Maryland
Department of the Environment

Overview of Maryland's Air Monitoring Network

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Joint Meeting-BTRB Technical Committee and Interagency Consultation Group

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Topics Covered

- Regulatory requirements
- Network design
- Maryland's monitoring network
- Near Road/Transport Studies/Sensors

Regulatory Requirements

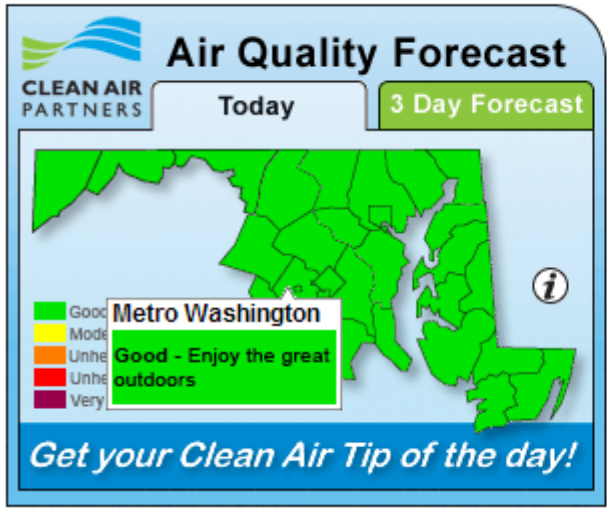
- Title 40 of the Code of Federal Regulations is “Protection of Environment.” Parts 50, 53 and 58 are applicable to air quality monitoring and the discussion today
  - Part 50 - National Primary and Secondary Ambient Air Quality Standards
  - Part 53 –Ambient Air Monitoring Reference and Equivalent Methods
  - Part 58 – Ambient Air Quality Surveillance

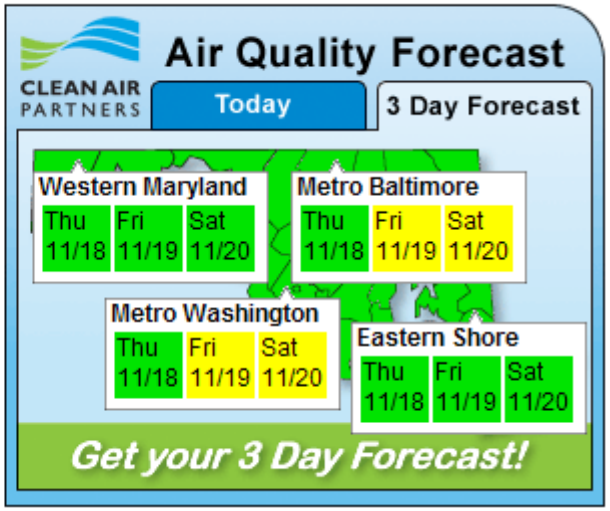
Regulatory Requirements

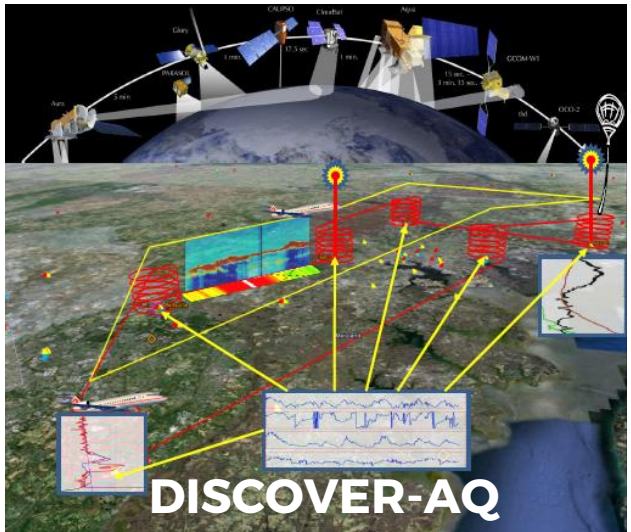
- Part 58- Air Quality Surveillance
  - Annual Network Plan
  - 5-Year Assessment
  - Annual Data Certification
  - Quality Assurance Requirements
  - Network Design Criteria
    - Minimum number of monitors
    - Network objectives
    - Monitoring site types
    - Spatial scales
    - Required monitoring

Network Design

- Objectives
  - Provide data to public in timely manner
  - Determine attainment status relative to the NAAQS
  - Support emissions control strategy development and track progress of implementation
  - Support air pollution research studies

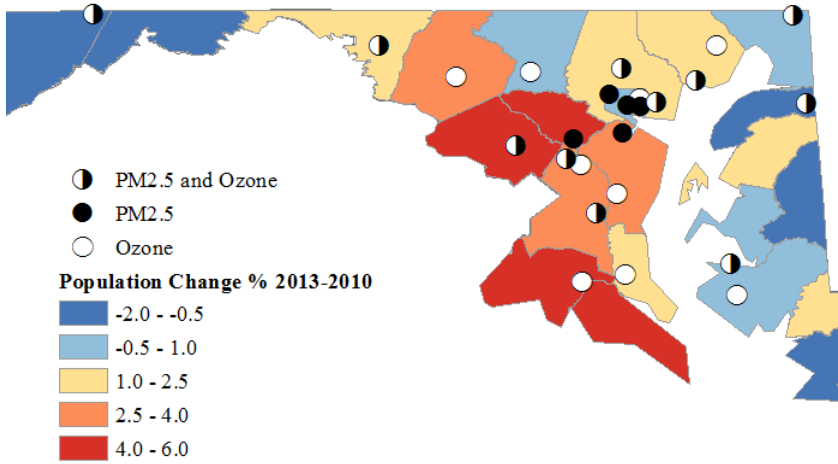


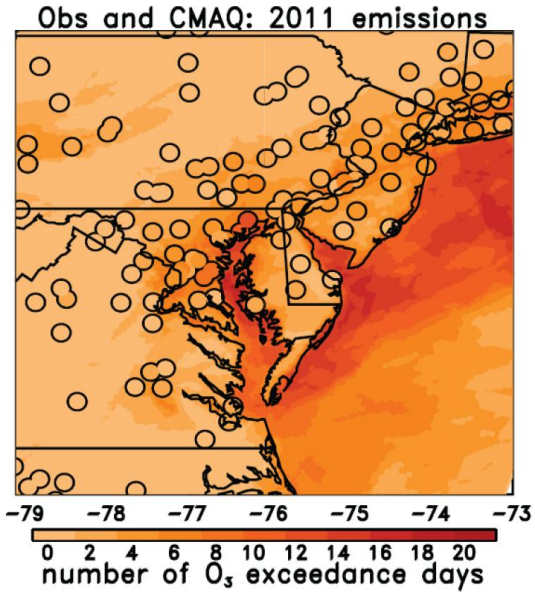




Network Design

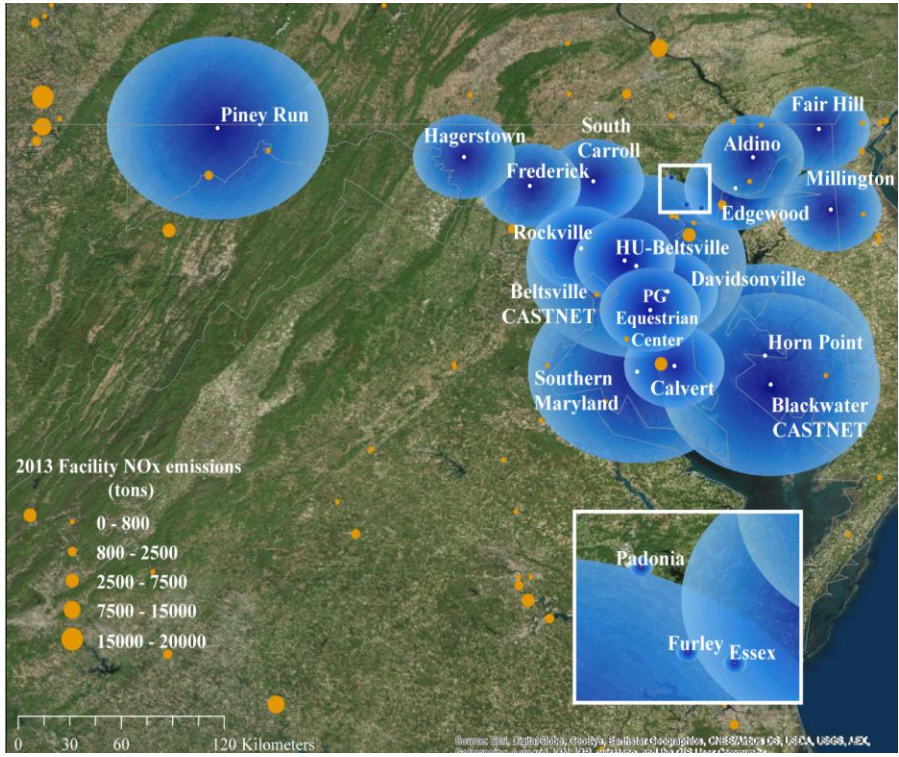
- Monitoring Site Types
  - Highest expected concentrations in the network area
  - In high population areas
  - Impact of significant sources or source categories
  - General background concentration levels
  - Extent of regional pollutant transport among populated areas
  - Impacts on visibility, vegetation damage, or other welfare-based impacts





Network Design

- Network Spatial Scales
  - Microscale: 1 – 100 meters
  - Middle: 100 – 500 meters
  - Neighborhood: 0.5 – 4.0 km
  - Urban: city-like dimensions, 4 – 50 km
  - Regional: rural homogeneous area 10's – 100's km
  - National & Global: characterize nations or the globe



Network Design

- Logistical Constraints and Other Considerations
  - Minimal interference and perturbation of wind flow by buildings, the tree canopy, or other obstacles
  - Availability of electrical power and telephone line
  - Cost of site lease, relocation or new deployment, site improvements such as road and fence
  - Safety, Security, and Accessibility (access to locked facilities)
  - Finite Resources – Funding, Staff
  - Longevity of site
  - Clear of immediate influence of sources (point, area, mobile) or within influence depending on site type




Network Design

- Federal network design criteria allow for the assumption that monitors will not operate in every time and space.

