Clean Air Progress in Maryland

Accomplishments 2015

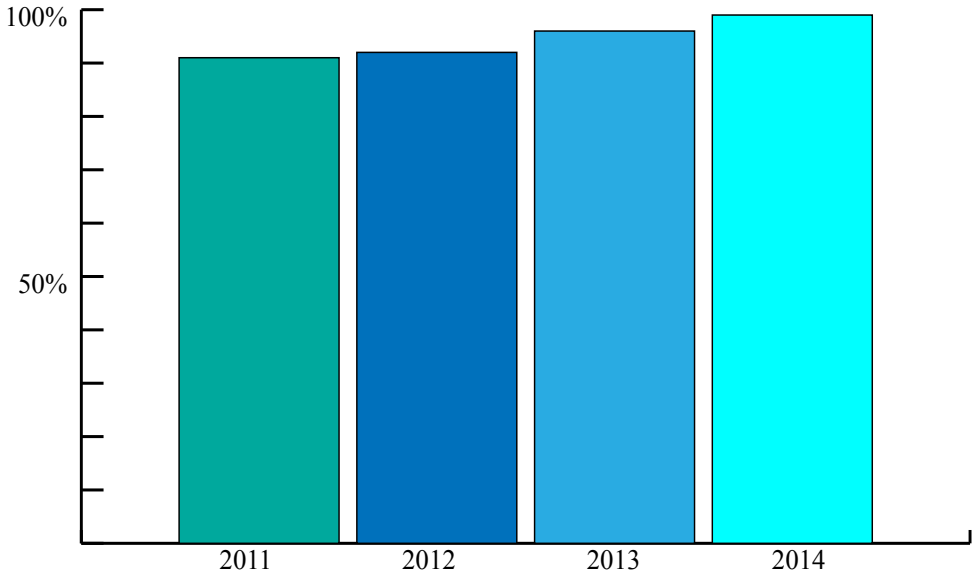


Maryland's Air

This year, for the first time in more than three decades, the U.S. Environmental Protection Agency (EPA) found that the metropolitan Baltimore area is meeting the health-based federal standard for ground-level ozone. Thanks to the sustained efforts of government, businesses, environmental advocates, scientists, health professionals and many others, Maryland and surrounding states have seen dramatic improvements in air quality. These improvements benefit public health, our quality of life and the economy.

Reductions in emissions from utilities, motor vehicles and other sources as diverse as manufacturing and consumer products have reduced the number of days on which Marylanders breathe unhealthy air. The reductions have also improved visibility. These improvements are the direct result of effective controls on local sources of air pollution. By requiring installation of state of the art control technologies and aggressive policies, we continue to progress toward cleaner air.

Good Air Quality Days in Maryland



To monitor this progress, follow MDE's Quality of Air monthly reports.

Inside

"Metropolitan Baltimore is meeting the health-based standard for ozone and that means hard work, strong controls, and steady investments are paying off. But we also know much more needs to be done, immediately and over the next five years, within the state and beyond, to consistently improve and maintain Maryland's air quality."

MDE Secretary Ben Grumbles

Criteria Pollutants

Ozone Standard & Designation

The Clean Air Act requires EPA to periodically review and revise air quality standards. The current standard, 75 parts per billion was established in 2008. In November 2014, EPA proposed strengthening the standard within the range of 65-70 parts per billion. Despite the progress that has been made in reducing ground level ozone, parts of Maryland continue to record some of the highest ozone levels in the east. These monitors are subject to the "perfect storm" for ozone air pollution, where unique meteorology and geography line up with transported pollution from power plants in the west and local pollution from the south, primarily cars and trucks along the I-95 corridor. This pollution is trapped along the western edge of the Bay by winds, called the Bay Breeze.

To address this continuing problem, MDE is working on new "inside Maryland" emission reduction efforts (See page 6) and also working in partnership with about 25 other states in the east to reduce emissions from power plants, cars, trucks and other sources. On many days, up to 70% of Maryland's ozone problem originates in upwind states.

