



MID-OHIO REGIONAL
MORPC
PLANNING COMMISSION

CENTRAL OHIO AIR QUALITY END OF SEASON REPORT

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CENTRAL OHIO END OF SEASON REPORT | NOV. 2018–OCT. 2019

The Mid-Ohio Regional Planning Commission (MORPC) is part of a network of agencies across the country that issues daily air quality forecasts and notifies the public when ozone and particle pollution levels are considered to be unhealthy for sensitive groups of people. Sensitive groups include children, adults who are active outdoors, people with heart or lung disease (such as asthma) and older adults.

MORPC forecasts for two main air pollutants that are a threat to public health in Central Ohio: ground-level ozone pollution and particle pollution (PM2.5). Central Ohio is currently attaining the National Ambient Air Quality Standards for both ozone and particle pollution. Ozone pollution is more common in the summer and is monitored from March through October. Particle pollution can occur year-round. High concentrations of ground-level ozone or particle pollution in the air can affect us all, especially sensitive groups of people.

MORPC works with Sonoma Technology, Inc. (STI) to deliver year-round daily air quality forecasts and Air Quality Alerts. This report provides an analysis of the 2018-2019 season for ozone and particle pollution.

SUMMARY:

- The majority of days in Central Ohio were in the Good Air Quality Index (AQI) category. For ozone, 78% of summer days were in the Good AQI category. For particle pollution, 89% of all days were in the Good AQI category.
- One day with Unhealthy for Sensitive Groups air pollution levels was observed during the year in July. The main pollutant was ozone. There were no Unhealthy for Sensitive Group days for particle pollution.
- Despite the improvement in number of days with air pollution levels that were Unhealthy for Sensitive Groups in 2018-2019, the number of days with Good air pollution levels decreased from 81% to 78% in 2018-2019 versus 2017-2018. This trend is associated with above average temperature and precipitation in Ohio over the past year.
- Over the past 26 years, the number of high ozone days has generally declined in Central Ohio. Since 2013, Central Ohio has experienced less than 10 high ozone days each year, compared to the average of 30 days per year from 1993 to 2018. A similar decline is seen in other major metropolitan areas in the region.
- Unlike the previous two years, significant wildfire smoke was not transported into the Columbus area from other regions. The reduction in the number of these events led to a majority of days with Good levels of particle pollution.

HIGHEST AQI DAYS

NOVEMBER 2018 - OCTOBER 2019

101 OZONE | JULY 15 NEW ALBANY

100 OZONE | JULY 1 NEW ALBANY

97 OZONE | JULY 13 NEW ALBANY

93 OZONE | JULY 10 & JUNE 28
NEW ALBANY

AIR QUALITY INDEX (AQI VALUES)	0 - 50	51 - 100	101 - 150	151 - 200	201 - 300
LEVELS OF HEALTH CONCERN	GOOD	MODERATE	UNHEALTHY FOR SENSITIVE GROUPS	UNHEALTHY	VERY UNHEALTHY



AIR POLLUTION OVERVIEW

Ozone Pollution

MORPC monitors and sends out forecasts and alerts for ground-level ozone pollution levels from March through October. Ground-level ozone pollution is created when emissions from sources such as cars, industry, and lawn equipment react chemically in the presence of sunshine. Concentrations of ground-level ozone peak when temperatures are warm, it is sunny, and winds are light. Ozone is the main ingredient of smog.

Particle Pollution

MORPC monitors and sends out forecasts and alerts for particle pollution levels year-round. Fine particle pollution (PM2.5) is made of microscopically small solid or liquid particles. Some sources of these fine particles are diesel trucks, buses, power plants, and wood burning fireplaces. Concentrations of PM2.5 often peak during overnight hours when cool air is trapped near the ground and pollution levels build in that layer of air. Particle pollution can also be transported into Central Ohio over large distances, such as from distant wildfires, if weather conditions are right.

