



DEPARTMENT OF THE ENVIRONMENT

## AMBIENT AIR MONITORING NETWORK PLAN for CALENDAR YEAR 2024



Prepared for: U.S. Environmental Protection Agency

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

May 5, 2023



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***On the cover: HU Beltsville monitoring station  
Photo credit – Kenna Ingham, Field Operator***

## ACRONYMS AND DEFINITIONS

|                 |   |
|-----------------|---|
| AADT            | Annual Average Daily Traffic  |
| AQS             | Air Quality System  |
| AQS ID          | 9-digit site identification number in AQS database  |
| ARA             | MDE's Air and Radiation Administration  |
| BAM             | Beta Attenuation [Mass] Monitor-for measuring continuous particulate matter   |
| CAA             | Clean Air Act   |
| CAAA            | Clean Air Act Amendments  |
| CAPS            | Cavity Attenuated Phase Shift (Direct NO <sub>2</sub> method)   |
| 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   |
| DPW             | Department of Public Works (Baltimore City)   |
| EGU             | Electrical Generating Unit  |
| EMP             | Enhanced Monitoring Plan  |
| EPA             | United States Environmental Protection Agency   |
| ERG             | Eastern Research Group, Research Triangle Park, NC (Carbonyls lab)  |
| 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 <sup>-9</sup> meter  |
| µm              | Micrometer, measure of length; 1 µm equals 10 <sup>-6</sup> meter   |
| NO              | Nitrogen Oxide  |
| NO <sub>2</sub> | Nitrogen Dioxide  |
| NO <sub>x</sub> | Oxides of Nitrogen (ozone precursor)  |
| NO <sub>y</sub> | Total Reactive Nitrogen Species (ozone precursor)   |

|                      |   |
|----------------------|---|
| O <sub>3</sub>       | Ozone   |
| OAQPS                | EPA's Office of Air Quality Planning & Standards  |
| PAMS                 | Photochemical Assessment Monitoring Station   |
| Pb                   | Lead  |
| PM <sub>2.5</sub>    | Particulate matter with an aerodynamic diameter less than or equal to 2.5 μm  |
| PM <sub>10</sub>     | Particulate matter with an aerodynamic diameter less than or equal to 10 μm   |
| PM <sub>10-2.5</sub> | 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 <sub>2</sub>      | Sulfur Dioxide  |
| SOP                  | Standard Operating Procedure  |
| SPM                  | Special Purpose Monitor   |
| STN                  | PM <sub>2.5</sub> Speciation Trends Network   |
| TSP                  | Total suspended particulate   |
| 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<sub>3</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), 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 October 26, 2015, EPA promulgated a rule (80 Fed. Reg. 65292) strengthening the primary and secondary 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. On June 4, 2018, EPA promulgated a rule (83 Fed. Reg. 25776) establishing attainment designations for the strengthened 2015 primary and secondary NAAQS for ozone. The following Maryland counties have been designated Marginal Nonattainment: Anne Arundel, Carroll, Harford, Howard, Cecil, Calvert, Charles, Frederick, Montgomery, Prince George's, Baltimore County, and the City of Baltimore. All other Maryland counties have been designated Attainment/Unclassifiable.

On December 16, 2014, EPA approved Maryland's request to re-designate the Baltimore Non-attainment Area to "Attainment" for the 1997 annual PM<sub>2.5</sub> NAAQS. This Area also attains the 2008 PM<sub>2.5</sub> annual standard and continues to attain that standard. The Baltimore Attainment Area includes the following: Anne Arundel, Baltimore, Carroll, Harford, and Howard Counties, and Baltimore City.

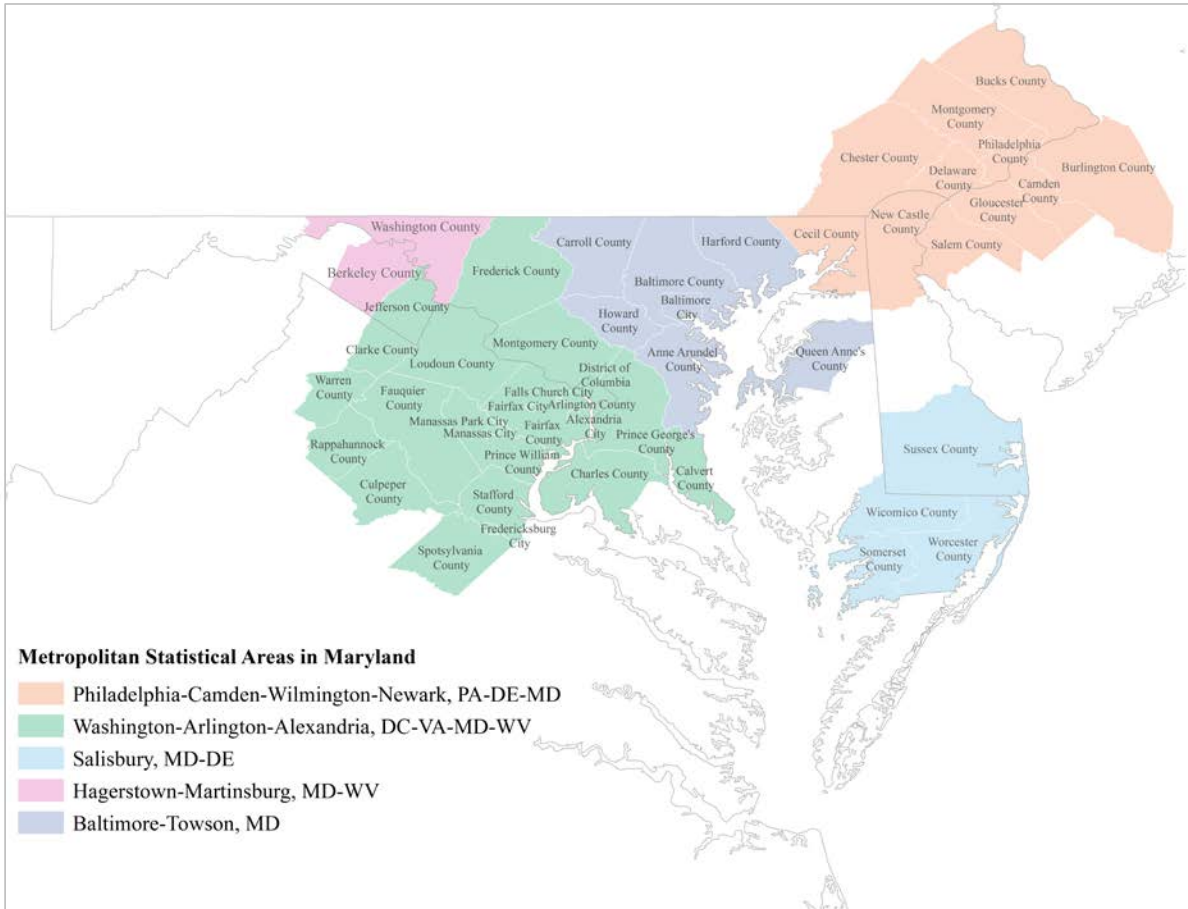
On June 30, 2016, the EPA designated portions of Maryland's Anne Arundel County and Baltimore County as non-attainment for the 2010 1-hour SO<sub>2</sub> NAAQS. The NAA extends approximately 26.8 kilometers (16.6 miles) from the Herbert A. Wagner's Unit 3 stack, which is located at 39.17765N latitude and 76.52752W longitude (see Maryland 2018 Monitoring Network Plan.) This designation was based on modeled, not monitored, SO<sub>2</sub> concentrations.



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: Federal reserve Economic Data, estimates as of May 5, 2021.**

| <b>MSA Name</b>                                    | <b>Population</b> | <b>Maryland Counties in the MSA</b>  |
|--|-------------------|--|
| Baltimore-Towson, MD                               | 2,800,189         | Carroll, Baltimore County, Baltimore City, Harford, Howard, Anne Arundel, Queen Anne's |
| Hagerstown-Martinsburg, MD-WV                      | 291,144           | Washington   |
| Washington-Arlington-Alexandria, DC-VA-MD-WV       | 6,324,629         | Frederick, Montgomery, Prince George's, Charles, Calvert                               |
| Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD | 6,107,906         | Cecil  |
| Salisbury, MD-DE                                   | 423,481           | Somerset, Wicomico, Worcester  |



**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<sub>x</sub>), 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. The final rule streamlines and modernizes the PAMS network to use monitoring resources most efficiently. States were required to comply with revised PAMS monitoring by June 1, 2021. There are no ambient standards for any of the VOC's.

Section 112 of the CAA currently identifies 188 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 plan was posted to MDE's website from Feb 28 through March 30, 2023. Please see Appendix C for screen shots showing that the Plan was posted for comment. No comments were received.

MDE is also required to certify the air quality monitoring data by May 1 for the previous calendar year's data. MDE's 2021 air quality monitoring data were certified on March 16, 2022. On December 6, 2022, MDE re-certified 2021 data after minor changes were made following a Technical Systems Audit by EPA Region III in September 2022. MDE certified 2022 data in the AQS database on April 26, 2023, and was signed by the Air and Radiation Administration Director on May 11, 2022.

## **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 that includes 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<sub>2.5</sub> 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 23 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). This total includes two ‘Haze Cams’, cameras exclusively used to monitor visibility, and one IMPROVE network monitor. The 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<sub>2.5</sub>, PM<sub>10</sub>, PM<sub>10-2.5</sub>, and speciated PM<sub>2.5</sub>.

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. Pollutant-specific network maps are included in each section. Additional topographic and area maps and site descriptions are provided in Appendix A.

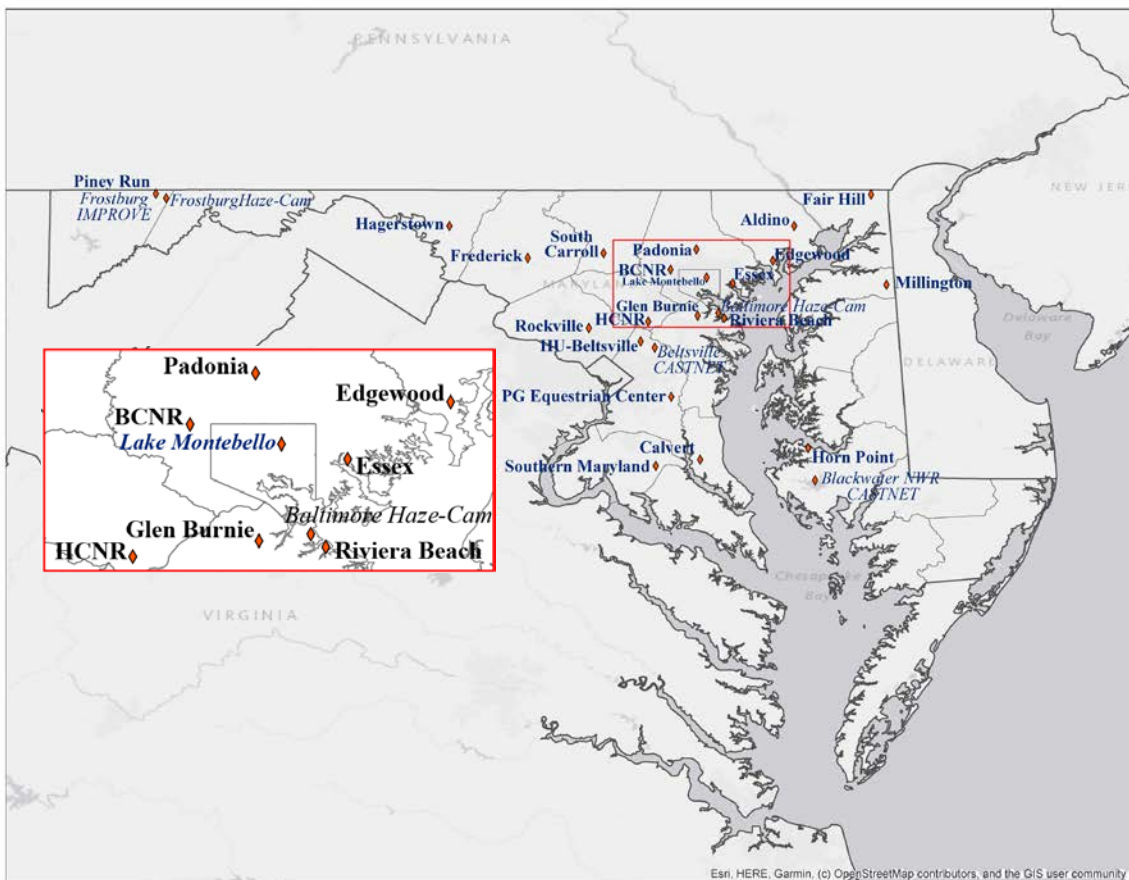


Figure 3-1 Maryland's current air monitoring network map

In addition to the ambient air monitoring stations operated and quality assured 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<sub>x</sub> Budget Trading Program, and the Clean Air Interstate Rule (CAIR). CASTNET measures ambient rural ozone concentrations. Results from CASTNET are used to report on geographic patterns and temporal trends in acidic pollutants, deposition, and regional ozone concentrations.

Maryland's 2023 Annual Network Plan was approved by EPA on December 14, 2022 (see Appendix B.)

The 2024 Network Plan does not propose any changes but does describe one minor station relocation that is the result of forces beyond our control:

- Anne Arundel County, Maryland, which owns the Glen Burnie site location, is selling the property to developers and therefore is requiring us to move. A new site location, also located in Anne Arundel County and which will be referred to as *Brooklyn Park*, has been identified and received preliminary approval from EPA Region III. Detailed information is contained in Tables 3-1 and 3-2; in the sections on O<sub>3</sub> and PM<sub>10</sub>; and in Appendix A Site Maps.

### **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<sub>2.5</sub> 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 (2017) | Distance from Nearest Road (m) | CBSA/MSA                       |
|--------------------------------------|--|------------------------------|----------|-----------------------------|------------------|-----------------------------|----------------------|--------------------------------|--------------------------------|
| Aldino, 240259001                    | 3538 Aldino Rd.  | Churchville, Harford         | 21028    | 39.563333, -76.203889       | Suburban         | Aldino Rd.                  | 1,411                | 156                            | Baltimore-Towson               |
| Baltimore County Near Road 240050009 | 4380 Old Court Rd.                                       | Pikesville, Baltimore County | 21208    | 39.371679, -76.746814       | Suburban         | I-695/I-795                 | 190,812              | 20                             | Baltimore-Towson               |
| Baltimore Haze Cam                   | Raven Power, 1000 Brandon Shores Dr.                     | Curtis Bay, 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           | Rural            | *                           | *                    | *                              | Wash-Arlington-Alexandria      |
| Blackwater NWR CASTNET, 240199991    | Blackwater National Wildlife Refuge                      | Cambridge, Dorchester        | 21613    | 38.445, -76.1114            | Rural            | *                           | *                    | *                              | Cambridge (Micro)              |
| Brooklyn Park, 240031004             | 5757 Belle Grove Road                                    | Brooklyn, Anne Arundel       | 21225    | 39.2177194, -76.6360972     | Suburban         | Belle Grove Road            | 13,710               | 800                            | Baltimore-Towson               |
| Calvert, 240090011                   | 350 Stafford Rd.   | Barstow, Calvert             | 20610    | 38.536722, -76.617194       | Rural            | Hallowing Pt. Rd. – Rt. 231 | 20,690               | 789                            | Wash-Arlington-Alexandria      |
| Edgewood, 240251001                  | Edgewood Chemical Biological Center (APG), Waehli Rd.    | Edgewood, Harford            | 21010    | 39.410191, -76.296946       | Rural            | Wise Rd.                    | 4,532                | 210                            | Baltimore-Towson               |
| Essex, 240053001                     | 600 Dorsey Ave.  | Essex, Baltimore County      | 21221    | 39.310833, -76.474444       | Suburban         | Woodward Dr.                | 2,190                | 16                             | Baltimore-Towson               |
| Fair Hill, 240150003                 | Fair Hill Natural Resource Mgmt. Area 4493 Telegraph Rd. | Elkton, Cecil                | 21921    | 39.702982, -75.864771       | Rural            | Telegraph Rd. (RT 273)      | 8,173                | 24                             | Philadelphia-Camden-Wilmington |
| Frederick Airport, 240210037         | 180 E. Treatment Plant Rd.                               | Frederick, Frederick         | 21701    | 39.422760, -77.375190       | Suburban         | Monocacy Blvd.              | 11,923               | 809                            | 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            | Rt. 40 National Pike        | 2,054                | 2,064                          | NA                             |
| Hagerstown, 240430009                | 18530 Roxbury Rd.  | Hagerstown, Washington       | 21740    | 39.564178, -77.720244       | Rural            | Sharpsburg Pike             | 9,161                | 910                            | Hagerstown-Martinsburg         |

| Site Name, AQS ID             | Street Address                                   | City, County                       | Zip Code | Latitude, Longitude (NAD83) | Location Setting | Nearest Road               | Traffic Count (2017) | Distance from Nearest Road (m) | CBSA/MSA                  |
|-------------------------------|--|------------------------------------|----------|-----------------------------|------------------|----------------------------|----------------------|--------------------------------|---------------------------|
| Horn Point, 240190004         | UMd Horn Point Lab<br>2020 Horns Point Rd        | Cambridge,<br>Dorchester           | 21613    | 38.587525,<br>-76.141006    | Rural            | Hudson Road                | 3,990                | 1,185                          | Cambridge (Micro)         |
| Howard Co. Near Rd, 240270006 | I-95 S Welcome Center                            | Laurel,<br>Howard                  | 20723    | 39.143130<br>-76.846110     | Suburban         | I-95                       | 203,912              | 16                             | Baltimore-Towson          |
| HU-Beltsville, 240330030      | Howard Univ., Beltsville Lab., 7501 Muirkirk Rd. | Beltsville,<br>Prince George's     | 20705    | 39.055277,<br>-76.878333    | Suburban         | Muirkirk Road              | 10,820               | 397                            | Wash-Arlington-Alexandria |
| Lake Montebello, 245105253    | Baltimore City DPW<br>3900 Hillen Road           | Baltimore City                     | 21218    | 39.33746,<br>-76.58905      | Urban            | Hillen Road                | 26,450               | 46                             | Baltimore-Towson          |
| Millington, 240290002         | Millington WMA- 33626<br>Massey-MD Line Rd.      | Massey,<br>Kent                    | 21650    | 39.305021,<br>-75.797317    | Rural            | RT 330, Massey-DE Line Rd. | 1,065                | 121                            | NA                        |
| Padonia, 240051007            | 103 Galloway Ave                                 | Cockeysville,<br>Baltimore County  | 21030    | 39.460478<br>-76.633534     | Suburban         | York Road                  | 36401                | 94                             | Baltimore-Towson          |
| PG Equestrian Ctr, 240338003  | 14900 Pennsylvania Ave.                          | Upper Marlboro,<br>Prince George's | 20772    | 38.811940,<br>-76.744170    | Rural            | Pennsylvania Ave.          | 54,981               | 170                            | Wash-Arlington-Alexandria |
| Piney Run, 240230002          | Frostburg Reservoir,<br>Finzel                   | Finzel, Garrett                    | 21532    | 39.705950,<br>-79.012000    | Rural            | Rt. 40 National Pike       | 2,054                | 2,064                          | NA                        |
| Rockville, 240313001          | LE Smith Env Educ Ctr,<br>5110 Meadowside Ln.    | Rockville,<br>Montgomery           | 20855    | 39.114313,<br>-77.106876    | Rural            | Muncaster Mill Road        | 17,572               | 499                            | Wash-Arlington-Alexandria |
| South Carroll, 240130001      | South Carroll H.S. 1300<br>W Old Liberty Rd.     | Sykesville,<br>Carroll             | 21784    | 39.444294,<br>-77.042252    | Rural            | W. Liberty Rd.             | 10,561               | 227                            | Baltimore-Towson          |
| Southern Maryland, 240170010  | 14320 Oaks Rd.                                   | Charlotte Hall,<br>Charles         | 20622    | 38.508547,<br>-76.811864    | Rural            | Burnt Store Rd.            | 2,841                | 2,167                          | Wash-Arlington-Alexandria |

