Item 7, MWAQC
September 25, 2024

Memorandum

To: Metropolitan Washington Air Quality Committee (MWAQC)

From: Sunil Kumar, Principal Environmental Engineer, MWCOG

Date: September 25, 2024

Subject: Ambient Air Quality Monitoring in Metropolitan Washington Region

The purpose of this memorandum is to provide information on ambient air quality monitors in the metropolitan Washington region that were requested in the May 22, 2024 meeting of the Metropolitan Washington Air Quality Committee (MWAQC). The committee members requested that COG staff provide background information and address a few questions concerning air quality monitoring in the region. Those questions were related to different aspects of air quality monitoring, such as types of monitors (regulatory vs voluntary/community), entities responsible for the monitoring site selection, process for adding new monitoring sites for regulatory purposes, pollutants currently measured, differences in pollutants currently measured and those being requested through public comments, and the option for the region to measure additional pollutants or locate new monitors in areas, including those with hotspot concerns.

Types of monitoring

Following is the description of different types of air quality monitoring required by EPA and different types of monitors used for regulatory compliance with the National Ambient Air Quality Standards (NAAQS) and those that can be used at the community scale for non-regulatory purposes to measure different pollutants.

With regard to EPA's air quality regulatory requirements, monitoring includes 1) ambient air quality monitoring and 2) stationary source emissions monitoring. In addition, monitoring is also pursued by the general public using low-cost sensors and for research purposes (e.g., Environmental Justice) for a limited period of time.

1. Ambient air quality monitoring – involves monitoring of ambient air to evaluate the status of the air pollutants in the atmosphere as compared to clean air standards and historical information. It is used for determining compliance with the National Ambient Air Quality Standards (NAAQS), characterizing air quality and trends, estimating health-related exposure risks, developing and evaluating emission control strategies, evaluating source-receptor relationships, providing data for input to run and evaluate models, and measuring overall progress of air pollution control programs. EPA provides an interactive map of air quality monitors that displays monitor locations and monitor-specific information.

- NAAQS compliance monitors – These are official Federal Reference Method (FRM)/ Federal Equivalent Method (FEM) monitors. There are nineteen locations in the region where these monitors are located that measure Ozone (O3), Particulate Matter (PM2.5 & PM10), Carbon Monoxide (CO), Nitrogen dioxide (NO2), and Sulfur dioxide (SO2). Fig. 1 below shows a regulatory air monitoring station (FRM PM2.5 monitor).

Figure 1: Regulatory Air Monitoring Station (FRM PM2.5 monitor)

- Near-road monitors – They evaluate impacts of mobile sources on communities in near-road environments. There are two near-road monitoring stations in the region (one in DC near River Terrace-Anacostia Freeway and one in Springfield, VA). They measure NO2, PM2.5, and CO. They first started as research monitors, but now are integrated into the main monitoring network. https://www.epa.gov/amtic/near-road-monitoring
- Photochemical Assessment Monitoring Stations (PAMS) - Measure ozone precursors (volatile organic compounds (VOCs), carbonyl compounds, nitrogen oxides (NOx), and reactive nitrogen species (NOy), surface meteorology and boundary layer mixing height. https://www.epa.gov/amtic/photochemical-assessment-monitoring-stations-pams
- $PM_{2.5}$ Chemical Speciation Network (CSN) monitors – They provide data for trends analysis and a long-term record of the characterization of PM2.5. These monitors provide PM2.5 mass, toxic metals (such as aluminum and Pb), major ions (sulfates, nitrates, and ammonium), and organic and elemental carbon fractions. https://www.epa.gov/amtic/chemical-speciation-network-csn
- Interagency Monitoring of Protected Visual Environments [IMPROVE] monitors – They measure visibility and aerosol conditions, identify chemical species responsible for existing man-made visibility impairment, and document long-term trends in visibility. https://vista.cira.colostate.edu/Improve/improve-program/
- Clean Air Status and Trends Network (CASTNET) monitors – They measure O_3, NO_2, SO_2, and $PM_{2.5}$. Additionally, CASTNET data is used for assessing air pollution impacts to sensitive ecosystems and applications related to environmental assessments and permitting. https://www.epa.gov/castnet
- National Atmospheric Deposition Program (NADP) monitors – They estimate dry and total mercury and acid rain deposition. https://nadp.slh.wisc.edu/
- National Air Toxics Trends Station (NATTS) Sites – The NATTS program measures fifty eight VOC compounds, seven carbonyl compounds, seven metals compounds, and approximately twenty polyaromatic hydrocarbons or semi-volatile compounds. Two NATTS sites are in the Metro DC area, one in McMillan (DC) and one in HU-Beltsville (MD). The

purposes of these monitors include assessing trends and emission reduction program effectiveness, assessing and verifying exposure assessments, emission control strategy development, and as direct input to source receptor models. https://www3.epa.gov/ttnamti1/natts.html

