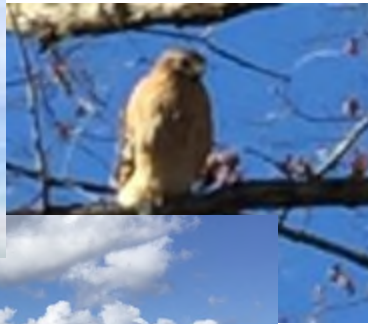


Richmond-Petersburg Ozone Advance Action Plan

Annual Report
04-30-2016



Abbreviations

CMAQ	Congestion, Mitigation, and Air Quality
CPCN	certificates of public convenience and necessity
DMME	Virginia Department of Mines, Minerals, and Energy
EGU	electrical generating unit
EPA	United States Environmental Protection Agency
EV	electric vehicles
FRM	Federal reference method
LEED	Leadership in Energy and Environmental Design
MATS	Mercury and Air Toxics Rule
$\mu\text{g}/\text{m}^3$	micrograms per cubic meter
MW	megawatts
NAAQS	National Ambient Air Quality Standard
NO_x	nitrogen oxides
$\text{PM}_{2.5}$	fine particulate matter less than 2.5 micrometers in diameter
ppb	parts per billion
RAMPO	Richmond Area Metropolitan Planning Organization
SCC	State Corporation Commission
SCR	selective catalytic reduction
SF	square foot
SO_2	sulfur dioxide
VCC	Virginia Clean Cities, Inc.
VCU	Virginia Commonwealth University
VDEQ	Virginia Department of Environmental Quality
VEMP	Virginia Energy Management Program
VOC	volatile organic compounds
VPA	Virginia Port Authority

Richmond-Petersburg Ozone and PM_{2.5} Air Quality - April 2016 Update

The Ozone Advance program is a collaborative effort between federal, state, and local governments as well as area stakeholders to develop an Action Plan for a region. Action Plans encourage programs and practices that facilitate emission reductions of ozone and fine particulate (PM_{2.5}) precursors so that citizens may continue to benefit from healthy air quality. These Action Plans help to ensure that covered areas remain compliant with federal National Ambient Air Quality Standards (NAAQS) and provide a roadmap for progress toward compliance with future NAAQS updates, such as the 2015 ozone NAAQS published on October 26, 2015 (80 FR 65292). The U.S. Environmental Protection Agency (EPA) provided programmatic guidance concerning the Ozone Advance program in April 2012. After reviewing air quality data and considering the information in the guidance document, leaders in the Richmond-Petersburg area and the Commonwealth of Virginia developed the Richmond-Petersburg Ozone Advance Action Plan to promote continued good air quality.

The Action Plan, which EPA received in April 2013, provided detailed information on the air quality in the Richmond-Petersburg area and across Virginia. The plan is available on the Virginia Department of Environmental Quality (VDEQ) website at <http://www.deq.virginia.gov/Programs/Air/AirQualityPlans/OzoneandPM25RegionalPlanningActivities.aspx>. This document updates the air quality information in the Action Plan and shows that air quality improvements are continuing. The improvements are the result of the emission reductions achieved from the many federal, state, and local air pollution control programs and voluntary efforts being implemented as well as the favorable meteorology during the summers of 2013, 2014, and 2015.

Ozone

Photochemical reactions between volatile organic compounds (VOC) and nitrogen oxides (NO_x) create ozone when they mix in the presence of sunlight. Ozone is the primary component of smog and a lung irritant. Populations that are especially susceptible to impacts from this pollutant include elderly people, children, and those with lung ailments such as asthma and emphysema. Ozone also interferes with plants' abilities to process food and ward off diseases.

Emission reductions of NO_x, the primary precursor to ozone in the Commonwealth, have been significant in recent years and should continue into the future, as detailed in the Action Plan. For example, emissions from on-road vehicles will continue to decrease due to the new Tier 3 Motor Vehicle Emission and Fuel Standards that EPA

finalized on April 28, 2014 (79 FR 23414). The Tier 3 program sets new, cleaner standards that start with model year 2017 vehicles.

Meteorology also plays a key role in ozone formation. The meteorology in 2009, 2013, 2014, and 2015 was not conducive to ozone formation due in part to greater than normal precipitation. In addition, below-normal ozone season maximum daily temperatures in 2009, 2013, and 2014 contributed to lower ozone values. The meteorology during the summers of 2010, 2011, and 2012 was more conducive to ozone formation. The 2010 ozone season in Virginia was the warmest on record. The 2011 and 2012 ozone seasons had higher than average maximum daily temperatures although precipitation in 2011 and 2012 was near or above normal levels. Table 1 summarizes Virginia's ozone season temperature and precipitation data for the period 2009 through 2015.

Table 1: Virginia Ozone Season Meteorology Data, 2009-2015

Year	Virginia Maximum Daily Average Temperature (°F) (May through September)			Virginia Precipitation (inches) (May through September)		
	Average Maximum Temperature	Normal	Departure from Normal (20 th Century)	Total Precipitation (inches)	Normal	Departure from Normal (20 th Century)
2009	80.1	81.1	-1.0	23.31	20.23	+3.08
2010	84.9		+3.8	19.52		-0.71
2011	82.5		+1.4	23.74		+3.51
2012	82.4		+1.3	20.50		+0.27
2013	79.8		-1.3	23.96		+3.73
2014	80.7		-0.4	19.32		-0.91
2015	82.2		+1.1	22.27		+2.04

Figure 1 shows the ozone air quality as measured in the Richmond-Petersburg area. Air quality in this part of the Commonwealth has improved over the last decade, and 2013-2015 monitoring data show a design value of 63 parts per billion (ppb). The long term improvement depicted in Figure 1 demonstrates that the emission reductions achieved both locally and regionally have improved air quality to the point where ozone air quality complies with, and is significantly beneath, the 2008 ozone NAAQS of 75 ppb. EPA published a more stringent ozone NAAQS on October 1, 2015, revising the standard to 70 ppb. Air quality data from the Richmond-Petersburg monitors for 2013 through 2015 also comply with this new standard.

