Seasonal Report

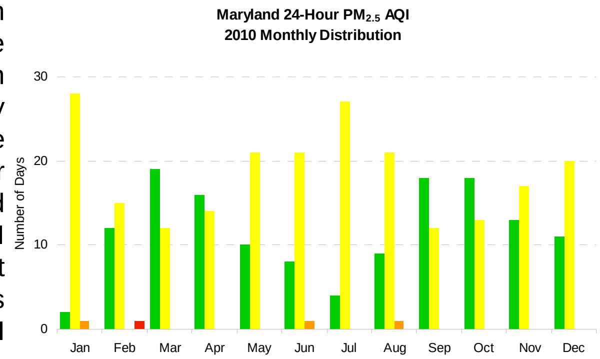
2011 Fine Particles

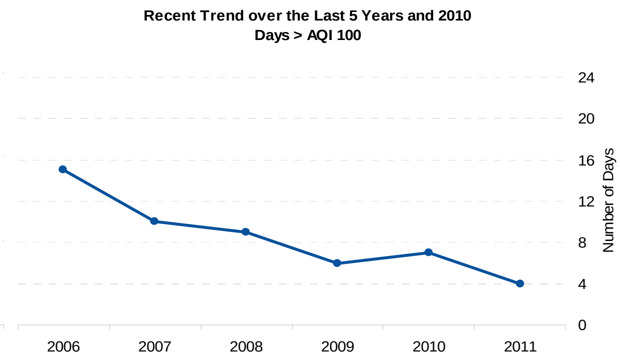
Maryland Department of the Environment

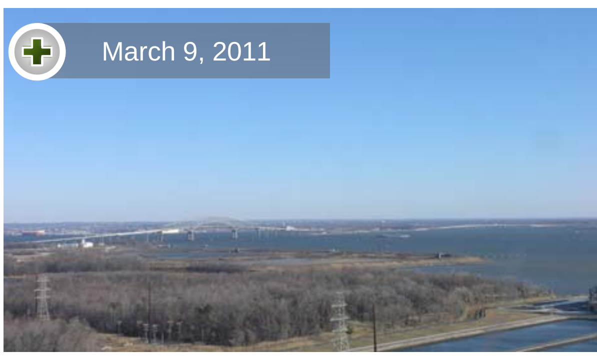
OVERVIEW

Fine particles ($PM_{2.5}$) penetrate deep in the lungs and are a health concern if airborne concentrations are too high. Each year, the severity of $PM_{2.5}$ is measured by the number of days when the daily 24-hour average concentration of $PM_{2.5}$ exceeds the Air Quality Index (AQI) value of 100 *(see bottom of page)*. $PM_{2.5}$ continued a downward trend in 2011 compared to the last 5 years *(see graph below)* with the majority of days in either the Good or Moderate AQI range *(see bar graph below)*. In fact, Maryland experienced only 4 days with an AQI above 100, a mere 1% of all days in 2011 *(see table on page 2)*. High concentrations of $PM_{2.5}$ are observable without instrumentation as visibility is markedly reduced during high $PM_{2.5}$ episodes. The images below show January 1, a day when $PM_{2.5}$ levels reached Unhealthy for Sensitive Groups (USG), versus a near ideal day on March 9.

The EPA recently revised the AQI for $PM_{2.5}$[1]. This revision causes a slight increase in the number of Moderate AQI days in Maryland. (See the air quality facts sheet on the MDE website for more information). For example, in 2011 Maryland experienced 154 Moderate AQI days using the old AQI but experienced 221 Moderate days using the new AQI. No other AQI thresholds were changed. Overall, Maryland $PM_{2.5}$ pollution continues to improve.



