
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 2022

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Commonly Used Abbreviations

AQM	Office of Air Quality Monitoring	ORVR	On Board Refueling Vapor Recovery
CAA	Clean Air Act		
CMS	Compliance Monitoring Strategy	OTR	Ozone Transport Region
CO	Carbon monoxide	Pb	Lead
CSAPR	Cross State Air Pollution Rule	PCE	Partial Compliance Evaluation
CTG	Control Technique Guideline	PM ₁₀	Particulate matter not more than 10 micrometers in diameter
DEQ	Virginia Department of Environmental Quality	PM _{2.5}	Particulate matter not more than 2.5 micrometers in diameter
ECHO	Enforcement and Compliance History Online	ppb	Parts per billion
EPA	Environmental Protection Agency	ppm	Parts per million
FCE	Full Compliance Evaluation	PSD	Prevention of Significant Deterioration
GVWR	Gross Vehicle Weight Rating	RACT	Reasonably Available Control Technology
HAP	Hazardous Air Pollutant		
I/M	Motor Vehicle Inspection and Maintenance Program	RBIS	Risk Based Inspection System
MACT	Maximum Achievable Control Technology	SAPCB	State Air Pollution Control Board
MATS	Mercury and Air Toxics Standard	SBA	Small Business Assistance
μg/m ³	Micrograms per cubic meter	SIP	State Implementation Plan
MSOS	Mobile Source Operations Section	SO ₂	Sulfur dioxide
NAAQS	National Ambient Air Quality Standard	SOP	State Operating Permit
NO ₂	Nitrogen dioxide	tpy	Tons per year
NO _x	Nitrogen oxides	VDH	Virginia Department of Health
NSR	New Source Review	VOC	Volatile Organic Compounds
ORE	On-Road Emissions Program	VPM	Virginia Productivity Measurements

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

Air quality in Virginia continues to improve. Ambient concentrations of fine particulate matter (PM_{2.5}), nitrogen dioxide (NO₂), carbon monoxide (CO) and ozone in Virginia met United States Environmental Protection Agency (EPA) National Ambient Air Quality Standards (NAAQS) in 2021. Ambient concentrations of sulfur dioxide (SO₂) near an emissions source located in Kimballton, Virginia, (Giles County) showed violations of the 2010 SO₂ NAAQS. DEQ is working with this facility to further reduce their SO₂ emissions and develop an attainment plan.

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), and regulatory changes stemming from the *South Coast Air Quality Management District v. EPA* decision.¹ EPA is reconsidering the 2006 and 2012 PM_{2.5} NAAQS, with changes expected to be proposed by the end of 2022.

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 for 2021

<i>Activity</i>	<i>Milestone</i>
Monitoring Locations:	35
Monitoring Instruments:	112
Minor Source Permits Issued:	252
State Major Source Permits Issued	2
PSD Permits Issued:	2
General Permits Issued:	2
State Operating Permits Issued:	8
Federal Operating Permits Issued:	2
Compliance Evaluations (all):	3,934
On Site Inspections:	717
Enforcement Actions:	399
Vehicle Emission Inspections Performed:	867,691 ²
Vehicle Emission Inspection Failures:	15,400
Vehicle Emission Inspection Station Overt Audits:	480
Vehicle Emission Inspection Station Covert Audits:	95
Consent Orders Issued:	33
Consent Order Civil Charges Collected:	\$1,702,509

¹ [https://www.cadc.uscourts.gov/internet/opinions.nsf/217B6778AE3EC89C8525823600532AE0/\\$file/15-1115-1718293.pdf](https://www.cadc.uscourts.gov/internet/opinions.nsf/217B6778AE3EC89C8525823600532AE0/$file/15-1115-1718293.pdf)

² Total includes tests performed at emissions inspection stations and on-road emissions (clean screen) tests.

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}, PM₁₀, NO₂, SO₂, 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 is improving. PM_{2.5} air quality is in the healthy range across Virginia and has been for the past several years. In 2020, air quality met federal ozone standards across the Commonwealth. However, the SO₂ monitoring site near Lhoist North America LLC, which began operations in 2017 as required by federal regulations, recorded data showing a violation of the SO₂ NAAQS for years 2017-2019 and for years 2018-2020. DEQ is continuing to work with the facility to further reduce SO₂ emissions and improve air quality.

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 as a result of complex reactions of chemicals such as sulfur dioxide and nitrogen oxides, 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: PM₁₀ and PM_{2.5}.

PM₁₀ is an airborne particulate of solid or liquid matter that is less than or equal to 10 micrometers in diameter. PM₁₀ 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.

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 even get into 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.

NO₂ is a gaseous air pollutant that forms when fossil fuels such as coal, oil, gasoline, or diesel burn at high temperatures. NO₂ 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.

SO₂ is one of a group of highly reactive compounds known as "oxides of sulfur." The largest source of SO₂ emissions is fossil fuel combustion at power plants and at other types of industrial facilities. Smaller sources of SO₂ 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 SO₂ 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, the majority of 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, 2022, approximately 112 instruments at 35 sites monitored ambient air quality across Virginia. One SO₂ monitoring site that is part of DEQ's network is maintained by an independent company and one NO₂ monitoring site is maintained by a different independent company. There are two federal ozone monitors included as part of the DEQ network as well.

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 sites described above are 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 <https://www.deq.virginia.gov/air/air-quality-monitoring-assessments/air-quality-reports>.

