MARYLAND

DEPARTMENT OF THE ENVIRONMENT

AMBIENT AIR MONITORING NETWORK PLAN FOR CALENDAR YEAR 2011

Prepared for:
U.S. Environmental Protection Agency

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

May 27, 2010

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* | Shari T. Wilson, *Secretary*

MDE

This page is intentionally blank.

TABLE OF CONTENTS

ACRONYMS AND DEFINITIONS

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
FEM	Federal Equivalent Method typically used by local and state agency to measure particulate matter and determine NAAQS attainment status.
FID	Flame Ionization Detector
FRM	Federal Reference Method typically used by local and state agency 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 then or equal to 2.5 μm.
PM_{10}	Particulate matter with an equivalent diameter less then or equal to 10 μm.
QA	Quality Assurance
RAIN	RURAL AEROSOL INSTENSIVE 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
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, and 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. Maps of non-attainment areas are shown in **Figure 1-1** and **Figure 1-2**. Counties outside of Maryland are included as they are part of the non-attainment area (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 Clean Air Act Amendments identified 188 toxics. As part of the monitoring effort for toxics, the Maryland Department of the Environment (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.

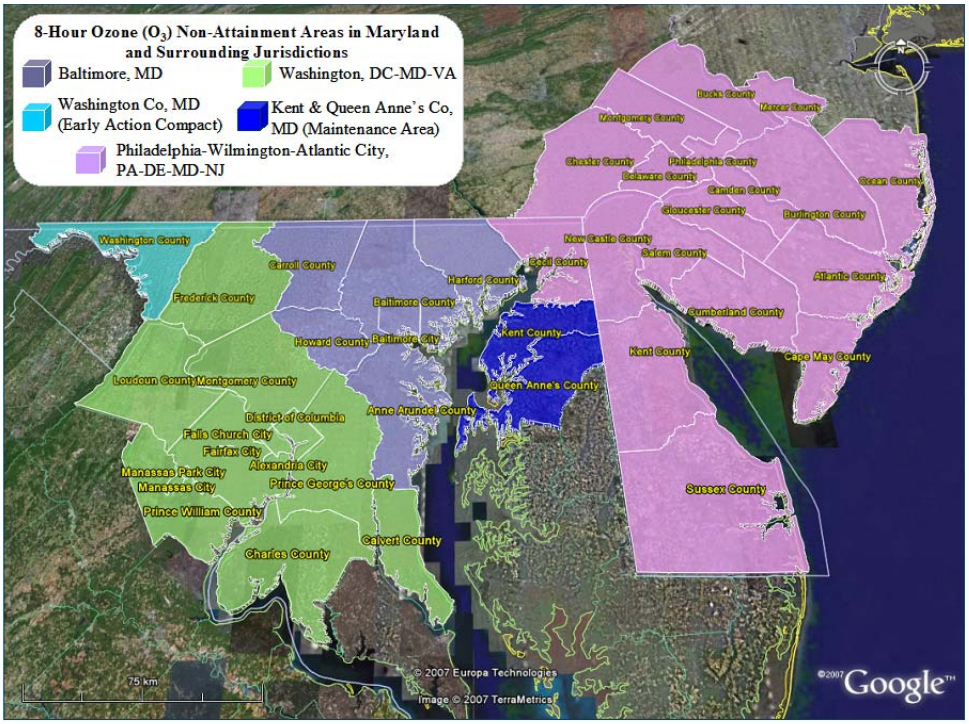

Figure 1-1. **Map depicting non-attainment areas for 8-hour ozone in Maryland and surrounding jurisdictions that are part of the NAA.**

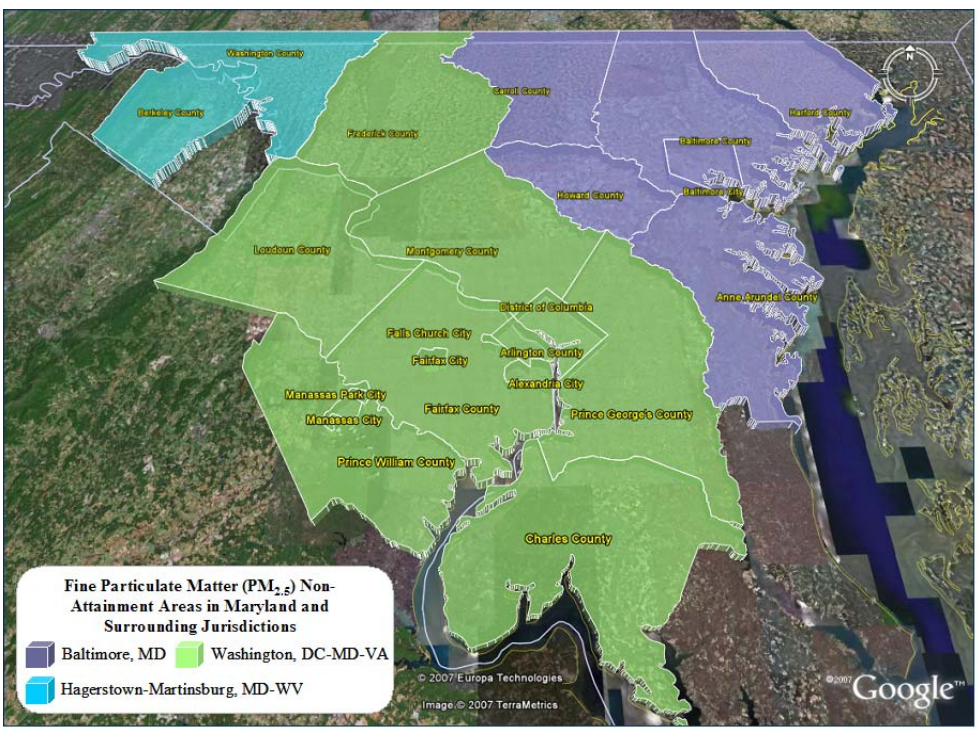

Figure 1-2. **Map depicting non-attainment areas for fine particulate matter ($PM_{2.5}$) in Maryland and surrounding jurisdictions that are part of the NAA.**

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 suitable and 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 26 air monitoring sites around the state and measures ground-level concentrations of criteria pollutants, air toxics, meteorology, and other research-oriented measurements. Although monitoring takes place statewide, most of the stations are concentrated in the urban/industrial areas, which 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 **Figure 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**. Lastly, 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 Rd.	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
Bladensburg VFD, 240330025	Bladensburg Volunteer Fire Department, 4213 Edmonston Road	Bladensburg, Prince George's	20710	38.941697, -76.933698	Suburban	Edmonston Road	-	-	155	DC-Arlington-Alexandria
Calvert Co, 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	-	-	151	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)	8381	2008	26	Wilmington, DE-MD-NJ
Fire Dept 20*, 245100008	Baltimore City Fire Department, 5714 Eastern Avenue	Baltimore City	21224	39.287680, -76.547616	Suburban	Eastern Avenue (Route 150)	21901	2008	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 HazeCam	Eastern Garrett Co. Vol. Fire Dept. 401 Finzel Road	Finzel, Garrett	21532	-	Rural	-	-	-	-	NA

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)
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 Ave.	-	-	38	Baltimore-Towson
Glen Burnie, 240031003	Anne Arundel Co Public Works BLDG, 7409 Baltimore Annapolis Blvd	Glen Burnie, Anne Arundel	21061	39.169533, -76.627933	Suburban	Baltimore Annapolis Blvd (Route 648).	16801	2008	98	Baltimore-Towson
Hagerstown, 240430009	18530 Roxbury Road	Hagerstown, Washington	21740	39.565556, -77.721944	Rural	Roxbury Road	50	1993	49	Hagerstown-Martinsburg
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	39.305000, -75.797333	Rural	Maryland Line Road (Route 330)	1392	2008	121	NA
NE Police, 245100006	Northeast Police Station, 1900 Argonne Drive	Baltimore City	21218	39.340556, -76.582222	Suburban	Argonne Drive	-	-	49	Baltimore-Towson
NW Police, 245100007	Northwest Police Station, 5271 Reisterstown Road	Baltimore City	21215	39.344444, -76.685278	Suburban	Reisterstown Road	16261	2008	26	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	23	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	46651	2008	191	D.C., Arlington, Alexandria
Piney Run, 240230002	Frostburg Reservoir, Finzel	Finzel, Garrett	21532	39.705916, -79.012028	Rural	Piney Run Road	-	-	1141	NA

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)
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, 240130001	1300 W. Old Liberty Road	Winfield, Carroll	21784	39.444167, -77.041667	Rural	Liberty Road (Route 26)	10962	2008	248	Baltimore-Towson
Southern Maryland, 240170010	Oaks Road	Hughesville, Charles	20622	38.504167, -76.811944	Rural	Oaks Road	-	-	723	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)	REPRESENTATIVE SCALE	MONITORING OBJECTIVE	TYPE	SAMPLE SCHEDULE
Aldino, 240259001	Nitrogen Dioxide, Nitric Oxide	5/1/1995	075	4	Urban	Population exposure	PAMS	Every hour
	Type 3 PAMS: Reactive Oxides of Nitrogen	6/1/1997	075	3.8	Urban	Population Exposure	PAMS	Every hour
	Ozone	4/20/1990	047	6	Urban	Maximum Ozone concentration	SLAMS	Every hour
Baltimore Haze Cam @ Brandon Shores	Visibility	4/1/2007	NA	NA	NA	Public Notification	NA	NA
Bladensburg VFD, 240330025	$PM_{2.5}$	1/1/2007	118	4	Neighborhood	Population Exposure	SLAMS	Every 3 days
Calvert Co., 240090011	Ozone	4/1/2005	047	4	Urban	Population Exposure	SLAMS	Every hour
Davidsonville, 240030014	Ozone	6/6/1980	047	4	Urban	Population Exposure	SLAMS	Every hour
Edgewood, 240251001	Ozone	3/10/1980	047	3.8	Urban	Highest Concentration	SLAMS	Every hour
	$PM_{2.5}$	1/1/1999	120	2.1	Neighborhood	Population Exposure	SLAMS	Every 3 days
Essex, 240053001	Air toxics	1/1/1993	150	4.0	Neighborhood	Population Exposure	Toxics	Every 6 days
	Carbon Monoxide	4/1/1967	054	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_{10} Continuous	4/1/1967	122	4.5	Neighborhood	Population Exposure	SLAMS	Every hour
	$PM_{2.5}$ Chemical Speciation	10/1/2000	810	5	Neighborhood	Population Exposure	STN	Every 3 days

