MARYLAND

DEPARTMENT OF THE ENVIRONMENT

AMBIENT AIR MONITORING NETWORK PLAN FOR CALENDAR YEAR 2015

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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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-EPA approved method designated as equivalent to the Federal Reference Method (FRM) for a specific pollutant to compared to the applicable NAAQS
FID	Flame Ionization Detector
FRM	Federal Reference Method-EPA approved reference method necessary for a specific pollutant to be compared to the applicable NAAQS
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 aerodynamic diameter less than or equal to 2.5 μm
PM_{10}	Particulate matter with an aerodynamic diameter less than or equal to 10 μm

PMcoarse	Particulate matter with an aerodynamic diameter less than or equal to 10 µm minus particulate matter with an aerodynamic 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 States with ozone nonattainment areas classified as serious, severe or extreme to incorporate enhanced monitoring for ozone, speciated volatile organic compounds (VOC’s), 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 VOC’s.

Section 112 of the 1990 CAAA identified 188 hazardous air pollutants (HAPS), also referred to as air toxics and required EPA to regulate facilities that emit one or more of these air toxics. EPA Region 3 has developed a Cooperative Air Toxics Monitoring Program and MDE operates several air toxics sites as part of the program. MDE also provides analytical support for other 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.

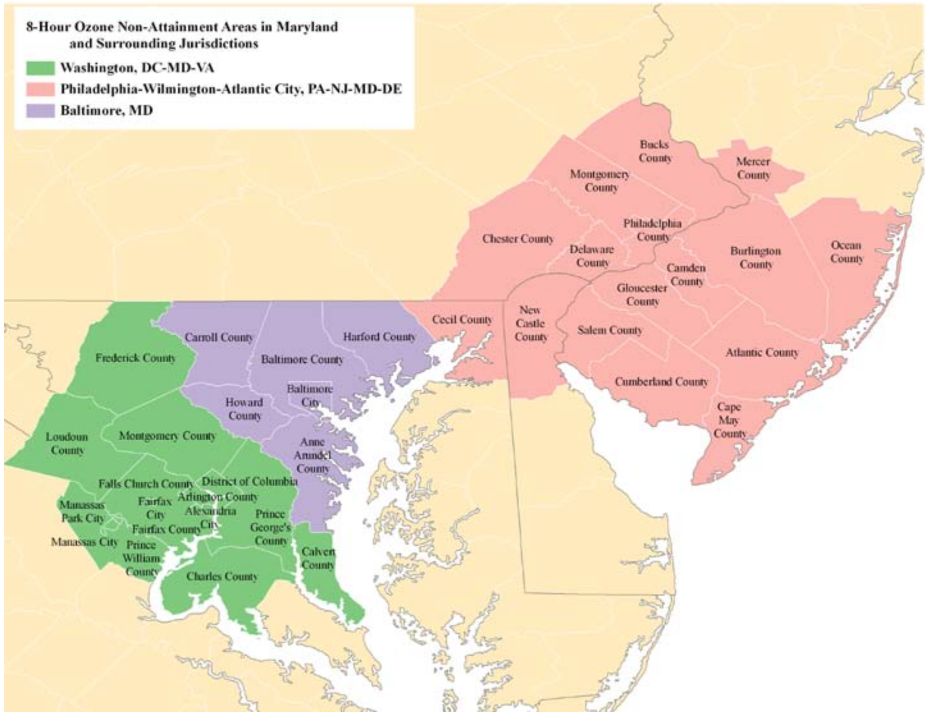

Figure 1-1. **Map depicting non-attainment areas for 8-hour ozone in Maryland and surrounding jurisdictions that are part of the NAA.**

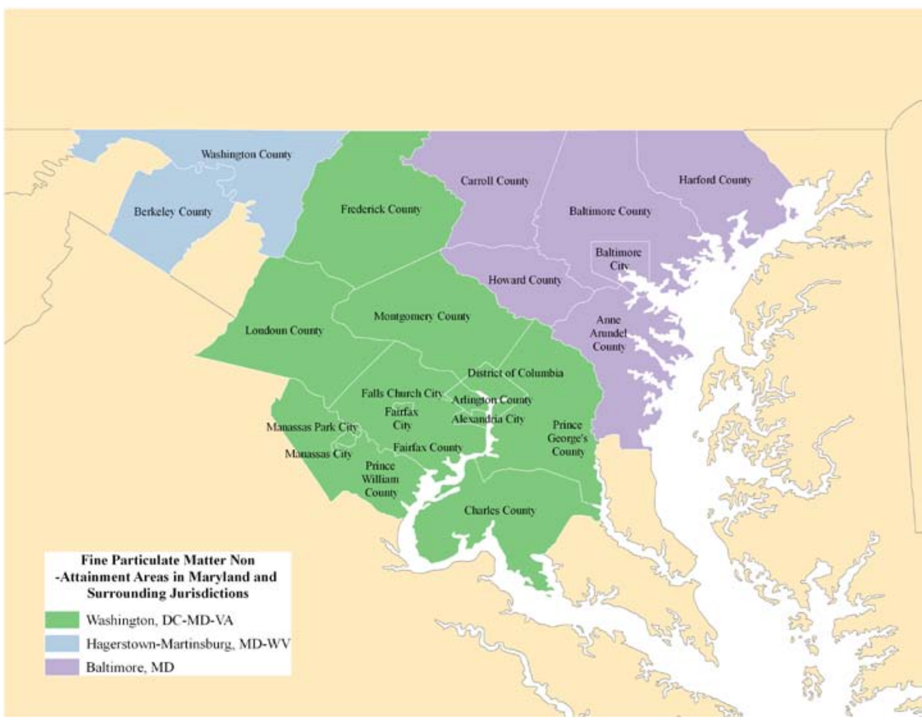

Figure 1-2. **Map depicting non-attainment areas for the fine particulate matter ($PM_{2.5}$) annual NAAQS in Maryland and surrounding jurisdictions that are part of the NAA.**

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 25 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 **Figure 3-1**. Additional topographic and aerial maps are provided in **Appendix A**.

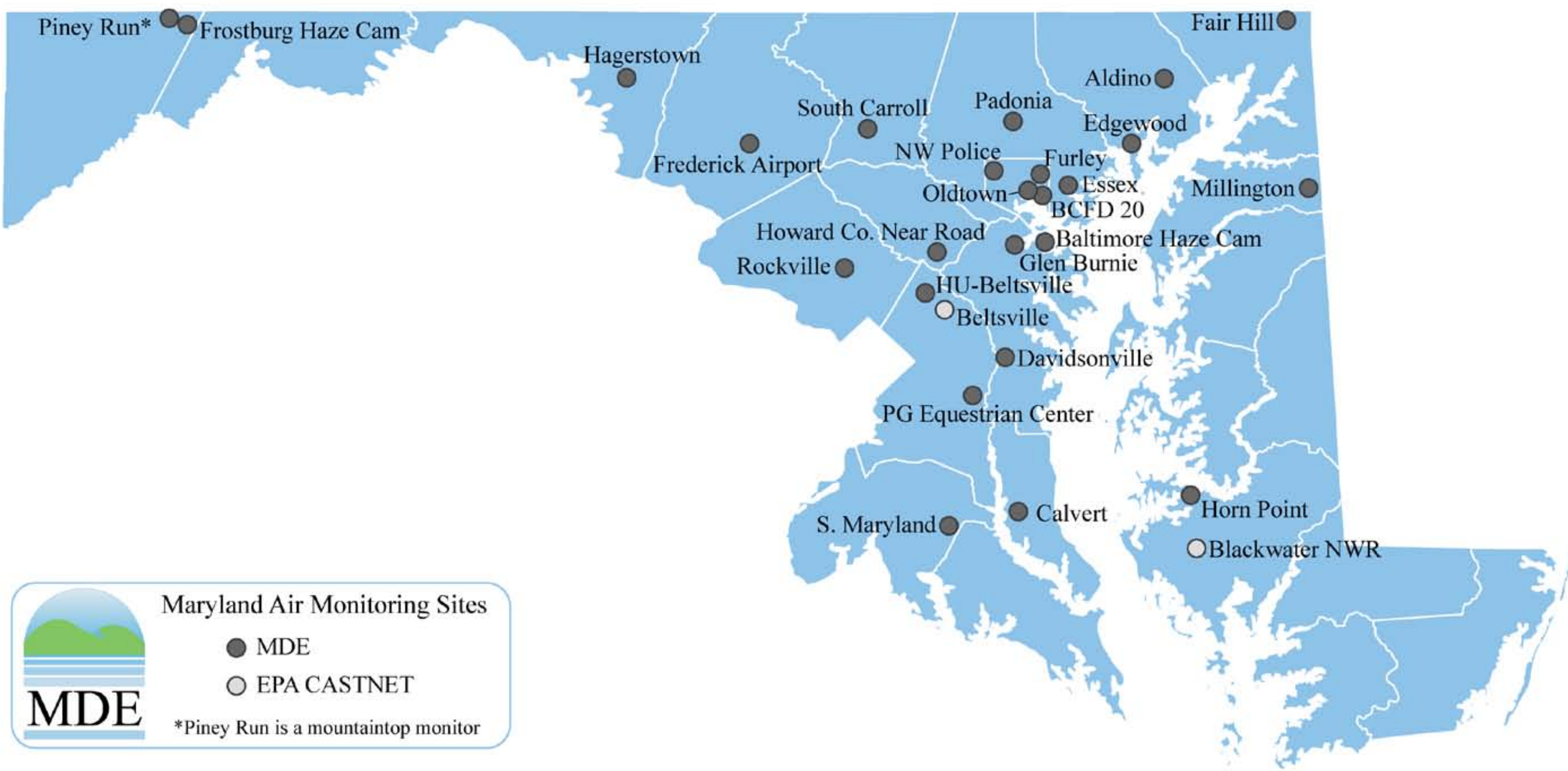

Figure 3-1. Maryland's current air monitoring network map.

Notes: 1) Piney Run also marks the Frostburg Improve site which is just a few meters away. 2) 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**. The Program also operates an extensive meteorological monitoring network, see **Appendix C**.

