AIR QUALITY AND AIR POLLUTION CONTROL POLICIES OF THE COMMONWEALTH OF VIRGINIA

A Report to the Honorable Glenn Youngkin, Governor and the General Assembly of Virginia

Virginia Department of Environmental Quality

October 2024

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Commonly Used Abbreviations

AQM	Office of Air Quality Monitoring
CAA	Clean Air Act
CMS	Compliance Monitoring Strategy
CO	Carbon monoxide
CSAPR	Cross State Air Pollution Rule
CTG	Control Technique Guideline
DEQ	Virginia Department of Environmental Quality
ECHO	Enforcement and Compliance History Online
EPA	Environmental Protection Agency
FCE	Full Compliance Evaluation
GVWR	Gross Vehicle Weight Rating
HAP	Hazardous Air Pollutant
I/M	Motor Vehicle Inspection and Maintenance Program
MACT	Maximum Achievable Control Technology
MATS	Mercury and Air Toxics Standard
$\mu g/m^3$	Micrograms per cubic meter
MSOS	Mobile Source Operations Section
NAAQS	National Ambient Air Quality Standard
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
NSR	New Source Review
ORE	On-Road Emissions Program
ORVR	On Board Refueling Vapor Recovery
OTR	Ozone Transport Region
Pb	Lead
PCE	Partial Compliance Evaluation
PM_{10}	Particulate matter not more than 10 micrometers in diameter
$PM_{2.5}$	Particulate matter not more than 2.5 micrometers in diameter
ppb	Parts per billion
ppm	Parts per million
PSD	Prevention of Significant Deterioration
RACT	Reasonably Available Control Technology
RBIS	Risk Based Inspection System
SAPCB	State Air Pollution Control Board
SBA	Small Business Assistance
SIP	State Implementation Plan
SO_2	Sulfur dioxide
SOP	State Operating Permit
tpy	Tons per year
VDH	Virginia Department of Health
VOC	Volatile Organic Compounds

1. Executive Summary

This report was prepared by the Virginia Department of Environmental Quality (DEQ) pursuant to § 10.1-1307 H of the Code of Virginia. This report details the status of Virginia's air quality, provides an overview of the air division programs, and briefly summarizes federal and state air quality programs.

1.1. Air Quality in the Commonwealth

Ambient concentrations of fine particulate matter ($PM_{2.5}$), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), and ozone in Virginia met United States Environmental Protection Agency (EPA) National Ambient Air Quality Standards (NAAQS) in 2023. During 2023, wildfires in other parts of the United States and Canada negatively impacted Virginia air quality, sporadically causing unhealthy air days, but generally concentrations continue to show improvement and compliance with the NAAQS. Virginia is developing an attainment plan for the Giles County SO_2 area and a redesignation request for the Northern Virginia, Metropolitan Washington, D.C. ozone nonattainment area.

1.2. Air Quality Policies in the Commonwealth

Virginia continues to work on Regional Haze analysis requirements stemming from the 2019 federal guidance, 2015 ozone NAAQS Good Neighbor provisions under the Clean Air Act (CAA) as published by EPA on June 5, 2023 (88 FR 36654), and regulatory changes stemming from the *South Coast Air Quality Management District v. EPA* decision.[1] However, on June 27, 2024, the Supreme Court blocked the Good Neighbor provisions from taking effect while litigation over the merits of the CAA ozone transport rule play out in lower courts. On March 6, 2024, EPA issued a revised $PM_{2.5}$ NAAQS, lowering the annual $PM_{2.5}$ standard from 12.0 $\mu g/m^3$ to 9.0 $\mu g/m^3$. All areas of the Commonwealth are in compliance with this new standard. On August 9, 2023, EPA proposed revisions to the Air Emissions Reporting Rule. The final changes are expected to be published in 2024 and may impact DEQ's approach to inventory development and require additional facilities to report data to DEQ and EPA.

1.3. Summary of Annual Air Division Activities

Table 1-1 provides a summary of air division activities related to permitting, compliance and enforcement under the Clean Air Act.

Table 1-1: Summary of Activity and Milestones

Activity	*Milestone*
Monitoring Locations:	33
Monitoring Instruments:	104
Minor Source Permits Issued:	324
State Major Source Permits Issued:	0
PSD Permits Issued:	0
General Permits Issued:	3
State Operating Permits Issued:	20
Federal Operating Permits Issued:	6[2]

[1] https://www.cadc.uscourts.gov/internet/opinions.nsf/217B6778AE3EC89C8525823600532AE0/$file/15-1115-1718293.pdf
[2] DEQ also issued 47 federal operating permit renewals during state fiscal year 2024.

Activity	*Milestone*
Compliance Evaluations (all):	3,738
On Site Inspections:	576
Enforcement Actions:	350
Vehicle Emission Inspections Performed:	874,399[3]
Vehicle Emission Inspection Failures:	15,608
Vehicle Emission Inspection Station Overt Audits:	465
Vehicle Emission Inspection Station Covert Audits:	108
Consent Orders Issued:	45
Consent Order Civil Charges Collected ($):	447,448.35

2. Status of Air Quality in the Commonwealth of Virginia

DEQ monitors a variety of pollutants in the ambient atmosphere. A portion of Virginia's monitoring network measures concentrations of the criteria pollutants: ozone, $PM_{2.5}$, PM_{10}, NO_2, SO_2, Lead (Pb), and CO. Criteria pollutants can be harmful to public health and the environment, and EPA has set NAAQS for these pollutants to protect public health and welfare. The two criteria pollutants that have historically presented challenges in Virginia are ozone and $PM_{2.5}$. Air quality for both pollutants improved through 2022. $PM_{2.5}$ air quality was in the healthy range across Virginia through 2022, and during that time, air quality met federal ozone standards across the Commonwealth. However, the federally required SO_2 monitoring site near Lhoist North America LLC, which began operations in 2017, continues to record data showing violations of the SO_2 NAAQS. DEQ is working with the facility to further reduce SO_2 emissions and improve air quality. Preliminary air quality data shows that out-of-state forest fires significantly degraded air quality for $PM_{2.5}$ and ozone during the summer of 2023.

2.1. Criteria Pollutant Overview

Ozone is not generally emitted directly into the atmosphere. Rather, a photochemical reaction between volatile organic compounds (VOC) and oxides of nitrogen (NO_X) creates this pollutant when these precursors combine in the presence of sunlight. Ozone, the primary component of smog, is a lung irritant and interferes with the ability of plants to process food and ward off diseases.

Particulate Matter (PM), also referred to as particulate pollution, is a mixture of solid particles and liquid droplets found in the air. Some particles are emitted directly from a source, such as construction sites, unpaved roads, fields, smokestacks or fires. Most particles form in the atmosphere because of complex reactions of chemicals such as SO_2 and NO_X, which are pollutants emitted from power plants, industries, and automobiles. PM contains microscopic solids or liquid droplets that are so small that they can be inhaled and cause serious health problems. Particle pollution includes PM_{10} and $PM_{2.5}$.

PM_{10} is an airborne particulate of solid or liquid matter that is less than or equal to 10 micrometers in diameter. 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.

[3] Number of vehicle emissions inspections completed at stations and the number of on-road vehicle emission inspections completed.

$PM_{2.5}$ is an airborne particulate of solid or liquid matter that is less than or equal to 2.5 micrometers in diameter. Small particles less than 10 micrometers in diameter can get deep into the lungs and may enter the bloodstream. Exposure to such particles poses adverse health impacts to the human respiratory and cardiovascular systems. $PM_{2.5}$ is the main cause of reduced visibility (haze) in parts of the United States, including many of our national parks and wilderness areas.

NO_2 is a gaseous air pollutant that forms when fossil fuels such as coal, oil, gasoline, or diesel burn at high temperatures. NO_2 contributes to the formation of particle pollution by converting in the atmosphere to nitrate aerosols, a component of $PM_{2.5}$. This gas is also a building block of ozone.

SO_2 is one of a group of highly reactive compounds known as "oxides of sulfur." The largest source of SO_2 emissions is fossil fuel combustion at power plants and at other types of industrial facilities. Smaller sources of SO_2 emissions include industrial processes such as extracting metal from ore and the combustion of sulfur-laden fuels by locomotives, large ships, and non-road equipment. Emissions of SO_2 also contribute to the formation of particle pollution by converting in the atmosphere to sulfate aerosols, a major component of $PM_{2.5}$.

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 processing, metals processing, ammunitions manufacturing, and piston-engine aircraft operating on leaded aviation gasoline.

CO is a colorless, odorless gas emitted from combustion processes. Particularly in urban areas, most CO emissions to ambient air originate from mobile sources. CO can cause harmful health effects by reducing oxygen delivery to the body's organs.

2.2. Monitoring Network

DEQ's Office of Air Quality Monitoring (AQM) maintains an extensive air quality monitoring network throughout the Commonwealth. As of July 1, 2024, approximately 104 instruments at 33 sites monitored ambient air quality across Virginia. One SO_2 monitoring site that is part of DEQ's network is maintained by an independent company. There are two federal ozone monitors included as part of the DEQ network as well. The number of instruments has decreased significantly from the last report due to the conversion from filter based particulate samplers to continuous instruments and due to the shutdown of the Radford Lead (Pb) monitoring site.

Figure 2.1 shows the various ozone monitoring sites in Virginia. All monitoring sites meet EPA's siting criteria (40 CFR Part 58, Appendices D and E), and all sites conform to EPA guidance documents and generally accepted air quality monitoring practices. AQM quality assures all data gathered from the Virginia air quality monitoring network in accordance with federal requirements (40 CFR Part 58, Appendix A). EPA performs the quality assurance at the two federal ozone sites. The industrial site described above is responsible for performing their own quality assurance procedures. The data are published annually in the *Virginia Ambient Air Monitoring Data Report* and are available from the DEQ website at Air Quality Reports | Virginia DEQ.