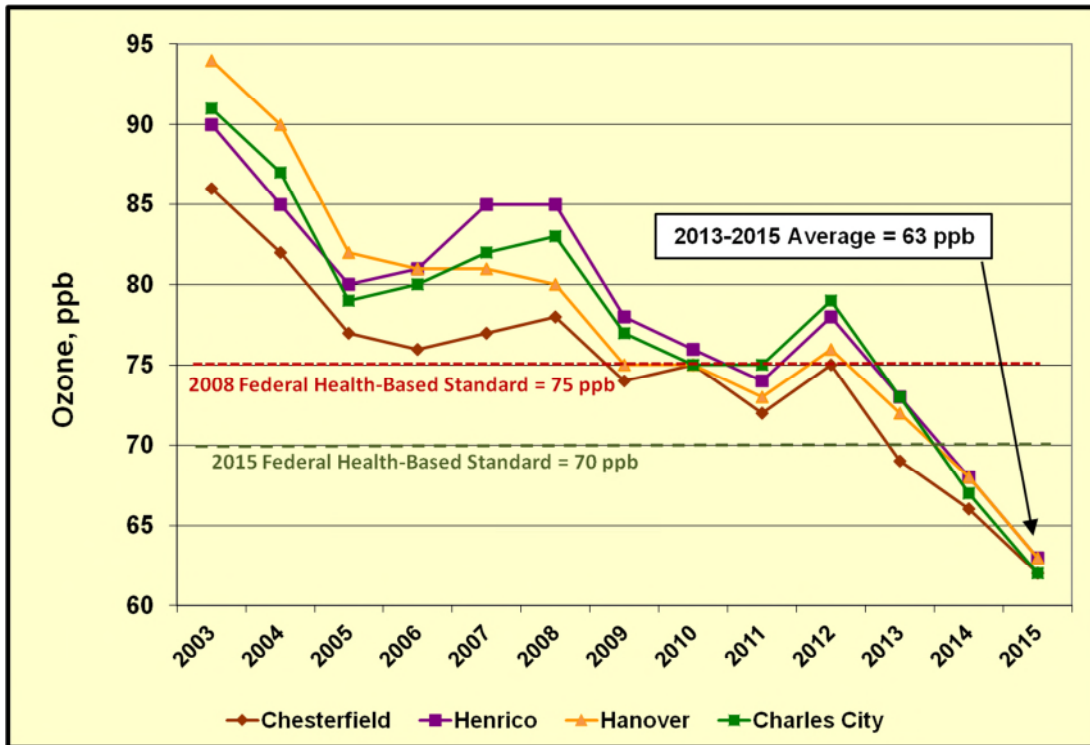


Figure 1: Richmond-Petersburg Ozone Air Quality

Monitoring data across Virginia show similar patterns of air quality improvement. Figure 2 provides this data for various areas of Virginia. All areas of the Commonwealth are benefitting from the ozone precursor emission reductions generated by federal, state, and local control programs, and the Commonwealth has seen tremendous improvements in ozone air quality over the last decade. Based on 2013-2015 data, air quality in all areas of the Commonwealth complies with the 2008 ozone NAAQS and the 2015 ozone NAAQS.

Figure 3 shows the number of ozone air quality exceedance days in Virginia since 1997 based on the 2015 ozone NAAQS. In 1998, Virginia recorded 108 exceedance days statewide. In 2010, the hottest and one of the driest summers on record, this value dropped to 52 exceedance days. In 2015, Virginia recorded only 13 exceedance days.