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	DIST FROM NEAREST ROAD (M)	CBSA
Aldino, 240259001	3560 Aldino Rd.	Aldino, Harford	21028	39.563333, -76.203889	Suburban	Aldino Rd.	1150	2008	14	Baltimore-Columbia-Towson
Baltimore Haze Cam	Raven Power, 1000 Brandon Shores Dr.	Pasadena, Anne Arundel	21226	39.181511, -79.537544	Urban	NA	NA	NA	NA	NA
BCFD-Truck Company 20, 245100008	5714 Eastern Ave.	Baltimore, City	21224	39.28777, -76.546861	Urban	Eastern Ave.	21901	2008	45	Baltimore-Columbia-Towson
Beltsville, 240339991	Powder Mill Rd.	Laurel, Prince Georges	20708	39.0284, -76.8171						Washington-Arlington-Alexandria
Blackwater NWR, 240199991	Blackwater National Wildlife Refuge	Cambridge, Dorchester	21613	38.445, -76.1114						Cambridge
Calvert, 240090011	350 Stafford Rd.	Barstow, Calvert	20678	38.536722, -76.617194	Rural	Stafford Rd.			53	Washington-Arlington-Alexandria
Davidsonville, 240030014	Davidsonville Rec. Ctr., 3801 Queen Anne Bridge Rd.	Davidsonville, Anne Arundel	21035	38.9025, -76.653056	Rural	Queen Anne Bridge Rd.	1895	1994	106	Baltimore-Columbia-Towson
Edgewood, 240251001	Edgewood Chemical Biological Center (APG), Waehli Rd.	Edgewood, Harford	21010	39.41, -76.296667	Rural	Waehli Rd.			16	Baltimore-Columbia-Towson
Essex, 240053001	600 Dorsey Ave.	Essex, Baltimore County	21221	39.310833, -76.474444	Suburban	Woodward Dr.	500	1993	5	Baltimore-Columbia-Towson
Fair Hill, 240150003	Fair Hill Natural Resource Mgmt. Area 4600 Telegraph Rd.	Fair Hill, Cecil	21921	39.701111, -75.86	Rural	Telegraph Rd. (RT 273)	8381	2008	26	Philadelphia-Camden-Wilmington
Frederick Airport, 240210037	180 E. Airport Dr.	Frederick, Frederick	21701	39.42276, -77.37519	Suburban	Disposal Plant Rd.	5	1998	9	Washington-Arlington-Alexandria
Frostburg Haze Cam	E. Garrett Co. Vol. Fire Dept. 401 Finzel Rd.	Finzel, Garrett	21532	39.705896, -7.01012117	Rural	NA	NA	NA	NA	NA
Frostburg IMPROVE	Frostburg Reservoir	Finzel, Garrett	21532	39.705896, -79.012117	Rural	Grantsville Rd.				NA
Furley, 245100054	Furley E.S. Rec. Ctr., 4633 Furley Ave.	Baltimore, City	21206	39.32889, -76.5525	Urban and Center City	Furley Ave.			29	Baltimore-Columbia-Towson
Glen Burnie, 240031003	AA Co. Public Works 7409 Balt-Annap. Blvd.	Glen Burnie, Anne Arundel	21061	39.169533, -76.627933	Suburban	Baltimore-Annapolis Blvd.	16801	2008	42	Baltimore-Columbia-Towson

SITE NAME, AQS ID	STREET ADDRESS	CITY, COUNTY	ZIP CODE	LATITUDE, LONGITUDE	LOCATION SETTING	NEAREST ROAD	TRAFFIC COUNT	TRAFFIC COUNT YEAR	DIST FROM NEAREST ROAD (M)	CBSA
Hagerstown, 240430009	18530 Roxbury Rd.	Hagerstown, Washington	21740	39.565556, -77.721944	Rural	Roxbury Rd.	50	1993	49	Hagerstown-Martinsburg
Horn Point, 240190004	University of Md - CES Horn Point Laboratory 2020 Horns Point Rd	Cambridge, Dorchester	21613	38.587635, -76.140449	Rural	Horns Point Rd.			64	Cambridge
Howard County Near Road, 240270006	I-95 S Welcome Center	Laurel, Howard	20723	39.143197 -76.846192	Suburban	I-95	190680	2012	Est. 20	Baltimore-Columbia-Towson
HU-Beltsville, 240330030	Howard University Beltsville Lab., 12003 Old Baltimore Pike	Beltsville, Prince Georges	20705	39.055277, -76.878333	Suburban	Old Baltimore Pike			385	Washington-Arlington-Alexandria
Millington, 240290002	Millington WMA-Massey-MD Line Rd.	Millington, Kent	21650	39.3052, -75.7972	Rural	RT 330, Massey-DE Line Rd.	1392	2008	121	NA
Northwest Police Station, 245100007	Northwest District Police Station, 5271 Reisterstown Rd.	Baltimore, City	21215	39.34465, -76.68538	Urban	Reisterstown Rd.	16261	2008	25	Baltimore-Columbia-Towson
Oldtown, 245100040	Oldtown Fire Station, 1100 Hillen St.	Baltimore, City	21202	39.298056, -76.604722	Urban and Center City	Hillen St.	15300	1990	7	Baltimore-Columbia-Towson
Padonia, 240051007	Padonia E.S., 9834 Greenside Dr.	Cockeysville, Baltimore County	21030	39.462024, -76.631261	Suburban	Greenside Dr.			46	Baltimore-Columbia-Towson
PG Equestrian Center, 240338003	14900 Pennsylvania Ave.	Greater Upper Marlboro, Prince Georges	20772	38.81194, -76.74417	Rural	Pennsylvania Ave.	46651	2008	191	Washington-Arlington-Alexandria
Piney Run, 240230002	Frostburg Reservoir, Finzel	Frostburg, Garrett	21532	39.70595, -79.012	Rural	Piney Run Rd.			1141	NA
Rockville, 240313001	L.E. Smith Env. Educ. Ctr, 5110 Meadowside Ln.	Rockville, Montgomery	20855	39.114444, -77.106944	Rural	Meadowside Ln.			77	Washington-Arlington-Alexandria
South Carroll, 240130001	South Carroll H.S. 1300 W Old Liberty Rd.	Sykesville, Carroll	21784	39.444167, -77.041667	Rural	Old Liberty Rd.	10962	2008	248	Baltimore-Columbia-Towson
Southern Maryland, 240170010	14320 Oaks Rd.	Charlotte Hall, Charles	20622	38.504167, -76.811944	Rural	Access Rd.			16	Washington-Arlington-Alexandria

Note: Blank cells indicate that no data was available. NA means not applicable for the cell. Also, the Beltsville, 240339991 and Blackwater NWR, 240199991 sites are a part of EPA's CASTNET monitoring network and are operated by the Clean Air Markets Division. They appear here, because they can be used to determine ozone attainment status. BCFD Truck Company 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. Monitor information for current Maryland ambient air monitoring sites.

Site Name & AQS ID	Parameter	Start Date	Method Code	Probe Height	Measurement Scale	Monitor Objective	TYPE	Schedule
Aldino, 240259001	Ozone (O_3)	04/20/1990	047	10	Urban	Highest Concentration	SLAMS	H
Baltimore Haze Cam	Visibility	04/01/2007	NA	NA	NA	Public Notification	NA	NA
BCFD-Truck Company 20, 245100008	PM_{10} - STP	03/10/2004	127	7.6	Neighborhood	Population Exposure	SLAMS	6
	$PM_{2.5}$ - Local Conditions	06/20/2001	118	7.9	Neighborhood	Population Exposure	SLAMS	3
Beltsville, 240339991	Ozone (O_3)	04/01/2011	047	10	Regional	Highest Concentration	CASTNET	H
Blackwater NWR, 240199991	Ozone (O_3)	01/01/2011	047	10	Regional	Highest Concentration	CASTNET	H
Calvert, 240090011	Ozone (O_3)	04/01/2005	047	4.6	Urban	Population Exposure	SLAMS	H
Davidsonville, 240030014	Ozone (O_3)	06/06/1980	047	4.5	Urban	Population Exposure	SLAMS	H
Edgewood, 240251001	Ozone (O_3)	03/10/1980	047	4.5	Urban	Highest Concentration	SLAMS	H
	$PM_{2.5}$ - Hourly	09/01/2011	170	5.1	Neighborhood	Population Exposure	SLAMS	H
Essex, 240053001	Air Toxics	01/01/1990	150	4	Neighborhood	Population Exposure	Other	6
	Carbon Monoxide (CO)	02/15/2006	593	4.4	Middle	Highest Concentration	SLAMS	H
	Nitric Oxide (NO)	01/01/1993	074	4.4	Neighborhood	Population Exposure, Max Precursor	Unofficial PAMS	H
	Oxides of Nitrogen (NO_X)	01/01/1980	074	4.4	Neighborhood	Max Precursor	Unofficial PAMS	H
	Nitrogen Dioxide (NO_2)	01/01/1972	074	4.4	Neighborhood	Max Precursor	Unofficial PAMS	H
	Ozone (O_3)	01/01/1972	047	4.4	Neighborhood	Highest Concentration, Population Exposure	SLAMS	H
	$PM_{2.5}$ - Local Conditions	01/01/1999	118	5.1	Neighborhood	Population Exposure	SLAMS	3
	$PM_{2.5}$ - Speciation	07/08/2004	812	5.0	Neighborhood	Population Exposure	Trends Speciation	6
	Sulfur Dioxide (SO_2)	07/01/2003	600	4.4	Neighborhood	Highest Concentration	SLAMS	R
	Type 2 PAMS VOCS	01/01/1992	126, 142	4	Neighborhood	Max Precursor, Highest Concentration	Unofficial PAMS	H & 6
Fair Hill, 240150003	Ozone (O_3)	01/01/1992	087	4.5	Urban	Regional Transport	SLAMS	H
	$PM_{2.5}$ - Hourly	07/01/2010	170	4.7	Regional	General/Background	SLAMS	H
Frederick Airport, 240210037	Ozone (O_3)	07/09/1998	087	4.6	Urban	Population Exposure	SLAMS	H
Frostburg IMPROVE, 240239000	IMPROVE Parameters	03/01/2004	NA	4.0	Regional	Public Notification	NA	6
Frostburg Haze Cam	Visibility	10/01/2005	NA	NA	NA	Public Notification	NA	NA
Furley, 245100054	Ozone (O_3)	08/20/2006	047	7.5	Neighborhood	Population Exposure	SLAMS	H
Glen Burnie, 240031003	PM_{10} - STP	08/22/2008	127	4.7	Neighborhood	Population Exposure	SLAMS	6
	PM_{10} - STP	08/22/2008	127	4.7	Neighborhood	Population Exposure	QA-Collocated	7
	$PM_{2.5}$ - Local Conditions	01/01/1999	118	5	Neighborhood	Population Exposure	SLAMS	3
Hagerstown, 240430009	Ozone (O_3)	04/01/1999	047	4.6	Urban	Highest Conc/ Population Exposure	SLAMS	H
	$PM_{2.5}$ - Hourly	07/01/2010	170	5.09	Urban	Highest Conc	SLAMS	H
Horn Point, 240190004	Carbon Monoxide (CO)	04/01/2012	593	4	Regional	Population Exposure	SLAMS	H