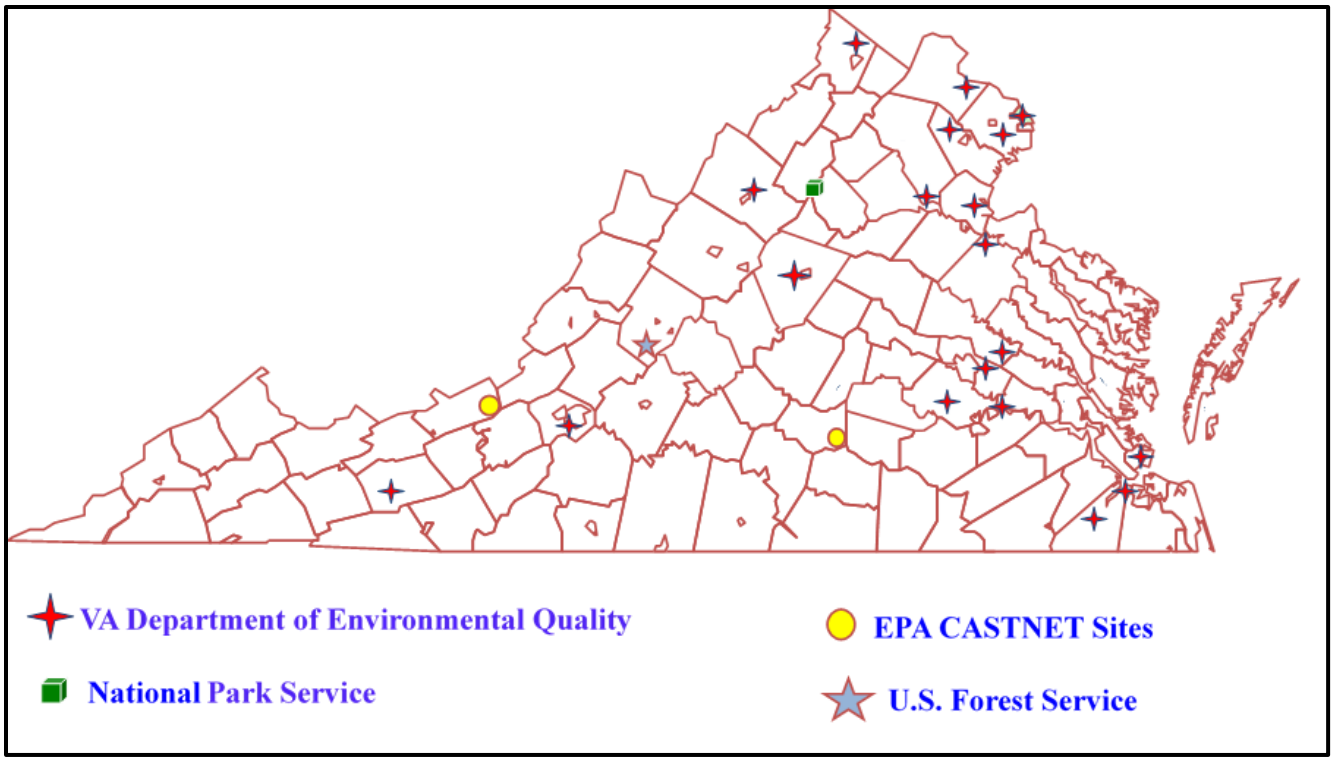


Figure 2-1: Virginia Ozone Monitoring Network

2.3. Near-Road Monitoring for NO_2

In February 2010, EPA promulgated a NO_2 NAAQS, setting the standard at 100 parts per billion (ppb). This standard included a requirement for the installation and operation of monitoring stations near heavily traveled roadways. According to federal mandates, DEQ must install three such monitoring stations. DEQ has installed two of the three monitoring stations. The Richmond station at Bryan Park is adjacent to the I-95 and I-64 interchange and has been running since October 2013. The northern Virginia site, which is in Springfield on Backlick Road, began sampling in April 2016. These data from these sites are available on DEQ's webpage. A third monitoring station will be installed in the Tidewater area and is expected to be operational by Winter 2025.

In October 2020 the Office of Air Quality Monitoring received a $526,603 grant to study particulate and air toxics metals pollution in two communities in Tidewater Virginia. The affected communities in this study are the East End Community of Newport News and the Lamberts Point Community in Norfolk. Both are low income and disadvantaged communities and have been historically impacted by coal transporting and loading facilities within their communities. The study is called the Tidewater Air Monitoring Evaluation (TAME) Study and has the following goals:

- Sample for particulate pollution in these communities;
- Analyze for air toxics metals from these samples;
- Have VDH perform a health risk assessment using the air quality data collected from the study; and

- Significantly and actively engage community residents in the study to address current and historic concerns relative to air quality in general and the specific impacts from the coal operations in their community.

The study is projected to be completed in October 2026.

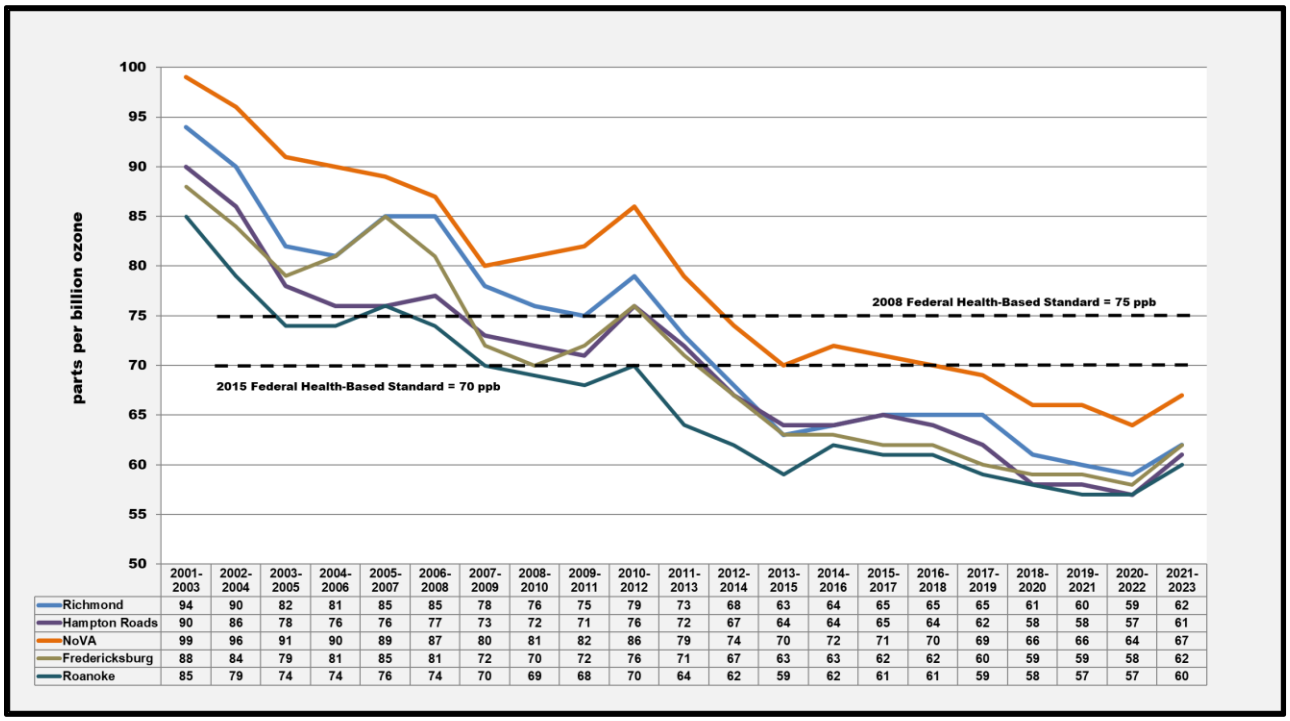
2.4. Data Trends for Criteria Pollutants

Trends for most criteria pollutants across Virginia show significant improvements over the past decade through 2023. These improvements are the result of emission reductions associated with a variety of control programs. Emissions from nearby states also have decreased, so that less pollution is transported into the Commonwealth from upwind areas.

Impacts of the COVID-19 pandemic influenced some 2020 design values. Emissions sources such as the transportation sector, agricultural burning, and prescribed fire had significantly reduced activity during part or all of 2020 due to stay-at-home orders and other factors.

Air quality impacts from wildfires influenced some of the 2023 design values, mainly those for $PM_{2.5}$ and ozone. While 2023 design values may have increased as compared to 2022 design values for these pollutants, the measured values in 2023 comply with federal health-based standards.

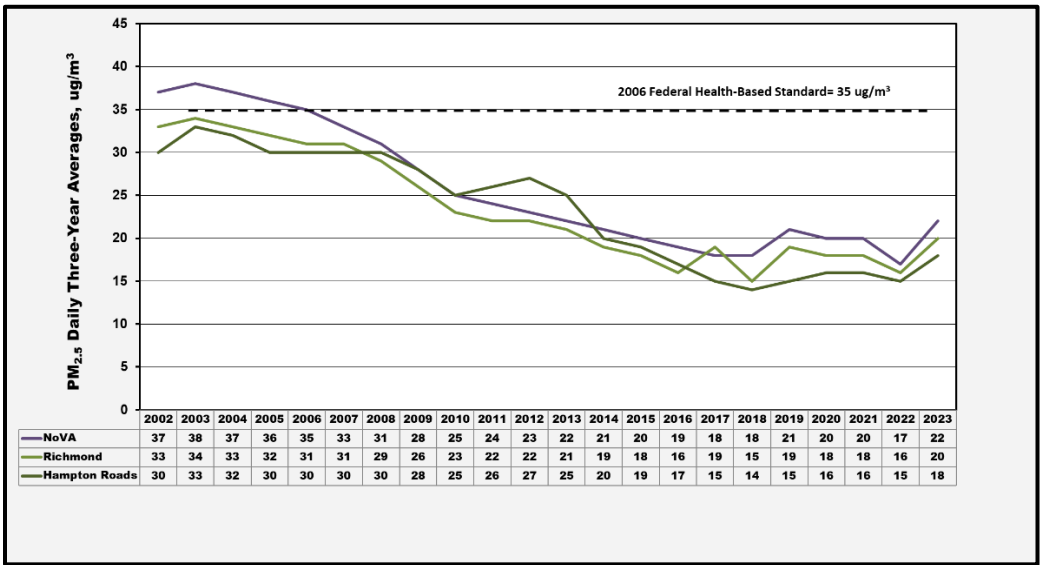
Figure 2-2 provides the three-year average ozone design value concentrations in the Hampton Roads, Richmond-Petersburg, Fredericksburg, Roanoke, and Northern Virginia areas. All areas demonstrate compliance with the 2008 ozone NAAQS of 0.075 ppm (75 ppb) as well as the 2015 ozone NAAQS of 0.070 ppm (70 ppb).



	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019	2018-2020	2019-2021	2020-2022	2021-2023
Richmond	94	90	82	81	85	85	78	76	75	79	73	68	63	64	65	65	65	61	60	59	62
Hampton Roads	90	86	78	76	76	77	73	72	71	76	72	67	64	64	65	64	62	58	58	57	61
NoVA	99	96	91	90	89	87	80	81	82	86	79	74	70	72	71	70	69	66	66	64	67
Fredericksburg	88	84	79	81	85	81	72	70	72	76	71	67	63	63	62	62	60	59	59	58	62
Roanoke	85	79	74	74	76	74	70	69	68	70	64	62	59	62	61	61	59	58	57	57	60

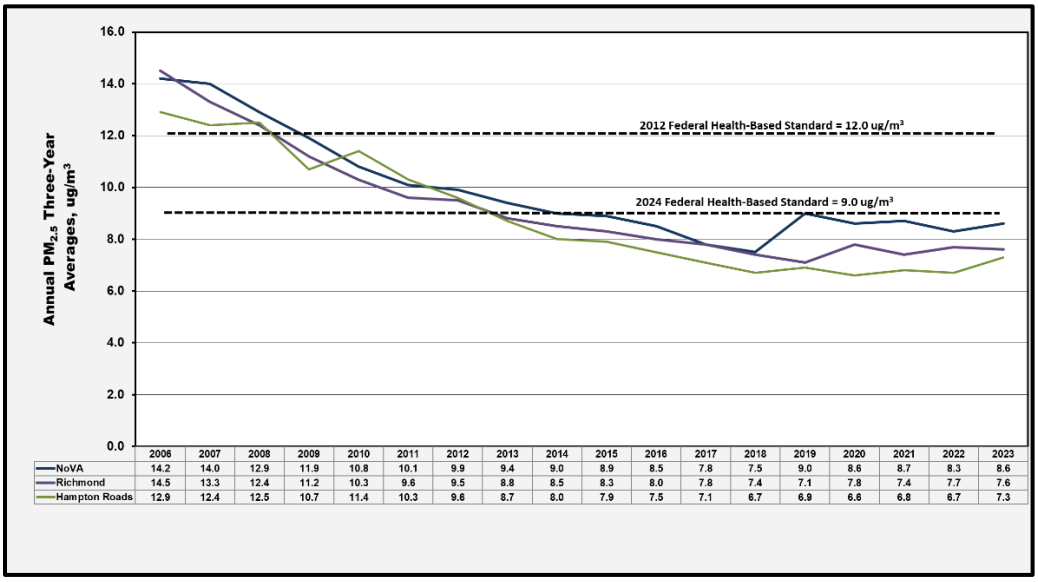
Figure 2-2: Ozone Concentrations, Three Year Average

Figure 2-3 provides the $PM_{2.5}$ daily design value concentrations for Hampton Roads, Richmond-Petersburg, and Northern Virginia. Figure 2-4 provides the annual average $PM_{2.5}$ design value concentrations for these three areas. Concentrations of $PM_{2.5}$ follow these trends across the Commonwealth and comply with the 2006 $PM_{2.5}$ daily NAAQS of 35 $\mu g/m^3$, the 2012 $PM_{2.5}$ annual NAAQS of 12.0 $\mu g/m^3$, and the 2024 $PM_{2.5}$ annual NAAQS of 9.0 $\mu g/m^3$.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
NoVA	37	38	37	36	35	33	31	28	25	24	23	22	21	20	19	18	18	21	20	20	17	22
Richmond	33	34	33	32	31	31	29	26	23	22	22	21	19	18	16	19	15	19	18	18	16	20
Hampton Roads	30	33	32	30	30	30	30	28	25	26	27	25	20	19	17	15	14	15	16	16	15	18

