MARYLAND

DEPARTMENT OF THE ENVIRONMENT

AMBIENT AIR MONITORING NETWORK PLAN FOR CALENDAR YEAR 2013

Prepared for:

U.S. Environmental Protection Agency

Prepared by:

Ambient Air Monitoring Program
Air and Radiation Management Administration
Maryland Department of the Environment

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MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard | Baltimore, MD 21230 | www.mde.state.md.us
410-537-3000 | 800-633-6101 | TTY Users: 800-735-2258
Martin O'Malley, *Governor* | Anthony G. Brown, *Lt. Governor*
Robert M. Summers, Ph.D., *Secretary*

MDE

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ACRONYMS AND DEFINITIONS

AADT	Annual Average Daily Traffic
AQS	Air Quality System
AQS ID	9-digit site identification number in AQS database
ARMA	MDE's Air and Radiation Management Administration
BAM/BAMM	Beta Attenuation [Mass] Monitor typically used for measuring continuous particulate matter
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CBSA	Core Based Statistical Area
CFR	Code of Federal Regulations
CSA	Combined Statistical Area
CSN	Chemical Speciation Network
CO	Carbon Monoxide
EGU	Electrical Generating Unit
FE-AADT	Fleet Equivalent Annual Average Daily Traffic
FEM	Federal Equivalent Method typically used by local and state agencies to measure particulate matter and determine NAAQS attainment status
FID	Flame Ionization Detector
FRM	Federal Reference Method typically used by local and state agencies to measure particulate matter and determine NAAQS attainment status
GC	Gas Chromatograph
HAPS	Hazardous Air Pollutants
IMPROVE	Interagency Monitoring of Protected Visual Environments
IR	Infrared (radiation)
MDE	Maryland Department of the Environment
MSA	Metropolitan Statistical Area typically used by the EPA to study air quality trends in major metropolitan areas across the U.S.
NAA	Non-attainment Area
NAAQS	National Ambient Air Quality Standards used for determining attainment status
NCore	National Core multi-pollutant monitoring stations
NESCAUM	Northeast States for Coordinated Air Use Management
nm	Nanometer, an SI unit for measuring length; 1 nm equals 10^{-9} meter.
NO	Nitrogen Oxide
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen (ozone precursor)
NO_y	Total Reactive Nitrogen Species (ozone precursor)
O_3	Ozone
OC/EC	Organic Carbon/Elemental Carbon
PAMS	Photochemical Assessment Monitoring Station
Pb	Lead
$PM_{2.5}$	Particulate matter with an equivalent diameter less than or equal to 2.5 μm
PM_{10}	Particulate matter with an equivalent diameter less than or equal to 10 μm
PMcoarse	Particulate matter with an equivalent diameter less than or equal to 10 μm minus particulate matter with an equivalent diameter less than or equal to 2.5 μm

QA	Quality Assurance
RAIN	Rural Aerosol Intensive Network
SIP	State Implementation Plan
SLAMS	State or Local Air Monitoring Stations
SO_2	Sulfur Dioxide
STN	$PM_{2.5}$ Speciation Trends Network
TEOM	Tapered Element Oscillating Microbalance
TSP	Total suspended particulate
μm	Micrometer (10^{-6} meter)
US EPA	United States Environmental Protection Agency
UV	Ultraviolet
VOCs	Volatile Organic Compounds

1. INTRODUCTION

In 1970, Congress passed the Clean Air Act (CAA) that authorized the Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for pollutants shown to threaten human health and welfare. Primary standards were set according to criteria designed to protect public health, including an adequate margin of safety to protect sensitive populations such as children and asthmatics. Secondary standards were set according to criteria designed to protect public welfare (decreased visibility, damage to crops, vegetation, buildings, etc.). As part of the CAA, both local and state agencies are required to maintain and operate ambient air quality monitoring networks.

The six pollutants that currently have NAAQS are: ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$ and PM_{10}), and lead (Pb). They are commonly called the "criteria" pollutants. When air quality does not meet the NAAQS for one of the criteria pollutants, the area is said to be in “non-attainment” with the NAAQS for that pollutant. Currently, Maryland is designated as non-attainment for both ground-level ozone and particulate matter, but the Maryland Department of the Environment (MDE) will be requesting that EPA redesignate the particulate matter non-attainment area (NAA) to attainment. Maps of NAAs are shown in **Figure 1-1** and **Figure 1-2**. Counties outside of Maryland are included as they are part of the NAA; however, this document will address only monitors in Maryland.

The EPA ozone precursor revisions to the air monitoring regulations (40 CFR Part 58) required by Title 1, Section 182 of the 1990 Clean Air Act Amendments (CAAA) were promulgated on February 12, 1993. The CAAA requires that the States incorporate enhanced monitoring for ozone, speciated volatile organic compounds (VOCs), oxides of nitrogen (NO_x), carbonyls, and meteorological parameters into their State Implementation Plan (SIP). The Part 58 regulations refer to these enhanced monitoring stations as photochemical assessment monitoring stations (PAMS). There is no ambient standard for any of the VOCs.

Section 112 of the 1990 CAAA identified 188 toxics. As part of the monitoring effort for toxics, MDE is operating an Air Toxic Network and provides analytical support for sampling sites in EPA Region 3.

As part of the CAA, states are required to submit an annual network plan to the U.S. EPA for review and approval. Since 2007, EPA has required State and Local Air Pollution Control Agencies to make this plan available for public inspection at least thirty days prior to formal submission to EPA. Refer to the Requirements for Monitoring Network Descriptions section for details.

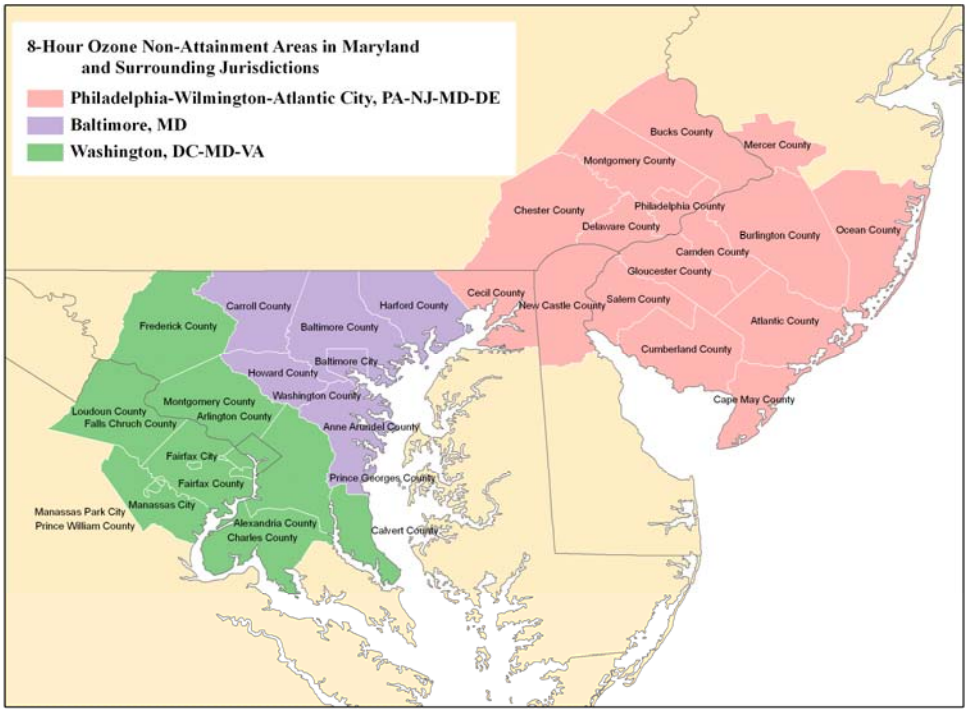

Figure 1-1. **Map depicting non-attainment areas for 8-hour ozone in Maryland and surrounding jurisdictions that are part of the NAA.**

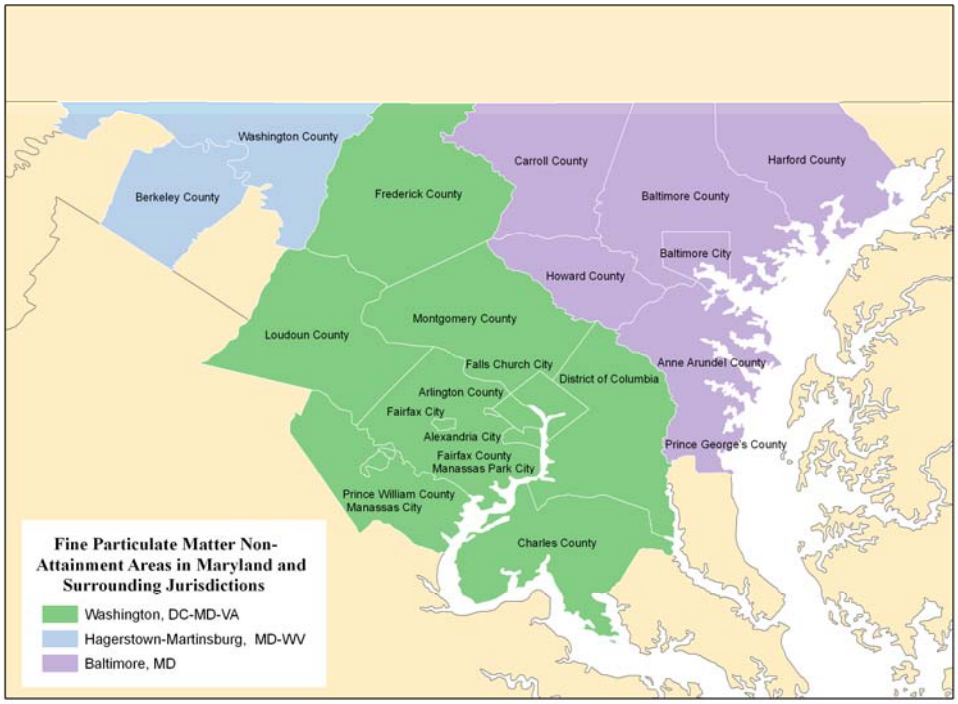

Figure 1-2. **Map depicting non-attainment areas for fine particulate matter ($PM_{2.5}$) in Maryland and surrounding jurisdictions that are part of the NAA.**

2. REQUIREMENTS FOR MONITORING NETWORK DESCRIPTIONS

In October 2006, the U.S. EPA issued final regulations concerning state and local agency ambient air monitoring networks. These regulations require an annual monitoring network plan including the information described below.

The annual monitoring network plan as described in §58.10 must contain the following information for existing and proposed site(s):

- The Air Quality System (AQS) site identification number.
- The location, including street address and geographical coordinates.
- The sampling and analysis method(s) for each measured parameter.
- The operating schedules for each monitor.
- Any proposals to remove or move a monitoring station within a period of 18 months following plan submittal.
- The monitoring objective and spatial representative scale for each monitor.
- The identification of sites that are suitable and sites that are non-suitable for comparison against the annual $PM_{2.5}$ NAAQS as described in §58.30.
- The Metropolitan Statistical Area (MSA), Core Based Statistical Area (CBSA), Combined Statistical Area (CSA) or other area represented by the monitor.

3. MARYLAND AIR MONITORING NETWORK

Maryland currently operates 22 air monitoring sites around the state that measure ground-level concentrations of criteria pollutants, air toxics, meteorological parameters, and research-oriented parameters. Although monitoring takes place statewide, most of the stations are concentrated in the urban/industrial areas that have the highest population and number of pollutant sources. This network is maintained and operated by the Ambient Air Monitoring Program (the Program), Air and Radiation Management Administration, Maryland Department of the Environment. A comprehensive air monitoring network map is shown in Fig 3-1. Additional topographic and aerial maps are provided in **Appendix A**.

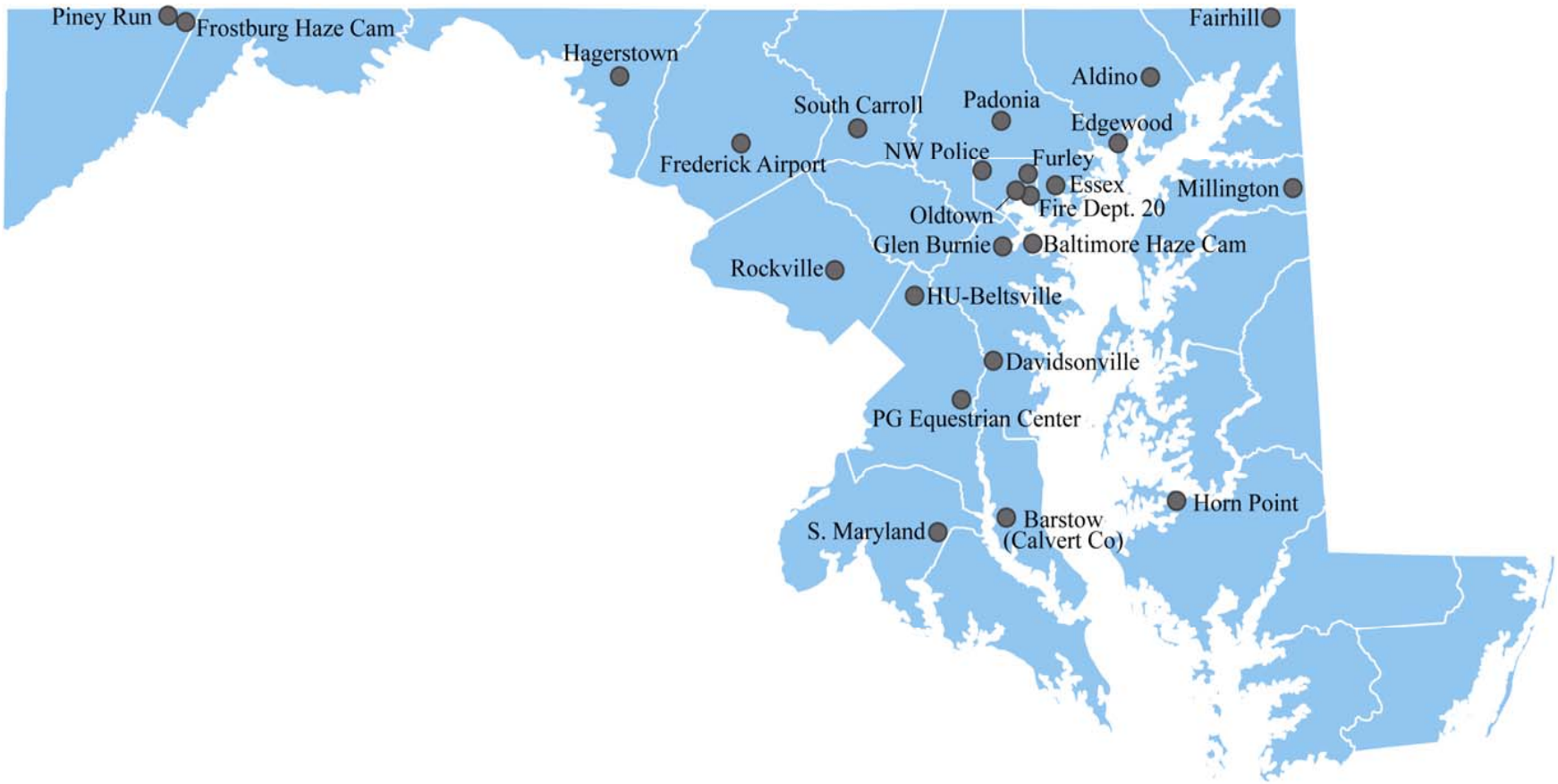

Figure 3-1. Maryland's air monitoring network map

Note: Piney Run also marks the Frostburg Improve site which is just a few meters away.
Note: Frostburg Haze Cam is located at Eastern Garrett Co. Vol. Fire Department.

3.1 General Information

The following tables include information required as part of the monitoring network description. General information (e.g. site name, AQS identification number, latitude, longitude, etc.) can be found in **Table 3-1**. Specific information related to each parameter measured at air monitoring sites is given in **Table 3-2a, b**. Monitoring method descriptions can be found in **Table 3-3**. Parameters measured as part of the air toxics, PAMS, IMPROVE, and speciated $PM_{2.5}$ mass are listed in **Table 3-4**.

