
Maryland
Department of
the Environment
Regulatory Ambient Air
Monitoring

Maryland Department of the Environment

- MDE – *regulatory Agency with a mission to protect and restore the environment for the health and well-being of all Marylanders*

- Admins:
  - Office of the Secretary
  - Air and Radiation
  - Water and Science
  - Land and Materials
  - Operations

Regulatory Ambient Air Monitoring

- CAA of 1970 and following amendments
- NAAQS – CO, Pb, NO2, O3, PM2.5 & 10, SO2
- Attainment?
- Consistency across the US

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		primary and secondary	Rolling 3 month average	0.15 µg/m^3	Not to be exceeded
Nitrogen Dioxide (NO_2)		primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb	Annual Mean
Ozone (O_3)		primary and secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	primary	1 year	12.0 µg/m^3	annual mean, averaged over 3 years
		secondary	1 year	15.0 µg/m^3	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Source: EPA.gov

Regulatory Ambient Air Monitoring

- Monitoring Regulations –
  - Title 40 CFR Part 50 – National Primary and Secondary Ambient Air Quality Standards
  - Title 40 CFR Part 53 – Ambient Air Monitoring Reference and Equivalent Methods
  - Title 40 CFR Part 58 – Ambient Air Quality Surveillance
- Regulations for measurement method, siting, operations, data collection, quality assurance review and data submission

Monitoring Methods & Instrumentation

- Carbon Monoxide - Non-dispersive infrared photometry / Gas Filter Correlation (Beer's Law)
- Ozone - UV photometry (attenuation)
- Nitrogen Dioxide - chemiluminescence, UV photolytic, cavity attenuated phase shift spectroscopy (CAPS)
- Sulfur dioxide – pulsed fluorescence
- PM-gravimetric, beta attenuation, light scattering
- Toxics – TO-11, TO-15, PAMS

Siting Regulations

Table 7-2 Summary of Probe and Monitoring Path Siting Criteria

Pollutant	Scale (maximum monitoring path length, meters)	Height from ground to probe, inlet or 80% of monitoring path [1] (meters)	Horizontal and vertical distance from supporting structures[2] to probe, inlet or 90% of monitoring path[1] (meters)	Distance from trees to probe, inlet or 90% of monitoring path[1] (meters)	Distance from roadways to probe, inlet or monitoring path[1] (meters)
SO_2 [3,4,5,6]	Middle (300 m) Neighborhood Urban, and Regional (1 km).	2–15	> 1	>10	N/A
CO [4,5,7]	Micro, Middle (300 m), Neighborhood (1 km).	3 ±1/2: 2–15	> 1	> 10	2–10; see Table 7–3 of this section for middle and neighborhood scales.
NO_2, O_3 [3,4,5]	Middle (300 m) Neighborhood, Urban, and Regional (1 km).	2–15	> 1	> 10	See Table 7-3 of this section for all scales.
Ozone precursors (for PAMS) [3,4,5].	Neighborhood and Urban (1 km)	2–15	> 1	> 10	
PM, Pb [3,4,5,6,8]	Micro: Middle, Neighborhood, Urban and Regional.	2–7 (micro); 2–7 (middle PM10-2.5); 2–15 (all other scales).	> 2 (all scales, horizontal distance only).	> 10 (all scales).	2–10 (micro); see Figure 7.3 of this section for all other scales

Figure 7.3 Left & top left glass intakes for manifolds; top right long tube manifold; bottom right short tube manifold with water trap.