SITE NAME, AQS ID	PARAMETER	START DATE	METHOD CODE	PROBE HEIGHT (M)	REPRESENTATIVE SCALE	MONITORING OBJECTIVE	TYPE	SAMPLE SCHEDULE
	$PM_{2.5}$	1/1/1999	120	4.7	Neighborhood	Population Exposure	SLAMS	Every 3 days
	Sulfur Dioxide	1/1/1972	060	5	Neighborhood	Highest Concentration	SLAMS	Every hour
Fairhill	Ozone	1/1/1992	047	4	Urban	Regional Transport	SLAMS	Every hour
	$PM_{2.5}$	1/1/1999	120	3.7	Regional	Regional Background	SLAMS	Every 3 days
	$PM_{2.5}$ Continuous	6/28/2006	170	3.7	Regional	Regional Background	SLAMS	Every hour
Fire Dept 20, 245100008	PM_{10} total 0-10 µm	3/10/2004	131	13	Neighborhood	Population Exposure	SLAMS	Every 6 days
	$PM_{2.5}$	6/20/2001	120	13	Middle	Source Oriented	SLAMS	Every day
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	Regional	Regional Transport	Improve	Every 3 days
Frostburg HazeCam	Visibility	10/1/2005	-	NA	NA	Public Notification	-	NA
Furley, 245100054	Ozone	8/20/2006	047	10	Neighborhood	Population Exposure	SLAMS	Every hour
Glen Burnie, 240031003	PM_{10}	4/11/90	122	2.7	Neighborhood	Population Exposure	SLAMS	Every 6 days
	$PM_{2.5}$	1/1/1999	118	2.2	Neighborhood	Population Exposure	SLAMS	Every day
Hagerstown, 240430009	$PM_{2.5}$ Continuous	5/1/2005	731	4	Urban	Highest Concentration	SPM	Every hour
	Ozone	4/1/1999	047	3.6	Urban	Population Exposure Highest Concentration	SLAMS	Every hour
	$PM_{2.5}$	4/1/1999	120	2	Neighborhood	Highest Concentration	SLAMS	Every 3 days
HU-Beltsville, 2400330030	Air toxics	5/10//2006	150	4	Neighborhood	Population Exposure	Toxics	Every 6 days
	Nitric Oxide, Nitrogen Dioxide, and Reactive Oxides of Nitrogen	5/28/2008	075	4	Urban	General / Background	NCore	Every hour
	Ozone	5/1/2005	047	4	Urban	Highest Concentration Population Exposure	NCore	Every hour

SITE NAME, AQS ID	PARAMETER	START DATE	METHOD CODE	PROBE HEIGHT (M)	REPRESENTATIVE SCALE	MONITORING OBJECTIVE	TYPE	SAMPLE SCHEDULE
	Type 3 PAMS: VOCs	5/10/2005	126	4	Urban	Upwind Background	Unofficial PAMS	Every 6 days, every 3 hours
	$PM_{2.5}$	7/10/2004	118	2	Urban	Population Exposure	NCore	Every 3 days
	$PM_{2.5}$ Continuous	9/1/2005	170	2	Urban	Population Exposure	SLAMS	Every hour
	$PM_{2.5}$ |Chemical Speciation	12/5/2004	810	2	Urban	Population Exposure	NCore	Every 6 days
	PM2.5 Elemental & Organic Carbon	2005	NA	4	Urban	General / Background	NA	Every 2 hours
	Sulfate ($PM_{2.5}$)	8/29/2005	NA	4	Urban	General / Background	NCore	Every hour
	Trace Carbon Monoxide	12/20/2006	554	4	Urban	General / Background	NCore	Every hour
	Trace Sulfur Dioxide	9/29/2006	560	4	Urban	General / Background	NCore	Every hour
Millington, 240290002	Ozone	6/19/1989	047	4	Urban	Population Exposure	SLAMS	Every hour
	$PM_{2.5}$ Continuous	1/24/08	731	2	Neighborhood	Forecasting	SPM	Every hour
NE Police, 245100006	Air toxics	1/1/1992	150	4	Neighborhood	Population Exposure	Toxics	Every 6 days
	$PM_{2.5}$	1/1/1999	120	8.8	Neighborhood	Population Exposure	SLAMS	Every day
NW Police, 245100007	$PM_{2.5}$	1/1/1999	120	9.7	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	054	4.2	Middle	Highest Concentration	SLAMS	Every hour
	Light Scatter	9/2004	NA	4	NA	NA	NA	Every hour
	Nitric Oxide, Nitrogen Dioxide, and Oxides of Nitrogen	1/1/1982	074	4.2	Middle	Highest Concentration	SLAMS	Every hour
	$PM_{2.5}$ Continuous	4/1/2002	170	4.5	Middle	Highest Concentration	SLAMS	Every hour
	$PM_{2.5}$	1/1/1999	120	4.9	Middle	Highest Concentration	SLAMS	Every day
Padonia,	Ozone	1/1/1979	047	3.8	Neighborhood	Population	SLAMS	Every hour

SITE NAME, AQS ID	PARAMETER	START DATE	METHOD CODE	PROBE HEIGHT (M)	REPRESENTATIVE SCALE	MONITORING OBJECTIVE	TYPE	SAMPLE SCHEDULE
40051007						Exposure		
	$PM_{2.5}$	1/1/1999	120	4.7	Neighborhood	Population Exposure	SLAMS	Every hour
PG Equestrian Center, 240338003	Ozone	4/1/2002	047	4.4	Urban	Population Exposure	SLAMS	Every hour
	$PM_{2.5}$	5/1/2002	120	4.8	Neighborhood	Population Exposure	SLAMS	Every 3 days
Piney Run, 240230002	Light Scatter	9/2004	NA	4	NA	NA	NA	Every hour
	Nitric Oxide, Nitrogen Dioxide, and Reactive Oxides of Nitrogen	5/1/2004	075	4	Regional	Regional Transport	NCore	Every hour
	Trace Carbon Monoxide	6/1/2004	554	4	Regional	Regional Transport	NCore	Every hour
	Ozone	4/1/2004	047	4	Regional	Regional transport	NCore	Every hour
	$PM_{2.5}$ Continuous	7/1/2004	731	4	Regional	Regional transport	NCore	Every hour
	PM2.5 Chemical Speciation (IMPROVE)	2005	NA	4	Regional	Regional Transport	Improve	Every 3 days
	PM2.5 Elemental & Organic Carbon	7/2004	NA	4	Regional	Regional Transport	NA	Every 2 hours
	Trace SO2	1/1/2007	560	4	Regional	Regional Transport	NCore	Every hour
	Sulfate (PM2.5)	7/1/2004	NA	4	Regional	Regional Transport	NCore	Every hour
Rockville, 240313001	Ozone	1/1/1980	047	4	Urban	Population Exposure	SLAMS	Every hour
	PM2.5 Continuous	8/22/08	170	4	Neighborhood	Population Exposure	SLAMS	Every hour
	$PM_{2.5}$	1/1/1999		4.9	Neighborhood	Population Exposure	SLAMS	Every 3 days
South Carroll, 240130001	Ozone	7/14/1983	047	4	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 to be announced by August 2010 would change the season to March through October.

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

Site Name	Parameter																			
	Air Toxics	CO	Light scatter	NO	NO_2	NO_X	NO_Y	O_3	PAMS VOC's	$PM_{2.5}$	$PM_{2.5}$ Elemental & Organic Carbon	$PM_{2.5}$ (continuous)	PM_{10}	PM_{10} (continuous)	Speciated $PM_{2.5}$	SO_2	Sulfate (PM2.5)	Trace CO	Trace SO_2	TOTALS
Aldino				1	1		1	1												4
Bladensburg										1										1
Calvert Co.								1												1
Davidsonville								1												1
Edgewood								1		1										2
Essex	1	1		1	1	1		1	1	1				1	1	1				11
Fairhill								1		1		1								3
Frederick Airport								1												1
Fire Dept 20										1			1							2
Furley								1												1
Glen Burnie										1			2	1						4
Hagerstown								1		1		1								3
HU-Beltsville	1	1		1	1	1	1	1	1	1	1	1			1	1	1	1	1	16
Millington								1				1								2
NE Police	1									1										2
NW Police										1										1
Oldtown	1	1	1	1	1	1				1	1	1								9
Padonia								1		2										3
PG Equestrian Center								1		2										3
Piney Run		1	1	1	1		1	1			1	1				1	1	1	1	11
Rockville								1		1		1								2
South Carroll								1												1
Southern Maryland								1												1
TOTALS	**4**	**4**	**2**	**5**	**5**	**3**	**3**	**17**	**2**	**16**	**3**	**7**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**86**

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*	113	Capillary GC ITD Mass Spectrometer
Carbon Monoxide	054	Nondispersive Infrared Photometry
Carbon Monoxide, Trace	554	Nondispersive Infrared Photometry

PARAMETER	METHOD CODE	SAMPLE ANALYSIS DESCRIPTION
Light Scatter	NA	Open-Air Integrating Nephelometer
Nitric Oxide and Nitrogen Dioxide	074	Chemiluminescence
Nitric Oxide, Nitrogen Dioxide, and Reactive Oxides Of Nitrogen	075	TECO 42S Chemiluminescence for Low Level Measurements
Oxides Of Nitrogen	074	Chemiluminescence
PAMS VOCs*	128	Gas Chromatograph with Flame; GC FID
PAMS VOCs*	126	Cryogenic Pre-concentration Trap GC/FID
Ozone	047,091	Ultra Violet Photometry
PM_{10} Total 0-10 µm	132	Gravimetric, Andersen RAAS 10-300
PM_{10} Continuous	731	Beta Attenuation
$PM_{2.5}$	120	Gravimetric, Andersen RAAS 2.5-300
$PM_{2.5}$	118	Gravimetric, Partisol Plus 2025
$PM_{2.5}$ 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
$PM_{2.5}$ Continuous	731	Beta Attenuation
$PM_{2.5}$ Speciation Mass	810	Gravimetric, Met One SASS using Teflon
$PM_{2.5}$- Elemental and Organic Carbon	NA	OCEC, Self-contained Non-dispersive Infrared (NDIR) Detector System.
IMPROVE Parameters*	NA	4 Module, Improve Protocol analysis
Sulfur Dioxide	060	Pulsed Fluorescence
Sulfur Dioxide, trace	560	Pulsed Fluorescence
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-Dichloro-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, 1,4-Dichlorobenzene, 1,2-Dichlorobenzene, 1,2,4-Trichlorobenzene, and Hexachloro-1,3-Butadiene
IMPROVE	Aerosol light extinction, Aerosol light scattering, Air temperature, Aluminum, Ammonium ion,

CONSTITUENT GROUP	COMPOUNDS IN THE CONSTITUENT GROUP
Parameters	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, PM10, PM2.5, 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 SO2 , trace CO, ozone, continuous PM2.5, 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

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

Carbon monoxide (CO) 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 MDE 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

Carbon monoxide 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 2010-2011

No changes planned.

4.2 Lead (Pb) – General Description

On October 15, 2008 EPA substantially strengthened the national ambient air quality standards (NAAQS) 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) and revised the secondary (welfare-based) standard to be identical in all respects to the primary standard.

4.2.1 Monitoring Requirements

In conjunction with strengthening the lead NAAQS, EPA identified the need for states to improve existing lead monitoring networks by requiring monitors be placed in areas with sources that emit one ton or more per year (tpy) of lead by January 1, 2010. MDE, in conjunction with EPA Region III, has reviewed the 2007 lead emissions inventory and found no lead sources with emissions of 1 tpy or greater: hence, no source oriented lead monitors are proposed. However, EPA is proposing to change the lead emissions monitoring threshold from 1 tpy to 0.50 tpy, and proposing to require lead monitoring at all NCore sites.

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 (such as cars and trucks) 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 2010-2011

To satisfy EPA's proposed requirements of lead monitoring at NCore sites, MDE will deploy lead monitors at the two Maryland NCore sites. In addition, MDE will address the lead sites with emissions of >0.50 tpy in our 2012 Annual Network Review.

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

Nitrogen dioxide (NO_2) 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

There is no minimum requirement for the number of NO_2 monitoring sites. Operation of the existing NO_2 sites in Maryland is required until MDE requests discontinuation of a site in the Annual Network Plan and the EPA Regional Administrator approves the request. At least one NO_2 monitor must be located to measure regional maximum concentration within the geographic area that it represents.