- Following Network Design Criteria ideally allows for monitoring of a thorough cross-section of the state including
  - high pollution areas
  - low pollution areas
  - areas under the immediate influence of significant sources
  - areas that make up the other site types and spatial scales

- Concept of representativeness: Monitors in areas with similar population densities, similar emission characteristics, and similar meteorology should measure similar pollution concentrations.

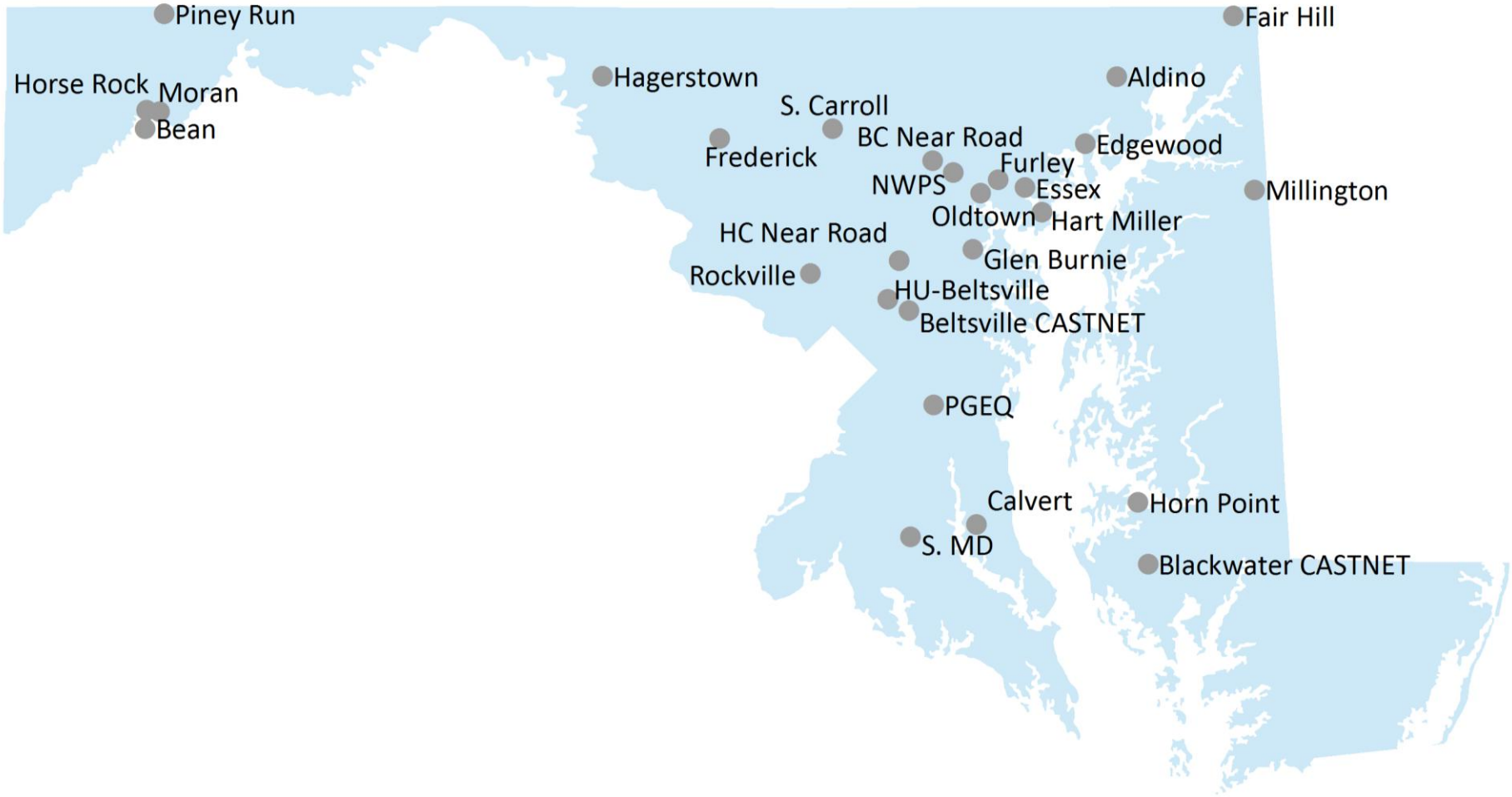



Required Monitoring

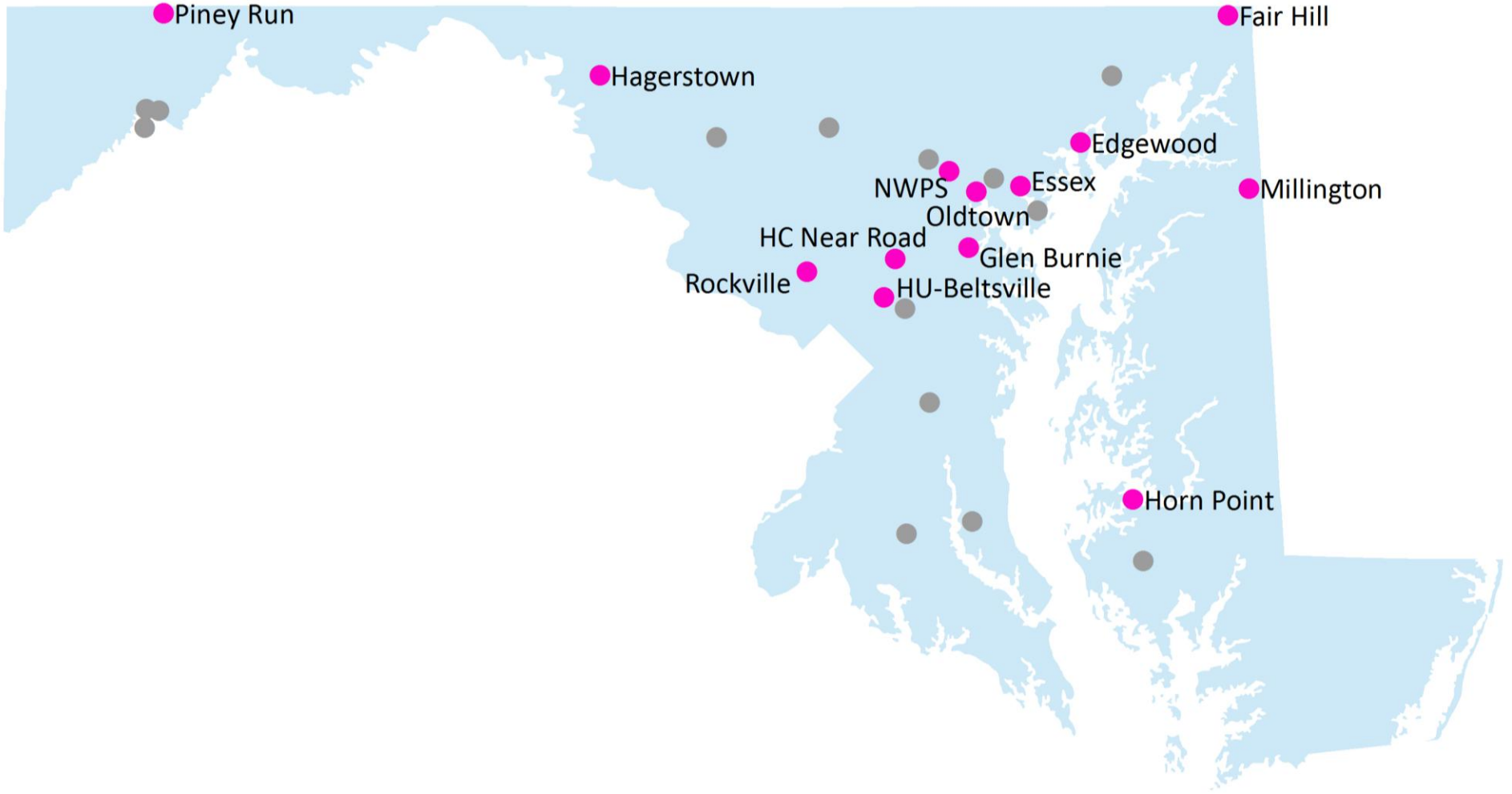
- Criteria Pollutants (NAAQS)
  - Ozone (O3)
  - Nitrogen Dioxide (NO2)
  - Sulfur Dioxide (SO2)
  - Particulate Matter (PM-10 & PM-2.5)
  - Carbon Monoxide (CO)
  - Lead (Pb)

- PM-2.5 Chemical Speciation Network (CSN)
- Photochemical Assessment Monitoring Stations (PAMS): Ozone precursors (VOCs & NOx) – Summertime only.
- National Core (NCore): Comprehensive multi-pollutant sites for long term trends of NAAQS and CSN, both urban and rural areas.
- Air Toxics: VOCs only.