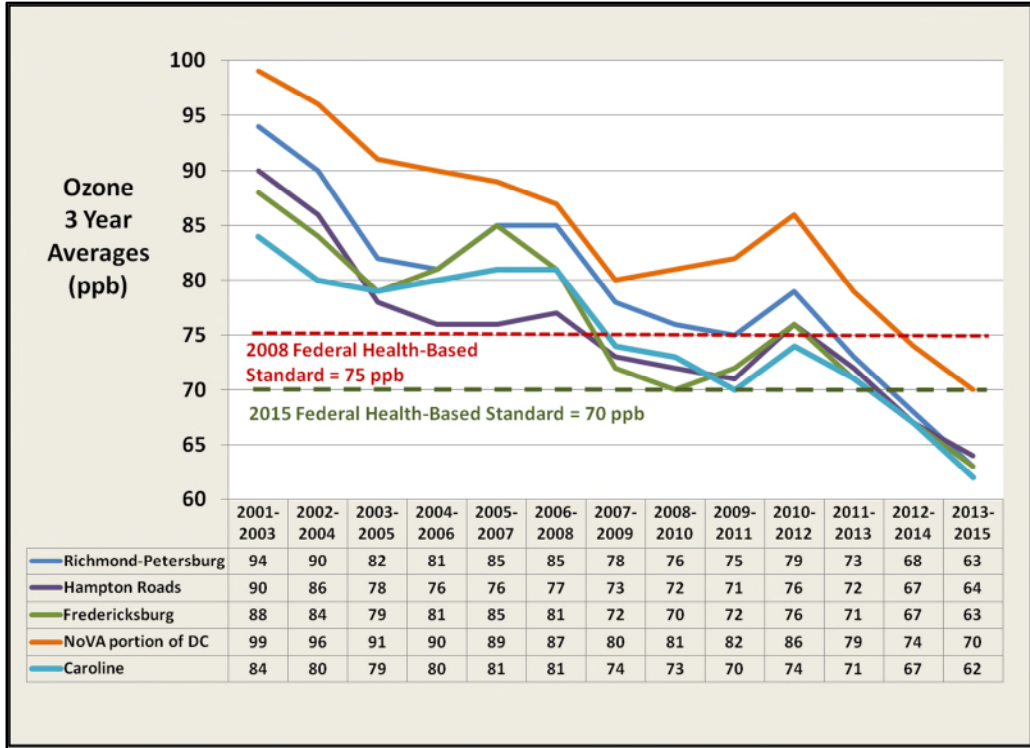


Figure 2: Ozone 3-Year Average in Virginia Areas

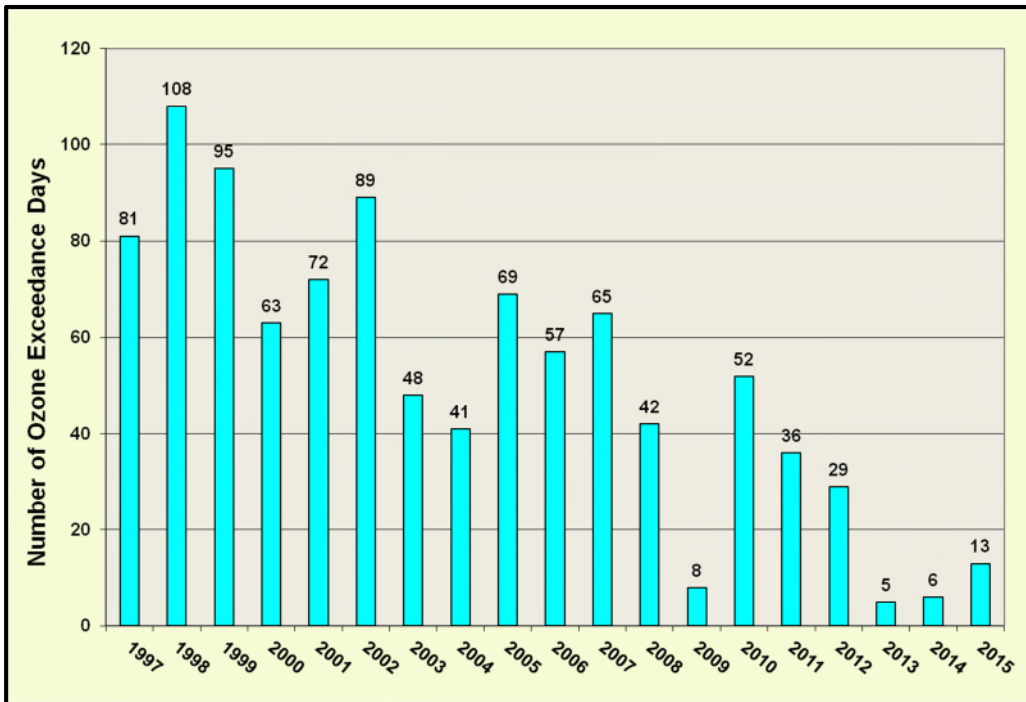


Figure 3: Virginia Ozone Exceedance Day Trends, 2015 Ozone NAAQS

PM_{2.5}

Federal regulations define PM_{2.5} as any airborne particle of solid or liquid matter with a diameter of no more than 2.5 micrometers, which is approximately 1/30th the width of a human hair. Exposure to high levels of PM_{2.5} adversely affects human health, and the main impacts of PM_{2.5} are on the respiratory system and the cardiovascular system. Children, the elderly, and individuals with pre-existing pulmonary or cardiac disease are the most susceptible to PM_{2.5} pollution.

Federal regulations provide two health-based standards for PM_{2.5}. The first value is a daily, or 24-hour, standard of 35 µg/m³, established in 2006. The second value is an annual average of 12.0 µg/m³, established in 2012. All monitors in Virginia comply with these NAAQS. Table 2 provides information from one PM_{2.5} Federal Reference Method (FRM) monitoring site in each area of the Commonwealth. These data show that PM_{2.5} air quality continues to improve and that a significant buffer exists between the monitored values and the health-based standards of 35 µg/m³ on a 24-hour basis and 12.0 µg/m³ on an annual basis. This improvement is largely due to SO₂ emission reductions because SO₂ forms sulfates, a component of PM_{2.5}, in the atmosphere. Reductions in SO₂ and VOC have also helped PM_{2.5} air quality by reducing the organic carbon portion of PM_{2.5}.

Table 1: Virginia Annual and 24-Hour PM_{2.5} Three-Year Averages

3 Year Period	Arlington 51-013-0020		Chesterfield 51-041-0003		Bristol 51-520-0006		Virginia Beach 51-810-0008	
	Annual	24-Hour	Annual	24-Hour	Annual	24-Hour	Annual	24-Hour
2001-2003	14.6 µg/m ³	38 µg/m ³	13.6 µg/m ³	34 µg/m ³	14.3 µg/m ³	33 µg/m ³	12.6 µg/m ³	33 µg/m ³
2002-2004	14.5 µg/m ³	37 µg/m ³	13.4 µg/m ³	33 µg/m ³	13.9 µg/m ³	31 µg/m ³	12.5 µg/m ³	32 µg/m ³
2003-2005	14.6 µg/m ³	36 µg/m ³	13.6 µg/m ³	33 µg/m ³	14.0 µg/m ³	30 µg/m ³	12.6 µg/m ³	30 µg/m ³
2004-2006	14.2 µg/m ³	34 µg/m ³	13.4 µg/m ³	30 µg/m ³	13.9 µg/m ³	31 µg/m ³	12.5 µg/m ³	30 µg/m ³
2005-2007	14.0 µg/m ³	32 µg/m ³	13.3 µg/m ³	31 µg/m ³	13.9 µg/m ³	30 µg/m ³	12.1 µg/m ³	30 µg/m ³
2006-2008	12.9 µg/m ³	30 µg/m ³	12.4 µg/m ³	28 µg/m ³	12.7 µg/m ³	28 µg/m ³	11.9 µg/m ³	30 µg/m ³
2007-2009	11.9 µg/m ³	27 µg/m ³	11.2 µg/m ³	24 µg/m ³	11.2 µg/m ³	25 µg/m ³	10.7 µg/m ³	26 µg/m ³
2008-2010	10.8 µg/m ³	24 µg/m ³	10.3 µg/m ³	21 µg/m ³	10.2 µg/m ³	22 µg/m ³	10.3 µg/m ³	24 µg/m ³
2009-2011	10.1 µg/m ³	22 µg/m ³	9.6 µg/m ³	21 µg/m ³	9.9 µg/m ³	21 µg/m ³	9.6 µg/m ³	23 µg/m ³
2010-2012	9.9 µg/m ³	22 µg/m ³	9.5 µg/m ³	21 µg/m ³	9.8 µg/m ³	20 µg/m ³	9.3 µg/m ³	24 µg/m ³
2011-2013	9.4 µg/m ³	21 µg/m ³	8.7 µg/m ³	21 µg/m ³	9.0 µg/m ³	18 µg/m ³	8.5 µg/m ³	22 µg/m ³
2012-2014	9.0 µg/m ³	21 µg/m ³	8.5 µg/m ³	19 µg/m ³	8.6 µg/m ³	16 µg/m ³	8.0 µg/m ³	20 µg/m ³
2013-2015	8.9 µg/m ³	20 µg/m ³	8.3 µg/m ³	18 µg/m ³	8.2 µg/m ³	15 µg/m ³	7.9 µg/m ³	19 µg/m ³

