An Air Quality Update

2000

2010

2020

* 2020 data is preliminary

Meets Standard | Exceeds Standard

<65 70 75 80 85 90 95 100 105 >110
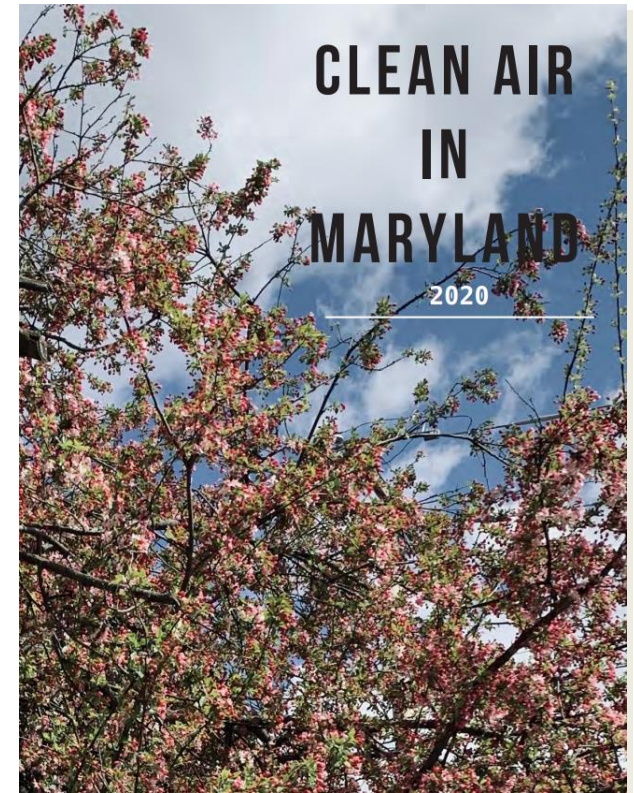
Overview of Presentation

- Air Quality Basics Refresher

- Clean Air Progress

- State and Federal Programs Addressing Air Pollution
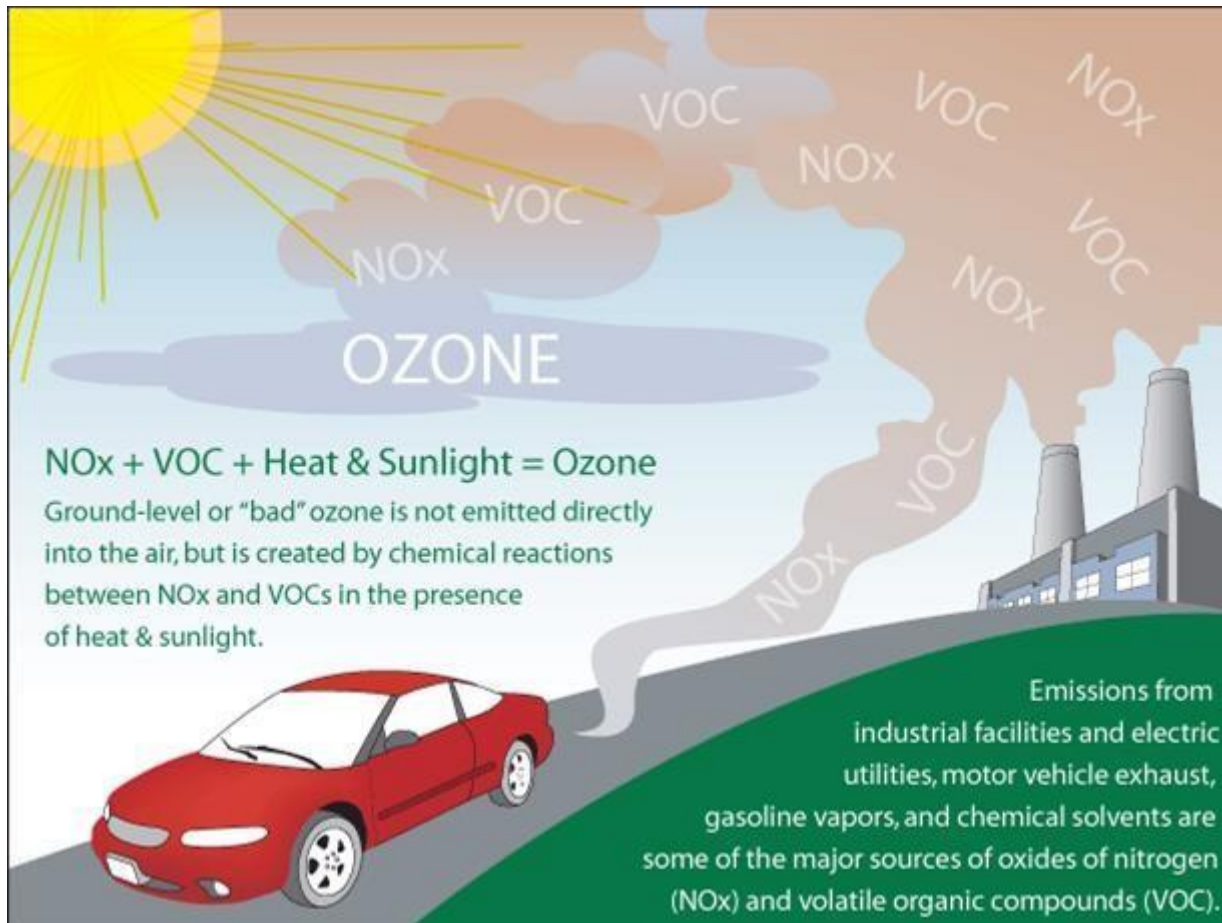
- Moving Forward - Priorities 2021 and 2022

https://mde.maryland.gov/programs/Air/Pages/index.aspx

AIR QUALITY BASICS

A REFRESHER

Ground-Level Ozone

- The most pervasive air pollutant in Maryland and many other parts of the country...

NOx + VOC + Heat & Sunlight = Ozone
Ground-level or "bad" ozone is not emitted directly into the air, but is created by chemical reactions between NOx and VOCs in the presence of heat & sunlight.

Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of oxides of nitrogen (NOx) and volatile organic compounds (VOC).
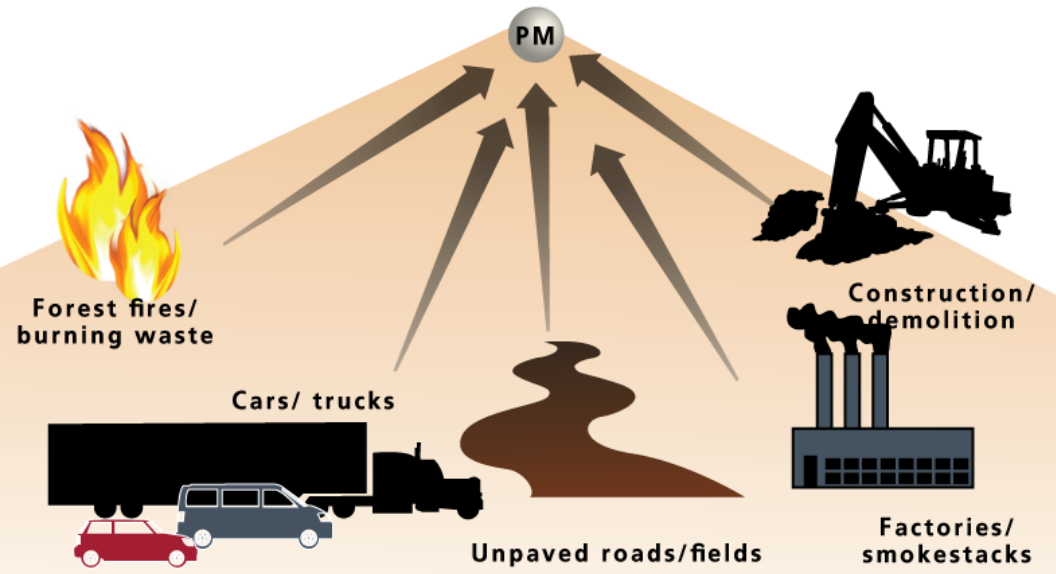
Particulate Matter

- For the past 10 years, fine particle levels have met the federal air quality standards. Typically, particle levels are higher in urban areas.

PRIMARY PARTICULATE MATTER

Emitted directly from a source into the atmosphere.

PM

Forest fires/ burning waste

Cars/ trucks

Construction/ demolition

Unpaved roads/fields

Factories/ smokestacks

HUMAN HAIR
50-70 μm *(microns)* in diameter

● PM$_{2.5}$
Combustion particles, organic compounds, metals, etc.
< 2.5 μm *(microns)* in diameter

● PM$_{10}$
Dust, pollen, mold, etc.
<10 μm *(microns)* in diameter

90 μm *(microns)* in diameter
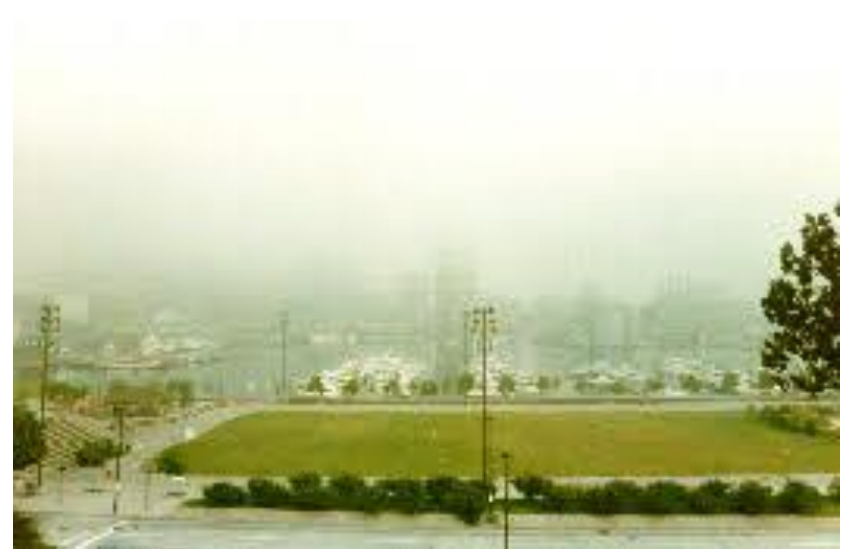FINE BEACH SAND

The Ugly...

- Significant air quality events, such as those occurring in Denora, PA in 1948, New York City in 1953, 1963 and 1966 as well as many others throughout the nation, prompted the federal government to enact the Clean Air Act

The Bad…

- Up until 2010, Maryland continued to experience numerous bad air quality events with ground-level ozone and particulate matter levels in the unhealthy range
  - 2005 MIT PM Study - Maryland identified as the riskiest place to breathe the air east of the Mississippi
  - 2008 - EPA designates the Baltimore area as the worst ozone area outside of California and Texas

The Good…

- In recent years, Maryland has achieved the federal fine particle standard, as well as the 2008 ozone standard, and is moving towards achieving the more stringent 2015 ozone standard. In 2020, Maryland recorded the fewest number of bad ozone days ever recorded in a year.
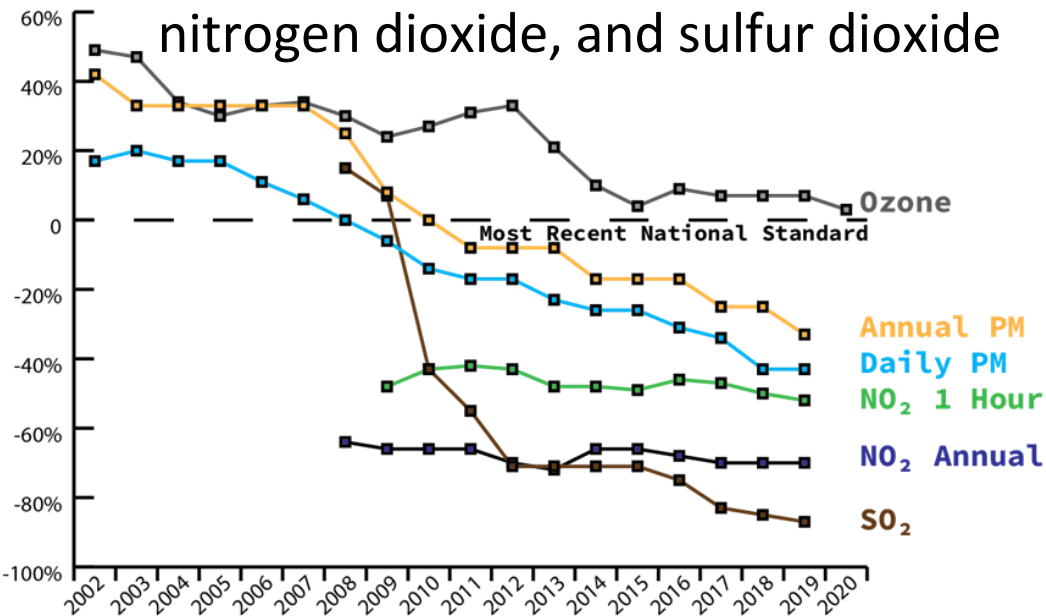
2021 - CLEAN AIR HIGHLIGHTS