4.3.2 Sources

Oxides of nitrogen are produced during high-temperature burning of fuels. Sources of NO_x include motor vehicles and stationary sources that burn fossil fuels such as power plants and industrial boilers.

4.3.3 Changes Planned for 2010-2011

No changes planned.

4.4 Ozone (O_3) – General Description and Sampling Method

Ozone (O_3) 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. The appropriate spatial scales for O_3 sites are neighborhood, urban, and regional. 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 VOC's or "precursors of ozone" can travel for many miles before chemical reactions in the atmosphere form O_3.

4.4.3 Changes Planned for 2010-2011

MDE is in the process of relocating the South Carroll ozone monitor to a site very close to the original site that better reflects 40CFR sitting criteria. Also, MDE plans to install a new monitoring site at University of Maryland Center for Environmental and Estuarine Studies near Cambridge on Maryland's Eastern Shore in late 2010 or early 2011 pending availability of resources.

MDE is proposing to change the representative scale for Fairhill from regional to urban. In addition, MDE is proposing to change the monitoring objectives of the following: Fairhill from background to regional transport, South Carroll from highest concentration to population exposure, HU-Beltsville will add population exposure to its list of monitoring objectives, and Hagerstown will add highest concentration to its list of monitoring objectives; as discussed in the 5-year Network Assessment. These changes will be made effective immediately following approval by the EPA Regional Administrator.

4.5 PM_{10} – General Description and Sampling Method

MDE 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 2010-2011

MDE is proposing to shut down the continuous PM_{10} monitor at Essex, as discussed in the 5-year Network Assessment. This change will be made effective immediately following approval by the EPA Regional Administrator.

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

MDE 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.

MDE uses MetOne SuperSAAS 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 $PM_{2.5}$ monitors located at Oldtown and Fire Dept 20 is representative of the middle scale and will not be compared to the annual $PM_{2.5}$ NAAQS of 15 $\mu g/m^3$.

EPA is in the process of reviewing and updating the PM NAAQS. The proposed rule is planned for November 2010. The program will address PM when the NAAQS and monitoring requirements are updated in the 2012 Annual Network Plan.

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 2010-2011

- MDE's existing Andersen RAAS FRM samplers are no longer manufactured or supported by their vendor. MDE has been phasing out the Andersen samplers and replacing them with new ThermoFisher 2025 FRM's as resources allow. Eleven of the 2025's have been deployed to existing sites and will be running during 2010-2011.

- MDE has been testing the newly designated FEM (March 8, 2008, Federal Register, pp. 13224-13225) MetOne BAM–1020, continuous, $PM_{2.5}$ monitors, collocated with $PM_{2.5}$ FRM's, at the following locations: Oldtown, Fairhill, Rockville and HU-Beltsville. These monitors have been designated as Special Purpose Monitors (SPM) which allows MDE time to evaluate their performance with respect to the Class III criteria (40CFR, Part 53). Prior to the expiration of SPM status in August 2010, the continuous SPM's will be redesignated to FEM's and their status will be changed to SLAMS making the data captured eligible for comparison to the $PM_{2.5}$, NAAQS. The FRM monitors collocated with them will be removed at Fairhill, Rockville and HU-Beltsville. The Oldtown FRM will continue to be collocated with a continuous FEM.

- MDE is proposing to change representative scale for Fire Dept. 20 from neighborhood to middle scale. In addition, MDE is proposing to change the monitoring objectives of the following: Oldtown from population exposure to highest concentration $PM_{2.5}$ site for the Baltimore, MD MSA, Hagerstown from population exposure to highest concentration $PM_{2.5}$ site for the Hagerstown, MD-Martinsburg, WV MSA, Piney Run will be a regional transport site once an FRM/FEM is deployed there, and Fire Dept. 20 from a population exposure to source oriented; as discussed in the 5-year Network Assessment. These changes will be made effective immediately following approval by the EPA Regional Administrator.

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

There are no minimum requirements for the number of SO_2 monitoring sites. Operation of the existing SO_2 sites in Maryland is required until MDE requests discontinuation and the EPA Regional Administrator approves the request. The EPA Regional Administration has not approved SO_2 monitoring for discontinuation; hence, the Program must operate at least one SO_2 monitor located to measure regional maximum concentration within the geographic area that it represents.

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 2010-2011

MDE is proposing to change the monitoring objective of Essex from population exposure to highest concentration, as discussed in the 5-year Network Assessment. This change will be made effective immediately following approval by the EPA Regional Administrator.

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 sites 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 section 4.8 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 O_3 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 3-2 for parameter information and monitoring objective at each monitoring site. For a map of monitoring locations in Maryland refer to Figure 3-1.

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 2010-2011

On Oct. 17, 2006, EPA finalized revisions to the PAMS monitoring rule that reduced some of the minimum requirements including NO_y. NO_y monitoring is now only required at one site per PAMS area, either a Type 1 or Type 3. Historical data completeness for NO_y at Aldino during the ozone season has been poor due to a combination of instrument operational problems and resource limitations during the ozone season. Since this measurement is no longer required, MDE is recommending discontinuing NO_y at Aldino, as discussed in the 5-year Network Assessment. In addition, MDE is proposing to change the VOCs monitoring objective of HU-Beltsville from population exposure to upwind background, as discussed in the 5-year Network Assessment. Both changes will be made effective immediately following approval by the EPA Regional Administrator.

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. MDE’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 3-2 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 2010-2011

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 MDE'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 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.

MDE 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 wirebound 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

MDE 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 3-2 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 2010-2011

MDE will begin PMCoarse monitoring by January 1, 2011 at both Piney Run and Beltsville. For Piney Run, FRM or FEM PM-2.5 and PM-10 monitors will have to be installed. At Beltsville, only a low volume PM-10 FEM is needed. These changes will be made pending availability of adequate resources.

In addition, the sampling frequency for the CSN monitor at Beltsville will be changed from a 1-in 6 to 1-in-3 day sampling schedule by Jan. 1, 2011, pending availability of adequate resources.

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[1] and fine particle focus. MDE participates in this network.

4.11.1 Monitoring Requirements

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

4.11.2 Monitoring Locations

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

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 vehicles and off-road, 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 2010 – 2011

See Section 4.10.4 for changes planned for the Piney Run site.

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.

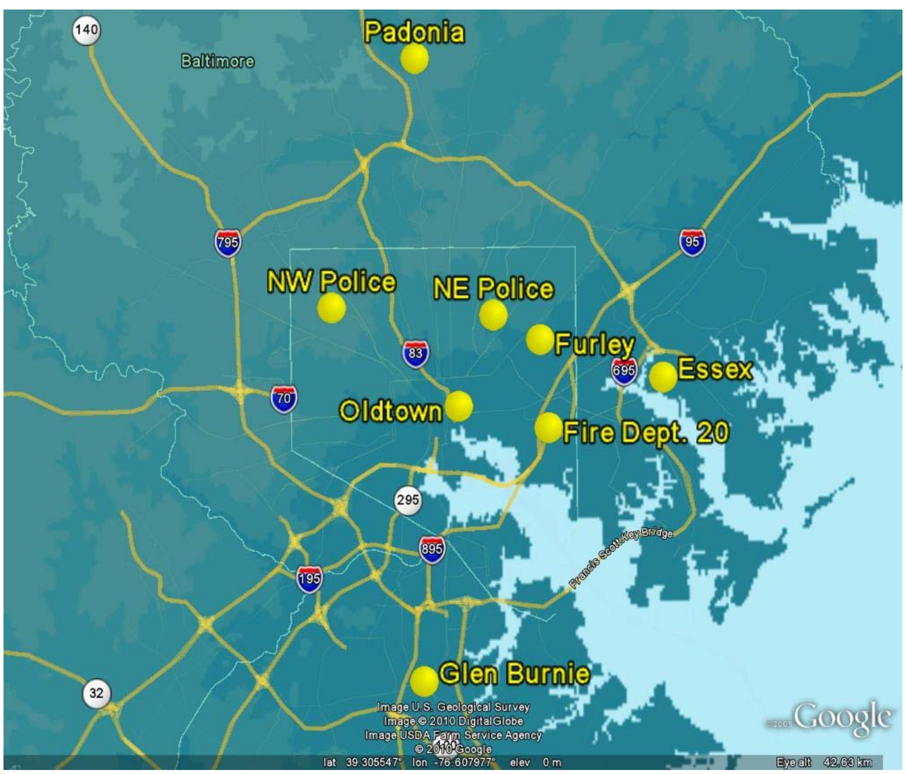

Figure A 1. Topographic map of air monitoring sites in Baltimore, MD.

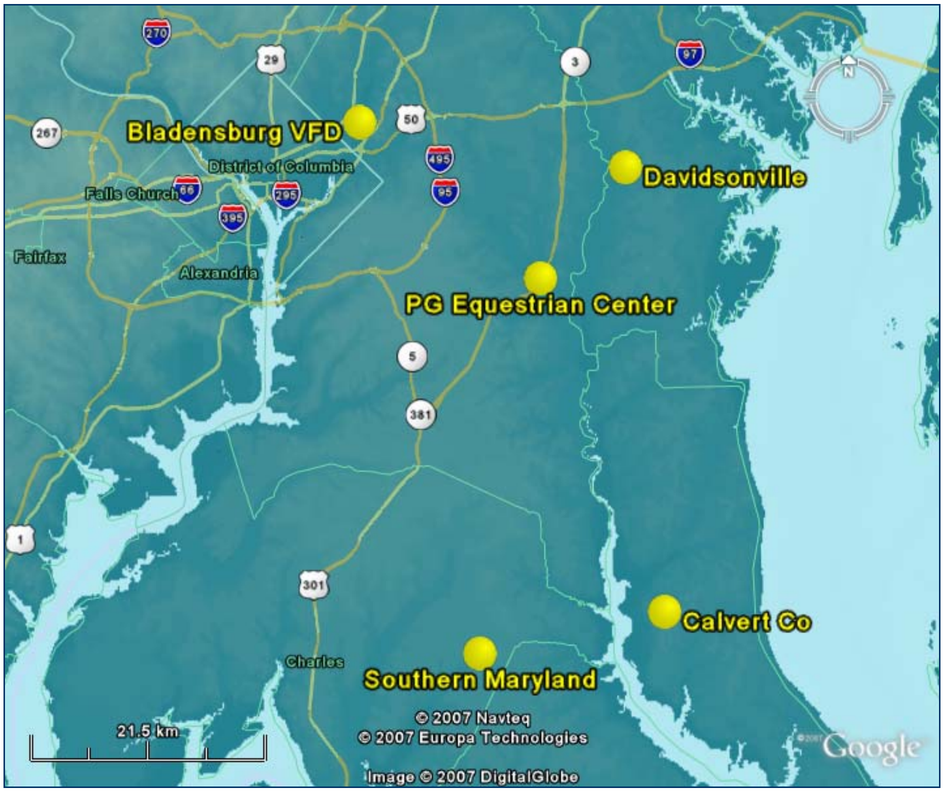

Figure A 2. Topographic map of air monitoring sites in Southern Maryland counties.

