Maryland Healthy Air Act and Observed Changes in Air Quality

Konstantin Vinnikov (Acting State Climatologist for Maryland)

The Maryland Healthy Air Act was developed with the purpose of bringing Maryland into attainment with the National Ambient Air Quality Standards for ozone and fine particulate matter by the federal deadline of 2010. The Healthy Air Act impacts Maryland’s largest coal-burning power plants, which account for over 95% of the state’s power plant emissions.

Historic Power Plant Electrical Power Output and Emissions of SO₂

MD

OH

PA

VA

WV

MD, POWER PLANTS ENERGY GENERATED, kW/km²

MD, SO₂ POWER PLANTS EMISSION, kg/(hr*km²)

MD, RATIO (SO₂ EMISSION)/(ENERGY GENERATED)

OH, POWER PLANTS ENERGY GENERATED, kW/km²

OH, SO₂ POWER PLANTS EMISSION, kg/(hr*km²)

OH, RATIO (SO₂ EMISSION)/(ENERGY GENERATED)

PA, POWER PLANTS ENERGY GENERATED, kW/km²

PA, SO₂ POWER PLANTS EMISSION, kg/(hr*km²)

PA, RATIO (SO₂ EMISSION)/(ENERGY GENERATED)

VA, POWER PLANTS ENERGY GENERATED, kW/km²

VA, SO₂ POWER PLANTS EMISSION, kg/(hr*km²)

VA, RATIO (SO₂ EMISSION)/(ENERGY GENERATED)

WV, POWER PLANTS ENERGY GENERATED, kW/km²

WV, SO₂ POWER PLANTS EMISSION, kg/(hr*km²)

WV, RATIO (SO₂ EMISSION)/(ENERGY GENERATED)
Monitoring of $SO_2$ concentration at EPA AIR Quality stations in MD and DC


DC. EPA 110010041. (38.8972°N, −76.9528°E). Time Series of Hourly $SO_2$, ppb
Diurnal-seasonal patterns of SO$_2$ concentrations for two periods: 2006-08 (three years before) and 2010-12 (three years after) the implementation of the MD Healthy Air Act
OBSERVED CHANGES IN PM2.5 CONCENTRATIONS
OBSERVED CHANGES OF SULFATE CONCENTRATIONS

Monthly SULFATE, EPA ID 240330030, (39.0553, -76.8783, 49m)

Monthly SULFATE, EPA ID 240053001 (39.3108, -76.4744, 5m)

Monthly SULFATE, EPA ID 110010043 (38.92185, -77.01318, 50m)

Monthly SULFATE, EPA ID 240230002 (39.70595, -79.0122, 767m)
OBSERVED CHANGES IN ATMOSPHERIC AEROSOL OPTICAL DEPTH

AERONET. Aerosol Optical Depth at 500 nm (τ500). GSFC, MD

AERONET. Aerosol Optical Depth at 500 nm (τ500). SERC, MD

AERONET. Aerosol Optical Depth at 500 nm (τ500). MD Science Center
CONCLUSION:
Long-term observations from surface monitors, aircraft, and satellites tell a consistent story of sulfur and PM2.5 pollution over Maryland in the past decade. Due to recent local and national regulations of power plant SO2 emissions, summertime tropospheric SO2 columns, PM2.5 levels, and AOD decreased substantially over the eastern United States. The Healthy Air Act, implemented in Maryland in 2009–2010, provided an exceptional opportunity to test the impact of a step change in local emissions on ambient pollution levels. This Maryland regulation reduced in-state power plant emissions of SO2 by ∼90%; long-term aircraft measurements, surface observations, and satellite products showed a reduction in column SO2 of ∼50%, while PM2.5 and AOD showed a reduction of ∼25%. Even though the regulations on Maryland power plants successfully reduced local SO2 pollution, PM pollution in Maryland is more regional, and regional/national regulations are needed for further improvement of air quality. [He et al., 2016]
Medical statistics displays noticeable decrease in the MD citizens’ death rate after 2010. This decrease is consistent with expected result of MD Healthy Air Act. Nevertheless, the same trend in mortality is also relevant to current progress in medical science and to improving of public access to medical service, and other factors.