



# Seasonal Report

## 2019 Ozone

### OVERVIEW

Cleaner air trends continue as 2019 was again very clean across the state of Maryland. Improvements in air quality continue to be seen as the number of ozone exceedance days across the state continue to decrease (*Figure 1*). Surface ozone typically begins to increase in April, persisting through September, as warm temperatures, more direct sunlight and weaker winds provide a favorable ozone formation environment. This timeframe is also coined the “ozone season”. Unlike upper atmospheric ozone, which protects us from harmful UV radiation emitted by the Sun, surface ozone can be detrimental to the human respiratory system. Several adverse health effects include reduced lung function, inflammation of airways, chest tightness and shortness of breath. The Environmental Protection Agency (EPA) sets National Ambient Air Quality Standards (NAAQS) for six criteria pollutants, one of which is ozone. The Air Quality Index (AQI, see legend at bottom) was developed by the EPA to easily communicate air quality status to the public. When the daily 8-hour average ozone concentration exceeds 70 parts per billion (ppb), or 100 on the AQI scale, it is deemed unhealthy for sensitive groups (USG). Days which fall into this category are known as “exceedance days” and can be a valuable indicator of the ozone season severity. In 2019 there were fourteen exceedance days (*Figure 1*), the second fewest Maryland has experienced since ozone measurements began back in 1980.

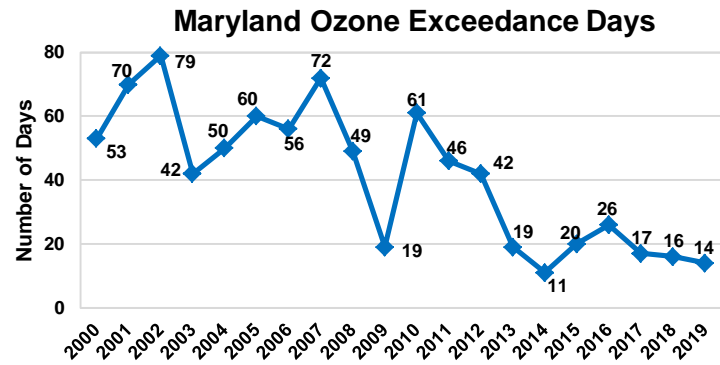


Figure 1: Total number of Maryland ozone exceedance days using the EPA 2015 70 ppb standard, 2000 – 2019.

### Maryland 2019 Ozone Exceedance Days

Date	Day	No. of Monitors	Highest AQI Monitor	8-Hr Average Ozone AQI
26-Jun	Wed	3	Edgewood	115
27-Jun	Thur	5	Essex	150
28-Jun	Fri	9	Glen Burnie	143
2-Jul	Tue	6	Fair Hill	150
16-Jul	Tue	7	Aldino & Furley	122
19-Jul	Fri	1	Edgewood	119
29-Jul	Mon	2	Edgewood	122
30-Jul	Tue	7	Aldino	129
6-Aug	Tue	5	HU-Beltsville	122
19-Aug	Mon	1	Edgewood	122
20-Aug	Tue	2	Frederick	112
11-Sep	Wed	2	Beltsville	112
12-Sep	Thur	1	Horn Point	126
16-Sep	Mon	2	Essex	122

Table 1: 2019 Maryland ozone exceedance days. Day of week is noted along with highest monitor and its color coded 8-hr AQI value.

### SEASONAL 2019 HIGHLIGHTS & QUICK STATS

#### Maryland Apr-Sep Average Daily Temperature:

Above normal (2<sup>nd</sup> Warmest) – Warmest on record: 2010

Days at or above 90°F at BWI: 59 (on average BWI has 32 days)

**Maryland Apr-Sep Precipitation:** Drier than normal (40<sup>th</sup> Driest)

**Mid-Atlantic Basin Apr-June Precipitation:** Well above norm (9<sup>th</sup> Wettest)

**Mid-Atlantic Basin July-Sept Precipitation:** Drier than normal (25<sup>th</sup> Driest)

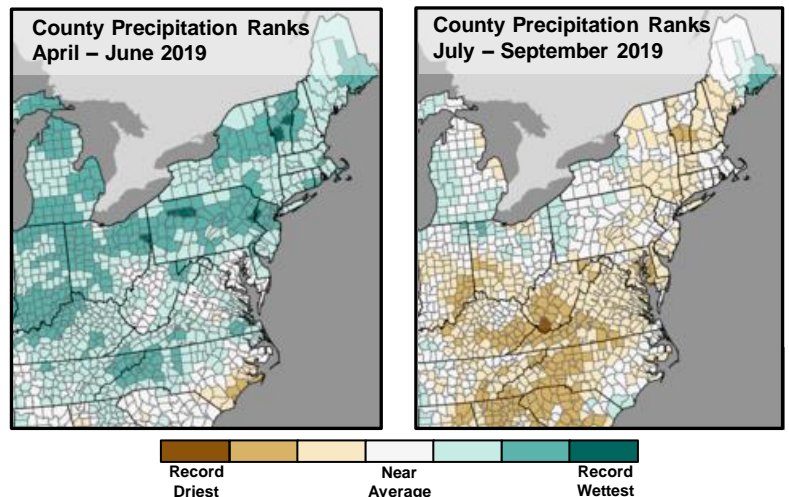


Figure 2: April – June 2019 county precipitation ranks (left) and July – September 2019 county precipitation ranks (right). Source: NOAA/NCDC Climate Division.