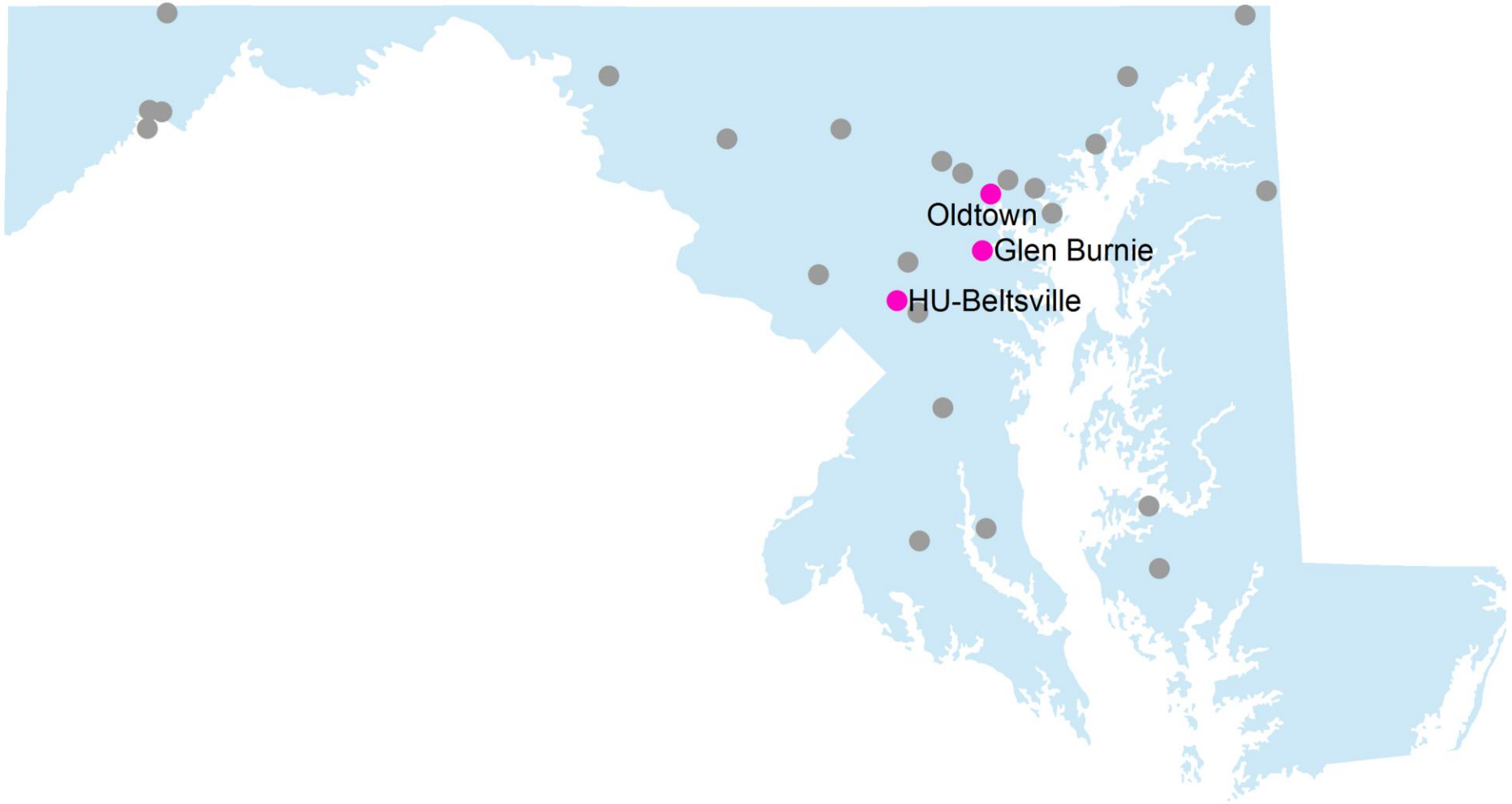
2017 Maryland Network-27 sites



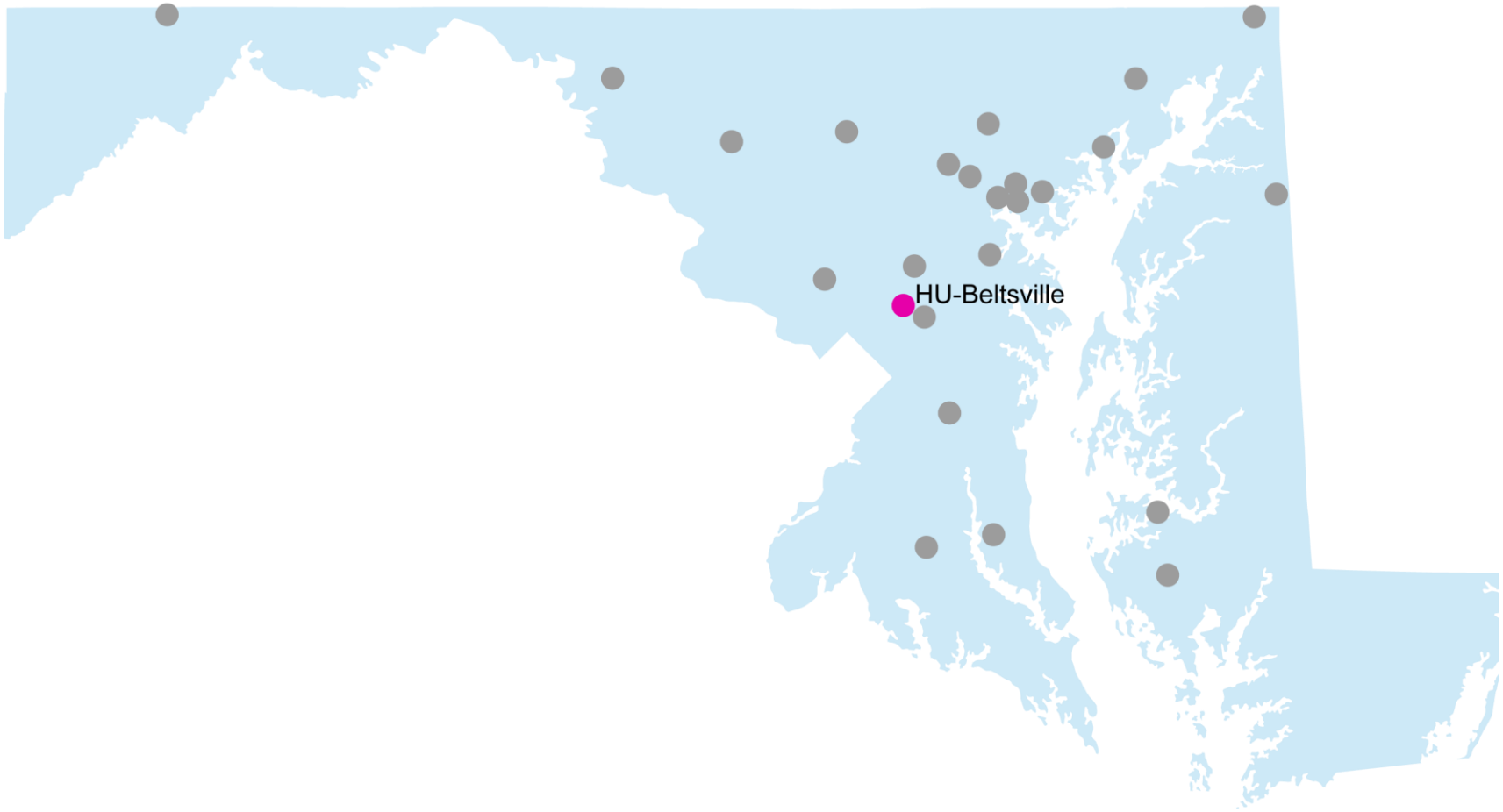
$PM_{2.5}$ Network-13 sites



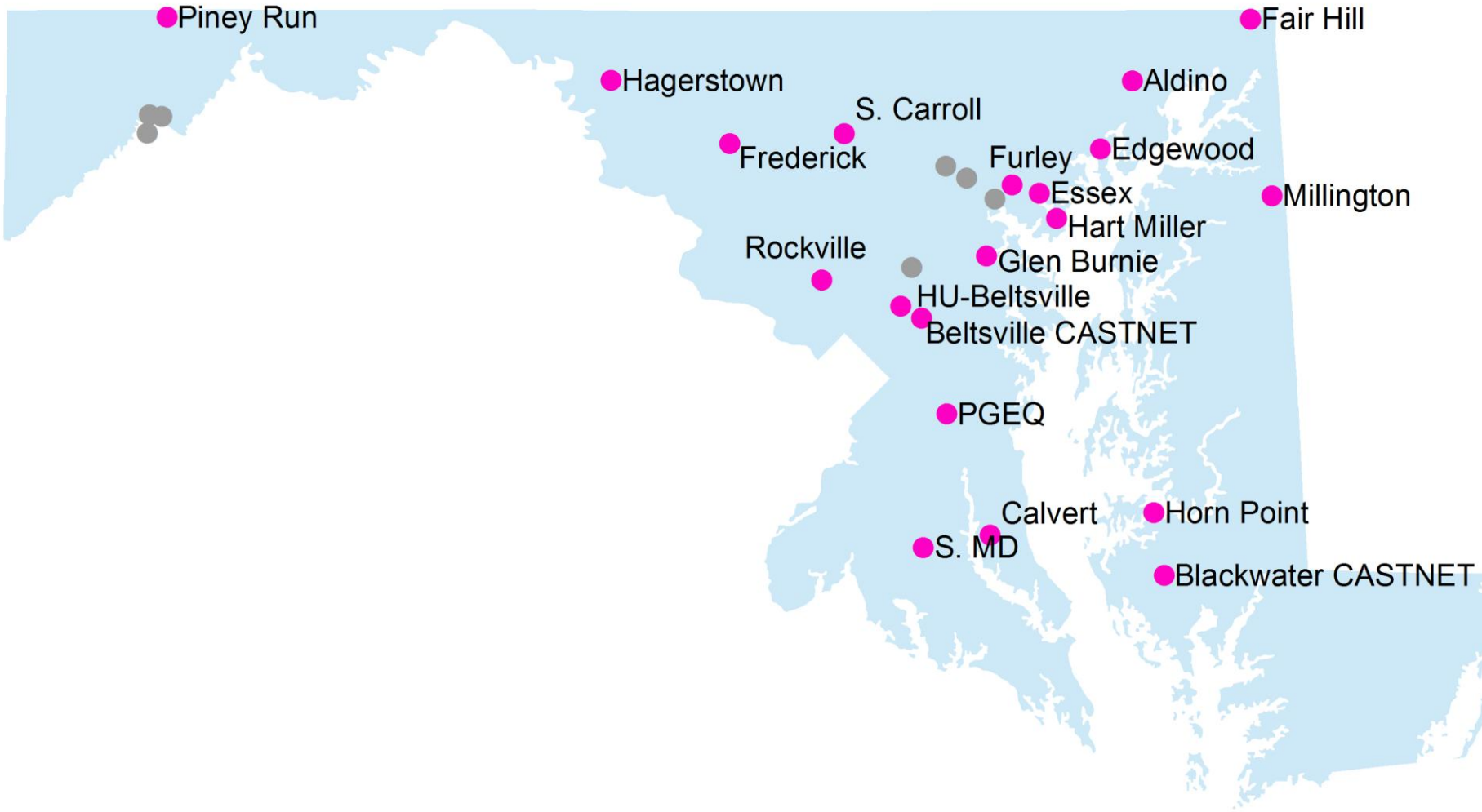
