Virginia Ambient Air Monitoring
2004 Data Report

Department of Environmental Quality

Commonwealth of Virginia
Department of Environmental Quality

Submitted by
Office of Air Quality Monitoring

This Ambient Air Monitoring Data Report is for the time period of January 1, 2004 to December 31, 2004

On The Cover

Thanks to Brian King for his picture on the Front Cover.

Robert G. Burnley, Director
Virginia Department of Environmental Quality

John M. Daniel, Jr.
Director, Air Division

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Director, Office of Air Quality Planning & Monitoring

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Acknowledgments:

Thanks to John M. Daniel, Jr., James E. Sydnor, James Dinh, Tom Jennings, Carolyn Stevens, Dan Salkovitz, Baxter Gilley and Charles (Brian) King.

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COMMONWEALTH of VIRGINIA

W. Tayloe Murphy, Jr.
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July 5, 2005

CERTIFICATION

Air quality data reported by the Virginia Department of Environmental Quality are collected using EPA certified equipment and procedures at sites meeting EPA siting criteria. The data summarized in this report for calendar year 2004 are accurate to the best of my knowledge.

John M. Daniel, Jr., P.E., DEE
Director, Air Division

FAIRFAX COUNTY

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June 28, 2005

CERTIFICATION

The Fairfax County Air Quality Monitoring Program's portion of the air quality data that is reported by Virginia Department of Environmental Quality are collected using EPA certified equipment and procedures at sites that meet EPA siting criteria. The data summarized in this report for calendar year 2004 are accurate to the best of my knowledge.

Barbara Hardy

Barbara Hardy
Air Quality Program Manager

Fairfax County is committed to non-discrimination on the basis of disability in all County programs, services and activities. For information call (703) 246-2411.

DEPARTMENT OF TRANSPORTATION
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CERTIFICATION

Air Quality data reported by the Virginia Department of Environmental Quality are collected using EPA certified equipment and procedures at the site meeting EPA siting criteria. The data summarized in this report for the calendar year 2004 are accurate to the best of my knowledge.

William J. Skrabak, Chief
Div. of Environmental Quality
Department of T&ES
City of Alexandria

ABBREVIATION TABLE

#N	Number of Samples
AQA	Air Quality Assessment
AQCR	Air Quality Control Region
ARITH.	Arithmetic
ATMN	Air Toxics Monitoring Network
CO	Carbon Monoxide
CONC	Concentrations
DEQ	Department of Environmental Quality
EPA	Environmental Protection Agency
IMPROVE	Interagency Monitoring of Protected Visual Environments
LAT	Latitude
LONG	Longitude
Met.	Meteorological Instrumentation
MSA	Metropolitan Statistical Area
NA	Not Available
NAMS	National Air Monitoring Station(s)
NMOC	Non-Methane Organic Compounds
NO_2	Nitrogen Dioxide
OBS.	Observations
O_3	Ozone
PAMHC	Total PAMS Hydrocarbon
PAMS	Photochemical Assessment Monitoring Station
PM_{10}	Particulate Matter with an aerodynamic diameter less than or equal to 10 microns
$PM_{2.5}$	Particulate Matter with an aerodynamic diameter less than or equal to 2.5 microns
POLLUT.	Pollutant
ppbC	Part Per Billion of Carbon
ppbv	Part Per Billion of Volume
ppm	Part Per Million
SLAMS	State and Local Air Monitoring Station(s)
SO_2	Sulfur Dioxide
SPM	Special Purpose Monitor
STD	Standard
StDev	Standard Deviation
TEOM	Tapered Element Oscillating Microbalance (a method for continuously measuring $PM_{2.5}$ in ambient air)
TNMOC	Total Nonmethane Organic Compound
ug/m_3	Micrograms per cubic meter
VOC	Volatile Organic Compounds

Introduction

The 2004 Virginia Ambient Air Monitoring Data Report is a compilation of air pollutant measurements made by the Virginia Department of Environmental Quality, the City of Alexandria, and Fairfax County. This report satisfies the requirements of the U.S. Environmental Protection Agency (EPA) for the reporting of air quality data as specified in the Code of Federal Regulations, Title 40, Part 58, Appendix F.

Ambient air quality was measured at 50 locations within the Commonwealth during 2004. These monitoring sites were established in accordance with EPA's siting criteria contained in 40 CFR Part 58, Appendices D and E, and monitoring network operations conformed to EPA guidance documents and generally accepted air quality monitoring practices. Quality assurance was performed in accordance with requirements contained in 40 CFR Part 58, Appendix A.

Ambient concentrations of carbon monoxide, nitrogen dioxide, sulfur dioxide, and PM_{10} continued to meet the EPA's National Ambient Air Quality Standards (NAAQS) during 2004. However, ambient concentrations of ozone continued to be a problem, especially in the Northern Virginia, Richmond, and Hampton Roads areas. Although the number of high ozone days has decreased significantly, there were days when the ozone levels exceeded the standards in all three areas. The one-hour ozone NAAQS was replaced on June 15, 2005 by the eight-hour standard, so future efforts to reduce ozone levels will be focused on attaining the eight-hour standard. The eight-hour ozone nonattainment area designations became effective on June 15, 2004, and the jurisdictions included in those area are listed on page 6. Also, EPA proposed to designate the Roanoke and Winchester areas as nonattainment but deferred final action for both areas pending the successful implementation of Early Action Compacts as agreed to by the local governments in those areas.

For fine particulates known as $PM_{2.5}$, all of DEQ's network monitors for this pollutant measured ambient concentrations below both the annual and 24-hour standards for the period through 2004. Nonetheless, on December 17, 2004, the EPA Administrator signed a *Federal Register* Notice designating nonattainment areas for the $PM_{2.5}$ NAAQS and included jurisdictions in Northern Virginia (as part of the Metro DC area) as not meeting the annual $PM_{2.5}$ standard of 15ug/m^3. These designations became effective on April 5, 2005. The list of these localities is provided on page 7.

AREAS DESIGNATED NONATTAINMENT FOR THE 8-HOUR OZONE NATIONAL AMBIENT AIR QUALITY STANDARD:	AREAS THAT HAVE BEEN IDENTIFIED AS NONATTAINMENT FOR THE 8-HOUR OZONE STANDARD, BUT HAVE RECEIVED DEFERMENT OF OFFICIAL NONATTAINMENT DESIGNATION:
NORTHERN VIRGINIA/MD NONATTAINMENT AREA Arlington County Fairfax County Loudoun County Prince William County City of Alexandria City of Fairfax City of Falls Church City of Manassas City of Manassas Park	**ROANOKE EARLY ACTION AREA** Botetourt County Roanoke County City of Roanoke City of Salem Town of Vinton
HAMPTON ROADS NONATTAINMENT AREA Gloucester County Isle of Wight County James City County York County City of Chesapeake City of Hampton City of Newport News City of Norfolk City of Poquoson City of Portsmouth City of Suffolk City of Virginia Beach City of Williamsburg	**FREDERICK COUNTY EARLY ACTION AREA** Frederick County City of Winchester
RICHMOND NONATTAINMENT AREA Charles City County Chesterfield County Hanover County Henrico County Prince George County City of Colonial Heights City of Hopewell City of Petersburg City of Richmond	
SHENANDOAH NATIONAL PARK NONATTAINMENT AREA Shenandoah National Park (the portions in Page and Madison Counties)	

$PM_{2.5}$ NONATTAINMENT AREA DESIGNATIONS FOR VIRGINIA		
Arlington County Fairfax County Loudoun County	Prince William County City of Alexandria City of Fairfax	City of Falls Church City of Manassas City of Manassas Park

DATA CAPTURE CRITERIA

Minimum Number of Observations	
3-Hour Average	3 Consecutive Hourly Observations
8-Hour	6 Hourly Observations
24-Hour	18 Hourly Observations
Quarterly Averages ($PM_{2.5}$, PM_{10})	75% of Scheduled Samples
Yearly Averages (Continuous Instruments)	75% of Total Possible Observations
Yearly Averages ($PM_{2.5}$, PM_{10})	Four Complete Quarterly Averages

National Ambient Air Quality Standards

National Ambient Air Quality Standards (NAAQS), published by the Environmental Protection Agency (EPA) in connection with the Clean Air Act and 40 CFR, Part 50, are listed below.

POLLUANT	PRIMARY STANDARD		SECONDARY STANDARD	
	ug / m³	ppm	ug / m³	ppm
CARBON MONOXIDE				
8-hour concentration	10,000[a]	9[a]		
1-hour concentration	40,000[a]	35[a]		
SULFUR DIOXIDE				
Annual arithmetic mean	80	0.03		
24-hour concentration	365[a]	0.14[a]		
3-hour concentration			1300[a]	0.50[a]
NITROGEN DIOXIDE				
Annual arithmetic mean	100	0.053	Same as primary	
OZONE				
8-hour concentration	157[b]	0.08[b]	Same as primary	
1-hour concentration	235	0.12		
LEAD				
Quarterly arithmetic mean	1.5		Same as primary	
PARTICULATE MATTER				
$PM_{2.5}$				
Annual arithmetic mean	15[c]			
24-hour concentration	65[d]			
PM_{10}			Same as primary	
Annual arithmetic mean	50			
24-hour concentration	150			

[a] Not to be exceeded more than once a year

[b] 3-year average of the 4th highest 8-hour concentration may not exceed 0.08 ppm

[c] Based on a 3-year average of annual arithmetic mean $PM_{2.5}$ concentrations

[d] Based on a 3-year average of 98th percentile of 24-hour $PM_{2.5}$ concentrations

DEPARTMENT OF ENVIRONMENTAL QUALITY

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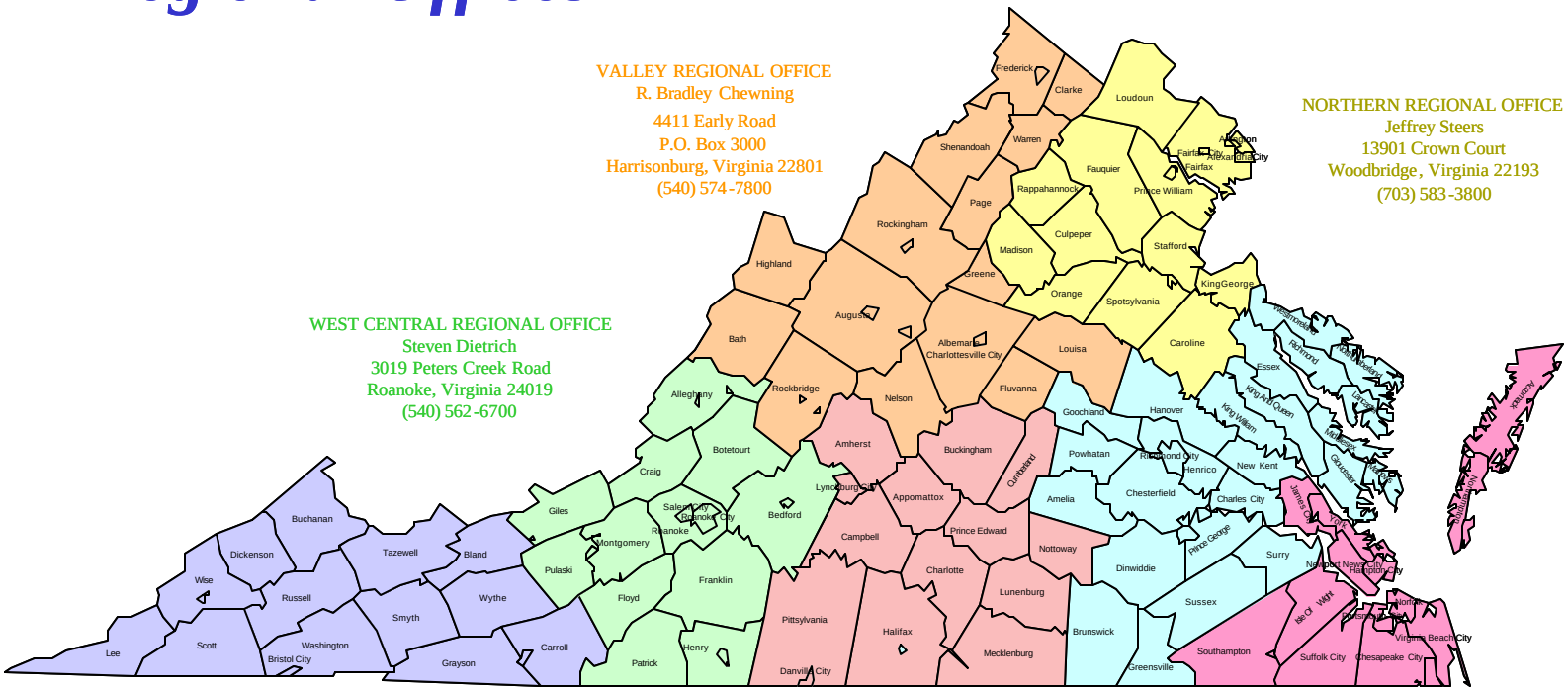

