Ozone National Ambient Air Quality Standard Health Exceedances on July 28, 2021

On Wednesday, July 28, 2021, there were no exceedances in New Jersey of the National Ambient Air Quality Standard (NAAQS) for ozone (daily maximum 8-hour average of 70 ppb). See Table 1. A table listing all the ozone exceedances for 2021 in New Jersey may be found at https://www.nj.gov/dep/airmon/pdf/2021-nj-aqi-exceedence-days.pdf.

Table 1. New Jersey Ozone Concentrations on 7/28/2021

STATION	Daily Maximum 8-Hr Average (ppb)
Ancora State Hospital	55
Bayonne	53
Brigantine	54
Camden Spruce St	57
Chester	36
Clarksboro	65
Colliers Mills	63
Columbia	27
Flemington	38
Leonia	40
Millville	61
Monmouth University	55
Newark Firehouse	47
Ramapo	32
Rider University	47
Rutgers University	61
Washington Crossing*	No Data
TOTAL EXCEEDANCES	0

*The Washington Crossing station is operated and maintained by EPA as part of the nationwide Clean Air Status and Trends Network (CASTNET).

From the out-of-state stations within New Jersey's ozone nonattainment areas, there was one (1) exceedance of the ozone NAAQS. See Table 2.

Table 2. Ozone Concentrations at Out-of-State Monitoring Stations in New Jersey's Ozone Nonattainment Areas on 7/28/2021

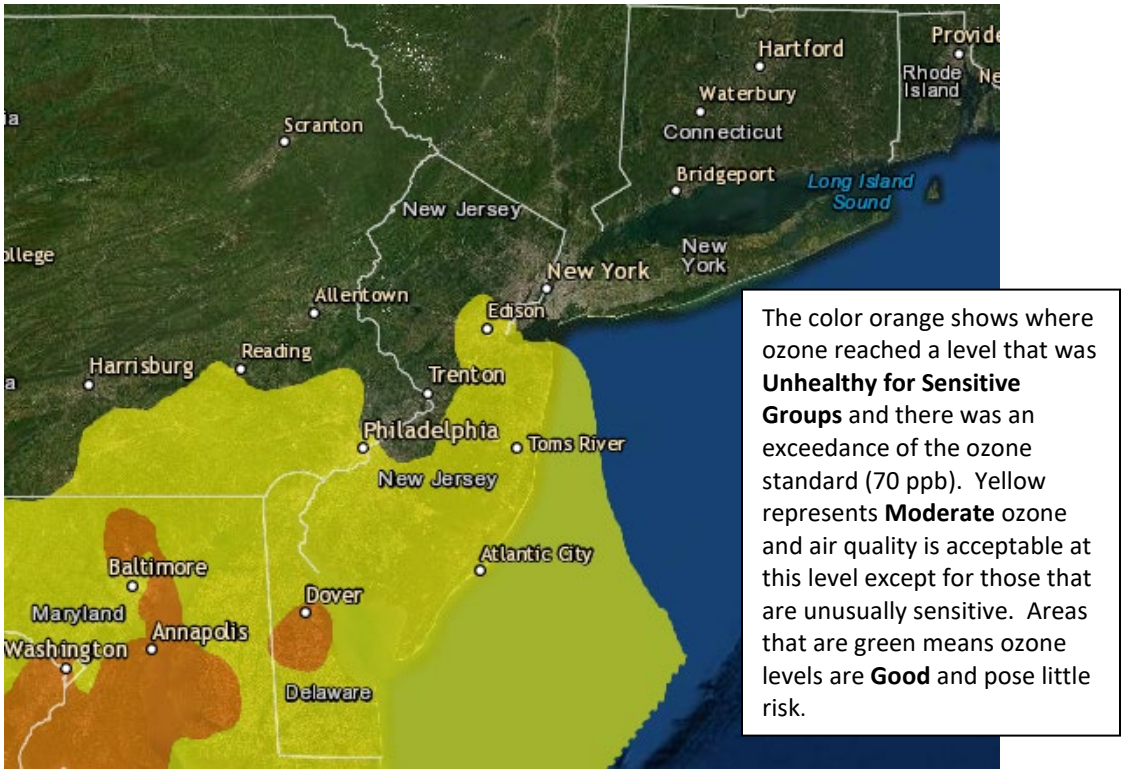
STATE	STATION	Daily Maximum 8-Hr Average (ppb)
CT	Danbury	37
CT	Greenwich	42
CT	Madison-Beach Road	46
CT	Middletown-CVH-Shed	35
CT	New Haven	41
CT	Stratford	46
CT	Westport	46
DE	BCSP (New Castle Co.)	58
DE	BELLFNT2 (New Castle Co.)	64
DE	KILLENS (Kent Co.)	71
DE	LEWES (Sussex Co.)	61
DE	LUMS 2 (New Castle Co.)	63
DE	MLK (New Castle Co.)	64
DE	SEAFORD (Sussex Co.)	65
MD	Fair Hill	63
NY	Babylon	44
NY	Bronx - IS52	43
NY	CCNY	44
NY	Flax Pond	42
NY	Fresh Kills	54
NY	Holtsville	44
NY	Pfizer Lab	43
NY	Queens	45
NY	Riverhead	41
NY	Rockland Cty	31
NY	White Plains	33
PA	BRIS (Bucks Co.)	53
PA	CHES (Delaware Co.)	66
PA	NEWG (Chester Co.)	58
PA	NORR (Montgomery Co.)	56
PA	LAB (Philadelphia Co.)	52
PA	NEA (Philadelphia Co.)	51
PA	NEW (Philadelphia Co.)	51
	TOTAL EXCEEDANCES	1