Air Quality Index

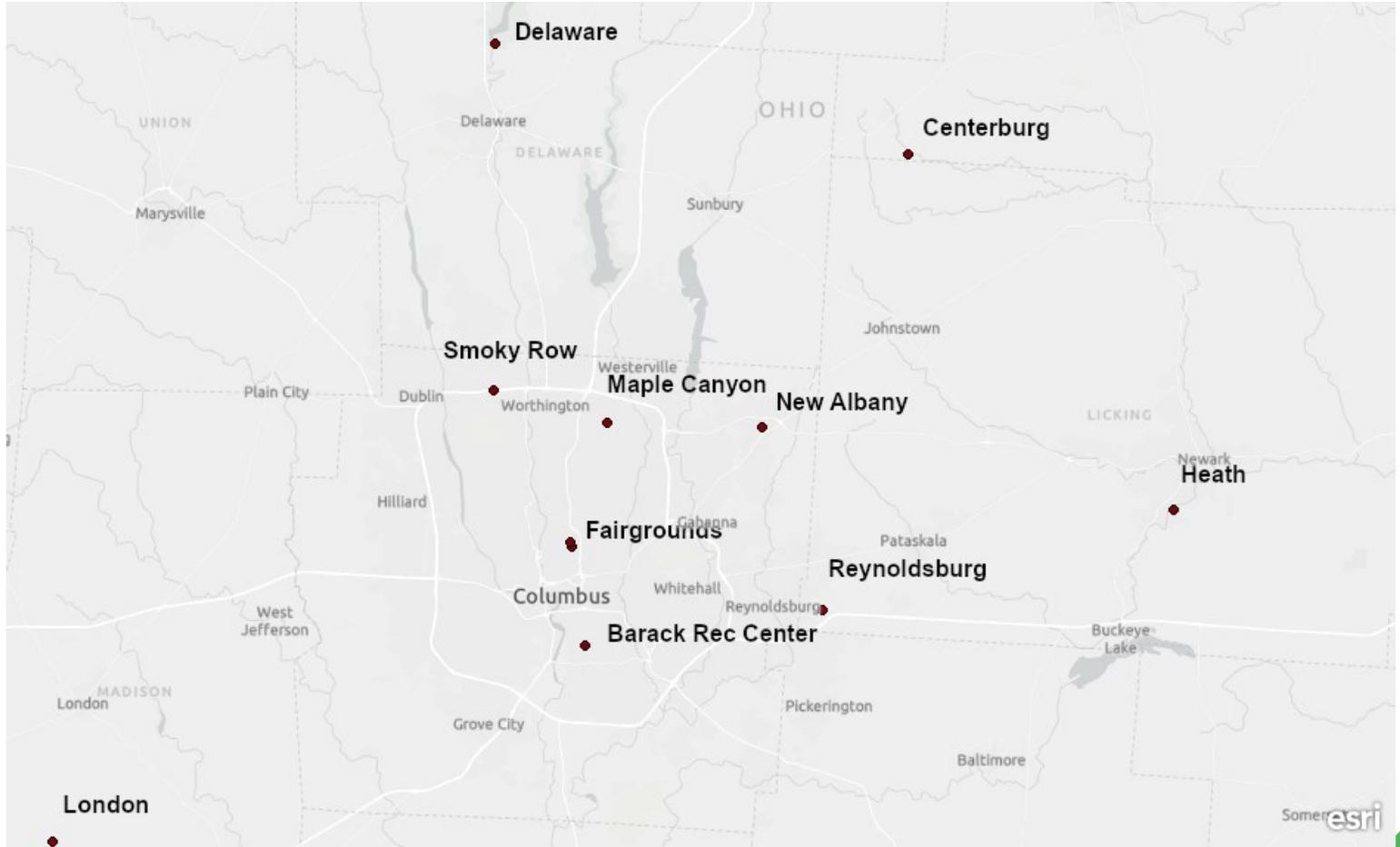
The Mid-Ohio Regional Planning Commission issues daily forecasts and Air Quality Alerts to keep the public informed of local air pollution levels. MORPC uses the Air Quality Index to report pollution levels. The higher the AQI level, the greater the health concern. When air pollution is expected to reach 101 AQI or above, MORPC issues an Air Quality Alert for Central Ohio.

Air Quality Index	Health Advisory
Good 0-50	None.
Moderate 51-100	Unusually sensitive people should consider reducing prolonged or heavy exertion.
Unhealthy for Sensitive Groups 101-150	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.
Unhealthy 151-200	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
Very Unhealthy 201-300	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.



CENTRAL OHIO OZONE AND PM2.5 MONITOR LOCATIONS

The Ohio EPA maintains the Ohio air monitoring network as part of its responsibility to regulate air quality to protect public health and the environment in the State of Ohio. The location of Central Ohio monitoring sites for ozone and particle pollution is shown in the map below.



