Ozone National Ambient Air Quality Standard Health Exceedances on August 25, 2021

On Wednesday, August 25, 2021, there were two (2) 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 8/25/2021

STATION	Daily Maximum 8-Hr Average (ppb)
Ancora State Hospital	53
Bayonne	74
Brigantine	57
Camden Spruce St	68
Chester	55
Clarksboro	61
Colliers Mills	52
Columbia	57
Flemington	58
Leonia	74
Millville	65
Monmouth University	64
Newark Firehouse	61
Ramapo	55
Rider University	65
Rutgers University	59
Washington Crossing*	67
TOTAL EXCEEDANCES	2

*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 ten (10) 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 8/25/2021

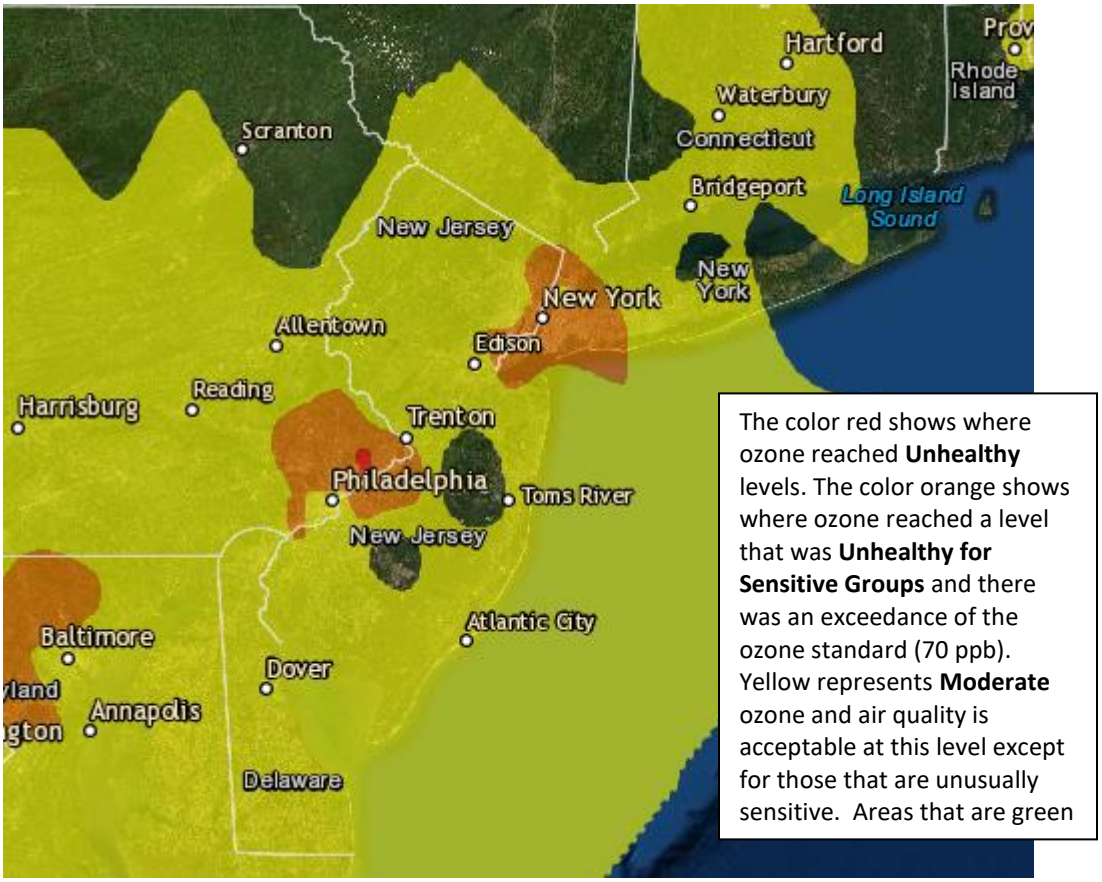
STATE	STATION	Daily Maximum 8-Hr Average (ppb)
CT	Danbury	49
CT	Greenwich	65
CT	Madison-Beach Road	62
CT	Middletown-CVH-Shed	59
CT	New Haven	54
CT	Stratford	61
CT	Westport	68
DE	BCSP (New Castle Co.)	65
DE	BELLFNT2 (New Castle Co.)	63
DE	KILLENS (Kent Co.)	63
DE	LEWES (Sussex Co.)	59
DE	LUMS 2 (New Castle Co.)	63
DE	MLK (New Castle Co.)	70
DE	SEAFORD (Sussex Co.)	65
MD	Fair Hill	66
NY	Babylon	78
NY	Bronx - IS52	68
NY	CCNY	70
NY	Flax Pond	48
NY	Fresh Kills	77
NY	Holtsville	63
NY	Pfizer Lab	75
NY	Queens	73
NY	Riverhead	48
NY	Rockland Cty	56
NY	White Plains	58
PA	BRIS (Bucks Co.)	83
PA	CHES (Delaware Co.)	71
PA	NEWG (Chester Co.)	62
PA	NORR (Montgomery Co.)	71
PA	LAB (Philadelphia Co.)	75
PA	NEA (Philadelphia Co.)	86
PA	NEW (Philadelphia Co.)	76
	TOTAL EXCEEDANCES	10