The number of days in 2021 on which exceedances of the ozone NAAQS were recorded for all the states within New Jersey's ozone nonattainment areas is summarized in Table 3.

Table 3. Number of Days Ozone NAAQS was Exceeded in NJ's Nonattainment Areas in 2021

STATE	# of Days NAAQS was Exceeded January 1 – July 28, 2021 NAAQS = 70 ppb
Connecticut	13
Delaware	3
Maryland	3
New Jersey	7
New York	11
Pennsylvania	7

Figure 1. Ozone Air Quality Index for July 28, 2021



Source: www.airnow.gov

For ozone terminology definitions see NJDEP Air Quality Planning's Glossary and Acronyms webpage: http://nj.gov/dep/baqp/glossary.html

Weather

On Wednesday, July 28th, an isolated exceedance in central Delaware was observed due to multiple frontal influences, favorable meteorological conditions, and a previously polluted air mass.

A stationary front was located over Delaware early on Tuesday, July 27th, where it meandered over the state throughout the entire day. This feature allowed for polluted air aloft to mix down to the surface and also cause a recirculation of winds, giving the surface level air mass over Delaware a disadvantage prior to the exceedance day. Late on the 27th, the stationary front began to dissipate and light northerly winds were noted overnight. To the north, a cold front stretched zonally across Pennsylvania and New Jersey. Despite the frontal boundaries, weak high pressure remained in place throughout the eastern United States, allowing for mostly sunny skies, temperatures reaching the upper 80's by late morning, and light northerly winds; all conditions conducive for ozone formation. By late morning/early afternoon, the cold front to the north had pushed south past Delaware, causing light winds to shift out of the southeast and cause surface temperatures to drop into the mid 70's. Despite the cooling effect, surface winds shifted almost a full 180 degrees, causing a recirculation of previously polluted air from the day prior right back into Delaware. This allowed for ozone concentrations to remain elevated into the afternoon and early evening hours. With elevated PM2.5 levels also noted throughout the region for multiple days, it is possible that lingering diffuse Canadian wildfire smoke could have also enhanced ozone concentrations at the surface.

These favorable weather conditions, multiple frontal boundaries, a previously polluted air mass, and localized/regional transport of pollutants all contributed to the exceedance observed in central Delaware on July 28th.

Where Did the Air Pollution that Caused Ozone Come From?

Air pollution from human activities including cars, trucks, factories, and power plants is blown by prevailing winds and reacts with sunlight and other ozone precursors to create poor air quality. An analysis of the meteorology and back trajectories from July 28th shows that the exceedance in central Delaware was influenced by a complex frontal pattern. This atmospheric setup allowed for favorable weather conditions for ozone formation as well as the transport of localized/regional emissions and previously polluted air, leading to elevated ozone levels in portions of the southern nonattainment area.

Figures 2, 3, and 4 show the back trajectories starting at different wind heights for the monitored exceedances on July 28, 2021. The figures illustrate where the air came from during the 48 hours preceding the 8-hour ozone standard exceedance. One monitoring station was chosen to model back trajectories and is listed in Table 4.