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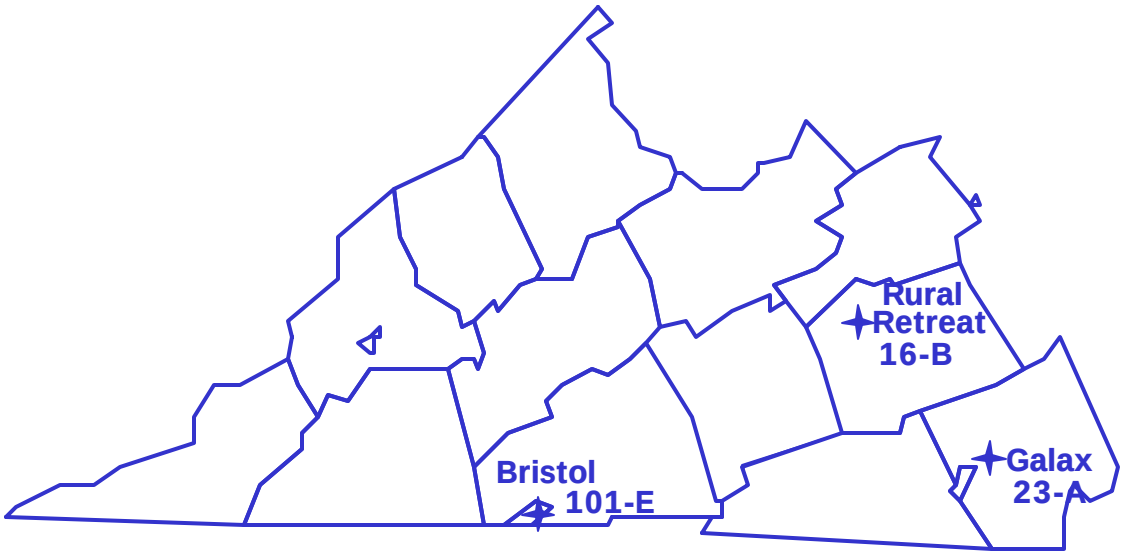
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
AMBIENT AIR MONITORING SITE LIST
2004

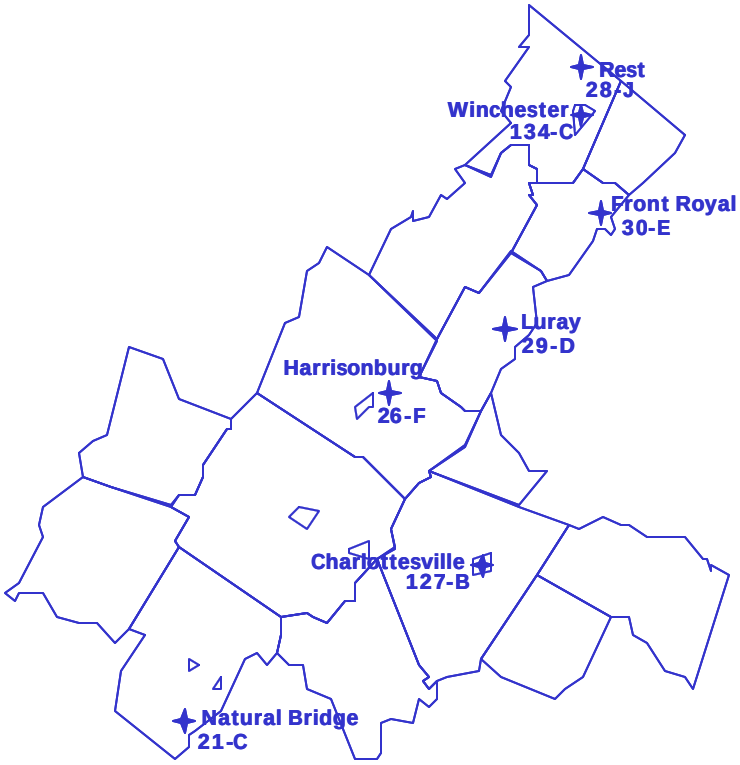
SOUTHWEST MONITORING NETWORK



STATION NUMBER	POLLUT.	SITE TYPE	LOCATION	AIRS NUMBER	CITY/ COUNTY	LAT/ LONG
16-B	O_3	SLAMS	Sewage Disposal Plant	51-197-0002	Rural Retreat Wythe Co.	36° 53' 35" -81° 15' 18"
23-A	PM_{10}	SLAMS	Gladeville Elementary School	51-035-0001	Galax Carroll Co.	36° 42' 09" -80° 52' 48"
101-E	$PM_{2.5}$, Speciation	SLAMS SPM	Highland View Elementary School	51-520-0006	Bristol	36° 36' 28" -82° 09' 52"

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
AMBIENT AIR MONITORING SITE LIST
2004

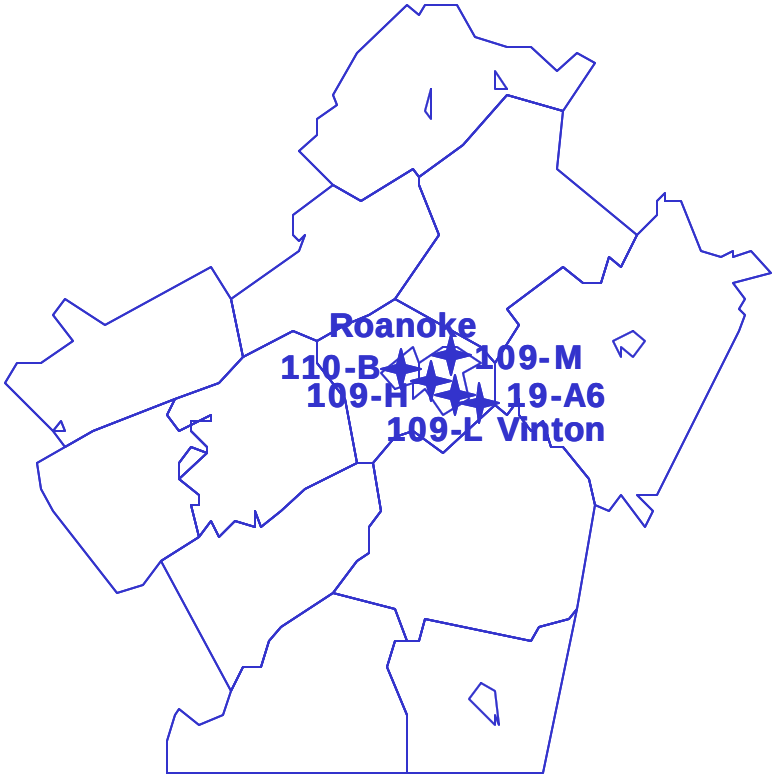
VALLEY MONITORING NETWORK



STATION NUMBER	POLLUT.	SITE TYPE	LOCATION	AIRS NUMBER	CITY/ COUNTY	LAT/ LONG
21-C	O_3, $PM_{2.5}$	SLAMS IMPROVE	Natural Bridge Ranger Station	51-163-0003	Rockbridge Co.	37° 37' 34" -79° 30' 47"
26-F	PM_{10}, SO_2, NO_2	SLAMS	Rockingham VDOT	51-165-0003	Harrisonburg Rockingham Co.	38° 28' 38" -78° 49' 09"
28-J	O_3	SLAMS	Woodbine Road Lester Building Systems	51-069-0010	Rest Frederick Co.	39° 16' 58" -78° 04' 53"
29-D	O_3, $PM_{2.5}$	SLAMS	Luray Caverns Airport	51-139-0004	Luray Page Co.	38° 39' 48" -78° 30' 17"
30-E	PM_{10}	SLAMS	Warren Co. Memorial Hospital 1000 Shenandoah Avenue	51-187-0004	Front Royal Warren Co.	38° 55' 58" -78° 11' 54"
127-B	PM_{10}	SLAMS	City Hall Annex 606 E. Market Street	51-540-0002	Charlottesville	38° 01' 57" -78° 28' 37"
134-C	PM_{10}	SLAMS	Winchester Courts Building	51-840-0002	Winchester	39° 11' 08" -78° 09' 47"

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
AMBIENT AIR MONITORING SITE LIST
2004

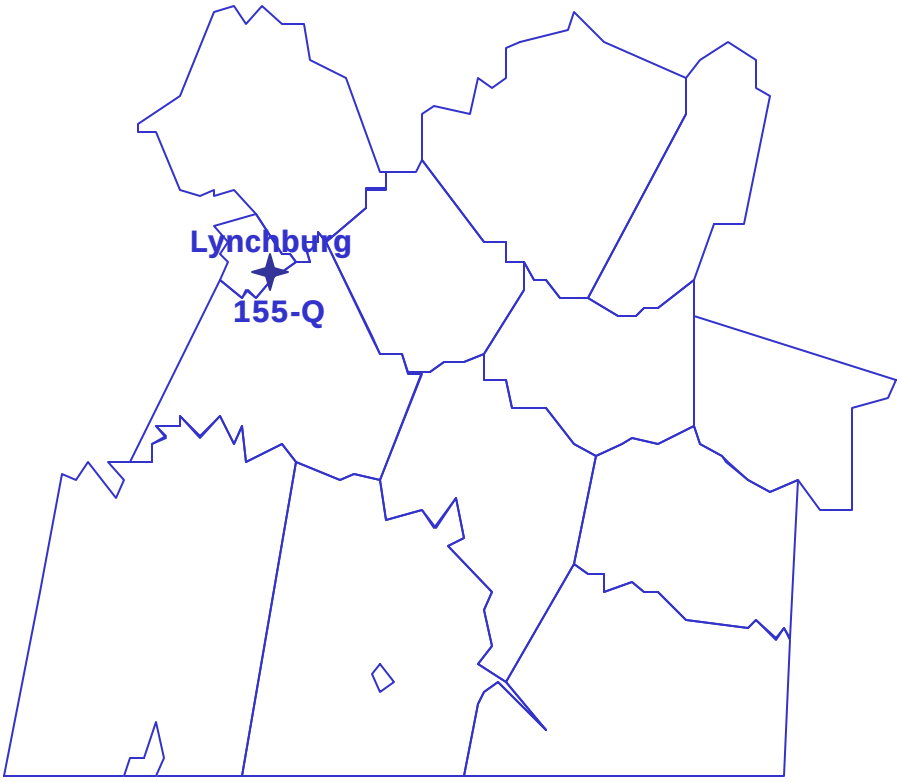
WEST CENTRAL MONITORING NETWORK



STATION NUMBER	POLLUT.	SITE TYPE	LOCATION	AIRS NUMBER	CITY/ COUNTY	LAT/ LONG
19-A6	SO_2, NO_2, O_3	NAMS/ SLAMS	East Vinton Elementary School Ruddell Road	51-161-1004	Vinton Roanoke Co.	37° 17' 08" -79° 53' 03"
109-H	PM_{10}	SLAMS	101 Cherry Hill Circle	51-770-0011	Roanoke	37° 16' 33" -79° 59' 58"
109-L	$PM_{2.5}$, Speciation	SLAMS SPM	Raleigh Court Library	51-770-0014	Roanoke	37° 15' 22" -79° 59' 06"
109-M	CO, TEOM	SLAMS	2020 Oakland Blvd.	51-770-0015	Roanoke	37° 17' 48" -79° 57' 20"
110-B	$PM_{2.5}$	SLAMS	Market St. Fire Station	51-775-0010	Salem	37° 17' 31" -80° 03' 25"

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
AMBIENT AIR MONITORING SITE LIST
2004

