MARYLAND
DEPARTMENT OF THE ENVIRONMENT

AMBIENT AIR MONITORING NETWORK PLAN
for CALENDAR YEAR 2019

Prepared for:
U.S. Environmental Protection Agency

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

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MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard | Baltimore, MD 21230 | www.mde.maryland.gov
410-537-3000 | 800-633-6101 | TTY Users: 800-735-2258
Lawrence J. Hogan, Jr., *Governor* | Boyd K. Rutherford, *Lt. Governor*
Ben Grumbles, *Secretary*

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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	Beta Attenuation [Mass] Monitor-for measuring continuous particulate matter
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CASTNET	Clean Air Status and Trends Network
CBSA	Core Based Statistical Area
CFR	Code of Federal Regulations
CSA	Combined Statistical Area
CSN	Chemical Speciation Network
CO	Carbon Monoxide
DRR	Data Requirement Rule
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
NAA	Non-Attainment Area
NAAQS	National Ambient Air Quality Standards-used for determining attainment status
NCore	National Core multi-pollutant monitoring stations
NEI	National Emissions Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
nm	Nanometer, measure of length; 1 nm equals 10^{-9} meter
μm	Micrometer, measure of length; 1 μm equals 10^{-6} 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
OAQPS	EPA's Office of Air Quality Planning & Standards
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
$PM_{10-2.5}$	Pronounced “PM coarse” - 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
PQAO	Primary Quality Assurance Organization
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
SIP	State Implementation Plan
SLAMS	State or Local Air Monitoring Stations
SO_2	Sulfur Dioxide
SOP	Standard Operating Procedure
SPM	Special Purpose Monitor
STN	$PM_{2.5}$ Speciation Trends Network
TSP	Total suspended particulate
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 air quality 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.

On June 1, 2015, EPA made the determination that the Baltimore, Maryland Moderate Non-Attainment Area (Baltimore NAA) has attained the 2008 8-hour ozone NAAQS for ground-level ozone. On October 1, 2015, EPA strengthened the NAAQS for ground-level ozone to 70 parts per billion (ppb), based on extensive scientific evidence about ozone’s effects on public health and welfare. The updated standards will improve public health protection, particularly for at-risk groups including children, older adults, people of all ages who have lung diseases such as asthma, and people who are active outdoors, especially outdoor workers. They also will improve the health of trees, plants, and ecosystems. EPA is currently working on attainment designations for the 2015 ozone NAAQS.

On December 16, 2014, EPA approved Maryland's request to re-designate the Baltimore NAA to “Attainment” for the 1997 annual $PM_{2.5}$ NAAQS. The Baltimore NAA also attains the 2008 $PM_{2.5}$ annual standard and continues to attain that standard. The Baltimore NAA includes the following: Anne Arundel, Baltimore, Carroll, Harford, and Howard Counties, and Baltimore City.

On June 30, 2016, the EPA designated portions of Maryland’s Anne Arundel County and Baltimore County as non-attainment for the 2010 1-hour SO_2 NAAQS (see 2018 Network Plan for details.) This designation was based on modeled, not monitored, SO_2 concentrations. In order to better evaluate actual ambient SO_2 concentrations, a source-oriented SO_2 monitor was established at Riviera Beach Elementary School as a Special Purpose Monitor on January 12, 2018. Details are explained in Section 4.7.3 of this document.

A Core Based Statistical Area (CBSA) is a U.S. geographic area defined by the Office of Management and Budget (OMB) that centers on an urban center of at least 10,000 people and adjacent areas that are socioeconomically tied to the urban center by commuting. The term "CBSA" refers collectively to both metropolitan statistical areas (MSA's) and micropolitan statistical areas. The OMB released new standards based on the 2010 Census on February 28, 2013. For the purposes of the Maryland Air Monitoring Network, the terms CBSA and MSA are interchangeable. The names and boundaries of the MSA's in Maryland are shown in Table 1-1 and Figure 1-2. Counties outside of Maryland are included in the map because they are part of the MSA; however, this document will only address monitors located in Maryland.

Table 1-1 Maryland's MSA's. Source: Maryland Dept. of Planning, 2012 estimates (http://www.mdp.state.md.us/msdc/census/cen2010/MetroAreaMap/table2.pdf)

MSA Name	Population	Maryland Counties in the MSA
Baltimore-Towson, MD	2,753,149	Carroll, Baltimore County, Baltimore City, Harford, Howard, Anne Arundel, Queen Anne's
Hagerstown-Martinsburg, MD-WV	256,278	Washington
Washington-Arlington-Alexandria, DC-VA-MD-WV	5,860,342	Frederick, Montgomery, Prince George's, Charles, Calvert
Philadelphia-Camden-Wilmington-Newark, PA-DE-MD	6,018,800	Cecil
Salisbury, MD-DE	381,868	Somerset, Wicomico, Worchester

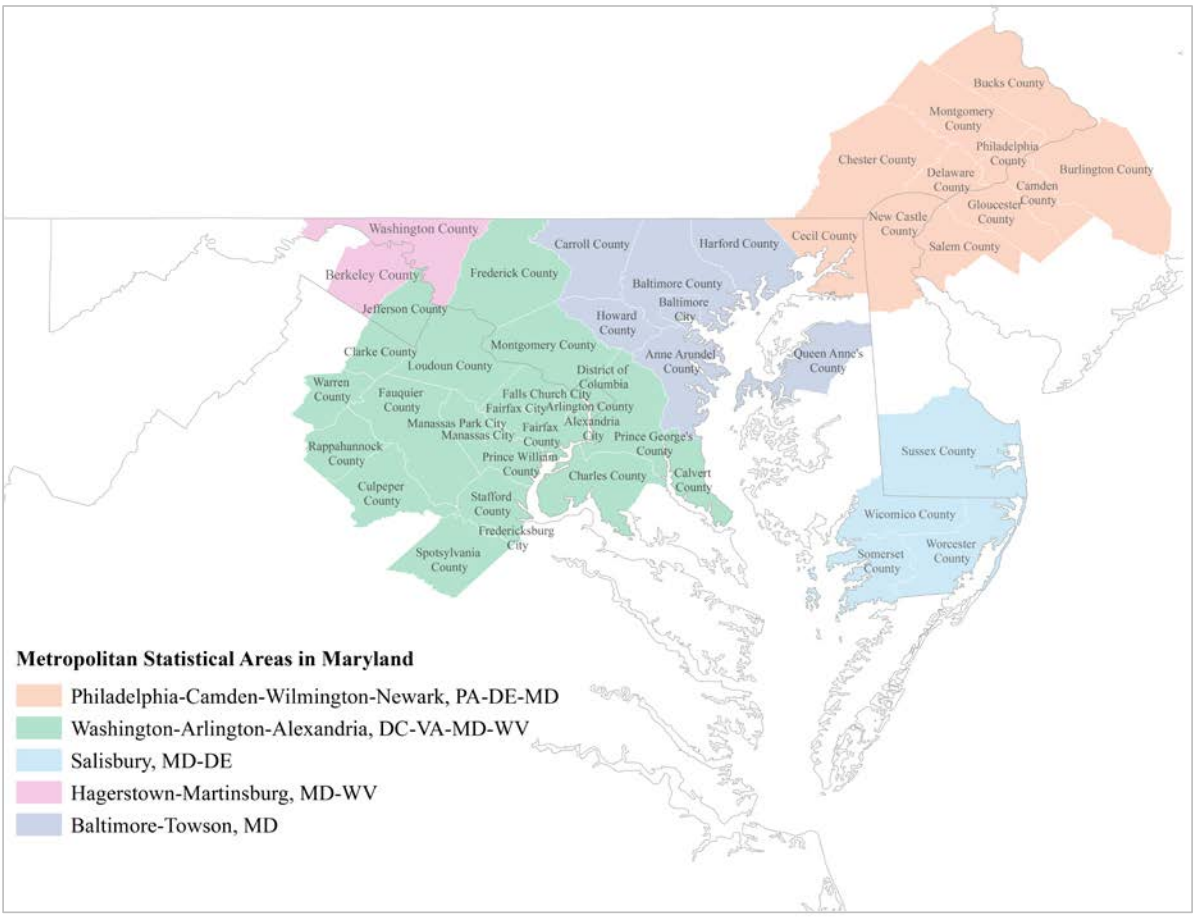

Figure 1-1 Map showing MSA's in Maryland.

The original 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 (VOC's), oxides of nitrogen (NO_x), carbonyls, and surface as well as upper air meteorological parameters (MET) into their State Implementation Plan (SIP). The Part 58 regulations refer to these enhanced monitoring stations as photochemical assessment monitoring stations (PAMS). The PAMS monitoring rules were revised along with the new 2015 ozone NAAQS in 2015. States are required to comply with revised regulations by the 2019 ozone monitoring season. The final rule streamlines and modernizes the PAMS network to use monitoring resources most efficiently. There are no ambient standards for any of the VOC's.

Section 112 of the CAA currently identifies 187 hazardous air pollutants (HAPS), also referred to as air toxics, and requires EPA to regulate facilities that emit one or more of these air toxics. EPA Region III 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 III.

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. This document will be available for public comment on the MDE website.

MDE is also required to certify the air quality monitoring data every May 1st for the previous calendar year's data. MDE's air quality monitoring data for 2017 were certified and submitted to EPA on April 10, 2018.

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 sites:

- 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 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 monitoring objective and spatial representative scale for each monitor
- 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 (Tables 3-1 and 3-2.) Two additional sites are 'Haze Cams', cameras exclusively used to monitor visibility. 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, Air and Radiation Administration (ARA), Maryland Department of the Environment (MDE). A comprehensive air monitoring network map is shown in Fig 3-1. Additional topographic and aerial maps and site descriptions are provided in Appendix A.

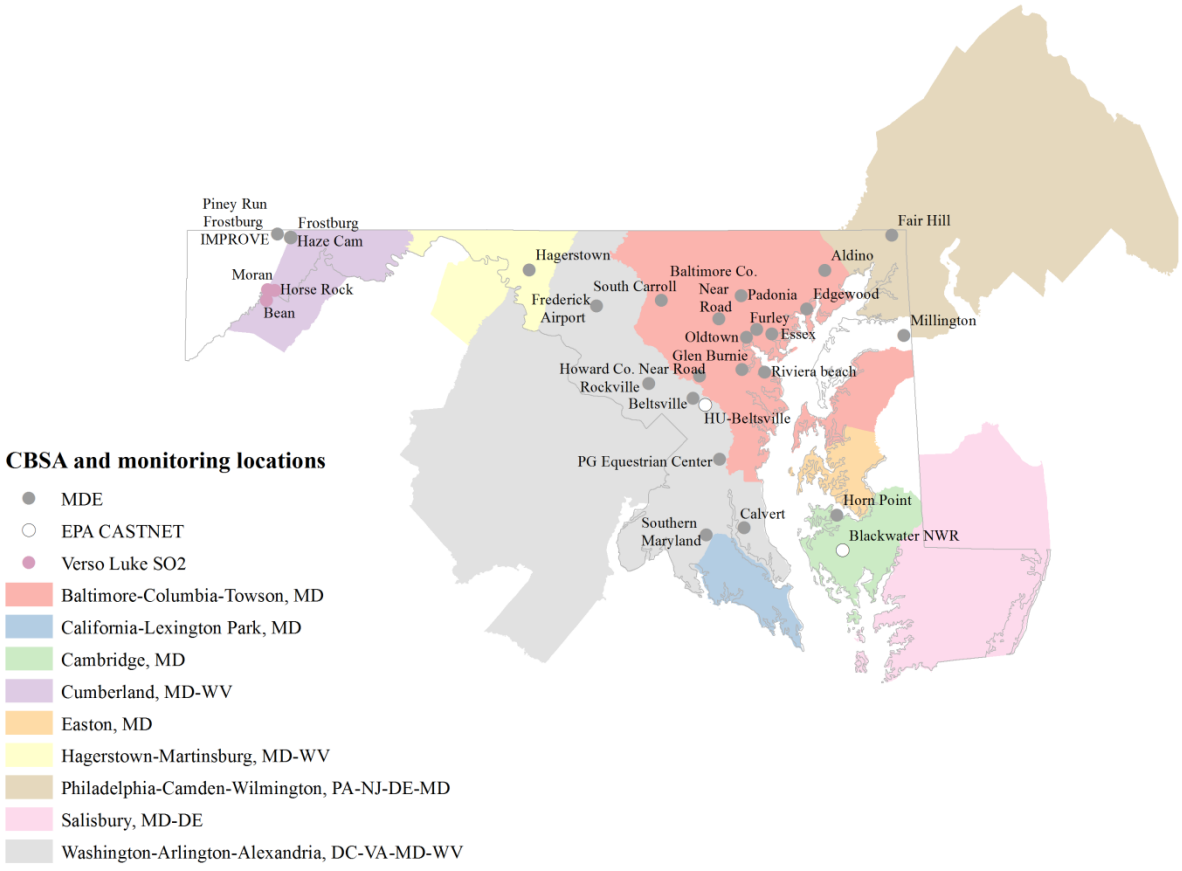

Figure 3-1 Maryland's Current Air Monitoring Network Map.

In addition to the 25 ambient air monitoring stations operated by MDE, two CASTNET sites are located in Maryland: Blackwater National Wildlife Refuge and Beltsville (Figure 3-1). CASTNET, the Clean Air Status and Trends Network, is a long-term environmental monitoring network with 90 sites located throughout the US and Canada. The sites are managed and operated by EPA's Clean Air Markets Division (CAMD) in cooperation with the National Parks Service (NPS) and other federal, state, and local partners. The network was established under the 1991 Clean Air Act Amendments (CAAA) to assess trends in acidic deposition due to emission reduction programs, such as the Acid Rain Program, NO_x Budget Trading Program, and the Clean Air Interstate Rule (CAIR). CASTNET measures ambient concentrations of sulfur and nitrogen species as well as rural ozone concentrations. Results from CASTNET are used to report on geographic patterns and temporal trends in acidic pollutants, deposition, and regional ozone concentrations. An IMPROVE (Interagency Monitoring of Protected Visual Environments) network monitor is operated near the Piney Run monitoring station (Figure 3-1). The IMPROVE network monitors measure $PM_{2.5}$, PM_{10}, $PM_{10\text{-}2.5}$, and speciated $PM_{2.5}$.

In support of the SO_2 Data Requirements Rule (DRR), three SO_2 monitors were deployed in January 2017 by Verso Luke Paper Mill in western Maryland (Figure 3-1; Tables 3-1 through 3-6). These sites are being operated by AECOM, under contract to Verso Luke Mill. MDE is the Primary Quality Assurance Organization (PQAO) for these sites, which includes performing annual instrument audits and reporting the data to AQS.

Maryland's 2018 Annual Network Plan was approved by EPA on November 17, 2017 (see Appendix B.) The following changes were implemented:

- Terminated one FRM $PM_{2.5}$ monitor: Northwest Police Station.
- Reduced the sampling frequency for several FRM $PM_{2.5}$ monitors:
  - Essex – reduce from 1/3 days to 1/6 days
  - Padonia collocated – reduce from 1/3 days to 1/12 days
  - Oldtown – reduce from 1/1 days to 1/3 days
- Terminated the lead (Pb) monitor at HU-Beltsville.
- Terminated the CO monitor at Horn Point.
- Moved the Padonia shelter, where $PM_{2.5}$ and seasonal O_3 monitors are run from its former location at the Padonia International Elementary School to the nearby Cockeysville Skate Park, approximately 300 meters west.
- Terminated the collection of PAMS data at HU-Beltsville, in support of enhanced PAMS monitoring at Essex. This change, which included relocating the Total Reactive Nitrogen Species (NO_y) monitor from Howard U to Essex, was approved on May 31, 2017 (Appendix D to the 2018 Monitoring Network Plan).
- The plan to relocate Furley is pending.

The 2019 Network Plan continues some of the changes begun in last year's plan, reflecting a shift in monitoring emphasis, with some pollutants becoming less of a concern and others becoming a higher priority. Detailed explanations of these proposals can be found in the "Changes Proposed" sections for the individual pollutants. This plan includes proposals for the following changes:

- Deployed an SO_2 monitor to Riviera Beach Elementary School as a Special Purpose Monitor.
- Discontinued the O_3 monitor at Hart-Miller Island, which was run as a Special Purpose Monitor.

3.1 General Network 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 Tables 3-2 and 3-3. Meteorological parameters measured are included in Table 3-4. Monitoring method descriptions can be found in Table 3-5. Parameters measured as part of the air toxics, PAMS, IMPROVE, and speciated $PM_{2.5}$ mass are listed in Table 3-6.