Data Source: VDEQ-Air Quality Monitoring Division

Figures 4 and 5 provide the annual and daily PM_{2.5} monitoring information, respectively, from the PM_{2.5} monitors located in the Richmond-Petersburg area. These figures highlight the remarkable improvement in PM_{2.5} air quality.

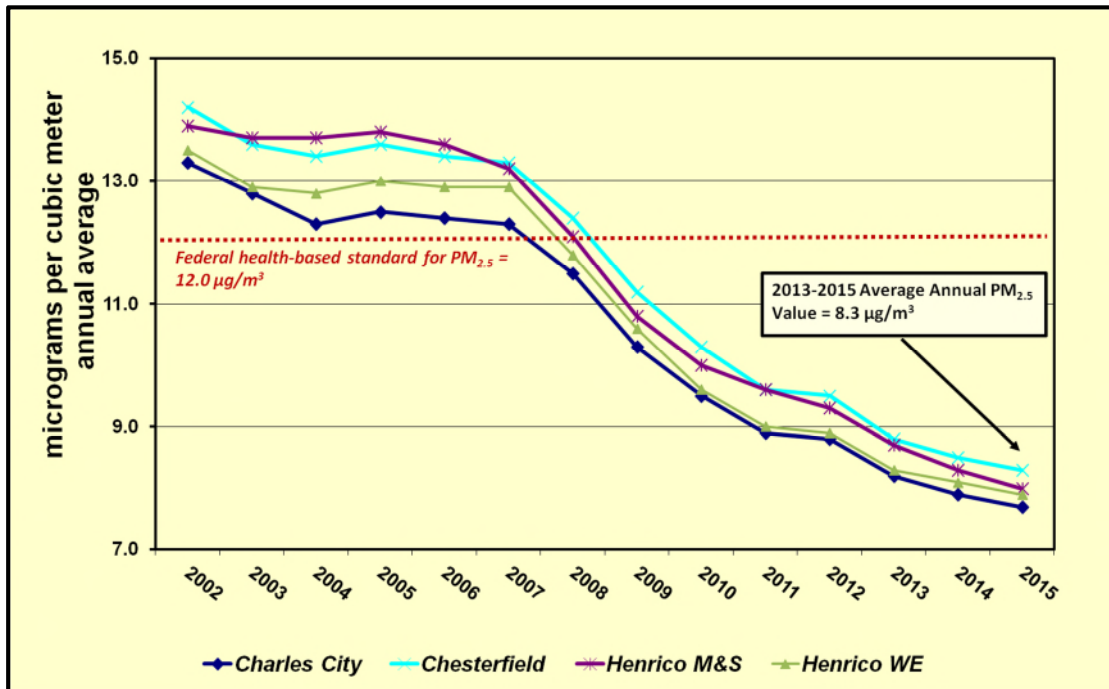


Figure 4: Richmond-Petersburg Annual PM_{2.5} Air Quality Data

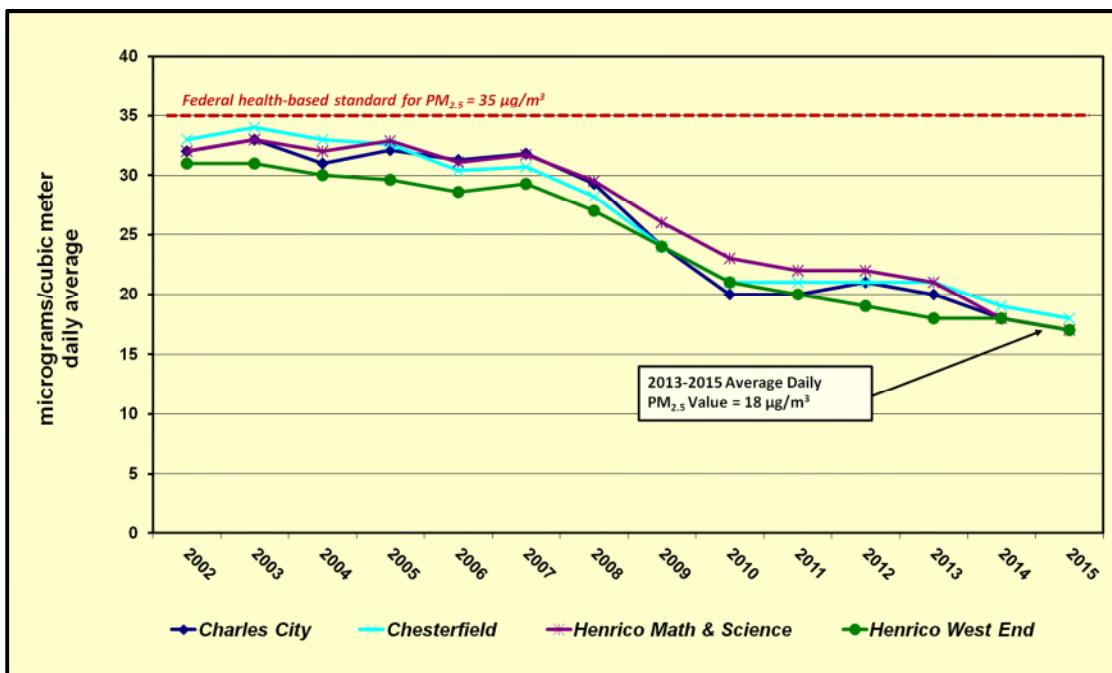


Figure 5: Richmond-Petersburg Daily PM_{2.5} Air Quality Data

Figure 6 shows the improvement in monitored sulfate concentrations over the last ten years, as measured by the PM_{2.5} speciation monitor located in Henrico, Virginia. This monitor has the ability to measure the components of PM_{2.5} pollution. The sulfate portion of PM_{2.5} has decreased markedly, as has the organic carbon portion.

