Fredericksburg Ozone Advance Action Plan

Annual Report
04-30-2015

Abbreviations

CMAQ	Congestion, Mitigation, and Air Quality
DMME	Virginia Department of Mines, Minerals, and Energy
EGU	electrical generating unit
EPA	United States Environmental Protection Agency
EV	electric vehicles
FAMPO	Fredericksburg Area Metropolitan Planning Organization
FGD	flue gas desulfurization unit
FRM	Federal reference method
HRTPO	Hampton Roads Transportation Planning Organization
LEED	Leadership in Energy and Environmental Design
MATS	Mercury and Air Toxics Rule
$\mu g/m^3$	micrograms per cubic meter
MW	megawatts
NAAQS	National Ambient Air Quality Standard
NO_X	nitrogen oxides
ORE	On Road Emissions Program
$PM_{2.5}$	fine particulate matter less than 2.5 micrometers in diameter
ppb	parts per billion
RAMPO	Richmond Area Metropolitan Planning Organization
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

Virginia Ozone and $PM_{2.5}$ Air Quality, April 2015 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 particular area. 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 any future NAAQS updates, such as the newly proposed ozone NAAQS published on December 17, 2014 (79 FR 75104). 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 Fredericksburg area and the Commonwealth of Virginia developed the Fredericksburg Ozone Advance Action Plan to promote continued good air quality.

The Action Plan, which EPA received in April 2013, provided information on the air quality in the Fredericksburg 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 state, federal, and local air pollution control programs and voluntary efforts being implemented as well as the favorable meteorology during the summers of 2013 and 2014.

Ozone

Photochemical reactions between volatile organic compounds (VOC) and nitrogen oxides (NO_X) create ozone when they combine 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. More reductions are expected, as detailed in the Action Plan, due to the new Tier 3 Motor Vehicle Emission and Fuel Standards that EPA finalized on April 28, 2014 (79 FR 23414).

Meteorology also plays a key role in ozone formation. The meteorology in 2009 and 2013 was not conducive to ozone formation due to cooler temperatures and more precipitation. Both years had cooler-than-average daily maximum temperatures during the May through September ozone season and higher-than-average precipitation, contributing to decreased ozone concentrations. 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 with a maximum daily temperature averaging 84.9°F (+3.8°F above normal) and had below average precipitation (-0.71 inches). The 2011 and 2012 ozone seasons also had higher-than-average maximum daily temperatures although precipitation in 2011 and 2012 was near or above normal levels. During

the summer of 2014, Virginia experienced cooler-than-normal temperatures and above normal rainfall, which again was not conducive to ozone formation.

Figure 1 below shows the ozone air quality as measured at the Stafford County monitor. The figure also provides data from the Caroline County monitor, which is located outside of the Fredericksburg area but is nearby. Air quality in this part of the Commonwealth has greatly improved over the last decade. This long term improvement indicates that the emission reductions achieved both locally and regionally have been successful in improving air quality to the point where ozone air quality complies with, and is significantly beneath, the 2008 ozone NAAQS of 75 parts per billion (ppb).