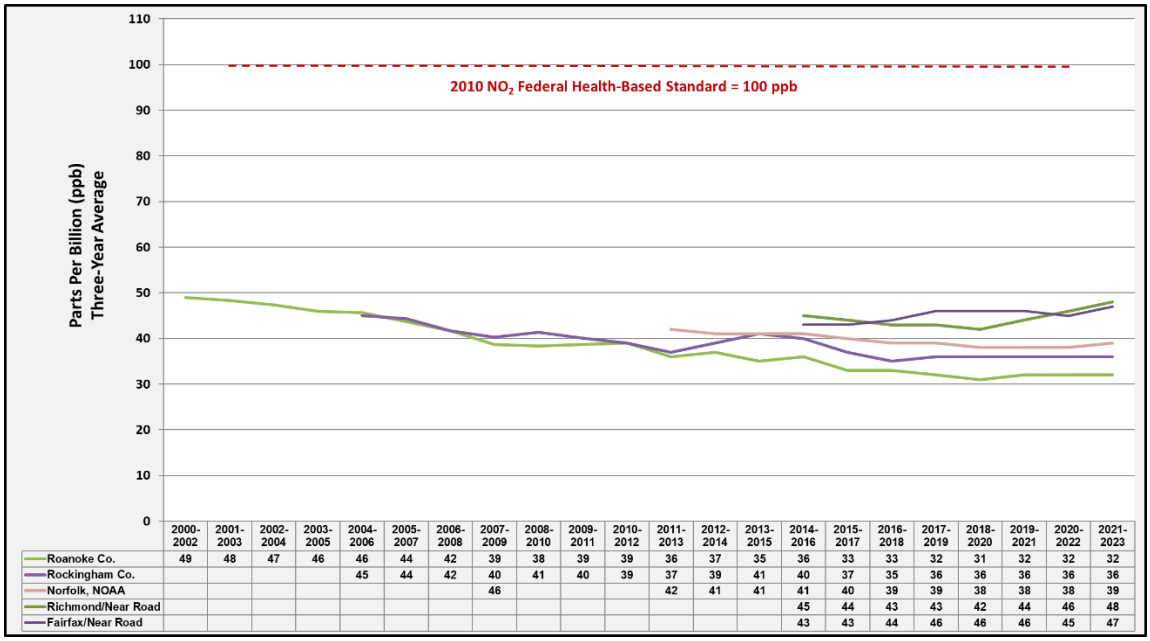
Figure 2-3: Daily $PM_{2.5}$ Averages



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
NoVA	14.2	14.0	12.9	11.9	10.8	10.1	9.9	9.4	9.0	8.9	8.5	7.8	7.5	9.0	8.6	8.7	8.3	8.6
Richmond	14.5	13.3	12.4	11.2	10.3	9.6	9.5	8.8	8.5	8.3	8.0	7.8	7.4	7.1	7.8	7.4	7.7	7.6
Hampton Roads	12.9	12.4	12.5	10.7	11.4	10.3	9.6	8.7	8.0	7.9	7.5	7.1	6.7	6.9	6.6	6.8	6.7	7.3

Figure 2-4: Annual $PM_{2.5}$ Averages

Figure 2-5 provides NO_2 measurements for the monitor with the highest recorded value in each area of the Commonwealth and compares this data to the 2010 NO_2 NAAQS of 100 ppb. All data show values well under the health-based standard.

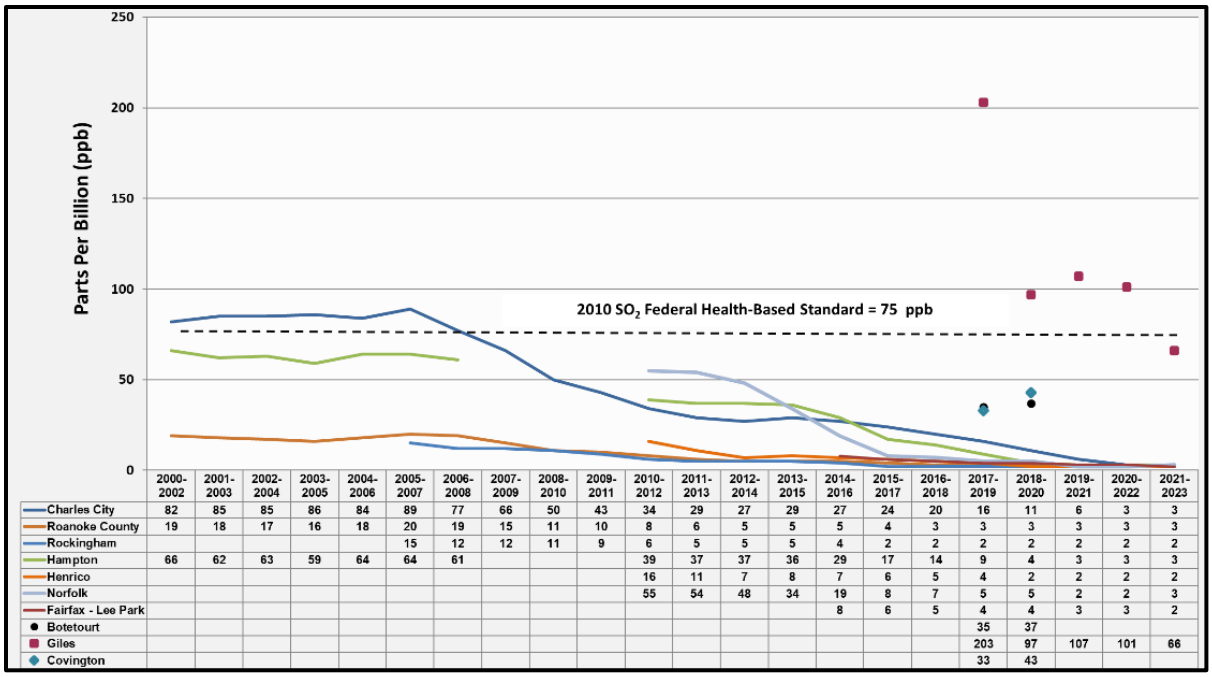


	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019	2018-2020	2019-2021	2020-2022	2021-2023
Roanoke Co.	49	48	47	46	46	44	42	39	38	39	39	36	37	35	36	33	33	32	31	32	32	32
Rockingham Co.					45	44	42	40	41	40	39	37	39	41	40	37	35	36	36	36	36	36
Norfolk, NOAA								46				42	41	41	41	40	39	39	38	38	38	39
Richmond/Near Road															45	44	43	43	42	44	46	48
Fairfax/Near Road															43	43	44	46	46	46	45	47

Figure 2-5: Virginia NO_2 Measurements

The 2010 SO_2 NAAQS federal implementation rule at 40 CFR 51 Subpart BB required certain facilities in Virginia to monitor the air quality near their property to determine if the facility's emissions caused SO_2 air quality violations. This approach stemmed from EPA's determination that ambient SO_2 concentrations were predominantly impacted by large industrial sources with high SO_2 emissions. These SO_2 monitors, which were installed in accordance with federal requirements and operated by the respective facility, recorded four years of data from 2017 to 2020 and are therefore included in the Commonwealth's SO_2 monitoring network. Figure 2-6 provides SO_2 measurements for all monitors currently in the network including the facility-specific monitors and compares this data to the 2010 SO_2 NAAQS of 75 ppb. The facility-specific monitoring sites for Botetourt and Covington show data for two, three-year averages, 2017-2019 and 2018-2020. As shown in this figure, the data points showed compliance with the standard and registered values less than 50% of the standard. Therefore, in accordance with federal guidance, the monitors in Botetourt and Covington were removed in early 2021.

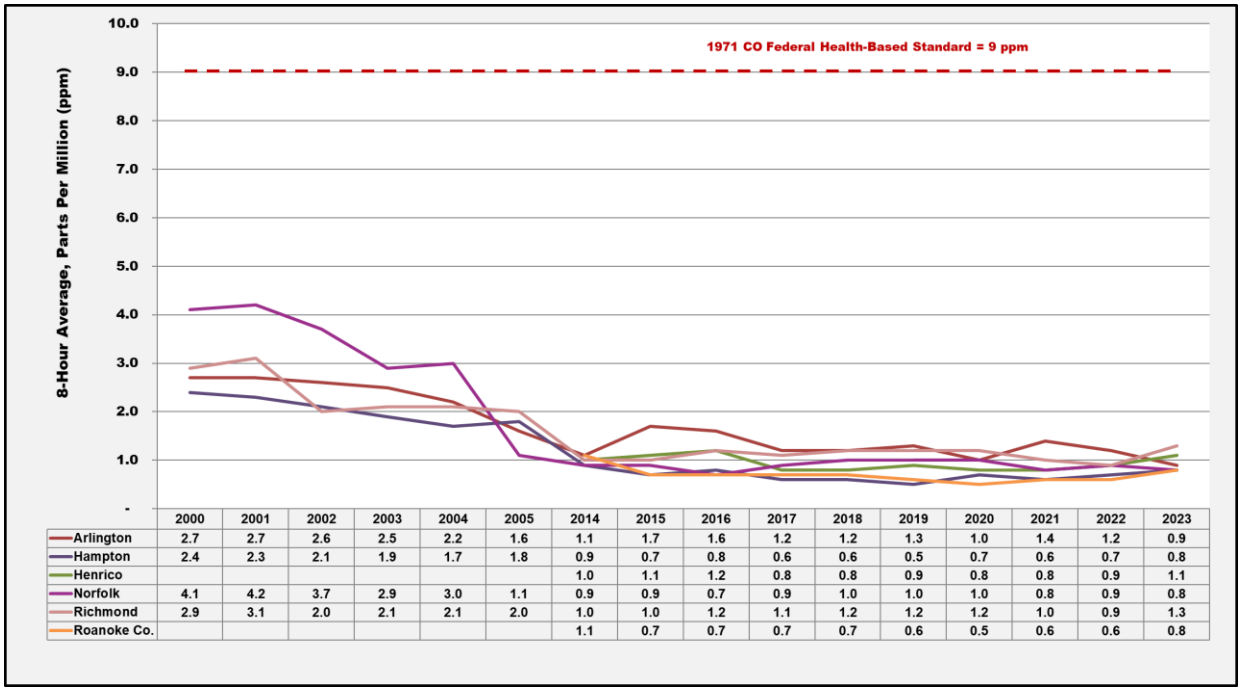
Until 2023, the Giles County three-year averages were above the health-based standard of 75 ppb. In 2023, the three-year average of 66 ppb, while compliant with the standard, was not 50% or less than the standard. Therefore, this monitor continues to operate. The noncompliant measured data resulted in the portion of Giles County around the Lhoist North America, LLC facility, the operator of the Giles County SO_2 monitor, to be designated nonattainment for the 2010 SO_2 NAAQS. See Section 3.1.6 for more information on this designation.



	2000-2002	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	2012-2014	2013-2015	2014-2016	2015-2017	2016-2018	2017-2019	2018-2020	2019-2021	2020-2022	2021-2023
Charles City	82	85	85	86	84	89	77	66	50	43	34	29	27	29	27	24	20	16	11	6	3	3
Roanoke County	19	18	17	16	18	20	19	15	11	10	8	6	5	5	5	4	3	3	3	3	3	3
Rockingham						15	12	12	11	9	6	5	5	5	4	2	2	2	2	2	2	2
Hampton	66	62	63	59	64	64	61				39	37	37	36	29	17	14	9	4	3	3	3
Henrico											16	11	7	8	7	6	5	4	2	2	2	2
Norfolk											55	54	48	34	19	8	7	5	5	2	2	3
Fairfax - Lee Park															8	6	5	4	4	3	3	2
Botetourt																		35	37			
Giles																		203	97	107	101	66
Covington																		33	43			

Figure 2-6: Virginia SO_2 Measurements

Figure 2-7 provides CO measurements from currently operating monitors for comparison against the 1971 CO NAAQS of 9 ppm.