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 (m) | Measurement Scale           | Monitor Objective            | Monitor Network/Type | Schedule |
|--------------------------------------|--|----------------|-------------|------------------|-----------------------------|------------------------------|----------------------|----------|
| Aldino, 240259001                    | Ozone (O <sub>3</sub> )                        | 04/20/1990     | 047         | 4.4              | Urban                       | Highest Concentration        | SLAMS                | H, S     |
| Baltimore County Near Road 240050009 | Direct NO <sub>2</sub> (CAPS)                  | 01/01/2019     | 212         | 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 <sub>3</sub> )                        | 04/01/2011     | 047         | 10               | Regional                    | Regional Transport           | CASTNET              | H        |
| Blackwater NWR CASTNET, 240199991    | Ozone (O <sub>3</sub> )                        | 01/01/2011     | 047         | 10               | Regional                    | Regional Transport           | CASTNET              | H        |
| Brooklyn Park, 240031004             | Ozone (O <sub>3</sub> )                        | 2023           | 087         | 5                | Neighborhood                | Population Exposure          | SLAMS                | H, S     |
|                                      | PM <sub>10</sub> - STP                         | 2023           | 127         | 4.7              | Neighborhood                | Population Exposure          | SLAMS                | 6        |
|                                      | PM <sub>10</sub> - STP                         | 2023           | 127         | 4.7              | Neighborhood                | Population Exposure          | QA-Collocated        | 6        |
| Calvert, 240090011                   | Ozone (O <sub>3</sub> )                        | 04/01/2005     | 087         | 4.6              | Urban                       | Population Exposure          | SLAMS                | H, S     |
| Edgewood, 240251001                  | Ozone (O <sub>3</sub> )                        | 03/10/1980     | 047         | 4.5              | Urban                       | Highest Concentration        | SLAMS                | H, S     |
|                                      | PM <sub>2.5</sub> - 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 NO <sub>2</sub> (CAPS)                  | 08/10/2017     | 212         | 4.4              | Neighborhood                | Population Exposure          | SLAMS                | H        |
|                                      | Nitric Oxide (NO)                              | 11/16/2017     | 699         | 10               | Neighborhood                | Maximum Precursor            | PAMS                 | H        |
|                                      | Reactive Oxides of Nitrogen (NO <sub>y</sub> ) | 11/16/2017     | 699         | 10               | Neighborhood                | Maximum Precursor            | PAMS                 | H        |
|                                      | NO <sub>y</sub> - NO                           | 11/16/2017     | 699         | 4.4              | Neighborhood                | Maximum Precursor            | PAMS                 | H        |
|                                      | Ozone (O <sub>3</sub> )                        | 01/01/1972     | 087         | 4.4              | Neighborhood                | Highest Conc, Pop. Expos     | SLAMS                | H        |
|                                      | PM <sub>2.5</sub> - Local Conditions           | 01/01/1999     | 145         | 5.1              | Neighborhood                | Population Exposure          | SLAMS                | 6        |
|                                      | PM <sub>2.5</sub> - Speciation                 | 07/08/2004     | 812         | 5.0              | Neighborhood                | Population Exposure          | Trends Speciation    | 3        |
|                                      | Sulfur Dioxide (SO <sub>2</sub> )              | 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 | PAMS / SLAMS                 | 6; S,H,3             |          |

| Site Name & AQS ID                       | Parameter                             | Start Date | Method Code | Probe Height (m) | Measurement Scale | Monitor Objective                 | Monitor Network/Type | Schedule |
|--|---------------------------------------|------------|-------------|------------------|-------------------|-----------------------------------|----------------------|----------|
| Fair Hill,<br>240150003                  | Ozone (O <sub>3</sub> )               | 01/01/1992 | 087         | 4.5              | Urban             | Regional Transport                | SLAMS                | H, S     |
|  | PM <sub>2.5</sub> - Hourly            | 07/01/2010 | 170         | 4.7              | Neighborhood      | Population Exposure               | SLAMS                | H        |
| Frederick Airport,<br>240210037          | Ozone (O <sub>3</sub> )               | 07/09/1998 | 087         | 4.6              | Urban             | Population Exposure               | SLAMS                | H, S     |
| Frostburg IMPROVE,<br>240239000          | IMPROVE Parameters                    | 03/01/2004 | NA          | 4.0              | Regional          | Public Notification               | NA                   | 3        |
| Frostburg Haze Cam                       | Visibility                            | 10/01/2005 | NA          | NA               | NA                | Public Notification               | NA                   | NA       |
| Hagerstown,<br>240430009                 | Ozone (O <sub>3</sub> )               | 04/01/1999 | 087         | 4.6              | Urban             | Highest Conc/ Population Exposure | SLAMS                | H, S     |
|  | PM <sub>2.5</sub> - Hourly            | 07/01/2010 | 170         | 5.1              | Urban             | Highest Conc                      | SLAMS                | H        |
| Horn Point,<br>240190004                 | Ozone (O <sub>3</sub> )               | 04/01/2012 | 087         | 4                | Regional          | General/Background                | SLAMS                | H        |
|  | PM <sub>2.5</sub> - Hourly            | 04/01/2012 | 170         | 4                | Regional          | General/Background                | SLAMS                | H        |
|  | Sulfur Dioxide (SO <sub>2</sub> )     | 04/01/2012 | 600         | 4                | Regional          | General/ Background               | SLAMS                | R        |
| Howard County Near<br>Road,<br>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 <sub>2</sub> )   | 04/01/2014 | 599         | 4                | Microscale        | Source Oriented/Highest Conc      | SLAMS                | H        |
|  | Oxides of Nitrogen (NO <sub>x</sub> ) | 04/01/2014 | 599         | 4                | Microscale        | Source Oriented/Highest Conc      | SLAMS                | H        |
|  | PM <sub>2.5</sub> - 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 (m) | Measurement Scale | Monitor Objective                         | Monitor Network/Type | Schedule |
|-------------------------------|---|------------|-------------|------------------|-------------------|---|----------------------|----------|
| HU-Beltsville,<br>240330030   | Carbon Monoxide (CO)                    | 01/01/2007 | 593         | 4.6              | Urban             | General/Background                        | SLAMS/NCore          | H        |
|                               | Air Toxics                              | 05/05/2005 | 150         | 4                | Neighborhood      | Population Exposure                       | Other                | 6        |
|                               | Direct NO <sub>2</sub> (CAPS)           | 11/1/2019  | 212         | 4.6              | Urban             | General/Background                        | SLAMS/NCore          | H        |
|                               | Ozone (O <sub>3</sub> )                 | 05/01/2005 | 087         | 4.6              | Urban             | Highest Conc./ Population Exposure        | SLAMS/NCore          | H        |
|                               | PM <sub>2.5</sub> Speciation            | 12/05/2004 | 812         | 4.6              | Urban             | Population Exposure<br>General/Background | SLAMS/NCore          | 3        |
|                               | PM <sub>10</sub> – STP                  | 07/25/2010 | 127         | 4.6              | Neighborhood      | Population Exposure                       | SLAMS/NCore          | 3        |
|                               | PM <sub>10-2.5</sub> - Local Conditions | 07/25/2010 | 176         | 4.6              | Neighborhood      | Population Exposure                       | SLAMS/NCore          | 3        |
|                               | PM <sub>2.5</sub> - Local Conditions    | 07/10/2004 | 145         | 4.6              | Urban             | Population Exposure                       | SLAMS/NCore          | 3        |
|                               | PM <sub>2.5</sub> - Local Conditions    | 07/31/2010 | 145         | 4.6              | Urban             | Population Exposure                       | QA-Collocated        | 12       |
|                               | PM <sub>2.5</sub> – Hourly              | 07/01/2010 | 170         | 4.5              | Urban             | Population Exposure                       | SLAMS/NCore          | H        |
|                               | Black Carbon                            | 12/01/2007 | 894         | 4                | NA                | NA  | SPM                  | H        |
|                               | Sulfur Dioxide (SO <sub>2</sub> )       | 09/29/2006 | 560         | 4.6              | Urban             | General/Background                        | SLAMS/NCore          | R        |
| VOCS                          | 05/05/2005                              | 126        | 4           | Urban            | Upwind/Background | Old PAMS/EMP                              | 6;<br>S: 3           |          |
| Lake Montebello,<br>245105253 | Ozone (O <sub>3</sub> )                 | 1/20/2022  | 087         | 4.5              | Neighborhood      | Population Exposure                       | SLAMS                | H, S     |
|                               | Air Toxics                              | 1/20/2022  | 150         | 4.5              | Neighborhood      | Population Exposure                       | Other                | 6        |
|                               | Direct NO <sub>2</sub> (CAPS)           | 1/12/2023  | 212         | 4.5              | Middle            | Highest Concentration                     | SLAMS                | H        |
|                               | PM <sub>10</sub> – STP                  | 1/20/2022  | 127         | 4.5              | Middle            | Population Exposure                       | SLAMS                | 6        |
|                               | PM <sub>2.5</sub> - Local Conditions    | 1/20/2022  | 145         | 4.5              | Middle            | Highest Concentration                     | SLAMS                | 3        |
|                               | PM <sub>2.5</sub> - Hourly              | 1/20/2022  | 170         | 4.5              | Middle            | Highest Concentration                     | SLAMS                | H        |
| Millington,<br>240290002      | Ozone (O <sub>3</sub> )                 | 06/19/1989 | 087         | 4.5              | Urban             | Population Exposure                       | SLAMS                | H, S     |
|                               | PM <sub>2.5</sub> - Hourly              | 07/01/2010 | 170         | 5                | Neighborhood      | Population Exposure                       | SLAMS                | H        |
| Padonia,<br>240051007         | Ozone (O <sub>3</sub> )                 | 01/01/1979 | 087         | 4.4              | Neighborhood      | Population Exposure                       | SLAMS                | H, S     |
|                               | PM <sub>2.5</sub> - Hourly              | 01/01/2016 | 170         | 4.8              | Neighborhood      | Population Exposure                       | SLAMS                | H        |
|                               | PM <sub>2.5</sub> - Local Conditions    | 01/01/1999 | 145         | 4.8              | Neighborhood      | Population Exposure                       | SLAMS                | 12       |

| Site Name & AQS ID              | Parameter                                      | Start Date | Method Code | Probe Height (m) | Measurement Scale | Monitor Objective   | Monitor Network/Type | Schedule |
|---------------------------------|--|------------|-------------|------------------|-------------------|---------------------|----------------------|----------|
| PG Equestrian Center, 240338003 | Ozone (O <sub>3</sub> )                        | 04/01/2002 | 087         | 4.4              | Urban             | Population Exposure | SLAMS                | H, S     |
| Piney Run, 240230002            | Carbon Monoxide (CO)                           | 09/01/2007 | 593         | 4.4              | Regional          | Regional Transport  | SLAMS/NCORE          | H        |
|                                 | Direct NO <sub>2</sub> (CAPS)                  | 07/12/2019 | 212         | 4.6              | Regional          | Regional Transport  | SLAMS/NCORE          | H        |
|                                 | Nitric Oxide (NO)                              | 05/01/2004 | 699         | 10               | Regional          | Regional Transport  | SLAMS/NCORE          | H        |
|                                 | NO <sub>y</sub> – NO                           | 05/01/2004 | 699         | 10               | Regional          | Regional Transport  | SLAMS/NCORE          | H        |
|                                 | Reactive Oxides of Nitrogen (NO <sub>y</sub> ) | 05/01/2004 | 699         | 10               | Regional          | Regional Transport  | SLAMS/NCORE          | H        |
|                                 | Ozone (O <sub>3</sub> )                        | 04/01/2004 | 087         | 4.4              | Regional          | Regional Transport  | SLAMS/NCORE          | H        |
|                                 | PM <sub>2.5</sub> – Hourly                     | 07/01/2010 | 170         | 4.9              | Regional          | Regional Transport  | SLAMS/NCORE          | H        |
| Rockville, 240130001            | Sulfur Dioxide (SO <sub>2</sub> )              | 04/01/2004 | 600         | 4.6              | Regional          | Population Exposure | SLAMS/NCORE          | R        |
|                                 | Ozone (O <sub>3</sub> )                        | 01/01/1980 | 087         | 4.6              | Urban             | Population Exposure | SLAMS                | H, S     |
| South Carroll, 240130001        | PM <sub>2.5</sub> - Hourly                     | 07/01/2010 | 170         | 5.3              | Neighborhood      | Population Exposure | SLAMS                | H        |
|                                 | Ozone (O <sub>3</sub> )                        | 07/14/1983 | 087         | 4.5              | Urban             | Population Exposure | SLAMS                | H, S     |
| Southern Maryland, 240170010    | Ozone (O <sub>3</sub> )                        | 10/02/1984 | 087         | 4.6              | Regional          | General Background  | SLAMS                | H, S     |

Sampling Schedule is coded as follows: 1 – every day, 2 – every 2 hours, 3 – every 3<sup>rd</sup> day, 6 - every 6<sup>th</sup> day, 12 – every 12<sup>th</sup> 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 ERG.

**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 (NOV) | 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         |
| Blackwater NWR CASTNET | 1         |                 |                |                 |                          |                            |                    |                      |                        |                      |                  |           |                   |                    |                          |              |          | 1         |
| Brooklyn Park          | 1         |                 |                |                 |                          |                            | 2                  |                      |                        |                      |                  |           |                   |                    |                          |              |          | 3         |
| Calvert                | 1         |                 |                |                 |                          |                            |                    |                      |                        |                      |                  |           |                   |                    |                          |              |          | 1         |
| Edgewood               | 1         |                 |                |                 |                          | 1                          |                    |                      |                        |                      |                  |           |                   |                    |                          |              |          | 2         |
| Essex                  | 1         | 1               | 1              | 1               |                          | 1                          |                    |                      | 1                      | 1                    | 2                | 1         |                   |                    |                          |              |          | 10        |
| Fair Hill              | 1         |                 |                |                 |                          |                            | 1                  |                      |                        |                      |                  |           |                   |                    |                          |              |          | 2         |
| Frederick Airport      | 1         |                 |                |                 |                          |                            |                    |                      |                        |                      |                  |           |                   |                    |                          |              |          | 1         |
| Frostburg Haze Cam     |           |                 |                |                 |                          |                            |                    |                      |                        |                      |                  |           |                   |                    |                          |              | 1        | 1         |
| Frostburg Improve      |           |                 |                |                 |                          |                            |                    |                      |                        |                      |                  |           | 1                 |                    |                          |              |          | 1         |
| 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        |
| Lake Montebello        | 1         |                 |                | 1               |                          |                            | 1                  | 1                    | 1                      |                      |                  |           | 1                 |                    |                          |              |          | 6         |
| Millington             | 1         |                 |                |                 |                          |                            | 1                  |                      |                        |                      |                  |           |                   |                    |                          |              |          | 2         |
| Padonia                | 1         |                 |                |                 |                          |                            | 1                  |                      | 1                      |                      |                  |           |                   |                    |                          |              |          | 3         |
| PG Equestrian Center   | 1         |                 |                |                 |                          |                            |                    |                      |                        |                      |                  |           |                   |                    |                          |              |          | 1         |
| Piney Run              | 1         | 1               | 1              | 1               |                          | 1                          | 1                  |                      |                        |                      |                  |           |                   |                    |                          |              |          | 6         |
| Rockville              | 1         |                 |                |                 |                          |                            | 1                  |                      |                        |                      |                  |           |                   |                    |                          |              |          | 2         |
| South Carroll          | 1         |                 |                |                 |                          |                            |                    |                      |                        |                      |                  |           |                   |                    |                          |              |          | 1         |
| Southern Maryland      | 1         |                 |                |                 |                          |                            |                    |                      |                        |                      |                  |           |                   |                    |                          |              |          | 1         |
| <b>Total</b>           | <b>20</b> | <b>4</b>        | <b>4</b>       | <b>5</b>        | <b>1</b>                 | <b>2</b>                   | <b>11</b>          | <b>4</b>             | <b>1</b>               | <b>5</b>             | <b>2</b>         | <b>3</b>  | <b>4</b>          | <b>1</b>           | <b>1</b>                 | <b>2</b>     | <b>2</b> | <b>72</b> |

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

| AQS State County Site | Local Site Name          | Barometric Pressure-64101 | Temp-62101 | Rain-65102 | Relative Humidity-62201 | Solar Radiation-63301 | Ultraviolet Radiation-63302 | Wind Direction-61104 | Wind Speed-61103 | Radar Wind Profiler | Total      |
|-----------------------|--------------------------|---------------------------|------------|------------|-------------------------|-----------------------|-----------------------------|----------------------|------------------|---------------------|------------|
| 240259001             | Aldino                   | 1                         | 1          | 1          | 1                       |                       |                             | 1                    | 1                |                     | 6          |
| 240050009             | Baltimore County Near Rd | 1                         | 1          | 1          | 1                       |                       |                             | 1                    | 1                |                     | 6          |
| 240031004             | Brooklyn Park            | 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          |
| 240430009             | Hagerstown               | 1                         | 1          | 1          | 1                       |                       |                             | 1                    | 1                |                     | 6          |
| 240190004             | Horn Point               | 1                         | 1          | 1          | 1                       |                       |                             | 1                    | 1                | 1                   | 7          |
| 240270006             | Howard County Near Rd    | 1                         | 1          | 1          | 1                       |                       |                             | 1                    | 1                |                     | 6          |
| 240330030             | HU-Beltsville            | 1                         | 1          | 1          | 1                       | 1                     |                             | 1                    | 1                | 1                   | 8          |
| 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                | 1                   | 8          |
| 240313001             | Rockville                | 1                         | 1          | 1          | 1                       |                       |                             | 1                    | 1                |                     | 6          |
| 240130001             | South Carroll            | 1                         | 1          | 1          | 1                       |                       |                             | 1                    | 1                |                     | 6          |
| <b>Total</b>          |                          | 16                        | 16         | 16         | 16                      | 3                     | 1                           | 16                   | 16               | 3                   | <b>103</b> |

**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 Aethalometer                            |
| Carbon Monoxide, trace  | 42101                 | 593         | Gas Filter Correlation Teledyne API T300U                |
| Direct NO <sub>2</sub>  | 42602-4               | 212         | API T500U - CAPS (Cavity Attenuated Phase Shift)         |
| Nitric Oxide and Nitrogen Dioxide (NO <sub>x</sub> )                | 42601-2, 42602, 42603 | 599         | Gas Phase Chemiluminescence, Teledyne API T200U          |
| Nitric Oxide and Reactive Oxides of Nitrogen (NO <sub>y</sub> – NO) | 42601, 42612, 42600   | 699         | Chemiluminescence, Teledyne API T200U NO <sub>y</sub>    |
| 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 (Markes-Agilent) |
| Ozone   | 44201                 | 047         | Ultraviolet Photometry (Thermo 49C)                      |
|   | 44201                 | 087         | Ultraviolet Radiation Absorption (API T400)              |
| PM <sub>10</sub>  | 81102                 | 127         | Gravimetric Partisol Model 2025i (Thermo)                |
| PM <sub>2.5</sub>   | 88101                 | 145         | Gravimetric, Partisol Plus 2025i                         |
| PM <sub>2.5</sub> continuous  | 88101-3               | 170         | FEM, Beta Attenuation                                    |
| PM <sub>2.5</sub> continuous  | 88101                 | 238         | Teledyne T640x PM Mass Monitor                           |
| PM <sub>10-2.5</sub> (PM Coarse)                                    | 86101                 | 176         | PAIRED Gravimetric Difference, Partisol Plus 2025i       |
| PM <sub>2.5</sub> Species* Constituents: Trace elements             | NA                    | 811         | Energy Dispersive XRF using Teflon filter                |
| PM <sub>2.5</sub> Species* Constituents: Ions                       | NA                    | 812         | Ion Chromatography using Nylon filter                    |
| PM <sub>2.5</sub> Species* Constituents: Organics                   | NA                    | 813         | Thermo-Optical Transmittance using Quartz filter         |
| PM <sub>2.5</sub> Speciation mass                                   | 88502-5               | 810         | Gravimetric, Met One SASS using Teflon                   |
| IMPROVE Parameters*   | NA                    | NA          | Four module, Improve Protocol analysis                   |
| Sulfur Dioxide, trace   | 42401                 | 560         | Pulsed Fluorescence, 43C-TLE/43I-TLE                     |
|   | 42401                 | 600         | Ultraviolet Fluorescence API T100U                       |
| 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,tetrafluoroethane, 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 <sub>10</sub> , PM <sub>2.5</sub> , 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 <sub>2.5</sub> Chemical Species | Aluminum, Ammonium Ion, Antimony, Arsenic, Barium, Bromine, Cadmium, Calcium, Cerium, Cesium, Chloride, Chlorine, Chromium, Cobalt, Copper, Elemental Carbon, Indium, Iron, Lead, Magnesium, Manganese, Nickel, Organic Carbon, Phosphorus, Potassium, Potassium Ion, Rubidium, Selenium, Silicon, Silver, Sodium, Sodium Ion, Strontium, Sulfate, Sulfur, Tin, Titanium, Total Nitrate, Vanadium, Zinc, 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. The Maryland CO monitoring network is shown in Figure 4.1.