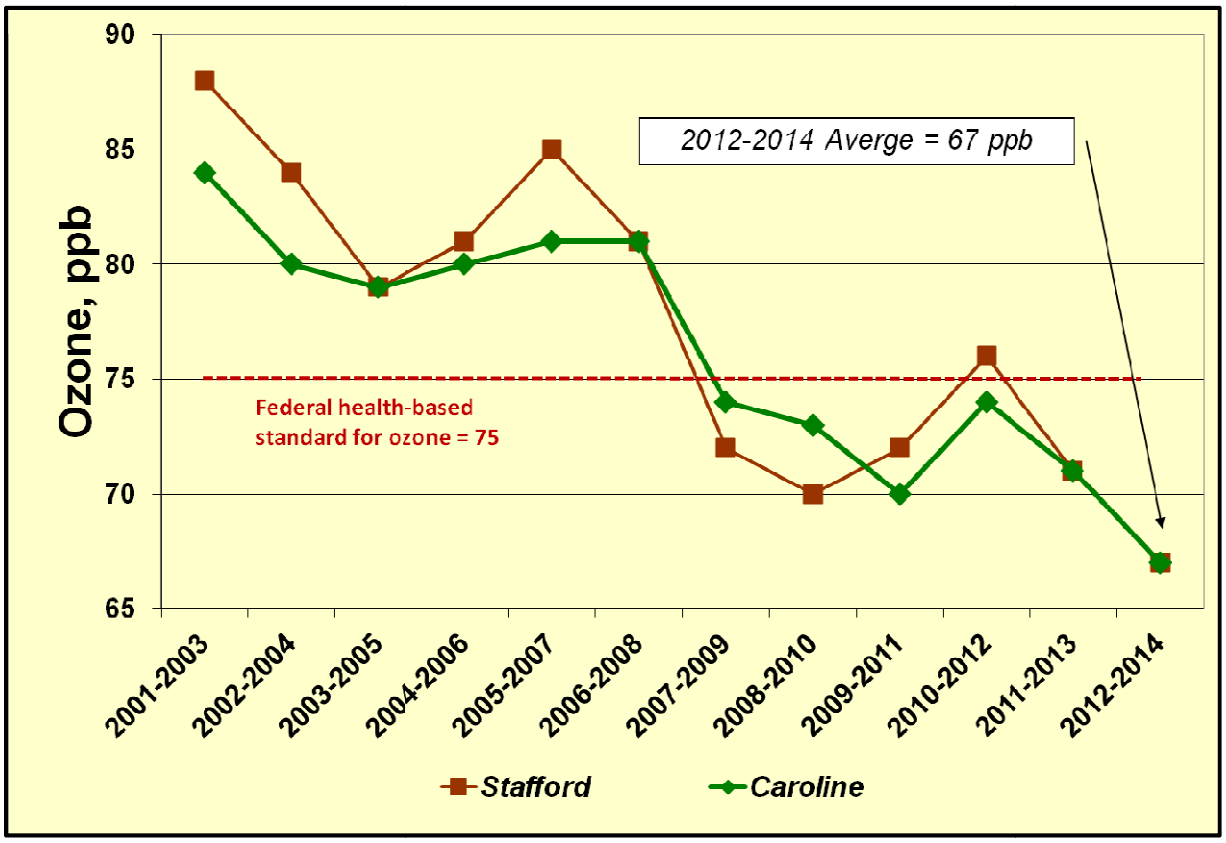
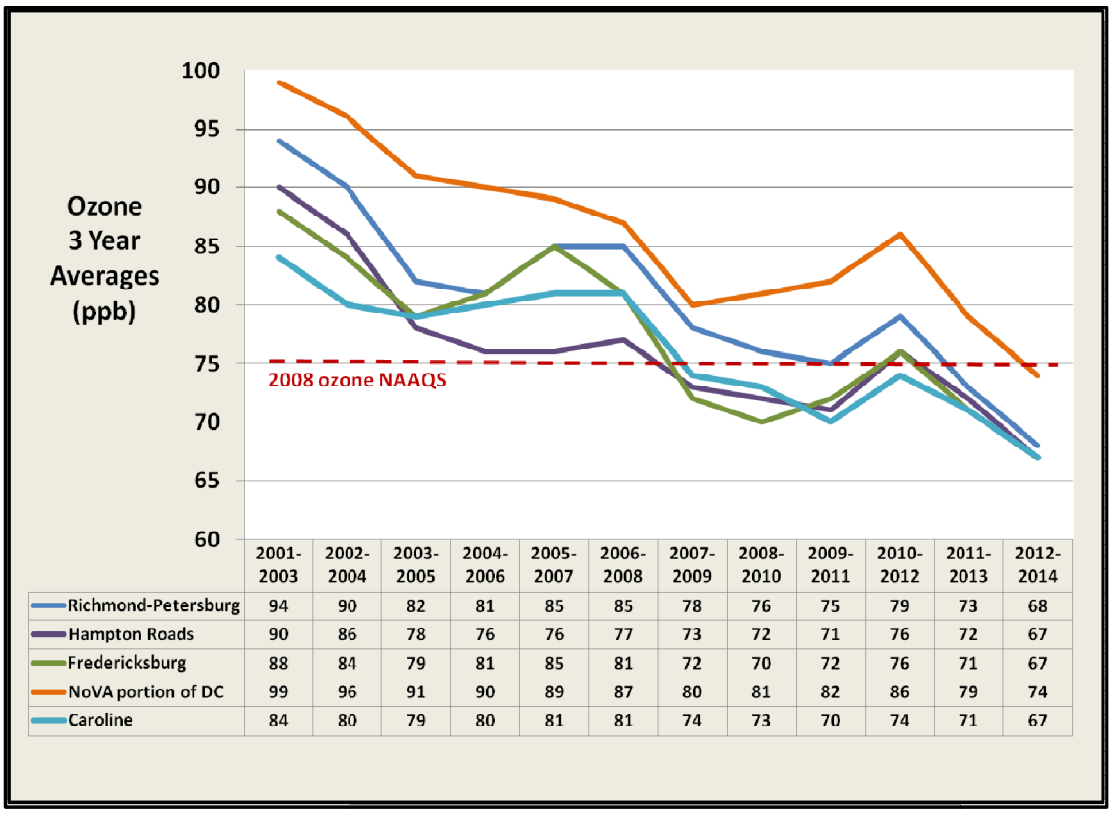