SOUTH CENTRAL MONITORING NETWORK

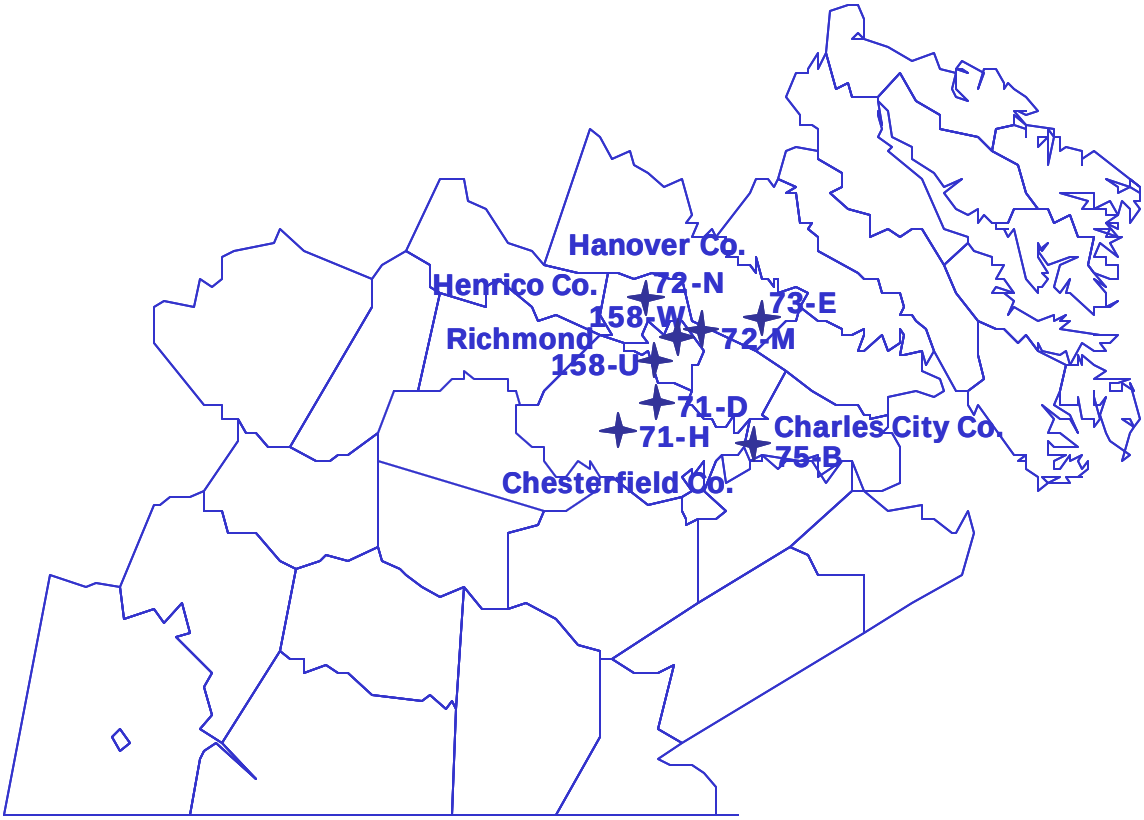


STATION NUMBER	POLLUT.	SITE TYPE	LOCATION	AIRS NUMBER	CITY/ COUNTY	LAT/ LONG
155-Q*	$PM_{2.5}$	SLAMS	Leesville Hwy. & Greystone Dr.	51-680-0015	Lynchburg	37° 33' 18" -79° 21' 45"

* maintained by West Central Region personnel

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
AMBIENT AIR MONITORING SITE LIST
2004

PIEDMONT MONITORING NETWORK



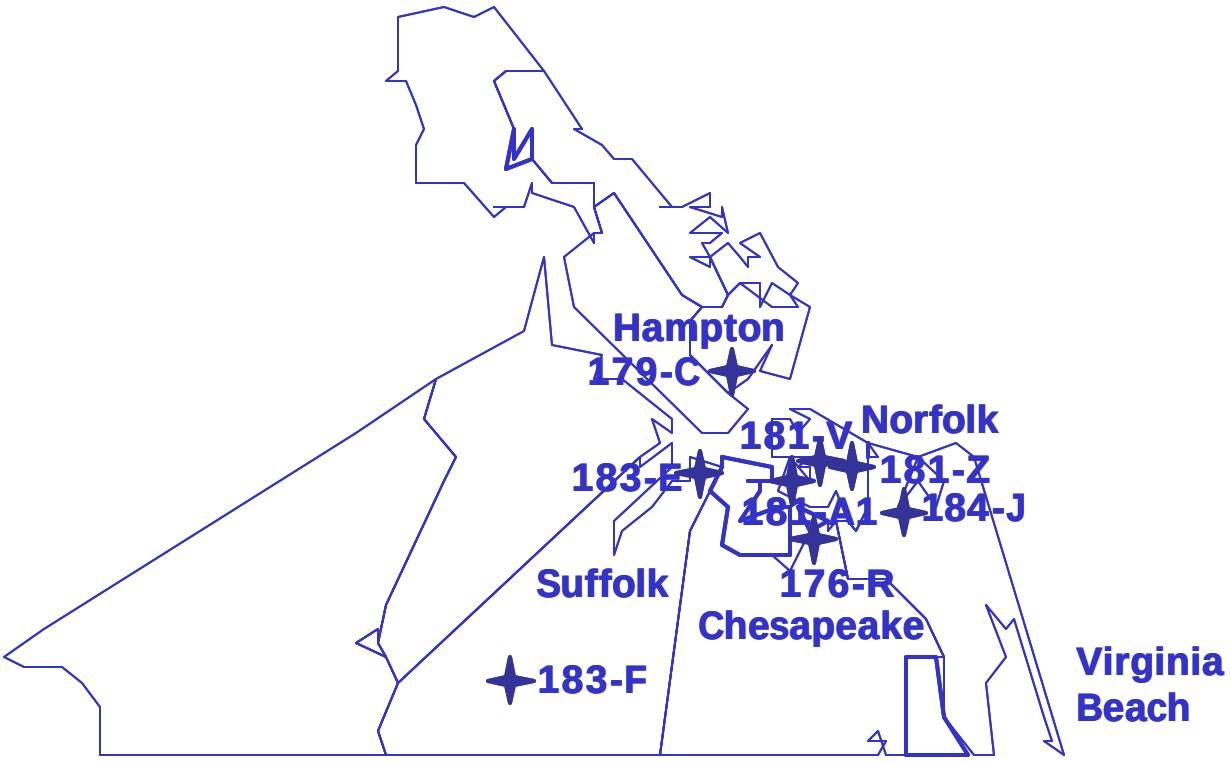
STATION NUMBER	POLLUT.	SITE TYPE	LOCATION	AIRS NUMBER	CITY/ COUNTY	LAT/ LONG
71-D	$PM_{2.5}$	SLAMS	Bensley Armory	51-041-0003	Chesterfield Co.	37° 26' 10" -77° 27' 03"
71-H	O_3	SLAMS	Beach Road Highway Shop	51-041-0004	Chesterfield Co.	37° 21' 32" -77° 35' 37"
72-M	O_3, VOC, $PM_{2.5}$, TEOM	NAMS/ SLAMS	Math and Science Center 2401 Hartman Street	51-087-0014	Henrico Co.	37° 33' 30" -77° 24' 01"
72-N	$PM_{2.5}$	SLAMS	DEQ - Piedmont Regional Office 4949A Cox Road	51-087-0015	Henrico Co.	37° 40' 13" -77° 34' 03"
73-E	O_3	NAMS	McClellan Road	51-085-0003	Hanover Co.	37° 36' 21" -77° 13' 07"

PIEDMONT (Cont.)

STATION NUMBER	POLLUT.	SITE TYPE	LOCATION	AIRS NUMBER	CITY/ COUNTY	LAT/ LONG
75-B	O_3, NO_2, SO_2, $PM_{2.5}$	NAMS/ SLAMS	Charles City County Route 608	51-036-0002	Charles City Co.	37° 20' 31" -77° 15' 39"
158-U	CO	SLAMS	Forest Hill Fire Station 7410 Forest Hill Avenue	51-760-0022	Richmond	37° 32' 22" -77° 31' 58"
158-W	CO, SO_2, NO_2	SLAMS	Science Museum of Virginia DMV and Leigh Street	51-760-0024	Richmond	37° 33' 45" -77° 27' 55"

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
AMBIENT AIR MONITORING SITE LIST
2004

TIDEWATER MONITORING NETWORK



STATION NUMBER	POLLUT.	SITE TYPE	LOCATION	AIRS NUMBER	CITY/ COUNTY	LAT/ LONG
176-R	PM_{10}	NAMS	Oscar Smith Middle School Stadium 2500 Rodgers Street	51-550-0012	Chesapeake	36° 48' 14" -76° 16' 21"
179-C	PM_{10}, CO, SO_2, O_3 $PM_{2.5}$ TEOM	NAMS/ SLAMS	Virginia School for the Deaf & Blind 700 Shell Road	51-650-0004	Hampton	37° 00' 12" -76° 23' 57"
181-A1	PM_{10}, $PM_{2.5}$, Toxics	SLAMS	NOAA Property 2nd and Woodis Avenue	51-710-0024	Norfolk	36° 51' 28" -76° 18' 06"
181-V	CO	NAMS	Post Office 600 Church Street	51-710-0019	Norfolk	36° 51' 12" -76° 16' 43"

TIDEWATER (Cont.)

STATION NUMBER	POLLUT.	SITE TYPE	LOCATION	AIRS NUMBER	CITY/ COUNTY	LAT/ LONG
181-Z	CO, SO_2, NO_2	NAMS/ SLAMS	Norfolk State University	51-710-0023	Norfolk	36° 51' 01" -76° 15' 28"
183-E	O_3	NAMS	Tidewater Community College Frederick Campus	51-800-0004	Suffolk	36° 54' 12" -76° 26' 19"
183-F	O_3	NAMS	Tidewater Research Station Route 610	51-800-0005	Suffolk	36° 40' 03" -76° 43' 53"
184-J	$PM_{2.5}$	SLAMS	DEQ - Tidewater Regional Office 5636 Southern Blvd.	51-810-0008	Va. Beach	36° 50' 28" -76° 10' 53"

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
AMBIENT AIR MONITORING SITE LIST
2004

NORTHERN VA. MONITORING NETWORK

STATION NUMBER	POLLUT.	SITE TYPE	LOCATION	AIRS NUMBER	CITY/ COUNTY	LAT/ LONG
37-B	O_3	SLAMS	Phelps Wildlife Area Route 651	51-061-0002	Sumerduck Fauquier Co.	38° 28' 30" -77° 46' 04"
38-I	NO_2, O_3, $PM_{2.5}$	SLAMS	Broad Run High School Route 641	51-107-1005	Ashburn Loudoun Co.	39° 01' 28" -77° 29' 24"
42-B	PM_{10}	SLAMS	Farmington Elementary School Sunset Lane	51-047-0002	Culpeper Culpeper Co.	38° 27' 26" -78° 00' 40"
44-A	O_3	SLAMS	Widewater Elementary School Den Rich Road	51-179-0001	Widewater Stafford Co.	38° 28' 59" -77° 22' 13"

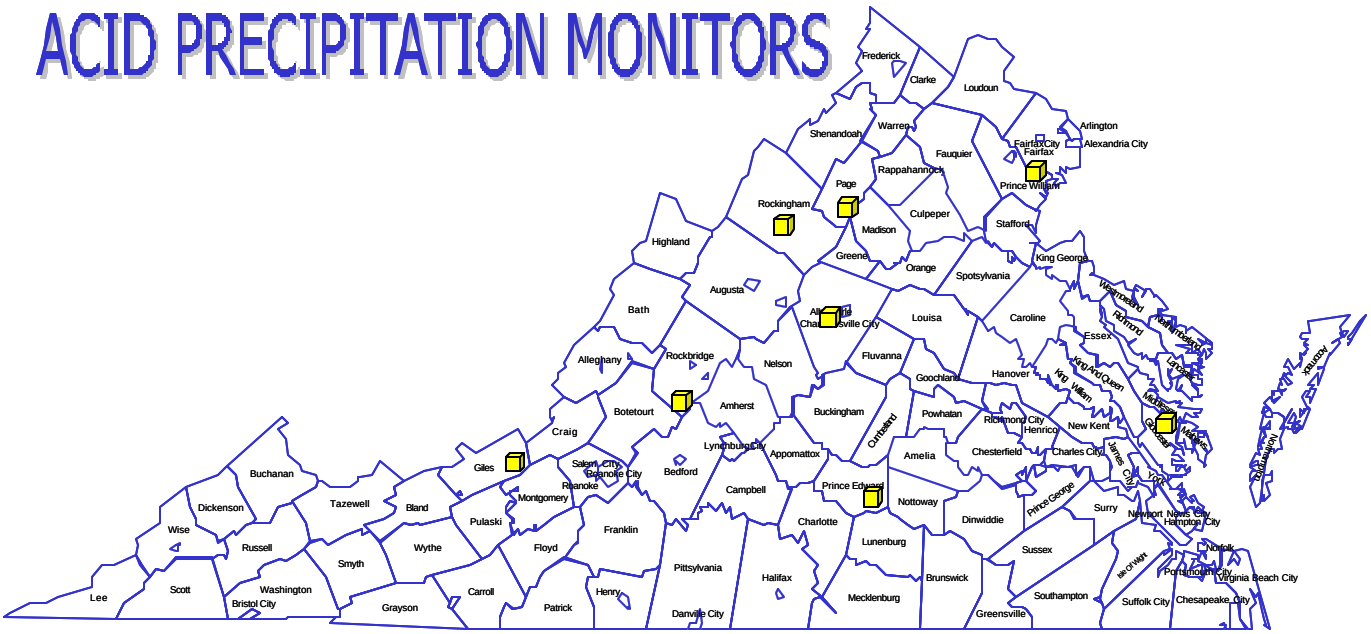
NORTHERN VA. (Cont.)

