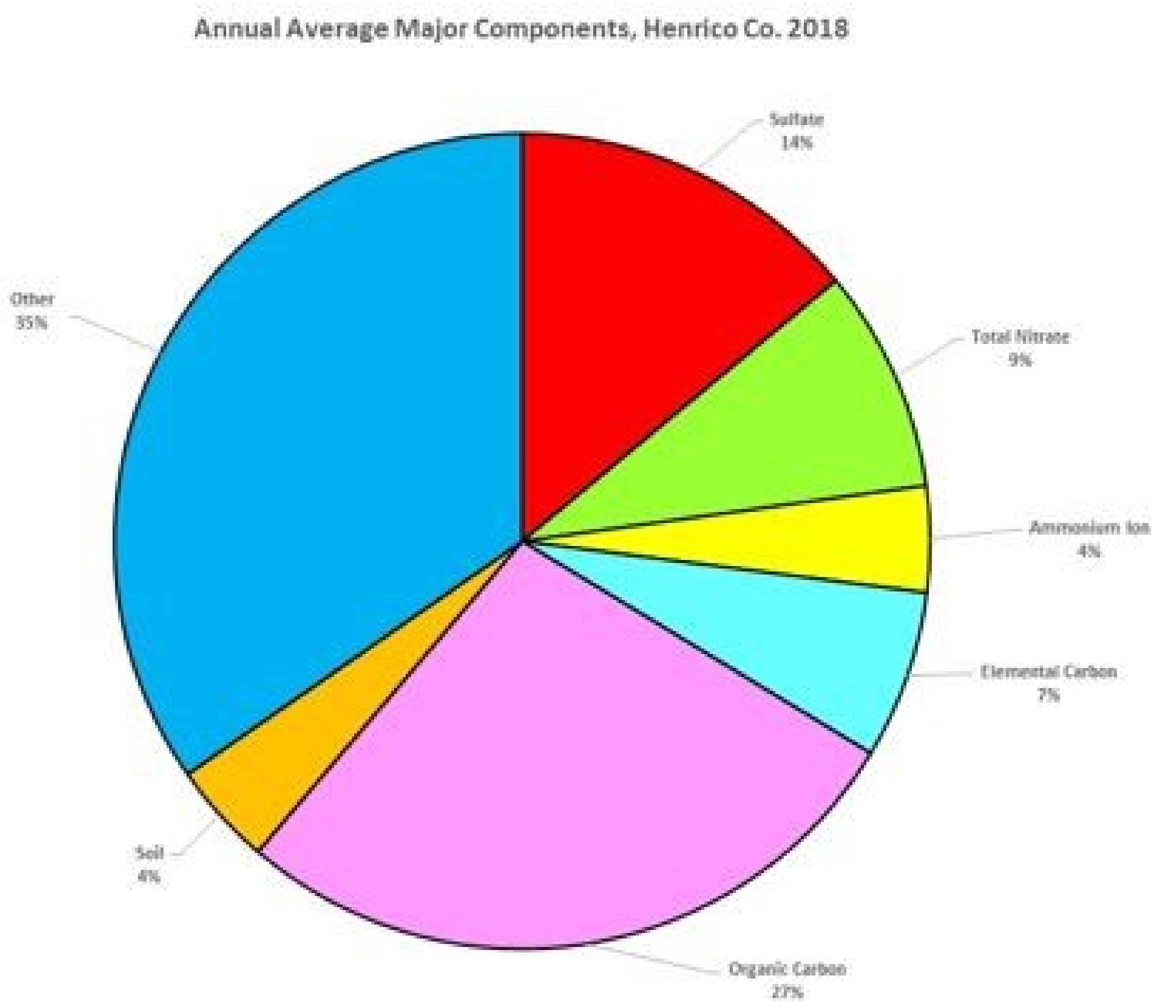
The resulting data provide a "chemical fingerprint" of air masses moving through the Richmond area. These data, in conjunction with historical data from other speciation sites, including those outside Virginia, give a representative picture of the constituents of the air samples, which help identify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

PM$_{2.5}$ Continuous: Unlike the PM$_{2.5}$ 24-hour sampler, these instruments collect particulate samples on a continuous basis, and data can be compiled into hourly and 24-hour averages. PM$_{2.5}$ continuous samplers are operated in Henrico Co., Roanoke Co., Fairfax Co., Shenandoah National Park, Frederick Co., Albemarle Co., and the Cities of Richmond and Hampton. Some of these continuous monitors are designated as Federal Equivalent Method (FEM) monitors, meaning that they may be used to determine NAAQS compliance as well as to report the AQI, whereas the TEOM continuous monitors are used strictly for AQI and forecasting purposes only.

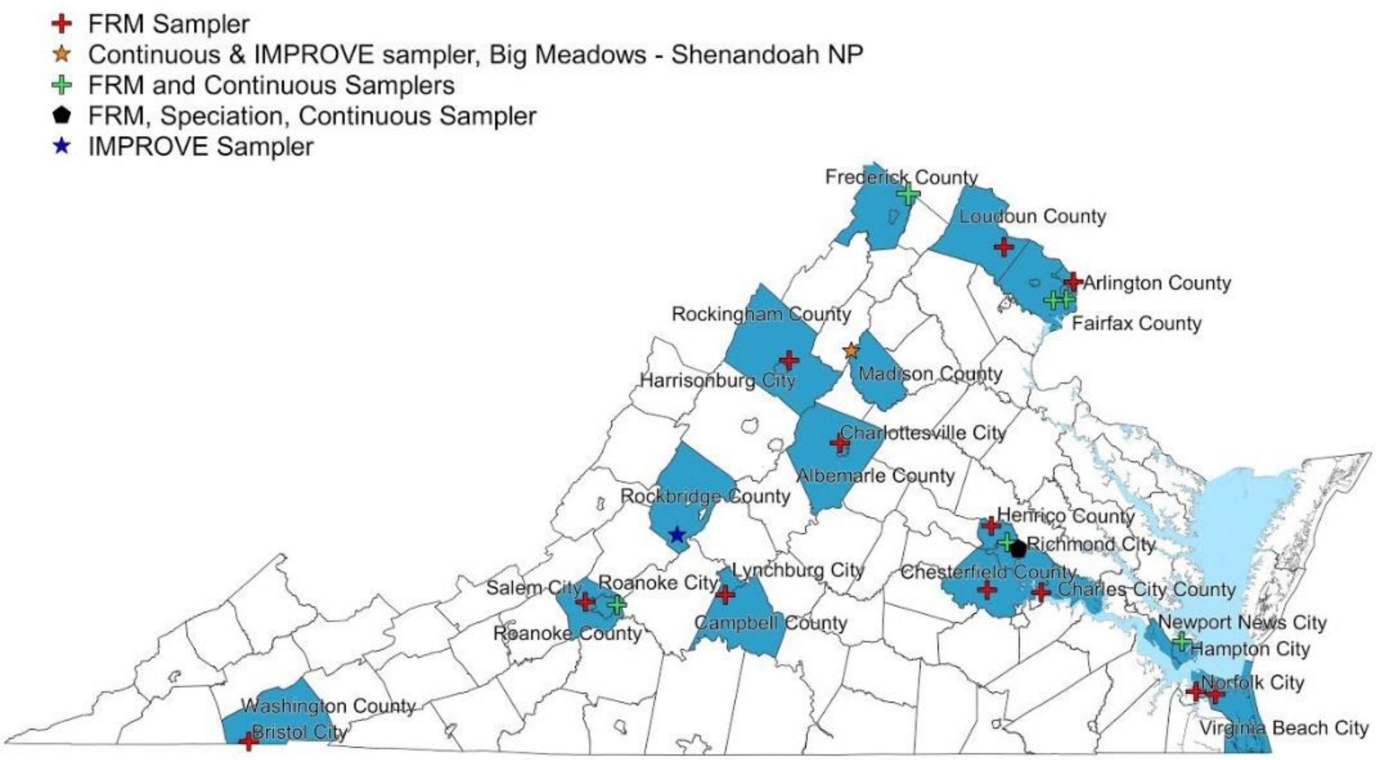
The purpose of each of the PM$_{2.5}$ samplers is determined by the type and designation of the sampler. The FRM and the FEM samplers collect data that are used to determine if the state is complying with the national ambient air quality standards (NAAQS) for particulate matter. The speciation sampler 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. Some of the continuous particulate monitors provide real-time data on fine particulate levels. The hourly average data are polled by a central computer, and then posted on the DEQ Air Monitoring webpage. The data are also simultaneously sent to EPA's national air quality website at Airnow.

PM2.5 Monitoring Network

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



PM2.5 Monitoring Network



PM2.5 Monitoring Network

National Ambient Air Quality Standards (NAAQS)

Primary Standard for $PM_{2.5}$:

- Annual Arithmetic Mean – the 3 year average of the weighted annual mean $PM_{2.5}$ concentration must not exceed 12.0 $\mu g/m^3$.
- 24-Hour concentration – the 3 year average of the 98^{th} percentile of 24-hour concentrations must not exceed 35 $\mu g/m^3$.

Secondary Standard for $PM_{2.5}$:

- Annual Arithmetic Mean – the 3 year average of the weighted annual mean $PM_{2.5}$ concentration must not exceed 15.0 $\mu g/m^3$.

2016-2018 $PM_{2.5}$ 24-hour Averages, 98^{th} Percentile Values ($\mu g/m^3$, LC)

Site	2016	2017	2018	3-Year Average
(101-E) **Bristol**	24.9**	16.2	14.3	18
(26-F) **Rockingham Co.**	17.6	14.6	18.4	17
(28-J) **Frederick Co.**	17.5	17.1	22.6	19
(33-A) **Albemarle Co.**	14.2	13.6	13.8	14
(19-A6) **Roanoke Co.**	15.0*	14.2	15.6*	15
(110-C) **Salem**	15.0	14.0	15.3	15
(155-Q) **Lynchburg**	12.8	14.6	13.5	14
(71-H) **Chesterfield Co.**	14.2*	14.6	14.1	14
(72-M) **Henrico Co.**	14.8	14.5	16.2	15
(72-N) **Henrico Co.**	15.0	14.7	14.5	15
(75-B) **Charles City Co.**	13.7	13.2	13.7	14
(158-X) **Richmond**	17.6	17.0*	19.4	18
(179-K) **Hampton**	12.5	15.5	13.4	14
(181-A1) **Norfolk**	13.3	12.7	13.8	13
(184-J) **Va. Beach**	14.6	13.5*	14.6*	14
(38-I) **Loudoun Co.**	15.6	14.2	16.6	15
(47-T) **Arlington Co.**	17.9	16.2	15.9	17
(46-B9) **Franconia, Fairfax Co.**	16.9	15.1	16.5	16
(46-C2) **Springfield, Fairfax Co.**	15.4*	19.2*	19.7	18

* Annual value did not meet completeness criteria
** Influenced by fires in Tennessee, Virginia and Western NC

PM2.5 Monitoring Network

NAAQS

Primary Standard for $PM_{2.5}$:

- Annual Arithmetic Mean – the 3 year average of the weighted annual mean $PM_{2.5}$ concentration must not exceed 12.0 $\mu g/m^3$.
- 24-Hour concentration – the 3 year average of the 98th percentile of 24-hour concentrations must not exceed 35 $\mu g/m^3$.

Secondary Standard for $PM_{2.5}$:

- Annual Arithmetic Mean – the 3 year average of the weighted annual mean $PM_{2.5}$ concentration must not exceed 15.0 $\mu g/m^3$.

2016-2018 $PM_{2.5}$ Weighted Annual Arithmetic Means ($\mu g/m^3$, LC)

Site	2016	2017	2018	3-Year Average
(101-E) **Bristol**	8.0	7.2	6.7	7.3
(26-F) **Rockingham Co.**	7.4	6.9	6.8	7.0
(28-J) **Frederick Co.**	7.4	7.5	7.3	7.4
(33-A) **Albemarle Co.**	6.8	6.7	6.0	6.5
(19-A6) **Roanoke Co.**	6.7*	6.6	6.6*	6.7
(110-C) **Salem**	7.6	7.0	7.0	7.2
(155-Q) **Lynchburg**	6.8	6.5	6.4	6.5
(71-H) **Chesterfield Co.**	7.5*	7.1	6.5	7.0
(72-M) **Henrico Co.**	7.0	7.5	6.9	7.1
(72-N) **Henrico Co.**	7.0	7.2	6.7	7.0
(75-B) **Charles City Co.**	6.5	6.9	6.4	6.6
(158-X) **Richmond**	8.5	8.4*	8.2	8.3
(179-K) **Hampton**	6.1	6.6	6.0	6.2
(181-A1) **Norfolk**	6.6	6.9	6.6	6.7
(184-J) **Va. Beach**	6.7	6.8*	6.7*	6.7
(38-I) **Loudoun Co.**	7.1	7.3	7.0	7.1
(47-T) **Arlington Co.**	7.5	7.6	7.4	7.5
(46-B9) **Franconia, Fairfax Co.**	6.7	6.9	6.9	6.8
(46-C2) **Springfield, Fairfax Co.**	8.1*	9.0*	8.9	8.7

* Annual value did not meet completeness criteria.

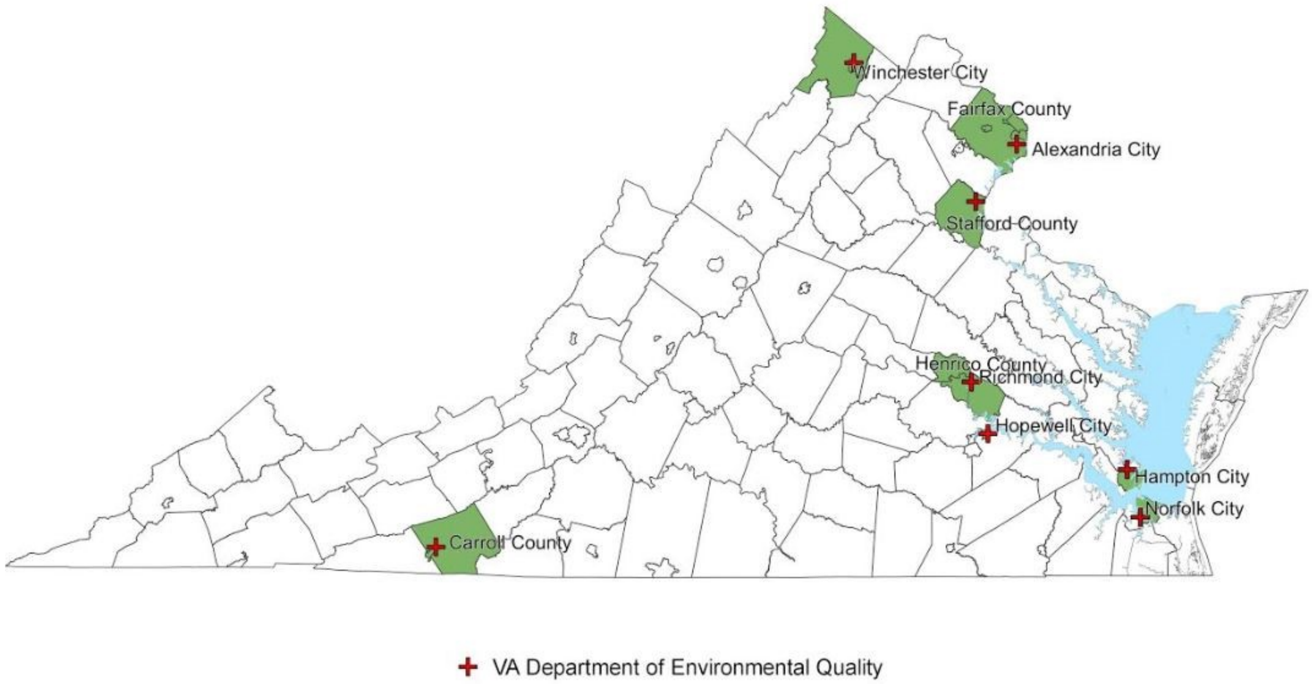
PM10 Monitoring Network

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

The National Ambient Air Quality Standards, or NAAQS, for particulate matter were revised in September 2006. EPA changed the existing standards for PM_{10} by revoking the annual standard of 50 micrograms per cubic meter, because current scientific evidence did not support a link between long-term exposure to coarse particles and health problems. However, the 24-hour PM_{10} standard was retained to protect citizens from effects of short-term exposures. For additional information on the revised particulate matter standards, see PM10 Standards.

To measure $PM_{10,}$ ambient air is drawn into a sampler that uses a particle size discrimination inlet. The inlet is designed so that particles in the size range of 10 micrometers (also called microns) or below stay suspended in the air stream, while larger particles settle out. The particles are captured on a filter, which is weighed before and after sampling, and the PM_{10} concentration is determined by dividing the change in filter mass by the volume of sampled air. The resulting PM_{10} concentration is reported as micrograms per cubic meter ($\mu g/m^3$). The normal sampling schedule is once every sixth day from midnight to midnight. The 6-day monitoring schedule can be found at PM10 Monitoring calendar.

PM10 Monitoring Network



National Ambient Air Quality Standards (NAAQS)

Primary Standard for PM_{10}:

- 24- hour concentration not to exceed 150 μg/m^3 more than once per year averaged over three years. An exceedance means a 24-hour average value that is above the level of the 24-hour standard after rounding to the nearest 10 μg/m^3.

Secondary Standard for PM_{10}:

- Same as Primary.

2016-2018 PM_{10} 24-Hour Average Concentrations (units in μg/m^3 STD)

Site	2016 1st Max	2016 2nd Max	2017 1st Max	2017 2nd Max	2018 1st Max	2018 2nd Max	>150 μg/m^3
(23-A) **Carroll Co.**	32	31	21	19	24	22	0
(134-C) **Winchester**	27	24	20	20	22	20	0
(72-M) **Henrico Co.**	25	24	25	22	19	19	0
(154-M) **Hopewell**	24	23	20	19	20	18	0
(179-K) **Hampton**	25	24	19	19	21	17	0
(181-A1) **Norfolk**	25	22	21	20	22	20	0
(44-A) **Stafford Co.**	--	--	--	--	23	23	0
(46-B9) **Fairfax Co.**	24	22	30	27	24	21	0

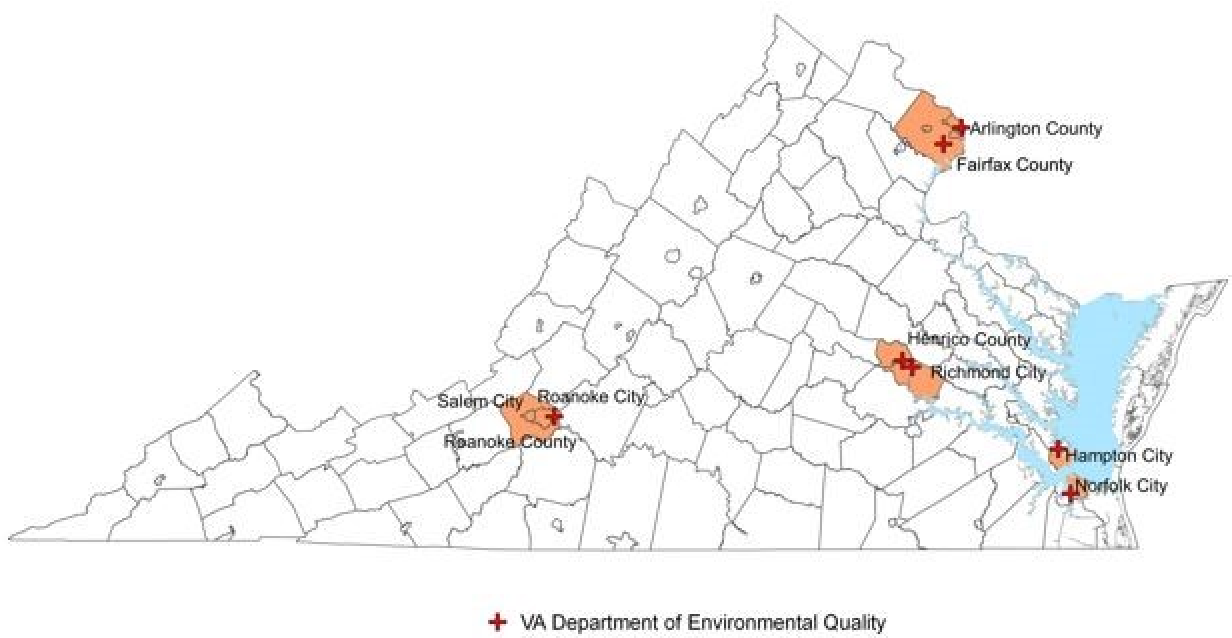
CO Monitoring Network

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

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

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

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



CO Monitoring Network

National Ambient Air Quality Standards (NAAQS)

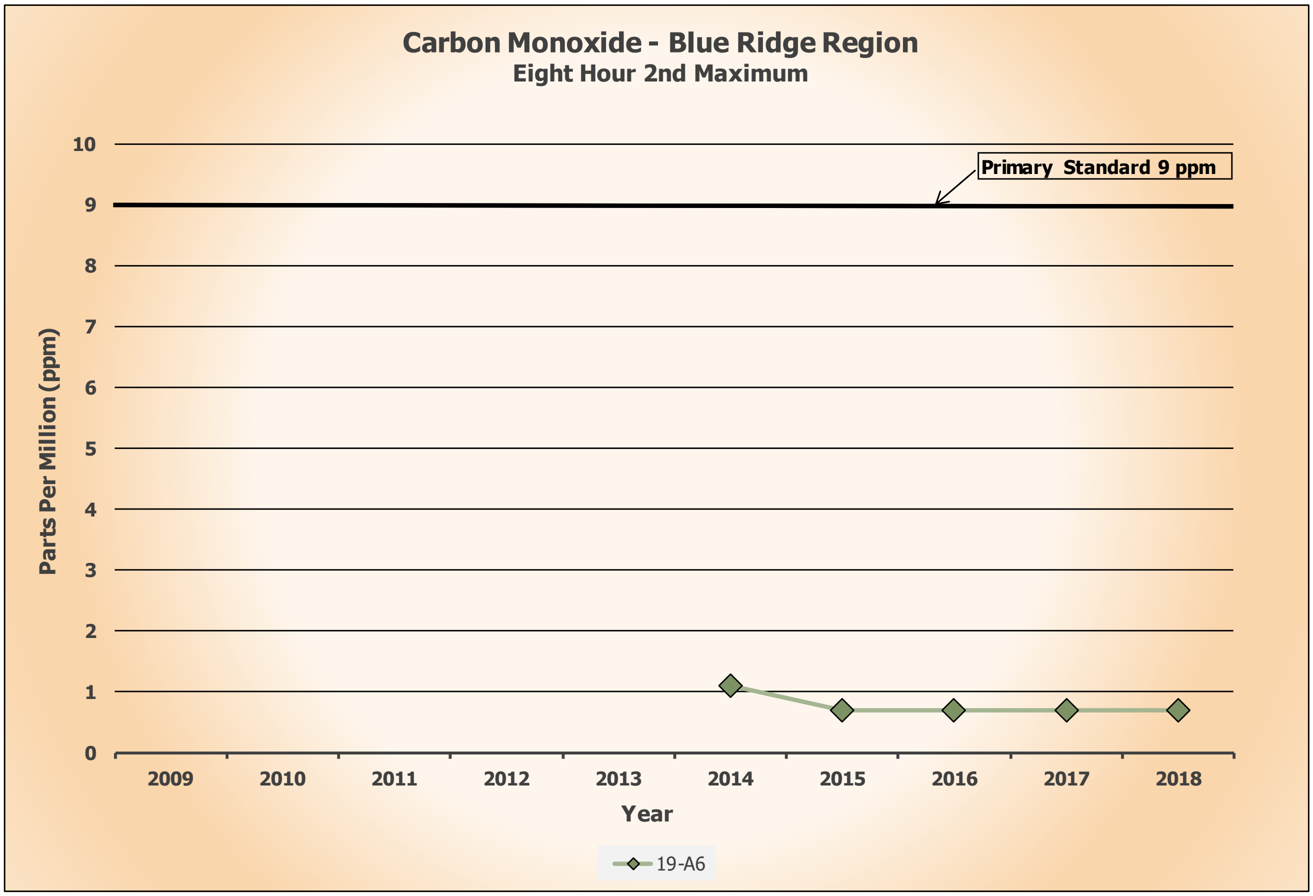
Primary Standard for CO:

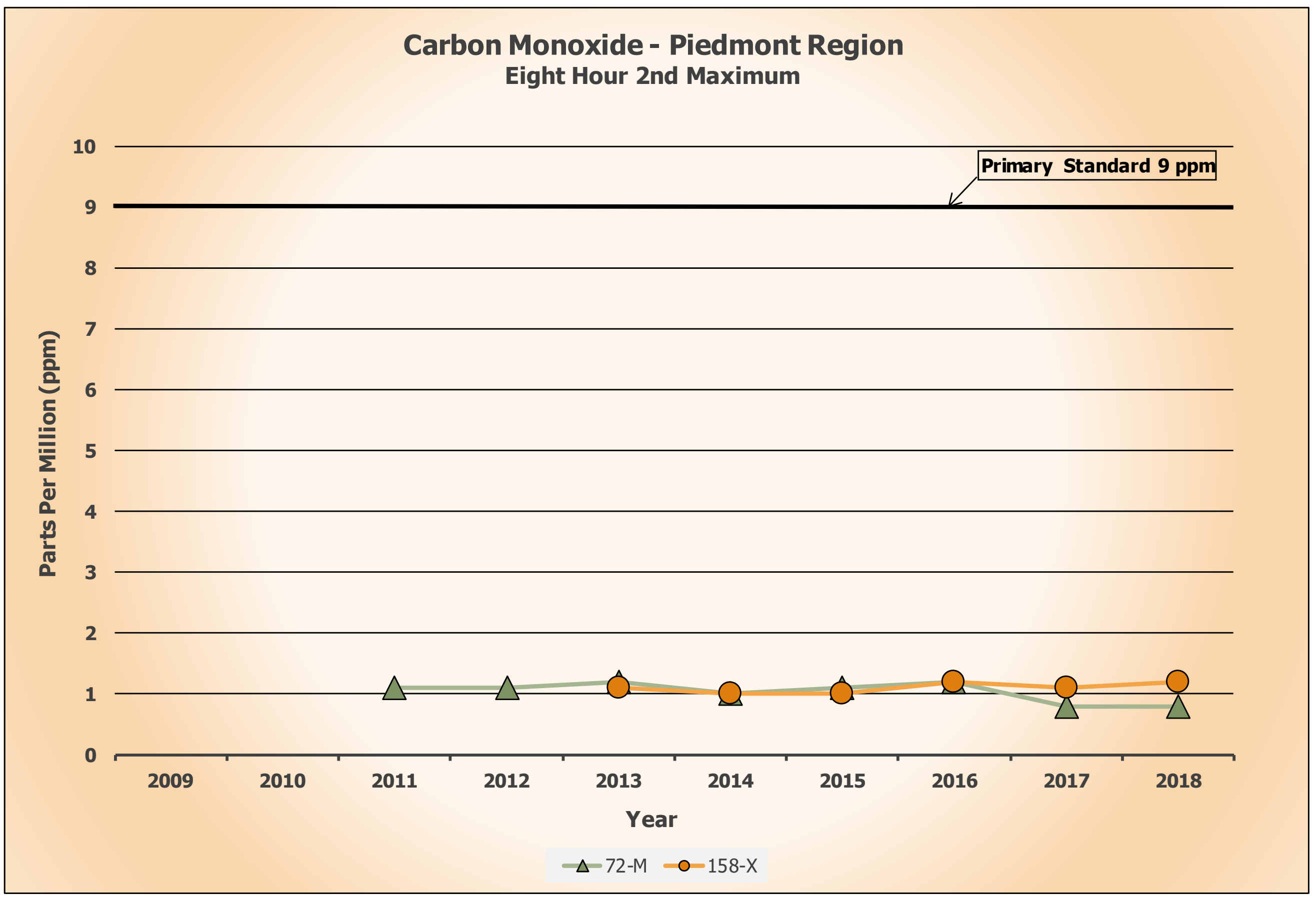
- 8-hour average not to exceed 9 ppm more than once per year.
- 1-hour average not to exceed 35 ppm more than once per year.

