Ozone National Ambient Air Quality Standard Health Exceedances on August 27, 2021

On Friday, August 27, 2021, there was one (1) exceedance 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 8/27/2021

STATION	Daily Maximum 8-Hr Average (ppb)
Ancora State Hospital	46
Bayonne	70
Brigantine	47
Camden Spruce St	56
Chester	47
Clarksboro	55
Colliers Mills	59
Columbia	35
Flemington	53
Leonia	62
Millville	44
Monmouth University	73
Newark Firehouse	59
Ramapo	43
Rider University	61
Rutgers University	60
Washington Crossing*	57
TOTAL EXCEEDANCES	1

*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 five (5) 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 8/27/2021

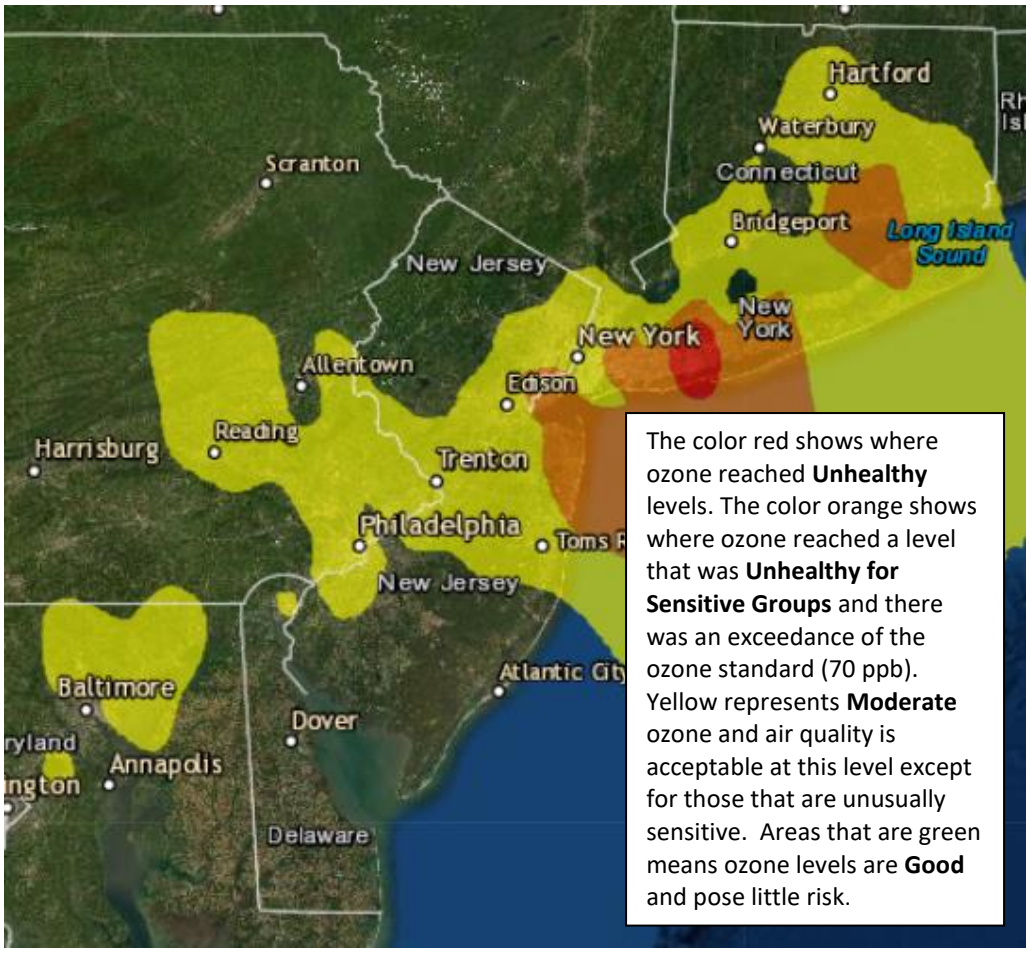
STATE	STATION	Daily Maximum 8-Hr Average (ppb)
CT	Danbury	45
CT	Greenwich	53
CT	Madison-Beach Road	84
CT	Middletown-CVH-Shed	63
CT	New Haven	52
CT	Stratford	65
CT	Westport	63
DE	BCSP (New Castle Co.)	43
DE	BELLFNT2 (New Castle Co.)	53
DE	KILLENS (Kent Co.)	45
DE	LEWES (Sussex Co.)	41
DE	LUMS 2 (New Castle Co.)	51
DE	MLK (New Castle Co.)	55
DE	SEAFORD (Sussex Co.)	47
MD	Fair Hill	54
NY	Babylon	87
NY	Bronx - IS52	63
NY	CCNY	63
NY	Flax Pond	52
NY	Fresh Kills	74
NY	Holtsville	81
NY	Pfizer Lab	61
NY	Queens	72
NY	Riverhead	59
NY	Rockland Cty	48
NY	White Plains	48
PA	BRIS (Bucks Co.)	58
PA	CHES (Delaware Co.)	55
PA	NEWG (Chester Co.)	47
PA	NORR (Montgomery Co.)	58
PA	LAB (Philadelphia Co.)	54
PA	NEA (Philadelphia Co.)	58
PA	NEW (Philadelphia Co.)	49
	TOTAL EXCEEDANCES	5