Figure 1: Fredericksburg Ozone Air Quality

Monitoring data across Virginia follow similar patterns, as shown in Figure 2. 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.

Figure 3 shows the number of ozone air quality exceedence days in Virginia since 1997. In 1998, Virginia recorded 82 exceedence days statewide. In 2010, the hottest and one of the driest summers on record, this value dropped to 25 exceedence days. The 2014 data shows only three exceedence days recorded.

Virginia Ozone and $PM_{2.5}$ Air Quality, April 2015 Update



	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007	2006-2008	2007-2009	2008-2010	2009-2011	2010-2012	2011-2013	2012-2014
Richmond-Petersburg	94	90	82	81	85	85	78	76	75	79	73	68
Hampton Roads	90	86	78	76	76	77	73	72	71	76	72	67
Fredericksburg	88	84	79	81	85	81	72	70	72	76	71	67
NoVA portion of DC	99	96	91	90	89	87	80	81	82	86	79	74
Caroline	84	80	79	80	81	81	74	73	70	74	71	67

Figure 2: Ozone 3-Year Average in Virginia Areas

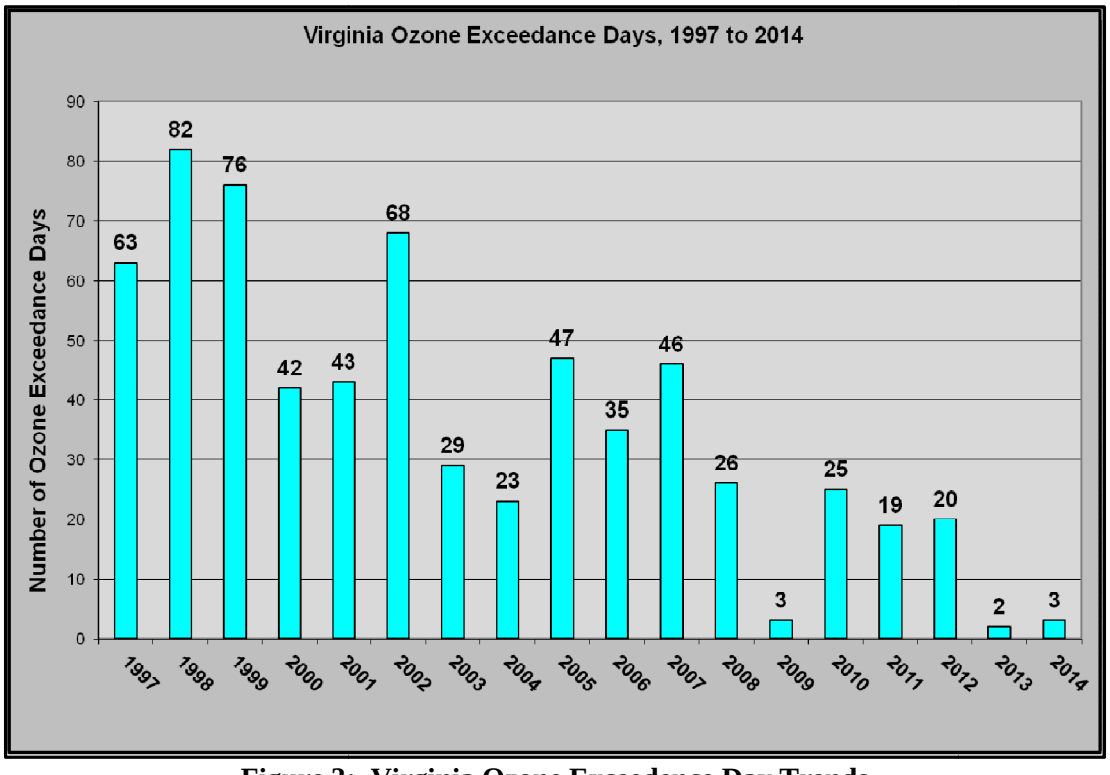


Figure 3: Virginia Ozone Exceedence Day Trends

Virginia Ozone and $PM_{2.5}$ Air Quality, April 2015 Update

$PM_{2.5}$

The federal regulations define $PM_{2.5}$ as any airborne particle of solid or liquid matter that is less than or equal to 2.5 micrometers in diameter, approximately $1/30^{th}$ the width of a human air. 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 is a daily, or 24-hour, standard of 35 $\mu g/m^3$, established in 2006. The second is an annual average of 12.0 $\mu g/m^3$, established in 2013. All monitors in Virginia comply with the 2006 daily $PM_{2.5}$ NAAQS and the 2013 annual $PM_{2.5}$ NAAQS. Recorded data is well below the federal standards. On October 6, 2014, EPA finalized a redesignation request for the only $PM_{2.5}$ nonattainment area in Virginia, the Metropolitan Washington, D.C. 1997 $PM_{2.5}$ NAAQS nonattainment area (79 FR 60081), which became effective November 5, 2014. Due to remarkable improvement in air quality over the last 10 years, EPA now recognizes the entire Commonwealth of Virginia as attaining all $PM_{2.5}$ NAAQS.

Table 1 provides information from one $PM_{2.5}$ Federal Reference Method (FRM) monitoring site in each area of the Commonwealth. While Fredericksburg does not have a $PM_{2.5}$ FRM monitoring site located within its boundaries, $PM_{2.5}$ air quality within Fredericksburg should reflect similar values due to the regional nature of $PM_{2.5}$ pollution. These data also 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 $\mu g/m^3$ on a 24-hour basis and 12.0 $\mu g/m^3$ on an annual basis. This improvement is largely due to SO_2 emission reductions because SO_2 forms sulfates, a component of $PM_{2.5}$, in the atmosphere. Reductions in VOC have also helped $PM_{2.5}$ air quality, by reducing the organic carbon portion of $PM_{2.5}$.

