Maryland
Department of
the Environment

Addressing Sulfur Dioxide (SO_2) Air Pollution in the Baltimore Area

Maryland Department of the Environment Presentation

Meeting With the Pasadena Community

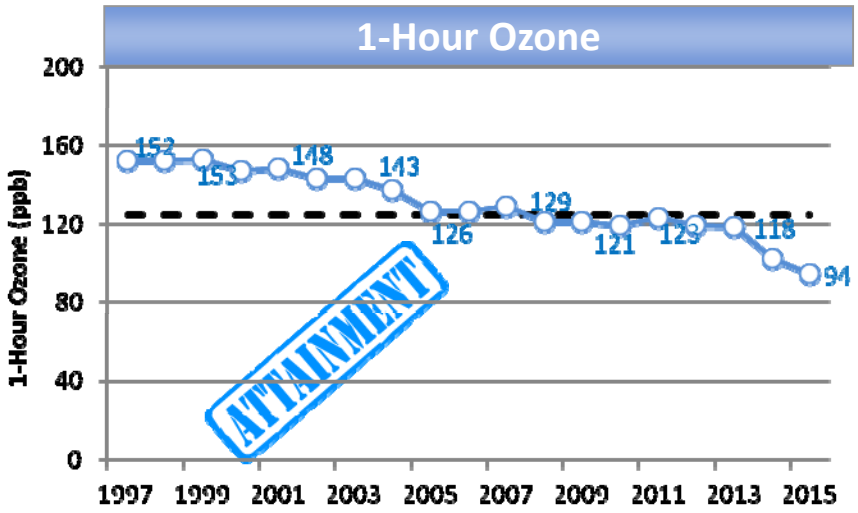
September 18, 2017

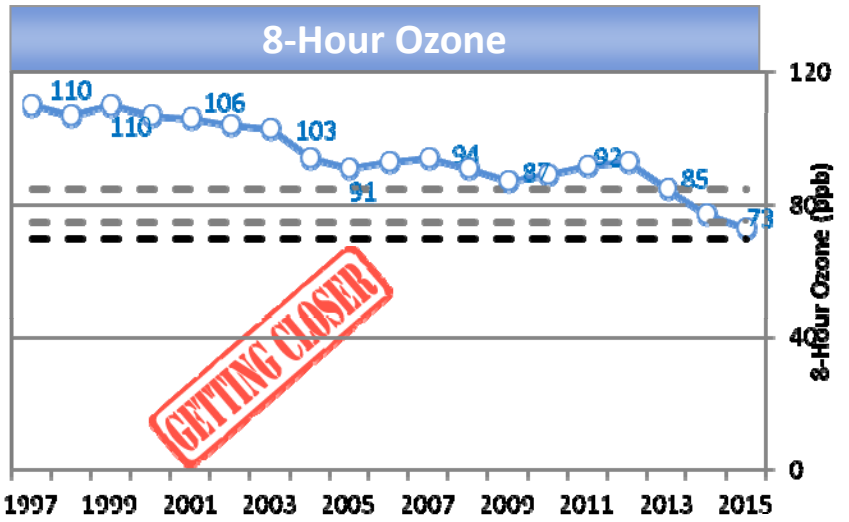
Topics Covered

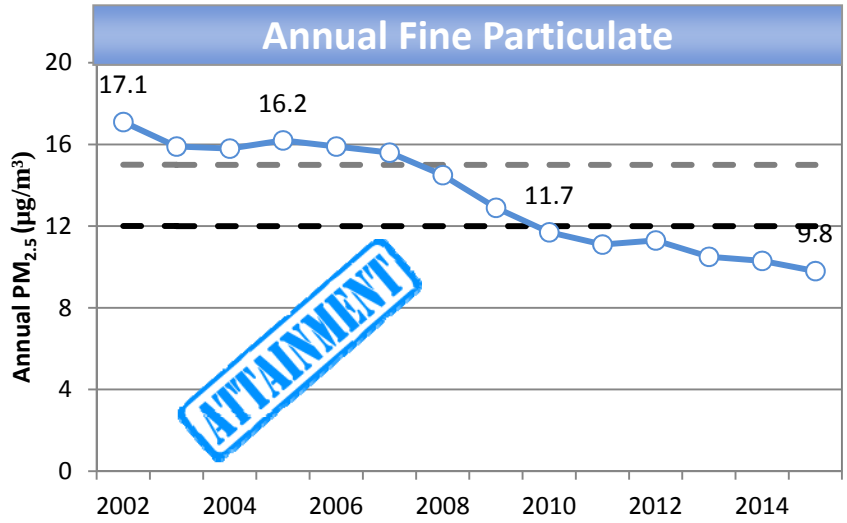
- Recent Progress on Air Quality in Maryland and Baltimore
- Sulfur Dioxide (SO_2) Nonattainment
  - The process
  - What current monitors tell us
  - SO2 Emission trends
- The new SO2 monitor for the Wagner area
- Status of the State Implementation Plan (SIP) for the Wagner area
  - Overview/timing
  - Sources covered
  - New controls
  - Public process
- Wrap-Up/Next Steps

