COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
Fax (804) 698-4019 TDD (804) 698-4021
www.deq.virginia.gov

Douglas W. Domenech
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

July 1, 2010

Mr. Shawn Garvin
Regional Administrator
U.S. EPA Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Subject: Virginia 2010 Air Quality Monitoring Network Assessment

Dear Mr. Garvin:

In accordance with the Commonwealth of Virginia State Implementation Plan and requirements of the EPA 105 and PM2.5 103 Grants, the Virginia Department of Environmental Quality has completed an assessment of the ambient air monitoring network.

This review was completed by the DEQ Office of Air Quality Monitoring. Attached is the final report generated from the assessment process. The assessment document consists of the results of the analysis of the overall monitoring networks within the Commonwealth of Virginia as well as an analysis of the impact of the changes made to the Fairfax County air monitoring network by the Fairfax County Health Department.

Please feel free to contact Chuck Turner of the Office of Air Quality Monitoring if you or your staff has any questions regarding the attached document.

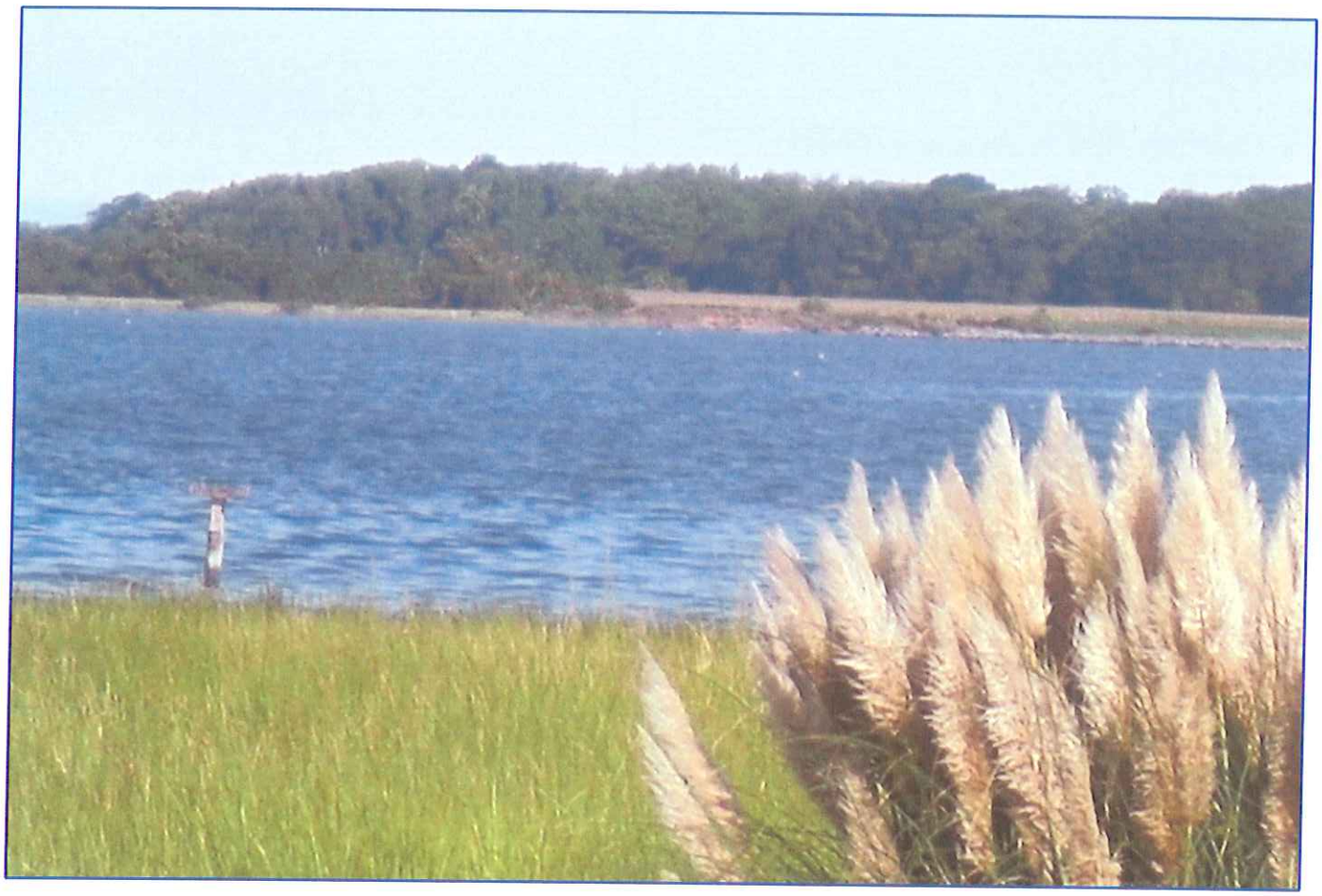
Sincerely,

David K. Paylor

cc: Walter Wilkie, EPA III
Mike Dowd, VA DEQ

Attachments

Virginia Department of Environmental Quality
Office of Air Quality Monitoring
Air Quality Monitoring Network Assessment



VIRGINIA DEPARTMENT OF
ENVIRONMENTAL QUALITY

Executive Summary

This document was developed to meet the requirements of §58.10 (d) of Title 40 of the Code of Federal Regulations. This section of the federal regulations requires that each state perform a periodic (every 5 year) assessment of the state's air monitoring network. The attached document represents the first such document generated for Virginia's Air Quality Monitoring Network. Generally, VA DEQ used modeled outputs from assessment tools provided by EPA to develop a sense of the 1) the land area covered by the ozone and PM2.5 monitors; 2) the data correlation among the ozone and PM2.5 data and 3) whether monitors needed to be added, removed or moved based on these modeled results. This document also evaluates the other criteria pollutants, PAMS and Toxics but without any modeled outputs. Evaluation of the networks outside of ozone and PM2.5 will be significantly impacted by upcoming NAAQS changes so detailed evaluation for these networks will need be saved for after the new monitoring networks are established under the revised standards.

From the results of the analyses performed as part of this Network Assessment the following recommendations/observations can be made:

- The Virginia Department of Environmental Quality can make informed and technically accurate compliance determinations in the Northern Virginia area using the Lee Park, Arlington Co., Alexandria, Loudon Co., and Prince William Co. ozone monitors after July 1, 2010 when Fairfax Co. completely eliminates their ozone air quality monitoring network. **(Page 7 Section 2.1)**
- The Virginia Department of Environmental Quality can make informed and technically accurate compliance determinations in the Northern Virginia area using the Lee Park, Arlington Co., Alexandria, and Loudon Co. PM2.5 monitors after July 1, 2010 when Fairfax Co. completely eliminates their PM2.5 air quality monitoring network. **(Page 10 Section 2.2)**
- The output from the New Sites Tool provided by EPA indicates that new ozone monitors could be required in Central Virginia. These sites will likely be included in the new sites established as part of the network changes that result from the new ozone standard expected in August 2010. **(Page 19 Section 3)**
- The Virginia Department of Environmental Quality, when the revised PM2.5 standard is promulgated, will review and evaluate the PM2.5 network in the Richmond Metropolitan Statistical Area for data redundancy and possible adjustment of the network. **(Page 26 Section 3)**

Table of Contents

Section	Page No.
Introduction	1
1. Meeting Air Quality Monitoring Objectives	3
1. Provide Air Pollution Data to the General Public In a Timely Manner	3
2. Support compliance with ambient air quality Standards and Emissions Strategy Development	5
2. Air Quality Monitoring Site Evaluation	7
1. Impact of the removal of the Fairfax County Ozone Monitors from the Air Monitoring Network	7
2. Impact of the removal of the Fairfax County PM2.5 Samplers from the Air Monitoring Network	10
3. Network Assessment and Evaluation by AQCR	11
Eastern Tennessee- Southwest Virginia AQCR	13
Valley of Virginia AQCR	15
Central Virginia AQCR	19
Northeastern Virginia AQCR	21
State Capital AQCR	24
Hampton Roads AQCR	27
National Capital Interstate AQCR	29
4. Network Assessment and Evaluation for Virginia	31
PM10 Network	31
Carbon Monoxide Network	32
Sulfur Dioxide Network	32
Nitrogen Dioxide	34
Photochemical Assessment (PAMS) Network	35
Urban Air Toxics Network	35
NATTS and NCore	35
Lead Monitoring	36
Speciation Sampler	37
3. Whether New Technologies are appropriate for incorporation Into the Ambient Air Monitoring Network	38

Attachment 1 Virginia Air Monitoring sites by Air Quality Control Region
Attachment 2 Numeric Correlation Tool output for Northern Virginia ozone
Attachment 3 Numeric Correlation Tool output for Northern Virginia PM2.5
Attachment 4 Area Served Model Output for Ozone and PM2.5 FRM

Introduction

§58.10 (d) of Title 40 of the Code of Federal Regulations establishes the requirement for a periodic i.e. every 5 years assessment of each state's air quality monitoring network. This requirement establishes that the first of these assessments is due to the Regional Administrator on July 1, 2010. The exact wording of the citation is as follows:

> (d) The State, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in appendix D to this part, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and whether new technologies are appropriate for incorporation into the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby States and Tribes or health effects studies. For PM2.5, the assessment also must identify needed changes to population-oriented sites. The State, or where applicable local, agency must submit a copy of this 5-year assessment, along with a revised annual network plan, to the Regional Administrator. The first assessment is due July 1, 2010.

The attached Air Quality Monitoring Assessment represents the Virginia Department of Environmental Quality's meeting of this regulatory requirement. This document was generated by VA DEQ's Office of Air Quality Monitoring.

Consistent with the regulatory requirement cited above; this document is divided into 3 separate sections;

1. Meeting Air Quality Monitoring Objectives
2. Air Quality Monitoring Site Evaluation
3. Air Quality Monitoring Technology

Each section is designed to address the specific regulatory requirement in §58.10 (d) and to provide EPA with sufficient information to evaluate whether VA DEQ has met the intent of the requirement for the Network Assessment as well as the regulatory requirements placed on the Air Quality Monitoring Network in Part 58 of Title 40 of the Code of Federal Regulations.

At the time of the development of this document, several new National Ambient Air Quality Standards are newly promulgated or in the process of being revised. At this time it is not possible to specifically identify the siting of the new monitors for the new NO2, SO2, or Ozone standards. While the Lead standard is in the process of being revised, the development of these monitoring sites is sufficiently developed that these sites can be included in this network assessment. Discussions of the projected impact of the new NO2, SO2 and Ozone standards will be included in Sections 1. Meeting Air Quality Objectives and 3. Air Quality Monitoring Technology. While specific sites cannot be identified, this document will cover anticipated requirements at the State level to project compliance needs for the final NO2 and SO2 standards.

The Virginia Department of Environmental Quality has, at the time of generating this document, already completed the requirement for an Annual Monitoring Network Plan described in §58.10 (a) (1) (DKP to SG, June 1, 2010). In the plan, VA DEQ described the disposition of the monitors located in Fairfax County that have historically been operated by the Fairfax County Department of Environmental Health. On July 1, 2009 the Fairfax County Board of Supervisors approved a budget that provided for a 1 year transition period for the County to cease operation of the County owned air monitoring network. As part of the Annual Network Review, VA DEQ evaluated the effectiveness of the remaining air monitoring network at meeting the objectives of Appendix D of 40 CFR Part 58 Appendix D. The technical details of that analysis are provided in this Document.

In an attempt to adhere strictly to the regulatory requirements described in §58.10 (d) the VA DEQ elected to not submit this document for public review prior to the July 1, 2010 deadline. The regulatory citation does not include a requirement for public notification and since the July 1, 2010 document is the first submittal of the 5 year Network Assessment, VA DEQ Office of Air Quality Monitoring elected to submit it to EPA and incorporate EPA comments and then provide the document for public review. It is the intention of the Office of Air Quality Monitoring to create an ongoing public process for the 5 Year Assessment Document so that the public can be kept up-to-date during the 5 years in between each overall assessment.

In applying the models provided by EPA for the Network Assessment the Office of Air Quality Monitoring attempted to approximate the Air Quality Control Regions (AQCR) as defined in the Virginia Air Quality regulations 9VAC5-20-200. This approach is consistent with the Annual Network Plan and is supported by regulatory definition. When the air quality control region contains counties included in an emissions control area, the model was applied such that all counties included in the emissions control area where included in the model analysis. This primarily affected AQCR VII which was expanded to include Stafford County when analyzing the ozone monitor sites in the Northern Virginia Area.

In putting together the Network Assessment the EPA models were invaluable to the process of completing Section 2. Air Quality Monitoring Site Evaluation of this document. To the greatest extent possible AQM attempted to include graphical presentation of all the model outputs in the presentation. In some cases DEQ chose to exclude some of the graphical outputs because in the best judgment of the staff, the outputs created a level of confusion in presenting the data or did not positively contribute to the context of the discussion. The decision to include or not include certain outputs does not detract from the essential function these models played in the development of the Network Assessment.

Section 1. Meeting Air Quality Monitoring Objectives

§58.10 (d) (1) indicates that one of the minimum requirements of the 5 year Network Assessment is to establish that existing air quality monitoring network meets the monitoring objectives as described in Appendix D to Part 58 of the 40 CFR. The objectives as delineated in Appendix D are as follows:

(a) Provide air pollution data to the general public in a timely manner

(b) Support compliance with ambient air quality standards and emissions strategy development.

(c) Support for air pollution research studies.

Each of the above referenced monitoring objectives and the means by which VA DEQ meets them is described below.

1. Provide Air Pollution Data to the General Public in a Timely Manner

The primary manner by which the VA DEQ provides air quality information to the general public is through presentation of Air Quality Index (AQI) information published on the public webpage (www.virginia.deq.gov). The AQI is a tool that simplifies reporting air quality information to the general public. The AQI is designed to convert ambient concentrations of air pollutants into an index of numeric and color-coded designations of air quality based on the concentrations. The means by which the AQI is calculated and applied is described in 40 CFR Part 58 Appendix G. These regulations state that the AQI must be reported if the Metropolitan Statistical Area has a population over 350,000.

DEQ provides AQI information for PM2.5 and for Ozone. DEQ does not routinely calculate and present AQI information for CO, SO2 or NO2. These pollutants are routinely well below the NAAQS standards so that AQI information for these pollutants does not have the potential for providing the public with information on potential health risks. The information on these pollutants is provided yearly in the Annual Air Quality Monitoring Report (discussed below). DEQ provides the AQI information for PM2.5 year round and for Ozone during the Ozone season.

Figure 1.1.1 below provides a picture of the Air Quality web page. This is the general information about the forecasting for the applicable MSA's state-wide. The table provides a listing of the MSA, the current day AQI calculation based on the highest monitored reading, the critical pollutant with the highest calculated AQI and the original forecasted information for the current day. Note also that there is a menu on the left side of the page that lists all monitored sites. This way the public has access to readings at each ozone and continuous PM2.5 monitor across the Commonwealth. Note also that DEQ provides contact information so that the general public has a means to get clarification on any of the information shown.
Figure 1.1.1 Virginia DEQ Air Quality Web Page

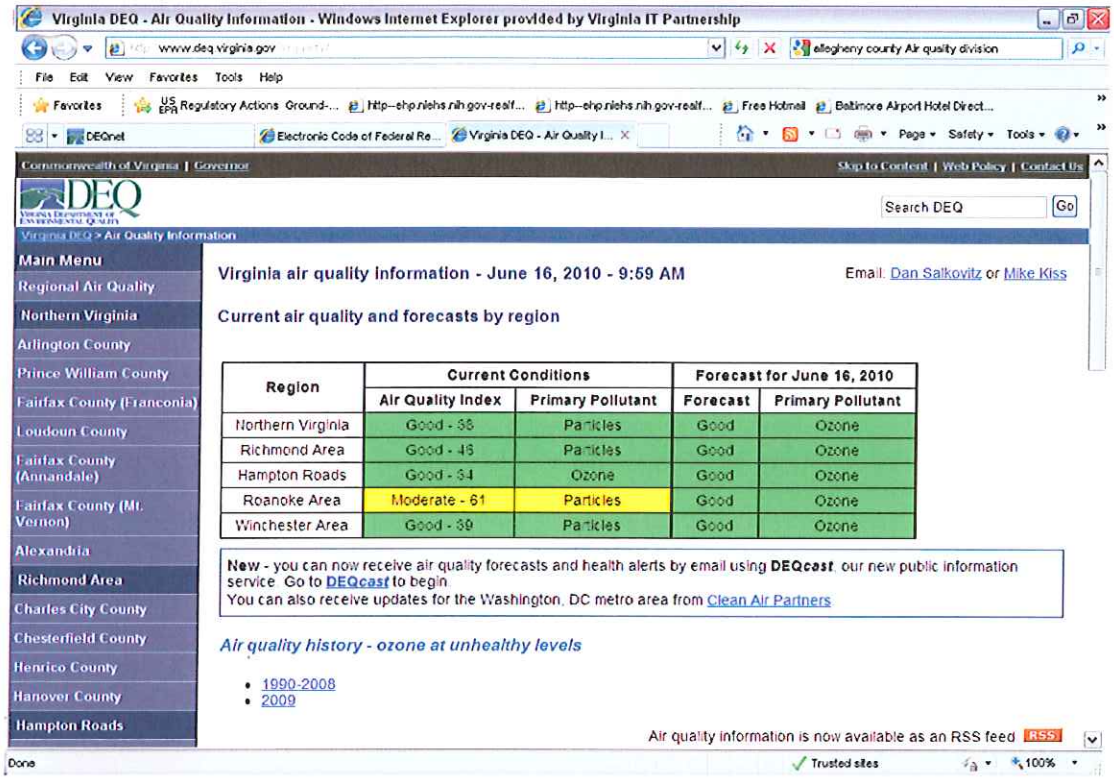
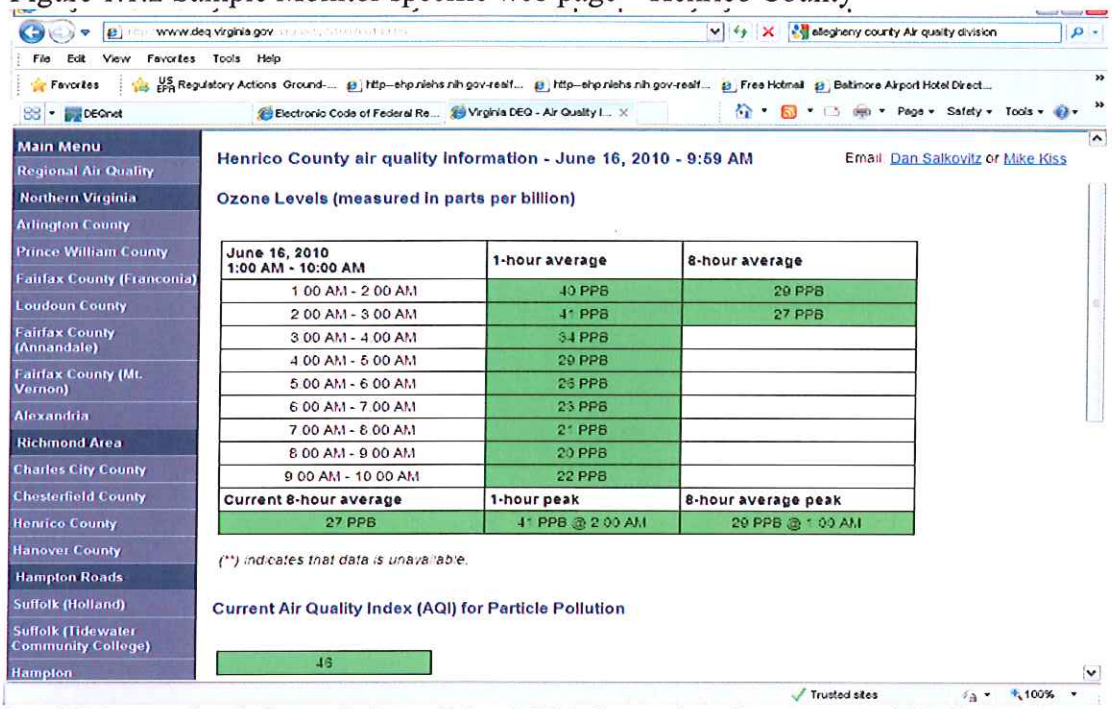


Figure 1.1.2 below is an example of the information provided on the individual monitors throughout the Commonwealth. The example shown is the Math Science Innovation Center monitor in Henrico County.

Figure 1.1.2 Sample Monitor specific web page – Henrico County



In addition to the daily updating of the AQI information for ozone and PM2.5 VA DEQ provides a comprehensive review and explanation of the air quality data generated across the Commonwealth in the form of the Annual Air Quality Monitoring Report. This report is posted each year around August and provides a

comprehensive presentation, description and explanation of the air quality standards, data and compliance status of the Commonwealth based on the air quality data captured for the prior calendar year. The Annual Report is posted on the public Web page and can be view at http://www.deq.virginia.gov/airmon/publications.html. In addition to the most recent calendar year data, the Annual Monitoring Report provides historical trends on all pollutants at all sites throughout the Commonwealth.

2. Support compliance with ambient air quality standards and emissions strategy development.

Appendix D to Part 58 also states that another air quality monitoring objective of the air monitoring network is to support compliance determinations based on comparison with the NAAQS standards and with emissions control strategies. Appendix D paragraph 1.1 (b) lists four possible uses of monitoring data that support achievement of this objective:

a. Data from FRM, FEM, and ARM monitors for NAAQS pollutants will be used for comparing an area's air pollution levels against the NAAQS.

b. Data from monitors of various types can be used in the development of attainment and maintenance plans.

c. SLAMS, and especially NCore station data, will be used to evaluate the regional air quality models used in developing emission strategies, and to track trends in air pollution abatement control measures' impact on improving air quality.

d. In monitoring locations near major air pollution sources, source-oriented monitoring data can provide insight into how well industrial sources are controlling their pollutant emissions.

Data supplied by the air monitoring network maintained by VA DEQ is used for all these above listed purposes. The subsequent paragraphs describe how the data generated by the VA air quality monitoring network support these data uses.

a. Data from FRM, FEM, and ARM monitors for NAAQS pollutants will be used for comparing an area's air pollution levels against the NAAQS

All monitors operating within the VA DEQ monitoring network that provide data for pollutants with NAAQS standards (i. e. criteria pollutants) use FRM or FEM methodologies. Attachment 1 of this report contains spreadsheets for each AQCR with a description of the monitoring methodology used for each pollutant at each monitoring site. In the attachment there is no reference to Urban Air Toxics samplers or NATTS Samplers because they are part of the Air Toxics program and do not have corresponding NAAQS standards. Attachment 1 contains a listing of all monitors used in the process of comparing monitored data for criteria pollutants against the appropriate NAAQS standard.