PROGRESS CONTINUES

Clean Air Highlights

- For nearly 30 years, Maryland's air quality has dramatically improved

- Air quality policies and regulations have lowered levels of six common pollutants — particles, ozone, lead, carbon monoxide, nitrogen dioxide, and sulfur dioxide
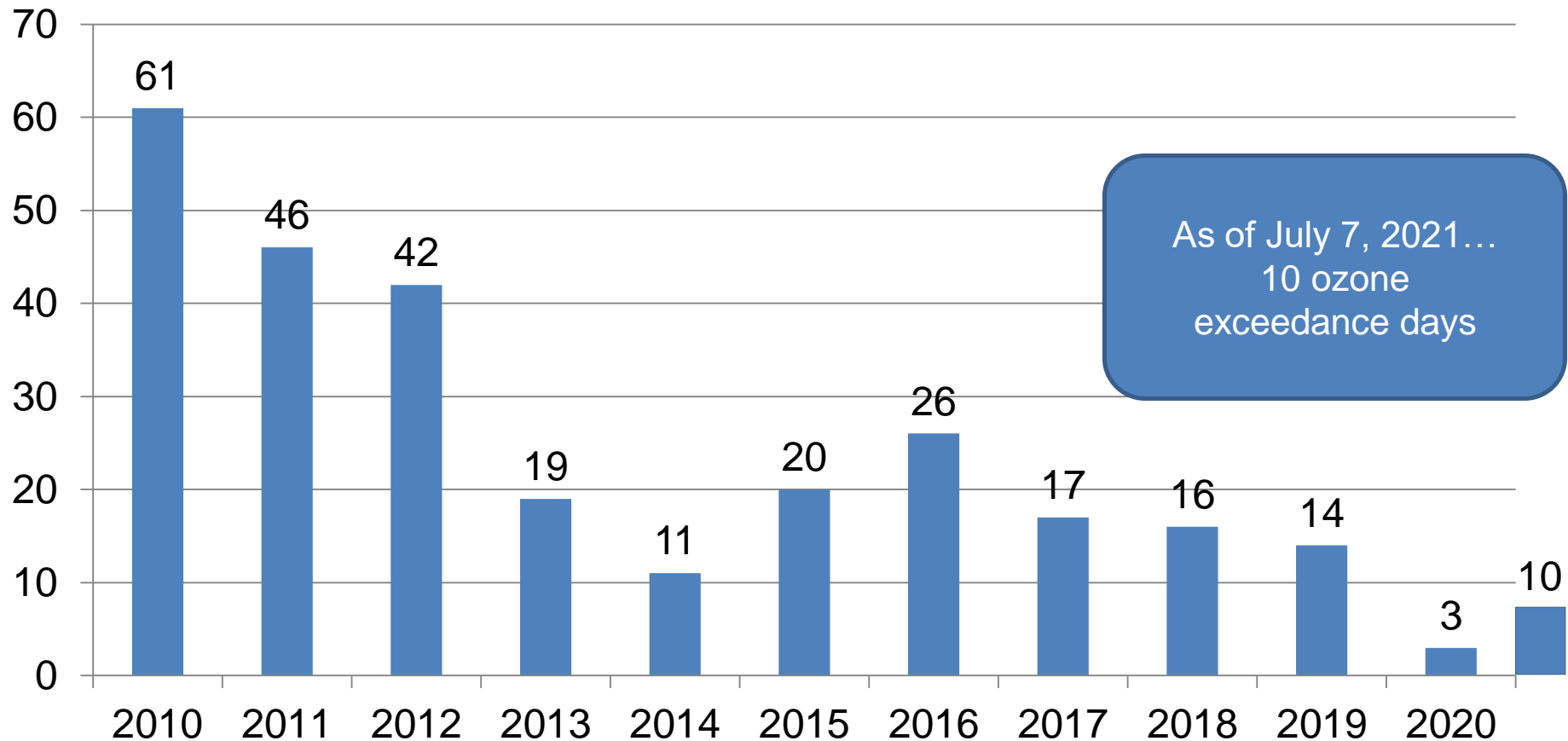

↓Nitrogen Dioxide (NO_2) Annual 16% (2008-2019)
↓Nitrogen Dioxide (NO_2) 1-Hour 8% (2009-2019
↓Ozone (O_3) 28% (2002-2020)
↓Particles ($PM_{2.5}$) Annual 53% (2002-2019)
↓Particles ($PM_{2.5}$) 24-Hour 51% (2002-2019)
↓Sulfur Dioxide (SO_2) 1-Hour 88% (2008-2019)

Maryland Bad Ozone Days

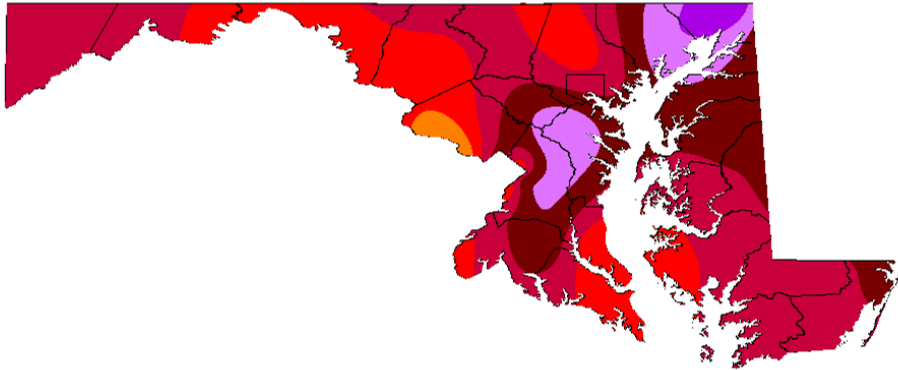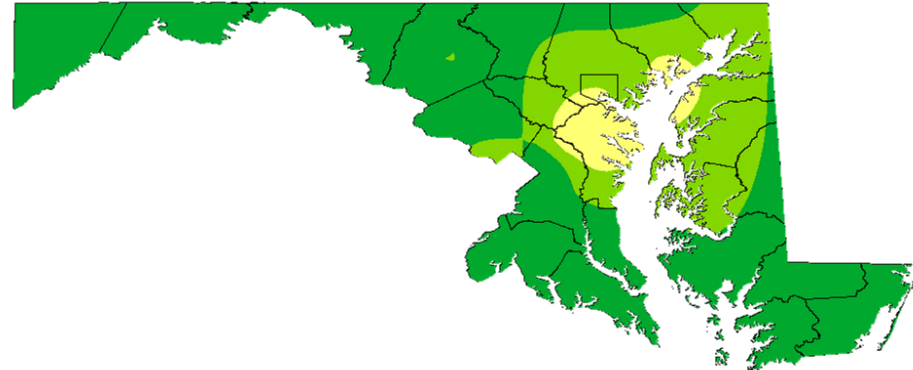## Exceedance Days