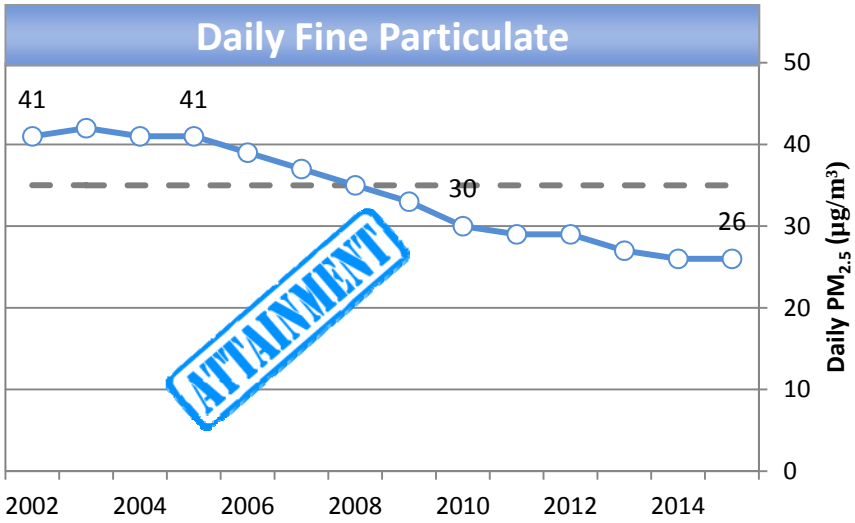

CLEANING THE AIR
DRAMATIC PROGRESS OVER THE PAST 10 YEARS

Progress in Cleaning Maryland's Air





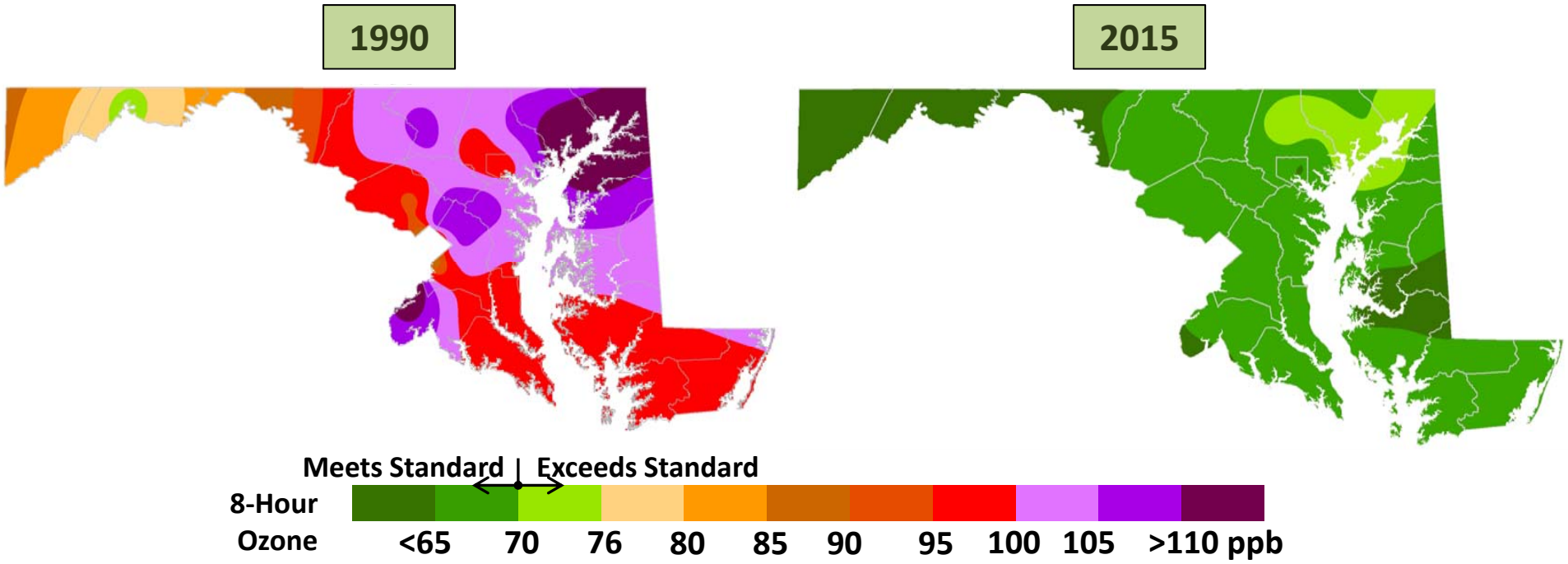




Clean Air Progress in Baltimore

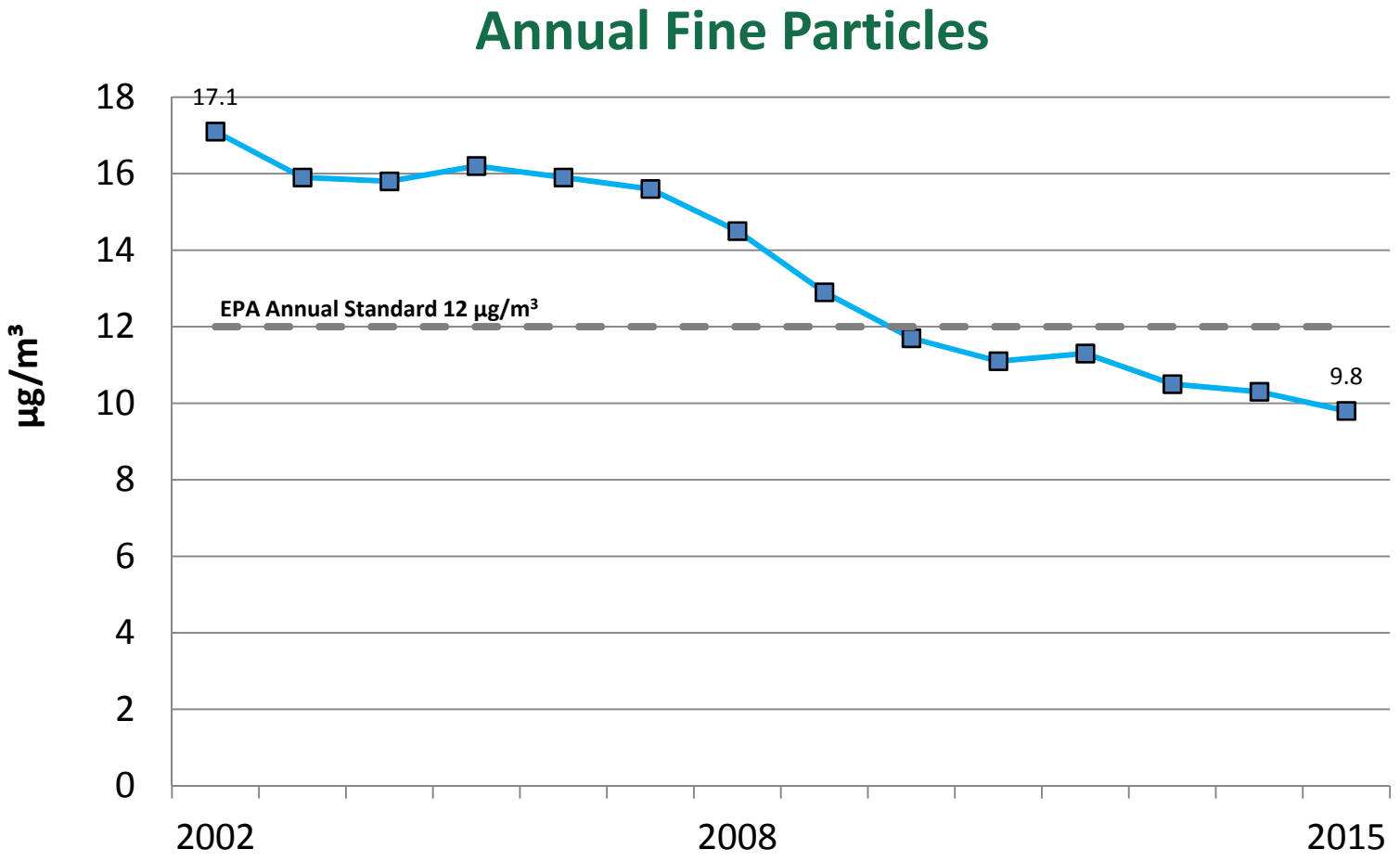
- Baltimore has historically measured some of the highest ozone in the East
- From 2013 to 2015, the Baltimore area did not exceed the current ozone standard
  - First time in 30 years … weather did play a role
- EPA has finalized a "Clean Data Determination"
- With hotter weather, Baltimore may see higher ozone … but Baltimore will continue to improve
- New, lower standard begins in 2017
  - New challenges