2. Stationary source emissions monitors – They are continuous emissions monitoring systems (CEMs) employed at large industrial facilities and power plants and are used to meet permitting or trading program requirements. Such monitors measure actual emissions on a mass per unit time basis (such as pounds per hour) or on a unit metric basis (such as pounds per million BTU heat input) from a specific process or unit. These monitors are quality assured according to federal requirements in 40 CFR 60 and 40 CFR 75. The facility being monitored is responsible for the installation and maintenance of these systems. https://www.epa.gov/emc/emc-continuous-emission-monitoring-systems

3. General public operated low-cost sensor monitors - These sensors measure $PM_{2.5}$ and PM_{10} concentrations, are not quality assured or audited on a regular basis and are not sited per EPA guidelines (e.g., Purple Air, Clarity Node, Quant AQ Moduleair, etc.). Such sensors are not approved by EPA for use as FEMs and cannot be used for regulatory compliance. After about four years (35,000 hours of operation), performance of these sensors can deteriorate.[1] However, their lower costs for installation and operation allow for a more ubiquitous presence, as show in Figure 2. Data from these sensors can help inform meteorologists and the public on the air quality impacts of short-term events such as wildfire smoke as well as provide general information on community background concentrations. They have also been used for short-term special studies projects. https://www2.purpleair.com/

Figure 2: Purple Air Monitor

[1] dSouza P. Barkjohn K., Clements A., Lee J., Crawford Bl, Kinney, P. “Analyzing degradation in low-cost air quality sensors”, 2023 Environmental Science: Atmospheres.

4. Research monitoring – This is often pursued using mobile monitoring platforms such as the ones used in Ivy City/Brentwood short-term air monitoring surveys. See Fig. 3 below.

Figure 3: Aclima's mobile monitoring vehicle used in the Ivy City/Brentwood monitoring study

Source: https://doee.dc.gov/service/mobile-community-air-monitoring-pilot-project

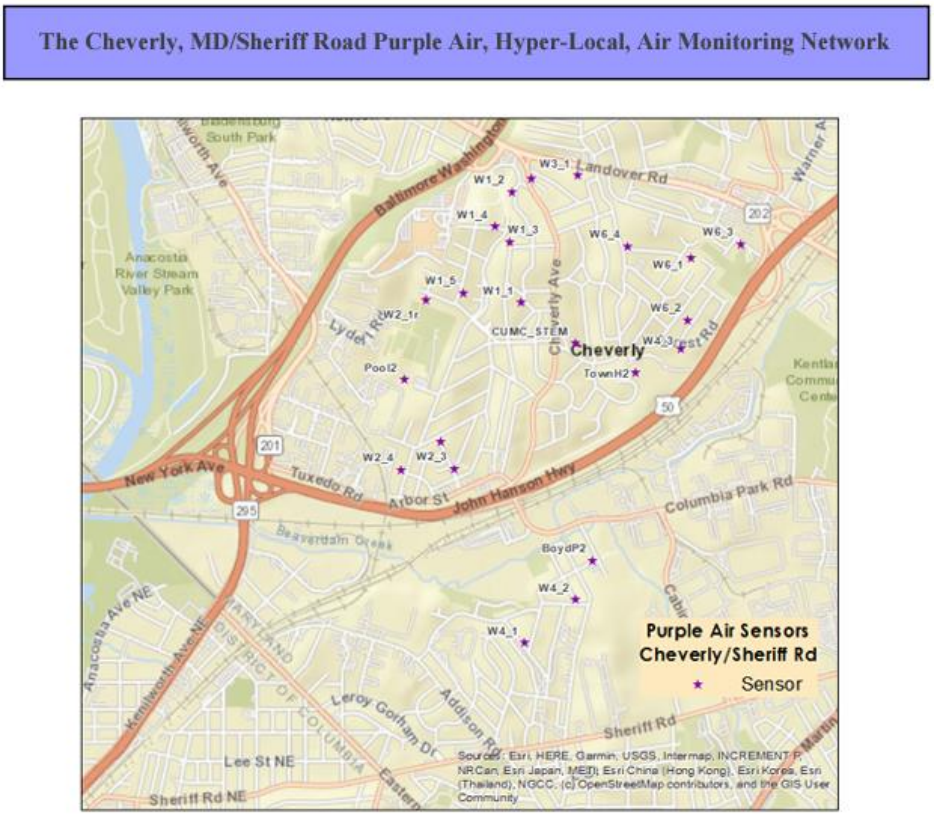


Figure 4: Map showing community network locations in Cheverly, MD

Source: Maryland Department of the Environment's Air Quality Partnership Project in Cheverly, Maryland, chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://mde.maryland.gov/programs/air/AirQualityCompliance/Documents/CheverlyStudy.pdf

