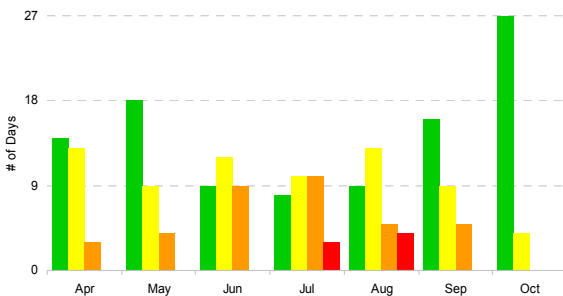
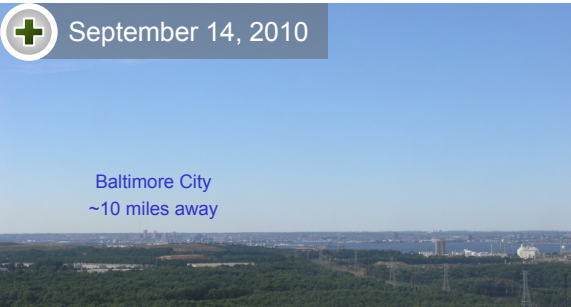
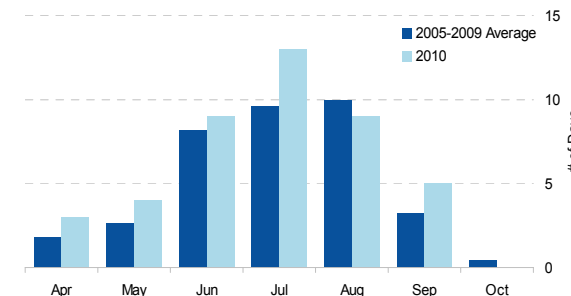


Maryland 8-Hr Average Ozone AQI  
2010 Monthly Distribution



Seasonal Comparison of Exceedance Days  
2010 and the Recent 5-Year Average



Maryland can experience high ground-level ozone as early as April and usually experiences its last high ozone day in late September. Ozone production significantly increases during the hot summer months. This increase frequently makes it the lead pollutant for the Mid-Atlantic region. Ozone activity is measured by the number of days when the ozone Air Quality Index<sup>1</sup> (AQI, see color bar below) is greater than 100. A day that exceeds the AQI value of 100 is classified as an exceedance day.

The 2010 ozone season was among the worst our state has experienced over the past few years. A total of 43<sup>2</sup> exceedance days were observed across Maryland, seven of which measured as high as the Unhealthy AQI. In addition, the 2010

season is shown to be above average when compared with the most recent five-year average of about 36 days for a given season. This above average trend corresponded with a record breaking number of 90°F days observed at the Baltimore Washington International Airport. However, compared to a longer range of ozone seasons, 2010 ranked as the 5<sup>th</sup> lowest in the number of ozone exceedance days since 1980 indicating that air quality has and continues to significantly improve. High ozone days can be evident visually as well. On the left, a picture from the Baltimore Haze Cam on September 14<sup>th</sup> shows clear conditions when ozone was in the Good range. On July 5<sup>th</sup>, visibility was significantly reduced due to ozone levels reaching the Unhealthy for Sensitive Groups (USG) AQI in the Baltimore area with a maximum AQI of Unhealthy elsewhere in the state. In these pictures, Baltimore is only about 10 miles away.

### SEASONAL HIGHLIGHTS

The first ozone exceedance day of the season occurred during the first week of April, which was surprisingly early. This was likely due to the arrival of unusually warm temperatures near 80°F which was said to be among the warmest first weeks in April ever experienced. Clear, sunny skies and warm temperatures helped elevate ozone levels because ozone activity is dependant on solar radiation to trigger a photochemical reaction that produces ozone from precursors such as oxides of nitrogen (NO<sub>x</sub>) and volatile organic compounds (VOCs). This reaction becomes more efficient in the presence of hot temperatures and low humidity. These conditions came together to cause a total of three exceedance days in the low USG range during April and all were observed at the Piney Run site (see table on pg. 2). This frequency of exceedance days in April was slightly above average compared to about two days that usually occur during this month according to the recent five-year average (see *Seasonal Comparison of Exceedance Days* chart). The above average trend in monthly exceedance days continued for the remainder of the summer along with significantly warmer temperatures than the climatological normals. For a month by month breakdown of the 2010 summer, see *Maryland 8-Hr Average Ozone AQI* chart.