Table 7-3 Minimum Separation Distance Between Roadways and Sampling Probes or Monitoring Paths at Neighborhood and Urban Scales for O_3, Oxides of Nitrogen (NO, NO_2, NO_x, NO_y) and CO

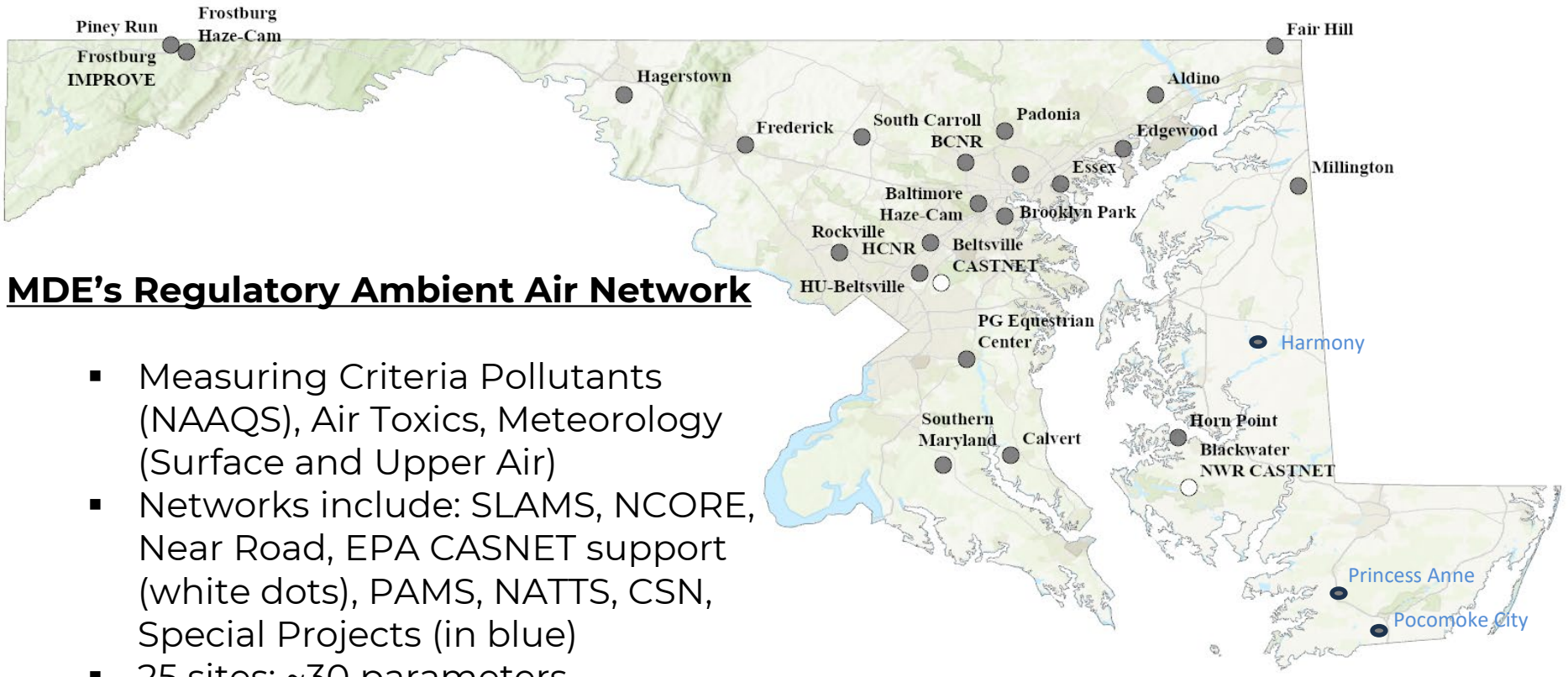
Roadway ave. daily traffic vehicles per day	O_3 and Oxides of N Neighborhood & Urban [1](meters)	O_3 and Oxides of N Neighborhood. & Urban [1& 2](meters)	CO Neighborhood (meters)
≤ 1,000	10	10	
10,000	10	20	
≤ 10,000			10
15,000	20	30	25
20,000	30	40	45
30,000			
40,000	50	60	
50,000			
≥ 60,000			
70,000	100	100	
≥110,000	250	250	

[1] Distance from the edge of the nearest traffic lane. The distance for intermedi
interpolated from the table values based on the actual traffic count.
[2] Applicable for ozone monitors whose placement has not already been approved as of December 18, 2006.