PM_{10} Network-3 sites



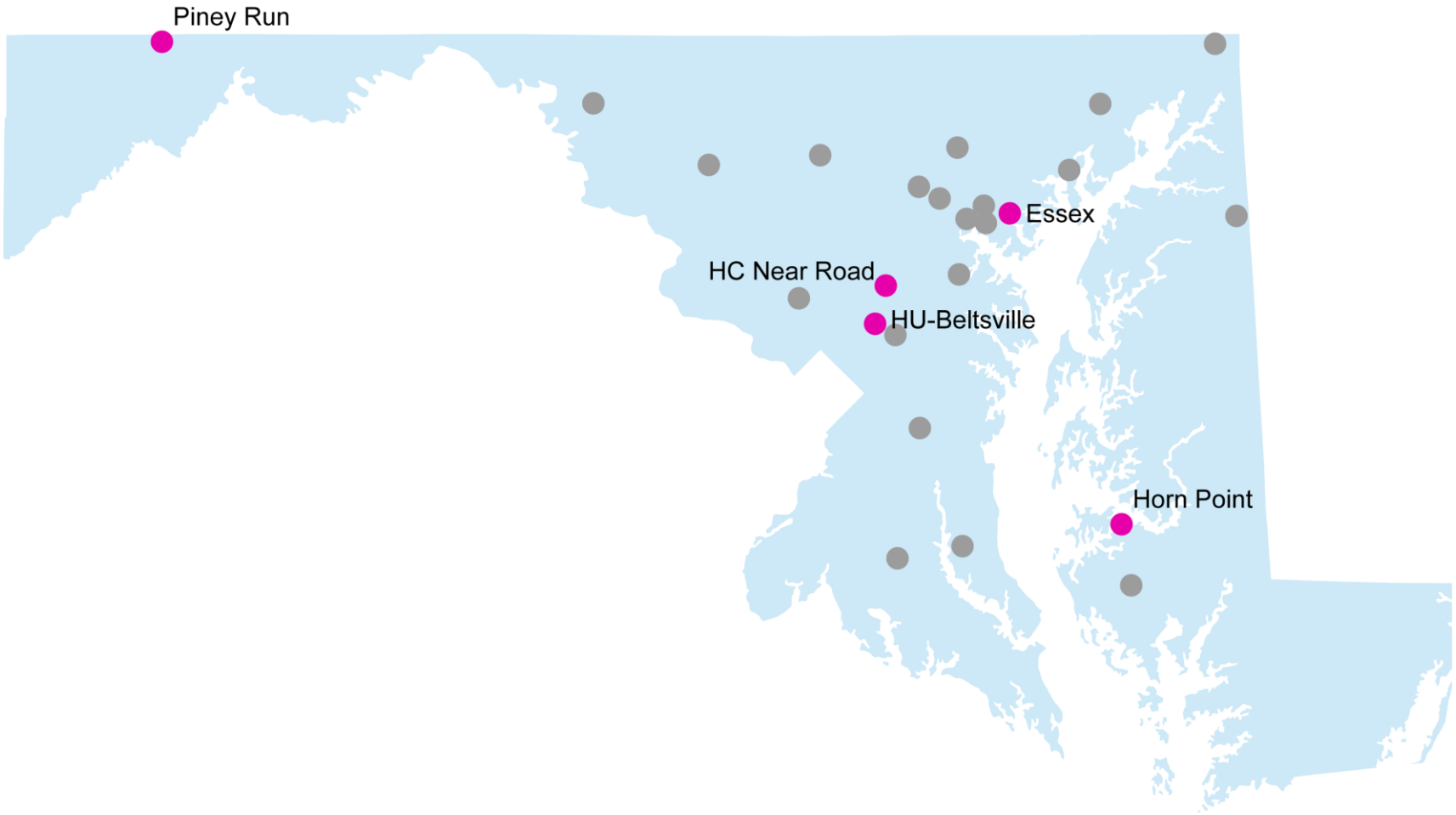
Lead Network-1 site



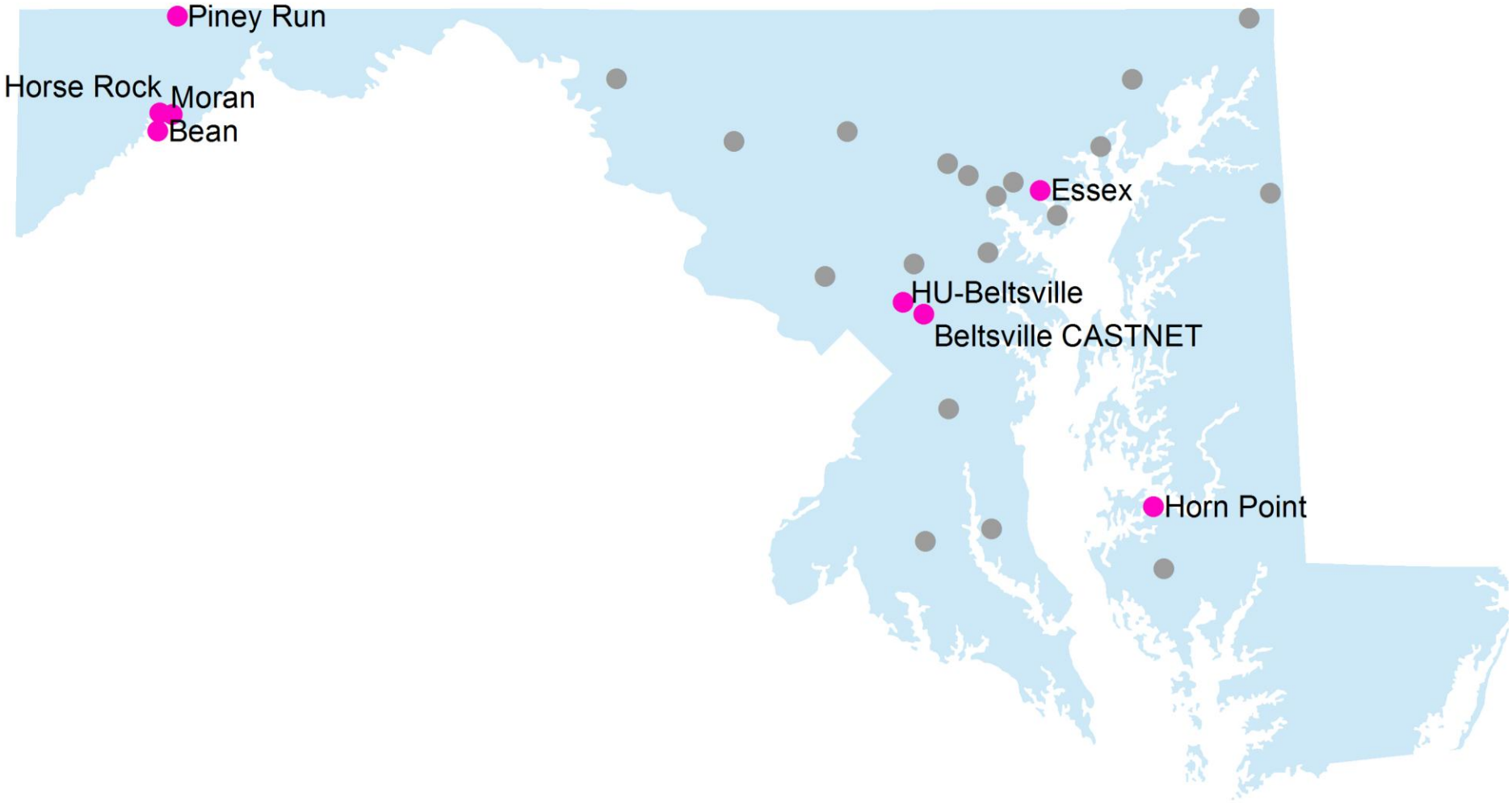
Ozone Network-20 sites