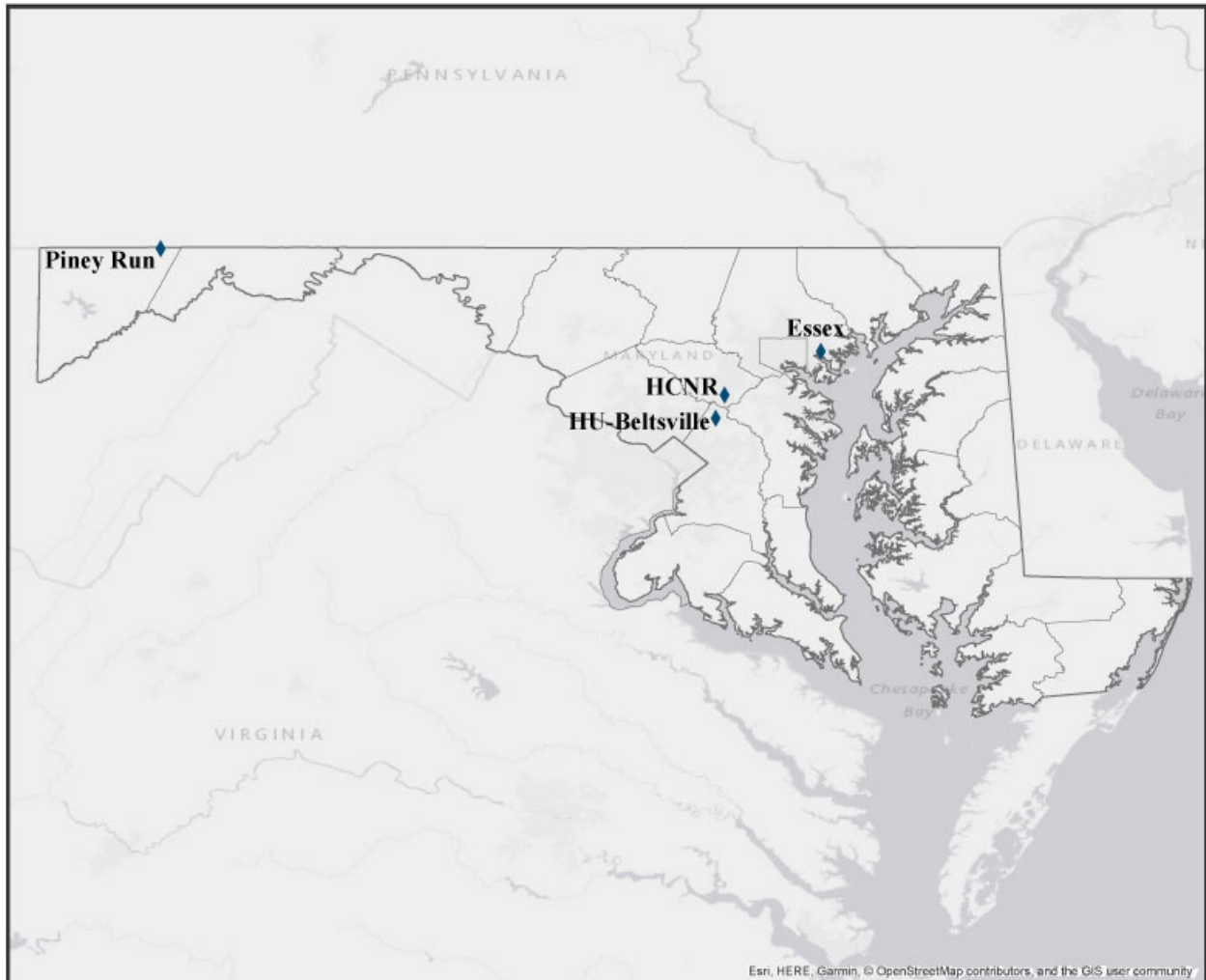


Figure 4-1 Maryland's CO monitoring network.

### 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<sub>2</sub> in urban areas having a population of 1 million or more. MDE added a CO monitor to the near road NO<sub>2</sub> 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<br>40 CFR Part 58 | Required in<br>Maryland | Number of monitors<br>active in Maryland |
|---|------------------------------|-------------------------|--|
| One CO monitor collocated with a Near Road NO <sub>2</sub> 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, as part of the PAMS monitoring requirements.

### 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 2023-2024

No changes planned.

## 4.2 Lead (Pb) – General Description and Sampling Method

Lead is collected by gravimetric PM<sub>10</sub> 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<sub>10</sub> monitor measures three-month average levels greater than or equal to 0.10 µg/m<sup>3</sup>, 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 µg/m<sup>3</sup> to 0.15 µg/m<sup>3</sup>. Revisions to the lead monitoring regulations were finalized on December 27, 2010 as follows:

**Table 4-2 Lead Monitoring Requirements**

| Requirement   | Appendix D<br>40 CFR Part 58 | Required<br>in MD | Number<br>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<sub>10</sub>. 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.)

### 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 2023-2024

No changes planned.

### 4.3 Nitrogen Dioxide (NO<sub>2</sub>) – 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<sub>2</sub> indirectly. First, nitrogen oxide (NO) is measured using the chemiluminescence reaction of nitric oxide (NO) with ozone (O<sub>3</sub>). 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<sub>2</sub>. 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<sub>x</sub>) are measured by passing the air through a converter where any NO<sub>2</sub> 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<sub>x</sub>. The NO<sub>2</sub> concentration is equal to the difference between NO<sub>x</sub> and NO. Reactive oxides of nitrogen (NO<sub>y</sub>) are measured in a similar manner to NO<sub>x</sub>, except that NO is measured by bypassing the converter. The combination of NO<sub>2</sub> and NO<sub>z</sub> can be then determined by difference. This procedure is similar to the current methodology used to measure NO<sub>x</sub>; however, the converter temperature is higher in order to more completely convert NO<sub>z</sub> species, and the converter has been moved to very near the sample inlet to avoid line losses of “sticky” NO<sub>y</sub> species such as HNO<sub>3</sub>.

Direct NO<sub>2</sub> monitoring using cavity-attenuated phase shift (CAPS) technology has been deployed to the Baltimore County Near Road, Essex, HU-Beltsville, Lake Montebello, and Piney Run sites. CAPS NO<sub>2</sub> monitors provide a direct absorption measurement of nitrogen dioxide. Unlike standard chemiluminescence-based monitors, these instruments require no conversion of NO<sub>2</sub> to another species and thus are not sensitive to other nitrogen-containing species.

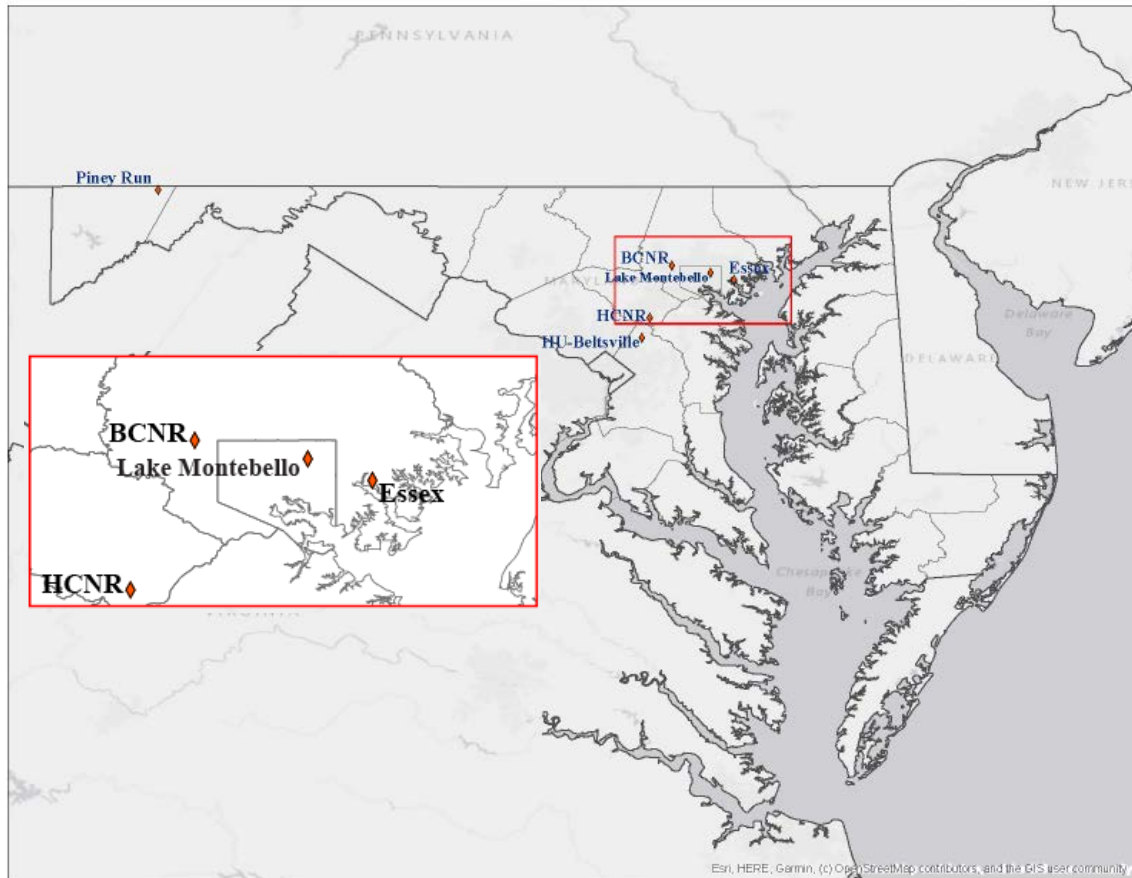
#### 4.3.1 Monitoring Requirements

The last revision to the NO<sub>2</sub> NAAQS was finalized on January 22, 2010, setting a new 1-hour NAAQS at 100 ppb, and retaining the previous annual average NAAQS at 53 ppb. On December 30, 2016, EPA published 40 CFR Part 50 Revision to the Near-Road NO<sub>2</sub> 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<sub>2</sub> Monitoring Requirements**

| Requirement  | Appendix D<br>40 CFR Part 58 | Required in<br>Maryland | Number of monitors<br>active in Maryland |
|--|------------------------------|-------------------------|--|
| Near Road NO <sub>2</sub> monitoring in CBSA with a population > 2,500,000 | 4.3.2(a)                     | 2                       | 2  |
| Area-wide NO <sub>2</sub> monitoring in CBSA with a population > 1,000,000 | 4.3.3                        | 1                       | 2  |
| Regional Administrator required monitoring                                 | 4.3.4                        | Variable                | 0  |

The Maryland NO<sub>2</sub> monitoring network is shown in Figure 4-2.



**Figure 4-2 Maryland's NO<sub>2</sub> monitoring network.**

### **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<sub>2</sub> monitors (Table 1-1). For the Baltimore-Towson, MD MSA, MDE is currently operating two near road NO<sub>2</sub> 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 (DOEE) and in Virginia by the Virginia Department of Environmental Quality (VADEQ). For the Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD MSA, the requirements are being met by monitors installed by the Philadelphia Air Management Service (AMS).

### **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<sub>2</sub> monitor (Table 1-1). MDE's NO<sub>2</sub> monitors at the Essex and Lake Montebello sites fulfill this requirement for the Baltimore-Towson, MD MSA.

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

### **Sensitive and Vulnerable Populations**

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

### **Additional NO<sub>2</sub> Monitoring Requirements**

Each State is required to operate one NCore site. This is discussed in more detail in Section 4.10. Maryland runs two NCore stations, Piney Run and HU-Beltsville, both of which monitor NO<sub>2</sub>.

### **4.3.2 Sources**

Oxides of nitrogen are produced during high-temperature burning of fuels. Sources of NO<sub>x</sub> include motor vehicles and stationary sources that burn fossil fuels such as power plants and industrial boilers.

### **4.3.3 Changes Planned for 2023-2024**

No changes planned.

#### 4.4 Ozone (O<sub>3</sub>) – 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<sub>3</sub> 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<sub>3</sub> 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 improves 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 included expanding the ozone season in Maryland from March 1 through October 31, beginning March 1, 2017.

##### 4.4.1 Monitoring Requirements

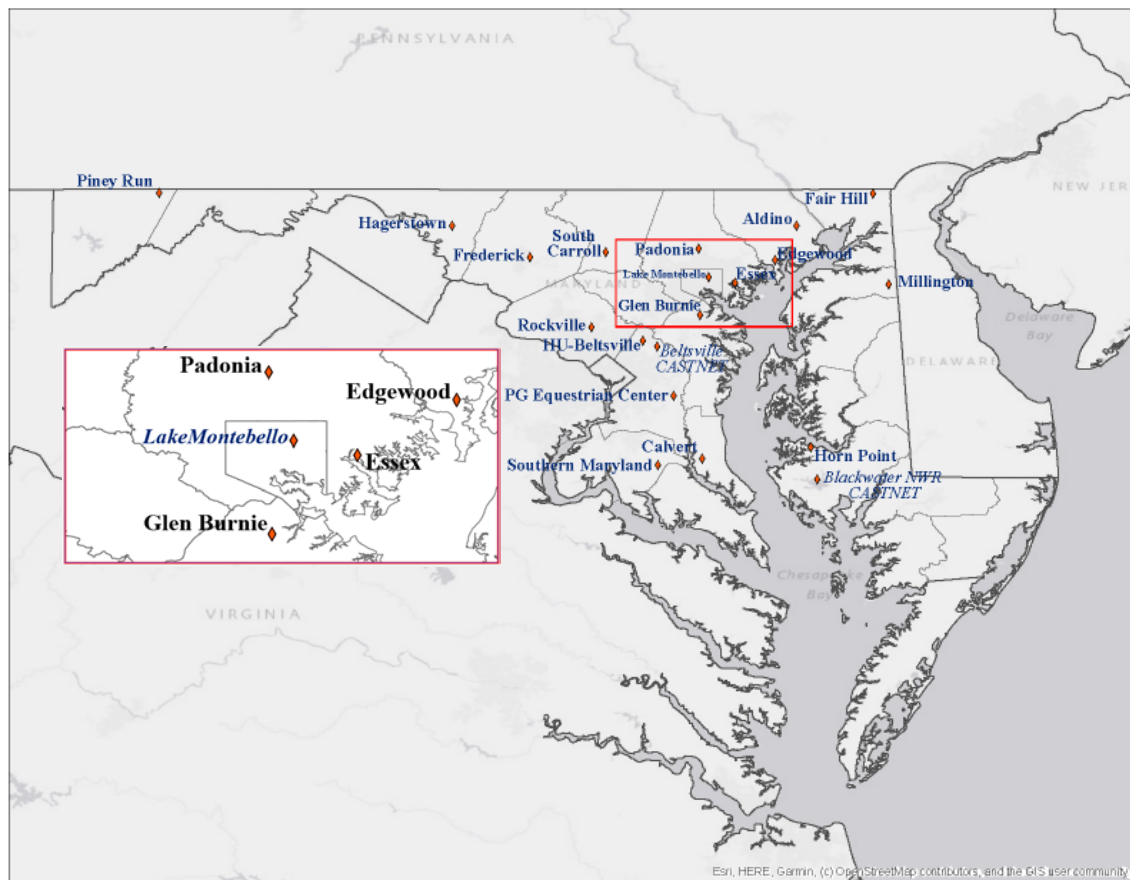
Ozone monitoring requirements are determined by the MSA population and design value, as specified in Table D-2 of 40 CFR Part 58 Appendix D. Table 4-4 shows that the MDE monitoring network meets or exceeds the minimum requirements. Since ozone levels decrease significantly in the colder periods of the 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**

| MSA Name   | Population | Monitors Deployed by State <sup>A</sup> |          |           |          |          |          | Total Monitors | Required<br>≥ 85% NAAQS |
|--|------------|---|----------|-----------|----------|----------|----------|----------------|-------------------------|
|  |            | DE                                      | DC       | MD        | VA       | WV       | PA       |                |                         |
| Baltimore-Towson, MD                               | 2,800,189  | 0                                       | 0        | 7         | 0        | 0        | 0        | 7              | 4                       |
| Hagerstown-Martinsburg, MD-WV                      | 291,144    | 0                                       | 0        | 1         | 0        | 1        | 0        | 2              | 1                       |
| Washington-Arlington-Alexandria, DC-VA-MD-WV       | 6,324,629  | 0                                       | 3        | 7         | 6        | 0        | 0        | 16             | 3                       |
| Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD | 6,107,906  | 4                                       | 0        | 1         | 0        | 0        | 7        | 12             | 3                       |
| Salisbury, MD-DE                                   | 423,481    | 2                                       | 0        | 0         | 0        | 0        | 0        | 2              | 2                       |
| <b>Total</b>                                       |            | <b>6</b>                                | <b>3</b> | <b>16</b> | <b>6</b> | <b>1</b> | <b>7</b> | <b>39</b>      | <b>13</b>               |

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.

The Maryland O<sub>3</sub> monitoring network is shown in Figure 4-3.



**Figure 4-3 Maryland's O<sub>3</sub> monitoring network.**

Within an O<sub>3</sub> network, at least one O<sub>3</sub> 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<sub>3</sub> 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<sub>3</sub> 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<sub>3</sub> 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.



### **Additional O<sub>3</sub> Monitoring Requirements**

Additional O<sub>3</sub> monitoring stations are located throughout Maryland to characterize population exposure to ozone. For the Baltimore-Towson, MD MSA, Padonia, Glen Burnie, Lake Montebello, and South Carroll are assigned this designation. For the Washington-Arlington-Alexandria, DC-MD-VA-WV MSA, Rockville, Frederick, and Calvert are assigned this designation, while the Southern Maryland site is in place to characterize the general background concentration. Piney Run, the rural NCore site, helps characterize regional ozone transport. On the Eastern Shore, Horn Point is in place to characterize the general background concentration and help notify the public about poor AQI conditions; Blackwater CASTNET is designated as a highest concentration monitor; and the Millington ozone monitor is not required at all but serves as an important tool in notifying the public of AQI forecasts.

#### **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<sub>x</sub>) 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<sub>x</sub> and VOC's or "precursors of ozone" can travel for many miles before chemical reactions in the atmosphere form O<sub>3</sub>.

#### **4.4.3 Changes Planned for 2023-2024**

Anne Arundel County, Maryland, which owns the Glen Burnie site location, is selling the property to developers and therefore is requiring us to move. A new site location, approximately 4 miles to the north of the Glen Burnie site, also located in Anne Arundel County and which will be referred to as *Brooklyn Park*, has been identified and received preliminary approval from EPA Region III. Seasonal ozone will be measured to characterize Population Exposure at the Neighborhood scale in a Suburban setting. Maps are available in Appendix A.

## 4.5 Particulate Matter (PM<sub>10</sub>) – General Description and Sampling Method

MDE uses manual gravimetric monitors to measure PM<sub>10</sub> mass concentrations. 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<sub>10</sub> 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 4-5 shows that the MDE monitoring network meets or exceeds the minimum requirements.