STATION NUMBER	POLLUT.	SITE TYPE	LOCATION	AIRS NUMBER	CITY/ COUNTY	LAT/ LONG
45-A	PM_{10}	SLAMS	Manassas Health Department 9301 Lee Avenue	51-153-0001	Manassas Prince William Co.	38° 45' 11" -77° 28' 39"
45-L	O_3, NO_2	SLAMS	Long Park Route 15	51-153-0009	Prince William Co.	38° 51' 19" -77° 38' 08"
46-B9	PAMS, O_3, CO, $PM_{2.5}$	PAMS	Lee District Park Telegraph Road	51-059-0030	Franconia Fairfax Co.	38° 46' 22" -77° 06' 20"
47-T	CO, NO_2, O_3, $PM_{2.5}$	SLAMS	Aurora Hills Visitors Center 18th and Hayes Streets	51-013-0020	Arlington Co.	38° 51' 27" -77° 03' 33"
48-A	O_3, NO_2, NO_Y, VOC	PAMS	U.S.G.S. Geomagnetic Center	51-033-0001	Corbin Caroline Co.	38° 12' 11" -77° 22' 38"
130-E	PM_{10}	SLAMS	Hugh Mercer Elementary School 2100 Cowan Boulevard	51-630-0004	Fredericksburg	38° 18' 17" -77° 29' 11"
L-46-A8	CO, SO_2, NO_2, O_3, $PM_{2.5}$	SLAMS	McLean Governmental Center 1437 Balls Hill Road	51-059-5001	McLean Fairfax Co.	38° 55' 55" -77° 11' 56"
L-46-B3	PM_{10}, O_3	SLAMS	Mt. Vernon Fire Station 2675 Sherwood Hall Lane	51-059-0018	Mount Vernon Fairfax Co.	38° 44' 33" -77° 04' 39"
L-46-F	CO, SO_2, NO_2, O_3, PM_{10}	SLAMS	Upper Cub Run Drive	51-059-0005	Chantilly Fairfax Co.	38° 53' 38" -77° 27' 55"
L-46-Z	PM_{10}	NAMS	Doctor's Exchange 6120 Brandon Avenue	51-059-3002	Springfield Fairfax Co.	38° 47' 01" -77° 10' 57"
L-46-C1	CO, SO_2, NO_2, O_3, $PM_{2.5}$, TEOM	SLAMS	Mason Governmental Center 6507 Columbia Pike	51-059-1005	Annandale Fairfax Co.	38° 50' 15" -77° 09' 47"
L-126-C	CO, SO_2, NO_2, O_3	NAMS/ SLAMS	Alexandria Health Department 517 North Saint Asaph Street	51-510-0009	Alexandria	38° 48' 38" -77° 02' 40
N-35-A	O_3,SO_2 $PM_{2.5}$, TEOM	Non-EPA Fed. IMPROVE	Big Meadows, National Park Service	51-113-0003	Madison Co.	38° 31' 19" -78° 26' 10"

TABLE OF THE NUMBER OF CRITERIA POLLUTANT MONITORING SITES NAMS/SLAMS 2004

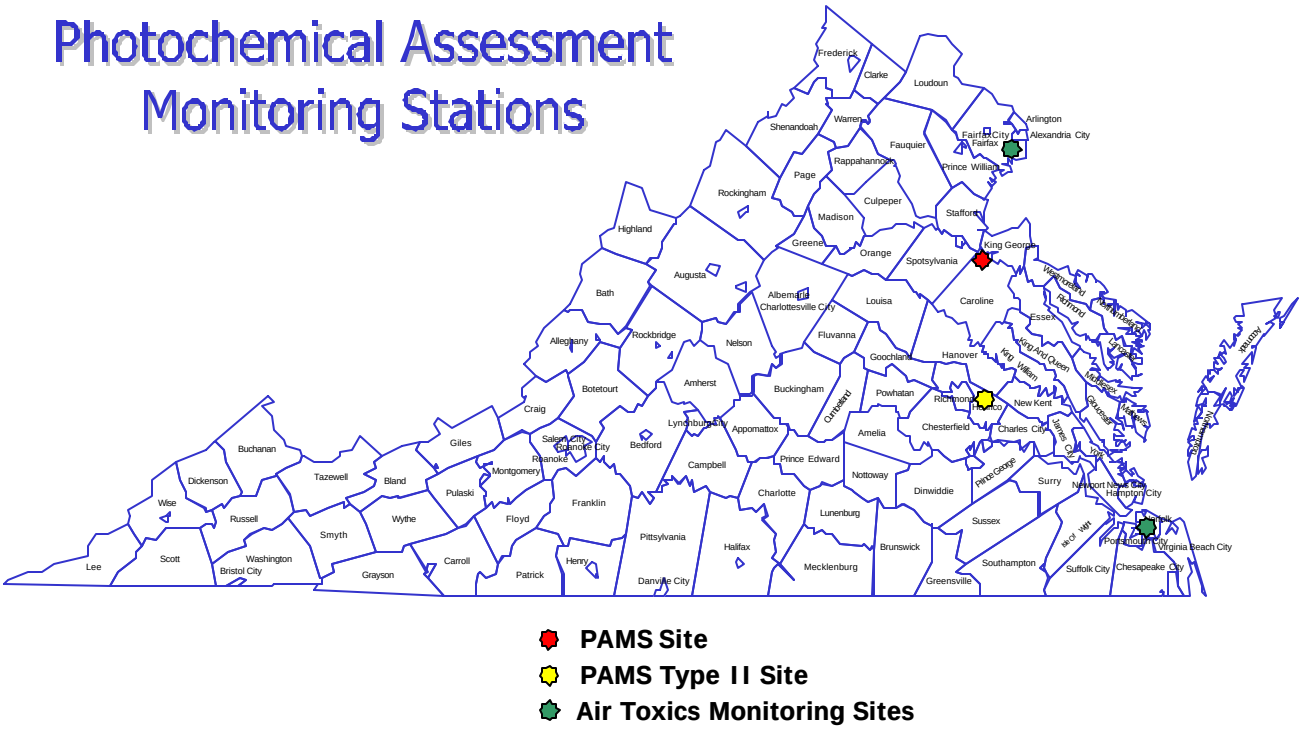
REGION	$PM_{2.5}$	PM_{10}	CO	SO_2	NO_2	O_3	TOTAL
Southwest	1	1	---	---	---	1	3
Valley	1	4	---	1	1	3	10
West Central	2	1	1	1	1	1	7
South Central	1	---	---	---	---	---	1
Piedmont	4	1	2	2	2	4	15
Tidewater	3	3	3	2	1	3	15
*Northern	5	6	6	4	8	12	41
TOTAL	**17**	**16**	**12**	**10**	**13**	**24**	**92**

* This includes sites operated by the DEQ, Fairfax Co., and Alexandria



The Virginia Department of Environmental Quality sponsored three NADP sites in 2004: Harcum in Gloucester County, Natural Bridge Station in Rockbridge County, and Mason Neck in Fairfax County.

The NADP now has eight monitoring sites in Virginia: Big Meadows (Shenandoah National Park), Hortons Station (Giles County), Charlottesville, Prince Edward County, Harcum (Gloucester County), Harrisonburg (Rockingham County), Natural Bridge Station (Rockbridge County), and Mason Neck (Fairfax County). National Acid Deposition Program site information and data are available on-line at **http://nadp.sws.uiuc.edu**.



In 2004, the Air Quality Monitoring (AQM) program of the Department of Environmental Quality operated two Photochemical Assessment Monitoring stations (PAMS) at Corbin in Caroline County, and the Mathematics and Science Center in Henrico County. Additionally, 24-hour PAMS Volatile Organic Compounds (VOC) samples were collected from two core Air Toxics Monitoring Network (ATMN) sites located on the property of the National Oceanic and Atmospheric Administration (NOAA) in Norfolk, and Lee District Park in Fairfax County, using a one in six day sampling schedule.

Corbin was operated all year as a PAMS Type I site, collecting one 24-hour VOC sample every six days (a Type I site measures upwind background ozone precursor concentrations). In addition, episodic sampling was conducted on days forecasted to be high ozone alert days for the Washington-Baltimore area in the summer.

The Math and Science Center monitoring station was operated as a revised PAMS Type II site during the 2004 season, collecting one 24-hour VOC canister sample and one 24-hour Carbonyl canister sample every six days all year (a Type II site measures maximum ozone precursor concentrations in the primary downwind direction on days conducive to ozone formation). In addition, hourly samples were collected using an Auto Gas Chromatograph, and 3-hour Carbonyl samples were collected every third day from June through August.

AQM used the manual method for collecting ambient air samples. This method involves the collection of integrated, whole air samples by using evacuated Summa^{T} canisters and RMESI air samplers. Each VOC sample from Corbin was analyzed by the Division of Consolidated Laboratory Services using a Gas Chromatograph/Flame Ionization Detector. Samples from Math and Science Center, Lee District Park, and NOAA were analyzed by the Maryland Department of the Environment, Air and Radiation Management Administration, using a Gas Chromatograph/Flame Ionization Detector.

All VOC samples were analyzed for the presence of fifty-five target volatile organic precursors, and the measured concentration of Total Nonmethane Organic Compounds (TNMOC).

Detailed PAMS data are available upon written request to the Virginia Department of Environmental Quality, Office of Air Quality Monitoring.

2004 AVERAGE CONCENTRATION OF DETECTABLE VOLATILE OZONE PRECURSORS
PHOTOCHEMICAL ASSESSMENT MONITORING STATION (PAMS) TYPE I - Corbin, VA
Concentrations are in ppbC

Parameter	Compound Name	#N	Minimum	Maximum	Median	Average	StDev
43203	Ethylene	58	0.13	3.42	1.25	1.42	0.91
43206	Acetylene	58	0.03	19.75	1.54	2.37	3.47
43202	Ethane	58	0.03	33.60	4.47	5.81	6.75
43205	Propylene	58	0.08	5.40	0.55	0.70	0.73
43204	Propane	58	0.13	8.59	3.36	3.67	2.17
43214	Isobutane	58	0.00	2.39	0.87	0.92	0.64
43280	1-butene	58	0.05	2.79	0.53	0.71	0.62
43212	n-butane	58	0.05	6.30	2.41	2.57	1.44
43216	t-2-butene	58	0.00	6.26	0.18	0.69	1.18
43217	c-2-butene	58	0.00	3.11	0.17	0.42	0.69
43221	Isopentane	58	0.29	15.54	1.83	2.82	3.03
43224	1-pentene	58	0.05	16.58	0.56	2.10	3.68
43220	n-pentane	58	0.05	4.06	0.94	1.07	0.79
43243	Isoprene	58	0.02	16.10	0.30	1.51	3.12
43226	t-2-pentene	58	0.00	7.55	0.16	1.03	1.83
43227	c-2-pentene	58	0.00	10.54	0.16	0.43	1.39
43244	2,2-dimethylbutane	58	0.01	1.80	0.18	0.25	0.28
43242	Cyclopentane	58	0.05	1.51	0.14	0.22	0.31
43284	2,3-dimethylbutane	58	0.05	2.39	0.33	0.53	0.54
43285	2-methylpentane	58	0.11	3.44	1.23	1.45	0.90
43230	3-methylpentane	58	0.00	2.36	0.46	0.63	0.47
43246	1-hexene	58	0.05	1.30	0.19	0.24	0.21
43231	n-hexane	58	0.05	1.45	0.56	0.52	0.30
43262	Methylcyclopentane	58	0.00	1.25	0.24	0.27	0.20
43247	2,4-dimethylpentane	58	0.01	1.04	0.18	0.22	0.18
45201	Benzene	58	0.03	2.38	1.11	1.03	0.59
43248	Cyclohexane	58	0.04	1.90	0.21	0.27	0.32
43263	2-methylhexane	58	0.05	1.97	0.47	0.48	0.38
43291	2,3-dimethylpentane	58	0.04	1.97	0.26	0.37	0.39
43249	3-methylhexane	58	0.04	3.18	1.03	0.97	0.70
43250	224-trimethylpentane	58	0.04	1.12	0.35	0.40	0.28
43232	n-heptane	58	0.02	2.62	0.26	0.33	0.39
43261	Methylcyclohexane	58	0.05	1.17	0.27	0.32	0.22
43252	234-trimethylpentane	58	0.05	1.85	0.23	0.31	0.31
45202	Toluene	58	0.11	4.48	1.55	1.60	0.86
43960	2-methylheptane	58	0.05	1.42	0.34	0.38	0.28
43253	3-methylheptane	58	0.05	3.26	0.52	0.90	0.88
43233	n-octane	58	0.05	4.70	0.22	0.33	0.62