Table 3-1 General Information for Current Maryland Ambient Air Monitoring Sites

Site Name, AQS ID	Street Address	City, County	Zip Code	Latitude, Longitude (NAD83)	Location Setting	Nearest Road	Traffic Count (2013)	Distance from Nearest Road (m)	CBSA/MSA
Aldino, 240259001	3560 Aldino Rd.	Aldino, Harford	21028	39.563333, -76.203889	Suburban	Aldino Rd.	1553	14	Baltimore-Towson
Baltimore County Near Road 240050009	4380 Old Court Rd.	Pikesville, Baltimore County	21208	39.371679, -76.746814	Suburban	I-695/I-795	189380	20	Baltimore-Towson
Baltimore Haze Cam	Raven Power, 1000 Brandon Shores Dr.	Pasadena, Anne Arundel	21226	39.181513 , -76.537625	Urban	NA	NA	NA	NA
Beltsville CASTNET, 240339991	Powder Mill Rd.	Laurel, Prince George's	20708	39.0284, -76.8171	*	*	*	*	*
Blackwater NWR CASTNET, 240199991	Blackwater National Wildlife Refuge	Cambridge, Dorchester	21613	38.445, -76.1114	*	*	*	*	*
Calvert, 240090011	350 Stafford Rd.	Barstow, Calvert	20678	38.536722, -76.617194	Rural	Stafford Rd.	3265	53	Wash-Arlington-Alexandria
Edgewood, 240251001	Edgewood Chemical Biological Center (APG), Waehli Rd.	Edgewood, Harford	21010	39.410191, -76.296946	Rural	Waehli Rd.	4240	16	Baltimore-Towson
Essex, 240053001	600 Dorsey Ave.	Essex, Baltimore County	21221	39.310833, -76.474444	Suburban	Woodward Dr.	9521	5	Baltimore-Towson
Fair Hill, 240150003	Fair Hill Natural Resource Mgmt. Area 4600 Telegraph Rd.	Fair Hill, Cecil	21921	39.701444, -75.860051	Rural	Telegraph Rd. (RT 273)	7123	26	Philadelphia-Camden-Wilmington
Frederick Airport, 240210037	180 E. Airport Dr.	Frederick, Frederick	21701	39.422760, -77.375190	Suburban	Disposal Plant Rd.	2254	9	Wash-Arlington-Alexandria
Frostburg Haze-Cam	E. Garrett Co. Vol. Fire Dept. 401 Finzel Rd.	Finzel, Garrett	21532	39.686467, -78.966917	Rural	NA	NA	NA	NA
Frostburg IMPROVE	Frostburg Reservoir	Finzel, Garrett	21532	39.705896, -79.012117	Rural	Grantsville Rd.	1990	1441	NA
Furley, 245100054	Furley Recreational Ctr. 4633 Furley Ave.	Baltimore, City	21206	39.328807, -76.553075	Urban and Center City	Furley Ave.	2271	29	Baltimore-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.	16591	42	Baltimore-Towson
Hagerstown, 240430009	18530 Roxbury Rd.	Hagerstown, Washington	21740	39.564178, -77.720244	Rural	Roxbury Rd.	8870	49	Hagerstown-Martinsburg
Horn Point, 240190004	UMd Horn Point Lab 2020 Horns Point Rd	Cambridge, Dorchester	21613	38.587525, -76.141006	Rural	Horns Point Rd.	4352	64	Cambridge (Micro)

Site Name, AQS ID	Street Address	City, County	Zip Code	Latitude, Longitude (NAD83)	Location Setting	Nearest Road	Traffic Count (2013)	Distance from Nearest Road (m)	CBSA/MSA
Howard Co. Near Rd, 240270006	I-95 S Welcome Center	Laurel, Howard	20723	39.143130 -76.846110	Suburban	I-95	192401	16	Baltimore-Towson
HU-Beltsville, 240330030	Howard Univ., Beltsville Lab., 12003 Old Baltimore Pike	Beltsville, Prince George's	20705	39.055277, -76.878333	Suburban	Old Baltimore Pike	15692	385	Wash-Arlington-Alexandria
Millington, 240290002	Millington WMA-Massey-MD Line Rd.	Millington, Kent	21650	39.305021, -75.797317	Rural	RT 330, Massey-DE Line Rd.	971	121	NA
Oldtown, 245100040	Oldtown Fire Station, 1100 Hillen St.	Baltimore, City	21202	39.297733, -76.604603	Urban and Center City	Hillen St.	12392	7	Baltimore-Towson
Padonia, 240051007	Padonia E.S., 9834 Greenside Dr.	Cockeysville, Baltimore County	21030	39.460478 -76.633543	Suburban	Greenside Dr.	1841	46	Baltimore-Towson
PG Equestrian Center, 240338003	14900 Pennsylvania Ave.	Upper Marlboro, Prince George's	20772	38.811940, -76.744170	Rural	Pennsylvania Ave.	52980	191	Wash-Arlington-Alexandria
Piney Run, 240230002	Frostburg Reservoir, Finzel	Frostburg, Garrett	21532	39.705950, -79.012000	Rural	Piney Run Rd.	1900	1141	NA
Riviera Beach, 240032002	Riviera Bch Elem Sch, 8515 Jenkins Road	Pasadena, Anne Arundel	21122	39.158883, -76.511367	Suburban	Jenkins Rd		1	Baltimore-Towson
Rockville, 240313001	LE Smith Env Educ Ctr, 5110 Meadowside Ln.	Rockville, Montgomery	20855	39.114313, -77.106876	Rural	Meadowside Ln.	16981	77	Wash-Arlington-Alexandria
South Carroll, 240130001	South Carroll H.S. 1300 W Old Liberty Rd.	Sykesville, Carroll	21784	39.444294, -77.042252	Rural	Old Liberty Rd.	9473	248	Baltimore-Towson
Southern Maryland, 240170010	14320 Oaks Rd.	Charlotte Hall, Charles	20622	38.508547, -76.811864	Rural	Access Rd.	5100	16	Wash-Arlington-Alexandria
Verso Luke Mill: Moran Property 24-001-8881	Rock Street, SW	Westernport, Allegany	21562	39.4864, -79.0638	Rural	Rock Street		1	Cumberland, MD-WV
Verso Luke Mill: Horse Rock 24-001-8882	Horse Rock Road	Westernport, Allegany	21562	39.483617, -79.026383	Rural	Minnetonka		1	Cumberland, MD-WV
Verso Luke Mill: Bean Property 54-057-8883	Old WV 46	Keyser, WV Mineral County	26726	39.4452, -79.0691	Rural	Hampshire Hill		1	Cumberland, MD-WV

Note: Blank cells indicate no data available. NA means not applicable. Traffic count data are AADT 2013, MD State Hwy Administration.

***** See EPA CASTNET Annual Network Plan *https://www.epa.gov/castnet/ozone*

Table 3-2 Monitor Information for Current Maryland Ambient Air Monitoring Sites

Site Name & AQS ID	Parameter	Start Date	Method Code	Probe Height	Measurement Scale	Monitor Objective	Monitor Network/Type	Schedule
Aldino, 240259001	Ozone (O_3)	04/20/1990	047	10	Urban	Highest Concentration	SLAMS	H, S
Baltimore County Near Road 240050009	Nitric Oxide (NO)	01/01/2016	599	4.4	Microscale	Source Oriented/Highest Conc	SLAMS	H
	Nitrogen Dioxide (NO_2)	01/01/2016	599	4.4	Microscale	Source Oriented/Highest Conc	SLAMS	H
	Oxides of Nitrogen (NO_X)	01/01/2016	599	4.4	Microscale	Source Oriented/Highest Conc	SLAMS	H
Baltimore Haze Cam Brandon Shores	Visibility	04/01/2007	NA	NA	NA	Public Notification	NA	NA
Beltsville CASTNET, 240339991	Ozone (O_3)	04/01/2011	047	10	Regional	Highest Concentration	CASTNET	H
	Reactive Oxides of Nitrogen (NO_Y)	11/01/2012	699	10	Regional	Highest Concentration	CASTNET	H
	Sulfur Dioxide (SO_2)	04/01/2011	560	10	Regional	Highest Concentration	CASTNET	F
Blackwater NWR CASTNET, 240199991	Ozone (O_3)	01/01/2011	047	10	Regional	Highest Concentration	CASTNET	H
Calvert, 240090011	Ozone (O_3)	04/01/2005	087	4.6	Urban	Population Exposure	SLAMS	H, S
Edgewood, 240251001	Ozone (O_3)	03/10/1980	047	4.5	Urban	Highest Concentration	SLAMS	H, S
	$PM_{2.5}$ - 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
	Direct CAPS True NO_2	08/10/2017	212	4.4	Neighborhood	Population Exposure	SLAMS	H
	Nitric Oxide (NO)	11/16/2017	699	4.4	Neighborhood	Maximum Precursor	PAMS	H
	Reactive Oxides of Nitrogen (NO_Y)	11/16/2017	699	4.4	Neighborhood	Maximum Precursor	PAMS	H
	NO_Y - NO	11/16/2017	699	4.4	Neighborhood	Maximum Precursor	PAMS	H
	Ozone (O_3)	01/01/1972	087	4.4	Neighborhood	Highest Concentration, Population Exposure	SLAMS	H
	$PM_{2.5}$ - Local Conditions	01/01/1999	145	5.1	Neighborhood	Population Exposure	SLAMS	6
	$PM_{2.5}$ - 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
	PAMS VOCS	01/01/1992	126, 142, 102*	4	Neighborhood	Max Precursor, Highest Conc	SLAMS/PAMS	H, 6, 12

Site Name & AQS ID	Parameter	Start Date	Method Code	Probe Height	Measurement Scale	Monitor Objective	Monitor Network/Type	Schedule
Fair Hill, 240150003	Ozone (O_3)	01/01/1992	087	4.5	Urban	Regional Transport	SLAMS	H, S
	$PM_{2.5}$ - Hourly	07/01/2010	170	4.7	Neighborhood	Population Exposure	SLAMS	H
Frederick Airport, 240210037	Ozone (O_3)	07/09/1998	087	4.6	Urban	Population Exposure	SLAMS	H, S
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	087	7.5	Neighborhood	Population Exposure	SLAMS	H, S
Glen Burnie, 240031003	Ozone (O_3)	04/01/2016	087	5	Neighborhood	Population Exposure	SLAMS	H
	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	6
Hagerstown, 240430009	Ozone (O_3)	04/01/1999	087	4.6	Urban	Highest Conc/ Population Exposure	SLAMS	H, S
	$PM_{2.5}$ - Hourly	07/01/2010	170	5.09	Urban	Highest Conc	SLAMS	H
Horn Point, 240190004	Ozone (O_3)	04/01/2012	087	4	Regional	General/Background	SLAMS	H
	$PM_{2.5}$ - Hourly	04/01/2012	170	4	Regional	General/Background	SLAMS	H
	Sulfur Dioxide (SO_2)	04/01/2012	600	4	Regional	General/ Background	SLAMS	R
Howard County Near Road, 240270006	Air Toxics	04/01/2014	150	4	Microscale	Source Oriented/Highest Conc	SLAMS	6
	Black Carbon	08/01/2015	894	4	Microscale	Source Oriented/Highest Conc	SPM	H
	Ultrafine Particle Counter	01/01/2017	173	4	Microscale	Source Oriented/Highest Conc	SPM	H
	Carbon Monoxide (CO)	04/01/2014	593	4	Middle Scale	Source Oriented/Highest Conc	SLAMS	H
	Nitric Oxide (NO)	04/01/2014	599	4	Microscale	Source Oriented/Highest Conc	SLAMS	H
	Nitrogen Dioxide (NO_2)	04/01/2014	599	4	Microscale	Source Oriented/Highest Conc	SLAMS	H
	Oxides of Nitrogen (NO_X)	04/01/2014	599	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

Site Name & AQS ID	Parameter	Start Date	Method Code	Probe Height	Measurement Scale	Monitor Objective	Monitor Network/Type	Schedule
HU-Beltsville, 240330030	Carbon Monoxide (CO)	01/01/2007	554	4.6	Urban	General/Background	SLAMS/NCore	H
	Air Toxics	05/05/2005	150	4	Neighborhood	Population Exposure	Other	6
	Nitric Oxide (NO)	01/01/2012	599	4.6	Urban	General/Background	SLAMS/NCore	H
	Nitrogen Dioxide (NO_2)	01/01/2012	599	4.6	Urban	General/Background	SLAMS/NCore	H
	Oxides of Nitrogen (NO_X)	01/01/2012	599	4.6	Urban	General/Background	SLAMS/NCore	H
	Ozone (O_3)	05/01/2005	087	4.6	Urban	Highest Conc./ Population Exposure	SLAMS/NCore	H
	$PM_{2.5}$ Speciation	12/05/2004	812	2.3	Urban	Population Exposure General/Background	SLAMS/NCore	3
	PM_{10} – STP	07/25/2010	127	2.3	Neighborhood	Population Exposure	SLAMS/NCore	3
	$PM_{10-2.5}$ - Local Conditions	07/25/2010	176	2.3	Neighborhood	Population Exposure	SLAMS/NCore	3
	$PM_{2.5}$ - Local Conditions	07/10/2004	145	2.3	Urban	Population Exposure	SLAMS/NCore	3
	$PM_{2.5}$ - Local Conditions	07/31/2010	145	2.3	Urban	Population Exposure	QA-Collocated	12
	$PM_{2.5}$ – Hourly	07/01/2010	170	4.5	Urban	Population Exposure	SLAMS/NCore	H
	Ultrafine Particle Counter	01/01/2017	173	4	NA	NA	SPM	H
	Black Carbon	12/01/2007	894	4	NA	NA	SPM	H
	Sulfur Dioxide (SO_2)	09/29/2006	560	4.6	Urban	General/Background	SLAMS/NCore	R
	TYPE 1/3 PAMS VOCS	05/05/2005	126	4	Urban	Upwind/Background	PAMS/NCore	6, S: 3
Millington, 240290002	Ozone (O_3)	06/19/1989	087	4.5	Urban	Population Exposure	SLAMS	H, S
	$PM_{2.5}$ - Hourly	07/01/2010	170	5	Neighborhood	Population Exposure	SLAMS	H
Oldtown, 245100040	Air Toxics	01/01/1990	150	9	Neighborhood	Population Exposure	Other	6
	Nitric Oxide (NO)	01/01/1994	599	4.2	Middle	Highest Concentration	SLAMS	H
	Nitrogen Dioxide (NO_2)	11/05/1981	599	4.4	Middle	Highest Concentration	SLAMS	H
	Oxides of Nitrogen (NO_X)	01/01/1982	599	4.4	Middle	Highest Concentration	SLAMS	H
	PM_{10} – STP	01/01/2017	127	4.9	Middle	Population Exposure	SLAMS	6
	$PM_{2.5}$ - Local Conditions	01/01/1999	145	4.9	Middle	Highest Concentration	SLAMS	3
	$PM_{2.5}$ - Hourly	07/01/2010	170	5.1	Middle	Highest Concentration	SLAMS	H

Site Name & AQS ID	Parameter	Start Date	Method Code	Probe Height	Measurement Scale	Monitor Objective	Monitor Network/Type	Schedule
Padonia, 240051007	Ozone (O_3)	01/01/1979	087	4.2	Neighborhood	Population Exposure	SLAMS	H, S
	$PM_{2.5}$ - Hourly	01/01/2016	170	4.8	Neighborhood	Population Exposure	SLAMS	H
	$PM_{2.5}$ - Local Conditions	01/01/1999	145	4.8	Neighborhood	Population Exposure	SLAMS	12
PG Equestrian Center, 240338003	Ozone (O_3)	04/01/2002	087	4.4	Urban	Population Exposure	SLAMS	H, S
Piney Run, 240230002	Carbon Monoxide (CO)	09/01/2007	554	4.4	Regional	Regional Transport	SLAMS/NCore	H
	Nitric Oxide (NO)	05/01/2004	699	10	Regional	Regional Transport	SLAMS/NCore	H
	Nitric Oxide (NO)	01/01/2014	599	4.6	Regional	Regional Transport	SLAMS/NCore	H
	Nitrogen Dioxide (NO_2)	01/01/2014	599	4.6	Regional	Regional Transport	SLAMS/NCore	H
	Oxides of Nitrogen (NO_X)	01/01/2014	599	4.6	Regional	Regional Transport	SLAMS/NCore	H
	NO_Y – NO	05/01/2004	699	10	Regional	Regional Transport	SLAMS/NCore	H
	Ozone (O_3)	04/01/2004	087	4.4	Regional	Regional Transport	SLAMS/NCore	H
	$PM_{2.5}$ – Hourly	07/01/2010	170	4.9	Regional	Regional Transport	SLAMS/NCore	H
	Reactive Oxides of Nitrogen (NO_Y)	05/01/2004	699	10	Regional	Regional Transport	SLAMS/NCore	H
	Sulfur Dioxide (SO_2)	04/01/2004	560	4.4	Regional	Population Exposure	SLAMS/NCore	R
Riviera Beach, 240032002	Sulfur Dioxide (SO_2)	1/12/2018	060	5	Neighborhood	Highest Concentration	SPM	R
Rockville, 240313001	Ozone (O_3)	01/01/1980	087	4.6	Urban	Population Exposure	SLAMS	H, S
	$PM_{2.5}$ - Hourly	07/01/2010	170	5.3	Neighborhood	Population Exposure	SLAMS	H
South Carroll, 240130001	Ozone (O_3)	07/14/1983	087	4.5	Urban	Population Exposure	SLAMS	H, S
Southern Maryland, 240170010	Ozone (O_3)	10/02/1984	087	4.6	Regional	General Background	SLAMS	H, S

Site Name & AQS ID	Parameter	Start Date	Method Code	Probe Height	Measurement Scale	Monitor Objective	Monitor Network/Type	Schedule
Verso Luke Mill: Moran Property 240018881	Sulfur Dioxide (SO_2)	01/11/2017	060	5	Neighborhood	Highest Concentration	SLAMS	R
Verso Luke Mill: Horse Rock 240018882	Sulfur Dioxide (SO_2)	01/11/2017	060	5	Neighborhood	Highest Concentration	SLAMS	R
Verso Luke Mill: Bean Property 540578883	Sulfur Dioxide (SO_2)	02/24/2017	060	5	Neighborhood	Highest Concentration	SLAMS	R

Sampling Schedule is coded as follows: 1 – every day, 2 – every 2 hours, 3 – every 3rd day, 6 - every 6th day, 12 – every 12th day, H – every hour, every day, R – both every hour and every five minutes every day, S – seasonally measured only. F means passive filter collected every 2 weeks. NA means not applicable for the cell. *Method Code 102 refers to carbonyl analyses performed by AMS Lab Philadelphia.

Table 3-3 Monitor Counts by Site (Cross-reference to Table 3-2)

Site Name	Ozone	Carbon Monoxide	Sulfur Dioxide	CAPS Direct NO2	Oxides of Nitrogen (NOx)	Reactive Oxides of N (NOy)	PM2.5 – Hourly FEM	PM10 STP (24-hr FRM)	PM10-2.5 LC 24-hr FRM)	PM2.5 LC (24-hr FRM)	PM2.5 Speciation	PAMS VOCS	HAPS / Air Toxics	IMPROVE Parameters	Ultrafine Particle Count	Aethalometer	Camera	Total
Aldino	1																	1
Baltimore Co. Near Rd					1													1
Baltimore Haze Cam																	1	1
Beltsville CASTNET	1		1			1												3
Blackwater NWR CASTNET	1																	1
Calvert	1																	1
Edgewood	1						1											2
Essex	1	1	1	1		1				1	1	1	1					9
Fair Hill	1						1											2
Frederick Airport	1																	1
Frostburg Hazecam																	1	1
Frostburg Improve														1				1
Furley	1																	1
Glen Burnie	1							2										3
Hagerstown	1						1											2
Horn Point	1		1				1											3
Howard County Near Rd		1			1		1						1		1	1		6
HU-Beltsville	1	1	1		1		1	1	1	2	1		1		1	1		13
Millington	1						1											2
Oldtown					1		1	1		1			1					5
Padonia	1						1			1								3
PG Equestrian Center	1																	1
Piney Run	1	1	1		1	1	1											6
Riviera Beach			1															1
Rockville	1						1											2
South Carroll	1																	1
Southern Maryland	1																	1
Verso: Moran			1															1
Verso: Horse Rock			1															1
Verso: Bean			1															1
Total	20	4	9	1	5	3	11	4	1	5	2	1	4	1	2	2	2	**77**

Table 3-4 Count of Meteorological Parameters Measured in the Maryland Network

AQS State County Site	Local Site Name	Barometric Pressure-64101	Temperature -62101	Rain - 65102	Relative Humidity - 62201	Solar Radiation-63301	Ultraviolet Radiation-63302	Wind Direction - 61104	Wind Speed - 61103	
240259001	Aldino	1	1	1	1			1	1	6
240050009	Baltimore County Near Rd	1	1	1	1			1	1	6
240251001	Edgewood	1	1	1	1			1	1	6
240053001	Essex	1	1	1	1	1	1	1	1	8
240150003	Fair Hill	1	1	1	1			1	1	6
240031003	Glen Burnie	1	1	1	1			1	1	6
240430009	Hagerstown	1	1	1	1			1	1	6
240190004	Horn Point	1	1	1	1			1	1	6
240270006	Howard County Near Rd	1	1	1	1			1	1	6
240330030	HU-Beltsville	1	1	1	1	1		1	1	7
240290002	Millington	1	1	1	1			1	1	6
240051007	Padonia	1	1	1	1			1	1	6
240338003	PG Equestrian Center	1	1	1	1			1	1	6
240230002	Piney Run	1	1	1	1	1		1	1	7
240032002	Riviera Beach	1	1	1	1			1	1	6
240313001	Rockville	1	1	1	1			1	1	6
240130001	South Carroll	1	1	1	1			1	1	6
Total		17	17	17	17	3	1	17	17	**106**

Table 3-5 Monitoring Methods and AQS Codes used in the Maryland Ambient Air Monitoring Network

Parameter	Parameter Code	Method Code	Sample Analysis Description
HAPS / Air Toxics*	NA	150	Cryogenic Pre-concentration: GC/MS
Black Carbon	84313	894	API Teledyne 633 Aethelometer
Carbon Monoxide, trace	42101	554	Gas Filter Correlation Thermo Electron 48I-TLE
	42101	593	Gas Filter Correlation Teledyne API 300 EU
True NO_2	42602-4	212	API T500U - Direct CAPS (Cavity Attenuated Phase Shift)
Nitric Oxide and Nitrogen Dioxide (NOx)	42601-2, 42602, 42603	599	Gas Phase Chemiluminescence, Teledyne API T200U
Nitric Oxide and Reactive Oxides of Nitrogen (NOy – NO)	42601, 42612, 42600	674	Thermo 42i-Y Chemiluminescence for low level measurements
	42601, 42612, 42600	691	Chemiluminescence, Ecotech EC9843
	42601, 42612, 42600	699	Chemiluminescence, Teledyne API T200U-Y
PAMS VOCS*	NA	102	DNHP followed by HPLC (AMS Lab, Phila., PA)
	NA	126	Cryogenic Pre-concentration Trap GC/FID
	NA	142	Pre-concentration Trap/Thermal, Auto GC (PE Clarus 500 Dual COL)
	NA	150	SS 6L- Pressurized, Cryogenic Pre-concentration: GC/MS
Ozone	44201	047	Ultraviolet Photometry
	44201	087	Ultraviolet Radiation Absorption (API T400)
PM_{10}	81102	127	Gravimetric, R - P CO Partisol Model 2025
PM_{10}	85101	122	FEM, Beta Attenuation
$PM_{2.5}$	88101	145	Gravimetric, Partisol Plus 2025
$PM_{2.5}$ continuous	88101-3	170	FEM, Beta Attenuation
$PM_{10-2.5}$ (PM Coarse)	86101	176	PAIRED Gravimetric Difference, Partisol Plus 2025
$PM_{2.5}$ Species* Constituents: Trace elements	NA	811	Energy Dispersive XRF using Teflon filter
$PM_{2.5}$ Species* Constituents: Ions	NA	812	Ion Chromatography using Nylon filter
$PM_{2.5}$ Species* Constituents: Organics	NA	813	Thermo-Optical Transmittance using Quartz filter
$PM_{2.5}$ Speciation mass	88502-5	810	Gravimetric, Met One SASS using Teflon
IMPROVE Parameters*	NA	NA	Four module, Improve Protocol analysis
Sulfur Dioxide	42401	060	Pulsed Fluorescence (43i and Airpointer)
Sulfur Dioxide, trace	42401	560	Pulsed Fluorescence, 43C-TLE/43I-TLE
	42401	600	Ultraviolet Fluorescence API 100 EU
Ultrafine Particle Counter	87101	173	Ultrafine Particle Counter
Visibility	NA	NA	Camera (Haze Cam)

*See Table 3-6 for constituents belonging to these groups. NA means not applicable for the cell. Parameter occurrence code (POC) 1 unless otherwise noted.