**Table 4-5 Number of PM<sub>10</sub> SLAMS Sites**

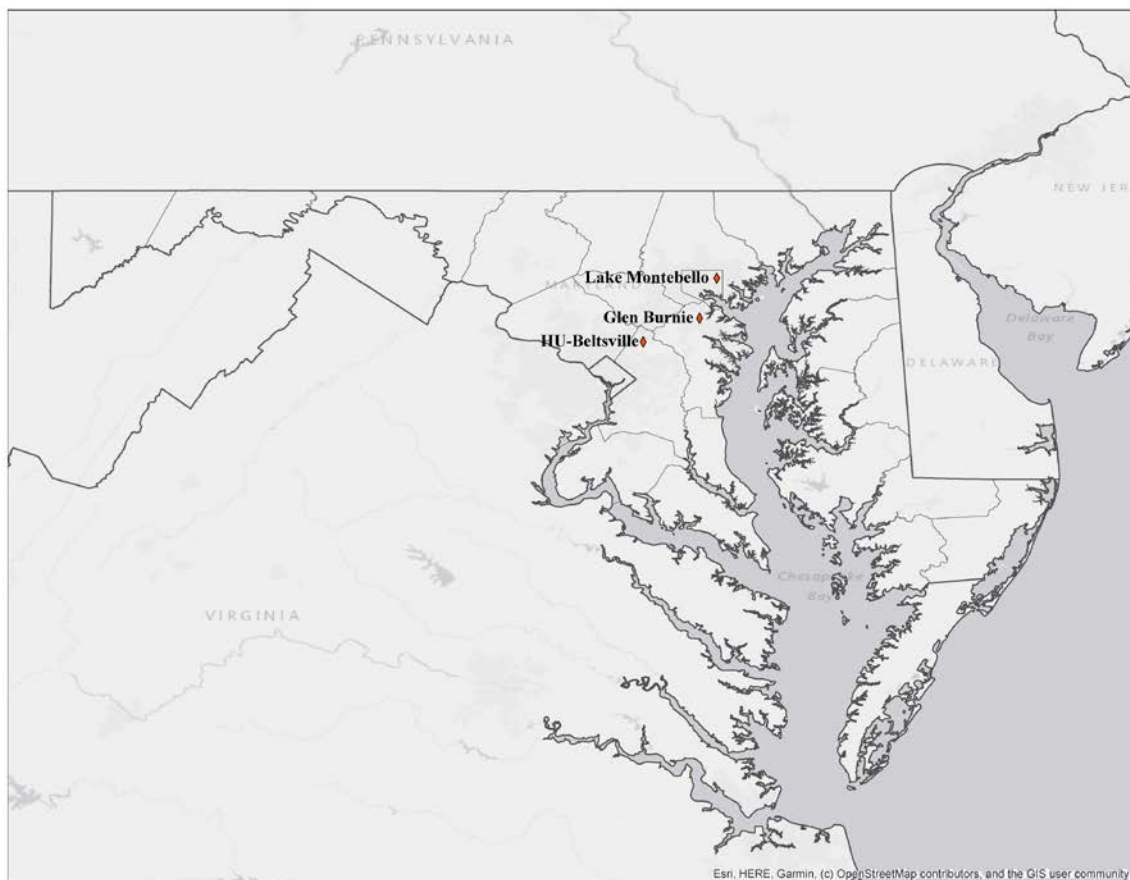
| MSA Name   | Population | Monitors Required <sup>A</sup> | Active Monitors in MD/Total <sup>B</sup> |
|--|------------|--------------------------------|--|
| Baltimore-Towson, MD                               | 2,800,189  | 2-4                            | 2/2                                      |
| Hagerstown-Martinsburg, MD-WV                      | 291,144    | 0-1                            | 0/0                                      |
| Washington-Arlington-Alexandria, DC-VA-MD-WV       | 6,324,629  | 2-4                            | 1/5                                      |
| Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD | 6,107,906  | 2-4                            | 0/2                                      |
| Salisbury, MD-DE                                   | 423,481    | 0-1                            | 0/0                                      |

A – All of the listed MSA’s have PM<sub>10</sub> ambient concentrations well below 80% of the PM<sub>10</sub> NAAQS.

B –Based on tables available at <https://www.epa.gov/air-trends/air-quality-design-values>.

### Minimum Requirements for Collocated PM<sub>10</sub>

A minimum of 15% (round up), or at least one of the PM<sub>10</sub> monitors must be collocated as specified in 40 CFR Part 58 Appendix A 3.3.4. MDE has 3 PM<sub>10</sub> monitors and two are collocated (at Glen Burnie), thereby meeting this requirement. The Maryland PM<sub>10</sub> monitoring network is shown in Figure 4-4.



**Figure 4-4 Maryland's PM<sub>10</sub> monitoring network.**

#### **4.5.2 Sources**

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

#### **4.5.3 Changes Planned for 2023-2024**

Anne Arundel County, Maryland, which owns the Glen Burnie site location, is selling the property to developers and therefore is requiring us to move. A new site location, also located in Anne Arundel County and which will be referred to as *Brooklyn Park*, has been identified and received preliminary approval from EPA Region III. The new site is located approximately 5 miles to the north of the Glen Burnie site. PM<sub>10</sub> will be measured to characterize Population Exposure at the Neighborhood scale in a Suburban setting. Please see Appendix A for maps.

## 4.6 Fine Particulate Matter (PM<sub>2.5</sub>) – General Description and Sampling Method

MDE uses both FRM manual gravimetric and FEM automated monitors (BAM's) to measure PM<sub>2.5</sub> mass concentrations. For the FRM manual gravimetric sampling, a very sharp cut cyclone (VSSC) is attached to the inlets of these monitors to exclude particles having diameters greater than 2.5 microns. Otherwise, the monitors work as described for PM<sub>10</sub> gravimetric monitoring. Some of the gravimetric monitors are specially equipped to collect PM<sub>2.5</sub> samples, which are later analyzed into concentrations of the samples' chemical constituents or species. See Table 3-6 for list of speciated PM<sub>2.5</sub> mass. MetOne Super SAAS samplers, URG 3000N, and IMPROVE samplers are used for the collection of samples for the chemical speciation of PM<sub>2.5</sub>. The samplers collect 3 to 4 filter samples simultaneously every third 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).

For the FEM continuous monitoring, the PM<sub>2.5</sub> 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.

### 4.6.1 Monitoring Requirements

The number of required PM<sub>2.5</sub> 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 4-6 shows that the MDE monitoring network meets or exceeds the minimum requirements.

**Table 4-6 Number of PM<sub>2.5</sub> SLAMS Sites Required**

| MSA Name   | Population | 2021 Annual Design Value (µg/m <sup>3</sup> ) | 2021 Daily Design Value (µg/m <sup>3</sup> ) | Required SLAMS Monitors | Monitors Active in MD/Total <sup>A,B</sup> | Required <sup>^</sup> 85% NAAQS |
|--|------------|---|--|-------------------------|--|---------------------------------|
| Baltimore-Towson, MD                               | 2,800,189  | 7.9   | 20   | 3                       | 5/5  | 3                               |
| Hagerstown-Martinsburg, MD-WV                      | 291,144    | 8.4   | 23*  | 1                       | 1/2  | 1                               |
| Washington-Arlington-Alexandria, DC-VA-MD-WV       | 6,324,629  | 8.8   | 22*  | 2                       | 2/11                                       | 3                               |
| Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD | 6,107,906  | 9.4   | 26*  | 3                       | 1/21                                       | 2                               |
| Salisbury, MD-DE**                                 | 423,481    | 7.9   | 19*  | 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.

\* Highest values not observed in Maryland.

\*\*Data do not meet validity requirements.

*Ambient Air Monitoring Network Plan for Calendar Year 2024*

The Maryland PM<sub>2.5</sub> monitoring network is shown in in Figure 4-5.

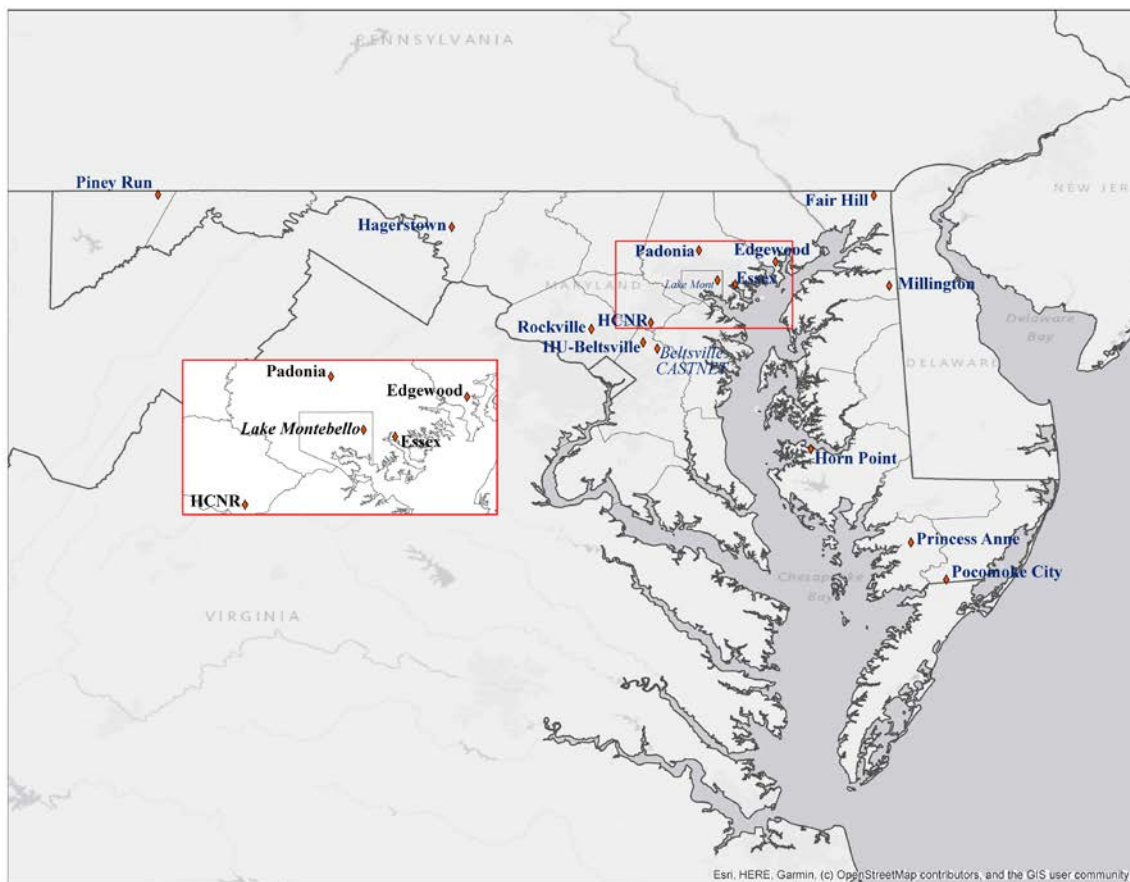


Figure 4-5 Maryland's PM<sub>2.5</sub> monitoring network.

### Minimum Requirements for Collocated PM<sub>2.5</sub>

Collocation requirements for PM<sub>2.5</sub> are based on the number of PM<sub>2.5</sub> 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<sub>2.5</sub> monitoring stations; therefore 2 must be collocated. MDE currently operates three collocated PM<sub>2.5</sub> monitors, one FRM-FRM (Howard U), one FRM-FEM, where the FRM is primary, (Lake Montebello), and one FEM-FRM, where the FEM is primary, (Padonia).

### **Requirements for Continuous PM<sub>2.5</sub> Monitoring**

At least one-half (round up) of the minimum number of sites per MSA must operate continuous PM<sub>2.5</sub> monitors. MDE operates 11 continuous PM<sub>2.5</sub> 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-NJ-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<sub>2.5</sub> Monitoring**

For MSA's with a population of one million or greater, at least one PM<sub>2.5</sub> monitor is to be located at a near road NO<sub>2</sub> station. The Howard County near road site fulfills this requirement for the Baltimore-Towson, MD MSA. MDE does not operate near road NO<sub>2</sub> stations in any other MSA (Section 4.3.1).

### **Requirements for PM<sub>2.5</sub> Chemical Speciation**

Each state shall continue to conduct chemical speciation monitoring and analyses at sites designated to be part of the PM<sub>2.5</sub> Chemical Speciation Network (CSN) consisting of PM<sub>2.5</sub> sites and supplemental sites. MDE conducts chemical speciation monitoring at Essex and HU-Beltsville, but only HU-Beltsville is designated as part of the CSN.

### **Other Requirements for PM<sub>2.5</sub> 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<sub>2.5</sub> site to monitor for regional background and at least one PM<sub>2.5</sub> site to monitor for regional transport. Each NCore station must operate a PM<sub>2.5</sub> monitor. Table 4-7 shows that MDE meets all of these additional requirements.

#### **4.6.2 Sources**

PM<sub>2.5</sub> pollution is emitted from combustion activities, such as industrial and residential fuel burning and motor vehicles. PM<sub>2.5</sub> 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 PM<sub>2.5</sub> Monitors in Maryland**

| Site Name          | Measurement Scale | Monitor Objective                             | MSA  |
|--------------------|-------------------|---|--|
| Lake Montebello    | Middle Scale      | Highest Concentration                         | Baltimore-Towson, MD                         |
| Howard Co. Near Rd | Microscale        | Highest Concentration/<br>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/<br>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

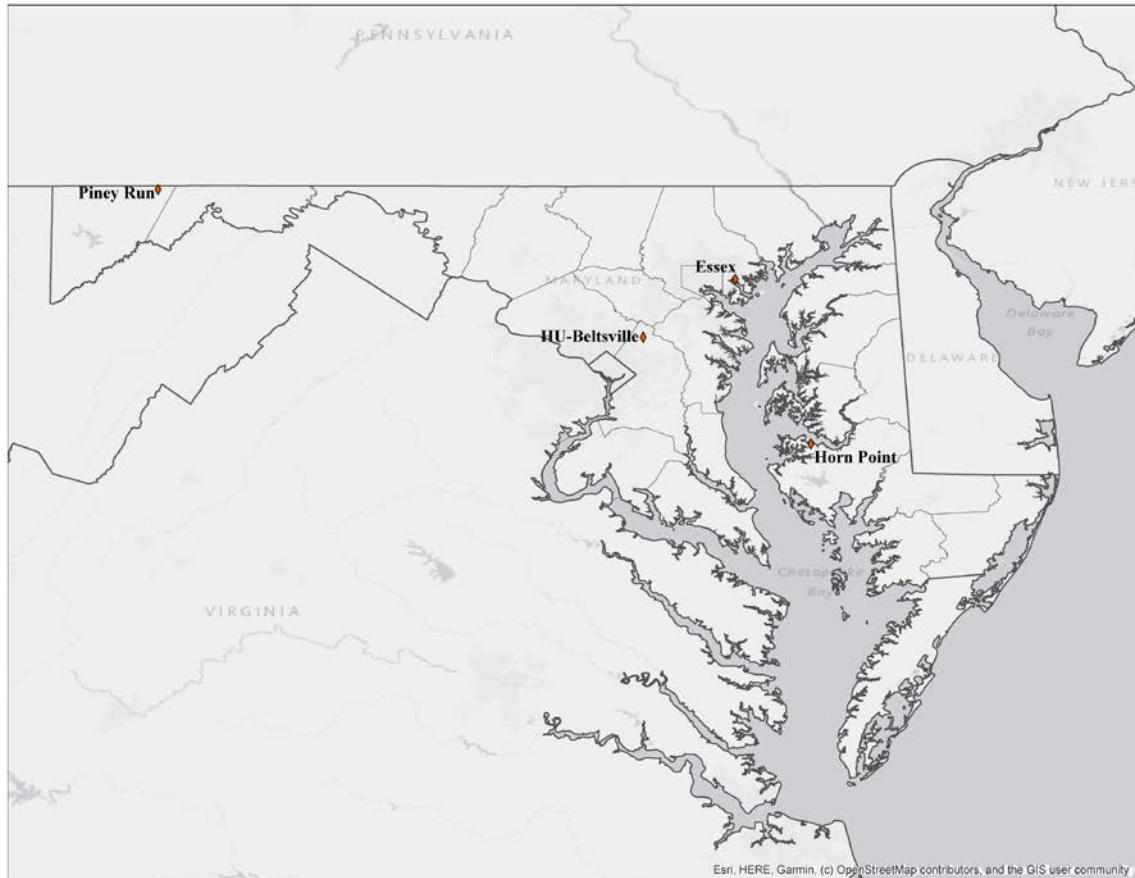
MDE operates both FRM and FEM PM<sub>2.5</sub> monitors (Table 3-2). Pursuant to the January 15, 2013 revisions to PM<sub>2.5</sub> monitoring requirements, MDE recommends that all of the FEM monitors currently operating in the MDE monitoring network remain eligible for comparison to the PM<sub>2.5</sub> 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 2022 and 2023. MDE will re-evaluate this recommendation for FEM data collected in the 36 months prior to January 1, 2021 and 2022 in next year's Annual Network Plan.

#### 4.6.4 Changes Planned for 2023-2024

American Rescue Plan award money will be used to upgrade the current PM<sub>2.5</sub> network with T640x instruments designed to collect PM data at a one-minute resolution. The Model T640x is an optical aerosol spectrometer that converts optical measurements to mass measurements by determining sampled particle size via scattered light at the single particle level according to Lorenz-Mie Theory. The first T640x is planned to be installed at Essex, although the instruments have not yet been purchased. MDE's 2023 Continuous Gas NAAQS QAPP will have complete details.

## 4.7 Sulfur Dioxide (SO<sub>2</sub>) – General Description and Sampling Method

Sulfur dioxide (SO<sub>2</sub>) 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<sub>2</sub> concentration. The Maryland SO<sub>2</sub> monitoring network is shown in figure 4-6.



**Figure 4-6 Maryland's SO<sub>2</sub> monitoring network**



### 4.7.1 Monitoring Requirements

The minimum number of required SO<sub>2</sub> monitors in each MSA is proportional to the product of the total amount of SO<sub>2</sub> 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<sub>2</sub> emissions shown in Table 4-9 are from the 2017 National Emissions Inventory (NEI).

**Table 4-8 Minimum SO<sub>2</sub> Monitoring Requirements**

| MSA Name   | 2020 Population Estimate <sup>A</sup> | 2017 NEI SO <sub>2</sub> (tons/year) <sup>B</sup> | PWEI (millions of people-tons per year) | Monitors Required | Monitors Active in MD/Total <sup>C</sup> |
|--|---------------------------------------|---|---|-------------------|--|
| Baltimore-Towson, MD                               | 2,800,189                             | 5,168   | 14,471                                  | 1                 | 1/1                                      |
| Hagerstown-Martinsburg, MD-WV                      | 291,144                               | 411   | 120                                     | 0                 | 0/0                                      |
| Washington-Arlington-Alexandria, DC-VA-MD-WV       | 6,234,629                             | 2,396   | 14,938                                  | 1                 | 1/5                                      |
| Salisbury, MD-DE                                   | 423,481                               | 10  | 4                                       | 0                 | 0/1                                      |
| Philadelphia-Camden-Wilmington-Newark, PA-NJ-DE-MD | 6,107,906                             | 9.3   | 57                                      | 1                 | 0/7                                      |

<sup>A</sup>Population from Federal Reserve Economic Data, estimates as of May 5, 2021.

<sup>B</sup>NEI from 2017 summaries <https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data>

<sup>C</sup>Total monitors in an MSA is based on tables available at <https://www.epa.gov/air-trends/air-quality-design-values>

### Other SO<sub>2</sub> Monitoring Requirements

The Regional Administrator may require additional SO<sub>2</sub> 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<sub>2</sub> monitor. This requirement is met at both the HU-Beltsville and Piney Run monitoring stations.