2004 AVERAGE CONCENTRATION OF DETECTABLE VOLATILE OZONE PRECURSORS
PHOTOCHEMICAL ASSESSMENT MONITORING STATION (PAMS) TYPE I - Corbin, VA (cont.)
Concentrations are in ppbC

Parameter	Compound Name	#N	Minimum	Maximum	Median	Average	StDev
45203	Ethylbenzene	58	0.05	1.43	0.28	0.36	0.26
45109	m/p-xylene	58	0.05	3.56	0.61	0.73	0.61
45220	Styrene	58	0.08	2.81	0.77	0.88	0.69
45204	o-xylene	58	0.03	2.24	0.27	0.35	0.38
43235	n-nonane	58	0.00	5.67	0.18	0.33	0.77
45210	Isopropylbenzene	58	0.00	1.44	0.13	0.17	0.20
45209	n-propylbenzene	58	0.05	2.36	0.22	0.31	0.40
45212	m-ethyltoluene	58	0.05	2.00	0.37	0.46	0.36
45213	p-ethyltoluene	58	0.05	1.27	0.15	0.21	0.22
45207	135-trimethylbenzene	58	0.00	2.88	0.23	0.44	0.54
45211	o-ethyltoluene	58	0.00	3.27	0.45	0.71	0.80
45208	124-trimethylbenzene	58	0.05	7.04	0.32	0.63	1.08
43238	n-decane	58	0.00	6.76	0.20	0.44	0.94
45225	123-trimethylbenzene	58	0.00	0.95	0.21	0.21	0.18
45218	m-diethylbenzene	58	0.00	1.70	0.35	0.40	0.37
45219	p-diethylbenzene	58	0.00	1.15	0.22	0.27	0.26
43954	n-undecane	58	0.00	4.87	0.31	0.51	0.72
43141	n-dodecane	58	0.00	8.60	0.13	0.45	1.22
43000	**PAMHC**	58	8.79	99.82	44.77	48.07	18.94
43102	**TNMOC**	58	10.56	193.53	74.34	77.43	32.32

2004 AVERAGE CONCENTRATION OF DETECTABLE VOLATILE OZONE PRECURSORS PHOTOCHEMICAL ASSESSMENT MONITORING STATION (PAMS) TYPE II - Math & Science Center

Concentrations are in ppbC

Parameter	Compound Name	#N	Minimum	Maximum	Median	Average	StDev
43203	Ethylene	58	0.10	19.70	2.26	3.20	2.84
43206	Acetylene	58	0.10	15.12	2.27	2.84	2.22
43202	Ethane	58	2.10	43.34	6.64	8.24	6.24
43205	Propylene	58	0.10	7.96	1.07	1.34	1.11
43204	Propane	58	0.10	37.87	6.36	7.26	5.38
43214	Isobutane	58	0.10	11.58	1.75	2.17	1.70
43280	1-butene	58	0.01	3.76	1.12	1.21	0.61
43212	n-butane	58	0.10	33.65	3.79	5.10	5.00
43216	t-2-butene	58	0.05	1.28	0.15	0.18	0.17
43217	c-2-butene	58	0.06	1.23	0.19	0.23	0.17
43221	Isopentane	58	0.10	28.68	4.57	5.69	4.50
43224	1-pentene	58	0.10	6.74	0.36	0.47	0.84
43220	n-pentane	58	0.10	10.49	1.93	2.20	1.51
43243	Isoprene	58	0.10	19.52	2.59	5.77	6.13
43226	t-2-pentene	58	0.10	3.08	0.39	0.47	0.42
43227	c-2-pentene	58	0.05	2.58	0.21	0.36	0.43
43244	2,2-dimethylbutane	58	0.07	2.60	0.36	0.41	0.35
43242	Cyclopentane	58	0.06	1.67	0.32	0.36	0.23
43284	2,3-dimethylbutane	58	0.06	3.26	0.54	0.59	0.45
43285	2-methylpentane	58	0.10	9.54	1.32	1.61	1.39
43230	3-methylpentane	58	0.10	7.85	1.31	1.44	1.09
43245	1-hexene	58	0.05	0.69	0.21	0.24	0.13
43231	n-hexane	58	0.10	6.74	1.00	1.18	0.96
43262	Methylcyclopentane	58	0.10	4.53	0.71	0.81	0.65
43247	2,4-dimethylpentane	58	0.08	2.01	0.29	0.35	0.28
45201	Benzene	58	0.10	7.61	1.58	1.79	1.06
43248	Cyclohexane	58	0.06	1.38	0.29	0.31	0.21
43263	2-methylhexane	58	0.10	3.91	0.53	0.67	0.57
43291	2,3-dimethylpentane	58	0.06	1.92	0.37	0.38	0.27
43249	3-methylhexane	58	0.10	4.59	0.64	0.77	0.64
43250	224-trimethylpentane	58	0.10	6.87	1.05	1.29	1.04
43232	n-heptane	58	0.08	3.54	0.52	0.61	0.49
43261	Methylcyclohexane	58	0.05	2.17	0.35	0.40	0.30
43252	234-trimethylpentane	58	0.07	3.23	0.43	0.53	0.47
45202	Toluene	58	0.10	19.44	3.10	4.00	3.02
43960	2-methylheptane	58	0.06	1.72	0.25	0.30	0.23
43253	3-methylheptane	58	0.10	1.75	0.35	0.38	0.23
43233	n-octane	58	0.08	2.14	0.34	0.40	0.30
45203	Ethylbenzene	58	0.08	4.09	0.57	0.72	0.61
45109	m/p-xylene	58	0.01	11.03	1.59	2.00	1.66
45220	Styrene	58	0.08	1.27	0.28	0.31	0.20

2004 AVERAGE CONCENTRATION OF DETECTABLE VOLATILE OZONE PRECURSORS PHOTOCHEMICAL ASSESSMENT MONITORING STATION (PAMS) TYPE II - Math & Science Center (cont.)

Concentrations are in ppbC

Parameter	Compound Name	#N	Minimum	Maximum	Median	Average	StDev
45204	o-xylene	58	0.10	4.63	0.62	0.77	0.66
43235	n-nonane	58	0.08	2.21	0.32	0.50	0.50
45210	Isopropylbenzene	58	0.05	0.58	0.09	0.11	0.08
45209	n-propylbenzene	58	0.07	1.29	0.21	0.25	0.17
45212	m-ethyltoluene	58	0.10	4.28	0.70	0.83	0.61
45213	p-ethyltoluene	58	0.10	2.03	0.49	0.54	0.29
45207	135-trimethylbenzene	58	0.05	2.19	0.29	0.36	0.30
45211	o-ethyltoluene	58	0.05	2.05	0.43	0.53	0.37
45208	124-trimethylbenzene	58	0.10	5.90	0.83	1.00	0.81
43238	n-decane	58	0.10	2.64	0.51	0.58	0.40
45225	123-trimethylbenzene	58	0.09	1.52	0.29	0.34	0.26
45218	m-diethylbenzene	58	0.06	0.67	0.18	0.19	0.11
45219	p-diethylbenzene	58	0.05	0.53	0.15	0.17	0.09
43954	n-undecane	58	0.10	1.88	0.48	0.50	0.28
43141	n-dodecane	58	0.08	4.53	0.37	0.71	0.83
43000	**PAMHC**	58	19.30	375.13	66.91	76.25	49.82
43102	**TNMOC**	58	0.01	555.86	157.17	158.60	72.05

2004 AVERAGE CONCENTRATION OF DETECTABLE VOLATILE OZONE PRECURSORS PHOTOCHEMICAL ASSESSMENT MONITORING STATION (PAMS) Reduced TYPE IIA -
Lee District Park
Concentrations are in ppbC

Parameter	Compound Name	#N	Minimum	Maximum	Median	Average	StDev
43203	Ethylene	53	0.71	8.87	1.70	2.26	1.46
43206	Acetylene	53	0.47	7.89	1.85	2.18	1.35
43202	Ethane	53	2.17	18.13	5.83	6.66	3.25
43205	Propylene	53	0.35	3.88	0.72	0.95	0.63
43204	Propane	53	1.39	18.10	3.94	5.09	3.06
43214	Isobutane	53	0.36	5.93	1.32	1.55	1.03
43280	1-butene	53	0.16	1.91	0.56	0.68	0.41
43212	n-butane	53	0.55	15.75	2.54	3.57	2.83
43216	t-2-butene	53	0.05	0.45	0.09	0.12	0.07
43217	c-2-butene	53	0.06	0.48	0.13	0.15	0.09
43221	Isopentane	53	0.96	7.99	2.39	3.10	1.78
43224	1-pentene	53	0.11	0.65	0.30	0.32	0.10
43220	n-pentane	53	0.43	4.49	1.45	1.55	0.72
43243	Isoprene	53	0.07	10.27	0.34	2.07	3.02
43226	t-2-pentene	53	0.06	0.55	0.15	0.17	0.10
43227	c-2-pentene	53	0.04	0.62	0.13	0.19	0.14
43244	2,2-dimethylbutane	53	0.10	0.55	0.21	0.24	0.11
43242	Cyclopentane	53	0.07	0.63	0.24	0.23	0.11
43284	2,3-dimethylbutane	53	0.11	0.81	0.39	0.39	0.17
43285	2-methylpentane	53	0.35	2.60	0.76	0.93	0.50
43230	3-methylpentane	53	0.21	1.84	0.62	0.69	0.33
43245	1-hexene	53	0.05	0.43	0.14	0.18	0.10
43231	n-hexane	53	0.26	2.48	0.63	0.78	0.44
43262	Methylcyclopentane	53	0.18	1.42	0.42	0.49	0.23
43247	2,4-dimethylpentane	53	0.05	0.49	0.19	0.20	0.10
45201	Benzene	53	0.48	4.16	1.27	1.43	0.65
43248	Cyclohexane	53	0.08	0.63	0.20	0.21	0.10
43263	2-methylhexane	53	0.14	1.11	0.34	0.41	0.22
43291	2,3-dimethylpentane	53	0.09	0.59	0.22	0.24	0.11
43249	3-methylhexane	53	0.16	1.32	0.48	0.52	0.24
43250	224-trimethylpentane	53	0.23	1.74	0.64	0.74	0.38
43232	n-heptane	53	0.15	1.12	0.34	0.39	0.20
43261	Methylcyclohexane	53	0.11	0.82	0.25	0.28	0.15
43252	234-trimethylpentane	53	0.08	0.75	0.28	0.32	0.16
45202	Toluene	53	0.90	7.59	2.03	2.54	1.39
43960	2-methylheptane	53	0.05	0.50	0.16	0.18	0.09
43253	3-methylheptane	53	0.08	0.55	0.21	0.23	0.10
43233	n-octane	53	0.07	0.96	0.25	0.29	0.18
45203	Ethylbenzene	53	0.19	1.40	0.40	0.48	0.25
45109	m/p-xylene	53	0.56	4.04	1.06	1.35	0.74

2004 AVERAGE CONCENTRATION OF DETECTABLE VOLATILE OZONE PRECURSORS PHOTOCHEMICAL ASSESSMENT MONITORING STATION (PAMS) Reduced TYPE IIA -
Lee District Park (cont.)
Concentrations are in ppbC

Parameter	Compound Name	#N	Minimum	Maximum	Median	Average	StDev
45220	Styrene	53	0.05	0.48	0.19	0.20	0.09
45204	o-xylene	53	0.22	1.44	0.42	0.52	0.27
43235	n-nonane	53	0.05	0.66	0.21	0.24	0.15
45210	Isopropylbenzene	53	0.03	0.30	0.06	0.08	0.05
45209	n-propylbenzene	53	0.05	0.36	0.15	0.16	0.07
45212	m-ethyltoluene	53	0.21	1.35	0.44	0.54	0.27
45213	p-ethyltoluene	53	0.11	0.72	0.33	0.36	0.14
45207	135-trimethylbenzene	53	0.05	0.57	0.19	0.22	0.12
45211	o-ethyltoluene	53	0.10	0.67	0.30	0.31	0.15
45208	124-trimethylbenzene	53	0.25	1.82	0.54	0.66	0.36
43238	n-decane	53	0.13	0.92	0.34	0.40	0.19
45225	123-trimethylbenzene	53	0.05	0.52	0.23	0.26	0.14
45218	m-diethylbenzene	53	0.03	0.38	0.10	0.12	0.07
45219	p-diethylbenzene	53	0.03	0.30	0.09	0.10	0.05
43954	n-undecane	53	0.09	0.79	0.27	0.32	0.15
43141	n-dodecane	53	0.04	0.44	0.20	0.22	0.10
43102	**PAMHC**	53	17.76	141.69	43.59	48.93	22.42
43000	**TNMOC**	53	40.89	188.10	82.92	87.64	29.76