The Shrinking Ozone Problem

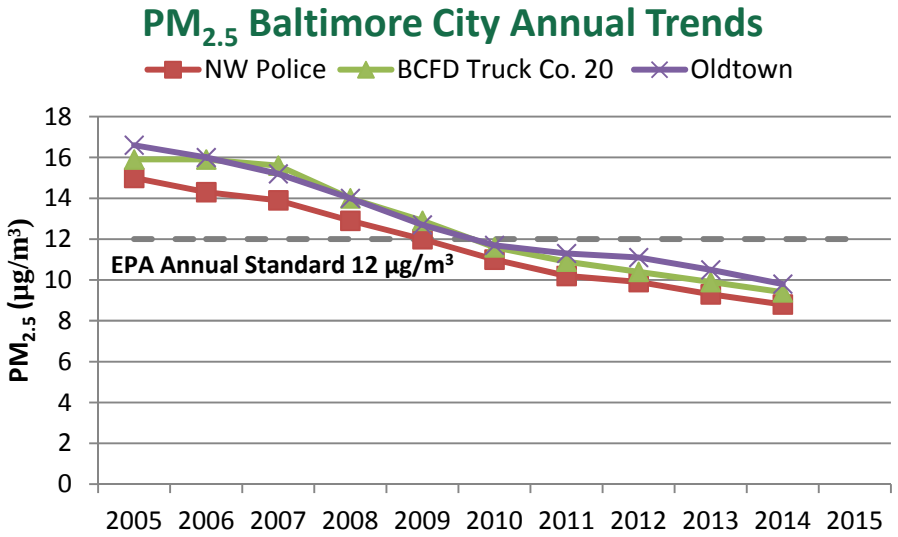


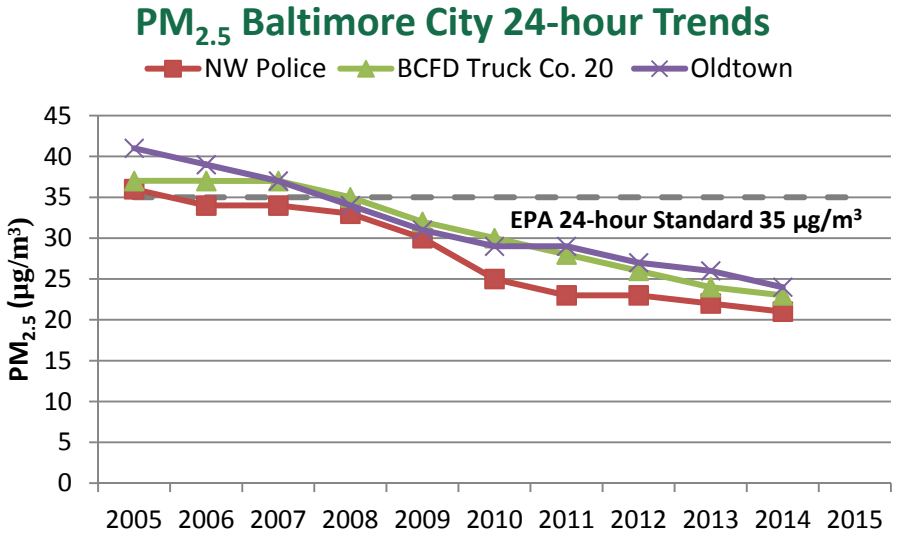
- In 2015 no monitors were above the 75 ppb threshold
- In 2015 only small areas of Baltimore, Harford and Cecil Counties were above the new ozone threshold of 70 ppb

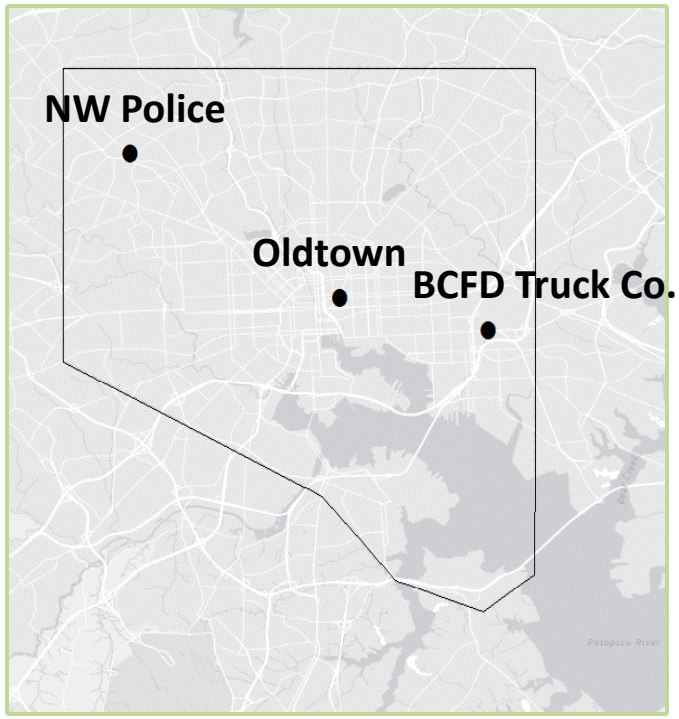
Fine Particle Air Pollution
Lower Levels Across the State



Fine Particles
Baltimore City Trends








SO_2 NONATTAINMENT

The Basics

- In 2010, EPA promulgated a 1-hour national standard for sulfur dioxide (SO_2)
  - The level of the standard is 75 parts per billion (ppb)
- In July 2016, EPA designated portions of Anne Arundel and Baltimore Counties as "nonattainment"

MDE Did Not Agree With EPA

- Analysis shows that current SO_2 levels are below the standard
  - EPA's designation is based upon 2012 to 2015 data
- MDE completed comprehensive analyses of 2015-2016 conditions
  - Governor Hogan recommended to EPA an "attainment" designation
- Analysis using most recent data shows that the area is in attainment
  - In 2015-2016, Wagner Unit #2 switched to coal with lower sulfur content and new controls were implemented at Wagner Unit #3
  - Historical SO_2 emissions levels & background concentrations in Maryland have dropped substantially