Site and Instrumentation costs

- Site costs - $150k - $250k one-time expenditure
  - Shelters
  - Analyzers
  - Calibration and dilution systems (including tanks, regulators)
  - Comm systems
  - Data management software
  - Land rent
- Monitoring objective
- Continued operation

MDE's 2024 Regulatory Air Monitoring Network



MDE's Regulatory Ambient Air Network

- Measuring Criteria Pollutants (NAAQS), Air Toxics, Meteorology (Surface and Upper Air)
- Networks include: SLAMS, NCORE, Near Road, EPA CASNET support (white dots), PAMS, NATTS, CSN, Special Projects (in blue)
- 25 sites: ~30 parameters measured, ~110 total instruments (over 500 pieces including ancillary equipment), 6 field operators!

Pollutant site requirements

- MSA / CBSA
  - In Maryland, shared

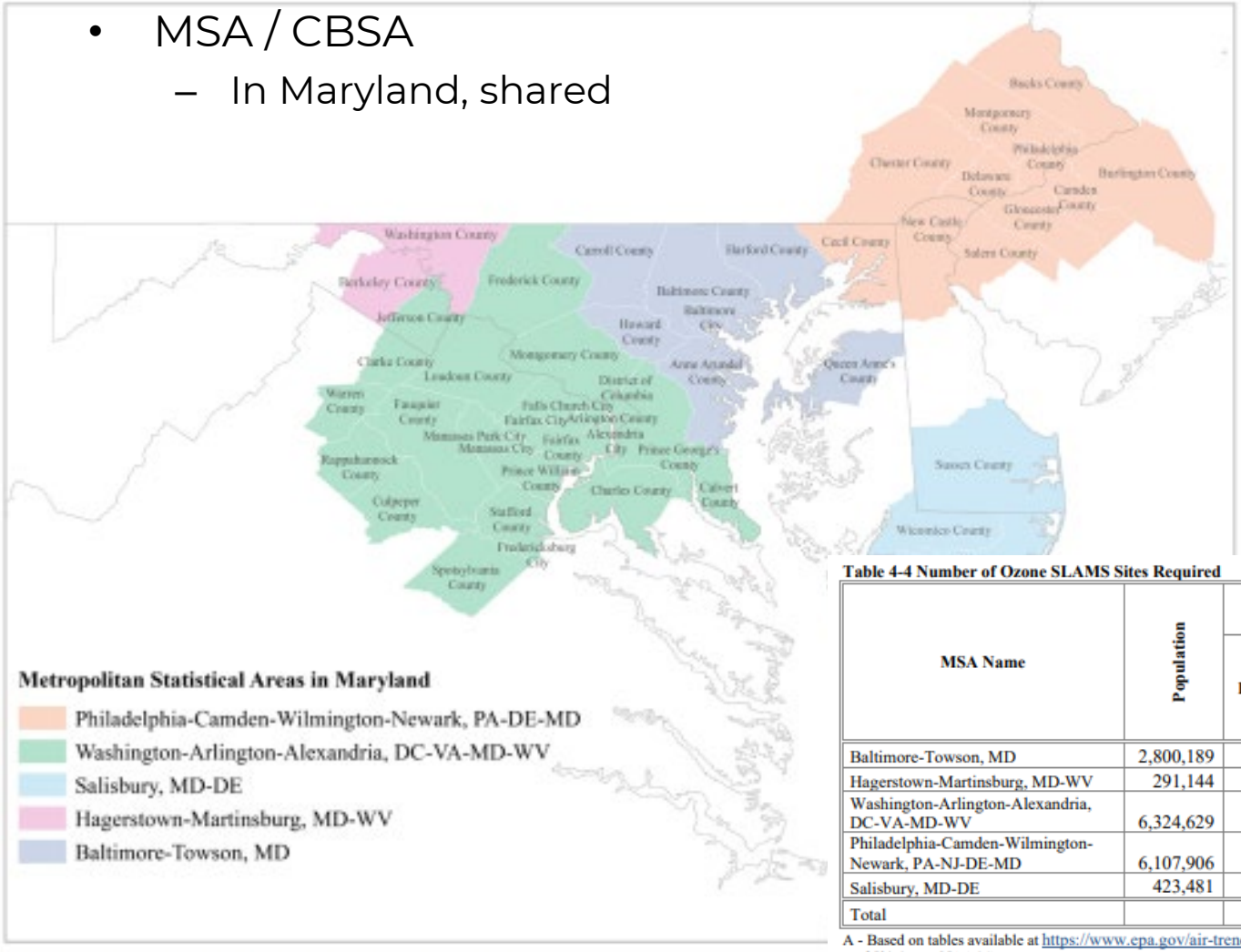


Figure 1-1 Map showing MSAs in Maryland.

Table 4-4 Number of Ozone SLAMS Sites Required

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

A - Based on tables available at https://www.epa.gov/air-trends/air-quality-design-values. All areas had their maximum site >= 85% Ozone NAAQS
-- indicates that no part of that State exists in that MSA.

Quality Assurance Requirements

$PM_{2.5}$ Filter Based Local Conditions Validation Template

1) Criteria (PM2.5 LC)	2) Frequency	3) Acceptable Range	Information /Action
CRITICAL CRITERIA- $PM_{2.5}$ Filter Based Local Conditions			
Field Activities			