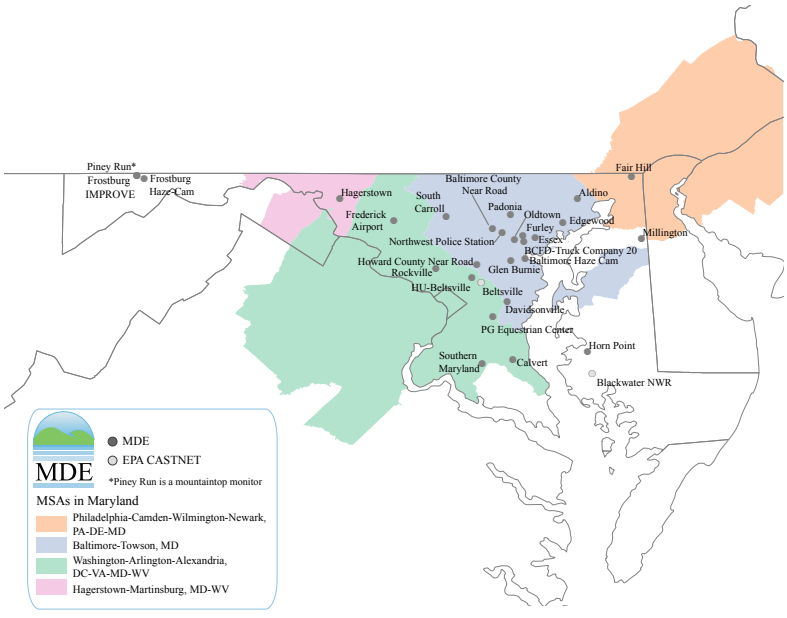
National Ambient Air Quality Standards (NAAQS)

The *Clean Air Act* requires the EPA to set NAAQS (40 CFR Part 50) for pollutants considered harmful to public health and the environment. EPA must designate areas as meeting (attainment) or not meeting (nonattainment) the NAAQS. The *Clean Air Act* requires states to develop a general plan to attain and maintain the NAAQS and specific plans to attain the standards for each area designated nonattainment. These plans, known as State Implementation Plans or SIPs, are prepared by state and local air quality management agencies and submitted to EPA for approval. Currently, parts of Maryland are designated as nonattainment. These persistent areas of nonattainment are largely caused by emissions generated in upwind states.

Monitoring Air Pollution in Maryland

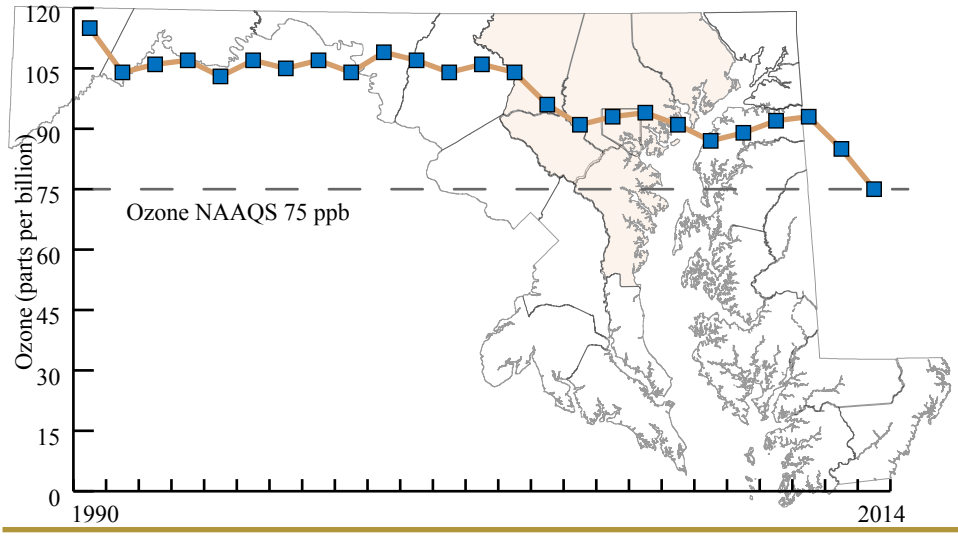
Maryland currently operates 26 air monitoring stations including two haze cameras around the State. In addition to the 26 monitoring stations operated by MDE, two CASTNET (Clean Air Status Trends Network) stations are located in Maryland: Blackwater National Wildlife Refuge and Beltsville. These sites are managed and operated by EPA's Clean Air Markets Division (CAMD) in cooperation with the National Parks Service and other federal, state and local partners.These measure ground-level concentrations of criteria pollutants and air toxics. They also take meteorological and other research oriented measurements. Although monitoring takes place Statewide, most of the stations are concentrated in the urban/industrial areas, which have the highest population and number of pollutant sources. This network is maintained and operated by the Ambient Air Monitoring Program of MDE's Air and Radiation Management Administration.