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 27, 2021 NAAQS = 70 ppb
Connecticut	20
Delaware	3
Maryland	3
New Jersey	12
New York	17
Pennsylvania	11

Figure 1. Ozone Air Quality Index for August 27, 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

High pressure persisted over the Mid-Atlantic region on Friday, August 27th, 2021, as a cold front was slow to approach the region from the north. Favorable weather conditions, in combination with the local/regional transport of emissions and previously polluted air, allowed for another day of widespread elevated ozone levels. Ozone exceedances were noted over far eastern locations of the nonattainment area on this day including, portions of Long Island/Staten Island, NY, and the Connecticut and New Jersey coastlines.

A Bermuda High, which dominated the weather pattern for several days, continued to impact the nonattainment area on Friday, providing the region with continued hot and humid conditions. A surface trough, extending from southern New England southwestward across the nonattainment area, allowed for a light and variable wind pattern on this day. This not only allowed for the localized transport of emissions from cars, trucks, and industry within the nonattainment area but additionally allowed for the regional transport of previously polluted air, which had been building for several days. Meanwhile, as a cold front slowly approached, scattered showers and thunderstorms developed across the nonattainment area in the early afternoon. As these storms progressed west to east, in the afternoon/evening hours, an increase in cloud cover was observed, leaving far eastern locations to see more of a mix of sun and clouds late in the day. It was likely the additional afternoon sunshine in these locations that contributed to the high ozone levels. Additionally, as the northern nonattainment area saw several days of high ozone leading up to this event, it's also likely that any vertical mixing associated with both the surface trough and the approaching thunderstorms, allowed for previously polluted air aloft to be mixed toward the surface, further increasing ozone levels.

Overall, the ozone exceedances observed over portions of the northern nonattainment area on Friday, August 27th can be attributed to favorable weather conditions for ozone formation as well as the local and regional transport of both 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 27th shows that the exceedances were influenced by a Bermuda high-pressure system and localized transport throughout the nonattainment area. The transport of localized 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 27, 2021. The figures illustrate where the air came from during the 48 hours preceding the 8-hour ozone standard exceedances. Six 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	Madison Beach	84
NY	Babylon	87
NY	Fresh Kills	74
NY	Holtsville	81
NY	Queens	72
NJ	Monmouth University	73

The surface-level back trajectories (Figure 2) show that air originated off the coast of Virginia and traveled generally in a northerly direction up the coastline. During the 48 hours preceding this event, surface level trajectories traveled very slowly, covering a very short distance. This allowed the air mass to grow increasingly polluted through transit while traveling over an area that observed unhealthy for sensitive groups ozone for several days prior. The trajectories traveling into Long Island and Connecticut followed this coastal path while hugging the New Jersey shoreline. At this time, trajectories stalled over Long Island where they likely picked up additional emissions from electric generation peaking units that may have been operating on this day. Meanwhile, surface trajectories traveling to New Jersey and Queens, entered southern New Jersey, and traveled over central New Jersey or Philadelphia before passing nearby the I-95 corridor and arriving at their destinations. These two trajectories likely picked up additional emissions from cars and trucks while traveling at ground level during transit.