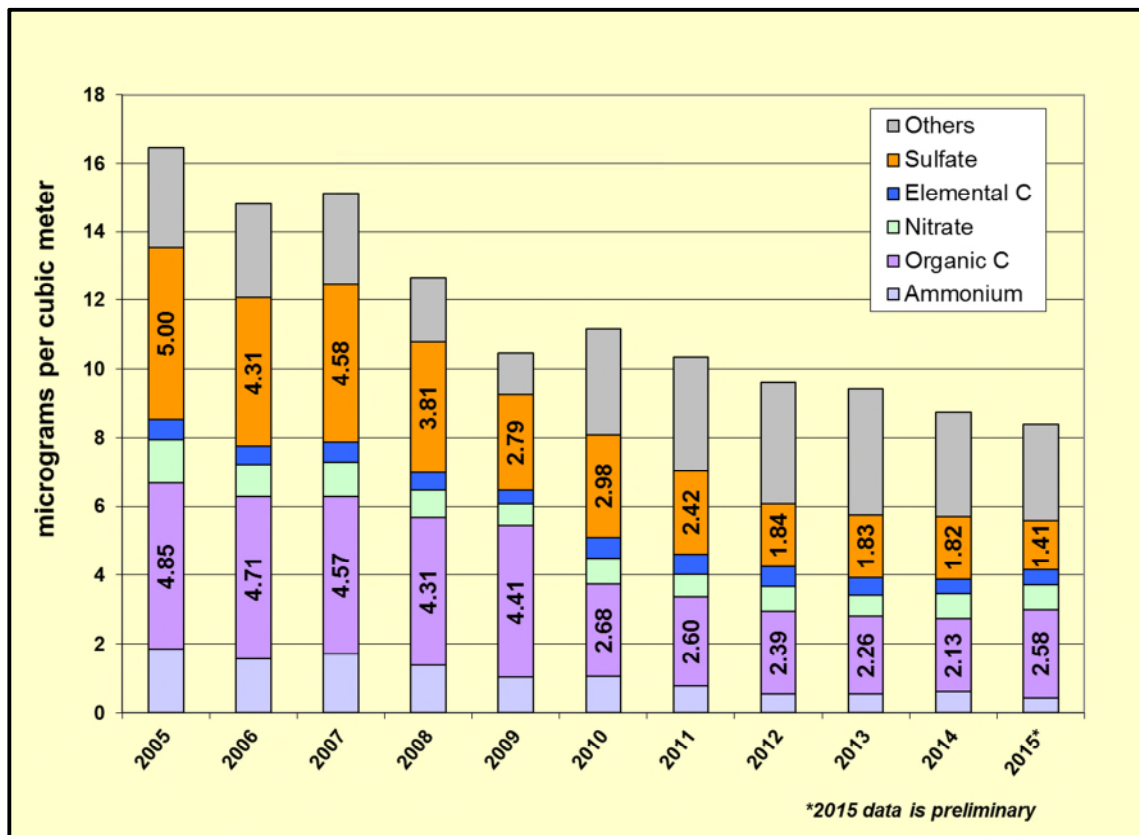


Figure 6: Henrico Speciation Data

Emissions Reduction Programs

The following tables provide updates on the programs described in the Richmond-Petersburg Ozone Advance Action Plan. Table 3 provides information on programs that are on-going as well as on programs that are currently in development or began after the area's leaders finalized the Richmond-Petersburg Ozone Advance Action Plan. Table 4 provides information on programs that have concluded.

For the summer of 2015, several NO_x emission reduction programs took effect that warrant highlighting. Within the Richmond-Petersburg region, for example, Honeywell-Hopewell completed work on two additional selective catalytic reduction (SCR) control devices and began operating the new SCRs in October 2014. These units reduced NO_x emissions by approximately 1,500 tons during 2015, as compared to previous years. The Philip Morris Park 500 facility, located in Richmond, Virginia, switched two

of their boilers from coal to natural gas. SO₂ and NO_x emissions in 2014 were 98 tons and 119 tons, respectively, for this facility. In 2015, the facility emitted less than 1 ton of SO₂ and 11 tons of NO_x.

Outside of the Richmond-Petersburg region, the Chesapeake Power Station, which is located in Chesapeake, Virginia, retired four coal-fired units in December 2014. These units emitted over 600 tons of NO_x during the 2014 ozone season. Huntington Ingalls Incorporated, located in Newport News, Virginia, received a permit to replace the residual oil-fired powerhouse boilers with new, natural gas fired boilers. This permit also authorized the conversion of the residual oil-fired, barge-mounted boilers to ultra-low sulfur distillate oil. Huntington Ingalls performed much of this work in 2015. Also in 2015, the Invista facility in Waynesboro, Virginia, permanently retired their coal-fired boilers and replaced them with new, natural gas-fired units. These changes helped to reduce the amount of NO_x and SO₂ transported into the Richmond-Petersburg region.