	2000	2001	2002	2003	2004	2005	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Arlington	2.7	2.7	2.6	2.5	2.2	1.6	1.1	1.7	1.6	1.2	1.2	1.3	1.0	1.4	1.2	0.9
Hampton	2.4	2.3	2.1	1.9	1.7	1.8	0.9	0.7	0.8	0.6	0.6	0.5	0.7	0.6	0.7	0.8
Henrico							1.0	1.1	1.2	0.8	0.8	0.9	0.8	0.8	0.9	1.1
Norfolk	4.1	4.2	3.7	2.9	3.0	1.1	0.9	0.9	0.7	0.9	1.0	1.0	1.0	0.8	0.9	0.8
Richmond	2.9	3.1	2.0	2.1	2.1	2.0	1.0	1.0	1.2	1.1	1.2	1.2	1.2	1.0	0.9	1.3
Roanoke Co.							1.1	0.7	0.7	0.7	0.7	0.6	0.5	0.6	0.6	0.8

Figure 2-7: Virginia CO Measurements

2.5. Impact of Forest Fires on Air Quality

During the summer of 2023, smoke from forest fires outside of Virginia resulted in increases in

monitored pollutant levels across the Commonwealth. Smoke from these large forest fires caused ozone and $PM_{2.5}$ exceedances of federal health-base air quality standards on numerous days. Smoke also caused a rare exceedance of the PM_{10} standard June 8, 2023, in Fairfax County, where the measured PM_{10} concentrations reached 191 $\mu g/m^3$. This exceedance was the first PM_{10} exceedance recorded in Virginia since 1991. These episodes of poor air quality are regional events, where large portions of the United States experienced unhealthy air.

For example, on June 29, 2023, 17 monitors in Virginia registered exceedances of the 24-hour $PM_{2.5}$ standard (35 $\mu g/m^3$). These monitors are in Albemarle County, the City of Richmond, Fairfax County, Henrico County, the City of Hampton, Frederick County, Rockingham County, Charles City County, Roanoke County, the Shenandoah National Park, Loudoun County, Arlington County, Chesterfield County, the City of Bristol, and the City of Lynchburg. Monitored values of $PM_{2.5}$ were as high as 103.4 $\mu g/m^3$, based on preliminary data. On June 29, 2023, six monitoring stations measured exceedances of the eight-hour ozone standard (0.070 ppm). These stations are in Prince William County, Rockingham County, Loudoun County, Frederick County, Fairfax County, and Arlington County. Monitored values were as high as 0.085 ppm, based on preliminary data. Satellite imagery for June 29 shows the impact of Canadian forest fire smoke, as seen in Figure 2-8.

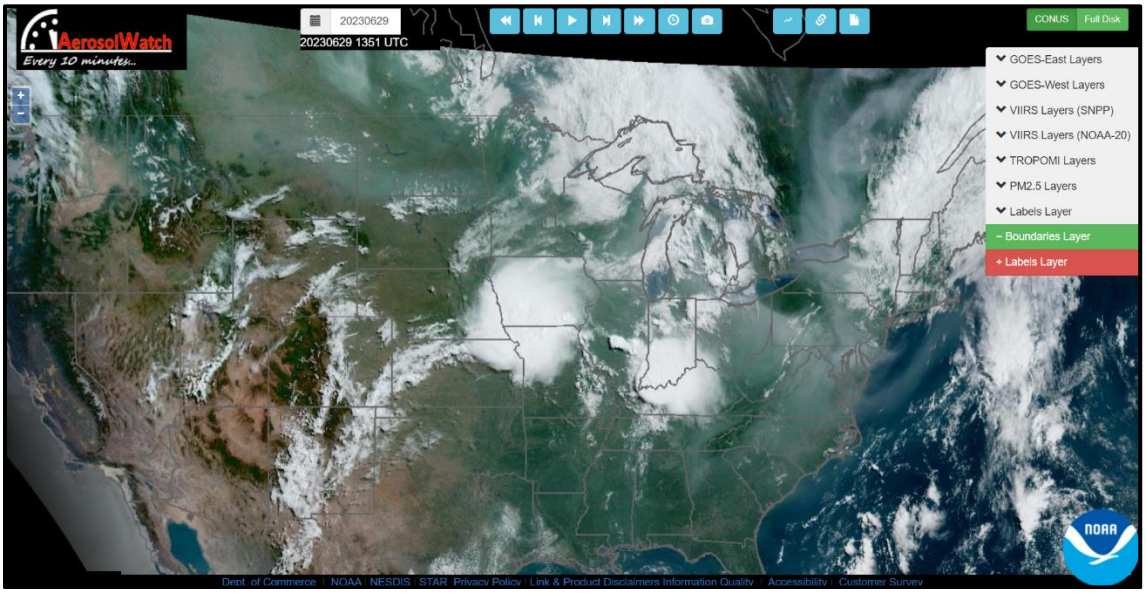


Figure 2-8: June 29, 2023 Satellite Imagery (image from [AerosolWatch -- satellite aerosol products imagery NOAA/NESDIS/STAR])

Figure 2-9 shows monitored air quality values on June 29, 2023, where monitoring sites across the Northeast, Mid-Atlantic, and Midwest registered air quality values in the unhealthy (red) range. Overlayed onto this map of monitoring sites is satellite imagery showing smoke plumes from Canadian forest fires.

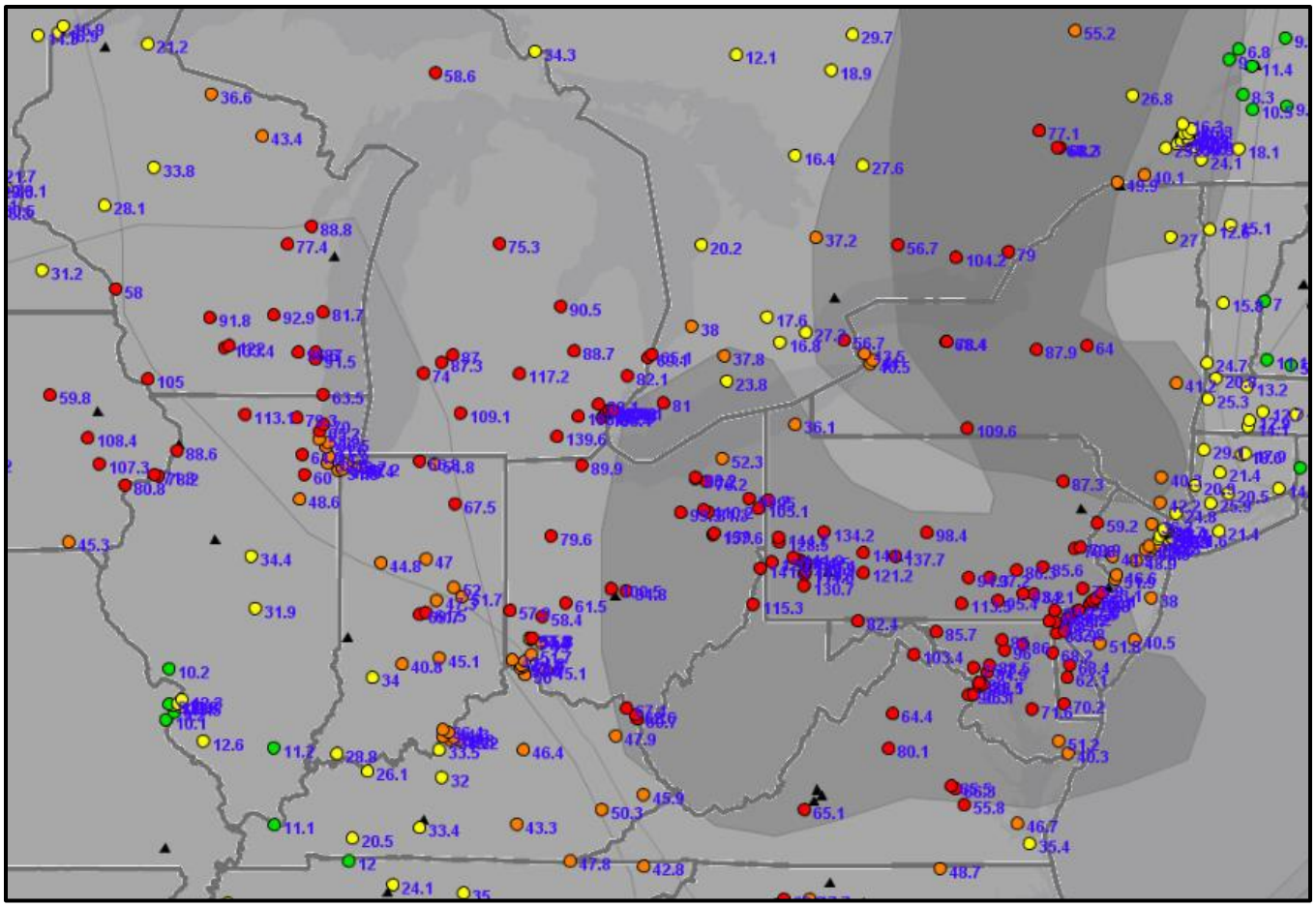


Figure 2-9: June 29, 2023, Air Monitoring Data and Smoke Imagery

Figure 2-10 shows areas of unexplained hotspots detected by satellite on June 29, 2023, which are likely large forest fires.

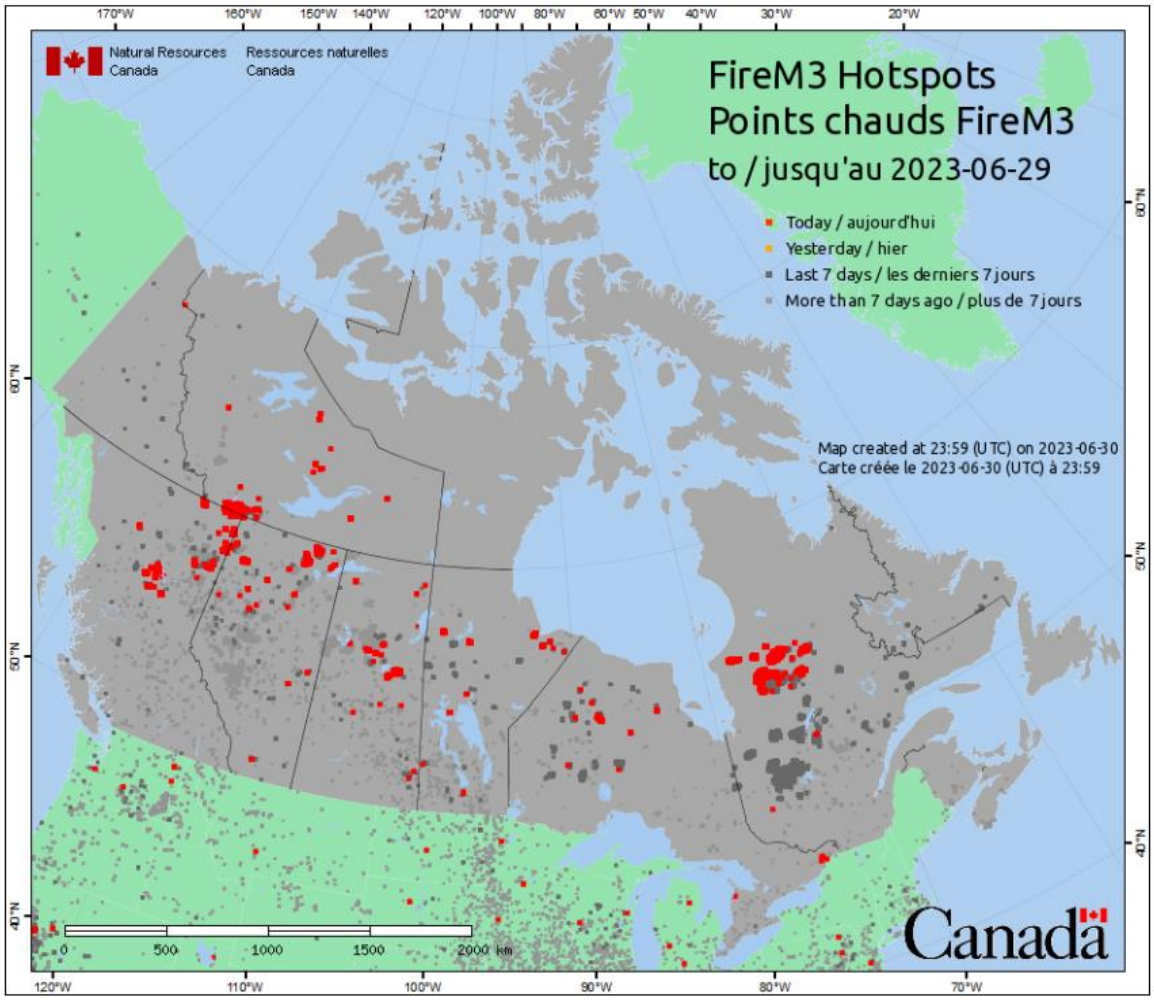


Figure 2-10: Canadian Forest Fires on June 29, 2023 (imagery from [Canadian Wildland Fire Information System | Fire M3 Hotspots (nrcan.gc.ca)])