The mid-level back trajectories (Figure 3) show that air originated over a variety of locations such as Pennsylvania, Maryland, and Virginia. While under the influence of high pressure and a surface trough, air at the mid-levels had the opportunity to follow high pressure circulation while originating in different locations. Three trajectories originated at points south of the nonattainment area and traveled northward over the Chesapeake Bay area and passed over the greater Washington D.C. metropolitan center. From here, trajectories made an eastward turn and traveled over southeastern Pennsylvania, and eventually passed over the New York City metropolitan center before arriving at their destinations. Meanwhile, the remaining three trajectories originated in northern Pennsylvania and upstate New York where they made a sharp hook toward the north before abruptly making a southward turn toward the Lower Hudson Valley.

The upper-level back trajectories (Figure 4) originated in Pennsylvania and traveled in a general eastward direction across the state, while others ventured slightly northward over New York. During transit, air traveled very slowly around the perimeter of high pressure, allowing the air mass to grow increasingly polluted from poorly controlled electric generating units and large industrial sources that may have been operating in these areas. Many trajectories made a slight southeast turn while passing over the Lower Hudson Valley and the greater New York City metropolitan center before reaching their destinations. Here, trajectories likely picked up emissions from the city and transported them to locations just downwind.

Figure 5 shows the National Air Quality Index observed on August 26th, the day prior to this exceedance event. As shown in the figure, widespread areas of moderate air quality, as well as some areas reaching the unhealthy for sensitive groups and unhealthy categories, were observed throughout the region. This

indicates that both local and long-range transport of previously polluted air and transport of local and region emissions were present. These conditions combined with favorable meteorological conditions led to the widespread ozone exceedances across the nonattainment area on August 27th.