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 – August 25, 2021 NAAQS = 70 ppb
Connecticut	18
Delaware	3
Maryland	3
New Jersey	10
New York	15
Pennsylvania	10

Figure 1. Ozone Air Quality Index for August 25, 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

A Bermuda High pressure established itself over the region on Wednesday, August 25th, allowing for weather conditions conducive to ozone formation. These favorable conditions, along with local and regional transport of pollutants and previously polluted air, allowed for elevated ozone levels across the nonattainment area.

The main weather for Wednesday, August 25, was the Bermuda High over the region. High pressure began to build into the region on Tuesday and continued to strengthen into Wednesday. On Wednesday morning, calm winds were observed, along with some patchy fog across the area. As the day progressed, abundant sunshine allowed daytime heating to ramp up and temperatures eventually reached the low 90s throughout much of the area. Meanwhile, calm to light southwesterly winds persisted, with little to no movement of the air mass occurring. This light flow allowed for localized transport of emissions from cars, trucks, and industry to enhance ozone levels under the favorable meteorological conditions present. A surface trough also developed for a brief time along the I-95 corridor in Pennsylvania, New Jersey, and New York, allowing for more vertical motion in the atmosphere and mixing of upper level air down to the surface. These areas saw ozone reach the unhealthy for sensitive groups category along with one monitor reaching the unhealthy category in Philadelphia.

The ozone exceedances that occurred on Wednesday can, in general, be attributed to the high pressure anchored over the region causing limited movement of air, and sunny skies to persist throughout the day. These favorable meteorological conditions, in combination with the local and regional transportation of emissions and previously polluted air, allowed for ozone to reach both the unhealthy and unhealthy for sensitive groups categories within the nonattainment area.

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 August 25th shows that the exceedances were influenced by a high-pressure system along with local and regional transport throughout the nonattainment area. The transport of local/regional emissions and previously polluted air, along with favorable weather conditions for ozone formation, led to elevated ozone levels at multiple monitors within the nonattainment area on this day.

Figures 2, 3, and 4 show the back trajectories starting at different wind heights for the monitored exceedances on August 25, 2021. The figures illustrate where the air came from during the 48 hours preceding the 8-hour ozone standard exceedances. Ten 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)
NJ	Bayonne	74
NJ	Leonia	74
NY	Queens	73
NY	Pfizer Lab	75
NY	Fresh Kills	77
PA	BRIS (Bucks Co.)	83
PA	NEA (Philadelphia Co.)	86
PA	NEW (Philadelphia Co.)	76
PA	CHES (Delaware Co.)	71
PA	LAB (Philadelphia Co.)	75

The surface-level back trajectories (Figure 2) show that air originated in various parts of the Great Lakes region. The first set of trajectories ending in the New York City metropolitan area originated in the northern Great Lakes region and traversed in a southeasterly direction over southern Ontario and into New York state. As the air mass made its final approach into northern New Jersey and the NYC metropolitan area, it began to stall drastically under the influence of high pressure, allowing for a buildup of regional and localized pollutants from cars, trucks, and industry. The second set of trajectories ending in the Philadelphia metropolitan area originated in southern Ontario and followed a similar southeasterly flow as the northern trajectories. The air mass traversed over western New York state, central Pennsylvania, and eventually into the greater Philadelphia region. Both sets of trajectories stalled drastically upon arrival in their respective urban centers, and experienced a heavy sinking motion towards the surface due to strong high pressure in close proximity. This allowed for the transport of a previously polluted air mass from upwind states to the surface when it reached the nonattainment area, where a stagnant air mass was already growing increasingly polluted from localized emissions.

