Seasonal Report

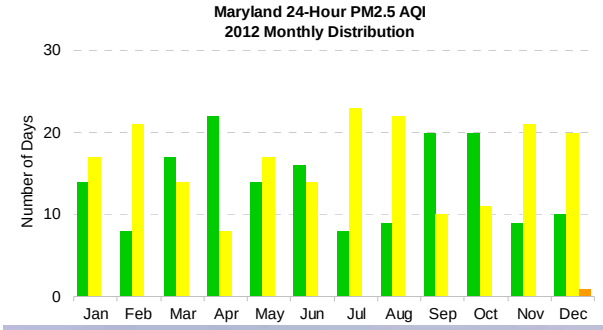
2012 Fine Particles

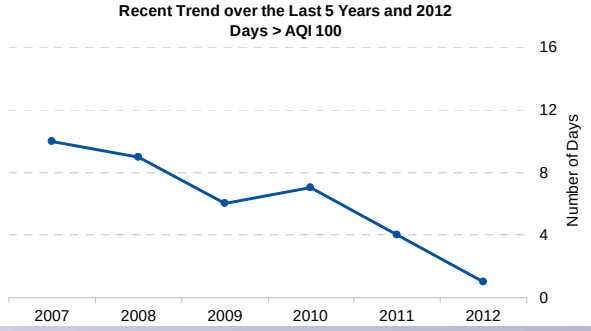
Maryland Department of the Environment

OVERVIEW

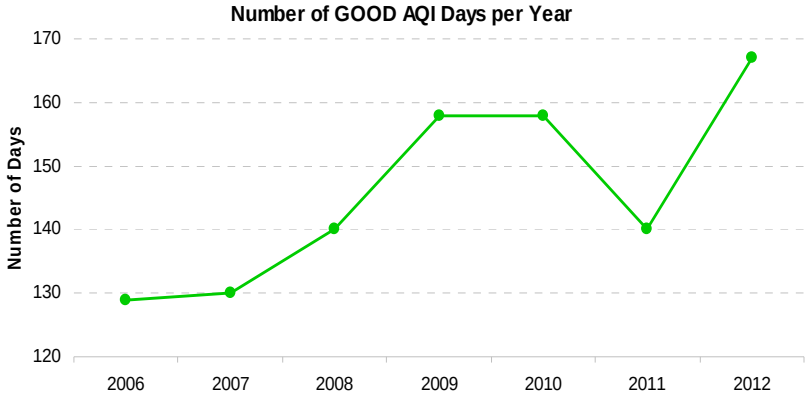
2012 was an exceptionally good year for fine particle ($PM_{2.5}$) air quality across the state. Typical weather patterns that produce pollution episodes were infrequent and weak. As such, $PM_{2.5}$ remained low throughout the year.

$PM_{2.5}$ can penetrate deep into the lungs and is a health concern if the airborne concentration is too high. Each year, the severity of $PM_{2.5}$ is measured by the number of days the daily 24-hour average concentration of $PM_{2.5}$ exceeds the Air Quality Index (AQI) value of 100 *(see bottom of page)*.





$PM_{2.5}$ pollution continued a downward trend in 2012 compared to the last 5 years *(see graph above)* with all but one day of the year either in Good or Moderate AQI range *(see bar graph above)*. In fact, Maryland experienced only 1 day with an AQI above 100! There were 198 Moderate AQI days in 2012. The air in 2012 was very clean in reference to $PM_{2.5}$. When $PM_{2.5}$ is high, hazy conditions are usually present. The only day of the year that $PM_{2.5}$ reached Unhealthy for Sensitive Groups (USG, AQI>100) had hazy conditions *(image above right)*. On December 1, 2012 the sky in Western Maryland was a diffuse gray color and details of the landscape were obscured. Despite the USG conditions, Mount Davis was just visible on the horizon in the right center of the image. A very clean day in April with a Good AQI exhibited more detail with a distinct horizon line and clear view of Mount Davis (*background, right center of image*).



SEASONAL HIGHLIGHTS

Maryland historically observed more days with $PM_{2.5}$ in the Moderate AQI range than in the Good range. However, 2012 had a relatively even number of days of Moderate and Good air quality reflecting the overall cleaner air Maryland experienced. In fact, Maryland has reclaimed over a month of the year as Good $PM_{2.5}$ air quality compared to just 6 years ago *(graph, left)*[1]. Good AQI days in 2012 were the highest they have been in over half a decade. With the upward trend in the number of Good AQI days and downward trend in the number of USG days, the overall $PM_{2.5}$ air quality has improved dramatically.