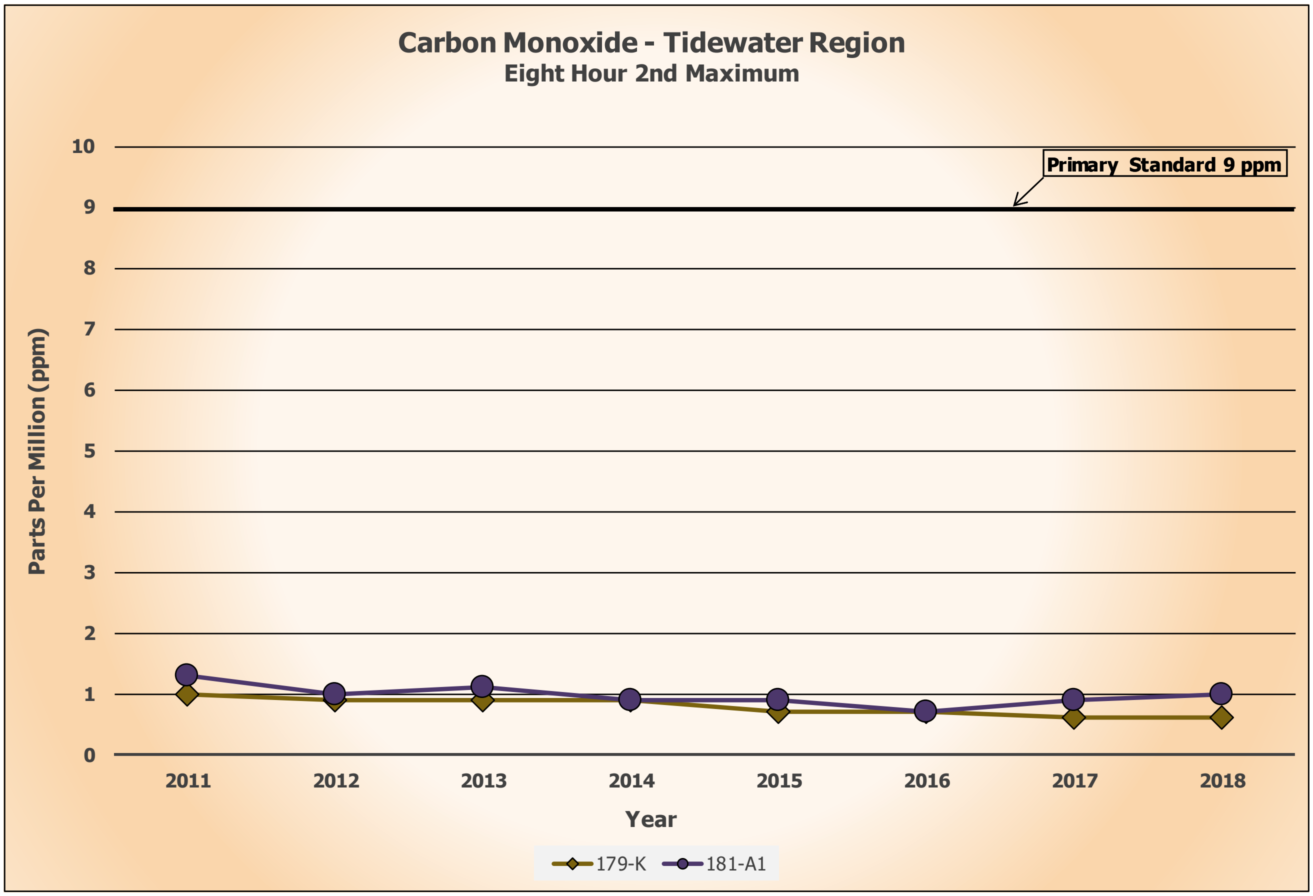
There are no Secondary Standards for CO because it does not harm vegetation or buildings.

Site	2018			
	1-Hour Avg. (ppm)		8-Hour Avg. (ppm)	
	1st Max.	2nd Max.	1st Max.	2nd Max.
(19-A6) **Roanoke Co.**	0.8	0.8	0.7	0.7
(72-M) **Henrico Co.**	1.1	1.1	0.8	0.8
(158-X) **Richmond**	1.4	1.3	1.3	1.2
(179-K) **Hampton**	0.8	0.7	0.6	0.6
(181-A1) **Norfolk**	1.8	1.4	1.0	1.0
(46-C2) **Fairfax Co.**	1.3	1.2	1.0	0.9
(47-T) **Arlington Co.**	1.6	1.6	1.2	1.2

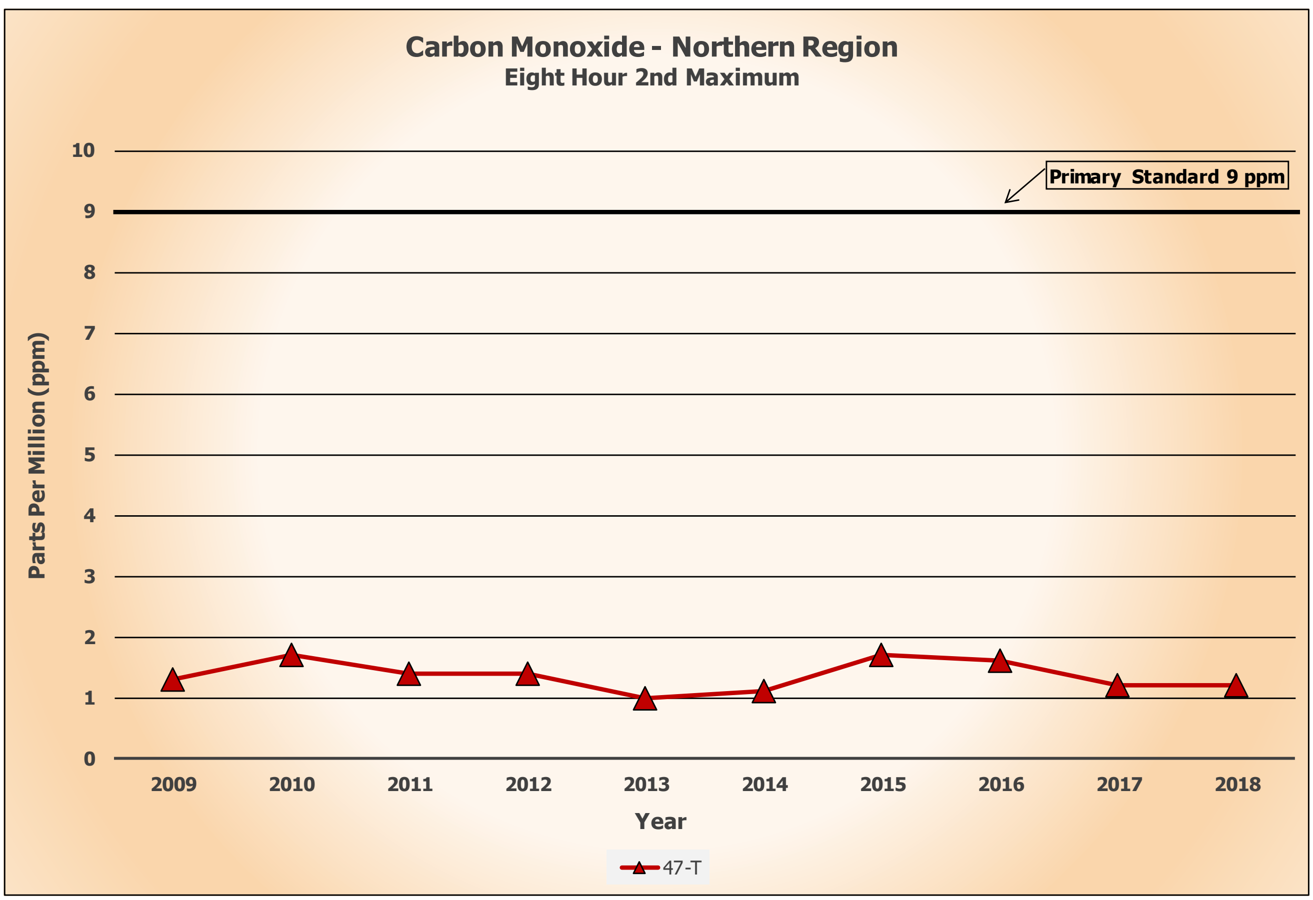
Eight Hour Averages stated as Ending Hour


Carbon Monoxide - Blue Ridge Region
Eight Hour 2nd Maximum
Primary Standard 9 ppm
Parts Per Million (ppm)
10
9
8
7
6
5
4
3
2
1
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
19-A6


Carbon Monoxide - Piedmont Region
Eight Hour 2nd Maximum
Primary Standard 9 ppm
Parts Per Million (ppm)
10
9
8
7
6
5
4
3
2
1
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
72-M
158-X



Carbon Monoxide - Tidewater Region
Eight Hour 2nd Maximum
Primary Standard 9 ppm
Parts Per Million (ppm)
10
9
8
7
6
5
4
3
2
1
0
2011
2012
2013
2014
2015
2016
2017
2018
Year
179-K
181-A1



Carbon Monoxide - Northern Region
Eight Hour 2nd Maximum
Primary Standard 9 ppm
Parts Per Million (ppm)
10
9
8
7
6
5
4
3
2
1
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
47-T

SO2 Monitoring Network

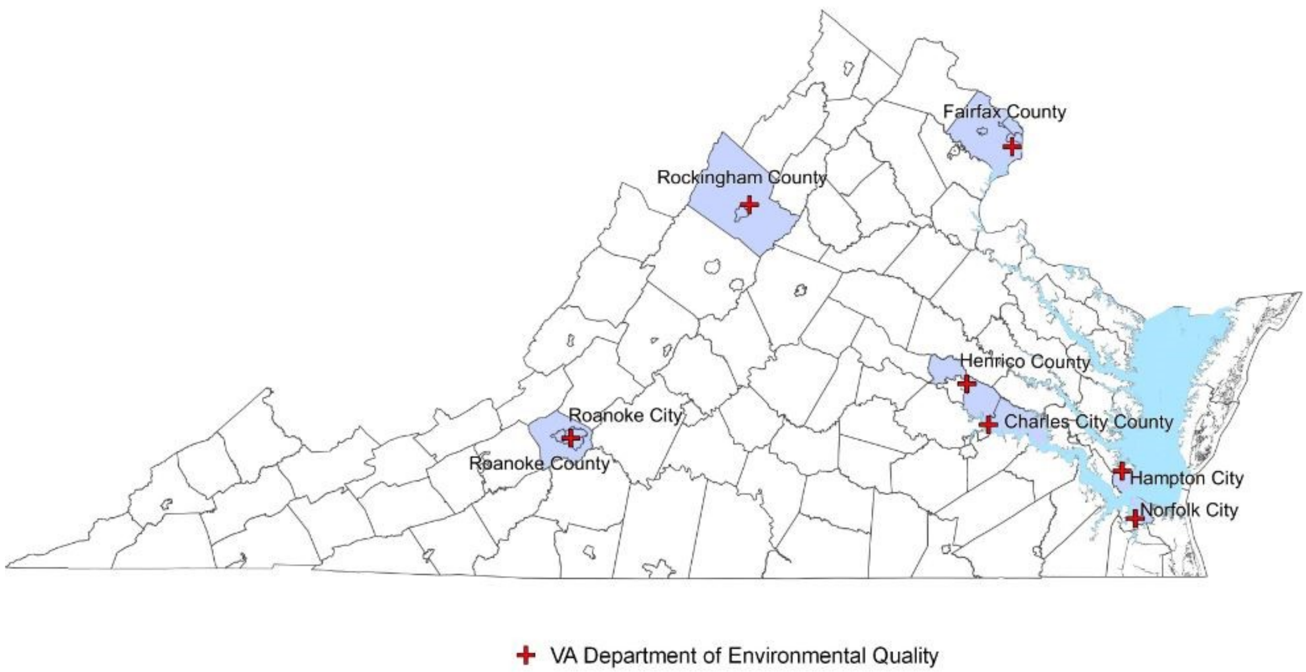
Sulfur dioxide (SO_2) is a colorless gas that has a strong odor. It results from burning of fuels containing sulfur (such as coal and oil), petroleum refining, and smelting (extracting metals from ore), and it also occurs naturally from volcanic eruptions. SO_2 can dissolve in water vapor to produce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

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

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

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

SO2 Monitoring Network



National Ambient Air Quality Standards (NAAQS)

Primary Standards for SO_2:

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

Secondary Standard for SO_2:

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

Sulfur Dioxide 99th Percentile 1-Hour Daily Maximum Values (ppb)

Site ID	City/County	2016	2017	2018	3-Yr Avg Design Value 2016-2018
26-F	Rockingham Co.	2	2	2	2
19-A6	Roanoke Co.	4	3	2	3
72-M	Henrico Co.	5	4	5	5
75-B	Charles City Co.	24	18	18	20
179-K	Hampton	17*	3	21	14
181-A1	Norfolk	9	3	10	7
46-B9	Fairfax Co.	5	4	5	5

* Did not meet completeness criteria

SO2 Monitoring Network

National Ambient Air Quality Standards (NAAQS)

Primary Standards for SO_2:

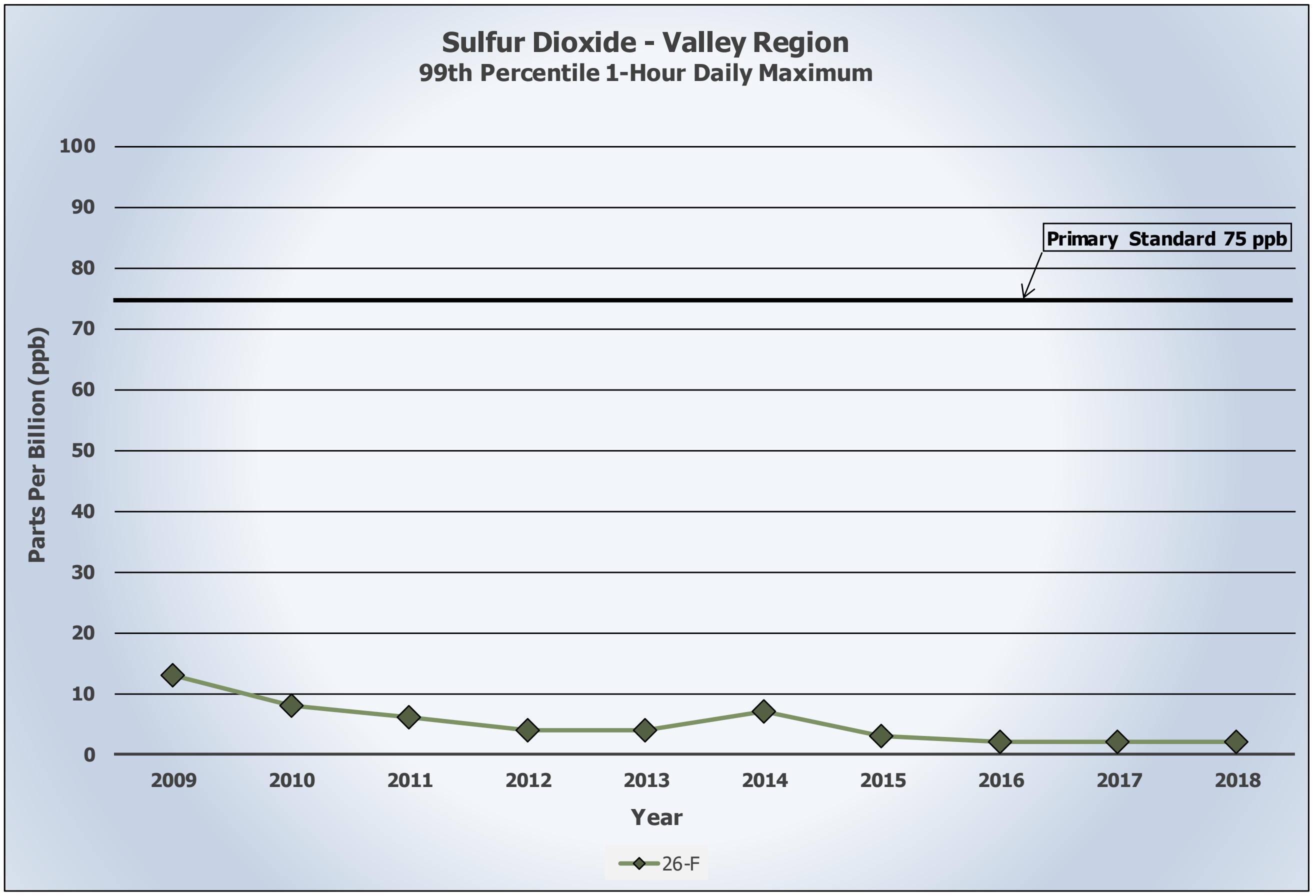
- 3-year average of the 99^{th} percentile 1-hour daily maximum values not to exceed 75 ppb.

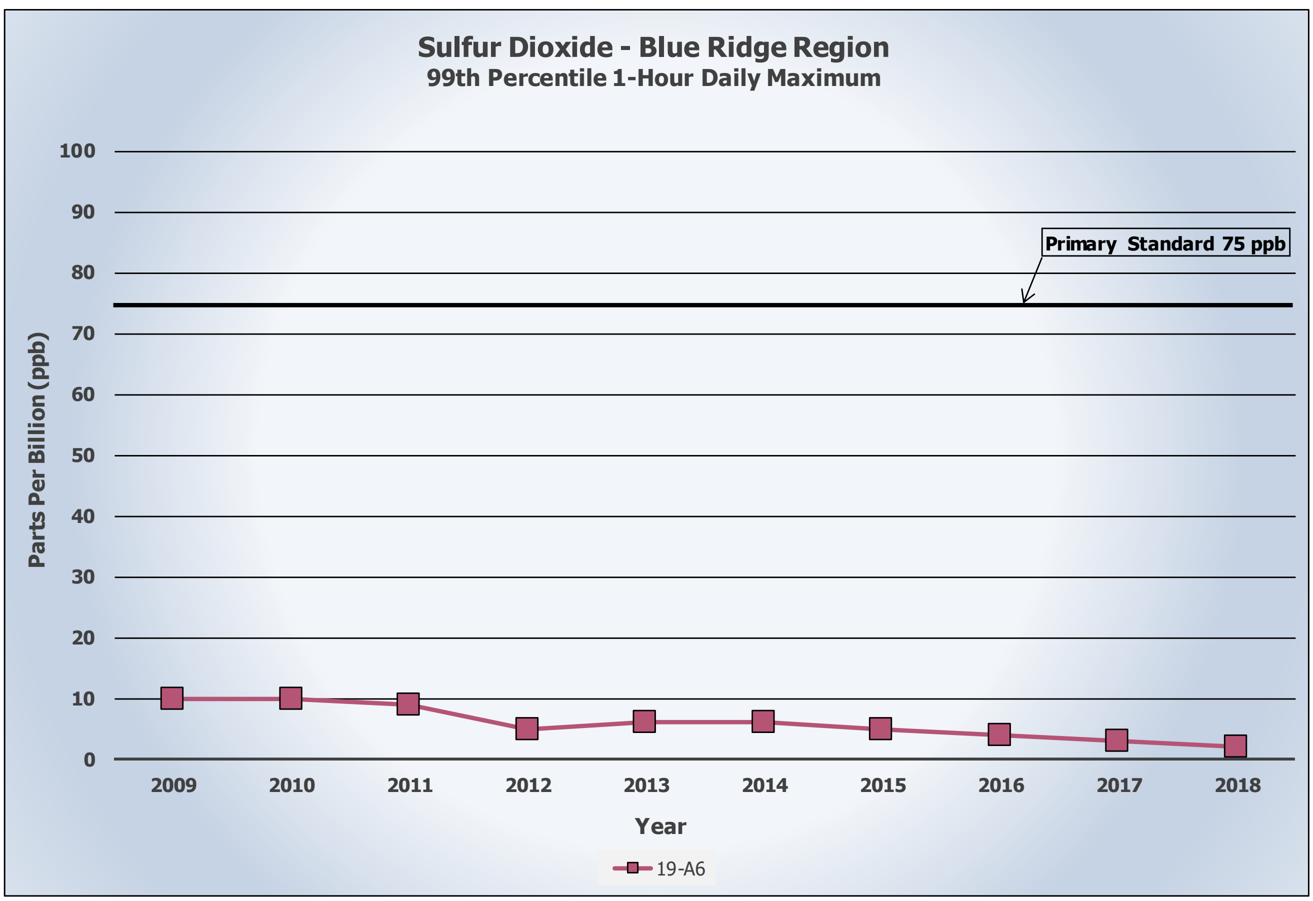
Secondary Standard for SO_2:

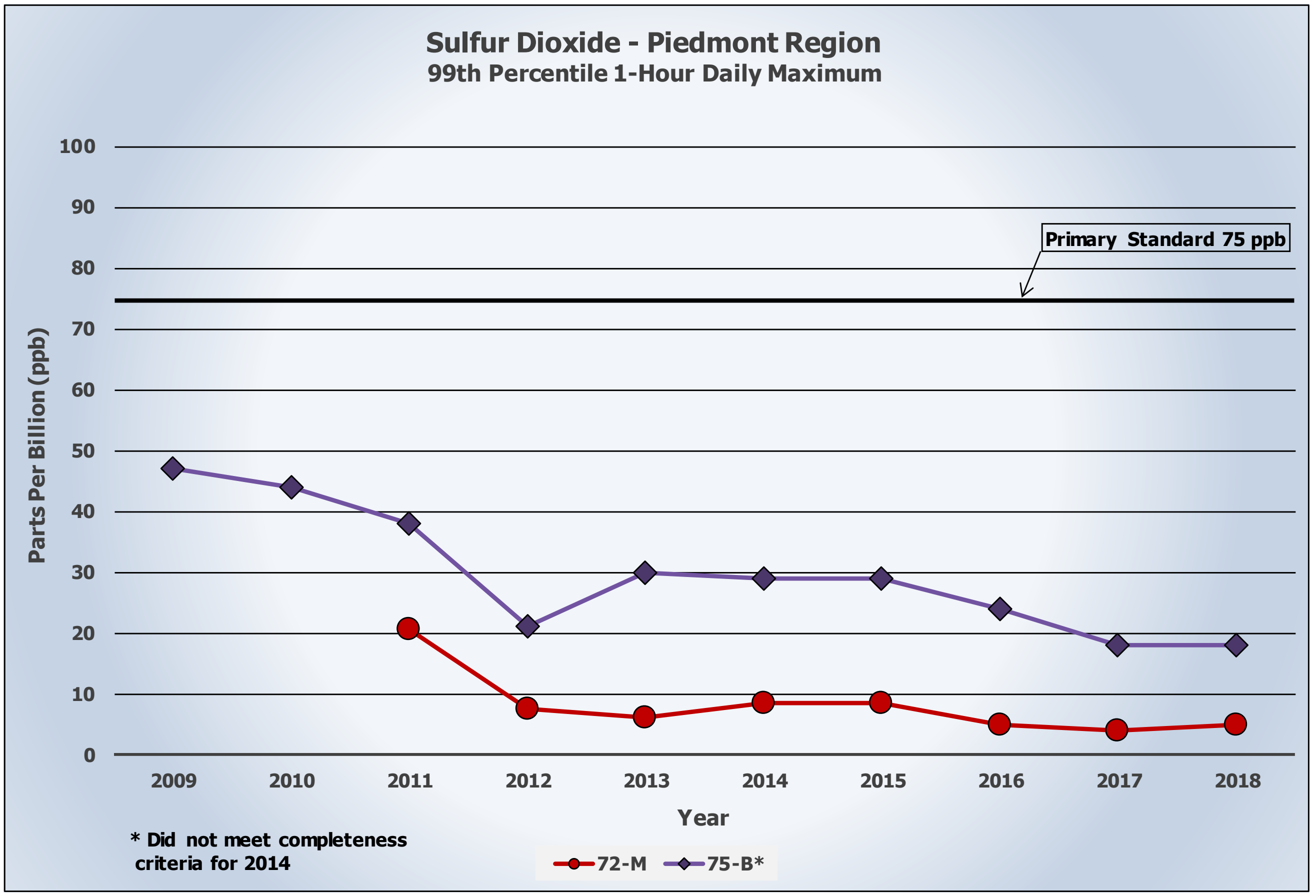
- 3-Hour concentration not to exceed 0.5 ppm (500 ppb) more than once per year.