Site Name & AQS ID	Parameter	Start Date	Method Code	Probe Height	Measurement Scale	Monitor Objective	TYPE	Schedule
	Nitric Oxide (NO)	04/01/2012	599	4	Regional	Population Exposure	SLAMS	H
	NO_Y - NO	04/01/2012	599	4	Regional	Population Exposure	SLAMS	H
	Ozone (O_3)	04/01/2012	087	4	Regional	Population Exposure	SLAMS	H
	$PM_{2.5}$ - Hourly	04/01/2012	170	4	Regional	Population Exposure	SLAMS	H
	Reactive Oxides of Nitrogen (NO_Y)	04/01/2012	599	4	Regional	Population Exposure General/ Background	SLAMS	H
	Sulfur Dioxide (SO_2)	04/01/2012	600	4	Regional	Population Exposure General/ Background	SLAMS	R
Howard County Near Road, 240270006	Air Toxics	04/07/2014	150		Microscale	Source Oriented/ Highest Conc.	SLAMS	H
	Black Carbon (Aethalometer)	TBD	NA	NA	NA	NA	NA	H
	Carbon Monoxide (CO)	04/01/2014	593	4	Microscale	Source Oriented/ Highest Conc.	SLAMS	H
	Nitric Oxide (NO)	04/01/2014	099	4	Microscale	Source Oriented/ Highest Conc.	SLAMS	H
	Nitrogen Dioxide (NO_2)	04/01/2014	099	4	Microscale	Source Oriented/ Highest Conc.	SLAMS	H
	Oxides of Nitrogen (NO_X)	04/01/2014	099	4	Microscale	Source Oriented/ Highest Conc.	SLAMS	H
	$PM_{2.5}$ - Hourly	04/01/2014	170	4.5	Microscale	Source Oriented/ Highest Conc.	SLAMS	H
	Ultrafine Particles	04/01/2014	NA	NA	NA	NA	NA	H
HU-Beltsville, 240330030	Carbon Monoxide (CO)	01/01/2007	554	4.6	Urban	General/Background	NCore	H
	Air Toxics	05/05/2005	150	4	Neighborhood	Population Exposure	Other	6
	Black Carbon (Aethalometer)	01/01/2009	NA	NA	NA	NA	NA	H
	Lead (Pb)	12/12/2011	811	2.3	Neighborhood	Population Exposure	NCore	6
	Lead (Pb)	12/12/2011	811	2.3	Neighborhood	Population Exposure	QA-Collocated	7
	Nitric Oxide (NO)	05/28/2005	574	10	Urban	General/Background	NCore	H
	Nitric Oxide (NO)	01/01/2012	099	4.6	Urban	General/Background	SLAMS	H
	Nitrogen Dioxide (NO_2)	01/01/2012	099	4.6	Urban	General/Background	SLAMS	H
	NO_Y - NO	05/28/2005	574	10	Urban	General/Background	NCore	H
	Oxides of Nitrogen (NO_X)	01/01/2012	099	4.6	Urban	General/Background	SLAMS	H
	Ozone (O_3)	05/01/2005	047	4.6	Urban	Highest Conc./	NCore	H
	$PM_{2.5}$ Speciation	12/05/2004	812	2.3	Urban	Population Exposure General/Background	NCore	3
	PM_{10} - STP	07/25/2010	127	2.3	Urban	Population Exposure	NCore	3
	PM_{10} - STP	07/31/2010	127	2.3	Urban	Population Exposure	QA-Collocated	6
	$PM_{10-2.5}$ - Local Conditions	07/25/2010	176	2.3	Urban	Population Exposure	NCore	3
	$PM_{10-2.5}$ - Local Conditions	07/31/2010	176	2.3	Urban	Population Exposure	QA-Collocated	6
	$PM_{2.5}$ - Local Conditions	07/10/2004	118	2.3	Urban	Population Exposure	NCore	3
	$PM_{2.5}$ - Local Conditions	07/31/2010	118	2.3	Urban	Population Exposure	QA-Collocated	6
	$PM_{2.5}$ - Hourly	07/01/2010	170	4.5	Urban	Population Exposure	NCore	H
	Elemental & Organic Carbon	01/01/2005	NA	4.0	NA	NA	NA	2
	Sulfate (SO_4^{2-})	08/29/2005	NA	4.0	NA	NA	NA	H
	Reactive Oxides of Nitrogen (NO_Y)	05/23/2008	574	10	Urban	General/Background	NCore	H
	Sulfur Dioxide (SO_2)	09/29/2006	560	4.6	Urban	General/Background	NCore	R
	TYPE 3 PAMS VOCS	05/05/2005	126	4	Urban	Upwind/Background	Unofficial PAMS	H

Site Name & AQS ID	Parameter	Start Date	Method Code	Probe Height	Measurement Scale	Monitor Objective	TYPE	Schedule
	Ultrafine Particles	TBD	NA	NA	NA	NA	NA	H
Millington, 240290002	Ozone (O_3)	06/19/1989	087	4.5	Urban	Population Exposure	SLAMS	H
	$PM_{2.5}$ - Hourly	07/01/2010	170	5	Neighborhood	Population Exposure	SLAMS	H
Northwest Police Station, 245100007	$PM_{2.5}$ - Local Conditions	01/01/1999	118	8.2	Neighborhood	Population Exposure	SLAMS	3
Oldtown, 245100040	Carbon Monoxide (CO)	01/01/1982	593	4.4	Middle	Highest Concentration	SLAMS	H
	Air Toxics	01/01/1990	150	9	Neighborhood	Population Exposure	Other	6
	Light Scatter	09/01/2004	NA	NA	NA	NA	NA	H
	Nitric Oxide (NO)	01/01/1994	099	4.2	Middle	Highest Concentration	SLAMS	H
	Nitrogen Dioxide (NO_2)	11/05/1981	099	4.4	Middle	Highest Concentration	SLAMS	H
	Oxides of Nitrogen (NO_X)	01/01/1982	099	4.4	Middle	Highest Concentration	SLAMS	H
	$PM_{2.5}$ - Local Conditions	01/01/1999	118	4.9	Middle	Highest Concentration	SLAMS	1
	$PM_{2.5}$ - Hourly	07/01/2010	170	5.1	Middle	Highest Concentration	SLAMS	H
Padonia, 240051007	Ozone (O_3)	01/01/1979	087	4.2	Neighborhood	Population Exposure	SLAMS	H
	$PM_{2.5}$ - Local Conditions	01/01/1999	118	4.8	Neighborhood	Population Exposure	SLAMS	3
	$PM_{2.5}$ - Local Conditions	01/01/1999	118	4.8	Neighborhood	Population Exposure	QA-Collocated	7
PG Equestrian Center, 240338003	Ozone (O_3)	04/01/2002	047	4.4	Urban	Population Exposure	SLAMS	H
	$PM_{2.5}$ - Local Conditions	05/01/2002	118	5.1	Neighborhood	Population Exposure	SLAMS	3
	$PM_{2.5}$ - Local Conditions	07/01/2002	118	4.9	Neighborhood	Population Exposure	QA-Collocated	7
Piney Run, 240230002	Carbon Monoxide (CO)	09/01/2007	554	4.4	Regional	Regional Transport	NCore	H
	Light Scatter	09/01/2004	NA	NA	NA	NA	NA	H
	Nitric Oxide (NO)	05/01/2004	591	10	Regional	Regional Transport	NCore	H
	Nitric Oxide (NO)	01/01/2014	099	4.6	Regional	Regional Transport	SLAMS	H
	Nitrogen Dioxide (NO_2)	01/01/2014	099	4.6	Regional	Regional Transport	SLAMS	H
	Oxides of Nitrogen (NO_X)	01/01/2014	099	4.6	Regional	Regional Transport	SLAMS	H
	NO_Y - NO	05/01/2004	591	10	Regional	Regional Transport	NCore	H
	Ozone (O_3)	04/01/2004	047	4.4	Regional	Regional Transport	NCore	H
	$PM_{10-2.5}$ - Local Conditions	01/01/2011	185	4.9	Regional	Regional Transport	NCore	H
	$PM_{2.5}$ - Hourly	07/01/2010	170	4.9	Regional	Regional Transport	NCore	H
	PM_{10} - Hourly	01/01/2011	NA	4.9	NA	NA	NA	H
	Reactive Oxides of Nitrogen (NO_Y)	05/01/2004	591	10	Regional	Regional Transport	NCore	H
	Sulfate (SO_4^{2-})	07/01/2004	NA	4.0	NA	NA	NA	H
	Sulfur Dioxide (SO_2)	04/01/2004	560	4.4	Regional	Population Exposure	NCore	R
Rockville, 240313001	Ozone (O_3)	01/01/1980	047	4.6	Urban	Population Exposure	SLAMS	H
	$PM_{2.5}$ - Hourly	07/01/2010	170	5.3	Neighborhood	Population Exposure	SLAMS	H
South Carroll, 240130001	Ozone (O_3)	07/14/1983	047	4.5	Urban	Population Exposure	SLAMS	H
Southern Maryland, 240170010	Ozone (O_3)	10/02/1984	047	4.6	Regional	General Background	SLAMS	H

* Sampling Schedule is coded as follows: 1 – every day, 2 – every 2 hours, 3 – every 3rd day, 6 - every 6th day, 7 – every 12th day, H – every hour, every day, R – both every hour and every five minutes every day. NA means not applicable for the cell. A blank cell means that data was not available.