Maryland Air Monitoring Sites



Ozone

Baltimore Region 8-Hour Ozone



Ozone NAAQS	
Final Rule	73 FR 16436, March 27, 2008
Averaging Time	8-hour
Level	75 parts per billion

The EPA's "Clean Data Determination", published in the March 18, 2015 Federal Register, demonstrates that the Baltimore Region did not exceed the current ozone standard for the first time since measurements began in 1980.

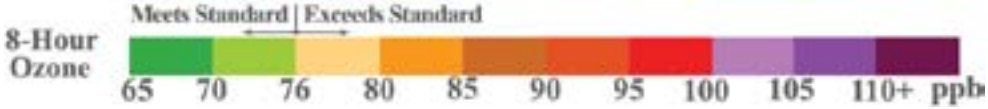
For the first time in 35 years, air quality monitors serving 90 percent of Maryland's population meet the standard.

The Shrinking Ozone Problem

Lower Ozone Levels and Smaller Problem Areas

2014

1990



The State of Maryland has been very aggressive in controlling pollution that is generated within the State's borders. Maryland was one of the first states to implement the NO_x RACT (1995), NO_x Budget Programs (2000) and the NO_x SIP Call (2003) which are viewed as wholesale successes in air pollution control. Most of Maryland's point sources that emit more that 25 tons per year of NO_x are controlled by regulations.

Numerous regulations to control NO_x and Volatile Organic Compounds (VOCs) from sources as diverse as consumer products, industry, electricity generation and fuels have been adopted in Maryland. Effective local controls are working to reduce ozone pollution, but robust regional and national programs are needed to support Maryland's efforts.

Resources

Maryland's State Implementation Plans
Maryland's Air Monitoring Network
National Ambient Air Quality Standards
Six Common Air Pollutants

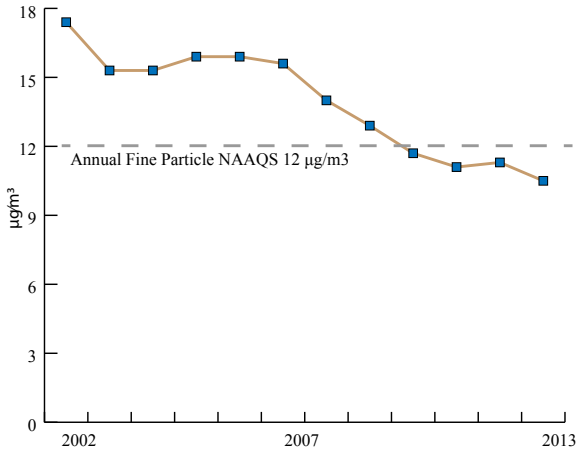
Fine Particles

Fine Particle NAAQS	
Final Rule	78 FR 3086, Jan. 15, 2013
Averaging Time	Annual Daily (24-hour)
Level	Annual 12 µg/m³ Daily 35 µg/m³

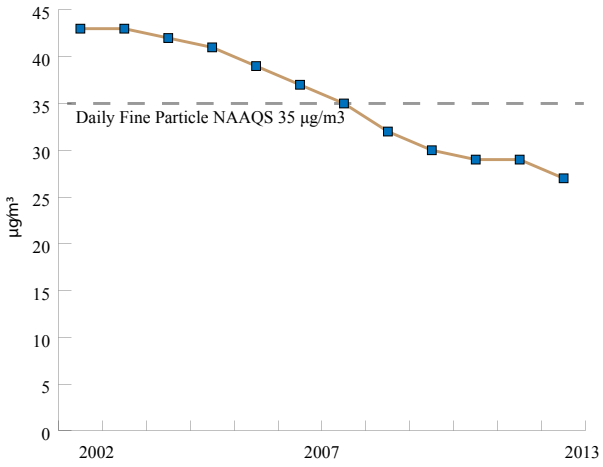
Maryland is currently attaining the fine particle standard across the State.