Table 3-6 Constituent Compounds and Species Measured in Maryland

CONSTITUENT GROUP	COMPOUNDS IN THE CONSTITUENT GROUP
HAPS / Air Toxics	Dichlorodifluoromethane, Chloromethane, 1,2-Dichloro-1,1,2,2,tetrafluorolethane, Chloroethene, 1,3-Butadiene, Trichlorofluoromethane, Acrolein, Acetone, Methylene Chloride, 1,1,2-Trichloro-1,2,2-trifluoroethane, 2-methoxy-2-methyl-Propane, Hexane, Chloroform, Tetrahydrofuran, 1,2-Dichloroethane, 1,1,1-Trichloroethane, Benzene, Carbon tetrachloride, Cyclohexane, 1,2-Dichloropropane, Trichloroethene, Heptane, Cis-1,3-Dichloro-1-Propene, Trans-1,3-Dichloro-1-Propene, Toluene, 1,2-Dibromoethane, Tetrachloroethylene, Chlorobenzene, Ethylbenzene, m & p- Xylene, Styrene, 1,1,2,2-Tetrachloroethane, o-Xylene, 1-Ethyl-4-Methylbenzene, 1,3,5-Trimethylbenzene, 1,2,4-Trimethylbenzene, 1,4-Dichlorobenzene
IMPROVE Parameters	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 VOC's	Acetaldehyde, Acetone, Acrolein, Formaldehyde, Methyl Ethyl Ketone, Methyl Isobutyle Ketone, Propionaldehyde, Ethene, Ethyne, Ethane, Propene, Propane, Isobutane, 1-Butene, Butane, T-2-Butene, C-2-Butene, Isopentane, 1-Pentene, Pentane, Isoprene, T-2-Pentene, C-2-Pentene, 2,2-Dimethylbutane, Cyclopentane, 2,3-Dimethylbutane, 2-Methylpentane, 3-Methylpentane, 1-Hexene, Hexane, Methylcyclopentane, 2,4dimethylpentane, Benzene, Cyclohexane, 2-Methylhexane, 2,3dimethylpentane, 3-Methylhexane, 2,2,4tmpentane, Heptane, Methylcyclohexane, 2,3,4-Tmpentane, Toluene, 2-Methylheptane, 3-Methylheptane, Octane, Ethylbenzene, M&P-Xylene, Styrene, O-Xylene, Nonane, Isopropylbenzene, Propylbenzene, 1-Ethyl-3-Mbenzene, 1-Ethyl-4-Mbenzene, 135tmbenzene, 1-Ethyl-2-Mbenzene, 124tmbenzene, Decane, 1,2,3-Trimbenzene, M-Diethylbenzene, P-Diethylbenzene, Undecane, Dodecane, Total HC, PAMSHC, 1,3-Butadiene, Alpha-pinene, Beta-pinene
$PM_{2.5}$ Chemical Species	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 added a CO monitor to the near road NO_2 monitoring site at the Interstate 95 South (I-95S) rest area between MD-32 and MD-216. This monitor began collecting data April 1, 2014. 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.

Table 4-1 CO Monitoring Requirements

Requirement	Appendix D 40 CFR Part 58	Required in Maryland	Number of monitors active in Maryland
One CO monitor collocated with a Near Road NO_2 monitor in an urban area with a population > 1 million	4.2.1	1	1
One CO monitor at each NCore site	3(b)	2	2

In addition to the three CO monitors referenced in the table above, Maryland operates a CO monitor at Essex, the newly designated PAMS site.

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 waste 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 2018-2019

No changes planned.

4.2 Lead (Pb) – General Description and Sampling Method

Lead is collected by gravimetric PM_{10} samplers as described in Section 4.5; then the filters are sent to a lab to be analyzed for lead by the x-ray fluorescence method. If a lead-PM_{10} monitor measures three-month average levels greater than or equal to 0.10 $\mu g/m^3$, 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 4-2 Lead Monitoring Requirements

Requirement	Appendix D 40 CFR Part 58	Required in MD	Number 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 (tpy)	4.5(a)	0	0
One source-oriented SLAMS site located to measure the maximum Pb concentration resulting from airport which emits 1.0 or more tpy	4.5(a)	0	0

On March 28, 2016, EPA published 40 CFR Part 58 Revisions to Ambient Monitoring Quality Assurance and Other Requirements; Final Rule. This rule revision eliminated the requirement in section 3 of appendix D to measure Pb at urban NCore sites either as Pb in Total Suspended Particles (Pb-TSP) or as Pb PM_{10}. In order to discontinue Pb measurements at urban NCore sites, Part II.I Network Design Requirements of the publication states:

"With specific regard to Pb monitoring at urban NCore sites, monitoring agencies should request permission from the EPA Regional Administrator to discontinue non-source oriented monitoring following the collection of at least 3 years of complete data at each affected site."

MDE terminated the Pb monitor at HU-Beltsville due to low concentrations (see the 2018 Monitoring Network Plan and Appendix B to this document.)

4.2.2 Sources

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. There are no sources in Maryland that emit more than ½ ton (1,000 pounds) of lead per year.

4.2.3 Changes Planned for 2018-2019

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. Until recently, it has only been possible to measure NO_2 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**.**

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. Reactive oxides of nitrogen (NO_y) are measured in a similar manner to NO_x, except that NO is measured by bypassing the converter. The combination of NO_2 and NO_z can be then determined by difference. This procedure is similar to the current methodology used to measure NO_x, however, the converter temperature is higher in order to more completely convert NO_z species, and the converter has been moved to very near the sample inlet to avoid line losses of "sticky" NO_y species such as HNO_3.

Direct NO_2 monitoring using cavity-attenuated phase shift (CAPS) technology was deployed to the Essex site on August 10, 2017. CAPS NO_2 monitors provide a direct absorption measurement of nitrogen dioxide. Unlike standard chemiluminescence-based monitors, these instruments require no conversion of NO_2 to another species and thus are not sensitive to other nitrogen-containing species.

4.3.1 Monitoring Requirements

On December 30, 2016, EPA published 40 CFR Part 50 Revision to the Near-Road NO_2 Minimum Monitoring Requirements, which eliminated the requirement for a near-road monitoring station in CBSA's having populations between 500,000 and 1,000,000 persons.

Table 4-3 NO_2 Monitoring Requirements

Requirement	Appendix D 40 CFR Part 58	Required in Maryland	Number of monitors active in Maryland
Near Road NO_2 monitoring in CBSA with a population > 2,500,000	4.3.2(a)	2	2
Area-wide NO_2 monitoring in CBSA with a population > 1,000,000	4.3.3	1	2
Regional Administrator required monitoring	4.3.4	Variable	0

Near Road Monitoring

There are three MSA's with populations greater than 2,500,000 that are either wholly in Maryland, or that Maryland is a part of, that each qualify for two near road NO_2 monitors (Table 1-1). For the Baltimore-Towson, MD MSA, MDE is currently operating two near road NO_2 monitoring stations: the Howard County Near Road site, located on I-95 S between Routes 32 and 216, and the Baltimore County Near Road site, located at the Maryland Transit Administration maintenance facility at the interchange of I-695 and I-795.

For the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA, the requirements will be met by monitors installed in Washington, DC by the District of Columbia Department of the Environment (DDOE) and in Virginia by the Virginia Department of Environmental Quality (VADEQ). For the Philadelphia-Camden-Wilmington-Newark, PA-DE-MD MSA, the requirements will be met by monitors installed by the Pennsylvania Department of Environmental Protection (PADEP).

Area Wide Monitoring

There are three MSA's with populations greater than 1,000,000 that are either wholly in Maryland, or that Maryland is a part of, that each qualify for one community wide NO_2 monitor (Table 1-1). MDE's NO_2 monitors at the Essex and Oldtown sites fulfill this requirement for the Baltimore-Towson, MD MSA.

For the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA, the requirements will be met by monitors installed in Washington, DC by the District of Columbia Department of the Environment (DDOE) and in Virginia by VADEQ. For the Philadelphia-Camden-Wilmington-Newark, PA-DE-MD MSA, the requirements will be met by monitors installed by PADEP.

Sensitive and Vulnerable Populations

EPA Region III has not required MDE to install any additional monitors to meet this requirement.

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 2018-2019

No changes planned.

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.

On October 1, 2015, EPA strengthened the NAAQS for ground-level ozone to 70 parts per billion (ppb), based on extensive scientific evidence about ozone's effects on public health and welfare. The updated standard will improve public health protection, particularly for at-risk groups including children, older adults, people of all ages who have lung diseases such as asthma, and people who are active outdoors, especially outdoor workers. They also will improve the health of trees, plants and ecosystems. The implementation of the 2015 Ozone NAAQS includes expanding the ozone season in Maryland from March 1 through October 31, beginning March 1, 2017.

4.4.1 Monitoring Requirements

Ozone monitoring requirements are determined by the MSA population and design value, as specified in Table D-2 of 40 CFR Part 58 Appendix D. Table 4-4 shows that the MDE monitoring network meets or exceeds the minimum requirements. Since ozone levels decrease significantly in the colder periods of the year in many areas, ozone is only required to be monitored during the designated "ozone season". The implementation of the 2015 Ozone NAAQS includes expanding the ozone season in Maryland from March 1 through October 31 starting in 2017.

Table 4-4 Number of Ozone SLAMS Sites Required (based on Table D–2, Appendix D to 40 CFR Part 58, Ozone Minimum Monitoring Requirements)

MSA Name	Population	Monitors Deployed by State[A]						Total Monitors	Required >= 85% NAAQS
		DE	DC	MD	VA	WV	PA		
Baltimore-Towson, MD	2,753,149	0	0	7	0	0	0	7	4
Hagerstown-Martinsburg, MD-WV	256,278	0	0	1	0	1	0	2	1
Washington-Arlington-Alexandria, DC-VA-MD-WV	5,860,342	0	3	7	7	0	0	17	3
Philadelphia-Camden-Wilmington-Newark, PA-DE-MD	6,018,800	4	0	1	0	0	8	13	3
Salisbury, MD-DE	381,868	2	0	0	0	0	0	2	2
Total		6	3	16	7	1	8	41	13

A - Based on tables available at https://www.epa.gov/air-trends/air-quality-design-values. All areas had their maximum site >= 85% Ozone NAAQS.

Within an O_3 network, at least one O_3 site for each MSA 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. For the Baltimore-Towson, MD MSA, Essex, Edgewood, and Aldino are assigned this designation. For the Washington-Arlington-Alexandria, DC-MD-VA-WV MSA, HU-Beltsville, Beltsville-CASTNET and PG Equestrian Center are assigned this designation for the Maryland portion of the MSA. For the Martinsburg-Hagerstown, MD-WV MSA, Hagerstown is assigned this designation.

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 (VOC's) in the presence of sunlight and warm temperatures. Sources of nitrogen oxides include automobiles, power plants and other combustion activities. VOC's 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 2018-2019

Hart-Miller Island

MDE will no longer run the Special Purpose Monitor located on Hart-Miller Island.

Furley

The Furley station will remain in its original location. A potential move is still under consideration.

Padonia

The Padonia station was moved during 2017 (see 2018 Monitoring Network Plan for details) and was operational again starting December 15, 2017. The seasonal O_3 monitor at Padonia became operational beginning March 1, 2018.

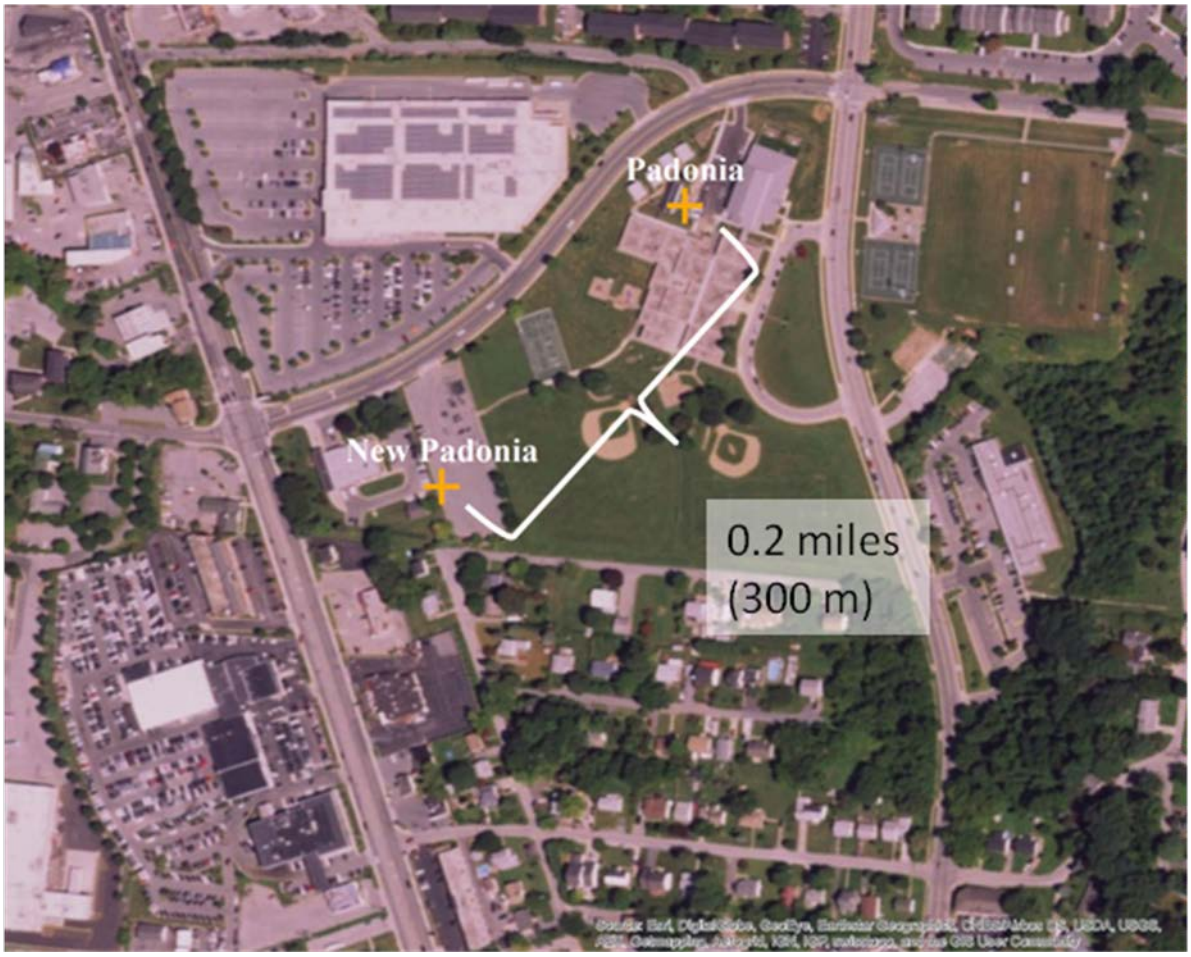

Figure 4-1 Map showing proposed new location for Padonia monitoring station.

4.5 Particulate Matter (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

The number of required PM_{10} monitors in each CBSA is determined by the CBSA population and design value, as specified in Table D-5 of Appendix D to 40 CFR Part 58. Table 4-6 shows that the MDE monitoring network meets or exceeds the minimum requirements.

Table 4-5 Number of PM_{10} SLAMS Sites Required (based on Table D–4, Appendix D to 40 CFR Part 58, PM_{10} Minimum Monitoring Requirements)

MSA Name	Population	Monitors Required[A]	Active Monitors in MD/Total[B]
Baltimore-Towson, MD	2,753,149	2-4	3/3
Hagerstown-Martinsburg, MD-WV	256,278	0-1	0/0
Washington-Arlington-Alexandria, DC-VA-MD-WV	5,860,342	2-4	1/7
Philadelphia-Camden-Wilmington-Newark, PA-DE-MD	6,018,800	2-4	0/4
Salisbury, MD-DE	381,868	0-1	0/0

A – All of the listed MSA's have PM_{10} ambient concentrations well below 80% of the PM_{10} NAAQS.
B –Based on tables available at http://www.epa.gov/airtrends/values.html.

Minimum Requirements for Collocated PM_{10}

A minimum of 15% (round up), or at least one, of the PM_{10} monitors must be collocated as specified in 40 CFR Part 58 Appendix A 3.3.1. MDE has 3 PM_{10} monitors and two are collocated, thereby meeting this requirement.

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 2018-2019

No changes planned.

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

MDE also uses both FRM manual gravimetric and FEM 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. 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 3-6 for list of speciated $PM_{2.5}$ mass. MetOne Super SAAS samplers, URG 3000N, 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 (Table 3-6).