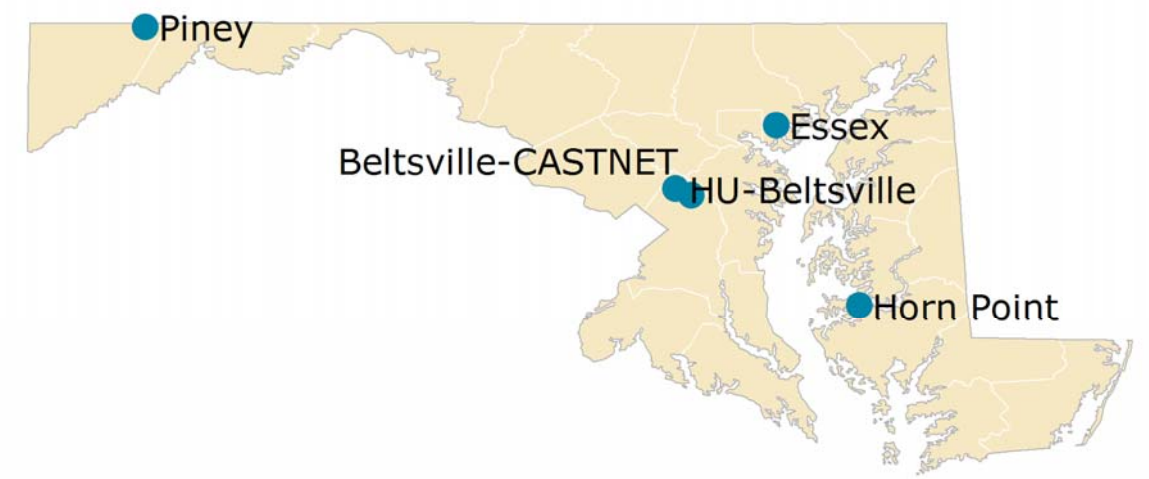
Maryland's Plan to Confirm Attainment

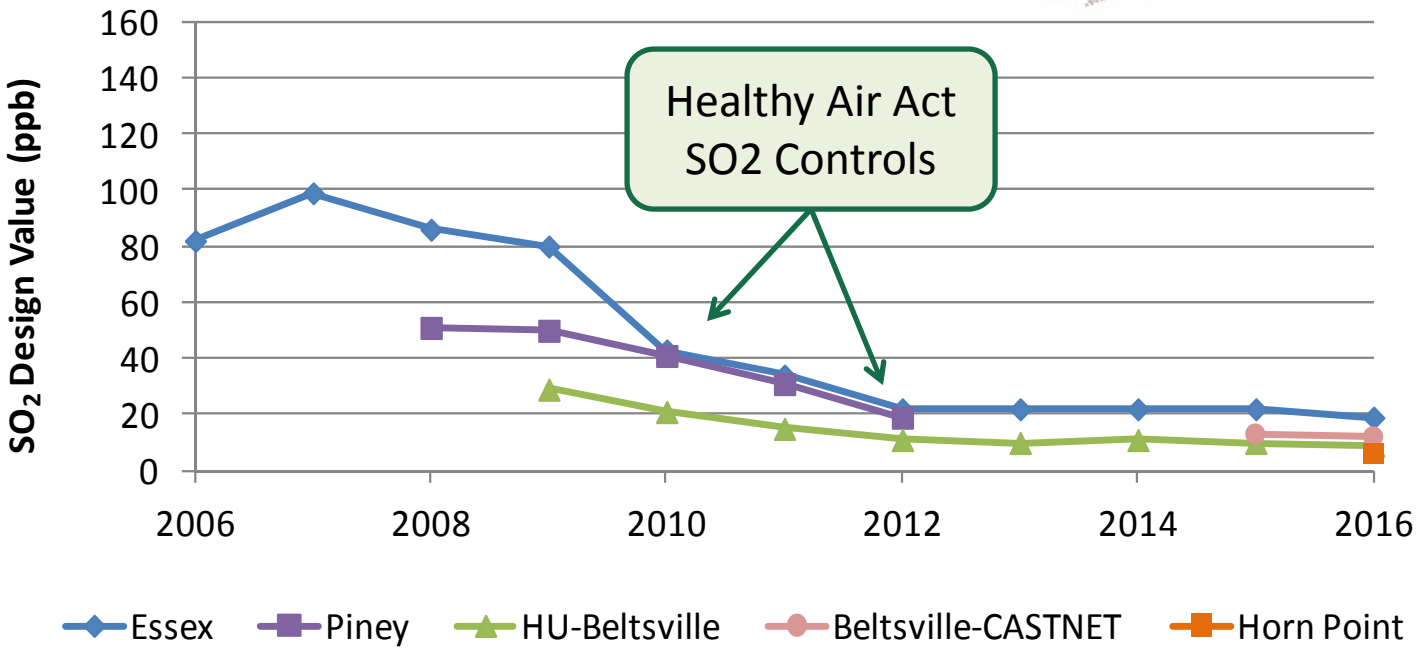
- Maryland is required to develop a State Implementation Plan (SIP)
  - A SIP is due in 2018 … it will show how the area is currently attaining the standard.
  - MDE plans to submit the SIP ASAP
  - Will include and make federally enforceable all of the new controls and changes that have occurred or are planned between 2015 and 2020

How Will Attainment Be Proven?

- EPA requires MDE to submit modeling for 2020 that will show the area is in attainment
- Maryland is also now installing an SO2 monitor in the area
- More later …

