Ozone National Ambient Air Quality Standard Health Exceedances on July 7, 2021

On Wednesday, July 7, 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.

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

STATION	Daily Maximum 8-Hr Average (ppb)
Ancora State Hospital	53
Bayonne	63
Brigantine	51
Camden Spruce St	69
Chester	57
Clarksboro	61
Colliers Mills	62
Columbia	51
Flemington	58
Leonia	46
Millville	56
Monmouth University	59
Newark Firehouse	62
Ramapo	58
Rider University	No Data
Rutgers University	63
Washington Crossing*	59
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 were nine (9) exceedances 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 7/7/2021

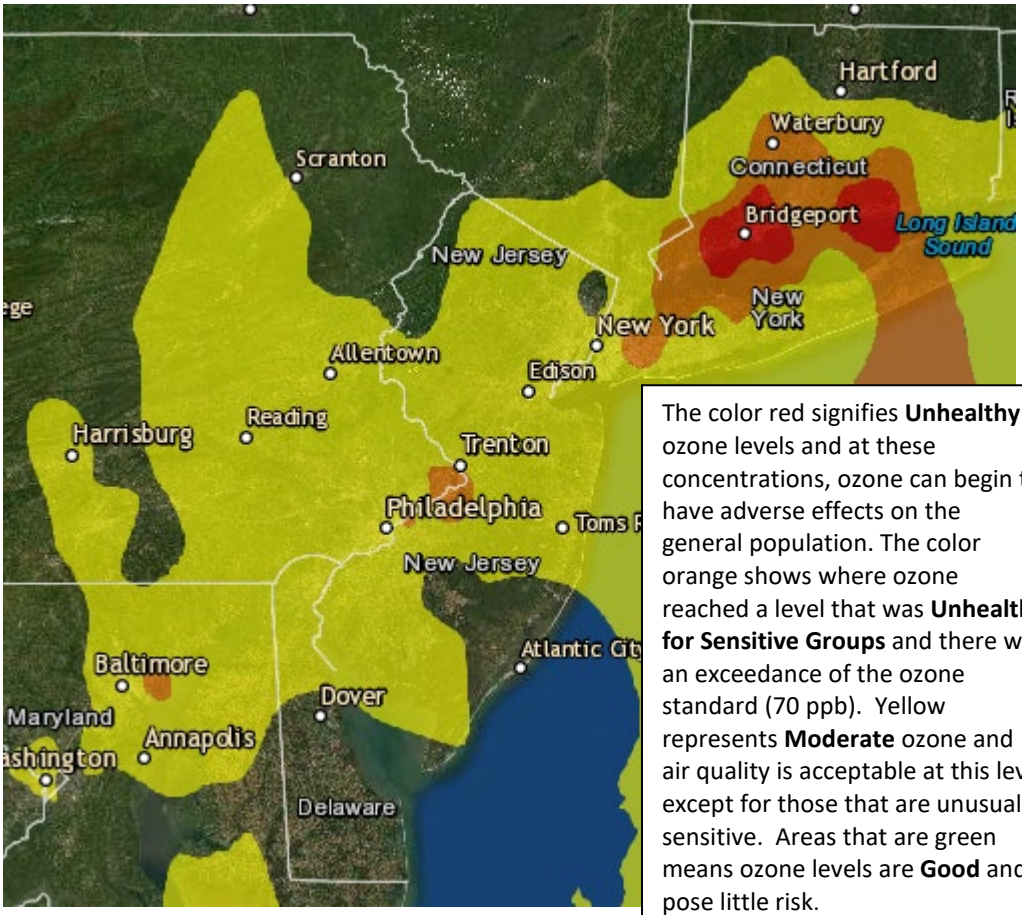
STATE	STATION	Daily Maximum 8-Hr Average (ppb)
CT	Danbury	60
CT	Greenwich	77
CT	Madison-Beach Road	89
CT	Middletown-CVH-Shed	69
CT	New Haven	81
CT	Stratford	91
CT	Westport	89
DE	BCSP (New Castle Co.)	55
DE	BELLFNT2 (New Castle Co.)	58
DE	KILLENS (Kent Co.)	53
DE	LEWES (Sussex Co.)	53
DE	LUMS 2 (New Castle Co.)	56
DE	MLK (New Castle Co.)	60
DE	SEAFORD (Sussex Co.)	51
MD	Fair Hill	62
NY	Babylon	69
NY	Bronx - IS52	67
NY	CCNY	66
NY	Flax Pond	83
NY	Fresh Kills	65
NY	Holtsville	62
NY	Pfizer Lab	69
NY	Queens	71
NY	Riverhead	68
NY	Rockland Cty	56
NY	White Plains	68
PA	BRIS (Bucks Co.)	74
PA	CHES (Delaware Co.)	64
PA	NEWG (Chester Co.)	55
PA	NORR (Montgomery Co.)	61
PA	LAB (Philadelphia Co.)	61
PA	NEA (Philadelphia Co.)	64
PA	NEW (Philadelphia Co.)	73
	TOTAL EXCEEDANCES	9