The mid-level back trajectories (Figure 3) show that air originated over northern Michigan and southern Ontario in the upper atmosphere and quickly traveled southeastward across the Great Lakes region, western/central New York, the Hudson Valley/northeastern Pennsylvania through August 24th, gradually descending in the atmosphere during this time. Air impacting northern locations slowed as it passed over the New York City metropolitan area into arrival. Meanwhile, air influencing southern locations traveled southward across New Jersey before recirculating over the Philadelphia metropolitan area into arrival. Overall, air slowed significantly in the last 12 to 18 hours of its transit, allowing for the additional buildup of emissions from cars, trucks, and industry within its respective metropolitan locations.

Similarly, the upper-level back trajectories (Figure 4) originated over the Great Lakes region. Air impacting northern locations originated over Wisconsin and quickly traveled east-southeast across Michigan, southeastern Ontario, western/central New York before slowing as it traveled southward over the Hudson Valley and the New York City metropolitan area. Meanwhile, air impacting southern locations originated over northern Michigan and traveled southeastward over southeastern Ontario,

western New York, central Pennsylvania and slowing as it approached the Philadelphia metropolitan area.

Figure 5 shows the National Air Quality Index observed on August 24th, the day prior to this exceedance event. As shown in the figure, widespread elevated levels of ozone were noted within the nonattainment area as well as over upwind locations, including the Great Lakes region and western/central Pennsylvania. This would indicate that both the localized and the long-range transport of previously polluted air, in combination with the transport of local/regional emissions, under favorable weather conditions, led to widespread ozone exceedances in the nonattainment area on August 25th.