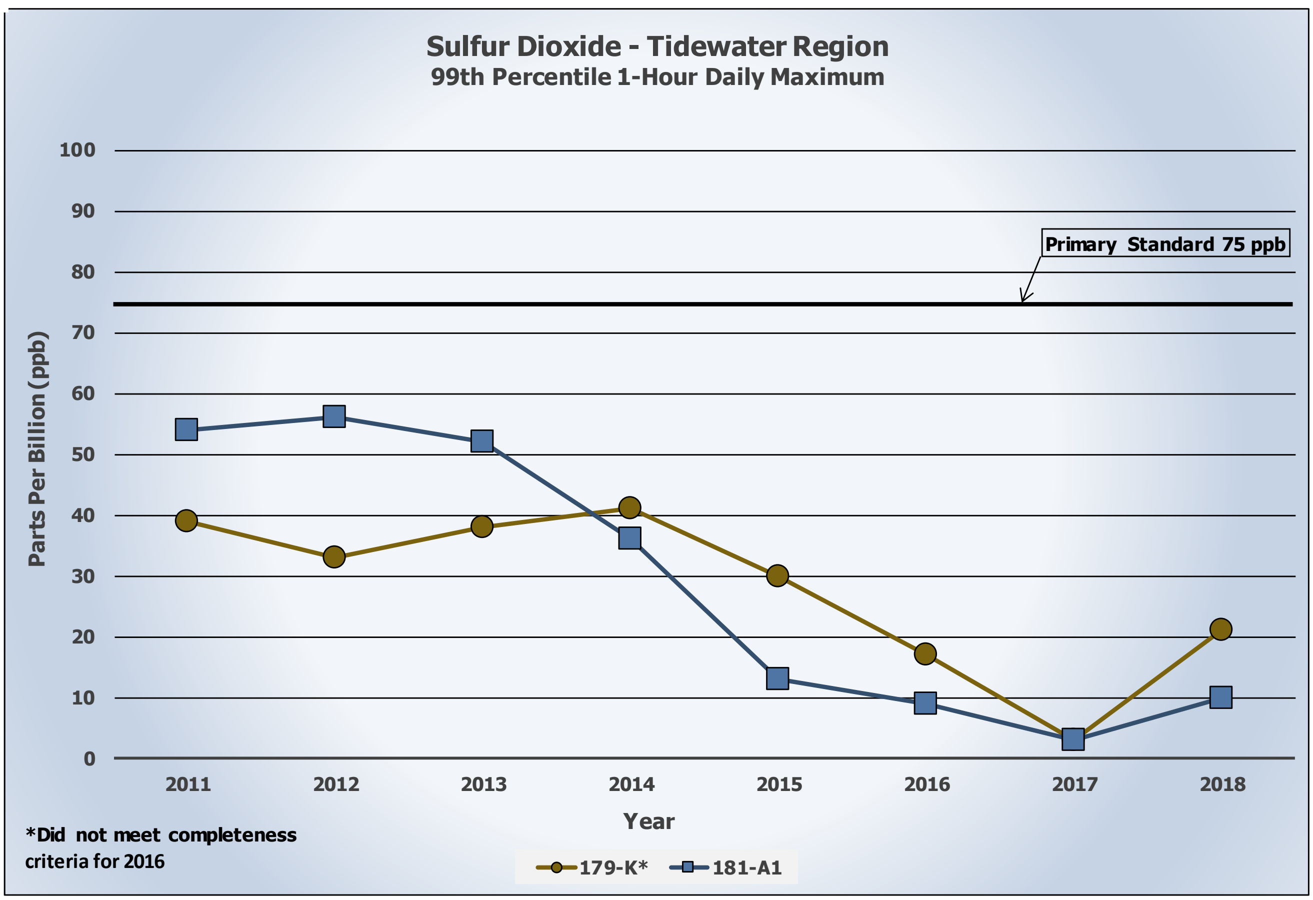
Sulfur Dioxide 3-Hour Block Average Maximum Values (ppb)

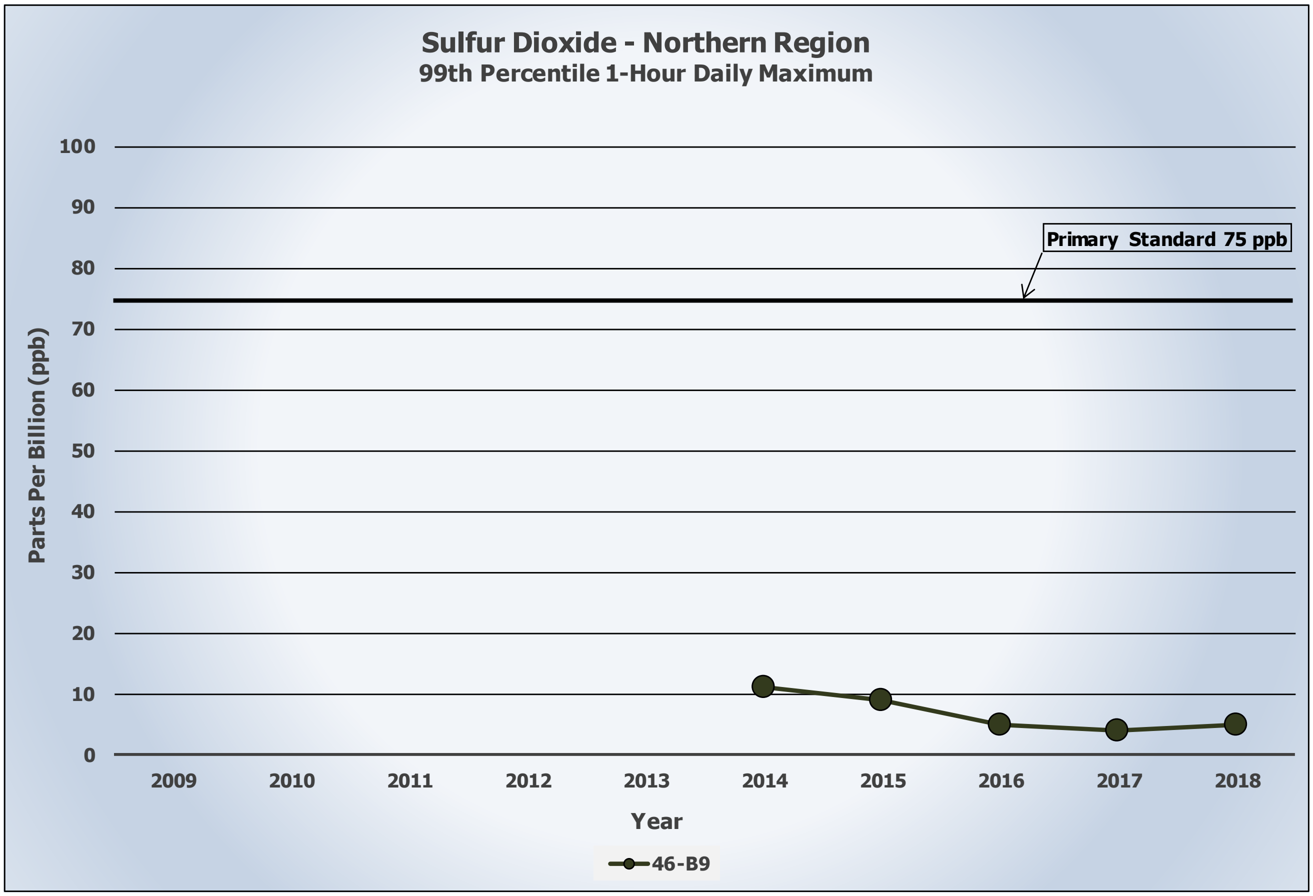
Site ID	City/County	2016	2017	2018	Number Obs. > 500 ppb
26-F	Rockingham Co.	2	2	2	0
19-A6	Roanoke Co.	4	3	3	0
72-M	Henrico Co.	6	5	5	0
75-B	Charles City Co.	16	15	15	0
179-K	Hampton	15	3	24	0
181-A1	Norfolk	13	5	18	0
46-B9	Fairfax Co.	6	5	6	0


Sulfur Dioxide - Valley Region
99th Percentile 1-Hour Daily Maximum
Parts Per Billion (ppb)
100
90
80
70
60
50
40
30
20
10
0
Primary Standard 75 ppb
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
26-F


Sulfur Dioxide - Blue Ridge Region
99th Percentile 1-Hour Daily Maximum
Parts Per Billion (ppb)
100
90
80
70
60
50
40
30
20
10
0
Primary Standard 75 ppb
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
19-A6


Sulfur Dioxide - Piedmont Region
99th Percentile 1-Hour Daily Maximum
100
90
80
70
60
50
40
30
20
10
0
Parts Per Billion (ppb)
Primary Standard 75 ppb
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
* Did not meet completeness criteria for 2014
72-M
75-B*


Sulfur Dioxide - Tidewater Region
99th Percentile 1-Hour Daily Maximum
100
90
80
70
60
50
40
30
20
10
0
Parts Per Billion (ppb)
Primary Standard 75 ppb
2011
2012
2013
2014
2015
2016
2017
2018
Year
*Did not meet completeness criteria for 2016
179-K*
181-A1



Sulfur Dioxide - Northern Region
99th Percentile 1-Hour Daily Maximum
Primary Standard 75 ppb
Parts Per Billion (ppb)
100
90
80
70
60
50
40
30
20
10
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
46-B9

NO2 Monitoring Network

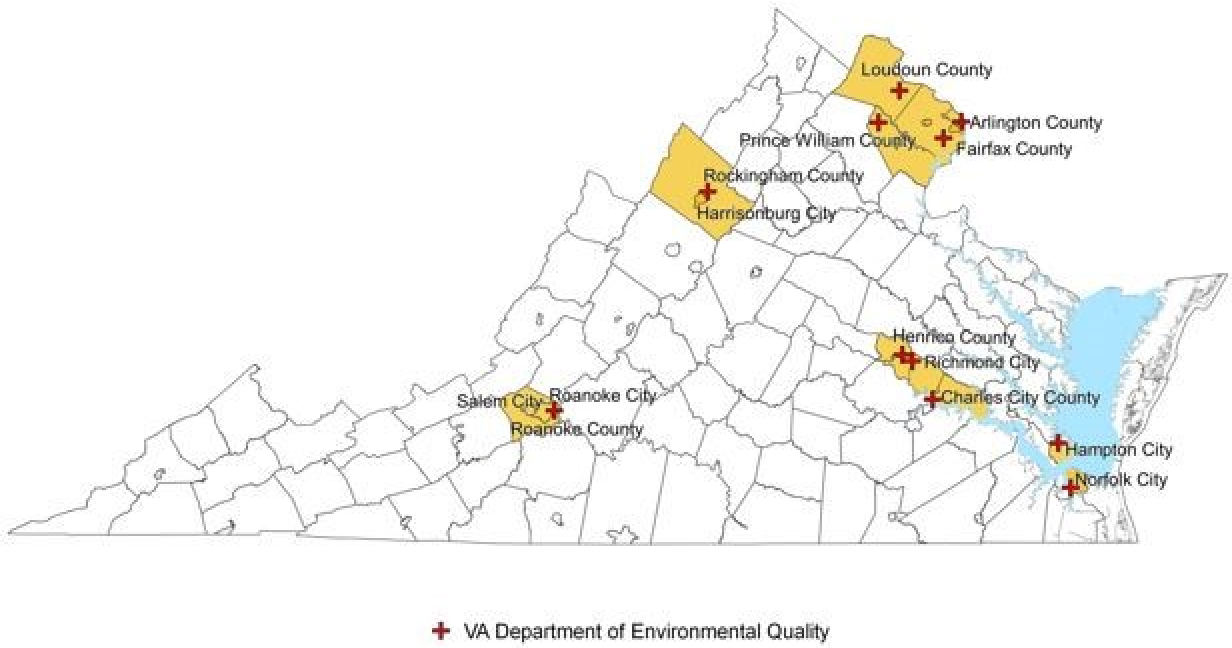
Nitrogen dioxide (NO_2) is one in a group of gases referred to as oxides of nitrogen (NO_X). Nitrogen dioxide, which is characterized by a reddish-brown color and pungent odor, along with the other NO_X gases, results from high-temperature burning of fossil fuels in automobiles, power plants, and other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

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

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

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

NO2 Monitoring Network



National Ambient Air Quality Standards (NAAQS)

Primary Standard for NO_2:

- 3-year average of the 98th percentile 1-hour daily maximum values not to exceed 100 ppb.
- Annual Arithmetic Mean not to exceed 53 ppb (.053 ppm).

Secondary Standard for NO_2:

- Same as primary.

Nitrogen Dioxide 98th Percentile 1-Hour Daily Maximum Values (ppb)

Site City/County	2016	2017	2018	3-Yr Avg. Design Value 2016-2018
(26-F) **Rockingham Co.**	34.6	34.7	35.6	35
(19-A6) **Roanoke Co.**	37.3	31.9	30.8	33
(72-M) **Henrico Co.**	35.6*	38.8	31.4	35
(75-B) **Charles City Co.**	43.6	32.2	30.5	35
(158-X) **Richmond**	43.9	42.2	43.1	43
(179-K) **Hampton**	26.5	28.1	25.5	27
(181-A1) **Norfolk**	39.0	40.2	38.4	39
(38-I) **Loudoun Co.**	35.4	35.0	32.6	34
(45-L) **Prince William Co.**	26.5	24.0	21.0	24
(46-C2) **Fairfax Co.**	42.5*	44.3	46.6	44
(47-T) **Arlington Co.**	44.0	42.5	41.9	43

* Did not meet completeness criteria

NO2 Monitoring Network

National Ambient Air Quality Standards (NAAQS)

Primary Standard for NO_2:

- 3-year average of the 98th percentile 1-hour daily maximum values not to exceed 100 ppb.
- Annual Arithmetic Mean not to exceed 53 ppb (.053 ppm).

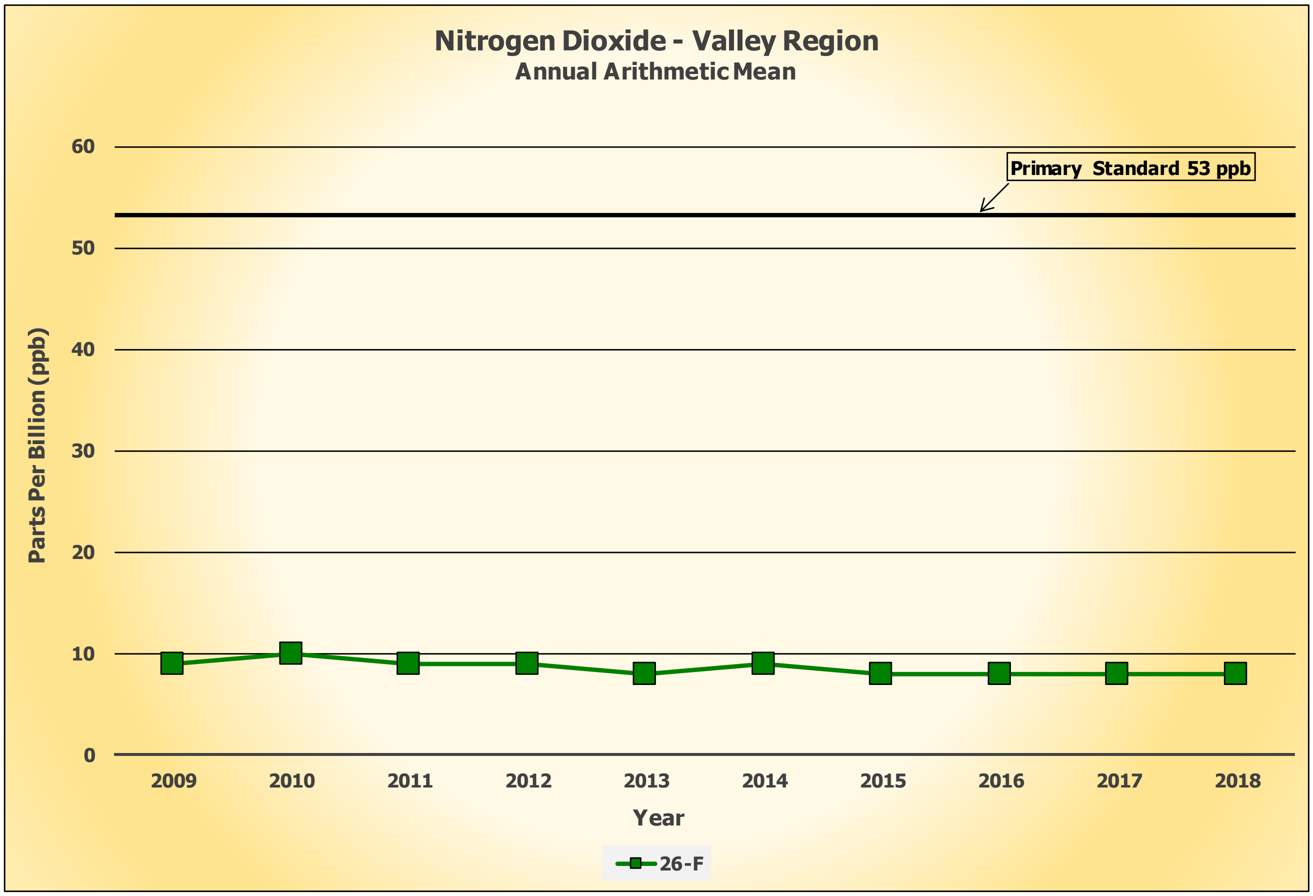
Secondary Standard for NO_2:

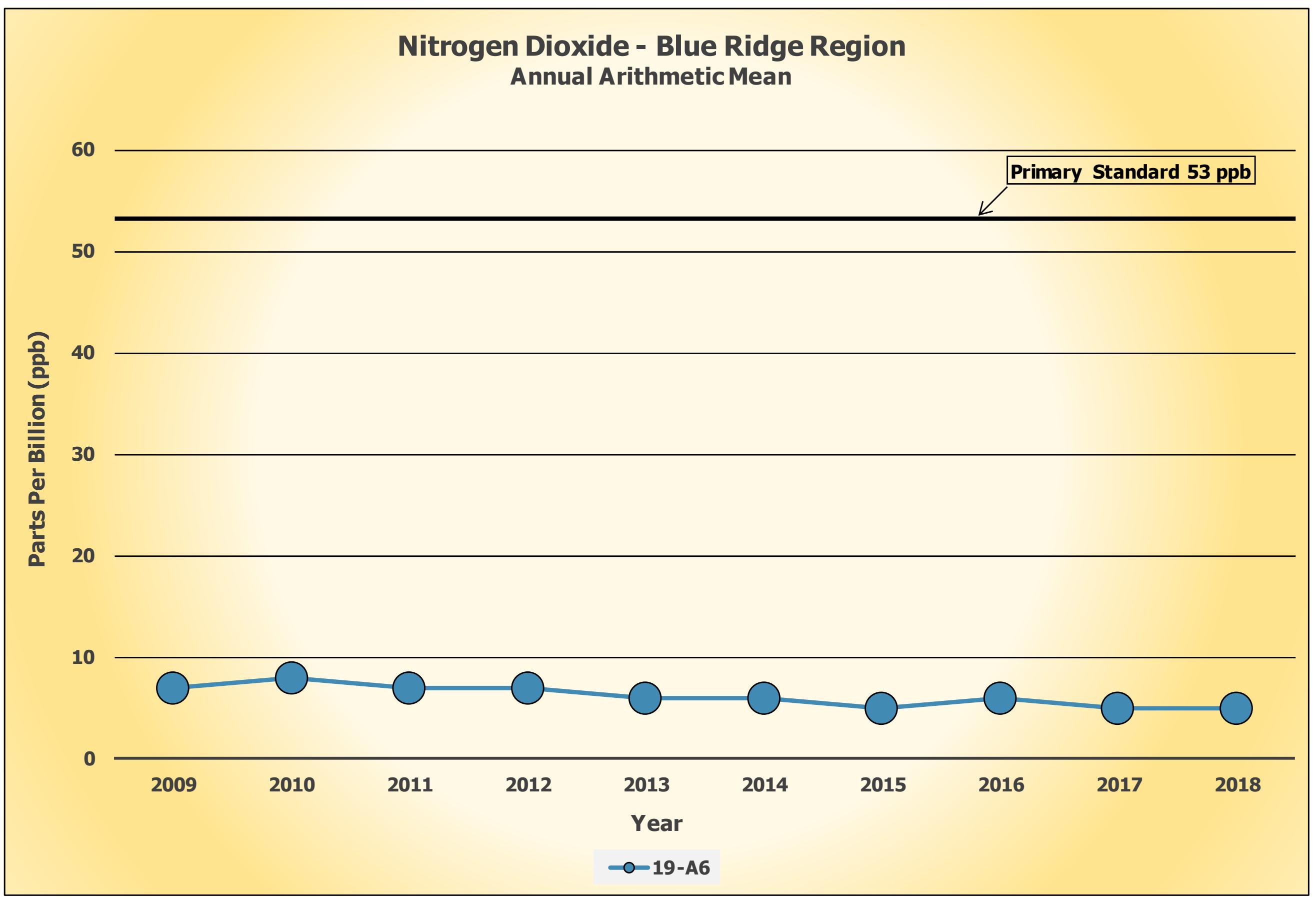
- Same as primary.

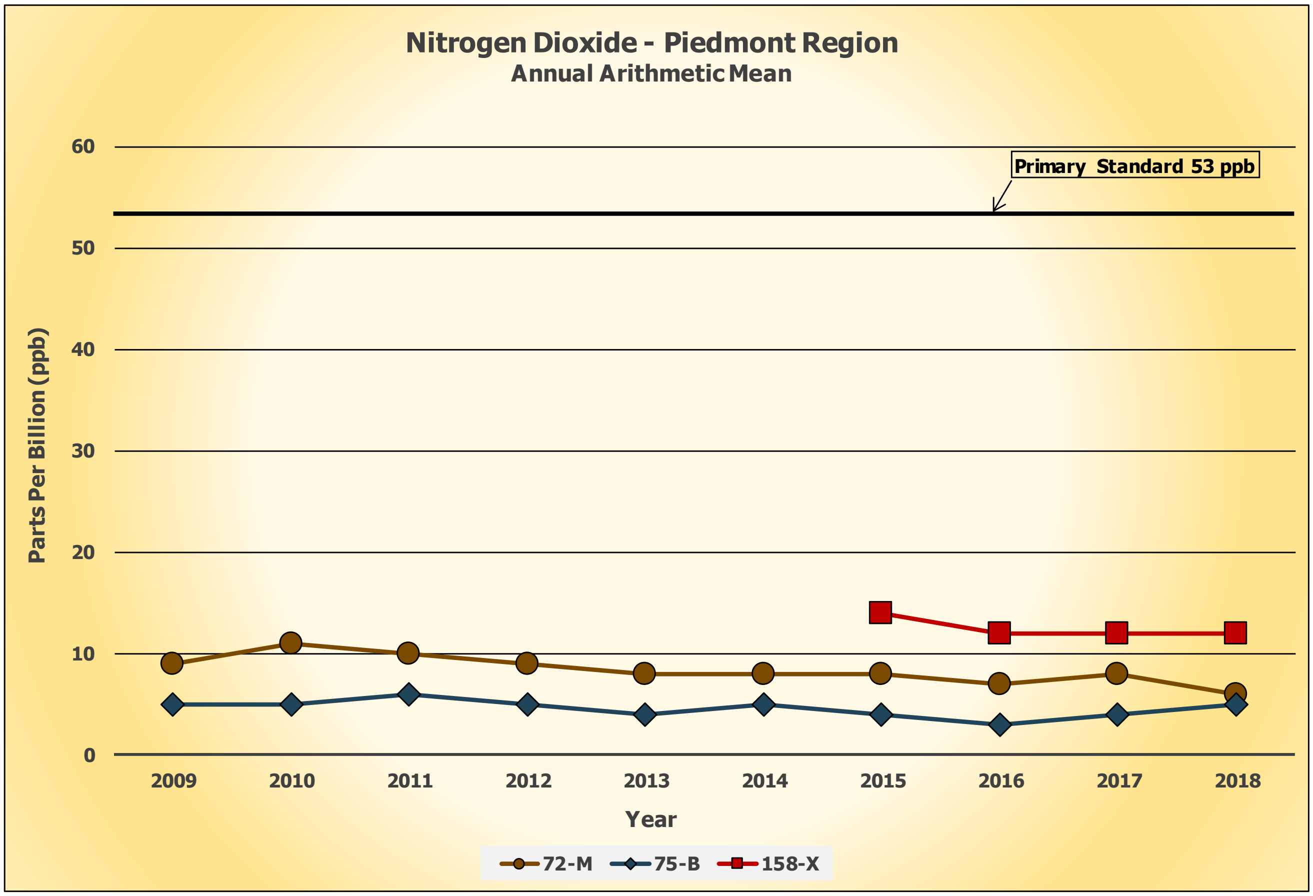
Annual Arithmetic Mean (ppb)