Responsible Entity for Site Selection

Metropolitan Washington region currently has nineteen ambient air monitoring sites spread across the District of Columbia (District), Maryland, and Virginia that measure a variety of pollutants for different purposes (See Figure 5 below). The Air Pollution Control Agencies of Maryland, Virginia, and the District work with US EPA and the public to select sites for air pollution monitors. 40 CFR Part 58, Appendix D describes various criteria for selection of such sites that have three main objectives:

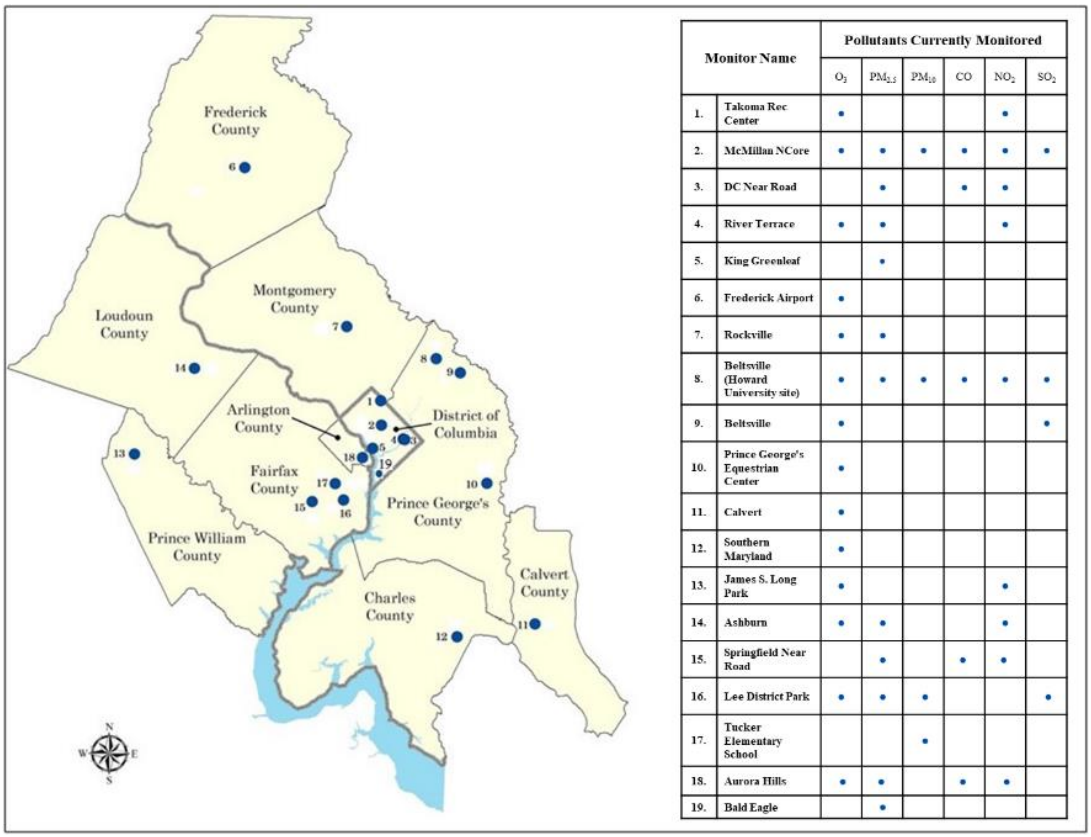
- Provide air pollution data to the general public in a timely manner
- Support compliance with ambient air quality standards and emissions strategy development. *A few sites are used to evaluate the regional air quality models used in developing emission strategies, and to track trends in air pollution abatement control measures' impact on improving air quality. At other sites near major air pollution sources, source-oriented monitoring data can provide insight into how well industrial sources are controlling their pollutant emissions*
- Support for air pollution research studies. (temporary, short-term)

In order to accomplish the above objectives, a monitoring network is designed with a variety of types of monitoring sites as follows:

- Sites located to determine the highest concentrations expected to occur in the area covered by the network.
- Sites located to measure typical concentrations in areas of high population density.
- Sites located to determine the impact of significant sources or source categories on air quality.
- Sites located to determine general background concentration levels.
- Sites located to determine the extent of regional pollutant transport among populated areas; and in support of secondary standards.
- Sites located to measure air pollution impacts on visibility, vegetation damage, or other welfare-based impacts.