Fine particles are composed of nitrogen and or sulfur compounds combined with other organic or inorganic compounds. The size of particles plays an important role in how they affect human health. Particles also degrade visibility.

Annual Fine Particles



Daily Fine Particles



Annual and daily standards are designed to protect people from long- and short-term effects of exposure to fine particle pollution.

Maryland is addressing the problem of fine particle pollution through the Healthy Air Act (electricity generation), the Diesel Vehicle Inspection Program (heavy duty diesel trucks) and other regulations aimed at reducing SO_2 and NO_x from cement plants, mining operations and paper mills.

Maryland has been meeting the federal standard for fine particle pollution since 2008 and has also been able to meet a more rigorous standard that was finalized in 2012.

Toxic Air Pollutants

Progress in Reducing Toxic Air Pollution

Maryland has made considerable progress in reducing exposure to other air pollutants, commonly called non-criteria pollutants or toxic air pollutants. Other examples of toxic air pollutants include benzene (a constituent in motor fuels and used as a solvent), acetaldehyde (used in the production of perfumes, polyester resins and basic dyes) and toluene (used as a solvent and in the production of common consumer products). Concentrations of all three of these air toxics have been cut nearly in half over the past ten years.

MDE has been monitoring for air toxics at a limited number of sites since 1990. In very general terms, regulatory programs appear to have reduced concentrations of key indicator air toxic pollutants by around 50 percent over the last 10 years and 80 percent over the last 20 years. The key air toxic pollutants examined include ethylbenzene, toluene and 1-3-butadiene, all of which are primarily associated with mobile sources.

Recent regulatory initiatives include the federal Mercury and Air Toxics Standards Rule which requires reductions in toxic emissions from power plants. Maryland facilities are working in cooperation with MDE to develop and implement emissions and compliance reports.

Reducing Emissions and Exposure to Diesel Exhaust

Maryland has worked to reduce emissions from diesel-powered vehicles to address particle and ozone pollution. Recent efforts to reduce diesel emissions include:

- Using both federal and state funds, MDE continues working with the Maryland Port Authority and Maryland Environmental Service to repower or replace old drayage trucks operating at the Port. These trucks haul cargo containers from ships unloading cargo at the Port of Baltimore. This program helps offset the cost of replacing older trucks with new ones that meet tougher emission standards.
- Airport shuttles operating at Baltimore Washington International Thurgood Marshall airport were retrofitted with diesel particulate filters to reduce exhaust emissions by approximately 60 to 90 percent. In addition, an electrical cleaning facility was purchased and installed to provide filter cleaning.
- MDE has worked with Maryland Energy Administration to implement an Idle Reduction Technology program. This program helps offset the cost of purchasing idle reduction technology for trucks operating and registered in Maryland. This program provides significant reductions in both emission and fuel usage.
- MDE worked with the Metropolitan Washington Council of Governments (MWCOG) to establish a Diesel Idle Reduction Campaign Driver Recognition Program for the District and the State of Maryland. The driver recognition program targets truck and bus drivers and companies.

Power Plant Controls

New Control of NO_x Emissions from Coal-Fired Electricity Generating Units (EGUs)

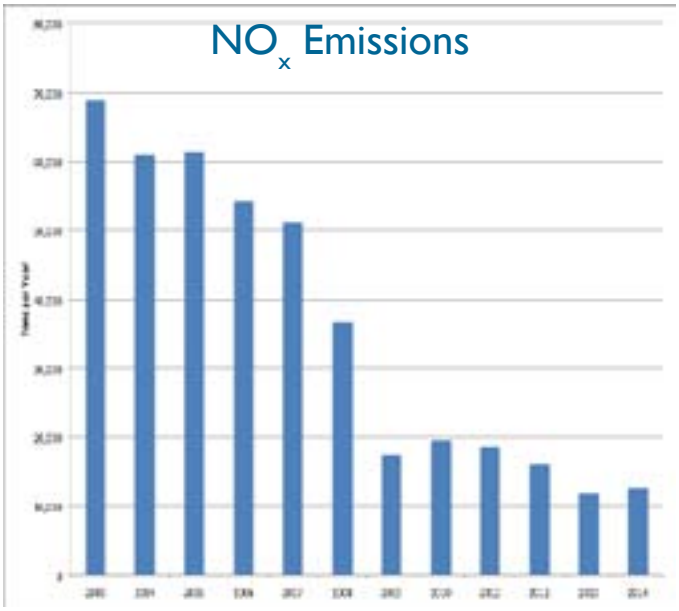
Maryland has recently moved forward with new regulations that will require even deeper emission reductions of NO_x from coal-fired electricity generating units (EGUs). These regulations require EGUs to minimize emissions throughout the entire summer ozone season and are expected to become effective in May, 2015. This regulatory initiative will achieve approximately 10 tons of new emission reductions on the worst ozone days each summer and provide immediate additional public health protection.