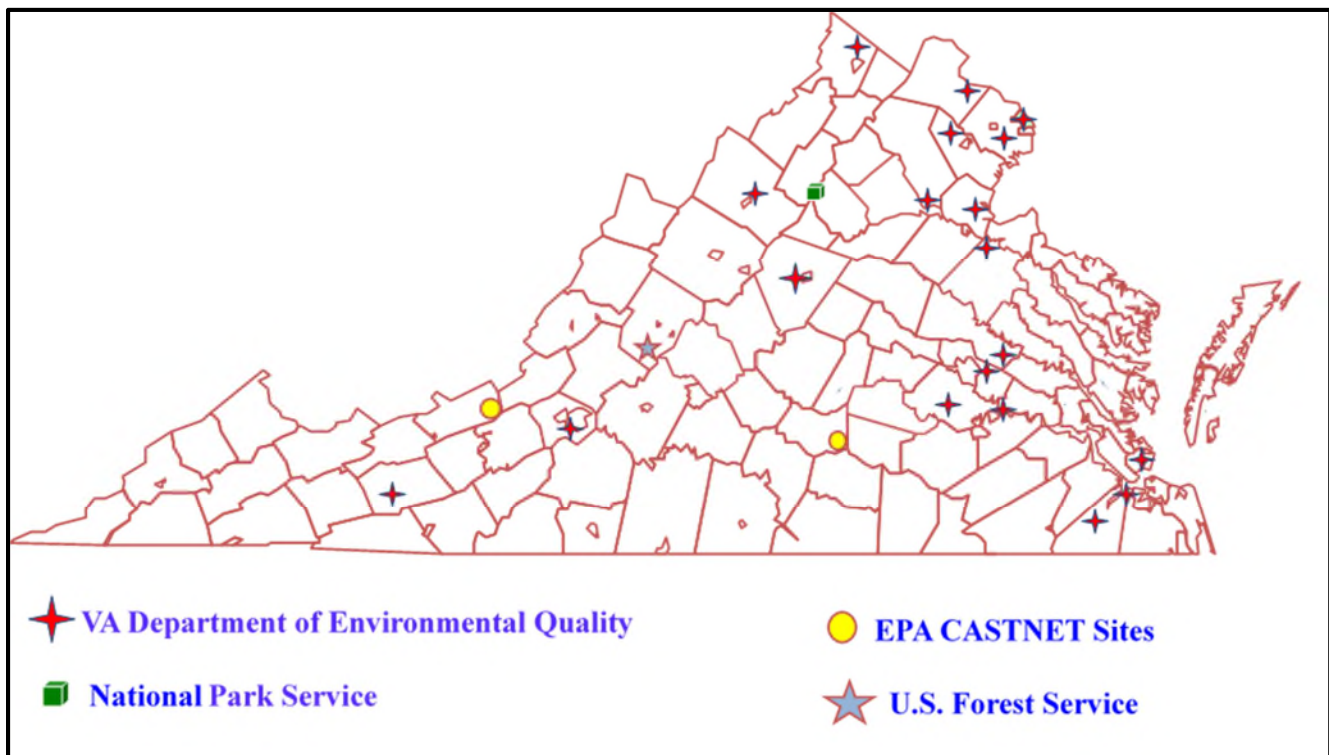


Figure 2-1: Virginia Ozone Monitoring Network

2.3. Near-Road Monitoring for NO₂

In February 2010, EPA promulgated a new NO₂ NAAQS, setting the standard at 100 parts per billion (ppb). This standard included a new requirement for the installation and operation of monitoring stations in close proximity to 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 located 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 fall 2023.

In October of 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 environmental justice areas 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 of 2024.

2.4. Data Trends for Criteria Pollutants

Trends for most criteria pollutants across Virginia show significant improvements over the past decade. 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. Scientific studies are ongoing to determine what may be learned from this natural experiment.

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).

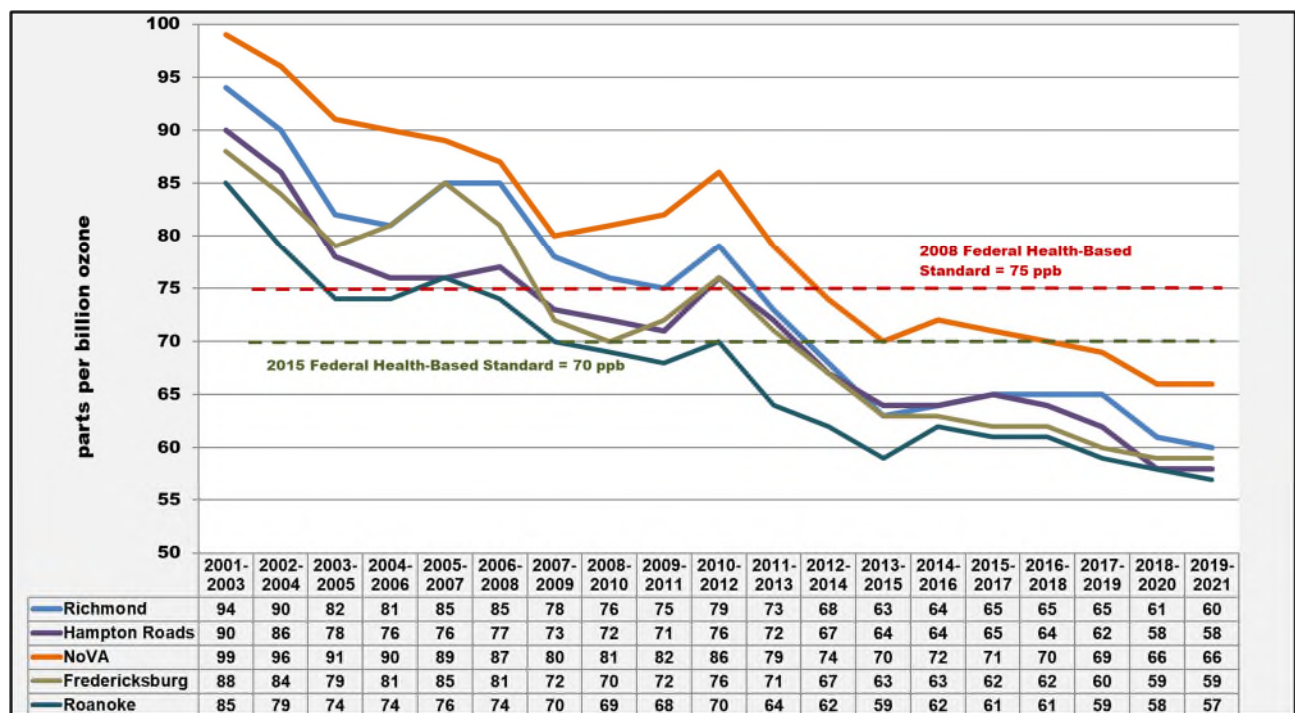


Figure 2-2: Ozone Concentrations, Three Year Average

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 µg/m³ and the 2012 PM_{2.5} annual NAAQS of 12.0 µg/m³.

