Ozone National Ambient Air Quality Standard Health Exceedances on August 13, 2021

On Friday, August 13, 2021, there were three (3) 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 8/13/2021

STATION	Daily Maximum 8-Hr Average (ppb)
Ancora State Hospital	62
Bayonne	78
Brigantine	52
Camden Spruce St	71
Chester	52
Clarksboro	67
Colliers Mills	64
Columbia	49
Flemington	56
Leonia	75
Millville	58
Monmouth University	65
Newark Firehouse	63
Ramapo	49
Rider University	62
Rutgers University	63
Washington Crossing*	59
TOTAL EXCEEDANCES	3

*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 sixteen (16) 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 8/13/2021

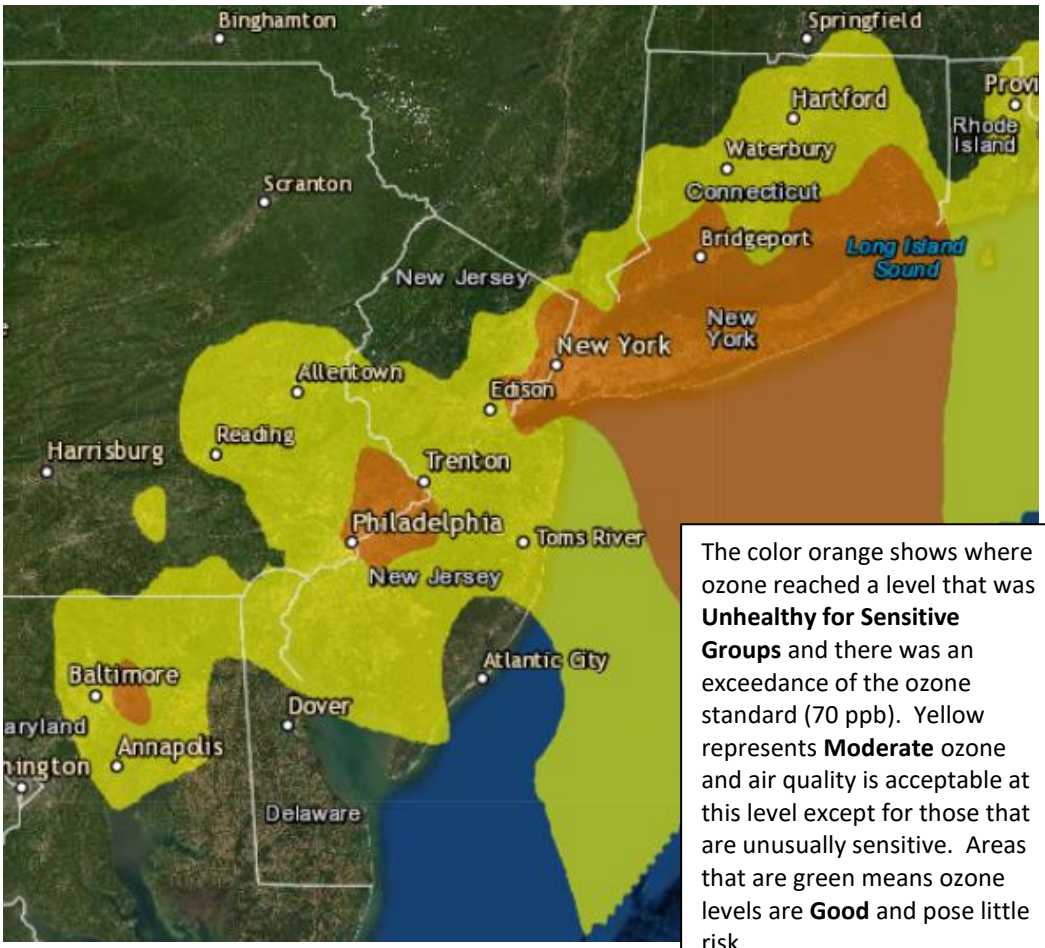
STATE	STATION	Daily Maximum 8-Hr Average (ppb)
CT	Danbury	59
CT	Greenwich	76
CT	Madison-Beach Road	73
CT	Middletown-CVH-Shed	66
CT	New Haven	63
CT	Stratford	80
CT	Westport	82
DE	BCSP (New Castle Co.)	53
DE	BELLFNT2 (New Castle Co.)	64
DE	KILLENS (Kent Co.)	51
DE	LEWES (Sussex Co.)	46
DE	LUMS 2 (New Castle Co.)	58
DE	MLK (New Castle Co.)	62
DE	SEAFORD (Sussex Co.)	50
MD	Fair Hill	58
NY	Babylon	80
NY	Bronx - IS52	76
NY	CCNY	78
NY	Flax Pond	75
NY	Fresh Kills	75
NY	Holtsville	58
NY	Pfizer Lab	76
NY	Queens	78
NY	Riverhead	76
NY	Rockland Cty	48
NY	White Plains	62
PA	BRIS (Bucks Co.)	77
PA	CHES (Delaware Co.)	66
PA	NEWG (Chester Co.)	52
PA	NORR (Montgomery Co.)	61
PA	LAB (Philadelphia Co.)	73
PA	NEA (Philadelphia Co.)	78
PA	NEW (Philadelphia Co.)	77
	TOTAL EXCEEDANCES	16