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 7, 2021 NAAQS = 70 ppb
Connecticut	11
Delaware	2
Maryland	3
New Jersey	5
New York	7
Pennsylvania	6

Figure 1. Ozone Air Quality Index for July 7, 2021



The color red signifies **Unhealthy** ozone levels and at these concentrations, ozone can begin to have adverse effects on the general population. The color orange shows where ozone reached a level that was **Unhealthy for Sensitive Groups** and there was an exceedance of the ozone standard (70 ppb). Yellow represents **Moderate** ozone and air quality is acceptable at this level except for those that are unusually sensitive. Areas that are green means ozone levels are **Good** and pose little risk.

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

High pressure was stationed over much of the eastern United States on Wednesday July 7, 2021, and provided favorable meteorological conditions for ozone formation. Similar meteorological conditions in the days leading up to this high ozone event allowed pollutants at the surface to accumulate, while also providing localized and regional transport of ozone precursors from upwind states. The nonattainment area observed several exceedances on this day, where portions of eastern Pennsylvania and Long Island, New York reached the unhealthy for sensitive groups (USG) category, and isolated locations in Connecticut recorded unhealthy levels.

High pressure established itself over the eastern section of the United States in the days leading up to this event. In addition, a stationary front to the northwest of the nonattainment area allowed for hot and humid air to channel into the region. Favorable meteorological conditions for ozone production were present, including light southwesterly winds, abundant sunshine, and temperatures soaring into the low to mid 90s. This allowed for the localized transport of emissions from cars, trucks, and industry along the I-95 corridor, as well as previously polluted air from upwind states. A lingering surface trough was also established over the region, which allowed for vertical motion in the atmosphere, mixing previously polluted air towards the surface, further increasing ozone levels. Additionally, in contrast to monitors in Connecticut and New York, monitor locations throughout much of New Jersey recorded extreme heat, with values ranging in the mid to upper 90s. As noted in previous occasions, this extreme heat could be what inhibited ozone production in New Jersey and could be a reason why exceedance locations were not as widespread across the nonattainment area.

Favorable weather conditions, in combination with localized and regional transport of previously polluted air, were all factors leading to the exceedances in Pennsylvania, New York, and Connecticut on this day.

Where Did the Air Pollution that Caused Ozone Come From?

Figures 2, 3, and 4 show the back trajectories starting at different wind heights for the monitored exceedances on July 7, 2021. The figures illustrate where the air came from during the 48 hours preceding the 8-hour ozone standard exceedances. Nine monitoring stations were chosen to model back trajectories and are listed in Table 4.

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

STATE	STATION	Daily Maximum 8-Hr Average (ppb)
CT	Greenwich	77
CT	Madison Beach Road	89
CT	New Haven	81
CT	Stratford	91
CT	Westport	89
NY	Flax Pond	83
NY	Queens	71

PA	Bristol	74
PA	NEW	73

Back trajectories from July 7th show that air at the surface traveled along the Mid-Atlantic coast, while air at upper levels came from a northwesterly direction and traveled along the large area of high pressure over the region. Surface trajectories were able to pick up emissions at the ground while the gentle sinking motion aloft allowed pollutants to mix down to the surface. This, in combination with a previously polluted airmass upwind and the favorable meteorological conditions mentioned above, led to the exceedances observed.