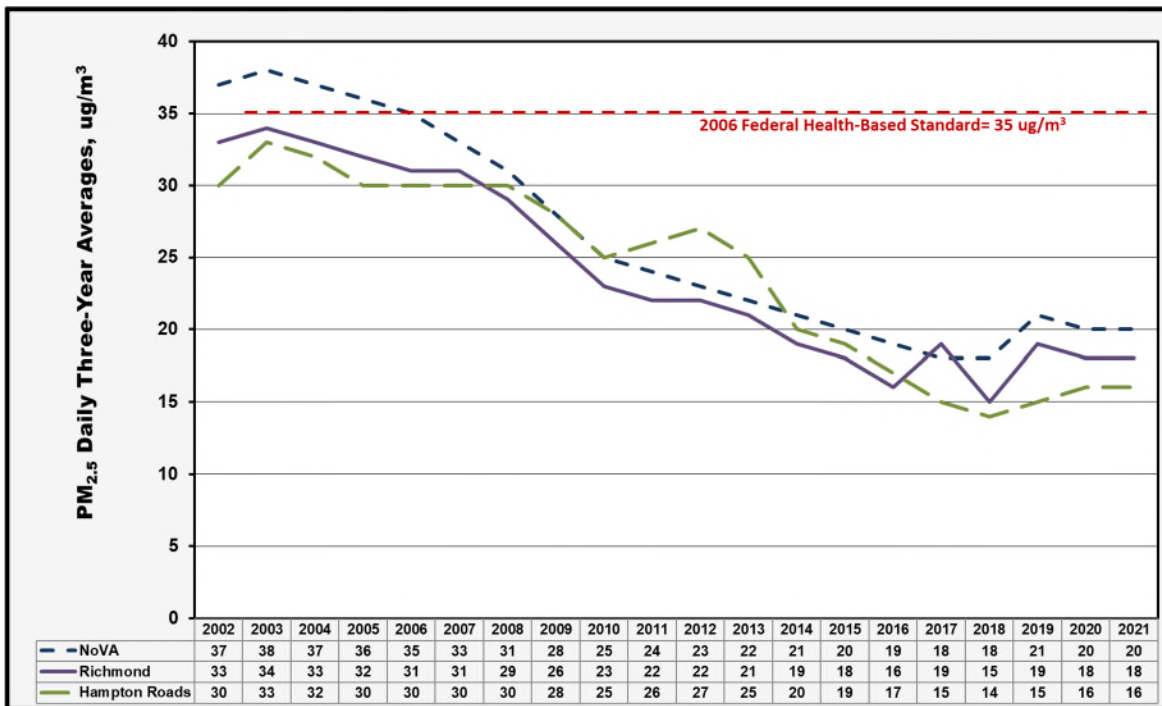


Figure 2-3: Daily PM_{2.5} Averages

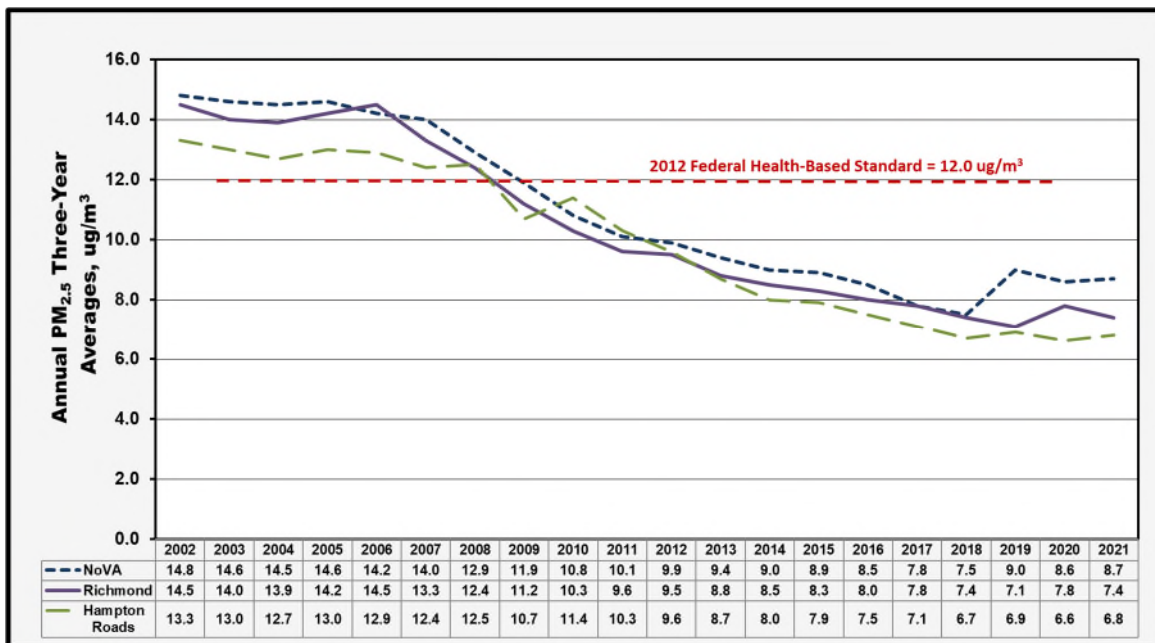


Figure 2-4: Annual PM_{2.5} Averages

Figure 2-5 provides NO₂ measurements for monitors that are currently operating and compares this data to the 2010 NO₂ NAAQS of 100 ppb. All data show values well under the health-based standard.

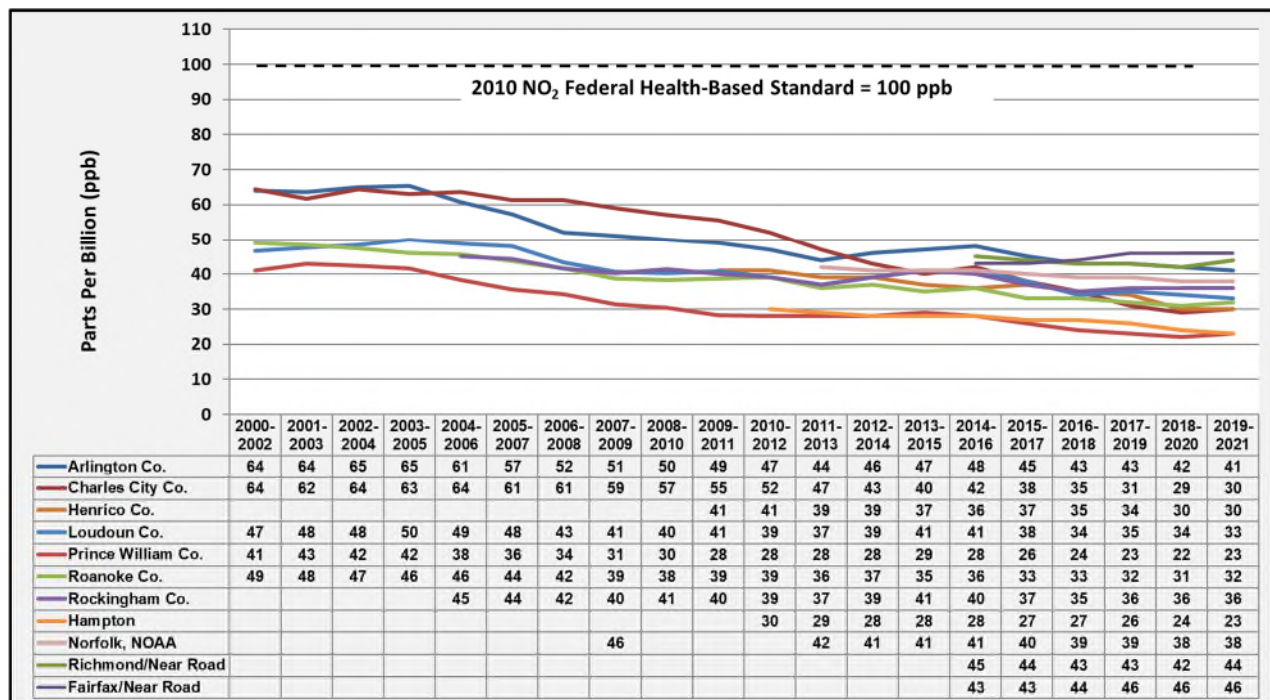


Figure 2-5: Virginia NO₂ Measurements

The 2010 SO₂ NAAQS federal implementation rule required certain facilities in Virginia to monitor the air quality near their property to determine if the facility's emissions caused SO₂ air quality violations. This approach stemmed from EPA's determination that ambient SO₂ concentrations were predominantly impacted by large industrial sources with high SO₂ emissions. These SO₂ monitors, which were installed in accordance with federal requirements and operated by the respective facility, have recorded four years of data from 2017 to 2020 and are therefore included in the Commonwealth's SO₂ monitoring network. Figure 2-6 provides SO₂ measurements for all monitors currently in the network including the facility-specific monitors and compares this data to the 2010 SO₂ 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. The Giles County three-year averages for 2017-2019 (203 ppb) and for 2018-2020 (97 ppb) are above the health based standard of 75 ppb. This monitor continues to operate. These measured data resulted in the portion of Giles County around the Lhoist North America, LLC facility, the operator of the Giles County SO₂ monitor, to be designated nonattainment for the 2010 SO₂ NAAQS. See Section 3.1.6 for more information on this designation.