In 2023, Virginia monitors recorded exceedances for particulate matter on nine days, with the highest reading equal to 147 µg/m^3 (Fairfax County) and for ozone on five days, with the highest recorded reading equal to 0.093 ppm (Stafford County). In contrast, for all of 2022, Virginia recorded no $PM_{2.5}$ exceedance days and only two ozone exceedance days. These forest fire-driven poor air quality days increased eight-hour ozone concentrations, daily $PM_{2.5}$ concentrations, and annual $PM_{2.5}$ concentrations in 2023 across the Commonwealth and especially in the northern portion of Virginia as shown in Figure 2-2, Figure 2-3, and Figure 2-4 respectively. However, while short term exceedances were observed, no violations of the federal health-based standards occurred.

3. Air Pollution Control Overview

This overview describes planning, permitting, compliance, enforcement, and other initiatives. Each section provides information on significant current policy issues related to each category.

3.1. Air Quality Planning and Regulatory Initiatives

Air quality planning strategies focus on meeting all federal requirements associated with current

NAAQS and regional haze. DEQ also expends resources on improving the Virginia portion of EPA's emissions inventory and modeling platforms and analyzing potential effects of proposed rules and federal guidance documents.

3.1.1. 1971 CO NAAQS

On August 31, 2011 (76 FR 54294), EPA issued a decision to retain the primary CO NAAQS, which were originally promulgated in 1971. The primary standards are 9 ppm measured over an eight-hour period and 35 ppm measured over a one-hour period. EPA revised the CO monitoring network requirements to include near-road CO monitoring sites in large urban areas. All jurisdictions within the Commonwealth are attaining these standards and are designated either attainment areas or attainment/maintenance areas for the 1971 CO NAAQS.

3.1.2. 2006 $PM_{2.5}$ NAAQS

On October 17, 2006 (71 FR 61144), EPA promulgated a revised $PM_{2.5}$ NAAQS. The 2006 standard revised the daily $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ and retained the $PM_{2.5}$ annual standard of 15.0 $\mu g/m^3$. On November 13, 2009 (74 FR 58688), EPA published the final designations for the 2006 daily $PM_{2.5}$ standard, and all areas of the Commonwealth were designated as attainment or unclassifiable.

3.1.3. 2008 Ozone NAAQS

On March 27, 2008 (73 FR 16436), EPA revised both the primary and the secondary NAAQS for ozone to 0.075 ppm. EPA published the final area designations and classifications for this standard on May 21, 2012 (77 FR 30088). EPA designated all areas of the Commonwealth, except for Northern Virginia, as attaining this standard. EPA designated Northern Virginia as nonattainment, with a classification of marginal. On April 15, 2019 (84 FR 15108), EPA redesignated the Northern Virginia area as attainment/maintenance for this standard.

Due to *South Coast Air Quality Management District v. EPA* legal decisions, DEQ submitted, and EPA has approved second maintenance plans for the Richmond-Petersburg area (approved March 23, 2023, 88 FR 17376), the Hampton Roads area (approved October 17, 2023, 88 FR 71489), and the Fredericksburg area (April 12, 2024, 89 FR 25812).

3.1.4. 2008 Lead NAAQS

On November 12, 2008 (73 FR 66964), EPA strengthened the NAAQS for lead (Pb), revising the level of the health-based standard to 0.15 $\mu g/m^3$. On November 22, 2011 (76 FR 72097), EPA published the final Pb designations for the 2008 Pb NAAQS and designated the entire Commonwealth as attainment/unclassifiable since monitoring data showed compliance with the new standard.

3.1.5. 2010 NO_2 NAAQS

On February 9, 2010 (75 FR 6474), EPA revised the primary NO_2 NAAQS and set the standard at 100 ppb over a one-hour average. On February 17, 2012 (77 FR 9532), EPA classified all areas of the Commonwealth as attainment/unclassifiable for this standard.

3.1.6. 2010 SO_2 NAAQS

On June 22, 2010 (75 FR 35520), EPA finalized a new primary NAAQS for SO_2. This regulation significantly strengthened the short-term requirements by lowering the standard to 75 ppb on a one-hour basis. On January 9, 2018 (83 FR 1098), EPA designated all jurisdictions in Virginia as attaining this standard except for Buchanan County, Alleghany County, Botetourt County, Giles County and the City of Covington. Buchanan County was designated unclassifiable. EPA based these attainment designations on modeling analyses and data from the SO_2 monitoring network.

EPA designated Botetourt County, Alleghany County, and the City of Covington as attaining the standard on March 26, 2021 (86 FR 16055). Based on air quality monitoring data and Virginia's April 24, 2020, recommendations, EPA designated the portion of Giles County containing the Lhoist North America – Kimballton Plant as nonattainment for the standard. The remainder of Giles County was designated attainment/unclassifiable.

As shown in Figure 2-6, in 2023 the monitor in Giles County registered compliant data (66 ppb) for the first time since its inception.

DEQ has developed an attainment plan, including a site-specific modeling analysis and draft state operating permit for Lhoist North America – Kimballton Plant to address planning requirements under the CAA for this NAAQS. Based on the compliant air quality, DEQ expects to draft a redesignation request and maintenance plan once the final attainment plan, modeling analysis, and state operating permit is submitted to EPA.

3.1.7. 2012 $PM_{2.5}$ NAAQS

On January 15, 2013 (78 FR 3086), EPA published a rule strengthening the NAAQS for $PM_{2.5}$. This rule left the daily value initially published in 2006 unchanged at 35 $\mu g/m^3$ but reduced the annual threshold from 15 $\mu g/m^3$ to 12 $\mu g/m^3$. On January 15, 2015 (80 FR 2206), EPA designated all of Virginia unclassifiable/attainment for this standard.

3.1.8. 2015 Ozone NAAQS

On October 26, 2015 (80 FR 65292), EPA revised the NAAQS for ozone. This revision lowered the standard from 0.075 ppm to 0.070 ppm. On June 4, 2018 (83 FR 25838), EPA designated all areas of the Commonwealth except nine jurisdictions in Northern Virginia as attaining this standard. The nine jurisdictions in Northern Virginia designated as nonattainment with a classification of marginal are the Counties of Arlington, Fairfax, Loudoun, and Prince William and the Cities of Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park. These jurisdictions are part of the Metropolitan Washington, D.C. nonattainment area, which is comprised of jurisdictions in Maryland and Virginia and includes the District of Columbia. The compliance date for this area was August 3, 2021.

On October 7, 2022, EPA reclassified the area to moderate based on air quality data from years 2018 through 2020 showing levels just slightly higher than 0.070 ppm (87 FR 60917). However, monitoring data for 2021 and 2022 showed that the Metropolitan Washington DC area, of which Northern Virginia is a part, attained the standard. Based on the compliant data, EPA published a proposed clean data determination for the area on February 1, 2023 (88 FR 6688). A clean data determination would suspend many of the attainment planning requirements and allow states to focus on developing and

submitting a maintenance plan for the 2015 ozone NAAQS.

This year DEQ must work with facilities on the reasonably available control technology (RACT) requirements for the 2015 ozone NAAQS, as required by §182 and §184 of the CAA. These RACT requirements apply to major stationary sources of NO_X and VOC in the Northern Virginia nonattainment area.

EPA published a final action to retain the 2015 ozone NAAQS without revision on December 31, 2020 (85 FR 87256). Subsequently, EPA announced its decision to reconsider the 2020 ozone NAAQS final action, and EPA published a draft policy assessment for this reconsideration on April 29, 2022 (87 FR 25485). On August 21, 2023, EPA announced a new review of the ozone NAAQS.

On June 5, 2023, EPA published a final rule to address Good Neighbor provisions under the CAA (88 FR 36656). The Good Neighbor provisions mandate that states may not cause or significantly contribute to downwind state ozone nonattainment areas or interfere with maintenance of a standard in downwind states. This federal implementation plan applies to both electric generating units and industrial units emitting NO_X in Virginia. Industrial units such as boilers, natural gas compressor stations, and cement manufacturing operations are subject to requirements under this federal implementation plan. However, on June 27, 2024, the Supreme Court blocked the Good Neighbor provisions from taking effect while litigation over the merits of the CAA ozone transport rule play out in lower courts.

3.1.9. 2024 $PM_{2.5}$ NAAQS

On March 6, 2024, EPA published a final reconsideration of the NAAQS for $PM_{2.5}$ (89 FR 16202). EPA revised the primary annual $PM_{2.5}$ standard by lowering the level from 12.0 $\mu g/m^3$ to 9.0 $\mu g/m^3$. EPA retained the primary 24-hour $PM_{2.5}$ standard of 35 $\mu g/m^3$. As shown in Figure 2-4, Virginia's $PM_{2.5}$ monitors demonstrate compliance with the new annual standard even with the unusually high reading during 2023 from wildfire impacts. EPA will likely complete the process of designating areas as meeting or not meeting the new NAAQS in 2026 using data from years 2022 through 2024.

3.1.10. Regional Haze

Section 169 A of the Clean Air Act (CAA) mandates the protection of visibility in national parks, forests, and wilderness areas, referred to as Class I federal areas. The absorption and scattering of light by fine particles cause visibility impairment (haze) in these areas. Sources and activities that emit fine particles and their precursors, such as NO_X, SO_2, VOC, and ammonia, contribute to this problem. In 1999, EPA finalized the Regional Haze Rule, which requires that state, tribal, and federal agencies work together to improve visibility in 156 national parks and wilderness areas.

DEQ developed a first-round state implementation plan (SIP) to address visibility impairment in the Commonwealth's two Class I areas, the Shenandoah National Park and the James River Face Wilderness Area, as well as a progress report showing visibility improvements achieved and expected future visibility improvements. Figure 3-1 shows actual visibility improvements at Dickey's Ridge in the Shenandoah National Park. The left image shows visibility at 30.54 deciview, the visibility impairment measured during 2002 on 20% most impaired days. The right image shows visibility at 16.33 deciview, the visibility impairment measured during 2022 on 20% most impaired days. This progress in visibility improvement is mainly due to the reduced emissions of SO_2 and sulfates from fuel combustion sources.