The surface-level back trajectories (Figure 2) show that air originated off the coasts of North Carolina and Virginia. From there, trajectories traveled north up the Mid-Atlantic coastline, and over the Chesapeake Bay Region and Delaware, where they likely picked up emissions from cars, trucks, and industry. Traveling at ground level during their path, the trajectories continued to pick up emissions as they moved northeastward over Philadelphia, where two trajectories would arrive at their destinations. From here, the rest moved over New Jersey, up the I-95 corridor, and over New York City and Long Island. The trajectories also may have also picked up emissions from electric generation peaking units in operation because of the hot and humid conditions. The rest of the trajectories continued to move over Long Island Sound before arriving at their destinations along the Connecticut coastline.

The mid- and upper-level back trajectories (Figure 3) followed similar transport pathways. These trajectories show that air originated in the Great Lakes and Ohio River Valley regions and made an eastward journey traversing many states. At their origin, surface ozone concentrations reached the unhealthy for sensitive groups category in some locations. At both levels of the atmosphere, trajectories traveled in a general east/southeasterly direction around the perimeter of high pressure through heavily industrialized regions located west of the nonattainment area. Trajectories impacting Philadelphia passed over the Ohio River Valley and southern Pennsylvania before entering the Philadelphia metro area and reaching their endpoints. Meanwhile, trajectories impacting New York and Connecticut traveled over some isolated locations of moderate air quality as they advanced through western New York. Next, trajectories aloft made a turn southward toward the Lower Hudson Valley and metropolitan New York City, where some trajectories reached their destination. Upon reaching the New York City metropolitan area, trajectories aloft made a turn to the northeast, and downwind to Connecticut.

Figure 5 shows the National Air Quality Index observed on July 6th, the day prior to this exceedance event. As seen in the figure, moderate air quality and an isolated area of unhealthy for sensitive groups (USG) air quality was observed in portions of the Ohio River Valley and Great Lakes region, indicating that any residual ozone aloft was likely brought down to the surface from the mid and upper levels. Additionally, the nonattainment zone saw widespread moderate air quality the day prior, with isolated areas of USG observed in Maryland and Connecticut. With surface trajectories traveling up the I-95 corridor, the previously deteriorated air mass that lingered over the region helped to further enhance ozone levels. This suggests that a previously polluted air mass from upwind states was transported to an already polluted surface. Due to the favorable meteorological conditions mentioned above, ozone concentrations were able to spike well into the USG category in Pennsylvania, New York City, Long Island, and Connecticut, with three monitors in Connecticut reaching unhealthy ozone levels.