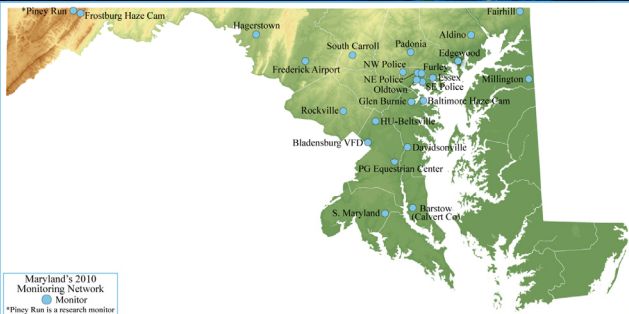
The 2010 summer was the 4<sup>th</sup> warmest summer on record in the US (June - August) according to NCDC. In fact, many cities along the East Coast broke maximum temperature records including Philadelphia, PA, Trenton, NJ, Washington, DC, and Baltimore, MD. Some of these records were set as far back as 1894 (June 23<sup>rd</sup>, NWS). Comparatively, June showed nine exceedance days of the USG AQI, up from the average of approximately eight days. One ozone episode in June lasted almost seven consecutive days from the 21-27<sup>th</sup> except for the 24<sup>th</sup>. This is a rare occurrence with respect to recent years. Generally, ozone episodes last only a few days. During July, there were 13 exceedance days. This surpassed the number of Good/Moderate days. Also, July observed the first Unhealthy AQI values of the 2010 season, and on three occasions. These Unhealthy AQI days were July 5<sup>th</sup>, 6<sup>th</sup>, and 23<sup>rd</sup> with eight ozone monitors observing AQI greater than 100 on July 5<sup>th</sup>, 11 monitors on July 6<sup>th</sup>, and four monitors on July 23<sup>rd</sup>. Unhealthy AQI values have also become uncommon due to the many air pollution controls implemented on both a national and statewide scale. August was one of the only months that fell short of its corresponding monthly exceedance day average. However, it observed the most Unhealthy days of the season. In particular, August 10<sup>th</sup> measured an AQI value of 200 which was just shy of the Very Unhealthy AQI category (see [Quality of Air Summary](#) for Baltimore in August 2010 online for more). September continued to break temperature records across the country and the final exceedance day occurred late in the month. By October, no exceedance days were experienced in Maryland.