4.6.1 Monitoring Requirements

The number of required $PM_{2.5}$ monitors in each MSA is determined by the MSA population and design value, as specified in Table D-5 of Appendix D to 40 CFR Part 58. Table 4-7 shows that the MDE monitoring network meets or exceeds the minimum requirements.

Table 4-6 Number of $PM_{2.5}$ SLAMS Sites Required (based on Table D–5, Appendix D to 40 CFR Part 58, $PM_{2.5}$ Minimum Monitoring Requirements)

MSA Name	Population	Annual Design Value ($\mu g/m^3$)	Daily Design Value ($\mu g/m^3$)	Required SLAMS Monitors	Monitors Active in MD/Total[A,B]	Required ≥ 85% NAAQS
Baltimore-Towson, MD	2,753,149	9.8	26	3	8/8	3
Hagerstown-Martinsburg, MD-WV	256,278	10.3	26	1	1/2	1
Washington-Arlington-Alexandria, DC-VA-MD-WV	5,860,342	9.4	22	2	2/10	3
Philadelphia-Camden-Wilmington-Newark, PA-DE-MD	6,018,800	11.8	30	3	1/22	2
Salisbury, MD-DE	381,868	8.4	21	0	0/1	0

A - Based on tables available at https://www.epa.gov/air-trends/air-quality-design-values.
B- Total number of monitors includes those located in other States.

Minimum Requirements for Collocated $PM_{2.5}$

Collocation requirements for $PM_{2.5}$ are based on the number of $PM_{2.5}$ monitors within a Primary Quality Assurance Organization (PQAO) and by measurement method (FRM or FEM) as specified in 40 CFR Part 58 Appendix A 3.2.5 and Appendix D 4.7.2. MDE is its own PQAO so all monitors in Maryland are counted in the collocation requirements. A minimum of 15% (round up) of the monitors must be collocated. MDE has 12 $PM_{2.5}$ monitoring stations; therefore 2 must be collocated. MDE currently operates three collocated $PM_{2.5}$ monitors, one FRM-FRM (Howard U), one FRM-FEM, where the FRM is primary, (Oldtown), and one FEM-FRM, where the FEM is primary, (Padonia).

Requirements for Continuous $PM_{2.5}$ Monitoring

At least one-half (round up) of the minimum number of sites per MSA must operate continuous $PM_{2.5}$ monitors. MDE operates 11 continuous $PM_{2.5}$ monitors, four in the Baltimore-Towson, MD MSA; two in the Washington-Arlington-Alexandria, DC-VA-MD-WV MSA; one in the Philadelphia-Camden-Wilmington-Newark, PA-DE-MD MSA; and one in the Hagerstown-Martinsburg, MD-WV MSA. The other three are in areas not designated as MSA's (Figure 3-1; Tables 3-1 and 3-2).

Requirements for Near Road $PM_{2.5}$ Monitoring

For MSA's with a population of one million or greater, at least one $PM_{2.5}$ monitor is to be located at a near road NO_2 station. The Howard County near road site fulfills this requirement for the Baltimore-Towson, MD MSA. MDE does not operate near road NO_2 stations in any other MSA (Section 4.3.1).

Requirements for $PM_{2.5}$ Chemical Speciation

Each state shall continue to conduct chemical speciation monitoring and analyses at sites designated to be part of the $PM_{2.5}$ Speciation Trends Network (STN). MDE conducts chemical speciation monitoring at Essex and HU-Beltsville, but only HU-Beltsville is designated as part of the STN.

Other Requirements for $PM_{2.5}$ Monitoring

The required monitoring sites must be located to represent area-wide air quality. These will typically be either neighborhood or urban scale, although micro or middle scale may be appropriate in some urban areas. At least one monitoring site must be neighborhood scale or greater in an area of expected maximum concentration and one site must be sited in an area of poor air quality. Each State shall have at least one $PM_{2.5}$ site to monitor for regional background and at least one $PM_{2.5}$ site to monitor for regional transport. Each NCore station must operate a $PM_{2.5}$ monitor. Table 4-7 shows that MDE meets all of these additional requirements.

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.

Table 4-7 Monitor Objective Types and Scales Assigned to Monitors in the Maryland $PM_{2.5}$

Site Name	Measurement Scale	Monitor Objective	MSA
Oldtown	Middle Scale	Highest Concentration	Baltimore-Towson, MD
Howard Co. Near Rd	Microscale	Highest Concentration/ Source Oriented	Baltimore-Towson, MD
Padonia	Neighborhood	Population Exposure	Baltimore-Towson, MD
Essex (FRM only)	Neighborhood	Population Exposure	Baltimore-Towson, MD
Edgewood	Neighborhood	Population Exposure	Baltimore-Towson, MD
Hagerstown	Urban Scale	Population Exposure/ Highest Concentration	Hagerstown-Martinsburg, MD-WV
Fair Hill	Regional Scale	Population Exposure	Philadelphia-Camden-Wilmington, PA-DE-MD
Rockville	Neighborhood	Population Exposure	Washington-Arlington-Alexandria, DC-VA-MD-WV
HU-Beltsville	Urban Scale	Population Exposure	Washington-Arlington-Alexandria, DC-VA-MD-WV
Horn Point	Regional Scale	Population Exposure	NA
Millington	Neighborhood	Population Exposure	NA
Piney Run	Regional Scale	Regional Transport	NA

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

MDE operates both FRM and FEM $PM_{2.5}$ monitors (Table 3-2). 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 first quarter of 2012, and prospectively for data collected in 2018 and 2019. MDE will re-evaluate this recommendation for FEM data collected in the 36 months prior to January 1, 2017 and 2018 in next year's Annual Network Plan.

4.6.4 Changes Planned for 2018-2019

No changes planned.

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

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

On August 10, 2015, the U.S. EPA finalized requirements for air agencies to characterize air quality around sources that emit 2,000 tons per year (tpy) or more of SO_2. On January 5, 2016, MDE notified EPA Region III of six SO_2 emissions sources located in Maryland for which air quality will be characterized. These sources are listed in Table 4-12, along with 2014 emissions data, which are the basis for the Rule.

Table 4-8 Maryland's List of Sources Subject to the Final, 1-hour SO_2 Data Requirements Rule.*

Facility Name	CAMD SO_2 (tons)	MDE Data System (TEMPO) SO_2 (tons)
Brandon Shores	3,145.09	12,757.31**
CP Crane	1,887.16	1,890.04
Chalk Point	3,928.48	3,933.20
Herbert A Wagner	9,610.26	12,757.31**
Verso Luke Mill	N/A	16,999.39
Morgantown	2,961.76	3,134.47

*Note that every other source in Maryland emits less than 1,000 tpy of SO_2, per TEMPO 2014 data.
** This is the total for Ft. Smallwood, including both Brandon Shores and HA Wagner
CAMD: Clean Air Markets Division

This final rule gives air agencies the flexibility to characterize air quality using either modeling of actual source emissions or using appropriately sited ambient air quality monitors. Only Verso Luke Mill opted for the monitoring path. Verso Luke Mill began monitoring SO_2 at two locations in Allegany County, Maryland in January 2017, and at a third station location in Mineral County, WV (Tables 3-1 through 3-4; Appendix A - Site locations, Figure A-29)in February 2017. The three Verso Luke Mill stations, Moran, Horse Rock, and Bean, are being operated by Verso Luke Mill, to fulfill the SO_2 DRR. Verso Luke Mill is responsible for the collection of SO_2 ambient air monitoring data and will perform all required QC checks. MDE, as the PQAO, is responsible for performing annual performance evaluations, reviewing the data for quality assurance purposes, and delivering the data to AQS.

On June 30, 2016, the EPA designated portions of Maryland's Anne Arundel County and Baltimore County as non-attainment for the 2010 1-hour SO_2 NAAQS. The NAA extends approximately 26.8 kilometers (16.6 miles) from the Herbert A. Wagner's Unit 3 stack, which is located at 39.17765N latitude and 76.52752W longitude (see Maryland 2018 Monitoring Network Plan.) This designation was based on modeled, not monitored, SO_2 concentrations. In order to better evaluate actual ambient SO_2 concentrations, a source-oriented SO_2 monitor was established at Riviera Beach Elementary School as a Special Purpose Monitor on January 12, 2018.

4.7.1 Monitoring Requirements

The minimum number of required SO_2 monitors in each MSA is proportional to the product of the total amount of SO_2 emissions in the MSA and its population, as specified in 40 CFR Part 58, Appendix D, Section 4.4. The resulting value is defined as the Population Weighted Emissions Index (PWEI). SO_2 emissions shown in Table 4-13 are from the 2011 National Emissions Inventory (NEI).

Table 4-9 Minimum SO_2 Monitoring Requirements

MSA Name	2016 Population Estimate[A]	2014 NEI SO_2 (tons/year)[B]	PWEI (millions of people-tons per year)	Monitors Required	Monitors Active in MD/Total[C]
Baltimore-Towson, MD	2,798,886	18,452	51,644	1	1/1
Hagerstown-Martinsburg, MD-WV	263,817	2,096	553	0	0/0
Washington-Arlington-Alexandria, DC-VA-MD-WV	6,131,977	13,237	81,170	1	1/4
Salisbury, MD-DE	400,200	1,252	501	0	0/1
Philadelphia-Camden-Wilmington-Newark, PA-DE-MD	6,070,500	12,934	78,518	1	0/10

[A]Population from US census https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml
[B]NEI from 2014 Sector summaries https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data
[C]Total monitors in an MSA is based on tables available at https://www.epa.gov/air-trends/air-quality-design-values

Other SO_2 Monitoring Requirements

The Regional Administrator may require additional SO_2 monitoring stations above the minimum in areas where the minimum requirements are not deemed sufficient to meet monitoring objectives. There are no additional monitors required in Maryland by the Regional Administrator.

Each NCore station must operate a SO_2 monitor. This requirement is met at both the HU-Beltsville and Piney Run monitoring stations.

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 SO_2 emissions are from EGUs. Coal operated EGUs account for 95% of these emissions.

4.7.3 Changes Planned for 2018-2019

No changes planned.

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

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

On October 1, 2015, the PAMS monitoring rule (40 CFR Part 58, Appendix D, Section 5) was revised in conjunction with the strengthening of the ozone NAAQS. States have until June 1, 2019 to meet these new requirements. MDE's plan to implement the new requirements is presented in Section 4.8.4 of this document. In the meantime, states with existing PAMS sites like Maryland are obliged to continue operation under the pre-existing requirements.

MDE was granted a waiver (Appendix D to the 2018 Monitoring Network Plan) to terminate the collection of PAMS data at HU-Beltsville in support of enhanced PAMS monitoring at Essex. This change, which included relocating the Total Reactive Nitrogen Species (NO_y) monitor from Howard U to Essex, was approved on May 31, 2017.

Methods used to sample and analyze VOC's 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 day(June – August) 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 and Locations

Design criteria for the existing PAMS network are based on locations relative to ozone precursor source areas and predominant wind directions associated with high ozone events (40 CFR 58 Appendix D, 5.1). The overall design should enable characterization of precursor emissions sources within the ozone NAA's. There are specific monitoring objectives associated with each PAMS location: transport of ozone and its precursors, and the photochemical processes related to ozone non-attainment. These specific monitoring objectives associated with each of these sites result in four distinct site types and are as follows:

- Type 1 sites are intended to characterize upwind background and transported ozone and its precursor concentrations entering the area and will identify those areas which are subjected to transport.
- Type 2 sites are intended to monitor the magnitude and type of precursor emissions in the area where maximum precursor emissions are expected to impact and are suited for the monitoring of urban air toxic pollutants.
- Type 3 sites are intended to monitor maximum ozone concentrations occurring downwind from the area of maximum precursor emissions.
- Type 4 sites are intended to characterize the downwind transported ozone and its precursor concentrations exiting the area and will identify those areas which are potentially contributing to overwhelming transport in other areas.

A Type 2 site is required for each PAMS area. Only two sites are required for each area, providing all chemical measurements are made. The PAMS network for the Baltimore NAA is described in Table 4-14. There is one PAMS monitoring station for the Baltimore, MD NAA: the Essex Type 2 site.

The required PAMS monitoring locations and frequencies from the PAMS monitoring rule (40 CFR 58, Appendix D, Table D-6) are provided in Table 4-15. The requirements are all being met.

Table 4-10 Monitoring Details for PAMS Network

Site Name	PAMS Type	Parameters Observed	Monitoring Objective
Essex	Type 2	O_3	Population exposure
		VOCs	Maximum precursor emissions impact Population exposure
		NO_x	Maximum precursor emissions impact Population exposure
		CO	Maximum precursor emissions impact Highest concentration Population exposure

Table 4-11 Summary of Required PAMS Monitoring Locations and Frequencies

Measurement	Where required	Sampling frequency (all daily except for upper air meteorology)	Status
Speciated VOC's	Two sites per area, one of which must be a Type 2 site.	During the PAMS monitoring period: (1) Hourly auto GC, or (2) Eight 3-hour canisters, or (3) 1 morning and 1 afternoon canister with a 3-hour or less averaging time plus Continuous Total Non-methane Hydrocarbon measurement.	Met at Essex (Type 2, auto GC)
Carbonyl sampling	Type 2 site in areas classified as serious or above for the 8-hour ozone standard.	3 sequential 8-hour samples on a 1-in-3 day basis during the PAMS monitoring period.	Met at Essex
NO_X	All Type 2 sites.	Hourly during the ozone monitoring season.	Met at Essex
NO_y	One site per area at the Type 3 or Type 1 site.	Hourly during the ozone monitoring season.	Met at Essex
CO (ppb level)	One site per area at a Type 2 site.	Hourly during the ozone monitoring season.	Met at Essex
Ozone	All sites.	Hourly during the ozone monitoring season.	Met at Essex
Surface met	All sites.	Hourly during the ozone monitoring season.	Met at Essex
Upper air meteorology	One representative location within PAMS area.	Sampling frequency must be approved as part of the annual monitoring network plan required in 40 CFR 58.10.	Met at Essex

4.8.2 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.

4.8.3 Changes Planned for 2018-2019

No changes planned.

4.8.4 Implementation Plan for Revised PAMS Monitoring Rule (October 1, 2015) Requirements

Under the October 1, 2015 revisions to the PAMS monitoring rule, state and local monitoring agencies are required to collect and report PAMS measurements at each NCore site with a population of 1,000,000 or more beginning June 1, 2019. PAMS measurements include:

(1) Hourly averaged speciated volatile organic compounds (VOCs);

(2) Three 8-hour averaged carbonyl samples per day on a 1 in 3 day schedule, or hourly averaged formaldehyde;

(3) Hourly averaged O_3;

(4) Hourly averaged nitrogen oxide (NO), true nitrogen dioxide (NO_2), and total reactive nitrogen (NO_y);

(5) Hourly averaged ambient temperature;

(6) Hourly vector-averaged wind direction;

(7) Hourly vector-averaged wind speed;

(8) Hourly averaged atmospheric pressure;

(9) Hourly averaged relative humidity;

(10) Hourly precipitation;

(11) Hourly averaged mixing-height;

(12) Hourly averaged solar radiation; and

(13) Hourly averaged ultraviolet radiation.

MDE has been granted a waiver from the EPA Region III Administrator to collect the required PAMS measurements at the Essex site in lieu of the HU-Beltsville site in order to maintain the 25 year historical record of ozone precursor trends collected at the Essex site, located in the Baltimore-Towson, MD CBSA.

As of the time of this Network Plan's publication, it is MDE's intention to adopt the national PAMS Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOP's) and to follow the guidance presented in the PAMS Technical Assistance Document. These documents have not been finalized and MDE reserves the right to implement deviations or procedural differences upon review of

the completed documents, subject to EPA approval. Any such deviations or procedural differences will be addressed in subsequent amendments to this plan or future Annual Network Plans and supporting documentation (e.g., MDE-specific QAPP's, SOP's, etc.).

With respect to PAMS instrumentation at the Essex site, beginning no later than June 1, 2019, MDE intends to utilize the following:

Hourly Speciated VOC's
Hourly averaged speciated VOC's will be measured, at a minimum, from June through August with a Markes-Agilent Auto GC, or the Perkin Elmer GC if the Marks-Agilent is not received in time.

Carbonyls
Carbonyl sampling will be made at a frequency of three 8-hour on a one-in-three day basis from June through August annually using an ATEC Model 8000-2 Eight Channel Automated Carbonyl sampler with co-located independent channel. Samples will be analyzed by EPA Method TO-11A, as used in the National Air Toxics Trends (NATTS) program.

Nitrogen Oxides
Hourly averaged NO, NO_y and true NO_2 will be measured, at a minimum, from June through August. True NO_2 will be measured with a TeledyneAPI Model T500U CAPS NO_2 analyzer. NO and NOy will be measured using a Thermo 42i-Y.

Meterological Parameters
Hourly averaged temperature, vector-averaged wind speed, vector-averaged wind direction, atmospheric pressure, relative humidity and precipitation will be measured with a Vaisala Model WXT520.

Hourly averaged solar radiation will be measured with Kipp and Zonen SPLite instrument. Hourly averaged ultraviolet radiation will be measured with an Eppley Labs TUVR instrument. Hourly averaged mixing height will be measured with a Viasala Model CL51 ceilometer.

4.8.4 MDE Enhanced Monitoring Plan

EPA developed a Technical Note "Guidance for Photochemical Assessment Monitoring Stations (PAMS) Required Network Implementation Plans and Enhanced Monitoring Plans (EMP's)" that recommends monitoring organizations submit the EMP by July 1, 2018 along with the annual network plan. The actual regulatory requirement for EMP contained in 50CFR58, Appendix D.5(h) states that "the EMP shall be submitted to the EPA Regional Administrator no later than October 1, 2019" for states in the Ozone Transport Region.

In recognition of EPA's guidance recommending an earlier EMP submittal MDE is proposing the following measurements be considered basic elements of the required EMP:

- Year round ozone monitoring at Piney Run, Essex, HU-Beltsville, and Horn Point beginning in 2020.
- Additional VOC measurements at HU-Beltsville, beginning in June 2019, consisting of eight 3-hour canister samples collected every third day June through August.

- Operation of radar wind profilers at Piney Run, HU-Beltsville, and Horn Point beginning in 2020.

Collection and reporting of these measurements will be contingent on receipt of sufficient additional EPA funding directed specifically towards these EMP activities.

In addition to the activities listed above, MDE is considering the use of low cost sensors to measure ozone at higher spatial resolution as a means to investigate concentration gradients and spatial variability. MDE is also exploring the possibility of pooling future EMP funding with other states within the OTR. The goal in mind is to develop an OTR-wide approach to special intensive studies possibly utilizing aircraft, ozonesondes, LIDAR, unmanned aerial vehicles (UAVs), low cost sensors, and other research measurement platforms.

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 3-6. Air toxics samples are collected for 24 hours in canisters with a XonTech 910A or Atec 2200 canister sampler on an every sixth day schedule. The canisters are returned to the MDE 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, MDE 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; Oldtown, Baltimore City; Howard County Near Road, Howard County; and HU-Beltsville, Prince George's County. Refer back to Table 3-2 Monitor Information for Current Maryland Ambient Air Monitoring Sites, 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 2018-2019

No changes planned.

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 (40 CFR, Part 58). NCore sites are required to measure, at a minimum, $PM_{2.5}$ particle mass using continuous and integrated/filter-based samplers, $PM_{10-2.5}$ particle mass, O_3, SO_2, CO, NO/NO_y, wind speed, wind direction, barometric pressure, rain, relative humidity, and ambient temperature.