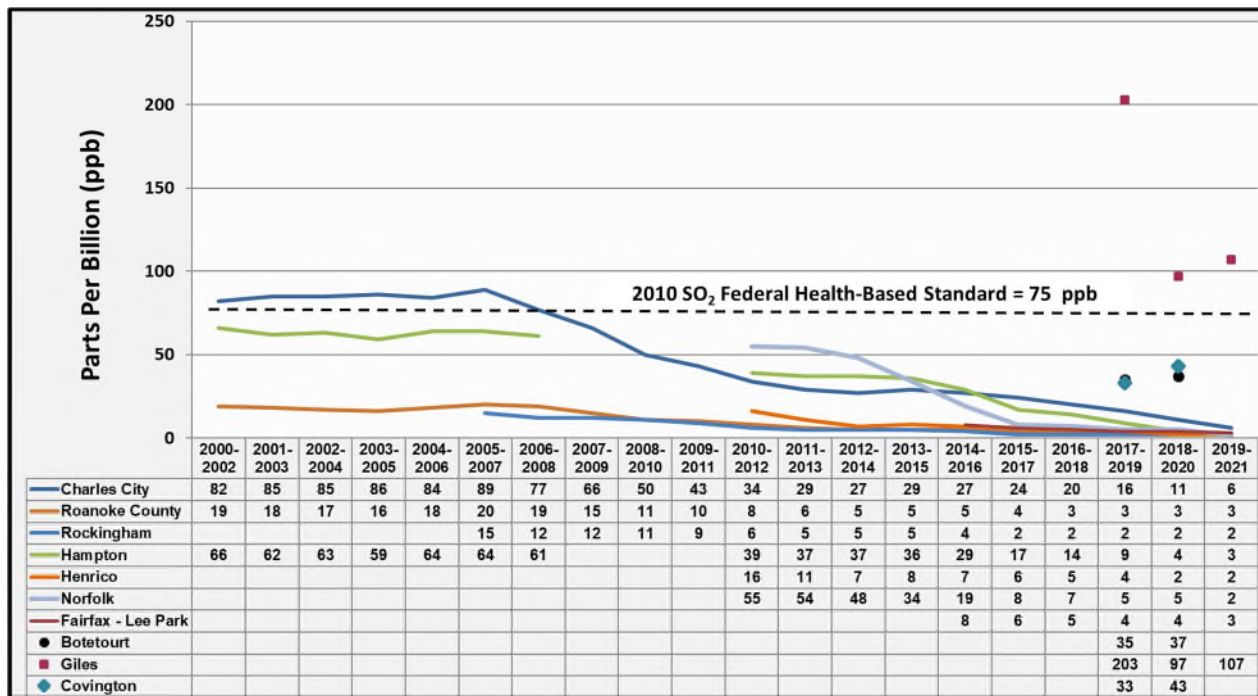


Figure 2-6: Virginia SO₂ Measurements

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

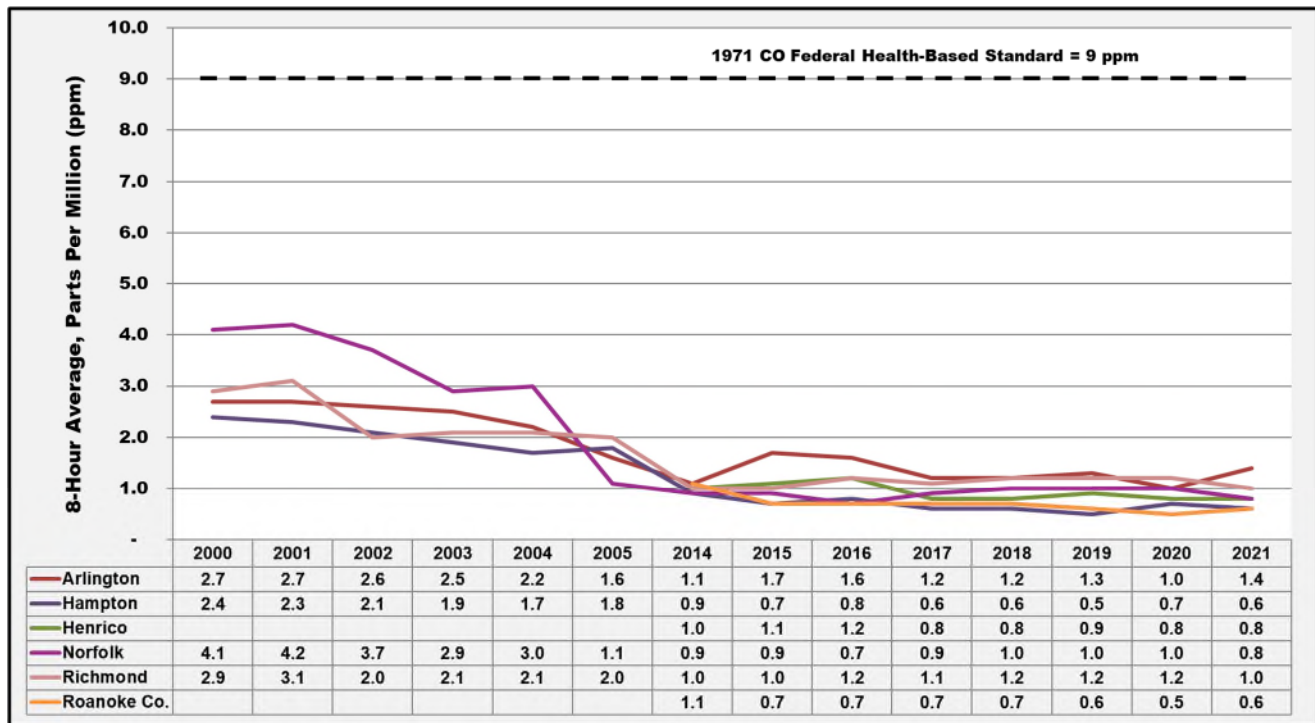


Figure 2-7: Virginia CO Measurements

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. CO NAAQS

On August 31, 2011 (76 FR 54294), EPA issued a decision to retain the existing primary CO NAAQS, which were originally promulgated in 1971. The existing 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 µg/m³ to 35 µg/m³ and retained the PM_{2.5} annual standard of 15.0 µg/m³. 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. In May of 2022, EPA published the final policy assessment for a revision to the 2006 PM_{2.5} standard. The conclusion to this document suggests that the 2006 PM_{2.5} NAAQS annual standard may be retained.