### Air Quality Index (AQI)



<sup>1</sup> AQI based on the 2008 8-hr ozone NAAQS

<sup>2</sup> Report based on preliminary ozone data



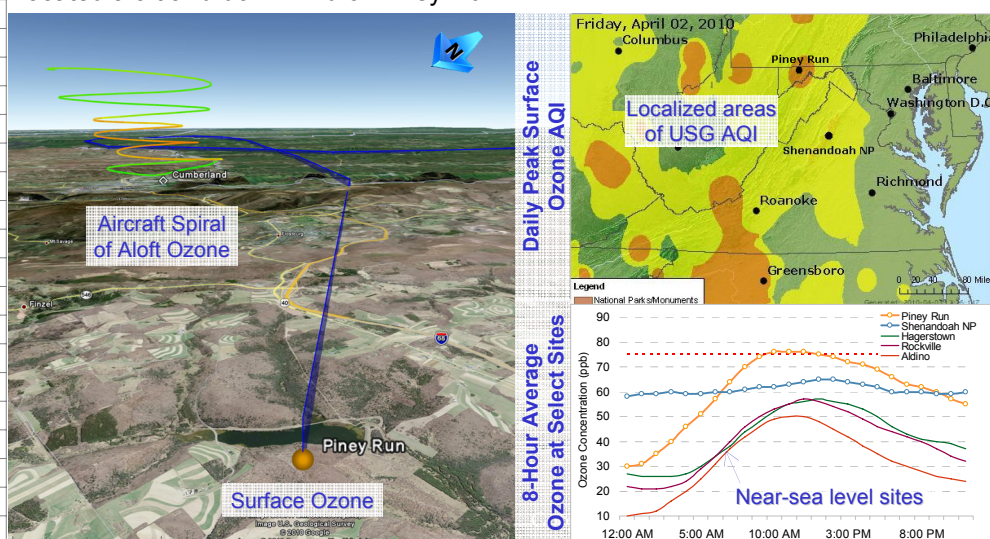
### FEATURED EPISODE: APRIL 2, 2010

As the first ozone exceedance day of the season, April 2<sup>nd</sup>'s weather conditions were similar to many poor air quality episodes. However, it was unusual for these conditions to arrive so early in the season. As with many high ozone days, the Bermuda high pressure system set up along the coast causing light winds from the south. Temperatures were hot, particularly in western Maryland, West Virginia, and Virginia, reaching the upper 80's°F. However in Maryland, only the Piney Run site observed USG AQI values (see *Daily Peak Surface Ozone AQI* image). Unlike other MDE monitors, Piney Run is a high elevation site that sits at 2,563 ft. A graph below shows the hourly trends of 8-hour average ozone concentrations at Piney Run, Shenandoah NP (a high elevation site in Virginia), and other select Maryland monitors. The 75 parts per billion, or ppb, (red dashed line) is equal to the AQI value of 100. The graph shows ozone was generally very low in the morning and night while reaching peak values in the afternoon. This was because ozone requires sunlight to be produced. This trend was evident for all monitors except Shenandoah NP where ozone consistently hovered around 60 ppb. This phenomenon typically occurs because a nocturnal temperature inversion sets up, creating an elevated reservoir of aged ozone from other states and is transported northeastward. This scenario transpired at the Shenandoah NP site on the night of April 1<sup>st</sup> and its high elevation allowed the monitor to measure the ozone reservoir. When the inversion broke in the morning, the pollutants mixed down toward the surface. This effect along with any locally produced ozone caused Piney Run to reach the USG AQI.

The elevated reservoir can also be seen by aircraft measurements. On April 2<sup>nd</sup>, MDE meteorologists anticipated an ozone episode and requested that a research flight be conducted by University of Maryland at College Park (UMD) (see *Measuring Aloft Regional Air Pollution using Aircraft* online). The 3D image below shows that ground-level ozone at Piney Run was USG (orange circle) and a backward trajectory (blue line) from the site indicates that the air mass traveled from the southeast through West Virginia and Virginia. During the research flight, an aircraft spiral was performed over Cumberland, MD. The spiral's green shading indicates low ozone concentrations in the 50-60 ppb range while orange shows ozone in the 65-75 ppb range. The spiral makes it clear that ozone is indeed located aloft and downwind of Piney Run.

### Maryland 2010 Ozone Exceedance Days

Date	# of Monitors	Monitor with Highest AQI	8-Hour Average Ozone AQI
2-Apr	1	Piney Run	101
11-Apr	1	Piney Run	106
15-Apr	1	Piney Run	119
1-May	1	Fairhill	106
5-May	1	Edgewood	104
21-May	1	Edgewood	101
27-May	4	Edgewood	135
2-Jun	4	Edgewood	129
4-Jun	1	HU-Beltsville	101
12-Jun	1	Rockville	109
21-Jun	3	Calvert Co.	116
22-Jun	7	HU-Beltsville	140
23-Jun	2	Edgewood	116
25-Jun	3	Edgewood	129
26-Jun	5	Edgewood	129
27-Jun	1	Edgewood	109
3-Jul	2	HU-Beltsville	116
4-Jul	3	Edgewood	137
5-Jul	8	Edgewood	154
6-Jul	11	Davidsonville	159
7-Jul	12	HU-Beltsville	147
8-Jul	4	Frederick Co.	145
15-Jul	1	Davidsonville	101
16-Jul	3	Fairhill	132
17-Jul	1	Edgewood	127
23-Jul	4	Edgewood	164
27-Jul	2	South Carroll	111
28-Jul	2	HU-Beltsville & Fairhill	104
31-Jul	2	Edgewood	106
9-Aug	3	HU-Beltsville	109
10-Aug	14	Essex	200
11-Aug	5	Calvert Co.	154
17-Aug	1	Davidsonville	114
19-Aug	2	Edgewood	145
20-Aug	3	Davidsonville	122
29-Aug	2	Edgewood	151
30-Aug	8	Calvert Co.	156
31-Aug	3	Edgewood	137
1-Sep	6	Edgewood	137
2-Sep	7	Padonia	142
3-Sep	1	Frederick Co.	119
23-Sep	1	Frederick Co.	101
24-Sep	3	Aldino, Edgewood, & Fairhill	104



Visit [www.mde.state.md.us/air](http://www.mde.state.md.us/air) for more information, current air quality conditions, and forecasts, or call the air quality hotline at 410-537-3247.

### Air Quality Index (AQI)