Sampling methods for $PM_{2.5}$, 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. $PM_{10-2.5}$ is determined by the difference between collocated PM_{10} and $PM_{2.5}$ FRM samplers.

The meteorological parameters (Table 3-4) are measured as follows:

- The Vaisala WXT530 PTU module contains separate sensors for pressure, temperature and humidity measurements. 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 WXT530 uses RAINCAP Sensor 2- technology in precipitation measurement. The precipitation sensor comprises 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 WXT530 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 Kipp and Zonen SPLite instrument is used to measure solar radiation at Essex and HU-Beltsville. It uses a photodiode detector, which creates a voltage output that is proportional to the incoming radiation. Ultraviolet (UV) radiation is measured at Essex using an Eppley Labs TUVR instrument.

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 operates two NCore stations, at HU-Beltsville and Piney Run. The HU-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 2018-2019

MDE was granted a waiver from the EPA to discontinue NOy monitoring at the HU-Beltsville NCore site beginning January 1, 2019. The waiver request letters and the EPA approval to move the NOy monitor from HU-Beltsville to Essex are contained in Appendix D of the 2018 Monitoring Network Plan.

MARYLAND

DEPARTMENT OF THE ENVIRONMENT

APPENDIX A

TOPOGRAPHIC MAP AND AREAL MAPS with SITE DESCRIPTIONS of AIR MONITORING STATIONS IN MARYLAND

Prepared for:
U.S. Environmental Protection Agency

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

June 21, 2018

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard | Baltimore, MD 21230 | www.mde.maryland.gov
410-537-3000 | 800-633-6101 | TTY Users: 800-735-2258
Lawrence J. Hogan, Jr., *Governor* | Boyd K. Rutherford, *Lt. Governor*
Ben Grumbles, *Secretary*

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TABLE of FIGURES

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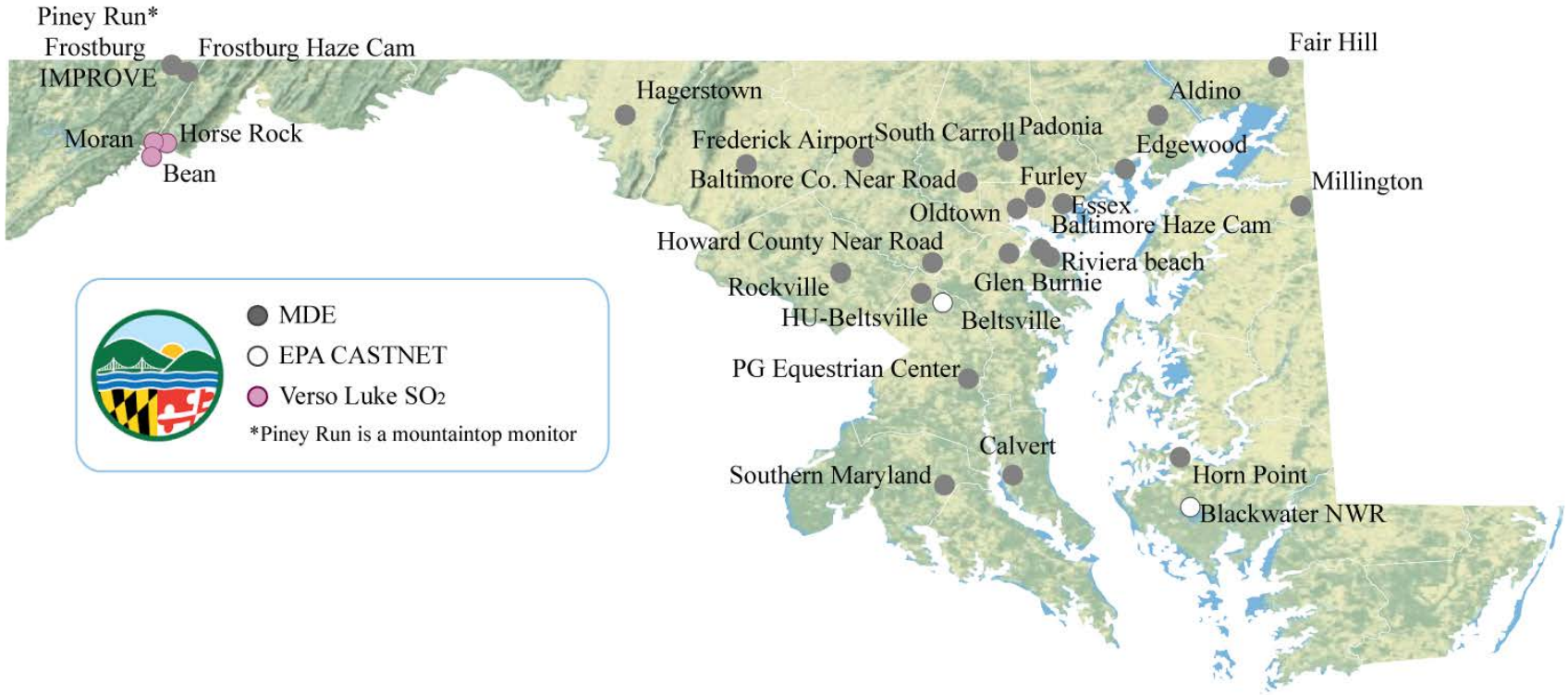

Figure A- 1. Topographic map of air monitoring sites in Maryland.

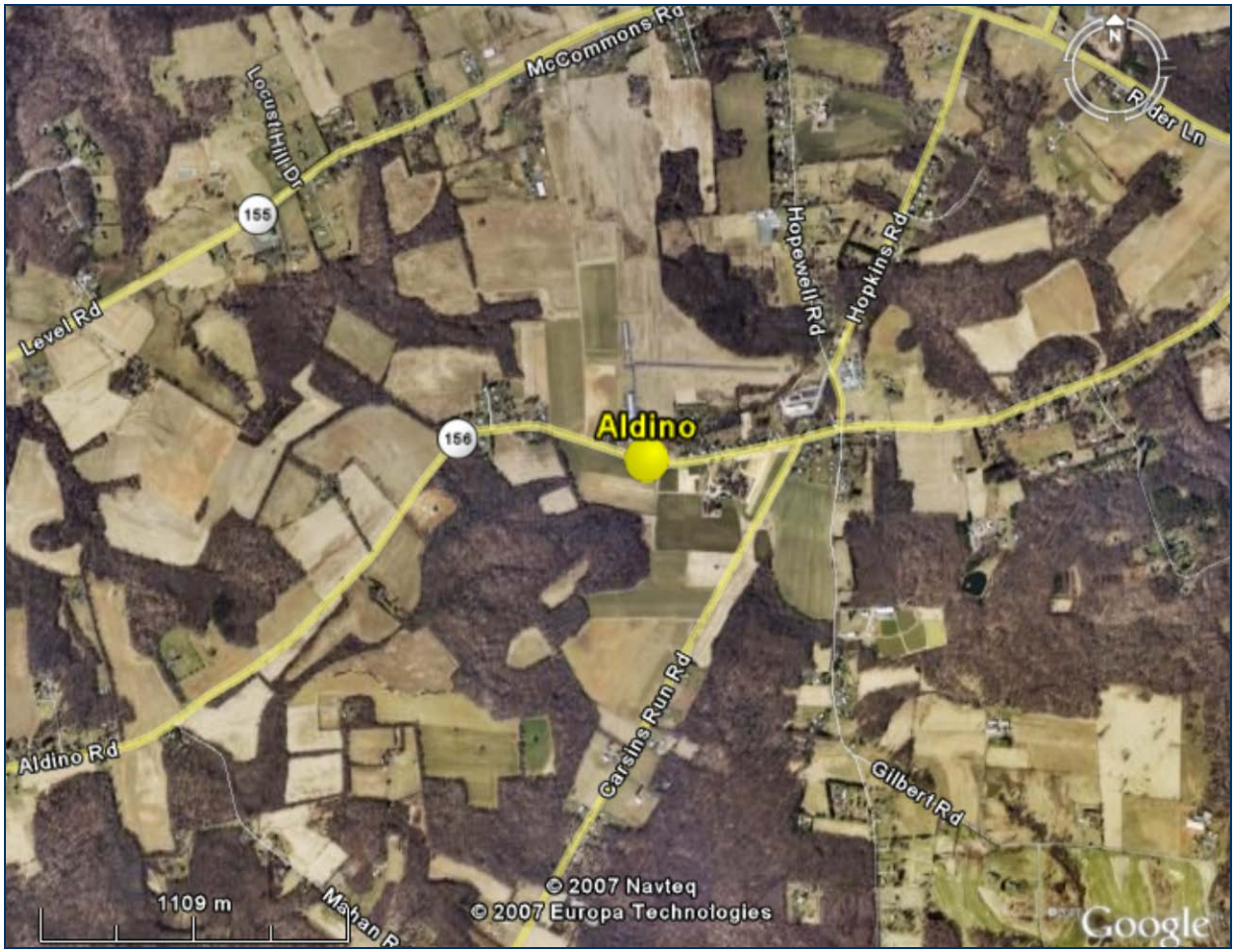

Figure A- 2. Areal map of Aldino air monitoring site in Harford County, MD. Aldino was chosen as a seasonal ozone monitoring site because of the potential to measure the highest concentration of ozone at an urban measurement scale in a suburban setting. To the north of the Aldino monitoring site lies a two lane road, Aldino Road, about 20 feet from the side of the shelter, with a couple of telephone poles and a sod field on the far side of the road. To the east and directly next to the shelter is a parking lot to hold a single row of about 20 cars. At the far end of the parking lot is a one-story office building belonging to Harford Air Services. There are several small airplanes and several hangars behind the office building. To the south is a large flat grassy field containing a grass/dirt runway and another small hangar. To the west is the end of the runway, a house just past the runway, and the continuation of Aldino Road and the sod farm.

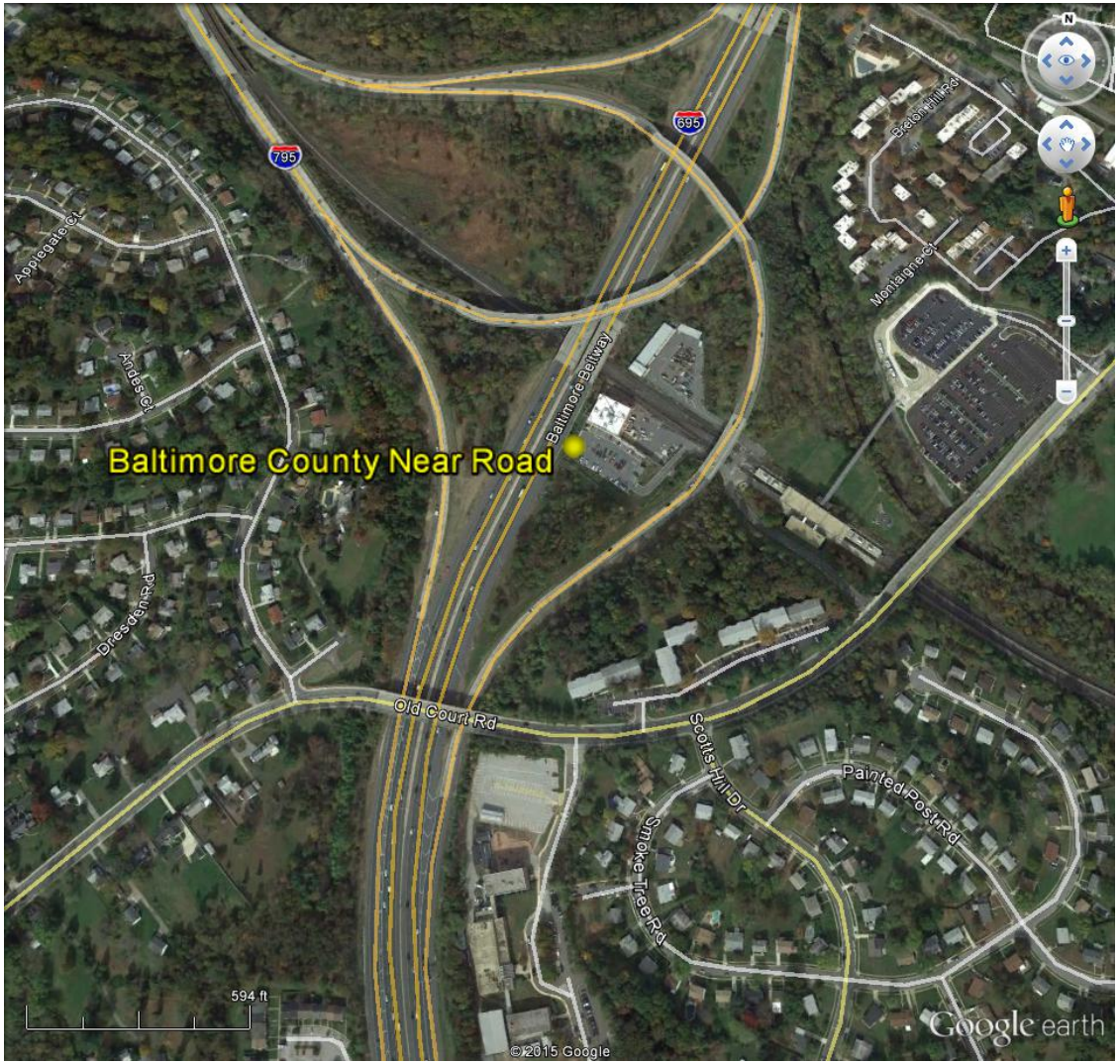

Figure A- 3. Areal map of the Baltimore County Near Road air monitoring site in Baltimore County, MD. BCNR, located in a suburban setting, was chosen as a site for monitoring air quality near roads, including NO, NO_2, and NO_x, source-oriented/highest concentration at the microscale. The BCNR site is in the back left corner of a Metro Station parking lot next to a gazebo that is to the left of the site.

Figure A- 4. Areal map of Baltimore Haze Cam site at Brandon Shores in Anne Arundel County, MD. Brandon Shores was chosen as a Haze Cam site for the purpose of providing public notification of visibility in an urban setting. The location provides an excellent vista of downtown Baltimore City.

Figure A- 5. Areal map of Beltsville CASTNET air monitoring site in Prince George's County, MD. Beltsville was chosen as an ozone monitoring site in the CASTNET network because of the potential to measure the highest concentration of ozone at a regional measurement scale.

Figure A- 6. Areal map of Blackwater NWR CASTNET air monitoring site in Dorchester County, MD. Blackwater was chosen as an ozone monitoring site in the CASTNET network because of the potential to measure the highest concentration of ozone at a regional measurement scale.

Figure A- 7. Areal map of Calvert air monitoring site in Calvert County, MD. Calvert was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at the urban measurement scale in a rural setting. The site is located at a recycling facility on a paved parking lot adjacent to a large radio tower that is several hundred feet high.

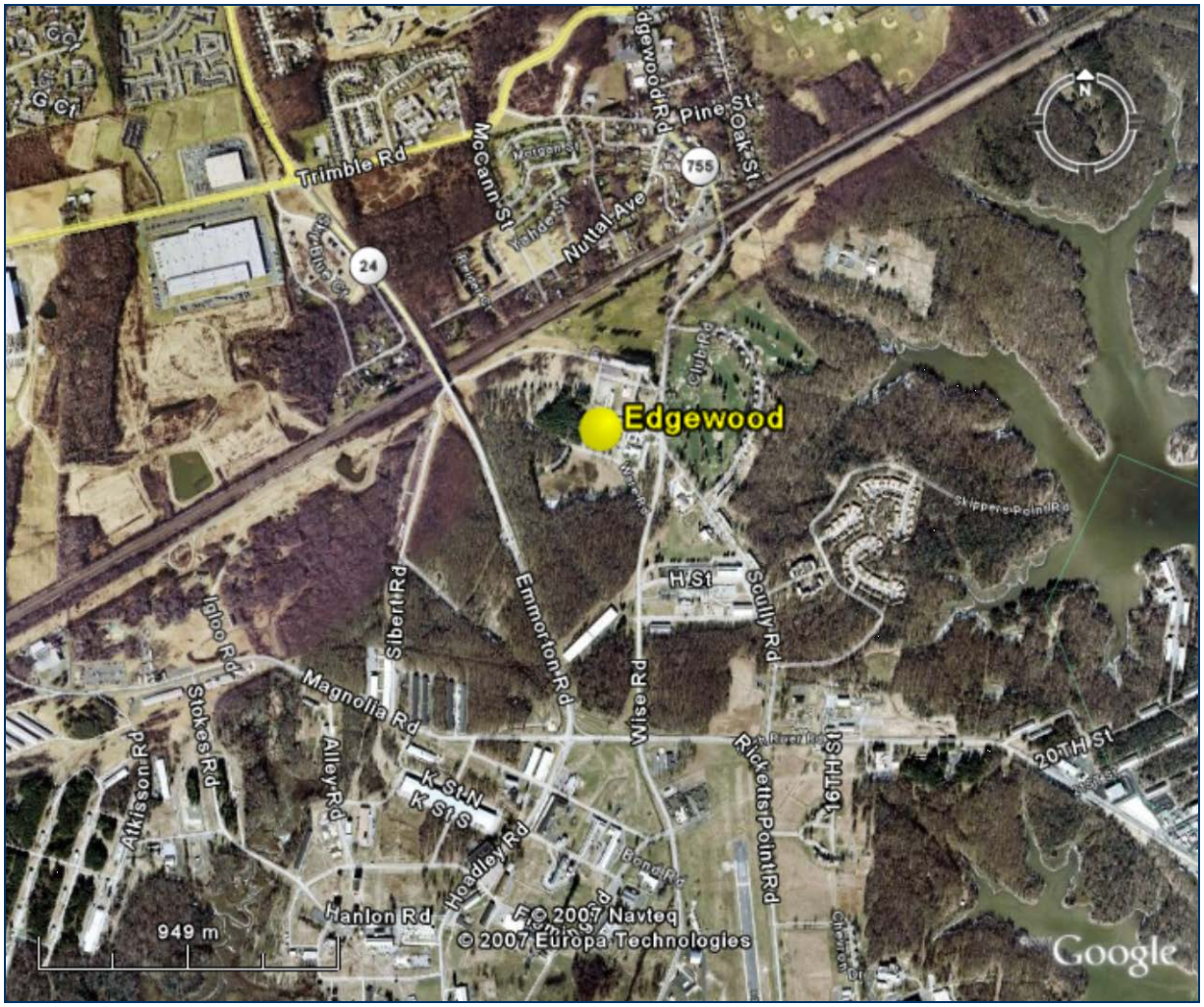

Figure A- 8. Areal map of Edgewood air monitoring site in Harford County, MD. Edgewood was chosen as a seasonal ozone monitoring site because of the potential to measure the highest concentration of ozone at the urban measurement scale. It was chosen as a $PM_{2.5}$ monitoring site because it has the potential to measure population exposure to PM at the neighborhood scale. It is located in a rural setting. The site is located within the Aberdeen Proving Grounds. Adjacent to the site are woods, a few small buildings, and mobile units that the Army uses as storage for their own ambient air monitoring equipment. The site is several miles west of the Chesapeake Bay.