The data generated from the Attachment 1 monitors is used for comparison with the NAAQS standards to support attainment determinations. VA DEQ has delineated non-attainment areas in Virginia's Air Quality regulations at 9 VAC 5-20-204. Three separate non-attainment areas are listed. The instrumentation listings describing the monitors and methods used in support of this determination are contained in Attachment 1, spreadsheets AQCR 1-7.

b. *Data from monitors of various types can be used in the development of attainment and maintenance plans.*

The VA DEQ Office of Air Quality Planning develops the attainment plans that apply to the Northern Virginia Non-attainment area as well as the maintenance plans for the Richmond Maintenance area and the Tidewater Maintenance area. The design values used to ascertain attainment as well as the severity of the non-compliance (i.e. marginal, moderate, etc.) are calculated using data generated from the monitoring network maintained by DEQ. Design values are calculated using only data gathered using FRM or FEM monitors.

c. *SLAMS, and especially NCore station data, will be used to evaluate the regional air quality models used in developing emission strategies, and to track trends in air pollution abatement control measures' impact on improving air quality.*

VA DEQ uses monitored data to validate the regional models used in the attainment and maintenance plan development process. The NCore station, located in the Richmond Metropolitan area, will be an integral part of that effort when it is officially operational on January 1, 2011. The VA DEQ maintains an ongoing effort at evaluating the trends in local air quality and publishing the results of this trend analysis in its annual report. The design values are also published in this report. The webpage provides to the general public a means of evaluating the DEQ trend analysis for Particulate and Ozone pollution.

d. *In monitoring locations near major air pollution sources, source-oriented monitoring data can provide insight into how well industrial sources are controlling their pollutant emissions.*

VA DEQ has included several source oriented monitors in its existing network. Table 1.2.1 below lists the monitor, site, pollutant and source for which the monitor is installed. Those sites listed in italics are projected sites.

Table 1.2.1 Source Oriented Monitors in VA's Air Quality Monitoring Network

Name of Site	AQS Number	Monitor	Pollutant	Source
Tucker Elementary School Alexandria	51-510-0020	SSI Hi Vol	PM-10	Virginia Paving, Inc. (Reg. # 70579)
Buchanan Co. - VP-1 Site	51-027-0006	TSP Hi Vol	TSP-Lead	Jewell Coal and Coke Corp. (Reg. # 10200)
Roanoke City - Cherry Hill Subdivision	51-770-0011	TSP Hi Vol	TSP-Lead	Steel Dynamics Corp. (Reg. # 20131)
Amherst Co. – Central VA Training Center.	*51-009-0007*	*TSP Hi Vol*	*TSP-Lead*	*Griffin Pipe Products, Inc. (Reg. # 30397)*

Section 2.Air Quality Monitoring Site Evaluation

In addition to demonstrating that the monitoring network must meet the objectives of Appendix D, §58.10 (d) indicates that the monitoring network review must determine "whether new sites are needed, whether existing sites are no longer needed and can be terminated". This section of the Monitoring Network Review discusses the EPA model outputs that facilitate comparison of monitoring sites with other monitoring sites, evaluation of monitoring sites within the AQCR where it is located and the need for new sites within the Air Quality Control Region. Recent budgetary realities have caused Fairfax County to eliminate their air monitoring budget which has forced the closure of 4 separate monitoring sites within the county. Section 2 will provide an extensive analysis of the impact of this reduction in the number of monitors on monitoring in AQCR VII and the Washington D.C. Metropolitan Statistical Area.

1. Impact of the removal of the Fairfax County Ozone Monitors from the Air Monitoring Network

In a letter dated February 16, 2010, the Fairfax County Health Department indicated that it was their intent to cease air monitoring activities at the stations listed in Table 2.1.1 below effective June 30, 2010. Due to budget constraints the monitoring activities had already been cut back to just ozone and PM2.5 activities on July 1, 2009. The fiscal year from July 1, 2009 to June 30, 2010 was designated as a transitional year to allow the County to transition the air monitoring staff to other positions and to provide VA DEQ time to evaluate options related to ongoing monitoring activities at these sites.

Table 2.1.1 Fairfax County Monitoring Sites projected to close July 1, 2010

EPA ID	POLLUTANT	LOCATION	CITY/ COUNTY	LAT/LONG
51-059-5001	CO, SO_2, O_3, NO_2, $PM_{2.5}$	McLean Governmental Center - 1437 Balls Hill Road	McLean Fairfax Co.	38° 55′ 55″ -77° 11′ 56″
51-059-0018	O_3, PM_{10}	Mt. Vernon Fire Station 2675 Sherwood Hall Lane	Mount Vernon Fairfax Co.	38° 44′ 33″ -77° 04′ 39″
51-059-0005	CO, SO_2, O_3, NO_2, PM_{10}	Upper Cub Run Drive	Chantilly Fairfax Co.	38° 53′ 38″ -77° 27′ 55″
51-059-1005	CO, SO_2, O_3, NO_2, $PM_{2.5}$, TEOM	Mason Governmental Center 6507 Columbia Pike	Annandale Fairfax Co.	38° 50′ 15″ -77° 09′ 47″

When first notified by Fairfax County, VA DEQ performed an initial comparison of the Northern Virginia sites using a Pearson Correlation approach. The analysis evaluated monitors in AQCR VII for Ozone due to the non-attainment status of the area. The results of the analysis are contained in Figure 2.1.1 below. Generally, a correlation greater than 0.6 is considered a high correlation so evaluation of the table below indicates that the data generated from the ozone monitors in the Northern Virginia area is highly correlated amongst all of the monitors analyzed.

Table 2.1.2 Initial Pearson Correlation Screening for Fairfax County Ozone Monitors

Northern Virginia AQCR VII						
Correlations (Pearson)						
	Alexandria (51-510-0009)	Arlington	Fairfax - Lee Park	Fairfax- McLean	Fairfax - Chantilly	Fairfax - Annandale
Arlington 51-013-0020	0.9703					
Fairfax - Lee Park 51-059-0030	0.8893	0.9197				
Fairfax – McLean 51-059-5001	0.9786	0.9714	0.8933			
Fairfax – Chantilly 51-059-0005	0.9631	0.9663	0.909	0.9761		
Farifax – Annandale 51-059-1005	0.9379	0.9615	0.9284	0.9391	0.943	
Fairfax - Mt Vernon 51-059-0018	0.9407	0.9555	0.9362	0.9361	0.9428	0.9513

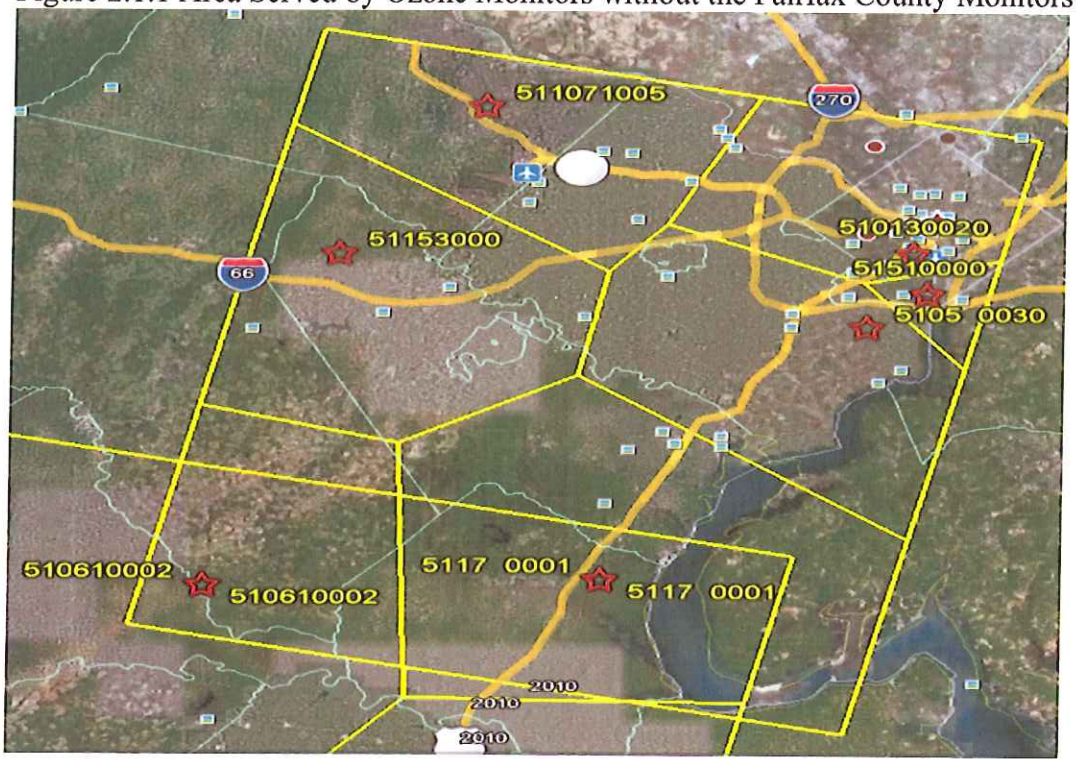
Upon receipt of the models provided by EPA VA DEQ ran the Interactive Correlation Matrix Tool to determine if the monitors maintained by DEQ including the Ozone monitor maintained by DEQ at the Lee Park site (51-059-0030) in Fairfax County would provide DEQ with sufficient accurate data to support the monitoring objective described in Appendix D paragraph 1.1(a). Attachment 2 contains the results of the modeling run using ozone data from 2005 through 2008. The analysis of the results of the model runs indicates the following:

- The Mount Vernon ozone Monitor and the Lee Park ozone Monitor are correlated to a high degree and the average relative difference indicates that the data sets are similar.
- The Chantilly Monitor and the Ashburn Monitor are highly correlated.
- The Aurora Hills (Arlington Co.) Monitor correlates well with both the Mason and Mclean monitors.

The Lee Park Monitor is approximately 2 miles distance from the Mount Vernon monitor. The Chantilly Monitor and the Ashburn Monitor are 11 miles apart. The above analysis supports the observation that the data generated from the Lee Park Monitor, Ashburn and Aurora Hills would yield the same determinations relative to NAAQS compliance or non-compliance with the applicable Ozone standards. VA DEQ can continue to make regulatorily correct and technically accurate compliance decisions without the data sets generated by the Mount Vernon, Mason, McLean and Chantilly monitors.

In addition to the Interactive Correlation model provided by EPA, DEQ reviewed the output from the Area Served model provided by EPA. The output from this model is provided below. Note that even with the Fairfax County monitors not included there is overlap among the remaining monitors in terms of the area represented. Note that the Arlington (51-013-0020), Alexandria (51-510-0009), and Lee Park (51-059-0030) are superimposed, that is the model cannot distinguish the locations of the monitors within the resolution of the model. Also note that the area within the Commonwealth of Virginia served by these 3 monitors represents only a small part of the Virginia portion of the National Capital Interstate Air Quality Control Region. The remaining portions of AQCR are covered by other monitors.

Figure 2.1.1 Area Served by Ozone Monitors without the Fairfax County Monitors



The elimination of the Fairfax County Monitors will not compromise the compliance of the Washington MSA with Appendix D requirements for the number of Ozone Monitors. Table D-2 of Appendix D indicates that the number of required monitors for the Washington MSA is 3. Table 2.1.2 below provides the number of monitors in the MSA excluding the monitors eliminated by Fairfax County.

Table 2.1.2 Ozone Monitors in the Washington MSA

	#Mons By State								
MSA	10	11	24	51	54	Total Mons	Population	# required >= 85% NAAQS	# required < 85% NAAQS
Washington,DC-MD-VA-WV	3	1	5	3	1	13	4923153	3	1

2. Impact of the removal of the Fairfax County PM2.5 Samplers from the Air Monitoring Network

In addition to analyzing the ozone monitors in Fairfax County VA DEQ analyzed the PM2.5 monitors at the McLean Governmental Center and the Mason Governmental Center. As with Ozone DEQ did an initial Pearson correlation analysis to compare the data sets to determine if the data sets are highly correlated. Table 2.1.3 below indicates that the data sets from the DEQ operated PM2.5 samplers in Loudon County and at Lee Park in Fairfax County correlate well with the PM2.5 samplers at Mason and McLean in Fairfax County.

Table 2.1.3 Initial Pearson Correlation Screening for Fairfax County PM2.5 Monitors

Northern Virginia AQCR VII				
Correlations (Pearson)				
	Fairfax County - Mason (510591005)	Fairfax County - Mclean (510595001)	Loudon County - Ashburn (511071005)	Fairfax County – Lee Park (510590030)
Arlington County – Aurora Hills (510130020)	0.9758	0.9652	0.9302	0.9659
Fairfax County - Mason (510591005)		0.9723	0.9519	0.9713
Fairfax County - Mclean (510595001)			0.9228	0.9503
Loudon County - Ashburn (511071005)				0.9135

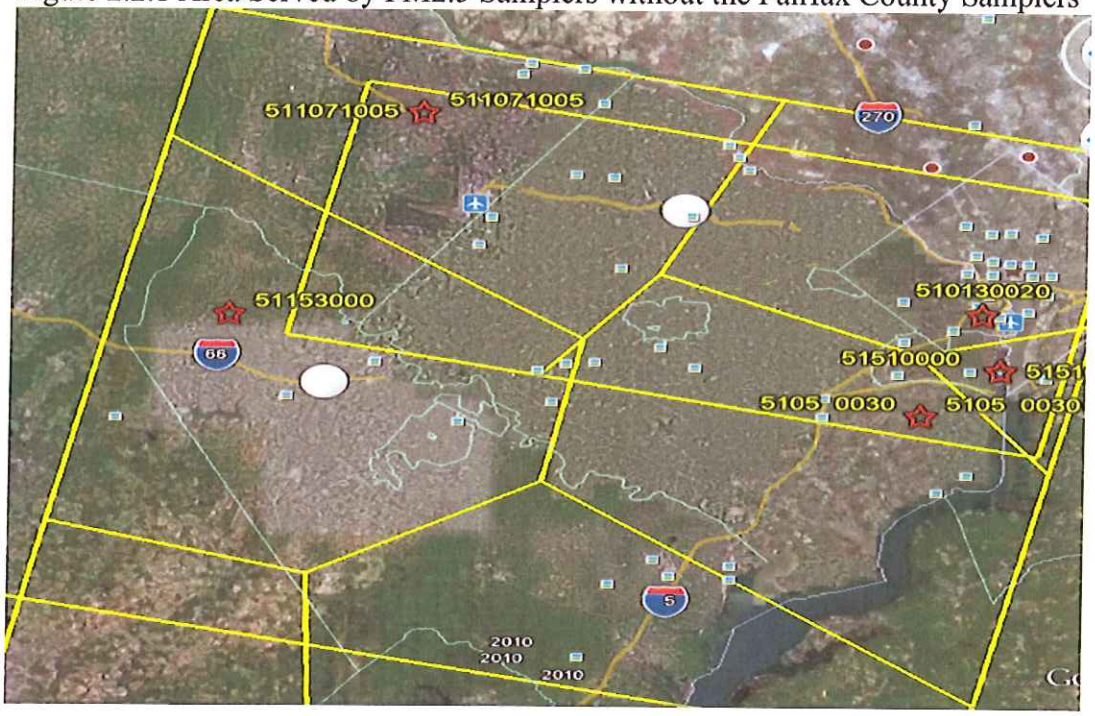
Upon receipt of the models provided by EPA VA DEQ ran the Interactive Correlation Matrix Tool to determine if the monitors maintained by DEQ including the PM2.5 sampler maintained by DEQ at the Lee Park site (51-059-0030) in Fairfax County would provide DEQ with sufficient accurate data to support the monitoring objective described in Appendix D paragraph 1.1(a). Attachment 3 contains the results of the Correlation Matrix Data Output modeling run using PM2.5 data from 2005 through 2008. The analysis of the results of the model runs indicates the following:

- The Lee Park daily PM2.5 sampler is correlated to a high degree with both the Mason PM2.5 sampler (51-059-1005) and the Mclean sampler (51-059-5001).
- The average relative differences among the data sets for these monitors indicate relatively little difference in the data sets.

In addition to the Interactive Correlation model provided by EPA, DEQ reviewed the output from the Area Served model provided by EPA. The output from this model is provided below. Note that even with the Fairfax County PM2.5 samplers not included there is overlap among the remaining monitors in terms of the area represented. Note that the Arlington (51-013-0020), Alexandria (51-510-0009), and Lee Park (51-059-0030) samplers are superimposed, that is the model cannot

distinguish the locations of the monitors within the resolution of the model. Also note that the area within the Commonwealth of Virginia served by these 3 monitors represents only a small part of the Virginia portion of the National Capital Interstate Air Quality Control Region. The remaining portions of AQCR are covered by other monitors.

Figure 2.2.1 Area Served by PM2.5 Samplers without the Fairfax County Samplers



The elimination of the Fairfax County PM2.5 samplers will not compromise the compliance of the Washington MSA with Appendix D requirements for the number of PM2.5 samplers. Table D-5 of Appendix D indicates that the number of required monitors for the Washington MSA is 3. Table 2.1.4 below provides the number of monitors in the MSA excluding the monitors eliminated by Fairfax County.

Table 2.1.4 PM2.5 samplers in the Washington DC MSA

	#Mons By State								
MSA	10	11	24	51	54	Total Mons	Population	# required >= 85% NAAQS	# required < 85% NAAQS
Washington,DC-MD-VA-WV	3	0	3	2	1	9	4923153	3	2

3. Network Assessment and Evaluation by Air Quality Control Region

The EPA provided statistical models that allow VA DEQ to evaluate the air quality monitoring network at the Air Quality Control Region level. These models can be described as follows:

Correlation Matrix Tool - The correlation matrix tool is a static analysis and interactive tool which shows the correlation, relative difference, and distance between pairs of sites within a CBSA or a user selected region.

Removal Bias Tool - The removal bias tool consists of a series of static analyses and an interactive tool meant to aid in determining redundant sites and act as a means of validating a network after sites have been chosen for removal.

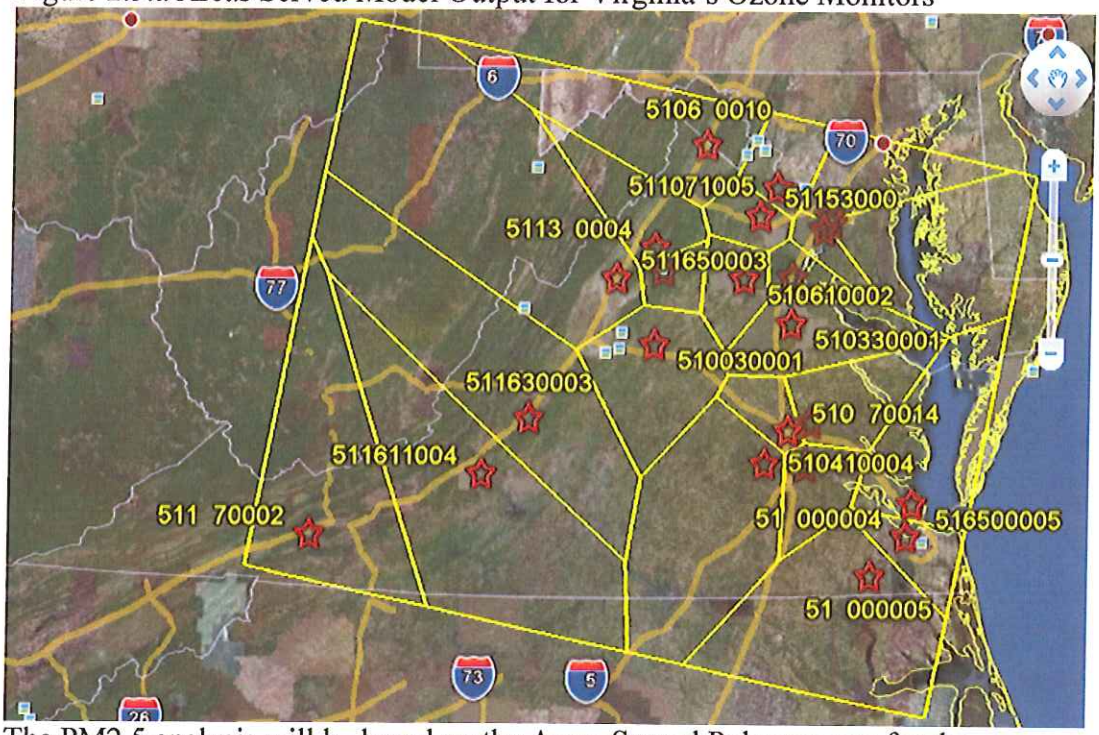
New Sites Tool - The new sites tool provides a way to determine areas where new sites could provide more information to characterize air quality.

Area Served Tool - The area served tool uses a spatial analysis technique known as Voronoi or Thiessen polygons to show the area represented by a monitoring site. The shape and size of each polygon is dependent on the proximity of the nearest neighbors to a particular site.

DEQ will use the above tools to evaluate the existing monitoring network in each air quality control region as defined in 9 VAC 5-20-200. The analysis will then evaluate the PAMS site, the Chemical Speciation monitor and projected impacts of new NAAQS standards.

The ozone analysis will be based on the Areas Served Polygon map for the Commonwealth of Virginia as shown below:

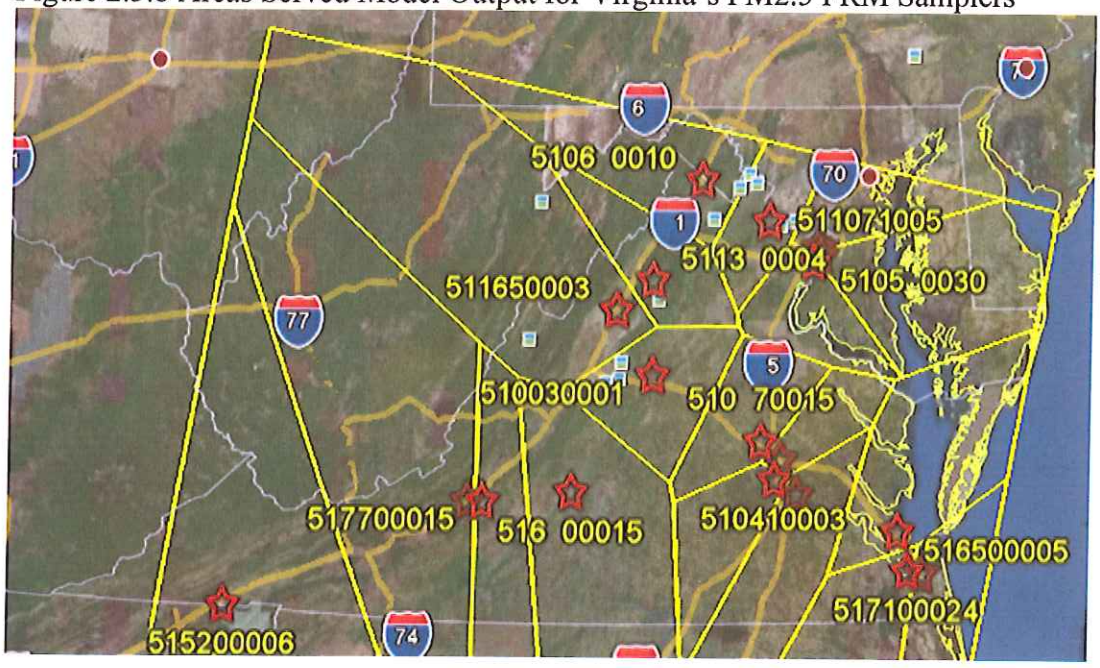
Figure 2.3.a Areas Served Model Output for Virginia's Ozone Monitors



The PM2.5 analysis will be based on the Areas Served Polygon map for the Commonwealth of Virginia as shown below:

Attachment 4 to this document contains larger copies of figures 2.3.a and 2.3.b as well.