MDE is also looking ahead and plans to require even greater NO_x reductions from EGUs in the 2020 time frame to ensure continued progress under the new ozone standard expected later this year. MDE will work with affected sources and other stakeholders to finalize these new requirements by Fall, 2015.

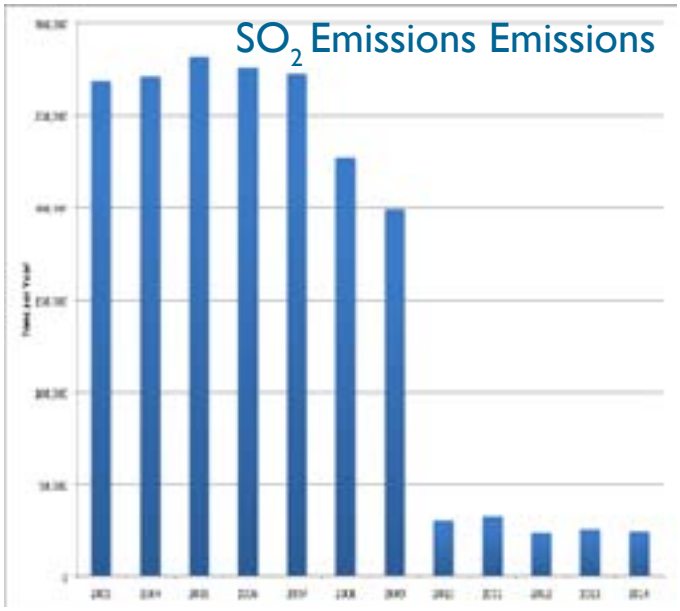
Continued reductions of NO_x emissions benefit public health and the environment by lessening ozone formation in the summer and particle pollution.

The Maryland *Healthy Air Act*, adopted by the Maryland General Assembly in 2006, is the toughest power plant emission law on the East Coast. Designed to bring Maryland into compliance with NAAQS for ozone and fine particles, the *Healthy Air Act* requires reductions in NO_x and SO_2. The Act also requires control of mercury emissions and greenhouse gases. The emissions reductions from the *Healthy Air Act* came in two phases. The first phase required reductions in the 2009-2010 time frame and, compared to a 2002 emissions baseline, reduced NO_x emissions by almost 70 percent and SO_2 emissions by 80 percent. The Act required 80 percent control of mercury emissions by 2010.

The second phase of emissions controls occured in the 2010-2013 time frame. At full implementation, the *Healthy Air Act* will reduce NO_x emissions by about 75 percent and SO_2 emissions by about 85 percent from the 2002 baseline. Ninety percent of mercury emissions are to be controlled by 2013.



NO_x emissions, a major component of particle pollution and an ozone precursor, have been reduced by 70 percent from pre-Healthy Air Act levels.



Before the Healthy Air Act was adopted, there were no controls in place for SO_2.

With the Healthy Air Act in place, SO_2 emissions, a major component of particle pollution, have been reduced by 85 percent from pre-Healthy Air Act levels.

Clean Cars & Electric Vehicles

The *Maryland Clean Cars Program*, enacted by the Maryland General Assembly in 2007, adopted California's vehicle emission standards. These new car standards became effective in Maryland for model year 2011 vehicles, significantly reducing a number of emissions including VOCs, NO_x and GHGs. By adopting California's standards, Maryland joined other states committed to further reducing pollution from motor vehicles.