For the upcoming summer of 2016, additional changes and new programs will provide more emission reductions of ozone precursors. For example, Chesterfield County introduced 20 new propane-powered school buses in February 2016, which emit less pollution and cost the county less for fuel and maintenance than diesel-powered buses. The Port of Richmond began using their new crane, which was partially funded through the Congestion, Mitigation, and Air Quality (CMAQ) program and which emits at much lower rates than older cargo handling equipment. The cover of this report features a picture of this new cargo handler. Regionally, Celco, a large manufacturing operation located in Narrows, Virginia, retired six coal-fired boilers in the fall of 2015. The facility replaced these units with new, low-emitting, natural gas-fired units. These changes will reduce annual upwind emissions by approximately 3,000 tons of NO_x and 7,000 tons of SO₂, based on 2014 emissions data from the facility.

A disk containing supporting information, including the various documents referenced in Table 3 and Table 4, is included as part of this report.

Table 3: Emission Reduction Programs-In Development or On-going

Control Program	Stakeholders	Time Frame	Milestones	Program Type	Feedback & Comments
Metropolitan Planning Organization					
64 Express	VPA, RAMPO, HRTTO	On-going	TEUs transported annually	Voluntary	<ul style="list-style-type: none"> In 2015, 14,114 containers moved by the barge service, a 47% increase from 2014. Barge service increased from 2 trips/week to 3 trips/week in January 2015, averaging 200 containers transported per week. See Annual Report-Expanded Green Operator Report 10-30-15.pdf
RideFinders	Ridefinders, RAMPO	On-going	VMT avoided annually Vehicle trips avoided annually	Voluntary	<ul style="list-style-type: none"> FY 2015 estimate of 57,832,020 VMT reduced annually. See Ridefinders FY15 Annual Report.pdf
DMME-Division of Energy					
VEMP	DMME	On-going	SF of public buildings retrofitted? Private capital deployed? Energy savings?	Voluntary	<ul style="list-style-type: none"> Total value of contracts through FY 2014 is \$685 million. Cumulative estimated CO₂ emission reductions through calendar year 2014 are 271,732 tons. See VEMP – Performance Contracting.docx.
Energize Virginia	DMME	2011-2016	Funds awarded? Programs to be implemented?	Voluntary	<ul style="list-style-type: none"> More than \$10M awarded in 2012. Projects include energy performance contracts, and a solar thermal system. More than \$1.7M has been repaid as of 01/31/2015. See Energize Virginia.docx.
Residential Retrofit Program	DMME, RREA, LEAP	On-going	# of homes evaluated Energy savings?	Voluntary	<ul style="list-style-type: none"> Over 3,000 home energy checkups completed. See Residential Retrofit Program.docx. http://leap-va.org/success-stories/
United States Army Base - Fort Lee					
Low NO _x Burner Requirements	Fort Lee	On-going	Program on-going?	Voluntary	<ul style="list-style-type: none"> Program is on-going. Estimated NO_x reductions of 14,040 lbs in 2015. Total NO_x reductions since 2005: 30 tons

Table 3: Emission Reduction Programs-In Development or On-going

Control Program	Stakeholders	Time Frame	Milestones	Program Type	Feedback & Comments
Sustainable Building Practices	Fort Lee	On-going	Program on-going? New certifications?	Voluntary	<ul style="list-style-type: none"> Since 2005, Fort Lee has applied the LEED Silver standard to all new construction and major renovation, saving thousands of dollars from reduced energy and water consumption. Construction during the last ten years includes over 63 buildings. Of those 63 registered buildings, there are 11 buildings pursuing silver certification and 10 buildings pursuing gold certification.
Renewable Energy	Fort Lee	On-going	Program on-going? New installations?	Voluntary	<ul style="list-style-type: none"> Fort Lee currently has two large barracks, totaling 217,000 SF, equipped with GSHP. The current GSHPs provide 3,342 MMBTUs of thermal energy each year (0.7% of demand) with an annual energy cost savings of \$21,000. Fort Lee was funded in FY13 to build two new barracks (a 300-man and a 600-man) that will utilize ground coupled (geothermal) water source heat pumps. Both barracks are scheduled for completion in early FY16. The RECs for the 300-man barracks will be 1,675 MMBTU/yr and the RECs for the 600-man barracks will be 5,076 MMBTU/yr. Fort Lee evaluated the potential for purchasing electricity generated from landfill gas and found it to be approximately 15% more than the electricity from Fort Lee's utility provider. There is also a hot water heater at one of the new dental facilities that uses solar power to heat the water.
Transportation and Mobile Emissions	Fort Lee	On-going	TMP drafted? Hybrids purchased? NEVs purchased? Fuel saved? Other metrics?	Voluntary	<ul style="list-style-type: none"> The TMP is complete and is in the implementation stage. No new NEVs. Some hybrids have been purchased to replace standard gasoline vehicles as well as low GHG fuel vehicles that are considered "alternative." New fuel efficient conventional vehicles purchased. There are over 100 Flex fuel vehicles, but the E85 dispensing facilities are further than the garrison allows for personnel to travel to fill tanks. The upgrading of the transportation motor pool is complete. During the final stages of the project, it was decided to not supply biodiesel.
<i>Dominion Virginia Power</i>					
Energy Conservation Programs	Dominion	On-going	Program on-going?	Voluntary	<ul style="list-style-type: none"> Company currently offers several energy conservation programs to its residential and non-residential utility customers in Virginia and continues to evaluate opportunities to redesign current, and develop new, demand-side management initiatives. https://www.dom.com/dominion-virginia-power/customer-service/energy-conservation/ec-programs.jsp