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, with the exception of 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 has developed second maintenance plans for the Richmond-Petersburg area and for the Hampton Roads area for this standard. DEQ submitted the Richmond-Petersburg plan in final form to EPA on September 20, 2021. The Hampton Roads plan, which includes data supporting offshore wind project development, has completed the public comment process and is being finalized. Second maintenance plans are under development for the Fredericksburg area and the Shenandoah National Park.

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 $0.15 \mu\text{g}/\text{m}^3$. 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 NO₂ NAAQS

On February 9, 2010 (75 FR 6474), EPA revised the primary NO₂ 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 SO₂ NAAQS

On June 22, 2010 (75 FR 35520), EPA finalized a new primary NAAQS for SO₂. 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 with the exception of 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 outputs and data from the SO₂ 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.

DEQ is working with Lhoist and EPA to develop an attainment plan. However, using federal guidance, Lhoist is conducting a model performance evaluation, the purpose of which is to better calibrate the EPA modeling tools for the complex terrain surrounding the facility. Without such calibration, the modeling tools tend to be overly conservative in complex terrain, which could result in emission limitations that are unnecessarily stringent.

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 $35 \mu\text{g}/\text{m}^3$ but reduced the annual threshold from $15 \mu\text{g}/\text{m}^3$ to $12 \mu\text{g}/\text{m}^3$. On January 15, 2015 (80 FR 2206), EPA designated all of Virginia unclassifiable/attainment for this standard. On December 18, 2020 (85 FR 82684), EPA published a final action retaining the annual NAAQS for PM_{2.5}. After announcing on June 10, 2021, a reconsideration of the decision to retain this standard, EPA published a final policy assessment in May of 2022 that indicates this standard may be strengthened.

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 April 13, 2022, EPA proposed to increase the classification of 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 21842). However, monitoring data for 2021 shows that the Metropolitan Washington DC area, of which Northern Virginia is a part, attained the standard based on 2019 through 2021 data.

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). The draft policy assessment suggests retaining the current primary and secondary NAAQS for ozone based on existing data.

On April 6, 2022, EPA published a proposed rule to address Good Neighbor provisions under the CAA. These 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 proposed federal implementation plan would apply to both electric generating units and industrial units emitting NO_x in Virginia.

3.1.9. 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, SO₂, 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 provides measurements of visibility impairment based on Interagency Monitoring of Protected Visual Environments ([IMPROVE](http://vista.cira.colostate.edu/IMPROVE/Data/NaturalConditions/NaturalConditionsII_Format2_v2.xls)) monitoring data.³ The data in this figure show the significant visibility improvement on haziest days as well as on clearest days for the

³ http://vista.cira.colostate.edu/IMPROVE/Data/NaturalConditions/NaturalConditionsII_Format2_v2.xls

Shenandoah National Park (SHEN) in green hues using the square and circle data markers and for the James River Face Wilderness Area (JARI) in blue hues using the triangle and diamond data markers. This progress in visibility improvement is mainly due to the reduced emissions of SO₂ and sulfates from fuel combustion sources.

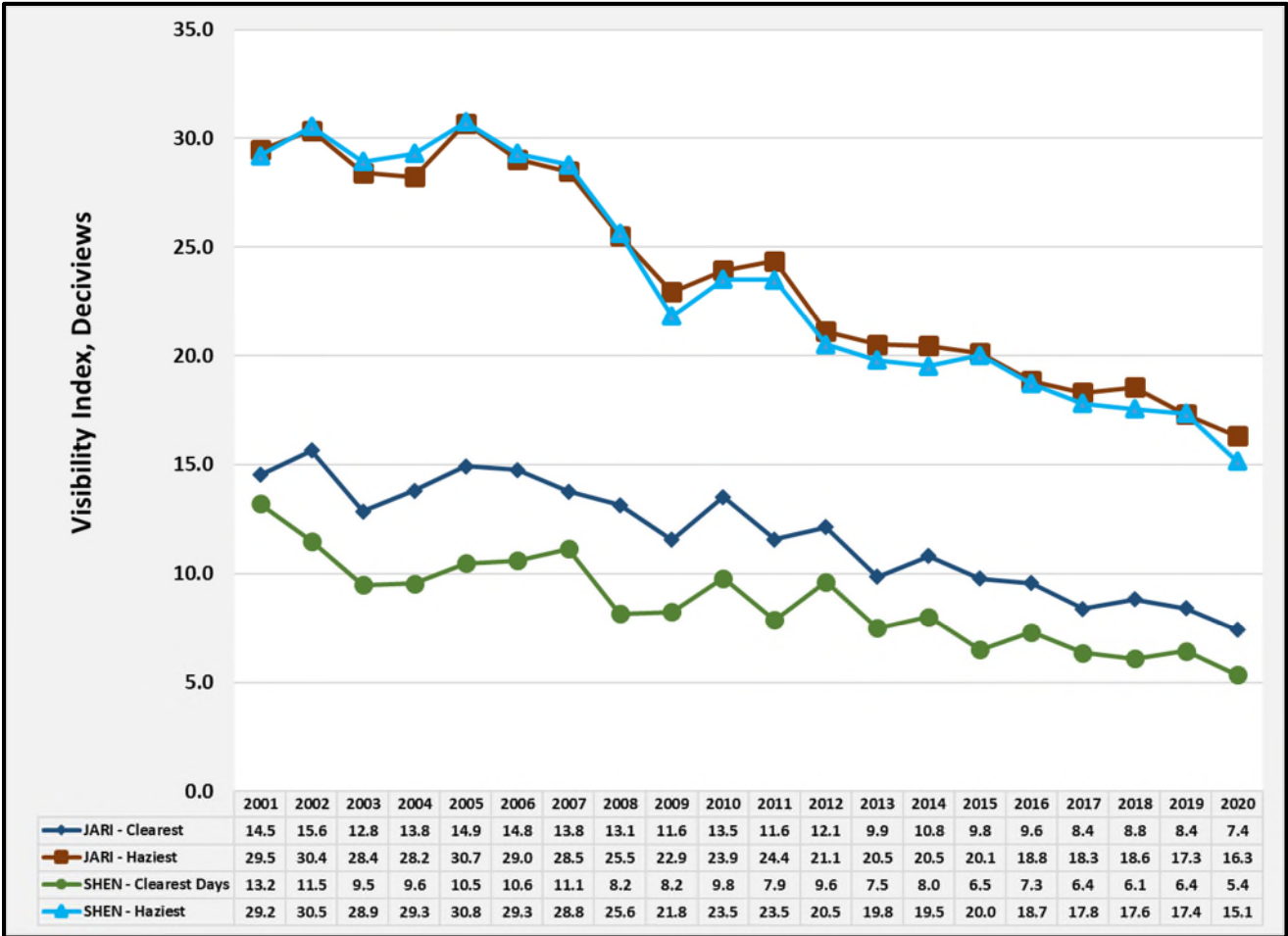


Figure 3-1: Annual Visibility Impairment (dv) for James River Face Wilderness Area and Shenandoah National Park

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.