Figure 2. 48-hour Back Trajectories for August 27, 2021 at 10 meters

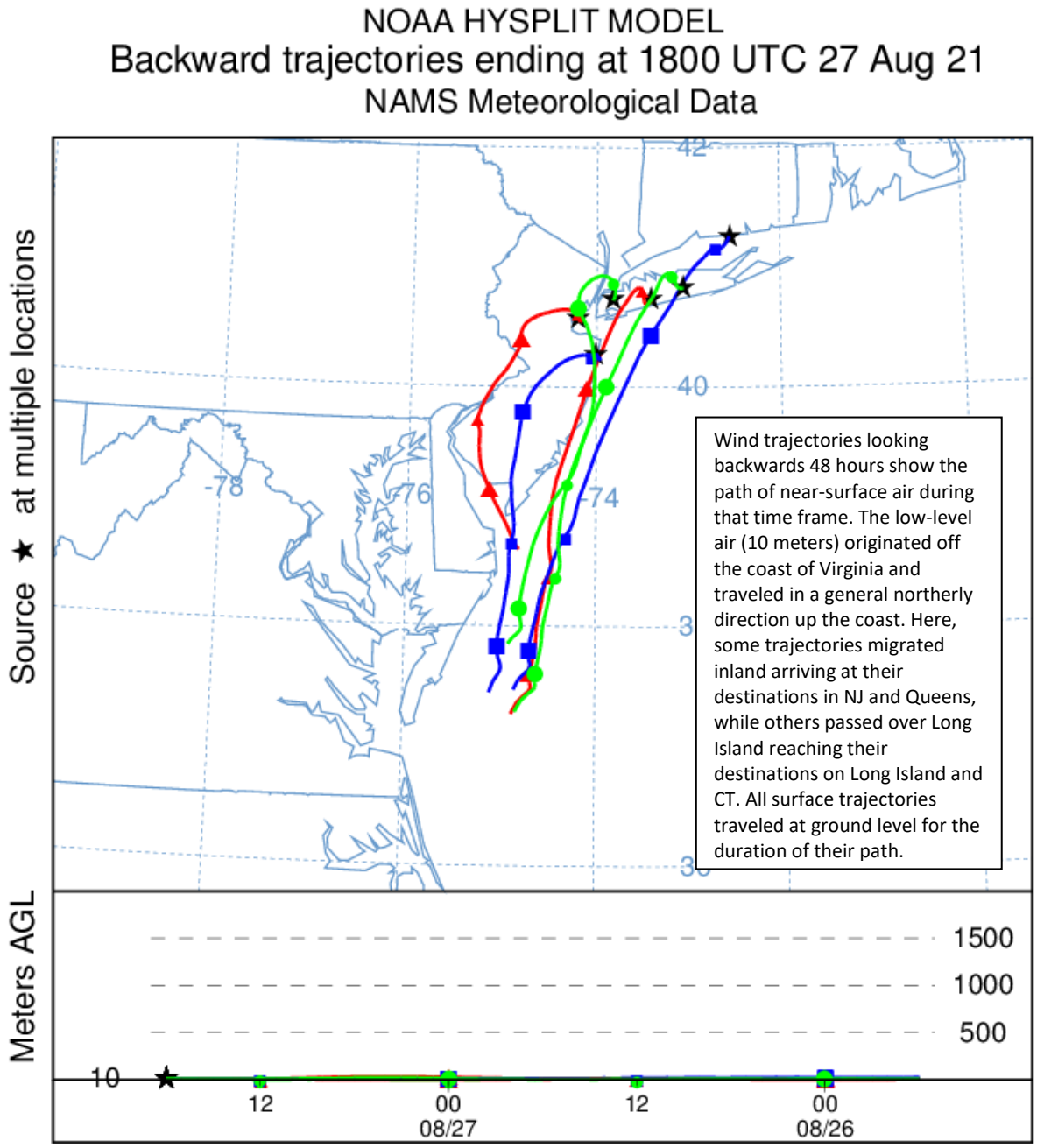


Figure 3. 48-hour Back Trajectories for August 27, 2021 at 500 meters