Figure 2. 48-hour Back Trajectories for August 25, 2021 at 10 meters

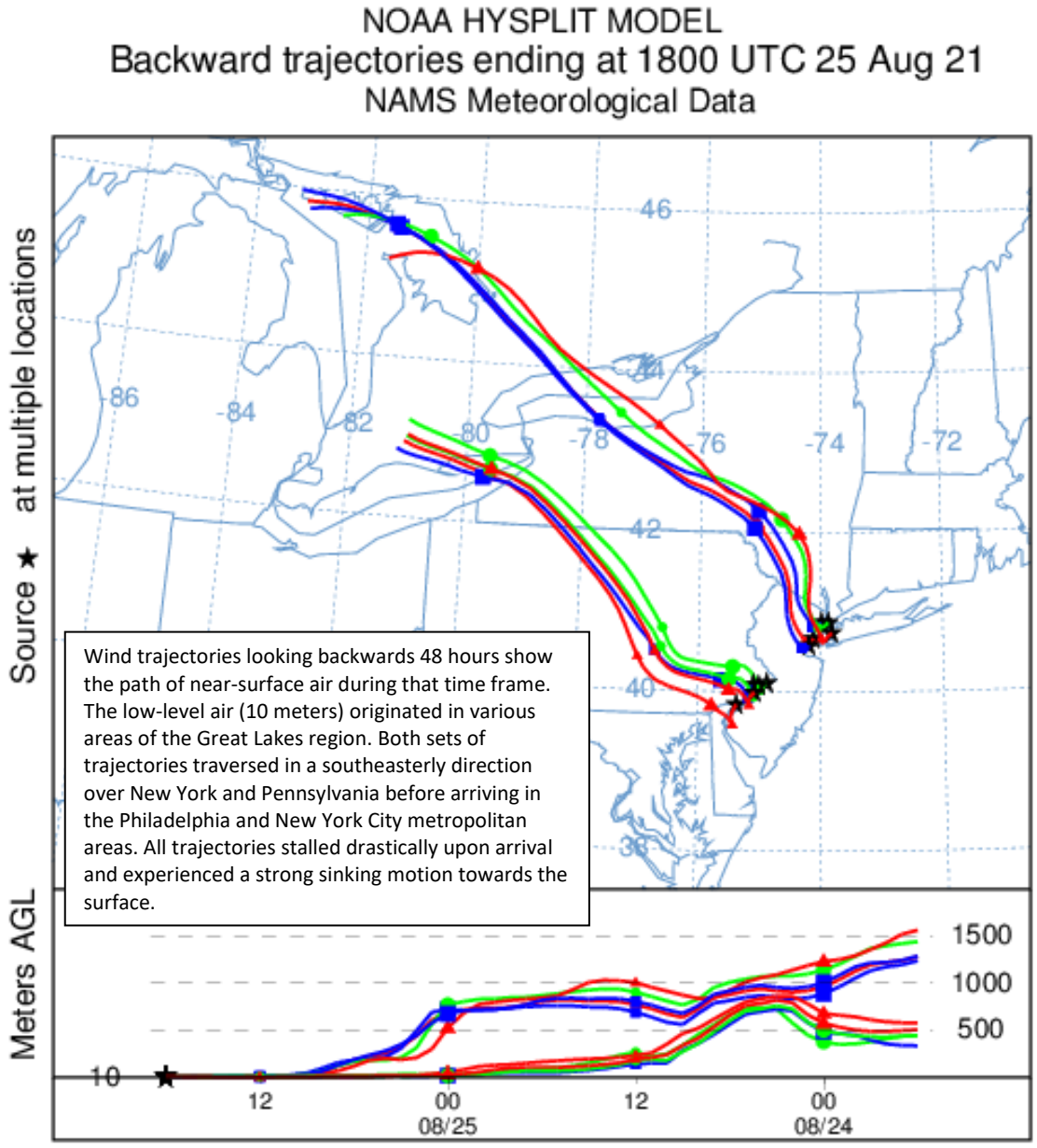


Figure 3. 48-hour Back Trajectories for August 25, 2021 at 500 meters