Figure 3-1: 2002 (left) and 2022 (right) 20% Most Impaired Day Visibility at Dickey's Ridge, Shenandoah National Park

In concert with other southeastern states, DEQ is working to finalize the next Regional Haze SIP revision, which was due to EPA in 2021. As part of this submission, the CAA requires that DEQ undertake a four factor analysis for certain sources and emissions sectors to determine if reasonable controls are in place or available. The factors required to be considered are potential costs of compliance, time necessary for compliance, energy, and non-air quality environmental impacts of compliance, and remaining useful life of sources subject to this analysis. DEQ issued a permit on December 8, 2023, to WestRock-Covington limiting facility-wide SO_2 emissions to 1,359 tons as part of this effort, a 1,900 ton reduction from their actual emissions of SO_2 in 2022. DEQ is continuing to work with Jewell Coke Company on their reasonable control evaluation. DEQ also participates on the southeastern state subcommittee that is developing the draft of the progress report due to EPA in 2025.

3.2. Air Permitting Activities

DEQ issues two basic types of air permits: construction permits and operating permits. Construction permits, termed New Source Review (NSR) permits, apply to new facilities as well as existing facilities that undergo an expansion or modification. Operating permits apply to sources that are already in operation.

DEQ has three construction permit programs for criteria pollutants, as described below:

The Prevention of Significant Deterioration (PSD) major new source review program applies to major sources that are in an area that is in attainment with the National Ambient Air Quality Standards (NAAQS). Sources must apply Best Available Control Technology (BACT) as well as undergo a thorough air quality analysis demonstration (i.e., air modeling) to assure the new facility or major

modification to an existing facility will not cause or contribute to a violation of the NAAQS or have an adverse impact on any Class I area. DEQ did not issue any PSD Significant Amendment permits in state fiscal year 2024.

The second program is the nonattainment major NSR program, which applies to major sources located in an area designated as nonattainment for one or more NAAQS. A facility in a nonattainment area must apply the Lowest Achievable Emission Rate (LAER), which is often more rigorous than BACT, and must obtain offsets for the pollutant for which the area is not in attainment. DEQ did not issue any nonattainment NSR permits in state fiscal year 2024.

The third program is the minor NSR program. This program applies to new sources or existing sources that are undergoing a modification and are below major source emissions thresholds. During the 2024 fiscal year, DEQ issued 324 minor NSR permits. Additionally, the minor NSR program is used to issue state major source permits, which apply to those sources that have emissions greater than 100 tpy of a criteria pollutant but do not fit the criteria to be classified as PSD or nonattainment major NSR. DEQ did not issue any state major permits in fiscal year 2024. Virginia also has general permits (i.e., permits by regulation) for non-metallic mineral processors and distributed generation. If a facility meets the necessary requirements, the facility may use the general permit process instead of the normal minor NSR permitting process. DEQ issued 3 general permits during state fiscal year 2024.

DEQ issues two types of operating permits: state operating permits (SOPs) and federal operating permits, including federal Title V operating permits and federal Acid Rain program permits, as described below:

SOPs are used primarily to cap a source's emissions to keep it below major source emissions thresholds and therefore exempt from a major source permitting program. Facilities often use SOPs to place federally and state enforceable limits on hazardous air pollutants (HAPs) to remain exempt from the federal HAP program. The federal HAP program generally requires the implementation of maximum achievable control technology (MACT) standards. A source may request SOPs at any time, and DEQ may issue SOPs as necessary (due to a modeled or actual exceedance of a NAAQS or to meet a CAA requirement). DEQ issued 20 SOPs during state fiscal year 2023.

The federal operating permits issued by DEQ, include federal Title V operating permits as well as federal Acid Rain program permits. The Title V permit program applies to sources that meet the criteria for being "major" under Title V of the CAA. The purpose of a Title V permit is to compile all requirements from a source's multiple air permits and applicable regulations into one permit document. A newly constructed source that is large enough to qualify as a Title V source must apply for a Title V permit within one year of starting operation. Title V permits must be renewed every five years. Acid Rain permits also are considered federal operating permits. DEQ must issue these permits to sources that are subject to the federal Acid Rain program (CAA Title IV). DEQ issued 6 federal operating permits and 47 operating permit renewals during state fiscal year 2024.

The Air Permitting Program continues to utilize DEQ's Permit Enhancement and Evaluation Platform (PEEP). Air Permitting is consistently meeting all target timelines established in PEEP.

Additional information about air permitting activities at DEQ is available on DEQ's website at https://www.deq.virginia.gov/permits/air.

3.3. Air Compliance Activities

DEQ's air compliance program identifies and addresses potential violations of applicable regulations and laws to ensure compliance by facilities operating within the Commonwealth. The focus of the air compliance program is to return facilities to compliance expeditiously, supporting DEQ's mission to protect the environment and human health. To do so, air compliance personnel perform partial compliance evaluations (PCEs) and full compliance evaluations (FCEs). These actions include onsite inspections, test observations, and comprehensive evaluations of the facility records and equipment associated with pollutant emissions, including examination and review of documents detailing throughputs, emissions, monitoring, testing, and various reports submitted by the facilities.

DEQ's air compliance program operates in accordance with EPA's 2016 Clean Air Act Stationary Source Compliance Monitoring Strategy (CMS). This strategy primarily identifies the largest potential emitters of air pollution for an FCE at a minimum recommended frequency of once every two years. Depending on available resources, DEQ's air compliance program also identifies smaller potential emitters under its Risk-Based Inspection Strategy (RBIS). This strategy allows flexibility during inspection planning, and DEQ regional offices may identify facilities for a FCE based on potential noncompliance or in response to sector initiatives.

Virginia has 3,817 registered air facilities, excluding gasoline service stations. For the 2023 federal fiscal year (October 1, 2022, through September 30, 2023), the air compliance program conducted 3,738 compliance evaluations, including 576 on-site inspections and 110 stack test observations. As a result, the air compliance program issued 350 enforcement actions.

DEQ reports compliance and enforcement activities related to Virginia's regulated facilities to EPA on a weekly basis. This information is publicly available on EPA's Environmental Compliance and History Online (ECHO) website: https://echo.epa.gov.

3.4. Air Enforcement Activities

The goal of enforcement is to take appropriate actions to address violations of environmental laws and return facilities to compliance with Virginia's statutory and regulatory requirements. The mechanism used by DEQ to achieve compliance is proportional to the violation, responsive to the facility's compliance history, and protective of human health and the environment. In addition, an appropriate enforcement action, which may include a civil charge and recovery of economic benefit, sends a message of deterrence to the regulated community. In federal fiscal year 2023, DEQ issued 45 consent orders that resulted in a total of $447,448.35 in civil charges collected.

3.5. Small Business Assistance

DEQ provides various forms of compliance assistance to potentially thousands of small businesses throughout the Commonwealth. DEQ provides these services at no cost to facilities to inform, educate, and assist small businesses in complying with environmental regulations. More generally, the Small Business Assistance (SBA) program conducts personal and web-based outreach to small businesses, providing access to various resources including regulatory updates, fact sheets, checklists, brochures,

enforcement case assistance, and financial resources. DEQ maintains the SBA website at: https://www.deq.virginia.gov/our-programs/small-business-assistance.

3.6. Motor Vehicle Inspection and Maintenance Program

Virginia's motor vehicle inspection and maintenance (I/M) program improves air quality by identifying high-emitting vehicles in need of repair operating in the Commonwealth's nonattainment area and requiring them to be fixed as a prerequisite to vehicle registration. The CAA mandates I/M for several areas across the country, including the Northern Virginia area, based upon criteria such as air quality classification, population, and geographic location.

DEQ's decentralized I/M program includes over 500 permitted emissions inspection stations and over 200 certified repair facilities. These stations and facilities use the latest accepted technology to determine which vehicles emit excessive pollutants. Gasoline-powered vehicles up to 10,000 pounds gross vehicle weight rating (GVWR) and newer than 25 model years and diesel-powered vehicles up to 8,500 pounds GVWR and 1997 model year and newer registered in the I/M area are required to pass an emissions test or receive a waiver every two years to obtain vehicle registration. In calendar year 2023, inspection stations performed 763,908 initial vehicle emissions inspections, of which 15,608 (or 1.8%) failed inspection, prompting repair of these vehicles. DEQ maintains an I/M program website at Vehicle Emissions (Air Check) | Virginia DEQ.

3.6.1. Mobile Source Operations Section

The Mobile Source Operations Section (MSOS) of DEQ's Northern Regional Office monitors the performance of the various emissions inspection stations, certified emissions repair facilities, nearly 300 certified emissions repair technicians and over 1,300 licensed emissions inspectors within the I/M program. In calendar year 2023, MSOS personnel conducted 465 overt and 108 covert performance audits at emissions inspection stations.

3.6.2. On-Road Emissions Monitoring Program

Virginia's On-Road Emissions (ORE) program is designed to use on-road, remote sensing devices to identify both high-emitting and very clean vehicles. With few exceptions, gasoline-powered vehicles with a model year of 1968 and newer and 10,000 pounds GVWR or less registered or operated primarily (as defined by regulation) in the I/M area are subject to the ORE program. Emissions data are collected by the remote sensing devices as vehicles travel through designated on-road sites. These data are then used to determine whether the emissions meet applicable standards and if any owner notification is warranted. Data are also used for program evaluation purposes.

Owners of high-emitting vehicles are sent a Notice of Violation (NOV) and are prompted to receive a confirmation test and necessary repairs. Vehicles failing the confirmation test must be repaired and re-inspected until they pass or receive a DEQ-issued waiver. Low-income owners may be eligible for repair assistance. In 2023, DEQ issued 1,722 NOVs to owners of high-emitting vehicles. Of the 1,047 vehicles submitted for confirmation tests, 36% failed and an additional 17% had emissions control monitors "not ready" indicating issues with the vehicle's emissions control system. Repairs resulting from this program help improve air quality and allow DEQ to monitor program compliance of subject vehicles between normal inspection cycles.

Owners of exceptionally clean vehicles subject to biennial inspections and meeting program requirements may receive a "clean screen" notice through the RAPIDPASS program and have the option to redeem them in lieu of vehicle testing at a traditional emissions inspection station. Legislation passed in 2012 allows up to 30% of the eligible I/M fleet to be clean-screened through the ORE program. In 2023, there were 110,491 on-road emissions tests completed.

Additionally, DEQ administers an evaporative emissions ("liquid leaker") advisory program, which uses the remote sensing devices to identify vehicles with very high evaporative emissions, separate from tailpipe exhaust emissions. Since this is advisory only, vehicles do not need to be registered or operated primarily in the I/M area; all Virginia-registered vehicles meeting other ORE criteria are subject to the program. Vehicle owners are mailed advisory notices explaining on-road detection, the potential leak and actions that may be taken if the owner decides to have their vehicle examined. The advisory notice clearly explains that no action is required but does request feedback should the owner choose to have the vehicle examined and/or repaired. Information provided to DEQ aids in evaluating air quality benefits associated with the identification and repair of evaporative emissions leaks. DEQ began sending these notices in June 2018. Of the five advisory notices sent in calendar year 2023, no responses were received from owners. DEQ will use this and subsequent years' data to estimate the potential emissions reductions and benefits these types of repairs may provide in continuing efforts to improve the Commonwealth's air quality.

4. Emission Estimates and Control Programs

Figure 4-1 provides Virginia emissions data for years 2011 and 2020 from EPA's National Emissions Inventory (NEI). As shown in Figure 4-1, anthropogenic emissions of NO_X, VOC, and SO_2 in Virginia have decreased significantly between 2011 and 2020. The reductions shown are the result of control programs implemented at the federal and state level as well as changing economic factors.