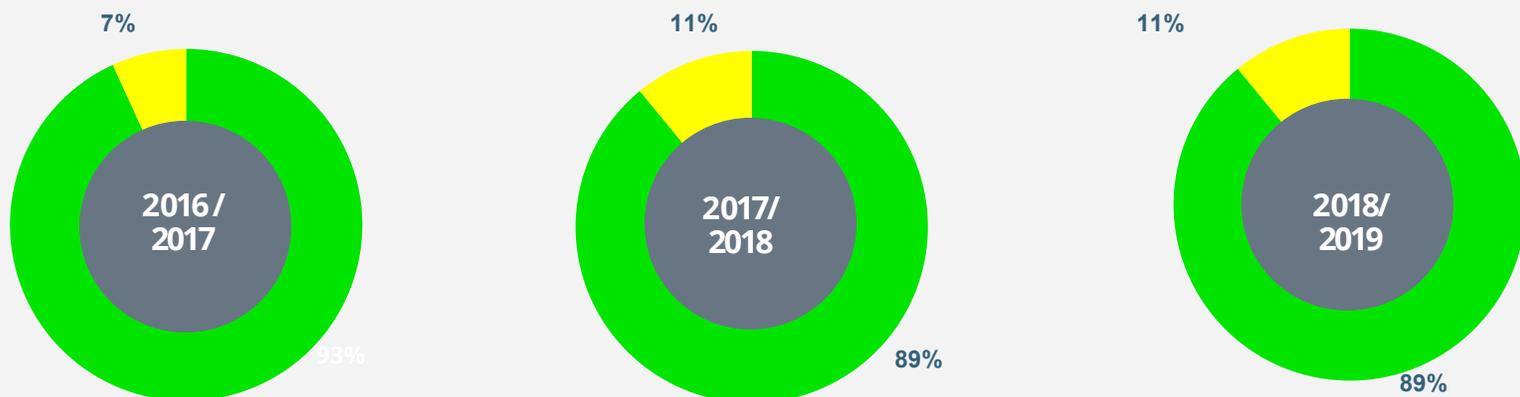
CENTRAL OHIO END OF SEASON REPORT | NOV. 2018–OCT. 2019

Particle pollution levels did not reach the Unhealthy for Sensitive Groups (USG) AQI category in Central Ohio during the 2018-2019 season (top row of figure below). During this season, air quality for PM_{2.5} was in the Good category of the Air Quality Index (AQI) on 89% of days and in the Moderate AQI category on only 11% of days.

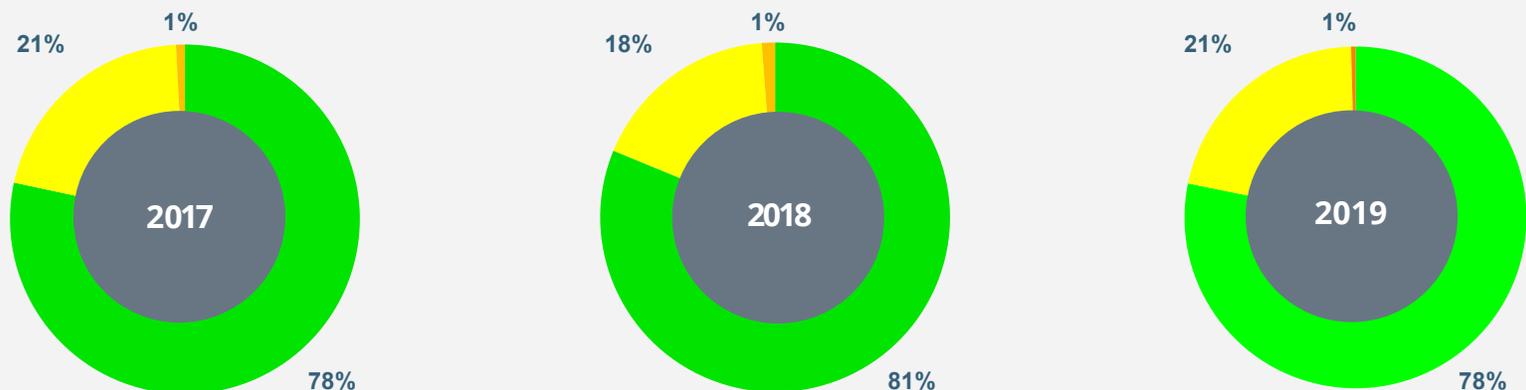
Ozone AQI levels reached the USG AQI category on one day in the Columbus region during the 2019 summer season. Air quality for ozone was in the Good category of the AQI on 78% of days and in the Moderate AQI category on 21% of days.

Overall, the percentage of Good AQI days has remained fairly steady over the last three years for both ozone and PM_{2.5}.

PERCENTAGE OF DAYS AT EACH AQI CATEGORY—PM_{2.5} (NOVEMBER THROUGH OCTOBER)