Figure 2.3.b Areas Served Model Output for Virginia's PM2.5 FRM Samplers

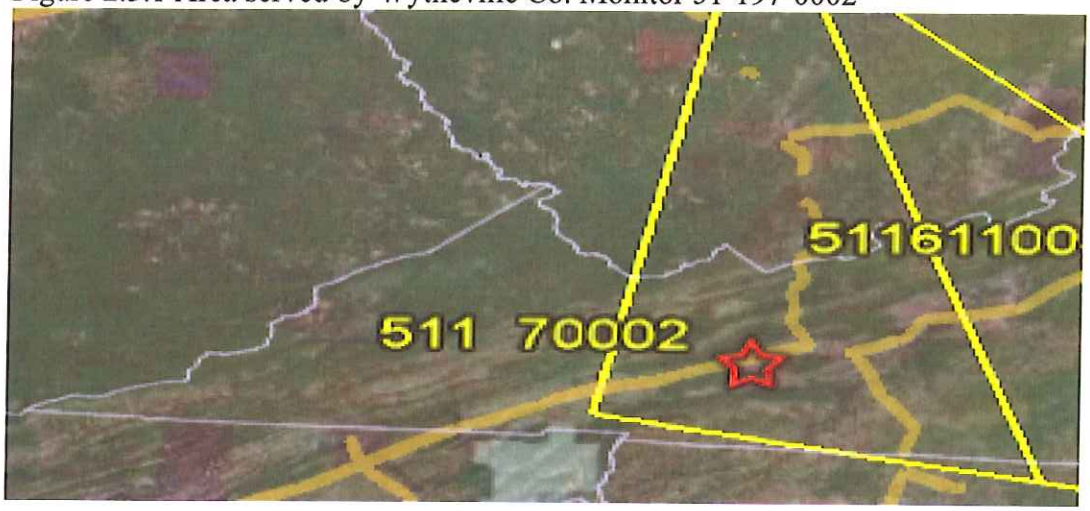


Eastern Tennessee-Southwestern Virginia Interstate AQCR (Virginia) – This AQCR (AQCR 1) encompasses the following counties and cities:

Counties – Bland, Buchanan, Carroll, Dickenson, Grayson, Lee, Russell, Scott, Smyth, Tazewell, Washington, Wise, Wythe
Cities – Bristol, Galax Norton

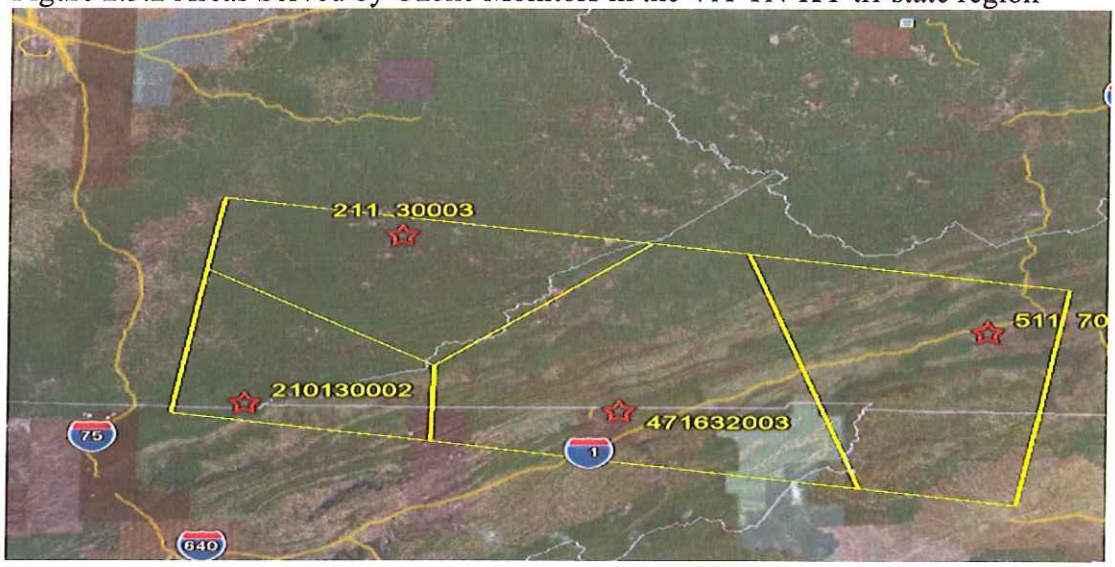
Applying the area served tool for the ozone monitor located in this AQCR the model generates the following output:

Figure 2.3.1 Area served by Wytheville Co. Monitor 51-197-0002



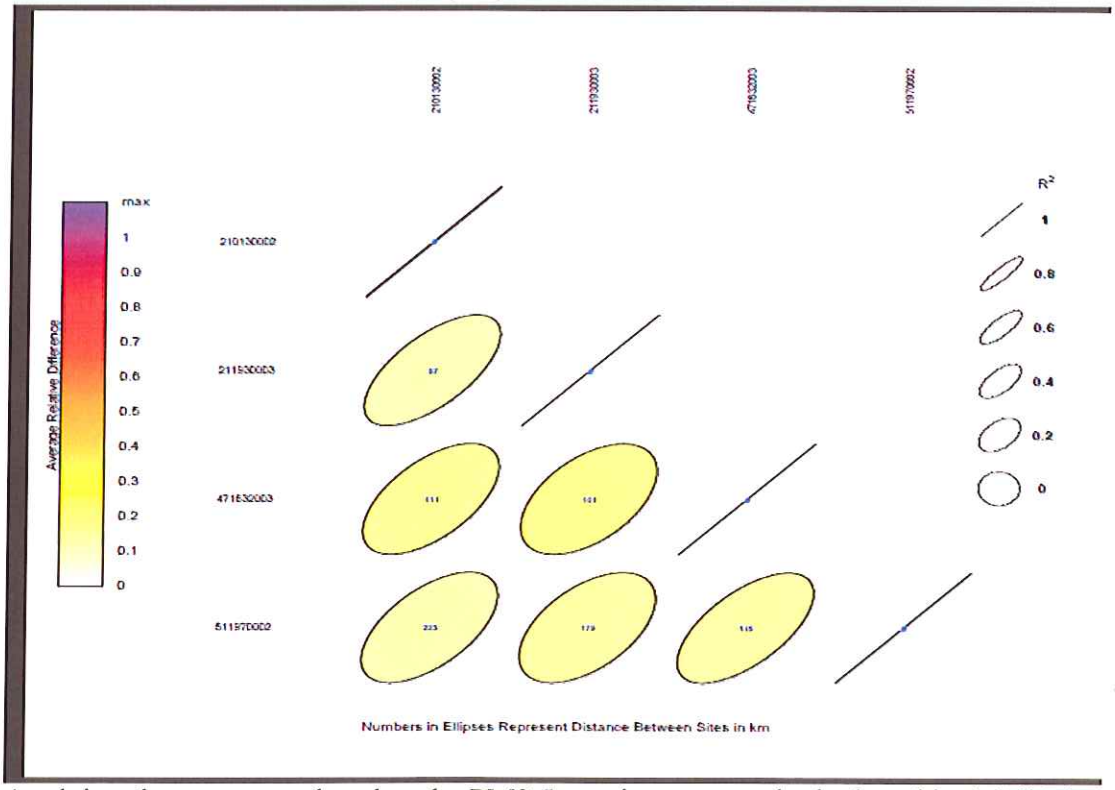
This monitor covers the eastern portion of AQCR 1 from the eastern edge of the region. The western portion of the region is relatively undeveloped and contains few major sources of VOC's that would contribute to the formation of ozone.

Figure 2.3.2 Areas Served by Ozone Monitors in the VA-TN-KY tri-state region



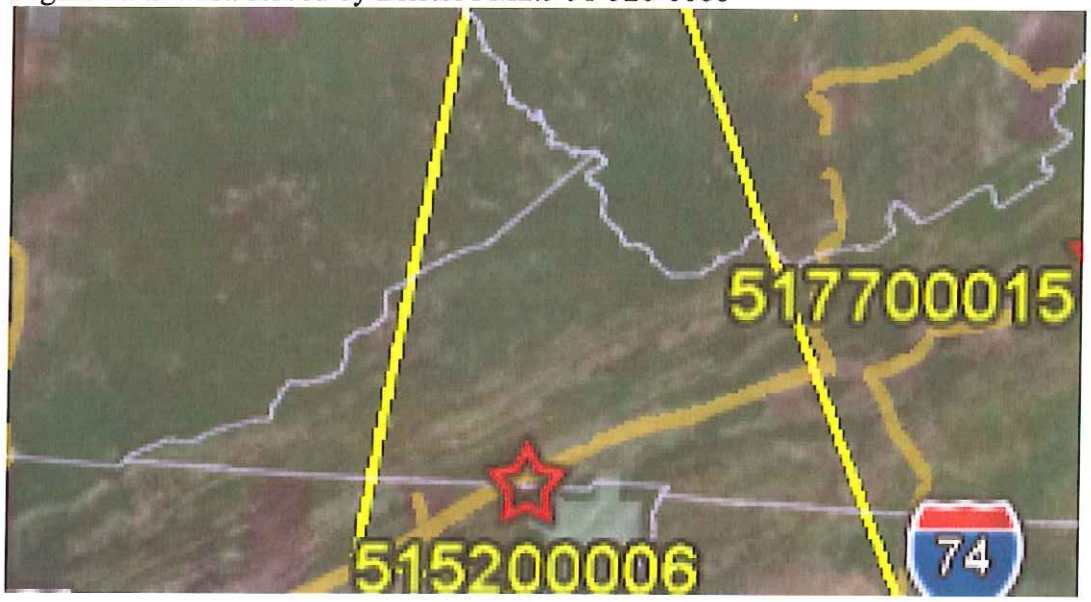
Evaluating the monitors in the contiguous states to AQCR 1 indicates that the data generated from these monitors is not highly correlated. The lack of correlation amongst the monitors indicates very little redundancy amongst the monitors whose area served includes AQCR 1.

Chart 2.3.1 Correlation Matrix Tool applied to AQCR 1 for Ozone monitors



Applying the area served tool to the PM2.5 monitors currently deployed in AQCR 1 the output generated is as follows:

Figure 2.3.3 Area served by Bristol PM2.5 51-520-0006



The overall monitoring coverage in AQCR 1 is provided in Table 2.3.1 below. The southwest portion of Virginia

Table 2.3.1 Listing of monitoring sites in AQCR 1

EPA ID	POLLUTANT	LOCATION	CITY/COUNTY	LAT/LONG
51-197-0002	O_3	Sewage Disposal Plant	Rural Retreat Wythe Co.	36° 53′ 35″ -81° 15′ 18″
51-035-0001	PM_{10}	Gladeville Elementary School	Galax Carroll Co.	36° 42′ 09″ -80° 52′ 48″
51-520-0006	$PM_{2.5}$	Highland View Elementary School	Bristol	36° 36′ 28″ -82° 09′ 52″

Valley of Virginia Intrastate Air Quality Control Region - This AQCR (AQCR 2) encompasses the following counties and cities:

Counties: Alleghany, Augusta, Bath, Botetourt, Clarke, Craig, Floyd, Frederick, Giles, Highland, Montgomery, Page, Pulaski, Roanoke, Rockbridge, Rockingham, Shenandoah, Warren
Cities: Buena Vista, Clifton Forge, Covington, Harrisonburg, Lexington, Radford, Roanoke. Salem, Staunton, Waynesboro, Winchester

Figure 2.3.4 below shows the areas served by the monitors located in the Valley of Virginia AQCR. To clarify the map the listing of monitors in AQCR 2 is delineated in Table 2.3.2. The ozone monitors in AQCR 2. follow the Interstate 81 corridor down through the Roanoke area. Big Meadows site in Madison County (51-510-0009) is approximately 3200 feet above sea level and can be viewed as a regional scale monitor.

Figure 2.3.4 Areas served by Ozone monitors located in AQCR 2

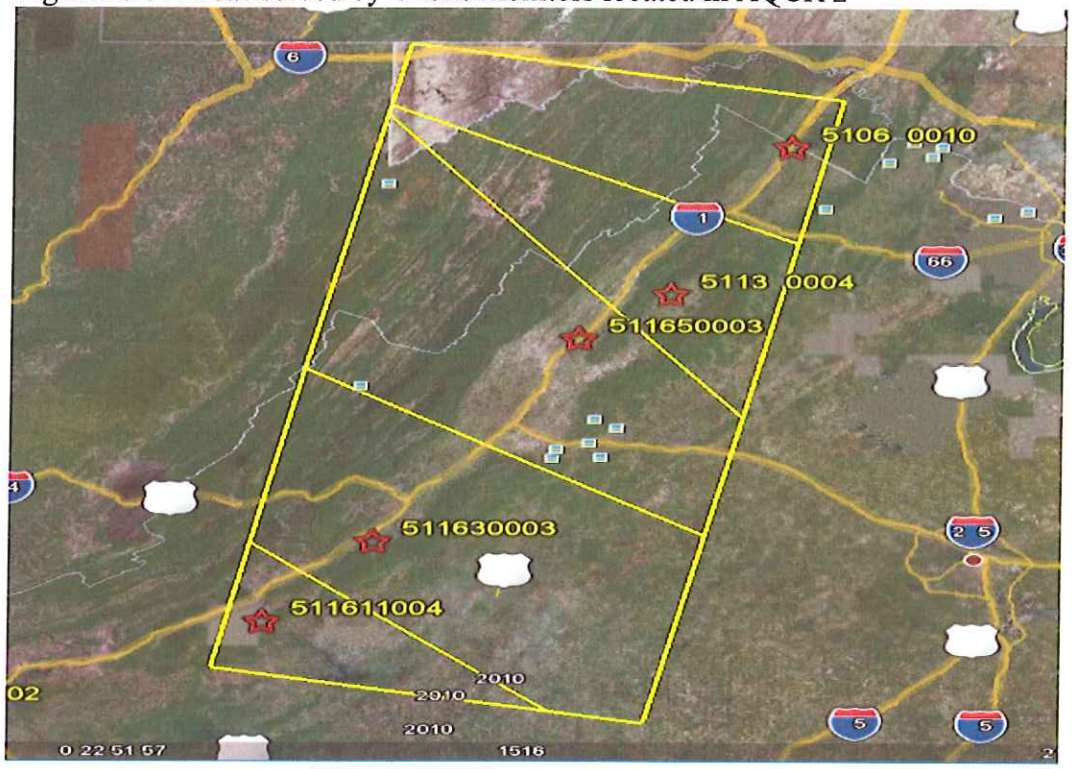


Table 2.3.2 Listing of Ozone monitors in AQCR 2

EPA ID	LOCATION	CITY/COUNTY	LAT/LONG
51-163-0003	Natural Bridge Ranger Station	Rockbridge Co.	37° 37′ 34″ -79° 30′ 47″
51-165-0003	Rockingham VDOT	Harrisonburg Rockingham Co.	38° 28′ 38″ -78° 49′ 09″
51-069-0010	Woodbine Road Lester Building Systems	Rest Frederick Co.	39° 16′ 58″ -78° 04′ 53″
51-161-1004	East Vinton Elementary School Ruddell Road	Vinton Roanoke Co.	37° 17′ 08″ -81° 15′ 18″
51-510-0009	Big Meadows, National Park Service	Madison Co.	38° 31′ 19″ -78° 26′ 10″
51-139-0004	Luray Caverns Airport	Page Co.	39° 15′ 24″ -78° 05′ 25″

Evaluating the monitors in AQCR 2 indicates that the data generated from these monitors is not highly correlated. Chart 2.3.2 below contains the output of the correlation matrix tool which demonstrates no redundancy amongst the ozone monitors whose area served includes AQCR 2.

The PM2.5 monitors currently in use in AQCR 2 are listed in Table 2.3.3 below. The monitors listed are the 1 in 3 day samplers with the exception of the everyday sampler at Round Hill School in Roanoke City (51-770-0015). Not included in the analysis is the TEOM continuous PM2.5 monitor at Big Meadows (51-510-0009) or the TEOM continuous PM2.5 monitor at Round Hill School. These monitors are used for forecasting purposes and are not currently FRM monitors. There are currently no speciation monitors in AQCR 2. The original speciation monitor located in Roanoke was removed and retired consistent with the requirements of the chemical speciation network.

Chart 2.3.2 Correlation Matrix Tool applied to AQCR 2 for Ozone monitors

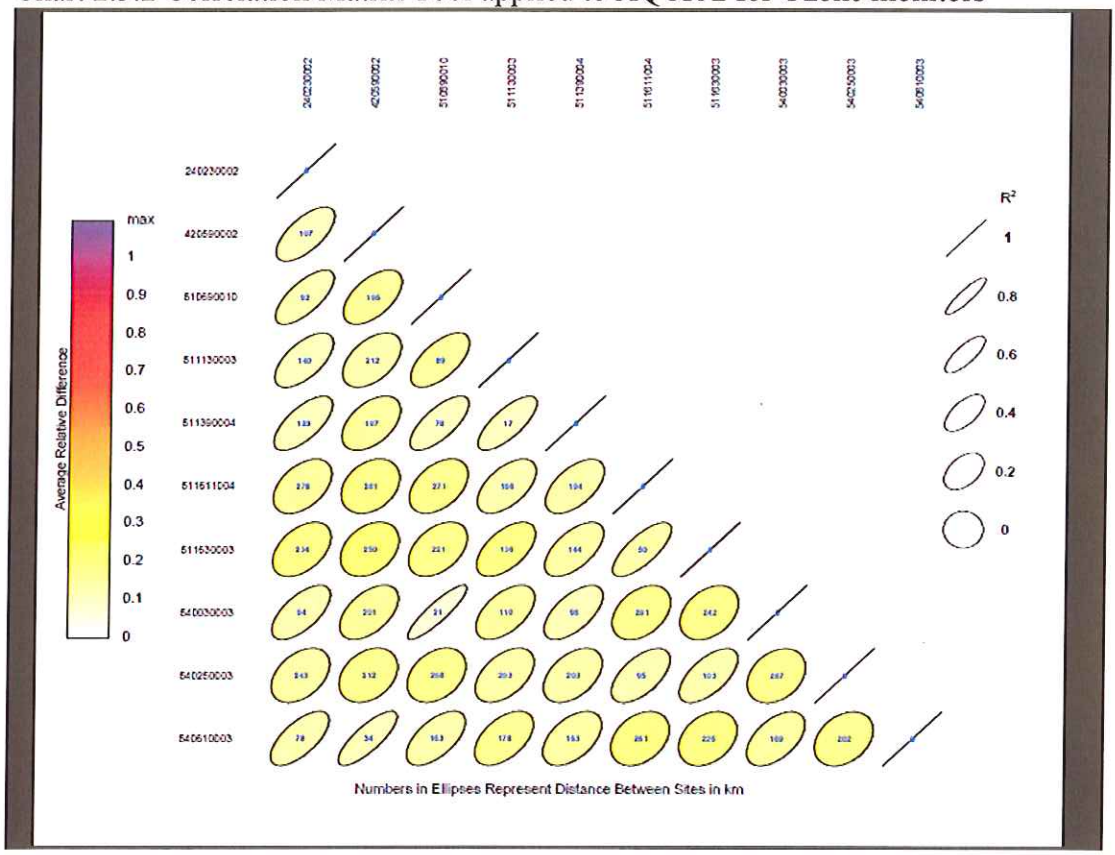


Table 2.3.3 Listing of PM2.5 FRM monitors in AQCR 2

EPA ID	LOCATION	CITY/COUNTY	LAT/LONG
51-163-0003	Natural Bridge Ranger Station	Rockbridge Co.	37° 37′ 34″ -79° 30′ 47″
51-165-0003	Rockingham VDOT	Harrisonburg Rockingham Co.	38° 28′ 38″ -78° 49′ 09″
51-069-0010	Woodbine Road Lester Building Systems	Rest Frederick Co.	39° 16′ 58″ -78° 04′ 53″
51-770-0015	Round Hill School	Roanoke City	37° 17′ 48″ -79° 57′ 20″
51-775-0011	Salem High School	Salem City	37° 17′52″ -80° 4′ 52″
51-510-0009	Big Meadows, National Park Service	Madison Co.	38° 31′ 19″ -78° 26′ 10″
51-139-0004	Luray Caverns Airport	Page Co.	39° 15′ 24″ -78° 05′ 25″

Figure 2.3.5 below contains the areas served tool output for the PM2.5 FRM samplers located in Valley of Virginia Air Quality Control Region. As with the ozone monitors these follow the I-81 corridor.

The Correlation Matrix Tool output for AQCR 2 contains only 5 PM2.5 FRM samplers. This is due to the fact that the tools use up to 2008 data to generate the correlations and the PM2.5 samplers at Rest (51-069-0010) and Salem HS (51-775-0011) were not fully operational at that time. The information for their locations was loaded into the Areas Served Tool but no correlation could be developed because no data was available for 2008. Evaluation of Chart 2.3.3 below indicates very little redundancy among those samplers that were evaluated.

Figure 2.3.5 Areas served by PM2.5 monitors located in AQCR 2

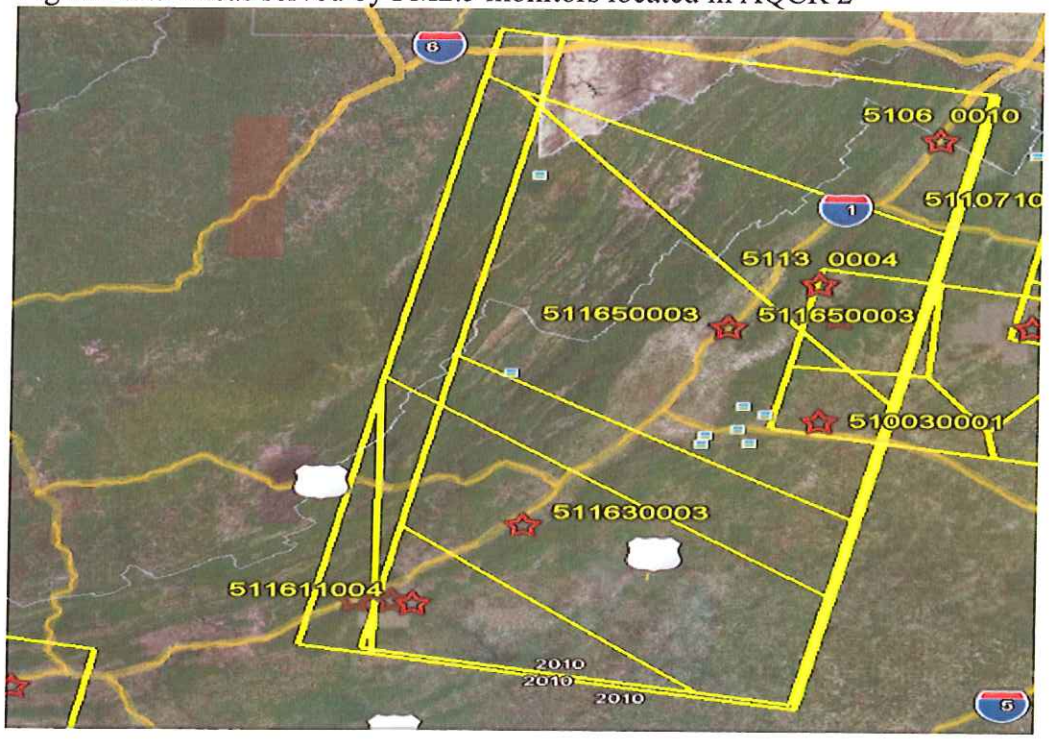
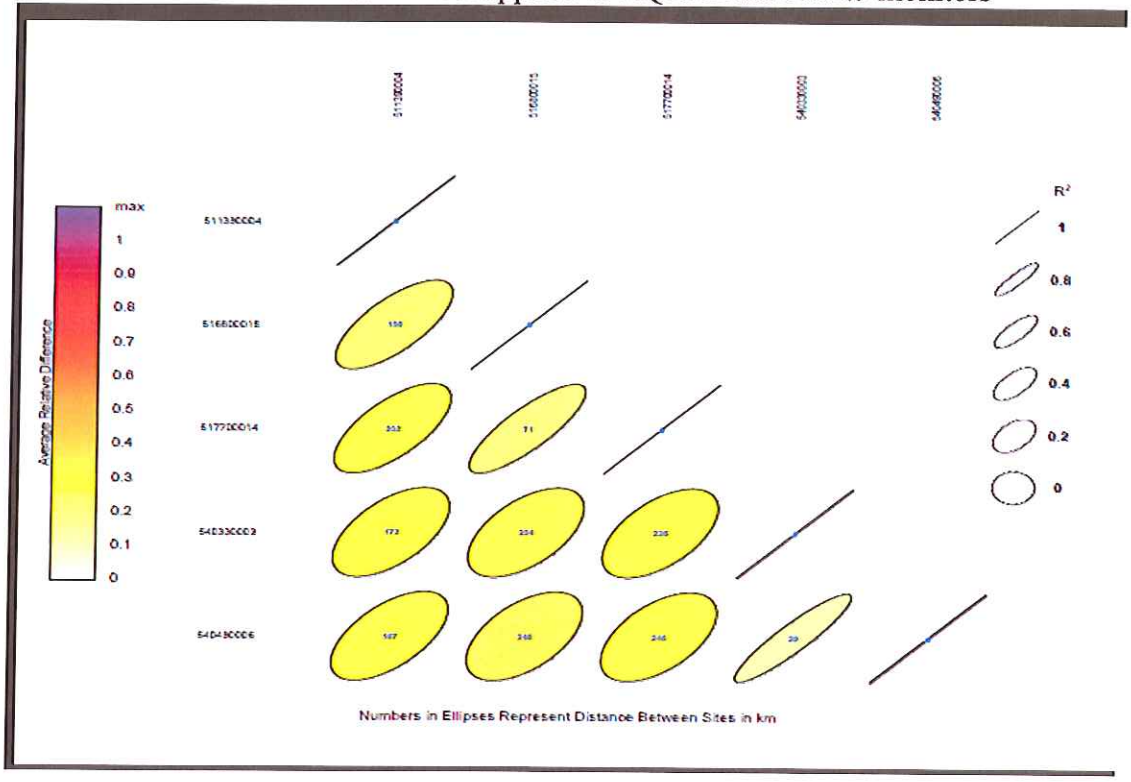


Chart 2.3.3 Correlation Matrix Tool applied to AQCR 2 for PM2.5 monitors



The remaining monitors for the other criteria pollutants are listed in Attachment 1 to this document.