Table 1: Annual and 24-Hour $PM_{2.5}$ 3-Year Averages Across the Commonwealth

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 $\mu g/m^3$	38 $\mu g/m^3$	13.6 $\mu g/m^3$	34 $\mu g/m^3$	14.3 $\mu g/m^3$	33 $\mu g/m^3$	12.6 $\mu g/m^3$	33 $\mu g/m^3$
2002-2004	14.5 $\mu g/m^3$	37 $\mu g/m^3$	13.4 $\mu g/m^3$	33 $\mu g/m^3$	13.9 $\mu g/m^3$	31 $\mu g/m^3$	12.5 $\mu g/m^3$	32 $\mu g/m^3$
2003-2005	14.6 $\mu g/m^3$	36 $\mu g/m^3$	13.6 $\mu g/m^3$	33 $\mu g/m^3$	14.0 $\mu g/m^3$	30 $\mu g/m^3$	12.6 $\mu g/m^3$	30 $\mu g/m^3$
2004-2006	14.2 $\mu g/m^3$	34 $\mu g/m^3$	13.4 $\mu g/m^3$	30 $\mu g/m^3$	13.9 $\mu g/m^3$	31 $\mu g/m^3$	12.5 $\mu g/m^3$	30 $\mu g/m^3$
2005-2007	14.0 $\mu g/m^3$	32 $\mu g/m^3$	13.3 $\mu g/m^3$	31 $\mu g/m^3$	13.9 $\mu g/m^3$	30 $\mu g/m^3$	12.1 $\mu g/m^3$	30 $\mu g/m^3$
2006-2008	12.9 $\mu g/m^3$	30 $\mu g/m^3$	12.4 $\mu g/m^3$	28 $\mu g/m^3$	12.7 $\mu g/m^3$	28 $\mu g/m^3$	11.9 $\mu g/m^3$	30 $\mu g/m^3$
2007-2009	11.9 $\mu g/m^3$	27 $\mu g/m^3$	11.2 $\mu g/m^3$	24 $\mu g/m^3$	11.2 $\mu g/m^3$	25 $\mu g/m^3$	10.7 $\mu g/m^3$	26 $\mu g/m^3$
2008-2010	10.8 $\mu g/m^3$	24 $\mu g/m^3$	10.3 $\mu g/m^3$	21 $\mu g/m^3$	10.2 $\mu g/m^3$	22 $\mu g/m^3$	10.3 $\mu g/m^3$	24 $\mu g/m^3$
2009-2011	10.1 $\mu g/m^3$	22 $\mu g/m^3$	9.6 $\mu g/m^3$	21 $\mu g/m^3$	9.9 $\mu g/m^3$	21 $\mu g/m^3$	9.6 $\mu g/m^3$	23 $\mu g/m^3$
2010-2012	9.9 $\mu g/m^3$	22 $\mu g/m^3$	9.5 $\mu g/m^3$	21 $\mu g/m^3$	9.8 $\mu g/m^3$	20 $\mu g/m^3$	9.3 $\mu g/m^3$	24 $\mu g/m^3$
2011-2013	9.4 $\mu g/m^3$	21 $\mu g/m^3$	8.7 $\mu g/m^3$	21 $\mu g/m^3$	9.0 $\mu g/m^3$	18 $\mu g/m^3$	8.5 $\mu g/m^3$	22 $\mu g/m^3$
2012-2014	9.0 $\mu g/m^3$	21 $\mu g/m^3$	8.5 $\mu g/m^3$	19 $\mu g/m^3$	8.6 $\mu g/m^3$	16 $\mu g/m^3$	8.0 $\mu g/m^3$	20 $\mu g/m^3$

Data Source: VDEQ-Air Quality Monitoring Division

Figure 4 shows the improvement in monitored sulfate concentrations over the last several 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.