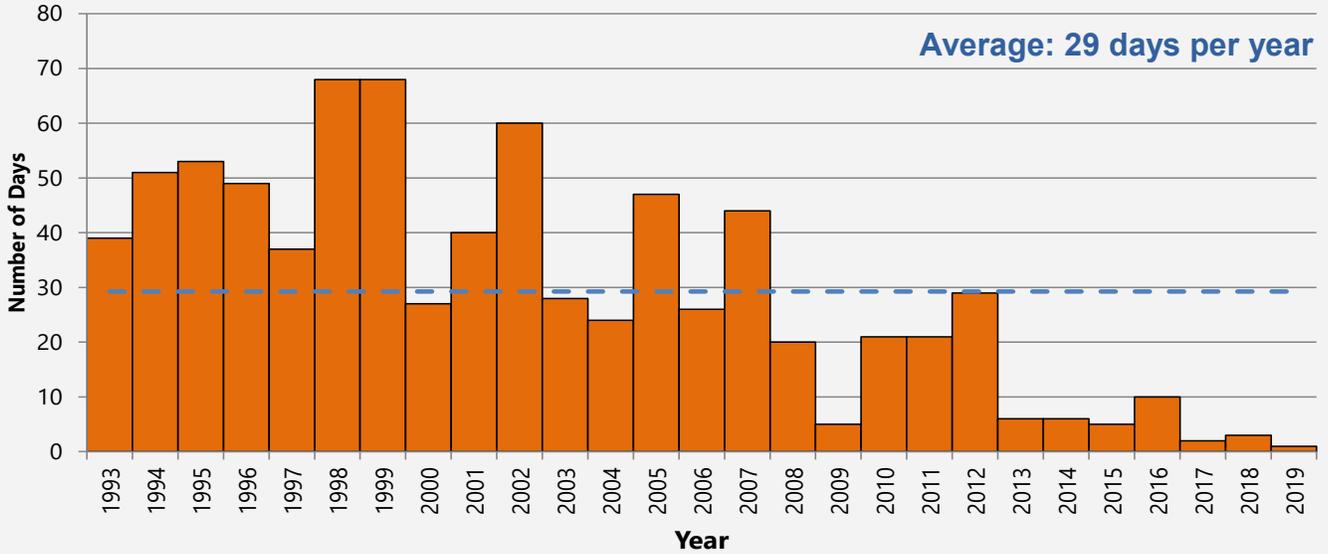
PERCENTAGE OF DAYS AT EACH AQI CATEGORY—SUMMERTIME OZONE (MARCH-OCTOBER)



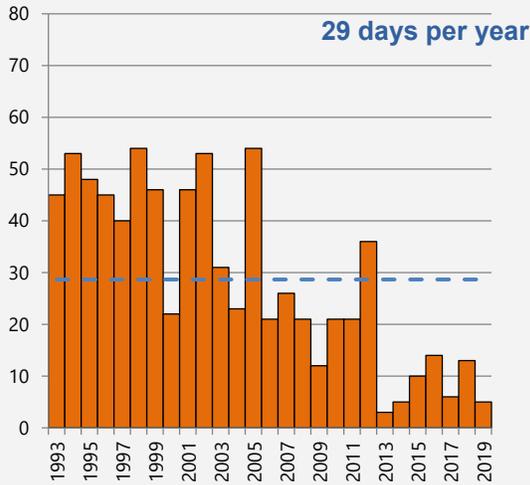
REGIONAL COUNTS OF HIGH OZONE DAYS

Over the past 26 years, the number of high ozone days when pollution levels exceeded the national standard has gone down in Central Ohio, caused mostly by emissions reductions. However, there are differences from year to year caused by weather conditions. The charts below indicate the number of high ozone days each year (orange bars) for several major cities throughout the region. The long-term (27 year) averages are indicated with the dashed blue line.