Table 3-1 General information for current Maryland ambient air monitoring sites

SITE NAME, AQS ID	STREET ADDRESS	CITY, COUNTY	ZIP CODE	LATITUDE, LONGITUDE	LOCATION SETTING	NEAREST ROAD	TRAFFIC COUNT	TRAFFIC COUNT YEAR	DISTANCE FROM NEAREST RD. (M)	CORE BASED STATISTICAL AREA (CBSA)
Aldino, 240259001	3560 Aldino Road	Aldino, Harford	21028	39.563333, -76.203889	Suburban	Aldino Road	1150	2008	14	Baltimore-Towson
Baltimore Haze Cam @ Brandon Shores	Brandon Shores Power Plant 1000 Brandon Shores Dr	Anne Arundel	21226	39.181511, -76.537544	Suburban	-	-	-	-	NA
Calvert County, 240090011	350 Stafford Road	Barstow, Calvert	20678	38.536722, -76.617194	Rural	Stafford Road	-	-	53	DC-Arlington-Alexandria
Davidsonville, 240030014	Davidsonville Recreation Center, 3801 Queen Anne Bridge Road	Davidsonville, Anne Arundel	21035	38.902500, -76.653056	Rural	Queen Anne Bridge Road	-	-	106	Baltimore-Towson
Edgewood, 240251001	Edgewood Chemical Biological Center (APG), Waehli Road	Edgewood, Harford	21010	39.410000, -76.296667	Rural	Waehli Road	-	-	16	Baltimore-Towson
Essex, 240053001	600 Dorsey Avenue	Essex, Baltimore	21221	39.310833, -76.474444	Suburban	Franklin Avenue	200	1993	5	Baltimore-Towson
Fairhill, 240150003	4600 Telegraph Road	Fairhill, Cecil	21921	39.701111, -75.860000	Rural	Telegraph Road (Route 273)	7270	2010	26	Wilmington, DE-MD-NJ
Fire Dept 20*, 245100008	Baltimore City Fire Department, 5714 Eastern Avenue	Baltimore City	21224	+39.287770,-76.546861	Suburban	Eastern Avenue (Route 150)	22351	2010	45	Baltimore-Towson
Frederick Airport, 240210037	Frederick County Airport, 180 E Airport Drive	Frederick, Frederick	21701	39.408056, -77.375833	Suburban	Disposal Plan Road	5	1998	9	DC-Arlington-Alexandria
Frostburg Haze- Cam	Eastern Garrett Co. Vol. Fire Dept. 401 Finzel Road	Finzel, Garrett	21532	-	Rural	-	-	-	-	NA
Frostburg Improve 240239000	Frostburg Reservoir	Finzel, Garrett	21532	39.705896, -79.012117	Rural	Piney Run Road	-	-	1141	NA
Furley, 245100054	Furley E.S. Recreational Center, 4633 Furley Avenue	Baltimore City	21206	39.328890, -76.552500	Urban and City Center	Furley Avenue	-	-	29	Baltimore-Towson
Glen Burnie, 240031003	Anne Arundel County Public Works Bldg, 7409 Baltimore	Glen Burnie, Anne Arundel	21061	39.169533, -76.627933	Suburban	Baltimore Annapolis Blvd	16801	2008	42	Baltimore-Towson

SITE NAME, AQS ID	STREET ADDRESS	CITY, COUNTY	ZIP CODE	LATITUDE, LONGITUDE	LOCATION SETTING	NEAREST ROAD	TRAFFIC COUNT	TRAFFIC COUNT YEAR	DISTANCE FROM NEAREST RD. (M)	CORE BASED STATISTICAL AREA (CBSA)
	Annapolis Blvd					(Route 648)				
Hagerstown, 240430009	18530 Roxbury Road	Hagerstown, Washington	21740	39.565556, -77.721944	Rural	Roxbury Road	50	1993	49	Hagerstown-Martinsburg
Horn Point	University of Maryland Center for Environmental and Estuarine Studies, Horns Point Road	Cambridge, Dorchester	21613	38.58742, -76.14159	Rural	Horns Point Road	-	-	-	Cambridge
HU-Beltsville, 240330030	Howard University's Beltsville Laboratory, 12003 Old Baltimore Pike	Beltsville, Prince George's	20705	39.055277, -76.878333	Suburban	Muirkirk Road	-	-	409	D.C., Arlington, Alexandria
Millington, 240290002	Millington Wildlife Management Area, Massey-Maryland Line Road (Route 330)	Massey, Kent	21650	39.305200, 75.797200	Rural	Maryland Line Road (Route 330)	1001	2010	121	NA
NW Police, 245100007	Northwest Police Station, 5271 Reisterstown Road	Baltimore City	21215	39.344650, -76.685380	Suburban	Reisterstown Road	24961	2010	25	Baltimore-Towson
Oldtown, 245100040	Oldtown Fire Station, 1100 Hillen Street	Baltimore City	21202	39.298056, -76.604722	Urban and City Center	Hillen Street	15300	1990	7	Baltimore-Towson
Padonia, 240051007	Padonia Elementary School, 9834 Greenside Drive	Cockeysville, Baltimore	21030	39.460833, -76.631111	Suburban	Greenside Drive	-	-	93	Baltimore-Towson
PG Equestrian Center, 240338003	PG County Equestrian Center, 14900 Pennsylvania Ave.	Greater Upper Marlboro, Prince George's	20772	38.811940, -76.744170	Rural	Pennsylvania Avenue	49770	2010	191	D.C., Arlington, Alexandria
Piney Run, 240230002	Frostburg Reservoir, Finzel	Finzel, Garrett	21532	39.705916, -79.012028	Rural	Piney Run Road	-	-	1141	NA
Rockville, 240313001	Lathrop E. Smith Environmental Education Center, 5110 Meadowside Lane	Rockville, Montgomery	20855	39.114444, -77.106944	Rural	Meadowside Lane	-	-	77	DC-Arlington-Alexandria
South Carroll,	1300 W. Old Liberty	Winfield, Carroll	21784	39.444167,	Rural	Liberty Road		2010		

SITE NAME, AQS ID	STREET ADDRESS	CITY, COUNTY	ZIP CODE	LATITUDE, LONGITUDE	LOCATION SETTING	NEAREST ROAD	TRAFFIC COUNT	TRAFFIC COUNT YEAR	DISTANCE FROM NEAREST RD. (M)	CORE BASED STATISTICAL AREA (CBSA)
240130001	Road			-77.041667		(Route 26)	9680		248	Baltimore-Towson
Southern Maryland, 240170010	Oaks Road	Hughesville, Charles	20622	38.504167, -76.811944	Rural	Oaks Road	-	-	16	DC-Arlington-Alexandria

Fire Dept 20 was called S.E. Police Station in previous reports. It was relocated from the S.E. Police Station site to the fire department next door

Table 3-2a. Parameter information for current Maryland ambient air monitoring sites

SITE NAME, AQS ID	PARAMETER	START DATE	METHOD CODE	PROBE HEIGHT (M)	REPRESEN-TATIVE SCALE	MONITORING OBJECTIVE	TYPE	SAMPLE SCHEDULE
Aldino, 240259001	Ozone	4/20/1990	047	6.0	Urban	Maximum Ozone concentration	SLAMS	Every hour
Baltimore Haze Cam @ Brandon Shores	Visibility	4/1/2007	NA	NA	NA	Public Notification	NA	NA
Calvert Co., 240090011	Ozone	4/1/2005	047	4.6	Urban	Population Exposure	SLAMS	Every hour
Davidsonville, 240030014	Ozone	6/6/1980	047	4.5	Urban	Population Exposure	SLAMS	Every hour
Edgewood, 240251001	Ozone	3/10/1980	091	4.5	Urban	Highest Concentration	SLAMS	Every hour
	$PM_{2.5}$ Continuous	1/1/1999	170	5.1	Neighborhood	Population Exposure	SLAMS	Every hour
Essex, 240053001	Air Toxics	1/1/1993	150	4.0	Neighborhood	Population Exposure	Toxics	Every 6 days
	Carbon Monoxide	4/1/1967	593	4.6	Middle	Highest Concentration	SLAMS	Every hour
	Nitric Oxide	1/1/1993	074	4.6	Neighborhood	Maximum Precursor Emissions Impact	SLAMS	Every hour
	Nitrogen Dioxide	1/1/1972	074	4.6	Neighborhood	Maximum Precursor Emissions Impact	SLAMS	Every hour
	Oxides of Nitrogen	1/1/1980	074	4.6	Neighborhood	Maximum Precursor Emissions Impact	SLAMS	Every hour
	Ozone	1/1/1972	047	4.6	Neighborhood	Population Exposure	SLAMS	Every hour
	Type 2 PAMS: VOCs	6/1/1996	128/126/102	4.0	Neighborhood	Maximum Precursor Emissions Impact	PAMS	Every hour, Every 6 days
	$PM_{2.5}$ Chemical Speciation	10/1/2000	810	5.0	Neighborhood	Population Exposure	STN	Every 3 days
	$PM_{2.5}$	1/1/1999	118	5.1	Neighborhood	Population Exposure	SLAMS	Every 3 days
	Sulfur Dioxide	1/1/1972	600	5.0	Neighborhood	Highest Concentration	SLAMS	Every hour
Fairhill,	Ozone	1/1/1992	091	4.0	Urban	Regional	SLAMS	Every hour

SITE NAME, AQS ID	PARAMETER	START DATE	METHOD CODE	PROBE HEIGHT (M)	REPRESEN-TATIVE SCALE	MONITORING OBJECTIVE	TYPE	SAMPLE SCHEDULE
240150003						Transport		
	$PM_{2.5}$ Continuous	6/28/2006	170	4.7	Regional/Background	Regional	SLAMS	Every hour
Fire Dept 20, 245100008	PM_{10}	3/10/2004	118	13	Neighborhood	Population Exposure	SLAMS	Every 6 days
	$PM_{2.5}$	6/20/2001	118	13	Middle	Source Oriented	SLAMS	Every 3 days
Frederick Airport, 240210037	Ozone	7/9/1998	047	3.4	Urban	Population Exposure	SLAMS	Every hour
Frostburg Improve, 240239000	IMPROVE Parameters	3/1/2004	NA	4.0	Regional	Regional Transport	Improve	Every 3 days
Frostburg, HazeCam	Visibility	10/1/2005	-	NA	NA	Public Notification	-	NA
Furley, 245100054	Ozone	8/20/2006	091	10	Neighborhood	Population Exposure	SLAMS	Every hour
Glen Burnie, 240031003	PM_{10}	4/11/90	118	2.7	Neighborhood	Population Exposure	SLAMS	Every days
	$PM_{2.5}$	1/1/1999	118	2.2	Neighborhood	Population Exposure	SLAMS	Every 3 days
Hagerstown, 240430009	$PM_{2.5}$ Continuous	5/1/2005	170	4.0	Urban	Highest Concentration	SPM	Every hour
	Ozone	4/1/1999	047	4.6	Urban	Population Exposure, Highest Concentration	SLAMS	Every hour
Horn Point,	Ozone	4/1/2012	087	4.0	To Be Determined	To Be Determined	To Be Determined	Every hour
	Nitric Oxide and Reactive Oxides of Nitrogen	4/1/2012	599	4.0	To Be Determined	To Be Determined	To Be Determined	Every hour
	Trace Carbon Monoxide	4/1/2012	593	4.0	To Be Determined	To Be Determined	To Be Determined	Every hour
	Trace Sulfur Dioxide	4/1/2012	600	4.0	To Be Determined	To Be Determined	To Be Determined	Every hour
	$PM_{2.5}$ Continuous	4/1/2012	170	4.0	To Be Determined	To Be Determined	To Be Determined	Every hour
HU-Beltsville, 2400330030	Air Toxics	5/10/2006	150	4.0	Neighborhood	Population Exposure	Toxics	Every 6 days
	Lead	12/12/2011	811	2.3	Neighborhood	Population Exposure	NCore	Every 3 days
	Nitric Oxide and Reactive Oxides of	5/28/2008	074	.6	Urban	General/ Background	NCore	Every hour

SITE NAME, AQS ID	PARAMETER	START DATE	METHOD CODE	PROBE HEIGHT (M)	REPRESEN-TATIVE SCALE	MONITORING OBJECTIVE	TYPE	SAMPLE SCHEDULE
	Nitrogen							
	Ozone	5/1/2005	047	.6	Urban	Highest Concentration, Population Exposure	NCore	Every hour
	Type 3 PAMS, VOCs	5/10/2005	126	4.6	Urban	Upwind Background	Unofficial PAMS	Every 6 days, every 3 hours
	PM_{10}	7/25/2010	127	2.3	Urban	Population Exposure	NCore	Every 3 days
	$PM_{2.5}$	7/10/2004	118	2.3	Urban	Population Exposure	NCore	Every 3 days
	$PM_{2.5}$ Continuous	9/1/2005	170	4.5	Urban	Population Exposure	SLAMS	Every hour
	PM Coarse	1/1/2011	176	2.3	Neighborhood	Population Exposure	NCore	Every 3 days
	$PM_{2.5}$ Chemical Speciation	12/5/2004	810	2.3	Urban	Population Exposure	NCore	Every 6 days
	$PM_{2.5,}$ Elemental & Organic Carbon	2005	NA	4.0	Urban	General / Background	NA	Every 2hours
	Sulfate ($PM_{2.5}$)	8/29/2005	NA	4.0	Urban	General / Background	NCore	Every hour
	Trace Carbon Monoxide	12/20/2006	554	4.6	Urban	General / Background	NCore	Every hour
	Trace Sulfur Dioxide	9/29/2006	560	4.6	Urban	General / Background	NCore	Every hour
Millington, 240290002	Ozone	6/19/1989	047	4.5	Urban	Population Exposure	SLAMS	Every hour
	$PM_{2.5}$ Continuous	1/24/08	170	5	Neighborhood	Forecasting	SPM	Every hour
NW Police, 245100007	$PM_{2.5}$	1/1/1999	118	8.2	Neighborhood	Population Exposure	SLAMS	Every 3 days
Oldtown, 245100040	Air Toxics	1/1/1991	150	4	Middle	Population Exposure	Toxics	Every 6 days
	Carbon Monoxide	1/1/1982	593	4.4	Middle	Highest Concentration	SLAMS	Every hour
	Light Scatter	9/1/2004	NA	NA	NA	NA	NA	Every hour
	Nitric Oxide, Nitrogen Dioxide, and Oxides of Nitrogen	1/1/1982	074	4.6	Middle	Highest Concentration	SLAMS	Every hour
	$PM_{2.5}$ Continuous	4/1/2002	170	5.1	Middle	Highest Concentration	SLAMS	Every hour

SITE NAME, AQS ID	PARAMETER	START DATE	METHOD CODE	PROBE HEIGHT (M)	REPRESEN-TATIVE SCALE	MONITORING OBJECTIVE	TYPE	SAMPLE SCHEDULE
	$PM_{2.5}$	1/1/1999	118	4.9	Middle	Highest Concentration	SLAMS	Every day
Padonia, 240051007	Ozone	1/1/1979	091	4.2	Neighborhood	Population Exposure	SLAMS	Every hour
	$PM_{2.5}$	1/1/1999	118	4.8	Neighborhood	Population Exposure	SLAMS	Every 3 days
PG Equestrian Center, 240338003	Ozone	4/1/2002	047	4.4	Urban	Population Exposure	SLAMS	Every hour
	$PM_{2.5}$	5/1/2002	118	5.1	Neighborhood	Population Exposure	SLAMS	Every 3 days
Piney Run, 240230002	Light Scatter	9/2004	NA	4.0	NA	NA	NA	Every hour
	Nitric Oxide, and Reactive Oxides of Nitrogen	5/1/2004	591	10	Regional	Regional Transport	NCore	Every hour
	Trace Carbon Monoxide	6/1/2004	554	4.0	Regional	Regional Transport	NCore	Every hour
	Ozone	4/1/2004	047	4.0	Regional	Regional transport	NCore	Every hour
	$PM_{2.5}$ Continuous	7/1/2004	170	4.9	Regional	Regional transport	NCore	Every hour
	PM coarse	1/1/2011	185	4.9	Urban	General/ Background	NCore	Every hour
	$PM_{2.5}$ Chemical Speciation (IMPROVE)	2005	NA	4.0	Regional	Regional Transport	Improve	Every 3 days
	$PM_{2.5}$ Elemental & Organic Carbon	7/2004	NA	4.0	Regional	Regional Transport	NA	Every 2 hours
	Trace SO2	1/1/2007	560	4.0	Regional	Regional Transport	NCore	Every hour
	Sulfate ($PM_{2.5}$)	7/1/2004	NA	4.0	Regional	Regional Transport	NCore	Every hour
Rockville, 240313001	Ozone	1/1/1980	047	4.0	Urban	Population Exposure	SLAMS	Every hour
	$PM_{2.5}$ Continuous	8/22/08	170	5.3	Neighborhood	Population Exposure	SLAMS	Every hour
South Carroll, 240130001	Ozone	7/14/1983	047	4.0	Urban	Population Exposure	SLAMS	Every hour
Southern Maryland, 240170010	Ozone	10/2/1984	047	4	Regional	General / Background	SLAMS	Every hour

Note: Based on the air monitoring regulations CFR 40 part 58 7.30 (a) (1), data collected by the $PM_{2.5}$ monitor located at Oldtown is representative at the middle scale and will not be compared to the annual $PM_{2.5}$ NAAQS of 15 $\mu g/m^3$. Ambient air monitoring sites operate year-round except ozone where noted; Ozone Final Monitoring Rule announced August, 2011 would change the season to March through October. Following an EPA directive, nitrogen

dioxide (NO_2) measured by method codes 574 and 591 is no longer being reported. This change effects the nitrogen oxides analyzers located at HU-Beltsville and Piney Run.