As of July 7, 2021…
10 ozone
exceedance days

* 2020/21 data is preliminary

The Geographic Scope of Air Quality

1998

2020*

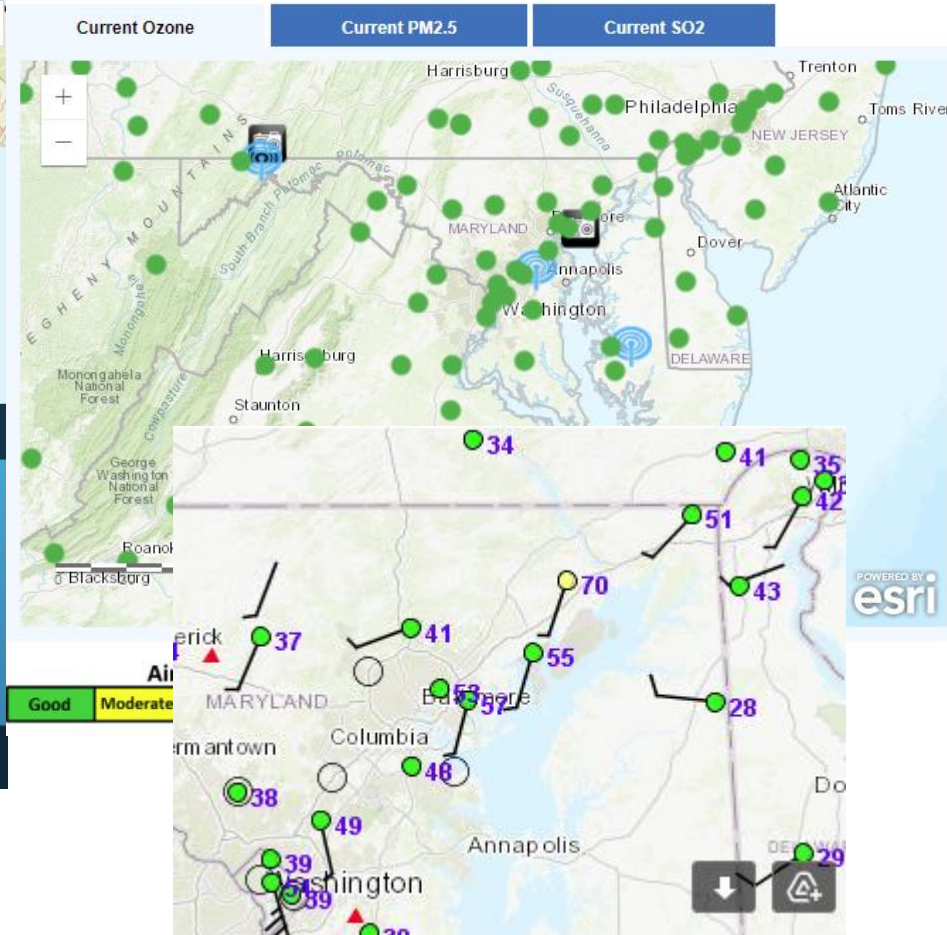## Lower Ozone Levels and Significant Spatial Risk Reduction

8-Hour Ozone

Meets Standard | Exceeds Standard

<65   70   75   80   85   90   95   100   105   >110 ppb

Forecast and Real-time data

https://www.cleanairpartners.net/current-and-forecasted-air-quality

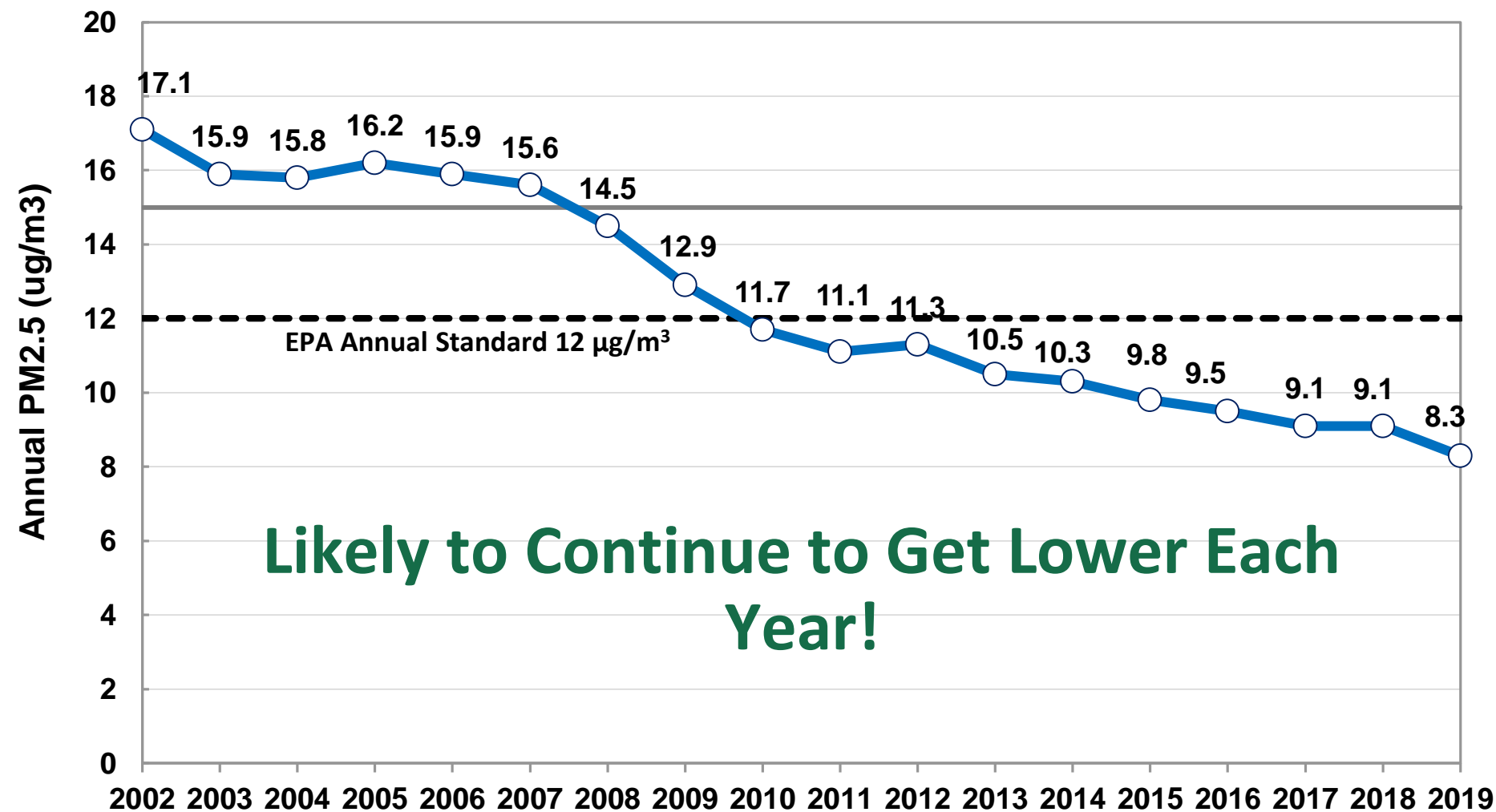https://mde.maryland.gov/programs/Air/AirQualityMonitoring/Pages/index.aspx