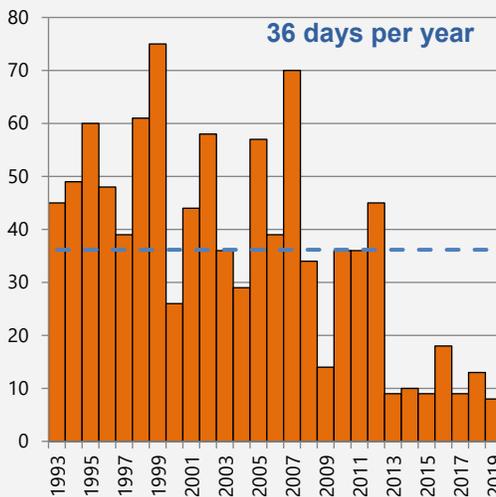
Columbus



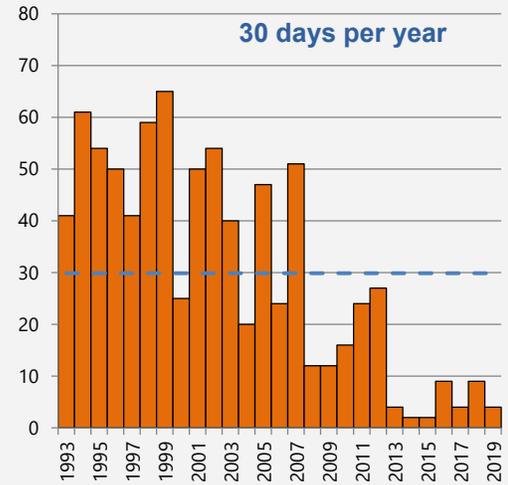
Cleveland



Cincinnati

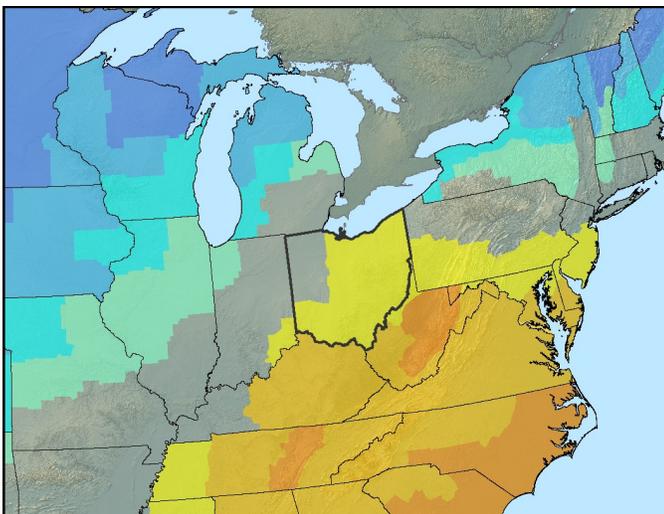
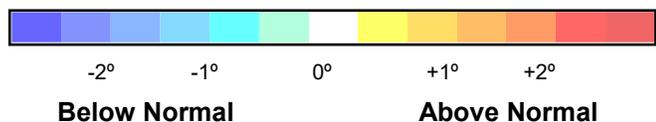


Indianapolis

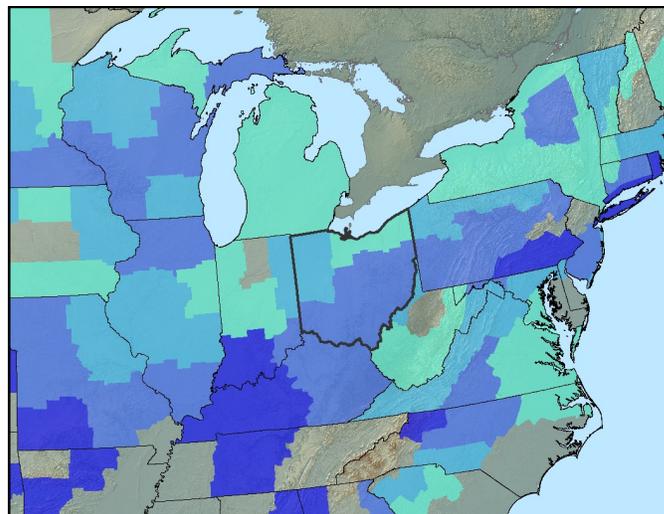
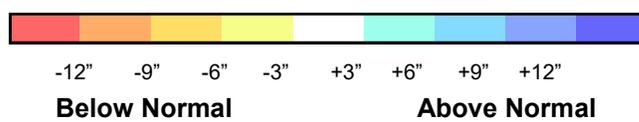


SEASONAL WEATHER SUMMARY

Temperature Anomalies (F)
November 2018 – October 2019
Versus 2007– 2016 Average



Precipitation Anomalies (inches)
November 2018 – October 2019
Versus 2007– 2016 Average



Weather patterns can have a strong impact on air quality in Central Ohio. Temperatures were slightly higher than average during the 2018-19 forecast season.

Anomalously cold conditions in November 2018 strengthened overnight temperature inversions and resulted in the most Moderate PM_{2.5} days of any month this past year.

In the summer, July was the hottest month and had below-average precipitation. Four of the five highest ozone days occurred during July, with the fifth occurring on June 28.

Despite shorter daylight hours, above-normal temperatures in September enhanced ozone formation, resulting in eight days with Moderate or higher ozone levels.

Columbus, Ohio	Temperature departure from normal (°F)	Precipitation departure from normal (inches)	Moderate or higher PM _{2.5} days	Moderate or higher ozone days
November	-5.2	+2.50	9	--
December	+3.8	+0.60	4	--
January	-0.2	+0.36	3	--
February	+2.0	+3.24	3	--
March	-3.8	+2.31	3	0
April	+1.9	+0.15	0	3
May	+2.7	-0.37	2	9
June	-0.4	+3.03	1	10
July	+2.8	-1.57	8	14
August	+0.6	-0.04	1	9
September	+6.0	-1.99	3	8
October	+3.4	+1.44	0	0