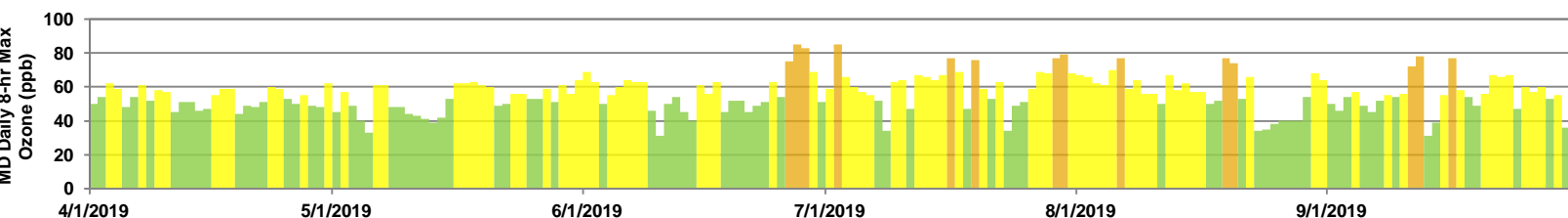


Figure 3: Maximum daily 8-hour ozone concentration (ppb) in Maryland from April 1 – September 30, 2019. Bars are color coded by AQI.

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

\*Unhealthy for Sensitive Groups  
Based on 2015 8-hour ozone NAAQS

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Boulevard | Baltimore, MD 21230

410-537-3000 | 1-800-633-6101

Larry Hogan, Governor | Boyd Rutherford, Lt. Governor | Ben Grumbles, Secretary





# Seasonal Report

## 2019 Ozone

### SEASONAL HIGHLIGHTS (cont.)

Temperatures across Maryland and much of the continental United States were above average during the 2019 ozone season. Maximum temperatures in Maryland were 3.5°F above normal, ranking it the second warmest on record dating back to 1895. The number of days where the maximum temperature reached or exceeded 90°F at BWI airport was 59, nearly double the typical average. This ties the all-time record for a single season, matching 2010. In comparison, the 2010 ozone season had 61 exceedance days versus just 14 in 2019 (see Figure 1). Continued reductions in NO<sub>x</sub> emissions both locally and regionally are clearly evident as the total number of exceedance days dropped by over 80% comparing the two years.

Precipitation across Maryland and the Mid-Atlantic had a unique split between the first half and second half of the 2019 ozone season. The first half (April – June) saw an active meteorological pattern with above average precipitation (Figure 2). With more clouds and precipitation, ozone formation wasn't ideal despite the unseasonal warmth. Maryland did not see its first ozone exceedance day until late June. Figure 4 shows the date of the first ozone exceedance day (using the 70 ppb ozone standard) in Maryland between 2000 and 2019. On average this typically occurs in April to early May. However in 2019 the first ozone exceedance day was not until June 26<sup>th</sup>, the latest occurrence by over a month!

Despite very favorable weather conditions during the second half to the ozone season, Maryland was still able to avoid reaching AQI values in the Unhealthy range (Table 1). The last time this occurred was 2014. In addition, zero ozone exceedance days in 2019 fell on a weekend. This has been a continuing trend in recent years as NO<sub>x</sub> emissions continue to decline. Vehicles are a well-known source of NO<sub>x</sub> emissions, a precursor to ozone formation. With less total NO<sub>x</sub> and with fewer vehicles on the road on Saturdays and Sundays, it has become difficult in Maryland to produce high ozone.

### TROPOspheric Monitoring Instrument (TROPOMI)

The TROPOspheric Monitoring Instrument, aka TROPOMI, is a single sensor aboard the Copernicus Sentinel-5 Precursor satellite. The satellite was launched in October of 2017 with the goals of better estimating long-term trends related to air quality and climate change along with improving air quality modeling and air quality forecasting accuracy. The TROPOMI sensor observes sunlight that is scattered back to space by Earth's surface and atmosphere, detecting the individual fingerprints of gases in different parts of the spectrum. TROPOMI is unique as it measures in the ultraviolet, visible, near-infrared, and shortwave infrared spectral bands. This means that a wide range of pollutants such as nitrogen dioxide, ozone, formaldehyde, sulphur dioxide, methane and carbon monoxide can be imaged more accurately than ever before. With a resolution as high as 3.6 km x 5.6 km, it is considerably smaller than its predecessor sensor instrument OMI, which has a pixel size around 24 km x 13 km. This higher resolution allows the sensor to detect air pollution over cities as well as individual point sources.