Table 4. Monitoring Station with an 8-hr Ozone Exceedance that was Selected to Run 48-hr Back Trajectories

STATE	STATION	Daily Maximum 8-Hr Average (ppb)
DE	KILLENS (Kent Co.)	71

The surface-level back trajectory (Figure 2) shows that air remained very localized during its 48-hour path as it recirculated, under the influence of a complex frontal pattern, over Delaware and the Delaware Bay. Air originated over central Delaware and meandered across the state on July 27th as it was influenced by a stationary front draped across the Mid-Atlantic region. As a cold front approached from the north on the 28th, air then recirculated over the northern Delaware Bay prior to arrival. During its entire path, air remained at the surface. It not only transported previously polluted air across the region but allowed for the transport of localized emissions from cars, trucks, and industry which, under the influence of favorable weather conditions, further enhanced ozone levels.

The mid-level back trajectory (Figure 3) shows that air at this level originated over the Great Lakes region, where areas of moderate air quality were observed the day prior. The trajectory traveled in a clockwise direction around high pressure centered over the Ohio River Valley, moving southeasterly over far western New York and Pennsylvania. Once over Pennsylvania, the trajectory took an eastward turn and then abruptly moved south, where it encountered a cold front moving down from the northeast. From here, the trajectory continued to move south over Delaware, ahead of that cold front, where it moved over Dover, DE vicinity. This allowed air another opportunity to pick up local emissions from cars, trucks, and local industry, before eventually reaching its destination.

Figure 4 shows that the upper-level back trajectory originated over Iowa and traveled in a northeasterly direction around the perimeter of high pressure. Upper-level air originally travelled at near surface levels, before intersecting with a low-pressure system, causing air to rise significantly. The air parcel then shifted to a southeasterly flow and traversed over the Great Lakes region. From here, the trajectory continued to travel over Pennsylvania and the Baltimore metropolitan area before arriving at its endpoint in central Delaware. Overall, widespread moderate and USG air quality was observed during much of the air parcel's transit.

Finally, Figure 5 shows the National Air Quality Index observed on July 27th, the day prior to this exceedance event. As shown in the figure, widespread elevated levels of ozone were observed throughout much of the Mid-Atlantic region and Northeastern United States. The localized and regional transport of ozone precursors and previously polluted air, in combination with favorable meteorological conditions mentioned previously, helped lead to one exceedance in the nonattainment area.