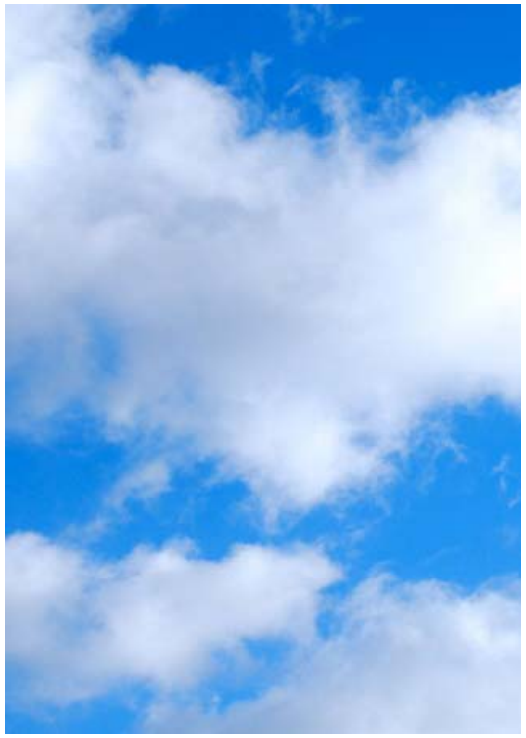
What Current SO2 Monitors Tell Us



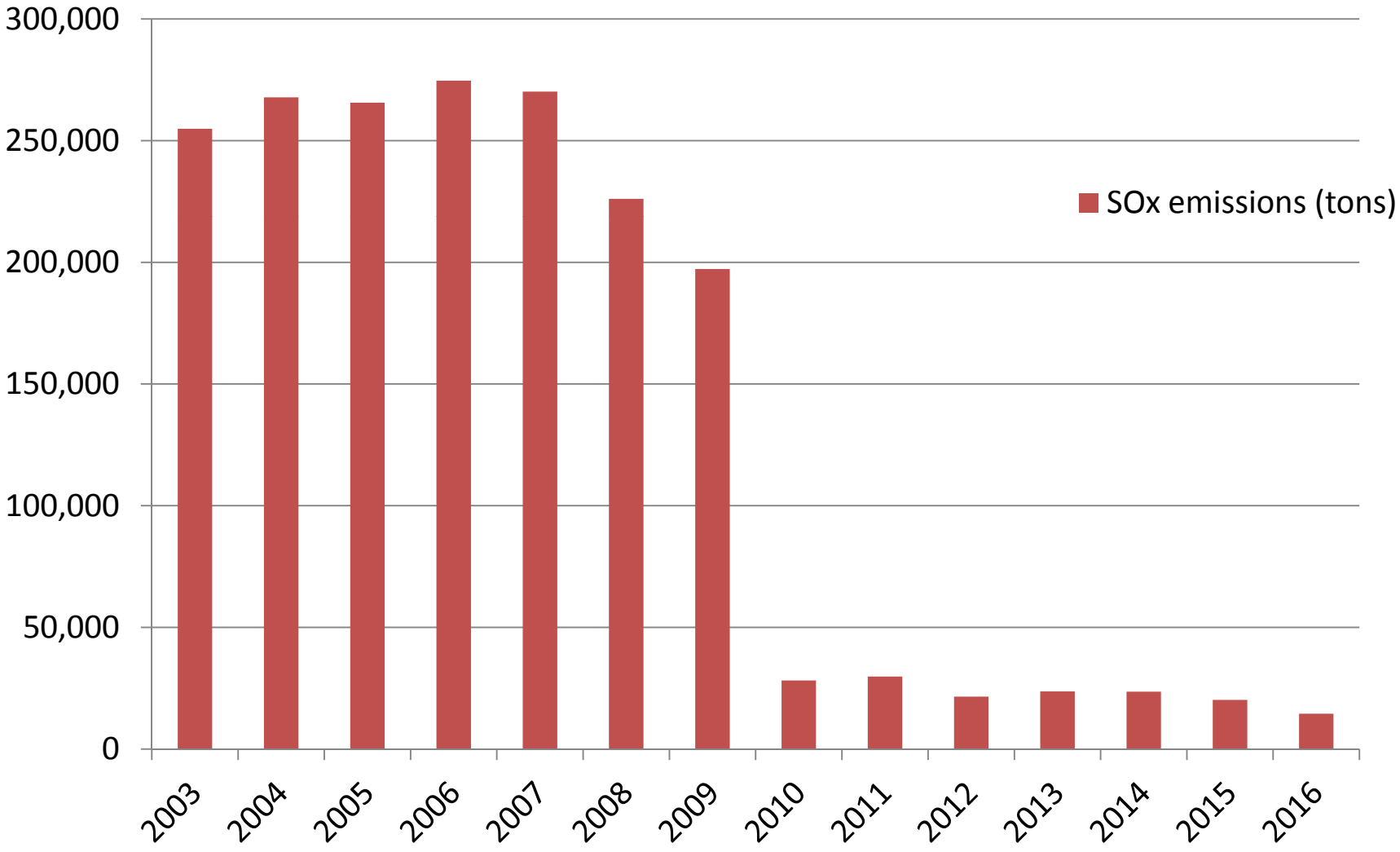


Maryland Healthy Air Act

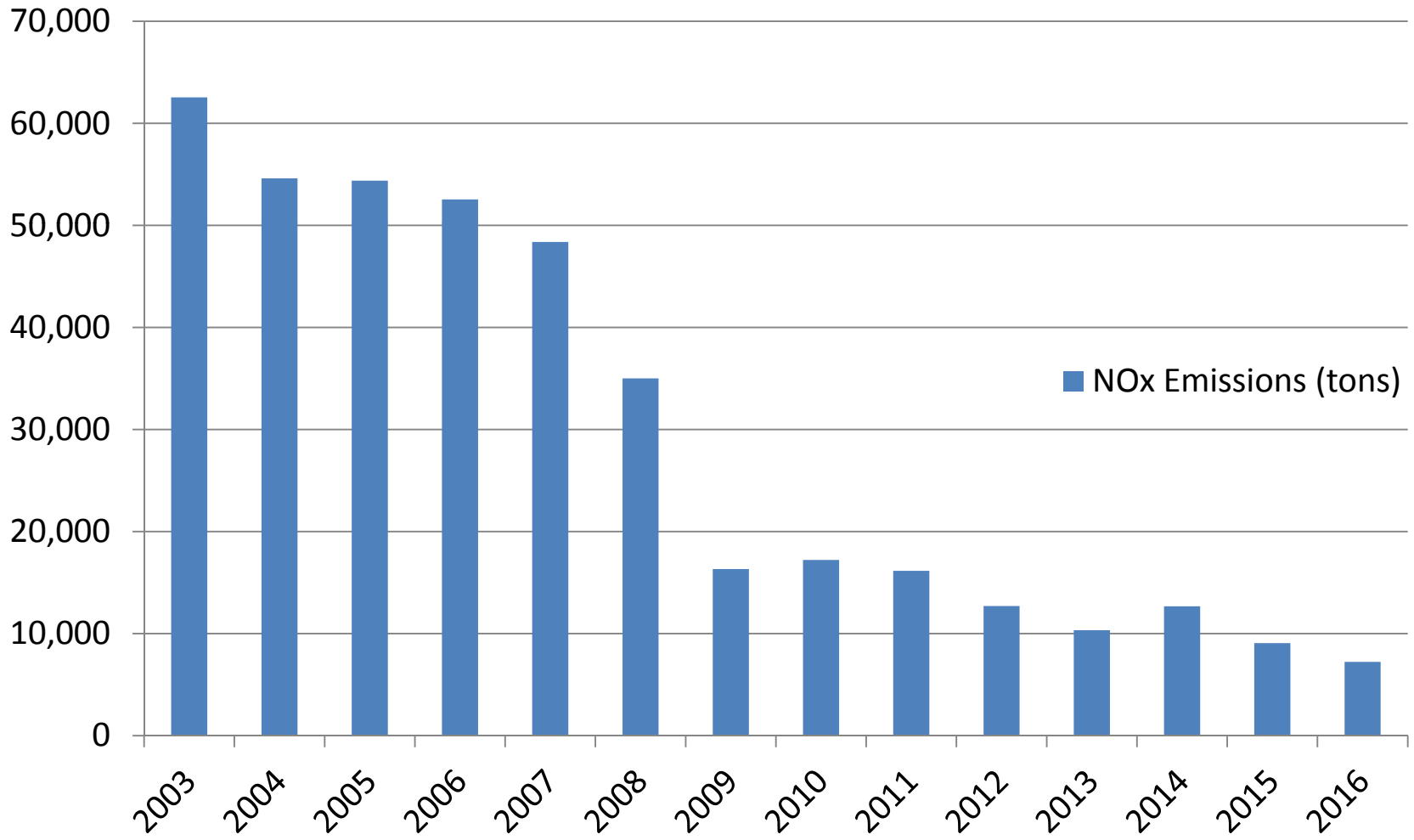
- The most significant emission reducing program in Maryland
- Widely applauded by environmental groups
- Environmental community & utilities worked with MDE as partners to design and implement
- Almost $2.6 billion investment by Maryland utilities
- Helped to dramatically clean the air – fine particles, ozone and mercury
  - … and SO2