In addition to the emission standards, a key component of the California program is the zero emission vehicle (ZEV) requirement. This requires the automakers to make an increasing percentage of their vehicles ZEVs. ZEVs include plug-in hybrids, battery electric and hydrogen-powered fuel cell electric vehicles. Affordable, readily available clean vehicles are an important component of efforts to reduce greenhouse gas emissions and to lessen the impacts of climate change. To date, manufacturers have introduced over two dozen models in these categories and they are beginning to become accepted in the market. The ZEV requirement requires significant increases in the number of ZEVs in model year 2018 with numbers increasing until 2025. Maryland has already seen significant statewide growth in these types of vehicles. This has meant growth not only in the vehicle market but significant growth in the development of the needed charging infrastructure to support this market. To date there are over six hundred public chargers operating throughout the state and this number is expected to increase significantly by the end of calendar year 2015.

The importance of ZEVs was further reinforced in 2014 when eight states developed a ZEV Action Plan. The plan seeks to to reduce greenhouse gas and smog-causing emissions by developing infrastructure, coordinating policies, codes and standards and developing a regional market for ZEVs. Maryland, California, Connecticut, Massachusetts, New York, Oregon, Rhode Island and Vermont are participating in the ZEV Action Plan. These states comprise approximately one quarter of the nation's new car sales. States, the auto industry, infrastructure developers and other stakeholders are participating in the implementation of the plan.

MDE Secretary Ben Guumbles plugs in at Montgomery Park with the Assistance of MDE's Tom French

Clean Cars Need Clean Infrastructure

Maryland has been busy making electric infrastructure available to all its residents. To date, there are over six hundred electric vehicle rechargers located throughout the state. The State of Maryland offers incentives that will cover approximately half the charger and installation cost for both Maryland residents and businesses.

In calendar year 2015, Maryland will invest over 3 million dollars to provide chargers at transit stations and service areas. This investment will provide Maryland with one of the most substantial networks of Level 3 Fast Chargers on the east coast. These Fast Chargers can refuel an electric vehicle in approximately twenty minutes.

Maryland is taking a lead in installing workplace charging at many of its office locations. The Maryland Department of the Environment installed an ten additional chargers at its headquarters. These chargers were made possible by a partnership between MDE, its building management and MEA. The chargers are currently free and are available to both private and state vehicles.

Air Pollution Knows No Bounds

Promoting Regional Solutions to Transported Pollution

Maryland's research shows that measured "incoming" ozone levels are often at levels that are already higher than the current standard. This air pollution that floats from state to state affects almost every state east of the Mississippi River.

Over the past few years, Maryland has played a critical role in bringing together approximately 25 states in the east to see where progress could be made in addressing this critical issue. This collaborative effort with Air Directors and Commissioners in many states is looking at new regional control efforts for power plants, vehicles and other sources of air pollution. Emission reduction progress is expected to begin this summer.

EPA has also moved forward with an initiative to require "Good Neighbor" plans from states whose emissions significantly contribute to problems in downwind areas. Although Maryland is a state that receives a significant amount of transported air pollution from the west and the south, our emissions also float downwind and affect areas like Philadelphia and New York. Maryland submitted its Good Neighbor plan to EPA in 2012 and is working on an update that is expected to be completed by the end of 2015.

Understanding Air Pollution Transport

Transported pollution is the top contributor to Maryland's ground-level ozone problem. Extensive scientific research conducted over the past 20 years confirms the existence of an aloft ozone reservoir in which ozone and its precursors are formed and freely transported in the middle of the night. This elevated reservoir is trapped at about 2,000 feet above the earth's surface by a nocturnal inversion and can be pushed by elevated nighttime winds for hundreds of miles in a single night. Maryland has data from airplanes, balloons, mountaintop monitors, wind profilers and other measuring equipment that support these conclusions. Our monitors show that as the nocturnal inversion begins to break up in the morning, the aloft ozone, routinely measured at levels above 75 parts per billion (ppb), slowly mixes down to earth. The elevated reservoir is created by emissions from nearby, upwind states.

We also have empirical evidence of emissions transported by the nocturnal low level jet (NLLJ). This is a strong southwest wind along the eastern side of the Appalachian Mountains that is measured at about 2,000 feet above ground level. The NLLJ begins at sundown and can last until dawn. It can start as far south as North Carolina and can reach as far north as New Jersey,
Connecticut and Massachusetts. Given an average speed of 30 mph, a NLLJ that runs for seven hours carries gases and particulates 210 miles. Data collected simultaneously from wind profilers and ozonesondes (a balloon-borne ozone measuring instrument) has revealed that ozone is transported via the NLLJ. Use of LIDAR (Light Detection and Ranging) remote sensing data reveals similar transport patterns for particles.