WEATHER & AIR QUALITY

Weather patterns in 2012 were generally atypical. It is common for $PM_{2.5}$ to increase during the summer due to rising temperatures and humidity fed by southerly and southwesterly winds with July the peak month for $PM_{2.5}$ production. Instead, the summer of 2012 was dominated by a very large and intense dome of hot and dry air across the Central United States. This dome caused upper level winds in the atmosphere to change their typical summer orientation over Maryland. Northwest winds occurred more frequently, which helped keep $PM_{2.5}$ concentrations low. A more active weather pattern persisted through remaining parts of the year. The end result was a fewer number of days with conditions favorable for $PM_{2.5}$ production and accumulation to USG levels.

Historically, a secondary peak in $PM_{2.5}$ occurs in winter when air quality episodes develop because surface temperatures drop and trap airborne pollutants near the ground. November was a significantly cold month for an exceptionally warm year, ranking as the 18th coldest in Maryland. The unusually cold conditions contributed to the only USG episode of 2012 on December 1, which occurred just prior to the onset of exceptionally warm temperatures for December. *(continued on next page)*

AQI 0-50 Good	51-100 Moderate	101-150 USG*	151-200 Unhealthy	201-300 Very Unhealthy	301-500 Hazardous

[1] Report based on the revised $PM_{2.5}$ AQI implemented in 2013. More information on the change in the number of Good/Moderate AQI days due to the $PM_{2.5}$ AQI revision can be found at MDE.

*Unhealthy for sensitive Groups

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard | Baltimore, MD 21230
410-537-3000 | 1-800-633-6101
Martin O'Malley, *Governor* | Anthony G. Brown, *Lt. Governor* | Robert M. Summers, Ph.D., *Secretary*