Central Virginia Intrastate Air Quality Control Region – This region (AQCR 3) encompasses the following Counties and Cities:

Counties: Campbell, Charlotte, Cumberland, Franklin, Halifax, Henry, Lunenburg, Mecklenberg, Nottoway, Patrick, Pittsylvania, Prince Edward

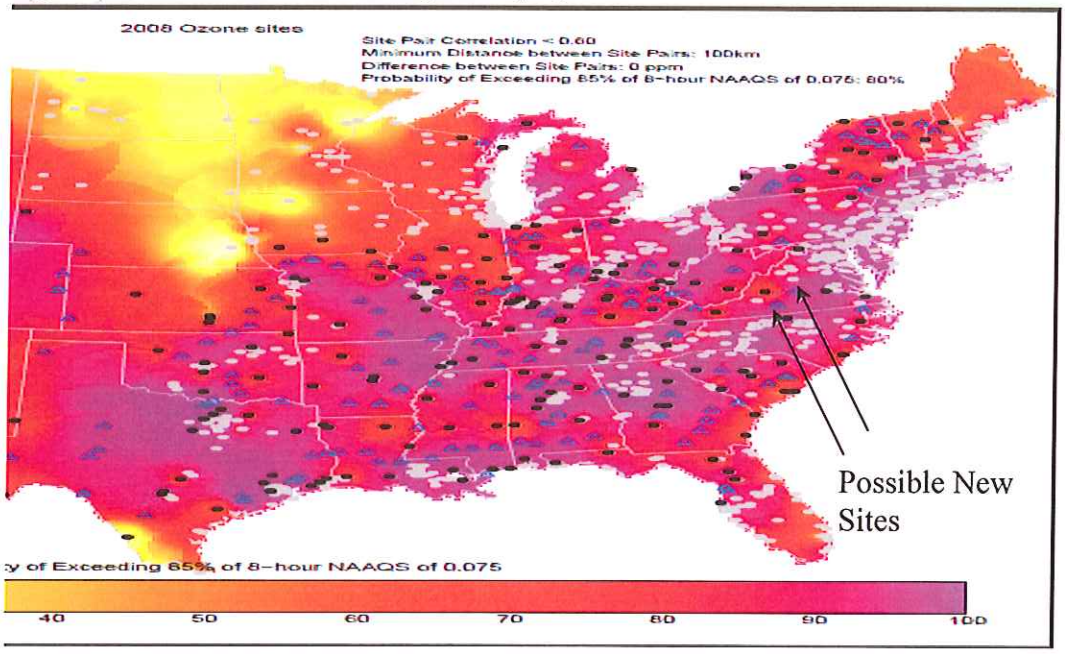
Cities: Bedford, Danville, Lynchburg, Martinsville, South Boston

AQCR 3 currently contains no ozone monitors. This is due to several factors:

1. Historically these areas were sparsely populated with little development. With the growth in Central Virginia this is no longer the case. The Lynchburg/Campbell County areas have achieved sufficient growth in recent years that a PM2.5 FRM sampler was placed in the Lynchburg City limits.
2. This area is not fed by any of the large interstates that transect Virginia. Interstates 81, 95 and 85 do not pass through this portion of Virginia but recent upgrades and expansion to State Route 460 have made this a heavily traveled road for both commuter traffic and long distance travel.
3. With the exception of Lynchburg there are no metropolitan areas in this AQCR. This portion of Virginia has historically been an agricultural part of the Commonwealth. The Southside counties of Halifax, Lunenburg, Mecklenberg, Nottoway as well as Prince Edward have historically been farming communities with little industrial activity.

The proposed change to the Ozone Standard will impact AQCR 3. The proposal as it exists at this writing indicates that there will be a need for a new monitor in Lynchburg, and Danville as well as a rural monitor potentially located in Prince Edward County. The New Sites Tool Run for the entire Commonwealth is displayed in Figure 2.3.6 below.

Figure 2.3.6 New Sites Tool output for proposed new ozone sites



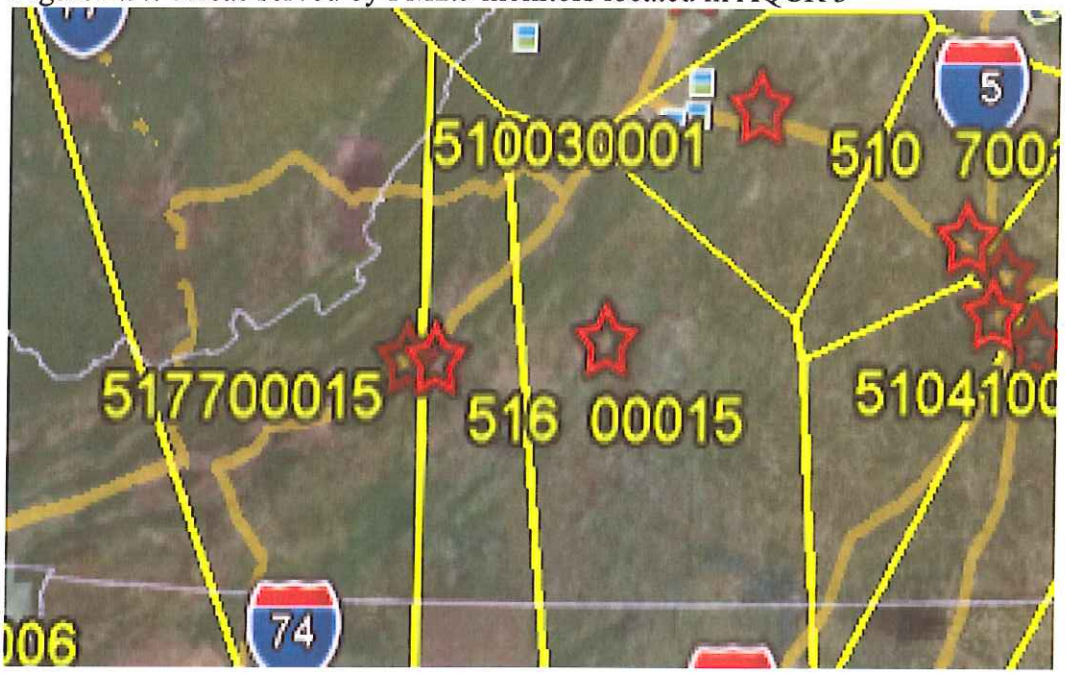
There is currently only one PM2.5 FRM sampler in AQCR 3. It is located in the city of Lynchburg as described in Table 2.3.4 below.

Table 2.3.4 Listing of PM2.5 FRM Samplers in AQCR 3

EPA ID	LOCATION	CITY/COUNTY	LAT/LONG
51-680-0015	Leesville Hwy. & Greystone Dr.	Lynchburg	37° 33′ 18″ -79° 21′ 45″

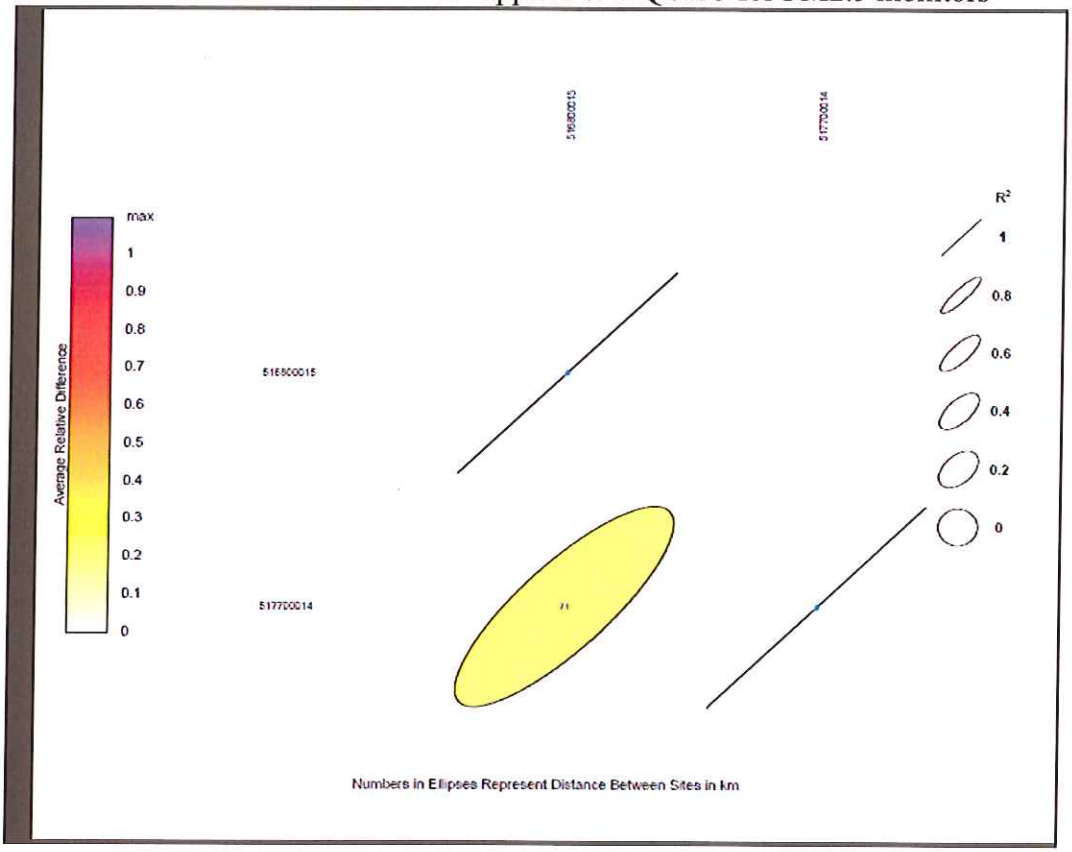
The Areas Served Tool output contained in Figure 2.3.7 below shows that the Lynchburg PM2.5 FRM monitor is one of several PM2.5 monitors located in Central Virginia with the western edge being monitored as part of AQCR 2 and the eastern edge being monitored as part of AQCR 5, the State Capital AQCR. Note also that north of the Lynchburg monitor is the Albemarle County PM2.5 FRM sampler (51-630-0004) which is in the southern portion of AQCR 4, the Northeastern Intrastate AQCR.

Figure 2.3.7 Areas served by PM2.5 monitors located in AQCR 3



In running the correlation matrix Tool for the Lynchburg PM2.5 sampler, DEQ compared the data set generated from the Roanoke Round Hill ES monitor (51-770-0015). The output indicated relatively low correlation and therefore no redundancy.

Chart 2.3.4 Correlation Matrix Tool applied to AQCR 3 for PM2.5 monitors



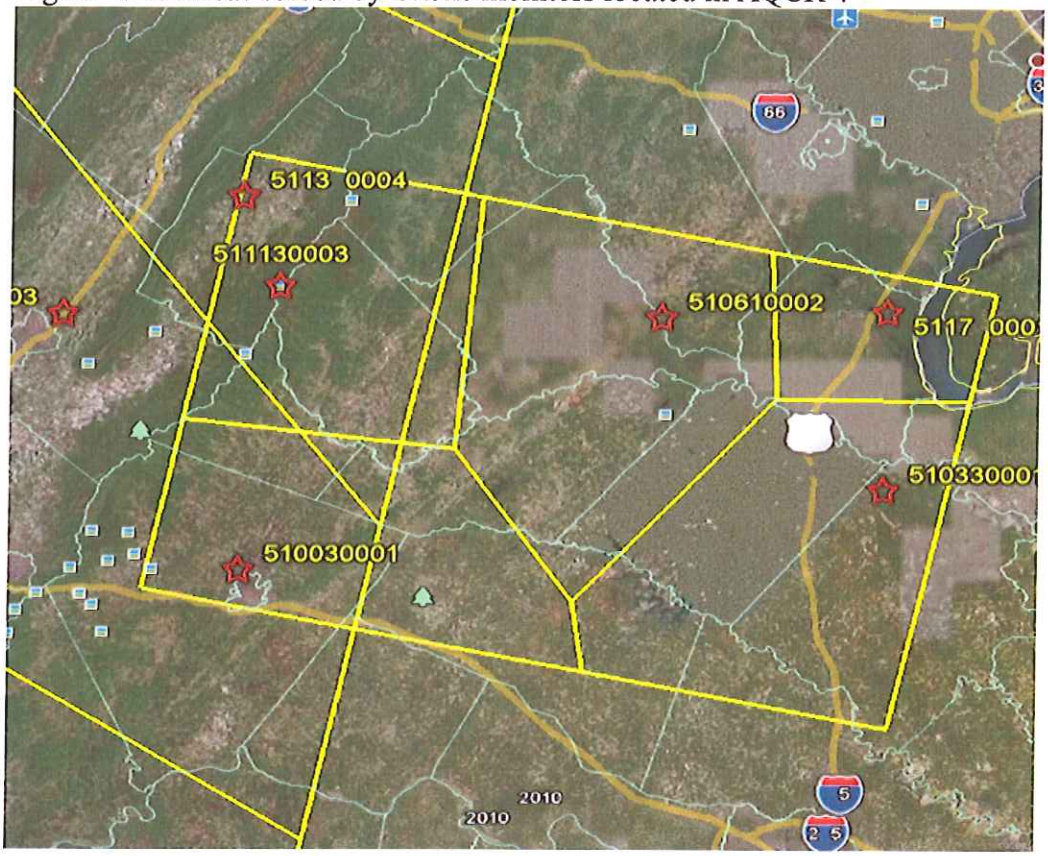
Northeastern Virginia Intrastate Air Quality Control Region - This region (AQCR 4) encompasses the following Counties and Cities:

Counties: Accomack, Albemarle, Caroline, Culpeper, Essex, Fauquier, Fluvanna, Gloucester, Greene, King and Queen, King George, King William, Lancaster, Louisa, Madison, Mathews, Middlesex, Nelson, Northampton, Northumberland, Orange, Rappahannock, Richmond, Spotsylvania, Stafford, Westmoreland

Cities: Charlottesville, Fredericksburg

Figure 2.3.8 below shows the areas served by the monitors located in the Northeastern Virginia AQCR. To clarify the map the listing of monitors in AQCR 4 is delineated in Table 2.3.5. The Albemarle County monitor (51-003-0001) began operation in Spring of 2008 and is the newest ozone site in the Commonwealth. The Albemarle monitor serves the Charlottesville area. AQCR 4 extends from the eastern shore to the central Virginia piedmont area and includes ozone monitors in Caroline County and in Fauquier County both of which can be classified as rural monitors.

Figure 2.3.8 Areas served by Ozone monitors located in AQCR 4



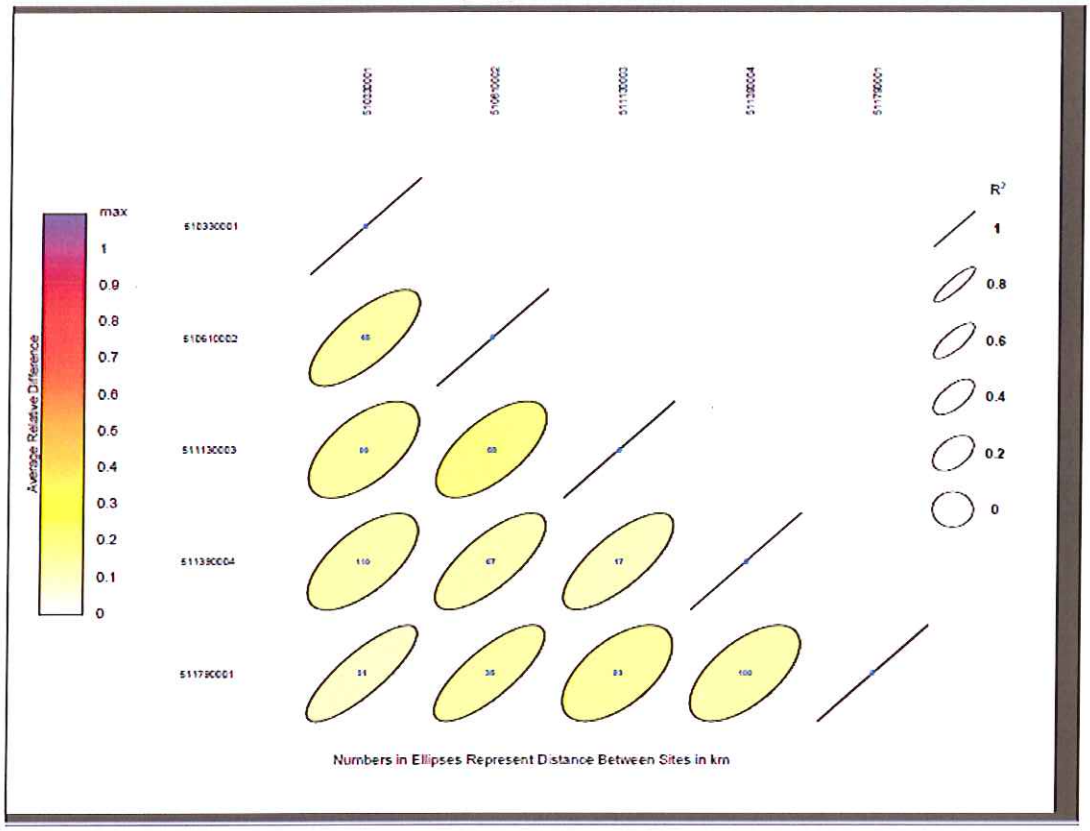
The Correlation Matrix Tool output is contained in Chart 2.3.5 below. Note that the correlation includes the Page County (51-139-004) and Madison County (51-113-0003) and does not include Albemarle. This is due to the proximity of these monitors to the AQCR 4 and due to the newness of the Albemarle monitor. Note that the correlation indicates little redundancy among these monitors.

Table 2.3.5 Listing of Ozone Monitors in AQCR 4

EPA ID	LOCATION	CITY/COUNTY	LAT/LONG
51-033-0001	U.S.G.S. Geomagnetic Center	Corbin Caroline Co.	38° 51′ 27″ -77° 03′ 33″
51-061-0002	Phelps Wildlife Area Route 651	Sumerduck Fauquier Co.	38° 28′ 30″ -77° 46′ 04″
51-179-0001	Widewater Elementary School Den Rich Road	Widewater Stafford Co.	38° 28′ 59″ -77° 22′ 13″
51-003-0001	Albemarle High School	Albemarle Co.	38° 18′ 17″ -77° 29′ 11″

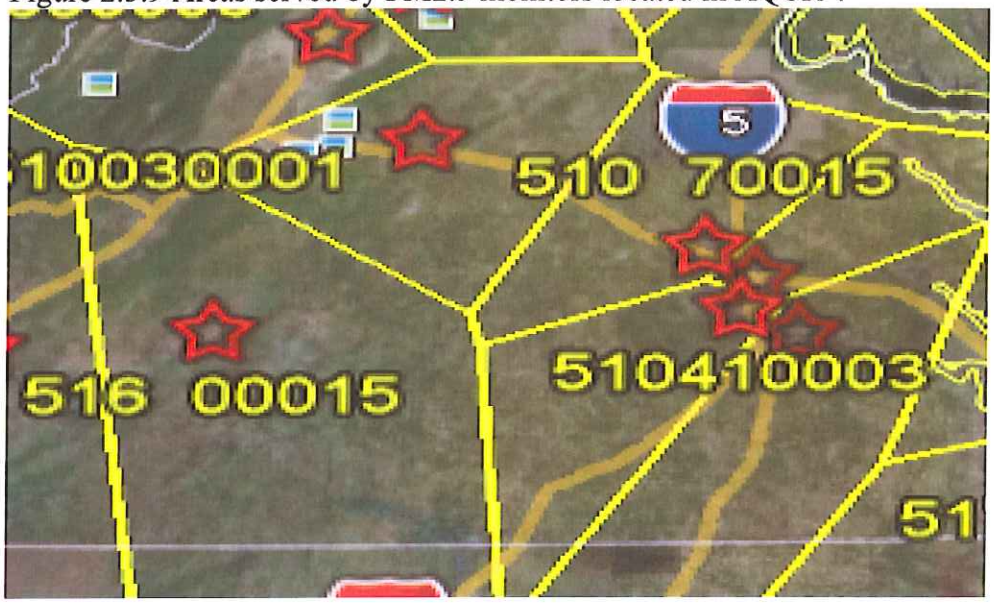
The Areas Served Tool output contained in Figure 2.3.9 below shows that the Lynchburg PM2.5 FRM monitor and the Page County PM2.5 FRM monitor bound the western edge of AQCR 4. The Albemarle monitor is located in a central location in the AQCR Note also that the PM2.5 FRM monitors in AQCR 5 bound the south central portion of AQCR 4.

Chart 2.3.5 Correlation Matrix Tool applied to AQCR 4 for Ozone monitors



The Albemarle monitor data was not included in the Correlation Matrix tool for AQCR 4 due to a lack of data so the Correlation Matrix output is not included here. Previous figures have demonstrated the lack of redundancy relative to the Lynchburg and Page County PM2.5 FRM monitors. The VA DEQ will evaluate the inclusion of PM2.5 samplers along with additional ozone sites that will be required as part of the proposed change to the ozone standard.