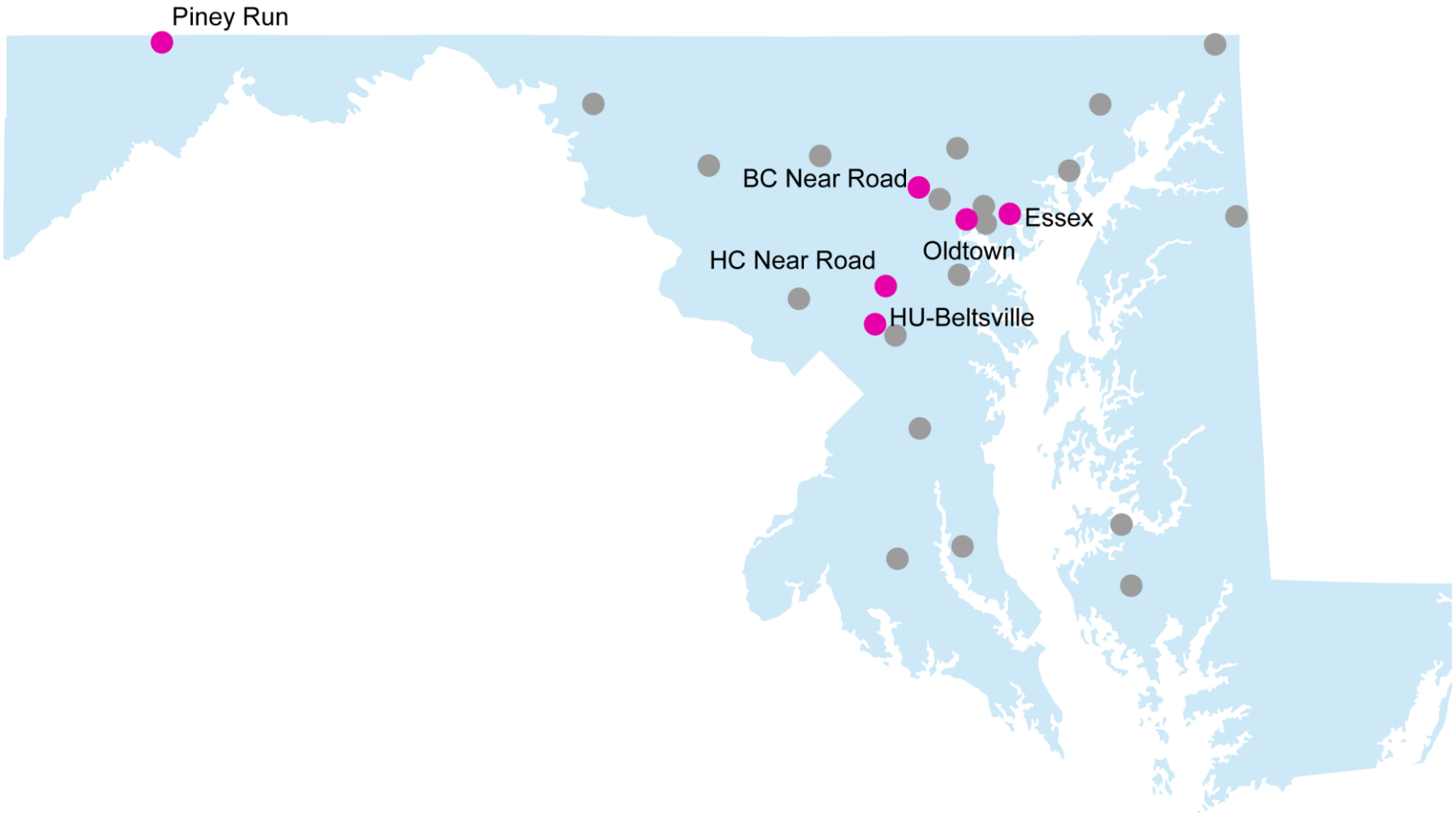
CO Network-5 sites



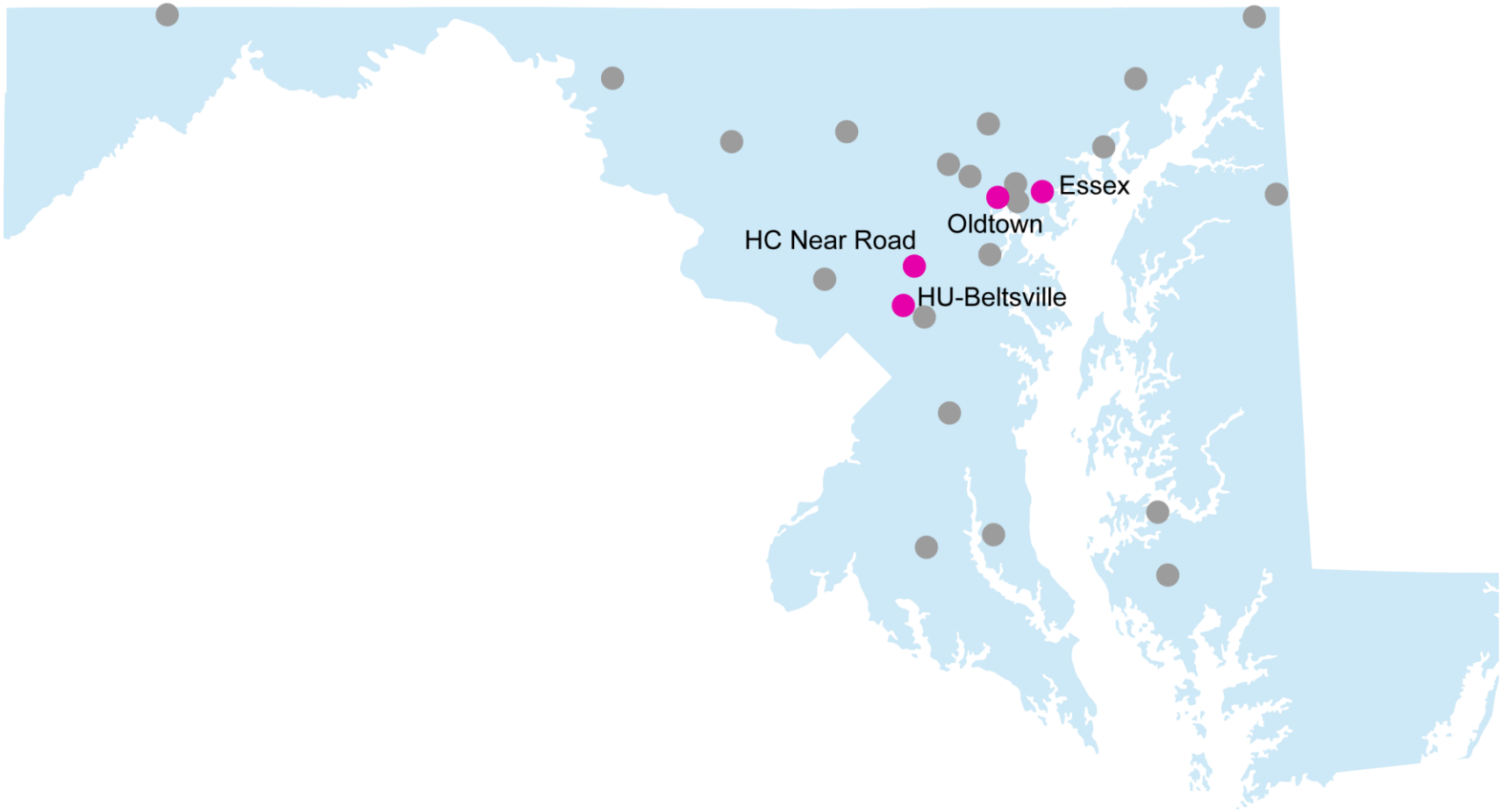
SO_2 Network-8 sites



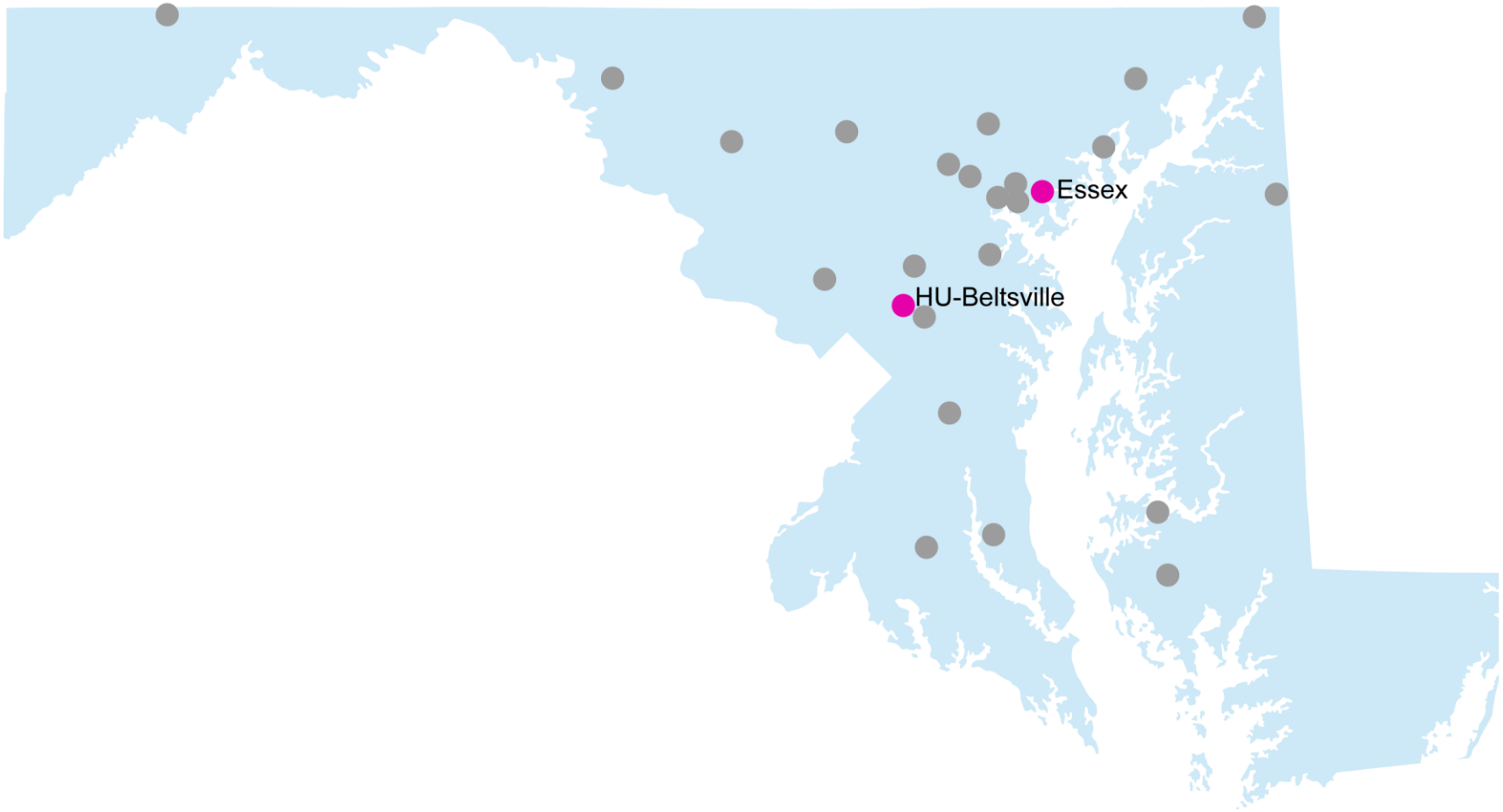
NO_2 Network-5 sites