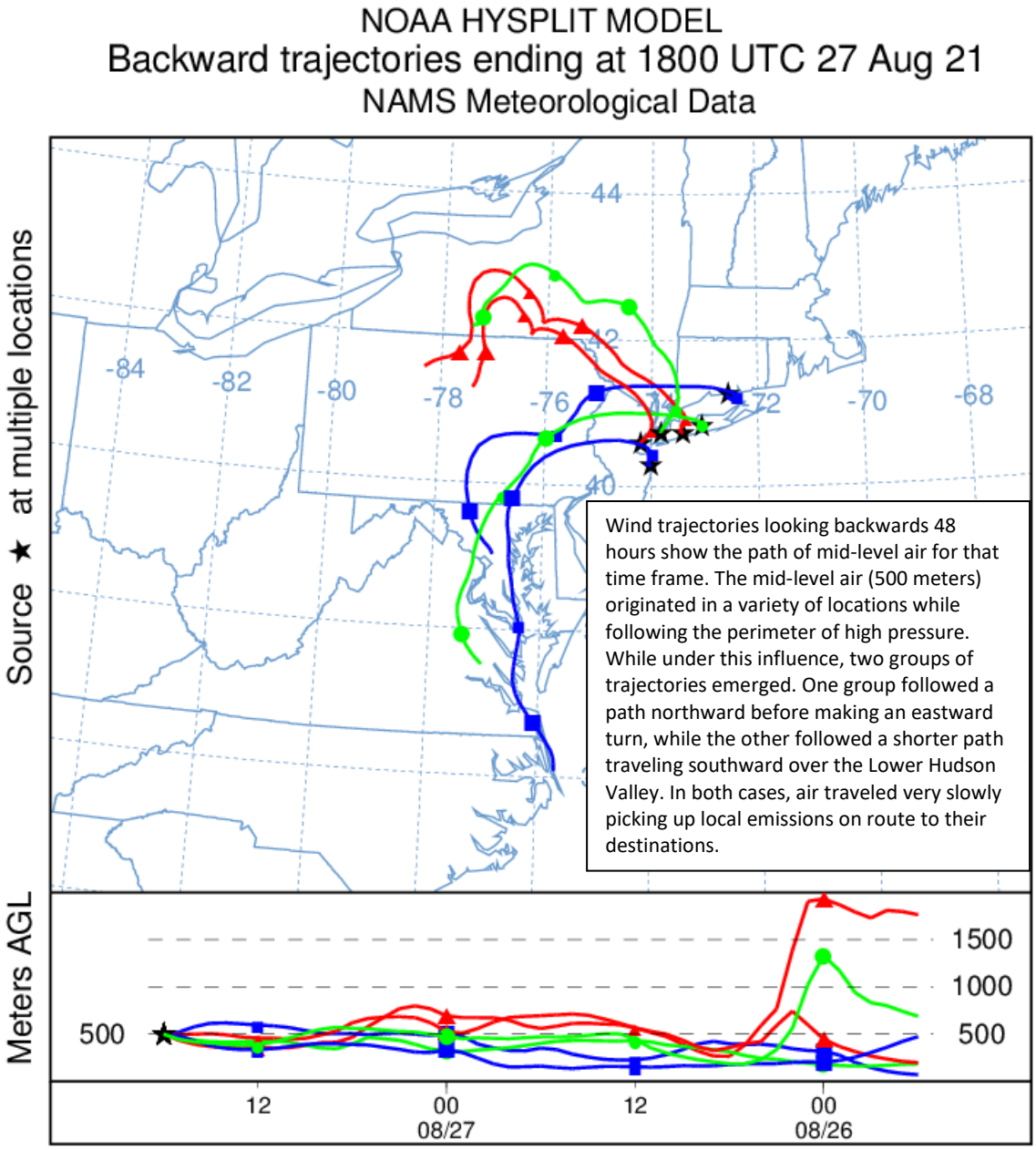


Figure 4. 48-hour Back Trajectories for August 27, 2021 at 1500 meters

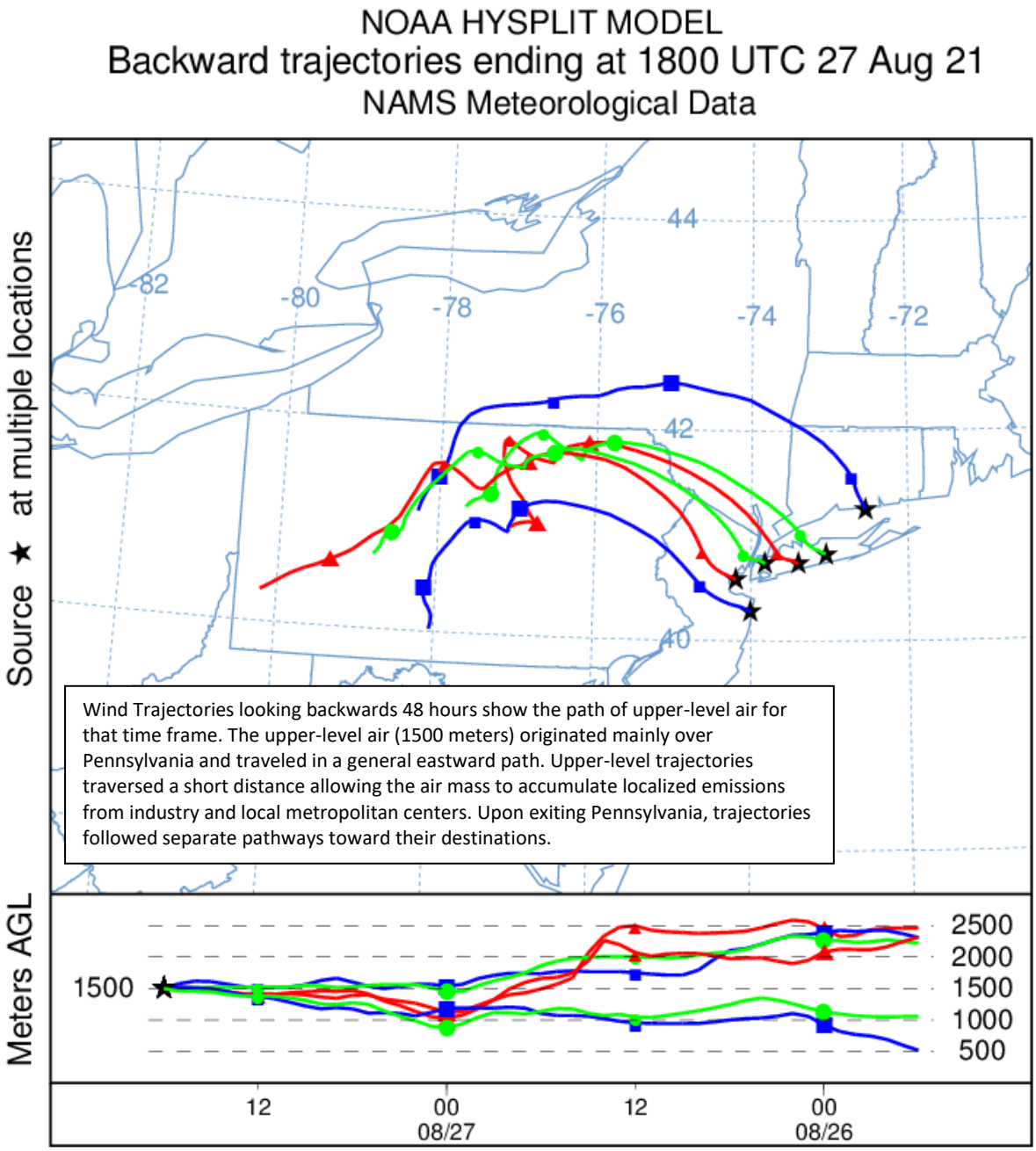