Total Sulfur Dioxide Emissions, Maryland Healthy Air Act (Coal) Facilities



Total Nitrogen Oxides Emissions Maryland Healthy Air Act (Coal) Facilities




THE NEW
SO_2 MONITOR

Siting a Monitor - The Process

- Perform dispersion modeling to identify areas of highest source impact
- MDE and EPA evaluate potential monitor locations by conducting thorough site surveys to ensure federal siting regulations can be met
- Site for FR

Buildings, trees and other obstacles may provide surfaces for SO_2 adsorption or reactions and can restrict airflow

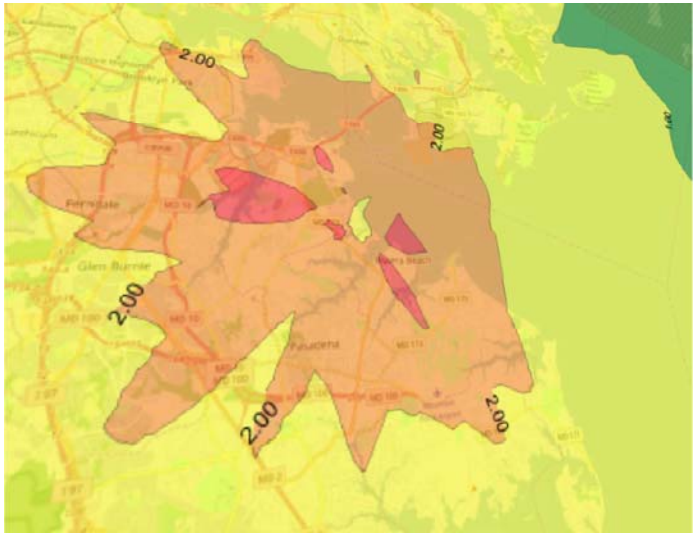
- ✓Distance from obstacle to monitor inlet must be at least twice the height the obstacle protrudes above inlet
- ✓90% of the monitoring path must have unrestricted airflow and be located away from obstacles
- ✓90% or the monitoring path must be at least 10 meters from drip line of trees

Monitor Siting - Some Challenges

- Logistical Constraints and Other Considerations
  - Availability of electrical power and telephone line
  - Necessary site improvements such as road and fence
  - Safety, security, and accessibility (access to locked facilities)
  - Access agreement negotiations including possible rental fees
  - Finite resources – funding, staff
  - Longevity of site

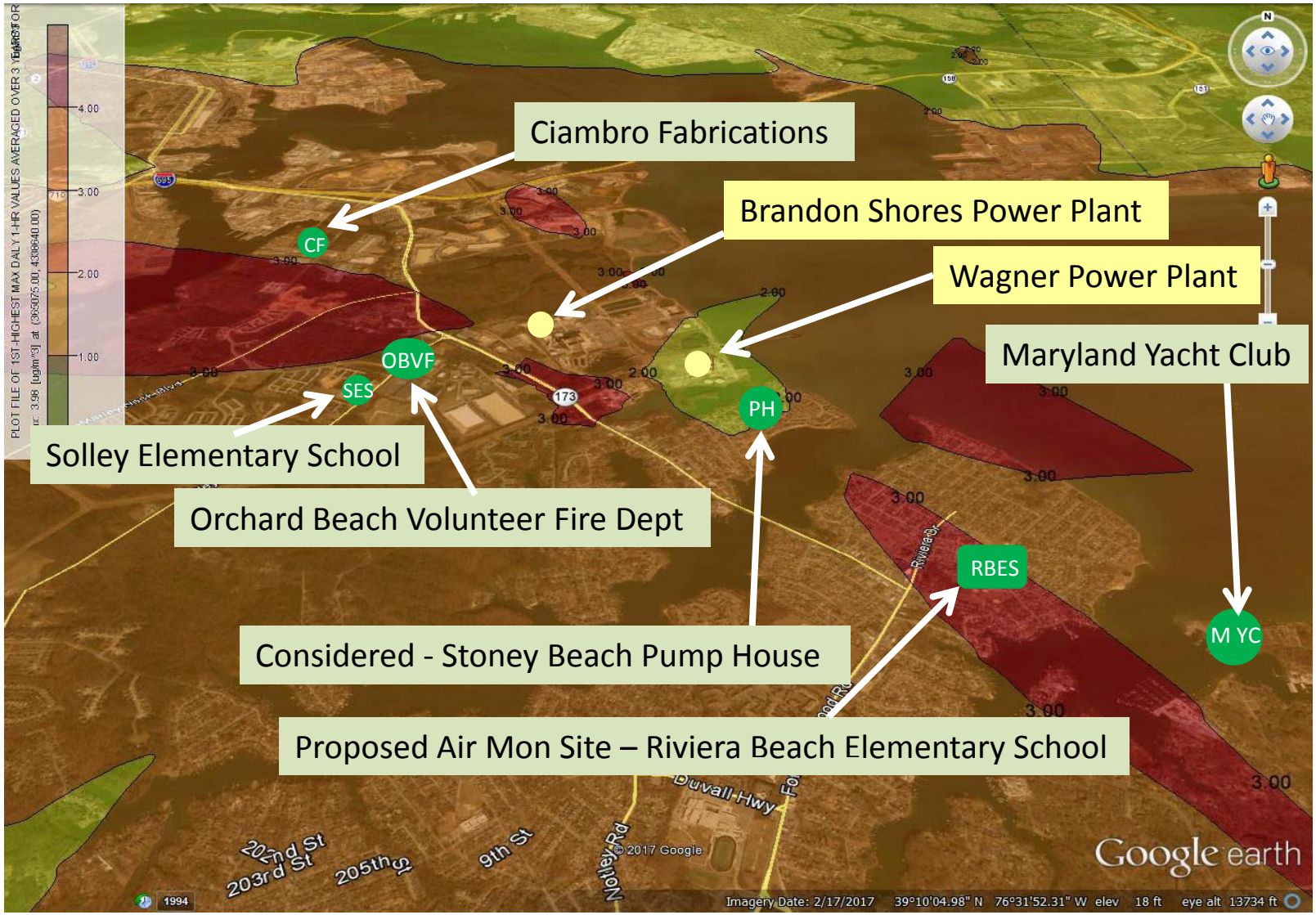
Dispersion Modeling Setup

- Purpose to determine potential location for an SO_2 monitor
  - Need to site the monitor where levels are likely to be higher
- Used 2014 -2016 met data.
- Used most recent version of EPA approved dispersion model (AERMOD).
- Considered all emission sources in the area
  - Maximum 1-hour SO_2 concentrations