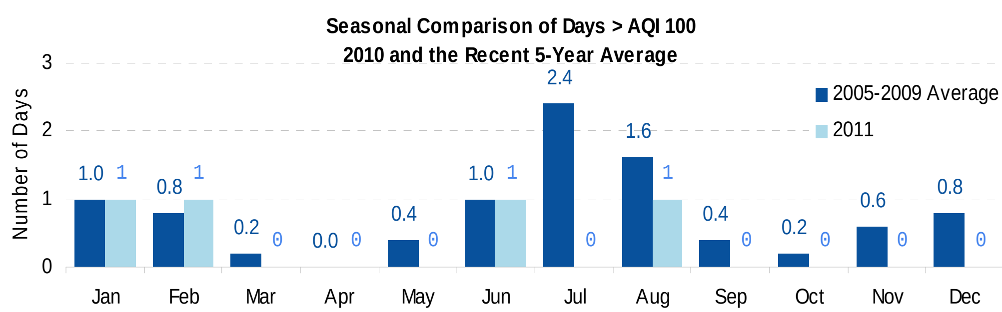




SEASONAL HIGHLIGHTS

Maryland experienced more days in the Moderate range than in the Good range throughout the year except during the transitional seasons of spring (March and April) and fall (September and October). Weather systems occur more frequently during these months and tend to remove $PM_{2.5}$ from the air. Moderate $PM_{2.5}$ levels were prevalent from May – August and also in January. It is common for $PM_{2.5}$ to increase during the summer as increasing temperatures increase humidity levels, which is conducive to $PM_{2.5}$ formation. Though temperature and humidity both drop in winter, wintertime $PM_{2.5}$ events occur because airborne pollutants become trapped in a shallow depth near the ground due to the cold. Overall, 2011 was the second warmest year on record and had above average rainfall. July typically has the highest number of Moderate $PM_{2.5}$ or greater days *(see chart below)* as it is climatologically the warmest month of the year and therefore has the highest humidity content. However, despite being the second warmest July ever, there were zero $PM_{2.5}$ USG days. Maryland continued to show a downward trend in $PM_{2.5}$ despite warmer conditions. Since 2006, the observed number of USG days per year has decreased by 11 days, largely due to emissions control programs. *(see chart, top right)*

The first Unhealthy $PM_{2.5}$ AQI day since 2006 occurred on February 19th. The Van Dusen Fire[2] caused intense but localized $PM_{2.5}$ concentrations as a large mulch pile caught fire. The resulting smoke plume could be seen from miles away. Hourly AQI measurements at HU-Beltsville reached Hazardous levels, and for the first time in five years the 24-hour average $PM_{2.5}$ concentration reached the Unhealthy range.



WEATHER & AIR QUALITY

Temperature and precipitation were both above the 1971-2000 average. Maryland as a state experienced its second warmest year as many local areas set all time records. Baltimore-Washington International Airport (BWI) experienced 40 *(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] Based on the new $PM_{2.5}$ AQI implemented in 2013
[2] Event classification as "exceptional event" under review by EPA
*Unhealthy for Sensitive Groups

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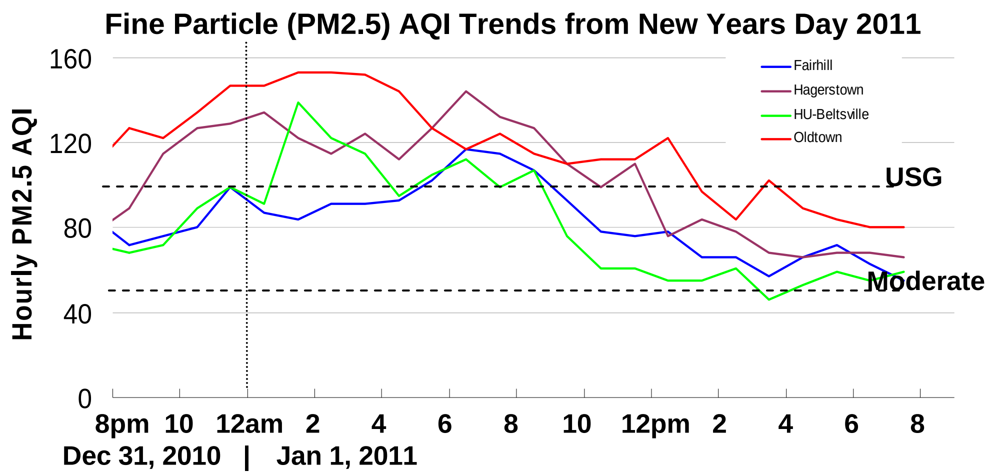
WEATHER & AIR QUALITY *(cont.)*

(continued from previous page) days above 90°F (normal is 26) with 24 days occurring in July. Despite above average yearly rainfall, July experienced drier than normal conditions. Observed rainfall at BWI was only 2.77" in July (normal is 4.07"). The drier than usual conditions likely prohibited $PM_{2.5}$ from reaching USG in July *(see bottom chart page 1)*. The large number of Moderate days in January were due to below normal monthly temperatures and precipitation. The drier than normal conditions suggest fewer storms, allowing cold air to trap and collect pollutants near the surface. Greater rainfall in the transitional seasons caused an overall wetter than normal year, and resulted in greater amounts of Good AQI during those seasons.