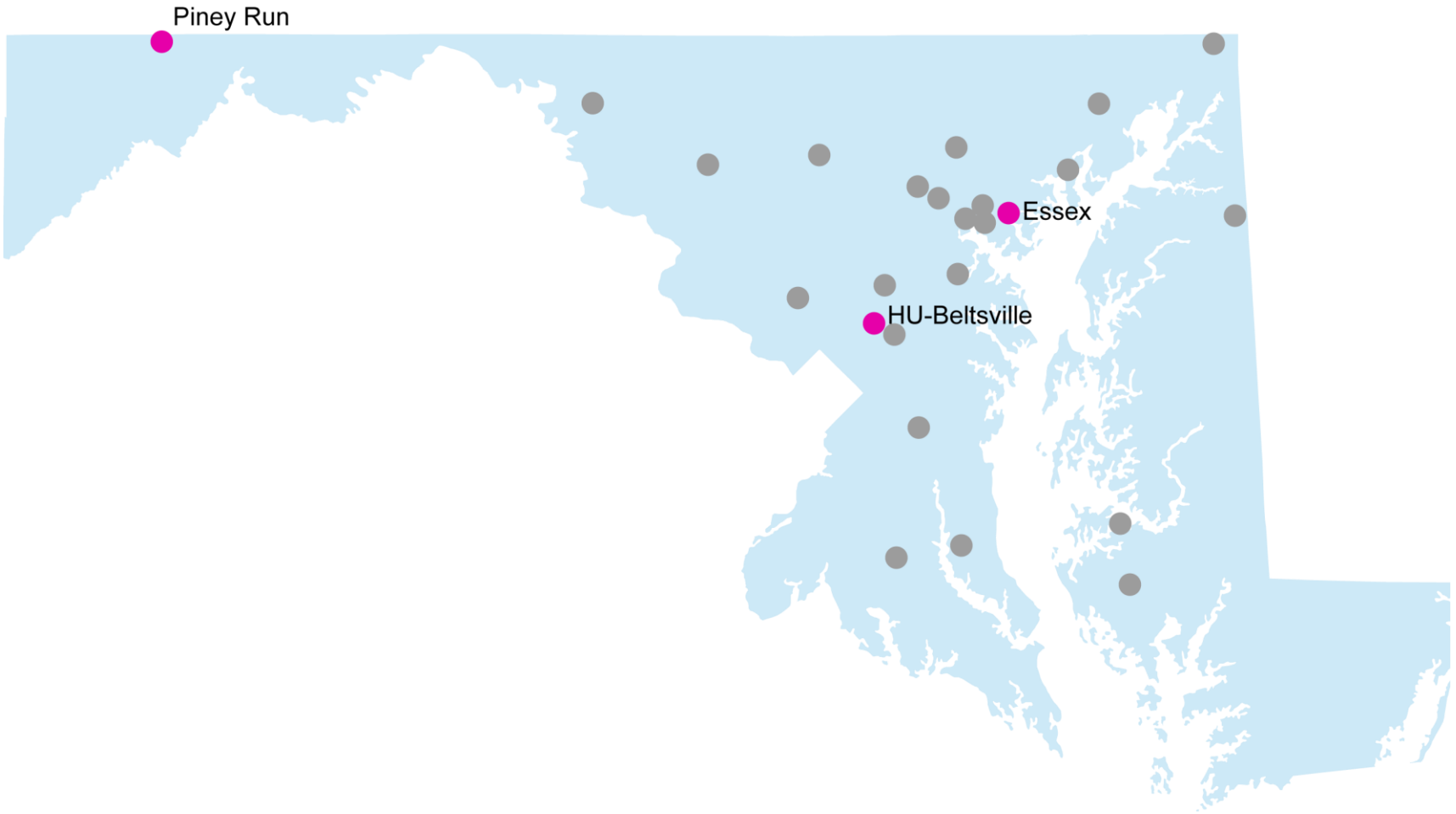
Air Toxics Network-4 sites



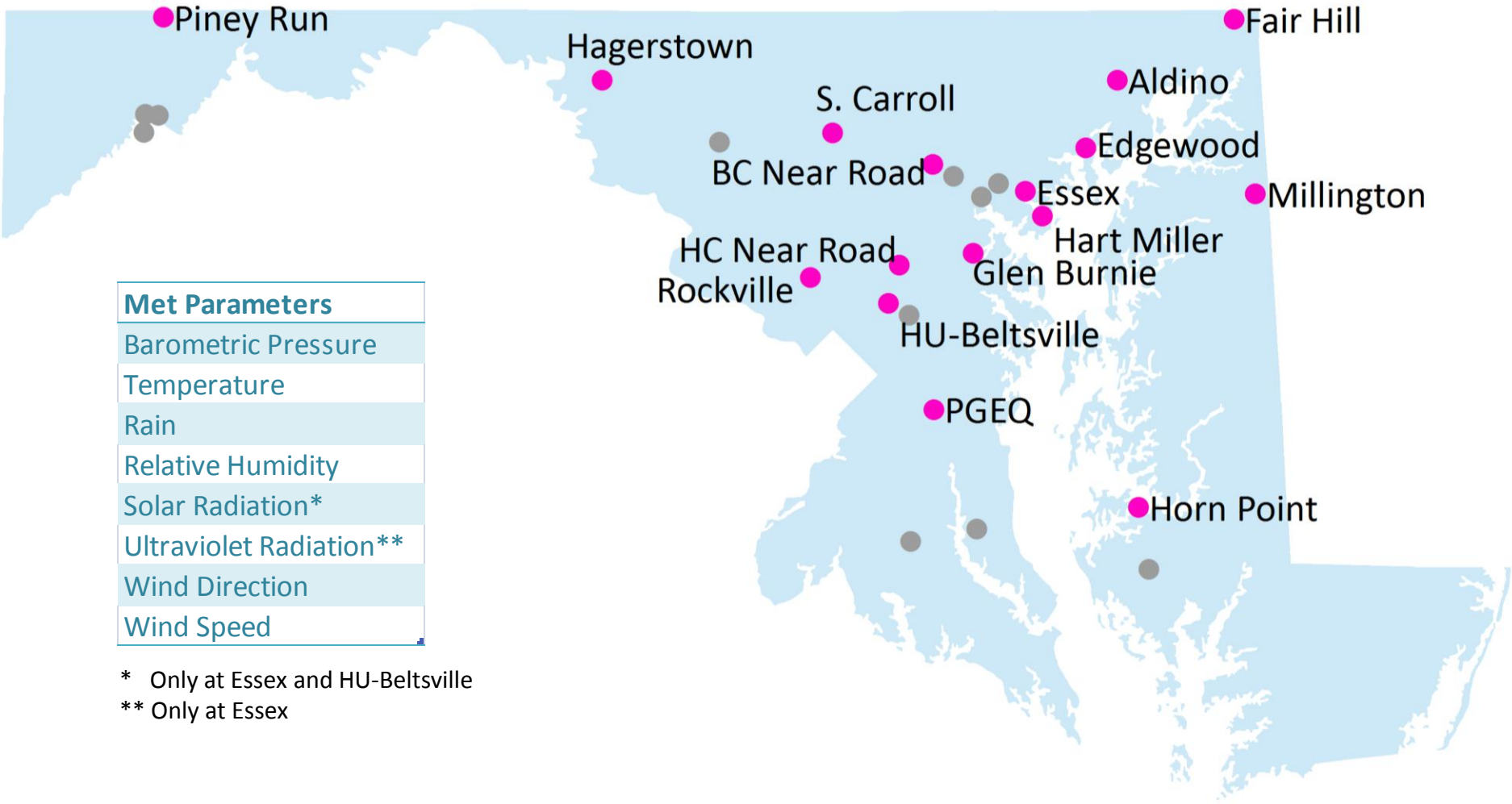
Photochemical Assessment Monitoring Stations (PAMS)-2 sites