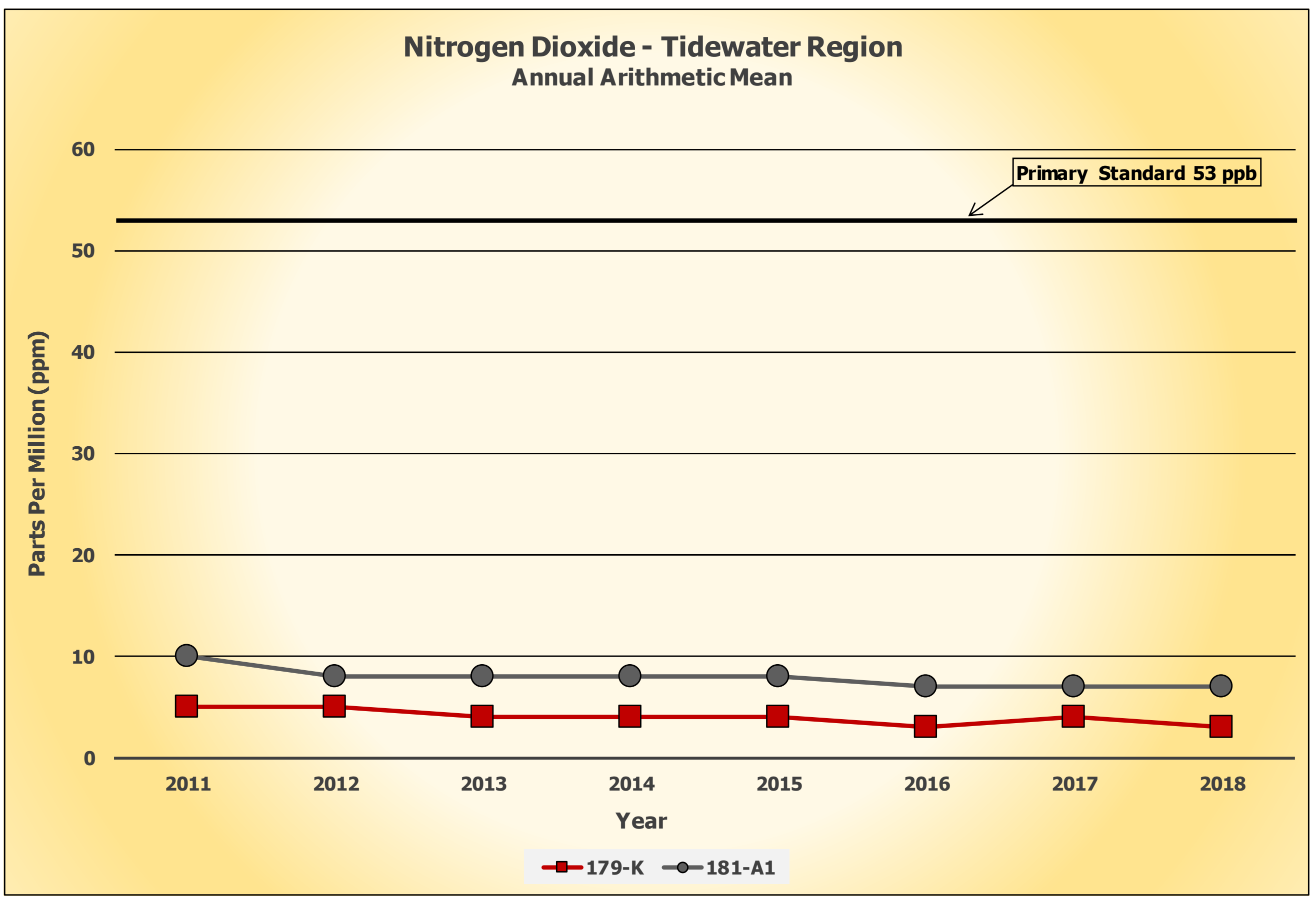
Site	2016	2017	2018
(26-F) **Rockingham Co.**	8	8	8
(19-A6) **Roanoke Co.**	6	5	5
(72-M) **Henrico Co.**	7	8	6
(75-B) **Charles City Co.**	3	4	5
(158-X) **Richmond**	12	12	12
(179-K) **Hampton**	3	4	3
(181-A1) **Norfolk**	7	7	7
(38-I) **Loudoun Co.**	7	6	6
(45-L) **Prince William Co.**	5	4	4
(46-C2) **Fairfax Co.**	15*	15	15
(47-T) **Arlington Co.**	11	9	9

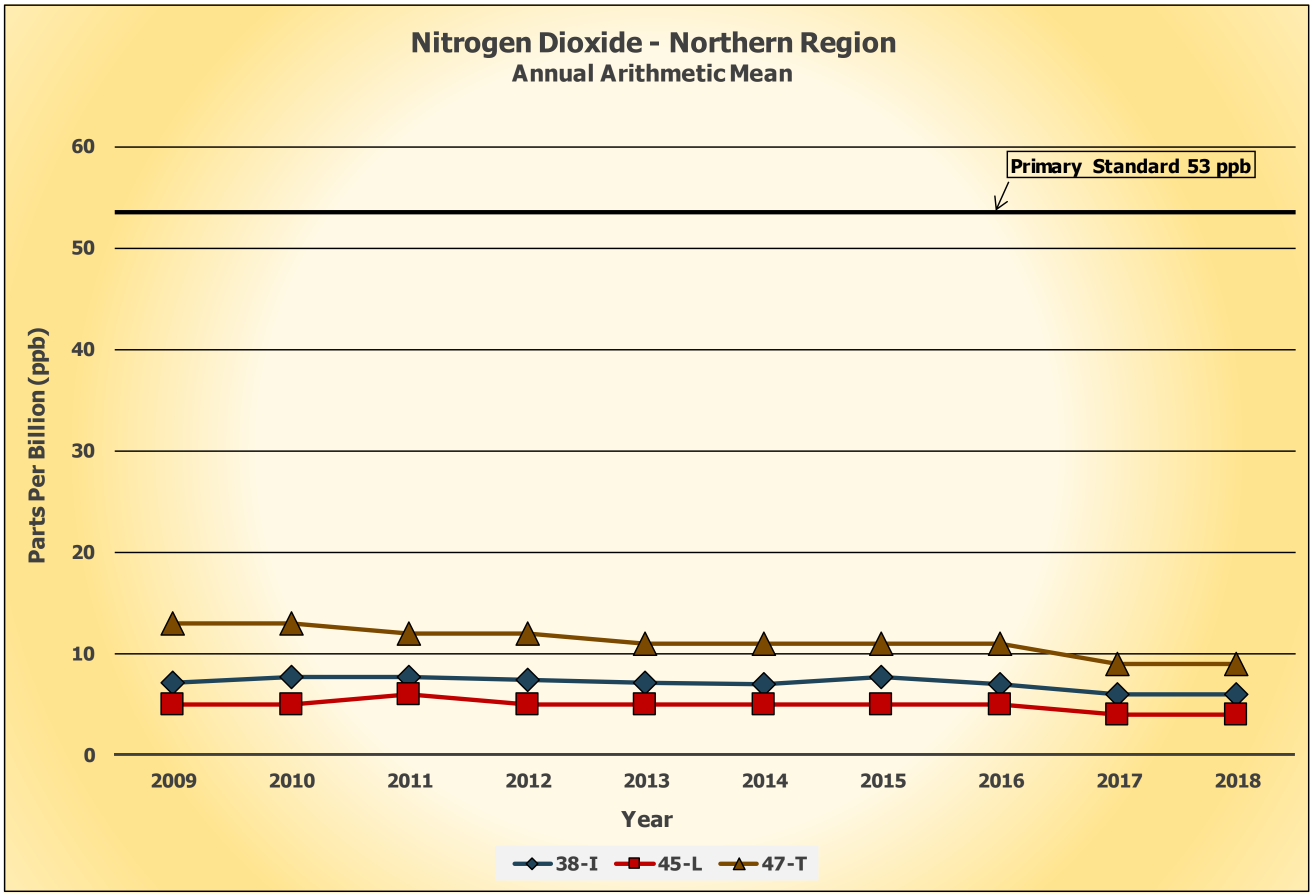
* Did not meet completeness criteria


Nitrogen Dioxide - Valley Region
Annual Arithmetic Mean
Primary Standard 53 ppb
Parts Per Billion (ppb)
60
50
40
30
20
10
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
26-F


Nitrogen Dioxide - Blue Ridge Region
Annual Arithmetic Mean
Primary Standard 53 ppb
Parts Per Billion (ppb)
60
50
40
30
20
10
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
19-A6


Nitrogen Dioxide - Piedmont Region
Annual Arithmetic Mean
Primary Standard 53 ppb
Parts Per Billion (ppb)
60
50
40
30
20
10
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
72-M
75-B
158-X


Nitrogen Dioxide - Tidewater Region
Annual Arithmetic Mean
Primary Standard 53 ppb
Parts Per Million (ppm)
60
50
40
30
20
10
0
2011
2012
2013
2014
2015
2016
2017
2018
Year
179-K
181-A1


Nitrogen Dioxide - Northern Region
Annual Arithmetic Mean
Primary Standard 53 ppb
Parts Per Billion (ppb)
60
50
40
30
20
10
0
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
38-I
45-L
47-T

Ozone Monitoring Network

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

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

Ground-level ozone is a seasonal pollutant, and the length of the ozone season varies across the country. In some areas, the season may last most of the year, but in Virginia it is usually only a problem during the late spring to summer months when the sunlight is most intense. Virginia is required to operate its ozone monitors from the months of March 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 effects 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.

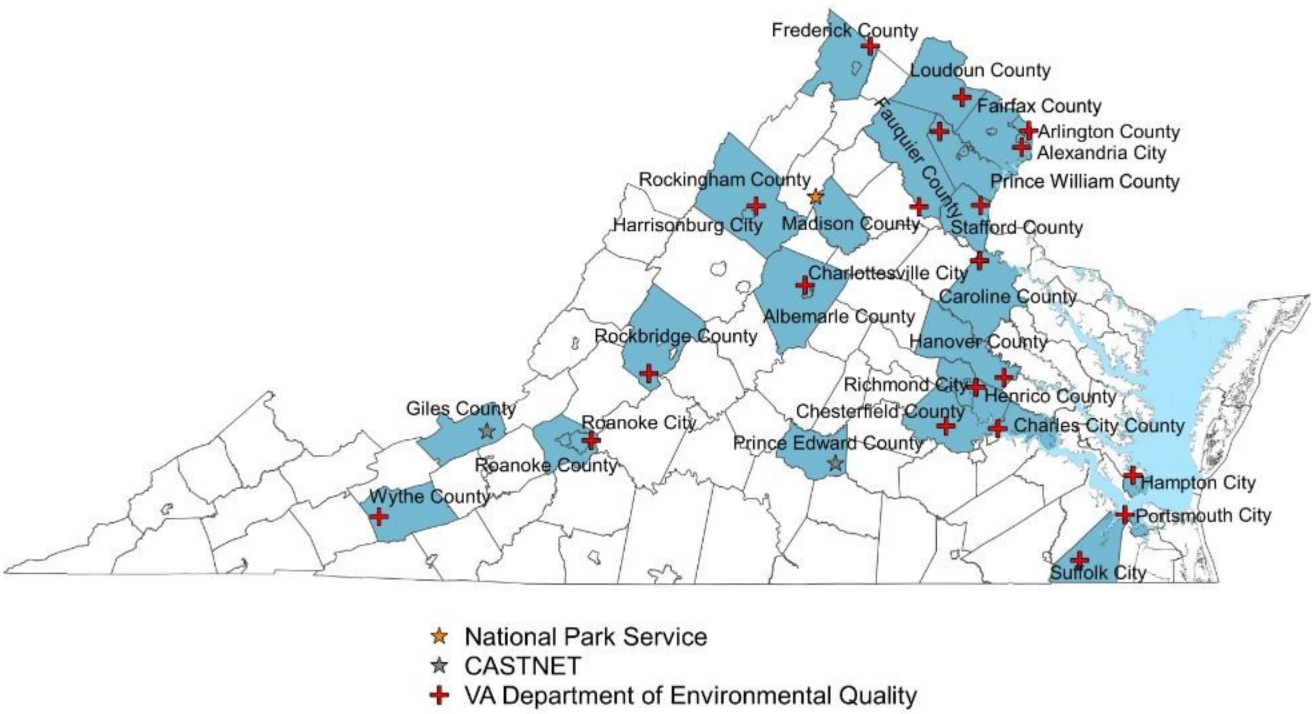
Ozone Monitoring Network

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 March to October on the DEQ web page. In addition, animated ozone maps for Virginia and other parts of the United States are available at EPA's AirNow website.

Ozone Monitoring Network

The National Park Service operated one ozone monitor at Big Meadows in Shenandoah National Park in 2018. Daily data from this site are available at the DEQ website, and historical data may be obtained on the internet at NPS Gaseous Pollutant and Meteorological Data or at EPA's AirData website. EPA also maintains ozone monitoring sites in Giles and Prince Edward counties as part of the CASTNET (Clean Air Status and Trends Network) program. Data from these sites are available for download at the Castnet website



Ozone Monitoring Network

National Ambient Air Quality Standards (NAAQS)

Primary Standard for O_3:

- Maximum 8-hour average concentration of 0.070 ppm, effective October 1, 2015, based on 3-year average of the annual fourth highest daily maximum 8-hour averages.

- Secondary Standard for O_3:

  Same as primary

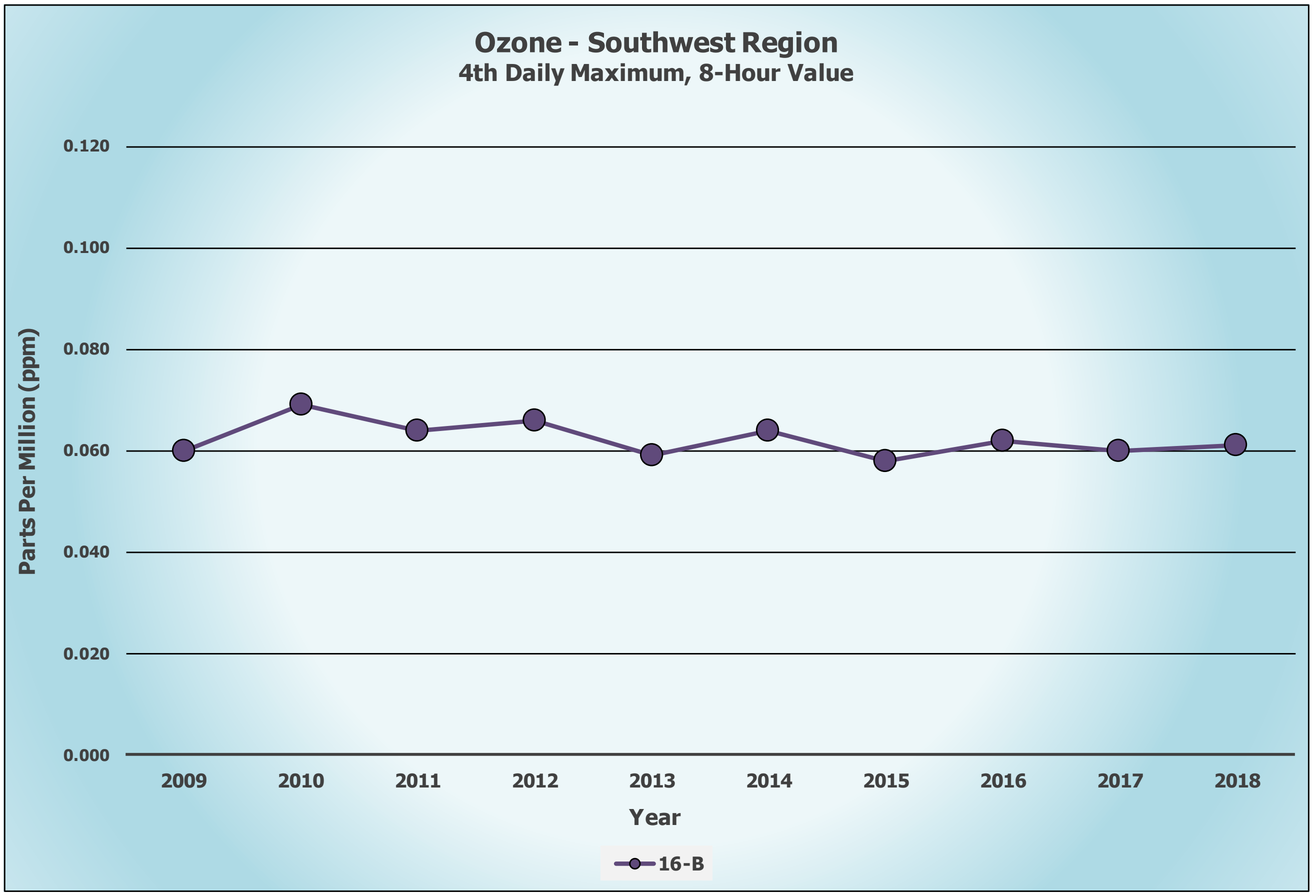
The standard is attained at a monitoring site when the 3-year average of the fourth highest daily maximum 8-hour average for each of the three most recent years is less than or equal to 0.070 ppm.

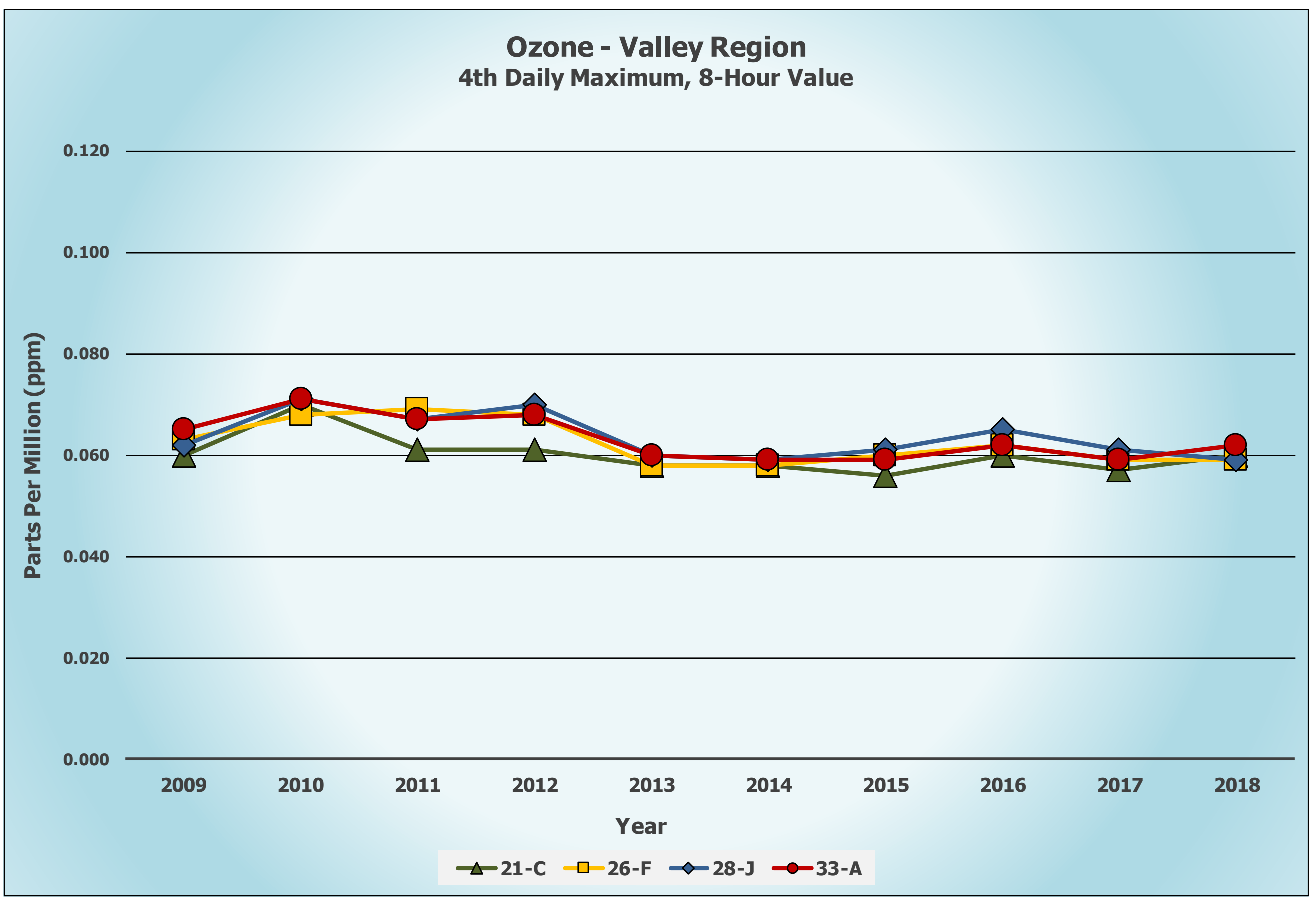
Site	Days Exceeded 0.070 ppm	2018 Highest Daily Maximum 8-Hour Avg.			
		1st Max.	2nd Max.	3rd Max.	4th Max.
(16-B) **Wythe Co.**	0	.065	.064	.062	.061
(26-F) **Rockingham Co.**	0	.063	.062	.061	.059
(28-J) **Frederick Co.**	0	.062	.061	.060	.059
(33-A) **Albemarle Co.**	0	.068	.066	.062	.062
(19-A6) **Roanoke Co.**	0	.066	.063	.063	.062
(21-C) **Rockbridge Co.**	0	.067	.062	.061	.060
(71-H) **Chesterfield Co.**	0	.063	.060	.058	.058
(72-M) **Henrico Co.**	1	.084	.067	.066	.065
(73-E) **Hanover Co.**	0	.069	.067	.067	.066
(75-B) **Charles City Co.**	1	.072	.069	.066	.064
(179-K) **Hampton**	0	.069	.068	.063	.062
(183-E) **Suffolk**	0	.066	.064	.063	.063
(183-F) **Suffolk**	0	.063	.062	.061	.059
(37-B) **Fauquier Co.**	0	.064	.063	.062	.060
(38-I) **Loudoun Co.**	0	.068	.066	.066	.065
(44-A) **Stafford Co.**	1	.074	.067	.064	.064
(45-L) **Prince William Co.**	0	.070	.066	.065	.065
(46-B9) **Fairfax Co.**	1	.071	.070	.069	.066
(47-T) **Arlington Co.**	3	.077	.072	.071	.070
(48-A) **Caroline Co.**	0	.065	.064	.063	.062

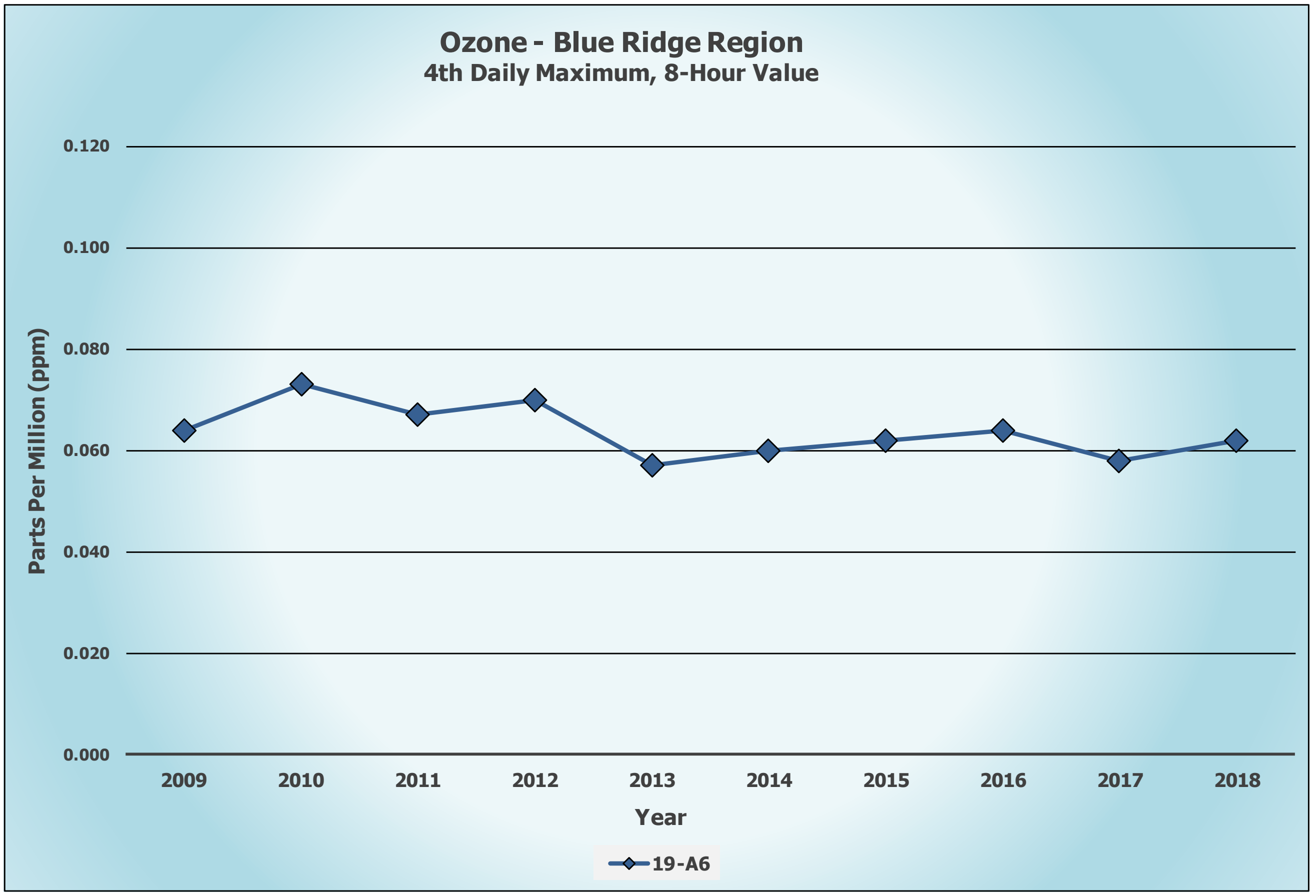
2016-2018 Fourth-Highest Daily Maximum 8-Hour Ozone Averages (units parts per million)

Areas	Monitor Location (County/City)	2016	2017	2018	3-Year Average (NAAQS = .070 ppm)
Richmond Maintenance Area	Chesterfield Co.	.063	.060	.058	.060
	Henrico Co.	.066	.067	.065	.066
	Hanover Co.	.065	.064	.066	.065
	Charles City Co.	.065	.061	.064	.063
Hampton Roads Maintenance Area	Hampton City	.068	.064	.062	.064
	Suffolk City (TCC)	.063	.060	.063	.062
	Suffolk City (Holland)	.061	.058	.059	.059
Fredericksburg Maintenance Area	Stafford Co.	.066	.058	.064	.062
Northern Virginia Nonattainment Area	Loudoun Co.	.068	.066	.065	.066
	Prince William Co.	.067	.065	.065	.065
	Arlington Co.	.072	.070	.070	.070
	Fairfax Co. (Lee Park)	.073	.068	.066	.069
Shenandoah National Park Maintenance Area	Madison Co. (Big Meadows)	.066	.062	.062	.063
Areas Currently Designated Attainment	Wythe Co.	.062	.060	.061	.061
	Rockbridge Co.	.060	.057	.060	.059
	Rockingham Co.	.062	.059	.059	.060
	Frederick Co.	.065	.061	.059	.061
	Albemarle Co.	.062	.059	.062	.061
	Roanoke Co.	.064	.058	.062	.061
	Fauquier Co.	.063	.056	.060	.059
	Caroline Co.	.062	.061	.062	.061

A 3-year average greater than .070 ppm exceeds the 8-hour NAAQS for ozone.