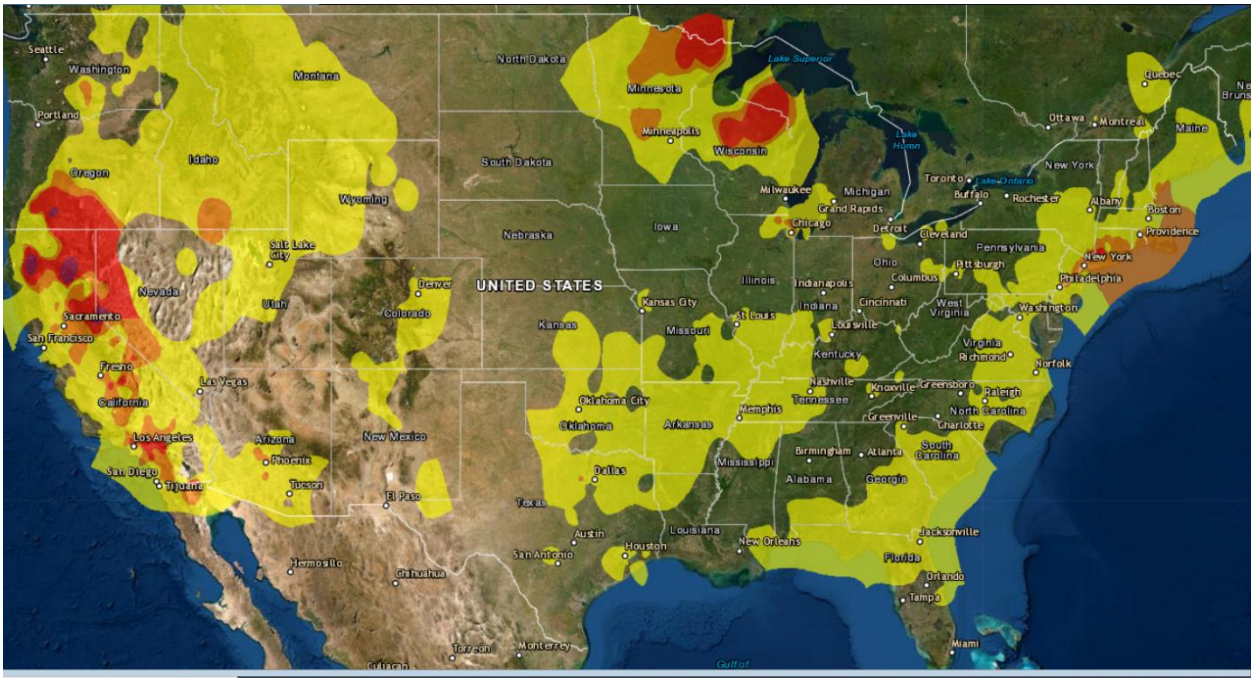


Figure 5. Combined Air Quality Index for the United States on August 26, 2021



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/ .