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

Site Name	Air Toxics	Black Carbon (Aethalometer)	Carbon Monoxide	Elemental & Organic Carbon	IMPROVE Parameters	Lead (Pb)	Light Scatter	Nitric Oxide (NO)	Nitrogen Dioxide (NO_2)	NO_y - NO	Oxides of Nitrogen (NO_X)	Ozone	PM_{10}	PM_{10} STP	$PM_{10-2.5}$ - Local Conditions	$PM_{2.5}$ - Local Conditions	$PM_{2.5}$ Speciation	Reactive Oxides of Nitrogen (NO_y)	Sulfate	Sulfur Dioxide	Type 2 PAMS VOCS	TYPE 3 PAMS VOCS	Visibility	$PM_{2.5}$ - Hourly	Ultrafine Particles	Grand Total
Aldino												1														1
Baltimore Haze Cam																							1			1
BCFD-Truck Company 20														1		1										2
Beltsville												1														1
Blackwater NWR												1														1
Calvert												1														1
Davidsonville												1														1
Essex	1		1					1	1		1	1				1	1			1	1					10
Fair Hill												1												1		2
Frederick Airport												1														1
Frostburg Haze Cam																							1			1
Frostburg IMPROVE					1																					1
Furley												1														1
Glen Burnie														2		1										3
Hagerstown												1												1		2
Horn Point			1					1		1		1						1		1				1		7
Howard County Near Road	1	1	1					1	1		1													1	1	8
HU-Beltsville	1	1	1	1		2		1	1	1	1	1		2	2	2	1	1	1	1		1		1	1	24
Millington												1												1		2
Northwest Police Station																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				1		12
Rockville												1												1		2
South Carroll												1														1
Southern Maryland												1														1
Grand Total	4	2	6	2	1	2	2	6	4	3	4	19	1	5	3	11	2	3	2	4	1	1	2	9	2	101

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 Pre-concentration: GC/MS Solid Phase Micro Extraction: GC/MS
Black Carbon (Aethalometer)	NA	Particles collected on a filter, black carbon mass concentration determined by optical analysis, Teledyne API model 633 Aethalometer Black Carbon Monitor
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 NOY – NO	574	TECO 42S Chemiluminescence for low-level measurements
	591	Chemiluminescence Ecotech EC9843
	599	Chemiluminescence, Teledyne API 200 EU/501
	099	Instrumental, gas phase Chemiluminescence
PAMS VOCS*	128	Gas Chromatograph, with flame; GC FID
	126	Cryogenic Pre-concentration trap GC/FID
	142	Pre-concentration trap/Thermal, Auto GC (PE Clarus 500 Dual COL)
	150	SS 6L- Pressurized, Cryogenic Pre-concentration: GC/MS
Ozone	047	Ultraviolet Photometry
	087	Ultraviolet Radiation Absorption
PM_{10}	127	Gravimetric, R - P CO Partisol Model 2025
$PM_{2.5}$	118	Gravimetric, Partisol Plus 2025
$PM_{2.5}$ Continuous	170	FEM, Beta Attenuation
$PM_{10-2.5}$ (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	Thermo-Optical Transmittance using Quartz filter
$PM_{2.5}$ 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	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 Fluorescence with high-efficiency SO_4 TO SO_2 Converter
Ultrafine Particles	NA	Condensation particle counting, water is the condensing fluid followed by laser detection, Teledyne API Ultrafine Particle Monitor Model 651
Visibility	NA	Camera

*See Table 3-4 for constituents belonging to these groups. NA means not applicable for the cell.

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

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

EPA revised the minimum monitoring requirements for CO on August, 12, 2011. One CO monitor is required to be collocated with a near-road NO_2 in urban areas having a population of 1 million or more. MDE began operating a near-road CO at the Howard County Near Road site on April 1, 2014. CO monitoring is also required at NCore sites (addressed in Section 4.10) 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.

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 2014-2015

None.

4.2 Lead (Pb) – General Description and Sampling Method

MDE collects lead 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. If a lead-PM_{10} monitor measures three-month average levels greater than or equal to 0.10 μg/m3, then MDE must install and operate a lead-TSP monitor within six months.

4.2.1 Monitoring Requirements

The latest revision to the lead (Pb) NAAQS was finalized on October 15, 2008, lowering the primary and secondary standards from 1.5 $\mu g/m^3$ to 0.15 $\mu g/m^3$. Revisions to the lead monitoring regulations were finalized on December 27, 2010 as follows:

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

Requirement	Appendix to Part 58	Required in MD
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
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
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

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 2014-2015

No changes planned.

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

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

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. In addition to establishing a new 1-hour NO_2 NAAQS, EPA revised the NO_2 monitoring requirements in urban areas as follows:

Near-Road Monitoring

EPA requires two near-road monitors in CBSAs with populations greater than or equal to 2.5 million people. The Baltimore-Columbia-Towson CBSA has a population of 2,710,489 (April 1, 2010 http://www.census.gov/popest/data/metro/totals/2011/index.html). MDE has received funding from to EPA to install two near-road NO_2 monitors in the Baltimore-Columbia-Towson, MD CBSA. MDE began NO_2 monitoring at the first near-road site (at the rest area along I-95) on April 1, 2014.

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 Nationwide to help protect communities that are susceptible and vulnerable to NO_2 related health effects.

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 2014-2015

Near-Road Monitoring

MDE plans to install a second near-road site at the MTA maintenance facility at the interchange of I-695 and I-795. MDE chose this site based on field reconnaissance and filter-based sampling conducted during the pilot study and detailed in MDE's Calendar Year 2013 Annual Network Plan. MDE had considered installing the near-road site at the Fort McHenry Toll Plaza, but due to planned construction activities MDOT and MDE agreed that this would not be feasible. The near-road site at the MTA maintenance facility will be operational by January 1, 2015 and will monitor NO_2 and meteorological conditions.

As time and resources allow, MDE is considering installing ultrafine and black carbon (aethalometer) instrumentation at the Howard County Near Road site.

Community-wide Monitoring

MDE's existing NO_2 monitors at the Essex and Oldtown sites fulfill this requirement. No changes are planned.

Sensitive and Vulnerable Populations

EPA Region III has not required 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 MSA's 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 2014-2015

No changes planned.

4.5 PM_{10} – General Description and Sampling Method

MDE uses both manual gravimetric and automated monitors to measure PM_{10} mass concentrations. The PM_{10} Beta Attenuation Monitor (BAM) automatically measures and records dust concentrations with built-in data logging. The principal of beta ray attenuation is used 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

MDE 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 2014-2015

No changes planned.

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. 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. MetOne Super SAAS samplers and IMPROVE samplers are used 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

On January 15, 2013, EPA strengthened the national air quality standard for fine particulate by lowering the annual level of the standard to $12\mu g/m^3$ from $15\mu g/m^3$. The 24-hour standard was retained at $35\ \mu g/m^3$. As part of the revisions to the $PM_{2.5}$ standard, EPA added these monitoring requirements:

- Near-road monitoring at one location in urban areas having a population of 1 million or more with monitoring to begin by January 1, 2015.
- Monitoring agencies may recommend that data from Federal Equivalent Method (FEM) monitors not meeting certain performance criteria be set aside, with EPA approval, and excluded from comparison to the $PM_{2.5}$ NAAQS.

Area-wide Monitoring

MDE 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 area-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.

MDE is also required to operate continuous fine particulate analyzers at three or more 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.

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 2014-2015

MDE will operate one $PM_{2.5}$ sampler at the Howard County Near Road monitoring site by January 1, 2015.

4.6.4 Applicability of FEM Data for Comparison to the NAAQS and Reporting the AQI

MDE operates both FRM and FEM $PM_{2.5}$ monitors (see **Table 3-2a**, **3.2b** and **Table 3-3**). Pursuant to the January, 15 2013 revisions to $PM_{2.5}$ monitoring requirements, MDE recommends that all of the FEM monitors currently operating in the MDE monitoring network remain eligible for comparison to the $PM_{2.5}$ NAAQS and for reporting the AQI. This recommendation applies retrospectively to FEM data collected since the second quarter of 2010, when MDE began operating FEM monitors, and prospectively for data collected in 2014 and 2015. MDE will re-evaluate this recommendation, retrospectively, for FEM data collected in the 36 months prior to January 1, 2015 and prospectively, during 2015, in next year's Annual Network Plan, as provided for in the revised $PM_{2.5}$ monitoring regulations.

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 strengthened the health-based National Ambient Air Quality Standard (NAAQS) for sulfur dioxide (SO_2) by setting a new 1-hour NAAQS at 75 ppb and revoked the two existing primary standards of 140 ppb evaluated over 24-hours, and 30 ppb evaluated over an entire year. In addition to establishing a new 1-hour SO_2 NAAQS, EPA revised the SO_2 monitoring requirements. **Table 4-2** 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-Columbia-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	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 2014-2015

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 PAM's 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/Atec Model 2200 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

MDE must operate at least the minimum PAMS monitoring network listed in 40 CFR Part 58 Appendix D Table D-6. PAM's 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 two monitors that are part of the PAMS network. The Type 1 is located at HU-Beltsville, Prince George's County; and the Type 2 is located at Essex, Baltimore 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 2014-2015

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/Atec 2200 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

There are no EPA monitoring requirements for air toxics. As part of the EPA Region III Cooperative Toxic Monitoring Program, MDE operates three air toxic monitoring stations to assess general urban levels. Toxics are sampled every sixth day year-round.

4.9.2 Monitoring Locations

There are three locations where air toxics are monitored in Maryland: Essex, Baltimore County, 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 2014-2015

MDE is planning to add hexavalent chromium to the suite of air toxics measured at the Oldtown monitoring station. Samples will be collected on a one-in-six day schedule. Ambient air samples are collected on bicarbonate impregnated ash less cellulose filters and shipped to analysis laboratories in coolers. The filters are analyzed with the modified CARB 039 method. In the laboratory filters are extracted with sodium bicarbonate solution via hand shaking and the extract is analyzed by IC and UV-VIS detector.

4.10 NCore – General Description and Sampling Method

NCore, or National Core multi-pollutant monitoring stations, is the 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. More information on meteorological parameters are provided in **Appendix C**.

4.10.1 Monitoring Requirements

Each State is required to operate one NCore site. 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 3-2a** 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 2014-2015

As time and resources allow, MDE is considering installing ultrafine and black carbon (aethalometer) instrumentation at the HU-Beltsville site for comparison with the Howard County Near Road site.

4.11 The Rural Aerosol Intensive Network

Previous MDE annual network plans referenced the Rural Aerosol Intensive Network (RAIN). While the monitoring performed under this umbrella network is still being conducted at the Piney Run site, RAIN no longer exists as a formal entity.

APPENDIX A– TOPOGRAPHIC AND AERIAL MAPS

This appendix contains topographic and aerial maps for currently operating 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**, **Table 3-4**, and **Appendix C**.