Ozone - Southwest Region
4th Daily Maximum, 8-Hour Value
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Parts Per Million (ppm)
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
16-B


Ozone - Valley Region
4th Daily Maximum, 8-Hour Value
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Parts Per Million (ppm)
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
21-C
26-F
28-J
33-A


Ozone - Blue Ridge Region
4th Daily Maximum, 8-Hour Value
Parts Per Million (ppm)
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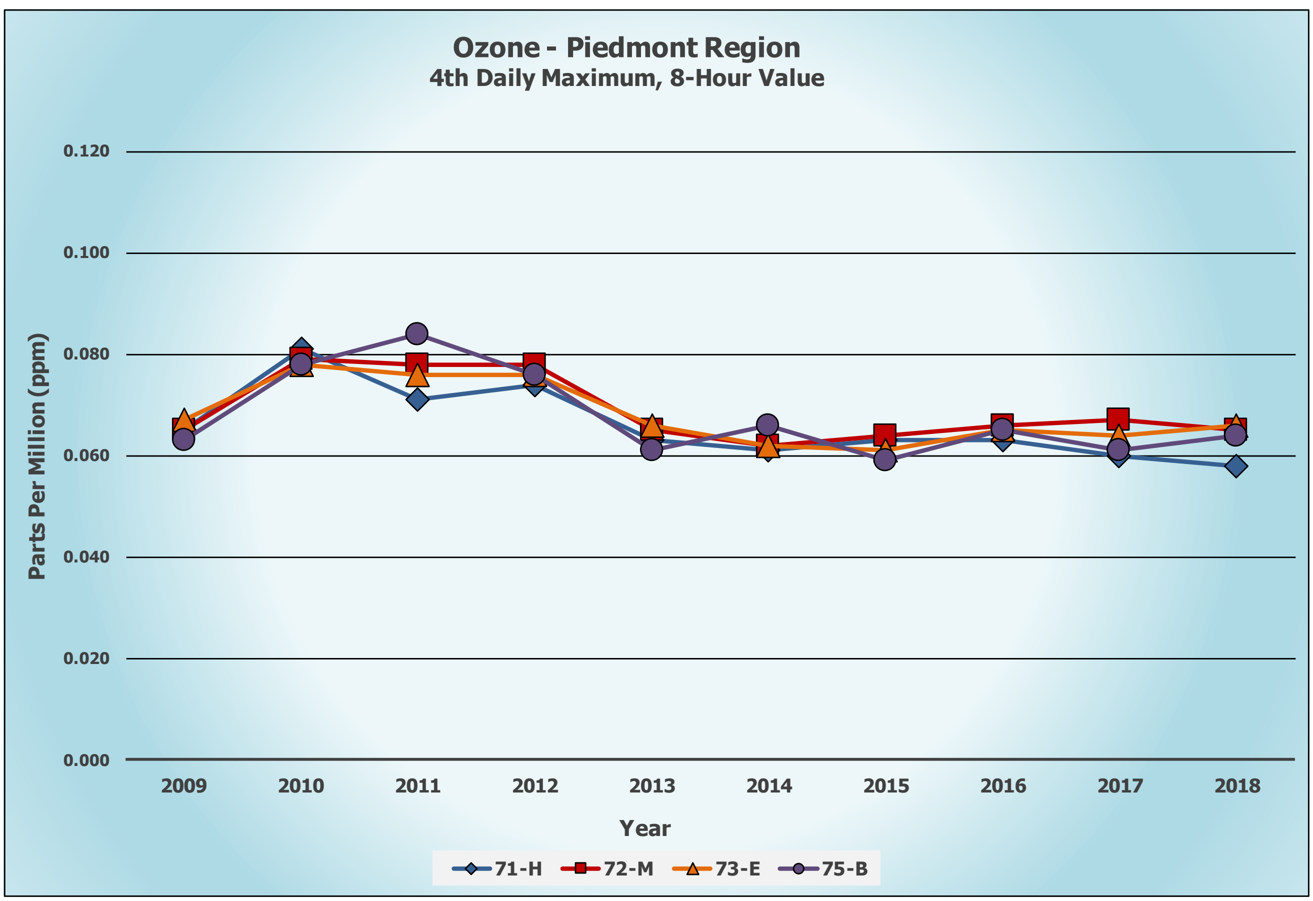
0.100
0.080
0.060
0.040
0.020
0.000
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
19-A6


Ozone - Piedmont Region
4th Daily Maximum, 8-Hour Value
Parts Per Million (ppm)
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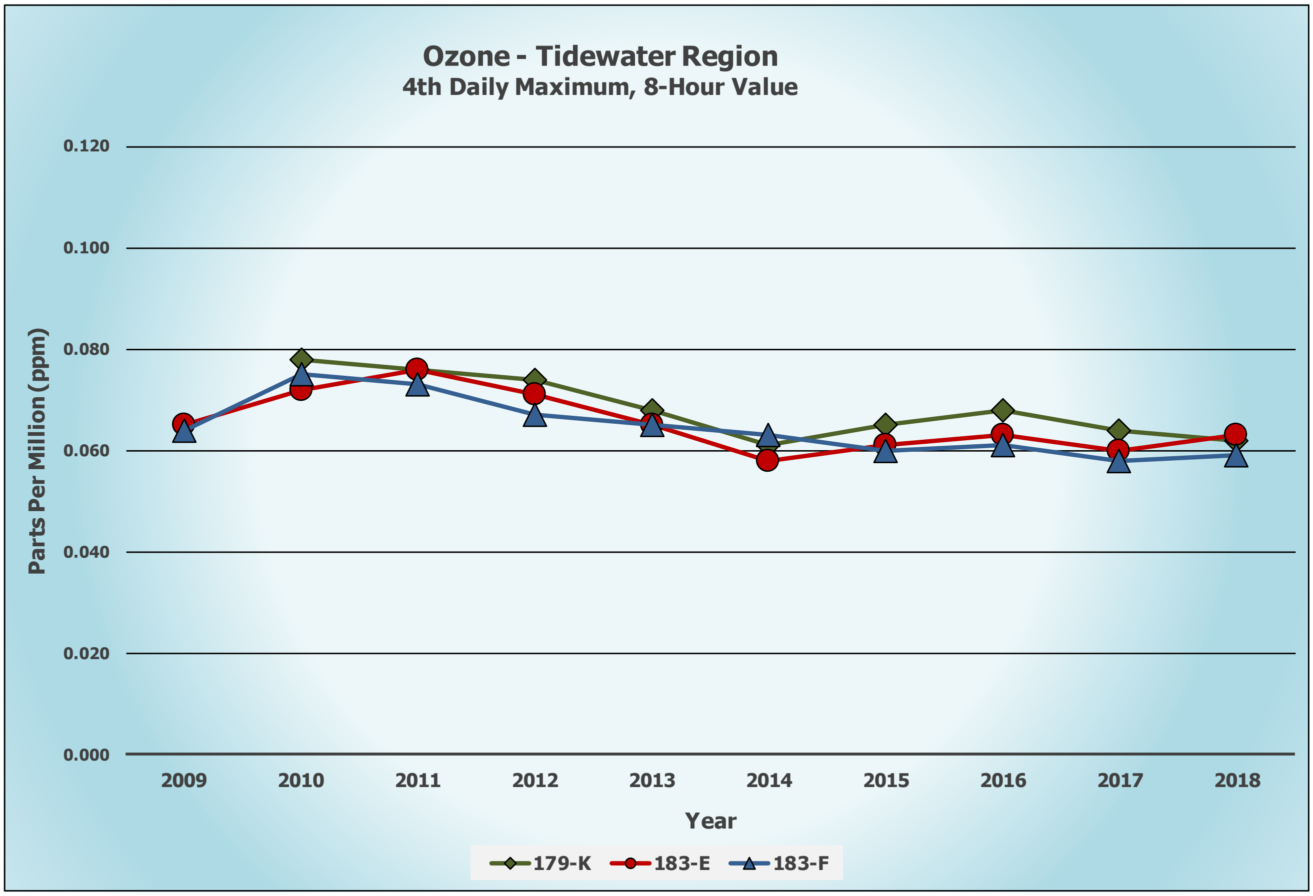
0.100
0.080
0.060
0.040
0.020
0.000
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
71-H
72-M
73-E
75-B


Ozone - Tidewater Region
4th Daily Maximum, 8-Hour Value
Parts Per Million (ppm)
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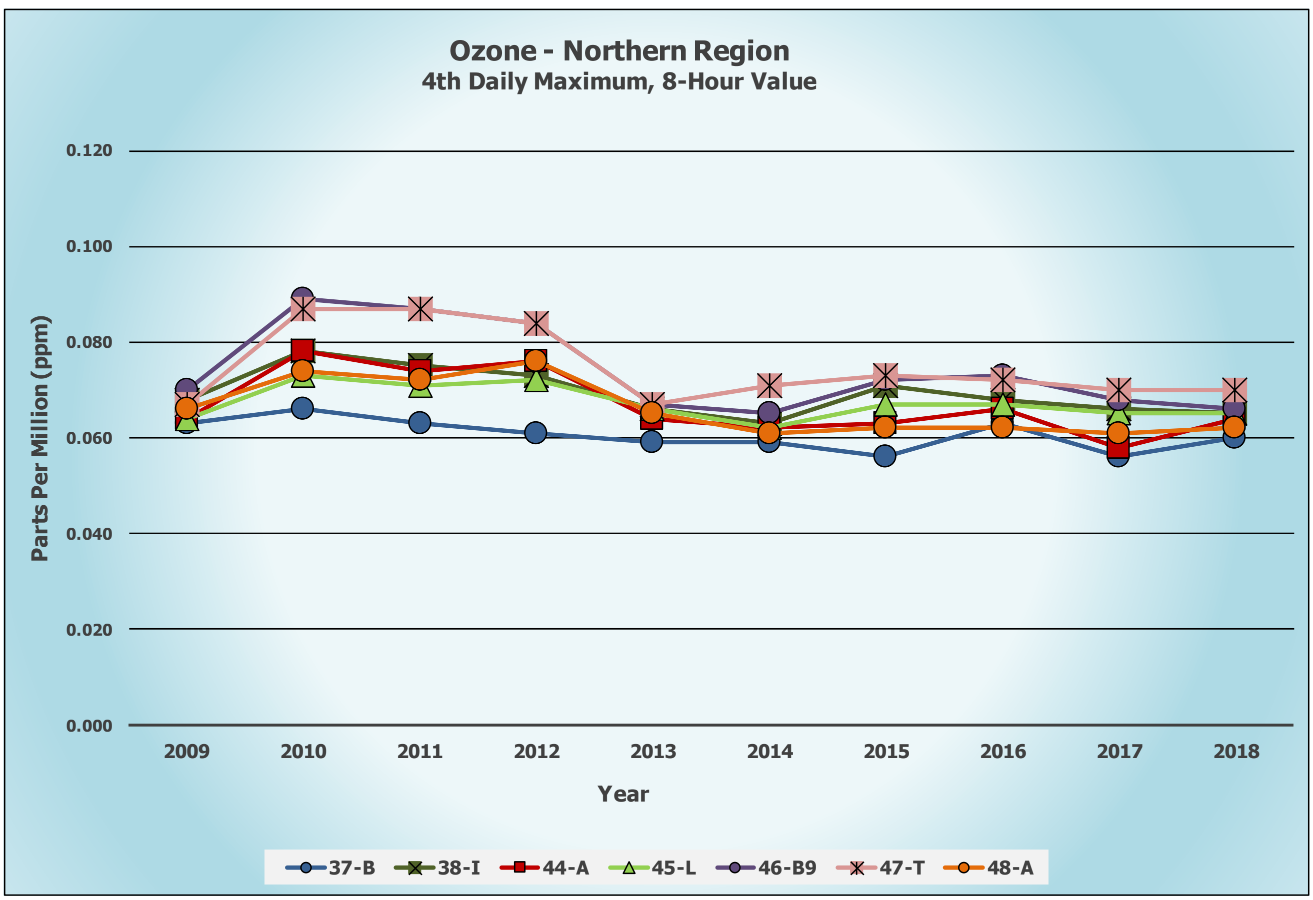
0.100
0.080
0.060
0.040
0.020
0.000
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
179-K
183-E
183-F


Ozone - Northern Region
4th Daily Maximum, 8-Hour Value
Parts Per Million (ppm)
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0.100
0.080
0.060
0.040
0.020
0.000
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Year
37-B
38-I
44-A
45-L
46-B9
47-T
48-A

Lead Monitoring Network

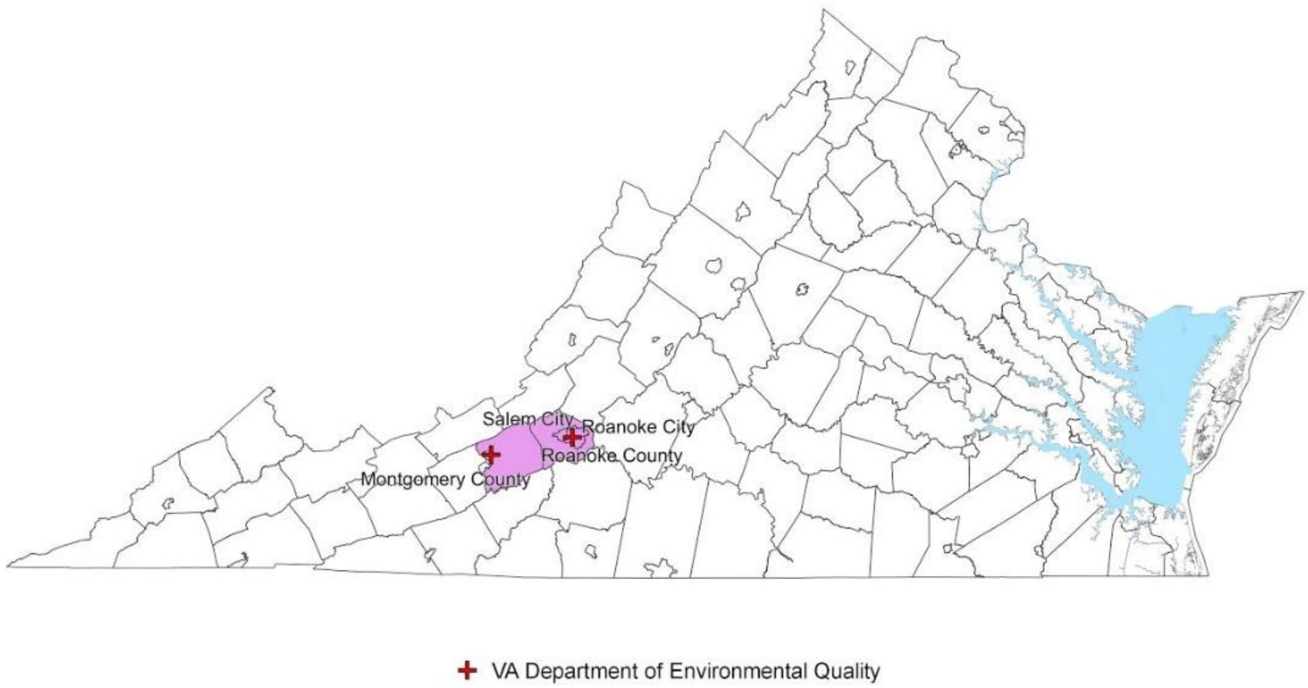
Lead (Pb) is a metal found naturally in the environment as well as in manufactured products. In the past, emissions from cars and trucks using leaded gasoline were the primary sources of lead in the atmosphere. Efforts by EPA to remove lead from motor vehicle gasoline resulted in dramatic reductions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

To measure lead, ambient air is drawn into a high volume sampler. The sample air flows across an 8 x 10 inch glass fiber filter at a rate of 39-60 cubic feet per minute for a 24-hour period. The filter is sent to the Division of Consolidated Laboratories, where a small portion of it is analyzed using inductively coupled plasma – mass spectrometry (ICP-MS). The resulting lead concentration is reported as micrograms per cubic meter ($\mu g/m^3$). The normal sampling schedule is once every sixth day from midnight to midnight. The lead sampling schedule for 2018 can be found here at Lead Sampling Calendar.

Lead Monitoring Network



National Ambient Air Quality Standards (NAAQS)

Primary Standard for Pb:

- 0.15 µg/m^3 three-month rolling average

Secondary Standard for Pb:

- Same as Primary

2018 Pb 3-Month Averages (units in µg/m^3, LC)

Site	No. Valid 3-Month Observations	1st Max	2nd Max	>0.15 µg/m^3
(18-C) **Montogomery Co.**	12	0.00	0.00	0
(109-N) **Roanoke**	12	0.02	0.02	0

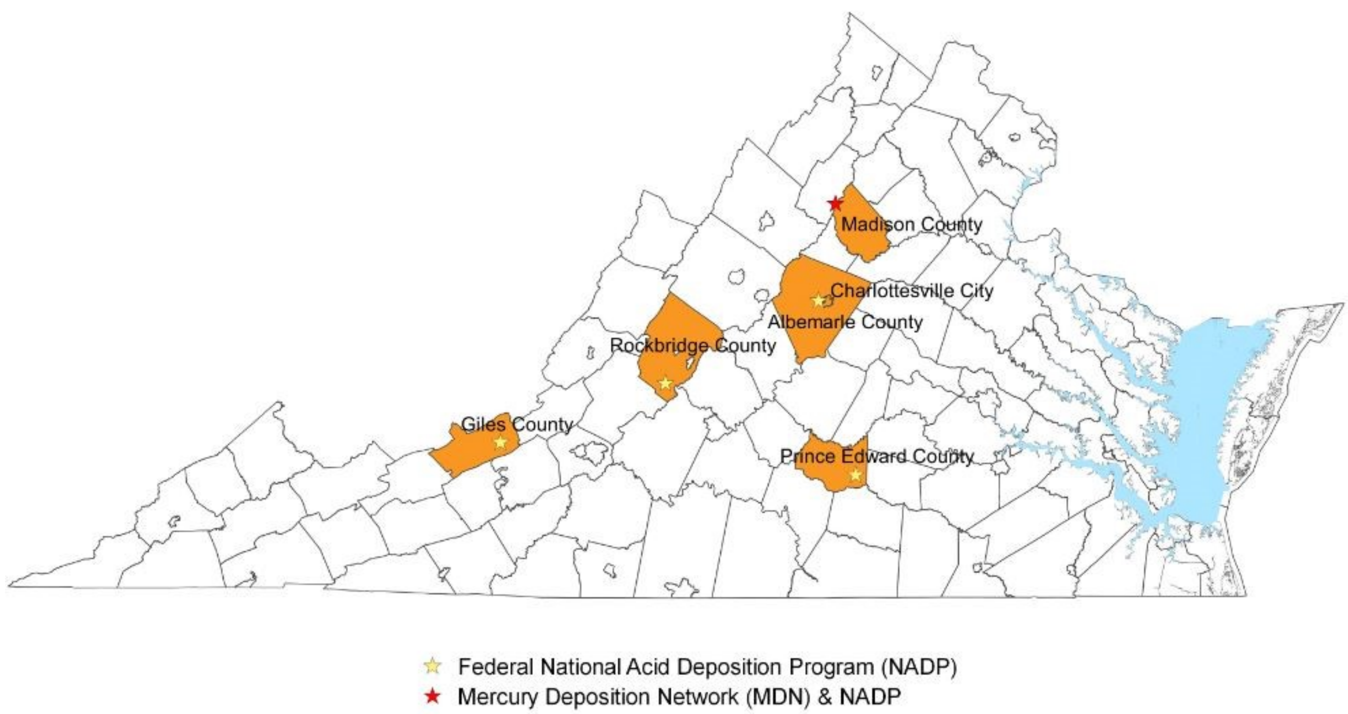
Acid Precipitation Network

Air Toxics Monitoring Network

Acid Precipitation Network

The National Acid Deposition Program (NADP) had five monitoring sites in Virginia in 2018: 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 National Atmospheric Deposition Program 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 Mercury Deposition Network.



Air Toxics Monitoring Network

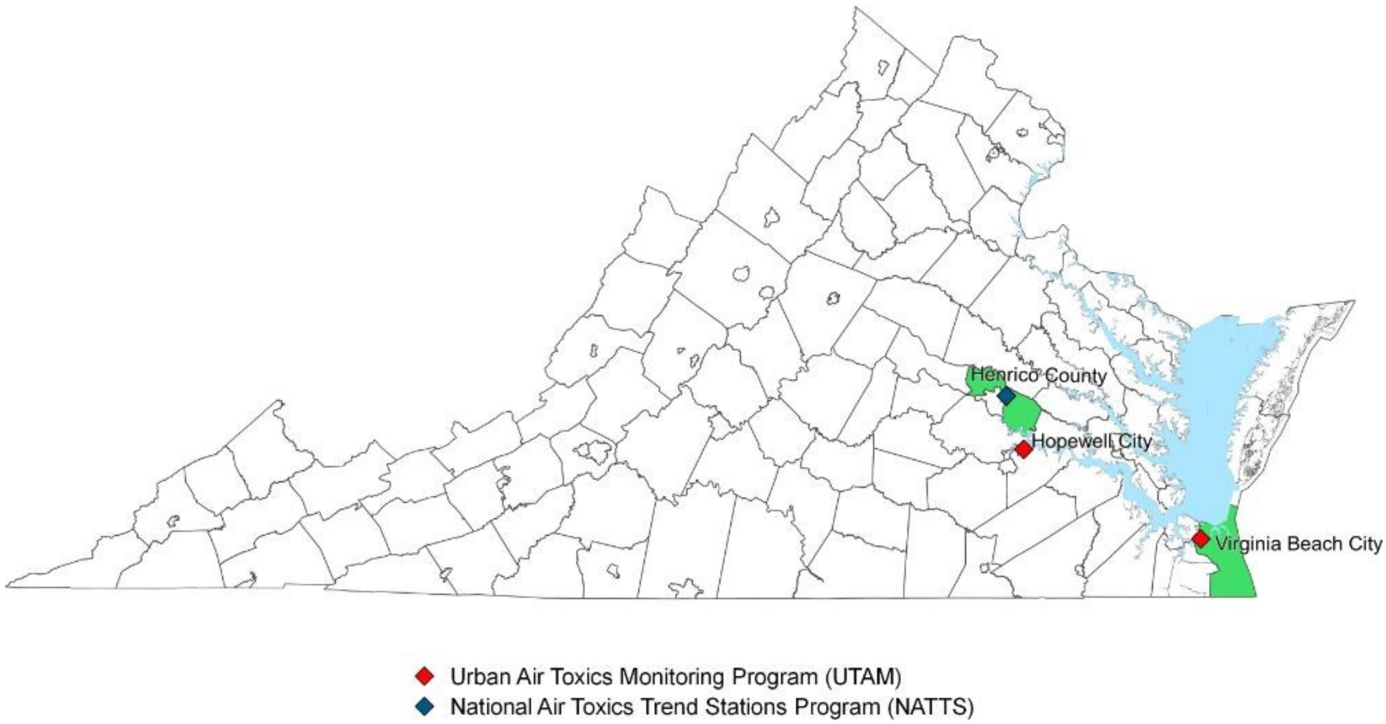
In 2018, the Office of Air Quality Monitoring (AQM) of the Department of Environmental Quality (DEQ) operated an Air Toxics Monitoring Network (ATMN). The ATMN consists of three separate monitoring programs. The Urban Air Toxics Monitoring Program (UATM), The National Air Toxics Trend Stations Program (NATTS), and The Community Air Toxics Assessment Monitoring Program (CAMP).

The UATM program consisted of two sites that were located at the Carter G. Woodson Middle School in Hopewell and the DEQ Tidewater Regional Office (TRO) in Virginia Beach. Sampling at these sites consisted of Volatile Organic Compounds (VOC), Carbonyls, and Total Suspended Particulate (TSP) Metals. Each of the UATM sites had a sampling schedule consisting of 24-hour samples collected every 6th day. Data from these sites will be used to characterize air toxics concentrations in the respective urban areas.

AQM used the manual method for collecting ambient air samples for VOC analysis. Whole air samples were collected using evacuated Silco^{T} or SUMMA^{T} canisters and RMESI (RM Environmental Systems, Inc.) air samplers. The Division of Consolidated Laboratory Services (DCLS), the Virginia state laboratory, analyzed samples. DCLS used a Gas Chromatograph equipped with a Mass Selective Detector and employed method TO15. Carbonyls were collected on DNPH (2,4-Dinitrophenylhydrazine) treated sorbent tubes using ATEC 8000 cartridge samplers. Samples taken were analyzed by the DCLS, using a Liquid Chromatographic procedure designated as method TO11A. Metals samples were collected using a high volume Total Suspended Particulate (TSP) sampler and were analyzed by the DCLS. Analysis utilized inductively coupled plasma mass spectrometry (ICP-MS) using method IO-3.1 and IO-3.5.