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 13, 2021 NAAQS = 70 ppb
Connecticut	18
Delaware	3
Maryland	3
New Jersey	9
New York	14
Pennsylvania	9

Figure 1. Ozone Air Quality Index for August 13, 2021



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 continued to dominate the weather pattern on Friday, August 13th, 2021, ahead of a slowly approaching cold front from the Great Lakes region. Favorable weather conditions in combination with the local/regional transport of emissions and previously polluted air allowed for elevated ozone levels across the nonattainment area. Several ozone exceedances were noted in the Philadelphia metropolitan area on this day with a more widespread event observed over the New York City metropolitan area, Long Island, and the Connecticut coastline.

A Bermuda High remained anchored over the western Atlantic Ocean for another day. This atmospheric setup allowed for continued sunshine as well as hot and humid conditions across the nonattainment area. A predominant surface trough was also noted on this day, extending from Maine southwest through southern New England, across the Long Island Sound and Long Island, through central New Jersey, and into the Mid-Atlantic region. This surface trough slowly progressed east and meandered along the coastline for much of the day. The placement of this trough not only allowed for vertical motion in the atmosphere, mixing any previously polluted air toward the surface but, it allowed for a varying wind pattern across the region. A south to southwesterly flow was noted in portions of the northern nonattainment area while locations south saw more of a southwest to westerly wind flow for much of the day. In each location, the transport of metropolitan emissions, as well as emissions from cars, trucks, and industry, enhanced ozone levels under the favorable weather conditions. Additionally, the Long Island Sound region saw multiple days of high ozone leading up to this event and it's likely that this previously polluted air further enhanced ozone levels in the northern nonattainment area on this day.

Overall, the ozone exceedances across the nonattainment area on Friday, August 13th can be attributed to favorable weather conditions for ozone formation as well as the localized/regional transport of emissions and previously polluted air.

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 13th shows that the exceedances were influenced by a Bermuda high pressure system along with local and regional transport into 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 13, 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)
CT	Greenwich	76
CT	Stratford	80
CT	Westport	82
NY	Babylon	80
NY	CCNY	78
NY	Queens	78
NJ	Camden Spruce St.	71
NJ	Leonia	75
PA	Bristol	77
PA	NEA	78

The surface-level back trajectories (Figure 2) show that air originated in a variety of locations. The first group of surface trajectories traversed a long distance spanning multiple states. Originating in Kansas and Tennessee, surface trajectories traveled in a general east-northeasterly direction across portions of the Mid-west, Ohio River Valley, and Pennsylvania, picking up emissions from these heavily industrialized regions. Upon arrival, this group of three trajectories passed over northern New Jersey and the New York City metropolitan center where it picked up additional emissions from cars and trucks before arriving at their destinations just downwind of the city. Meanwhile, the second group of trajectories made a more direct route generally following the I-95 corridor. Originating in northern Virginia and near the Washington D.C. metropolitan center, surface trajectories traveled in a northeasterly direction into Delaware and Pennsylvania. While following the I-95 corridor, this group of trajectories passed over multiple metropolitan centers including Philadelphia and New York City picking up emissions from cars, trucks, and industry. Along this path, trajectories deposited their emissions at various endpoints in multiple states leading to a multi-state exceedance event.