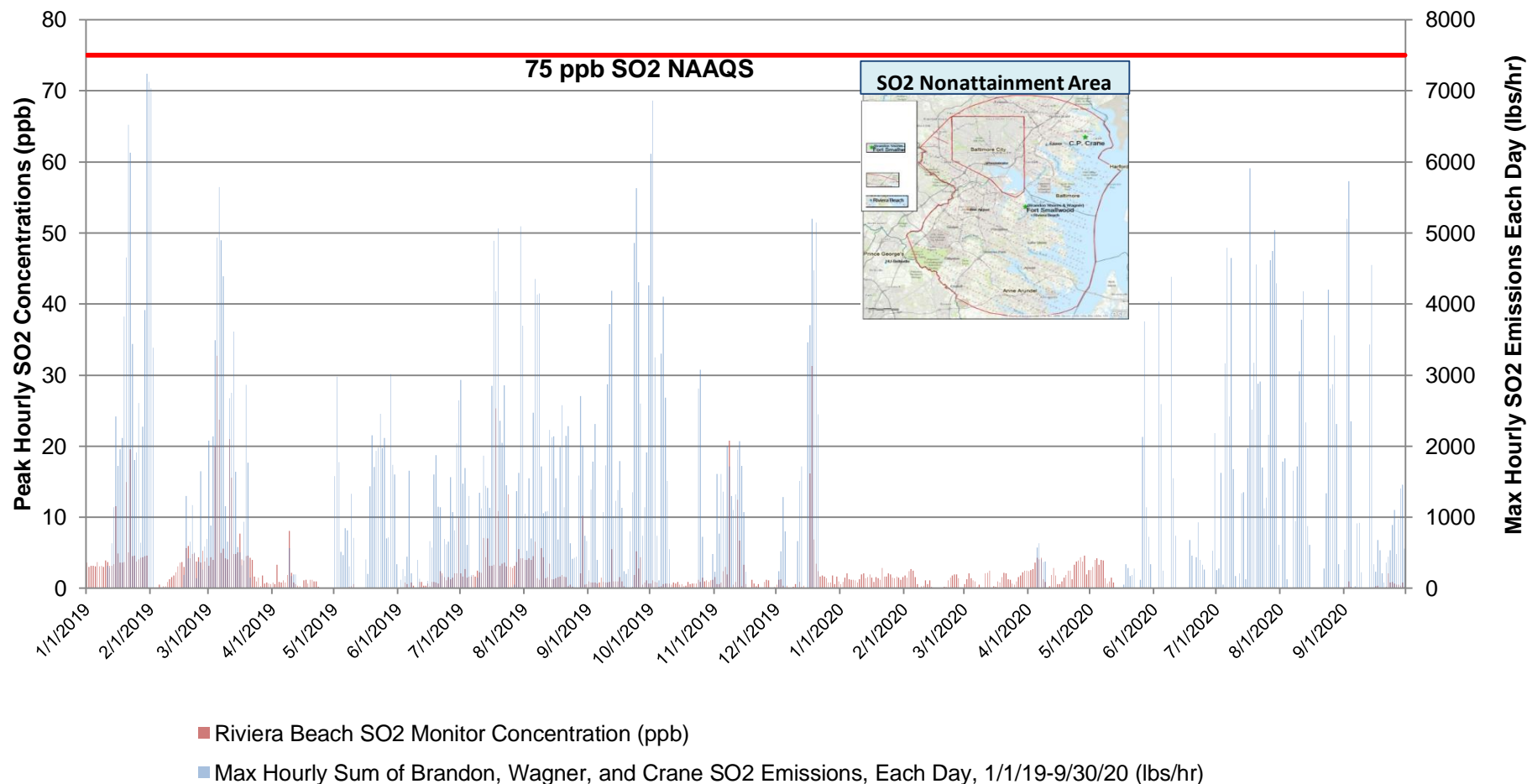# Fine Particle Air Pollution
Lower Levels Across the State

Graph: Annual PM2.5 (ug/m3) by year

- 2002: 17.1
- 2003: 15.9
- 2004: 15.8
- 2005: 16.2
- 2006: 15.9
- 2007: 15.6
- 2008: 14.5
- 2009: 12.9
- 2010: 11.7
- 2011: 11.1
- 2012: 11.3
- 2013: 10.5
- 2014: 10.3
- 2015: 9.8
- 2016: 9.5
- 2017: 9.1
- 2018: 9.1
- 2019: 8.3

EPA Annual Standard 12 µg/m³
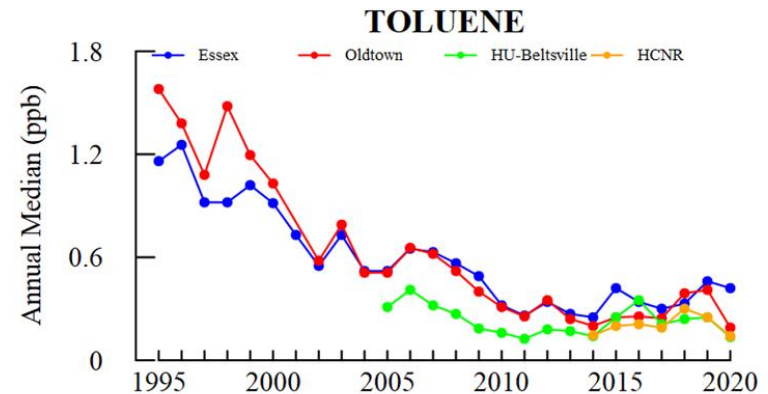
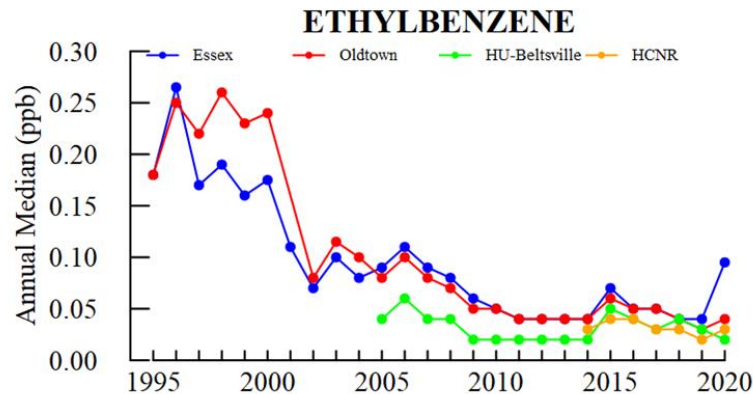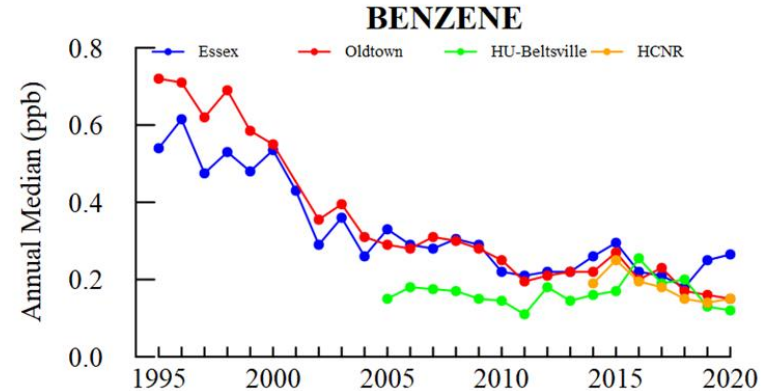## Likely to Continue to Get Lower Each Year!