Table 3: Emission Reduction Programs-In Development or On-going

Control Program	Stakeholders	Time Frame	Milestones	Program Type	Feedback & Comments
Utility-Scale Solar	Dominion	On-going		Voluntary	<ul style="list-style-type: none"> • In February 2015, Dominion announced plans to develop multiple utility-scale solar projects totaling 400 megawatts of electricity. All projects will be built in Virginia with involvement of Virginia-based companies and are expected to be operational by 2020. http://dom.mediaroom.com/2015-02-05-Dominion-Virginia-Power-Planning-Major-Expansion-of-Large-Scale-Solar-in-Virginia. • On October 1, 2015, Dominion filed with the Virginia State Corporation Commission (SCC) for certificates of public convenience and necessity (CPCN) for three separate solar projects that would be located in Powhatan, Louisa, and Isle of Wight counties. Collectively, as proposed, these projects would total 56 MW of solar capacity. http://dom.mediaroom.com/2015-10-01-Dominion-Virginia-Power-seeks-to-build-56-megawatts-of-new-solar • On February 8, 2016, Dominion announced it was partnering with SunEnergy1 to install over 91,000 solar panels at a new solar farm in Chesapeake, VA capable of generating up to 20 MW of electricity. Dominion will purchase the output of the facility under a 20-year power purchase agreement. https://www.dom.com/corporate/news/news-releases/137105. • Dominion is partnering with the Commonwealth of Virginia and Microsoft for a 20 MW solar facility in Fauquier County, VA. The facility is expected to become operational in late 2017, pending regulatory approval. https://www.dom.com/corporate/news/news-releases/137114, http://www.richmond.com/business/local/article_f6a2af9d-4787-50fc-85ea-74bdf5eead10.html, and https://www.dom.com/corporate/what-we-do/electricity/generation/solar/remington-solar-power-facility • In November 2015, the company announced the acquisition of an 80 megawatt solar facility (Amazon Solar Farm) in Accomack County, Virginia from project developer Community Energy, Inc. http://dom.mediaroom.com/2015-11-16-Dominion-Acquires-Solar-Energy-Project-on-Virginias-Eastern-Shore.

Table 3: Emission Reduction Programs-In Development or On-going

Control Program	Stakeholders	Time Frame	Milestones	Program Type	Feedback & Comments
Solar Partnership Program	Dominion	2013-2018	Program on-going?	Voluntary	<ul style="list-style-type: none"> • Dominion has recently completed the installation of an array of ground-mounted solar panels at the Phillip Morris USA (Altria) facility in Chesterfield County, VA that will be capable (under optimal conditions) of generating about 2,450 kW of electricity. • In addition, the company has completed solar installations on the rooftops of Canon Virginia Environmental Technologies in Gloucester County, VA; Old Dominion University in Norfolk, VA; Virginia Union University in Richmond, VA; Randolph-Macon College in Ashland, VA; the Capital One facility in Richmond, VA; and West Branch High School in Chesapeake, VA. • These combined facilities represent a total of over 4.5 megawatts of solar generating capacity. • https://www.dom.com/business/dominion-virginia-power/ways-to-save/renewable-energy-programs/solar-partnership-program
Renewable Generation – Schedule RG	Dominion	On-going	Program approval received	Voluntary	<ul style="list-style-type: none"> • Company received approval of program from SCC in December 2013. • Company began accepting applications in April 2014. • https://www.dom.com/business/dominion-virginia-power/ways-to-save/renewable-energy-programs/schedule-rg
Renewable Energy Pilot Program	Dominion	On-going	SCC established program guidelines in November 2013	Voluntary	<ul style="list-style-type: none"> • As of December 1, 2013, qualified customers may participate in the Virginia SCC's Renewable Energy Pilot Program. This pilot program allows qualified customers to enter into a Power Purchase Agreement (PPA) with a third party renewable energy supplier. The energy supplied must come from a wind or solar generator located on the customer's premise. • https://www.dom.com/business/dominion-virginia-power/ways-to-save/renewable-energy-programs/renewable-energy-pilot-program
Alternative Vehicles and Fuels Program	Dominion	On-going	% of fleet powered by alternative fuels?	Voluntary	<ul style="list-style-type: none"> • Vehicles powered by alternative fuels now make up about 33% of Company's on-road fleet of about 6,000 cars and trucks. • https://www.dom.com/corporate/our-commitments/environment/what-we-are-doing/greening-our-vehicle-fleet

Table 3: Emission Reduction Programs-In Development or On-going

Control Program	Stakeholders	Time Frame	Milestones	Program Type	Feedback & Comments
Virginia Clean Cities					
Virginia Get Ready	VCC	On-going	Statewide network of chargers	Voluntary	<ul style="list-style-type: none"> • Deployed two EV planning docs in 2013 as well as tools for advancing electric vehicles and infrastructure. • VA registrations of electric vehicles increased from 1,837 in 2014 to 2,347 in 2015. VA public charging stations increased in number from 275 in 2014 to 358 in 2015. • Deployed dozens of DC Fast Chargers in major cities in 2014. • See http://www.virginiaev.org/ • See va_electric+hybrid_vehicles_and_stations_2008-2015.xlsx • See Clean-Cities-2015-Annual_report_VA-Virginia-Clean-Cities-Expanded-Edition.pdf
Honeywell NO_x Control Installation					
Honeywell SCR Installation	VDEQ	12/2012 through 06/2019	# of SCR installed?	Permitting; Consent Agreement	<ul style="list-style-type: none"> • Two SCR commenced operation December 2012. • Two additional SCR began operating October of 2014.
Virginia Department of Environmental Quality – Ozone Forecasting					
Ozone Forecasting	VDEQ	On-going	Program funded?	Voluntary	<ul style="list-style-type: none"> • Program continues to be funded and operating.
Regional Reductions					
Yorktown Power Station	Dominion	2017	Retirement of two coal fired EGUs	MATS	<ul style="list-style-type: none"> • Dominion will retire two coal-fired units at the Yorktown Power Station contingent upon the completion of a transmission upgrade project expected to be in service no earlier than 2nd quarter 2017.
Other Programs Not Included in the Richmond-Petersburg Ozone Advance Action Plan					
GRTC Bus Conversion	RAMPO	2013-2016	Station constructed Vehicles acquired	Voluntary	<ul style="list-style-type: none"> • GRTC is converting its fleet of diesel-powered buses to compressed natural gas. • Has acquired 65 CNG buses as of 2014.