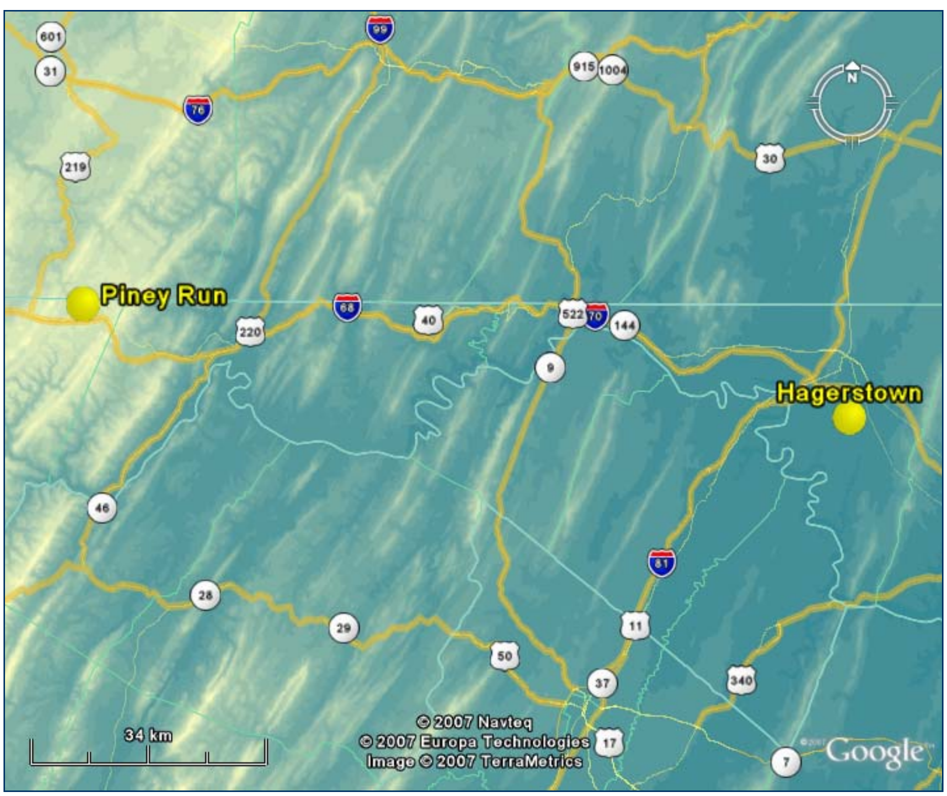

Figure A 3. Topographic map of air monitoring sites in Western Maryland counties.

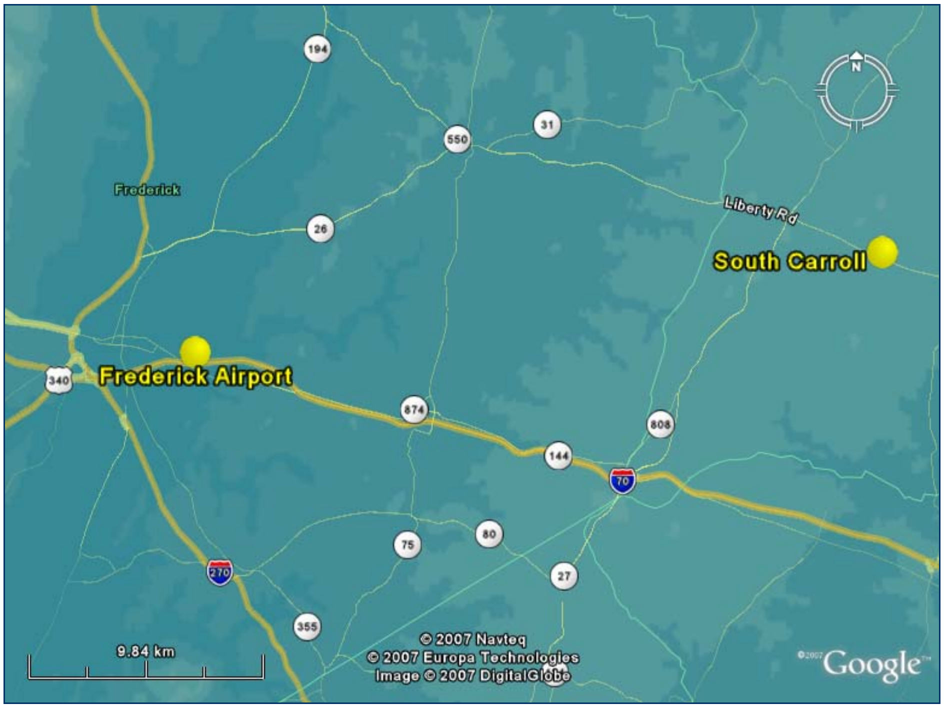

Figure A 4. Topographic map of air monitoring sites in Carroll and Frederick counties.

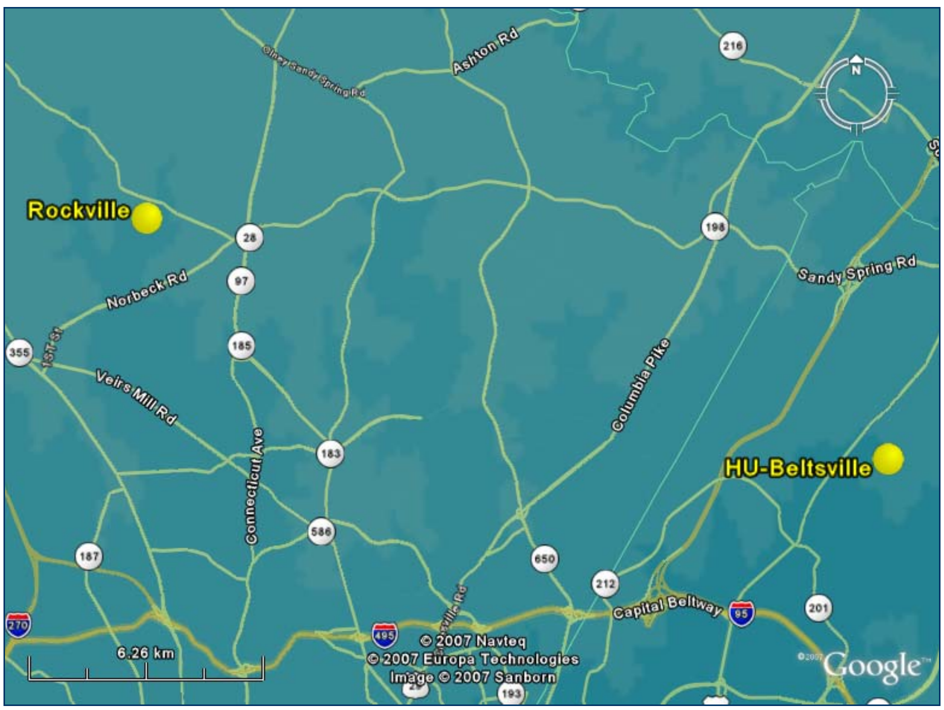

Figure A 5. Topographic map of air monitoring sites to the north of Washington, DC.

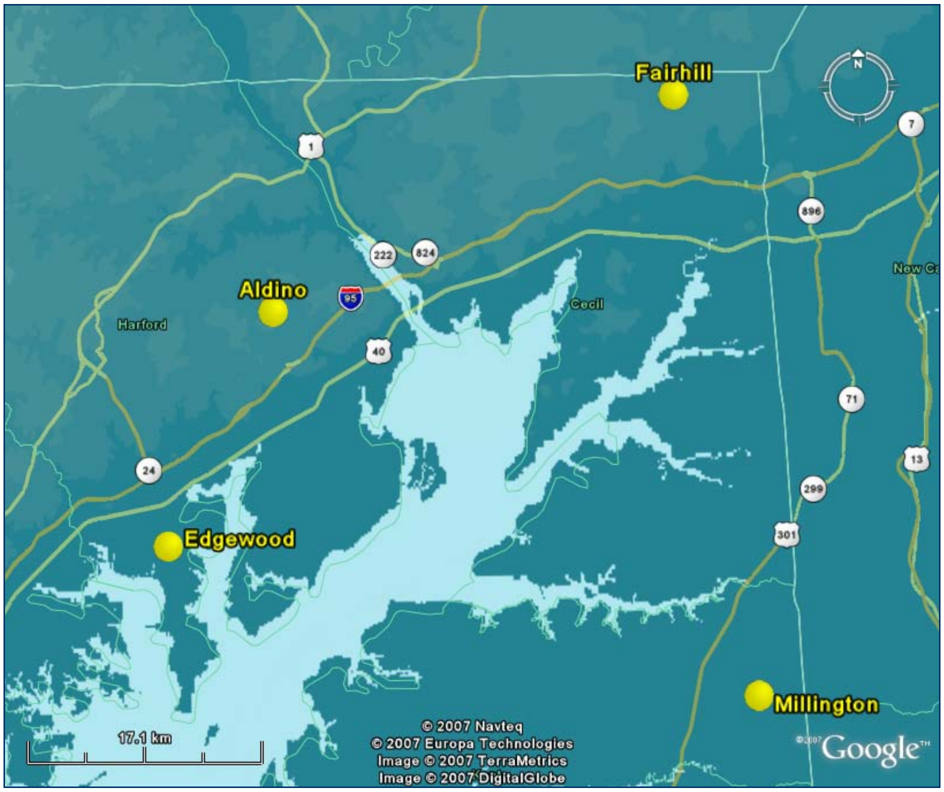

Figure A 6. **Topographic map of air monitoring sites located in Northeastern counties and the Eastern Shore.**