### 4.7.2 Sources

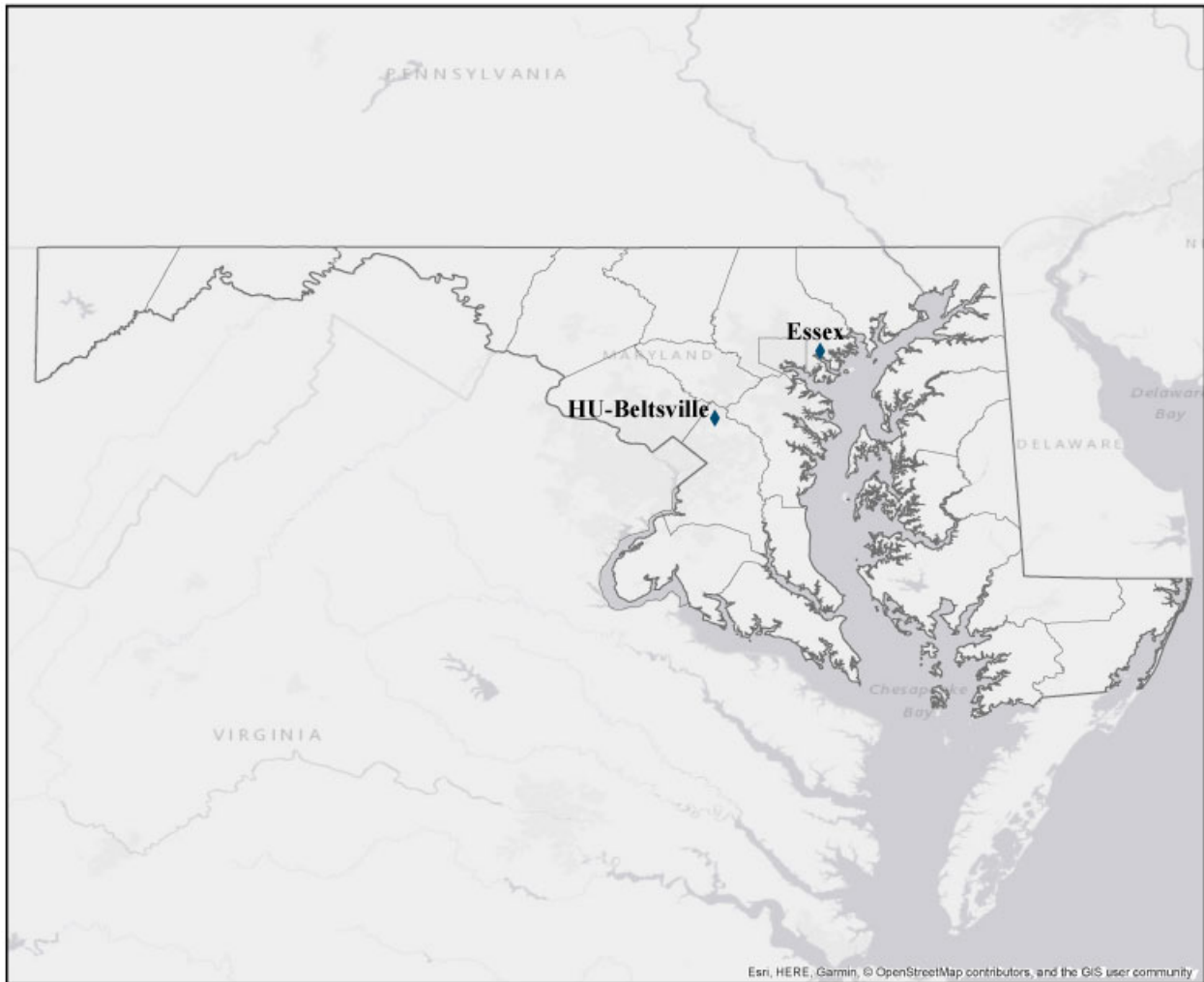
The main sources of SO<sub>2</sub> are combustion of coal and oil (mostly from electrical generating units (EGUs), refineries, smelters, and industrial boilers). Nationally, two-thirds of all SO<sub>2</sub> emissions are from EGUs. Coal operated EGUs account for 95% of these emissions.

### 4.7.3 Changes Planned for 2023-2024

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<sub>3</sub>, NO, NO<sub>x</sub>, NO<sub>2</sub>, NO<sub>y</sub>, and speciated volatile organic compounds (VOC's). The Maryland PAMS monitoring network is shown in Figure 4-7.



**Figure 4-7 Maryland's PAMS monitoring network.**

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, 2021 to meet these new requirements. MDE's PAMS Quality Assurance Project Plan was approved by the EPA on February 3, 2021.

Based on 40 CFR part 58, Appendix D, State air monitoring agencies were required to begin making the revised PAMS measurements at their NCore location(s) by June 1, 2019. EPA proposed a two-year extension to this deadline on May 31, 2019 because many states had not yet received the equipment and training needed to implement the new requirements. A final rule extending the start date from June 1, 2019 to June 1, 2021 was signed on December 20, 2019 and published in the Federal Register on January 8, 2020. Agencies may elect to start the revised PAMS requirements sooner if they so choose. MDE has all the necessary equipment and began collecting the required PAMS measurements June 1, 2020. A CL51 ceilometer is in the process of being relocated to the Essex site.

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<sub>y</sub>) monitor from Howard U to Essex, was approved on May 31, 2017.

Methods used to sample and analyze VOC's and NO<sub>y</sub> follow (NO/NO<sub>x</sub> and O<sub>3</sub> have already been described in Sections 4.3 and 4.4, respectively):

- Ambient air is collected in three 8-hour canister samples every 3<sup>rd</sup> day during PAMS season (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 year round 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 Markes-Agilent auto GC.
- Ambient air is sampled hourly for NO<sub>y</sub> using an API T200U NO<sub>y</sub> low level oxides of nitrogen analyzer.

#### **4.8.1 Monitoring Requirements and Locations for Revised PAMS Monitoring Rule**

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, 2021. 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<sub>3</sub>;
- (4) Hourly averaged nitrogen oxide (NO), true nitrogen dioxide (NO<sub>2</sub>), and total reactive nitrogen (NO<sub>y</sub>);
- (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.

MDE adopted the national PAMS Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOP's), with minor modifications. EPA approval was granted on Feb 3, 2021.

With respect to PAMS instrumentation at the Essex site, MDE utilizes 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.

#### 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 ERG laboratory services (RTP, NC) using EPA Method TO-11A, as used in the National Air Toxics Trends (NATTS) program.

#### Nitrogen Oxides

Hourly averaged NO, NO<sub>y</sub> and true NO<sub>2</sub> will be measured, at a minimum, from June through August. True NO<sub>2</sub> will be measured with a Teledyne API Model T500U CAPS NO<sub>2</sub> analyzer. NO and NO<sub>y</sub> will be measured using an API T200U NO<sub>y</sub> analyzer.

#### Meteorological 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 WXT536.

Hourly averaged solar radiation will be measured with a Kipp and Zonen SMP3 instrument. Hourly averaged ultraviolet radiation will be measured with a Kipp and Zonen SUV-5 instrument. Hourly averaged mixing height will be measured with a Viasala Model CL51 ceilometer.

### **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 2023-2024**

No changes planned.

#### 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 recommended monitoring organizations submit the EMP by July 1, 2018 along with the annual network plan. In addition to the requirements listed in Section 4.8.1, the October 1, 2015 revisions to the PAMS monitoring rule also require states with moderate and above 8-hour ozone nonattainment areas and states in the Ozone Transport Region to develop and implement an Enhanced Monitoring Plan (EMP) detailing enhanced ozone and ozone precursor monitoring activities to be performed. The 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.

MDE has implemented the following measurements as basic elements of the required EMP:

- Year round ozone monitoring at Piney Run, Essex, HU-Beltsville, and Horn Point as of 2020.
- Additional VOC measurements at HU-Beltsville, as of June 2019, consisting of eight 3-hour canister samples collected every third day June through August.
- PAMS analysis performed on air toxics canisters collected at HU-Beltsville, Essex, Oldtown, and Howard County Near Road.
- Operation of radar wind profilers at Piney Run, HU-Beltsville, and Horn Point as of 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. Maryland’s air toxics monitoring network is show in Figure 4-8.

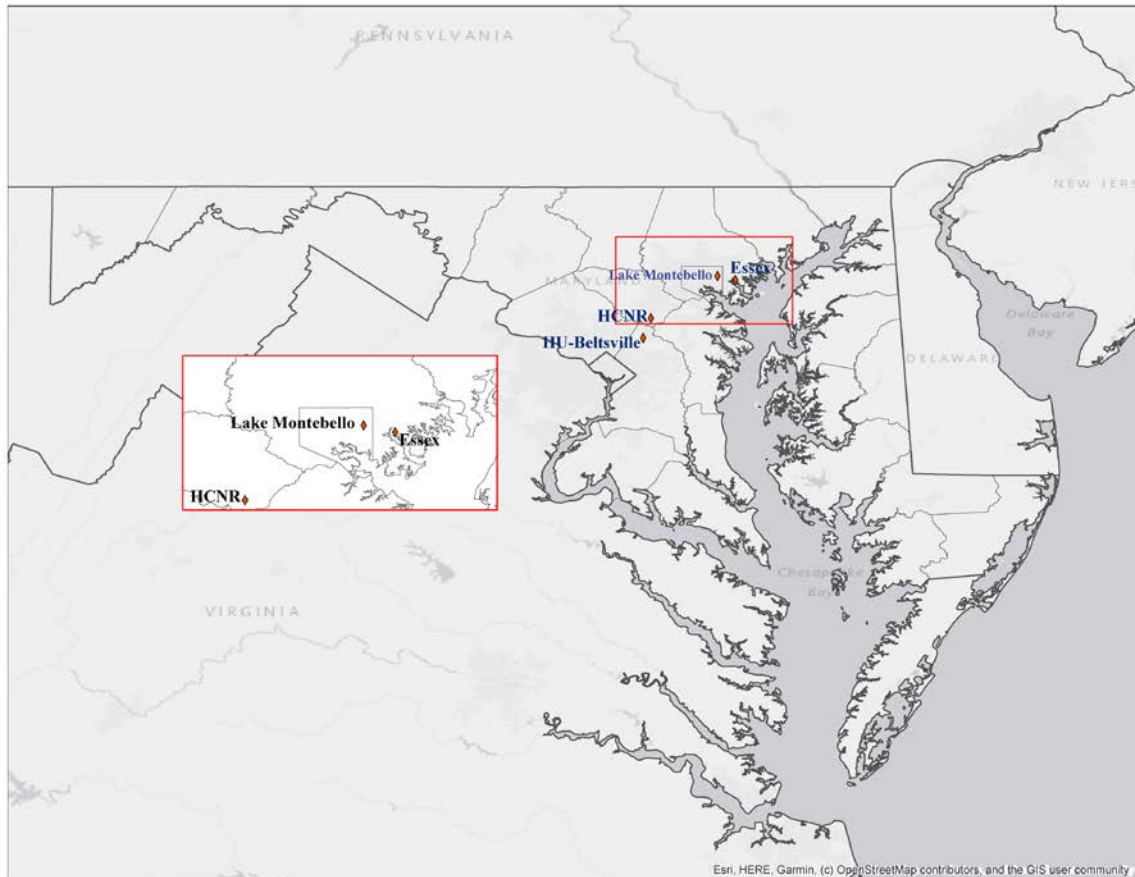


Figure 4-8 Maryland's Air Toxics monitoring network.

### 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; Lake Montebello, 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 2023-2024**

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<sub>2.5</sub> particle mass using continuous and integrated/filter-based samplers, PM<sub>10-2.5</sub> particle mass, O<sub>3</sub>, SO<sub>2</sub>, CO, NO/NO<sub>y</sub>, wind speed, wind direction, barometric pressure, rain, relative humidity, and ambient temperature.

Sampling methods for PM<sub>2.5</sub>, O<sub>3</sub>, SO<sub>2</sub>, NO/ NO<sub>y</sub> are described under the individual pollutant sections throughout this document. Trace level measurement of CO and SO<sub>2</sub> is performed at NCore sites. PM<sub>10-2.5</sub> is determined by the difference between collocated PM<sub>10</sub> and PM<sub>2.5</sub> FRM samplers. The meteorological parameters (Table 3-4) are measured as follows:

- The Vaisala WXT536 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 WXT536 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 WXT536 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:

- The Kipp and Zonen SMP3 instrument is used to measure solar radiation at the Piney Run and HU-Beltsville NCore sites, as well as at Essex. 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 a Kipp and Zonen SUV-5 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 4-9.

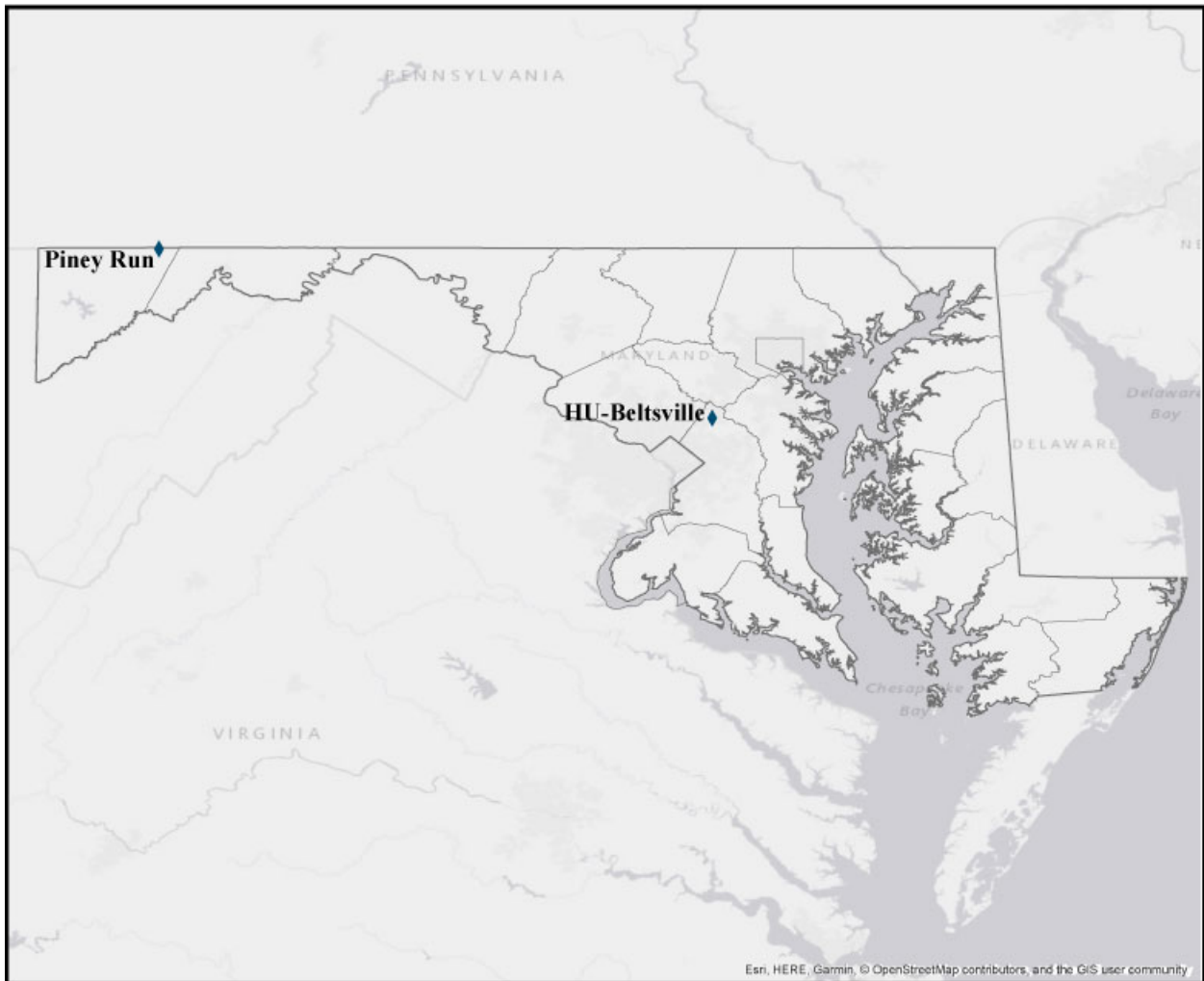


Figure 4-9 Maryland's NCore monitoring network.

#### **4.10.3 Sources**

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

#### **4.10.4 Changes Planned for 2023-2024**

No changes planned.

**APPENDIX A**  
to the Maryland 2024 Air Monitoring Network Plan  
*Topographic Map and Areal Maps*  
*with Site Descriptions of Air Monitoring Stations in Maryland*

May 2023

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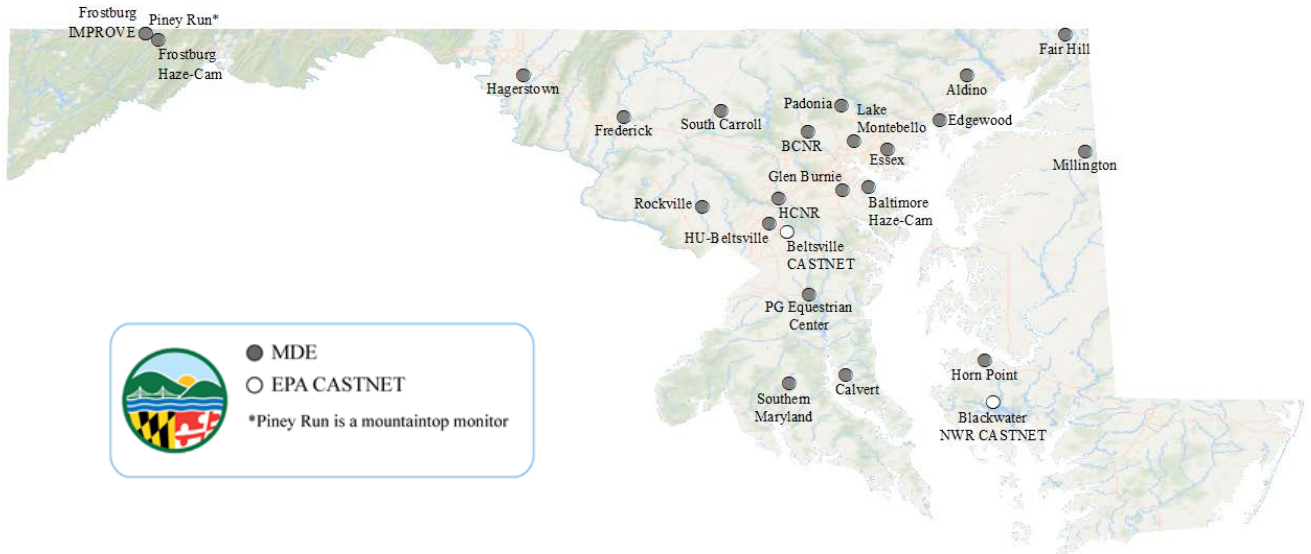
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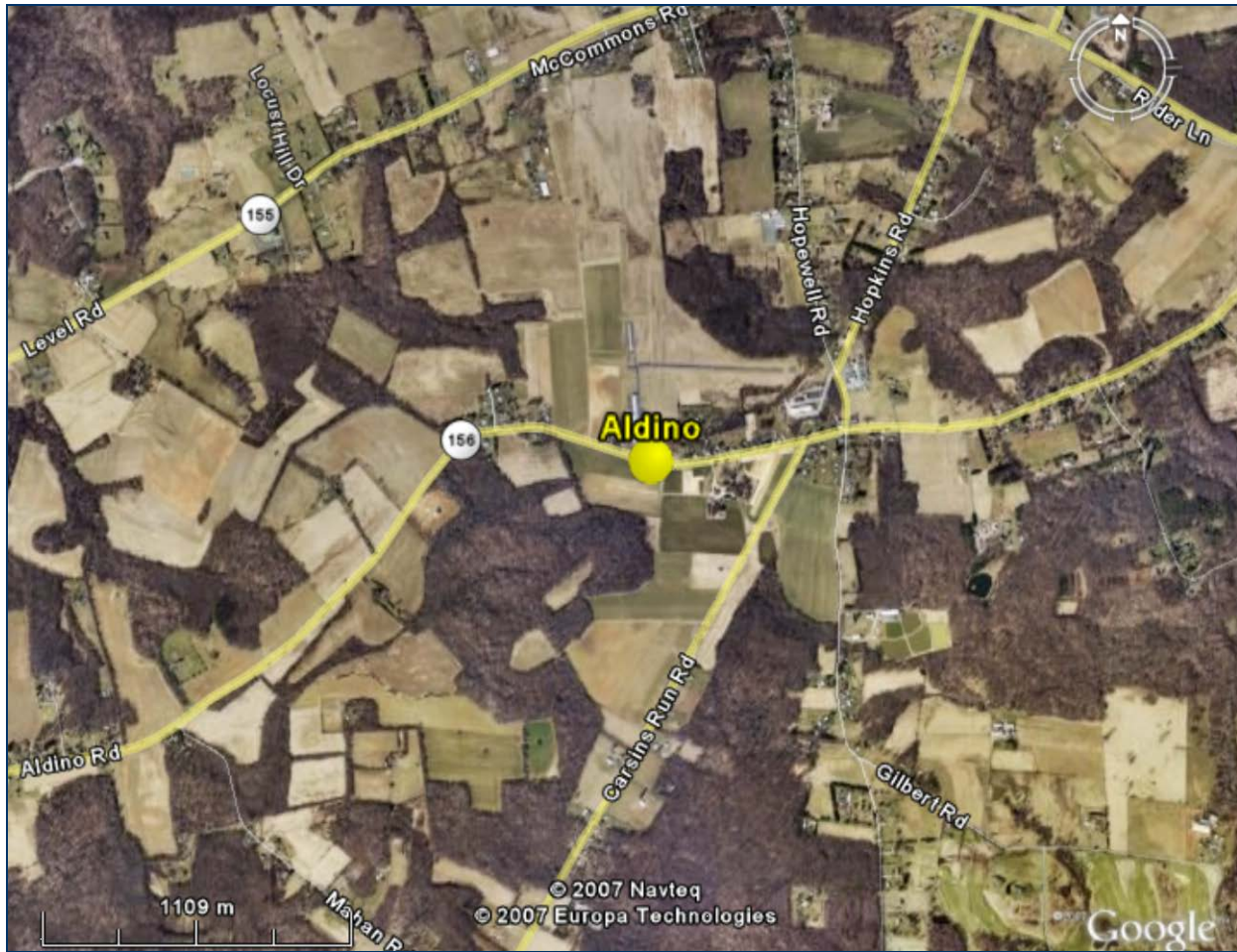
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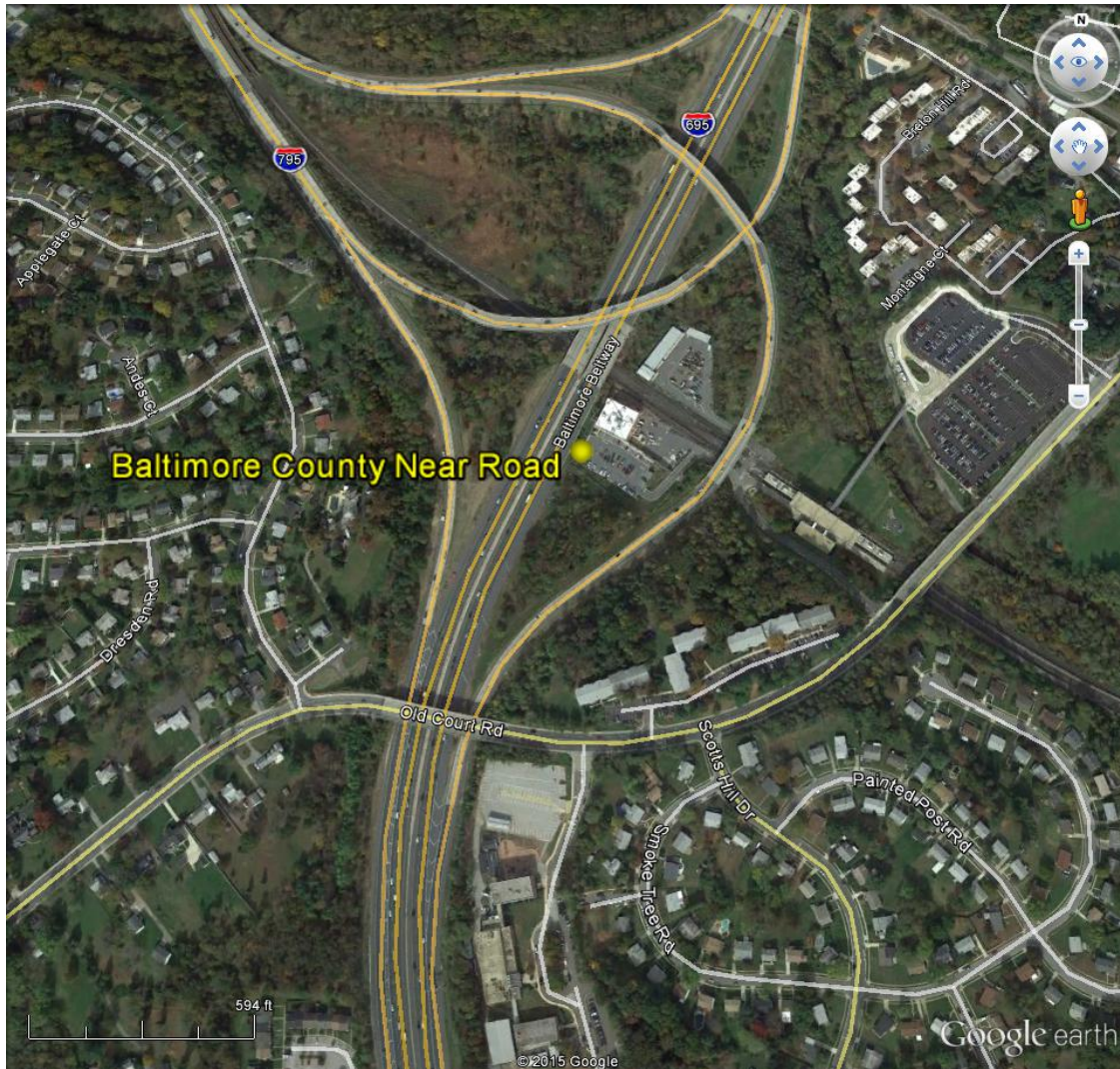
**Figure A- 1. Topographic map of air monitoring sites in Maryland.**