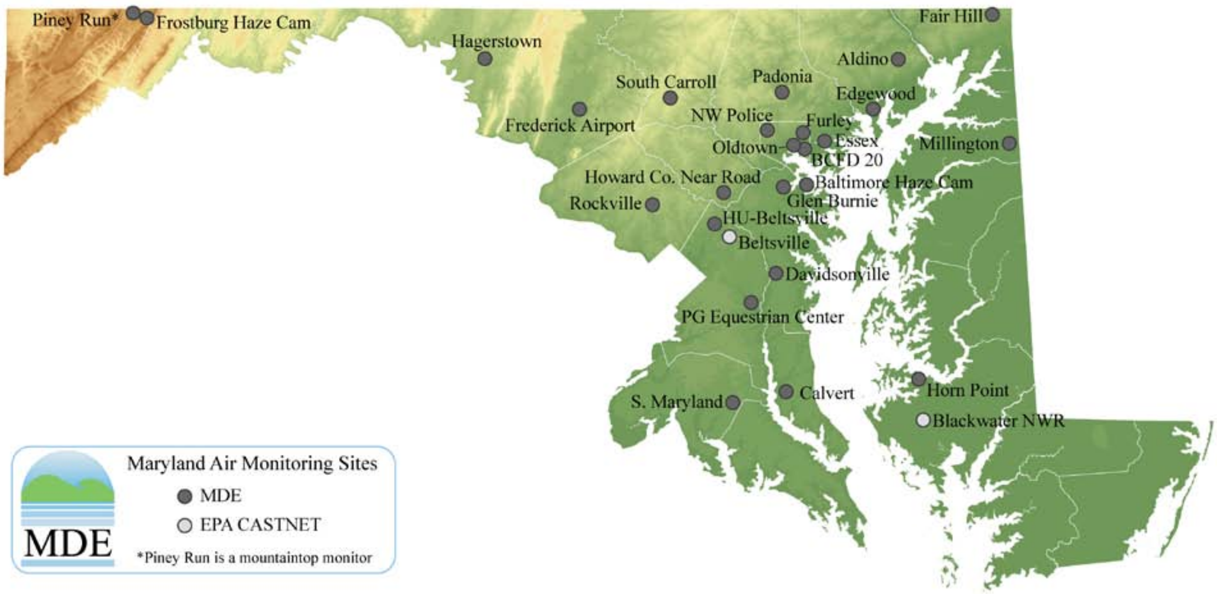

Figure A 1. **Topographic map of air monitoring sites in Maryland.**

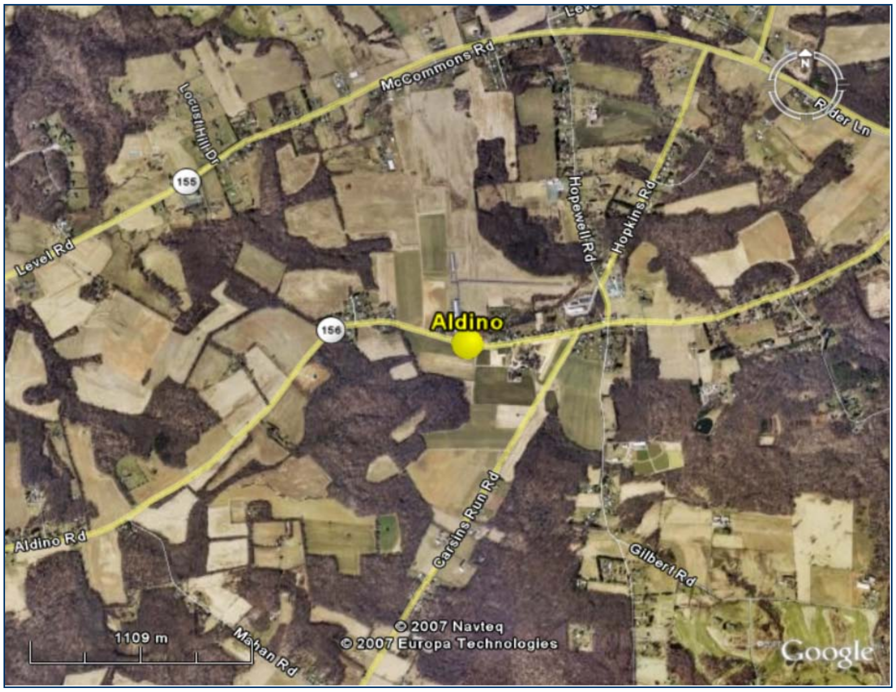

Figure A 2. **Aerial map of Aldino air monitoring site in Harford County, MD.**

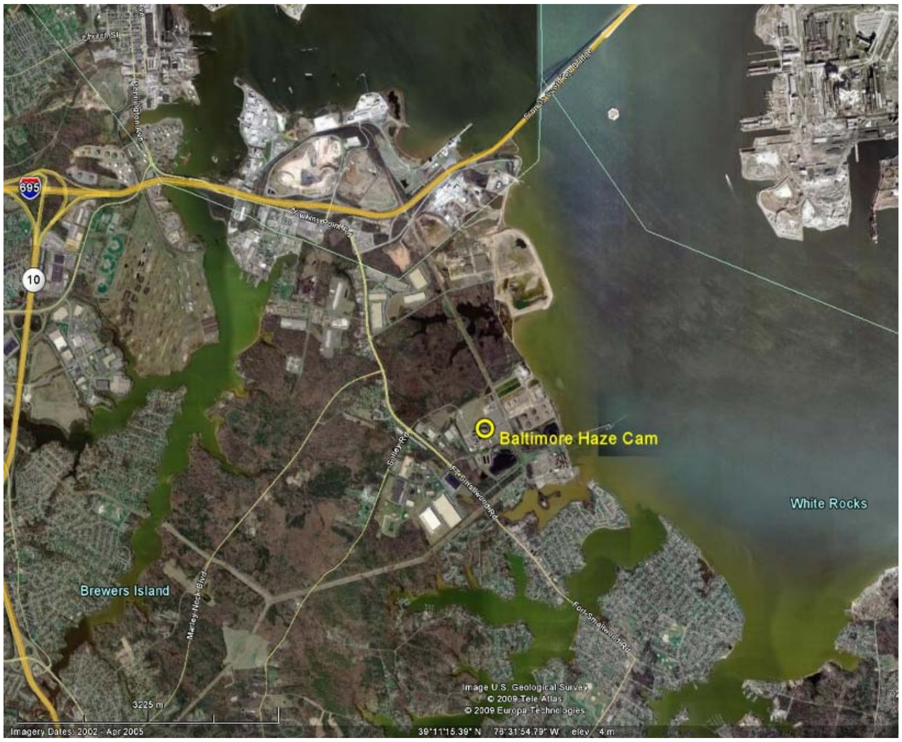

Figure A 3. Aerial map of Baltimore Haze Cam site at Brandon Shores in Anne Arundel County, MD.

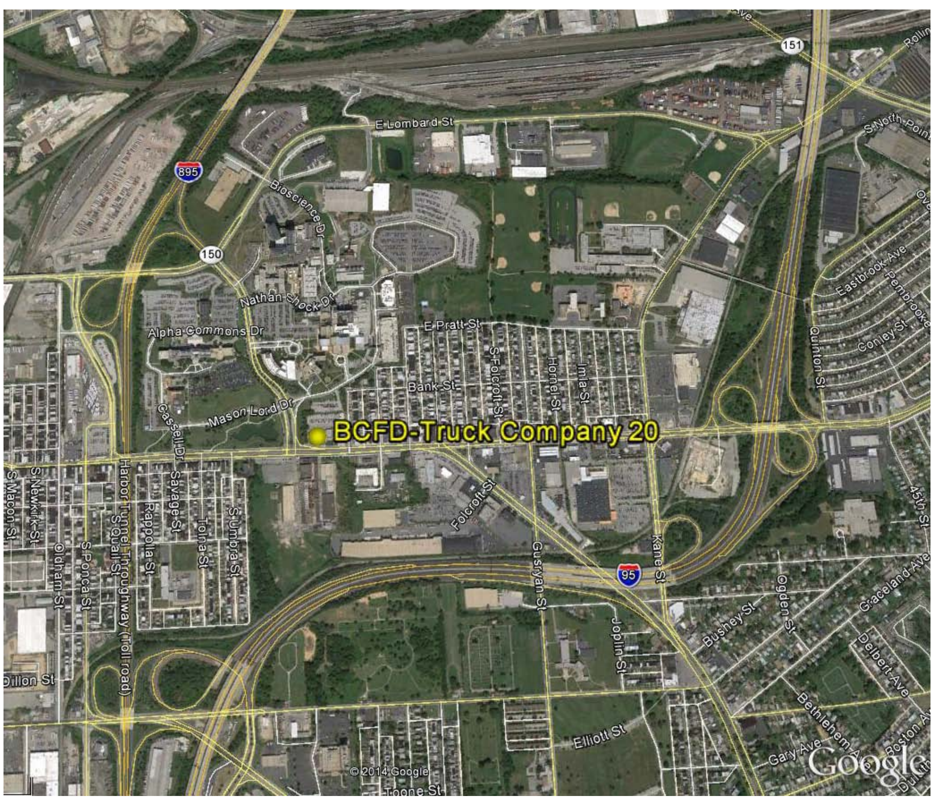

Figure A 4. Aerial map of BCFD-Truck Company 20 air monitoring site in Baltimore City, MD.

Figure A 5. **Aerial map of Beltsville air monitoring site in Prince George's County, MD.**

Figure A 6. **Aerial map of Blackwater NWR air monitoring site in Dorchester County, MD.**

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

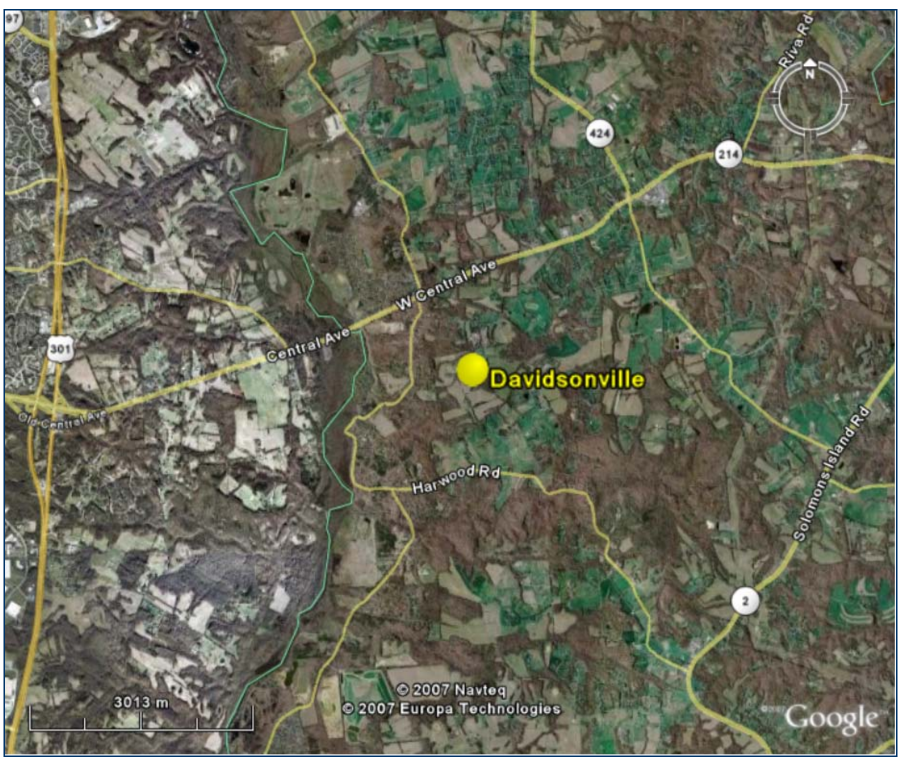

Figure A 8. **Aerial map of Davidsonville air monitoring site in Anne Arundel County, MD.**