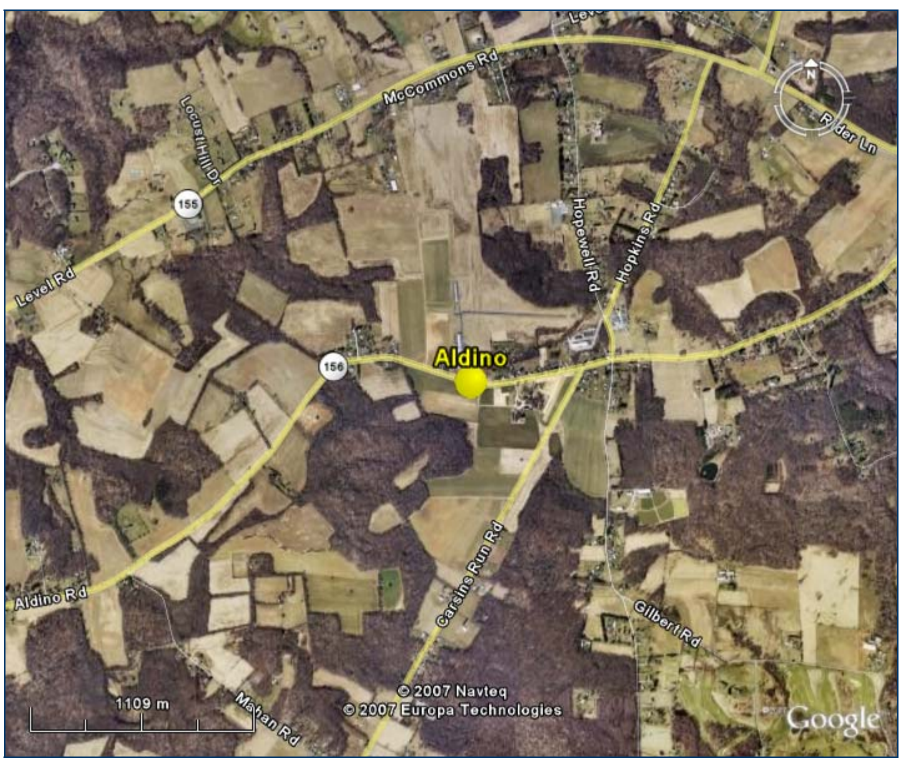

Figure A 7. **Aerial map of Aldino air monitoring site in Harford County, MD.**

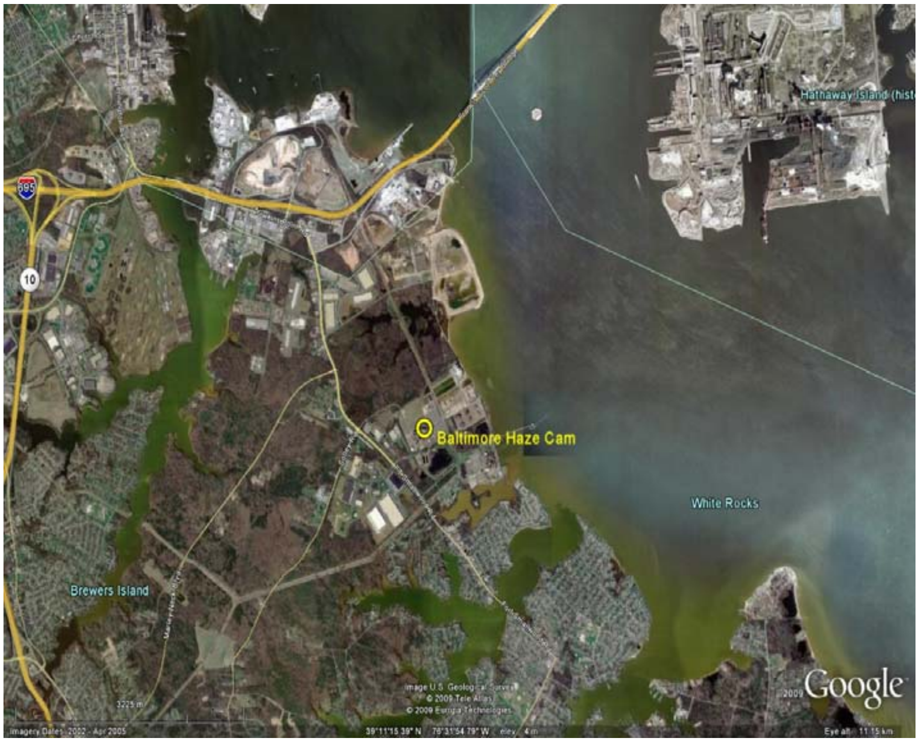

Figure A 8 **Aerial map of Haze Cam site at Brandon Shores**

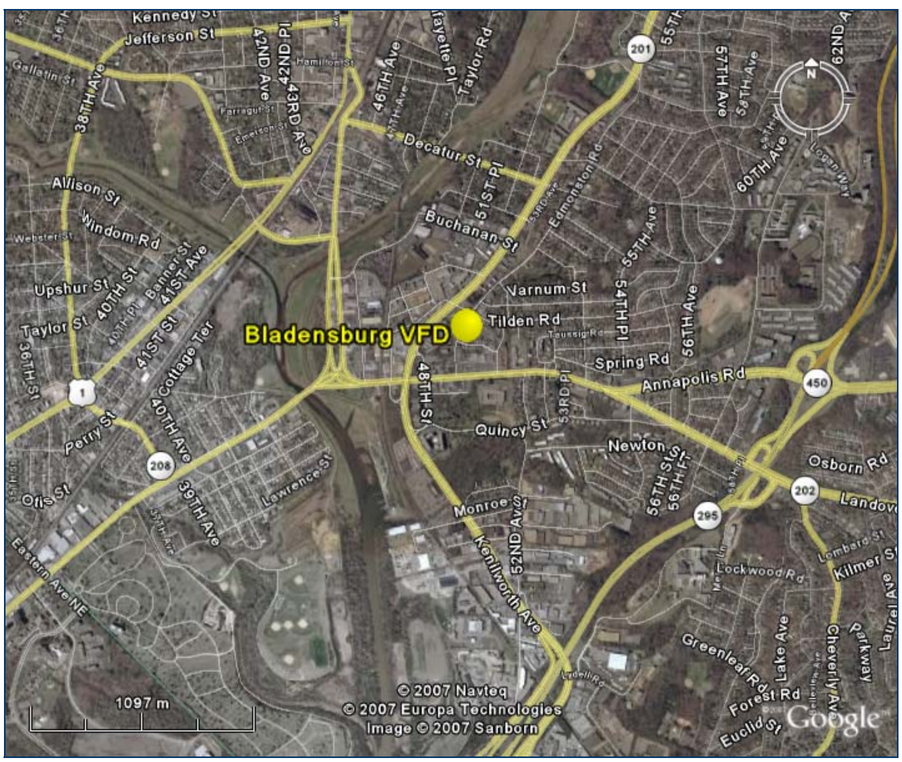

Figure A 9. **Aerial map of Bladensburg VFD air monitoring site in Prince George's County, MD.**

Figure A 10. Aerial map of Calvert Co air monitoring site in Calvert County, MD

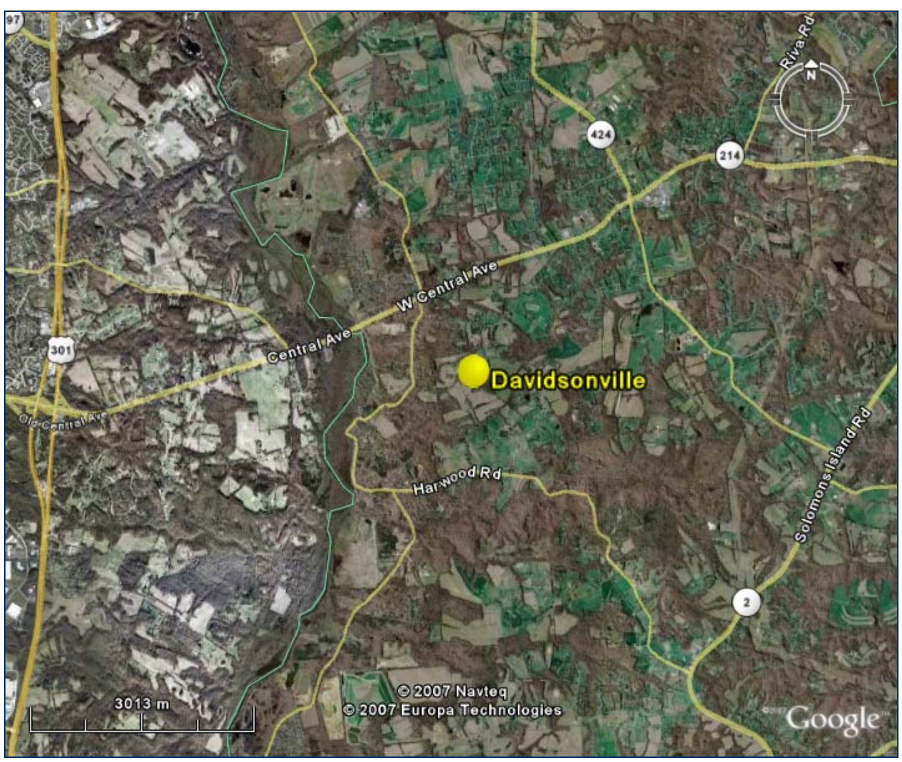

Figure A 11. Aerial map of Calvert Co air monitoring site in Calvert County, MD

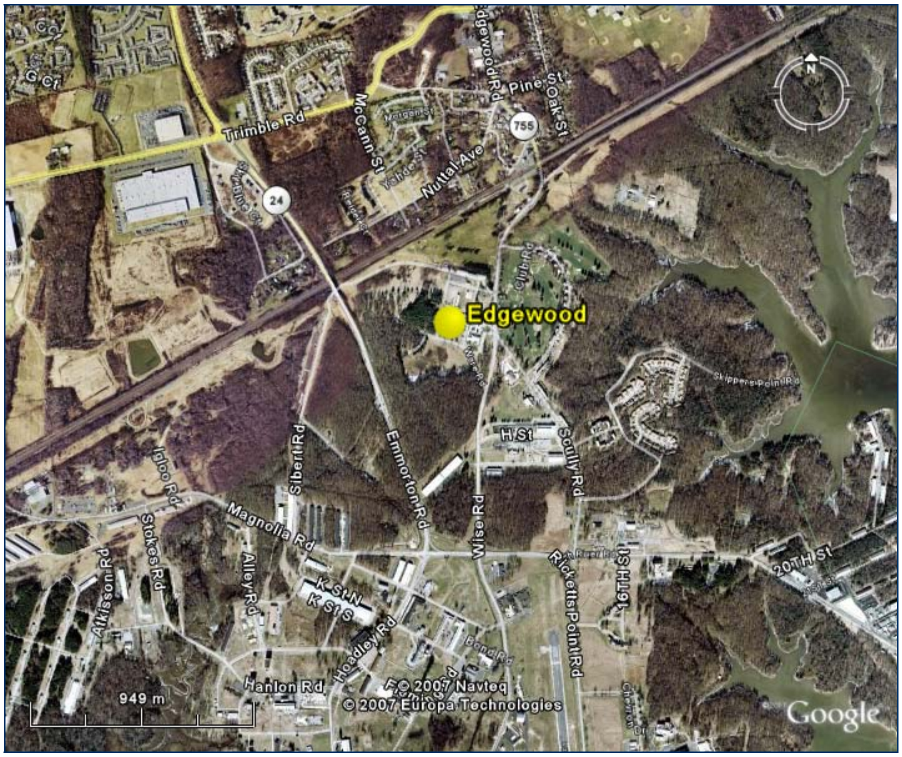

Figure A 12. Aerial map of Edgewood air monitoring site in Harford County, MD.