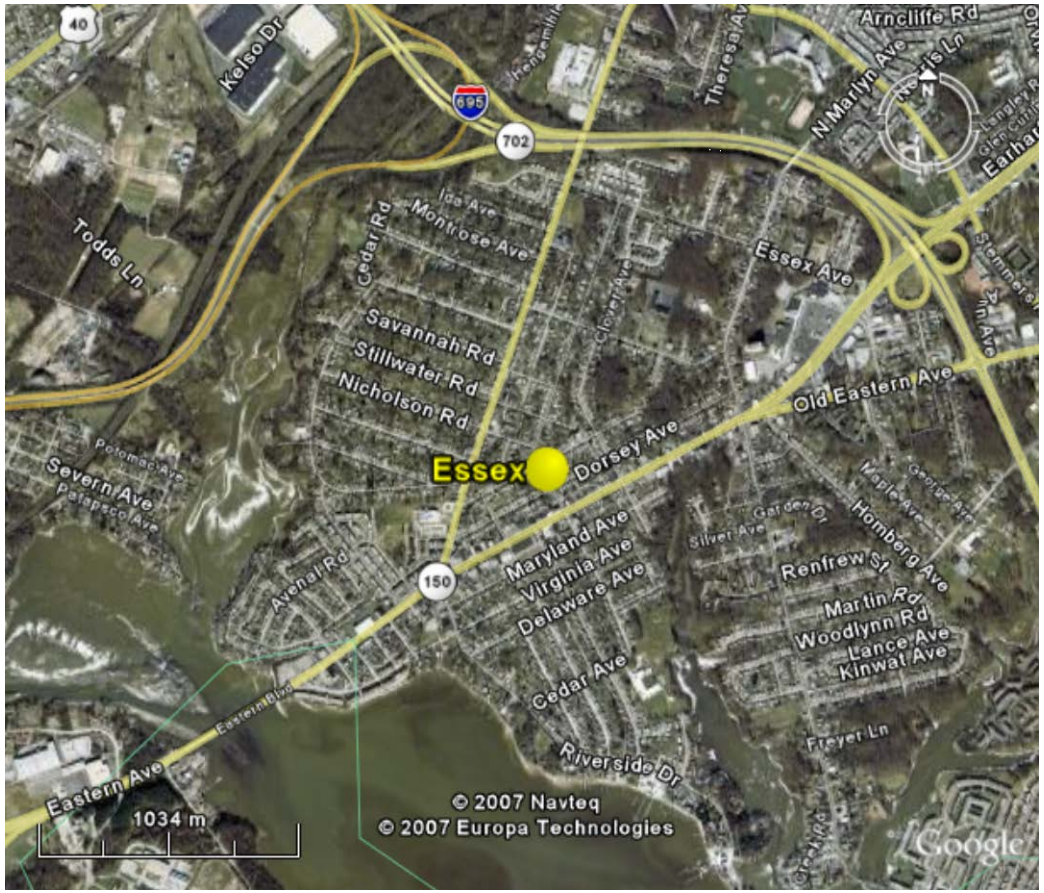

Figure A- 9. Areal Map of the Essex air monitoring site in Baltimore County, MD. Essex, located in a suburban setting, was chosen as a site for monitoring air toxics population exposure at the neighborhood scale; CO highest concentration at the middle scale; NO population exposure and maximum precursor at the neighborhood scale; NO_x and NO_2 maximum precursor at the neighborhood scale; year-round ozone highest concentration and population exposure at the neighborhood scale; $PM_{2.5}$ (local conditions and hourly) population exposure at the neighborhood scale; SO_2 highest concentration at the neighborhood scale; and Type 2 PAMS VOC's maximum precursor and highest concentration at the neighborhood scale. Essex is located in the parking lot of the Essex Senior Center, two blocks from a four-lane road going through the town. To the north of the monitoring station is a small patch of grass, a sidewalk, and Woodward Road, a two-lane road. To the south and west of the monitoring shelter is parking lot for the senior center, which can hold about 50 cars. The senior center is located just beyond the parking lot. The surrounding area is a neighborhood with one or two-story houses on less than quarter acre lots, power lines, and sparse trees.

Figure A- 10. Areal map of Fair Hill air monitoring site in Cecil County, MD. Fair Hill was chosen as a seasonal ozone monitoring site because of the potential to measure the regional transport of ozone at the urban measurement scale. It was chosen as a PM2.5 monitoring site because of the potential to measure general/background PM at the regional scale. It is located in a rural setting. To the north of the Fair Hill monitoring site lies a flat grass field, a single paved lane, and a steeplechase and turf track beyond the lane. In the far distance are a few single story office buildings, and a riding ring with bleachers. To the east continues the grass field and single paved lane. The steeplechase and turf track also continue this direction until meeting with several mature trees and a barn in the distance. To the south passes Rt. 273, a two lane road, just behind the shelter. Past the road is a grass field leading to several racing barns and a couple of mature trees with a training track in the background. To the west continues Rt. 273. Just beyond the road is a gravel parking lot for day horse trailer parking. On the near side of the road in the distance are several one story office and land management buildings.

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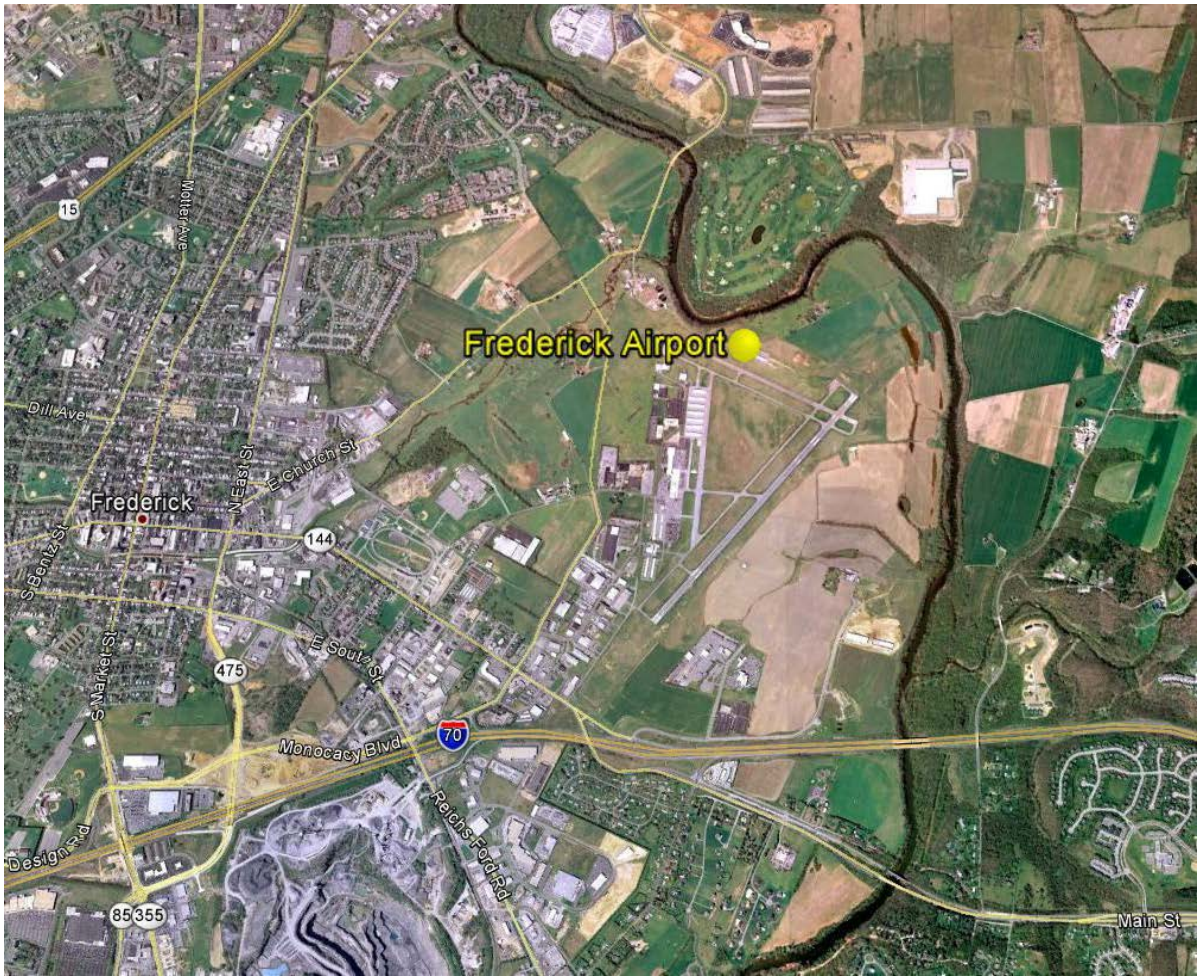

Figure A- 11. Areal map of Frederick Airport air monitoring site in Frederick County, MD. Frederick was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at an urban measurement scale in a suburban setting. The Frederick trailer sits off to the side of a road that passes through a Wastewater Treatment Facility. The trailer sits a few feet from a building and airplanes can frequently be observed taking off from the airport in the distance.

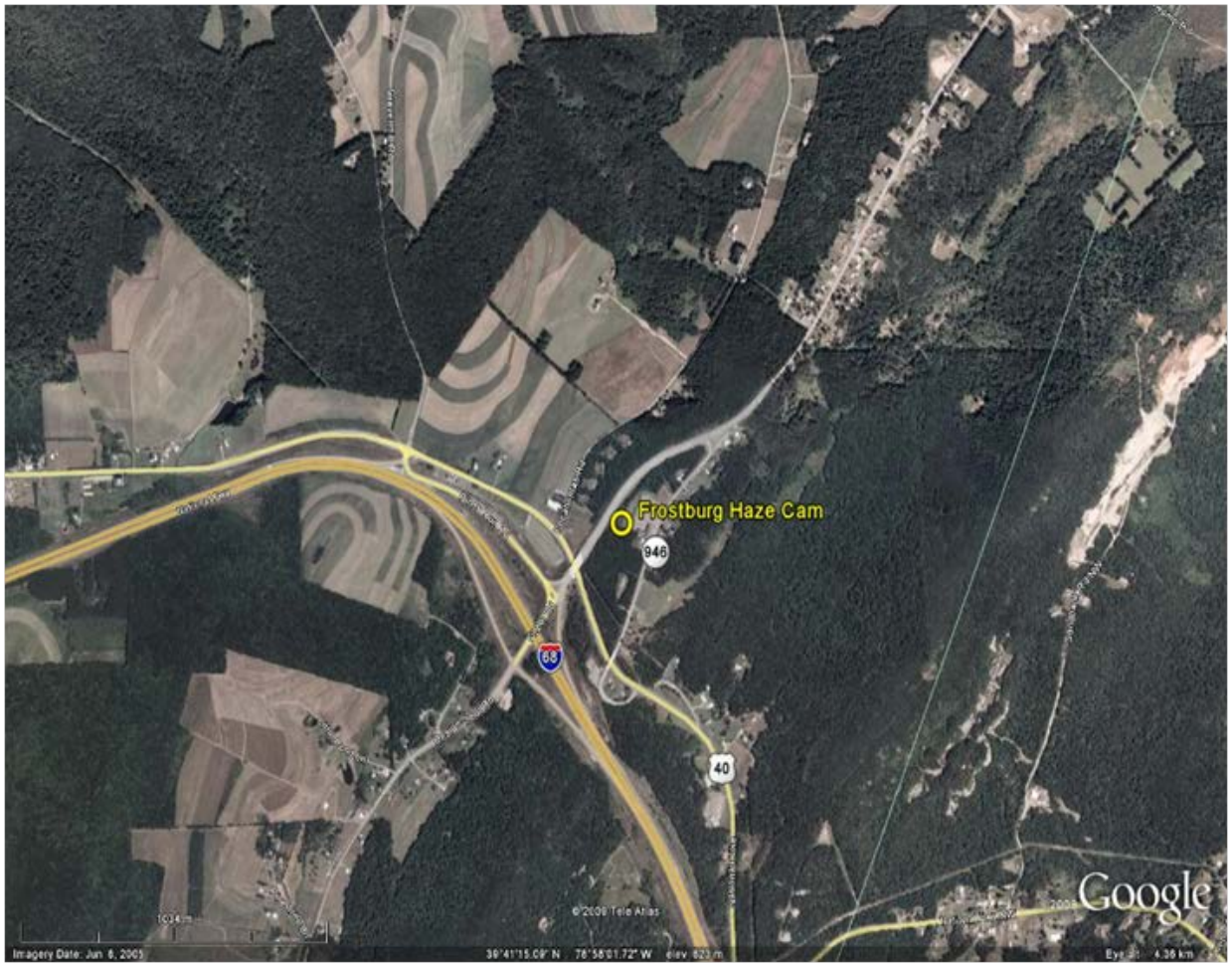

Figure A- 12. Areal map of Frostburg Haze Cam site in Garrett County, MD. Frostburg was chosen as a Haze Cam site for the purpose of providing public notification of visibility in a rural setting. The location provides a view of the Piney Run air monitoring station.

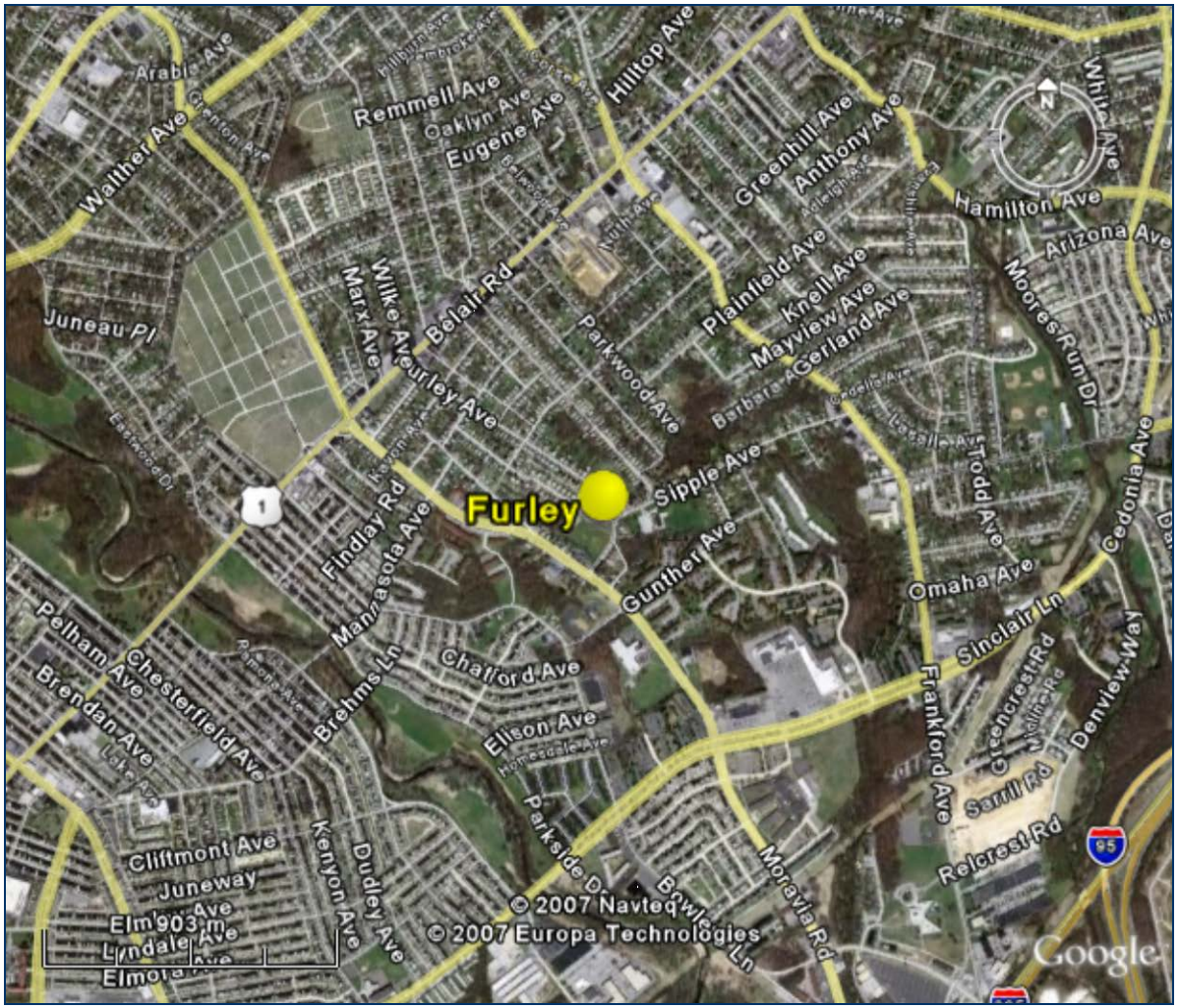

Figure A- 13. Areal map of Furley air monitoring site in Baltimore City, MD. Furley was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at the neighborhood measurement scale in an urban, city center setting. The Furley site is located within one of the cafeterias of Furley Elementary school (which is a pretty big school if you ever get lost in the hallways). The instruments are located in a cabinet (kind of like a rack) in the back left corner of the cafeteria.

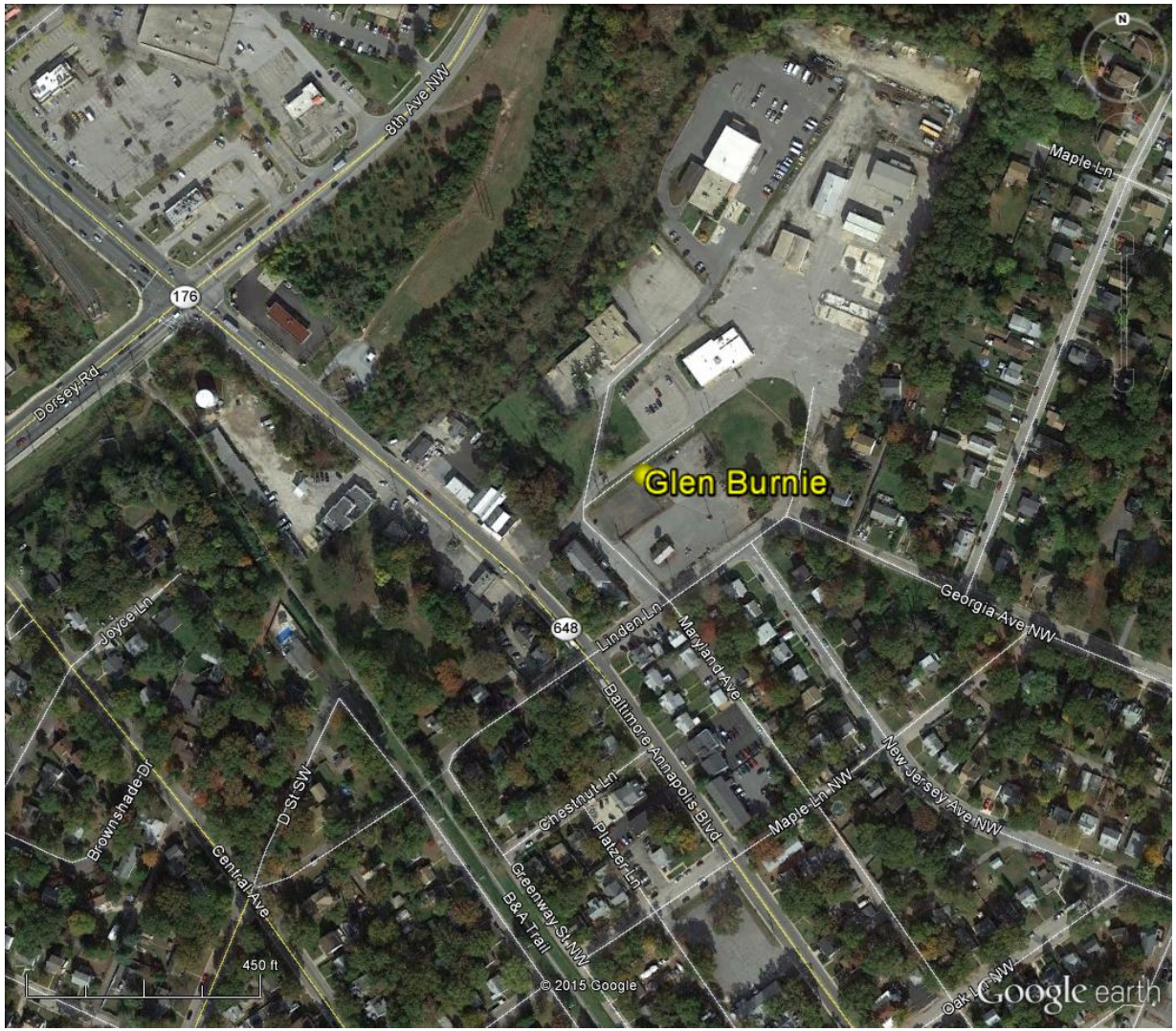

Figure A- 14. Areal map of Glen Burnie air monitoring site in Anne Arundel County, MD. Glen Burnie was chosen as a PM and seasonal ozone monitoring site because of the potential to measure the population exposure of PM_{10} and O_3 at the neighborhood scale in a suburban setting.