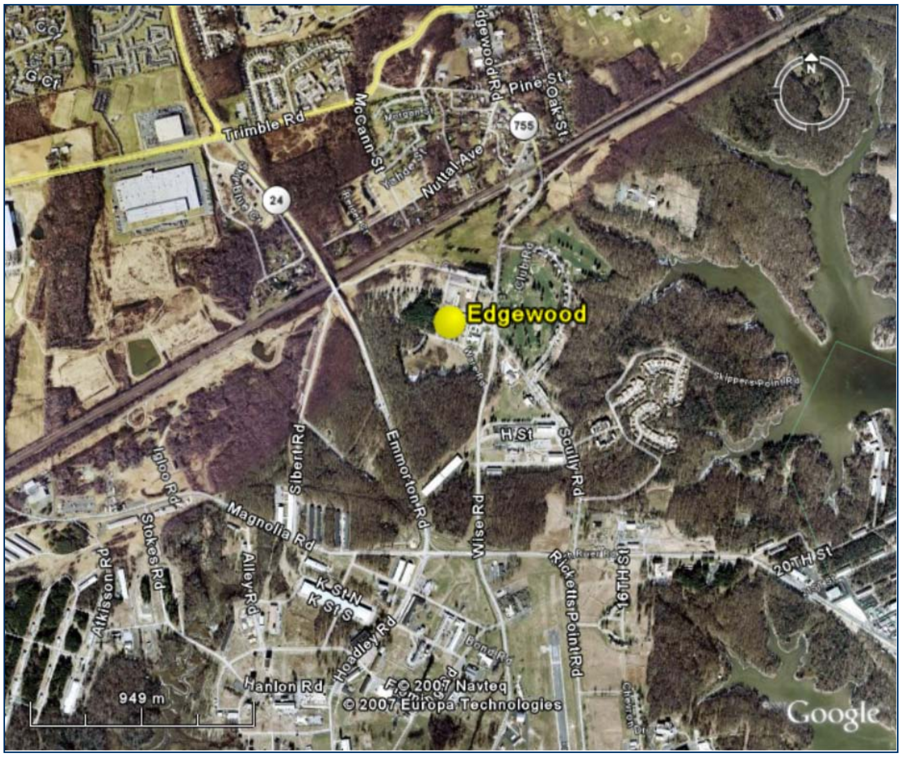

Figure A 9. **Aerial map of Edgewood air monitoring site in Harford County, MD.**

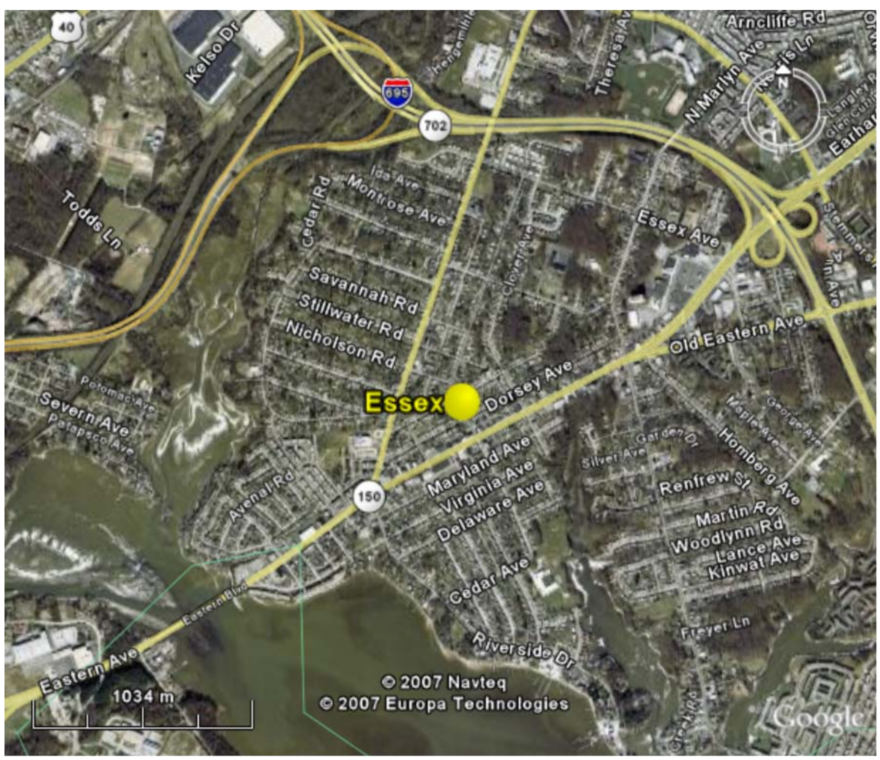

Figure A 10. **Aerial Map of the Essex air monitoring site in Baltimore County, MD.**

Figure A 11. Aerial map of Fair Hill air monitoring site in Cecil County, MD.

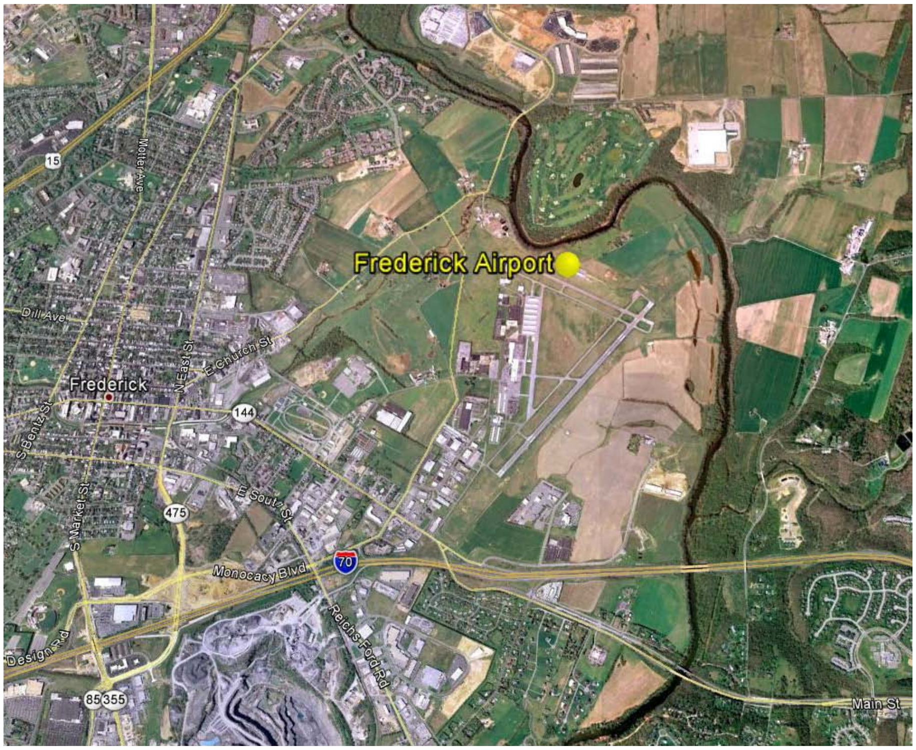

Figure A 12. Aerial map of Frederick Airport air monitoring site in Frederick County, MD.

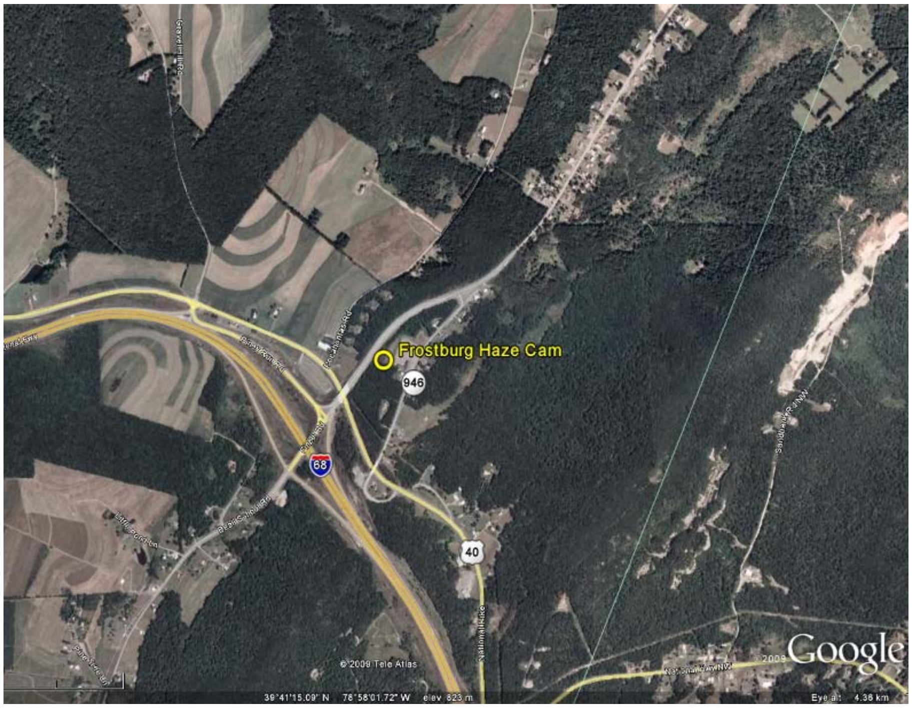

Figure A 13. Aerial map of Frostburg Haze Cam site in Garrett County, MD.

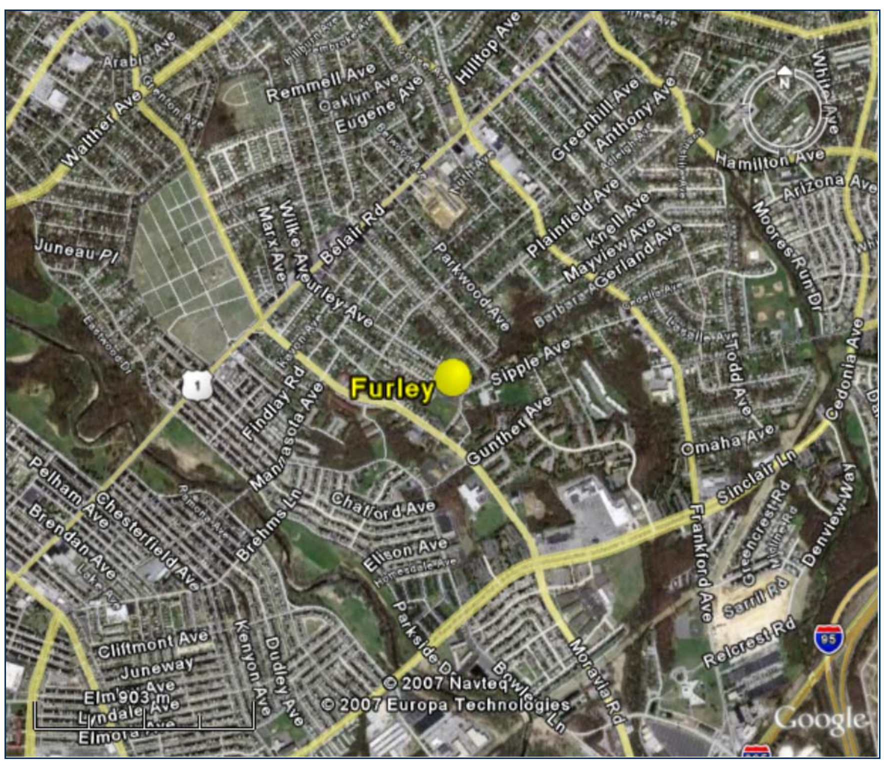

Figure A 14. Aerial map of Furley air monitoring site in Baltimore City, MD.