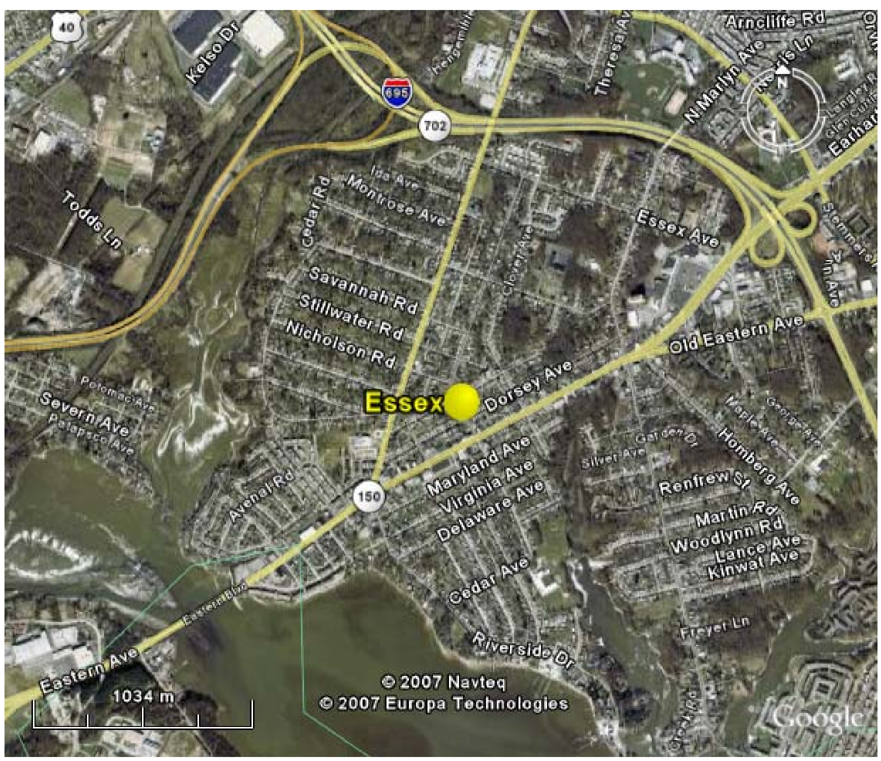

Figure A 13. Aerial Map of the Essex air monitoring site in Baltimore County, MD

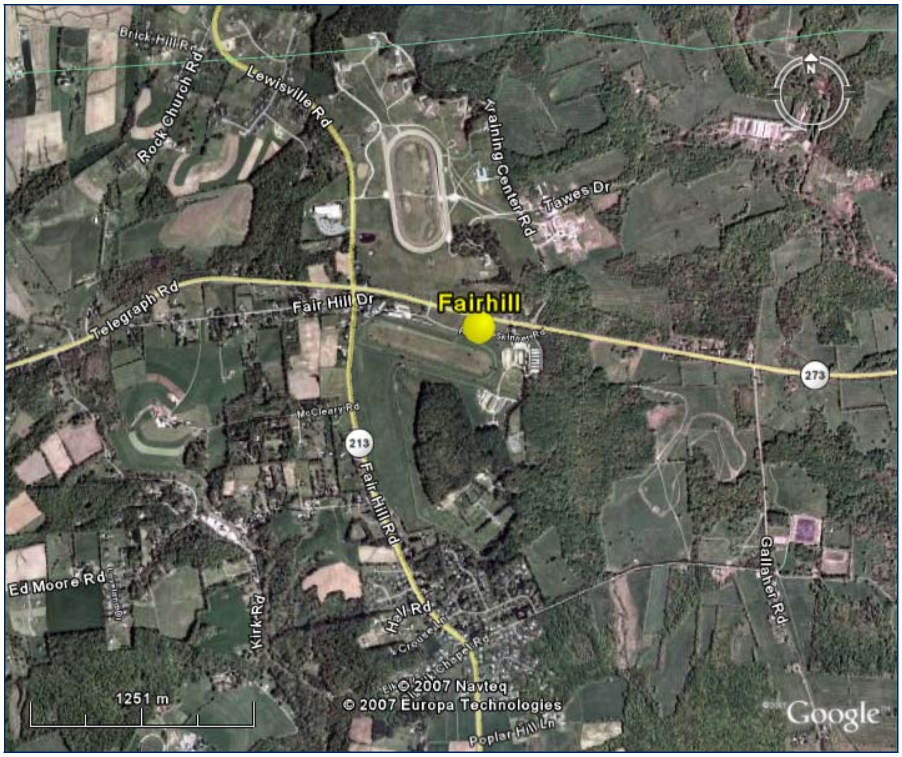

Figure A 14. **Aerial map of Fairhill air monitoring site in Cecil County, MD.**

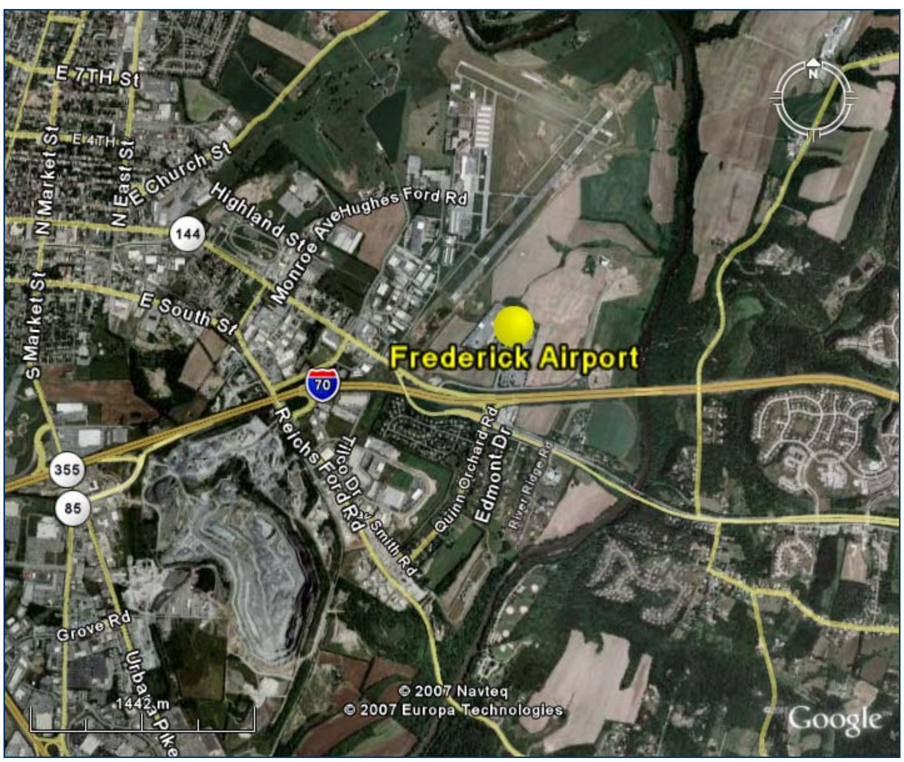

Figure A 15. **Aerial map of Frederick Airport air monitoring site in Frederick County, MD.**

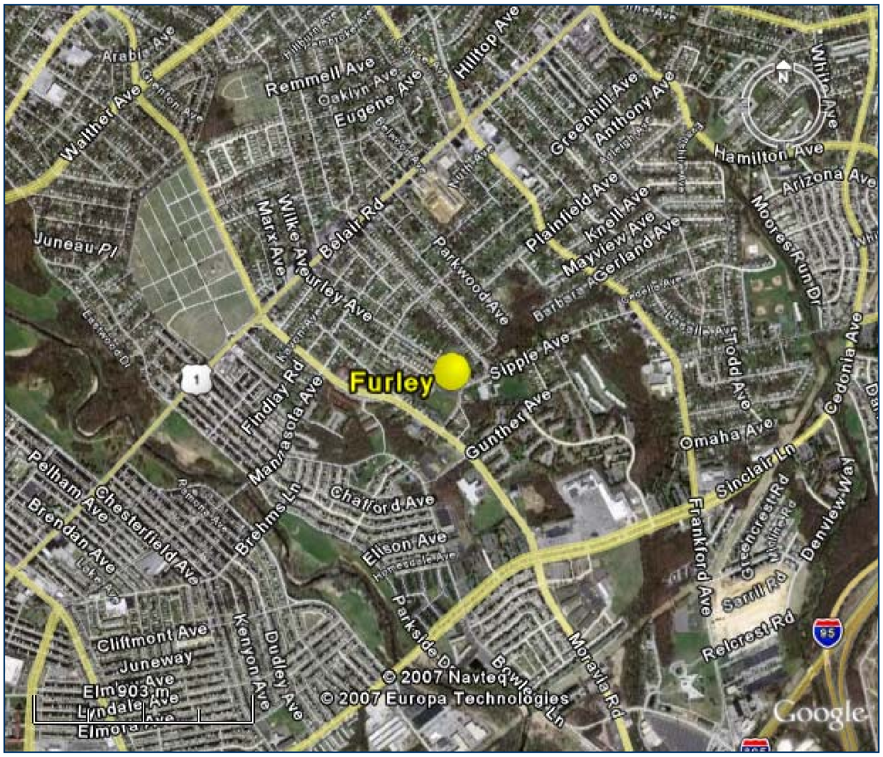

Figure A 16. **Aerial map of Furley air monitoring site in Baltimore City, MD.**

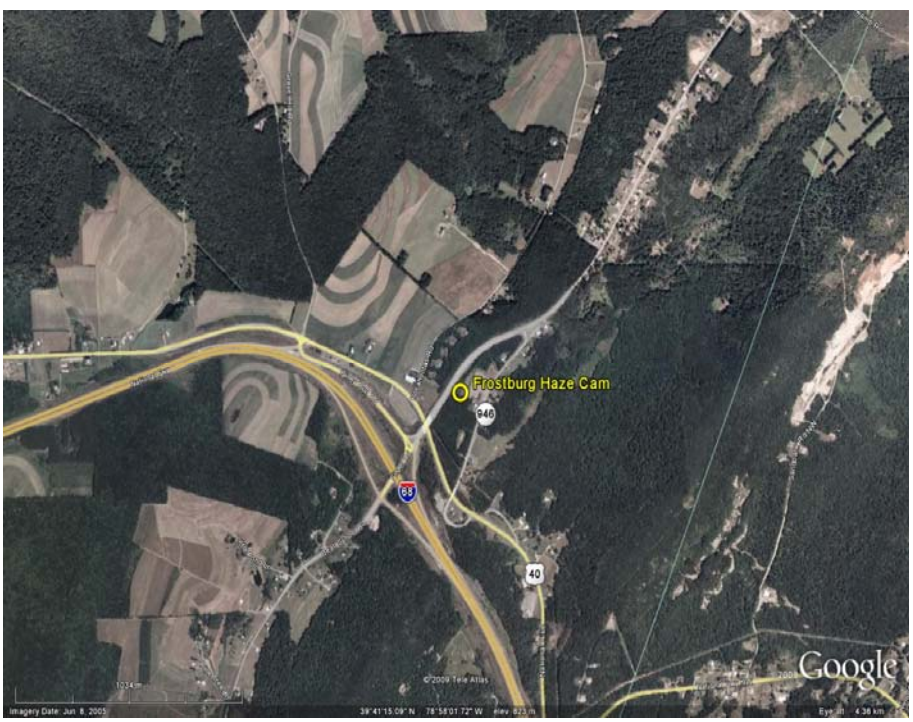

Figure A 17 **Aerial map of Frostburg Haze Cam site**

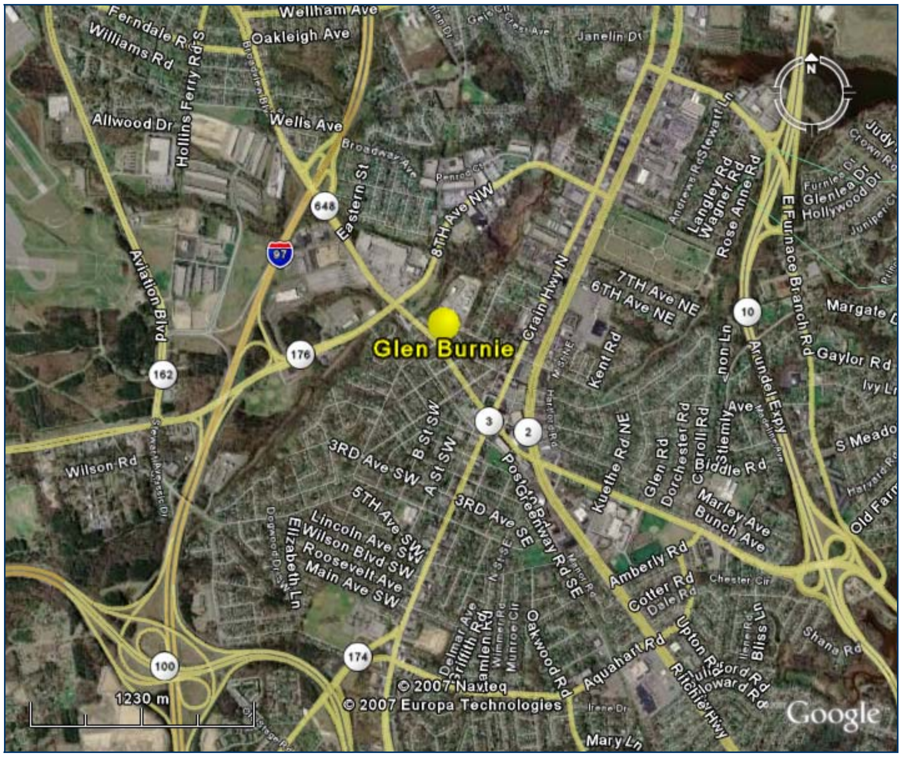

Figure A 18. Aerial map of Glen Burnie air monitoring site in Anne Arundel County, MD.