2004 AVERAGE CONCENTRATION OF DETECTABLE VOLATILE OZONE PRECURSORS
PHOTOCHEMICAL ASSESSMENT MONITORING STATION ADDITIONAL VOC PAMS Sampling -
National Oceanic and Atmospheric Administration (NOAA) Site

Concentrations are in ppbC

Parameter	Compound Name	#N	Minimum	Maximum	Median	Average	StDev
43203	Ethylene	56	0.93	11.22	2.52	2.84	1.85
43206	Acetylene	56	0.75	7.26	2.28	2.57	1.29
43202	Ethane	56	1.54	18.75	6.40	6.46	3.23
43205	Propylene	56	0.50	4.73	1.09	1.25	0.75
43204	Propane	56	1.27	32.10	4.78	5.89	4.58
43214	Isobutane	56	0.50	10.10	1.58	2.24	2.09
43280	1-butene	56	0.14	4.29	0.80	1.00	0.73
43212	n-butane	56	0.57	81.65	3.38	5.26	10.93
43216	t-2-butene	56	0.05	1.06	0.14	0.19	0.17
43217	c-2-butene	56	0.06	1.60	0.18	0.23	0.23
43221	Isopentane	56	1.69	19.97	3.52	5.08	4.30
43224	1-pentene	56	0.16	1.42	0.37	0.41	0.19
43220	n-pentane	56	0.71	9.67	1.72	2.09	1.43
43243	Isoprene	56	0.09	3.02	0.59	0.77	0.65
43226	t-2-pentene	56	0.11	1.29	0.27	0.32	0.24
43227	c-2-pentene	56	0.07	1.94	0.20	0.37	0.41
43244	2,2-dimethylbutane	56	0.10	1.69	0.30	0.37	0.26
43242	Cyclopentane	56	0.12	0.88	0.25	0.29	0.16
43284	2,3-dimethylbutane	56	0.13	2.23	0.46	0.51	0.33
43285	2-methylpentane	56	0.45	4.58	1.08	1.30	0.78
43230	3-methylpentane	56	0.34	3.04	0.85	0.98	0.55
43245	1-hexene	56	0.06	0.65	0.24	0.27	0.16
43231	n-hexane	56	0.38	5.66	0.91	1.20	0.87
43262	Methylcyclopentane	56	0.27	2.42	0.64	0.74	0.43
43247	2,4-dimethylpentane	56	0.07	1.64	0.24	0.28	0.25
45201	Benzene	56	0.51	4.98	1.47	1.60	0.76
43248	Cyclohexane	56	0.08	1.72	0.27	0.31	0.23
43263	2-methylhexane	56	0.16	1.93	0.49	0.56	0.33
43291	2,3-dimethylpentane	56	0.08	2.11	0.28	0.33	0.28
43249	3-methylhexane	56	0.23	2.31	0.64	0.73	0.39
43250	224-trimethylpentane	56	0.32	2.92	0.80	0.94	0.52
43232	n-heptane	56	0.17	1.78	0.48	0.53	0.30
43261	Methylcyclohexane	56	0.09	1.33	0.32	0.37	0.22
43252	234-trimethylpentane	56	0.11	1.30	0.33	0.38	0.23
45202	Toluene	56	1.20	45.82	2.70	4.34	6.59
43960	2-methylheptane	56	0.09	1.08	0.23	0.28	0.19
43253	3-methylheptane	56	0.09	1.10	0.29	0.33	0.19
43233	n-octane	56	0.12	1.23	0.36	0.40	0.23
45203	Ethylbenzene	56	0.27	3.71	0.59	0.77	0.57
45109	m/p-xylene	56	0.72	11.20	1.65	2.20	1.72
45220	Styrene	56	0.07	1.60	0.25	0.28	0.22
45204	o-xylene	56	0.30	4.22	0.63	0.83	0.64

2004 AVERAGE CONCENTRATION OF DETECTABLE VOLATILE OZONE PRECURSORS PHOTOCHEMICAL ASSESSMENT MONITORING STATION ADDITIONAL VOC PAMS Sampling - National Oceanic and Atmospheric Administration (NOAA) Site (cont.)

Concentrations are in ppbC

Parameter	Compound Name	#N	Minimum	Maximum	Median	Average	StDev
43235	n-nonane	56	0.08	1.58	0.34	0.45	0.36
45210	Isopropylbenzene	56	0.01	1.38	0.08	0.12	0.19
45209	n-propylbenzene	56	0.07	1.27	0.22	0.29	0.24
45212	m-ethyltoluene	56	0.23	4.17	0.78	0.92	0.64
45213	p-ethyltoluene	56	0.21	2.13	0.48	0.55	0.36
45207	135-trimethylbenzene	56	0.12	2.30	0.31	0.42	0.36
45211	o-ethyltoluene	56	0.16	1.87	0.40	0.48	0.32
45208	124-trimethylbenzene	56	0.39	5.69	0.97	1.23	0.91
43238	n-decane	56	0.18	1.72	0.50	0.57	0.33
45225	123-trimethylbenzene	56	0.10	2.93	0.45	0.56	0.45
45218	m-diethylbenzene	56	0.04	1.58	0.15	0.20	0.22
45219	p-diethylbenzene	56	0.07	1.14	0.14	0.18	0.16
43954	n-undecane	56	0.17	1.81	0.44	0.50	0.30
43141	n-dodecane	56	0.09	1.53	0.29	0.37	0.30
43102	**PAMHC**	56	23.62	209.54	52.94	64.92	39.46
43000	**TNMOC**	56	58.11	342.11	95.88	109.67	52.55

3 Hour Carbonyl Sampling - Math & Science Center - 2004 Summary Statistical Analysis

Unit of Concentration: ppbV

Time	Parameter	Compound Name	#N	Min.	Max.	Median	Average	StDev
5:00 AM - 8:00 AM	43502	Formaldehyde	31	0.86	4.79	2.07	2.22	0.91
	43503	Acetaldehyde	31	0.23	1.44	0.79	0.81	0.26
	43504	Propionaldehyde	31	0.01	1.07	0.39	0.46	0.32
	43505	Acrolein	31	0.01	0.26	0.07	0.08	0.06
	43551	Acetone	31	1.00	3.69	2.02	2.06	0.64
	43552	Methyl Ethyl Ketone	31	0.16	0.60	0.32	0.33	0.12
	43560	Methyl Isobutyl Ketone	31	0.01	0.03	0.01	0.02	0.01
8:00 AM - 11:00 AM	43502	Formaldehyde	31	1.10	8.07	3.56	4.06	2.04
	43503	Acetaldehyde	31	0.57	2.16	0.99	1.06	0.40
	43504	Propionaldehyde	31	0.01	1.45	0.44	0.53	0.34
	43505	Acrolein	31	0.01	0.22	0.07	0.08	0.05
	43551	Acetone	31	0.92	4.39	2.18	2.34	0.82
	43552	Methyl Ethyl Ketone	31	0.18	1.65	0.36	0.44	0.27
	43560	Methyl Isobutyl Ketone	31	0.01	0.07	0.01	0.03	0.02
11:00 AM - 2:00 PM	43502	Formaldehyde	31	0.01	8.40	4.76	4.79	2.00
	43503	Acetaldehyde	31	0.02	1.82	0.98	1.04	0.37
	43504	Propionaldehyde	31	0.01	1.13	0.40	0.49	0.31
	43505	Acrolein	31	0.01	0.18	0.05	0.06	0.03
	43551	Acetone	31	0.03	4.58	2.36	2.49	0.95
	43552	Methyl Ethyl Ketone	31	0.01	0.70	0.37	0.40	0.15
	43560	Methyl Isobutyl Ketone	31	0.06	0.04	0.01	0.02	0.01
2:00 PM - 5:00 PM	43502	Formaldehyde	31	1.44	7.18	4.77	5.07	1.50
	43503	Acetaldehyde	31	0.17	1.71	1.00	1.03	0.36
	43504	Propionaldehyde	31	0.01	1.13	0.37	0.45	0.26
	43505	Acrolein	31	0.01	0.19	0.06	0.07	0.05
	43551	Acetone	31	1.35	3.94	2.55	2.70	0.70
	43552	Methyl Ethyl Ketone	31	0.17	0.68	0.42	0.42	0.13
	43560	Methyl Isobutyl Ketone	31	0.06	0.05	0.01	0.02	0.06

Air Toxics Monitoring Network Stations

In 2004, the Air Quality Monitoring (AQM) program of the Department of Environmental Quality operated three Air Toxics Monitoring Network (ATMN) stations. These sites are located at the Math and Science Center in Henrico County, NOAA property in the city of Norfolk, and Lee District Park in Fairfax County. Sampling at these sites consisted of VOC, Carbonyl ,and Total Suspended Particulate (TSP) collection. Sampling frequency consisted of one 24-hour sample collected every 6th day. Data from these sites will be used to characterize air toxics concentrations in the respective urban areas.

AQM used the manual method for collecting ambient air samples for VOC analysis. Whole air samples were collected using evacuated Summa^{T} canisters and Xontech air samplers. Each sample was analyzed by the Maryland Department of the Environment, Air and Radiation Management Administration, using a Gas Chromatograph equipped with a Mass Selective Detector.

Carbonyls were collected on DNPH (2,4-Dinitrophenylhydrazine) treated sorbent tubes using ATEC^{t} cartridge samplers. Analyses were performed by the Philadelphia Health Department using a Liquid Chromatographic procedure.

Detailed data collected at these sites in 2004 are available upon written request to the Virginia Department of Environmental Quality, Office of Air Quality Monitoring.

Detectable VOC In 24-Hour Canister Samples
GC/MSD - Math & Science Center - Henrico County, VA
January 1 to December 31, 2004 - Concentrations are in ppbV

Parameter	Compound Name	#N	Min.	Max.	Median	Average	StDev
43823	Dichlorodifluoromethane	58	0.47	0.62	0.53	0.53	0.04
43801	Chloromethane	58	0.40	0.65	0.52	0.52	0.06
43208	Freon 114	58	0.05	0.28	0.09	0.10	0.04
43860	Vinyl Chloride	58	0.01	0.01	0.01	0.01	0.00
43218	1,3-Butadiene	58	0.01	0.45	0.05	0.06	0.06
43819	Bromomethane	58	0.01	0.04	0.01	0.01	0.01
43812	Chloroethane	58	0.01	0.03	0.01	0.01	0.00
43811	Trichlorofluoromethane	58	0.22	0.32	0.25	0.25	0.02
43704	Acrylonitrile	57	0.50	5.60	1.94	2.38	1.47
43826	1,1-Dichloroethylene	58	0.01	0.01	0.05	0.01	0.00
43802	Dichloromethane	58	0.05	0.28	0.09	0.10	0.04
43207	Freon 113	58	0.07	0.10	0.08	0.08	0.01
43813	1,1-Dichloroethane	58	0.00	0.01	0.00	0.00	0.00
43839	cis-1,2-Dichloroethene	58	0.01	0.01	0.01	0.01	0.00
43803	Chloroform	58	0.01	0.04	0.02	0.02	0.01
43815	Ethylene Dichloride	58	0.01	0.02	0.01	0.01	0.00
43814	Methyl Chloroform	58	0.01	0.03	0.02	0.02	0.01
45201	Benzene	58	0.05	1.21	0.21	0.25	0.17
43804	Carbon Tetrachloride	58	0.02	0.12	0.08	0.08	0.02
43829	1,2-Dichloropropane	58	0.00	0.03	0.00	0.00	0.00
43824	Trichloroethene	58	0.01	0.02	0.01	0.01	0.00
43831	cis-1,3-Dichloropropylene	58	0.01	0.01	0.01	0.01	0.00
43830	trans-1,3-Dichloropropylene	58	0.01	0.01	0.01	0.01	0.00
43820	1,1,2-Trichloroethane	58	0.01	0.01	0.01	0.01	0.00
45202	Toluene	58	0.03	2.09	0.32	0.42	0.33
43843	Ethylene Dibromide	58	0.01	0.01	0.01	0.01	0.00
43817	Tetrachloroethylene	58	0.01	0.15	0.02	0.03	0.02
45801	Chlorobenzene	58	0.00	0.02	0.00	0.00	0.00
45203	Ethylbenzene	58	0.01	0.41	0.05	0.07	0.06
45109	m/p- Xylene	58	0.01	1.01	0.14	0.17	0.16
45220	Styrene	58	0.00	0.13	0.02	0.03	0.02
43818	1,1,2,2-Tetrachloroethane	58	0.01	0.01	0.01	0.01	0.00
45204	o-Xylene	58	0.00	0.40	0.05	0.06	0.06
45213	p-Ethyltoluene	58	0.00	0.20	0.03	0.04	0.04
45207	1,3,5-Trimethylbenzene	58	0.00	0.16	0.02	0.02	0.02
45208	1,2,4-Trimethylbenzene	58	0.00	0.54	0.07	0.08	0.08
45806	1,3-Dichlorobenzene	58	0.00	0.03	0.00	0.00	0.00
45807	1,4-Dichlorobenzene	58	0.00	0.13	0.02	0.02	0.02
45805	1,2-Dichlorobenzene	58	0.00	0.03	0.00	0.00	0.00
45810	1,2,4-Trichlorobenzene	58	0.00	0.08	0.00	0.00	0.01
43844	Hexachlorobutadiene	58	0.01	0.04	0.01	0.01	0.00