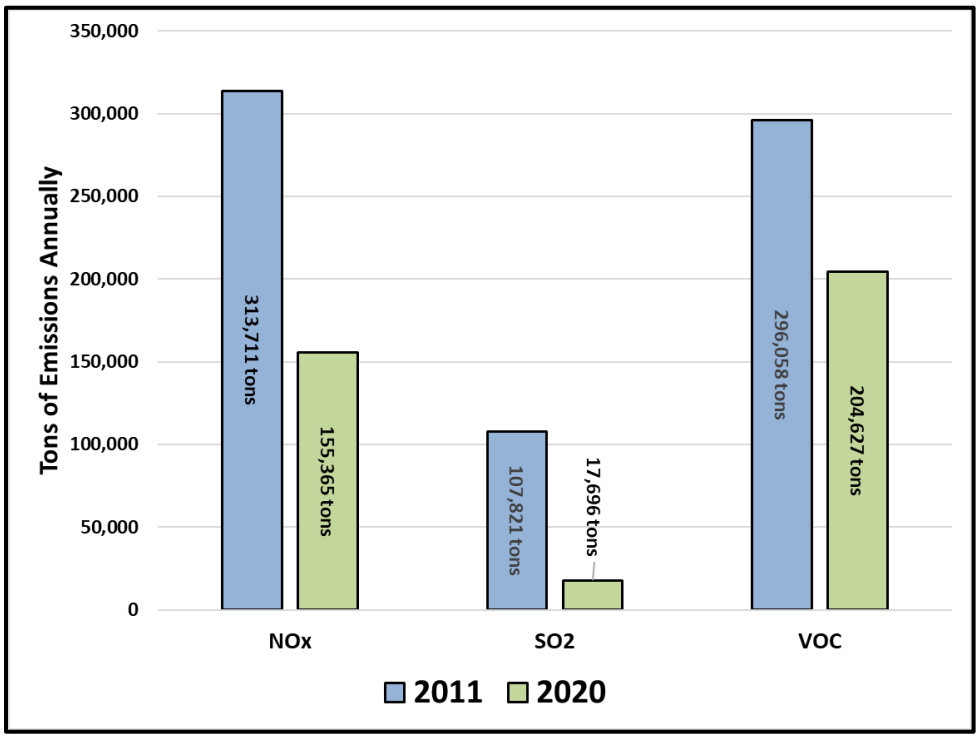


Figure 4-1: 2011 and 2020 Anthropogenic Emission Estimates for Virginia

Figure 4-2 compares the percentage of emissions for SO_2 and NO_X derived from each source sector in 2011 and 2020. For SO_2, emissions decreased from 107,821 tons in 2011 to 17,696 tons in 2020. In 2011, fuel combustion for the purposes of creating electricity accounted for 64% of the SO_2 emissions in Virginia. In 2020, this sector accounts for only 7% of total SO_2 emissions in Virginia. Industrial fuel combustion (28%) followed by metals processing (25%) accounted for the majority of SO_2 emissions in 2020.

NO_X emissions have decreased from 313,711 tons in 2011 to 155,365 tons in 2020. Figure 4-2 shows that highway vehicles and off-highway engines account for 68% of all anthropogenic NO_X emissions in 2011 and 63% of all anthropogenic NO_X emissions in 2020. NO_X emissions from highway vehicles and off-highway engines may have been depressed during 2020 due to the COVID-19 pandemic response.

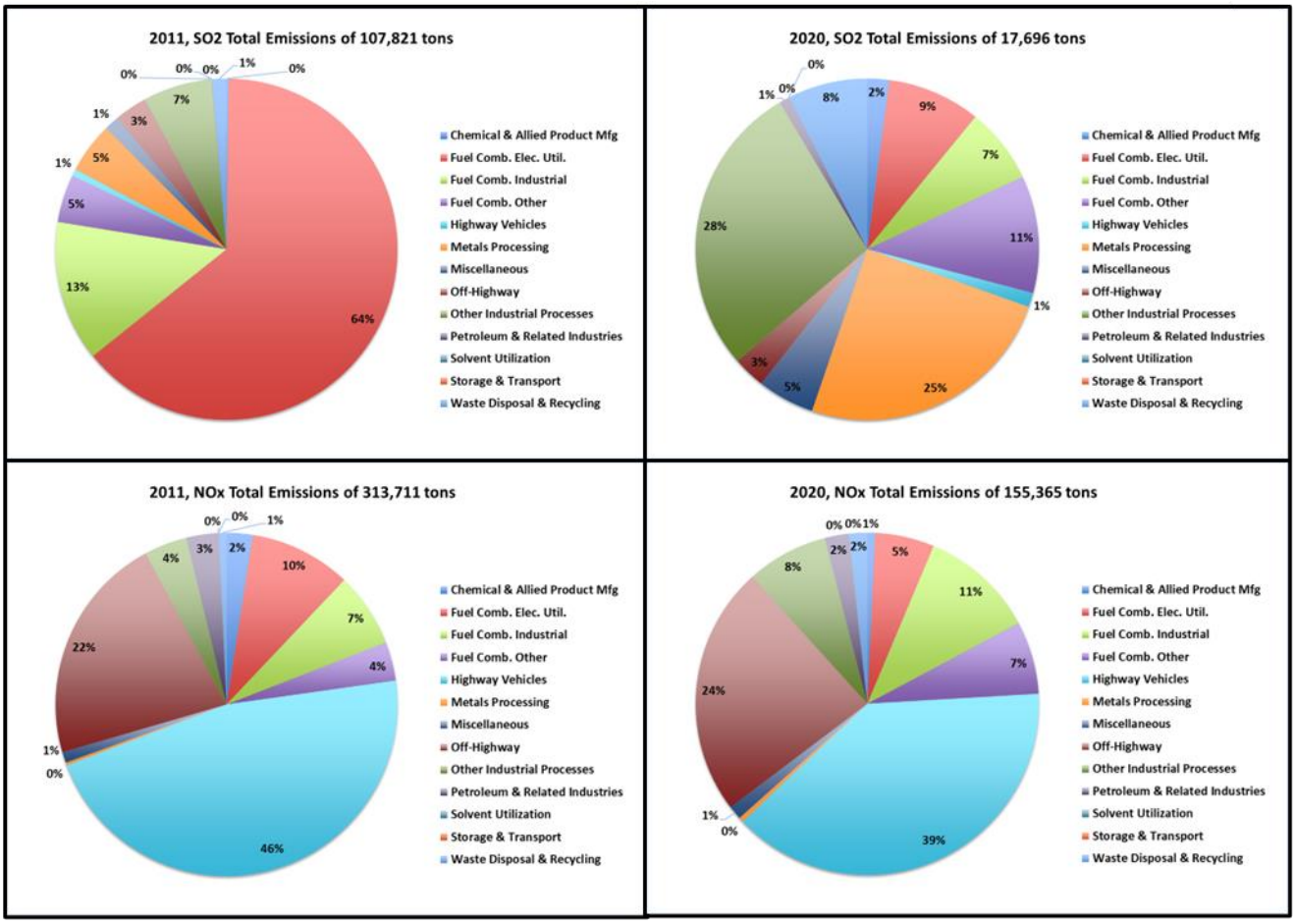


Figure 4-2: 2011 and 2020 Percent Emission of NO_X and SO_2 by Sector

4.1. Emissions from Electrical Generation

Figure 4-3 provides the annual emissions of SO_2 and NO_X from Acid Rain Program electrical generating units located in Virginia. These units are the largest fossil fuel-fired equipment in the Commonwealth. Emission reductions from this source sector are attributable to several factors, including control programs such as the federal Mercury and Air Toxics Rule; retirement of older, high-emitting units; and

the construction and operation of new, very low-emitting units. Between 2002 and 2023, Virginia emissions and emission rates decreased in this source sector even though fuel usage rates, depicted by the solid line in Figure 4-3, have increased in recent years.

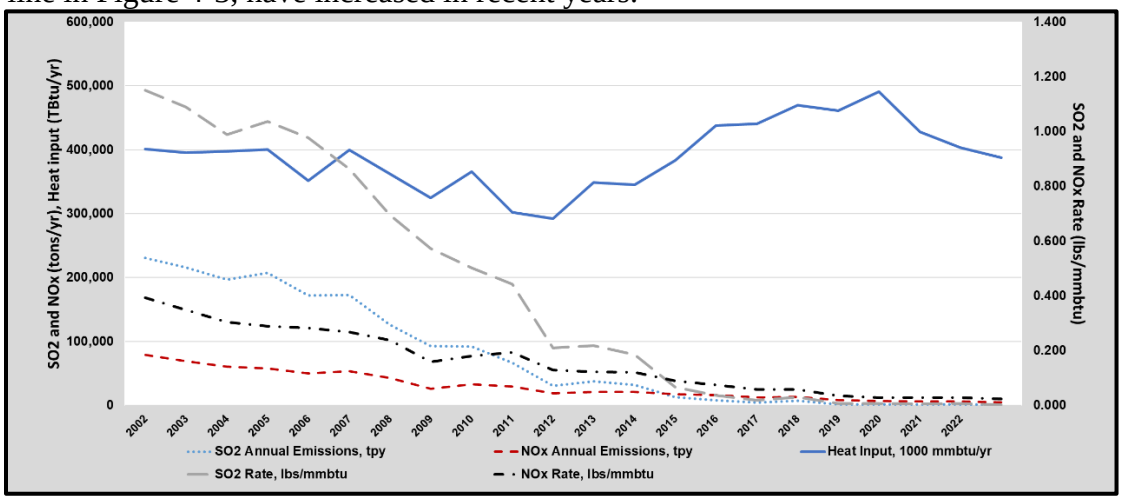


Figure 4-3: Virginia Acid Rain Unit Emissions

4.2. On Road Mobile Source Programs

On-road mobile sources include highway vehicles that use gasoline, diesel, and other fuels. These sources include both light duty and heavy-duty vehicles. In EPA's NEI data for 2011 and 2020, the on-road mobile source sector accounts for 46% and 39%, respectively, of Virginia's entire anthropogenic NO_X inventory. NO_X is the predominant cause of ozone in this part of the United States and contributes to nitrogen deposition in the Chesapeake Bay. Virginia on-road mobile source NOx emissions have steadily decreased from 2011 to 2020. On-road mobile source NO_X emissions in 2011 were approximately 145,762 tons while in 2020 the on-road mobile source NO_X emissions were approximately 60,394 tons. The data for 2020 may be somewhat depressed by the COVID-19 pandemic response.

On January 24, 2023 (88 FR 4296), EPA published a new rule controlling emissions from heavy duty engines and vehicles. This rule adopts stronger standards reducing NO_X emissions from heavy-duty vehicles and engines starting in model year 2027. EPA provides more information on this rule at https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-and-related-materials-control-air-pollution.

On April 18, 2024 (89 FR 27842), EPA finalized a more stringent set of emission standards for light-duty and medium duty on-road engines that would phase-in over model years 2027 through 2032. The standards reduce passenger car, light truck, and medium-duty vehicle emissions of hydrocarbons, NO_X, and $PM_{2.5}$. EPA provides more information on this rule at https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-multi-pollutant-emissions-standards-model.

4.3. Reformulated Gasoline

Reformulated gasoline (RFG) is gasoline blended to burn more cleanly than conventional gasoline. Using this fuel reduces emissions of VOC, CO, and NO_X as well as some toxic pollutants like benzene. The CAA under § 211(k)(10)(D) mandated the use of RFG in certain large, metropolitan areas, including ten jurisdictions in the Northern Virginia area. Based on air quality, other Virginia areas opted

into this program to garner reductions necessary to reduce ozone concentrations. Such areas in Virginia include seven jurisdictions in the Richmond-Petersburg area and 11 jurisdictions in the Hampton Roads area. Based on 2016 Virginia Department of Motor Vehicle data, these jurisdictions house 58% of all registered vehicles in Virginia. Based on Virginia Department of Transportation data, these jurisdictions account for 52% of all vehicle miles traveled in Virginia.

EPA estimates that RFG reduces mobile source emissions of VOC by 27% and NO_X by 7% as compared to emissions from conventional gasoline. Emission reductions occur for on-road use, such as in passenger vehicles and gasoline-powered trucks, and in other types of engines, such as lawn equipment, watercraft, and gasoline-powered generators. EPA also estimates that RFG emits 22% less toxic air pollutants than conventional gasoline. EPA provides more information on this program at https://www.epa.gov/gasoline-standards/reformulated-gasoline.