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 located 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 issued 2 PSD permits in state fiscal year 2022.

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 2022.

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 2022 fiscal year, DEQ issued 252 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 issued 2 state major permit in fiscal year 2022. 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 2 general permits during state fiscal year 2022.

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 8 SOPs during state fiscal year 2022.

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 2 federal operating permits and 28 operating permit renewals during state fiscal year 2022.

DEQ is actively working on ways to incorporate environmental justice in the air permitting process.

Information about air permitting activities at DEQ is available on DEQ's website at <https://www.deq.virginia.gov/permits-regulations/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 of documents detailing throughputs, emissions, testing, and reporting.

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 an FCE based on potential noncompliance or in response to sector initiatives.

Virginia has 3,717 registered air facilities, excluding gasoline service stations. For the 2021 federal fiscal year (October 1, 2020 through September 30, 2021), the air compliance program conducted 3,934 compliance evaluations, including 717 on-site inspections and 103 stack test observations. As a result, the air compliance program issued 399 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 2021, DEQ issued 33 consent orders and one consent decree that resulted in a total of \$1,702,509 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 in order 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/permits-regulations/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 about 300 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 in order to obtain vehicle registration. In calendar year 2021, inspection stations performed 775,896 initial vehicle emissions inspections, of which, 15,400 (or 1.9%) failed inspection, prompting repair of these vehicles. DEQ maintains an extensive I/M program website at <https://www.deq.virginia.gov/air/vehicle-emissions-air-check>.

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, over 400 certified emissions repair technicians and over 1,500 licensed emissions inspectors within the I/M program. In calendar year 2021, MSOS personnel conducted 480 overt and 95 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 2021, DEQ issued 851 NOVs to owners of high-emitting vehicles. Of the 552 vehicles submitted for confirmation tests, 33% failed and an additional 19% 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 2021, there were 91,476 clean screens redeemed.

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 86 advisory notices sent in calendar year 2021, four responses were received, including two repair forms. 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 and projections from a number of EPA sources. The emissions estimates from 2008, 2011, 2014, and 2017 are from EPA’s [National Emissions Inventory](#) (NEI). The data from 2016 and the projections to 2028 are taken from EPA’s [2016 emissions inventory modeling platform](#). As shown in Figure 4-1, anthropogenic emissions of NO_x, VOC, and SO₂ in Virginia have decreased significantly between 2008 and 2017. Projected emissions for 2028 continue these downward trends. Between 2008 and 2028, NO_x emissions are projected to drop 66%, VOC emissions are projected to drop 37%, and SO₂ emissions are projected to drop 90%. These emission estimates reflect forecasted growth in vehicle miles traveled, population, and industry through 2028. The reductions shown are the result of control programs implemented at the federal and state level as well as changing economic factors.

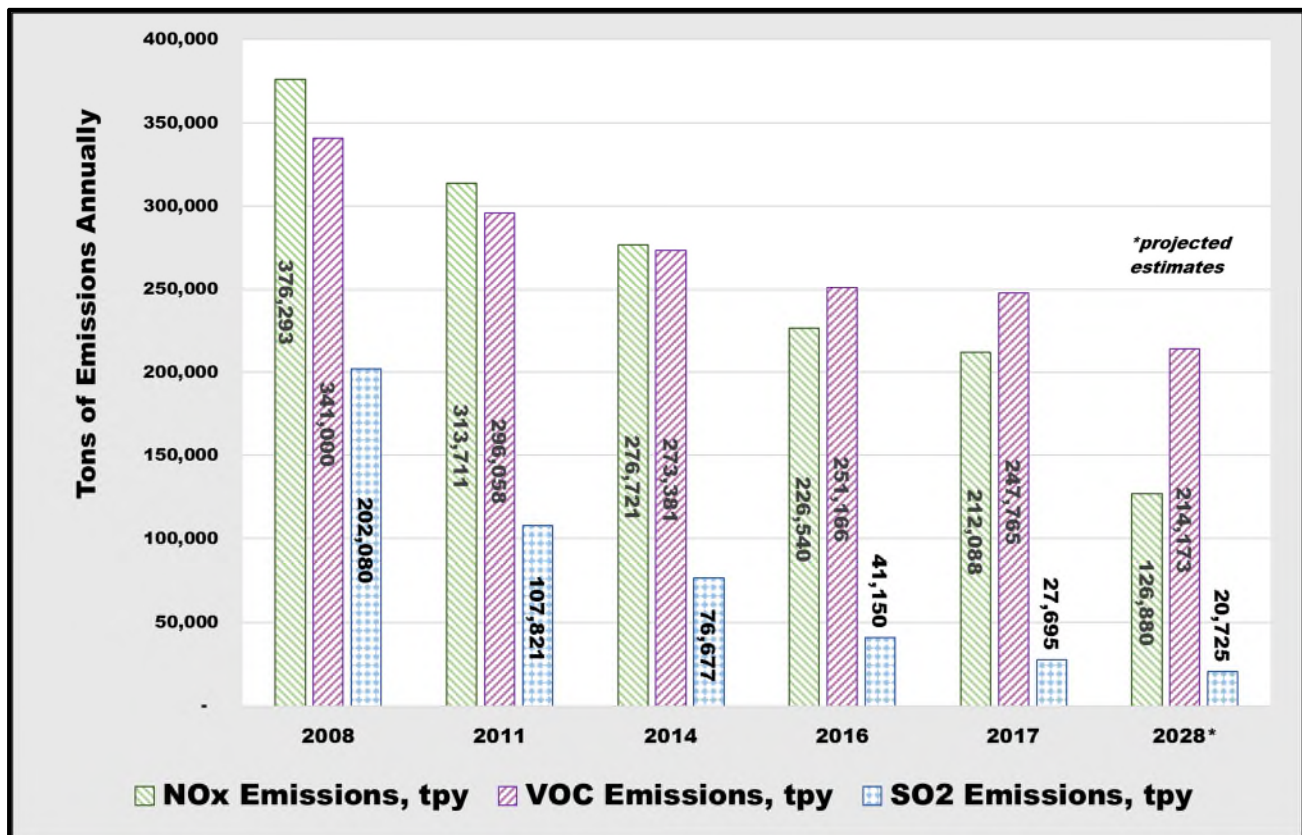


Figure 4-1: Anthropogenic Emission Estimates for Virginia

4.1. Emissions from Electrical Generation

Figure 4-2 provides the annual emissions of SO₂ 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 a number of 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 2021, Virginia emissions and emission rates decreased in this source sector even though fuel usage rates, depicted by the solid line in Figure 4-2, have increased in recent years.