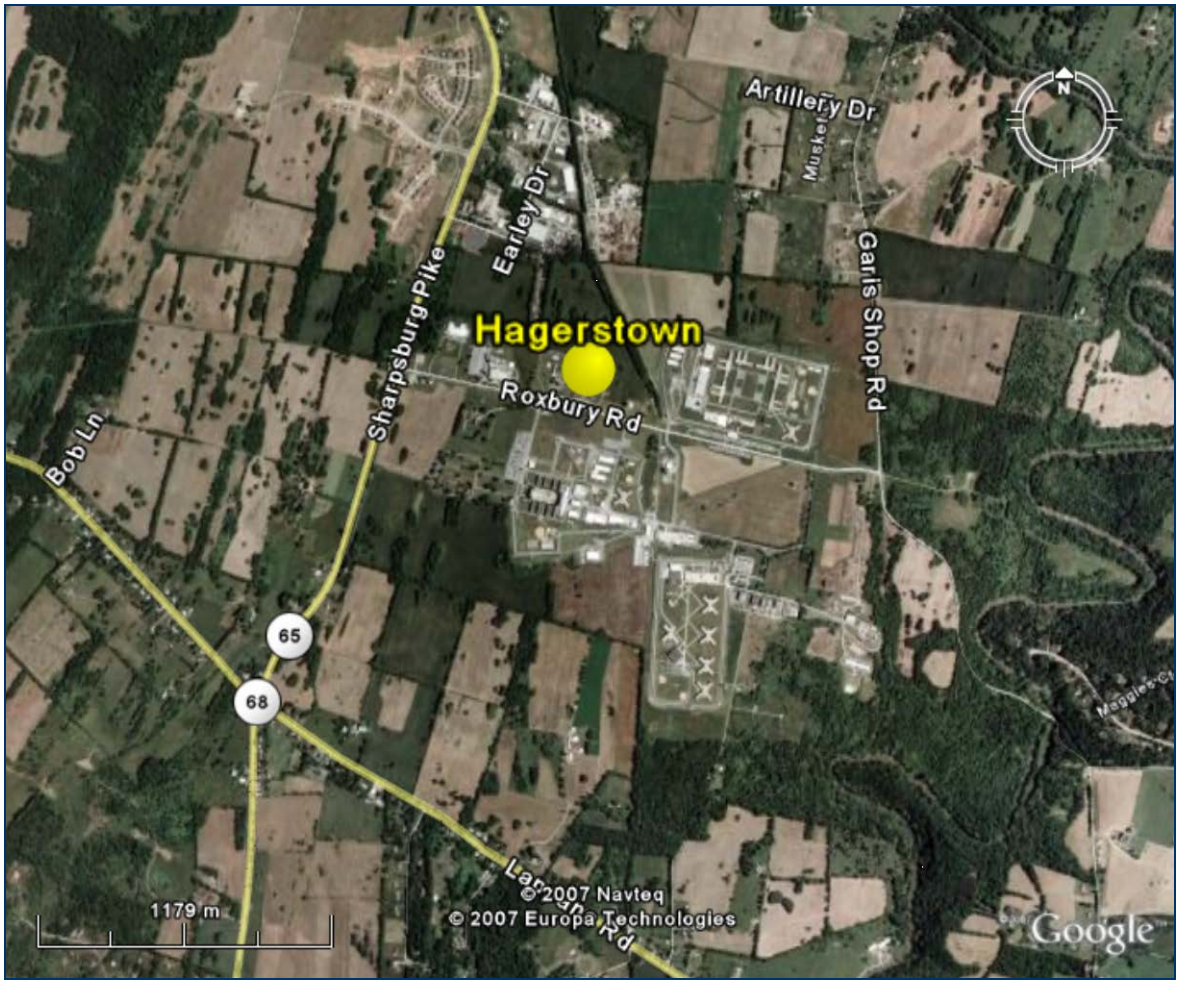

Figure A- 15. Areal map of Hagerstown air monitoring site in Washington County, MD. Hagerstown was chosen as a seasonal ozone monitoring site because of the potential to measure the highest concentration and population exposure of ozone at the urban scale. It was chosen as a $PM_{2.5}$ monitoring site because of the potential to measure population exposure to $PM_{2.5}$ at the urban scale. It is located in a rural setting. The Hagerstown trailer sits right by a blue water tower on rolling hills a few hundred feet from a correctional facility. You can see two parking lots - one lot that is passed to get to the trailer and one lot that is across the road from the trailer.

Figure A- 16. Areal map of the Horn Point air monitoring site in Dorchester County, MD. Horn Point, located in a rural setting, was chosen as a site for monitoring CO population exposure at the regional scale; NO population exposure at the regional scale; NO_y-NO population exposure at the regional scale; year-round ozone population exposure at the regional scale; $PM_{2.5}$ (hourly) population exposure at the regional scale; Reactive oxides of Nitrogen (NO_y) population exposure at the regional scale; and SO_2 population exposure at the regional scale. The site is located on the lower eastern shore and sits in an open field with pine trees in the distance surrounding the site. The University of Maryland Center for Environmental and Estuarine Studies is next door to the site.

Figure A- 17. Areal map of the Howard County Near Road air monitoring site in Howard County, MD. HCNR, located in a suburban setting, was chosen as a site for monitoring air quality near roads, including air toxics, CO, NO, NO2, NOx, and PM2.5 source-oriented/highest concentration at the microscale. To the north of the Howard County Near Road monitoring site is a small grassy area with a few trees along with a gravel access road and the Rest Stop just beyond. The Rest Stop accommodates many tractor trailers and cars. To the east the grassy patch continues and acts as storm water management for the parking area and just beyond is the on-ramp to access the parking area. To the south just behind the trailer is interstate 95 spanning 8 lanes with a good size grass median. On the far side of the road is the rest stop for north bound traffic. To the west the interstate continues and is joined by the exit ramp from the rest area. There are trees and woods on the far side of the exit ramp.

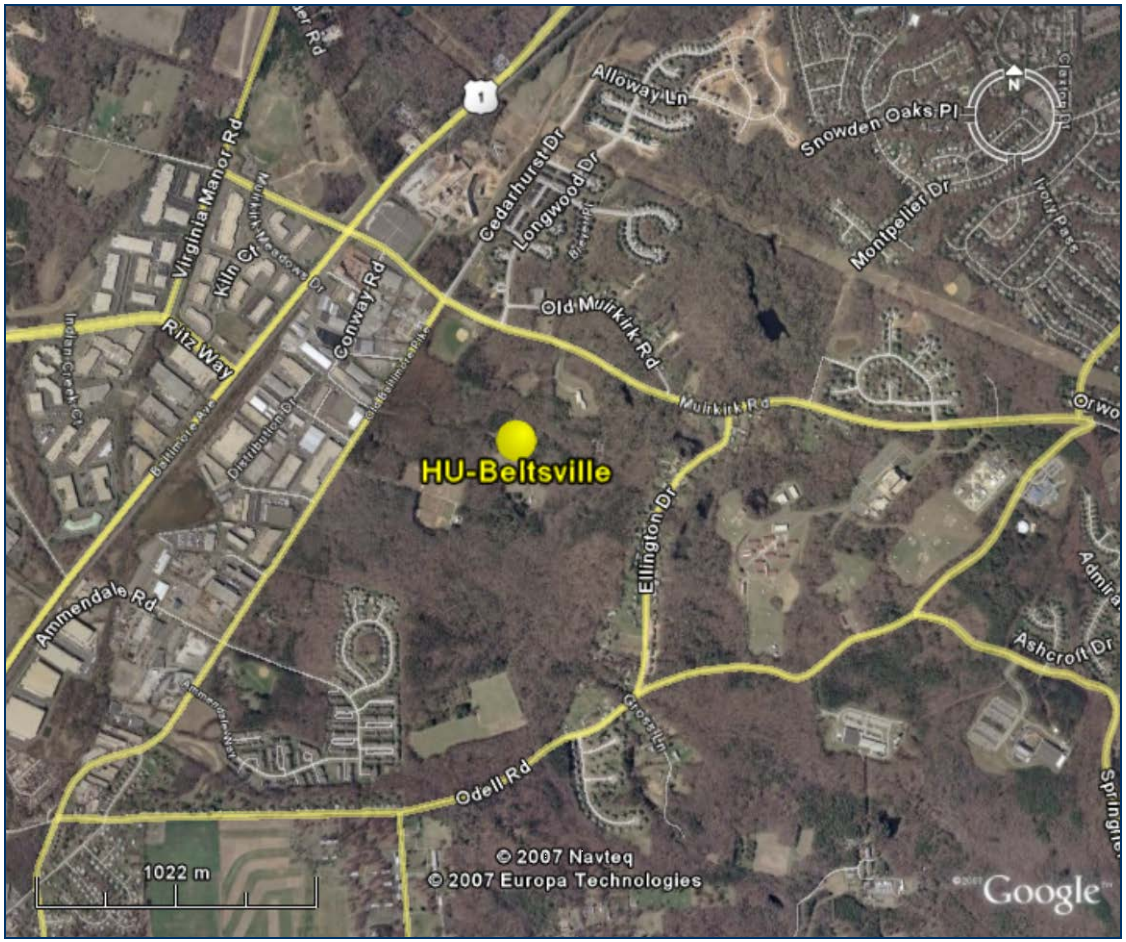

Figure A- 18. Areal map of HU-Beltsville air monitoring site in Prince George's County, MD. HU-Beltsville, an NCore station located in a suburban setting, was chosen as a site for monitoring air toxics population exposure at the neighborhood scale; CO, NO, NO_2, NO_y-NO, NO_x, and NO_y general/background at the urban scale; year-round ozone highest concentration and population exposure at the urban scale; PM population exposure at the urban scale for $PM_{2.5}$ and neighborhood scale for PM_{10}; SO_2 general/background at the urban scale; and Type 3 PAMS VOC's upwind/background at the urban scale. The site is in an open yard surrounded by trees.

Figure A- 19. Areal map of Millington air monitoring site in Kent County, MD. Millington was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at the urban scale. It was chosen as a $PM_{2.5}$ monitoring site because it has the potential to measure population exposure to $PM_{2.5}$ at the neighborhood scale. It is located in a rural setting. The site is located on the upper eastern shore in a wildlife management area and is adjacent to fields and woods. A few hundred yards away is a small use airport.

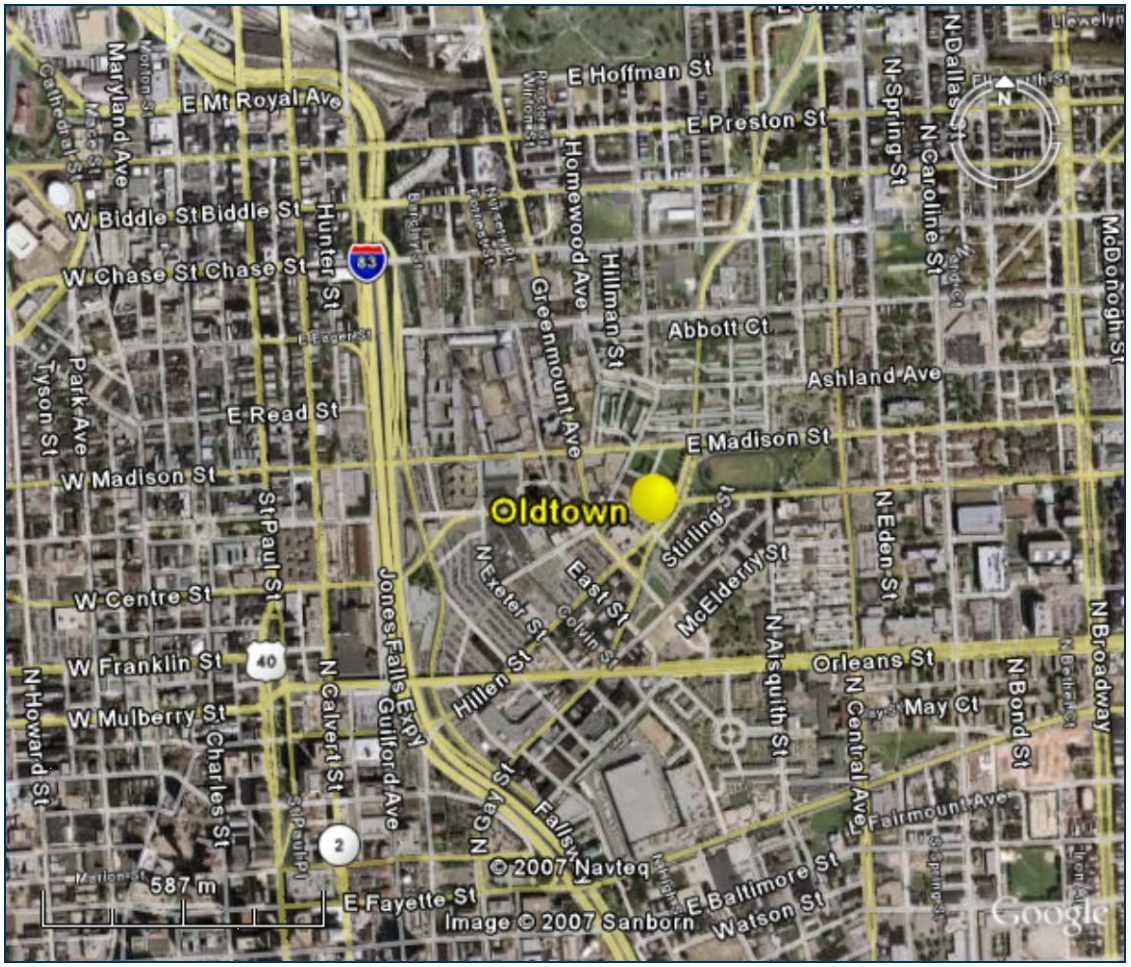

Figure A- 20. Areal map of Oldtown air monitoring site in Baltimore City, MD. Oldtown, located in an urban and center city setting, was chosen as a site for monitoring air toxics, CO, NO, NO2, NOx, and PM2.5 highest concentration at the middle scale, and air toxics population exposure at the neighborhood scale. The Oldtown trailer sits in a parking lot off to the side of a very busy four-way intersection right by a bus stop where buses stop often. There is also a fire station within a couple hundred feet of the trailer and nearby sidewalks by the bus stop and along the street next to the trailer.

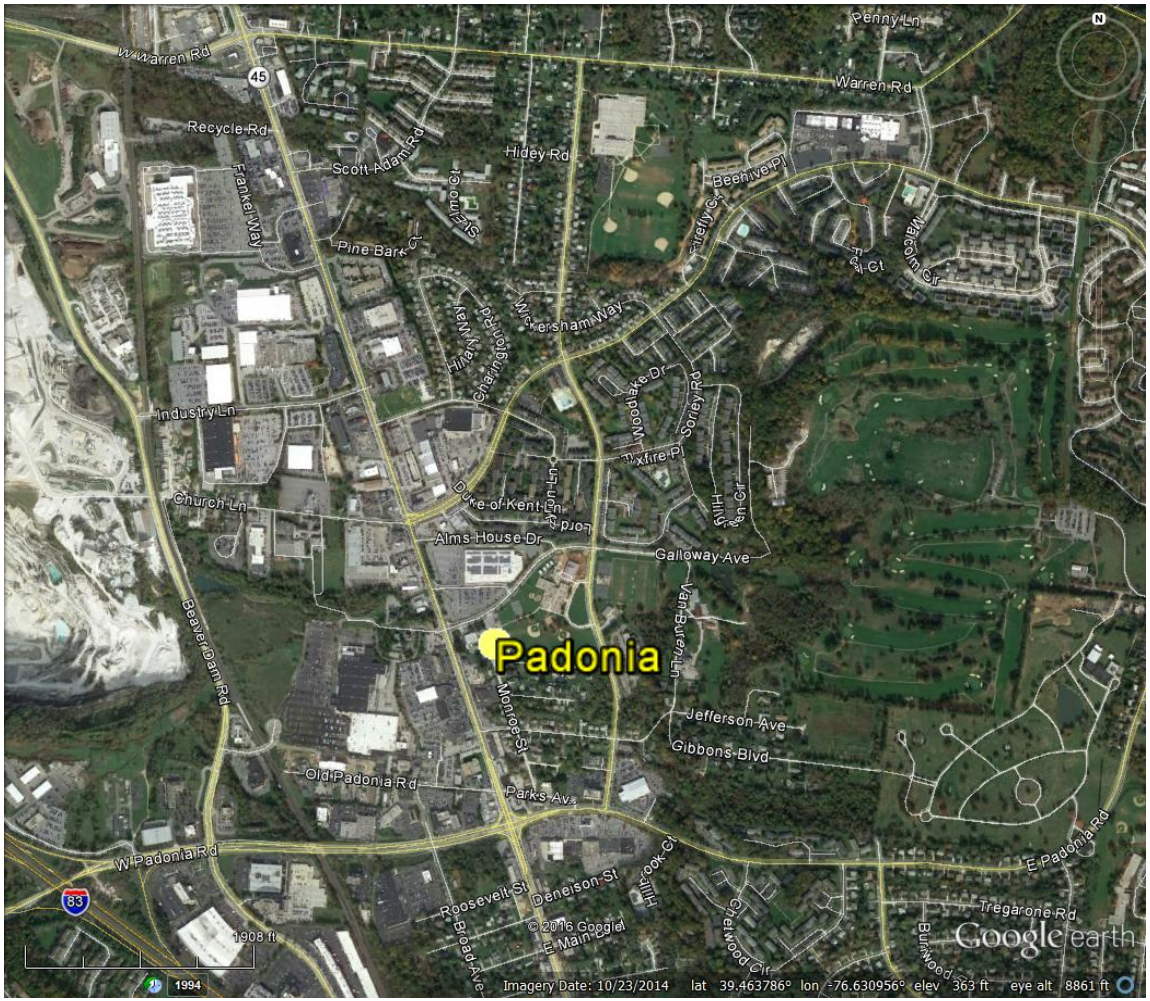

Figure A- 21. Areal map of new Padonia air monitoring site in Baltimore County, MD. Padonia was chosen as a seasonal ozone and $PM_{2.5}$ monitoring site because of the potential to measure the population exposure of ozone and $PM_{2.5}$ at the neighborhood scale. It is located in a suburban setting. The Padonia trailer was on an elementary school grounds near a small parking lot until March 1, 2017, when MDE was forced by the school to remove it due to construction activities. The station was restarted at the new location on December 15, 2017. There is a gravel pit, a landfill, and a spice company all off Beaver Dam Road, to the west and slightly north of the site.