In 2017 DEQ evaluated the emissions benefits of this program using MOVES2014a and the 2011 input data for Virginia jurisdictions. This analysis estimated the daily and annual benefits achieved from implementation of the RFG program in 2011. Table 4-1 summarizes these estimated 2011 reductions from the RFG program on a daily basis and on an annual basis.

Table 4-1: RFG Program - Emissions Benefit

Area	NO_X tons/day	NO_X tpy	VOC tons/day	VOC tpy	CO tons/day	CO tpy
Northern Virginia/D.C.	1.39	210.31	1.90	415.01	18.63	3,391.49
Richmond-Petersburg	1.13	162.50	1.64	321.52	14.35	2,575.94
Hampton Roads	1.49	187.94	2.05	347.49	19.75	2,665.26
Virginia Total	4.00	560.75	5.59	1,084.03	52.72	8,632.69

On December 4, 2020 (85 FR 78412), EPA finalized an action that updated many of the federal gasoline and diesel fuel quality programs, including the RFG program. The streamlined regulation does not affect the stringency of any of the fuel quality program standards. However, changes to recertification provisions may facilitate the distribution of an ethanol-free RFG in RFG areas should manufacturers decide to create and market such a product.

4.4. Non-Road Mobile Control Programs

Non-road mobile equipment includes off-road mobile sources that use gasoline, diesel, and other fuels. Source types include construction equipment, lawn and garden equipment, aircraft ground support equipment, locomotives, and commercial marine vessels. In EPA's NEI data for 2011 and 2020, the non-road mobile source sector accounts for 22% and 24%, respectively, of Virginia's entire anthropogenic NOx inventory.

Federal regulations control emissions of various pollutants from these non-road mobile source categories. These federal regulations require manufacturers to build cleaner engines. Most of these regulations have phase-in periods, where standards are more stringent for equipment manufactured in later years. These federal standards address a range of non-road sources including recreational vehicles, marine vessels, locomotives, and lawn and garden equipment. Air pollution benefits are realized through the purchase of new equipment and the benefits to air quality continue until the entire equipment fleet is replaced.

On October 20, 2023 (88 FR 72372), EPA published a final determination that lead emissions from certain aircraft engines cause or contribute to air pollution which may endanger public health and welfare. This determination requires EPA to develop proposed emission standards for leaded emissions from aircraft and to prescribe standards to control or eliminate lead from aircraft fuel. EPA provides more information on this rule at https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-lead-emissions-aircraft.

4.5. Volkswagen Environmental Mitigation Trust Agreement for State Beneficiaries

The Commonwealth of Virginia's Beneficiary Mitigation Plan (Plan) describes the range of eligible on road and non-road mobile source mitigation actions that Virginia may fund with the $93.6 million allocated to it under the fully executed Environmental Mitigation Trust Agreement for State Beneficiaries (State Trust Agreement) that took effect October 2, 2017, in the case, *In Re: Volkswagen "Clean Diesel" Marketing, Sales Practices, and Products Liability Litigation.* The State Trust Agreement is an element of the settlements resolving allegations that Volkswagen (VW) violated the Clean Air Act by the sale of approximately 590,000 2.0- and 3.0-liter diesel engine motor vehicles (model year 2009 to 2016) equipped with "defeat devices" in the form of computer software designed to cheat on federal emissions tests including approximately 16,000 vehicles in Virginia. DEQ was designated the Lead Agency by the Commonwealth of Virginia to manage the states' $93,633,980 allocation of the $2.95 billion Trust through a Beneficiary Mitigation Plan (BMP). The primary goal of the BMP is to mitigate approximately 2,095 short tons of excess NO_X emitted by more than 16,000 VW diesel vehicles registered in Virginia. Other priorities delineated in the BMP, including reducing air pollution in disproportionately impacted areas of the state, attaining and maintaining federal air quality standards for ground-level ozone, improving visibility under the regional haze program, and reducing nitrogen loads to the Chesapeake Bay.[4] More than $80 million of the $93.6 million has been obligated for eligible NO_X mitigation projects delineated by the State Trust Agreement. Information on the implementation of the State Trust Agreement is provided on DEQ's VW Mitigation webpage at https://www.deq.virginia.gov/topics-of-interest/volkswagen-settlement-agreement.

5. Greenhouse Gas Emissions Inventory

Pursuant to subsection H of § **10.1-1307**, beginning with the report issued on October 1, 2022, and every four years after, DEQ shall include a greenhouse gas (GHG) emissions inventory for baseline calendar year 2010 and changes in GHG emissions relative to the GHG 2010 emission baseline case.

DEQ has now updated the annual statewide GHG inventory to 2020 and the results are shown below.

Figure 5-1 illustrates the estimated GHG emissions by sector for the baseline year 2010. In 2010, approximately 160 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) was emitted in the Commonwealth. The use of CO_2e as a standard measure allows for the comparison of greenhouse gases based on their global warming potential. For instance, a ton of methane emissions causes at least 25 times the amount of warming as a ton of CO_2 and can be described as 25 tons of CO_2e.

[4] DEQ collaborated with EPA to develop a white paper entitled *Influence of Volkswagen Settlement Agreements on Chesapeake Water Quality*, which provides a standard method for converting reductions in NOx emissions achieved through the implementation of VW mitigation to reduced nitrogen loads to the Bay. This standard method can be used by all Chesapeake Bay Partner states (https://www.chesapeakebay.net/channel_files/28679/influence_of_volkswagen_settlement_agreements_on_chesapeake_water_quality_final_8-20-18.pdf).

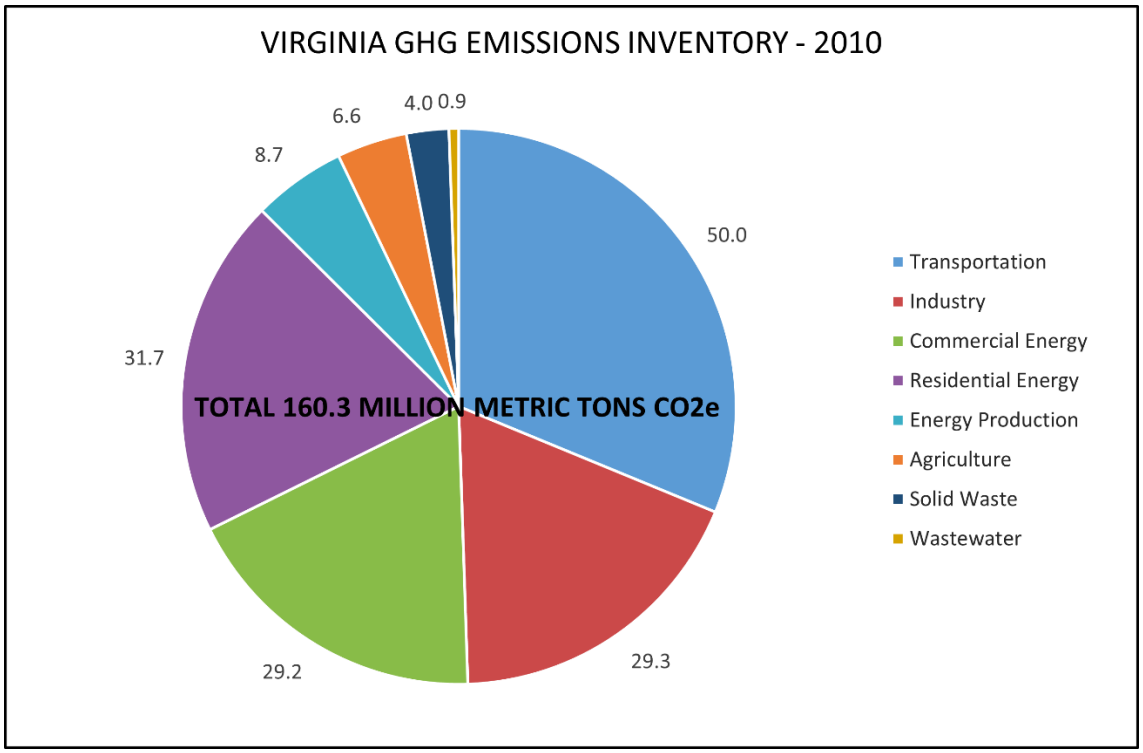


Figure 5-1: 2010 Baseline GHG Emissions by Sector

Figure 5-2 depicts the estimated GHG emissions by sector in 2020. In the calendar year 2020, about 123 $MMTCO_2e$ were emitted in the Commonwealth, representing a reduction of approximately 23.2 percent compared to GHG emissions in 2010.

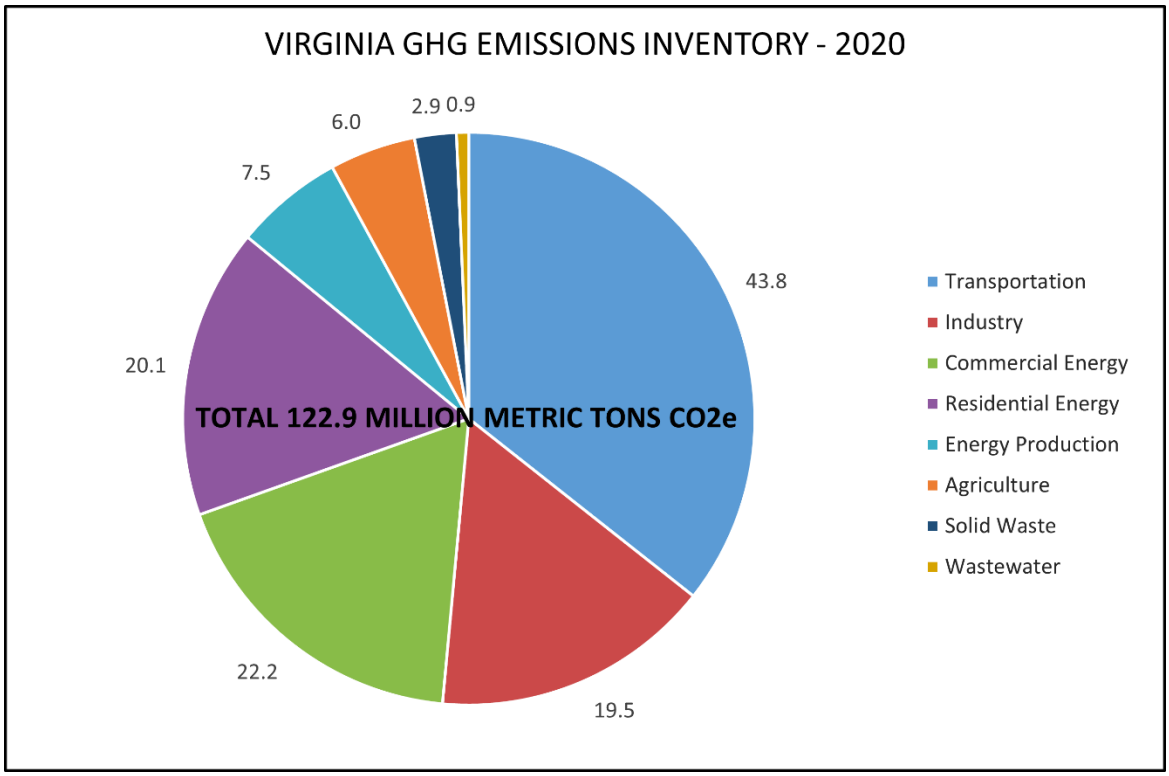


Figure 5-2: 2020 GHG Emissions by Sector

Virginia's GHG inventory includes emissions offset data from natural sources such as forests, soil, and urban trees. In 2020, natural sources offset 50.3 $MMTCO_2e$, compared to 51.1 $MMTCO_2e$ in 2010. This means that in 2020, natural sources sequestered 40.9 percent of Virginia's GHG emissions, compared to a sequestration rate of 31.9 percent in 2010.

Reports detailing the methodologies and findings of the 2010 baseline and 2016-2020 GHG emissions inventories, encompassing sector-specific emissions and emissions offset data, can be accessed on DEQ's website at: https://www.deq.virginia.gov/our-programs/air/greenhouse-gases.