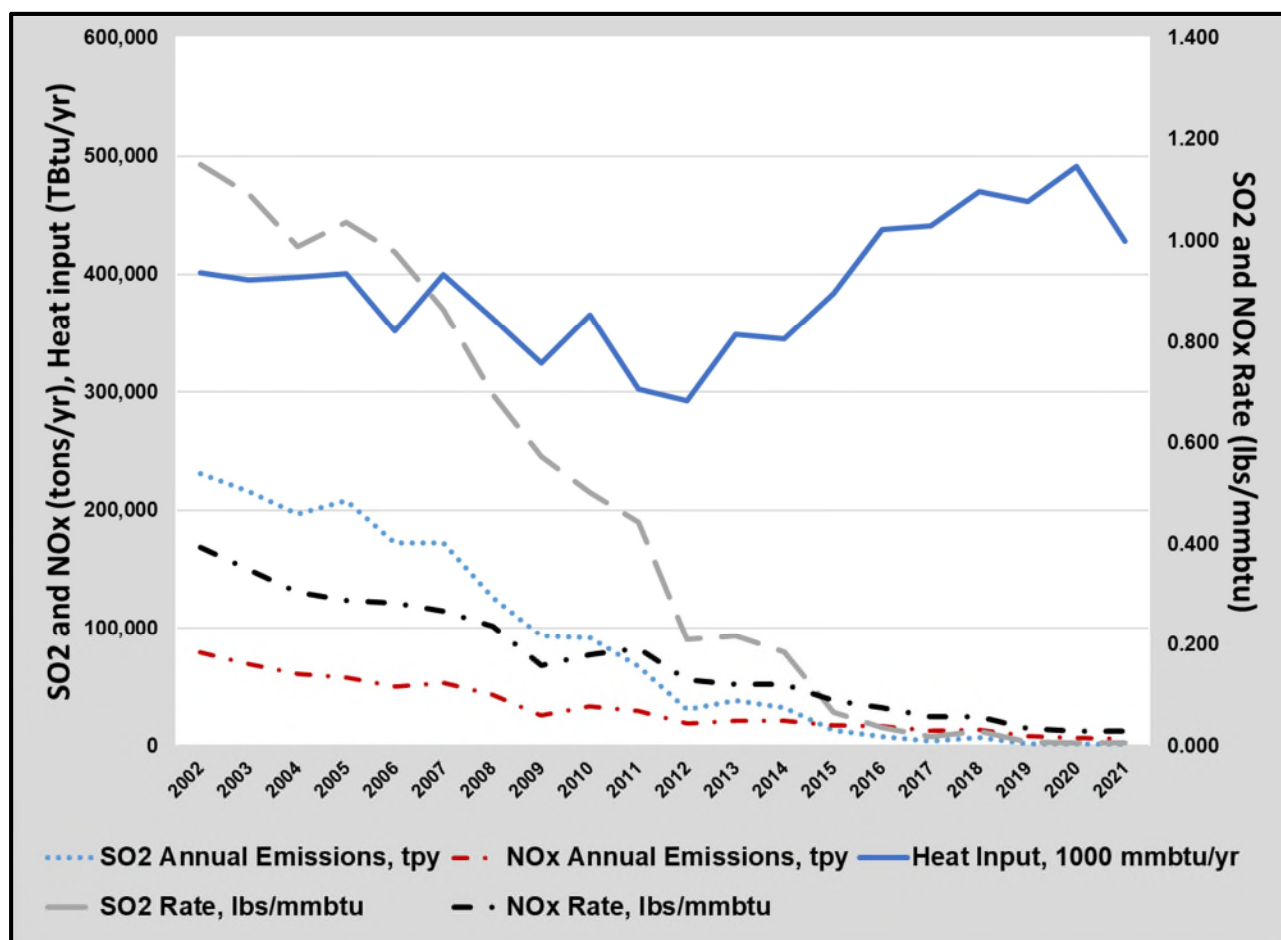


Figure 4-2: Virginia Acid Rain Unit Emissions

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 2008, 2011, 2014, and 2017, the on-road mobile source sector accounts for between 45% and 48% 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. Analogous to the decline displayed in Figure 4-1, Virginia on-road mobile source NO_x emissions have steadily decreased from 2008 to 2017.

On April 28, 2014 (79 FR 23414), EPA finalized a new rule that lowers emissions standards from on-road gasoline engines beginning with model year 2017 vehicles. This rule, known as the Tier 3 standards, also reduced the amount of sulfur in gasoline beginning in 2017. Reducing the sulfur content of gasoline allowed manufacturers to equip vehicles with better emission controls so that new vehicles meet lower engine standards. The cleaner fuel also reduced emissions from existing vehicles allowing them to operate more efficiently. EPA provides more information on this rule at <http://www.epa.gov/otaq/tier3.htm>.

The General Assembly passed legislation in 2021 directing the State Air Pollution Control Board to adopt a low emissions vehicle and zero emissions vehicle program for motor vehicles beginning with model year 2025. The State Air Pollution Control Board adopted an implementing regulation on December 2, 2021. This regulation is anticipated to help to reduce emissions of NO_x and VOC as well as other pollutants from passenger vehicles after 2025.

On March 28, 2022 (87 FR 17414), EPA published a proposed rule that would further reduce air pollution from highway heavy-duty engines. This proposal updates standards, which were originally published more than 20 years ago, for highway heavy-duty trucks. The proposal has implementation dates starting in 2027. This rule, when finalized, will help to reduce emissions from this significant emissions sector.

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. **Error! Reference source not found.** 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 2008, 2011, 2014, and 2017, the non-road mobile source sector accounts for between 19% and 24% 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. For example, EPA estimates that the Clean Air Non-road Diesel rule will result in a 90% reduction in NOx and a 95% reduction in PM. 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. EPA provides more information about these standards at <https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-emissions-nonroad-vehicles-and-engines>.

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 is the designated Lead Agency acting on the State's behalf as beneficiary to implement Virginia's allocation of the \$2.95 billion Trust through a Beneficiary Mitigation Plan (Plan). The primary goal of the Plan is to mitigate approximately 2,095 short tons of excess NOx emitted by more than 16,000 VW diesel vehicles registered in Virginia. Other priorities delineated in the Plan, 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 \$82 million of the \$93.6 million has been obligated for eligible NOx mitigation projects. The public can sign-up to receive updates and track progress on the implementation

⁴ DEQ collaborated with the U.S Environmental Protection Agency (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).

of the State Trust Agreement on DEQ's VW Mitigation webpage at: <https://www.deq.virginia.gov/get-involved/topics-of-interest/volkswagen-settlement-agreement>.

5. Greenhouse Gas Emissions Inventory

Pursuant to subsection H of § 10.1-1307, DEQ is including the estimated economy-wide statewide greenhouse gas (GHG) emissions inventory for baseline year 2010, and the 2018 GHG emissions inventory to show changes in GHG emissions relative to the 2010 baseline GHG emissions inventory in the October 2022 report, and every four years thereafter.

Figure 5-1 depicts the estimated GHG emissions by sector for baseline year 2010. For baseline year 2010, approximately 160 million metric tons of carbon dioxide equivalent (MMTCO₂e) were emitted in the Commonwealth. CO₂e is the standard way of describing GHGs so that they can be compared because different gases can have different global warming potentials. For example, a ton of methane emissions will cause at least 25 times the amount of warming as a ton of CO₂, and can be described as 25 tons of CO₂e.