Mid and upper-level trajectories (Figure 3) followed similar transport pathways and originated across multiple states generally in Oklahoma and the southeast region. From here, mid-level trajectories traveled in an east-northeasterly direction across the Ohio River Valley while following the perimeter of high pressure. This path allowed trajectories to pick up additional emission poorly controlled electric generating units and large industrial sources while passing over this region. Upon entering Pennsylvania, some trajectories traveled over the Philadelphia suburbs, the metropolitan center and arrived at their endpoints shortly thereafter. Meanwhile, other trajectories passed over northern New Jersey and New York City before arriving at their destinations.

Figure 5 shows the National Air Quality Index observed on August 12th, the day prior to this exceedance event. As shown in the figure, air quality conditions were generally clean over the eastern half of the United States while some areas of moderate and USG air quality were observed in and around the urban areas of the nonattainment area. This indicates that localized emissions from the NYC/Philadelphia metropolitan areas and Long Island Sound region in combination with favorable weather conditions, likely contributed to the exceedances on August 13th.

Figure 2. 48-hour Back Trajectories for August 13, 2021 at 10 meters

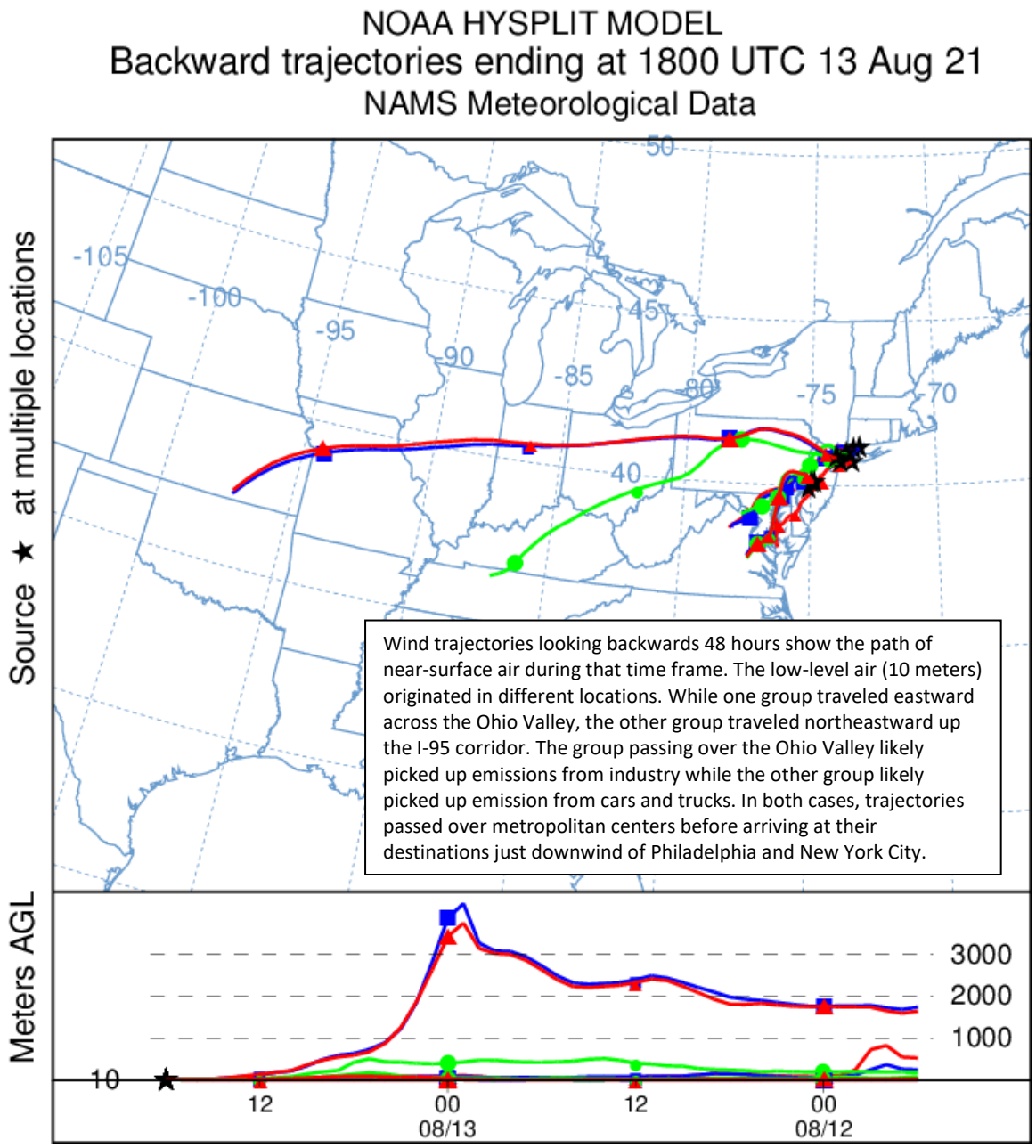


Figure 3. 48-hour Back Trajectories for August 13, 2021 at 500 meters

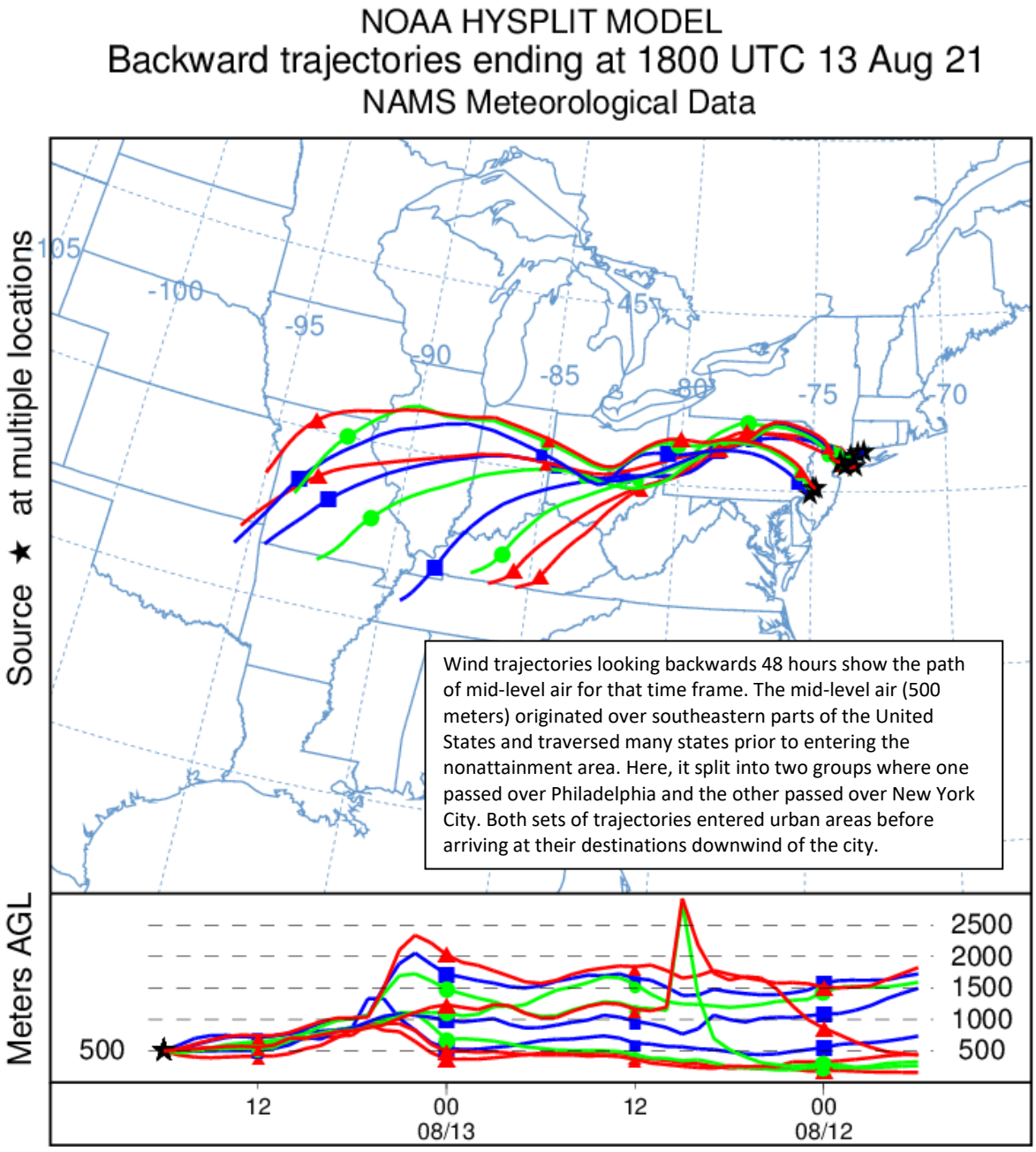


Figure 4. 48-hour Back Trajectories for August 13, 2021 at 1500 meters

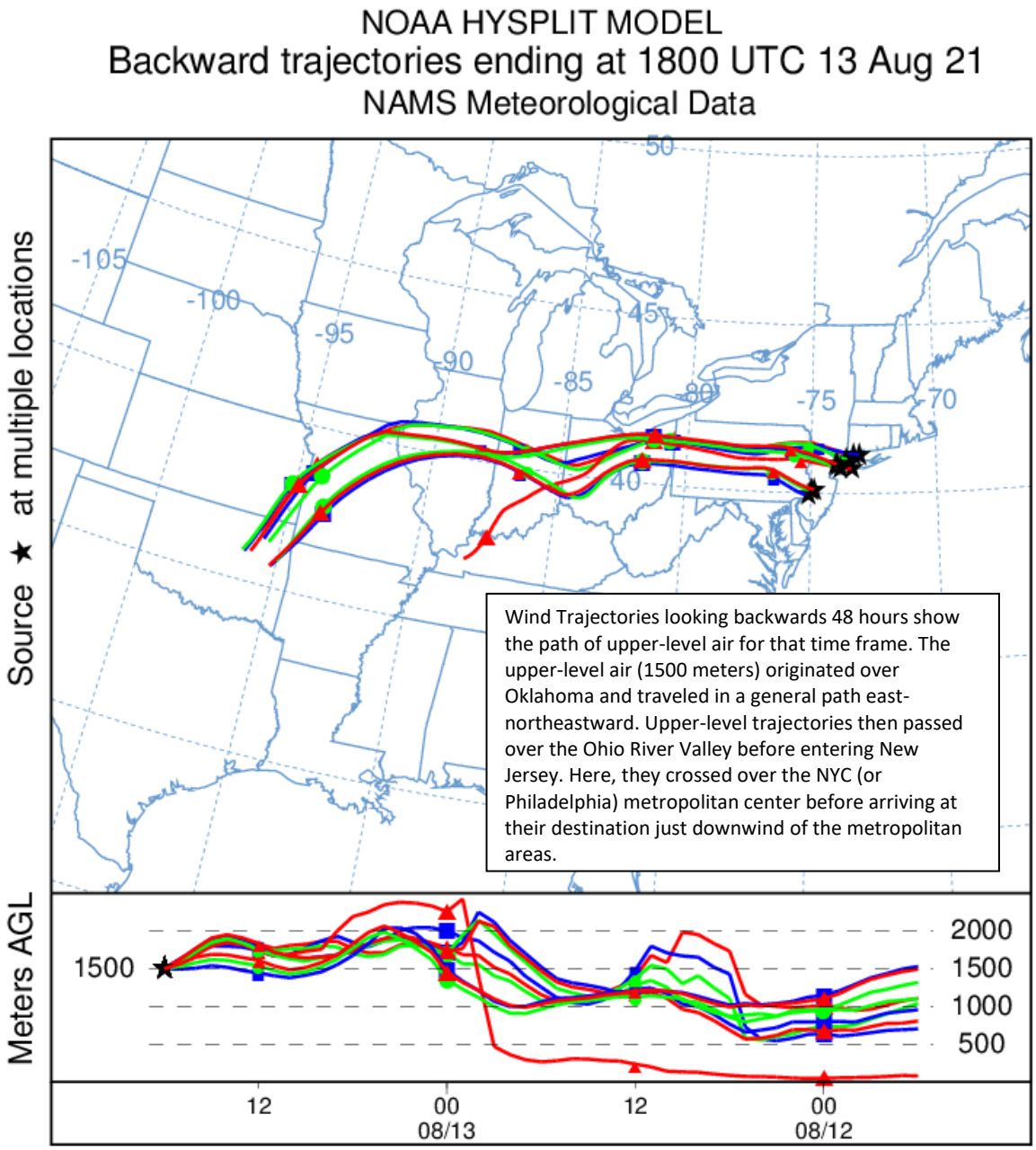
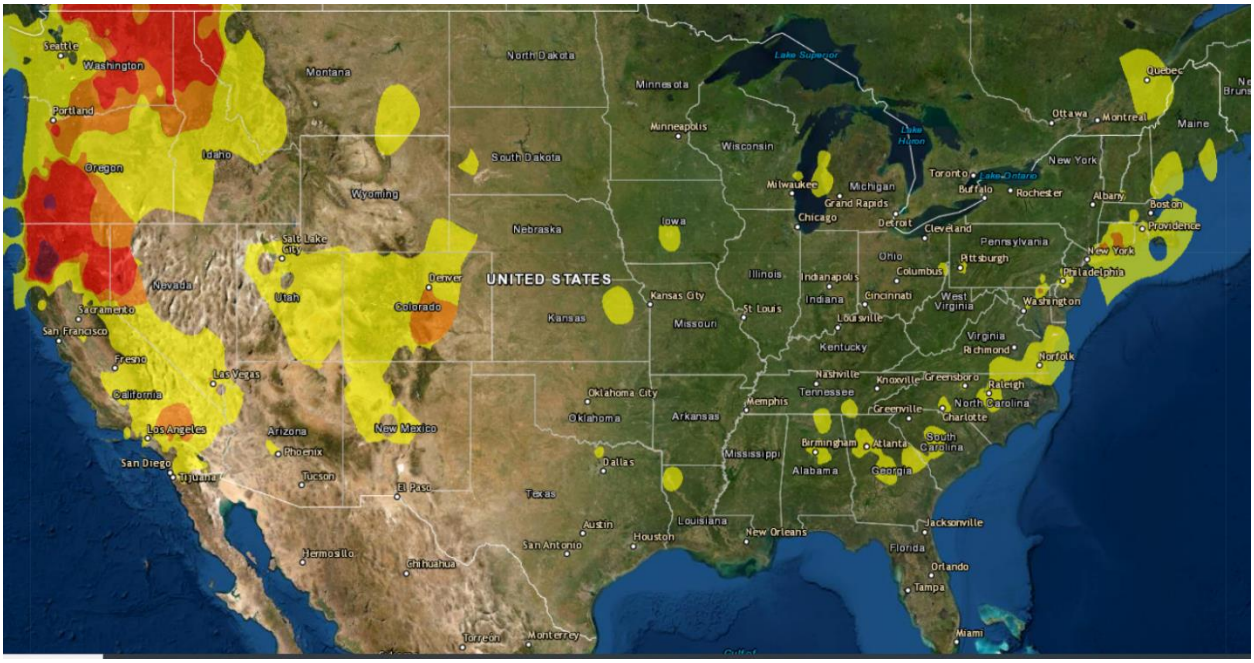


Figure 5. Ozone Air Quality Index for the United States on August 12, 2021



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/ .