**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. As a result of construction activities at the airport, the Aldino station needed to be moved a short distance from its original location. Due to a runway reconfiguration, the station was moved approximately 237 meters to the north east, away from the roadway into a field on the property. 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<sub>2</sub>, and NO<sub>x</sub>, 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.



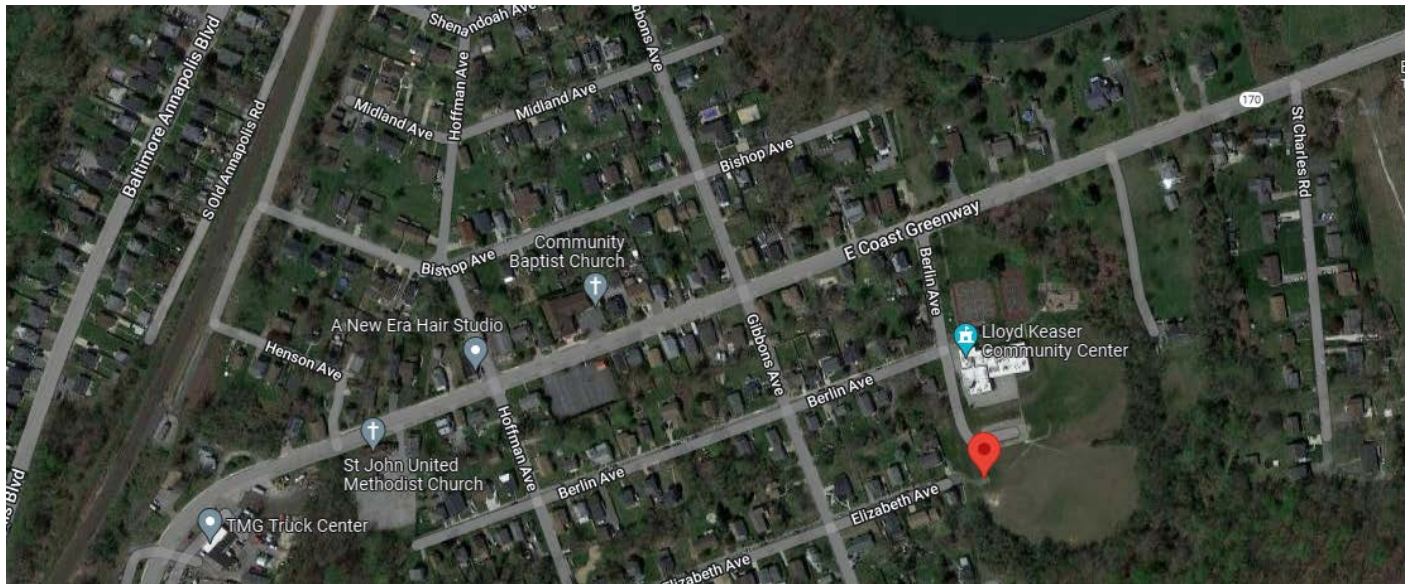
**Figure A- 5. Areal map of Beltsville CASTNET air monitoring site in Prince George’s County, MD.**

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.



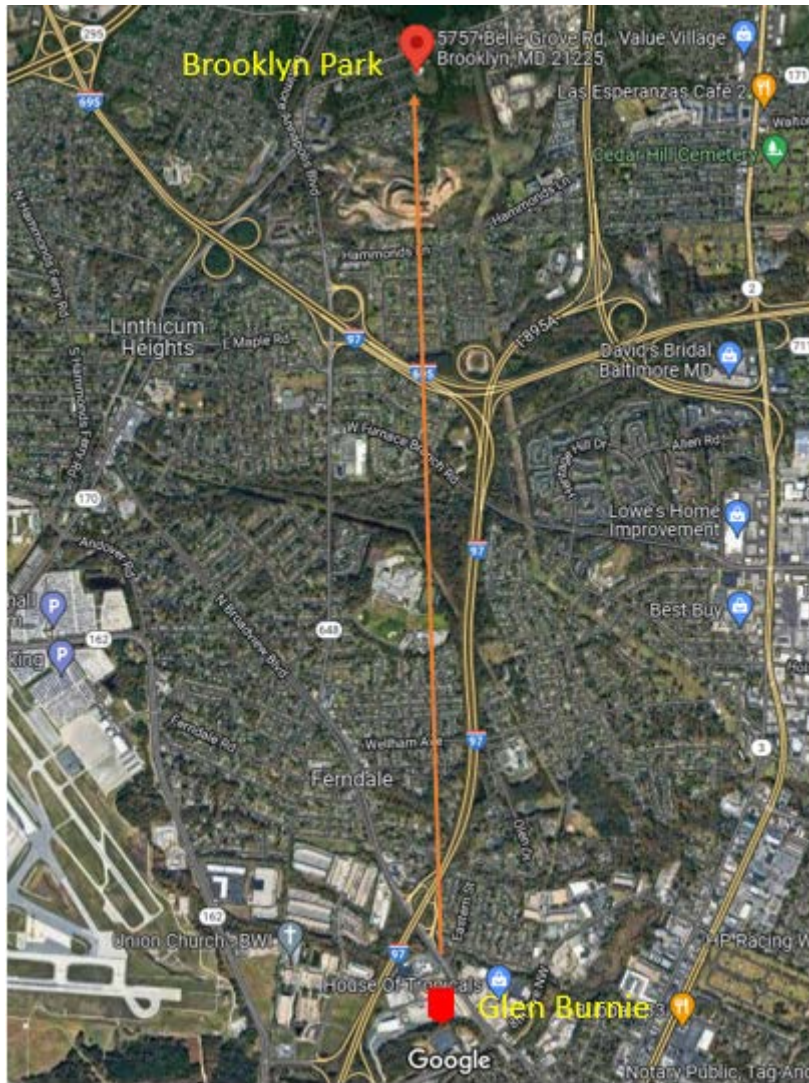
**Figure A- 6. Areal map of Blackwater NWR CASTNET air monitoring site in Dorchester County, MD.**

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.



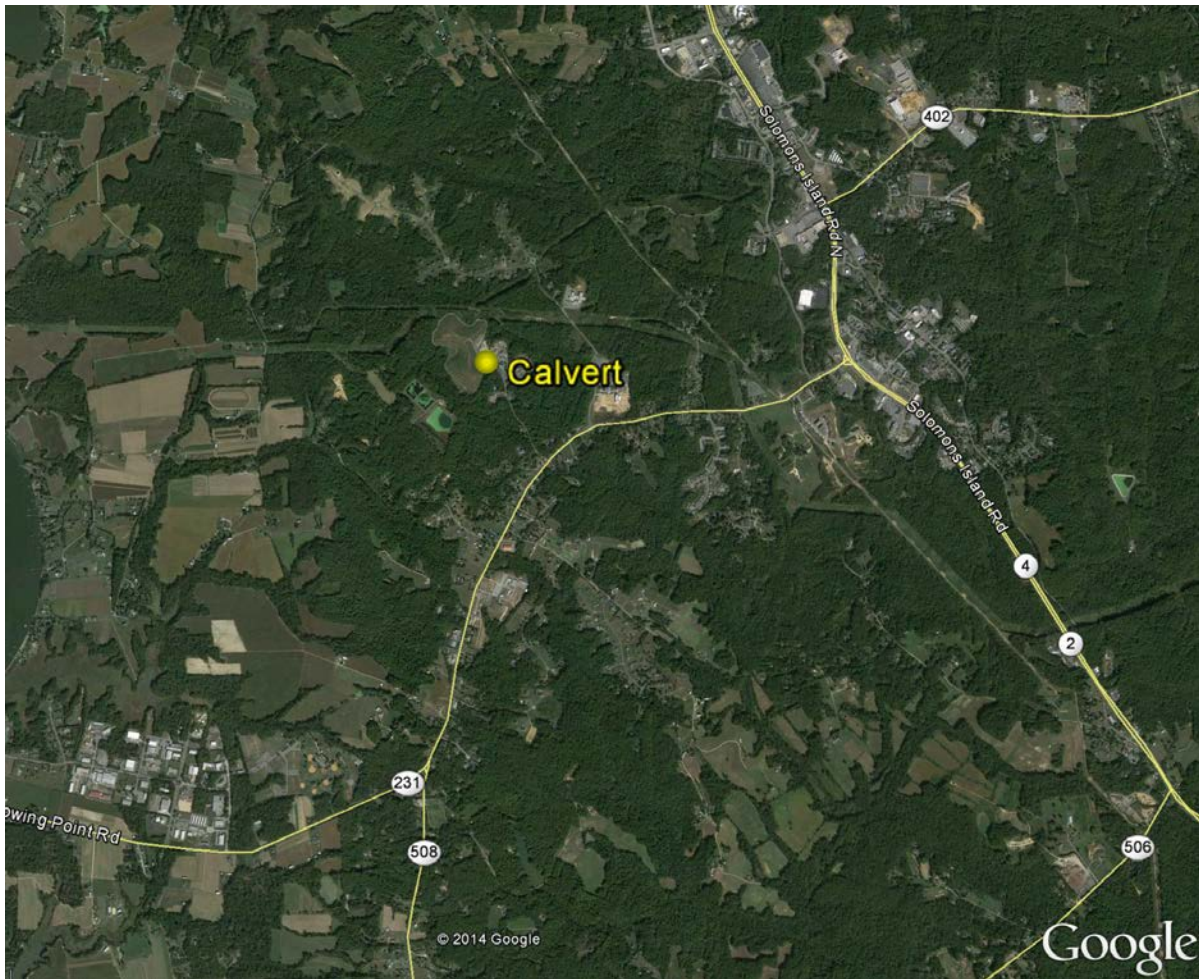
**Figure A- 7 Areal map of new Brooklyn Park air monitoring site in Anne Arundel, MD.**

Brooklyn Park replaces Glen Burnie. Anne Arundel County, Maryland, which owns the Glen Burnie site location, is selling the property to developers and therefore is requiring us to move. The new site location, also located in Anne Arundel County and which will be referred to as Brooklyn Park, has been identified and received preliminary approval from EPA Region III. Seasonal ozone and PM<sub>10</sub> will be measured to characterize Population Exposure at the Neighborhood scale in a Suburban setting.



**Figure 8 shows the distance between the old Glen Burnie site and the new Brooklyn Park site.**

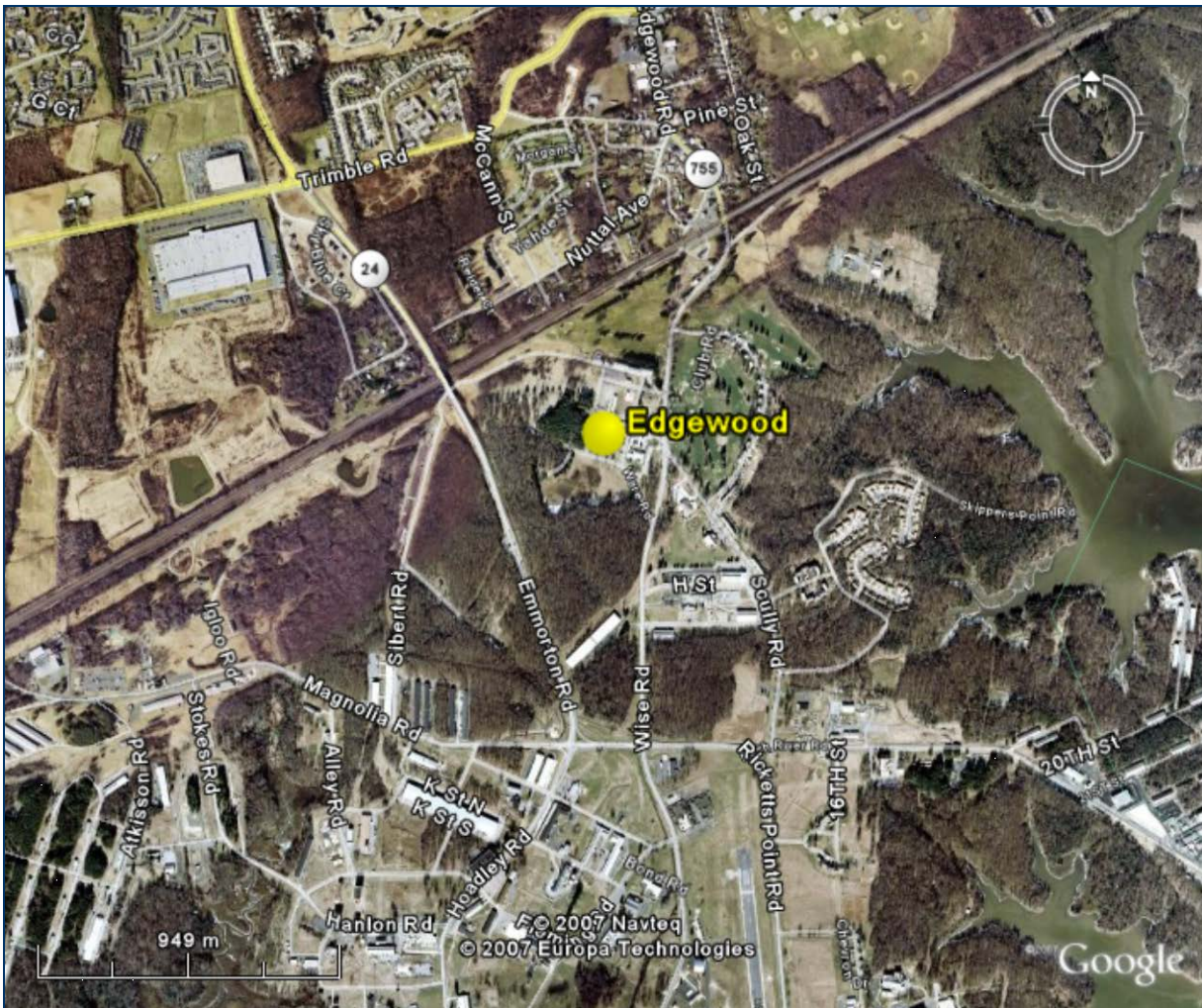
The new station is located approximately 4 miles north of the previous site.