The NATTS program operated one station located at the MathScience Innovation Center (MSIC) in Henrico County. The NATTS site had a sampling schedule consisting of 24-hour samples collected every 6th day. Data from this site will be evaluated along with data from all of the NATTS sites nationally. AQM used the manual method for collecting ambient air samples for VOC analysis. Whole air samples were collected using evacuated Silco^{T} 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, 2018- Concentrations are in ppbV

(non detects are counted as zeros for statistical purposes)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
43205	Propylene	54	0.00	0.45	0.00	0.037	0.118
43207	Freon 113	54	0.07	0.13	0.08	0.082	0.009
43208	Freon 114	54	0.00	0.00	0.00	0.000	0.000
43209	Ethyl Acetate	54	0.00	0.18	0.00	0.012	0.032
43218	1,3-Butadiene	54	0.00	0.00	0.00	0.000	0.000
43231	Hexane	54	0.00	0.41	0.08	0.087	0.065
43232	Heptane	54	0.00	0.10	0.00	0.019	0.032
43248	Cyclohexane	54	0.00	0.01	0.00	0.000	0.001
43372	MTBE	54	0.00	0.00	0.00	0.000	0.000
43441	Methyl Methacrylate	54	0.00	0.00	0.00	0.000	0.000
43505	Acrolein	54	0.00	1.11	0.20	0.214	0.258
43702	Acetonitrile	54	0.00	1.07	0.27	0.235	0.200
43704	Acrylonitrile	54	0.00	0.00	0.00	0.000	0.000
43801	Chloromethane	54	0.44	0.70	0.59	0.593	0.071
43802	Dichloromethane	54	0.09	0.87	0.17	0.197	0.118
43803	Chloroform	54	0.02	0.04	0.02	0.025	0.006
43804	Carbon Tetrachloride	54	0.06	0.16	0.08	0.084	0.015
43806	Bromoform (Tribromomethane)	54	0.00	0.07	0.00	0.003	0.012
43811	Trichlorofluoromethane	54	0.21	0.46	0.26	0.262	0.035
43812	Chloroethane	54	0.00	0.00	0.00	0.000	0.000
43813	1,1-Dichloroethane	54	0.00	0.00	0.00	0.000	0.000
43814	Methyl chloroform	54	0.00	0.00	0.00	0.000	0.000
43815	Ethylene dichloride	54	0.00	0.00	0.00	0.000	0.000
43817	Tetrachloroethylene	54	0.00	0.04	0.02	0.018	0.013
43818	1,1,2,2-Tetrachloroethane	54	0.00	0.05	0.00	0.004	0.010
43819	Bromomethane	54	0.00	0.00	0.00	0.000	0.000
43820	1,1,2-Trichloroethane	54	0.00	0.05	0.00	0.005	0.012
43823	Dichlorodifluoromethane	54	0.46	0.62	0.55	0.548	0.039
43824	Trichloroethylene	54	0.00	0.03	0.00	0.001	0.004
43826	1,1-Dichloroethylene	54	0.00	0.00	0.00	0.000	0.000
43828	Bromodichloromethane	54	0.00	0.00	0.00	0.000	0.000
43829	1,2-Dichloropropane	54	0.00	0.00	0.00	0.000	0.000
43830	trans-1,3-Dichlopropylene	54	0.00	0.00	0.00	0.000	0.000
43831	cis-1,3-Dichlopropylene	54	0.00	0.00	0.00	0.000	0.000
43832	Dibromochloromethane	54	0.00	0.03	0.00	0.001	0.006
43838	Trans-1,2-Dichloroethene	54	0.00	0.00	0.00	0.000	0.000
43839	cis-1,2-Dichloroethene	54	0.00	0.00	0.00	0.000	0.000
43843	Ethylene Dibromide	54	0.00	0.12	0.00	0.008	0.023
43844	Hexachlorobutadiene	54	0.00	0.02	0.00	0.001	0.004
43860	Vinyl Chloride	54	0.00	0.00	0.00	0.000	0.000
45109	m/p-Xylene	54	0.00	0.16	0.05	0.058	0.032
45201	Benzene	54	0.03	0.26	0.11	0.118	0.049
45202	Toluene	54	0.03	0.62	0.15	0.165	0.101
45203	Ethylbenzene	54	0.00	0.06	0.02	0.020	0.014
45204	o-Xylene	54	0.00	0.07	0.02	0.025	0.014
45207	1,3,5-Trimethylbenzene	54	0.00	0.02	0.00	0.004	0.006
45208	1,2,4-Trimethylbenzene	54	0.00	0.22	0.03	0.046	0.043
45213	p-Ethyltoluene	54	0.00	0.09	0.00	0.007	0.017
45220	Styrene	54	0.00	0.17	0.00	0.024	0.040
45801	Chlorobenzene	54	0.00	0.13	0.00	0.012	0.029
45805	1,2-Dichlorobenzene	54	0.00	0.27	0.00	0.032	0.064
45806	1,3-Dichlorobenzene	54	0.00	0.39	0.00	0.045	0.092
45807	1,4-Dichlorobenzene	54	0.00	0.45	0.01	0.058	0.117
45810	1,2,4-Trichlorobenzene	54	0.00	0.45	0.00	0.059	0.119
46401	Tetrahydrofuran	54	0.00	0.11	0.00	0.005	0.018

Detectable VOC in 24-Hour Canister Samples
GC/MSD - Carter G. Woodson Middle School (UATM Site), Hopewell, VA
January 1 to December 31, 2018 - Concentrations are in ppbV

(NonDetects are considered zeros for statistical purposes. Results below MDLs and/or Reporting Limits are reported.)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
43205	Propylene	57	0.00	2.08	0.00	0.036	0.112
43207	Freon 113	57	0.07	5.02	0.08	0.088	0.022
43208	Freon 114	57	0.00	0.00	0.00	0.000	0.000
43209	Ethyl Acetate	57	0.00	0.41	0.00	0.007	0.020
43218	1,3-Butadiene	57	0.00	0.00	0.00	0.000	0.000
43231	N-Hexane	57	0.00	4.97	0.09	0.087	0.075
43232	N-Heptane	57	0.00	3.18	0.00	0.056	0.153
43248	Cyclohexane	57	0.00	0.09	0.00	0.002	0.006
43372	Methyl Tert-Butyl Ether	57	0.00	0.00	0.00	0.000	0.000
43441	Methyl Methacrylate	57	0.00	0.00	0.00	0.000	0.000
43505	Acrolein	57	0.00	22.11	0.34	0.388	0.370
43702	Acetonitrile	57	0.00	20.18	0.33	0.354	0.537
43704	Acrylonitrile	57	0.00	0.00	0.00	0.000	0.000
43801	Chloromethane	57	0.48	33.98	0.60	0.596	0.062
43802	Dichloromethane	57	0.06	6.53	0.11	0.115	0.054
43803	Chloroform	57	0.00	1.35	0.02	0.024	0.010
43804	Carbon Tetrachloride	57	0.04	4.21	0.07	0.074	0.016
43806	Bromoform	57	0.00	0.03	0.00	0.001	0.003
43811	Trichlorofluoromethane	57	0.00	14.18	0.25	0.249	0.037
43812	Ethyl Chloride	57	0.00	0.00	0.00	0.000	0.000
43813	1,1-Dichloroethane	57	0.00	0.02	0.00	0.000	0.003
43814	Methyl Chloroform	57	0.00	0.00	0.00	0.000	0.000
43815	1,2-Dichloroethane	57	0.00	0.00	0.00	0.000	0.000
43817	Tetrachloroethylene	57	0.00	0.80	0.01	0.014	0.012
43818	1,1,2,2-Tetrachloroethane	57	0.00	0.11	0.00	0.002	0.005
43819	Bromomethane	57	0.00	0.00	0.00	0.000	0.000
43820	1,1,2-Trichloroethane	57	0.00	0.06	0.00	0.001	0.005
43823	Dichlorodifluoromethane	57	0.46	31.06	0.55	0.545	0.038
43824	Trichloroethylene	57	0.00	0.09	0.00	0.002	0.006
43826	1,1-Dichloroethene	57	0.00	0.02	0.00	0.000	0.003
43828	Bromodichloromethane	57	0.00	0.00	0.00	0.000	0.000
43829	1,2-Dichloropropane	57	0.00	0.00	0.00	0.000	0.000
43830	trans-1,3-Dichloropropylene	57	0.00	0.00	0.00	0.000	0.000
43831	Cis-1,3-Dichloropropylene	57	0.00	0.00	0.00	0.000	0.000
43832	Dibromochloromethane	57	0.00	0.02	0.00	0.000	0.003
43838	trans-1,2-Dichloroethene	57	0.00	0.00	0.00	0.000	0.000
43839	cis-1,2-Dichloroethene	57	0.00	0.00	0.00	0.000	0.000
43843	1,2-Dibromoethane	57	0.00	0.24	0.00	0.004	0.011
43844	Hexachloro-1,3-Butadiene	57	0.00	0.06	0.00	0.001	0.005
43860	Vinyl Chloride	57	0.00	0.00	0.00	0.000	0.000
45109	m & p- Xylene	57	0.00	2.85	0.04	0.050	0.032
45201	Benzene	57	0.03	6.63	0.10	0.116	0.058
45202	Toluene	57	0.03	9.42	0.13	0.165	0.186
45203	Ethylbenzene	57	0.00	0.98	0.02	0.017	0.014
45204	o-Xylene	57	0.00	1.19	0.02	0.021	0.015
45207	1,3,5-Trimethylbenzene	57	0.00	0.27	0.00	0.005	0.009
45208	1,2,4-Trimethylbenzene	57	0.00	2.14	0.02	0.038	0.045
45213	4-Ethyltoluene	57	0.00	0.44	0.00	0.008	0.028
45220	Styrene	57	0.00	1.75	0.01	0.031	0.050
45801	Chlorobenzene	57	0.00	0.47	0.00	0.008	0.019
45805	1,2-Dichlorobenzene	57	0.00	1.04	0.00	0.018	0.030
45806	1,3-Dichlorobenzene	57	0.00	1.46	0.00	0.026	0.043
45807	1,4-Dichlorobenzene	57	0.00	1.99	0.01	0.035	0.059
45810	1,2,4-Trichlorobenzene	57	0.00	2.18	0.00	0.038	0.080
46401	Tetrahydrofuran	57	0.00	0.10	0.00	0.002	0.009

Detectable VOC in 24-Hour Canister Samples
GC/MSD - Tidewater Regional Office (UATM Site), Va. Beach, VA
January 1 to December 31, 2018 – Concentrations are in ppbV

(NonDetects are considered zeros for statistical purposes. Results below MDLs and/or Reporting Limits are reported.)

Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
43205	Propylene	55	0.00	1.00	0.00	0.074	0.191
43207	Freon 113	55	0.00	0.12	0.08	0.075	0.025
43208	Freon 114	55	0.00	0.00	0.00	0.000	0.000
43209	Ethyl Acetate	55	0.00	0.08	0.00	0.004	0.015
43218	1,3-Butadiene	55	0.00	0.00	0.00	0.000	0.000
43231	N-Hexane	55	0.00	0.45	0.10	0.117	0.096
43232	N-Heptane	55	0.00	0.13	0.03	0.037	0.042
43248	Cyclohexane	55	0.00	0.06	0.00	0.003	0.011
43372	Methyl Tert-Butyl Ether	55	0.00	0.00	0.00	0.000	0.000
43441	Methyl Methacrylate	55	0.00	0.00	0.00	0.000	0.000
43505	Acrolein	55	0.00	2.73	0.34	0.423	0.410
43702	Acetonitrile	54	0.00	17.68	1.80	3.235	4.088
43704	Acrylonitrile	55	0.00	0.00	0.00	0.000	0.000
43801	Chloromethane	55	0.44	0.90	0.64	0.640	0.092
43802	Dichloromethane	55	0.06	0.45	0.10	0.108	0.052
43803	Chloroform	55	0.00	0.07	0.03	0.027	0.011
43804	Carbon Tetrachloride	55	0.03	0.23	0.08	0.079	0.027
43806	Bromoform	55	0.00	0.12	0.00	0.003	0.016
43811	Trichlorofluoromethane	55	0.21	0.32	0.25	0.253	0.020
43812	Ethyl Chloride	55	0.00	0.00	0.00	0.000	0.000
43813	1,1-Dichloroethane	55	0.00	0.04	0.00	0.001	0.005
43814	Methyl Chloroform	55	0.00	0.04	0.00	0.001	0.005
43815	1,2-Dichloroethane	55	0.00	0.05	0.00	0.001	0.007
43817	Tetrachloroethylene	55	0.00	0.35	0.03	0.059	0.069
43818	1,1,2,2-Tetrachloroethane	55	0.00	0.04	0.00	0.003	0.007
43819	Bromomethane	55	0.00	0.00	0.00	0.000	0.000
43820	1,1,2-Trichloroethane	55	0.00	0.03	0.00	0.003	0.007
43823	Dichlorodifluoromethane	55	0.45	0.62	0.54	0.541	0.039
43824	Trichloroethylene	55	0.00	0.04	0.00	0.002	0.007
43826	1,1-Dichloroethene	55	0.00	0.04	0.00	0.001	0.005
43828	Bromodichloromethane	55	0.00	0.04	0.00	0.001	0.005
43829	1,2-Dichloropropane	55	0.00	0.05	0.00	0.001	0.007
43830	trans-1,3-Dichloropropylene	55	0.00	0.00	0.00	0.000	0.000
43831	Cis-1,3-Dichloropropylene	55	0.00	0.03	0.00	0.001	0.004
43832	Dibromochloromethane	55	0.00	0.08	0.00	0.001	0.011
43838	trans-1,2-Dichloroethene	55	0.00	0.00	0.00	0.000	0.000
43839	cis-1,2-Dichloroethene	55	0.00	0.04	0.00	0.001	0.005
43843	1,2-Dibromoethane	55	0.00	0.05	0.00	0.006	0.012
43844	Hexachloro-1,3-Butadiene	55	0.00	0.04	0.00	0.002	0.006
43860	Vinyl Chloride	55	0.00	0.00	0.00	0.000	0.000
45109	m & p- Xylene	55	0.00	0.23	0.06	0.065	0.045
45201	Benzene	55	0.07	6.51	0.14	0.468	1.137
45202	Toluene	55	0.04	0.81	0.16	0.200	0.166
45203	Ethylbenzene	55	0.00	0.07	0.02	0.024	0.016
45204	o-Xylene	55	0.00	0.07	0.02	0.024	0.018
45207	1,3,5-Trimethylbenzene	55	0.00	0.03	0.00	0.005	0.008
45208	1,2,4-Trimethylbenzene	55	0.00	0.21	0.02	0.038	0.043
45213	4-Ethyltoluene	55	0.00	0.21	0.00	0.012	0.034
45220	Styrene	55	0.00	0.27	0.02	0.035	0.050
45801	Chlorobenzene	55	0.00	0.67	0.00	0.055	0.142
45805	1,2-Dichlorobenzene	55	0.00	0.17	0.00	0.022	0.040
45806	1,3-Dichlorobenzene	55	0.00	0.24	0.00	0.028	0.054
45807	1,4-Dichlorobenzene	55	0.00	0.34	0.00	0.036	0.070
45810	1,2,4-Trichlorobenzene	55	0.00	0.47	0.00	0.038	0.096
46401	Tetrahydrofuran	55	0.00	0.03	0.00	0.001	0.004

24 Hour Carbonyl Sampling 2018 Summary Statistical Analysis

Concentrations are in ug/m^3

(non detects are counted as zeros for statistical purposes)

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Carter G. Woodson Middle School	43502	Formaldehyde	60	0.62	5.15	1.69	1.946	1.050
	43503	Acetaldehyde	60	0.43	2.42	1.25	1.256	0.411
	43504	Propionaldehyde	60	0.00	0.48	0.20	0.211	0.099
	43552	Methyl Ethyl Ketone	60	0.00	0.90	0.44	0.410	0.198
	43560	Methyl Isobutyl Ketone	60	0.00	0.00	0.00	0.000	0.000

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Tidewater Regional Office	43502	Formaldehyde	58	0.21	8.43	1.76	2.041	1.368
	43503	Acetaldehyde	58	0.67	2.43	1.18	1.320	0.480
	43504	Propionaldehyde	58	0.11	0.56	0.22	0.242	0.098
	43552	Methyl Ethyl Ketone	58	0.11	1.60	0.53	0.591	0.283
	43560	Methyl Isobutyl Ketone	58	0.00	0.11	0.00	0.003	0.018

NATTS Carbonyl Sampling 2018 Summary Statistical Analysis

Concentrations are in ug/m^3

(non detects are counted as zeros for statistical purposes)

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
MathScience Innovation Center	43502	Formaldehyde	60	0.97	6.35	2.19	2.551	1.366
	43503	Acetaldehyde	60	0.60	2.87	1.20	1.229	0.421
	43504	Propionaldehyde	60	0.00	0.82	0.22	0.236	0.126
	43551	Acetone	60	0.37	8.22	2.75	2.922	1.536
	43552	Methyl Ethyl Ketone	60	0.06	1.15	0.46	0.462	0.229
	43560	Methyl Isobutyl Ketone	60	0.00	0.13	0.00	0.003	0.017

TSP Metals Sampling 2018 Summary Statistical Analysis

Concentrations are in ng/m^3

(non detects are counted as zeros for statistical purposes)

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Carter G. Woodson Middle School	12103	Arsenic	61	0.31	3.71	1.21	1.251	0.657
	12105	Beryllium	61	0.00	0.08	0.00	0.006	0.012
	12110	Cadmium	61	0.00	0.43	0.09	0.109	0.084
	12112	Chromium	61	1.44	6.22	2.73	2.836	0.796
	12128	Lead	61	0.63	12.94	2.77	3.174	1.909
	12132	Manganese	61	2.43	77.67	10.33	14.825	13.206
	12136	Nickel	61	0.45	2.31	1.19	1.270	0.406

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
Tidewater Regional Office	12103	Arsenic	58	0.21	4.14	0.60	0.904	0.761
	12105	Beryllium	58	0.00	0.02	0.00	0.003	0.004
	12110	Cadmium	58	0.00	0.17	0.04	0.044	0.033
	12112	Chromium	58	1.00	2.87	1.53	1.601	0.414
	12128	Lead	58	0.37	5.94	1.57	1.820	1.135
	12132	Manganese	58	1.24	18.64	4.71	6.151	4.244
	12136	Nickel	58	0.34	2.09	0.68	0.796	0.383

NATTS PM10 Metals Sampling 2018 Summary Statistical Analysis

Concentrations are in ng/m^3

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

Site	Parameter	Compound Name	Num	Minimum	Maximum	Median	Average	StDev
MathScience Innovation Center	82103	Arsenic	60	0.14	3.09	0.54	0.699	0.529
	82105	Beryllium	60	0.00	0.00	0.00	0.002	0.002
	82110	Cadmium	60	0.00	0.16	0.05	0.054	0.027
	82112	Chromium	60	0.94	1.89	1.24	1.235	0.178
	82128	Lead	60	0.33	4.80	1.32	1.523	0.897
	82132	Manganese	60	0.42	5.82	1.77	1.957	1.096
	82136	Nickel	60	0.25	0.91	0.49	0.494	0.139

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 its Air Quality Index webpage. 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 AirNow.

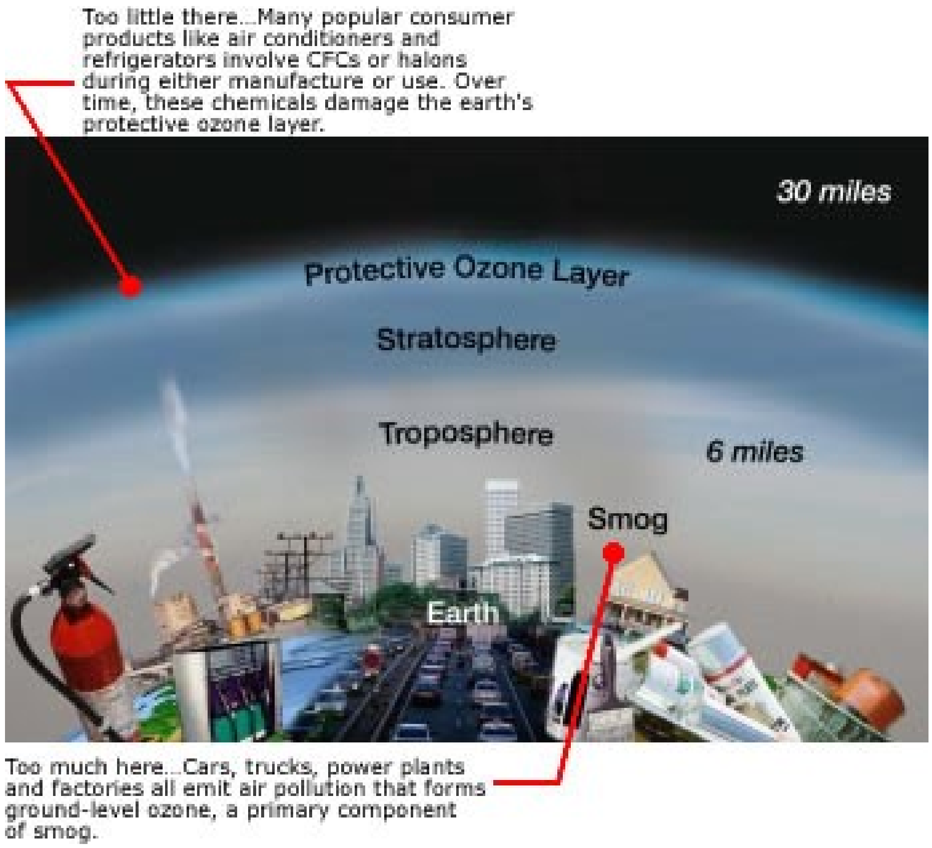
In addition to the internet, current and forecasted AQI levels are broadcast on local television and radio weather reports in many areas, as well as printed in newspapers. By reaching out to the public using these different media, individuals can plan their activities to reduce exposure during episodes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

Air Quality Index (0-500)	Levels of Health Concern	Meaning
(0-50)	Good	Air quality is considered satisfactory, and air pollution poses little or no risk.
(51-100)	Moderate	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.
(101-150)	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
(151-200)	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
(201-300)	Very Unhealthy	Health warnings of emergency conditions. The entire population is more likely to be affected.
(301-500)	Hazardous	Health alert: everyone may experience more serious health effects.

Note: Values above 500 are considered Beyond the AQI. Follow recommendations for the "Hazardous category." Additional information on reducing exposure to extremely high levels of particle pollution is available "here"

OZONE



What is ozone?

Ozone is a gas that occurs both in the Earth's upper atmosphere and at ground level. Ozone can be "good" or "bad" for your health and the environment, depending on its location in the atmosphere.

How Can Ozone Be Both Good and Bad?

Ozone occurs in two layers of the atmosphere. The layer closest to the Earth's surface is the troposphere. Here, ground-level or "bad" ozone is an air pollutant that is harmful to breathe and it damages crops, trees and other vegetation. It is a main ingredient of urban smog. The troposphere generally extends to a level about 6 miles up, where it meets the second layer, the stratosphere. The stratosphere or "good" ozone layer extends upward from about 6 to 30 miles and protects life on Earth from the sun's harmful ultraviolet (UV) rays.

What is Happening to the "Good" Ozone Layer?

Ozone is produced naturally in the stratosphere. But this "good" ozone is gradually being destroyed by man-made chemicals referred to as ozone-depleting substances (ODS), including chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halons, methyl bromide, carbon tetrachloride, and methyl chloroform. These substances were formerly used and sometimes still are used in coolants, foaming agents, fire extinguishers, solvents, pesticides, and aerosol propellants. Once released into the air these ozone-depleting substances degrade very slowly. In fact, they can remain intact for years as they move through the troposphere until they reach the stratosphere. There they are broken down by the intensity of the sun's UV rays and release chlorine and bromine molecules, which destroy the "good" ozone. Scientists estimate that one chlorine atom can destroy 100,000 "good" ozone molecules.

Even though we have reduced or eliminated the use of many ODSs, their use in the past can still affect the protective ozone layer. Research indicates that depletion of the "good" ozone layer is being reduced worldwide. Thinning of the protective ozone layer can be observed using satellite measurements, particularly over the Polar Regions.

How Does the Depletion of "Good" Ozone Affect Human Health and the Environment?

Ozone depletion can cause increased amounts of UV radiation to reach the Earth which can lead to more cases of skin cancer, cataracts, and impaired immune systems. Overexposure to UV is believed to be contributing to the increase in melanoma, the most fatal of all skin cancers. Since 1990, the risk of developing melanoma has more than doubled.

UV can also damage sensitive crops, such as soybeans, and reduce crop yields. Some scientists suggest that marine phytoplankton, which are the base of the ocean food chain, are already under stress from UV radiation. This stress could have adverse consequences for human food supplies from the oceans.

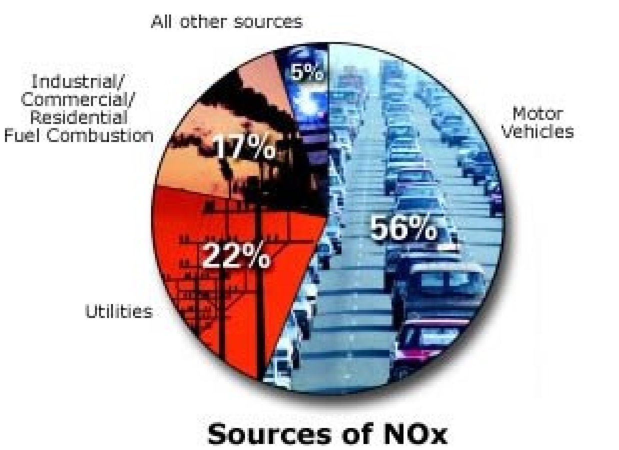
What is Being Done About the Depletion of "Good" Ozone?

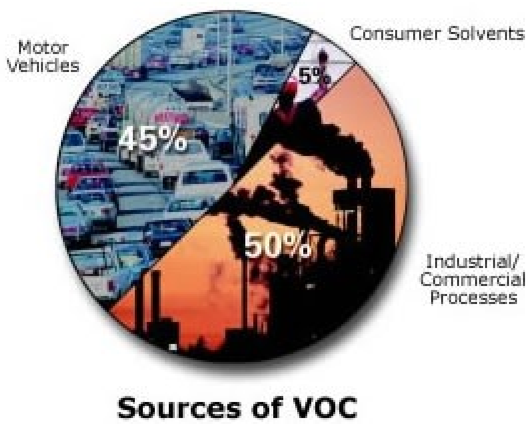
The United States, along with over 180 other countries, recognized the threats posed by ozone depletion and in 1987 adopted a treaty called the Montreal Protocol to phase out the production and use of ozone-depleting substances.

EPA has established regulations to phase out ozone-depleting chemicals in the United States. Warning labels must be placed on all products containing CFCs or similar substances and nonessential uses of ozone-depleting products are prohibited. Releases into the air of refrigerants used in car and home air conditioning units and appliances are also prohibited. Some substitutes to ozone-depleting products have been produced and others are being developed. If the United States and other countries stop producing ozone-depleting substances, natural ozone production should return the ozone layer to normal levels by about 2050.

What Causes "Bad" Ozone?

Ground-level or "bad" ozone is not emitted directly into the air, but is created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight. Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NOx and VOC.





At ground level, ozone is a harmful pollutant. Ozone pollution is a concern during the summer months because strong sunlight and hot weather result in harmful ozone concentrations in the air we breathe. Many urban and suburban areas throughout the United States have high levels of "bad" ozone. But many rural areas of the country are also subject to high ozone levels as winds carry emissions hundreds of miles away from their original sources.

How Does "Bad" Ozone Affect Human Health and the Environment?

Breathing ozone can trigger a variety of health problems including chest pain, coughing, and throat irritation. It can worsen bronchitis, emphysema, and asthma. "Bad" ozone also can reduce lung function and inflame the linings of the lungs. Repeated exposure may permanently scar lung tissue.

Healthy people also experience difficulty breathing when exposed to ozone pollution. Because ozone forms in hot weather, anyone who spends time outdoors in the summer may be affected, particularly children, older people, outdoor workers and people exercising. Millions of Americans live in areas where the national ozone health standards are exceeded.