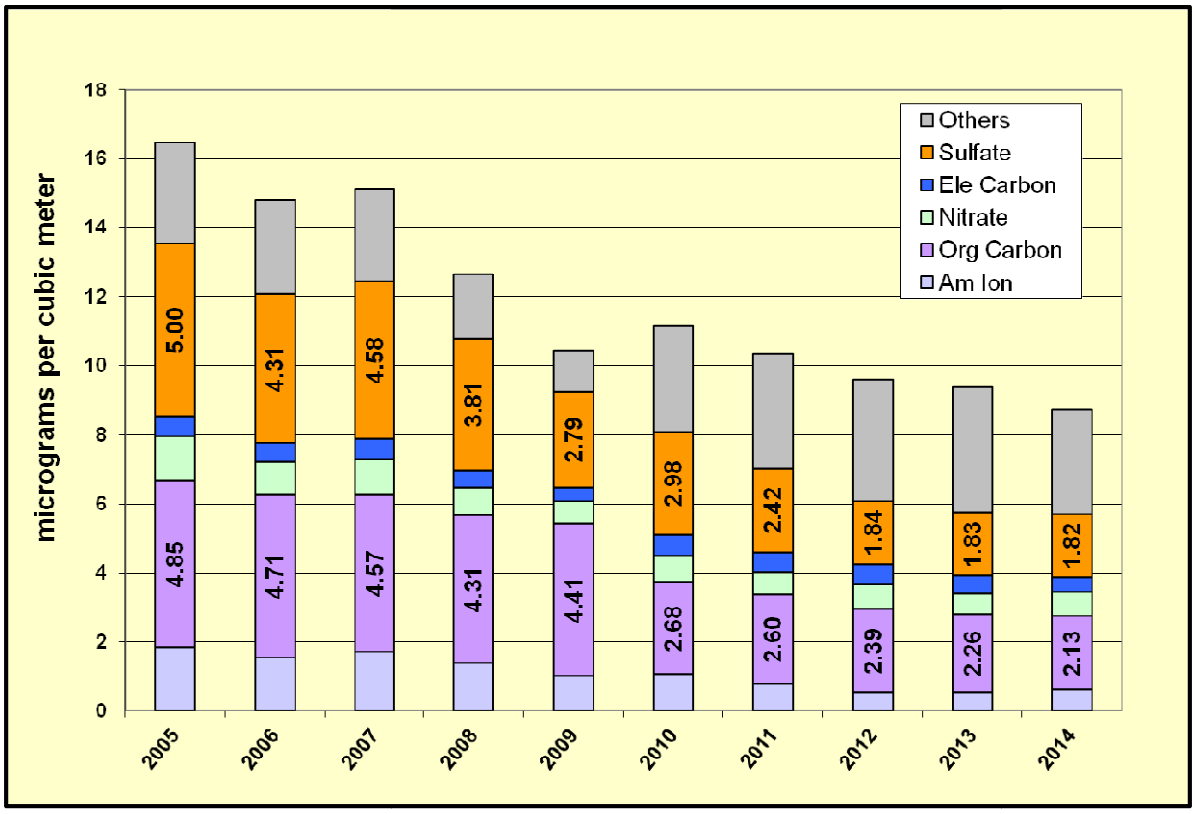


Figure 4: Henrico Speciation Data

Emission Reduction Programs

Existing control programs are reducing pollution and improving air quality. These programs are helping Virginia get a head start on meeting the new, health-based ozone standard, which is due to be finalized by the end of 2015. Upcoming control programs, such as the Tier 3 vehicle standards, should continue improving ozone air quality in the Commonwealth of Virginia.

The following table provides an update on the programs described in the Fredericksburg Ozone Advance Action Plan. These programs are progressing well and will help to lower overall emissions in coming years. During the summer of 2015, several NO_X emission reductions will have occurred that warrant highlighting. Honeywell-Hopewell has completed work on two additional selective catalytic reduction (SCR) control devices and began operating the new SCRs in October 2014. These units will reduce NO_X emissions by approximately 1,500 tons during 2015, as compared to previous years. The Chesapeake Power Station, located in Chesapeake, Virginia, retired four coal-fired units in December 2014. The Invista facility in Waynesboro, Virginia, has permanently retired the coal-fired power house units and replaced them with new, natural gas-fired units. These changes will help reduce the amount of NO_X and SO_2 transported

into the Fredericksburg region. VDEQ has provided a CD containing supporting information, including the various documents referenced in Table 2 below.

Fredericksburg Ozone Advance Action Plan
Annual Report

Table 2: Emission Reduction Programs

Control Program	Stakeholders	Time Frame	Milestones	Program Type	Feedback & Comments
Metropolitan Planning Organizations					
CMAQ Projects	FAMPO	2012-2018	Programs initiated?	Voluntary	• Ongoing
GWRide Connect	FAMPO GWRideConnect	On going	VMT avoided annually Vehicle trips avoided annually Vanpools formed	Voluntary	• Programs ongoing • See GWRideConnect Annual Work Plan Outline FY16.docx • http://www.gwrideconnect.org
Virginia Department of Environmental Quality					