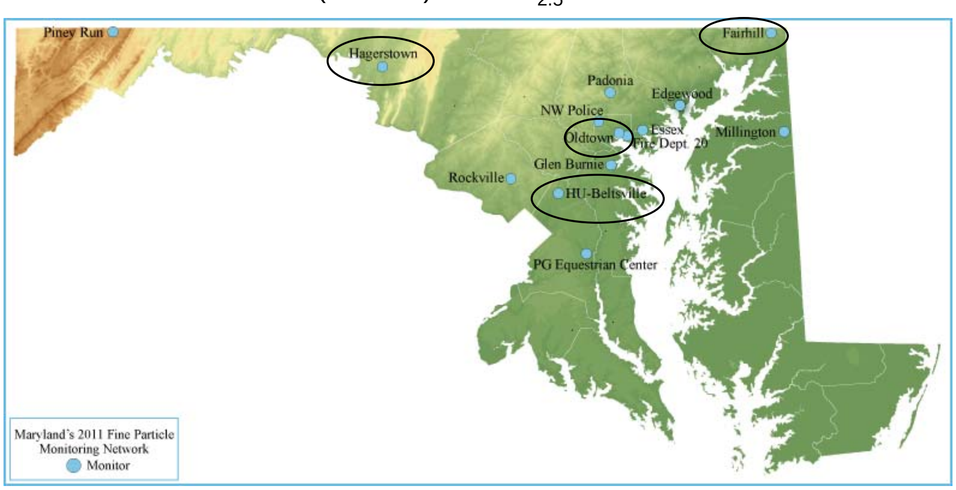
FEATURED EPISODE: New Years Day, January 1, 2011

Maryland started the year with a New Years Day USG $PM_{2.5}$ event. Moderate $PM_{2.5}$ concentrations existed during the evening of December 31, 2010. Concentrations continued to rise through midnight and peaked at Oldtown *(see graph below)* around 2am on January 1st. Several other monitoring sites also reported increasing $PM_{2.5}$ concentrations through early New Years Day. Light southerly winds, clear skies overnight, and temperatures dropping steadily through the night caused an inversion to strengthen through the night that trapped any surface pollution. The result was a regional $PM_{2.5}$ event as several monitors in Maryland observed high concentrations of $PM_{2.5}$ into New Years Day.

One of the largest contributors of $PM_{2.5}$ is combustion (fire). Many areas in Maryland still employ wood burning stoves for heat. With chilly temperatures in place on New Years Eve, $PM_{2.5}$ concentrations were elevated partially due to this practice as the inversion trapped smoke near the ground. Fireworks are also traditionally used for New Years Eve celebrations and have peak usage at midnight. As the use of fireworks increased towards midnight, so too did the amount of $PM_{2.5}$ observed around Maryland. Higher concentrations of $PM_{2.5}$ were found near urban centers like Baltimore, Washington D.C. and Hagerstown, which have large public firework displays and/or a greater number of wood burning stoves. Monitors near these cities all show maximum $PM_{2.5}$ concentrations after midnight *(see graph)*.



Though concentrations decreased on January 1st, $PM_{2.5}$ was still above USG levels by sunrise at many locations. New Years Day started sunny, but quickly clouded over and without sun, much of the $PM_{2.5}$ remained trapped near the cold surface. At 1pm on January 1st, a thick haze shrouded much of the Key Bridge *(see image on page 1)* and a thin veil of orange/brown smoke was still visible over the Chesapeake Bay just east of Baltimore. A large portion of southern Pennsylvania also experienced USG levels of $PM_{2.5}$ as light south and southwest winds moved surface pollution northeastward. Fairhill, for example, reached USG levels several hours after the peak at Oldtown. All of Maryland east of the Appalachians experienced at least a Moderate AQI day. With the temperature inversion, higher $PM_{2.5}$ concentrations remained trapped near the surface. Because of wood burning stoves and the previous night's fireworks, areas such as Baltimore (Oldtown) had $PM_{2.5}$ concentrations climb above USG for the 24-hour average. Though weather conditions trapped pollutants, $PM_{2.5}$ concentrations would not likely have increased to USG levels without human activity, demonstrating the important role humans have in determining air quality.



Maryland 2011 PM2.5 Exceedance Days			
Date	No. of Monitors	Highest AQI Monitor	24-hr Average PM2.5 AQI
1-Jan	1	Oldtown	111
19-Feb	1	HU-Beltsville	162
9-Jun	2	Millington/Fairhill	107
28-Aug	1	NW Police	141

Above: $PM_{2.5}$ hourly concentrations at Fairhill, Hagerstown, HU-Beltsville, and Oldtown. Left: Locations of monitors within Maryland. Table above: The 4 USG or greater days in 2011.

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