Table 3-2b Parameter counts by site (cross-reference to Table 3-2a)

Site Name	Air Toxics	Carbon monoxide	Lead	Light Scatter	Nitrogen Oxide	Nitrogen Dioxide	NO_X	Oxides of Nitrogen	Ozone	PAMS VOC's	$PM_{2.5}$	$PM_{2.5}$ Elemental & Organic Carbon	$PM_{2.5}$ (continuous)	PM_{10}	PM_{10} (continuous)	PM (coarse)	Speciated $PM_{2.5}$	Sulfur Dioxide	Sulfate ($PM_{2.5}$)	Trace CO	Trace SO_2	TOTALS
Aldino									1													**1**
Calvert County									1													**1**
Davidsonville									1													**1**
Edgewood									1				1									**2**
Essex	1	1			1	1	1		1	1	1						1	1				**10**
Fairhill									1				1									**2**
Frederick Airport									1													**1**
Fire Dept 20											1			1								**2**
Furley									1													**1**
Glen Burnie											1			2								**3**
Hagerstown									1				1									**2**
Horn Point		1			1	1			1				1					1				**6**
HU-Beltsville	1		1		1		1	1	1	1	2	1	1	2		2	1		1	1	1	**19**
Millington									1				1									**2**
NW Police											1											**1**
Oldtown	1	1		1	1	1	1				1		1									**8**
Padonia									1		2											**3**
PG Equestrian Center									1		2											**3**
Piney Run				1	1			1	1			1	1		1	1			1	1	1	**11**
Rockville									1				1									**2**
South Carroll									1													**1**
Southern Maryland									1													**1**
TOTALS	**3**	**3**	**1**	**2**	**5**	**3**	**3**	**2**	**18**	**2**	**11**	**2**	**9**	**5**	**1**	**3**	**2**	**2**	**2**	**2**	**2**	**83**

Note the above table does not include RAIN, Visibility, or IMPROVE monitors; see Table 3-2a and Section 4 for details about those monitors

Table 3-3 Monitoring methods and associated AQS codes used in the Maryland ambient air monitoring network

PARAMETER	METHOD CODE	SAMPLE ANALYSIS DESCRIPTION
Air Toxics*	150	Cryogenic precon: gc/ms
Carbon Monoxide, Trace	554,	Gas Filter Correlation Thermo Electron 48i-TLE
	593	Gas Filter Correlation Teledyne API 300 EU
Lead	811	X-ray Fluorescence (EDXRF) FRM
Light Scatter	NA	Open-Air Integrating Nephelometer
Nitric Oxide and Nitrogen Dioxide	074	Chemiluminescence
Nitric Oxide, and Reactive Oxides Of Nitrogen	574	TECO 42S Chemiluminescence for Low Level Measurements
	591	Chemiluminescence Ecotech EC9843
Nitric Oxide	599	Chemiluminescence, Teledyne API 200 EU/501
PAMS VOCs*	128	Gas Chromatograph with Flame; GC FID
	126	Cryogenic Pre-concentration Trap GC/FID
Ozone	047	Ultra Violet Photometry
	091	Ultraviolet radiation absorption
PM_{10}	127	Gravimetric, R - P Co Partisol Model 2025
$PM_{2.5}$	118	Gravimetric, Partisol Plus 2025
$PM_{10-2.5}$(PM Coarse)	176	Paired gravimetric difference, Partisol Plus 2025
	185	Paired Gravimetric Difference, Met One BAM-1020 System
$PM_{2.5}$ Species* Constituents: Trace Elements	811	Energy Dispersive XRF using Teflon Filter
$PM_{2.5}$ Species* Constituents: Ions	812	Ion Chromatography using Nylon Filter
$PM_{2.5}$ Species* Constituents: Organics	813	Using Quartz Filter - Thermo-Optical Transmittance
$PM_{2.5}$ Speciation Mass	810	Gravimetric, Met One SASS using Teflon
$PM_{2.5}$ Continuous	127	FEM, Beta Attenuation
$PM_{2.5}$- Elemental and Organic Carbon	NA	OCEC, Self-contained Non-dispersive Infrared (NDIR) Detector System.
IMPROVE Parameters*	NA	Four Module, Improve Protocol analysis
Sulfur Dioxide	060	Pulsed Fluorescence
Sulfur Dioxide, Trace	560,	Pulsed Fluorescence, 43C-TLE/43i-TLE
	600	Ultraviolet Fluorescence API 100 EU
Sulfate-$PM_{2.5}$	NA	Pulsed Fluorescent with High Efficiency SO_4 to SO_2 Converter
Visibility	NA	Camera

*See Table 3-4 for constituents belonging to these groups

Table 3-4 Constituent compounds and species measured in Maryland.

CONSTITUENT GROUP	COMPOUNDS IN THE CONSTITUENT GROUP
Air Toxics	Dichlorodifluoromethane, Chloromethane, 1,2-Dichloropropane, 1,1,2,2-Tetrafluoroleth, Chloroethene, 1,3-Butadiene, Bromomethane, Chloroethane, Trichlorofluoromethane, Acrolein, Acetone, 1,1-Dichloroethene, Methylene Chloride, Carbon disulfide, Isopropyl Alcohol, 1,1,2-Trichloro-1,2,2-trifluoroethane, Trans-1,2-Dichloroethene, 1,1-Dichloroethane, 2-methoxy-2-methyl-Propane, Methyl ethyl Ketone (2-butanone), Cis-1,2-Dichloroethene, Hexane, Chloroform, Ethyl Acetate, Tetrahydrofuran, 1,2-Dichloroethane, 1,1,1-Trichloroethane, Benzene, Carbon tetrachloride, Cyclohexane, 1,2-Dichloropropane, Bromodichloromethane, Trichloroethylene, Heptane, Cis-1,3-Dichloro-1-Propene, Methyl Isobutyl Ketone, Trans-1,3-Dichloro-1-Propene, 1,1,2-Trichloroethane, Toluene, Dibrochloromethane, Methyl butyl Ketone, (2-Hexanone), 1,2-Dibromoethane, Tetrachloroethylene, Chlorobenzene, Ethyl benzene, m & p- Xylene, Bromoform (Tribromomethane), Styrene, 1,1,2,2-Tetrachloroethane, o-Xylene, 1-Ethyl-4-Methylbenzene, 1,3,5-Trimethylbenzene, 1,2,4-Trimethylbenzene, Benzyl Chloride, 1,3-dichlorobenzene, Acetonitrile, Acrylonitrile, 1,4-Dichlorobenzene, 1,2-Dichlorobenzene, 1,2,4-Trichlorobenzene, and Hexachloro-1,3-Butadiene
IMPROVE Parameters	Aerosol light extinction, Aerosol light scattering, Air temperature, Aluminum, Ammonium ion, Ammonium Nitrate, Ammonium sulfate, Arsenic, Bromine, Calcium, Chloride, Chlorine Chromium, Copper, Elemental carbon, Humidity, Hydrogen, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Nitrate, Nitrite, Organic carbon, Phosphorus, PM_{10}, $PM_{2.5}$, Potassium, Relative Humidity, Rubidium, Selenium, Silicon, Sodium, Strontium, Sulfate, Sulfur Dioxide, Sulfur, Titanium, Vanadium, Zinc, and Zirconium
PAMS VOCs	Acetone, Ethane, Acetylene, Propane, 2,2-dimethylbutane, Benzene, i-Butane, n-Butane, i-Pentane, n-Pentane, 2,2,4-trimethylpentane, i-Propylbenzene, n-hexane, 2-methylpentane, 2,3-dimethylbutane, Cyclopentane, Ethylbenzene, n-Propylbenzene, 3-methylpentane, Toluene, Styrene, n-Heptane, 2-methylhexane, 2,4-dimethylpentane, 2,3,4-trimethylpentane, o-Xylene, 3-methylhexane, 2,3-dimethylpentane, Formaldehyde, n-Octane, 2-methylheptane, Cyclohexane, 3-methylheptane, n-Nonane, m&p-Xylenes, Methylcyclohexane, Methylcyclopentane, n-Decane, n-Undecane, Acetaldehyde, 1,2,3-Trimethylbenzene, 1,2,4-Trimethylbenzene, 3-methyl-1-butene, 1-Butene, Propene, 1-Pentene, 1,3,5-Trimethylbenzene, 2-methyl-1-pentene, 2-methyl-2-butene, c-2-hexene, c-2-pentene, c-2-Butene, Cyclopentene, 4-methyl-1-pentene, t-2-hexene, t-2-Butene, t-2-pentene, Isoprene
RAIN	Sulfate, EC/OC, light scattering, trace SO_2 , trace CO, ozone, continuous $PM_{2.5}$, surface meteorology, visual scene images - Haze Cam, IMPROVE parameters
Speciated $PM_{2.5}$ Mass	Aluminum, Ammonium, antimony, Arsenic, Barium, Bromine, Cadmium, Calcium, Carbonate carbon, Cerium, Cesium, Chlorine, Chromium, Cobalt, Copper, Elemental carbon, Europium, Gallium, Gold, Hafnium, Indium, Iridium, Iron, Lanthanum, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Niobium, Nitrate, OCX, OCX2, Organic carbon, Phosphorus, Pk1_OC, Pk2_OC, Pk3_OC, Pk4_OC, Potassium, PyrolC, Rubidium, Samarium, Scandium, Selenium, Silicon, Silver, Sodium, Strontium, Sulfate, Sulfur, Tantalum, Terbium, Tin, Titanium, Total carbon, Vanadium, Wolfram, Yttrium, Zinc, and Zirconium

4. SPECIFIC POLLUTANT NETWORK DESCRIPTIONS AND REQUIREMENTS

EPA Ambient Air Monitoring requirements for some pollutants are based on CBSA population counts. *CFR 40, TABLE D–5 OF APPENDIX D TO PART 58,* requires that population be based on the latest available census figures. CBSA population counts used for this year's report are 2008 estimates sourced from AQS[1].

4.1 Carbon Monoxide (CO) – General Description and Sampling Method

Carbon monoxide is measured by infrared absorption photometry. Air is drawn continuously through a sample cell where infrared light passes through it. Carbon monoxide molecules in the air absorb part of the infrared light, reducing the intensity of the light reaching a light sensor. The light is converted into an electrical signal related to the concentration of carbon monoxide in the sample cell.

4.1.1 Monitoring Requirements

There is no minimum requirement for the number of CO monitoring sites. Operation of the existing CO sites in Maryland is required until the Program requests discontinuation of a site in the Annual Network Plan and the EPA Regional Administrator approves the request. Where CO monitoring is ongoing, at least one site must be a maximum concentration site for that area under investigation.

4.1.2 Sources

CO is formed when carbon in fuel is not completely burned. The EPA estimates that approximately 60% of all CO emissions are from motor vehicle exhaust. Other sources include incinerators, wood stoves, furnaces, and some industrial processes. Concentrations are highest along heavily traveled highways, and decrease significantly the further away the monitor is from traffic. Therefore, CO monitors are usually located close to roadways or in urban areas.

4.1.3 Changes Planned for 2012-2013

No changes planned.

4.2 Lead (Pb) – General Description and Sampling Method

On October 15, 2008, EPA substantially strengthened the national ambient air quality standards for lead (see 73 FR 66934). EPA revised the level of the primary (health-based) standard from 1.5 $\mu g/m^3$ to 0.15 $\mu g/m^3$, measured as total suspended particles (TSP), but PM_{10} will be allowed at NCore sites) and revised the secondary (welfare-based) standard to be identical in all respects

[1] Note that 2010 census counts were used to calculating the PWEI, an index that's required for determining the number of sulfur dioxide monitors.

to the primary standard. On December 30, 2009, EPA proposed revisions to the lead monitoring requirements pertaining to where State and local monitoring agencies would be required to conduct lead monitoring. The final rule became effective on January 26, 2011.

Using the low volume PM-10 with XRF analysis, lead is collected by gravimetric PM_{10} samplers as described in Section 4.5; then the filters are sent to a lab to be analyzed for lead by the x-ray fluorescence method.

4.2.1 Monitoring Requirements

Table 4-1. Monitoring required due to Revisions to Pb ambient air monitoring regulations

Requirement	Appendix to Part 58	Required in MD	Comments
One source-oriented SLAMS site located to measure the maximum Pb concentration resulting from each non-airport Pb source which emits 0.50 or more tons per year	4.5(a)	0	The Program modeled the .57tpy GenOn Energy in Charles County and found it below the threshold and will be submitting a wavier for it.
One source-oriented SLAMS site located to measure the maximum Pb concentration resulting from airport which emits 1.0 or more tons per year	4.5(a)	0	The Program, in conjunction with EPA Region III, found no Pb sources satisfying this requirement in the 2007 emissions inventory
Non-source oriented Pb monitoring at each required NCore site in a CBSA having a population of 500,000 or more	4.5(b)	1	One monitor is in operation at HU-Beltsville

4.2.2 Sources

Lead (Pb) is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been motor vehicles and industrial sources. As a result of EPA's regulatory efforts to remove lead from gasoline, emissions of lead from the transportation sector dramatically declined by 95 percent between 1980 and 1999, and levels of lead in the air decreased by 94 percent between 1980 and 1999. Today, the highest levels of lead in air are usually found near lead smelters. Other stationary sources are waste incinerators, utilities, lead-acid battery manufacturers and general aviation airports. Soil can pick up lead from exterior paint, or other sources such as past use of leaded gas in cars.

4.2.3 Changes Planned for 2012-2013

No changes planned.

4.3 Nitrogen Dioxide (NO_2) – General Description and Sampling Method

On January 22, 2010, EPA strengthened the health-based National Ambient Air Quality Standard (NAAQS) for nitrogen dioxide (NO_2) by setting a new 1-hour NAAQS at 100 ppb. The existing annual average NAAQS of 53 ppb has been retained as well.

Nitrogen dioxide is produced during high-temperature burning of fuels. Sources include motor vehicles and stationary sources that burn fossil fuels such as power plants and industrial boilers. It is measured indirectly. First, nitrogen oxide (NO) is measured using the chemiluminescence reaction of nitric oxide (NO) with ozone (O_3). Air is drawn into a reaction chamber where it is mixed with a high concentration of ozone from an internal ozone generator. Any NO in the air reacts with the ozone to produce NO_2. Light emitted from this reaction is detected with a photomultiplier tube and converted to an electrical signal proportional to the NO concentration. Next, total nitrogen oxides (NO_x) are measured by passing the air through a converter where any NO_2 in the air is reduced to NO before the air is passed to the reaction chamber. By alternately passing the air directly to the reaction chamber, and through the converter before the reaction chamber, the analyzer alternately measures NO and NO_x. The NO_2 concentration is equal to the difference between NO_x and NO.

4.3.1 Monitoring Requirements

In addition to establishing a new 1-hour NO_2 NAAQS, EPA has set new requirements for NO_2 monitoring in urban areas as follows:

Near Road Monitoring

At least one monitor must be located near a major road in any urban area with a population greater than or equal to 500,000 people. A second monitor is required near another major road in areas with either:

(1) Population greater than or equal to 2.5 million people, or
(2) One or more road segment with an annual average daily traffic (AADT) count greater than or equal to 250,000 vehicles.

These NO_2 monitors must be placed near those road segments ranked with the highest traffic levels by AADT, with consideration given to fleet mix, congestion patterns, terrain, geographic location, and meteorology in identifying locations where the peak concentrations of NO_2 are expected to occur. Monitors must be placed no more than 50 meters (about 164 feet) away from the edge of the nearest traffic lane.

Community Wide Monitoring

A minimum of one monitor must be placed in any urban area with a population greater than or equal to 1 million people to assess community-wide concentrations.

Monitoring to Protect Susceptible and Vulnerable Populations

Working with the states, EPA Regional Administrators will site at least 40 additional NO_2 monitors to help protect communities that are susceptible and vulnerable to NO_2 related health effects.

All new NO_2 monitors must begin operating no later than January 1, 2013.

Changes Planned for 2012-2013

Near Road Monitoring

MDE has received funding from to EPA to install one near road NO_2 monitor by January 1, 2013. Based on field reconnaissance and filter-based sampling detailed in Appendix C, MDE has chosen the southbound I-95 rest area between MD216 and MD32 for the near road monitoring site.

Area-wide Monitoring

MDE's existing NO_2 monitors at the Essex and Oldtown sites fulfill this requirement.

Sensitive and Vulnerable Populations

EPA Region III is not requiring MDE to install any additional monitors to meet this requirement.