Figure 2. 48-hour Back Trajectories for July 7, 2021 at 10 meters

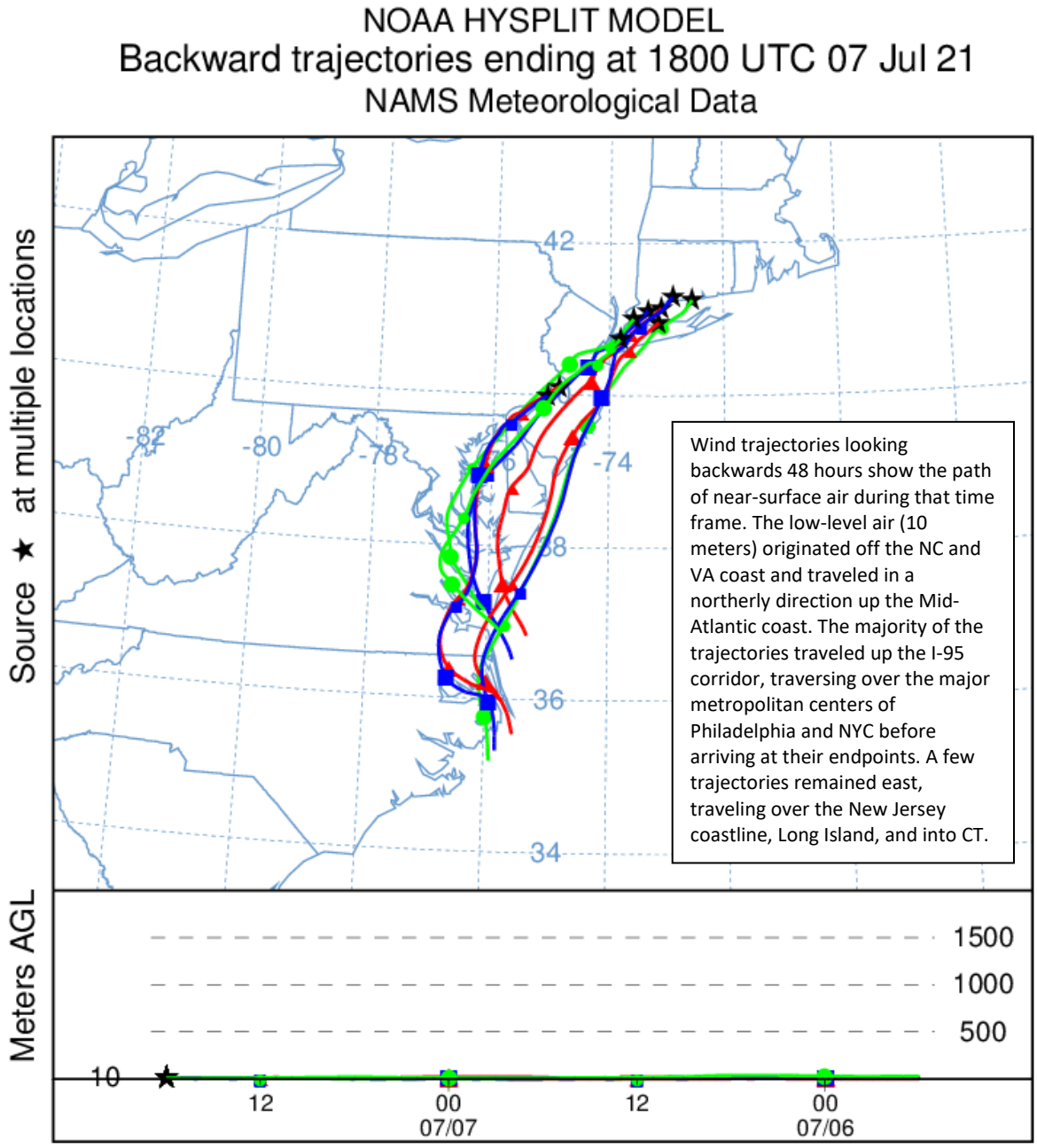


Figure 3. 48-hour Back Trajectories for July 7, 2021 at 500 meters