Ground-level or "bad" ozone also damages vegetation and ecosystems. It leads to reduced agricultural crop and commercial forest yields, reduced growth and survivability of tree seedlings, and increased susceptibility to diseases, pests and other stresses such as harsh weather. In the United States alone, ground-level ozone is responsible for an estimated $500 million in reduced crop production each year. Ground-level ozone also damages the foliage of trees and other plants, affecting the landscape of cities, national parks and forests, and recreation areas.

What Is Being Done About "Bad" Ozone?

Under the Clean Air Act, EPA has set protective health-based standards for ozone in the air we breathe. EPA, state, and cities have instituted a variety of multi-faceted programs to meet these health-based standards. Throughout the country, additional programs are being put into place to cut NOx and VOC emissions from vehicles, industrial facilities, and electric utilities. Programs are also aimed at reducing pollution by reformulating fuels and consumer/commercial products, such as paints and chemical solvents, that contain VOC. Voluntary programs also encourage communities to adopt practices, such as carpooling, to reduce harmful emissions.

High-Altitude "Good" Ozone

- Protect yourself against sunburn. When the UV Index is "high" or "very high": Limit outdoor activities between 10 am and 4 pm, when the sun is most intense. Twenty minutes before going outside, liberally apply a broad-spectrum sunscreen with a Sun Protection Factor (SPF) of at least 15. Reapply every two hours or after swimming or sweating. For UV Index forecasts, check local media reports or visit: https://www.epa.gov/sunsafety/uv-index-1
- Use approved refrigerants in air conditioning and refrigeration equipment. Make sure technicians that work on your car or home air conditioners or refrigerator are certified to recover the refrigerant. Repair leaky air conditioning units before refilling them.

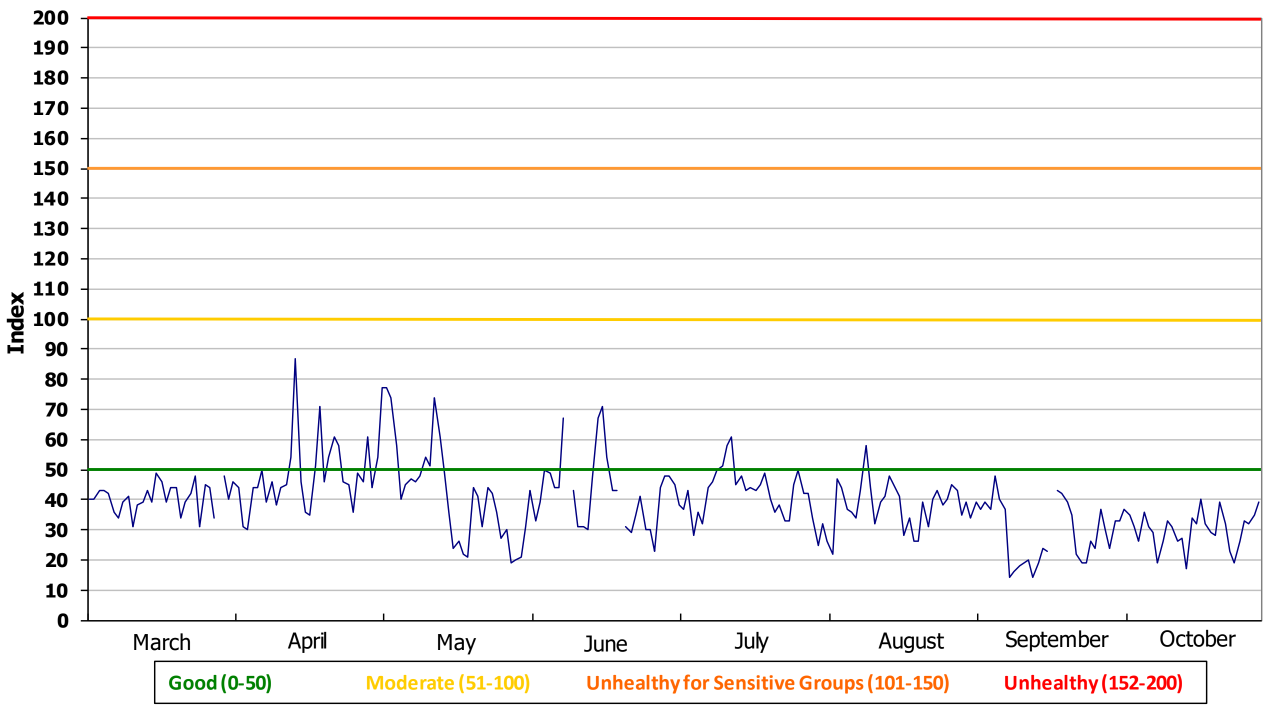
Ground-Level "Bad" Ozone

- Check the air quality forecast in your area. At times when the Air Quality Index (AQI) is forecast to be unhealthy, limit physical exertion outdoors. In many places, ozone peaks in mid-afternoon to early evening. Change the time of day of strenuous outdoor activity to avoid these hours, or reduce the intensity of the activity. For AQI forecasts, check your local media reports or visit: http://epa.gov/airnow
- Help your local electric utilities reduce ozone air pollution by conserving energy at home and the office. Consider setting your thermostat a little higher in the summer. Participate in your local utilities' load-sharing and energy conservation programs.
- Reduce air pollution from cars, trucks, gas-powered lawn and garden equipment, boats and other engines by keeping equipment properly tuned and maintained. During the summer, fill your gas tank during the cooler evening hours and be careful not to spill gasoline. Reduce driving, carpool, use public transportation, walk, or bicycle to reduce ozone pollution, especially on hot summer days.
- Use household and garden chemicals wisely. Use low VOC paints and solvents. And be sure to read labels for proper use and disposal.

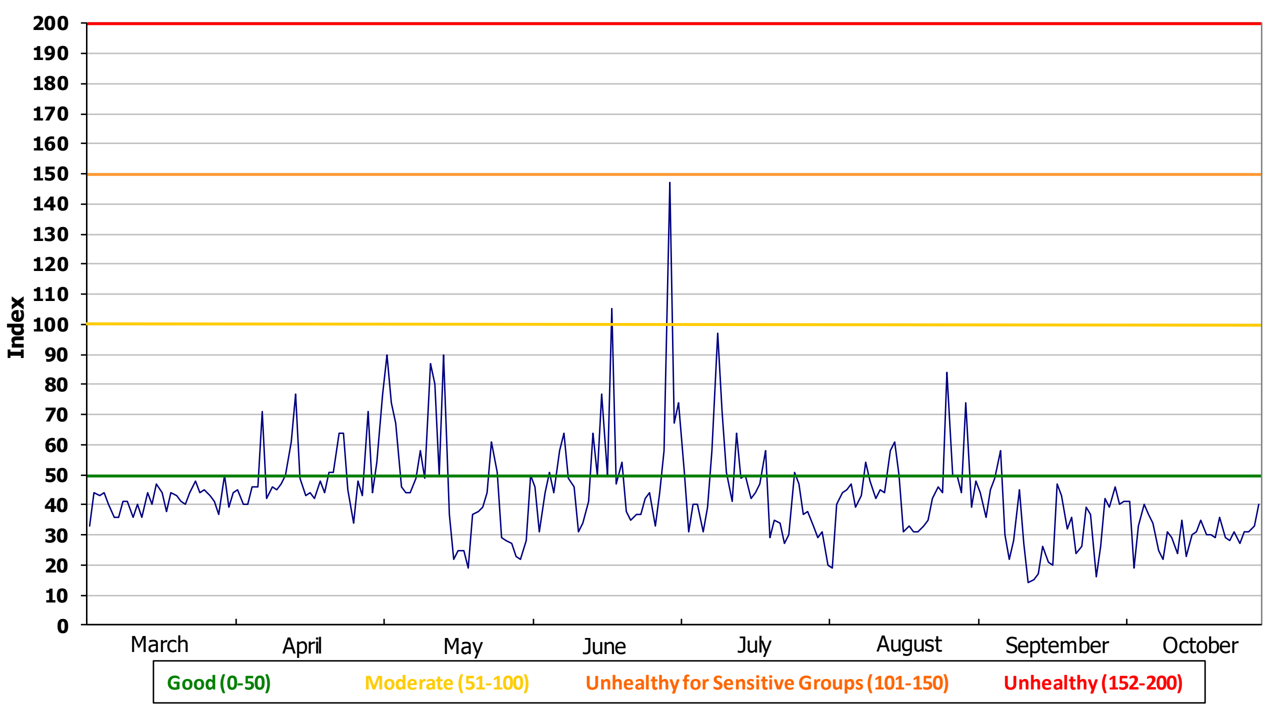
For more information, please visit this site:
[Tips for What You Can Do]

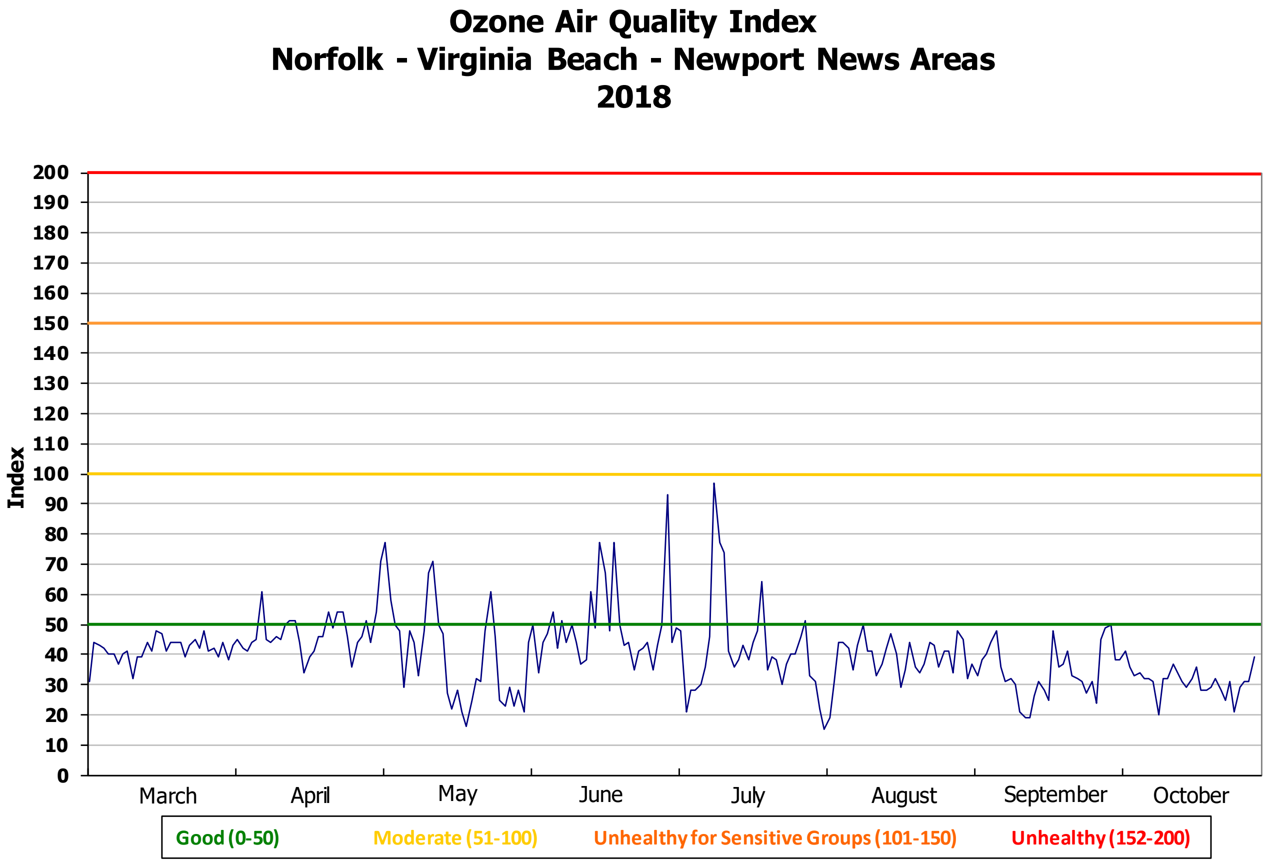
EPA United States Environmental Protection Agency
[Airnow]

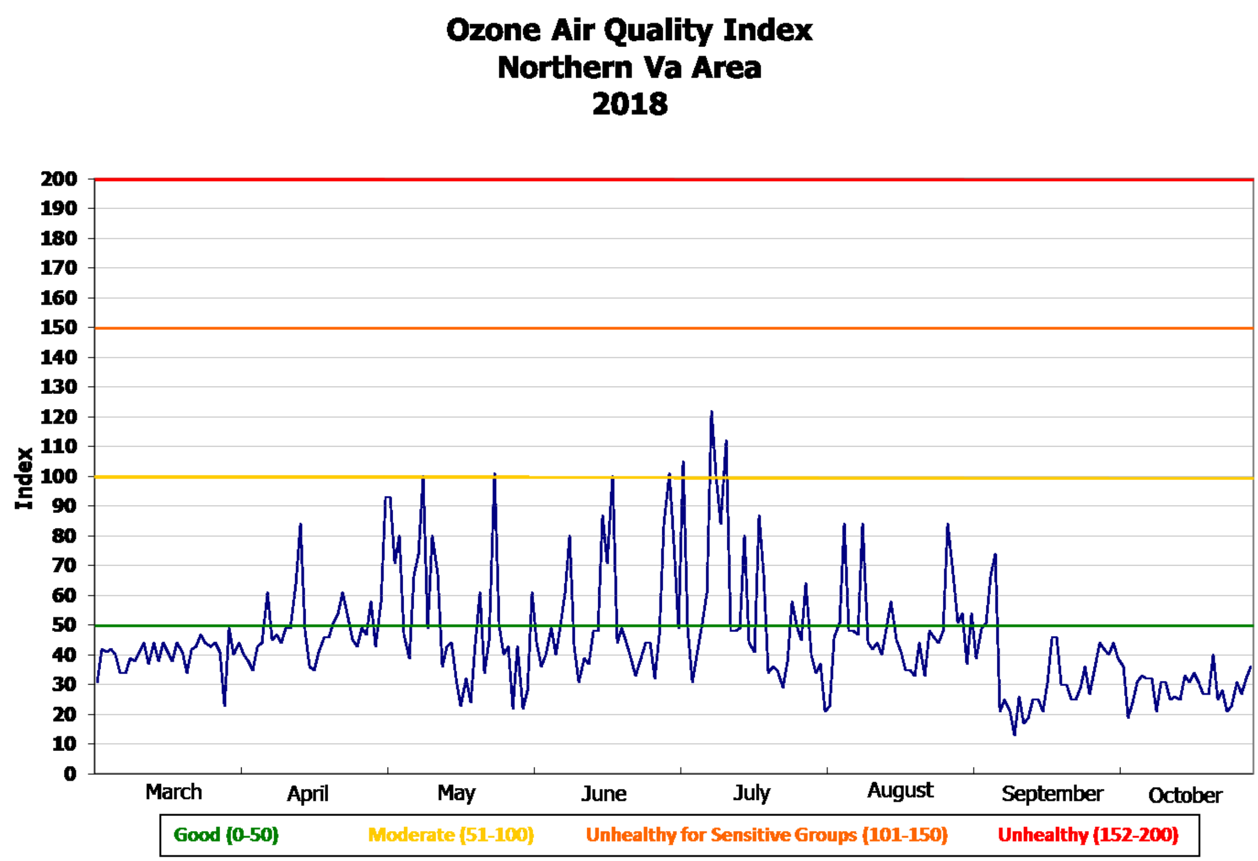
Ozone Air Quality Index
Roanoke Area
2018



Ozone Air Quality Index
Richmond - Petersburg Areas
2018




Ozone Air Quality Index
Norfolk - Virginia Beach - Newport News Areas
2018
Index
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
March
April
May
June
July
August
September
October
Good (0-50)
Moderate (51-100)
Unhealthy for Sensitive Groups (101-150)
Unhealthy (152-200)


Ozone Air Quality Index
Northern Va Area
2018
Index
200
190
180
170
160
150
140
130
120
110
100
90
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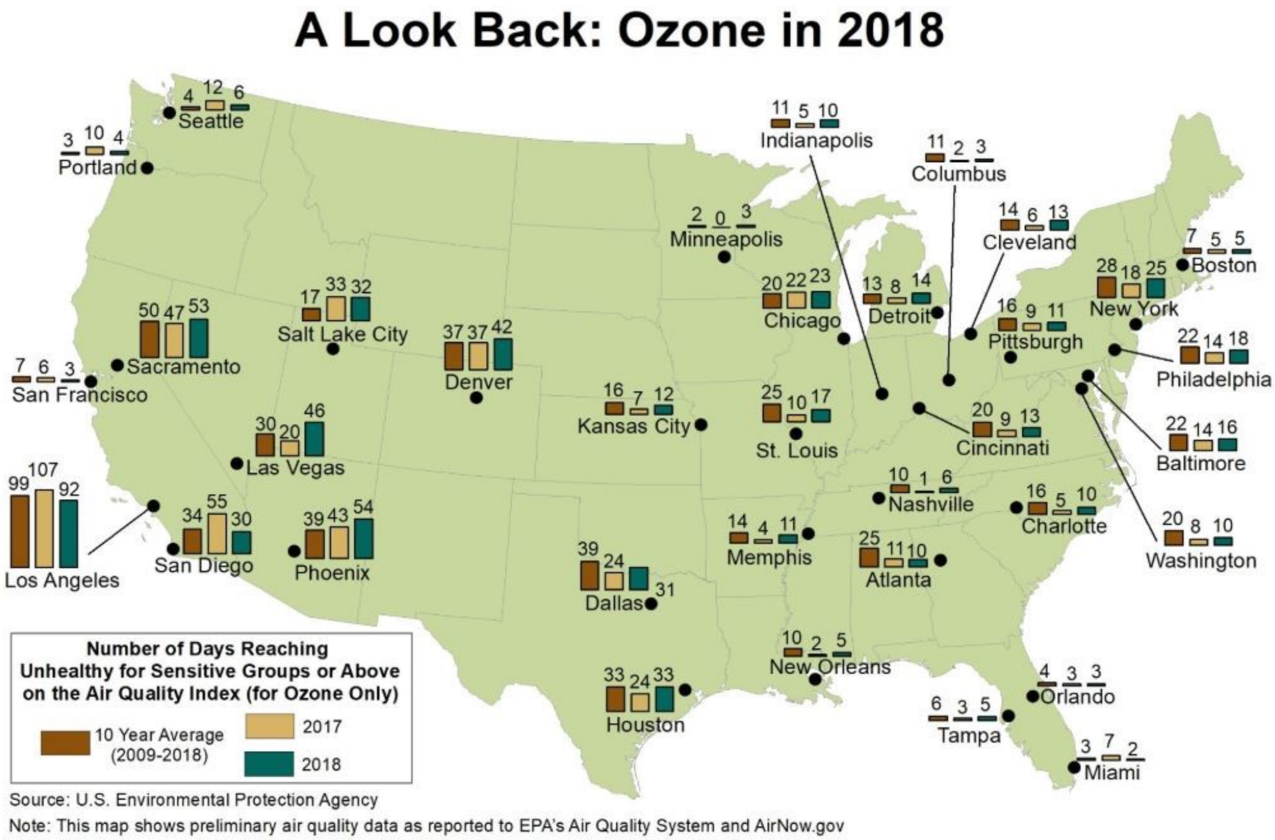
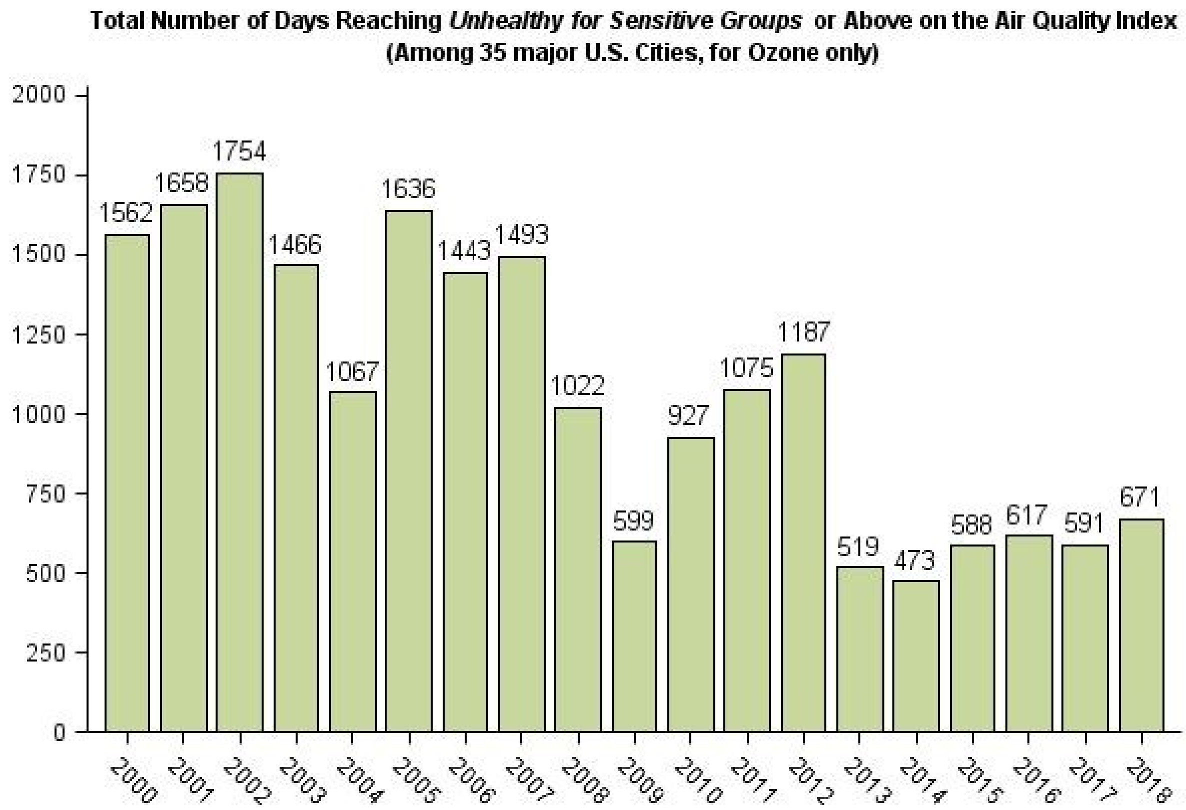
70
60
50
40
30
20
10
0
March
April
May
June
July
August
September
October
Good (0-50)
Moderate (51-100)
Unhealthy for Sensitive Groups (101-150)
Unhealthy (152-200)



A number of factors influence ozone formation, including emissions from cars, trucks, buses, power plants, and industries, along with weather conditions. Weather is especially favorable for ozone formation when it's hot, dry and sunny, and winds are calm and light. Federal and state regulations, including regulations for power plants, vehicles and fuels, are helping reduce ozone pollution nationwide.

For the 35 metropolitan areas in this story map, the graphic below shows the total number of unhealthy days for ozone pollution since the year 2000.



Sensitive groups for Ozone include people with lung disease such as asthma, older adults, children and teenagers, and people who are active outdoors.