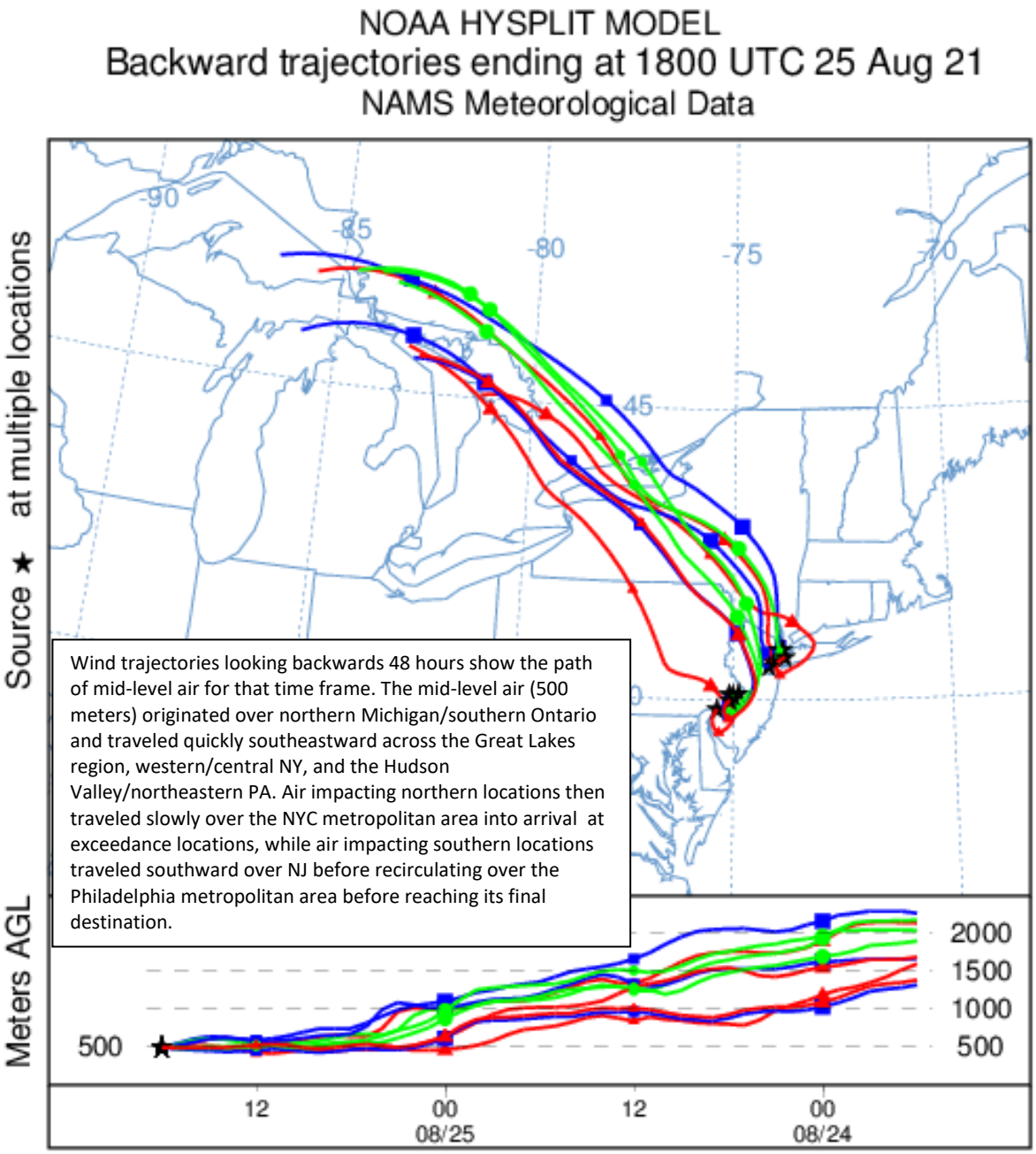


Figure 4. 48-hour Back Trajectories for August 25, 2021 at 1500 meters

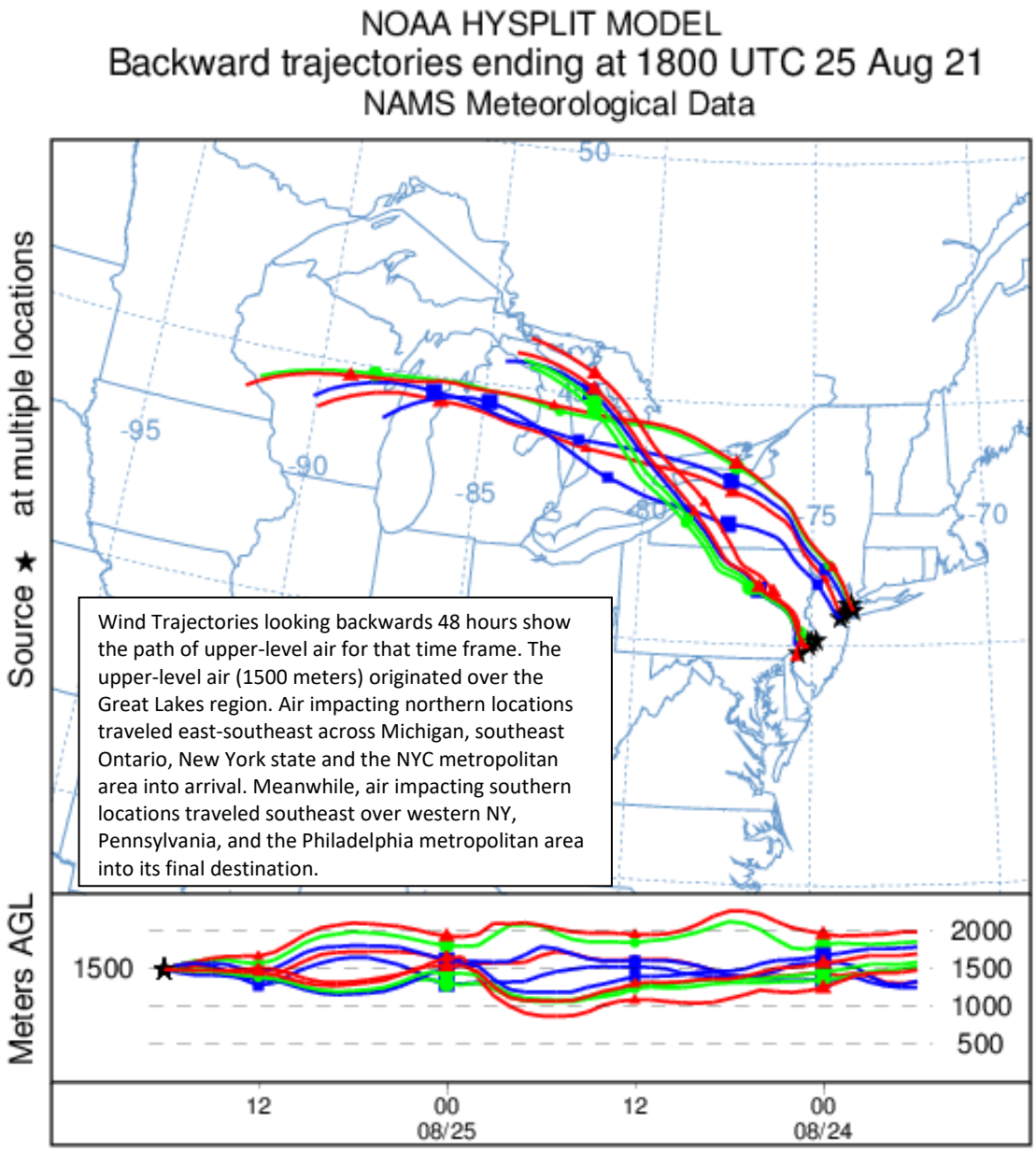