Expansion of ORE	VDEQ	Full Impl: 12/2015	Program implemented?	Regulation	• Program to be implemented spring 2015.
DMME-Division of Energy					
VEMP	DMME	On going	SF of public buildings retrofitted? Private capital deployed? Energy savings?	Voluntary	• Total value of contracts through FY 2014 is $685 million. Cumulative estimated CO_2 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	• 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.
Virginia Clean Cities					
Propane Autogas Program	VCC	2009-2013	Successful national deployment	Voluntary	• 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

Fredericksburg Ozone Advance Action Plan
Annual Report

Control Program	Stakeholders	Time Frame	Milestones	Program Type	Feedback & Comments
Virginia Get Ready	VCC	On going	Statewide network of chargers	Voluntary	• Deployed two EV planning docs in 2013 as well as tools for advancing electric vehicles and infrastructure. • VA registrations of electric vehicles increased from 1,257 in 2013 to 1,837 in 2014. • VA public charging stations increased in number from 212 in 2013 to 275 in 2014. • Deployed dozens of DC Fast Chargers in major cities in 2014 • See http://www.virginiaev.org/ • See va_electric+hybrid_vehicles_and_stations_2008-2014.xlsx
Regional Reductions					
Honeywell SCR Installation	VDEQ	12/2012 through 06/2019	# of SCR installed? Annual emissions of NO_X?	Permitting; Consent Agreement	• Two SCR commenced operation December 2012. • Two additional SCR began operating October of 2014.
Invista Powerhouse Project	VDEQ	2013-2014	Construction begun? New units operational? Coal units retired?	Permit	• 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	Construction begun? New units operational? Coal units retired?	Permit	• The facility informed VDEQ that construction commenced for the six natural gas boilers on 7/16/2013.
Fort A.P. Hill	Fort A.P. Hill	Ongoing	• Annual emission estimates • New programs implemented or studied?		• New Army Reserve Center Complex-LEED Certified Gold July 2013 • AWG Complex certified LEED Silver in near term. • See AP Hill – annual report rev.docx