4.4 Ozone (O_3) – General Description and Sampling Method

Ozone is measured by ultraviolet absorption photometry. Air is drawn continuously through a sample cell where ultraviolet light passes through it. O_3 molecules in the air absorb part of the ultraviolet light, reducing the intensity of the light reaching a light sensor. The light is converted into an electrical signal related to the concentration of O_3 in the sample cell.

4.4.1 Monitoring Requirements

Within an O_3 network, at least one O_3 site for each MSA, or CSA if multiple MSAs are involved, must be designed to record the maximum concentration for that particular metropolitan area. More than one maximum concentration site may be necessary in some areas Since O_3 requires appreciable formation time, the mixing of reactants and products occurs over large volumes of air, and this reduces the importance of monitoring small-scale spatial variability. The appropriate spatial scales for O_3 sites are neighborhood, urban, and regional.

The prospective maximum concentration monitor site should be selected in a direction from the city that is most likely to observe the highest O_3 concentrations, more specifically, downwind during periods of photochemical activity. Since O_3 levels decrease significantly in

the colder parts of the year in many areas, O_3 is required to be monitored only during the "ozone season" as designated in the 40 CFR Part 58 Appendix D, which in Maryland is April 1 through October 31.

4.4.2 Sources

Ozone is not emitted directly from a pollution source but is formed in the lower atmosphere by the reaction of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight and warm temperatures. Sources of nitrogen oxides include automobiles, power plants and other combustion activities. VOCs can come from automobiles, gasoline vapors, and a variety of large and small commercial and industrial sources that use chemical solvents, paint thinners, and other chemical compounds. NO_x and VOCs or "precursors of ozone" can travel for many miles before chemical reactions in the atmosphere form O_3.

4.4.3 Changes Planned for 2012-2013

No changes planned.

4.5 PM_{10} – General Description and Sampling Method

The Program uses both manual gravimetric and automated monitors to measure PM_{10} mass concentrations in the Maryland network. The PM_{10} Beta Attenuation Monitor (BAM) automatically measures and records dust concentrations with built-in data logging. It uses the principal of beta ray attenuation to provide a simple determination of mass concentration. An external pump pulls a measured amount of air through a filter tape for a one-hour period. The filter tape, impregnated with ambient dust, is placed between the source and the detector thereby causing the attenuation of the measured beta-particle signal. The degree of attenuation of the beta-particle signal is used to determine the mass concentration of particulate matter on the filter tape and hence the hourly volumetric concentration of particulate matter in the ambient air.

Gravimetric samplers draw air through a specially designed inlet that excludes particles larger than 10 microns in diameter for a period of 24 hours. The particles are collected on a Teflon filter that is weighed to determine the particulate mass. These samplers report the air volume measured during the sampling period allowing the concentration (mass/volume) to be calculated.

4.5.1 Monitoring Requirements

Maryland must operate the minimum of two PM_{10} SLAMS monitoring sites as listed in 40 CFR, Part 58 Appendix D, Table D-4.

4.5.2 Sources

Major sources of PM_{10} include steel mills, power plants, motor vehicles, industrial plants, unpaved roads, and agricultural tilling. The wide variety of PM_{10} sources means that the chemical and physical composition of coarse particles is highly variable.

4.5.3 Changes Planned for 2012-2013

No changes planned.

4.6 Fine Particulate Matter ($PM_{2.5}$) – General Description and Sampling Method

The Program also uses both manual gravimetric and automated monitors, BAM's, to measure $PM_{2.5}$ mass concentrations in Maryland. A filter attached to the inlets of these monitors excludes particles having diameters greater than 2.5 microns. Otherwise, the monitors work as described for PM_{10} gravimetric and automated monitoring, section 4.5. Some of the gravimetric monitors are specially equipped to collect $PM_{2.5}$ samples which are later analyzed into concentrations of the samples' chemical constituents or species. See Table 3-4 for list of speciated $PM_{2.5}$ mass.

The Program uses MetOne Super SAAS samplers and IMPROVE samplers for the collection of samples for the chemical speciation of $PM_{2.5}$. The samplers collect 3 to 4 filter samples simultaneously every third or sixth day for a period of 24 hours. These samples are then sent to an EPA contract laboratory for chemical analyses. There are over 50 species consisting of ions, metals and carbon species quantified by the analyses (see Table 3-4).

4.6.1 Monitoring Requirements

Maryland must operate at least the minimum number of required $PM_{2.5}$ sites listed in 40 CFR Part 58 Appendix D Table D-5. These required monitoring stations or sites must be located to represent community-wide air quality. In addition, the following specific criteria also apply:

- At least one monitoring station is to be sited in a population-oriented area of expected maximum concentration.
- For areas with more than one required station, a monitoring station is to be located in an area of poor air quality.
- Each state shall install and operate at least one $PM_{2.5}$ site to monitor for regional background and at least one $PM_{2.5}$ site to monitor regional transport.

Maryland is also required to operate continuous fine particulate analyzers at three monitoring sites, and one of those sites must be collocated for quality assurance purposes.

In addition, chemical speciation is encouraged at sites where the chemically resolved data would be useful in developing the State Implementation Plan (SIP) and supporting health effects related studies.

Please note that data collected by the $PM_{2.5}$ monitor located at Oldtown is representative of the middle scale and will not be compared to the annual $PM_{2.5}$ NAAQS of 15 $\mu g/m^3$.

4.6.2 Sources

$PM_{2.5}$ pollution is emitted from combustion activities (such as industrial and residential fuel burning and motor vehicles). $PM_{2.5}$ can also form in the atmosphere from precursor compounds through various physical and chemical processes.

4.6.3 Changes Planned for 2012-2013

No changes planned.

4.7 Sulfur Dioxide (SO_2) – General Description and Sampling Method

Sulfur dioxide (SO_2) is measured with a fluorescence analyzer. Air is drawn through a sample cell where it is subjected to high intensity ultraviolet light. This causes the sulfur dioxide molecules in the air to fluoresce and release light. The fluorescence is detected with a photo multiplier tube and converted to an electrical signal proportional to the SO_2 concentration.

4.7.1 Monitoring Requirements

On June 22, 2010 EPA published final rules revising SO_2 monitoring networks. The rule requires monitoring organizations to submit a plan for establishing SO_2 monitoring sites in accordance with these requirements by July 1, 2011. Table 4-3 shows monitoring required in all Maryland CBSA's due to revisions to the SO_2 ambient air monitoring regulations.

Table 4-2. Monitoring Required by Revisions to SO_2 Ambient Air Monitoring Regulations for all Maryland CBSA's

Requirement	Appendix to Part 58, section	CBSA affected	Required in MD	Comments
Monitors based on the population in each CBSA weighted by SO_2 emissions	4.4.2	Baltimore-Towson, MD	1	No additional monitors are required based on recalculation of the population weighted emissions index (PWEI) using 2008 Maryland SO_2 emissions and 2010 Maryland county census data.
		PA-NJ-DE-MD	2	No additional monitors required in Maryland
		DC-VA-MD-WV	3	No additional monitors required in Maryland
Regional Administrator Required Monitoring	4.4.3		0	EPA Region III has not informed the Program of any administrator required monitoring
NCore Monitoring	4.4.5		2	Already satisfied at both NCore sites

4.7.2 Sources

The main sources of SO_2 are combustion of coal and oil (mostly from electrical generating units (EGUs), refineries, smelters, and industrial boilers). Nationally, two-thirds of all sulfur dioxide emissions are from EGUs. Coal operated EGUs account for 95% of these emissions.

4.7.3 Changes Planned for 2012-2013

No changes planned

4.8 PAMS (Photochemical Assessment Monitoring Stations) – General Description and Sampling Method

The purpose of the PAMS program is to provide an air quality database that will assist in evaluating and modifying control strategies for attaining the ozone NAAQS. The selection of parameters to be measured at a PAMS site varies with the site's ozone nonattainment designation (moderate, serious, severe or extreme) and whether the site is upwind or downwind of ozone precursor source areas. The parameters are O_3, NO, NO_x, NO_2, NO_y and speciated volatile organic compounds (VOCs).

Methods used to sample and analyze VOCs and NO_y follows (NO/NO_x and O_3 have already been described in Sections 4.3 and 4.4, respectively):

Ambient air is collected in eight 3-hour canister samples every 3rd (June – August) day using a XonTech Model 910A Canister Sampler with a Model 912 multi-canister sampling adapter. The canisters are returned to the laboratory for analysis on an EnTech/Agilent GC/FID system.

Ambient air is collected in 24-hour canister samples every sixth day using a XonTech Model 910A Canister Sampler. The canisters are returned to the laboratory for analysis on an EnTech/Agilent GC/FID system. These are the same canister samples listed in section 4.9 below but analyzed for the PAMS list of compounds.

Ambient air is collected and analyzed on-site every hour (June – August) using a Perkin Elmer VOC Air Analyzer with dual flame ionization detectors.

Ambient air is sampled hourly for NO_y using a TECO, Model 42C low level oxides of nitrogen analyzer.

4.8.1 Monitoring Requirements

Maryland must operate at least the minimum PAMS monitoring network listed in 40 CFR Part 58 Appendix D Table D-6. PAMS sites sample during the months of June, July, and August. The following specific criteria apply:

At least one site is established to monitor the magnitude and type of precursor emissions in the area where maximum precursor emissions are expected.

At least one site is established to characterize upwind background and transport ozone and its precursor concentrations entering the area.

At least one NO_y site per area is established to monitor maximum O_3 concentrations occurring downwind from the area of maximum precursor emissions.

4.8.2 Monitoring Locations

There are three monitors that are part of the PAMS network. The Type 1 is located at HU-Beltsville, Prince George's County; the Type 2 is located at Essex, Baltimore County; and the Type 3 is located at Aldino, Harford County. Refer back to Table 3-2a for parameter information and monitoring objective at each monitoring site. For a map of monitoring locations in Maryland refer to Appendix A.

4.8.3 Sources

PAMS VOC's can come from automobiles, gasoline vapors, and a vast variety of large and small commercial, and industrial sources that use chemical solvents, paint thinners and other chemical compounds.

4.8.4 Changes Planned for 2012-2013

No changes are planned

4.9 Air Toxics – General Description and Sampling Method

Air toxics, or hazardous air pollutants (HAPS), are those pollutants which are known or suspected to cause cancer or other serious health effects, such as reproductive or birth defects, or adverse environmental effects. The Program's air toxics network measures the toxic VOCs listed in Table 3-4. Air toxics samples are collected for 24 hours in canisters with a XonTech model 910A canister sampler on an every sixth day schedule. The canisters are returned to the laboratory for analysis on an Entech/Agilent gas chromatograph mass spectrometer system.

4.9.1 Monitoring Requirements

As part of the EPA Region III Cooperative Toxic Monitoring Program, Maryland operates four air toxic monitoring stations to assess general urban levels. Toxics are sampled every sixth day year-round.

4.9.2 Monitoring Locations

There are four monitors measuring air toxics in Maryland: Essex, Baltimore County, NE Police and Oldtown, Baltimore City, and HU-Beltsville, Prince George's County. Refer back to Table 3-2a for parameter information and monitoring objective at each monitoring site. For a map of monitoring locations in Maryland refer to Figure 3-1.

4.9.3 Sources

Toxics can come from automobiles, gasoline vapors, and a large variety of large and small commercial and industrial sources that use chemical solvents, paint thinners and other chemical compounds.

4.9.4 Changes Planned for 2012-2013

No changes planned.

4.10 NCore – General Description and Sampling Method

On October 30, 2009 EPA's Office of Air Quality Planning and Standards (OAQPS) formally approved The Program's request that both the HU-Beltsville and Piney Run monitoring stations to be designated NCore sites.

NCore, or National Core multi-pollutant monitoring stations, is a new National monitoring network required in the October 17, 2006 revisions to the Air Monitoring Regulations (40CFR, Part 58). NCore sites are required to measure, at a minimum, $PM_{2.5}$ particle mass using continuous and integrated/filter-based samplers, speciated $PM_{2.5}$, $PM_{10-2.5}$ particle mass, speciated $PM_{10-2.5}$, O_3, SO_2, CO, NO/NO_y, wind speed, wind direction, relative humidity, and ambient temperature.

Sampling methods for $PM_{2.5}$, speciated $PM_{2.5}$, O_3, SO_2, NO/ NO_y are described under the individual pollutant sections throughout this document. Trace level measurement of CO and SO_2 is performed at NCore sites. $PM_{10-2.5}$, or PMCoarse is determined by the difference between collocated PM_{10} and $PM_{2.5}$ FRM samplers. There is no generally accepted method to perform $PM_{10-2.5}$ chemical speciation at this time.

The meteorological parameters are measured as follows:

- The Vaisala WXT520 PTU module contains separate sensors for pressure, temperature and humidity measurement. The measurement principle of the pressure, temperature and humidity sensors is based on an advanced RC oscillator and two reference capacitors against which the capacitance of the sensors is continuously measured. The microprocessor of the transmitter performs compensation for the temperature dependency of the pressure and humidity sensors.

- The Vaisala WXT520 uses RAINCAP Sensor 2- technology in precipitation measurement. The precipitation sensor comprises of a steel cover and a piezoelectrical sensor mounted on the bottom surface of the cover. The precipitation sensor detects the impact of individual raindrops. Hence, the signal of each drop can be converted directly to accumulated rainfall. An advanced noise filtering technique is used to filter out signals originating from other sources and not raindrops.
- The Vaisala WXT520 uses WINDCAP sensor technology in wind measurement. The wind sensor has an array of three equally spaced ultrasonic transducers on a horizontal plane. Wind speed and wind directions are determined by measuring the time it takes the ultrasound to travel from each transducer to the other two. The wind sensor measures the transit time (in both directions) along the three paths established by the array of transducers. This transit time depends on the wind speed along the ultrasonic path. For zero wind speed, both the forward and reverse transit times are the same. With wind along the sound path, the up-wind direction transit time increases and the down-wind transit time decreases.

The Program operates other meteorological parameters not required by the NCore network, and they are measured as follows:

- MetOne's Model 092 instrument is used to measure barometric pressure. The instrument directly senses the weight of the air column or the atmospheric pressure.
- The Climatronics's P/N 102342 Pyranometer is used to measure solar radiation. The detector element is a circular wire bound multi-junction thermopile. This thermopile sensor absorbs solar radiation and converts it to heat. The heat flows through the sensor to the pyranometer housing and generates a voltages output signal that is proportional to the solar radiation.

4.10.1 Monitoring Requirements

Each State is required to operate one NCore site that must be physically established by January 1, 2011. Urban NCore stations are to be located at the urban or neighborhood scale to provide representative concentrations of exposure expected throughout the metropolitan area. Rural NCore stations are to be located to the maximum extent practicable at a regional or larger scale away from any large local emission source so that they represent ambient concentrations over an extensive area.

4.10.2 Monitoring Locations

The Program has been operating pilot NCore sites at HU-Beltsville since 2005 and Piney Run since 2004. The Beltsville site is considered an Urban NCore site and Piney Run, a Rural NCore site. Refer to Table 3-2a for parameter information and monitoring objective at each site. For a map of monitoring locations in Maryland, refer to Figure 3-1.

4.10.3 Sources

Sources have already been addressed under the individual pollutant sections throughout this document.

4.10.4 Changes Planned for 2012-2013

No changes planned

4.11 The Rural Aerosol Intensive Network – General Description

The Rural Aerosol Intensive Network (RAIN) is a small network of three monitoring sites coordinated by NESCAUM that supports the regional haze rule by determining relative contributions of source regions to visibility. RAIN monitors accomplish this by providing detailed characterization of transported pollution with both a visibility[2] and fine particle focus. The Program participates in this network.

4.11.1 Monitoring Requirements

See table 3-4 for a list of RAIN parameters.

4.11.2 Monitoring Locations

Frostburg – (Piney Run), Maryland, Mohawk Mt., Connecticut, and Acadia NP, Maine

4.11.3 Sources

Airborne fine particles consisting of sulfate, nitrate, and organic-carbon impair visibility. Sulfate forms from sulfur dioxide released by fuel burning sources such as power plants. Nitrate sources include highway and off-road vehicles, construction equipment. Organic-carbon sources also include on and off-road vehicles and also wildfires. Some of these pollutants are released locally, but some are transported hundreds of miles into the region.

4.11.4 Changes Planned for 2012-2013

No changes Planned

[2] MDE operates other sites having monitors that measure visibility, sulfate, OC/EC and light scatter, see Tables 3-1 and 3-2a for details.

APPENDIX A– TOPOGRAPHIC AND AERIAL MAPS

This section contains topographic and aerial maps for air monitoring stations in Maryland. Detailed information regarding each monitoring station (e.g. coordinates, parameters, method codes, etc.) can be found in Table 3-2a, Table 3-2b, Table 3-3, and Table 3-4.