Figure 2.3.9 Areas served by PM2.5 monitors located in AQCR 4



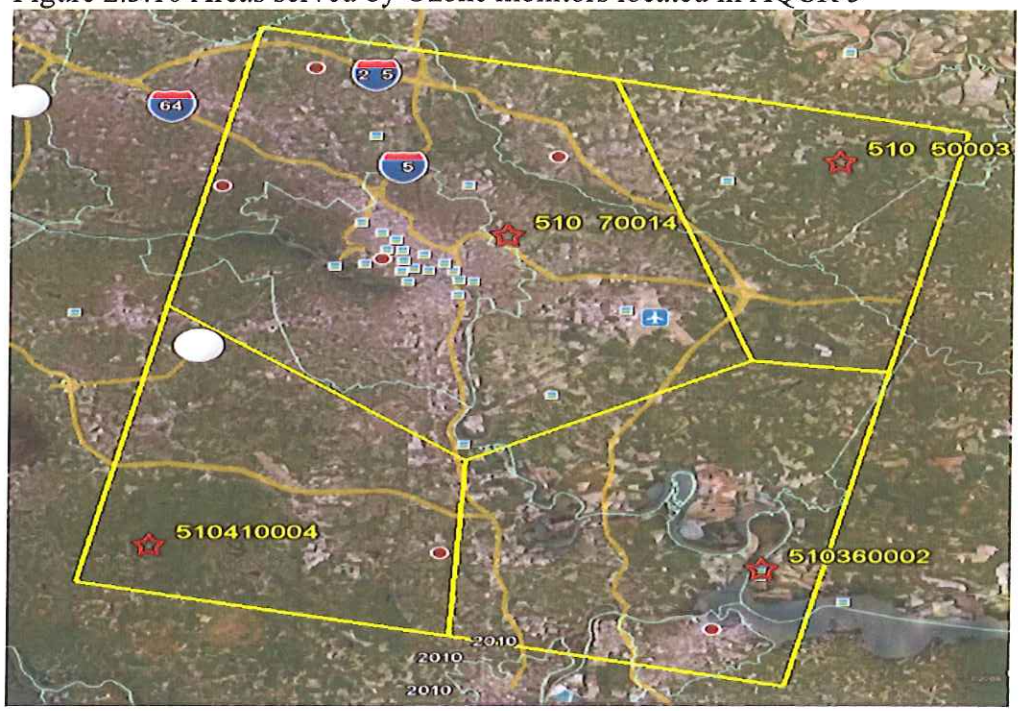
State Capital Air Quality Control Region – This region (AQCR 5) encompasses the following counties and cities:

Counties: Charles City, Chesterfield, Dinwiddie, Goochland, Greensville, Hanover, Henrico, New Kent, Powhatan, Prince George, Surry, Sussex

Cities: Colonial Heights, Emporia, Hopewell, Petersburg, Richmond

Figure 2.3.10 below shows the areas served by the monitors located in the State Capital AQCR. All monitors are located in the Metro Richmond area.

Figure 2.3.10 Areas served by Ozone monitors located in AQCR 5



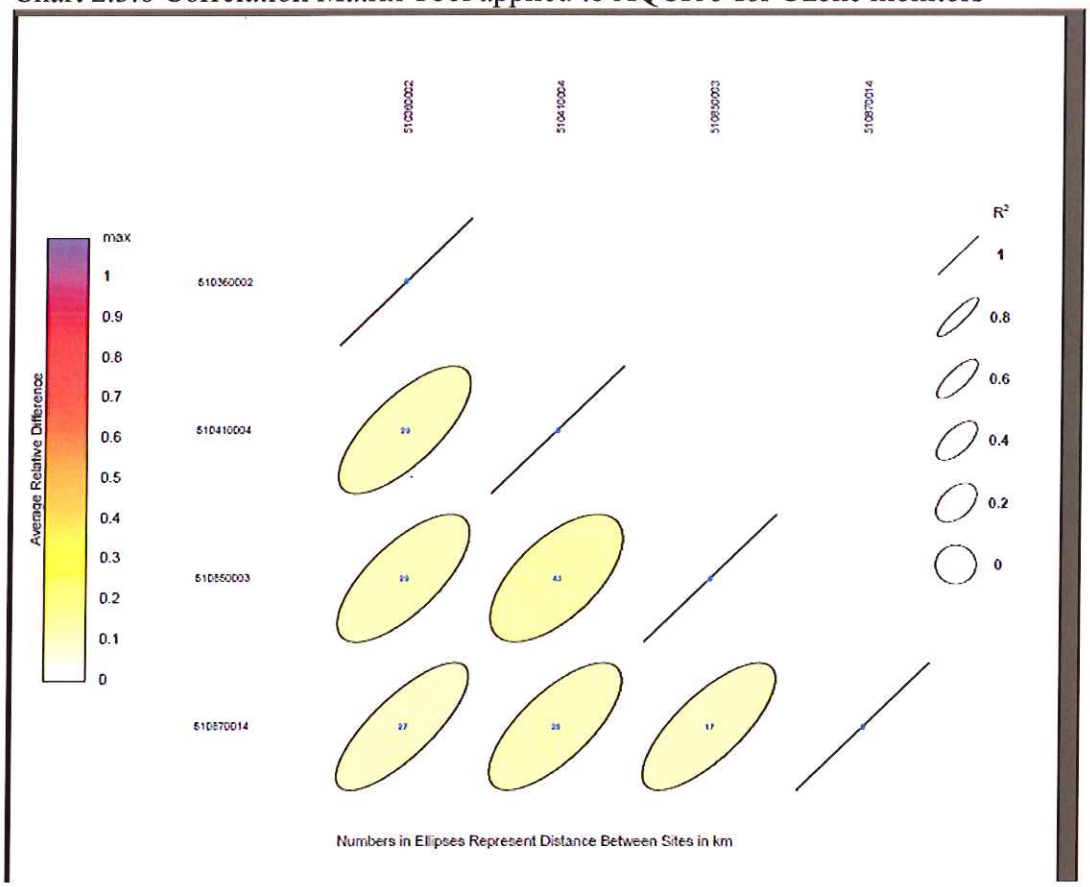
The listing of ozone monitoring sites in Table 2.3.6 below includes the ozone monitor at the MathScience Innovation Center (51-087-0014) which is the NCore site for the Commonwealth.

Table 2.3.6 Listing of Ozone Monitors in AQCR 5

EPA ID	LOCATION	CITY/COUNTY	LAT/LONG
51-041-0004	Beach Road Highway Shop	Chesterfield Co.	37° 21′ 32″ -77° 35′ 37″
51-087-0014	MathScience Innovation Center 2401 Hartman Street	Henrico Co.	37° 33′ 30″ -77° 34′ 01″
51-085-0003	McClellan Road	Hanover Co.	37° 36′ 21″ -77° 13′ 07″
51-036-0002	Charles City County Route 608	Charles City Co.	37° 20′ 31″ -77° 15′ 39″

The Correlation Matrix Tool in Chart 2.3.6 indicates little redundancy among the ozone sites in AQCR 5.

Chart 2.3.6 Correlation Matrix Tool applied to AQCR 5 for Ozone monitors



The Areas Served Tool output contained in Figure 2.3.11 below shows that the PM2.5 FRM monitors in AQCR 5 are located in the Metropolitan Richmond area. The samplers are collocated with the ozone monitors with the exception of the Piedmont Regional Office (51-087-0015) site and the Bensley Armory (51-041-0003) site.

Figure 2.3.11 Areas served by PM2.5 monitors located in AQCR 5

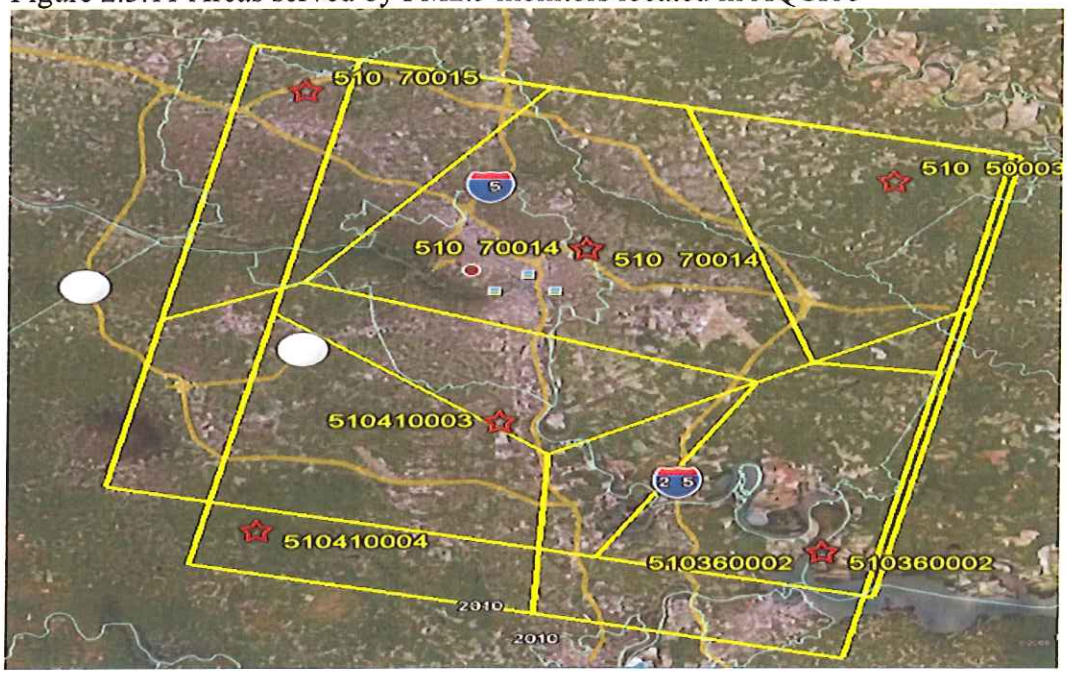


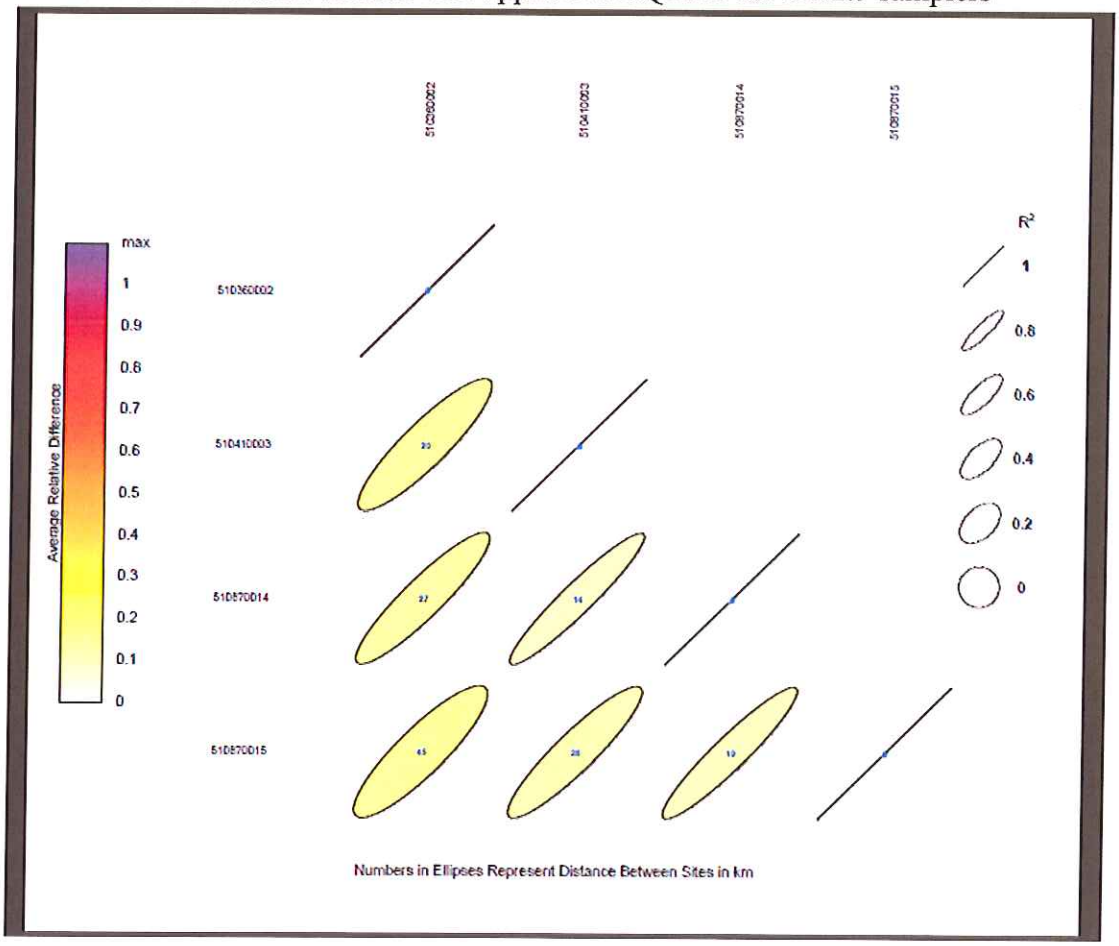
Table 2.3.7 below provides the information on the locations of the PM2.5 FRM samplers. Chart 2.3.7 below provides the Correlation matrix output for the PM2.5 FRM samplers in 0AQCR 5.

Table 2.3.7 Listing of PM2.5 FRM Samplers in AQCR 5

EPA ID	LOCATION	CITY/COUNTY	LAT/LONG
51-041-0003	Bensley Armory	Chesterfield Co.	37° 26′ 10″ -77° 27′ 03″
51-087-0014	MathScience Innovation Center 2401 Hartman Street	Henrico Co.	37° 33′ 30″ -77° 34′ 01″
51-087-0015	DEQ-Piedmont Regional Office 4949-A Cox Road	Henrico Co.	37° 40′ 13″ -77° 34′ 03″
51-036-0002	Charles City County Route 608	Charles City Co.	37° 20′ 31″ -77° 15′ 39″

The correlation matrix indicates a high level of correlation between the Bensley Armory site and the MathScience Center site. The MathScience Site is part of the NCore site and is collocated with the speciation sampler. It is also part, along with the low flow PM10, of the PMcoarse sampling method for the NCore site. The matrix also indicates a high correlation between the MathScience site and the PRO site. The PRO site is downwind of the City of Richmond where as the MathScience Center is an upwind site. No changes to either of these sites will be pursued at this time.

Chart 2.3.7 Correlation Matrix Tool applied to AQCR 5 for PM2.5 samplers



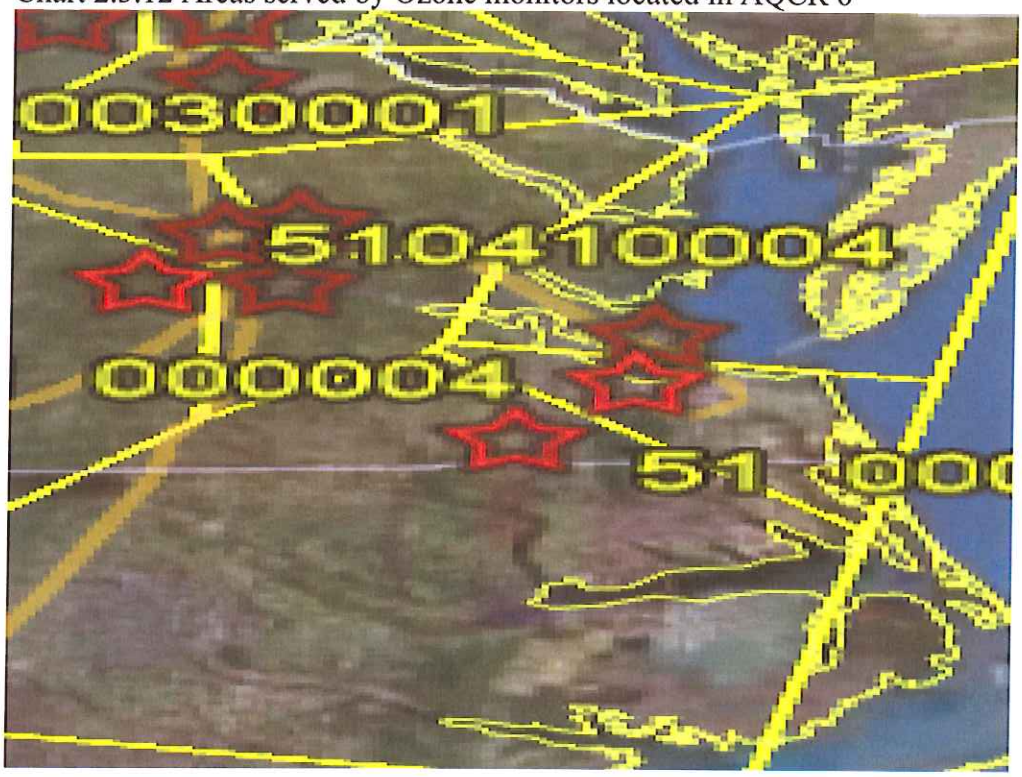
Hampton Roads Air Quality Control Region – This region (AQCR 6) encompasses the following counties and cities:

Counties: Isle of Wight, James City, Southampton, York

Cities: Chesapeake, Franklin, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, Williamsburg

The locations of the Hampton Roads area ozone monitors are shown graphically in Figure 2.3.12 below. Two monitors are located in the city of Suffolk and the monitor located north of mouth of the Chesapeake Bay has moved twice in the last 3 years. These moves resulted from shutting down of the Virginia School, the original location and the ability to only get temporary approval for relocation to a site in Newport News. This ozone monitor is now located at the NASA Langley site which should be a permanent location.

Chart 2.3.12 Areas served by Ozone monitors located in AQCR 6



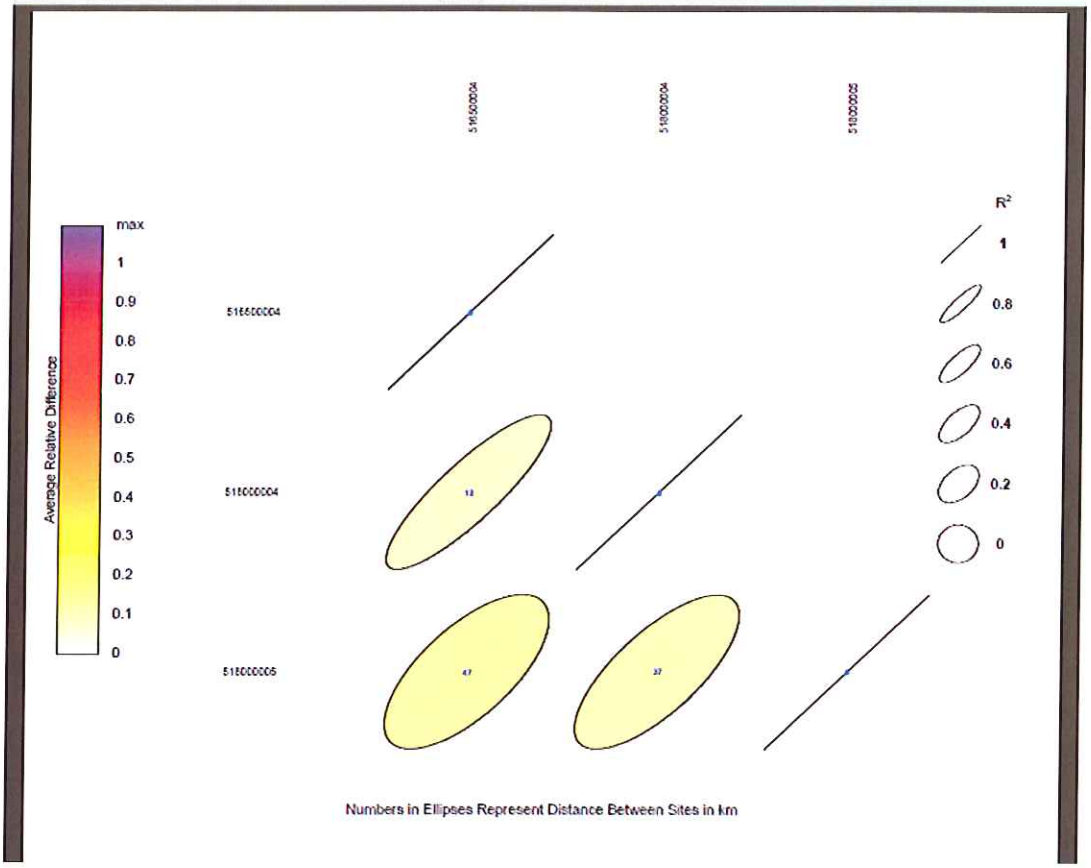
The listing of the ozone monitoring sites in Table 2.3.8 below lists the current locations as of July 1, 2010.

Table 2.3.8 Listing of Ozone Monitors in AQCR 6

EPA ID	LOCATION	CITY/COUNTY	LAT/LONG
51-650-0008	NASA Langley Research Center	Hampton	37° 06′ 13″ -76° 23′ 13″
51-800-0004	Tidewater Community College Frederick Campus	Suffolk	36° 54′ 12″ -76° 43′ 53″
51-800-0005	Tidewater Research Station	Suffolk	36° 40′ 03″ -76° 43′ 53″

The Correlation Matrix Output provided in Chart 2.3.8 below contains information from the original Hampton monitor (51-650-0004) from the Virginia School. The Hampton School monitor operated in that location through 2008 so this is the data that was used in developing the correlation. The new Hampton monitor at NASA Langley is similarly located so the correlation should apply at this monitor as well.

Chart 2.3.8 Correlation Matrix Tool applied to AQCR 6 for Ozone Monitors

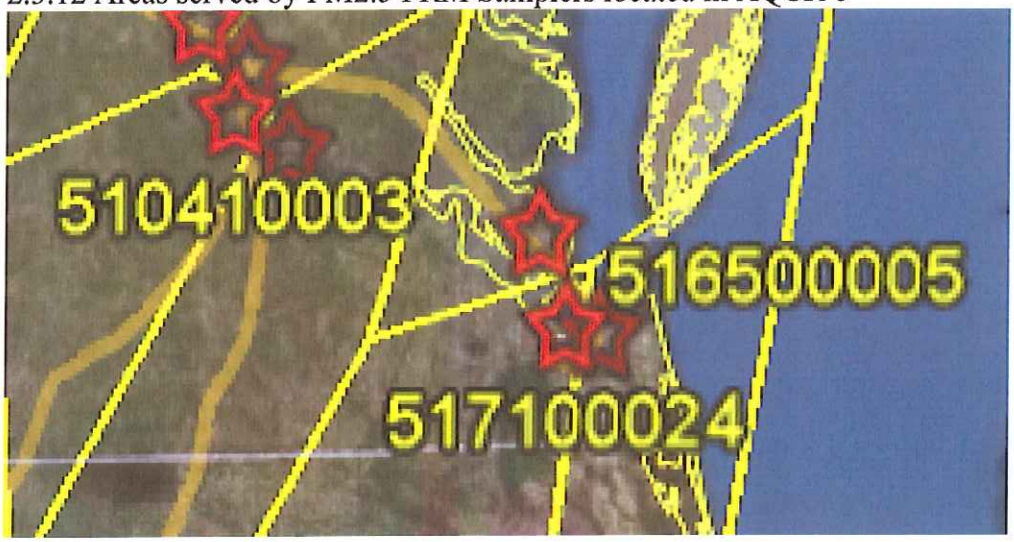


The PM2.5 FRM samplers shown in Figure 2.3.12 below represent the current locations of these monitors. The PM2.5 monitors, like the ozone monitors, have moved frequently over the last 4 years impacting the dataset available to the Correlation Matrix Tool to perform the correlation analysis. One of the PM2.5 FRM monitors was located at the old Virginia School Site in Hampton. That monitor has also been relocated to the new NASA Langley site. The NOAA site (51-710-0024) contains the collocated monitor as well as the 1 in 3 day FRM. The Regional Office site (51- 810-0008) is the everyday sampler. Table 2.3.9 below lists the current sites for the PM2.5 FRM samplers.