Sampler/Monitor	NA	*Meets requirements listed in FRM/FEM/ARM*	1) 40 CFR Part 58 App C Sec. 2.1 2) NA
Sampling Period (including multiple power failures)	*all filters*	*1380-1500 minutes, or if value < 1380 and exceedance of NAAQS [1/] midnight to midnight local standard time*	1, 2 and 3) 40 CFR Part 50 App L Sec. 3.3 and 40 CFR Part 50 App N Sec. 1 for the midnight to midnight local standard time requirement See details if less than 1380 min sampled
Variability in Flow Rate	*every 24 hours of op*	*CV ≤ 2%*	1, 2 and 3) 40 CFR Part 50, App L Sec. 7.4.3.2
One-point Flow Rate Verification	*every 30 days each seperated by 14 days*	*< ± 4.1% of transfer standard* < ± 5.1% of flow rate design value	1, 2 and 3) 40 CFR Part 50, App L, Sec. 9.2.5 and 7.4.3.1 and 40 CFR Part 58, Appendix A Sec. 3.2.1
Design Flow Rate Adjustment	*After multi-point calibration or*	*< + 2.1% of design flow rate*	1, 2 and 3) 40 CFR Part 50, App. L, Sec. 9.2.6
	maintenance		3) 40 CFR Part 50, App. L, Sec. 7.4.6.1
Internal Leak Check	If failure of external leak check	*< 80.1 mL/min*	1) 40 CFR Part 50, App. L, Sec. 7.4.6.2 2) Method 2-12, Sec. 7.4.4 3) 40 CFR Part 50, App. L, Sec. 7.4.6.2
Laboratory Activities			

Filter Holding Times (pre sampling) - ,</= 30 days before sampling
Sample Recovery Times - </= 7 days 9 hours from end of sampling period

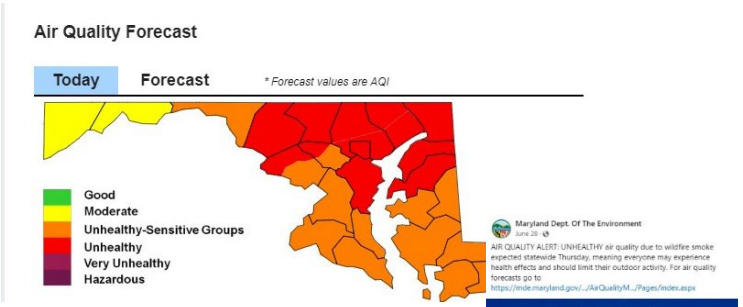
Flow Rate Verification – every 30 days, <+/- 4.1% of flow standard