$PM_{2.5}$ Speciation-3 sites



Meteorology

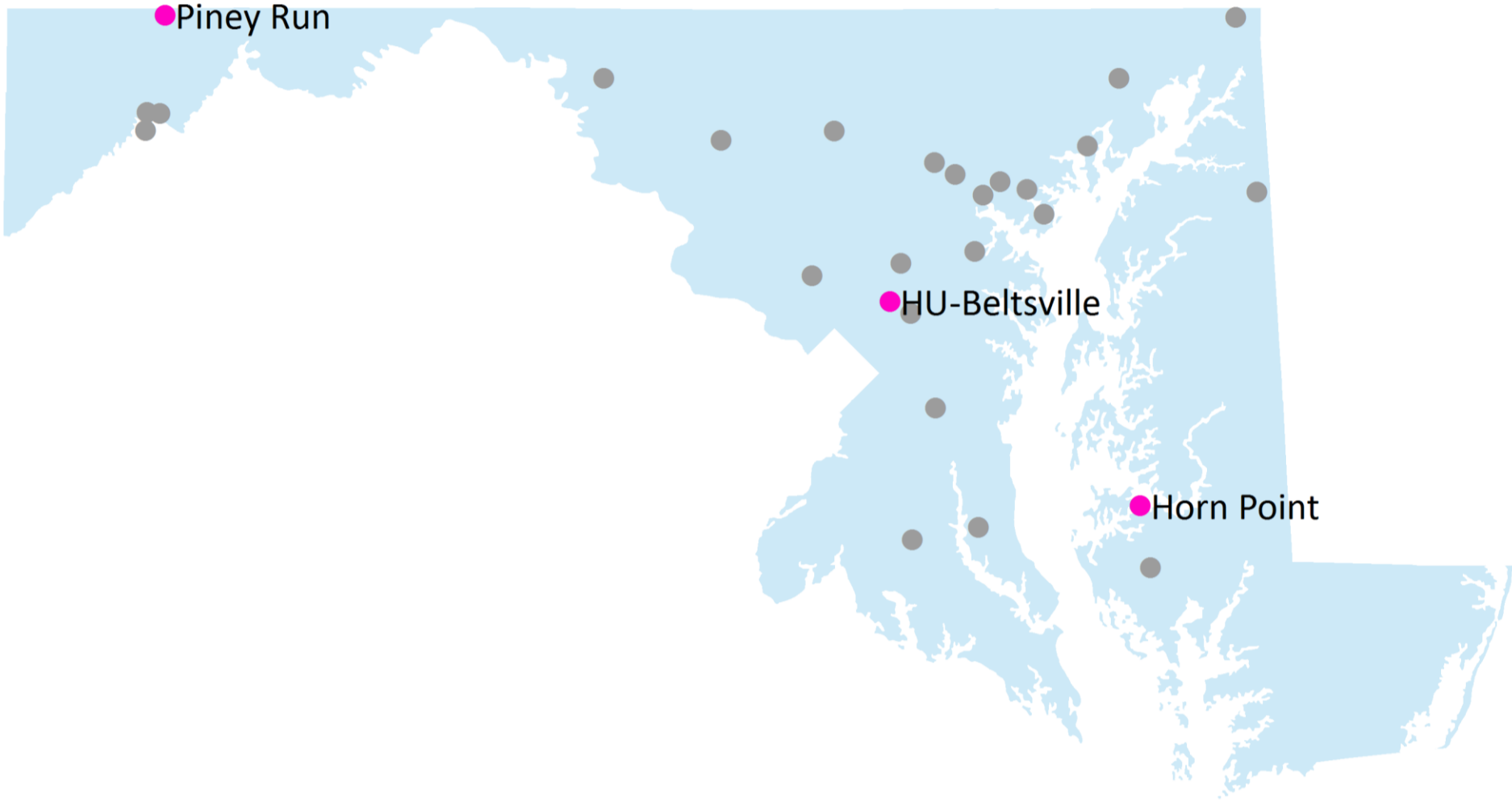


Met Parameters
Barometric Pressure
Temperature
Rain
Relative Humidity
Solar Radiation*
Ultraviolet Radiation**
Wind Direction
Wind Speed

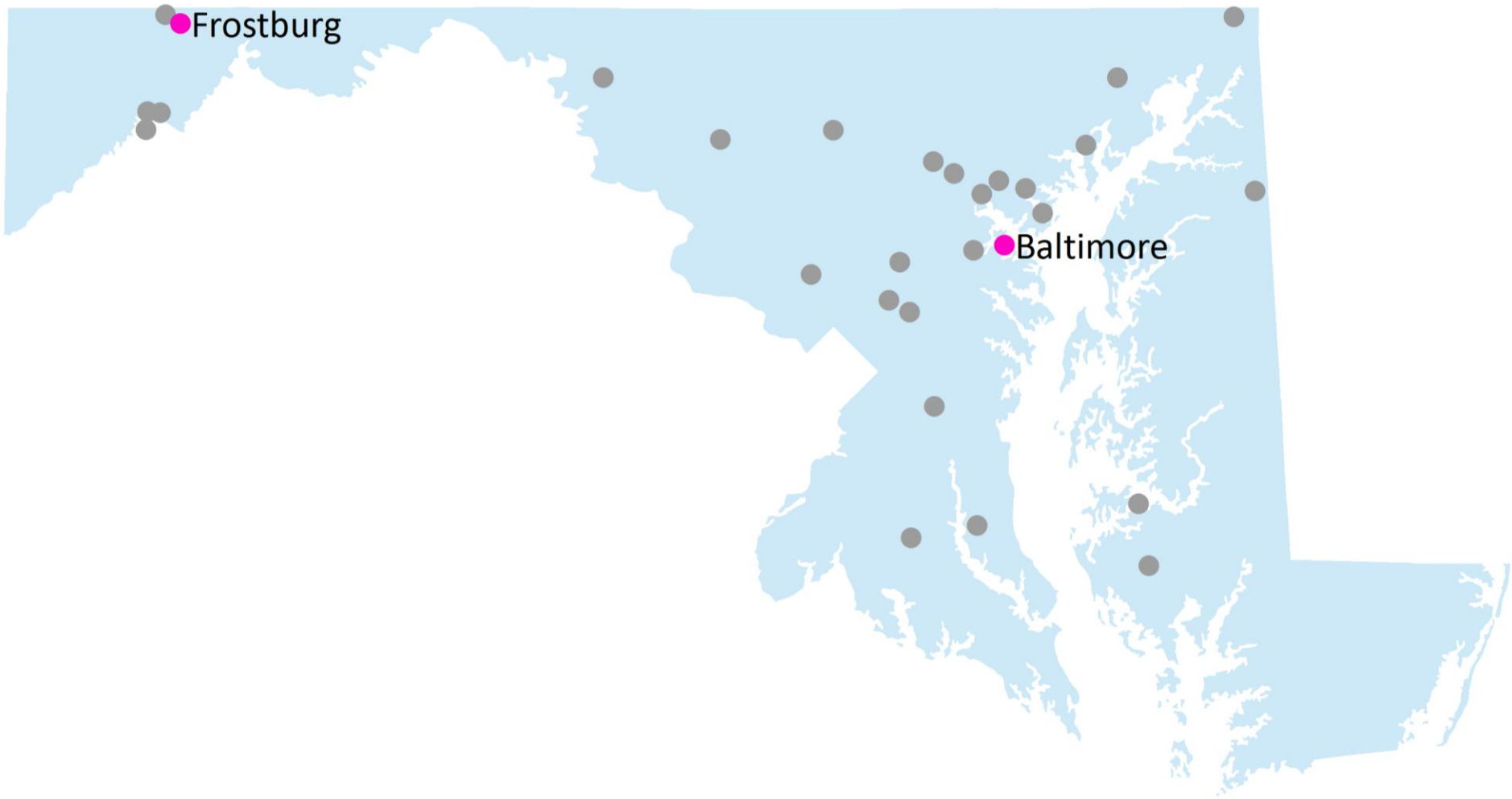
* Only at Essex and HU-Beltsville

** Only at Essex

Radar wind profilers



Haze cameras



Near Road Monitoring

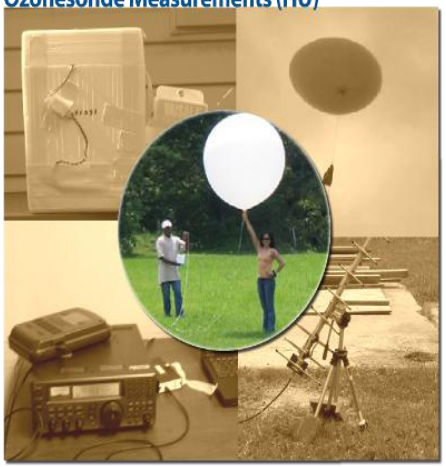
- MDE monitor 20 meters from I95-S between MD 32 and MD216.
  - The most heavily traveled road segment in the state.
  - Annual Average Daily Traffic (AADT) count =195,030 vehicles
  - 12,000 of these are diesel trucks.
- Diesel trucks idle at the site all night long.
- Parameters measured at this site include PM-2.5, CO and NO_2.
- No violations of the NAAQS have been recorded.
  - Reasonable conclusion: in areas of lower traffic, pollutant concentrations would be lower than those measured at this location.
- There are 69 near-road monitoring sites throughout the US and currently no area of the country is violating the NO_2 NAAQS.
- A review of the status and data from the National near-road monitoring: https://www.epa.gov/sites/production/files/2016-09/documents/near-road_air_quality_monitoring.pdf

Special Studies to Gauge Transported Air Pollution

Mountain Top (MDE)

Land Water Interface (MDE)

Ozonesonde Measurements (HU)



Aircraft Measurements (UMD)

Upper-Air Radar Wind Profiler & RASS (MDE)

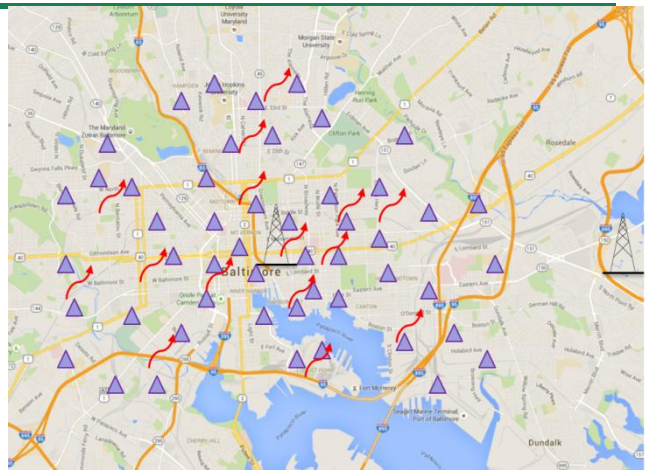
LIDAR - Aerosol Measurements (UMBC)