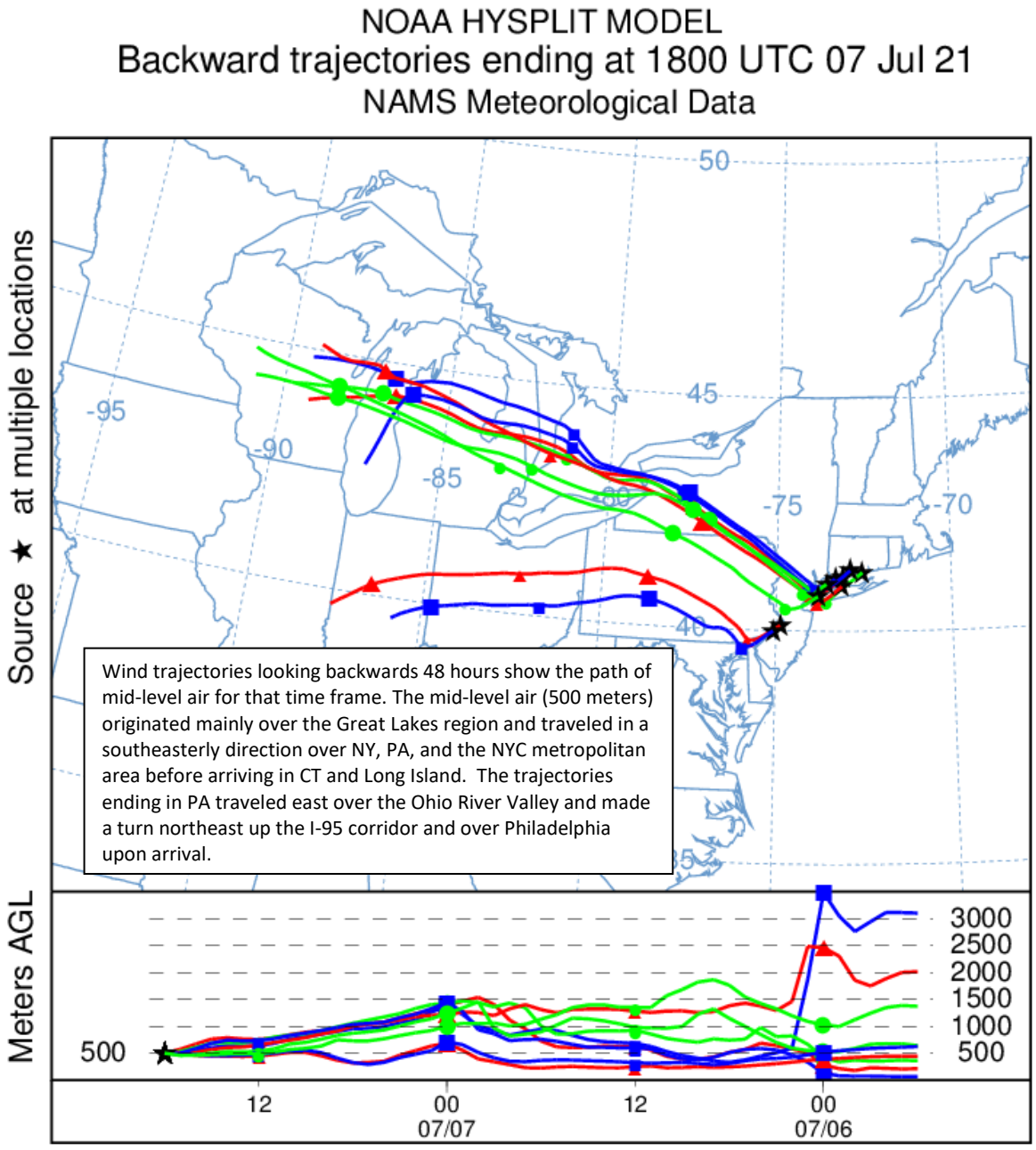


Figure 4. 48-hour Back Trajectories for July 7, 2021 at 1500 meters

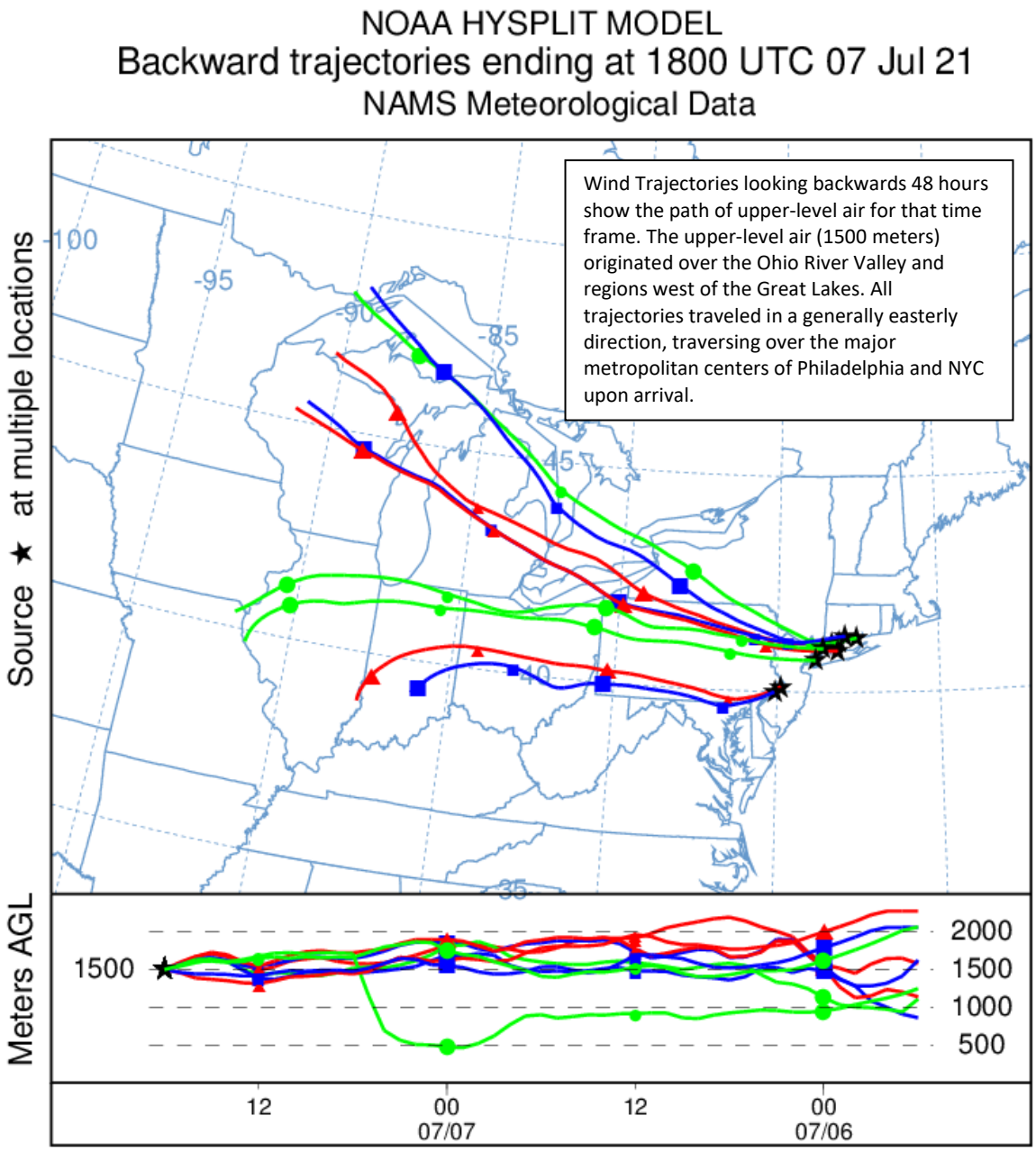