OZONE SUMMARY AND HIGHEST AQI DAYS

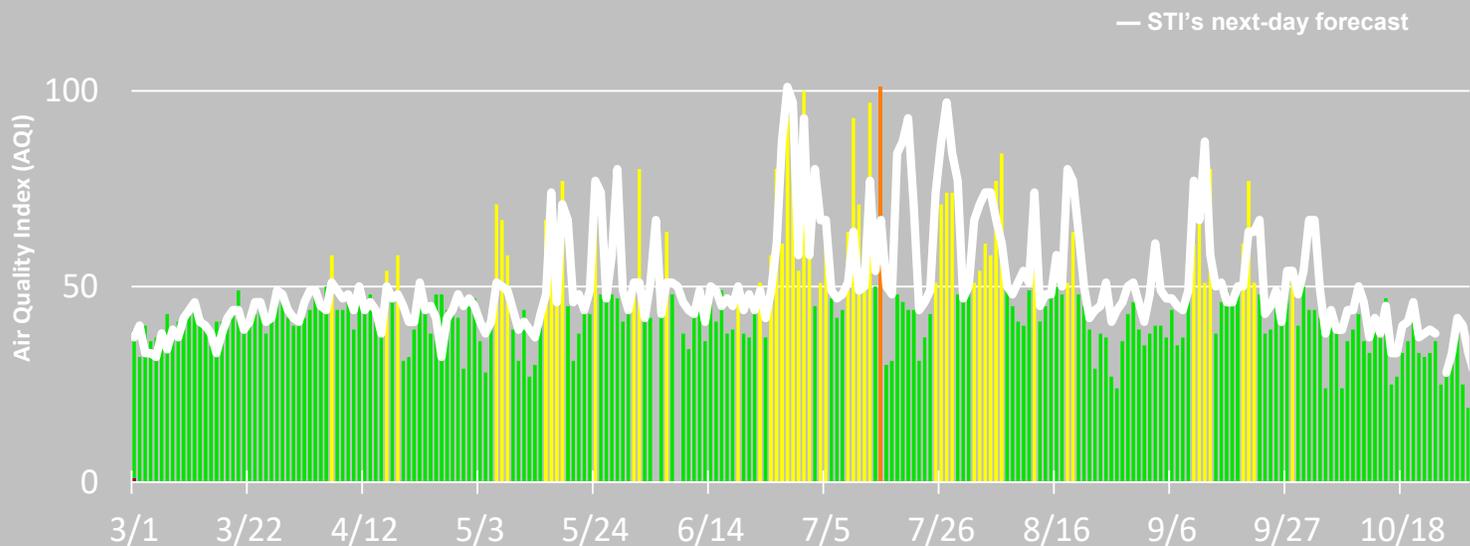
The table below shows the forecast and observed ozone AQI levels on days with forecast AQI levels above 100 or observed AQI levels above 90. On the only day an alert was issued (forecast AQI levels over 100), the observed ozone level was 93 AQI. Brief descriptions of weather conditions on selected high-AQI days (shown in bold in the table below) are provided on the following page.

Prevailing winds are frequently from the southwest or west on days with observed AQI levels above 100, leading to maximum readings at monitors to the northeast of major urban centers, such as the New Albany and London monitoring sites, due to pollution transport.

Date	Next-Day Forecast	Same-Day Forecast	Observed Ozone AQI	Peak Monitor
6/28/19	101	105	93	London
6/29/19	97	87	90	New Albany
7/1/19	93	64	100	New Albany
7/10/19	64	84	93	London
7/13/19	77	80	97	New Albany
7/15/19	67	80	101	New Albany

STI meteorologists were generally able to capture the trend of observed air quality levels with their next-day forecasts. The chart below shows daily observed AQI levels (colored bars) and next-day forecasts (white line) for ozone.

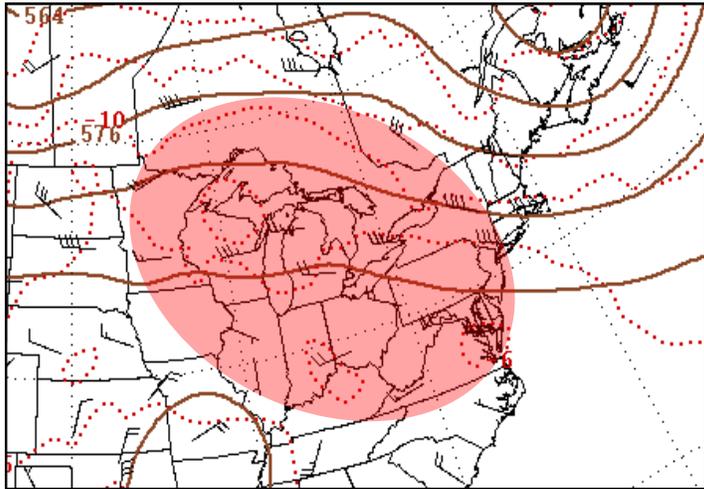
Daily Maximum Ozone AQI Values and Forecasts March–October 2019