Figure A 1. Topographic map of air monitoring sites in Baltimore, MD.

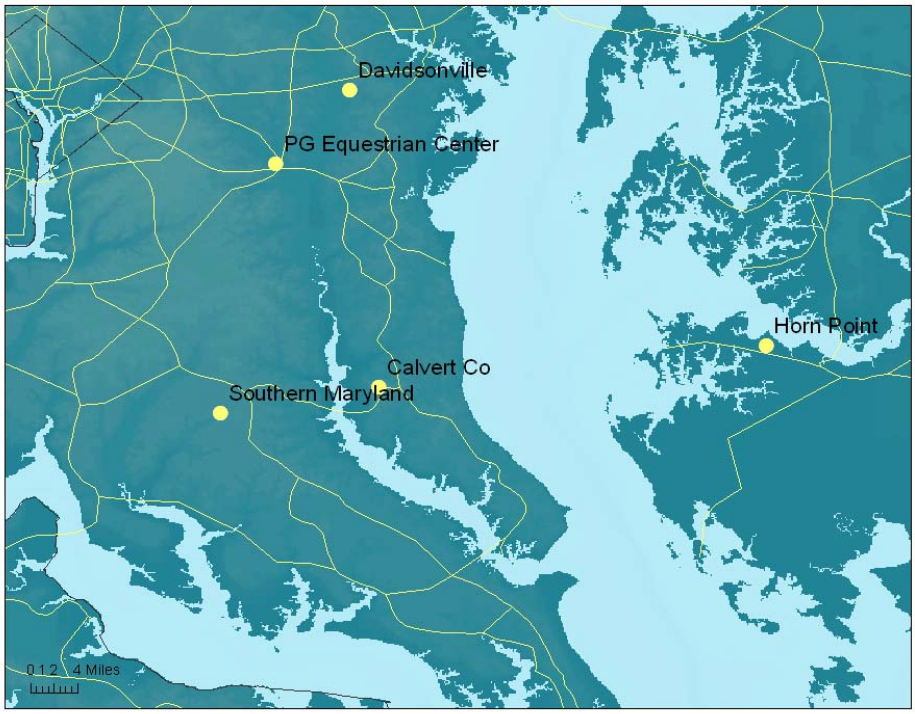

Figure A 2. Topographic map of air monitoring sites in Southern Maryland counties.

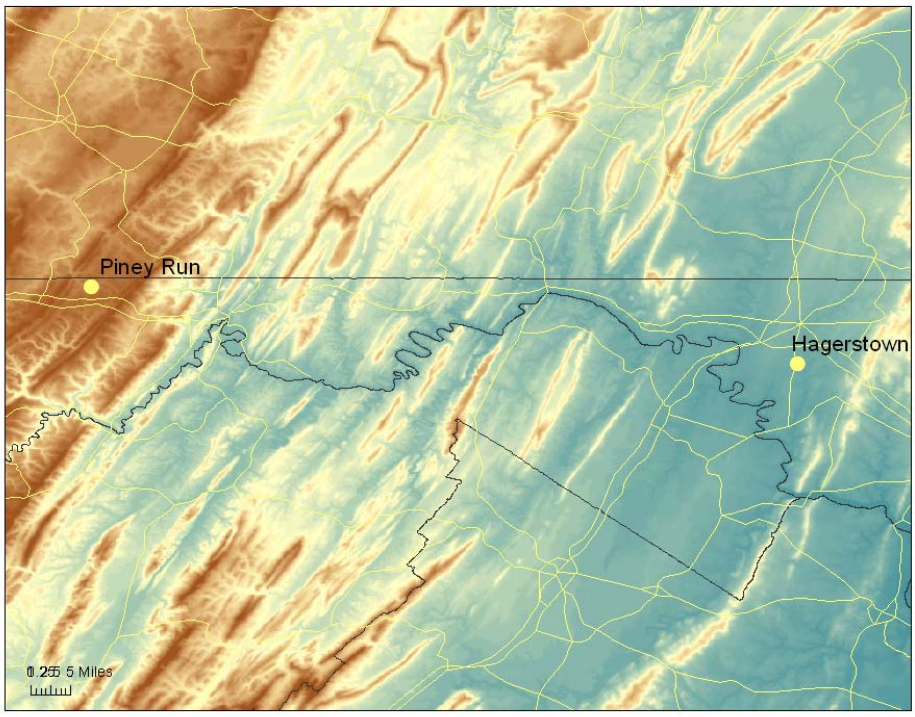

Figure A 3. Topographic map of air monitoring sites in Western Maryland counties.

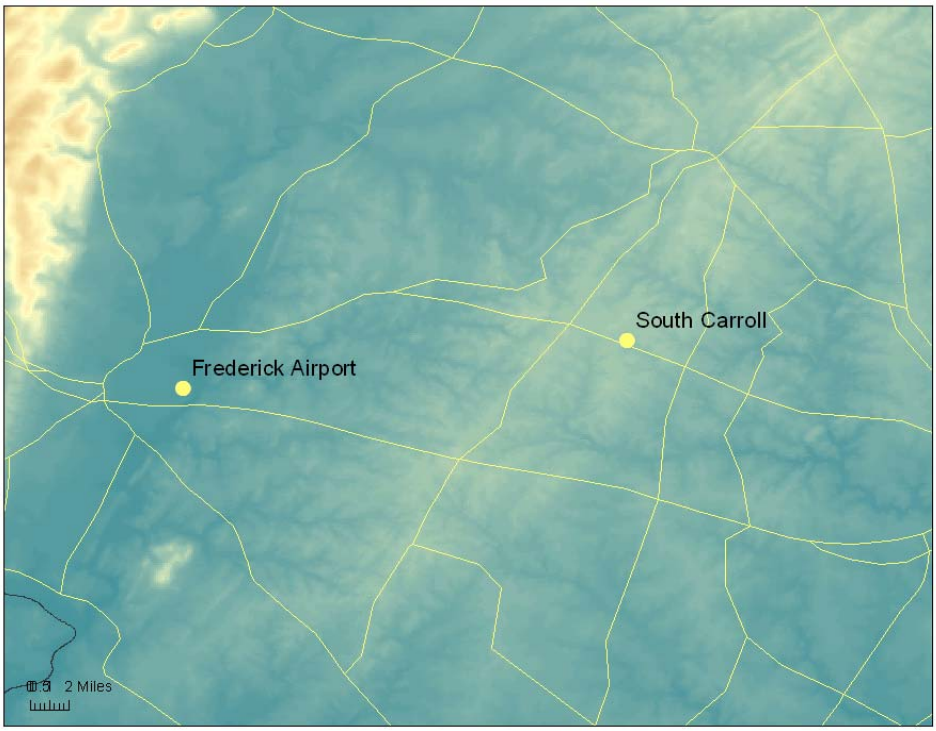

Figure A 4. Topographic map of air monitoring sites in Carroll and Frederick counties.

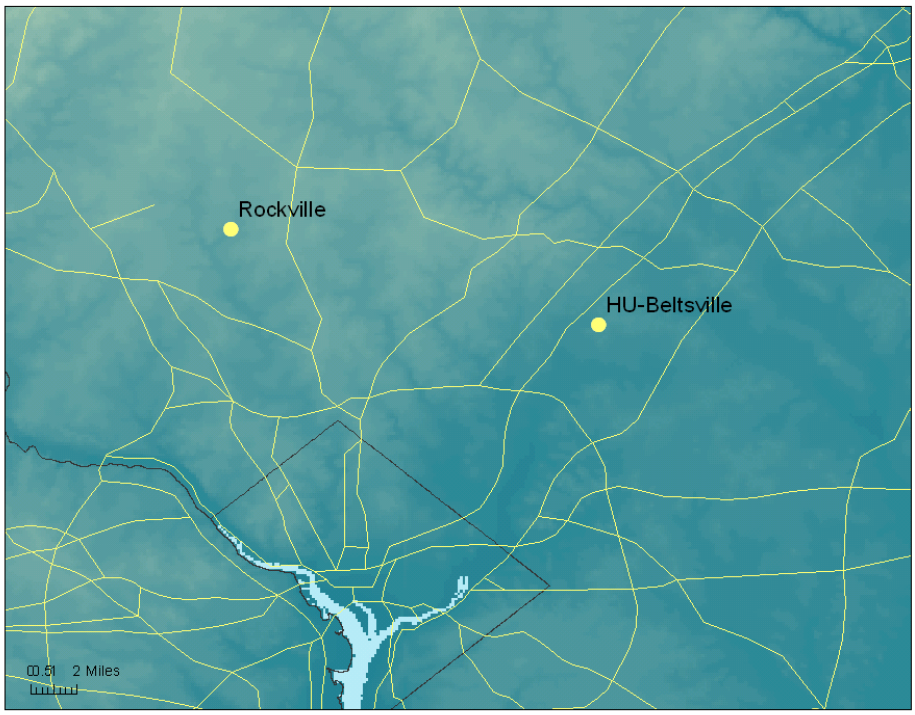

Figure A 5. Topographic map of air monitoring sites to the north of Washington, DC.

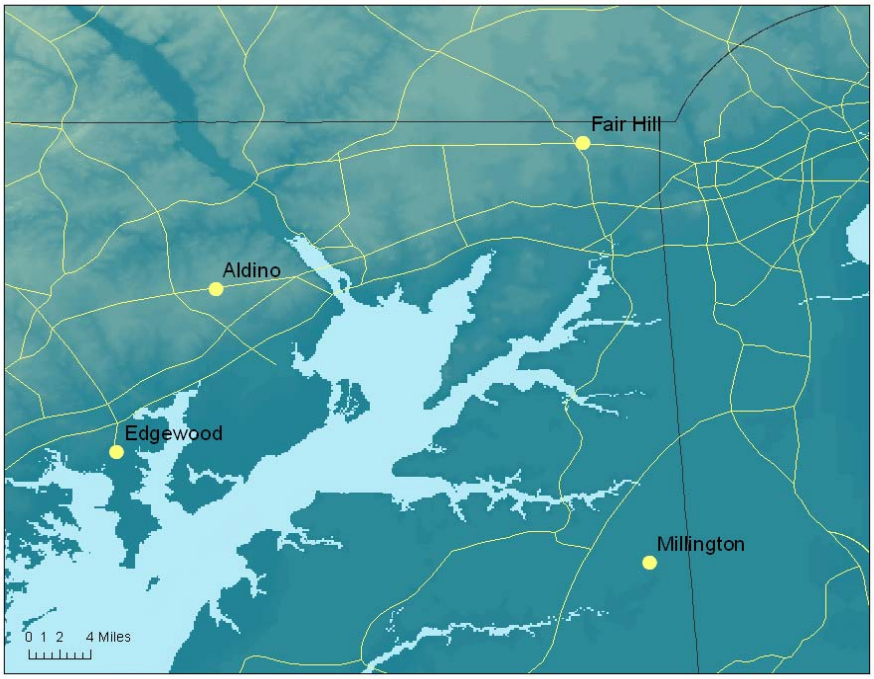

Figure A 6. Topographic map of air monitoring sites located in Northeastern counties and the Eastern Shore.

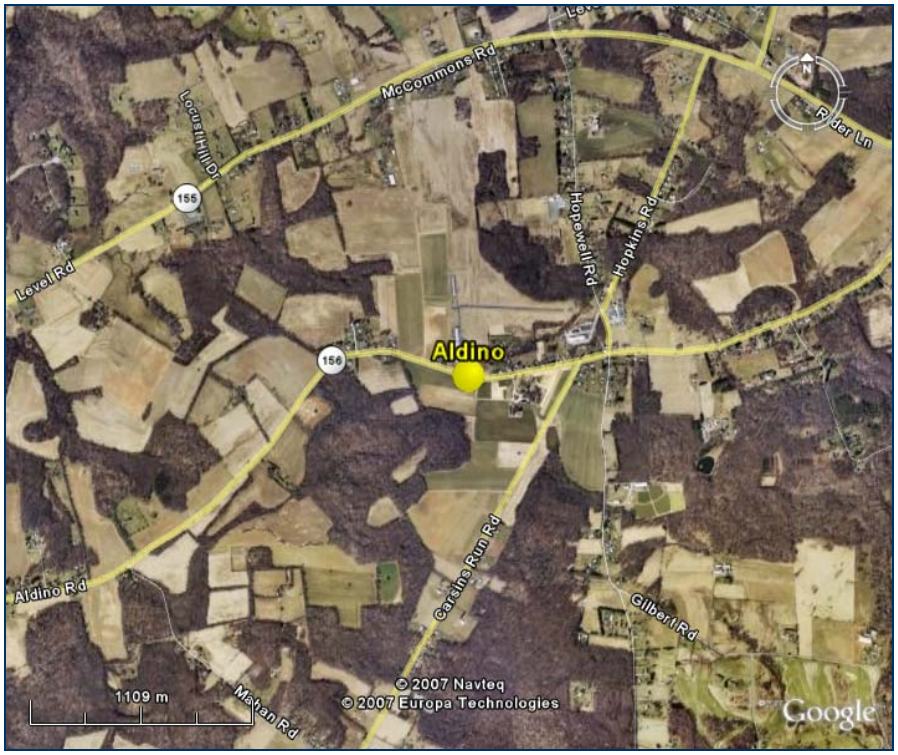

Figure A 7. Aerial map of Aldino air monitoring site in Harford County, MD.

Figure A 8. Aerial map of Haze Cam site at Brandon Shores

Figure A 9. Aerial map of Calvert Co air monitoring site in Calvert County, MD

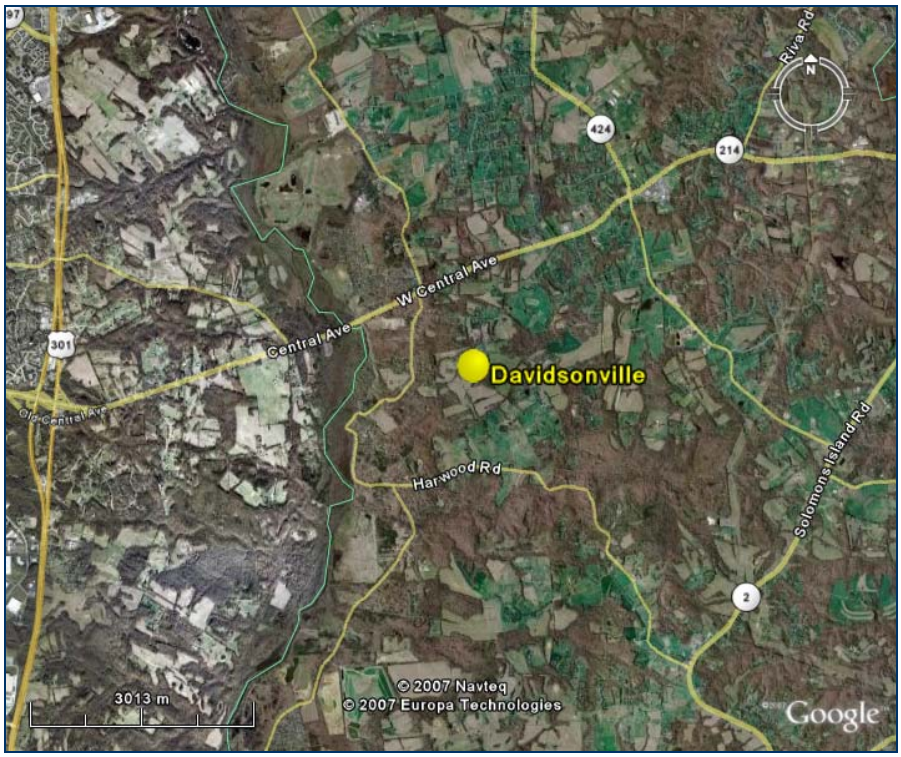

Figure A 10. Aerial map of Davidsonville air monitoring site in Anne Arundel County, MD

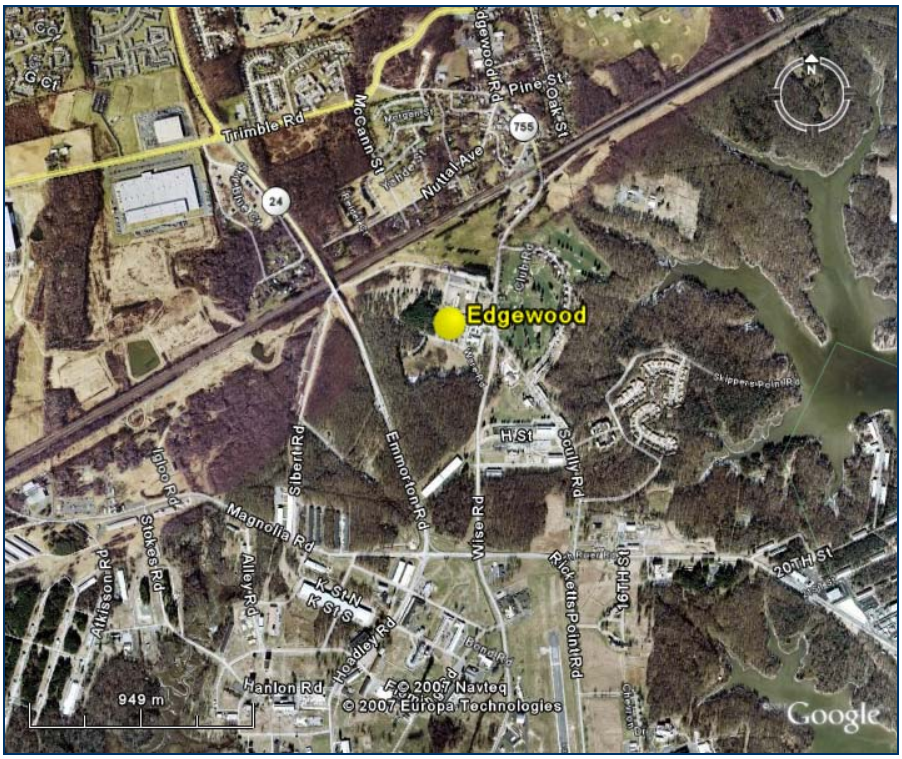

Figure A 11. Aerial map of Edgewood air monitoring site in Harford County, MD.