Figure 2. 48-hour Back Trajectories for July 28, 2021 at 10 meters

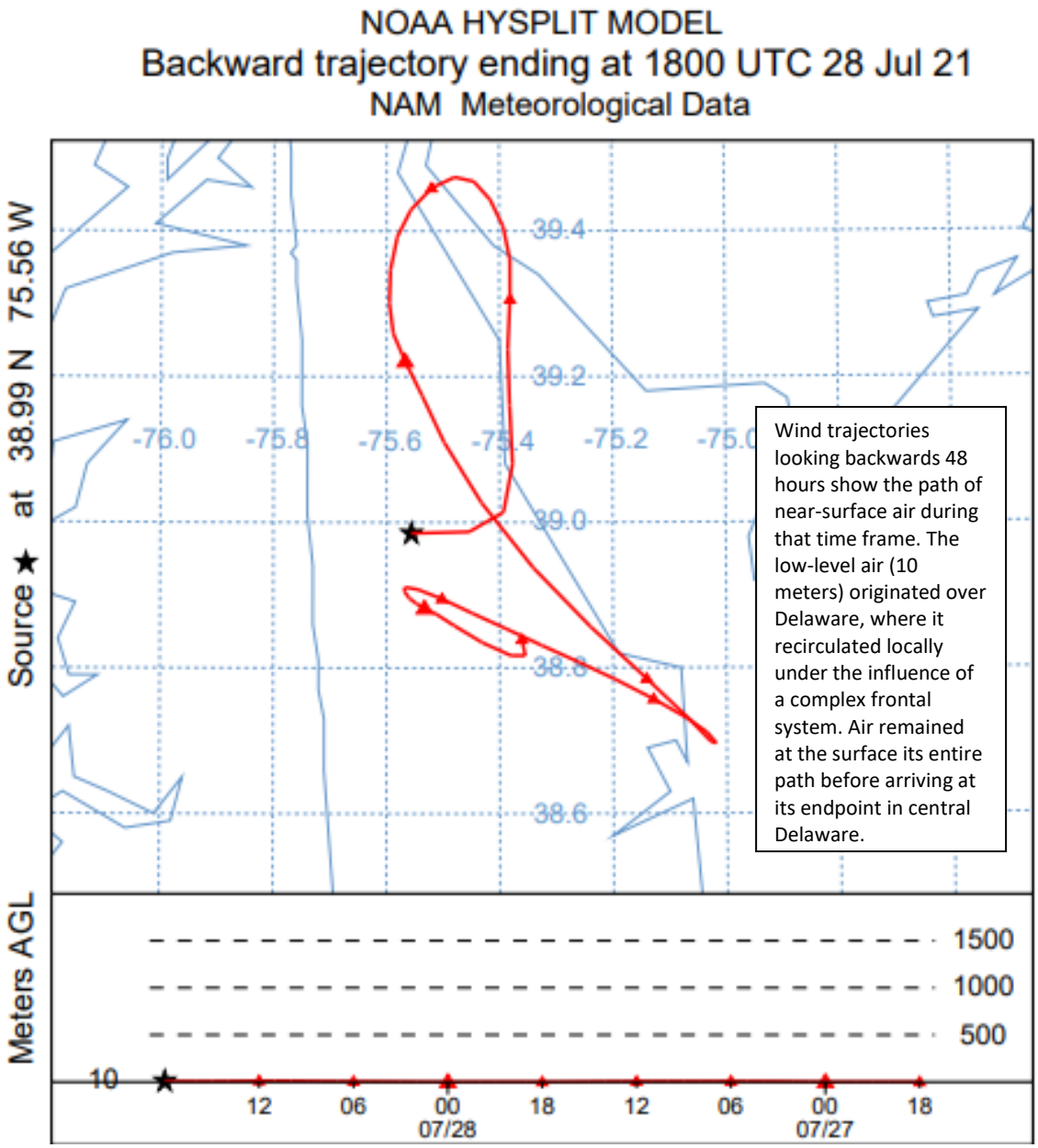


Figure 3. 48-hour Back Trajectories for July 28, 2021 at 500 meters

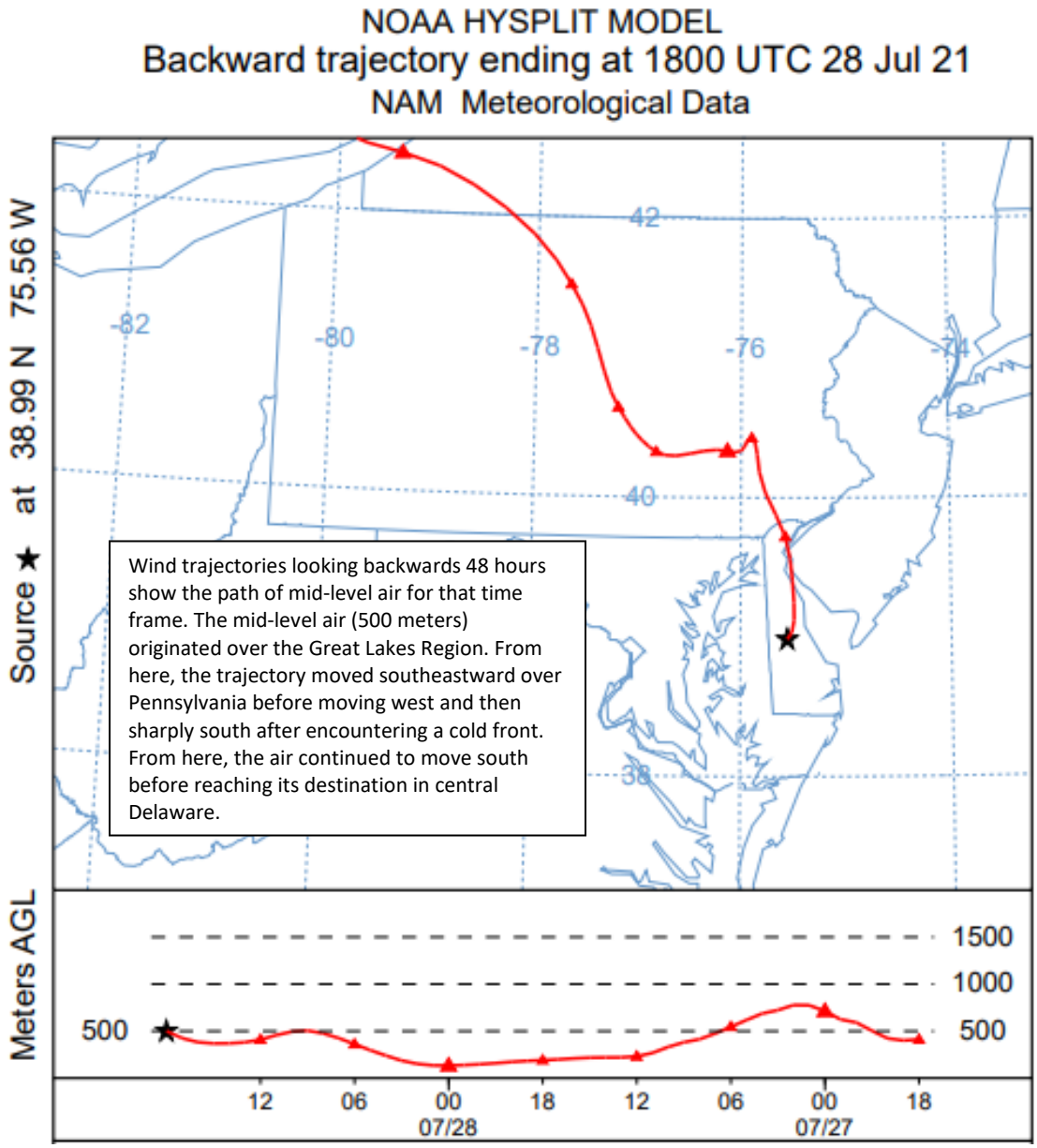


Figure 4. 48-hour Back Trajectories for July 28, 2021 at 1500 meters

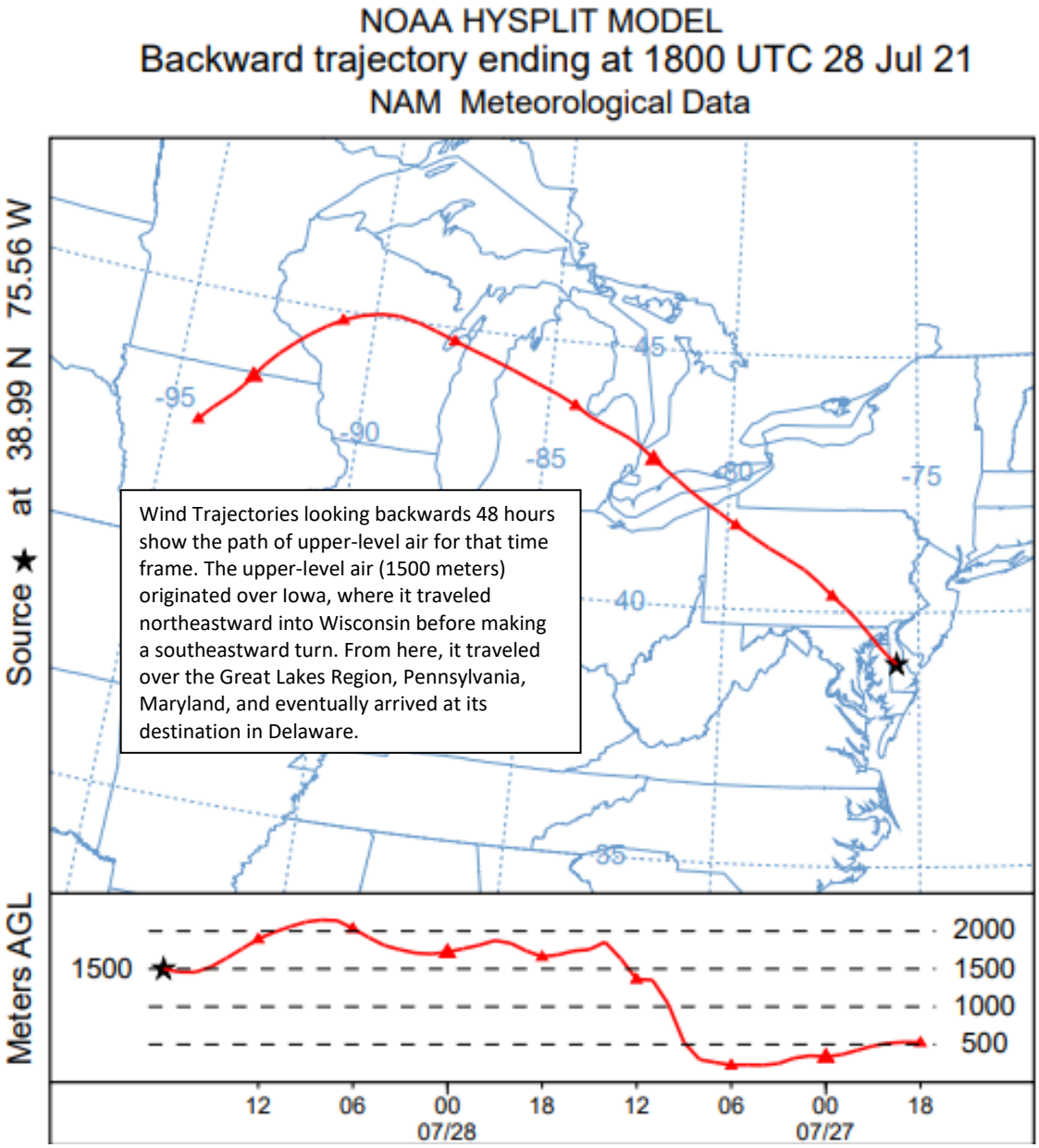
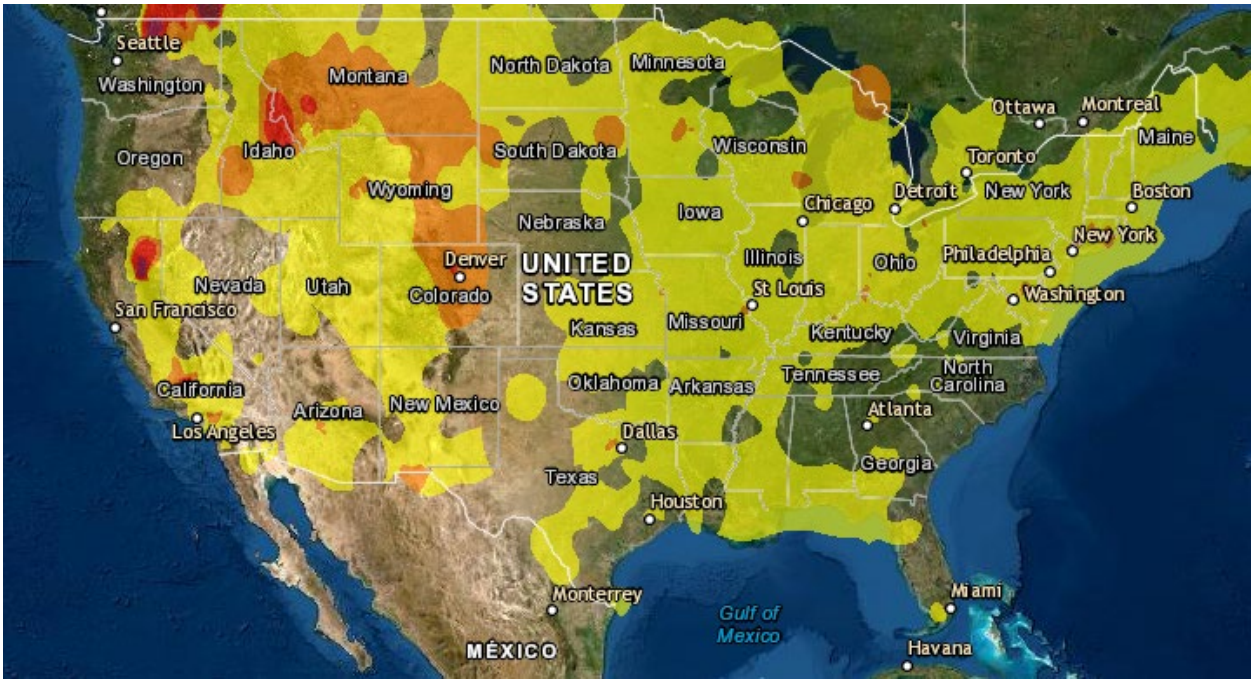


Figure 5. Combined Air Quality Index for the United States on July 27, 2021



Source: www.airnow.gov

How is Ozone Created?

Ground-level ozone is an air pollutant known to cause several health effects and negatively impact air quality and the environment in New Jersey. Ozone is formed when oxides of nitrogen (NOx) and volatile organic compounds (VOCs) react in the presence of sunlight. Ozone can irritate any person's lungs, but the effect may be more pronounced for those with existing lung-related deficiencies, and therefore, one should take extra precautions on bad ozone days.

Find Out About Air Quality Every Day

Learn more about your local ozone air quality forecast by visiting the "What's Your Air Quality Today?" page at http://www.nj.gov/dep/cleanairnj/ .