**Figure A- 9. Areal map of Calvert air monitoring site in Calvert County, MD.**

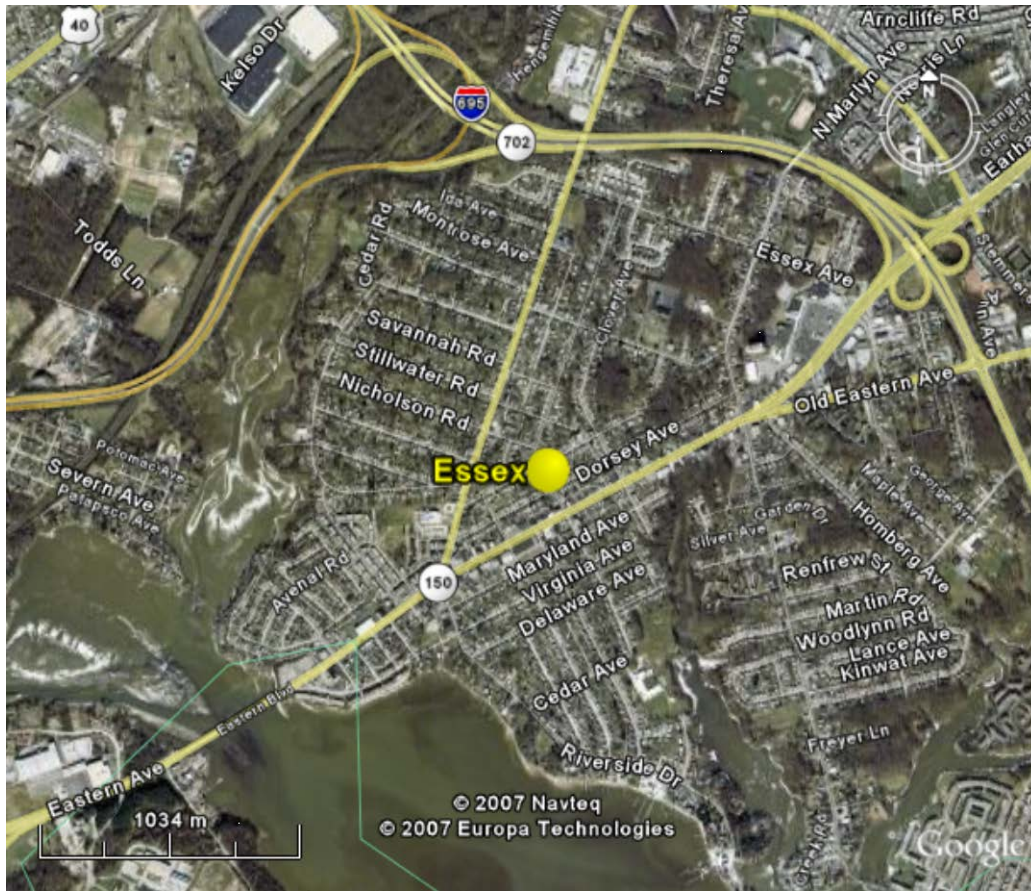
Calvert was chosen as a seasonal ozone monitoring site because of the potential to measure the population exposure of ozone at the urban measurement scale in a rural setting. The site is located at a recycling facility on a paved parking lot adjacent to a large radio tower that is several hundred feet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





**Figure A- 10. 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<sub>2.5</sub> 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- 11. 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; NOx and NO2 maximum precursor at the neighborhood scale; year-round ozone highest concentration and population exposure at the neighborhood scale; PM2.5 (local conditions and hourly) population exposure at the neighborhood scale; SO2 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.



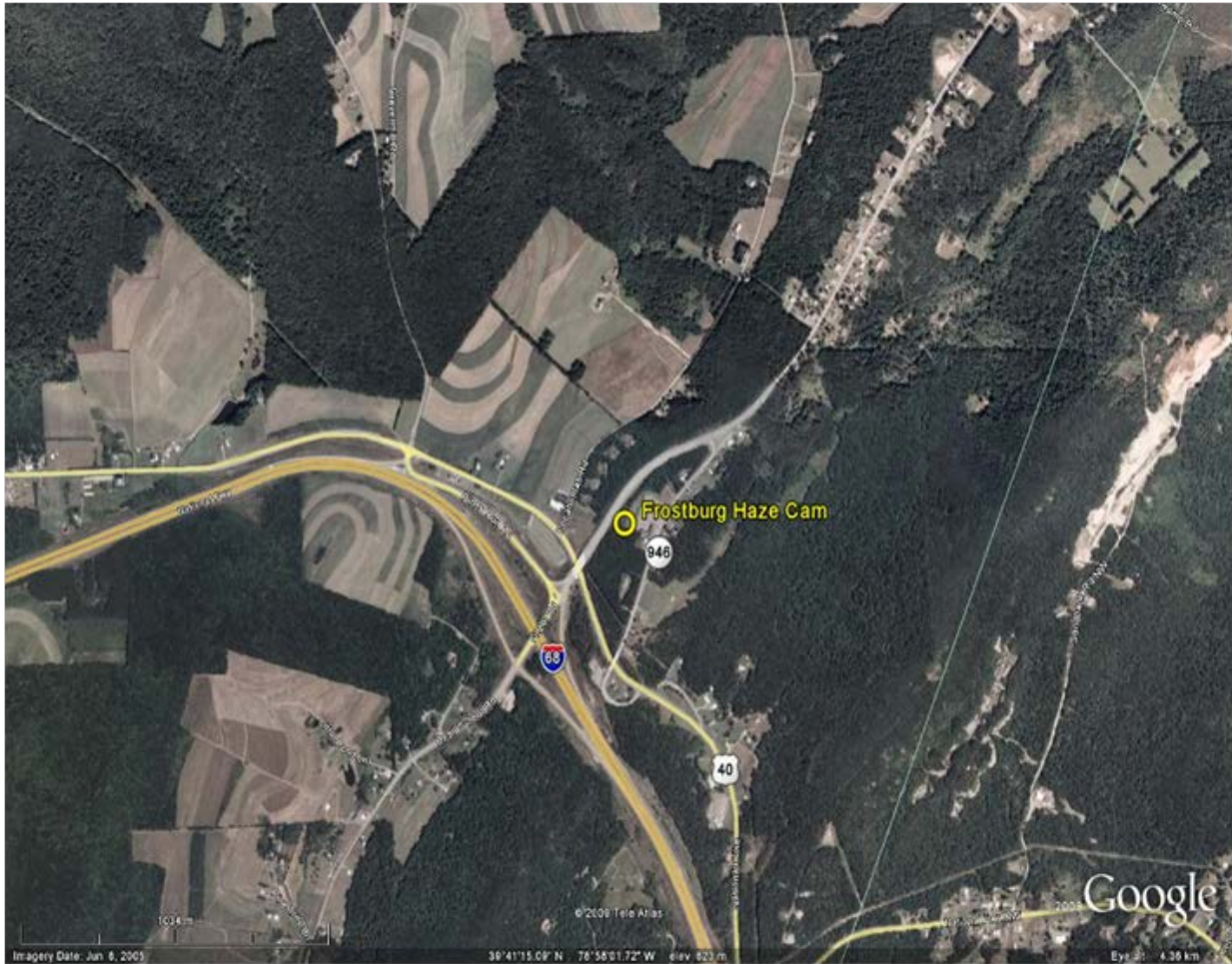
**Figure A- 12. Areal map of Fair Hill air monitoring site location in Cecil County, MD.**

The Fair Hill air monitoring station is approximately 440 meters to the west of the original location, and situated about 24 meters north of Rt. 273, Telegraph Road. The station will continue to be used to measure regional transport of ozone at the urban measurement scale, and general/background PM<sub>2.5</sub> at the regional scale, in a rural setting.



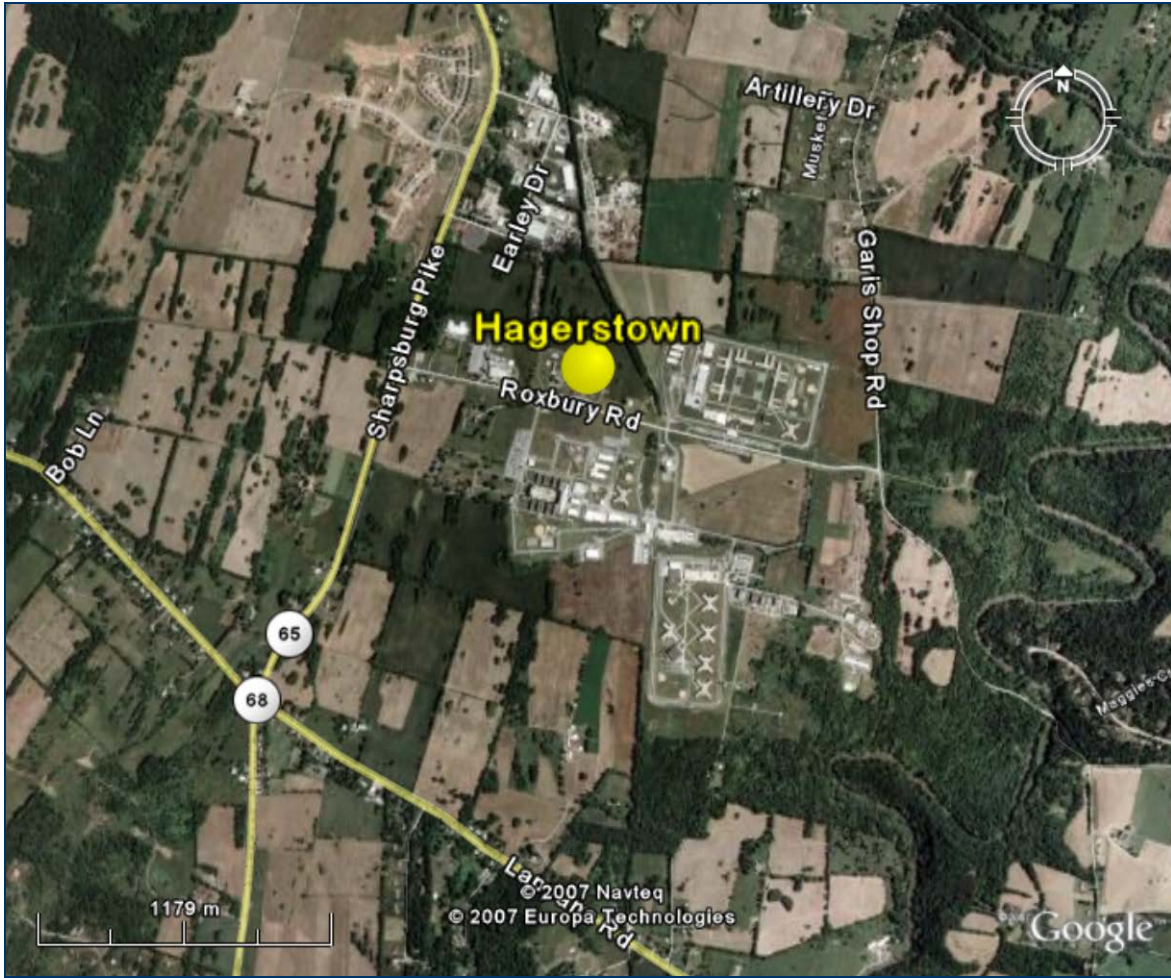
**Figure A- 13. Areal map of Frederick Airport air monitoring site in Frederick County, MD.**

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- 14. 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.



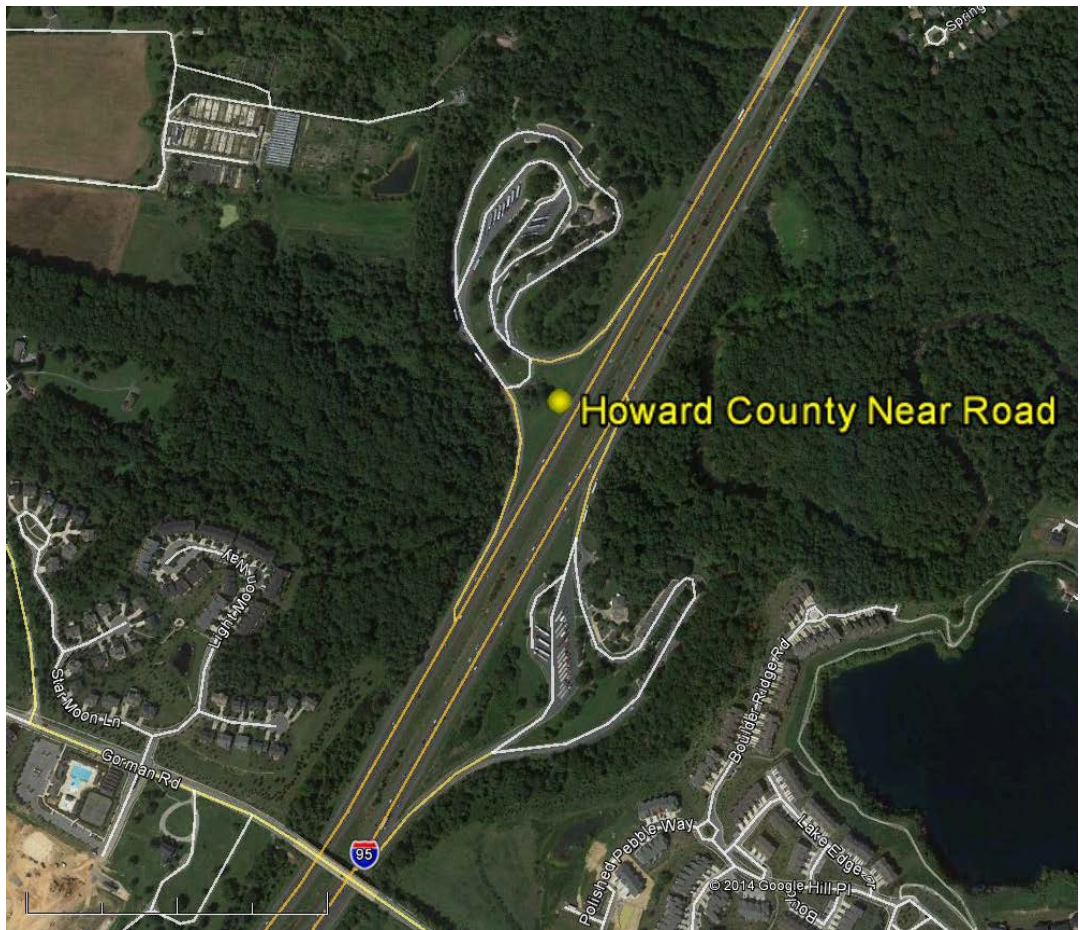
**Figure A- 15. Areal map of Hagerstown air monitoring site in Washington County, MD.**

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 PM2.5 monitoring site because of the potential to measure population exposure to PM2.5 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.**

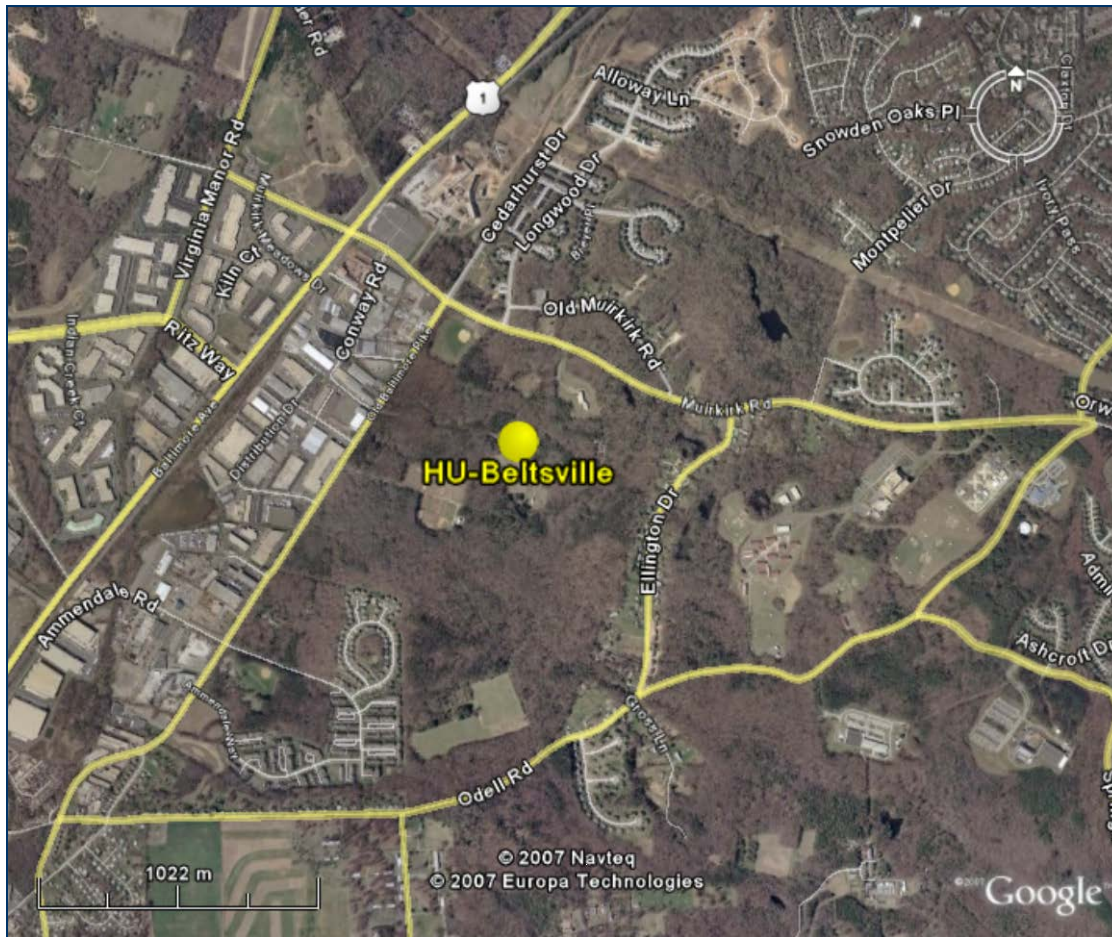
Horn Point, located in a rural setting, was chosen as a site for monitoring CO population exposure at the regional scale; NO population exposure at the regional scale; NOy-NO population exposure at the regional scale; year-round ozone population exposure at the regional scale; PM2.5 (hourly) population exposure at the regional scale; Reactive oxides of Nitrogen (NOy) population exposure at the regional scale; and SO2 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.**

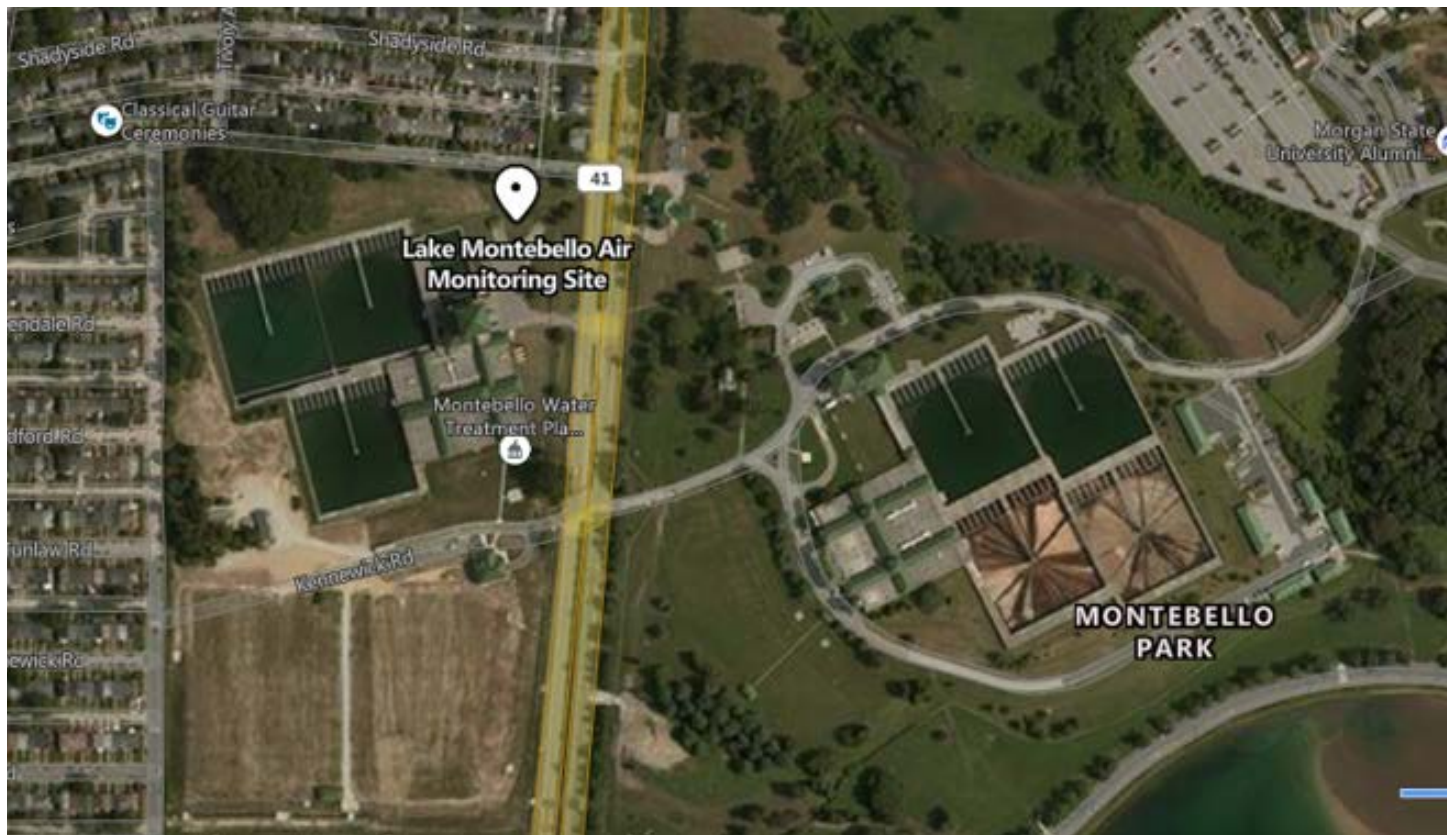
HCNR, located in a suburban setting, was chosen as a site for monitoring air quality near roads, including air toxics, CO, NO, NO<sub>2</sub>, NO<sub>x</sub>, and PM<sub>2.5</sub> source-oriented/highest concentration at the microscale. To the north of the Howard County Near Road monitoring site is a 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<sub>2</sub>, NO<sub>y</sub>-NO, NO<sub>x</sub>, and NO<sub>y</sub> 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<sub>2.5</sub> and neighborhood scale for PM<sub>10</sub>; SO<sub>2</sub> 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.