The figures below highlight TROPOMI nitrogen dioxide on June 25<sup>th</sup> and 26<sup>th</sup> 2019 around the Baltimore/DC area. Nitrogen dioxide,

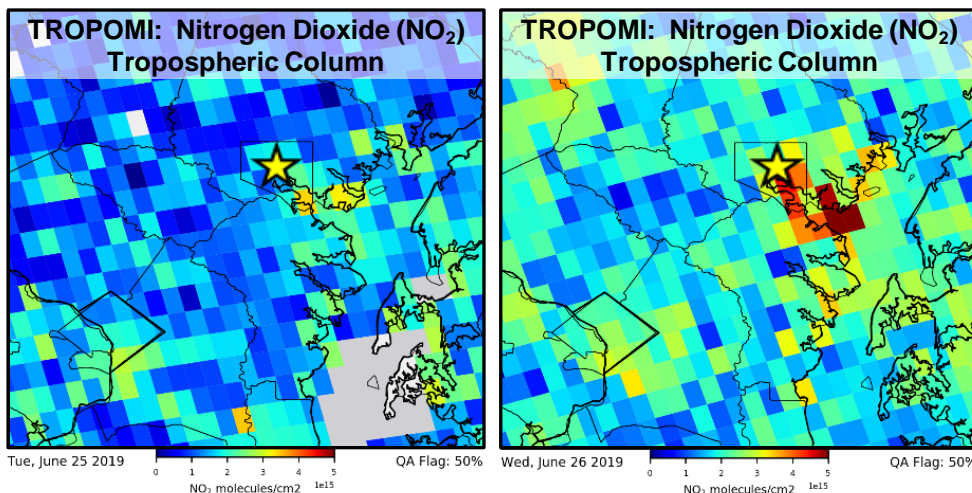


Figure 5: TROPOMI Tropospheric Column NO<sub>2</sub> around the Baltimore area on June 25<sup>th</sup> 2019 (Left) and June 26<sup>th</sup> 2019 (Right). Baltimore is indicated by yellow star.

a precursor to ozone, can be useful for picking out the regional signature as well as possible hotspots. On June 25<sup>th</sup>, the background regional NO<sub>2</sub> signature was fairly low as indicated by the primarily blue and green coloring. On this particular day ozone levels were low, with the maximum 8-hour concentration in the state being in the Good AQI range. Comparing this to the 26<sup>th</sup> there is a stark increase, with roughly double the NO<sub>2</sub> levels that were seen the previous day. In addition to this, you can also pick out the hotspot around and just downwind of Baltimore as indicated by the orange and red colors. It is worth noting that this was the date of Maryland's first ozone exceedance day in 2019 with the highest ozone concentrations being found around and just downwind of Baltimore.

### Date of First Maryland Ozone Exceedance Day

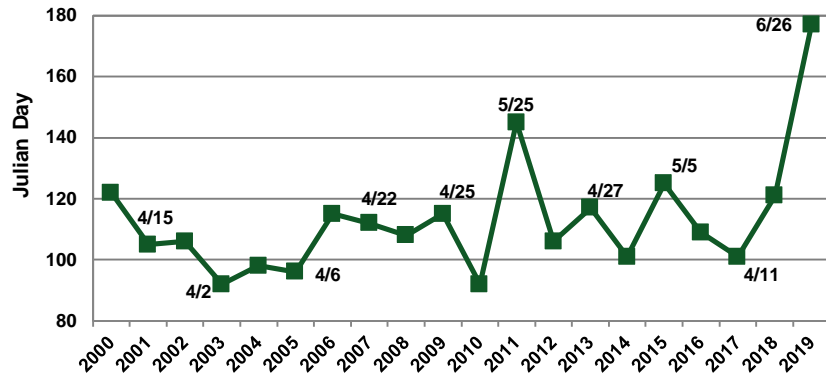


Figure 4: Day of the first Maryland ozone exceedance using the 2015 70 ppb ozone standard. Month/Day for odd number years are plotted for reference.

**AQI** 0-50  
Good

51-100  
Moderate

101-150  
USG\*

151-200  
Unhealthy

201-300  
Very Unhealthy

301-500  
Hazardous

\*Unhealthy for Sensitive Groups based on 2015 8-hr ozone NAAQS. Denotes the USG\*

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Boulevard | Baltimore, MD 21230

410-537-3000 | 1-800-633-6101

Larry Hogan, Governor | Boyd Rutherford, Lt. Governor | Ben Grumbles, Secretary