Detectable VOC In 24-Hour Canister Samples
GC/MSD - Lee District Park - Fairfax County, VA
January 1 to December 31, 2004 - Concentrations are in ppbV

Parameter	Compound Name	#N	Min.	Max.	Median	Average	StDev
43823	Dichlorodifluoromethane	52	0.46	0.61	0.53	0.53	0.03
43801	Chloromethane	52	0.42	0.62	0.51	0.51	0.04
43208	Freon 114	52	0.01	0.03	0.02	0.02	0.01
43860	Vinyl Chloride	52	0.01	0.01	0.01	0.01	0.00
43218	1,3-Butadiene	52	0.01	0.19	0.03	0.04	0.04
43819	Bromomethane	52	0.01	0.06	0.01	0.01	0.01
43812	Chloroethane	52	0.01	0.01	0.01	0.01	0.00
43811	Trichlorofluoromethane	52	0.22	0.30	0.25	0.25	0.02
43704	Acrylonitrile	52	0.00	0.29	0.01	0.03	0.05
43826	1,1-Dichloroethylene	52	0.01	0.01	0.01	0.01	0.00
43802	Dichloromethane	52	0.05	0.16	0.09	0.09	0.03
43207	Freon 113	52	0.07	0.10	0.08	0.08	0.01
43813	1,1-Dichloroethane	52	0.00	0.01	0.00	0.00	0.01
43839	cis-1,2-Dichloroethene	52	0.01	0.01	0.01	0.01	0.00
43803	Chloroform	52	0.01	0.04	0.02	0.02	0.01
43815	Ethylene Dichloride	52	0.01	0.02	0.01	0.01	0.00
43814	Methyl Chloroform	52	0.01	0.15	0.02	0.02	0.02
45201	Benzene	52	0.07	0.54	0.19	0.20	0.10
43804	Carbon Tetrachloride	52	0.07	0.12	0.08	0.09	0.01
43829	1,2-Dichloropropane	52	0.00	0.01	0.00	0.00	0.00
43824	Trichloroethylene	52	0.01	0.02	0.01	0.01	0.00
43831	cis-1,3-Dichloropropene	52	0.01	0.01	0.01	0.01	0.00
43830	trans-1,3-Dichloropropylene	52	0.01	0.01	0.01	0.01	0.00
43820	1,1,2-Trichloroethane	52	0.01	0.01	0.01	0.01	0.00
45202	Toluene	52	0.09	0.94	0.23	0.28	0.18
43843	Ethylene Dibromide	52	0.01	0.01	0.01	0.01	0.00
43817	Tetrachloroethylene	52	0.01	0.17	0.03	0.04	0.04
45801	Chlorobenzene	52	0.00	0.01	0.00	0.00	0.00
45203	Ethylbenzene	52	0.01	0.13	0.04	0.05	0.03
45109	m/p- Xylene	52	0.02	0.38	0.09	0.12	0.08
45220	Styrene	52	0.00	0.04	0.01	0.01	0.01
43818	1,1,2,2-Tetrachloroethane	52	0.01	0.01	0.01	0.01	0.00
45204	o-Xylene	52	0.01	0.13	0.04	0.04	0.03
45213	p-Ethyltoluene	52	0.00	0.11	0.02	0.02	0.03
45207	1,3,5-Trimethylbenzene	52	0.00	0.05	0.01	0.01	0.01
45208	1,2,4-Trimethylbenzene	52	0.00	0.16	0.05	0.05	0.04
45806	1,3-Dichlorobenzene	52	0.00	0.01	0.00	0.00	0.00
45807	1,4-Dichlorobenzene	52	0.00	0.03	0.01	0.01	0.01
45805	1,2-Dichlorobenzene	52	0.00	0.01	0.00	0.00	0.00
45810	1,2,4-Trichlorobenzene	52	0.00	0.02	0.00	0.00	0.00
43844	Hexachlorobutadiene	52	0.01	0.01	0.01	0.01	0.00

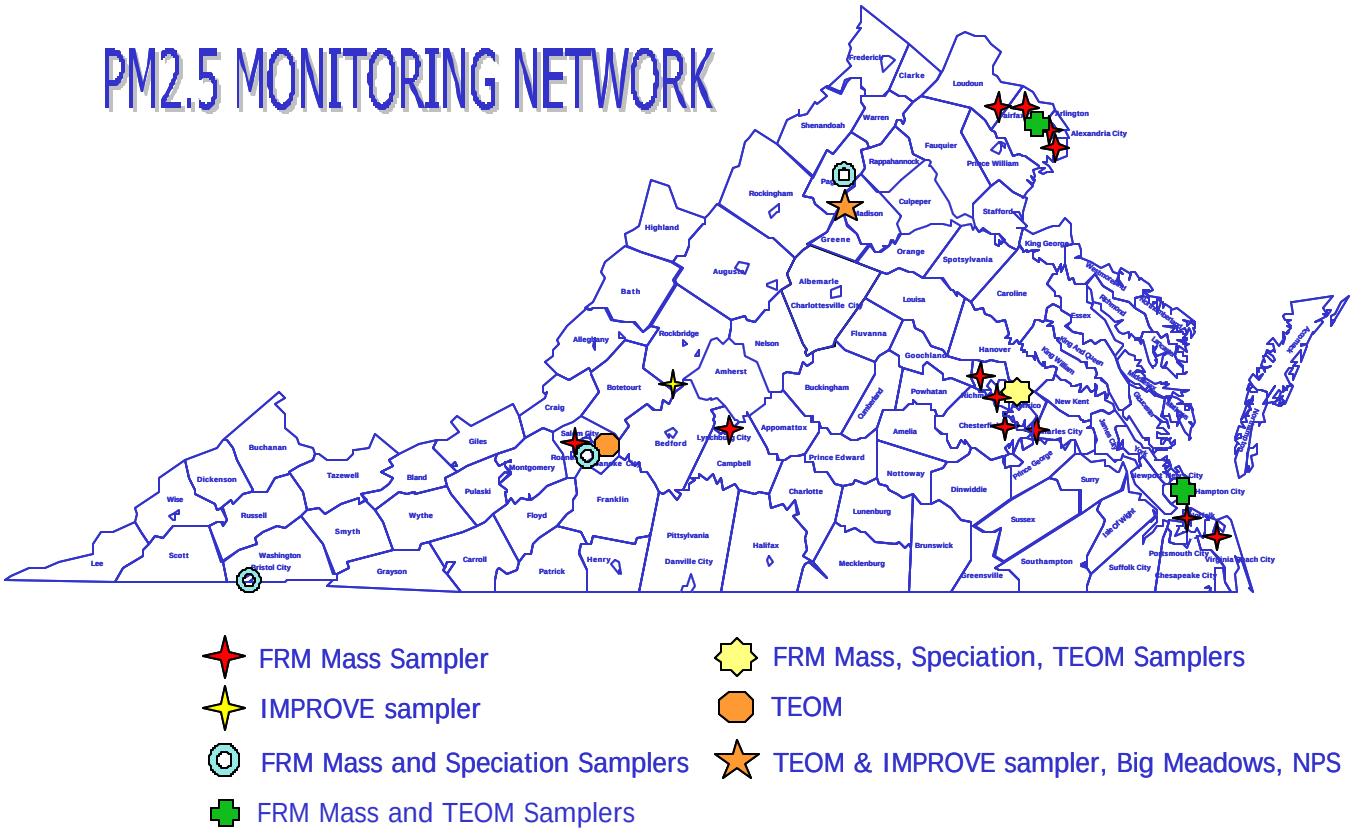
Detectable VOC In 24-Hour Canister Samples
GC/MSD - NOAA Site - Norfolk, VA
January 1 to December 31, 2004- Concentrations are in ppbV

Parameter	Compound Name	#N	Min.	Max.	Median	Average	StDev
43823	Dichlorodifluoromethane	57	0.45	0.61	0.52	0.52	0.03
43801	Chloromethane	57	0.42	0.66	0.51	0.52	0.06
43208	Freon 114	57	0.01	0.06	0.02	0.02	0.01
43860	Vinyl Chloride	57	0.01	0.10	0.01	0.01	0.02
43218	1,3-Butadiene	57	0.01	0.06	0.02	0.02	0.01
43819	Bromomethane	57	0.01	0.08	0.01	0.02	0.01
43812	Chloroethane	57	0.01	0.01	0.01	0.01	0.00
43811	Trichlorofluoromethane	57	0.21	0.43	0.24	0.25	0.03
43704	Acrylonitrile	57	0.00	0.74	0.03	0.06	0.11
43826	1,1-Dichloroethylene	57	0.01	0.02	0.01	0.01	0.00
43802	Dichloromethane	57	0.03	0.21	0.08	0.09	0.03
43207	Freon 113	57	0.07	0.10	0.08	0.08	0.01
43813	1,1-Dichloroethane	57	0.00	0.01	0.00	0.00	0.00
43839	cis-1,2-Dichloroethene	57	0.01	0.01	0.01	0.01	0.00
43803	Chloroform	57	0.01	0.11	0.02	0.02	0.01
43815	Ethylene Dichloride	57	0.01	0.02	0.01	0.01	0.00
43814	Methyl Chloroform	57	0.01	0.06	0.02	0.02	0.01
45201	Benzene	57	0.07	0.77	0.20	0.22	0.12
43804	Carbon Tetrachloride	57	0.05	0.10	0.08	0.08	0.01
43829	1,2-Dichloropropane	57	0.00	0.10	0.00	0.01	0.01
43824	Trichloroethylene	57	0.01	0.10	0.01	0.01	0.01
43831	cis-1,3-Dichloropropylene	57	0.01	0.09	0.01	0.01	0.01
43830	trans-1,3-Dichloropropylene	57	0.01	0.10	0.01	0.01	0.01
43820	1,1,2-Trichloroethane	57	0.01	0.01	0.01	0.01	0.00
45202	Toluene	57	0.12	6.69	0.29	0.53	0.99
43843	Ethylene Dibromide	57	0.01	0.01	0.01	0.01	0.00
43817	Tetrachloroethylene	57	0.01	0.12	0.02	0.03	0.03
45801	Chlorobenzene	57	0.00	0.02	0.00	0.00	0.00
45203	Ethylbenzene	57	0.02	0.34	0.06	0.08	0.06
45109	m/p- Xylene	57	0.06	1.22	0.14	0.20	0.19
45220	Styrene	57	0.00	0.09	0.02	0.02	0.02
43818	1,1,2,2-Tetrachloroethane	57	0.01	0.01	0.01	0.01	0.00
45204	o-Xylene	57	0.02	0.34	0.05	0.07	0.05
45213	p-Ethyltoluene	57	0.00	0.24	0.04	0.04	0.04
45207	1,3,5-Trimethylbenzene	57	0.00	0.19	0.02	0.03	0.03
45208	1,2,4-Trimethylbenzene	57	0.02	0.57	0.08	0.10	0.09
45806	1,3-Dichlorobenzene	57	0.00	0.01	0.00	0.00	0.00
45807	1,4-Dichlorobenzene	57	0.00	0.03	0.01	0.01	0.01
45805	1,2-Dichlorobenzene	57	0.00	0.01	0.00	0.00	0.00
45810	1,2,4-Trichlorobenzene	57	0.00	0.02	0.00	0.00	0.00
43844	Hexachlorobutadiene	57	0.01	0.01	0.01	0.01	0.00