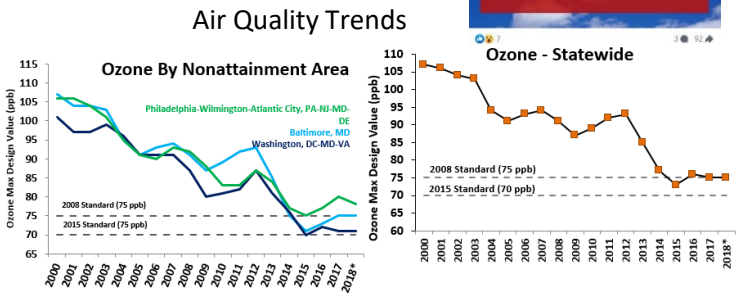
Laboratory Criteria –
Post Sampling Weighing requirements, Lab Temp and RH limits, Microbalance Auto-Calibration prior to weighing

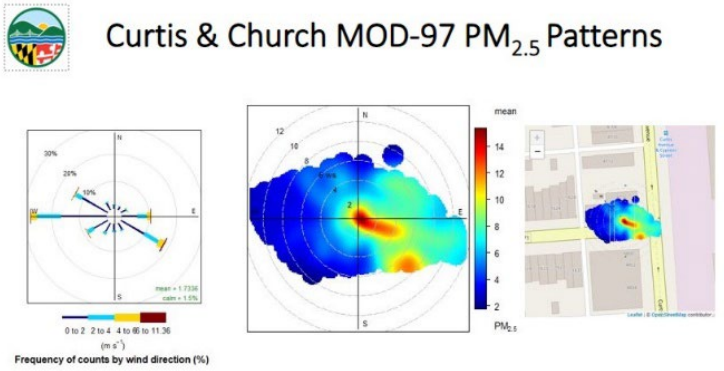
Additional Regulatory Data Uses

- **The Air Monitoring Program performs the following functions:**
  - Data Quality Control and Assurance

    - Data review, validation & reporting to Air Quality System (AQS)
    - Detailed SOPs and QAPPs for each pollutant, Annual Network Plan and 5-Year Network Assessment
    - Audits – internal and EPA audits of instrumentation performance.
  - Data Analysis
    - DV calculations, trends, summary statistics, exception events, quality of air summaries
    - IMPROVE, Haze Cams, Environmental Justice, Lower Eastern Shore Monitoring Project, Unified Ceilometer Network Support
    - Conceptual model development, ozone plume extent visualizations
    - Episode analyses, attainment demonstrations
  - Daily Air Quality Forecast and AQI Reporting
  - Analytical Laboratory - support 13 sites throughout Region III
  - Coordination of Meteorological, Dispersion and Photochemical Modeling
    - SIP Attainment Demonstrations and Sensitivity Runs
    - Permit Application Support and Review
  - Special Initiatives / Studies
    - Collaborations with EPA, NOAA, NASA, Universities, Communities