SO2 Air Pollution
Levels Well Below Standards

Peak Daily Riviera Beach Monitor SO2 Concentrations &
Maximum Hourly Sum of Brandon, Wagner, & Crane SO2 Emissions
Each Day, 1/1/19 – 9/30/20

■ Riviera Beach SO2 Monitor Concentration (ppb)

■ Max Hourly Sum of Brandon, Wagner, and Crane SO2 Emissions, Each Day, 1/1/19-9/30/20 (lbs/hr)

Air Toxics Have Been Reduced Significantly

- Air toxics are those known to cause cancer and other serious health impacts

- Over the last 25 years, Maryland has generally cut concentrations of air toxics by 50%

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What Has Driven the Progress?

- Maryland has adopted hundreds of emission control programs to reduce air pollution
  - A few of the higher profile efforts are listed below

- Stationary (smokestack sources):
  - The Maryland Healthy Air Act, The Regional Greenhouse Gas Initiative (RGGI), Maryland's 2015 NOx Regulations … many more

- Mobile sources:
  - The 2007 Clean Cars Program, Federal Tier 2 and 3 tailpipe standards, numerous diesel emission reduction efforts … many more

- Potential future emission reduction efforts:
  - The Transportation and Climate Initiative (TCI), Zero Emission Medium and Heavy Duty Trucks … many more

Driving Progress with Research

Aircraft Measurements

Ozonesonde Measurements
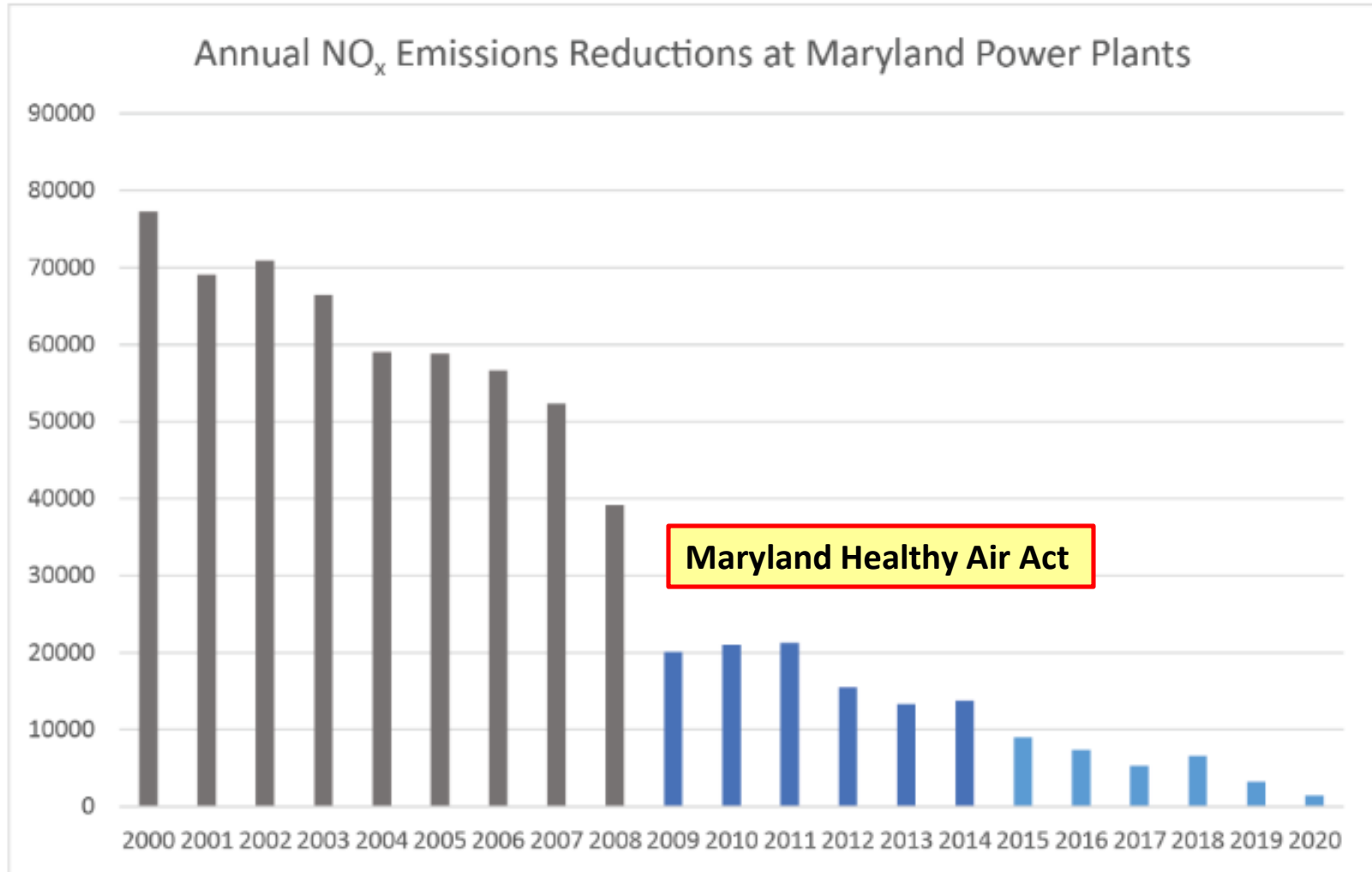

LIDAR
Aerosol Measurements

Upper-Air Radar Wind Profiler & RASS (MDE)

- MDE works in partnership with the other states, local universities (UMD at College Park, UMBC, and Howard University) and federal agencies (NASA, NOAA,NIST) to study ozone and fine particulate air pollution problems

- Major focus … Transport
  – Airplanes … Balloons … Lidar
  – Profilers … Satellites … Special monitors … Modeling
  – Much, much more

- Major driver of the last 15 years of progress. Key lessons learned:
  – About 70% of Maryland's ozone problem originates in upwind states
  – Reducing nitrogen oxide from power plants and vehicles and SO2 from power plants in MD and upwind states will dramatically reduce ozone and fine particulate in Maryland