Figure A 19. Aerial map of Hagerstown air monitoring site in Washington County, MD.

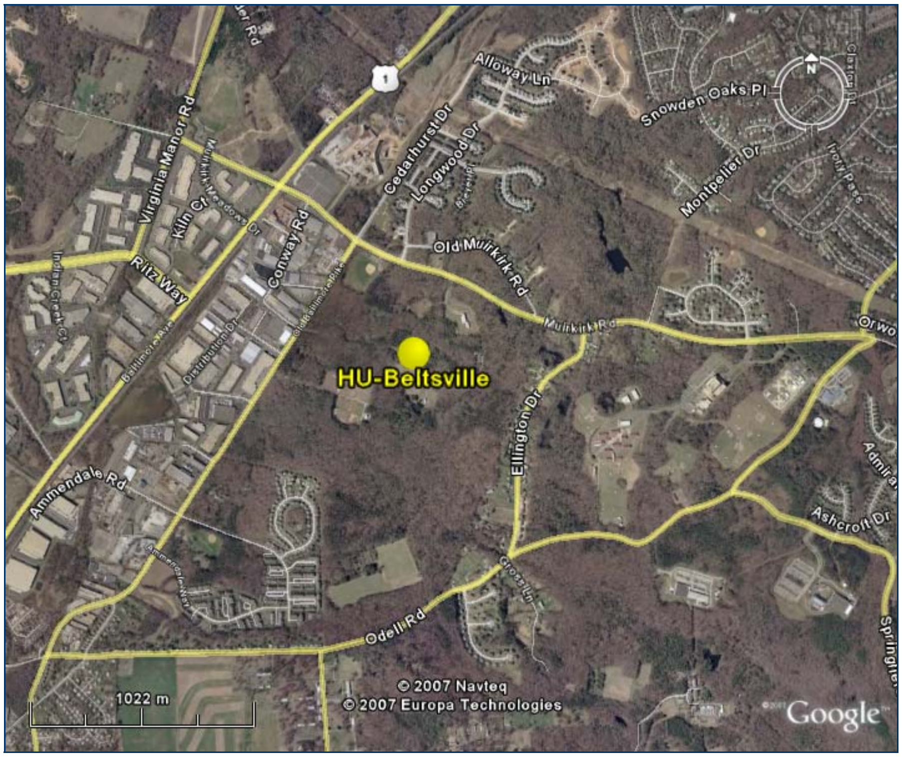

Figure A 20. Aerial map of HU-Beltsville air monitoring site in Prince George's County, MD.

Figure A 21. Aerial map of Millington air monitoring site in Kent County, MD.

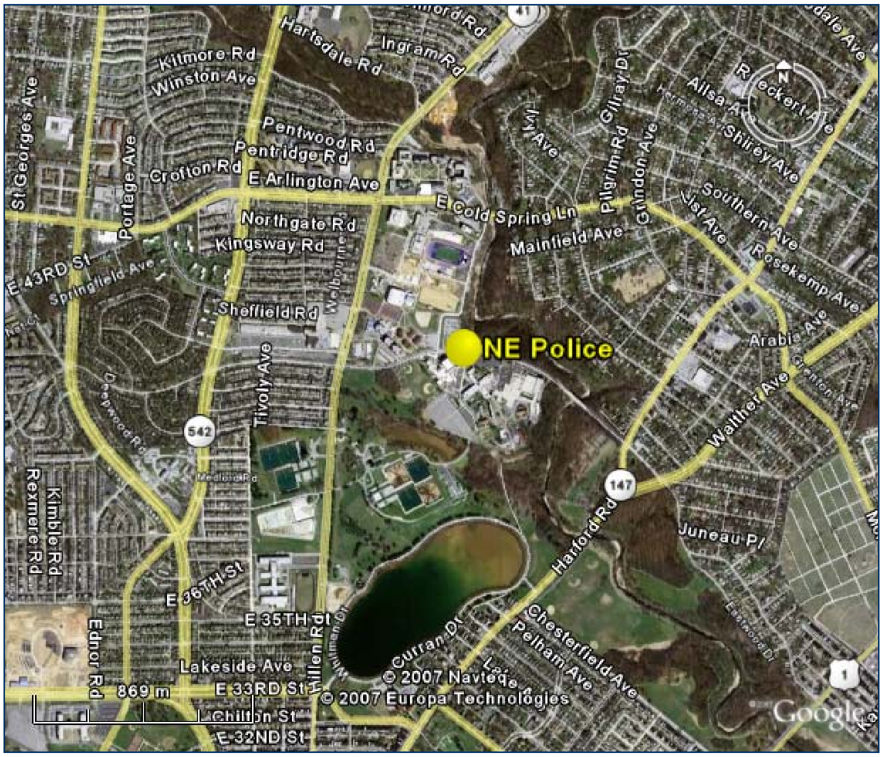

Figure A 22. **Aerial map of NE Police air monitoring site in Baltimore City, MD.**

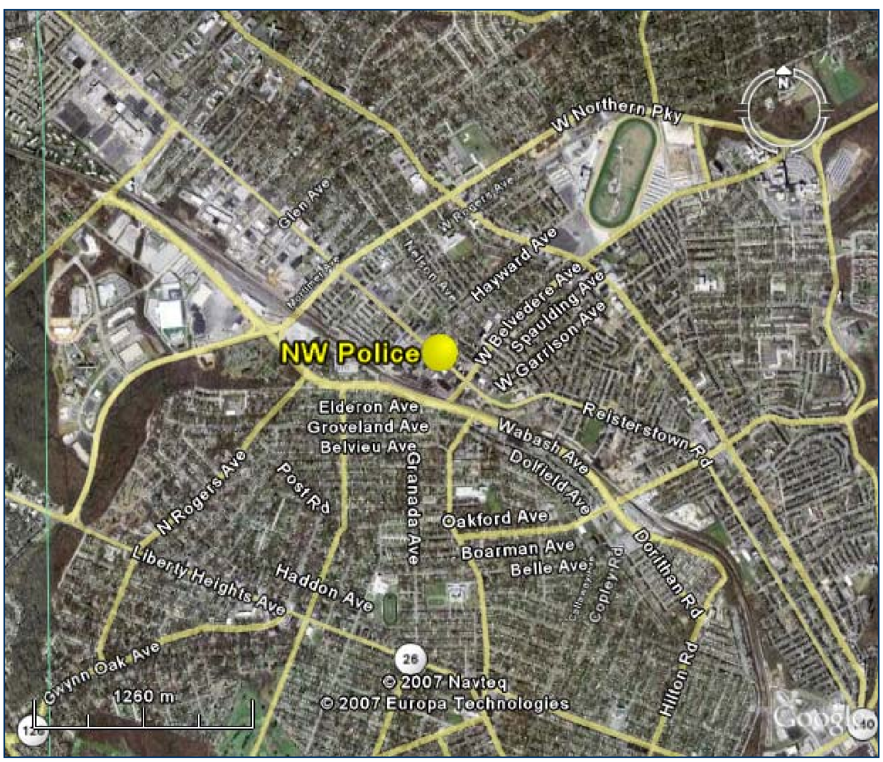

Figure A 23. **Aerial map of NW Police air monitoring site in Baltimore City, MD.**

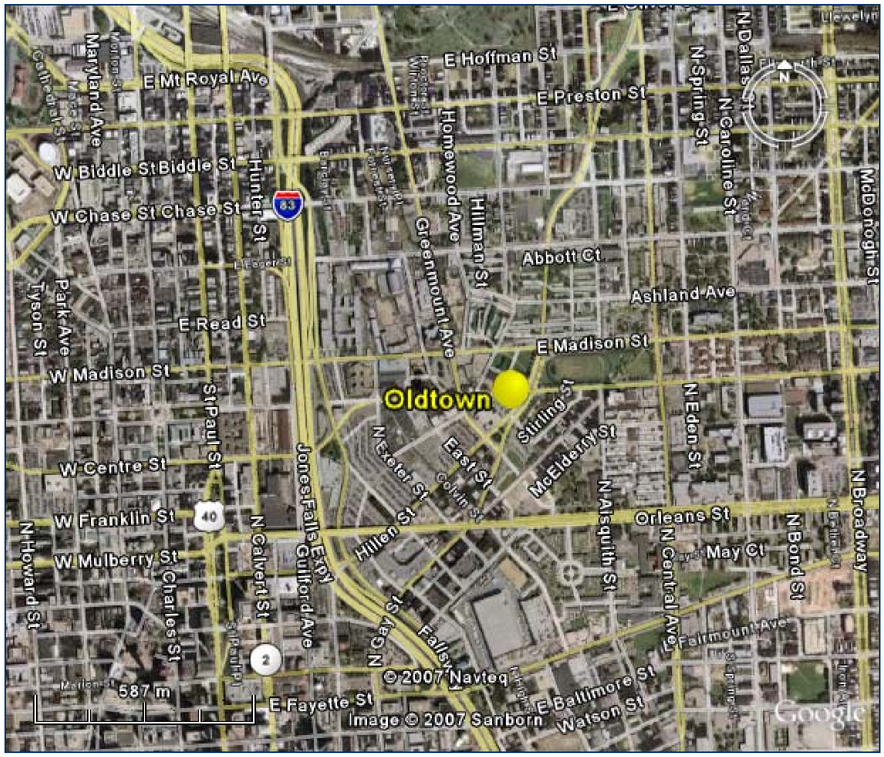

Figure A 24. **Aerial map of Oldtown air monitoring site in Baltimore City, MD.**