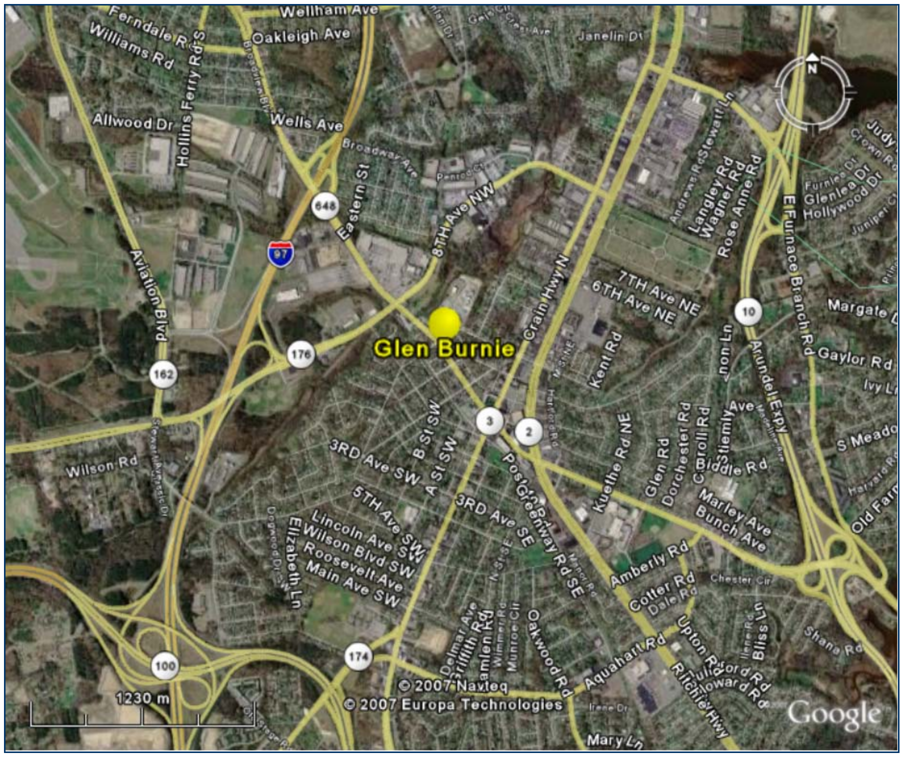

Figure A 15. **Aerial map of Glen Burnie air monitoring site in Anne Arundel County, MD.**

Figure A 16. **Aerial map of Hagerstown air monitoring site in Washington County, MD.**

Figure A 17. Aerial map of the Horn Point air monitoring site in Dorchester County, MD.

Figure A 18. Aerial map of the Howard County Near Road air monitoring site in Howard County, MD.

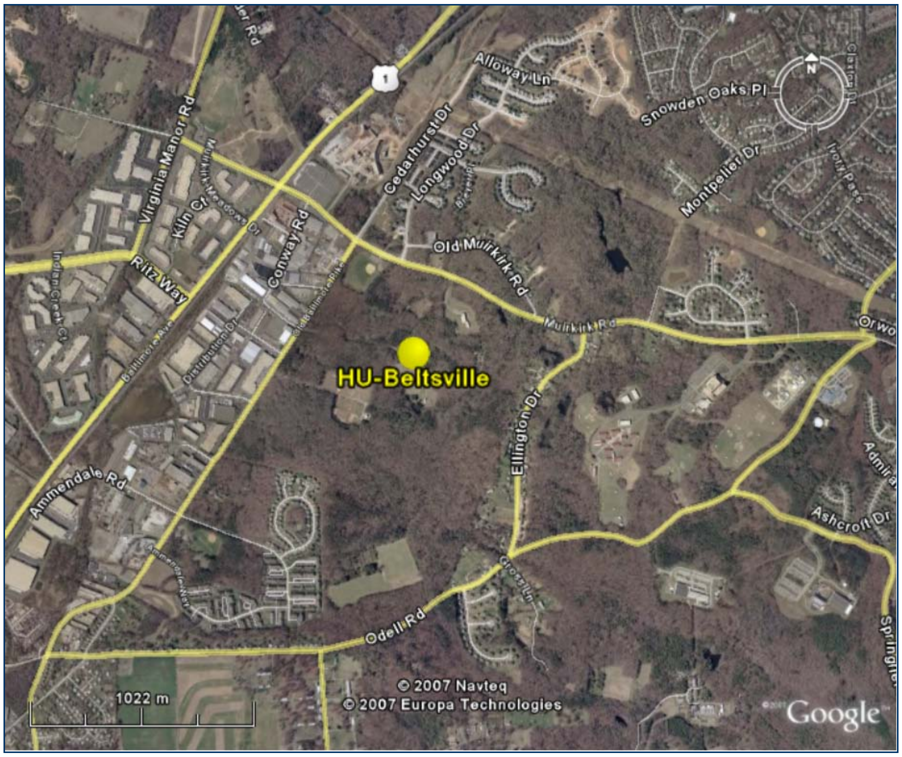

Figure A 19. **Aerial map of HU-Beltsville air monitoring site in Prince George's County, MD.**

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

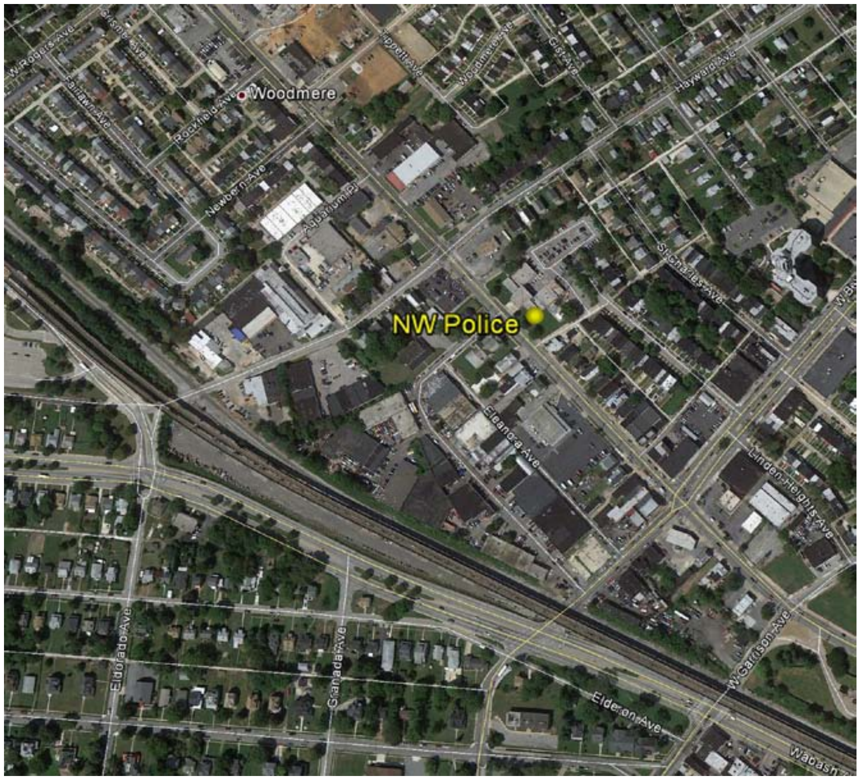

Figure A 21. Aerial map of NW Police air monitoring site in Baltimore City, MD.

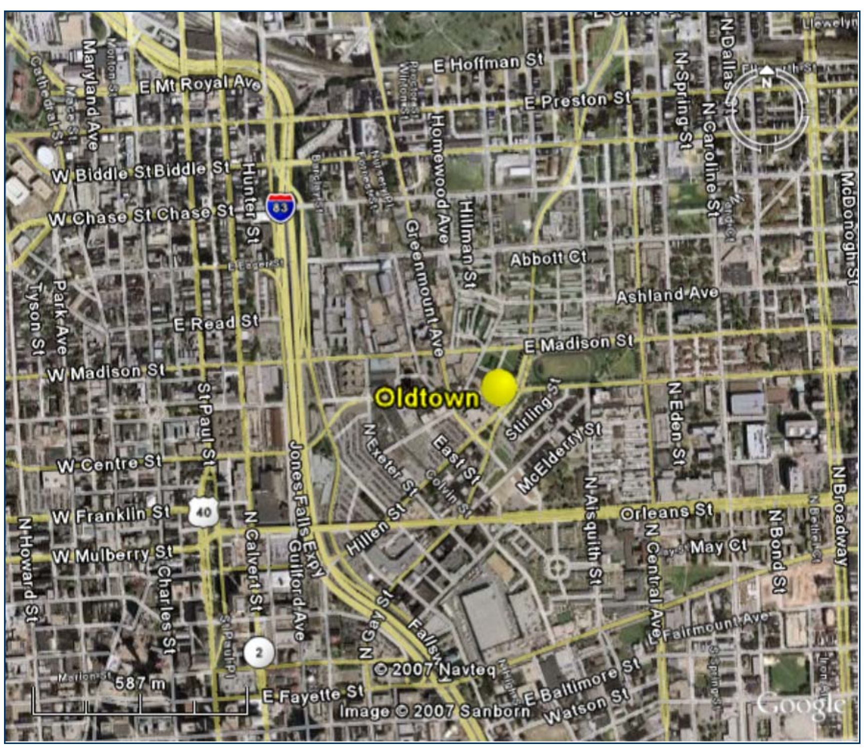

Figure A 22. Aerial map of Oldtown air monitoring site in Baltimore City, MD.