Table 2.3.9 Listing of PM2.5 FRM Samplers in AQCR 6

EPA ID	LOCATION	CITY/COUNTY	LAT/LONG
51-650-0008	NASA Langley Research Center	Hampton	37° 06′ 13″ -76° 23′ 13″
51-710-0024	NOAA Property 2nd and Woodis Avenue	Norfolk	36° 51′ 28″ -76° 18′ 06″
51-810-0008	DEQ – Tidewater Regional Office 5636 Southern Blvd.	Va. Beach	36° 50′ 28″ -76° 10′ 53″

2.3.12 Areas served by PM2.5 FRM Samplers located in AQCR 6



National Capital Interstate Air Quality Control Region (Virginia) – This region (AQCR 7) encompasses the following counties and cities:

Counties: Arlington, Fairfax, Loudoun, Prince William

Cities: Alexandria, Fairfax, Falls Church, Manassas, Manassas Park

The Area Served model output for AQCR 7 is presented without the Fairfax County monitors listed in Table 2.1.1 above.

Figure 2.3.13 Area Served by Ozone Monitors in AQCR 7

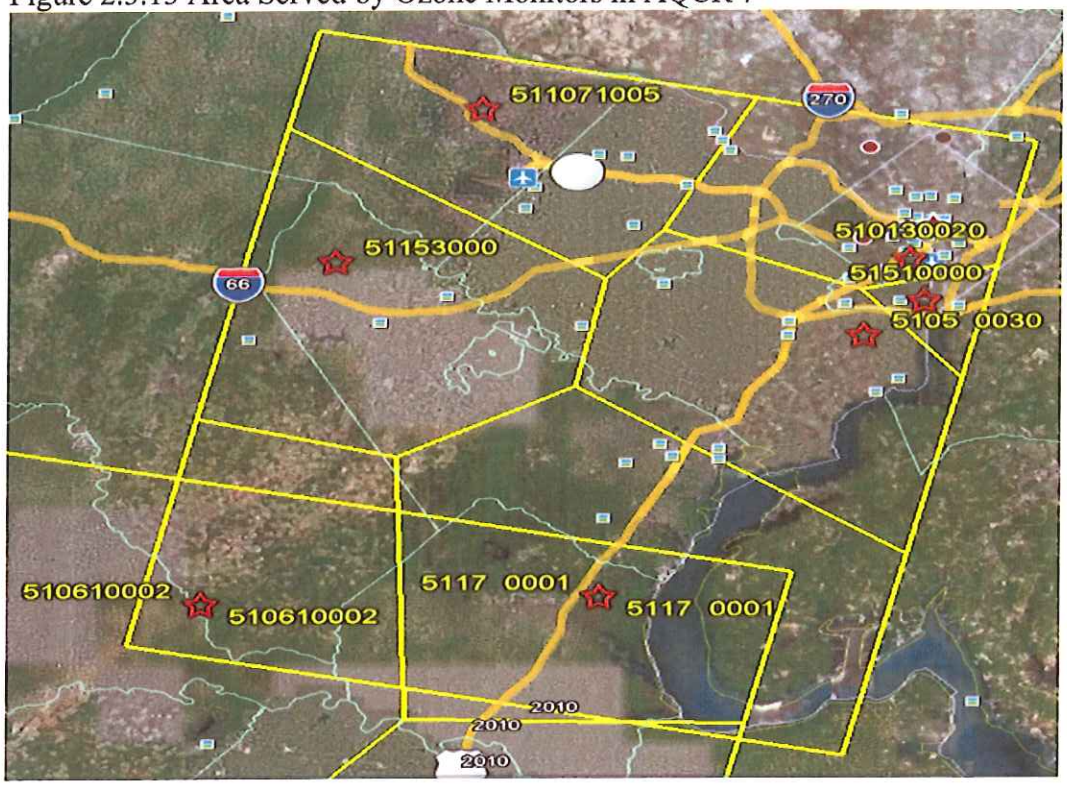


Figure 2.3.13 above contains some of the monitors maintained in AQCR 4. Table 2.3.10 below contains the list of the ozone monitors in AQCR 7 that will be operational after July 1, 2010. Refer to the Correlation discussion is Section 2 above for information regarding DEQ's analysis of redundancy in Northern Virginia.

Table 2.3.13 Listing of Ozone Monitors in AQCR 7

EPA ID	LOCATION	CITY/COUNTY	LAT/LONG
51-107-1005	Broad Run High School Route 641	Ashburn Loudoun Co.	39° 01′ 28″ -77° 29′ 24″
51-153-0009	Long Park Route 15	Prince William Co.	38° 51′ 19″ -77° 38′ 08″
51-059-0030	Lee District Park Telegraph Road	Franconia Fairfax Co.	38° 46′ 22″ -77° 06′ 20″
51-013-0020	Aurora Hills Visitors Center 18th and Hayes Streets	Arlington Co.	38° 51′ 27″ -77° 03′ 33″
51-510-0009	Alexandria Health Department 517 North Saint Asaph Street	Alexandria	38° 48′ 38″ -77° 02′ 40″

The Area Served Model output is presented in Figure 2.3.14 without the Fairfax County Monitors included. There is some overlap with AQCR 2 in Figure 2.3.14.

Figure 2.3.14 Area Served by PM2.5 FRM Samplers in AQCR 7

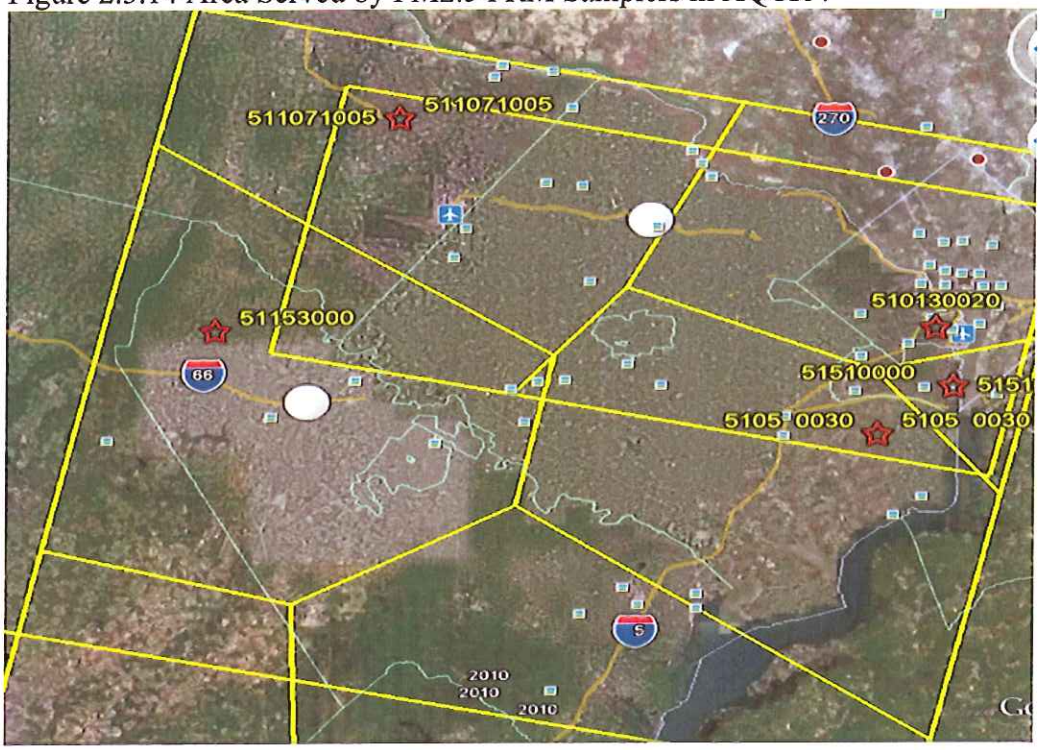


Table 2.3.14 lists the PM2.5 FRM sites in AQCR 7. Note that the PM2.5 sites coincide exactly with the Ozone sites. Refer to the Correlation discussion in Section 2 above for information regarding DEQ's analysis of redundancy relative to the PM2.5 FRM samplers in the Northern Virginia area.

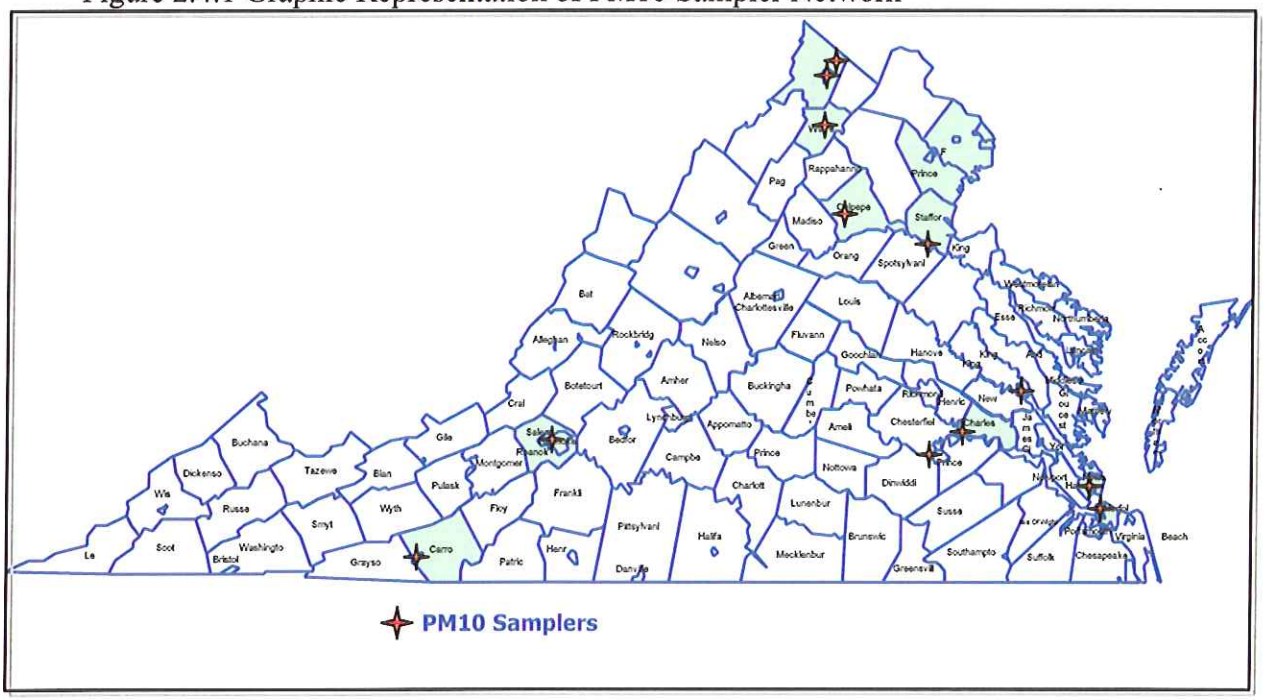
Table 2.3.14 Listing of PM2.5 FRM Samplers in AQCR 7

EPA ID	LOCATION	CITY/COUNTY	LAT/LONG
51-107-1005	Broad Run High School Route 641	Ashburn Loudoun Co.	39° 01′ 28″ -77° 29′ 24″
51-153-0009	Long Park Route 15	Prince William Co.	38° 51′ 19″ -77° 38′ 08″
51-059-0030	Lee District Park Telegraph Road	Franconia Fairfax Co.	38° 46′ 22″ -77° 06′ 20″
51-013-0020	Aurora Hills Visitors Center 18th and Hayes Streets	Arlington Co.	38° 51′ 27″ -77° 03′ 33″
51-510-0009	Alexandria Health Department 517 North Saint Asaph Street	Alexandria	38° 48′ 38″ -77° 02′ 40″

4. Network Assessment and Evaluation for the Commonwealth of Virginia

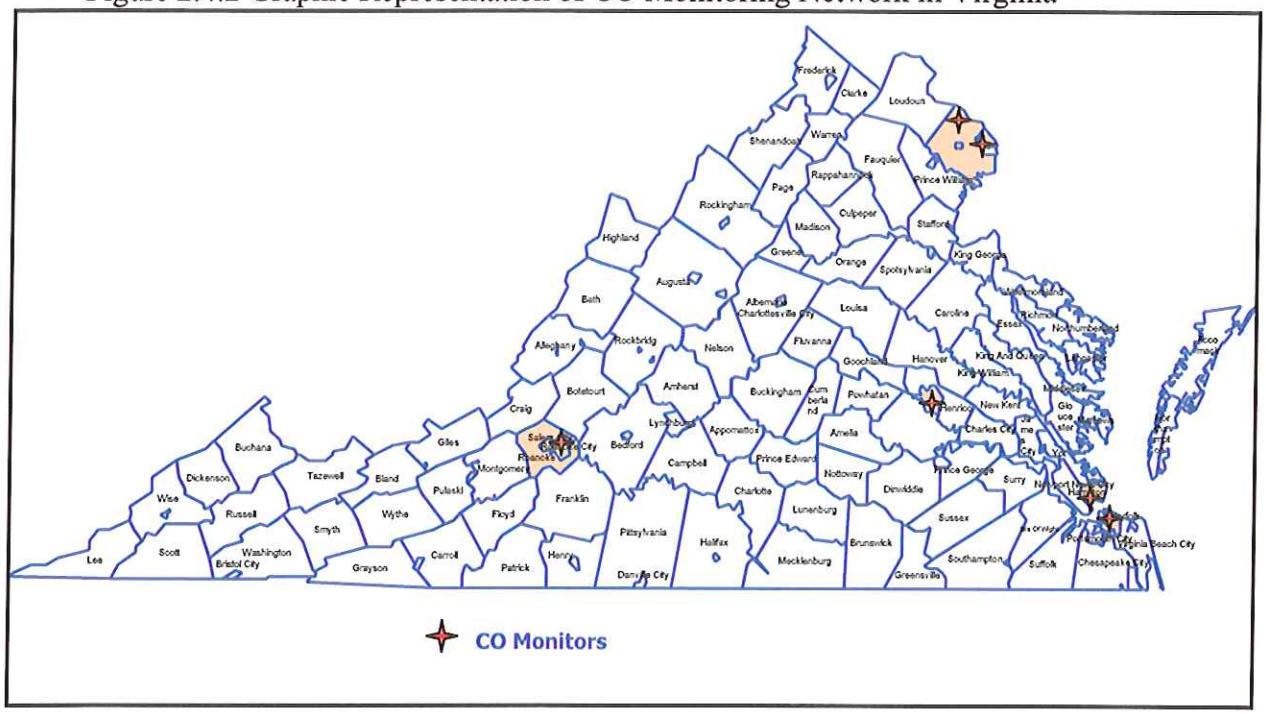
Particulate Matter Less than 10 Microns (PM10) – The VA DEQ maintains a statewide network of PM10 monitors consistent with the requirements of 40 CFR Part 58. There have been several changes to the PM10 network over the past 3 years, primarily driven by the Hopewell Community based Toxics study. As part of this study a PM10 monitor was placed at each of the 3 sites and provided PM10 data throughout the length of the study. After the study a monitor was left at the Carter Woodson site in Hopewell (51-670-0010) to remain as part of the total network. DEQ also added a monitor at the MathScience Center (51-087-0014) in Eastern Henrico County.

Figure 2.4.1 Graphic Representation of PM10 Sampler Network



Carbon Monoxide (CO) – Based on historic data demonstrating compliance with the NAAQS VA DEQ maintains a network of CO monitors as shown in Figure 2.4.2 below.

Figure 2.4.2 Graphic Representation of CO Monitoring Network in Virginia



The existing CO monitoring network for the Commonwealth of Virginia has evolved to its current structure based on the compliance status of each of the monitors. Table 2.4.1 below shows that the 2008 monitored results demonstrate compliance with both the 8 hour and 1 hour standards.

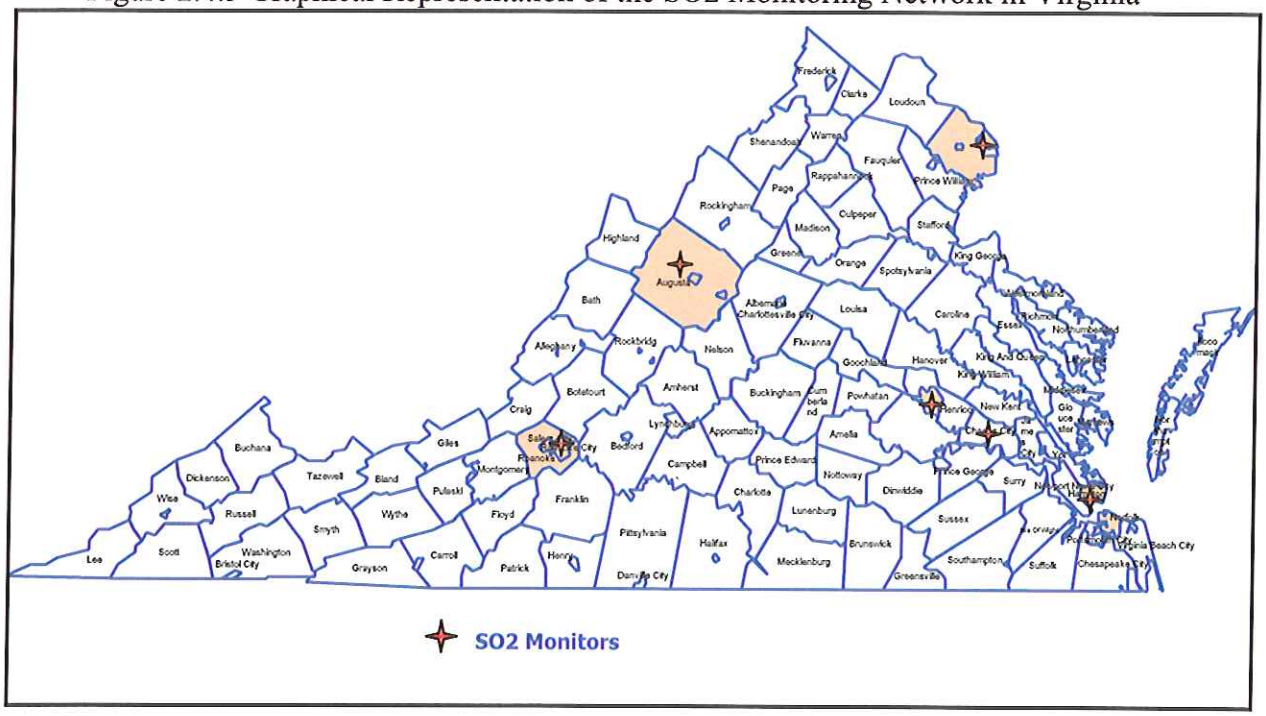
Table 2.4.1 CO Design Value Calculation 2008; Commonwealth of Virginia

Site	2008 (ppm)			
	1-Hour Avg.[1]		8-Hour Avg.[2]	
	1st Max.	2nd Max.	1st Max.	2nd Max.
(109-M) **Roanoke**	2.0	2.0	1.5	1.4
(158-W) **Richmond**	1.4	1.4	1.0	.9
(179-C) **Hampton**	4.2	4.1	1.6	1.3
(181-A1) **Norfolk**	4.7	4.5	2.2	1.9
(47-T) **Arlington Co.**	1.7	1.6	1.2	1.1
(L-126-C) **Alexandria**	1.9	1.9	1.3	1.2

1. 8-hour average not to exceed 9 ppm (10 mg/m^3) more than once per year.
2. 1-hour average not to exceed 35 ppm (40 mg/m^3) more than once per year

Sulfur Dioxide (SO_2) – The current SO2 monitoring network in the Commonwealth of Virginia is shown in Figure 2.4.3 below. These monitors do not represent the expectations for Virginia with respect to the implementation of the new NAAQS standard promulgated on June 2, 2010. VA DEQ is currently evaluating these standards and anticipates that all required new monitors will be in place by January 1, 2013 as required in the new standard.

Figure 2.4.3 Graphical Representation of the SO2 Monitoring Network in Virginia



Evaluation of the monitored data from the SO2 monitors maintained by DEQ indicates that Virginia is well within the standard for the primary annual (Table 2.4.3 below) and 24 hour (Table 2.4.2 below) standards. Virginia is also meeting the secondary standard as shown in Table 2.4.2 below.

Table 2.4.2 SO_2 Design Value Calculations for 2008

Site	2008 (ppm)			
	24-Hour Avg.[1]		3-Hour Avg.[2]	
	1st Max.	2nd Max.	1st Max.	2nd Max.
(26-F) **Rockingham Co.**	.007	.004	.014	.012
(19-A6) **Roanoke Co.**	.008	.007	.014	.010
(75-B) **Charles City Co.**	.014	.013	.041	.040
(158-W) **Richmond**	.011	.010	.026	.024
(179-C) **Hampton**	.013	.011	.062	.033
(181-A1) **Norfolk**	.016	.014	.055	.052
(L-126-C) **Alexandria**	.015	.012	.041	.025

1. 24-Hour concentration not to exceed 0.14 ppm (365 µg/m^3) more than once per year
2. 3-Hour concentration not to exceed 0.5 ppm (1300 □g/m^3) more than once per year

The current SO_2 monitoring network, while not meeting the complete requirements of the new monitoring standard, should contain monitors that can be included in the projected requirements. That is, DEQ believes that existing monitors in Northern Virginia, Richmond and Tidewater can be considered for inclusion with new, projected monitors in the final layout of the monitoring network that results from the implementation of the new standard. Using existing as well as proposed monitors to meet the new standard will be part of DEQ's proposal for meeting the monitoring requirements of the new standard.