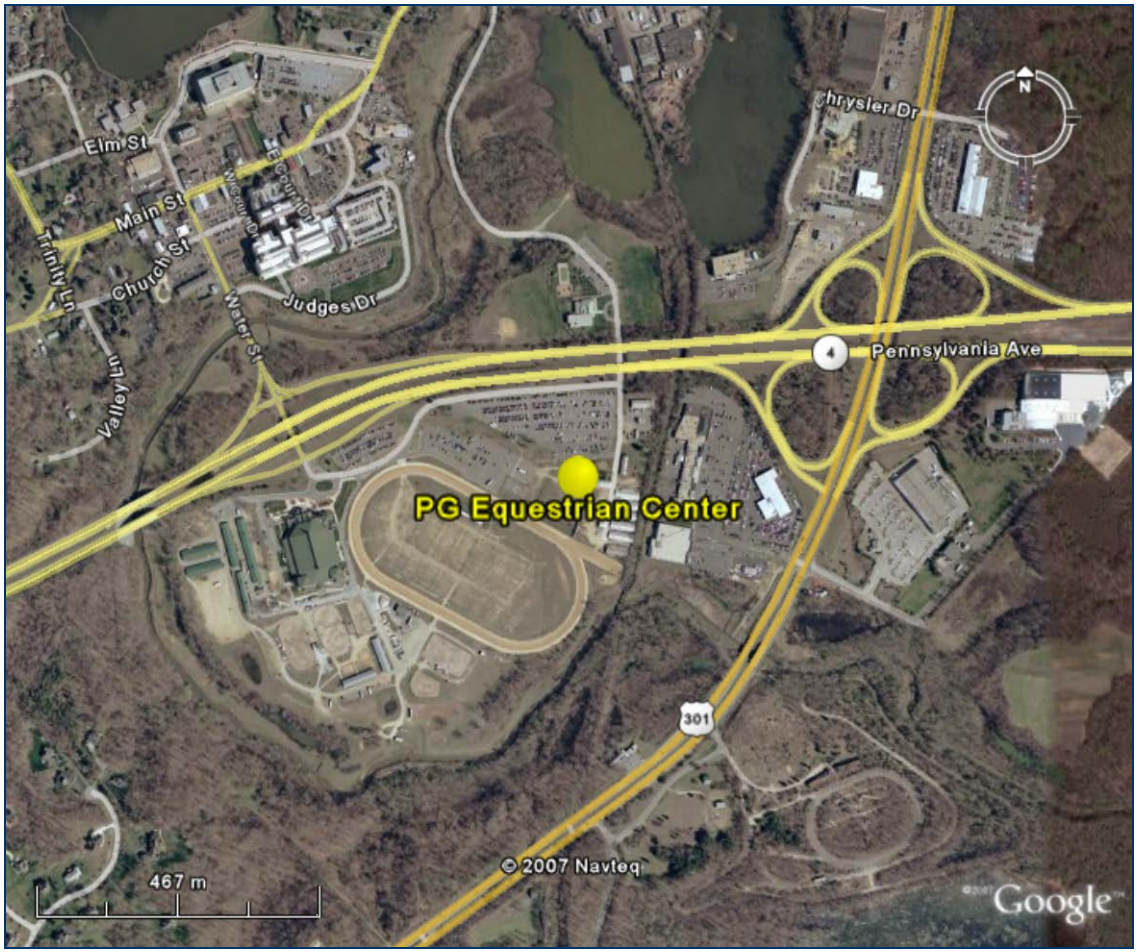

Figure A- 22. Areal map of PG Equestrian Center air monitoring site in Prince George's County, MD. PG Equestrian Center was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at the urban scale. It was chosen as a $PM_{2.5}$ monitoring site because it has the potential to measure population exposure to $PM_{2.5}$ at the neighborhood scale. It is located in a rural setting. The site sits in the parking lot of the Ranger office. Surrounding the site are parking lots and a horse track.

Figure A- 23. Areal map of Piney Run air monitoring site in Garrett County, MD. Piney Run, an NCore station located in a rural setting, is located on a mountain top at an elevation of 777 meters (2,548 feet). It was chosen as a site for monitoring year-round ozone, CO, NO, NO_2, NO_y-NO, NO_x, NO_y, SO_2, and $PM_{2.5}$ regional transport at the regional scale.

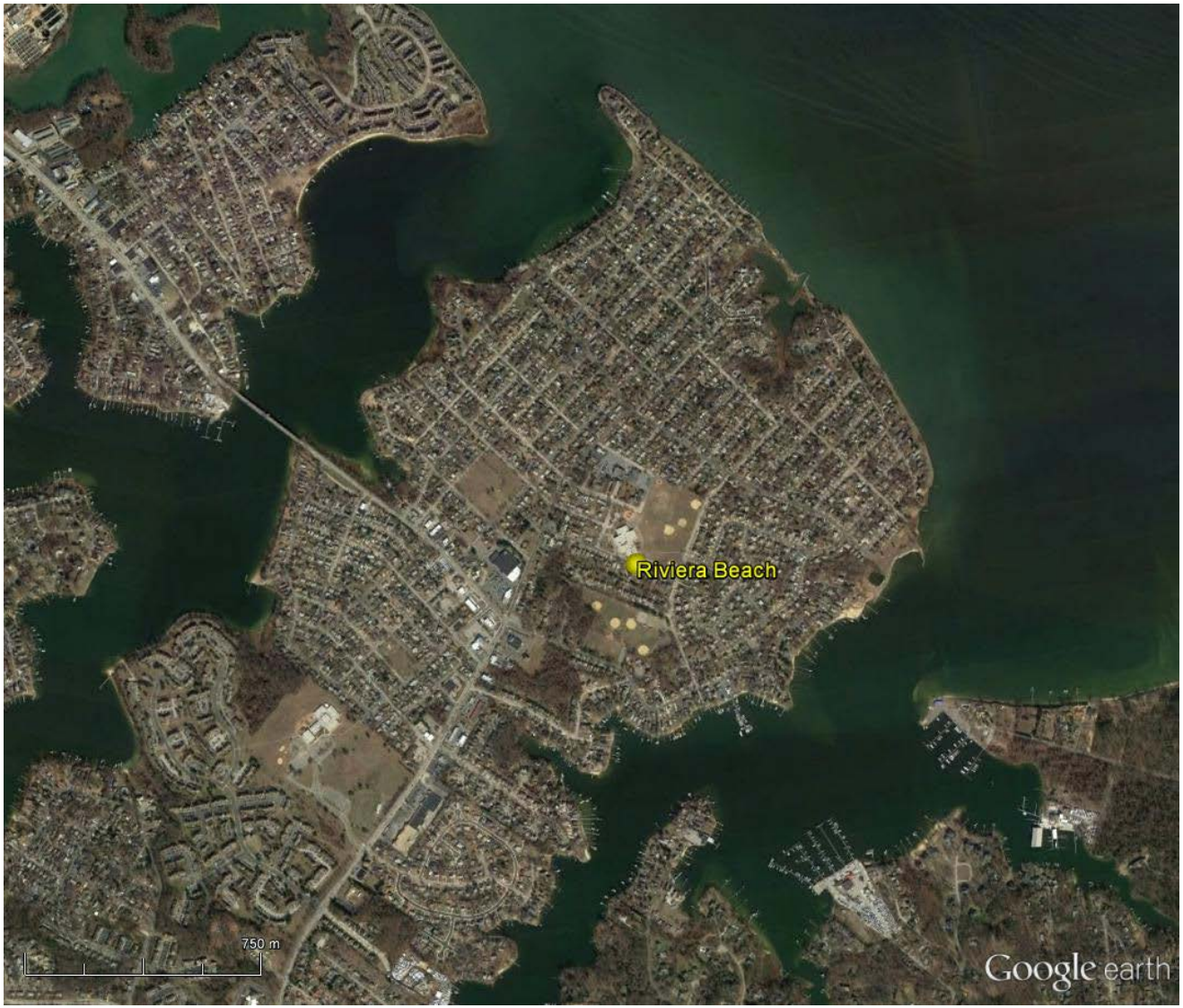

Figure A- 24. Areal map of Riviera Beach air monitoring site in Anne Arundel County, MD. Riviera Beach, a Special Purpose Monitor located in a suburban setting, is situated on the premises of Riviera Beach Elementary School. It was chosen as a site for monitoring SO_2 highest concentration at the neighborhood scale.

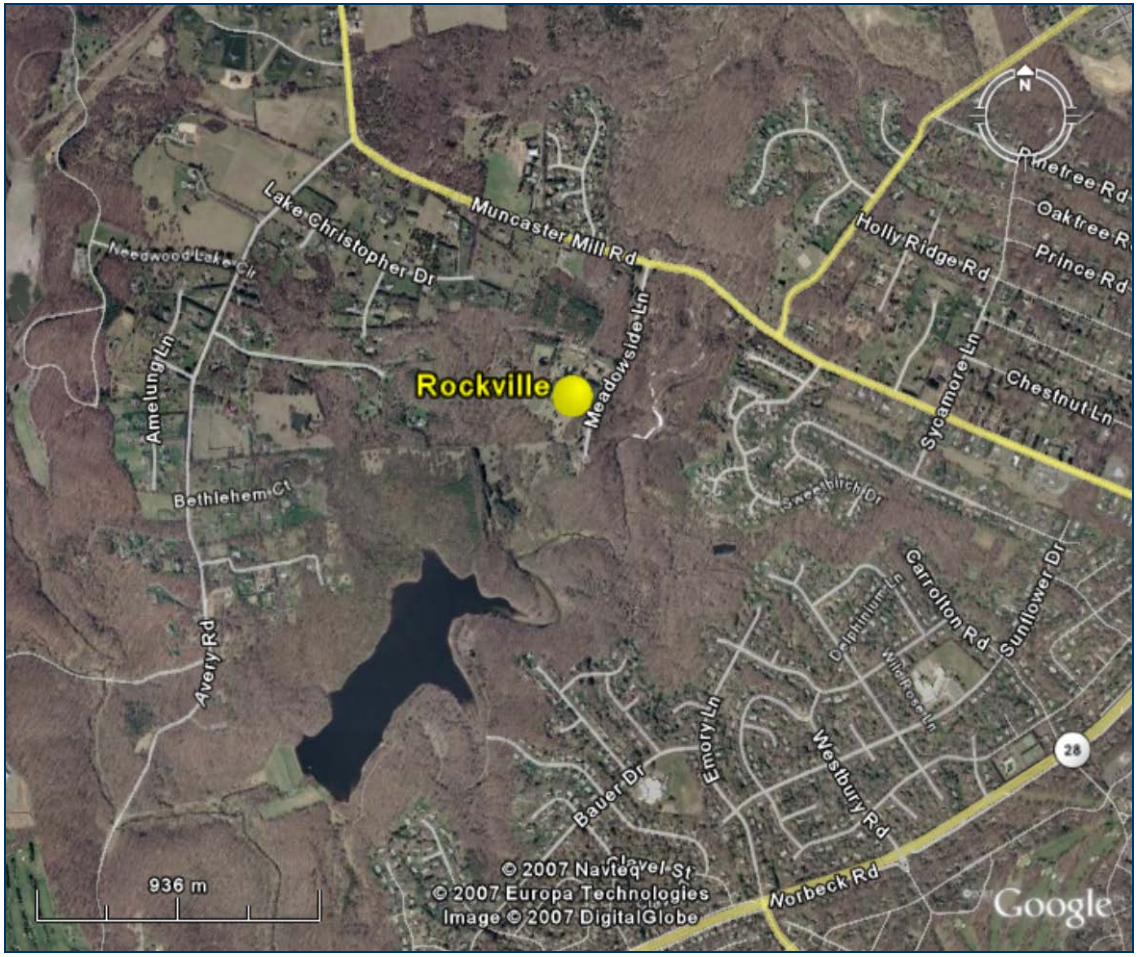

Figure A- 25. Areal map of Rockville air monitoring site in Montgomery County, MD. Rockville was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at the urban measurement scale. It was chosen as a $PM_{2.5}$ monitoring site because it has the potential to measure population exposure to PM at the neighborhood scale. It is located in a rural setting. The station will be moved about 37 feet (11 meters) to the south by the end of June. Five trees were removed to prevent any obstruction of the inlet prior to the beginning of the 2018 Ozone Season, in accordance with 40 CFR Part 58, Appendix E siting criteria.

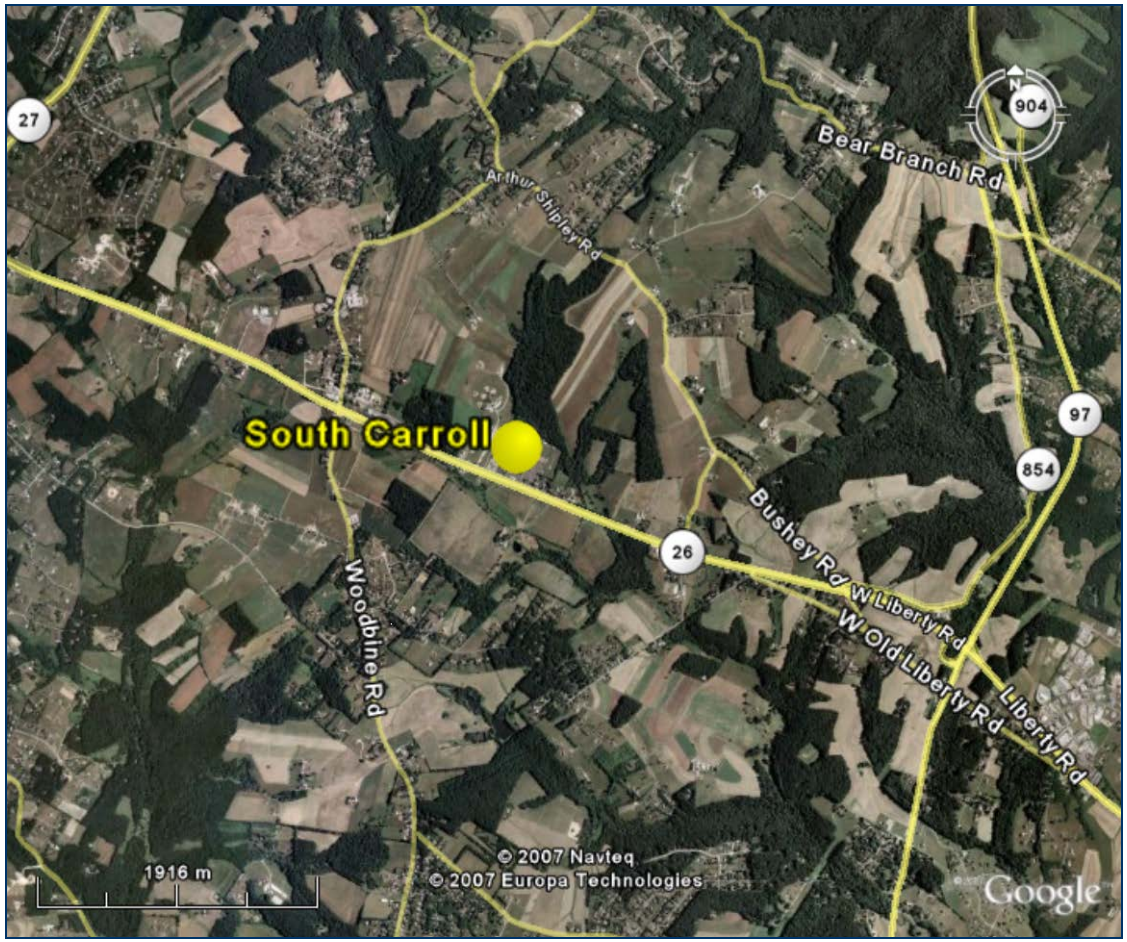

Figure A- 26. Areal map of South Carroll air monitoring site in Carroll County, MD. South Carroll was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at the urban measurement scale. It is located in a rural setting. The South Carroll trailer sits a few yards from South Carroll High School on the grounds of the school. There is a fence right alongside the trailer as well as ball playing fields within sight of the trailer.

Figure A- 27. Areal map of Southern Maryland air monitoring site in Charles County, MD. Southern Maryland was chosen as a seasonal ozone monitoring site because of the potential to measure the general background ozone at the regional measurement scale. It is located in a rural setting. This site is our most southern site and is located in the yard of a pre-release prison surrounded by fields and woods.

Figure A- 28. Areal map of Verso Luke Mill SO_2 monitoring sites in Allegany Co., MD and Mineral Co., WV. The three Verso Luke Mill stations, Moran, Horse Rock, and Bean, are being operated by Verso Luke Mill, in support of the SO_2 DRR.

MARYLAND

DEPARTMENT OF THE ENVIRONMENT

APPENDIX B

EPA Approval Letter (NOV. 17, 2017) for the 2018 Air Monitoring Annual Network Plan

Prepared for:
U.S. Environmental Protection Agency

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

June 21, 2018

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard | Baltimore, MD 21230 | www.mde.maryland.gov
410-537-3000 | 800-633-6101 | TTY Users: 800-735-2258
Lawrence J. Hogan, Jr., *Governor* | Boyd K. Rutherford, *Lt. Governor*
Ben Grumbles, *Secretary*

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

NOV 17 2017

The Honorable Benjamin H. Grumbles, Secretary
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, Maryland 21230

Dear Secretary Grumbles: BEN

By letter and enclosures dated June 20, 2017, the Maryland Department of Environmental (MDE) submitted to the U. S. Environmental Protection Agency (EPA) an annual ambient air monitoring network plan in accordance with the regulatory requirements of 40 CFR Part 58 - Standards for Ambient Air Quality Surveillance. Based on our review, EPA hereby approves MDE's June 29, 2017 annual ambient air monitoring network plan on the basis that the plan meets the requirements of 40 CFR Part 58.10. In addition, MDE also requested a waiver to relocate the Photochemical Assessment Monitoring Station (PAMS) from Beltsville, MD to Essex, MD. In accordance with 40 CFR Part 58 Appendix D, EPA hereby approves MDE's waiver request to allow the collection of the required PAMS measurements at an alternate location.

Finally, 40 CFR Section 58.11(c) requires any changes to the air monitoring network or design of the following air monitoring systems be approved by the EPA Administrator:

a) Particulate Matter Speciation Trends Network (STN)
b) The National Core Monitoring Network (NCore)

EPA determined that MDE's June 20\, 2017 annual ambient air monitoring network plan does not require approval from the EPA Administrator because there were no changes to any of the air monitoring systems listed above.

If you have any questions, please do not hesitate to contact me or have your staff contact Ms. Kyle Zieba, EPA's Maryland Liaison, at (215) 814-5420. For questions regarding this approval action, your staff may contact Ms. Cristina Fernandez, Director, Air Protection Division, at (215) 814-2178.

Sincerely,

Cosmo Servidio
Regional Administrator