Fredericksburg Ozone Advance Action Plan
Annual Report

Control Program	Stakeholders	Time Frame	Milestones	Program Type	Feedback & Comments
Generating unit retrofits and fuel switches	Dominion	2012-2016	Retrofits installed? Units where fuels have been successfully changed?	Permit	• Bremo Bluff ceased burning coal in fall of 2013. Facility is now burning solely natural gas.
				Permit	• Permits received for Hopewell, Altavista, and Southampton fuel switch from coal to biomass. Units have begun burning biomass and no longer burn coal.
				MATS; Consent Agreement	• Installation of SO_2 scrubbers has been completed for all coal units at the Chesterfield Power Station near Richmond, VA.
				MATS	• 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 by January 2017.
				MATS; 2010 SO_2 NAAQS	• Chesapeake Energy Center retired all coal-fired units in December 2014.
Solar Partnership Program	Dominion	2013-2018	Program ongoing? 1.2 MW in operation to date.	Voluntary	• Dominion announced 12/9/2013 the installation of more than 2,000 solar panels on the rooftop of Canon Virginia Inc, in Gloucester County, VA. The panels will generate more than 500 kw of electricity. • Company has installed 600 rooftop solar panels on the campus of Old Dominion University in Norfolk, VA that generate 132 kW of electricity. • In September 2014, Dominion announced selection of the Capital One facility in Chester, VA for the installation of nearly 2500 ground-mounted solar panels, which will be capable of generating up to 500 KW of electricity. • http://dom.mediaroom.com/2014-09-15-Dominion-Virginia-Power-Selects-Capital-One-for-First-Ground-Mounted-Solar-Panel-Installation-in-Central-Virginia
Renewable Generation – Schedule RG	Dominion	Ongoing	Program approval received	Voluntary	• 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

Fredericksburg Ozone Advance Action Plan
Annual Report

Control Program	Stakeholders	Time Frame	Milestones	Program Type	Feedback & Comments
Renewable Energy Pilot Program	Dominion	Ongoing	SCC established program guidelines in November 2013	Voluntary	• As of December 1, 2013, qualified customers may participate in the Virginia State Corporation Commission'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	Ongoing	% of fleet powered by alternative fuels?	Voluntary	• Vehicles powered by alternative fuels (AVFs) now make up about 28% of Company's on-road fleet of about 5,700 cars and trucks. • https://www.dom.com/corporate/our-commitments/environment/what-we-are-doing/greening-our-vehicle-fleet
Other					
Virginia Offshore Wind Technology Advancement Project	Dominion	2017-2018	n/a	Voluntary	• Dominion is planning an offshore wind technology testing facility, which will consist of two offshore wind turbines with a combined capacity of approximately 12 MW. https://www.dom.com/about/stations/renewable/vowtap.jsp • 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, and is actively developing this large-scale commercial off-shore wind project. https://www.dom.com/about/stations/renewable/commercial-offshore-wind-development-project.jsp • On March 13, 2015 DMME submitted a signed lease offer to the Bureau of Ocean Energy Management for counter signature, along with documents designating Dominion Virginia Power as the Lease Operator - a major milestone clearing the way for construction of the 12 MW VOWTAP project.
New, low-emitting facilities	Dominion	2015	Commercial operation begun	Permit	• Dominion began commercial operation of the Warren County Power Station in December of 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-steeper-power-peaks

Fredericksburg Ozone Advance Action Plan
Annual Report

Control Program	Stakeholders	Time Frame	Milestones	Program Type	Feedback & Comments
Green Operators Program at the Port of Richmond	VPA, RAMPO	2013-2015	n/a	Voluntary; funded by CMAQ and by DERA	• 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.