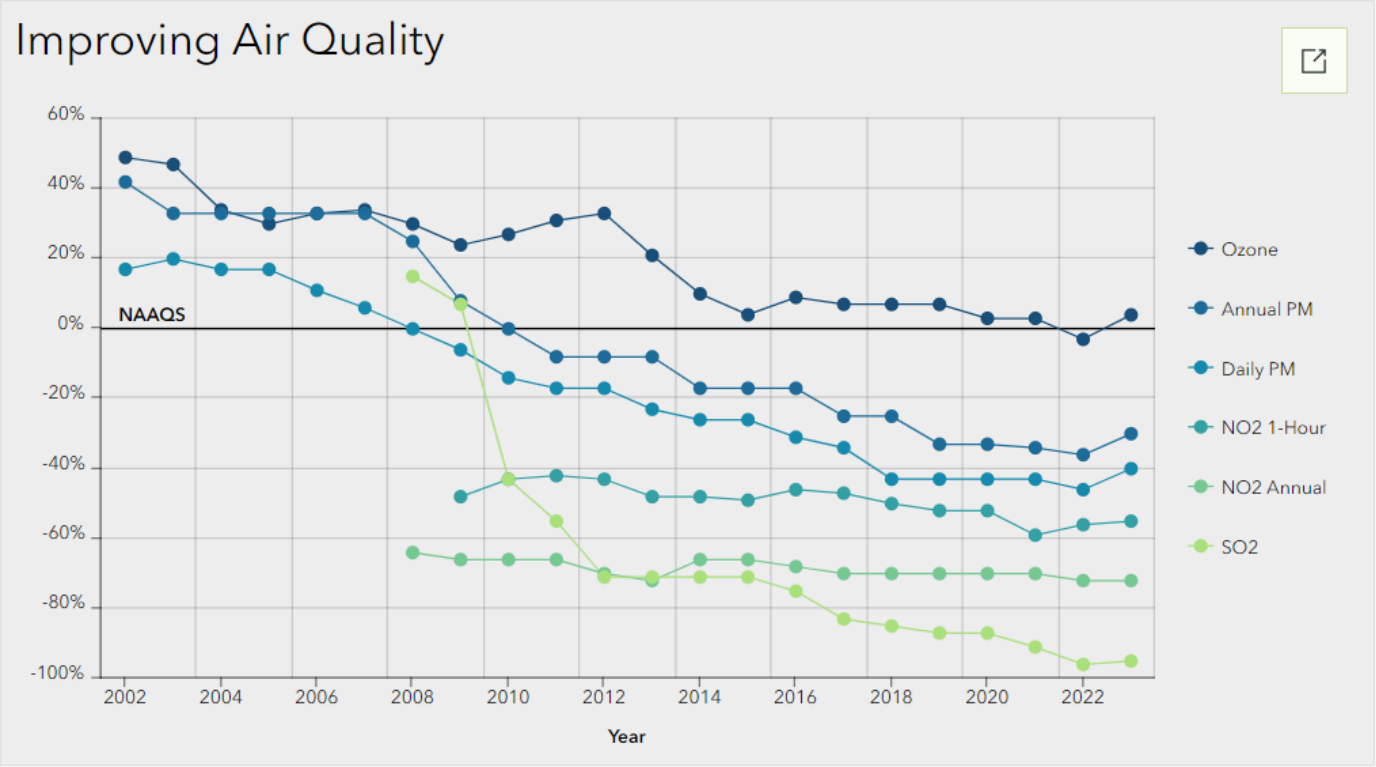






Air Quality Trends 2002 - 2023

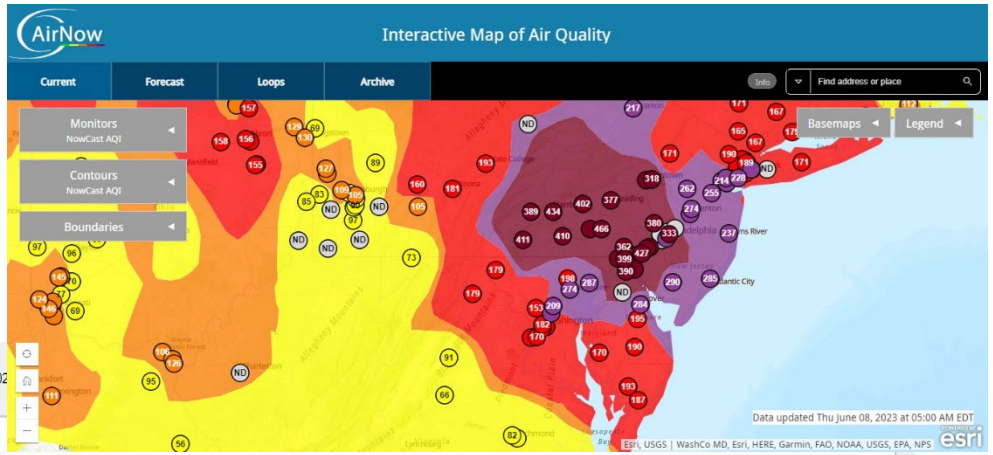
- Annual Pollutant Design Values compared to their respective National Ambient Air Quality Standard (NAAQS)
- Criteria pollutants overall have shown significant declines over the past 20 years