24 Hour Carbonyl Sampling 2004 Summary Statistical Analysis

Unit of Concentration: ppbV

Site	Parameter	Compound Name	#N	Min	Max	Median	Average	StDev
Math & Science Center	43502	Formaldehyde	58	0.91	6.00	2.32	2.70	1.22
	43503	Acetaldehyde	58	0.39	1.43	0.87	0.91	0.23
	43504	Propionaldehyde	58	0.00	0.40	0.26	0.25	0.09
	43505	Acrolein	58	0.01	0.17	0.05	0.06	0.03
	43551	Acetone	58	0.51	2.85	1.48	1.53	0.50
	43552	Methyl Ethyl Ketone	58	0.08	0.48	0.24	0.25	0.08
	43560	Methyl Isobutyl Ketone	58	0.00	0.03	0.01	0.01	0.01
Lee Park	43502	Formaldehyde	58	0.06	8.19	2.18	2.49	1.52
	43503	Acetaldehyde	58	0.08	1.59	0.82	0.83	0.28
	43504	Propionaldehyde	58	0.00	0.54	0.24	0.25	0.11
	43505	Acrolein	58	0.01	0.15	0.04	0.05	0.04
	43551	Acetone	58	0.24	2.61	1.45	1.40	0.52
	43552	Methyl Ethyl Ketone	58	0.01	0.54	0.21	0.22	0.09
	43560	Methyl Isobutyl Ketone	58	0.00	0.24	0.01	0.01	0.03
NOAA	43502	Formaldehyde	58	0.07	4.94	2.03	2.16	1.00
	43503	Acetaldehyde	58	0.11	1.51	0.73	0.77	0.29
	43504	Propionaldehyde	58	0.00	0.51	0.26	0.26	0.10
	43505	Acrolein	58	0.00	0.19	0.04	0.05	0.03
	43551	Acetone	58	0.01	2.75	1.09	1.10	0.56
	43552	Methyl Ethyl Ketone	58	0.06	0.43	0.20	0.21	0.08
	43560	Methyl Isobutyl Ketone	58	0.00	0.08	0.01	0.01	0.02



PM$_{2.5}$ is particulate matter (PM) that is less than or equal to 2.5 micrometers in aerometric diameter. Particles originate from a variety of anthropogenic stationary and mobile sources as well as from natural sources. Particles may be emitted directly or formed in the atmosphere by transformation of gaseous emissions such as sulfur oxides (SO_x), nitrogen oxides (NO_x), and Volatile Organic Compounds (VOC). The chemical and physical properties of particulate matter vary greatly with time, region, meteorology, and source category, thus complicating the assessment of health and welfare effects.

$PM_{2.5}$ standards were implemented by EPA to "provide increased protection against a wide range of PM-related health effects". These health effects include but are not limited to "premature mortality, decreased lung function, increased respiratory symptoms and disease such as asthma, and alterations in lung tissue". The standards are "requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of the pollutant in the ambient air. These effects include but are not limited to effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility, and climate, damage and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well being".

The Virginia DEQ $PM_{2.5}$ monitoring network utilizes three different types of particulate monitoring samplers:

$PM_{2.5}$ 24-hour Mass Sampler: This Federal Reference Method (FRM) sampler collects particulate matter on a stretched Teflon filter media. Three samplers (Richmond, Chesapeake, and Fairfax) collect 24-hour samples every day. The rest of these samplers collect 24-hour samples on a one-in-three-day schedule. Filters are retrieved from the field and shipped via courier to the Virginia Division of Consolidated Laboratories in Richmond. Once at the laboratory, the filters are equilibrated for a minimum of 24 hours prior to the final weighing.

$PM_{2.5}$ 24-hour Speciation Sampler: This sampler collects particulate matter on nylon, Teflon, and quartz filters, in three sampling modules. These modules are picked up by the operator after the sampling period and shipped refrigerated to the EPA Contract Laboratory. The lab analyzes the filters for mass loading, trace elements (such as: aluminum, antimony, arsenic, barium, bromine, zirconium), cations (ammonium, potassium, sodium), anions (nitrate, sulfate), and carbons (carbonate carbon, elemental carbon, organic carbon). The Richmond speciation monitor operates on a one-in-three-day sampling schedule. The Roanoke and Bristol speciation monitors operate on a one-in-six day sampling schedule.

$PM_{2.5}$ Continuous Monitor: This sampler collects particulate samples on a continuous basis, and data are compiled into hourly averages. The sampler utilizes a Tapered Element Oscillating Microbalance (TEOM) in the sampling design. TEOM samplers are operated by Virginia DEQ in Hampton and Henrico County, and by the Fairfax County Health Department in Fairfax County.

In addition to the $PM_{2.5}$ network operated by the DEQ, the National Park Service and the USDA Forest Service operated $PM_{2.5}$ samplers at Big Meadows and in Rockbridge Co. as part of the IMPROVE (Interagency Monitoring of Protected Visual Environments) network. This network employs different sampling methods than those used by the DEQ. Data for the IMPROVE network can be found on the internet at http://vista.cira.colostate.edu/improve.

VIRGINIA 2004
PM2.5 PARTICULATE MATTER SUMMARY BY REGION
METHOD CODE 118 - GRAVIMETRIC, R & P MODEL 2025 SEQUENTIAL
Micrograms Per Cubic Meter (ug/m3)

LOCATION/ STATION NO.	24-HOUR SAMPLING				QUARTERLY ARITHMETIC MEAN				ANNUAL ARITH. MEAN
	NO. OBS.	MAX	2ND MAX	98th PERCENTILE VALUE	I	II	III	IV	
SOUTHWEST REGION									
BRISTOL 101-E Highland View Elementary School	114	37.7	32.9	30.2	11.4	14.1	18.5	11.4	13.8
VALLEY REGION									
LURAY 29-D Luray Caverns Airport	115	29.2	27.3	27.2	11.5	11.8	16.1	9.0	12.1
WEST CENTRAL REGION									
ROANOKE 109-L Raleigh Court Library	120	35.0	32.7	32.2	10.7	14.4	18.3	10.8	13.5
SALEM 110-B Market Street Fire Station	118	36.2	34.0	33.0	11.1	15.1	19.3	11.6	14.3
LYNCHBURG 155-Q* Water Tank on Leesville Road	118	34.0	33.5	28.0	9.4	13.2	16.6	9.3	12.1
PIEDMONT REGION									
CHESTERFIELD CO. 71-D Bensley Armory	119	36.3	30.0	29.8	11.4	13.9	15.8	11.7	13.2
HENRICO CO. 72-M Math & Science Center	151	35.3	33.6	30.2	11.4	13.9	16.7	12.2	13.6

* This site is located in the South Central Region, but West Central Region maintains the station.

VIRGINIA 2004
PM2.5 PARTICULATE MATTER SUMMARY BY REGION
METHOD CODE 118 - GRAVIMETRIC, R & P MODEL 2025 SEQUENTIAL
Micrograms Per Cubic Meter (ug/m3)

LOCATION/ STATION NO.		24-HOUR SAMPLING				QUARTERLY ARITHMETIC MEAN				ANNUAL ARITH. MEAN
		NO. OBS.	MAX	2ND MAX	98TH PERCENTILE VALUE	I	II	III	IV	
PIEDMONT REGION (cont.)										
HENRICO CO. Piedmont Regional Office	72-N	111	33.8	28.3	28.1	9.9	13.2	16.0	10.8	12.5
CHARLES CITY CO. Route #608	75-B	120	36.6	30.3	28.9	9.7	14.1	15.1	10.1	12.2
TIDEWATER REGION										
HAMPTON Va. School for the Deaf & Blind	179-C	111	30.4	28.5	27.9	10.7	13.7	13.6	10.7	12.2
NORFOLK NOAA Facility	181-A1	121	31.4	30.1	28.2	11.1	14.3	13.7	11.8	12.7
VA. BEACH Tidewater Regional Office	184-J	344	40.8	35.7	27.9	11.5	13.2	12.9	12.0	12.4

VIRGINIA 2004
PM2.5 PARTICULATE MATTER SUMMARY BY REGION
METHOD CODE 118 - GRAVIMETRIC, R & P MODEL 2025 SEQUENTIAL
Micrograms Per Cubic Meter (ug/m3)

REGION/LOCATION STATION NO.	24-HOUR SAMPLING				QUARTERLY ARITHMETIC MEAN				ANNUAL ARITH. MEAN
	NO. OBS.	MAX	2ND MAX	98TH PERCENTILE VALUE	I	II	III	IV	
NORTHERN REGION									
LOUDOUN CO. 38-I Broad Run High School	116	44.0	38.2	34.2	12.2	13.1	19.8	11.2	14.1
FAIRFAX CO. 46-B9 Lee District Park	348	43.6	42.8	35.3	11.8	14.4	18.3	11.1	13.9
ARLINGTON CO. 47-T Aurora Hills Visitors Center	117	43.5	42.8	35.7	13.4	13.8	18.9	11.8	14.4
FAIRFAX CO. L-46-A8 McLean Governmental Center	114	44.8	40.5	33.7	11.9	13.5	18.8	12.0	14.0
FAIRFAX CO. L-46-C1 Mason Governmental Center	120	42.2	40.2	34.0	11.9	13.0	18.5	11.3	13.7

VIRGINIA 2004
PM2.5 PARTICULATE MATTER CONCENTRATIONS IN RANGES
METHOD 118 - GRAVIMETRIC, R & P MODEL 2025 SEQUENTIAL
Micrograms Per Cubic Meter (ug/m3)
Sampling Schedule Every Three Days

LOCATION/ STATION NO.	NO. 24-HR. OBS.	NO. OF 24-HOUR CONCENTATIONS IN RANGES						
		0 to 15	16 to 30	31 to 50	51 to 70	71 to 90	91 to 110	>110
SOUTHWEST REGION								
BRISTOL 101-E Highland View Elementary School	114	76	36	2	0	0	0	0
VALLEY REGION								
LURAY 29-D Luray Caverns Airport	115	81	34	0	0	0	0	0
WEST CENTRAL REGION								
ROANOKE 109-L Raleigh Court Library	120	79	38	3	0	0	0	0
SALEM 110-B Market Street Fire Station	118	72	42	4	0	0	0	0
LYNCHBURG 155-Q Water Tank on Leesville Road	118	83	33	2	0	0	0	0

VIRGINIA 2004
PM2.5 PARTICULATE MATTER CONCENTRATIONS IN RANGES
METHOD 118 - GRAVIMETRIC, R & P MODEL 2025 SEQUENTIAL
Micrograms Per Cubic Meter (ug/m3)
Sampling Schedule Every Three Days

LOCATION/ STATION NO.	NO. 24-HR. OBS.	NO. OF 24-HOUR CONCENTRATIONS IN RANGES						
		0 to 15	16 to 30	31 to 50	51 to 70	71 to 90	91 to 110	>110
PIEDMONT REGION								
CHESTERFIELD CO. 71-D Bensley Armory	119	82	36	1	0	0	0	0
HENRICO CO. 72-M Math & Science Center	151	105	44	2	0	0	0	0
HENRICO CO. 72-N Piedmont Regional Office	111	84	26	1	0	0	0	0
CHARLES CITY CO. 75-B Route #608	120	88	31	1	0	0	0	0
TIDEWATER REGION								
HAMPTON 179-C Va. School for the Deaf & Blind	111	84	27	0	0	0	0	0

VIRGINIA 2004
PM2.5 PARTICULATE MATTER CONCENTRATIONS IN RANGES
METHOD 118 - GRAVIMETRIC, R & P MODEL 2025 SEQUENTIAL
Micrograms Per Cubic Meter (ug/m3)
Sampling Schedule Every Three Days

LOCATION/ STATION NO.		NO. 24-HR. OBS.	NO. OF 24-HOUR CONCENTRATIONS IN RANGES						
			0 to 15	16 to 30	31 to 50	51 to 70	71 to 90	91 to 110	>110
TIDEWATER REGION (continued)									
NORFOLK NOAA Facility	181-A1	121	89	31	1	0	0	0	0
VIRGINIA BEACH Tidewater Regional Office	184-J*	344	244	96	4	0	0	0	0
NORTHERN REGION									
LOUDOUN Broad Run High School	38-I	116	76	35	5	0	0	0	0
FAIRFAX CO. Lee District Park	46-B9*	348	221	116	11	0	0	0	0
ARLINGTON CO. Aurora Hills Visitors Center	47-T	117	74	37	6	0	0	0	0

* This sampler runs daily.