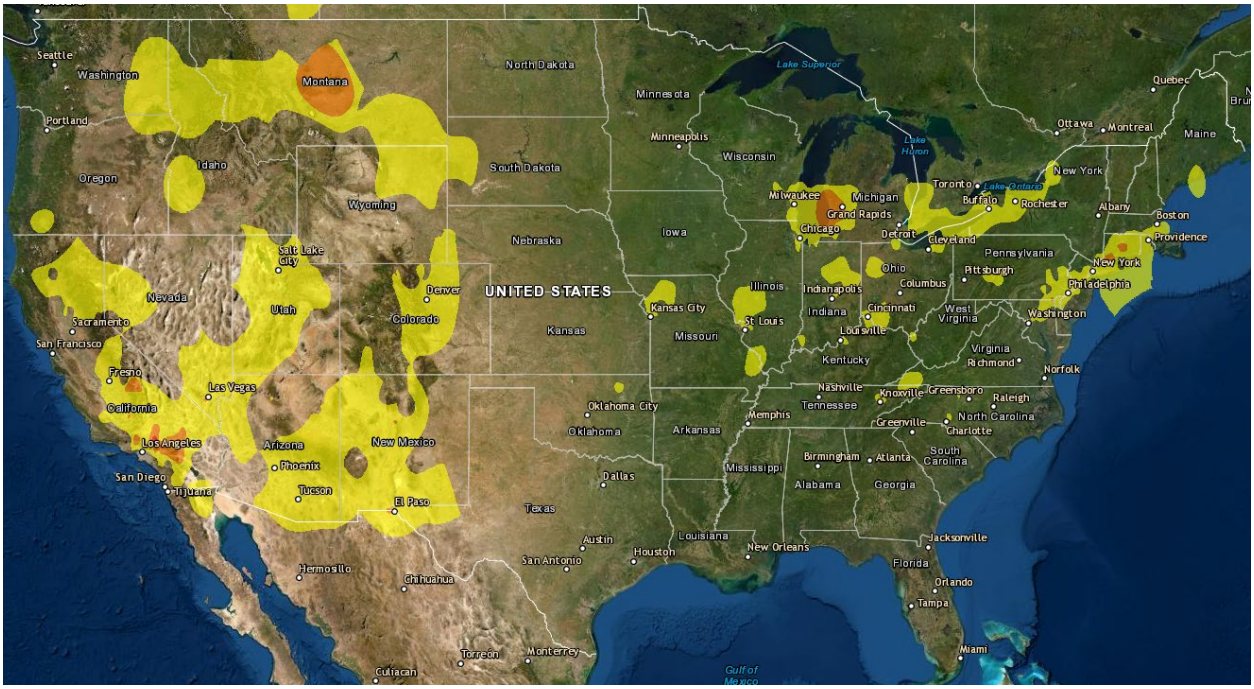


Figure 5. Combined Air Quality Index for the United States on July 6, 2021



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/ .