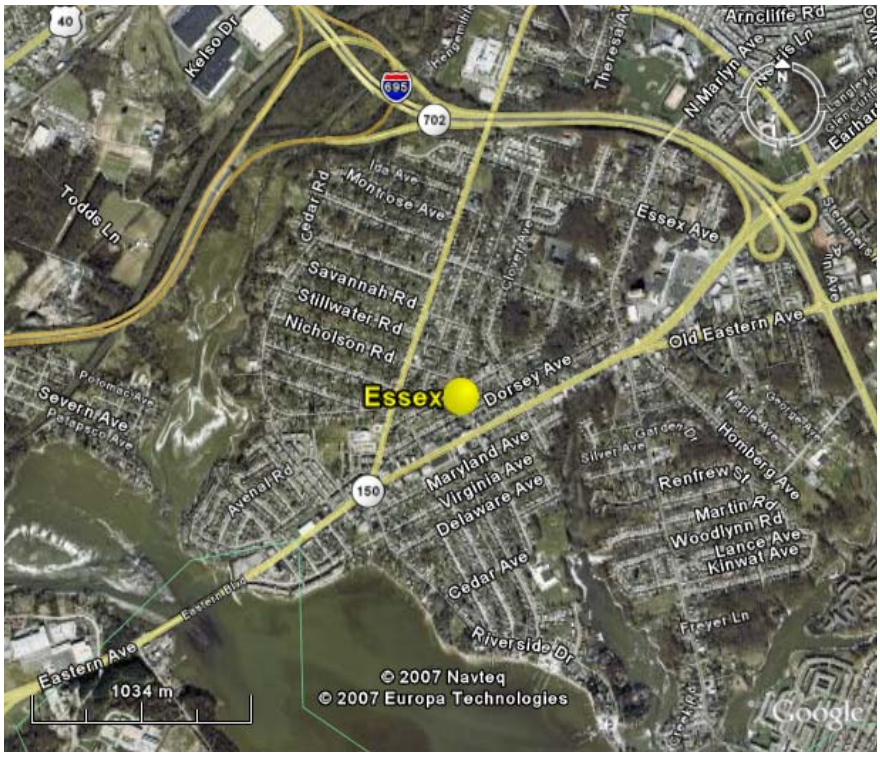

Figure A 12. Aerial Map of the Essex air monitoring site in Baltimore County, MD

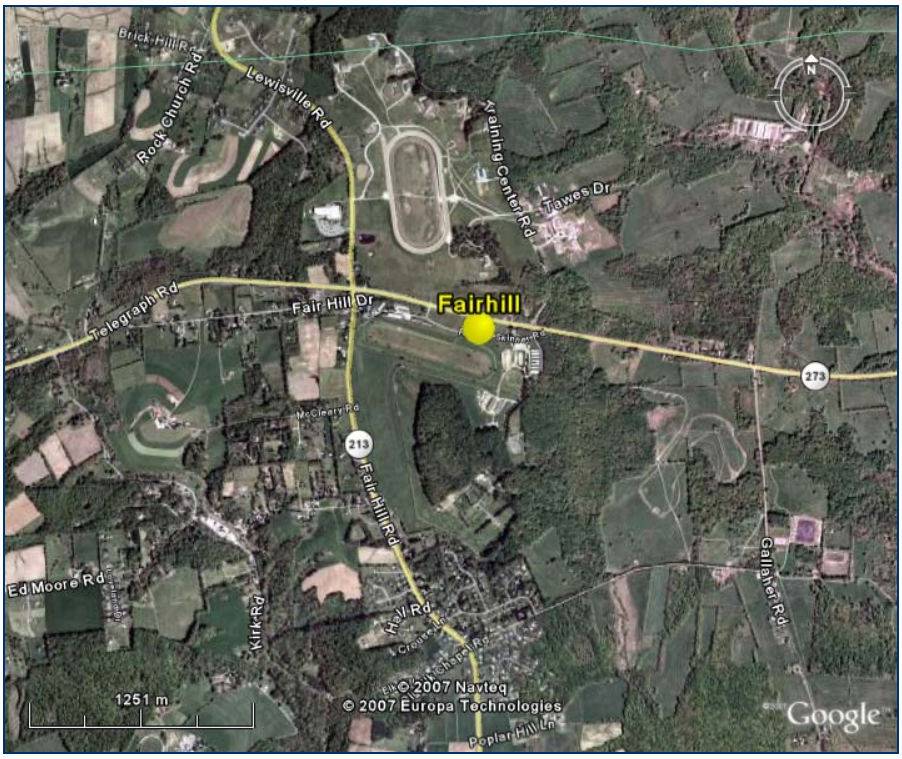

Figure A 13. Aerial map of Fairhill air monitoring site in Cecil County, MD.

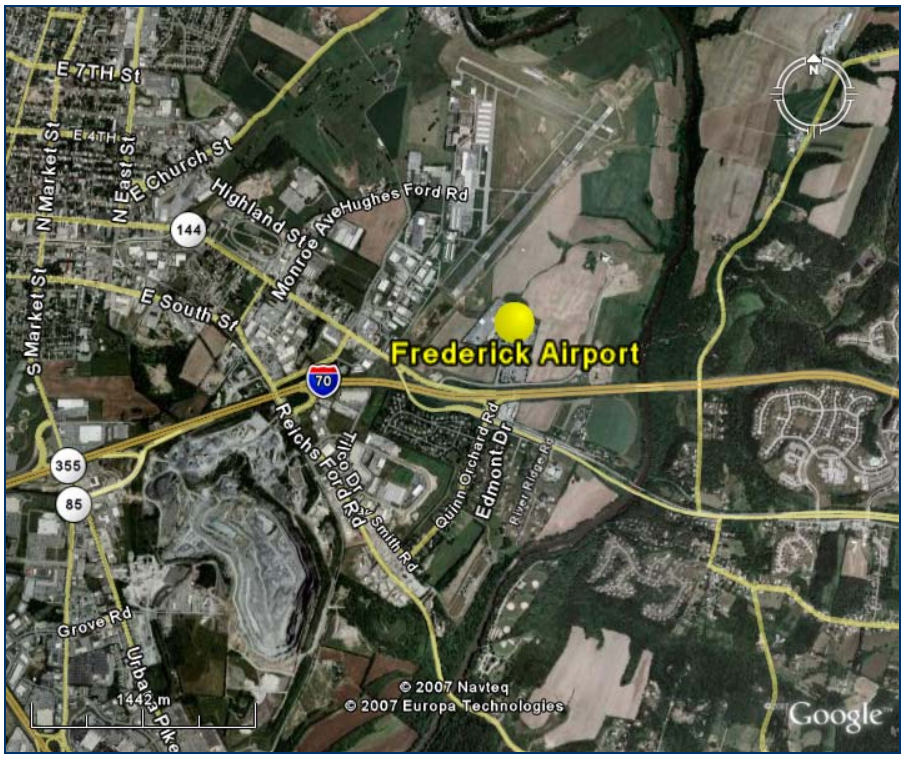

Figure A 14. Aerial map of Frederick Airport air monitoring site in Frederick County, MD.

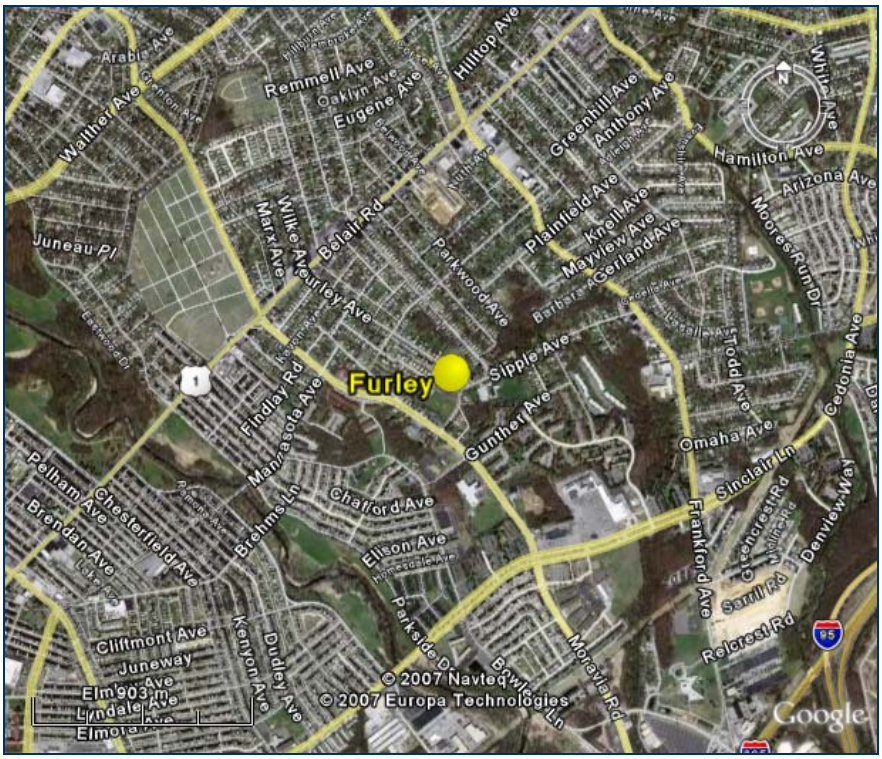

Figure A 15. Aerial map of Furley air monitoring site in Baltimore City, MD.

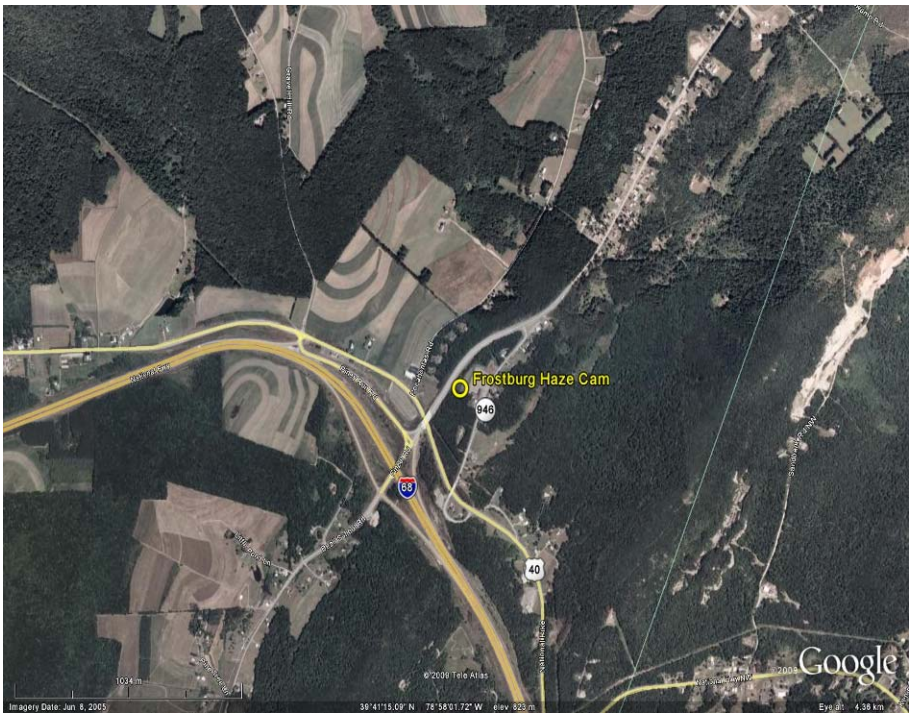

Figure A 16. Aerial map of Frostburg Haze Cam site

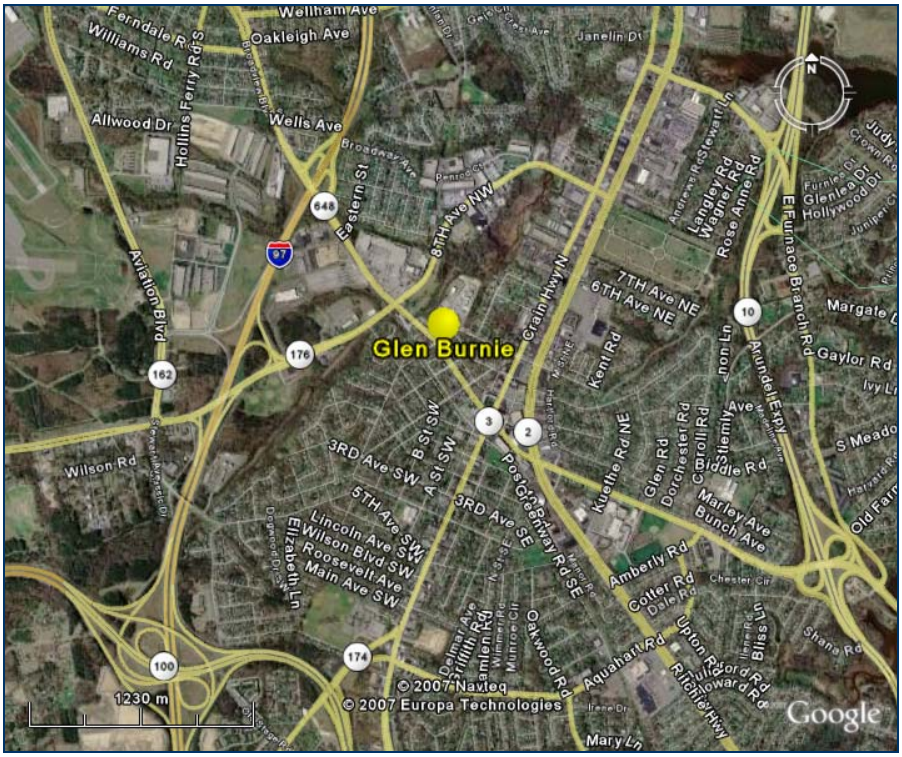

Figure A 17. Aerial map of Glen Burnie air monitoring site in Anne Arundel County, MD.

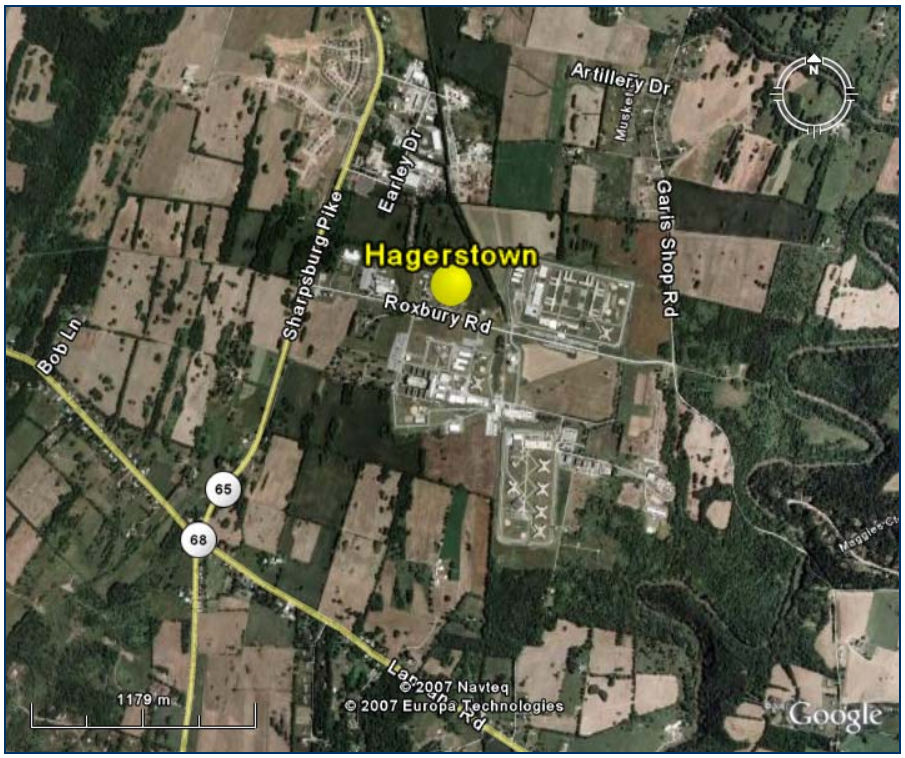

Figure A 18. Aerial map of Hagerstown air monitoring site in Washington County, MD.