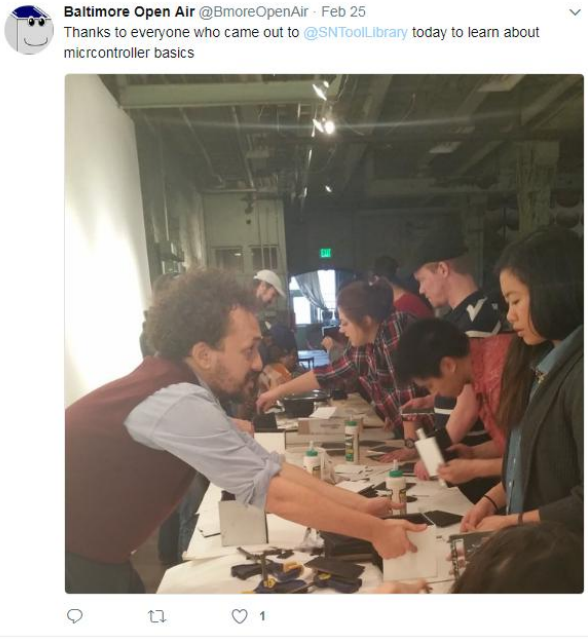
Air Quality Sensors

- Emerging technology
- Opportunities for research, advocacy and screening applications
- Highly variable data quality, messaging issues
- EPA and other agencies evaluating performance
- Can augment existing network

Air Quality Sensors

- SEARCH Project-Yale, JHU, CDC, U. Mich
- Baltimore Open Air– Johns Hopkins, Bmore Cool and Baltimore Office of Sustainability.





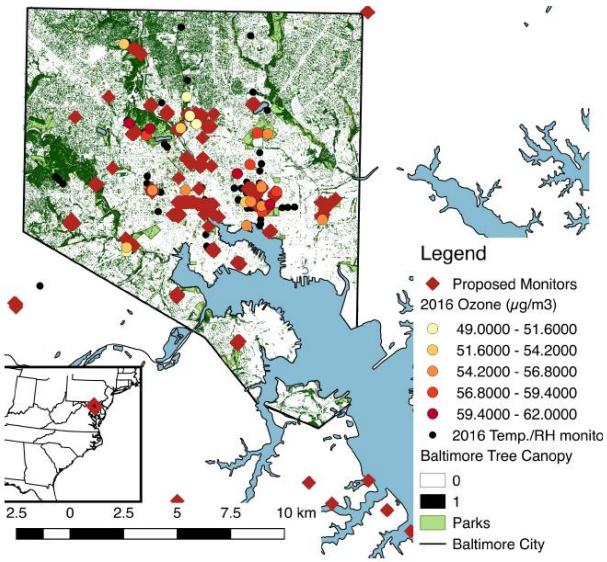


Figure 1: *Greater Baltimore previous and proposed monitoring networks.*

Links

- MDE Air Monitoring webpage

  http://mde.maryland.gov/programs/Air/

- Air Monitoring Network Plan

  http://mde.maryland.gov/programs/Air/AirQualityMonitoring/Documents/MDNetworkPlanCY2018.pdf

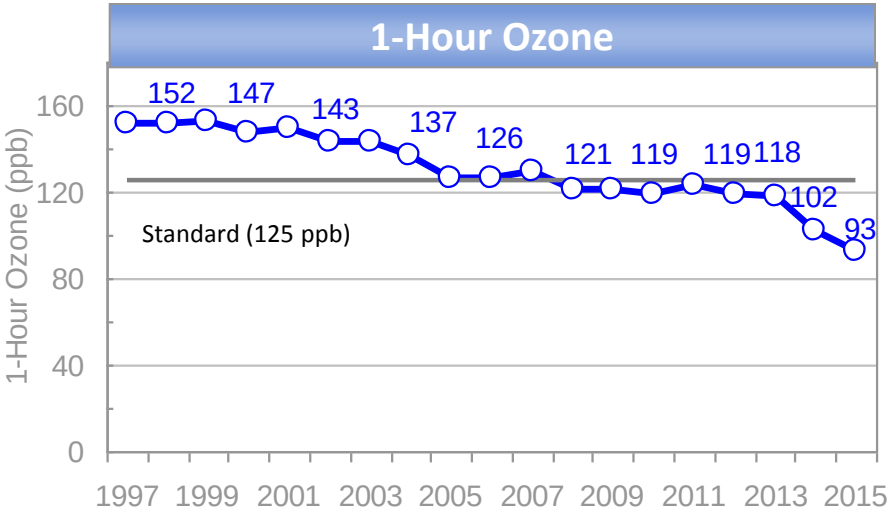
- Air Monitoring data

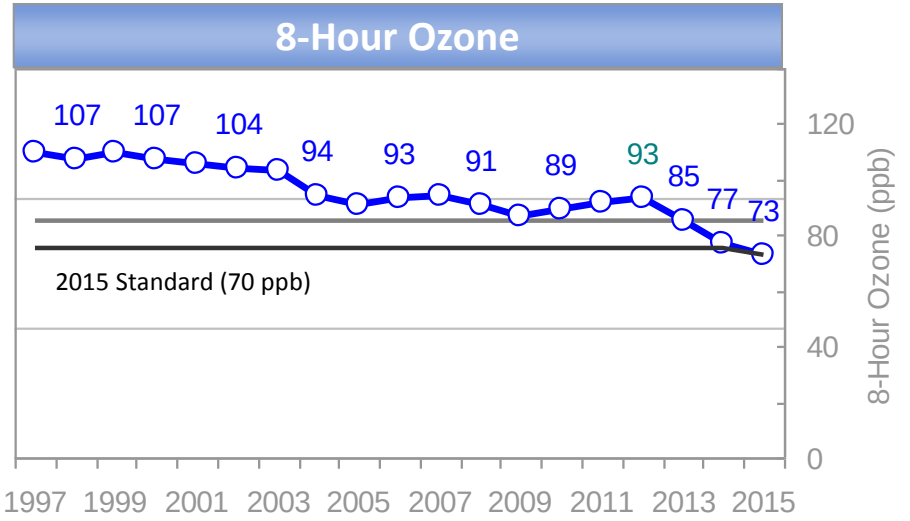
  https://www.epa.gov/outdoor-air-quality-data

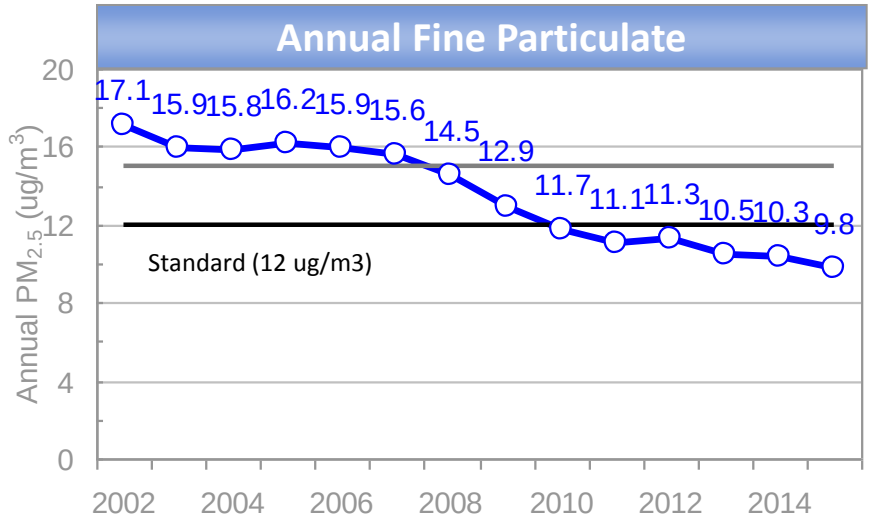
- Contact: david.krask@maryland.gov

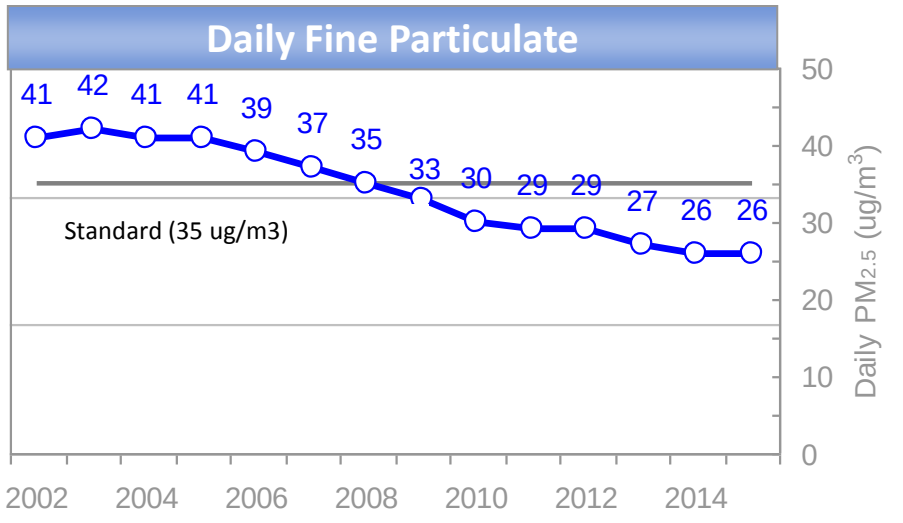
- Back up slides

Ozone and PM-2.5 Trends









Current NAAQS

Pollutant (Indicator)		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