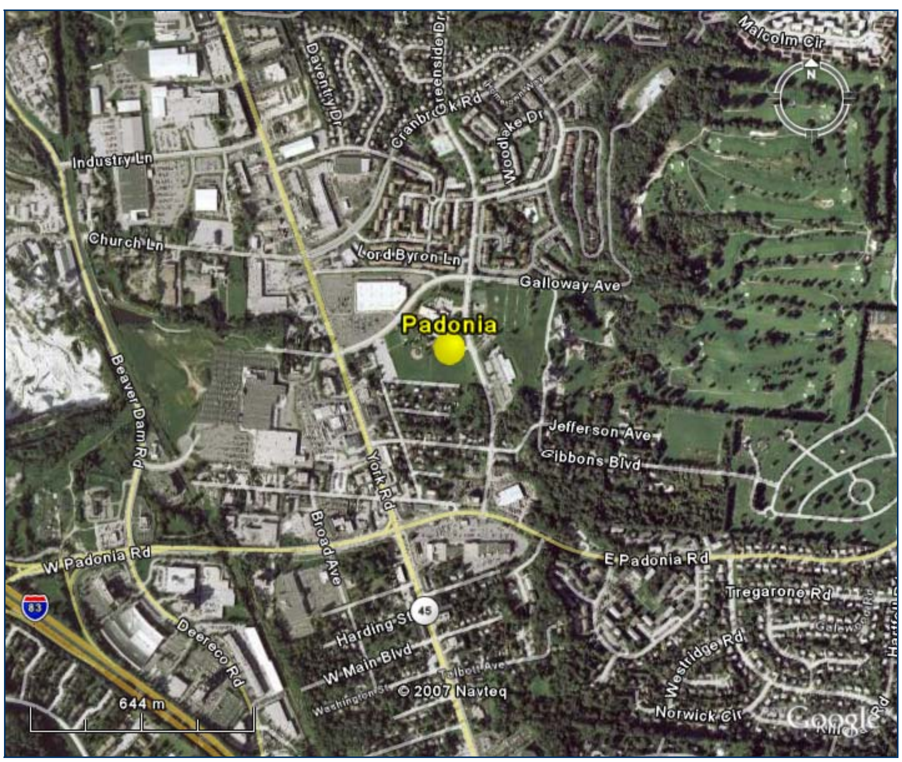

Figure A 25. **Aerial map of Padonia air monitoring site in Baltimore County, MD.**

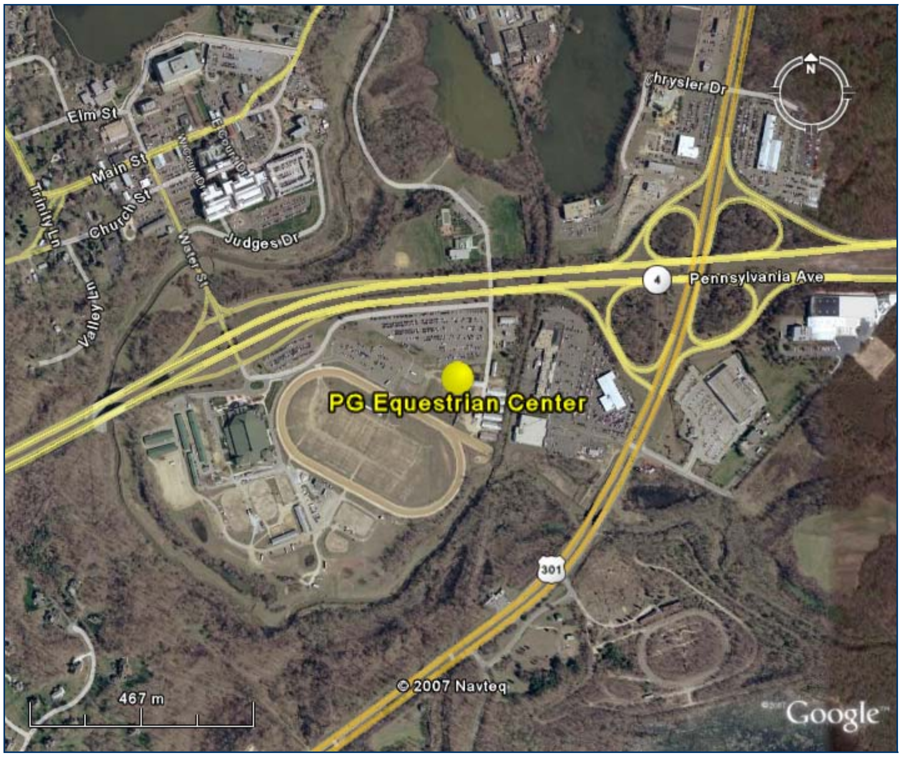

Figure A 26 Aerial map of PG Equestrian Center air monitoring site in Prince George's County, MD.

Figure A 27. Aerial map of Piney Run air monitoring site in Garrett County, MD.

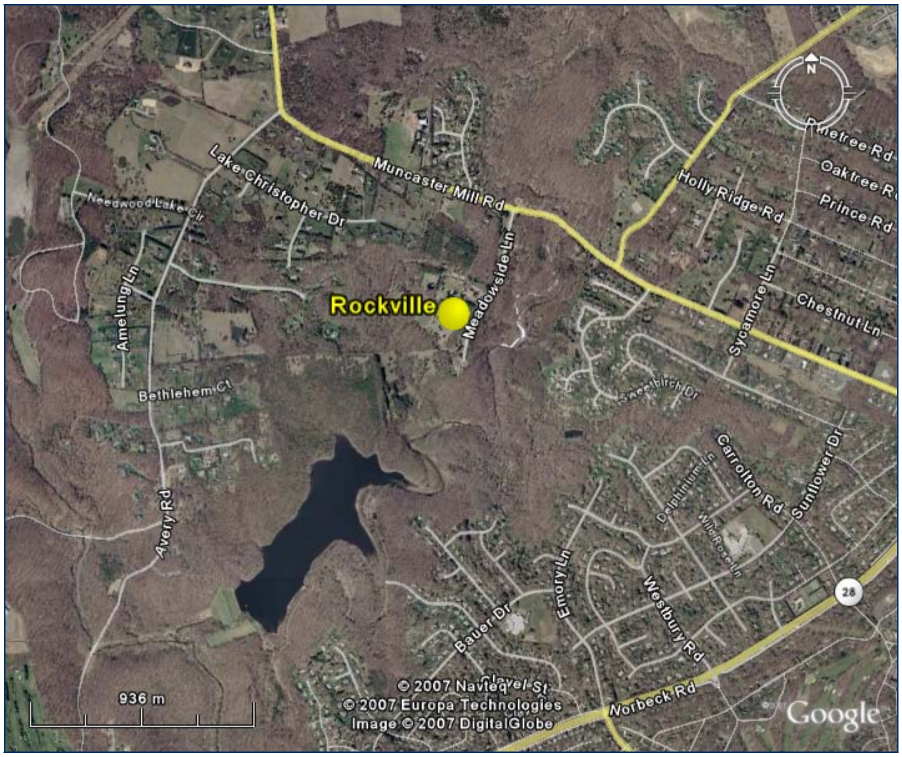

Figure A 28. Aerial map of Rockville air monitoring site in Montgomery County, MD.

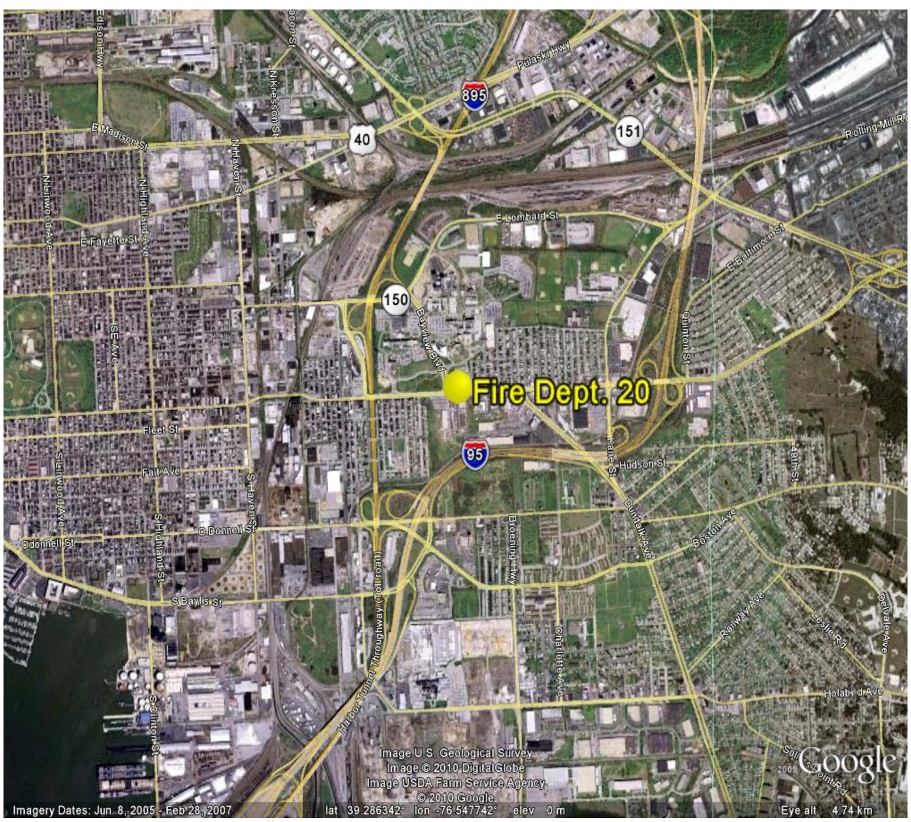

Figure A 29. Aerial map of Fire Dept. 20 air monitoring site in Baltimore City, MD.

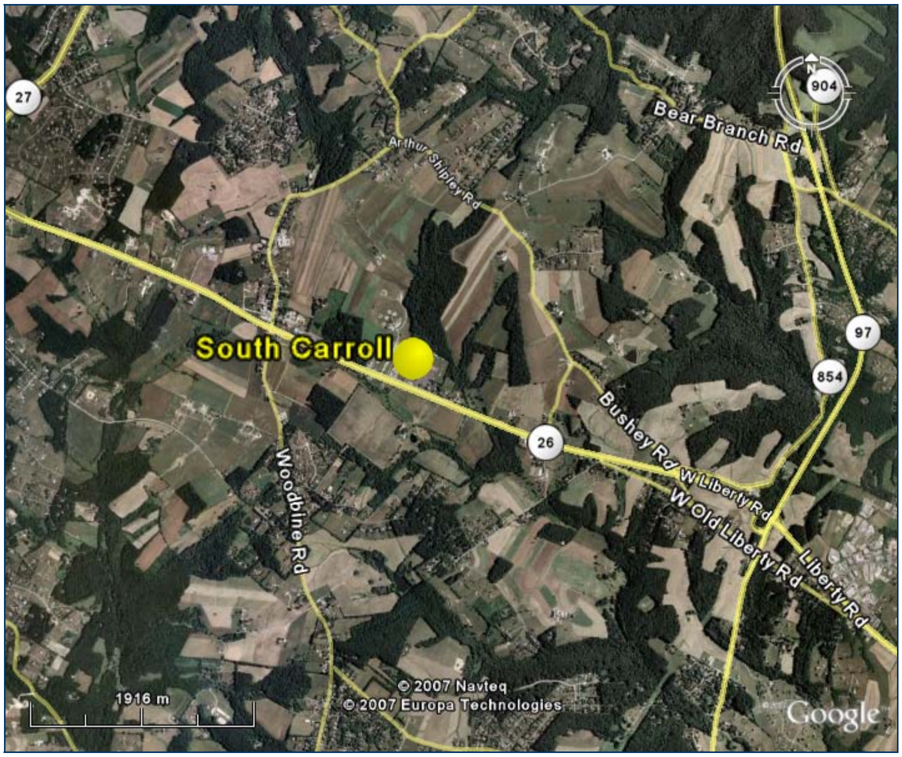

Figure A 30. **Aerial map of South Carroll air monitoring site in Carroll County, MD.**

Figure A 31. **Aerial map of Southern Maryland air monitoring site in Charles County, MD.**