Red areas show where model says SO2 levels are more likely to be higher

Location of Sites Being Considered and Close By Power Plants

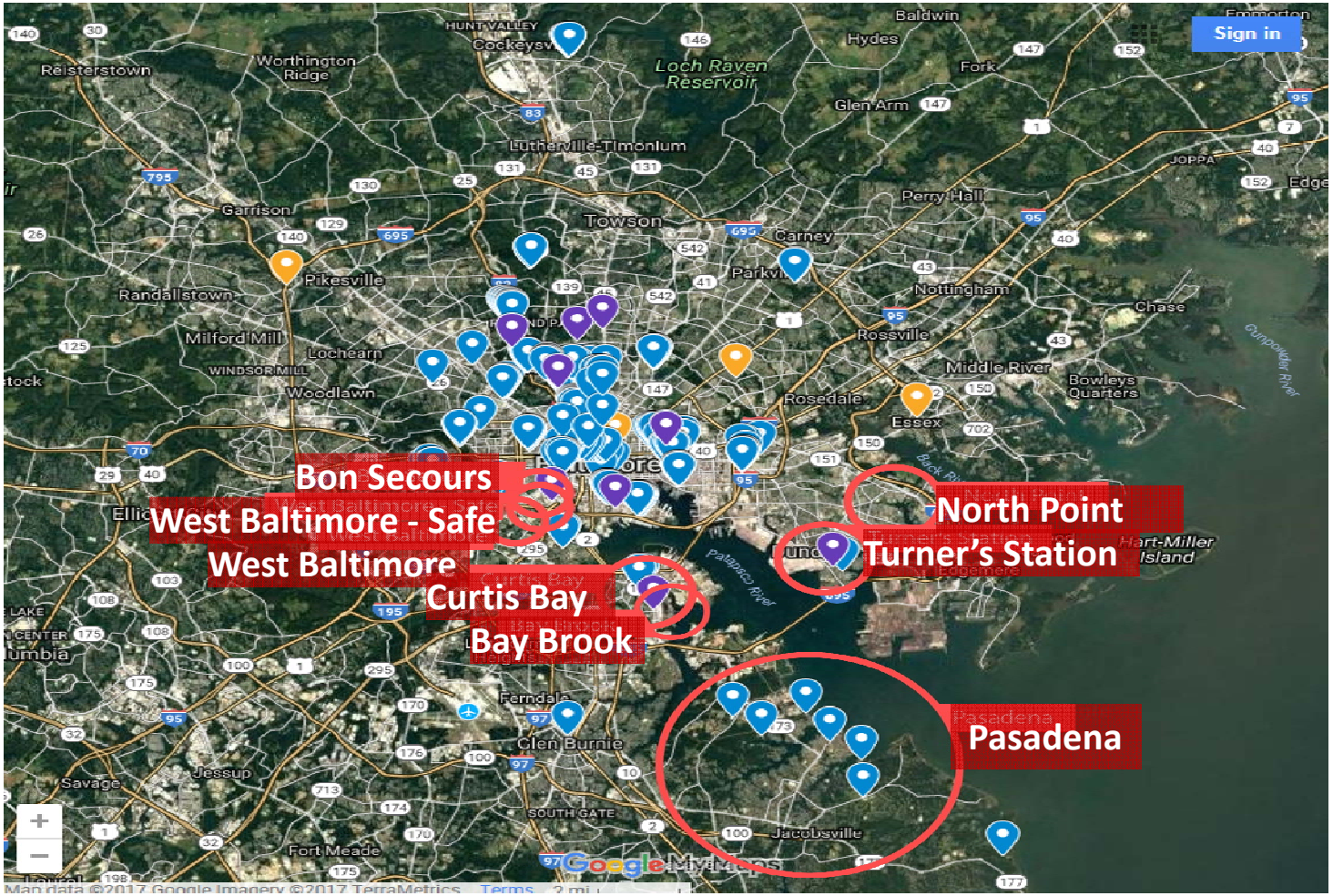


SO_2 Air Monitor – The Airpointer

The Baltimore Open Air Project*

A "Citizen Science" Project
Using Low Cost Air Sensors

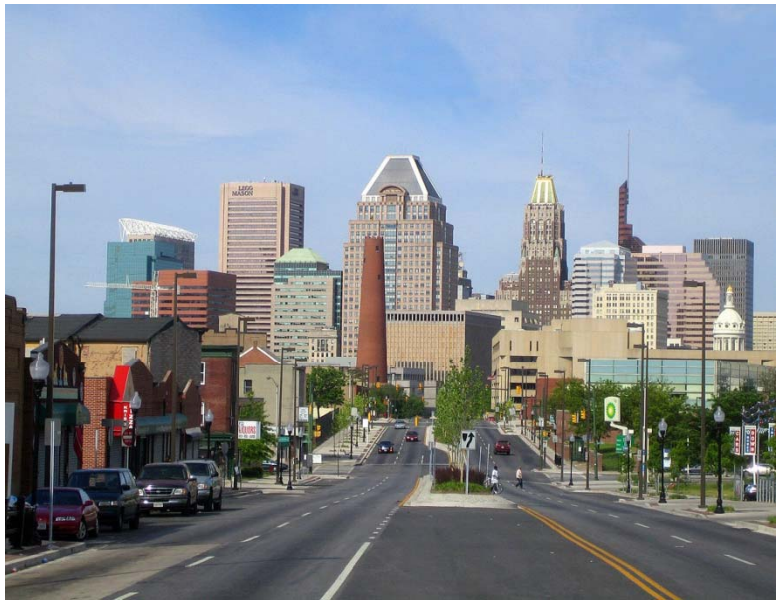
Proposed Sensor (Ozone & NO2) Locations



* This is an independent project being coordinated by students at Johns Hopkins. MDE is a partner.