For more information, please visit these EPA sites:

https://epa.maps.arcgis.com/apps/Cascade/index.html?appid=9bec4031ba6f4887a9f332a8f058b198

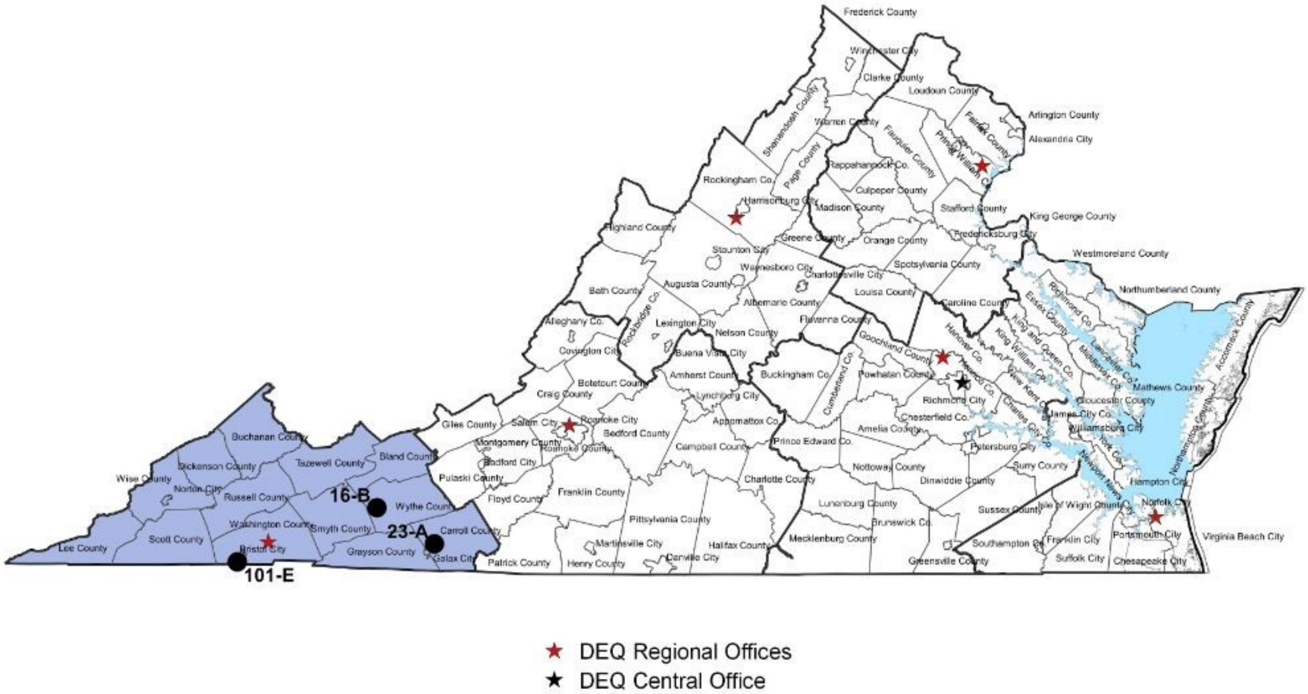
https://www.epa.gov/air-trends

Appendix A

Abbreviation Table

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

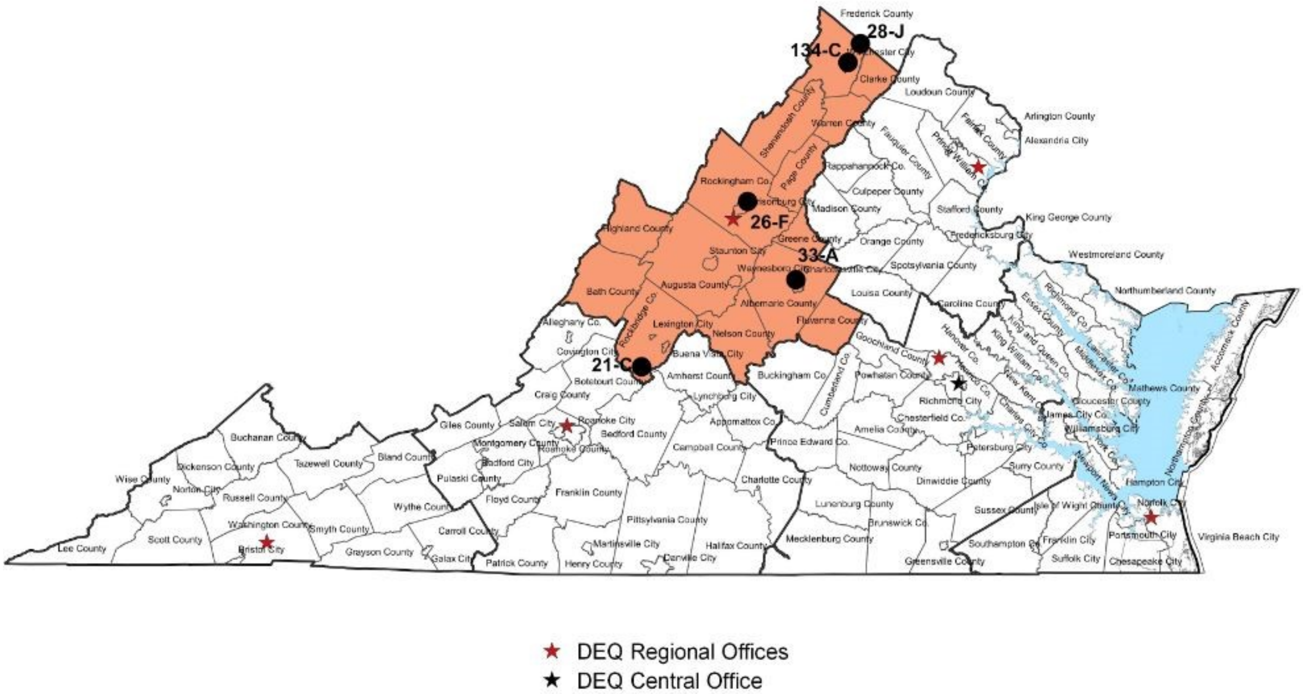
Southwest Monitoring Network



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
16-B	O_3	Sewage Disposal Plant	51-197-0002	Rural Retreat Wythe Co.	36.89117 -81.25423
23-A	PM_{10}	Gladeville Elementary School	51-035-0001	Galax Carroll Co.	36.70067 -80.87978
101-E	$PM_{2.5}$	Highland View Elementary School	51-520-0006	Bristol	36.60800 -82.16410

Contact Information for this Region:
Southwest Regional Office
Jeffery Hurst, Director
355-A Deadmore Street
Abingdon, VA 24210
(276) 676-4800

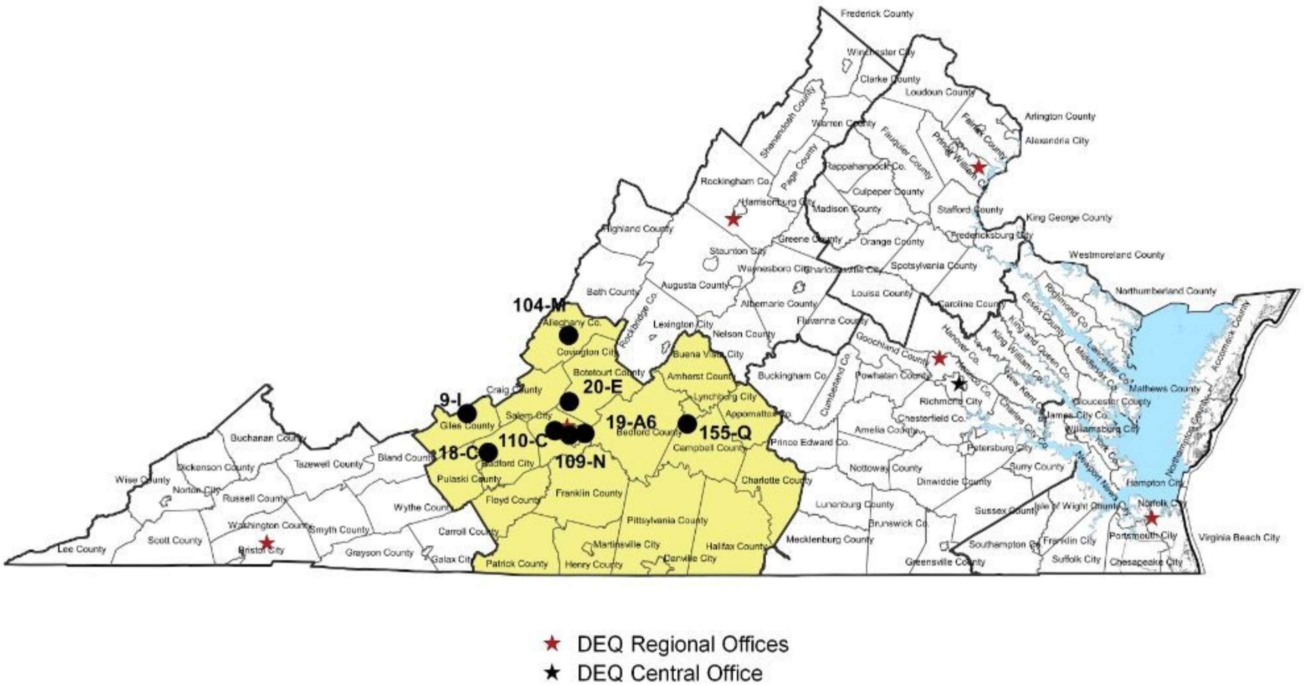
Valley Monitoring Network



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
21-C	O_3, IMPROVE	Natural Bridge Ranger Station	51-163-0003	Rockbridge Co.	37.62668 -79.51257
26-F	$PM_{2.5}$, SO_2, NO_2,O_3	Rockingham VDOT	51-165-0003	Harrisonburg Rockingham Co.	38.47753 -78.81952
28-J	O_3, $PM_{2.5}$, TEOM	Woodbine Road Lester Building Systems	51-069-0010	Rest Frederick Co.	39.28102 -78.08157
33-A	O_3, $PM_{2.5}$, $PM_{2.5}$ cont.	Albemarle High School	51-003-0001	Albemarle Co.	38.07657 -78.50397
134-C	PM_{10}	Winchester Courts Building	51-840-0002	Winchester	39.18397 -78.16308

Contact information for this Region:
Valley Regional Office
Amy T. Owens, Director
P.O. Box 3000
4411 Early Road
Harrisonburg, VA 22801
(540) 574-7808

Blue Ridge Monitoring Network

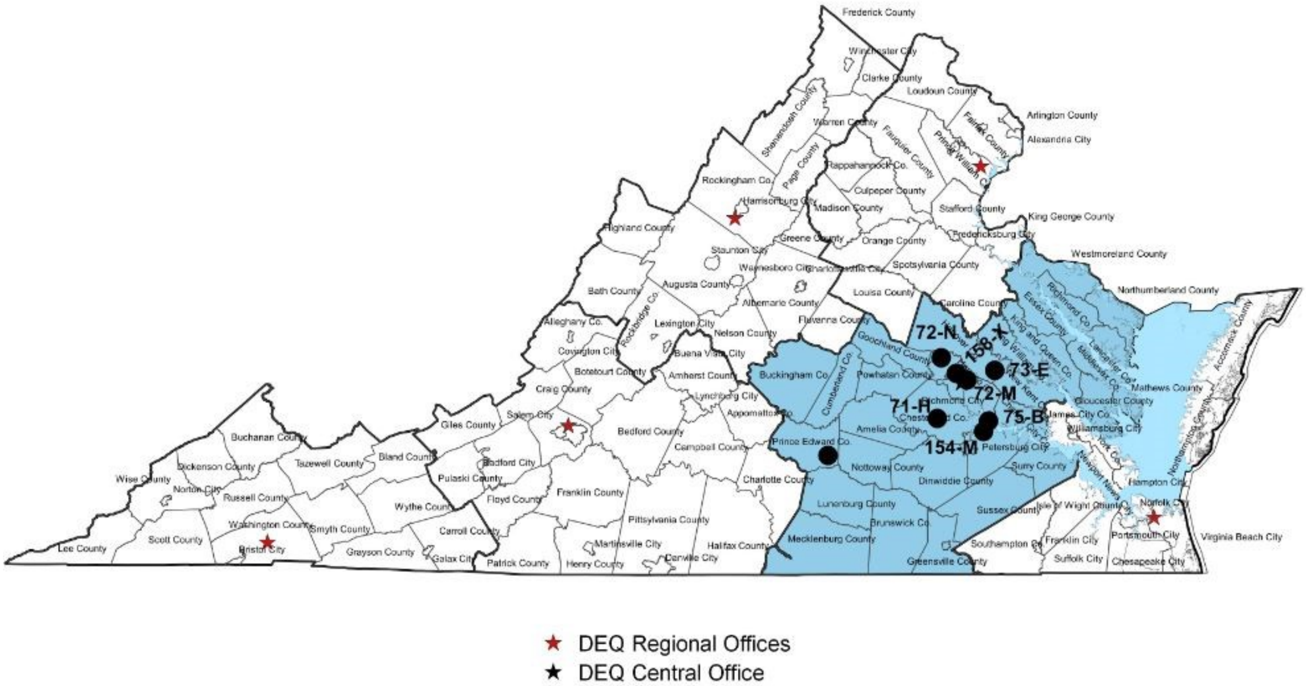


STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
18-C	Lead	Stroubles Creek Wastewater Treatment Plant	51-121-0009	Montgomery Co.	37.18494 -80.51606
19-A6	CO,SO_2, NO_2, O_3, $PM_{2.5}$, TEOM	East Vinton Elementary School Ruddell Road	51-161-1004	Vinton Roanoke Co.	37.28342 -79.88452
109-N	Lead	Mario Industries	51-770-0016	Roanoke	37.27494 -79.98567
110-C	$PM_{2.5}$	Salem High School	51-775-0011	Salem	37.29788 -80.08102
155-Q	$PM_{2.5}$	Leesville Hwy. & Greystone Dr.	51-680-0015	Lynchburg	37.33175 -79.21478

STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
9-I	SO_2	Giles County	51-071-0007	Giles County	37.3863 -80.6539
20-E	SO_2	Botetourt County	51-023-0004	Botetourt County	37.44796 -79.98649
104-M	SO_2	Covington City	51-580-0008	Covington City	37.79139 -79.9908

Contact information for this Region:
Blue Ridge Regional Office
Robert Weld, Director
901 Russell Drive
Salem, VA 24153
(540) 562-6870

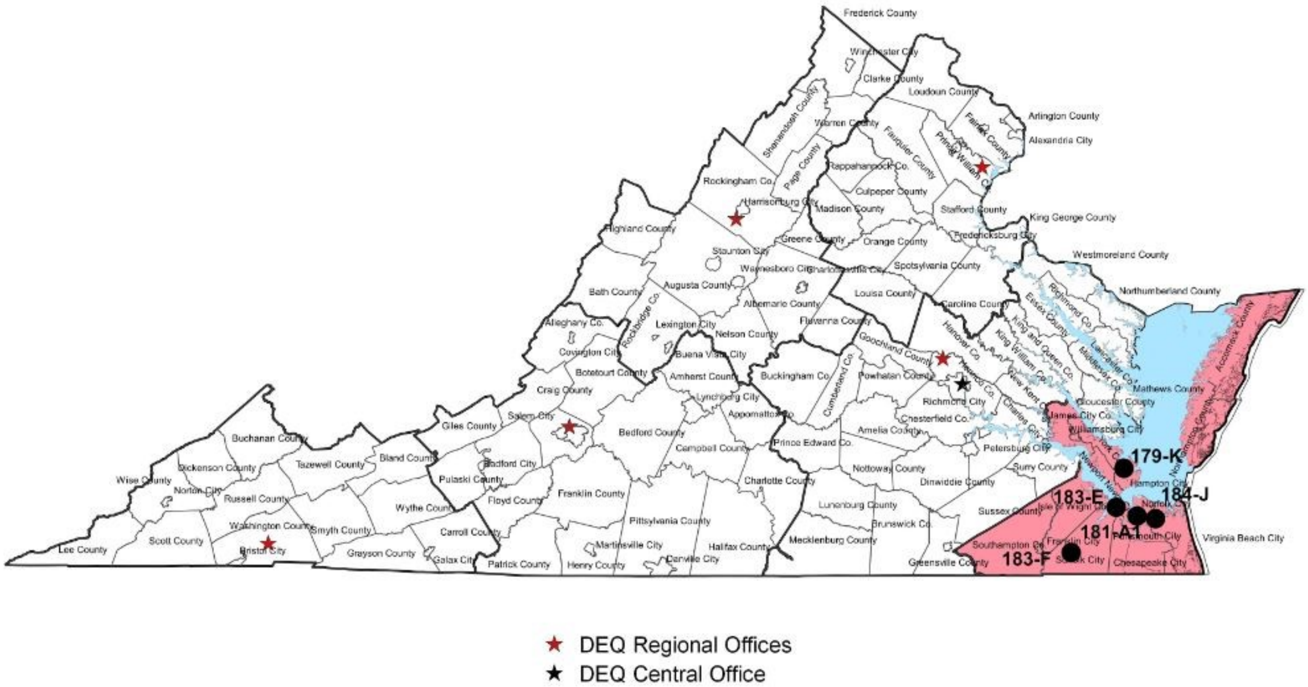
Piedmont Monitoring Network



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
71-H	O_3	Beach Road Highway Shop	51-041-0004	Chesterfield Co.	37.35748 -77.59355
72-M	O_3, VOC, $PM_{2.5}$, PM_{10},TEOM, Speciation, Toxics, Met, NCore, NATTS, PAMS	MathScience Innovation Center 2401 Hartman Street	51-087-0014	Henrico Co.	37.55652 -77.40027
72-N	$PM_{2.5}$	DEQ-Piedmont Regional Office 4949-A Cox Road	51-087-0015	Henrico Co.	37.67132 -77.56640
73-E	O_3	McClellan Road	51-085-0003	Hanover Co.	37.60613 -77.21880
75-B	O_3, NO_2, SO_2, $PM_{2.5}$	Charles City County Route 608	51-036-0002	Charles City Co.	37.34438 -77.25925
154-M	PM_{10}, Toxics	Carter G. Woodson Middle School 1000 Winston Churchill Dr.	51-670-0010	Hopewell	37.28962 -77.29182
158-X	CO, NO2, $PM_{2.5}$ cont.	Joseph Bryan Park	51-760-0025	Richmond	37.59088 -77.46925

Contact Information for this Region:
Piedmont Regional Office
James Golden, Director
4949-A Cox Road
Glen Allen, VA 23060
(804) 527-5053

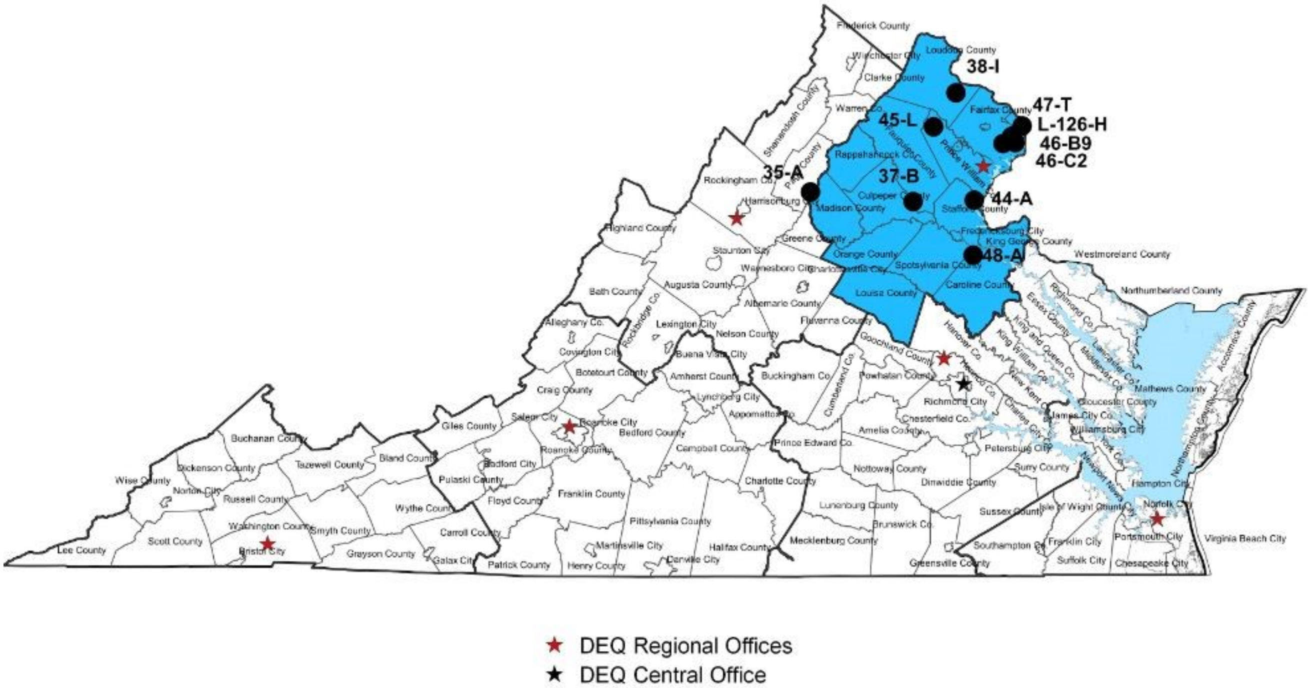
Tidewater Monitoring Network



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

Contact information for this Region:
Craig Nicol, Director
5636 Southern Blvd.
Virginia Beach, VA 23462
(757) 518-2173

Northern Monitoring Network



STATION NUMBER	POLLUT.	LOCATION	EPA ID	CITY/COUNTY	LAT/LONG
37-B	O_3	Phelps Wildlife Area Route 651	51-061-0002	Sumerduck Fauquier Co.	38.47367 -77.76772
38-I	O_3, NO_2, $PM_{2.5}$	Broad Run High School Route 641	51-107-1005	Ashburn Loudoun Co.	39.02473 -77.48925
44-A	O_3	Widewater Elementary School Den Rich Road	51-179-0001	Widewater Stafford Co.	38.48123 -77.37040
45-L	O_3, NO_2	Long Park Route 15	51-153-0009	Prince William Co.	38.85287 -77.63462
46-B9	SO_2, O_3, $PM_{2.5}$, PM_{10}, TEOM, Toxics	Lee District Park Telegraph Road	51-059-0030	Franconia Fairfax Co.	38.77335 -77.10468
46-C2	CO, NO_2, $PM_{2.5}$ cont.	6831 Backlick Road	51-059-0031	Springfield Fairfax Co.	38.76835 -77.18347
47-T	CO, NO_2, O_3, $PM_{2.5}$	Aurora Hills Visitors Center 18^{th} and Hayes Streets	51-013-0020	Arlington Co.	38.85770 -77.05922
48-A	O_3	U.S.G.S. Geomagnetic Center	51-033-0001	Corbin Caroline Co.	38.20087 -77.37742
L-126-H	PM_{10}	435 Ferdinand Day Drive	51-510-0020	Alexandria	38.80493 -77.12687
N-35-A	O_3, TEOM, IMPROVE	Big Meadows, National Park Service	51-113-0003	Madison Co.	38.52280 -78.43487

Contact Information for this Region:
Northern Regional Office
Thomas Faha, Director
13901 Crown Court
Woodbridge, VA 22193
(703) 583-3810

Data Capture Criteria

Minimum Number of Observations	
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

National Ambient Air Quality Standards

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide		Primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead		Primary and Secondary	Rolling 3 month average	0.15 μg/m^3 [(a)]	Not to be exceeded
Nitrogen Dioxide		Primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and Secondary	Annual	53 ppb [(b)]	Annual Mean
Ozone		Primary and Secondary	8-hour	0.070 ppm [(c)]	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution	**PM2.5**	Primary	Annual	12.0 μg/m^3	Annual Mean, averaged over 3 years
		Secondary	Annual	15.0 μg/m^3	Annual Mean, averaged over 3 years
		Primary and Secondary	24-hour	35 μg/m^3	98th percentile, averaged over 3 years
	PM10	Primary and Secondary	24-hour	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide		Primary	1-hour	75 ppb [(d)]	99th 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)] In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m3 as a calendar quarter average) also remain in effect.

[(b)] The level of the annual NO2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

[(c)] Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

[(d)] The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

Please see EPA's NAAQS Table for additional information.

Number of Criteria Pollutant Monitoring Sites

NCore/SLAMS 2018

REGION	$PM_{2.5}$	PM_{10}	Pb	CO	SO_2	NO_2	O_3	TOTAL
Southwest	1	1	---	---	---	---	1	3
Valley	3	1	---	---	1	1	4	10
Blue Ridge	3	---	2	1	1	1	1	9
Piedmont	5	2	---	2	2	3	4	18
Tidewater	3	2	---	2	2	2	3	14
***Northern**	4	3	---	2	1	4	8	22
TOTAL	**19**	**9**	**2**	**7**	**7**	**11**	**21**	**76**

* *This region's sites are operated by DEQ and NPS*

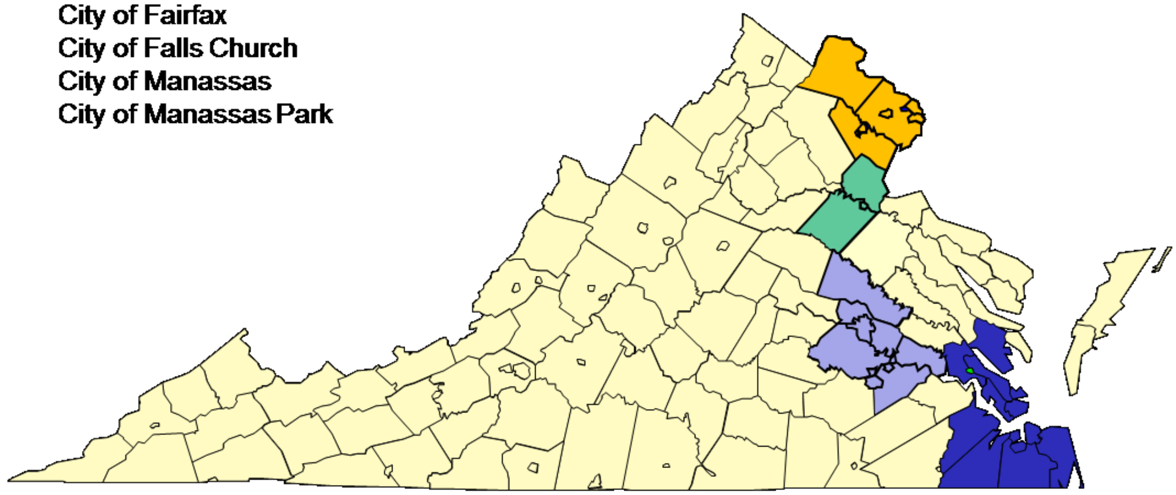
EPA is responsible for designating nonattainment and attainment/maintenance areas for the Commonwealth. Nonattainment and maintenance areas generally correspond to VOC and NOX emissions control areas. Virginia implements additional federal nonattainment and maintenance requirements within these control areas. Additionally, Virginia may designate certain areas of the state as VOC and NOX emissions control areas in order to implement requirements as needed to protect air quality. A list of VOC and NOX emissions control areas is found in the Regulations for the Control and Abatement of Air Pollution at 9VAC5-20-206.

Air Quality Planning Areas for the Commonwealth of Virginia

Northern VA/DC/MD 2015 Ozone NAAQS Nonattainment Area

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

**** Alexandria and Arlington are also attainment/maintenance for the 1985 CO NAAQS.***



Hampton Roads 1997 Ozone NAAQS Attainment/Maintenance Area and 2015 Ozone NAAQS Attainment Area

Gloucester County
Isle of Wight 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

Richmond-Petersburg 1997 Ozone NAAQS Attainment/Maintenance Area and 2015 Ozone NAAQS Attainment Area

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

Fredericksburg 1997 Ozone NAAQS Attainment/Maintenance Area and 2015 Ozone NAAQS Attainment Area

Spotsylvania County
Stafford County
City of Fredericksburg

Updated 7/26/2019

Air Quality Planning Areas/Nonattainment for Virginia

Appendix B

Air Quality Internet Links

AirData – Access to national and state air pollution data
Outdoor Air Quality Data

Air Emission Data Sources
Emissions Sources

Air Now – AQI maps
Real Time AQI

American Lung Association:
USA Lung

AQS Data Mart (AQS data for the scientific and technical community):
Data Mart

CASTNET (Clean Air Status and Trends Network)
Castnet

Department of Environmental Quality link:
Virginia DEQ

Environmental Education for teachers and students:
Resources for teachers
DEQ Education webpage

EPA Popular Resources
Environmental Topics

EPA's Technology Transfer Network (TTN) – Ambient Monitoring Technology Information Center (AMTIC)

IMPROVE
Interagency Monitoring of Protected Visual Environments

MARAMA
Mid-Atlantic Regional Air Management Association

Nonattainment area descriptions:
EPA's Green Book

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

2018 3-Day Monitoring Schedule for $PM_{2.5}$, PM_{10}, TSP and VOCs
Sampling Schedule Calendar

National Air Quality: Status and Trends of Key Air Pollutants
Air Trends

References

Code of Federal Regulations – 40 CFR 50 & 58
Electronic Code of Federal Regulations

Virginia Ambient Air Monitoring Data Reports
DEQ's Air Monitoring Publications

Air Quality System (AQS)
EPA's AQS

National Ambient Air Quality Standards
EPA NAAQS