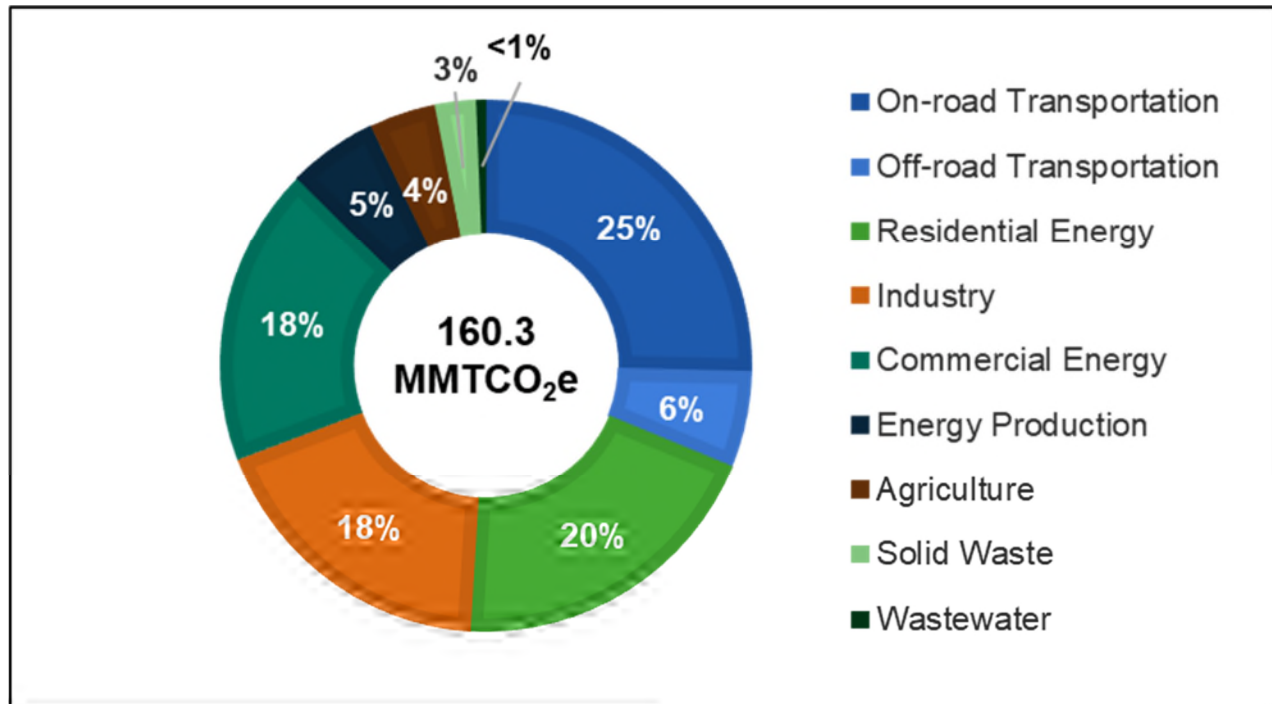


Figure 5-1: 2010 Baseline GHG Emissions by Sector

Figure 5-2 depicts the estimated GHG emissions by sector for calendar year 2018. In calendar year 2018, approximately 141 MMTCO₂e were emitted in the Commonwealth, approximately 12 percent less than GHG emissions emitted in 2010.

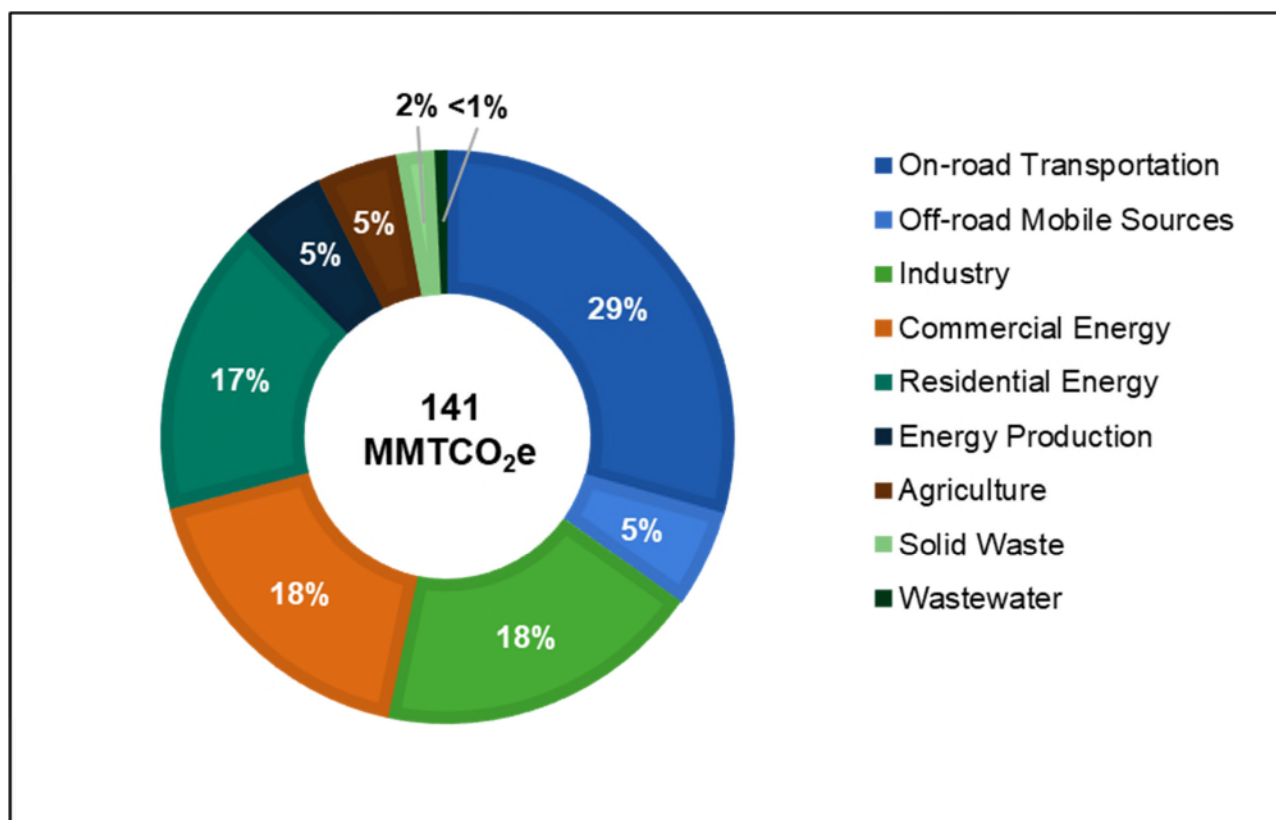


Figure 5-2: 2018 GHG Emissions by Sector

Reports summarizing the results of the 2010 baseline and 2018 GHG emissions inventories, including sector-specific analyses and methodologies are available on DEQ's website at www.deq.virginia.gov/air/greenhouse-gases