Option for the region to add monitoring sites or to measure additional pollutants:

The locations of monitors and the pollutants currently being measured are shown in Figure 5. The monitoring network in the region currently measures all pollutants required by the Clean Air Act. Though the metropolitan Washington region is required to have only four ozone, one CO, two NO2, three SO2, ten PM10, and three PM2.5 monitors, it operates more than the minimum required such monitors.



	Monitor Name	Pollutants Currently Monitored					
		O_3	$PM_{2.5}$	PM_{10}	CO	NO_2	SO_2
1.	Takoma Rec Center	•				•	
2.	McMillan NCore	•	•	•	•	•	•
3.	DC Near Road		•		•	•	
4.	River Terrace	•	•			•	
5.	King Greenleaf		•				
6.	Frederick Airport	•					
7.	Rockville	•	•				
8.	Beltsville (Howard University site)	•	•	•	•	•	•
9.	Beltsville	•					•
10.	Prince George's Equestrian Center	•					
11.	Calvert	•					
12.	Southern Maryland	•					
13.	James S. Long Park	•				•	
14.	Ashburn	•	•			•	
15.	Springfield Near Road		•		•	•	
16.	Lee District Park	•	•	•			•
17.	Tucker Elementary School			•			
18.	Aurora Hills	•	•		•	•	
19.	Bald Eagle		•				

Figure 5: Air Quality Monitors & Pollutants in Metropolitan Washington Region

Any new additional monitoring site for regulatory compliance purposes would require additional funding to install, operate, and maintain those monitors in addition to collecting monitored data, analyzing and quality assuring them, and transmitting them to EPA. For example, a typical FEM $PM_{2.5}$ monitor such as the one installed at the Bald Eagle site in Ward 8 of the District costs around $15,000 and lasts around 5-6 years. Additional costs need to be added to this for operation, maintenance, data collection, QA/QC, and data submittal. The timeline for planning for new FRM or FEM sites is about 18-24 months, once funding for the project has been secured. This timeframe is necessary to garner all local and state approvals; ensure utility connections; order, receive, and install equipment; and perform initial quality assurance tests before bringing the site online.

Process for Adding New Monitoring Sites

Like any other existing monitoring site, a new monitoring site also needs to meet one of the three objectives mentioned above. Once an objective has been identified, a site would have to be selected keeping in mind that objective.

The addition of new sites for air pollution monitors involves a systematic process to ensure effectiveness and representativeness. The steps typically include:

- Assessment of Need: Conducting a thorough assessment to identify areas lacking adequate monitoring coverage or experiencing significant pollution levels. The presence of at-risk communities with poor air quality, particularly where there are anticipated effects

from sources in the area (e.g., a major industrial area, point source(s), port, rail yard, airport, or other transportation facility or corridor).

- Site Evaluation: Evaluating potential locations based on factors such as proximity to pollution sources, population density, topography, and meteorological conditions.
- Technical Feasibility: Assessing the technical feasibility of installing and maintaining monitoring equipment at the proposed sites, considering factors like access to power, data connectivity, and security, right of way, access, and land availability.
- Regulatory Approval: Obtaining necessary permits and regulatory approvals from relevant authorities to establish new monitoring sites, ensuring compliance with environmental regulations.
- Installation and Calibration: Installing and calibrating monitoring equipment at the selected sites to ensure accurate measurement of pollutants.
- State Air Quality Annual Monitoring Network Plans: States are required by 40 CFR 58.10 to provide an annual monitoring network plan to EPA by July 1 of each year. The rule also requires that the proposed plan be published for a minimum of 30 days so that the public can make comments on the proposed document. These plans provide an overview of the existing monitoring network and describe any expected changes in the coming year.
- Data Integration: Integrating data collected from new monitoring sites into existing air quality monitoring networks for comprehensive analysis and reporting.

Engagement with state monitoring divisions is key to the process of new monitor installation. While it is quite resource intensive to install and maintain monitors, it is possible to do so with collaboration among different entities and funding help from EPA and others. Special studies, by state divisions or by other entities like universities, are conducted as funding and other resources allow. These studies can provide some good data that is used for different purposes. The importance of good communication between state staff, COG staff, and localities that want to be considered for a particular kind of monitor or study is a very important step. EPA and general assembly members could be approached for special grant funding for appropriations. Universities could also be approached to see if they will be interested in this effort. Good communication and a strong consensus by all parties concerned is a must for this effort to move forward.

State Air Pollution Monitoring Plans

Maryland Monitoring Program Description
https://mde.maryland.gov/programs/air/AirQualityMonitoring/Pages/Network.aspx

District of Columbia Monitoring Program Description
https://doee.dc.gov/service/ambient-air-quality-monitoring

Virginia Monitoring Program Description
https://www.deq.virginia.gov/our-programs/air/monitoring-assessments/air-monitoring