HIGHLIGHTED DAYS – OZONE

JUNE 28, 2019: 93 AQI

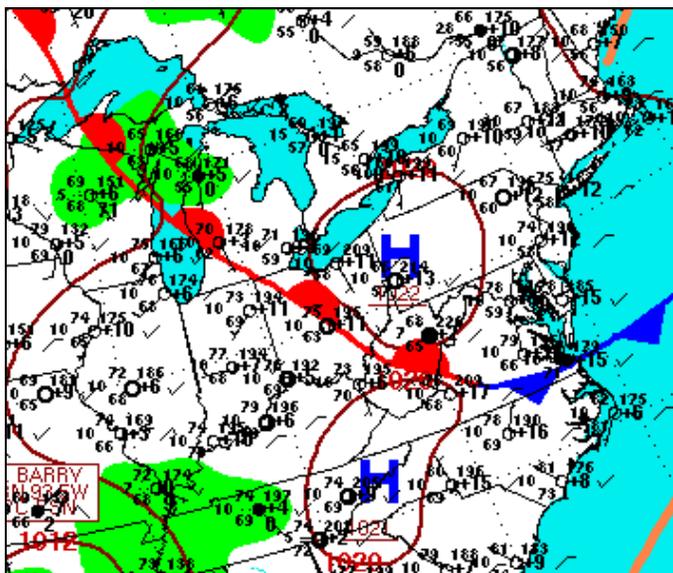
June 28 was an Air Quality Alert Day for Central Ohio. On this day, an upper-level ridge of high pressure over Ohio reduced atmospheric mixing and produced mostly sunny skies and temperatures in the 90s. These conditions enhanced ground-level ozone formation. In the afternoon, increasing westerly winds developed and aided dispersion. As a result, these conditions led to ozone levels that were in the high-Moderate range.



June 28: Weather map showing an upper-level ridge of high pressure over Ohio (denoted by the red shading). *Image from <https://www.wpc.ncep.noaa.gov>*

July 15, 2019: 101 AQI

Ozone levels on this day reached 101 AQI, the highest observed levels for the year. A surface high pressure system over Ohio during the morning hours resulted in light and variable winds, limiting pollutant dispersion. In addition, partly to mostly sunny skies and warm temperatures increased ozone production. Furthermore, a southwesterly wind shift in the afternoon transported regional pollutants into the Columbus region. On the previous day, July 14, the upwind region had observed Unhealthy for Sensitive Groups ozone levels. These conditions led to an Unhealthy for Sensitive Groups AQI day in Columbus on July 15.



July 15: Surface weather map showing a high pressure system nearby. *Image from <https://www.wpc.ncep.noaa.gov>*



PM_{2.5} SUMMARY AND HIGHEST AQI DAYS

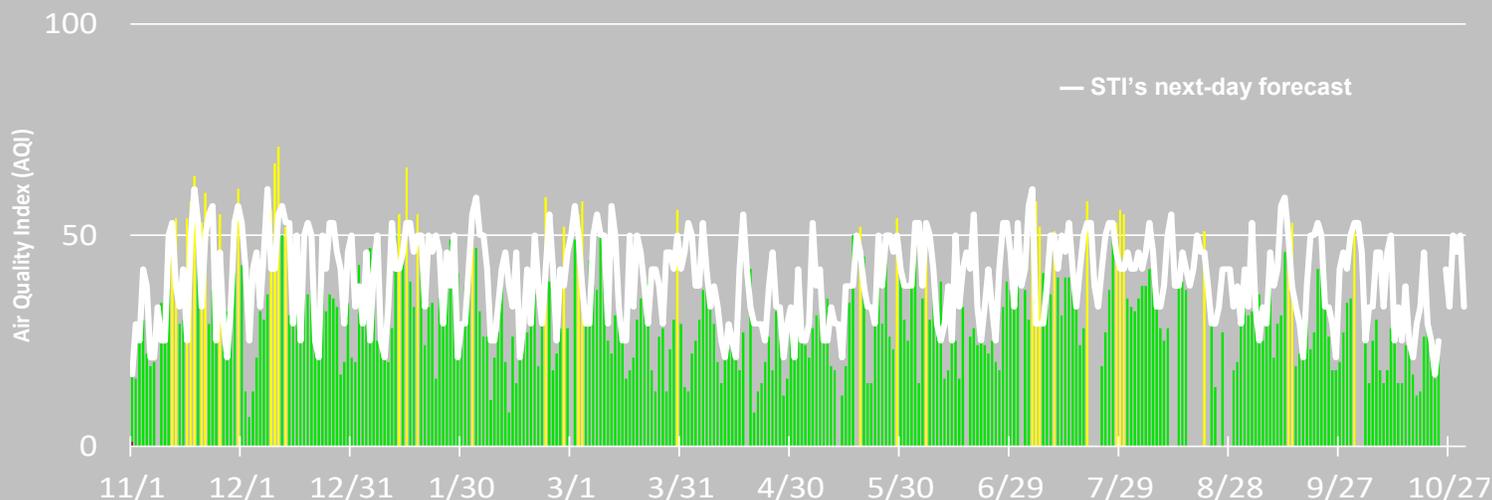
The table below shows the forecast and observed PM_{2.5} AQI levels on days with observed AQI levels of 60 or higher. No Air Quality Alerts were issued for PM_{2.5}, and no days with an AQI above 100 were observed.