The Baltimore "SEARCH" Project

- Another project in the Baltimore area that will be deploying low cost air sensors
- An effort being coordinated by Yale University and Johns Hopkins
  - MDE is a partner
- Still in the planning stage
- Exact location of sensors not yet determined
- May be trying to include sensors for SO2
- For more information contact Kirsten Kohler at Johns Hopkins

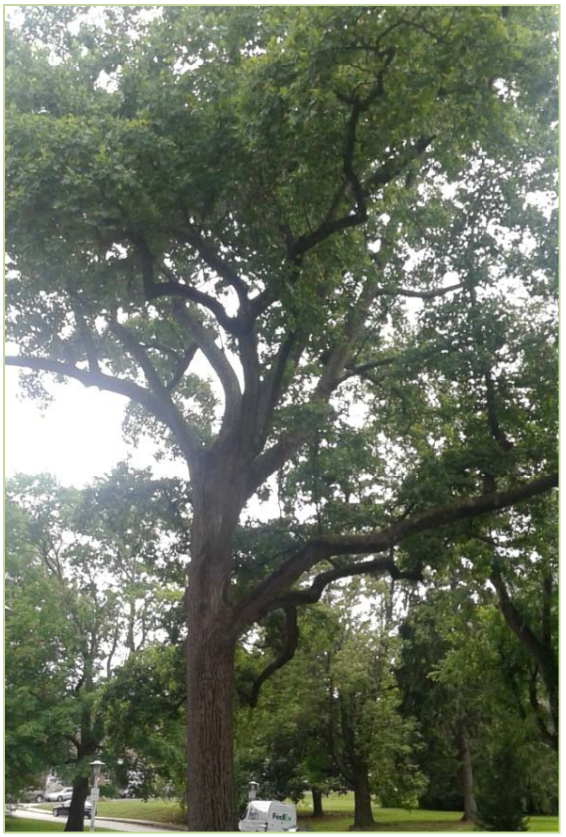



DEVELOPING
THE PLAN

Maryland SO_2 Attainment Plan

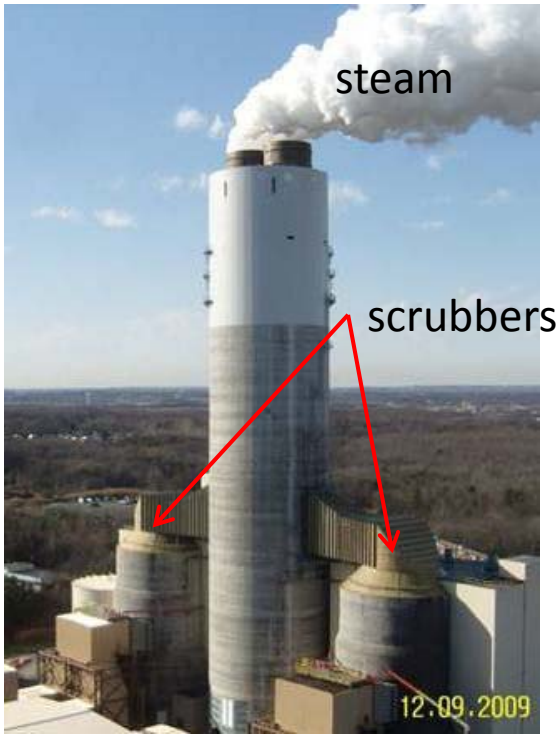
Maryland's State Implementation Plan (SIP) is due in 2018

- Will show how the area is attaining the standard
- Will use air quality modeling
- Will include and make federally enforceable:
  - All of the old and new controls that are designed to reduce SO2 emissions



SO_2 Emission Reductions at Brandon Shores Station

- Raven Power has invested approximately $1 Billion for air pollution controls since 2007
  - Annual operating cost for the air pollution controls is about $15 million
  - Controls include:
    - Electrostatic Precipitator (ESP) & baghouse for particulate control
    - Wet "FGD" scrubber for SO_2 /acid gas controls
    - Low NOx burners and Overfired Air (combustion controls) for NOx
    - Selective Catalytic Reduction (SCR) for post-combustion NOx control
    - Activated Carbon Injection for mercury control
    - Dry Sorbent Injection (DSI) to control acid gases and SO2
  - SO_2 emissions have been reduced by about 95%
  - NOx emissions have been reduced by 75% (unit 1) and 89% (unit 2)



SO_2 Reductions at Wagner Station

- Raven Power has invested about $25 million for air pollution controls at Wagner since 2007
  - Annual operating cost for the air pollution controls is about $1.7 million
- Controls include:
  - ESP or Multiclone for particulate
  - Reduced sulfur fuel for Units 1, 2, and 4
  - Dry Sorbent Injection (DSI) on Unit 3
  - Low NOx burners on Units 2, 3, and 4
  - Selective Non-Catalytic Reduction (SNCR) on Unit 2 & SCR on Unit 3 for NOx
  - Activated Carbon Injection for mercury, Units 2 and 3
  - DSI for other Hazardous Air Pollutants on Unit 3

Wagner Station (continued)

- H. A. Wagner Units controls - continued:
  - Unit 1: Natural gas (low SO_2)
  - Unit 2: Switched to low chlorine coal (low sulfur) in 2015; ran only 10% of the time in 2016
  - Unit 3 (coal): Installed a dry sorbent injection system for SO_2 reduction
  - Unit 4 (fuel oil): Unit runs infrequently (less than 6% of the time, 2014-2016)
- Controls have resulted in an emissions savings of about 13,000 tons of SO_2 annually
- Controls have resulted in an emissions savings of 4,000 tons of NO_x annually

C.P. Crane Station Controls

- Crane has invested about $110 Million on air pollution controls since 2005:
  - Use of low sulfur coal
  - DSI system for acid gas control and baghouses for particulate, which together, also reduce SO_2
  - SNCR and Over-Fire Air for NOx control
  - Activated Carbon Injection for Mercury Control
- SO2 emissions have been reduced by approximately 85%
- NOx emissions have been reduced by approximately 50%

SO2 Emissions by Plant

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Brandon Shores	42,041	39,924	32,821	1,260	2,829	2,848	2,870	3,145	2,953	2,719
C. P. Crane	30,631	24,352	12,477	5,589	5,682	2,173	2,972	1,887	1,325	1,049
H. A. Wagner	20,983	15,307	15,139	9,182	9,113	7,514	10,178	9,610	10,188	7,836
Total	**93,654**	**79,584**	**60,437**	**16,031**	**17,624**	**12,536**	**16,020**	**14,643**	**14,466**	**11,603**

tons per year

Potential Future Changes
Regulation & Energy Market Impacts

- Maryland Regulations (COMAR Ch. 38) for NOx control require that the Crane units and Wagner unit 2 to do one of the following by 2020:
  - Install selective catalyst reduction for NO_x, **or**
  - Switch fuel to natural gas (reduces SO_2), **or**
  - Shut down in 2020 (eliminates SO_2)
  - Significant new SO2 reductions are likely

- Market changes are also driving lower SO2 emissions
  - Natural gas continues to be relatively low cost
  - Both Crane units, Wagner Units 2 and 3 and Brandon Shores Units 1 and 2 operate less than they have historically
  - These are all of the coal units in the area

The Schedule and Public Process

- Fall/Winter 2017 - SO2 Monitor installed and operational
- December 2017 to January 2018 - Stakeholder Meetings on the SIP
- January 2018 - Public Release of the SIP
- February 2018 - Public Hearing on the SIP
- March ??, 2018 - SIP due to EPA