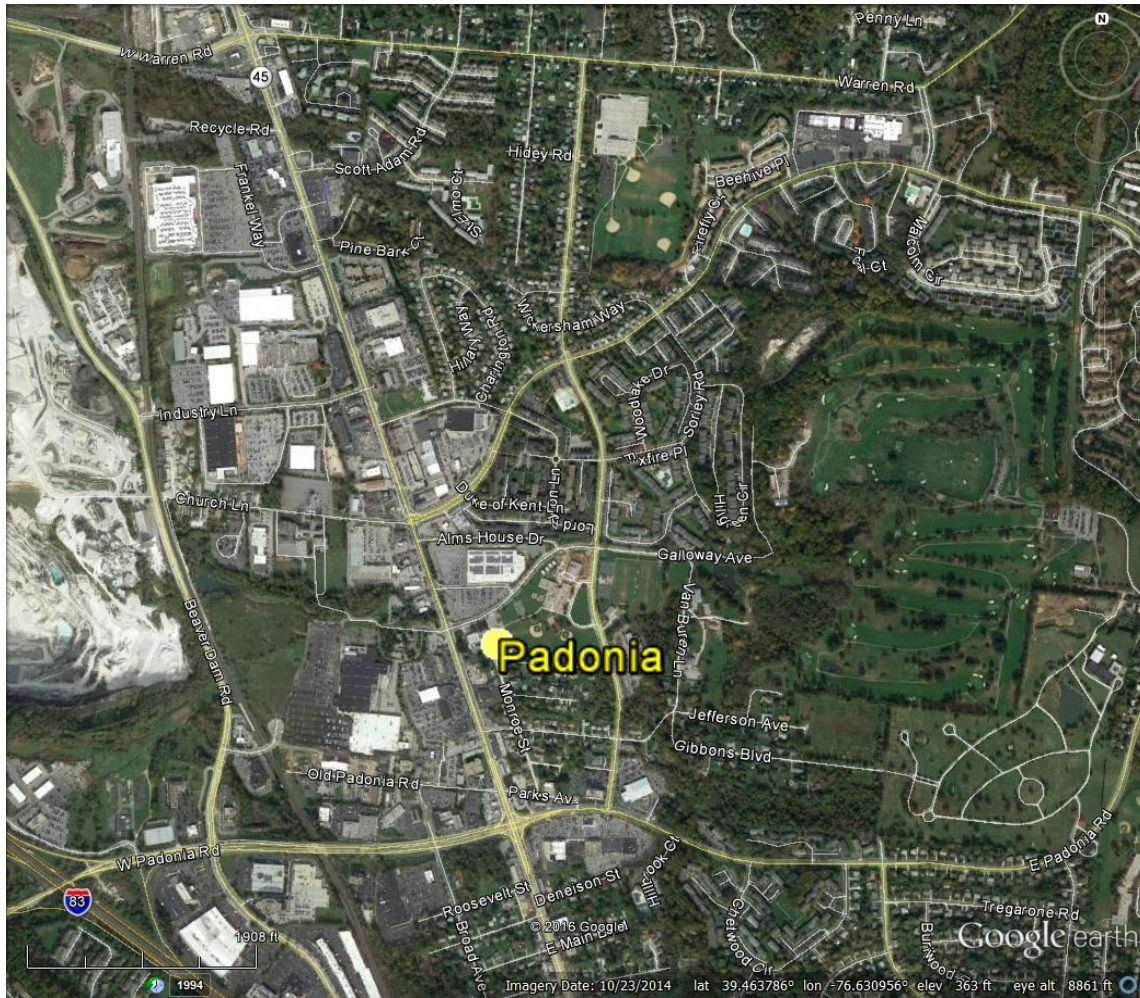
**Figure 19. Areal map of Lake Montebello air monitoring site in Baltimore City, MD.**

Lake Montebello, located in an urban setting, was chosen as a site for monitoring  $O_3$  and air toxics population exposure at the neighborhood scale, and CO, NO,  $NO_2$ ,  $NO_x$ , and  $PM_{2.5}$  highest concentration at the middle scale. The Lake Montebello trailer sits on property owned and used by Baltimore City Department of Public Works, at the Lake Montebello Water Treatment facility. This new site combines the monitoring objectives of the now-closed Furley and Oldtown sites.



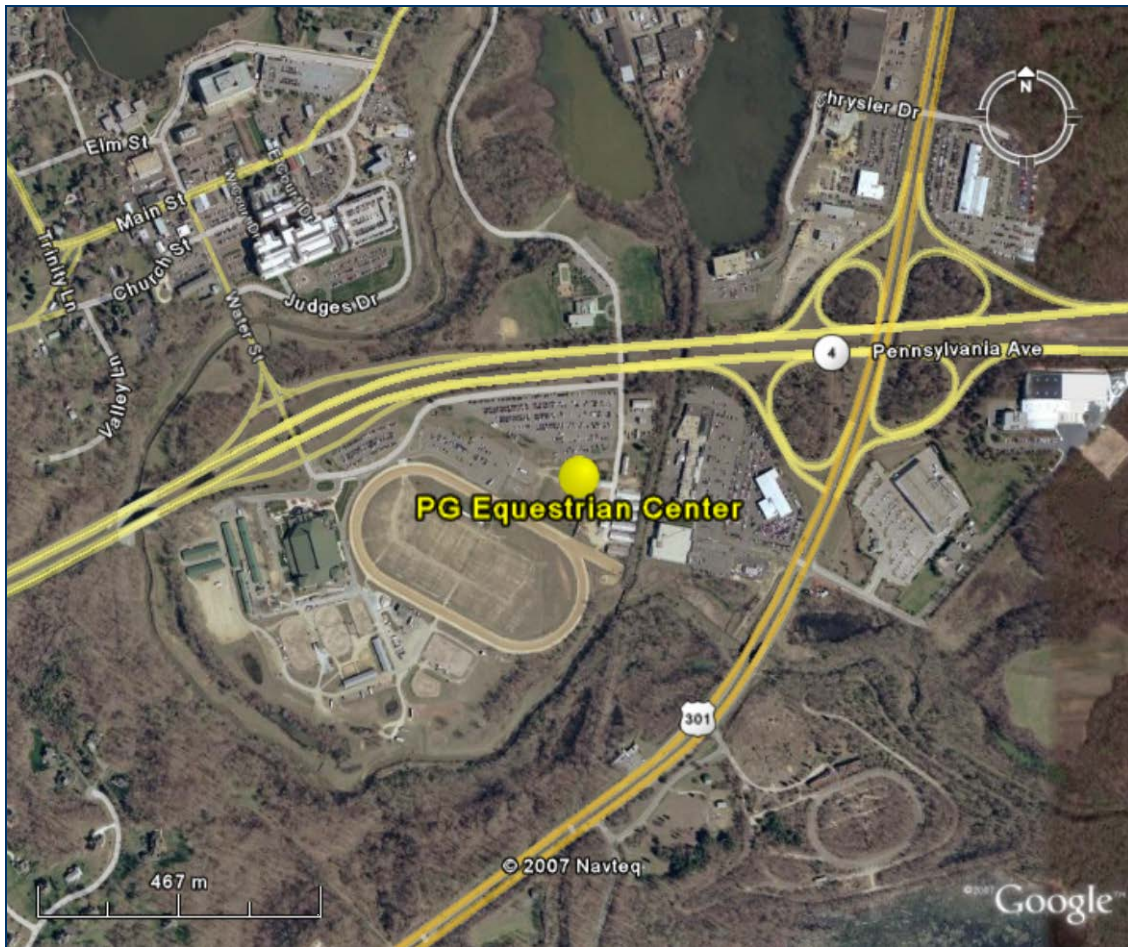
**Figure A- 20. Areal map of Millington air monitoring site in Kent County, MD.**

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<sub>2.5</sub> monitoring site because it has the potential to measure population exposure to PM<sub>2.5</sub> 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- 21. Areal map of new Padonia air monitoring site in Baltimore County, MD.**

Padonia was chosen as a seasonal ozone and PM<sub>2.5</sub> monitoring site because of the potential to measure the population exposure of ozone and PM<sub>2.5</sub> 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.



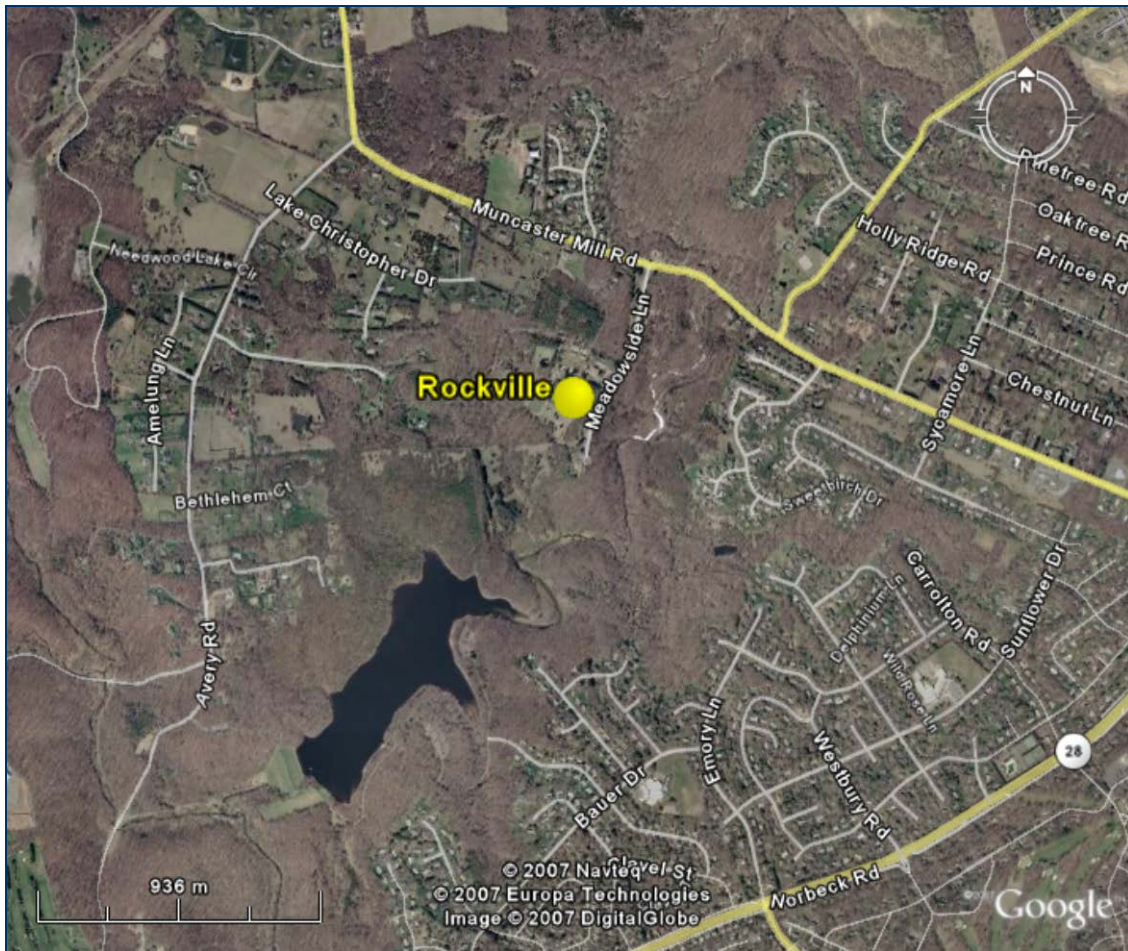
**Figure A- 22. Areal map of PG Equestrian Center air monitoring site in Prince George's County, MD.**

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<sub>2.5</sub> monitoring site because it has the potential to measure population exposure to PM<sub>2.5</sub> 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.



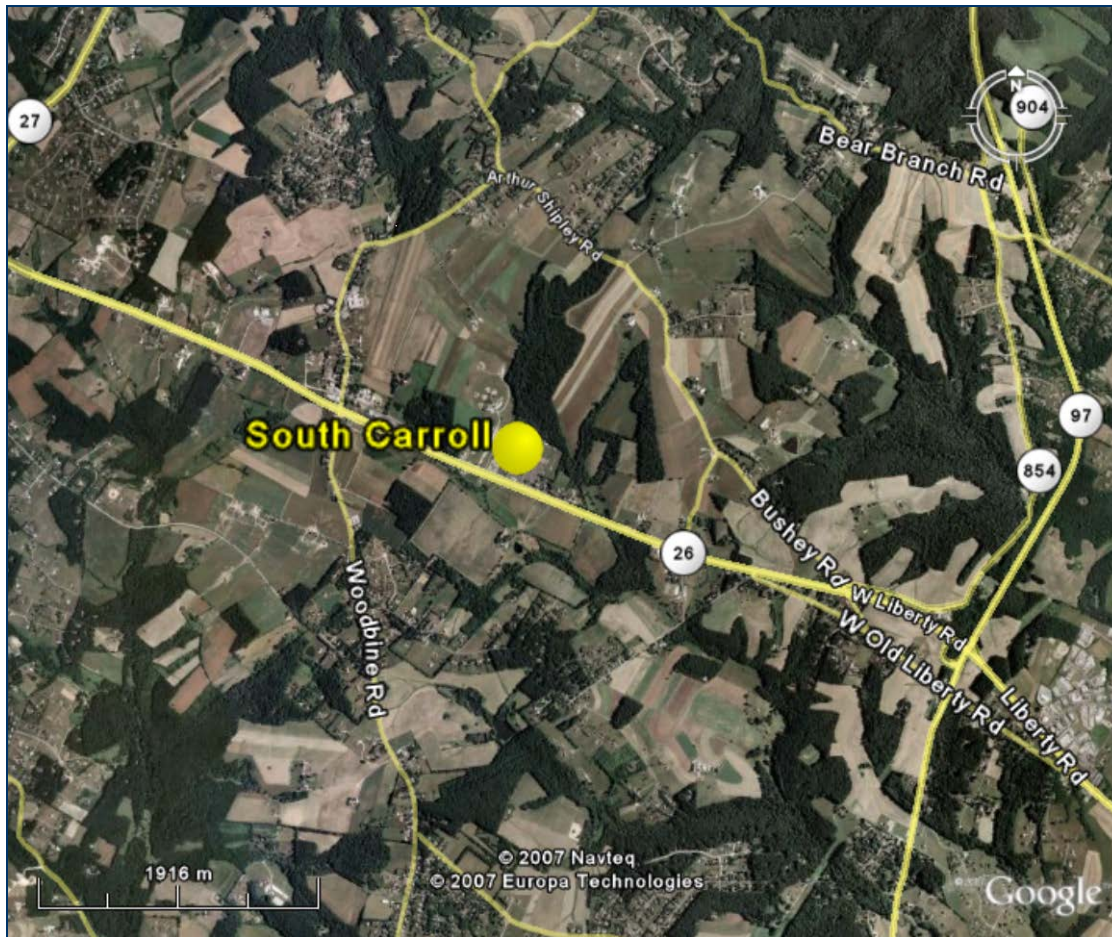
**Figure A- 23. Areal map of Piney Run air monitoring site in Garrett County, MD.**

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<sub>2</sub>, NO<sub>y</sub>-NO, NO<sub>x</sub>, NO<sub>y</sub>, SO<sub>2</sub>, and PM<sub>2.5</sub> regional transport at the regional scale.



**Figure A- 24. 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<sub>2.5</sub> 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- 25. 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- 26. 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.

**APPENDIX B**  
to the Maryland 2024 Air Monitoring Annual Network Plan

***EPA Approval Letter (DEC 14, 2022)***  
***for the 2023 Air Monitoring Annual Network Plan***

May 2023

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**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION III  
Four Penn Center  
1600 John F. Kennedy Boulevard  
Philadelphia, Pennsylvania 19103-2852**

Mr. Horacio Tablada, Secretary  
Maryland Department of the Environment  
1800 Washington Blvd.,  
Baltimore, Maryland 21230

Dear Secretary Tablada:

By letter and enclosures dated June 7, 2022, the Maryland Department of the Environment (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 - Ambient Air Quality Surveillance. MDE's request to discontinue the SO<sub>2</sub> monitor at Riviera Beach in Pasadena, Anne Arundel County, Maryland on April 13, 2022 was approved by EPA on May 6, 2022. Based on our review, EPA hereby approves MDE's May 25, 2022 annual ambient air monitoring network plan on the basis that the plan meets the requirements of 40 CFR Part 58.

Additionally, 40 CFR Section 58.11(c) requires any changes to the air monitoring network or design of the Particulate Matter Speciation Trends Network (STN) and the National Core Monitoring Network (NCore) air monitoring systems to be approved by the EPA Administrator. However, since there have been no changes to either of these two air monitoring systems, EPA has determined that MDE's 2022 annual ambient air monitoring network plan does not require further review and approval from the EPA Administrator. EPA Region III recognizes that MDE has received American Rescue Plan funds to upgrade Air Monitoring Equipment at existing air monitoring locations in and around vulnerable or overburdened communities.

If you have any questions, please do not hesitate to contact me or have your staff contact Ms. Cristina Fernandez, Director, Air and Radiation Division, at (215) 814-2178.

Sincerely,

Adam Ortiz  
Regional Administrator

cc: Mr. Chris Hoagland, MDE  
Mr. David Krask, MDE



## **APPENDIX C**

**to the Maryland 2024 Air Monitoring Annual Network Plan**

***Screen shot of MDE web page showing public comment period dates  
for the 2024 Air Monitoring Annual Network Plan***

May 2023

mde.maryland.gov/Pages/index.aspx

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**News**

- Shelburne Harvesting Advisory & Maps
- PFAS in Biosolids Regulatory Update
- Public Notice for PFA Exception Request for Sewer Extension in Montgomery County
- Ambient Air Monitoring Network Plan for Calendar Year 2024
- Back River Wastewater Treatment Plant
- Patapsco Wastewater Treatment Plant

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- Monitoring Network
- Air Quality Forecast
- Air Quality Facts
- Historical Data
- Quality of Air Summaries
- Seasonal Reports
- Air Monitoring Home

## Ambient Air Monitoring Network

### Ambient Air Monitoring Network Plan 2024

Accepting comments to [janice.lafont@maryland.gov](mailto:janice.lafont@maryland.gov) through close of business (or 5pm) on Friday, April 30th

- Current Ambient Air Monitoring Network Map
  - Ambient Air Monitoring Network Assessment 2015
  - Ambient Air Monitoring Network Plan 2023
- EPA Region III approved the 2023 Network Plan on December 14, 2022

Maryland currently operates 24 air monitoring sites around the state and measures ground-level concentrations of criteria pollutants, air toxics, meteorology, visibility, and other research-oriented measurements. Click [here](#) to see a map of the current ambient air monitoring network. The Department of the Environment makes a concerted effort to closely participate in the latest air pollution research in order to ensure the Department's policies reflect the current state of the science.



Maryland uses a variety of monitoring techniques to address interstate pollutants traveling on prevailing winds into Maryland from surrounding states and regions. Such transported pollutants contribute up to approximately 70% of pollutant levels in Maryland during bad air quality episodes. At times, transported pollution arriving in Maryland outweighs local emissions as the dominant contributor to Maryland's continued non-attainment status for the National Ambient Air Quality Standards (NAAQS) for ground-level ozone. On other occasions, depending on the weather, both transport and "home grown" pollution are equally important in Maryland's worst air pollution days.

The consequences of transported pollution are significant. Many people come to Maryland to enjoy the natural beauty of the state's