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NOx Reductions from Coal-fired Power Plants
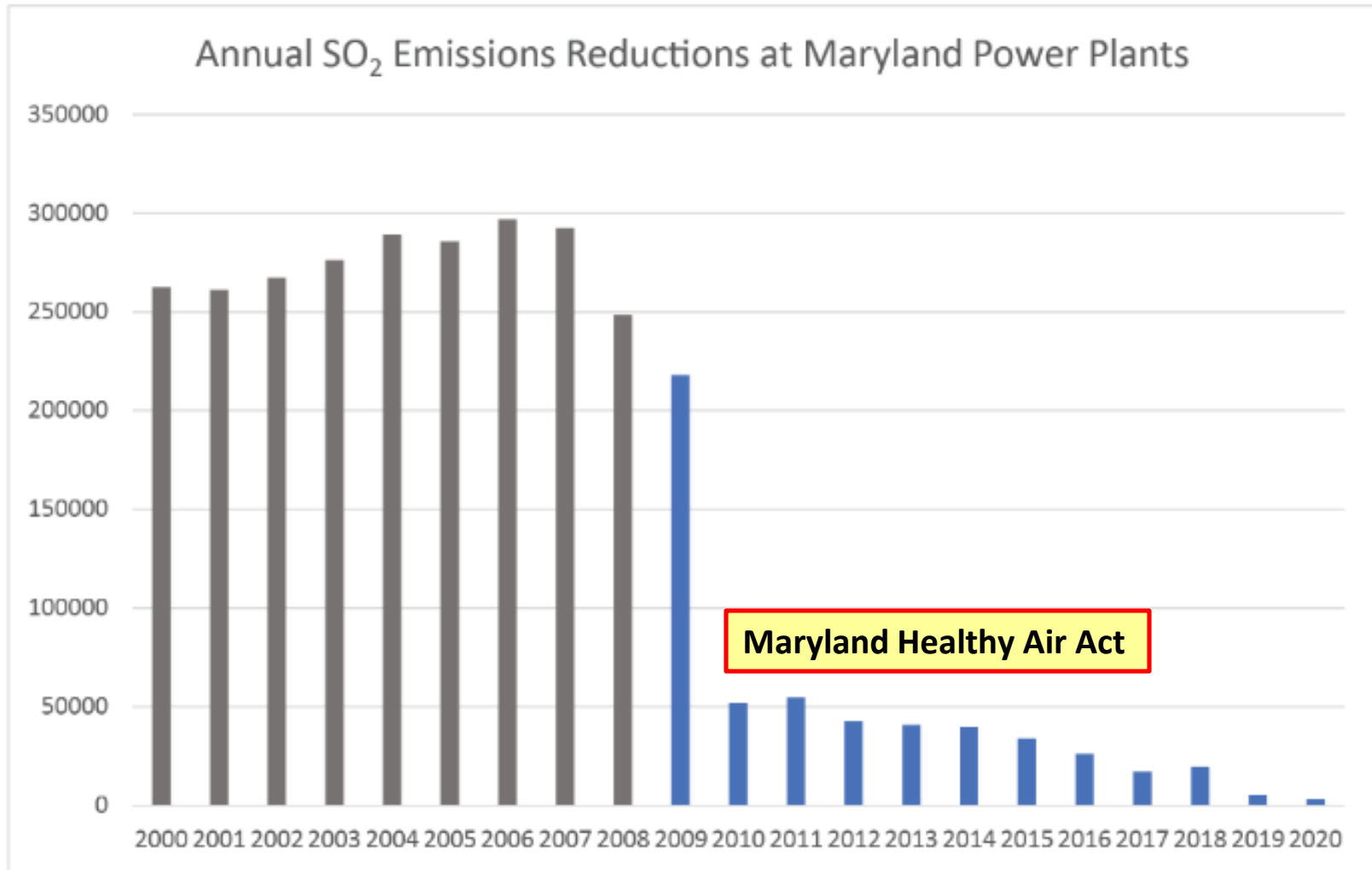

Annual NO$_x$ Emissions Reductions at Maryland Power Plants

Maryland Healthy Air Act

SO2 Reductions from Coal-fired Power Plants

Annual SO₂ Emissions Reductions at Maryland Power Plants
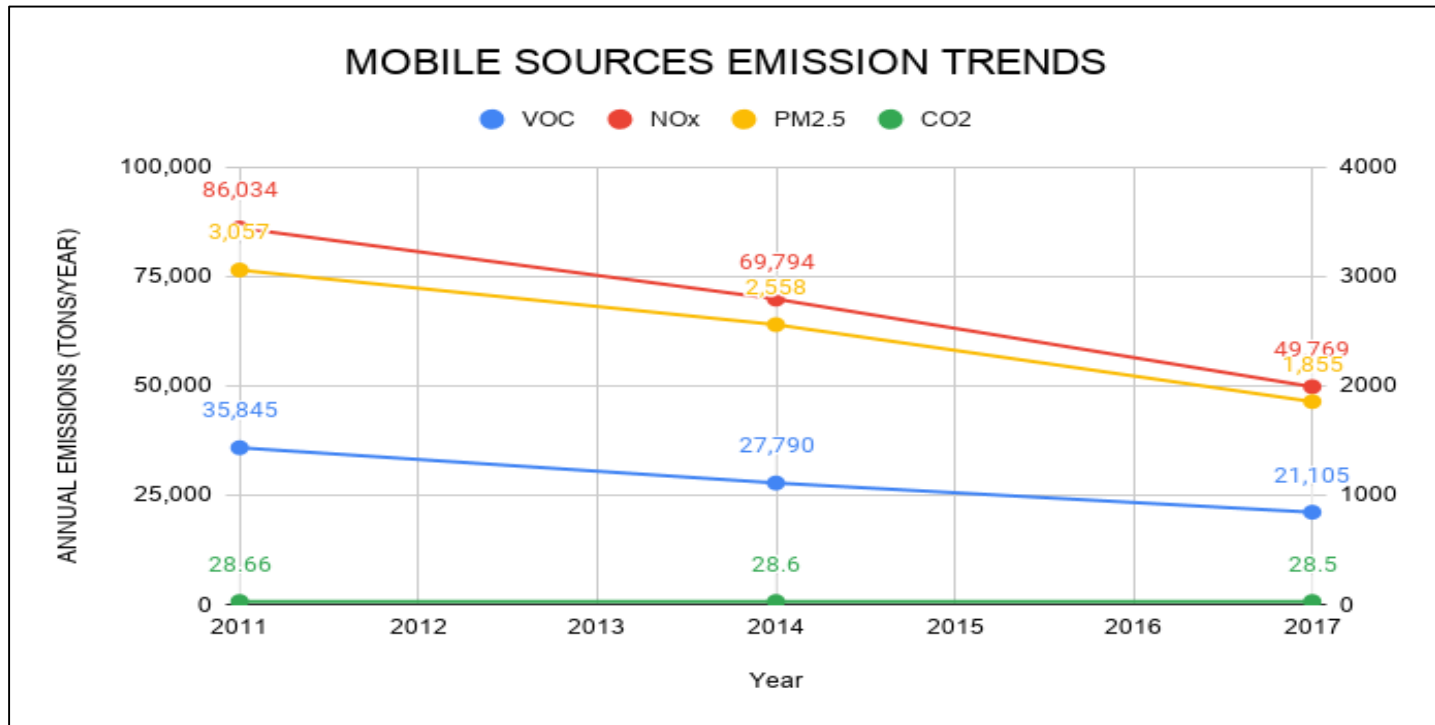
Maryland Healthy Air Act