Table A-20. Aerial map of the future Horn Point air monitoring site in Dorchester County, MD

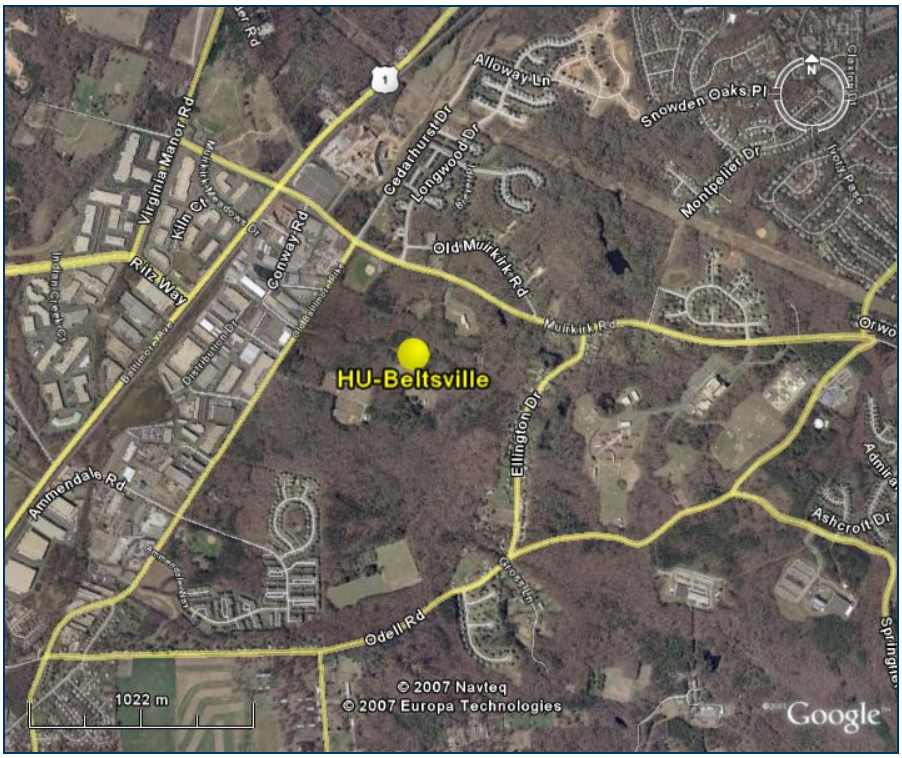

Figure A 19. Aerial map of HU-Beltsville air monitoring site in Prince George's County, MD.

Figure A 20. Aerial map of Millington air monitoring site in Kent County, MD.

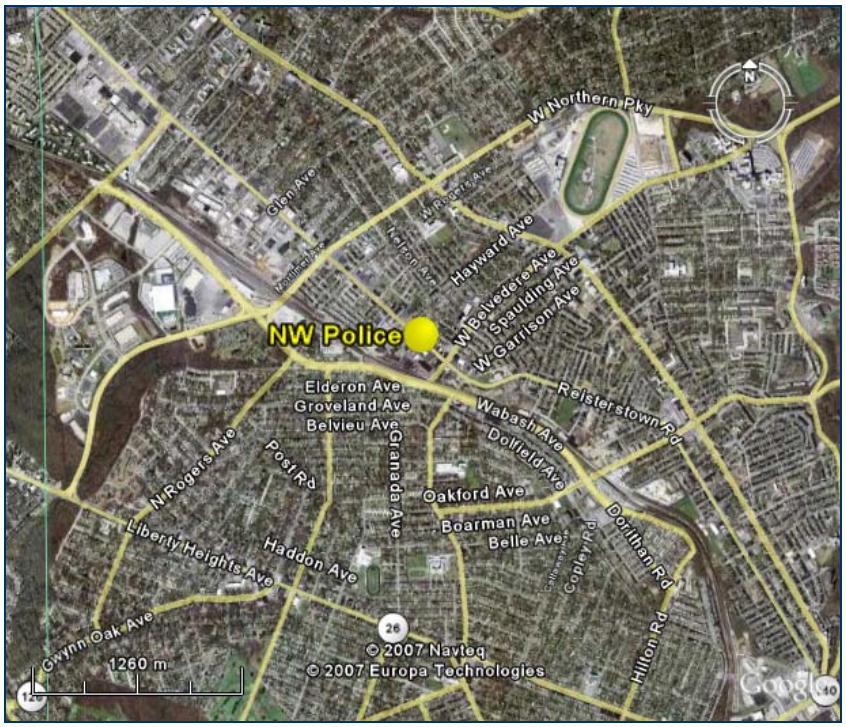

Figure A 21. Aerial map of NW Police air monitoring site in Baltimore City, MD.

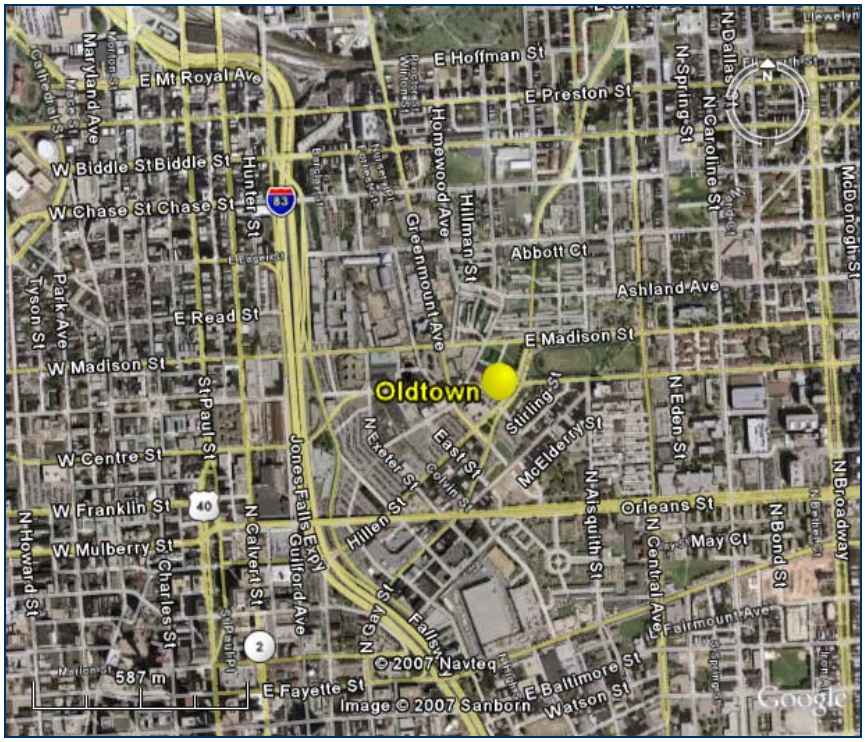

Figure A 22. Aerial map of Oldtown air monitoring site in Baltimore City, MD.

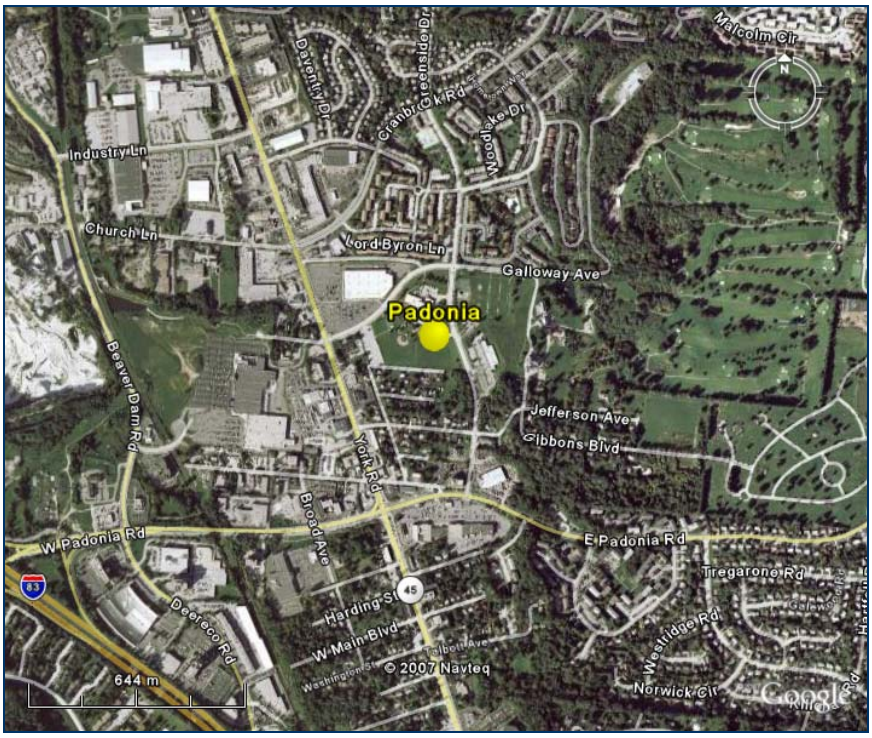

Figure A 23. Aerial map of Padonia air monitoring site in Baltimore County, MD.

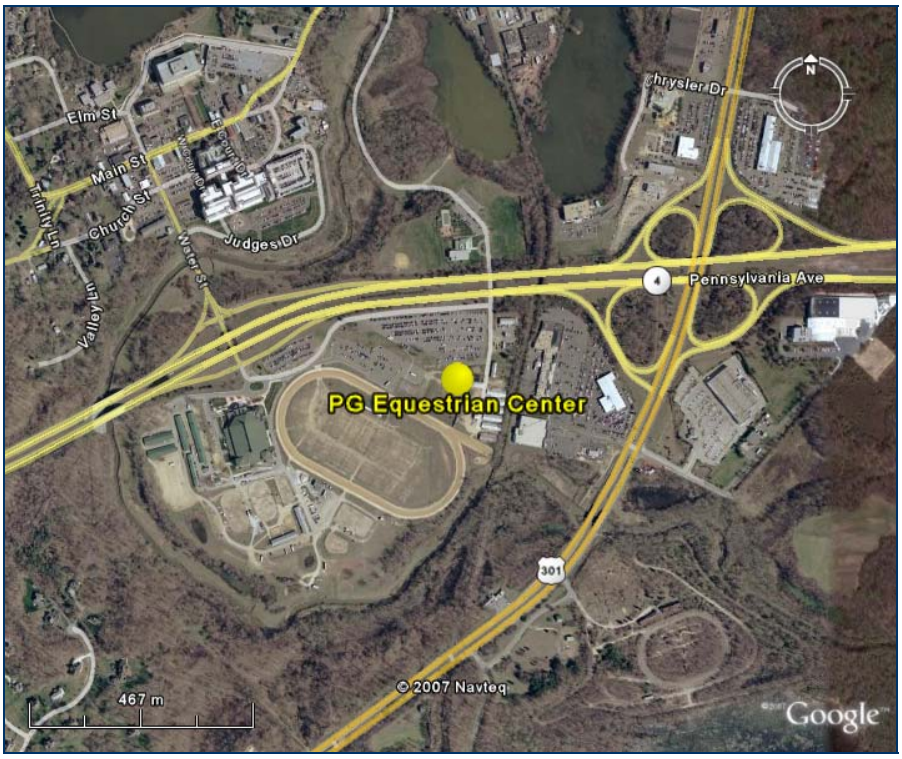

Figure A 24. Aerial map of PG Equestrian Center air monitoring site in Prince George's County, MD.

Figure A 25. Aerial map of Piney Run air monitoring site in Garrett County, MD.

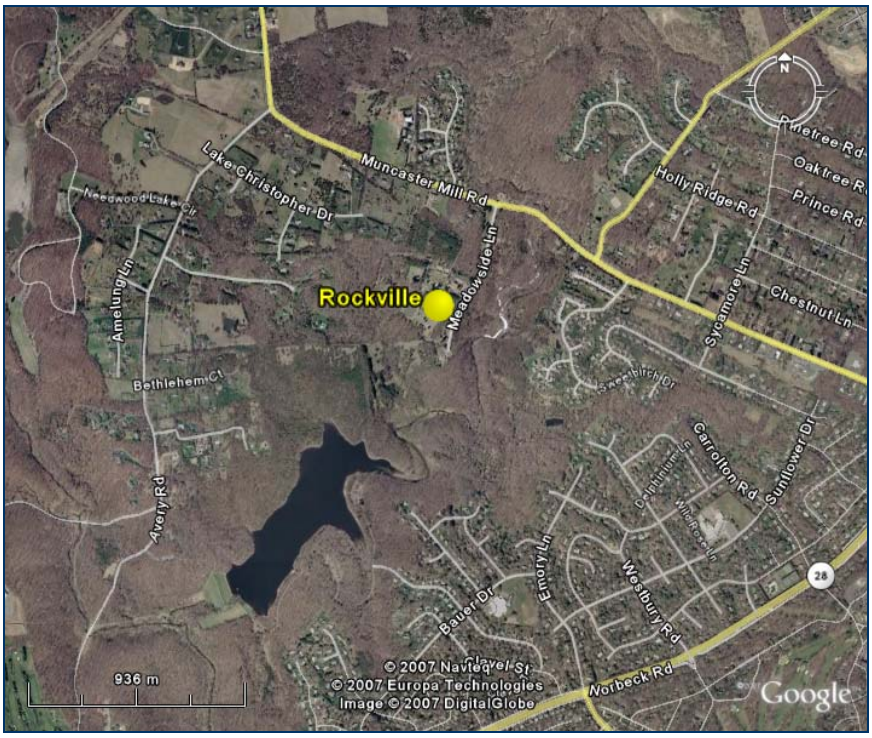

Figure A 26. Aerial map of Rockville air monitoring site in Montgomery County, MD.

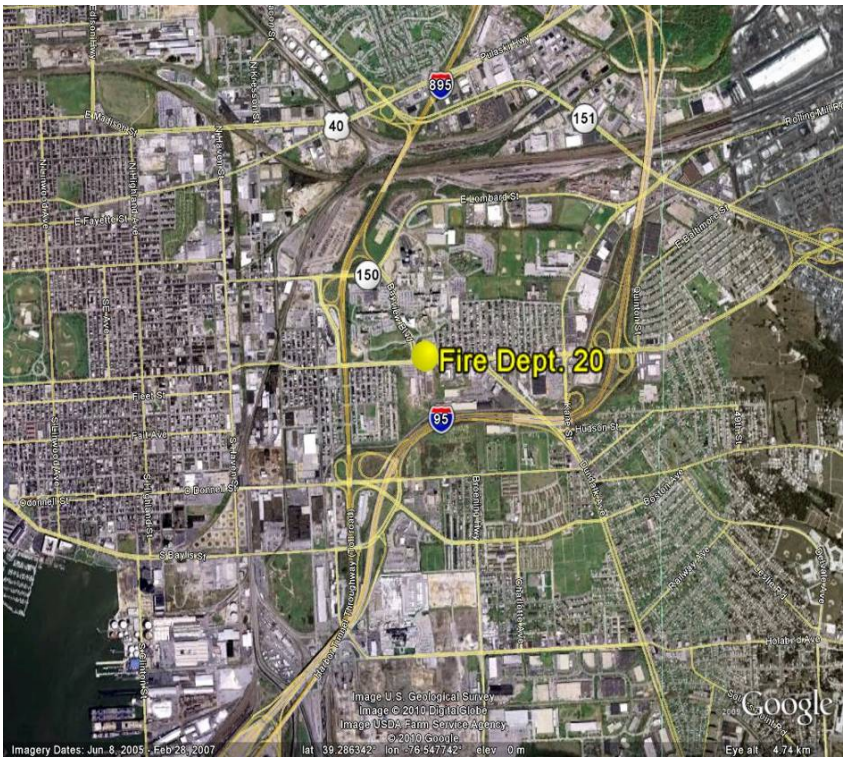

Figure A 27. Aerial map of Fire Dept. 20 air monitoring site in Baltimore City, MD.