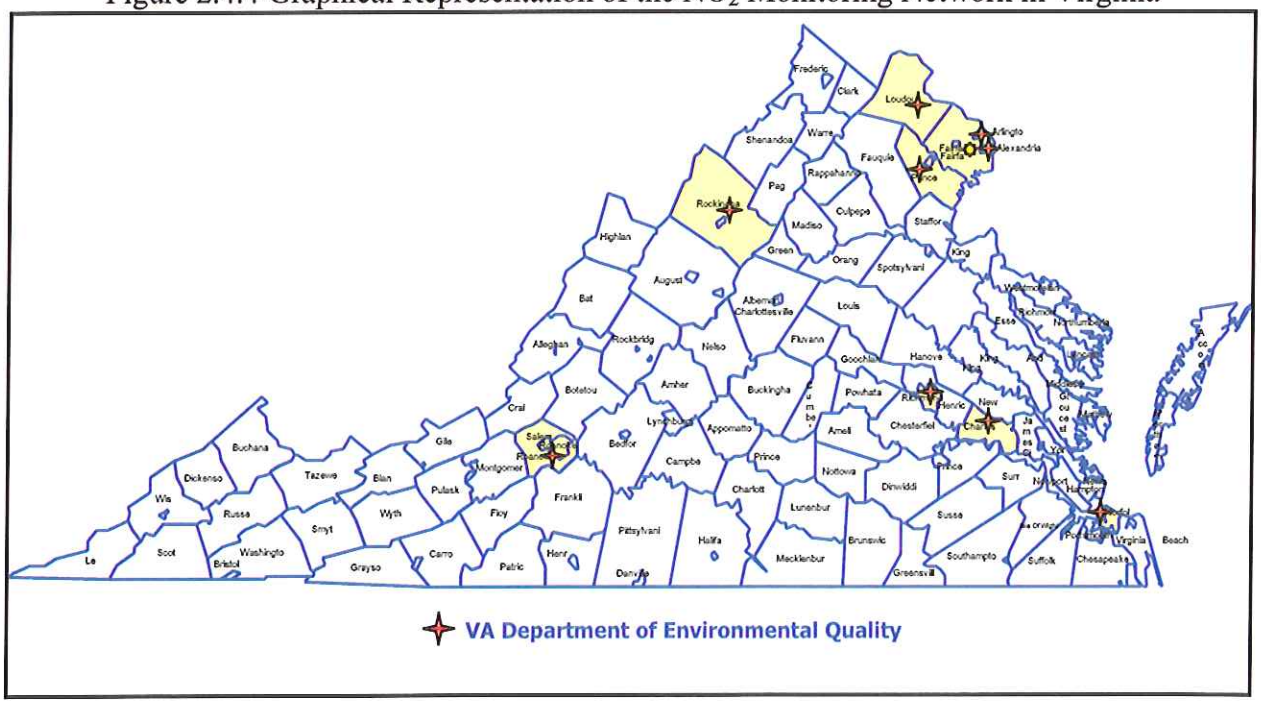
Table 2.4.3 SO_2 Annual Design Value Calculations for 2001 - 2008

Site	Annual Arithmetic Mean (ppm)[1]							
	2001	2002	2003	2004	2005	2006	2007	2008
(26-F) **Rockingham Co.**	--	--	--	--	.002	.002	.001	.001
(19-A6) **Roanoke Co.**	.003	.003	.003	.002	.003	.002	.003	.002
(75-B) **Charles City Co.**	.005	.005	.005	.004	.005	.004	.005	.004
(158-W) **Richmond**	.005	.004	.004	.004	.005	.004	.003	.003
(179-C) **Hampton**	.004	.004	.003	.004	.004	.004	.004	.003
(181-A1) **Norfolk**	--	--	--	--	--	--	.005	.004
(L-126-C) **Alexandria**	.006	.006	.006	.006	.005	.003	.004	.003

1. Annual Standard is 0.03 ppm

Nitrogen Dioxide (NO_2) - The current NO_2 monitoring network in the Commonwealth of Virginia is shown in Figure 2.4.4 below. These monitors do not represent the expectations for Virginia with respect to the implementation of the new NAAQS standard promulgated on February 9, 2010. VA DEQ is currently evaluating these standards and anticipates that all required new monitors will be in place by January 1, 2013 as required in the new standard.

Figure 2.4.4 Graphical Representation of the NO_2 Monitoring Network in Virginia



Evaluation of the monitored data from the NO_2 monitors maintained by DEQ indicates that Virginia is well below the primary standard ambient concentration as well as below the secondary standard (which is the same as the primary standard). The calculated annual concentrations for each of the NO2 monitors in the Commonwealth of Virginia are listed in Table 2.4.4 below.

Table 2.4.4 Annual NO2 concentration calculations 2001 - 2008

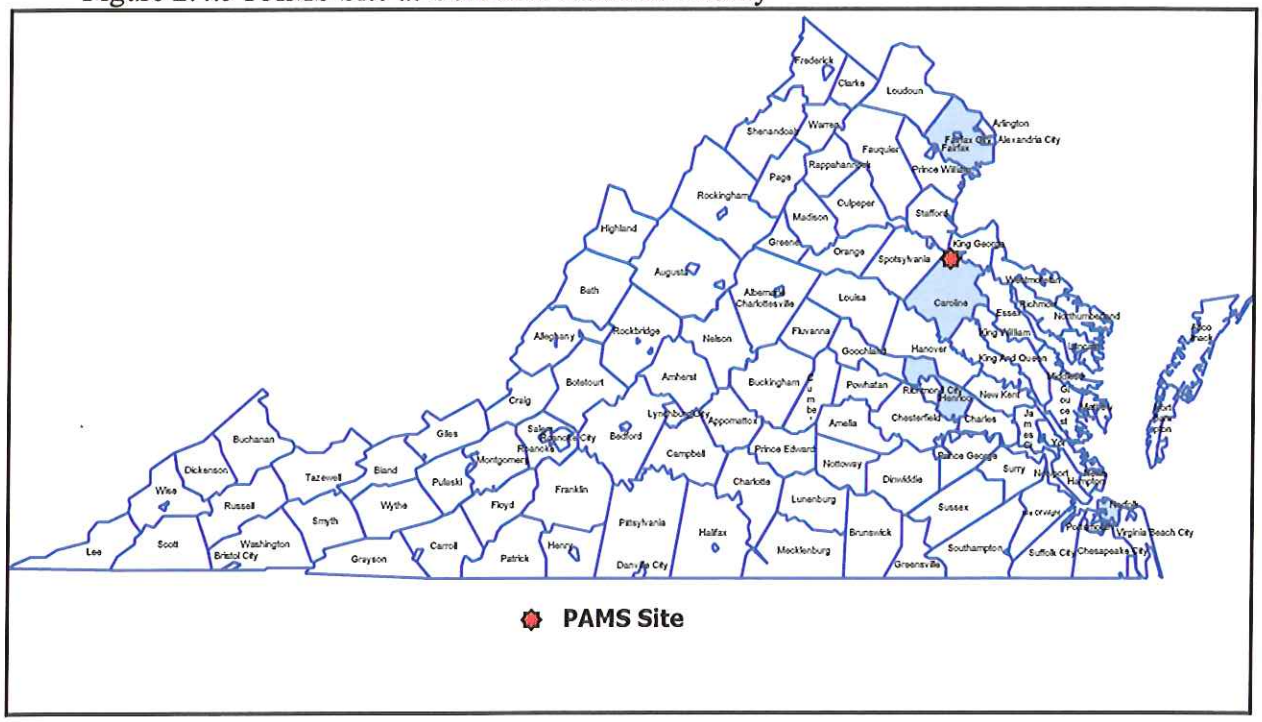
Site	Annual Arithmetic Mean (ppm)							
	2001	2002	2003	2004	2005	2006	2007	2008
(26-F) **Rockingham Co.**	--	--	--	--	.014	.012	.011	.011
(19-A6) **Roanoke Co.**	.014	.013	.013	.014	.014	.012	.010	.007
(72-M) **MathScience Innovation Ctr.**	--	--	--	--	--	--	--	.010
(75-B) **Charles City Co.**	.012	.012	.011	.011	.010	.010	.007	.006
(158-W) **Richmond**	.021	.020	.016	.015	.016	.016	.014	.012
(181-A1) **Norfolk**	--	--	--	--	--	--	.012	.010
(38-I) **Loudoun Co.**	.014	.014	.016	.015	.014	.013	.011	.008
(45-L) **Prince William Co.**	.011	.011	.012	.010	.009	.007	.007	.006
(47-T) **Arlington Co.**	.022	.022	.026	.022	.021	.018	.016	.013
(L-126-C) **Alexandria**	.023	.025	.023	.024	.024	.020	.018	.016

Annual Arithmetic Mean not to exceed 0.053 ppm (100 $\mu g/m^3$)

The current NO_2 monitoring network does not meet the siting criteria of the near road standards contained in the new NAAQS standard. DEQ is in the process of evaluating sites for the new road side monitors.

Photochemical Assessment Monitoring Systems Network (PAMS) – Virginia DEQ maintains one PAMS site at Corbin (51-033-0001) in Caroline County as shown in Figure 2.4.5 below. The site is an upwind site (Type I) for the Northern Virginia 1 hour non-attainment area. The site contains an Auto Gas Chromatograph, an NOy monitor and an Ozone monitor. The Auto GC and NOy run during June – August.

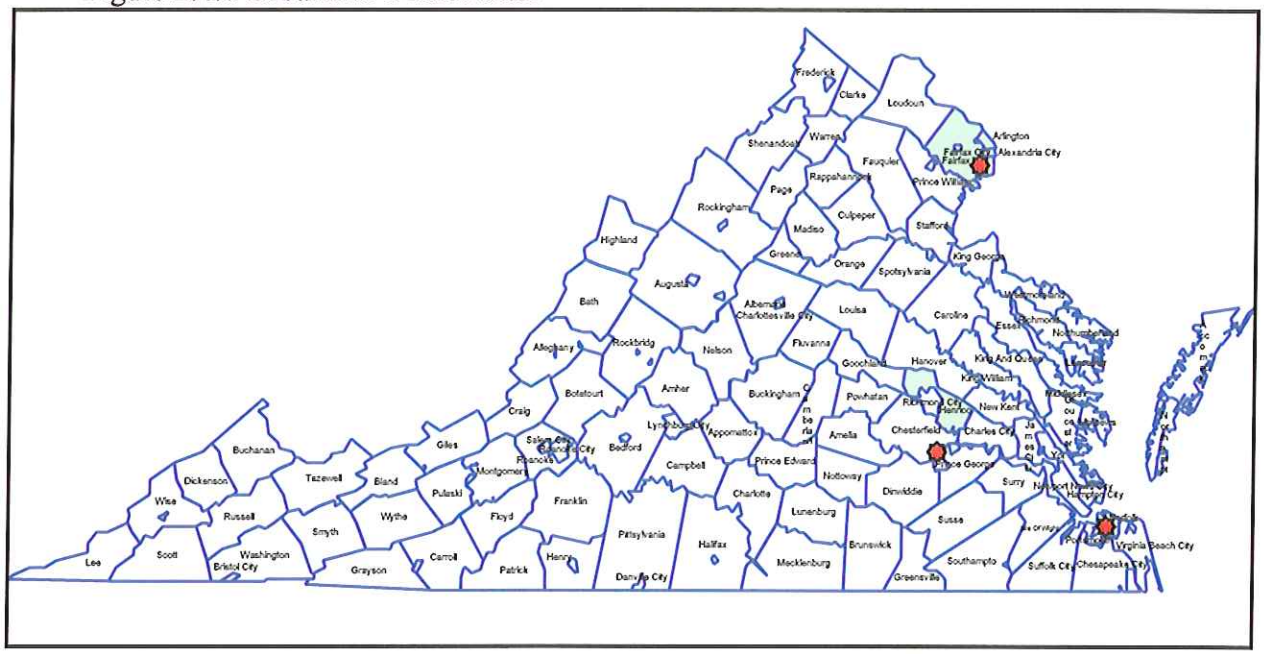
Figure 2.4.5 PAMS Site at Corbin in Caroline County



Urban Air Toxics Monitoring Network (UATM) – DEQ currently maintains 3 urban air toxics monitoring stations. These stations are located at Lee Park (51-059-0030) in Fairfax County, Carter Woodson Middle School (51-670-0011) in Hopewell, and

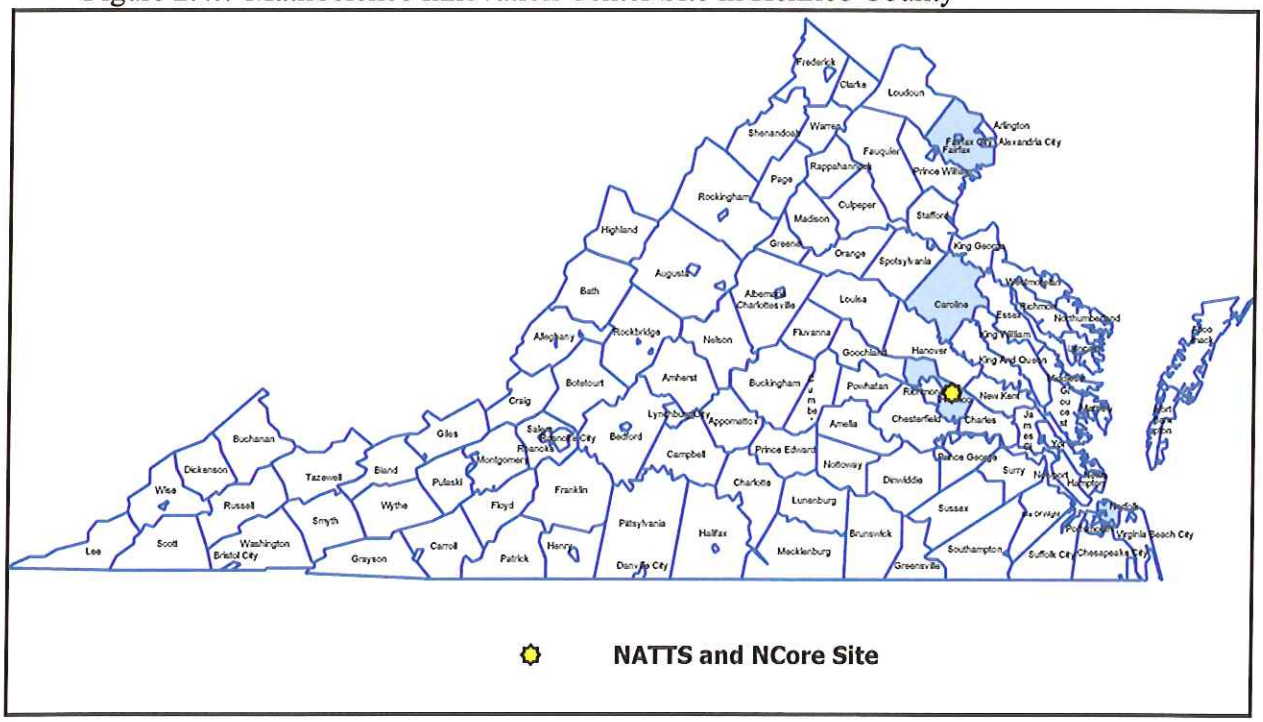
the Tidewater Regional Office (51-810-0008) in Virginia Beach. Figure 2.4.6 below identifies the locations of these sites. VA DEQ is part of the Region III contract for the analysis of the VOC's and the Carbonyl's. The metals are analyzed by the Virginia Division of Consolidated Laboratory Services.

Figure 2.4.6 Urban Air Toxics Sites



National Air Toxics Trend Site (NATTS) and NCore Site – In 2008 VA DEQ installed and began operation of a National Air Toxics Trend site at the Math Science Innovation Center (51-087-0014) in Henrico County (Richmond MSA). Figure 2.4.7 below shows the location of this site.

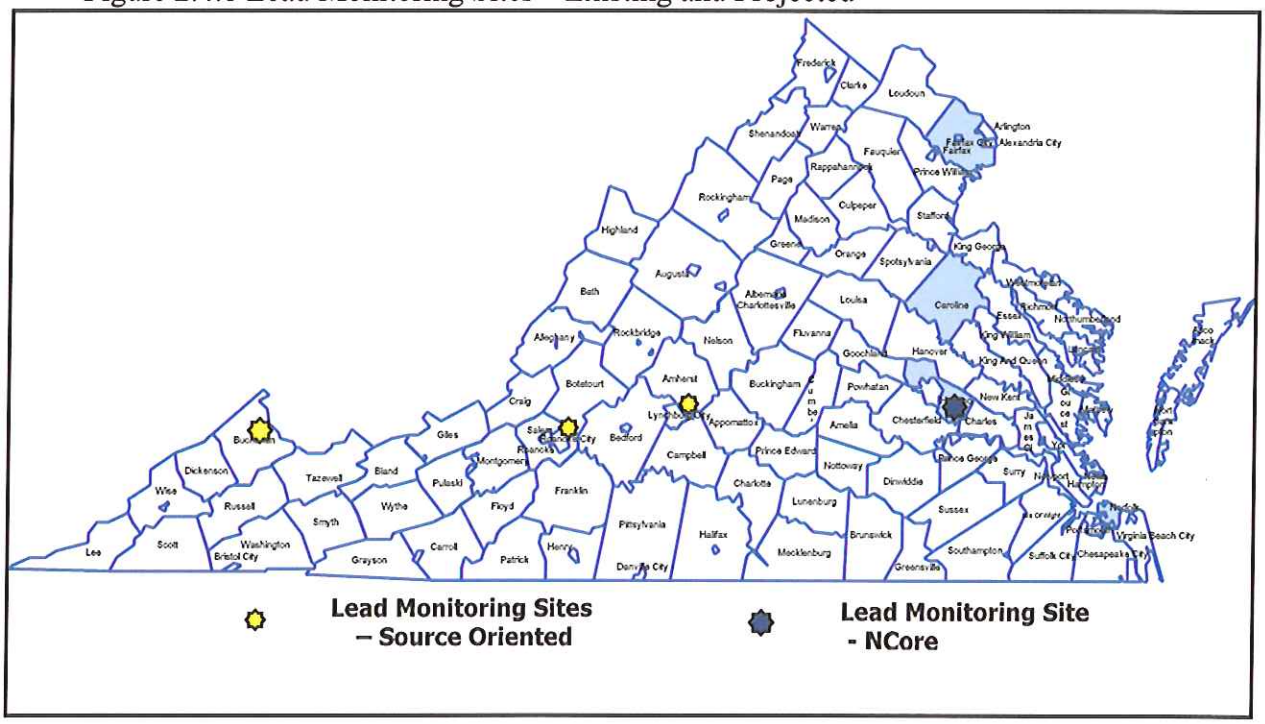
Figure 2.4.7 MathScience Innovation Center Site in Henrico County



The Math Science Innovation Center site is also where the NCore site is going to be located. Currently the NCore requirements are close to completion with the only requirements being the addition of a Trace CO monitor and a Trace SO2 monitor. Both monitors have been purchased and are being bench tested prior to installation in the fall. The NCore site will be completely operational prior to January 1, 2011.

Lead Monitoring (Pb) – As of July 1, 2010 VA DEQ will have 2 of the 4 Lead Sampling systems in place prior to the dead line of January 1, 2011. The listing of Source oriented monitors is provided in Table 1.2.1 on page 6 above. The NCore site will house the 4th Monitor.

Figure 2.4.8 Lead Monitoring Sites – Existing and Projected



PM2.5 Speciation Monitor – VA DEQ currently maintains one Speciation Monitor combined with a Carbon Monitor. These monitors are located at the MathScience Center also. The Carbon Monitor was installed and began operation in the fall of 2009. The Speciation Network is much reduced from the original deployment which was as high as 4 monitors prior to 2006. The cost of the analytical work caused DEQ to reduce the number of monitors to the currently operating sampler in Henrico County.

Section 3. Whether new technologies are appropriate for incorporation into the ambient air monitoring network

VA DEQ, as part of its standard approach to purchasing and deploying new monitoring equipment, evaluates the use of new technologies to replace existing monitoring systems. Currently DEQ is in the process of evaluating the expanded use of trace level monitoring systems as part of meeting the new NAAQS requirements for NO2, SO2 and in the future CO. DEQ is also evaluating an upgrade of its Data Acquisition System in each of the monitoring stations to improve data reliability and to provide for remote calibrations at each of the stations where it is technically feasible. DEQ is also looking into the possibility of using other technology such as Beta Attenuation to replace the TEOM's currently used for forecasting and AQI publication.

The rate at which these new technologies are integrated into the monitoring network is dependent on the Data Acquisition system. This project is currently in the proposal evaluation stage and will be awarded prior to the beginning of FFY11. The rate at which it is up and running will depend on the manpower DEQ has available to work on it. This is a challenge when considering the new NAAQS standards and the associated new monitoring network requirements.

Attachment 1 Virginia Air Monitoring sites by Air Quality Control Region

Attachment 1 VA DEQ, AQCR I SOUTHWEST VIRGINIA, 2010

SITE I.D.	POLLUTANT MEASURED	METHOD OR INSTRUMENT	SAMPLING INTERVAL	MONITORING OBJECTIVE	SCALE	BEGINNING DATE	MONITOR TYPE	LOCATION	LONGITUDE	LATITUDE
51-035-0001 (23-A)	PM-10	SSI HI VOL	1/6	Population	Neighborhood	5/28/89	SLAMS	Carroll Co. - Gladeville Elem. School	-80.8800	36.7025
51-197-0002 (16-B)	O3	UV Absorption	Continuous	Population	Regional	4/1/90	SLAMS	Rural Retreat - Wythe County Sewage Treatment Plant	-81.2550	36.8931
51-520-0006 (101-E)	PM2.5 FRM	Sequential	1/3	Population	Neighborhood	1/1/99	SLAMS	Bristol - Highland View Elem. Sch.	-82.1644	36.6078
51-027-0006 (4-G)	TSP - Lead	Tisch HI VOL TSP Sampler	1/6	Source-oriented	Neighborhood	projected 6/1/10	NAMS	Buchanan Co. - VP-1 Upper Stock Pile area	-82 01.090	37 14.851

There are no collocated monitors in AQCR I

Attachment 1. VA DEQ, AQCR II VALLEY OF VIRGINIA, 2010

SITE I.D.	POLLUTANT MEASURED	METHOD OR INSTRUMENT	SAMPLING INTERVAL	MONITORING OBJECTIVE	SCALE	BEGINNING DATE	MONITOR TYPE	LOCATION	LONGITUDE	LATITUDE
51-069-0010 (28-J)	O3 PM2.5 FRM PM2.5	UV Absorption Sequential TEOM	Continuous 1/3 Continuous	Population Population Background	Urban Urban Urban	4/1/91 1/1/08 1/1/08	SLAMS SLAMS SPM	Rest, Frederick County - Lester Buildings	-78.0814	39.2828
51-113-0003 (N-35-A)	O3 SO2 PM2.5 PM2.5	UV Absorption Fluorescence IMPROVE TEOM	Continuous Continuous 1/3 Continuous	Background Background Background Background	Regional Regional Regional Regional	5/04	Nat'l Park Nat'l Park IMPROVE Nat'l Park	Madison County - Shenandoah Nat'l Park Big Meadows	-78.4355	38.5227
51-139-0004 (29-D)	O3 PM2.5 FRM	UV Absorption Sequential	Continuous 1/3	Population Background Transport	Urban Regional	7/21/99 10/00	SLAMS SLAMS	Page County - Luray Caverns Airport	-78.5047	38.6633
51-161-1004 (19-A6)	NO2 O3 SO2	Chemiluminescence UV Absorption Fluorescence	Continuous Continuous Continuous	Population Population Population	Neighborhood Neighborhood Neighborhood	1/1/81 8/81 1/29/87	SLAMS SLAMS NAMS	Vinton - Roanoke Co. Horn Elem. School	-79.8842	37.2856
51-163-0003 (21-C)	O3 PM2.5	UV Absorption IMPROVE	Continuous Continuous	Background Background	Regional Regional	4/8/99	SLAMS IMPROVE	Rockbridge Co. - Natural Bridge Station	-79.5131	37.6261
51-165-0003 (26-F)	SO2 NO2 PM2.5 FRM O3	Fluorescence Chemiluminescence Sequential UV Absorption	Continuous Continuous 1/3 Continuous	Population Population Population Population	Neighborhood Neighborhood Neighborhood Neighborhood	9/22/97 4/04 1/1/07 4/1/07	SLAMS SLAMS SLAMS SLAMS	Rockingham Co. - VDOT	-78.8195	38.4775
51-187-0004 (30-E)	PM-10	SSI HI VOL	1/6	Population	Neighborhood	7/27/88	SLAMS	Front Royal - Warren Co. Memorial Hospital	-78.1983	38.9328
51-770-0011 (109-H)	PM-10 Lead	SSI HI VOL TSP HI VOL	1/6 1/6	Source Source	Middle Middle	5/9/88 10/22/09	SLAMS	Roanoke - Cherry Hill Subdivision	-79.9994	37.2758
51-770-0015 (109-M)	CO PM2.5 PM2.5 FRM	Gas Filter Corr. TEOM Sequential	Continuous Continuous Daily	Population Population Population	Neighborhood Neighborhood Neighborhood	4/04 4/04 1/1/07	SLAMS SPM SLAMS	Roanoke - Round Hill Elem. Sch.	-79.9557	37.2972
51-775-0011 (110-C)	PM2.5	Sequential	Daily	Population	Neighborhood	9/8/09	SLAMS	Salem - Salem High School	-80.0810	37.2979