Deactivation of Coal-fired Power Plants

- All of Maryland's coal-fired power plants to close by 2030
  - HA Wagner 2 – June 1, 2020
  - Dickerson – July 30, 2020
  - Chalk Point – June 1, 2021
  - Morgantown – June 1, 2022
  - Brandon Shores – October 1, 2025
  - HA Wagner – October 1, 2025
  - AES Warrior Run – 2030

- Gas and oil-fired units within facilities may continue operation

- Renewable energy and battery storage projects being planned as on-site replacement

Mobile Source Emission Reductions

- State and federal requirements have also driven significant reductions in emissions from mobile sources

MOBILE SOURCES EMISSION TRENDS

Legend: VOC, NOx, PM2.5, CO2

Year	VOC	NOx	PM2.5	CO2
2011	35,845	86,034	3,057	28.66
2014	27,790	69,794	2,558	28.6
2017	21,105	49,769	1,855	28.5

Y-axis: ANNUAL EMISSIONS (TONS/YEAR)
X-axis: Year

2021 AND 2022 PRIORITIES

2021/2022 Rapid-Fire Priorities

- Ozone
  - Transport
    - Section 184C (PA power plants that don't always run their controls), Cross State Air Pollution Rule (CSAPR) Update and Good Neighbor SIPs are all in the works right now
  - Municipal Waste Combustors
    - Permit conditions and tougher regulations are in the works
  - Aftermarket Catalysts
    - Still moving on MDE regulation, but federal action is also a possibility

- Sulfur Dioxide (SO2)
  - All areas in Maryland (3) now meeting the standard
  - Working to wrap-up attainment demo process for all 3 areas

Rapid-Fire Priorities (continued)

- Mobile
  - Medium & Heavy-Duty ZEV MOU a very high priority. Action Plan in Fall
  - The Transportation and Climate Initiative (TCI) also a high priority. Analyses and expansion of regional program still ongoing
  - Electric vehicles (EVs) are also another very high priority
  - California and Clean Air Act Section 177 opportunities will present themselves in 2021 and 2022
    - Potential regs for an advanced clean truck program, a heavy-duty diesel NOx program and an updated California car program are all at a point for consideration under 177
    - Also, a very real possibility that EPA will move to harmonize the federal program with the California program
  - Regs passed by AQCAC in June 2021:
    - Anti-Tampering … a very high priority
    - Modernization of the Vehicle Emission Inspection Program (VEIP)
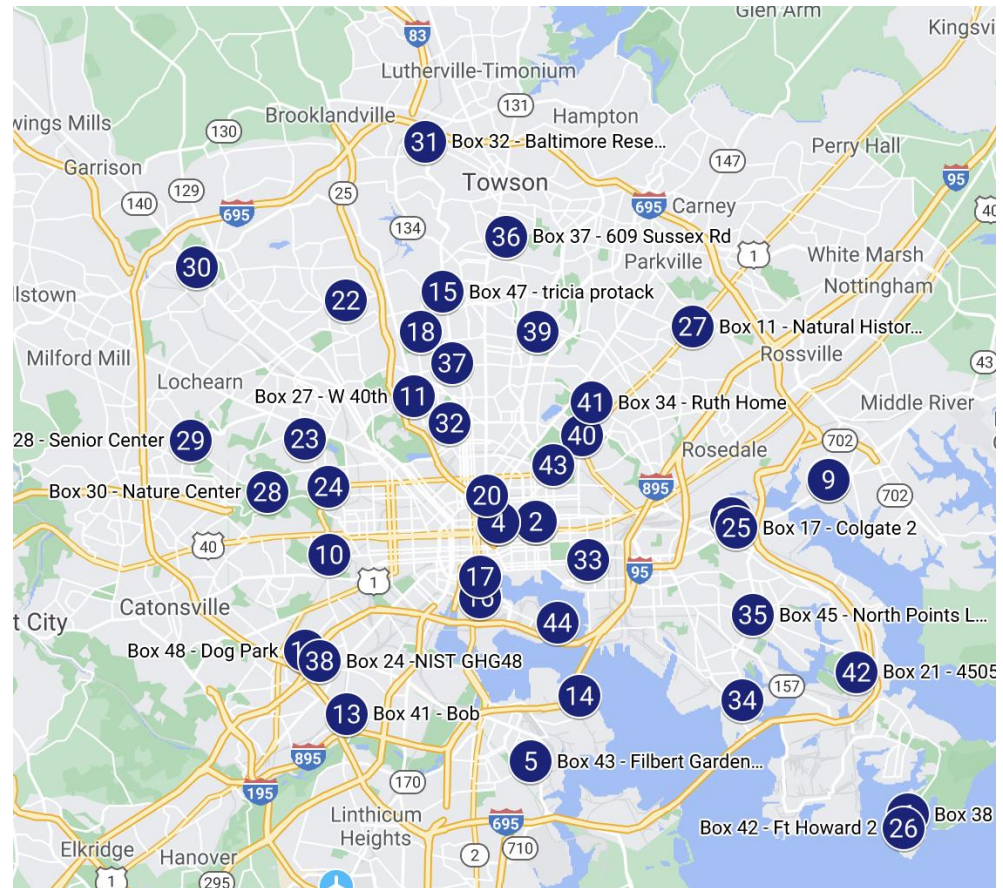
Rapid-Fire Priorities (continued)

- Environmental Justice (EJ)
  - Community-based air monitoring projects … now four efforts that are either up and running or soon to be up and running. Baltimore, Cheverly, St. Mary's County and DC area
  - Targeted inspection efforts in EJ areas
  - ARA efforts support reinvigorated MDE-wide process for EJ
  - Community partnerships – nine communities … since 2017
  - The Port Partnership
  - Permit and compliance efforts

- Maryland's Port and Peak Day Partnerships
  - Port partnership very strong, MDE, MDOT, MEA, the Port and over 15 different communities. Over $15 Million investment into clean air and very large reductions in NOx, greenhouse gases, PM, air toxics and diesel particulate. More reductions on the way.
  - MDE's peak day partnership effort is in its fourth year. Extra effort and reductions on worst ozone days from about 40 stationary NOx sources.

Hyper-Local Monitoring Projects

The Johns Hopkins/Yale "SEARCH" Project

- Lead by Johns Hopkins and Yale with MDE collaboration

- A project using a large network of low cost air quality sensors to look at air pollution variability across the Baltimore area

- Data on fine particulate, nitrogen dioxide, greenhouse gases and more being collected

- Similar projects in Cheverly, St. Mary's County and DC area

SEARCH sensor map courtesy of Kirsten Koehler (JHU)

QUESTIONS ... DISCUSSION