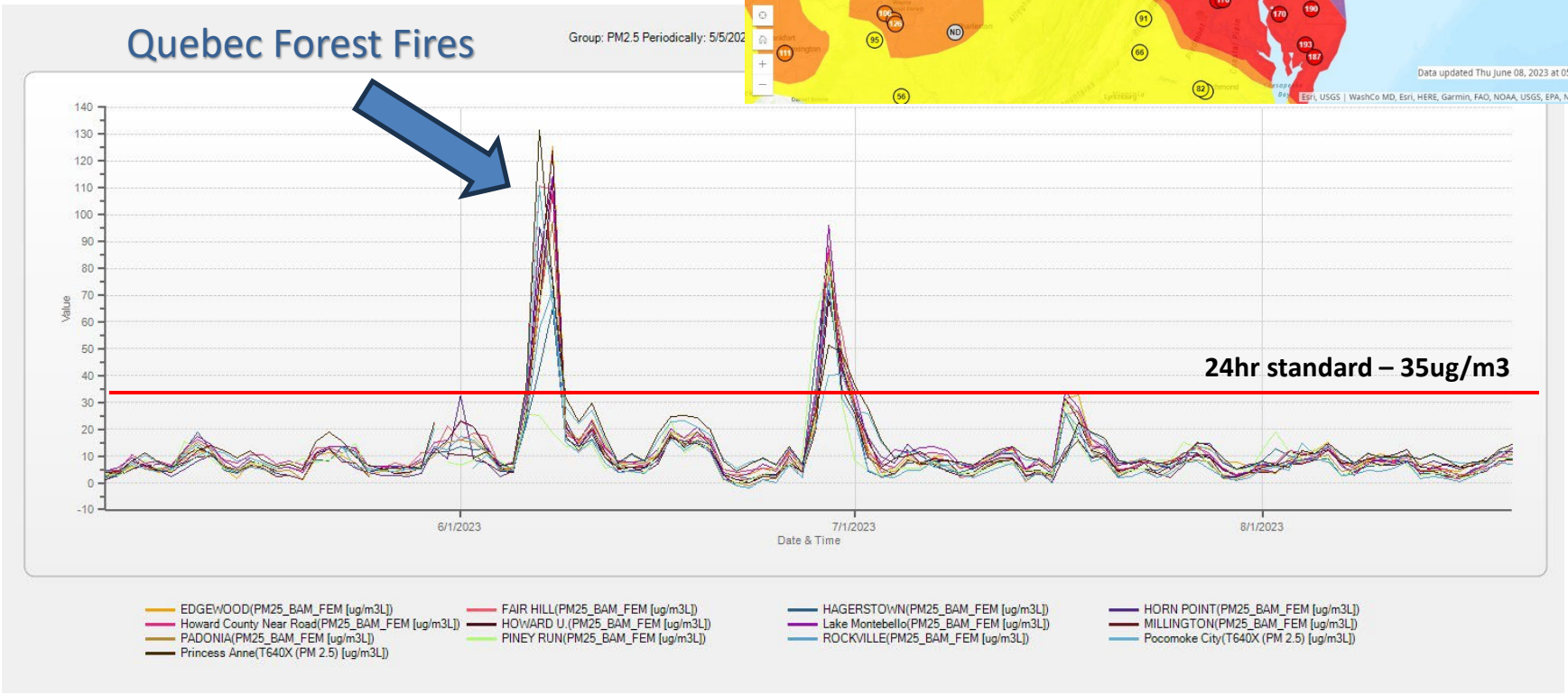


Source: 2024 Maryland Clean Air Progress Report

Summer Smoke in 2023

- Forest fires in Early June 2023
- PM2.5 exceedances, June 7,8, 28, 29, 30, 7/1 (PA only) and very close but no exceedances 7/17 and 7/18





Questions?

MDE Air Monitoring homepage:
https://mde.maryland.gov/programs/air/AirQualityMonitoring/Pages/index.aspx

MDE's Annual Network Plan:
https://mde.maryland.gov/programs/air/AirQualityMonitoring/Documents/MDNetworkPlanCY2023.pdf

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