There are no collocated monitors in AQCR II

Attachment 1. VA DEQ, AQCR III CENTRAL VIRGINIA, 2010

SITE I.D.	POLLUTANT MEASURED	METHOD OR INSTRUMENT	SAMPLING INTERVAL	MONITORING OBJECTIVE	SCALE	BEGINNING DATE	MONITOR TYPE	LOCATION	LONGITUDE	LATITUDE
51-680-0015 (155-Q)	PM2.5 FRM	Sequential	1/3	Population	Neighborhood	4/1/03	SLAMS	Lynchburg - Water Tank	-79.2148	37.3318

There are no collocated monitors in AQCR III

Attachment 1. VA DEQ, AQCR IV NORTHEAST VIRGINIA, 2010

SITE I.D.	POLLUTANT MEASURED	METHOD OR INSTRUMENT	SAMPLING INTERVAL	MONITORING OBJECTIVE	SCALE	BEGINNING DATE	MONITOR TYPE	LOCATION	LONGITUDE	LATITUDE
51-033-0001 (48-A)	O3 VOCs VOC NOy	UV Absorption Auto-GC TO-12 Chemiluminescence	Continuous Daily - Summer 1/6 Continuous	Background Background Background Background	Regional Neighborhood Regional Regional	4/1/93 6/1/02 6/1/93 7/22/96	PAMS PAMS PAMS PAMS	Caroline Co. - USGS Geomagnetic Center	-77.3772	38.2031
51-047-0002 (42-B)	PM-10	SSI HI VOL	1/6	Population	Neighborhood	4/24/92	SLAMS	Culpeper - Farmington Elem. School	-78.0111	38.4572
51-061-0002 (37-B)	O3	UV Absorption	Continuous	Background	Regional	9/1/81	SLAMS	Fauquier Co. - Phelps Wildlife Area	-77.7678	38.4750
51-179-0001 (44-A)	O3	UV Absorption	Continuous	Population	Neighborhood	9/1/92	SLAMS	Stafford Co. - Widewater Elem. School	-77.3703	38.4831
51-003-0001 33-A	O3 PM2.5 FRM PM2.5	UV Absorption Sequential TEOM	Continuous 1/3 Continuous	Population Population Background	Regional Neighborhood Neighborhood	4/1/08 4/1/08 4/1/08	SLAMS SLAMS SPM	Albemarle Co. - Albemarle High School	- 78.4973	38.0426
51-630-0004 (130-E)	PM-10	SSI HI VOL	1/6	Population	Neighborhood	11/12/89	SLAMS	Fredericksburg - Mercer Elem. School	-77.4864	38.3047

There are no collocated monitors in AQCR IV

Attachment 1. VA DEQ, AQCR V STATE CAPITOL, 2010

SITE I.D. SITE I.D.	POLLUTANT MEASURED	METHOD OR INSTRUMENT	SAMPLING INTERVAL	MONITORING OBJECTIVE	SCALE	BEGINNING DATE	MONITOR TYPE	LOCATION	LONGITUDE	LATITUDE
51-036-0002 (75-B)	O3	UV Absorption	Continuous	Population	Neighborhood	3/29/88	SLAMS	Charles City Co. - Route #608 Shirley Plantation	-77.2608	37.3419
	SO2	Pulsed Fluorescence	Continuous	Highest Concentration	Neighborhood	1/1/92	NAMS			
	NO2	Chemiluminescence	Continuous	Population	Neighborhood	3/9/93	SLAMS			
	PM2.5 FRM	Sequential	1/3	Population	Neighborhood	1/1/99	SLAMS			
51-041-0003 (71-D)	PM2.5 FRM	Sequential	1/3	Population	Neighborhood	1/1/99	SLAMS	Chesterfield Co. - Bensley Armory	-77.4508	37.4361
51-041-0004 (71-H)	O3	UV Absorption	Continuous	Population	Neighborhood	4/80	SLAMS	Chesterfield Co. - Beach Rd. VDOT	-77.5936	37.3589
51-085-0003 (73-E)	O3	UV Absorption	Continuous	Highest Concentration	Urban	4/1/01	NAMS	Hanover Co. - McClellan Road	-77.2188	37.6061
51-087-0014 (72-M)	O3	UV Absorption	Continuous	Population	Neighborhood	6/12/81	NAMS	Henrico Co. - MathScience Center	-77.4003	37.5583
	PM2.5 FRM	Sequential	Daily	Population	Neighborhood	1/1/99	SLAMS			
	PM2.5	TEOM	Continuous	Population	Neighborhood	7/18/00	SPM			
	PM2.5	Speciation	1/3 Mini-Trends	Population	Neighborhood	1/1/04	SPM			
	PM10	Sequential	1/3	Population	Neighborhood	10/8/09	SLAMS			
	Lead	TSP/ICPMS	1/6	Background	Neighborhood	11/1/08	SLAMS/Ncor			
	NOy	Chemiluminescence	Continuous	Population	Neighborhood	5/1/05	NCORE/SPM			
	NO2 Trace	Chemiluminescence	Continuous	Population	Neighborhood	5/1/05	NCORE/SPM			
51-087-0015 (72-N)	PM2.5 FRM	Sequential	1/3	Population	Neighborhood	1/1/99	SLAMS	Henrico Co. - Piedmont DEQ	-77.5675	37.6703
51-101-0003 (82-C)	PM-10	SSI HI VOL	1/6	Population	Neighborhood	1/11/90	SLAMS	West Point - Elementary School	-76.7953	37.5594
51-670-0010 (154-M)	PM-10	PM10 SSI HI VOL	1/6	Population	Neighborhood	11/1/08	SLAMS	Hopewell - Hopewell Toxics Study, Carter G. Woodson Middle School	-77.2901	37.2906
	Metals	PM10 SSI HI VOL	1/6	Population	Neighborhood	11/1/08	SLAMS			
51-760-0024 (158-W)	CO	Gas Filter Correlation	Continuous	Population	Neighborhood	2/13/98	SLAMS	Richmond - Science Museum, Broad Street	-77.4653	37.5628
	SO2	Pulsed Fluorescence	Continuous	Population	Neighborhood	2/13/98	SLAMS			
	NO2	Chemiluminescence	Continuous	Population	Neighborhood	2/13/98	SLAMS			

There is 1 collocated monitor in AQCR V. At Station 72-M, 510870014 - collocated PM2.5 FRM

Attachment 1. VA DEQ, AQCR VI HAMPTON ROADS, 2010

SITE I.D.	POLLUTANT MEASURED	METHOD OR INSTRUMENT	SAMPLING INTERVAL	MONITORING OBJECTIVE	SCALE	BEGINNING DATE	MONITOR TYPE	LOCATION	LONGITUDE	LATITUDE
51-700-0013 (180-C)	SO2	Fluorescence	Continuous	Population	Neighborhood	11/3/72	NAMS	Newport News - SCOT Facility NN Public Schools	-76.4811	37.0998
	O3	UV Absorption	Continuous	Population	Neighborhood	11/3/72	NAMS			
	PM2.5 FRM	Sequential	1/3	Population	Neighborhood	1/1/99	SLAMS			
	PM2.5	TEOM	Continuous	Population	Neighborhood	7/17/00	SPM			
	CO	Gas Filter Corr.	Continuous	Population	Neighborhood	7/1/99	SLAMS			
	PM10	SSI HI VOL	1/6	Population	Neighborhood	1/1/07	SLAMS			
	NO2	Chemiluminescence	Continuous	Population	Neighborhood	1/7/10	SLAMS			
51-710-0024 (181-A1)	PM10	SSI HI VOL	1/6	Population	Neighborhood	6/21/97	SLAMS	Norfolk - NOAA Storage Facility	-76.3017	36.8578
	PM2.5 FRM	Sequential	1/3	Population	Neighborhood	1/1/99	SLAMS			
51-800-0004 (183-E)	O3	UV Absorption	Continuous	Population	Neighborhood	4/1/87	NAMS	Suffolk - Tidewater Community College	-76.4386	36.9033
51-800-0005 (183-F)	O3	UV Absorption	Continuous	Population	Neighborhood	4/1/91	NAMS	Suffolk - Tidewater Research Station, Holland	-76.7314	36.6675
51-810-0008 (184-J)	PM2.5 FRM	Sequential	Daily	Population	Neighborhood	1/1/99	SLAMS	VA Beach - VA Beach DEQ Office	-76.1814	36.8411
	CO	Gas Filter Corr.	Continuous	Population	Neighborhood	12/22/09	SLAMS			
	SO2	Pulsed Fluorescence	Continuous	Population	Neighborhood	1/7/10	SLAMS			

There are two collocated monitors in AQCR VI. Collocated PM10 and PM2.5 FRM are both at 181-A1, 517100024, the NOAA Storage Facility in Norfolk.

Attachment 1. VA DEQ, AQCR VII NORTHERN VIRGINIA, 2010

SITE I.D.	POLLUTANT MEASURED	METHOD OR INSTRUMENT	SAMPLING INTERVAL	MONITORING OBJECTIVE	SCALE	BEGINNING DATE	MONITOR TYPE	LOCATION	LONGITUDE	LATITUDE
51-013-0020 (47-T)	O3	UV Absorption	Continuous	Population	Neighborhood	8/1/79	SLAMS	Arlington - Aurora Hills Visitors Center	-77.0592	38.8575
	NO2	Chemiluminescence	Continuous	Population	Neighborhood	8/1/79	SLAMS			
	CO	Gas Filter Correlation	Continuous	Population	Neighborhood	4/1/81	SLAMS			
	PM2.5 FRM	Sequential	1/3	Population	Neighborhood	1/1/99	SLAMS			
51-059-0030 (46-B9)	O3	UV Absorption	Continuous	Population	Neighborhood	7/1/98	PAMS	Fairfax - Lee District	-77.1056	38.7728
	PM2.5 FRM	Sequential	Daily	Population	Neighborhood	1/1/99	SLAMS			
51-107-1005 (38-I)	O3	UV Absorption	Continuous	Population	Neighborhood	4/4/98	SLAMS	Loudoun Co. - Broad Run H.S.	-77.4900	39.0244
	NO2	Chemiluminescence	Continuous	Population	Neighborhood	4/4/98	SLAMS			
	PM2.5 FRM	Sequential	1/3	Population	Neighborhood	1/1/99	SLAMS			
51-153-0009 (45-L)	O3	UV Absorption	Continuous	Population	Urban	4/1/91	SLAMS	Prince Wm. Co. - Long Park	-77.6356	38.8553
	NO2	Chemiluminescence	Continuous	Population	Urban	4/1/94	SLAMS			
51-510-0009 (L-126-C)	SO2	Pulsed Fluorescence	Continuous	Population	Neighborhood	10/69	NAMS	Alexandria, 517 N. Saint Asaph St.	-77.0447	38.8108
	O3	UV Absorption	Continuous	Population	Neighborhood	10/69	SLAMS			
	NO2	Chemiluminescence	Continuous	Population	Neighborhood	10/69	SLAMS			
	CO	Gas Filter Correlation	Continuous	Population	Neighborhood	12/6/72	SLAMS			
	PM10	SSI HI VOL	1/6	Population	Neighborhood	10/4/01	SLAMS			
	PM2.5 FRM	Sequential	1/3	Population	Neighborhood	1/1/99	SLAMS			
51-510-0020 (L-126-H)	PM10	SSI HI VOL	1/3	Source	Middle Scale	6/4/06	SLAMS	Alexandria - Tucker Elem. Sch.	-77.1268	38.8050

There are 3 collocated monitors in AQCR VII. A collocated PM2.5 FRM is located at Station 47-T, 510130020, Aurora Hills Visitor Center, Arlington

Attachment 2 Numeric Correlation Tool output for Northern Virginia Ozone

Attachment 2. Model Output from Correlation Matrix Model Northern Virginia Ozone Monitors

		Aurora Hills		Lee Park		Loudoun Co. (Ashburn)	
	years chosen in model	Pearson correlation R^2	average relative difference between sites	Pearson correlation R^2	average relative difference between sites	Pearson correlation R^2	average relative difference between sites
51-059-0005	2005	0.70	0.14	0.69	0.14		
Cub Run/Chantilly	2006	0.82	0.15	0.79	0.18	0.94	0.12
	2007	0.73	0.13	0.71	0.13	0.83	0.10
	2008	0.85	0.09	0.85	0.08	0.87	0.07
	2005:2006	0.74	0.15	0.73	0.16		
	2006:2007	0.78	0.14	0.75	0.15	0.89	0.11
	2007:2008	0.78	0.11	0.76	0.11	0.84	0.09
	2005:2007	0.74	0.14	0.72	0.15		
	2006:2008	0.79	0.12	0.76	0.13	0.87	0.10
	2005:2008	0.76	0.13	0.74	0.13		
51-059-0018	2005	0.86	0.08	0.91	0.07		
Mt. Vernon	2006	0.92	0.07	0.94	0.05	0.79	0.11
	2007	0.94	0.05	0.97	0.03	0.76	0.10
	2008	0.94	0.06	0.94	0.05	0.74	0.10
	2005:2006	0.89	0.07	0.93	0.06		
	2006:2007	0.92	0.06	0.95	0.04	0.77	0.11
	2007:2008	0.94	0.05	0.96	0.04	0.75	0.10
	2005:2007	0.90	0.07	0.94	0.05		
	2006:2008	0.93	0.06	0.95	0.04	0.76	0.10
	2005:2008	0.91	0.06	0.94	0.05		
51-059-1005	2005	0.94	0.07	0.88	0.07		
Mason	2006	0.87	0.08	0.82	0.10	0.85	0.09
	2007	0.94	0.05	0.91	0.07	0.87	0.07
	2008	0.91	0.06	0.84	0.08	0.73	0.10
	2005:2006	0.88	0.07	0.84	0.09		
	2006:2007	0.90	0.06	0.85	0.08	0.86	0.08
	2007:2008	0.93	0.05	0.88	0.07	0.81	0.08
	2005:2007	0.90	0.06	0.86	0.08		
	2006:2008	0.90	0.06	0.85	0.08	0.83	0.09
	2005:2008	0.90	0.06	0.85	0.08		
51-059-5001	2005	0.82	0.11	0.79	0.11		
McLean	2006	0.90	0.08	0.86	0.09	0.93	0.07
	2007	0.89	0.08	0.86	0.08	0.85	0.09
	2008	0.91	0.07	0.88	0.08	0.82	0.08
	2005:2006	0.86	0.09	0.83	0.10		
	2006:2007	0.89	0.08	0.86	0.09	0.89	0.08
	2007:2008	0.90	0.08	0.87	0.08	0.84	0.08
	2005:2007	0.87	0.09	0.84	0.09		
	2006:2008	0.90	0.08	0.87	0.08	0.87	0.08
	2005:2008	0.88	0.08	0.85	0.09		

Attachment 3 Numeric Correlation Tool output for Northern Virginia PM2.5

Attachment 3. Correlation Matrix Output for Northern Virginia PM2.5 samplers

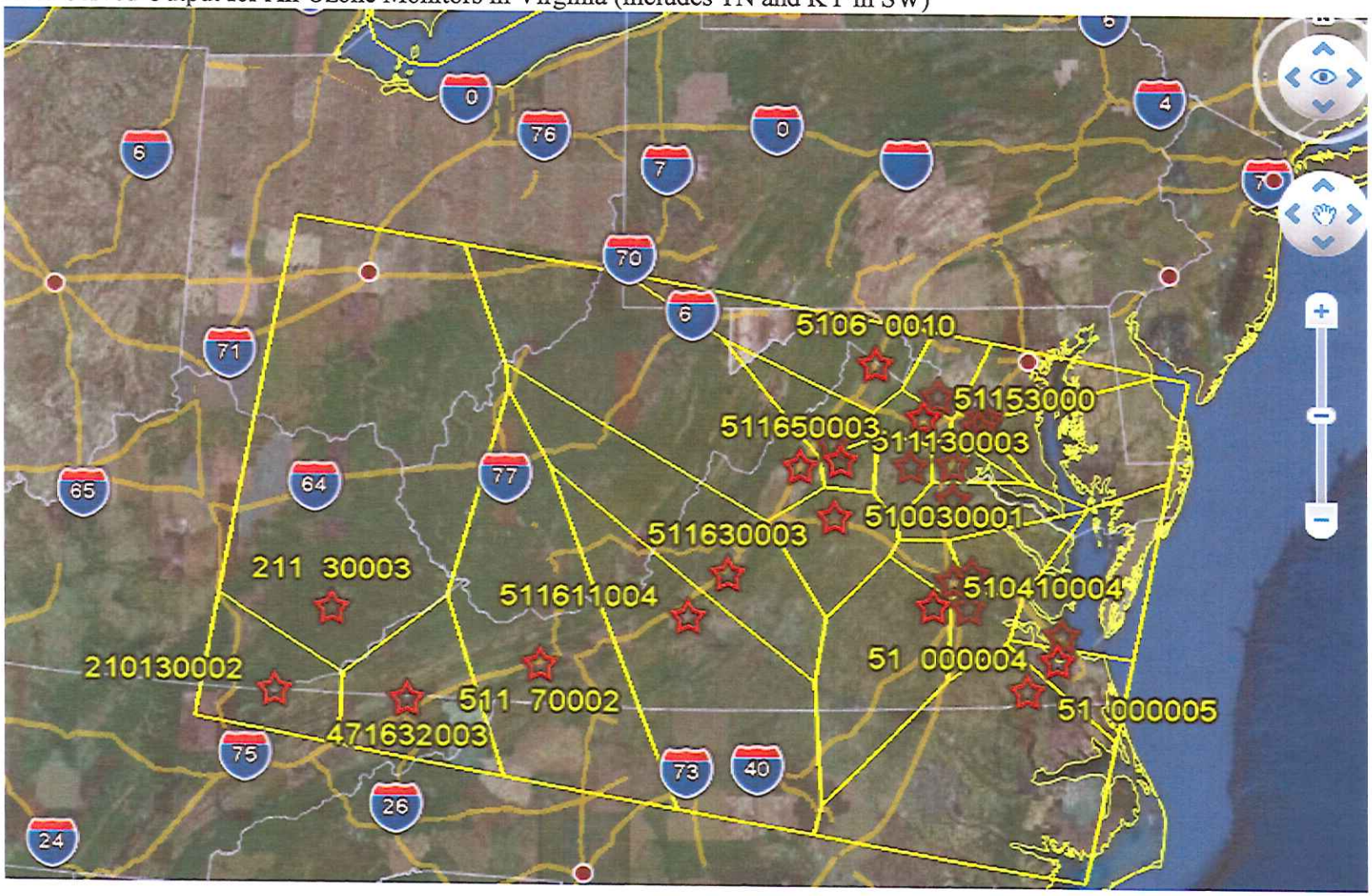
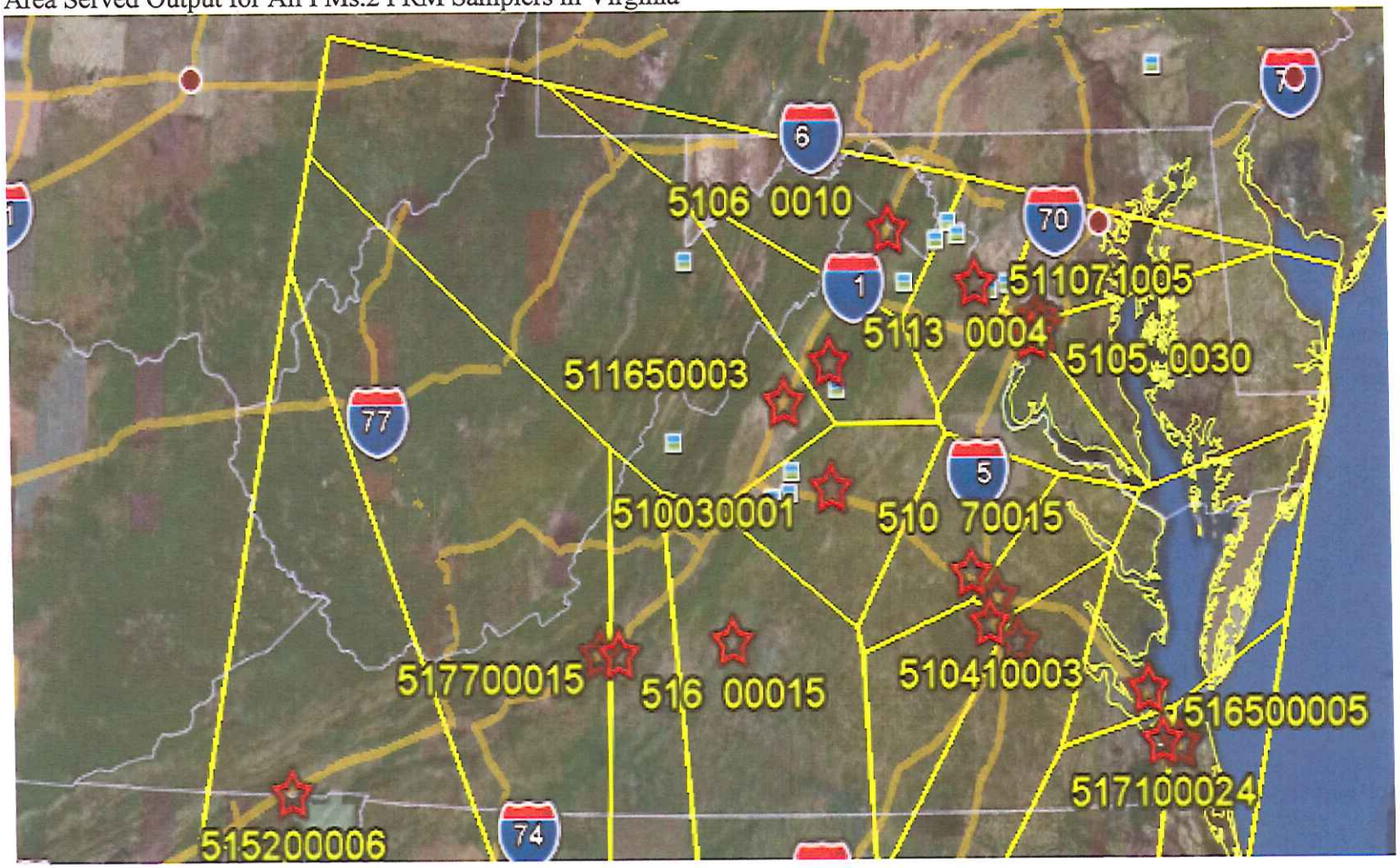
	Lee Park		Loudoun (Ashburn)	
	Pearson correlation R^2	average relative difference between sites	Pearson correlation R^2	average relative difference between sites
51-059-1005 Mason				
2005	0.92	0.08	0.90	0.12
2006	0.95	0.07	0.94	0.10
2007			0.89	0.13
2005:2006	0.93	0.08	0.92	0.11
2006:2007			0.92	0.12
2005:2007			0.91	0.12
51-059-5001 McLean				
2005	0.88	0.11	0.90	0.12
2006	0.91	0.12	0.93	0.12
2007			0.91	0.14
2008	0.91	0.10	0.72	0.13
2005:2006	0.89	0.11	0.91	0.12
2006:2007			0.92	0.13
2007:2008			0.80	0.14
2005:2007			0.91	0.12
2006:2008			0.84	0.13
2005:2008			0.86	0.13

Blank spaces indicate the data did not show up in the correlation tool output.
Each cell has the full value in it. Formatting use to display only 2 decimal places.

Attachment 4 Area Served Model Output for Ozone and PM2.5 FRM

Attachment 4. Area Served Model Outputs for the Commonwealth of Virginia

Area Served Output for All Ozone Monitors in Virginia (includes TN and KY in SW)



Area Served Output for All PMs.2 FRM Samplers in Virginia