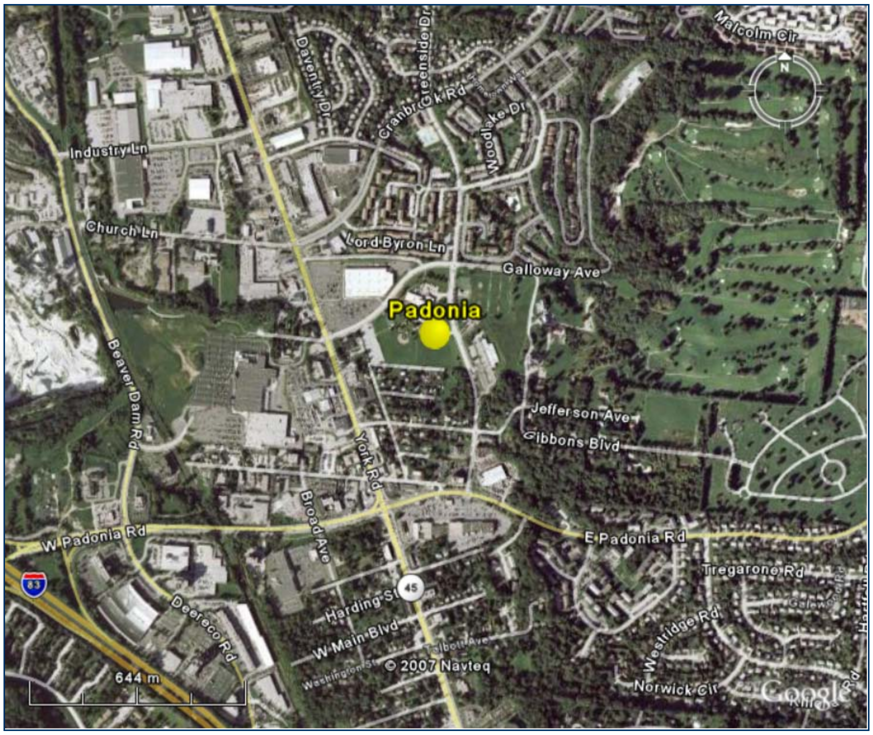

Figure A 23. Aerial map of Padonia air monitoring site in Baltimore County, MD.

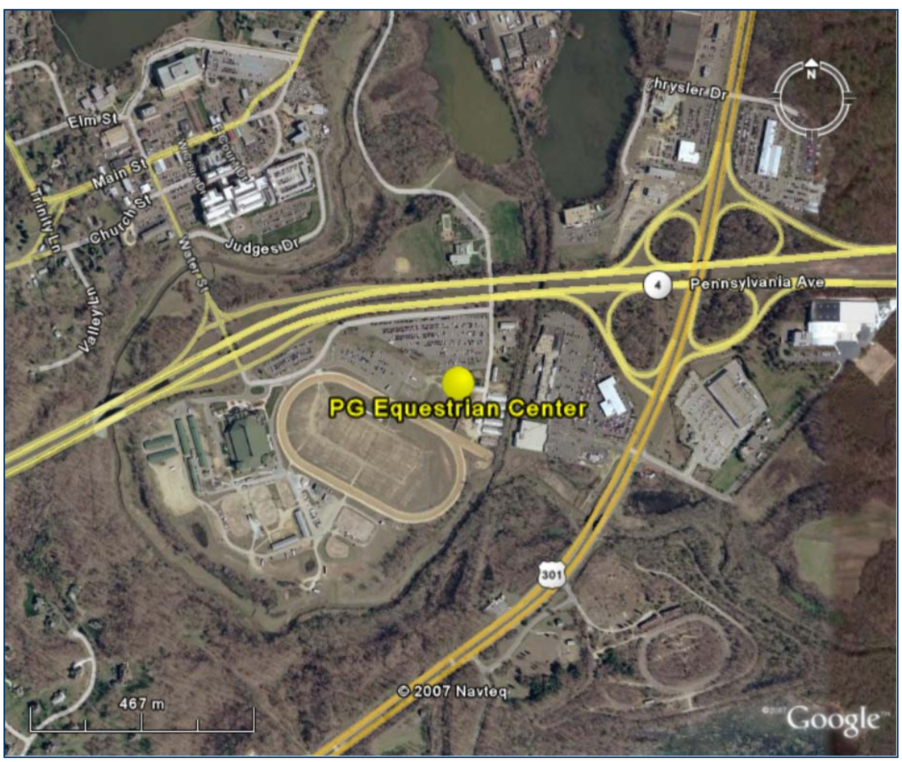

Figure A 24. Aerial map of PG Equestrian Center air monitoring site in Prince George's County, MD.

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

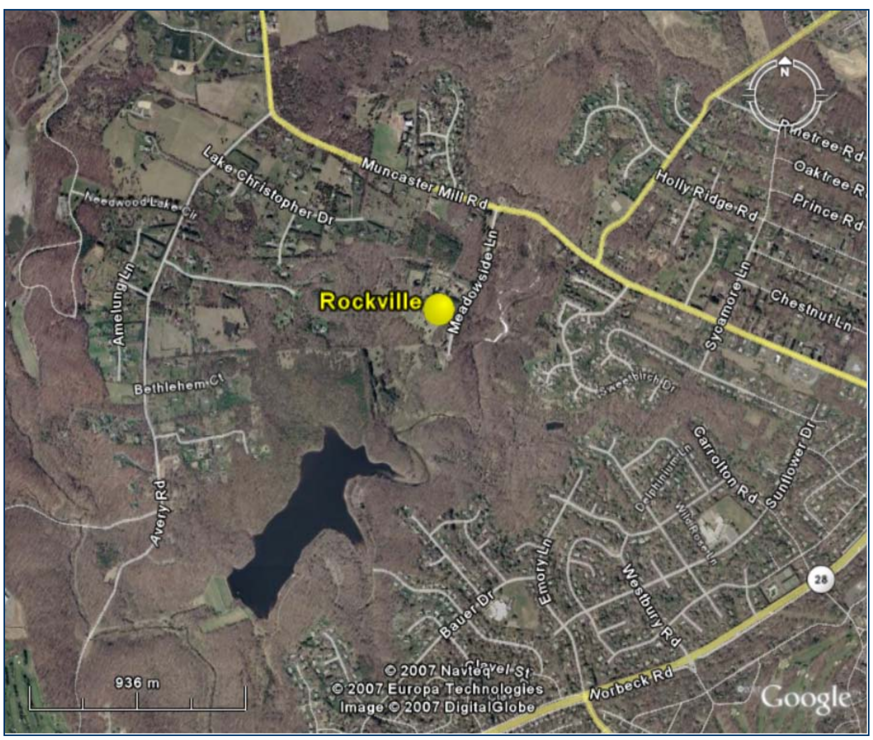

Figure A 26. Aerial map of Rockville air monitoring site in Montgomery County, MD.

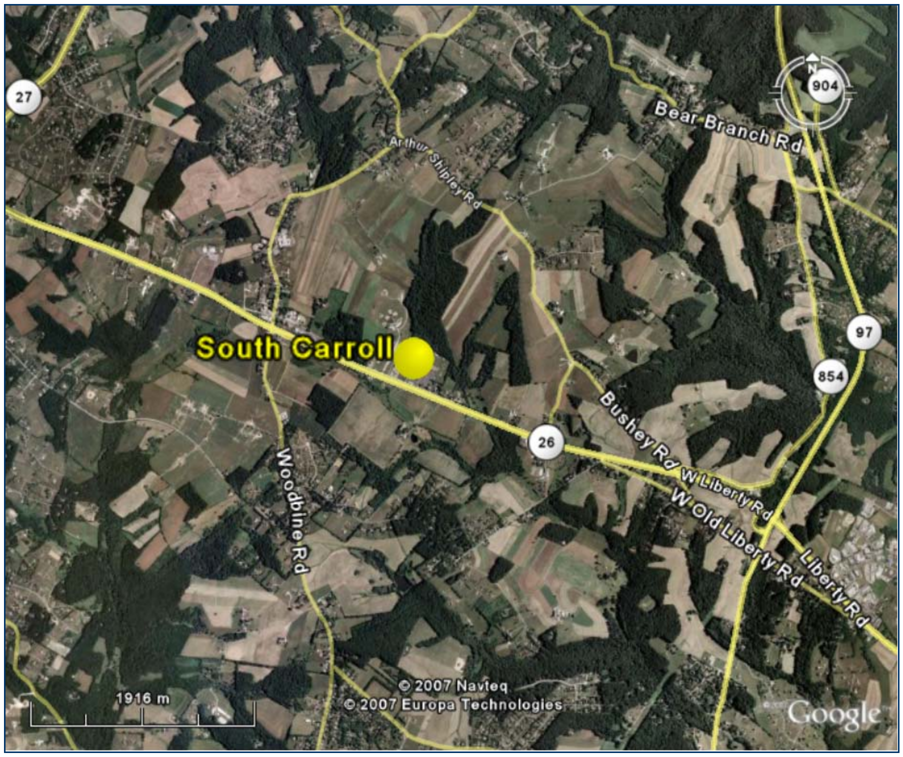

Figure A 27. **Aerial map of South Carroll air monitoring site in Carroll County, MD.**

Figure A 28. **Aerial map of Southern Maryland air monitoring site in Charles County, MD.**

APPENDIX B– SUMMARY OF MDE'S REQUESTS

EPA approved the collocation of a CO monitor at the near-road monitoring site called Howard County Near Road (240270006) at the I-95 rest stop between MD32 and MD216 as requested by MDE in the 2014 plan.

For 2015 MDE is requesting approval of:

- Adding one $PM_{2.5}$ sampler to the Howard County Near Road (240270006) site.
- Adding an additional near road site at the MTA maintenance facility at the interchange of I-695 and I-795.
- Conducting hexavalent chromium sampling at the program's Oldtown site in Baltimore City for a one in six day sampling frequency during a period of one year.

APPENDIX C– METEOROLOGICAL MEASUREMENTS

MDE measures the meteorological parameters at many sites within the network. A summary of meteorological parameters by site is show in **Table C 1**. The following parameters are measured at the NCore sites:

- 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 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.

Table C 1. Count of meteorological parameters measured in the MDE network.

AQS State County Site	Local Site Name	Barometric Pressure-64101	Outdoor Temperature-62101	Rain/Melt Precipitation-65102	Relative Humidity -62201	Solar Radiation-63301	Ultraviolet Radiation-63302	Wind Direction - Scalar-61102	Wind Speed - Scalar-61101	Radar Wind Profiler	Totals
240030014	Davidsonville	1	1	1	1			1	1		6
240051007	Padonia	1	1	1	1			1	1		6
240053001	Essex	1	1	1	1	1	1	1	1		8
240130001	South Carroll	1	1	1	1			1	1		6
240150003	Fair Hill	1	1	1	1			1	1		6
240190004	Horn Point	1	1	1	1	1		1	1	1	8
240230002	Piney Run	1	1	1	1	1		1	1	1	8
240251001	Edgewood	1	1	1	1			1	1		6
240259001	Aldino	1	1	1	1			1	1		6
240270006	Howard County Near Road	1	1	1	1			1	1		6
240290002	Millington	1	1	1	1			1	1		6
240313001	Rockville	1	1	1	1			1	1		6
240330030	HU-Beltsville	1	1	1	1	1		1	1	1	8
240338003	PG Equestrian Center	1	1	1	1			1	1		6
240430009	Hagerstown	1	1	1	1			1	1		6
Totals		15	15	15	15	4	1	15	15	3	98

Note: EPA CASTNET monitors are not included.