Table 3: Emission Reduction Programs-In Development or On-going

Control Program	Stakeholders	Time Frame	Milestones	Program Type	Feedback & Comments
Chesterfield County Alternative Fuel School Bus Initiative	Chesterfield	2016-2017	Vehicles acquired	Voluntary	<ul style="list-style-type: none"> The county purchased 20 new, propane fired school buses in February 2016 to replace older, diesel fired buses. See Propane Buses in Chesterfield County.pdf.
Green Operators Program at the Port of Richmond	VPA, RAMPO	2013-2015	n/a	Voluntary; funded by CMAQ and by DERA	<ul style="list-style-type: none"> Funds awarded from CMAQ to begin a retrofit/replacement operation for 100 Class 8b dray trucks that are 2003 MY or older; Estimated emission reductions of 107 tpy VOC and 4 tpy NO_x. Additional funds received from DERA. Richmond regional CMAQ funds authorized an additional \$500,000 for this program for FY2017-FY2021. See Richmond Regional TPO-TIP book 02-2016.pdf and Annual Report – Expanded Green Operator Report 10-30-15.pdf. www.greenoperator.org
Virginia Offshore Wind Technology Advancement Project	Dominion	2017-2018	n/a	Voluntary	<ul style="list-style-type: none"> Dominion is involved in the Virginia Offshore Wind Technology Advancement Project (VOWTAP), a research and development project supporting offshore wind generation, which will consist of two offshore wind (OSW) turbines with a combined capacity of approximately 12 MW. The company was awarded up to an additional \$47 million from the DOE on May 7, 2014, to help fund the construction of the OSW demonstration project. https://www.dom.com/corporate/what-we-do/electricity/generation/wind/virginia-offshore-wind-technology-advancement-project On September 4, 2013, Dominion bid \$1.6 million to win the lease for 112,800 acres off the Virginia coast to develop an off-shore wind farm capable of generating up to 2,000 MW of electricity https://www.dom.com/corporate/what-we-do/electricity/generation/wind/offshore-wind-power
Richmond Bike Share System	City of Richmond, RAMPO	Starting FY 2016	Program initiated? Usage	Voluntary	<ul style="list-style-type: none"> Using \$1M of CMAQ and almost \$2M of other funding, Richmond is starting a bike sharing program across the city to encourage the use of alternative methods of transportation.

Table 4: Emission Reduction Programs-Completed

Control Program	Stakeholders	Time Frame	Program Type	Feedback & Comments
Virginia Clean Cities				
Luck Stone	VCC, Luck Stone	2012	Voluntary	<ul style="list-style-type: none"> • Repowered/retrofitted equipment. • No reported equipment problems.
Propane Autogas Program	VCC	2009-2013	Voluntary	<ul style="list-style-type: none"> • Program concluded in 2013. • Converted 117 vehicles to autogas in VA. • Alternative fuel vehicles estimated to reduce NO_x emissions 273 tons annually in VA.
Virginia Commonwealth University				
Solar Energy	VCU	2015, on-going	Voluntary	<ul style="list-style-type: none"> • Program on-going.
Dashboard	VCU	2015,on-going	Voluntary	<ul style="list-style-type: none"> • Program on-going.
Sustainable Building Program	VCU	2013-2015	Voluntary	<ul style="list-style-type: none"> • Program on-going.
Wind Turbine Study	VCU	2013-2015	Voluntary	<ul style="list-style-type: none"> • Project and study complete. • No new wind turbines planned at this time.
Micro-Grid	VCU, Dominion	2015-on-going	Voluntary	<ul style="list-style-type: none"> • Program on-going.
Dominion				
Generating unit retrofits and fuel switches	Dominion	2012	MATS; Consent Agreement	<ul style="list-style-type: none"> • Installation of SO₂ scrubbers complete for all coal units at the Chesterfield Power Station near Richmond, VA
Virginia Port Authority and Richmond MPO				
Crane Acquisition at Port of Richmond	VPA, RAMPO	2015	Voluntary	<ul style="list-style-type: none"> • Funds from CMAQ used to purchase new, Tier 4 crane. Estimated emission reductions of 3.99 tpy NO_x. • See Annual Report – Expanded Green Operator Report 10-30-15.pdf
Philip Morris – Park 500				
Boiler Fuel Switch	Philip Morris	2015	Permit	<ul style="list-style-type: none"> • Facility converted coal-fired boilers to multi-fueled units and is not burning cleaner fuels.

Table 4: Emission Reduction Programs-Completed

Control Program	Stakeholders	Time Frame	Program Type	Feedback & Comments
Regional Reductions				
Invista Powerhouse Project	VDEQ	2013-2014	Permit	<ul style="list-style-type: none"> • New boilers started operation in January of 2014. • Shutdown request for existing boilers 1 and 2 effective January 9, 2014. • Shutdown request for existing boiler 3 effective March 12, 2014.
Celco Powerhouse Project	VDEQ	2015	Permit	<ul style="list-style-type: none"> • All coal fired boilers permanently shut down as of 9/23/2015.
Generating unit retrofits and fuel switches	Dominion	2014	Permit	<ul style="list-style-type: none"> • Bremono Bluff ceased burning coal in fall of 2013. Facility is now burning solely natural gas.
		2012-2013	Permit	<ul style="list-style-type: none"> • Permits received for Hopewell, Altavista, and Southampton fuel switch from coal to biomass. Units have begun burning biomass and no longer burn coal.
		2014	MATS; 2010 SO ₂ NAAQS	<ul style="list-style-type: none"> • Chesapeake Energy Center retired all coal-fired units in December 2014.
		2014	Permit	<ul style="list-style-type: none"> • Dominion began commercial operation of the Warren County Power Station in December 2014. This operation is a combined cycle facility rated at about 1,329 MW burning natural gas and equipped with state of the art controls. https://www.dom.com/residential/dominion-virginia-power/news/customer-newsletters/feb15-meeting-steep-power-peaks
National Parks	VCC, NPS	2014	Voluntary	<ul style="list-style-type: none"> • NPS added 12 prone lawn mowers and 2 electric vehicles to its fleet, along with a public EV charging station and 2 private EV charging stations.