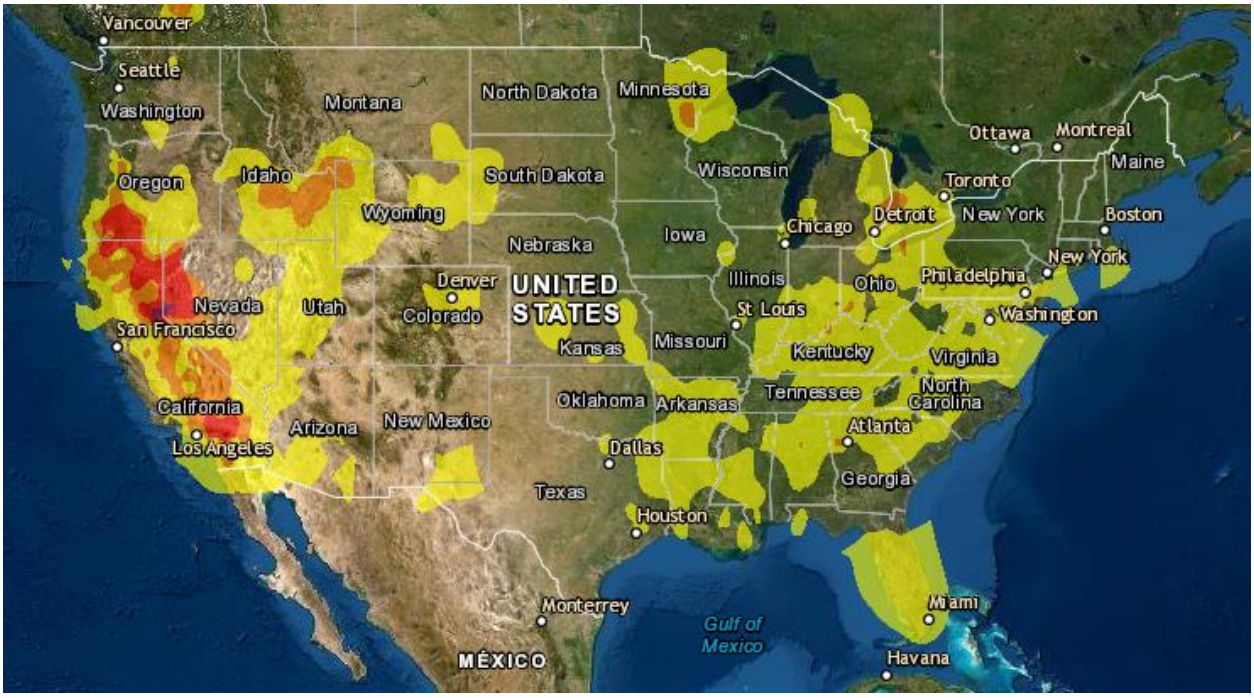


Figure 5. Combined Air Quality Index for the United States on August 24, 2021



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/ .