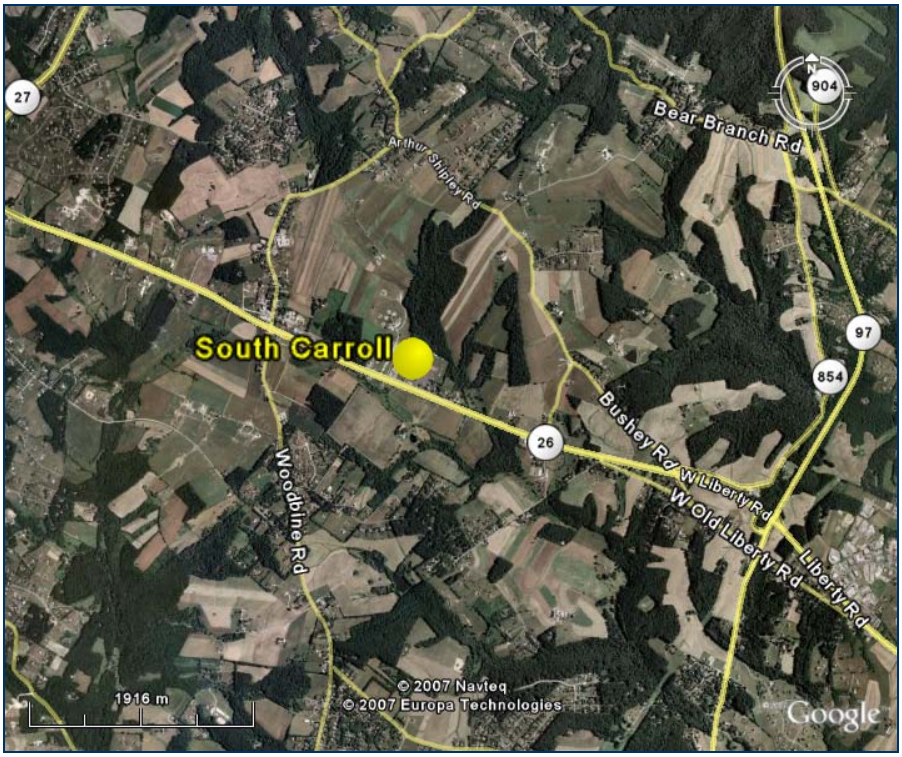

Figure A 28. Aerial map of South Carroll air monitoring site in Carroll County, MD.

Figure A 29. Aerial map of Southern Maryland air monitoring site in Charles County, MD.

APPENDIX B– SUMMAY OF PROPOSALS APPROVED BY EPA REGION III

Table B - 1Elements of the FY2012 Annual Monitoring Network Plan Approved by EPA Region III

POLLUTANT	SITE NAME	RECOMMENDED CHANGES
Air toxics	NE Police	Terminate monitoring of Air Toxic compounds at the NE Police site in Baltimore City
Ozone	Horn Point	Install O_3 monitor, in late 2011 pending availability of resources
Lead (Pb)	HU-Beltsville	Deploy a low volume, PM10, lead monitor at the HU-Beltsville site by December 12, 2011.
$PM_{2.5}$	Bladensburg VFD	Terminate PM2.5 sampling at the Bladensburg VFD (240330025)
	NE Police	Terminate NE Police (245100006) site in Baltimore City
	Network-wide	Replaced MDE's remaining, six Andersen RAAS FRM's with Thermo Fisher 2025 FRM samplers by the end of 2011
SO_2	Essex	Change the SO2 monitoring objective at the Essex site to highest concentration
	Baltimore-Towson CBSA	Operate one additional SO2 monitor in the Baltimore-Towson CBSA by January 1, 2013 (1)

Note: (1) Upon further analysis another SO_2 monitor was deemed not necessary.

Table B - 2 Elements of the FY2013 Annual Monitoring Network Plan

POLLUTANT	SITE NAME	RECOMMENDED CHANGES
NO2		Near road monitor at I95 rest stop

APPENDIX C –JUSTIFICATION FOR THE BALTIMORE MSA NEAR-ROAD NO_2 SITE LOCATION

Proposed site

Based on field reconnaissance and filter-based sampling detailed in the Summary of Results from Near-Road NO_2 Monitoring Pilot Study (STI, 2011), the Program has chosen the southbound I-95 rest area between MD216 and MD32. An aerial photo of the site is provided in **Figure C 1**.

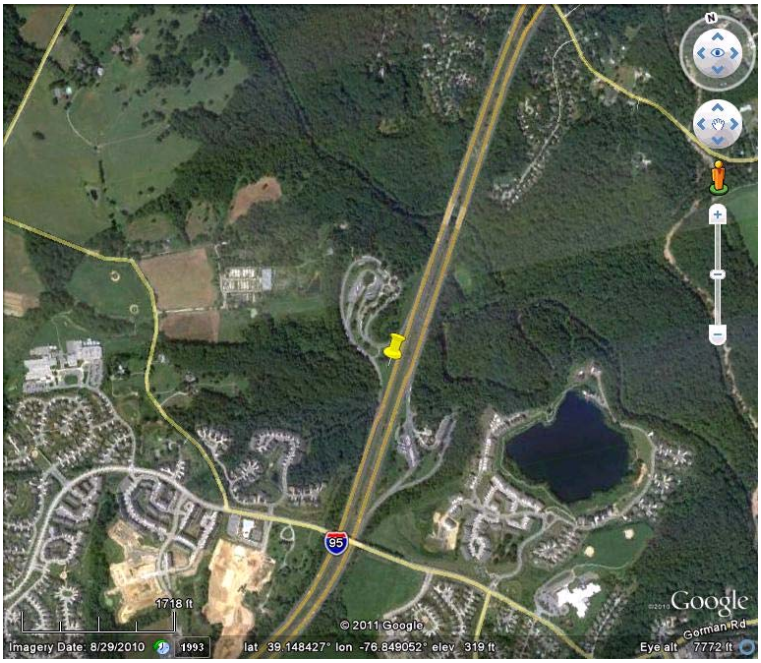

Figure C 1. Google Earth image of proposed permanent NO_2 site for Baltimore MSA.

Traffic analysis

The Program examined 2009 traffic data provided by the Maryland State Highway Administration. All road segments were sorted by AADT and Fleet-Equivalent (FE)-AADT. The FE-AADT is a metric developed in the EPA near-road TAD to account for both total traffic and heavy duty traffic where

$$\text{FE AADT} = (\text{AADT} - \text{HDc}) + (\text{HDm} * \text{HDc})$$

HDc is the total number of heavy duty vehicles and HDm is a constant representing the heavy duty to light duty NOx emission ratio for a particular road segment. EPA calculated an HDm of

10 from national average motor vehicle emissions and this HDm was used in the Program's FE-AADT calculations. Road segments with the top 20 highest FE-AADT are presented in **Table C 1**. This table shows how the ranking depends on the metric used (AADT versus FE-AADT). The first row of the table shows the road segment containing the rest area (discussed in this document). When the segments are ranked by AADT, this segment is 13th highest, but when segments are ranked by FE-AADT, this segment moves to rank 1.

Table C 1. Top 20 FE-AADT road segments in the Baltimore MSA. Also shown are AADT, HD traffic counts and rankings for AADT and FE-AADT.

STATION DESCRIPTION	AADT RANK	FE-AADT RANK	AADT	HD TRAFFIC COUNTS	FE-AADT
IS95-.50 MI N OF MD216	13	1	186750	29507	452309
IS95-.50 MI S OF MD216	15	2	186040	28278	440543
IS95-.40 MI N OF MD100	7	3	192100	26702	432417
IS95-.70 MI S OF MD175	12	4	187920	26873	429773
IS695-.40 MI N OF US1 (ARBUTUS)	5	5	192702	25244	419898
IS695-.20 MI N OF MD144	8	6	191912	23029	399177
IS95-.40 MI S OF WASHINGTON BLVD	24	7	173360	24964	398035
IS95-.30 MI N OF WASHINGTON BLVD	25	8	173000	24739	395651
IS83-.30 MI E OF JOPPA RD (ATR0031)	2	9	210790	20447	394810
IS695-.50 MI N OF MD122	3	10	203902	21206	394754
IS695-.20 MI N OF MD372	6	11	192302	22307	393065
IS695-.30 MI N OF IS795	11	12	188352	21472	381601
IS95-.50 MI S OF MD24	36	13	146750	25975	380523
IS695-.20 MI S OF US1 (ARBUTUS)	21	14	177562	22373	378917
IS95-.50 MI N OF MD43	29	15	160880	23488	372276
IS695-.30 MI E OF MD140	14	16	186582	19778	364581
IS 95 South of MD 103	4	17	193331	18753	362109
IS695-.30 MI E OF STEVENSON RD	16	18	185822	19325	359751
IS95-.20 MI N OF MD24	56	19	121100	26400	358698
IS695-.50 MI S OF IS70	10	20	188860	17753	348636

Meteorological analysis

The ruling on siting criteria for the near road monitor encourages states to place monitors in the climatologically downwind direction whenever possible. Wind speed and direction observations collected at the Beltsville-HU site (10 km south of the I95 rest area) are presented in wind rose plots in **Figure C 2**. The wind roses suggest that winds are variable and the determination of the I95 rest area site being climatologically downwind is inconclusive. During the pilot study (STI, 2011) weekly average filters were collected on both sides of the I95 rest area and during this five week study the southbound side (proposed side for permanent monitor) had on average higher concentrations than the northbound side. This difference could be related

to prevailing winds though conclusions could not be drawn from the limited data collected during the study.

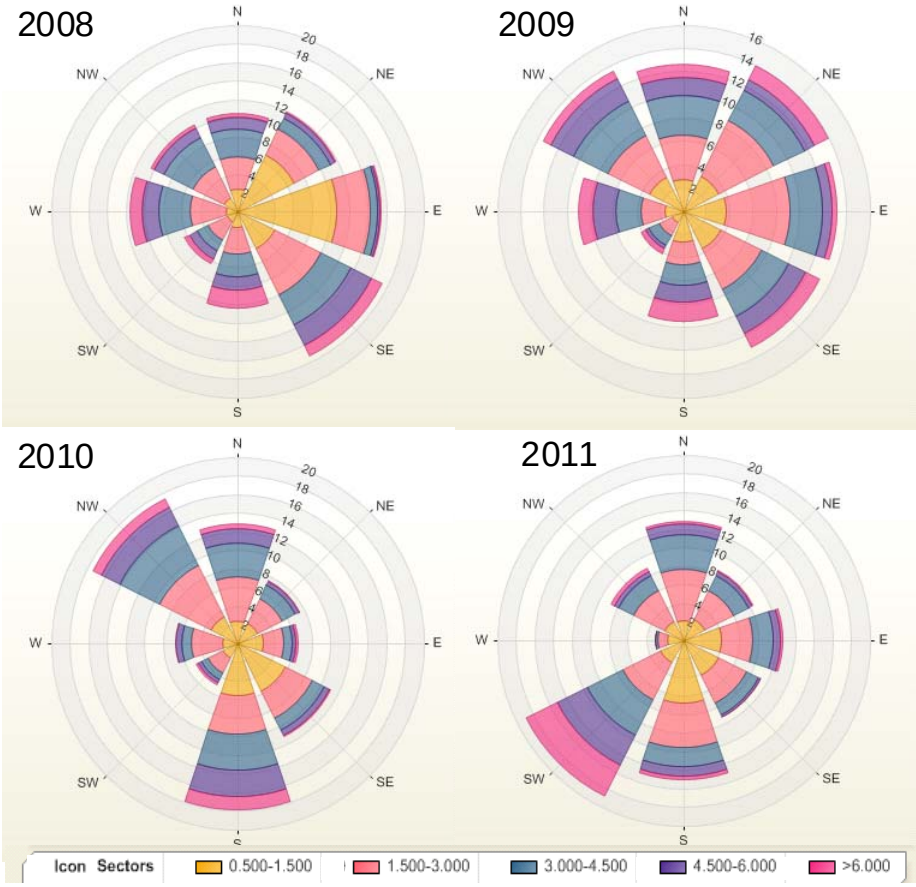

Figure C 2. Wind rose plots from the Beltsville-HU site for 2008 through 2011

Proposed site characteristics

A summary of the proposed near road site is provided in **Table C 2**. The site can be accessed from a small access road within the rest area exit (shown in **Figure C 3**). This access road allows for safe entrance to the site from I95. The Program has had informal discussions with Maryland State Highway Chief Permit Inspector Chris Lookingbill, and this site has no known safety issues aside from being 30 m from I95.

Table C 2. Site characteristics for proposed near-road site

	SITE CHARACTERISTICS
road segment	I95 between MD216 and MD 32
latitude	39.14323
longitude	-76.846
AADT	186750
AADT rank	13
FE-AADT	452309
FE-AADT rank	1

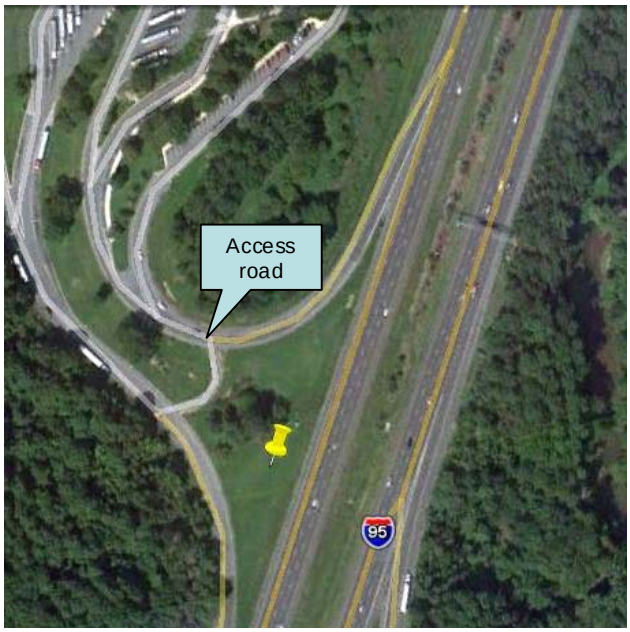

Figure C 3. Map showing access road off of I95 to be used for accessing the proposed monitoring site

Results from near-road pilot study for Baltimore.

The Program participated in EPA's near road pilot study, details of which can be found in the Summary of Results from Near-Road NO_2 Monitoring Pilot Study (STI, 2011). During this study weekly average NO_2 was collected on filters located within 20 m of major roads (**Figure C 4**). The two sites with the highest NO_2 concentrations were the Fort McHenry Toll plaza on I95 and the rest area. The toll plaza may be influenced by background sources including port

emissions, trains and other industrial activities nearby which may not address the near road nature described in the EPA's most recent rulemaking.

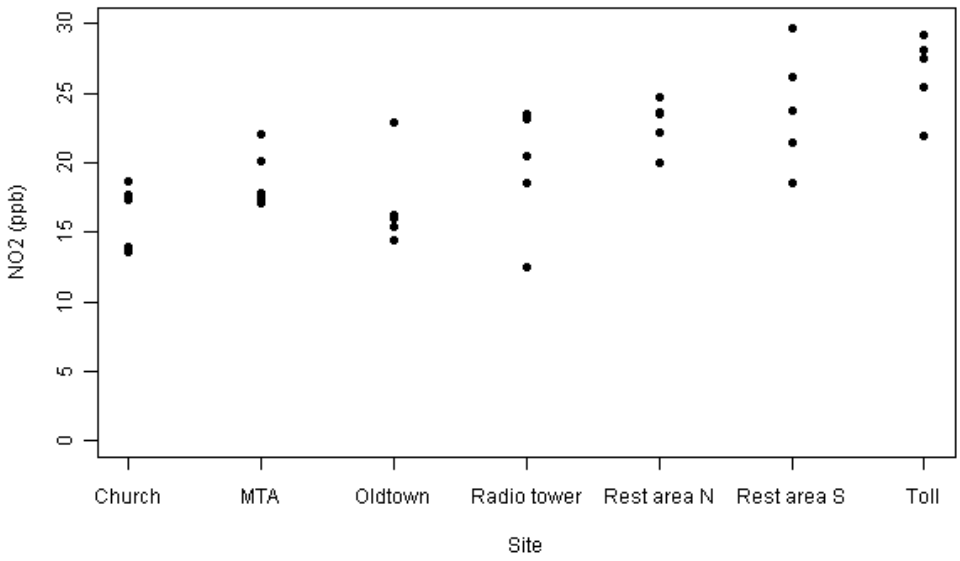

Figure C 4. NO_2 collected during five weeks in Baltimore during the EPA pilot study.

Conclusion

Based on results of field reconnaissance, analysis of AADT and FE-AADT and results from the passive filter sampling during the near-road pilot study the Program has determined that the best site for the permanent NO_2 is monitor is the southbound I-95 rest area between MD216 and MD32.

References

STI, 2011, Summary of Results from Near-Road NO_2 Monitoring Pilot Study Final Report Prepared for U.S. Environmental Protection Agency.