Transport becomes central to attainment in more and more states with each reduction in the NAAQS. Specifically, with each reduction in the NAAQS, the proportion of the NAAQS represented by transported pollution in these states increases. Meteorologists and atmospheric chemistry researchers at Howard University, the University of Maryland, and other institutions have documented the impact that meteorological and air transport processes, such as the NLLJ, and the elevated ozone reservoir have on local pollution levels.

Chemical lifetimes are longer and transport faster in the lower free troposphere (the boundary area between the portion of the atmosphere closest to the earth's surface, and the stratosphere) than at the earth's surface and, as a result, ozone and ozone precursors are commonly carried hundreds of miles from their sources. Following transport, air in the lower free troposphere mixes down to the surface as the nocturnal inversion breaks down due to solar heating in the mornings of ozone exceedance days. The relevant mixing layer for pollutants can vary in depth during a 24-hour period from less than about 350 feet at night to more than 3,000 feet on a warm and sunny day.

The Science

Scientific Evidence

There is an extensive body of scientific findings proving that regional transport plays a significant role in urban high ozone episodes in Maryland. More than 15 years of aircraft measurements by the University of Maryland have proven that aloft air coming into Maryland contains elevated ozone concentrations. This ozone is formed from emissions originating from sources in nearby states including Ohio, West Virginia, Pennsylvania and Virginia. Each of these states contributes substantially to Maryland's air quality problems. When this transported pollution mixes with local emission and settles close to the ground, Maryland experiences an ozone exceedence day.

Scientific observations lead us to conclude that a regional approach is needed to address Maryland's ozone problem. **Our data supports the statement that approximately 70% of the ozone measured in Maryland originates beyond Maryland's borders.** By continuing to implement effective local controls in combination with federal and regional efforts, Maryland will continue to improve its air quality.

DISCOVER-AQ: A Focus on Air Quality

In July 2011, a team of NASA and partner organization scientists flew in and around the Baltimore–Washington area taking detailed measurements of air pollution. The on-going mission, DISCOVER-AQ, is taking a closer look at the air quality near the surface of the Earth and helping us better understand the ingredients of the air we breathe. MDE's Air Monitoring Program supported the team conducting this innovative research.

Conclusion & Resources



Conclusion

We have effective air pollution controls in place to address the pollution we generate in Maryland. Vehicles and fuels are cleaner. Utilities have invested billions of dollars in pollution controls. We have reduced toxics emissions from fuels, paints and industrial processes. There is still work to be done to meet our air quality goals.

The science informs us that the solutions to our air problems exist within and beyond our borders. Pollution that originates in the south and midwest is carried to Maryland and beyond by winds that transport pollution between cities, over mountains and along the Chesapeake Bay. Our research indicates that states upwind of Maryland are responsible for about 70 percent of Maryland's air quality problem. Addressing air pollutants from neighboring states is a priority for Maryland and we are urging the EPA to adopt federal rules to reduce emissions from these states. We are also working with EPA and other states to use provisions in the federal *Clean Air Act* to ensure that these reductions in upwind states become effective.

Resources

Quality of Air Monthly Reports http://www.mde.state.md.us/programs/Air/AirQualityMonitoring/Pages/AQSummary.aspx

Maryland State Implementation Plans http://www.mde.state.md.us/programs/Air/AirQualityPlanning/Pages/programs/airprograms/air_planning/index.aspx

Air Monitoring Network http://www.mde.state.md.us/programs/Air/AirQualityMonitoring/Pages/Network.aspx

National Ambient Air Quality Standards http://www.epa.gov/ttn/naaqs/

Six Common Air Pollutants http://www.epa.gov/air/urbanair/

Maryland Healthy Air Act http://www.mde.maryland.gov/programs/air/pages/md_haa.aspx

Maryland Clean Cars Program http://www.mde.maryland.gov/programs/Air/MobileSources/CleanCars/Pages/index.aspx

NASA DiscoverAQ http://discover-aq.larc.nasa.gov/

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