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
SO\textsubscript{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

Piney Run
HU-Beltsville
Horn Point
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.

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.
Links

• MDE Air Monitoring webpage
  
  http://mde.maryland.gov/programs/Air/

• Air Monitoring Network Plan
  

• 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

1-Hour Ozone

8-Hour Ozone

Annual Fine Particulate

Daily Fine Particulate

1-Hour Ozone

8-Hour Ozone

Annual Fine Particulate

Daily Fine Particulate

Standard (125 ppb)

2015 Standard (70 ppb)

Standard (12 ug/m3)

Standard (35 ug/m3)
## Current NAAQS

<table>
<thead>
<tr>
<th>Pollutant (Indicator)</th>
<th>Primary/Secondary</th>
<th>Averaging Time</th>
<th>Level</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>primary</td>
<td>8 hours</td>
<td>9 ppm</td>
<td>Not to be exceeded more than once per year</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 hour</td>
<td>35 ppm</td>
<td></td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>primary and secondary</td>
<td>Rolling 3 month average</td>
<td>0.15 μg/m³</td>
<td>Not to be exceeded</td>
</tr>
<tr>
<td>Nitrogen Dioxide (NO₂)</td>
<td>primary</td>
<td>1 hour</td>
<td>100 ppb</td>
<td>98th percentile of 1-hour daily maximum concentrations, averaged over 3 years</td>
</tr>
<tr>
<td></td>
<td>primary and secondary</td>
<td>1 year</td>
<td>53 ppb</td>
<td>Annual Mean</td>
</tr>
<tr>
<td>Ozone (O₃)</td>
<td>primary and secondary</td>
<td>8 hours</td>
<td>0.070 ppm</td>
<td>Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years</td>
</tr>
<tr>
<td>PM₂.₅</td>
<td>primary</td>
<td>1 year</td>
<td>12.0 μg/m³</td>
<td>annual mean, averaged over 3 years</td>
</tr>
<tr>
<td></td>
<td>secondary</td>
<td>1 year</td>
<td>15.0 μg/m³</td>
<td>annual mean, averaged over 3 years</td>
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<tr>
<td></td>
<td>primary and secondary</td>
<td>24 hours</td>
<td>35 μg/m³</td>
<td>98th percentile, averaged over 3 years</td>
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<tr>
<td></td>
<td>PM₁₀</td>
<td>primary and secondary</td>
<td>24 hours</td>
<td>150 μg/m³</td>
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<tr>
<td>Sulfur Dioxide (SO₂)</td>
<td>primary</td>
<td>1 hour</td>
<td>75 ppb</td>
<td>99th percentile of 1-hour daily maximum concentrations, averaged over 3 years</td>
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<tr>
<td></td>
<td>secondary</td>
<td>3 hours</td>
<td>0.5 ppm</td>
<td>Not to be exceeded more than once per year</td>
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