Prevailing winds are frequently from the southwest or west on days with observed AQI levels above 100, leading to maximum readings at monitors to the northeast of major urban centers, such as the New Albany and London monitoring sites, due to pollution transport.

Date	Next-Day Forecast	Same-Day Forecast	Observed PM _{2.5} AQI	Peak Monitor
11/18/18	61	61	64	New Albany
11/21/18	50	55	60	New Albany
11/30/18	57	68	61	New Albany
12/10/18	42	63	67	New Albany
12/11/18	55	72	71	New Albany
1/15/19	53	68	66	New Albany

STI meteorologists were generally able to capture the trend of observed air quality levels with their next-day forecasts. The chart below shows daily observed AQI levels (colored bars) and next-day forecasts (white line) for PM_{2.5}.

Daily Maximum PM_{2.5} AQI Values and Forecasts November 2018–October 2019



FORECAST STATISTICS

STI provides same-day, next-day, and extended AQI daily forecasts for Central Ohio. A statistical summary of same-day and next-day forecasting performance at the Good-to-Moderate AQI threshold (51 AQI) is shown in the charts on the right and described below. These statistics assess the accuracy of the forecasts in determining if air quality pollution levels would be in the Good AQI range or in the Moderate or higher ranges. All forecast statistics discussed in this summary are described at the bottom of this page.

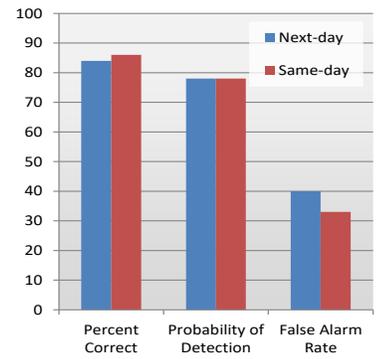
Of the 244 next-day ozone forecasts issued, 204 were correct at the Good-to-Moderate threshold, resulting in a Percent Correct (PC) of 84%. Of the 54 days with observed AQI levels of at least Moderate, 42 were correctly predicted in the next-day forecast, resulting in a Probability of Detection (POD) of 78%. The False Alarm Rate (FAR) for the next-day forecasts was 40%.

USG ozone AQI levels were observed on one day in Central Ohio during summer 2019. The next-day and same-day forecasts called for high-Moderate ozone levels on this day. An Air Quality Alert (next-day or same-day forecasts above 100 AQI) was issued on one day during summer 2019; on this day, high-Moderate ozone levels were observed.

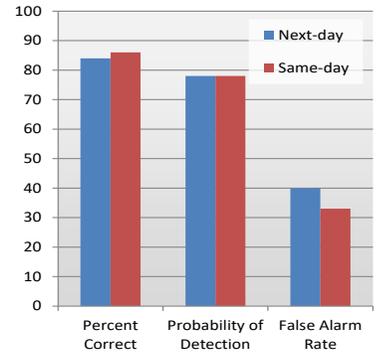
Of the next-day PM_{2.5} forecasts issued when valid data was measured (341 days), 282 were correct at the Good-to-Moderate threshold, resulting in a PC of 83%. Of the 39 days with observed AQI levels of Moderate, 12 were correctly predicted in the next-day forecast, resulting in a POD of 31%. The FAR for the next-day forecasts was 73%. However, the average bias is only 1.3 µg/m³.

The table below shows the forecast statistics for the Columbus region.

Good-to-Moderate Ozone
Forecast Statistics, March–Oct. 2019



Good-to-Moderate PM_{2.5} Forecast
Statistics, Nov. 2018–Oct. 2019



Pollutant	Good-to-Moderate Threshold									
	Same Day					Next Day				
	Percent Correct	Probability of Detection	False Alarm Rate	Bias	MAE	Percent Correct	Probability of Detection	False Alarm Rate	Bias	MAE
PM _{2.5}	93	83	34	+1.1 µg/m ³	1.7 µg/m ³	83	31	73	+1.3 µg/m ³	2.7 µg/m ³
Ozone	86	78	33	+2.1 ppb	4.6 ppb	84	78	40	+3.1 ppb	5.7 ppb

Statistical Definitions

Percent Correct: The percentage of forecasts that correctly predicted whether observations would be above or below a certain threshold.

Probability of Detection: The ability to correctly predict high-pollution events at or above a certain threshold.

False Alarm Rate: The percentage of cases for which a forecast of high pollution was incorrect at or above a certain threshold.

Bias: The average difference between forecast and observed concentrations. A positive bias indicates that the forecast concentrations tended to be higher than observed concentrations. A negative bias indicates that the forecast concentrations tended to be lower than observed.

Mean Absolute Error (MAE): Indicates the average absolute difference between forecast and observed concentrations. A low MAE suggests that forecasts tend to be fairly accurate.