MARYLAND
Department of the Environment

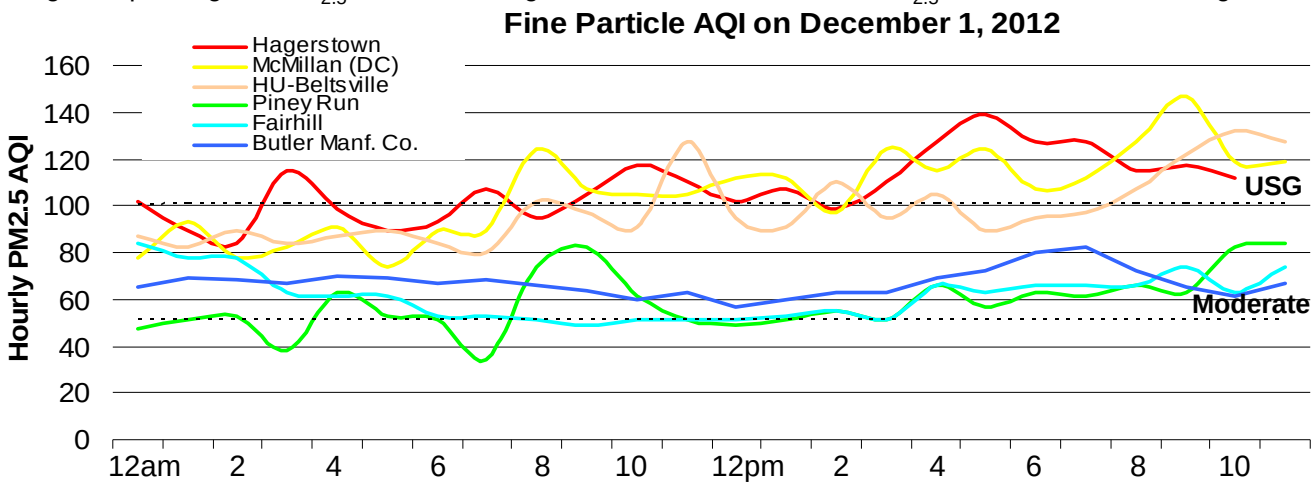
Seasonal Report

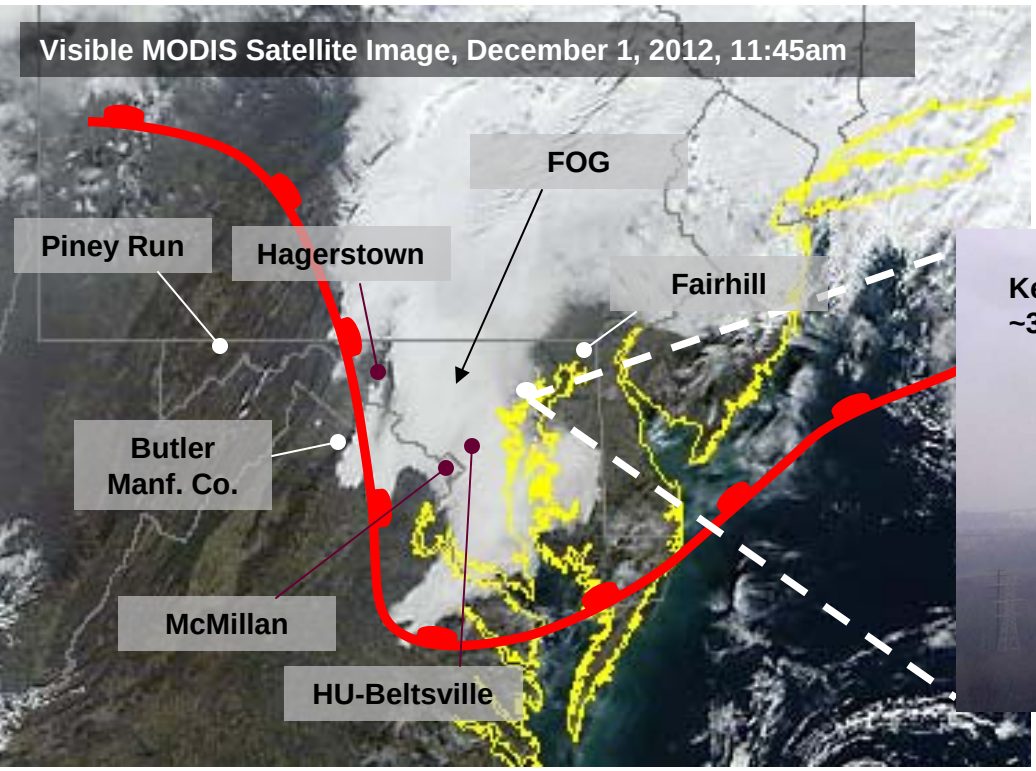
2012 Fine Particles

FEATURED EPISODE: December 1, 2012

Overnight between November 30th and December 1st a strong low-level temperature inversion formed, trapping pollutants near the surface. Slightly warmer air just above the surface reinforced by a nearby warm front helped strengthen this inversion and concentrate $PM_{2.5}$ along the front. High relative humidity in place created dense fog across much of Maryland east of the Appalachian Mountains, with visibility in the morning at or less than one mile in many places *(see image below)*. The stagnant, moist conditions evident by widespread morning fog were ideal for $PM_{2.5}$ production. Though fog lifted by the afternoon, clouds and hazy conditions lingered and $PM_{2.5}$ concentrations remained high as warmer air above the surface continued to trap $PM_{2.5}$ near the ground.

USG conditions developed on December 1st as Maryland transitioned from one of the coldest Novembers on record (18th coldest) to one of the warmest Decembers (9th warmest). In this instance, the unique geography of Maryland also helped increase pollutant levels. The Appalachian Mountains acted like a barrier to the atmosphere and prevented a relatively moist airmass from the Atlantic from being swept away by incoming air from the southwest. The mountains also kept the warm front from moving through quickly keeping cold, moist air at the surface with warm air above, further trapping $PM_{2.5}$. These combining factors allowed moist, stagnant, $PM_{2.5}$ conducive conditions to persist for many hours. Many monitors were already in the Moderate range at midnight with conditions suitable for $PM_{2.5}$ increases through the day. Hagerstown *(see chart below)* also observed high $PM_{2.5}$ through the day as foggy and hazy conditions lingered, pushing the $PM_{2.5}$ 24-hour average there above USG levels. $PM_{2.5}$ was concentrated along a corridor from Washington DC north into Pennsylvania. The chart to the left shows six monitors, three within and three outside of the fog. Those monitors within the fog showed considerably higher $PM_{2.5}$ concentrations. Very light easterly surface winds had blown $PM_{2.5}$ towards the west where the warm front acted to concentrate pollutants. Notice that although Piney Run and Butler Manf. Co. were near the front, they were on the opposite side of the warm front and out of the fog. These two monitors were not beneath a temperature inversion and as such, pollutants did not concentrate there.





AQI 0-50 Good	51-100 Moderate	101-150 USG*	151-200 Unhealthy	201-300 Very Unhealthy	301-500 Hazardous

Data Source: NASA

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard | Baltimore, MD 21230
410-537-3000 | 1-800-633-6101
Martin O'Malley, *Governor* | Anthony G. Brown, *Lt. Governor* | Robert M. Summers, Ph.D., *Secretary*

MDE