Ozone National Ambient Air Quality Standard Health Exceedances on August 26, 2021

On Thursday, August 26, 2021, there were six (6) 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 8/26/2021

STATION	Daily Maximum 8-Hr Average (ppb)
Ancora State Hospital	49
Bayonne	72
Brigantine	40
Camden Spruce St	60
Chester	63
Clarksboro	56
Colliers Mills	58
Columbia	62
Flemington	59
Leonia	84
Millville	47
Monmouth University	54
Newark Firehouse	72
Ramapo	62
Rider University	72
Rutgers University	72
Washington Crossing*	82
TOTAL EXCEEDANCES	6

*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 non-attainment areas, there were nineteen (19) exceedances of the ozone NAAQS. See Table 2.

Table 2. Ozone Concentrations at Out-of-State Monitoring Stations in New Jersey's Ozone Non-Attainment Areas on 8/26/2021

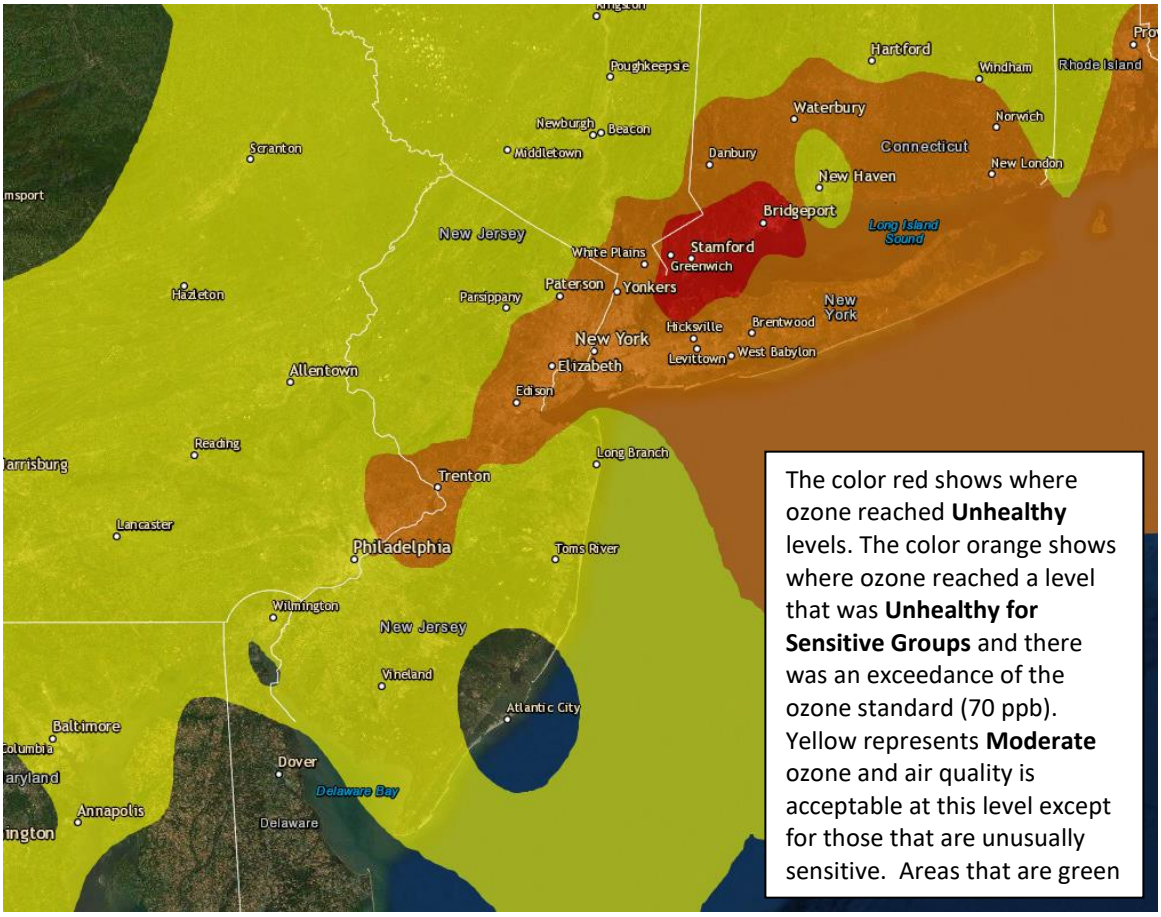
STATE	STATION	Daily Maximum 8-Hr Average (ppb)
CT	Danbury	74
CT	Greenwich	94
CT	Madison-Beach Road	85
CT	Middletown-CVH-Shed	79
CT	New Haven	67
CT	Stratford	87
CT	Westport	99
DE	BCSP (New Castle Co.)	52
DE	BELLFNT2 (New Castle Co.)	58
DE	KILLENS (Kent Co.)	43
DE	LEWES (Sussex Co.)	33
DE	LUMS 2 (New Castle Co.)	47
DE	MLK (New Castle Co.)	57
DE	SEAFORD (Sussex Co.)	40
MD	Fair Hill	60
NY	Babylon	79
NY	Bronx - IS52	80
NY	CCNY	81
NY	Flax Pond	82
NY	Fresh Kills	74
NY	Holtsville	81
NY	Pfizer Lab	85
NY	Queens	74
NY	Riverhead	80
NY	Rockland Cty	69
NY	White Plains	83
PA	BRIS (Bucks Co.)	80
PA	CHES (Delaware Co.)	62
PA	NEWG (Chester Co.)	54
PA	NORR (Montgomery Co.)	65
PA	LAB (Philadelphia Co.)	66
PA	NEA (Philadelphia Co.)	72
PA	NEW (Philadelphia Co.)	71
	TOTAL EXCEEDANCES	19

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

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

STATE	# of Days NAAQS was Exceeded January 1 – August 26, 2021 NAAQS = 70 ppb
Connecticut	19
Delaware	3
Maryland	3
New Jersey	11
New York	16
Pennsylvania	11

Figure 1. Ozone Air Quality Index for August 26, 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 Thursday, August 26th, a strong Bermuda high pressure system remained anchored off the Mid-Atlantic coast, resulting in several favorable meteorological conditions conducive to ozone formation. These favorable conditions, along with local and regional transport of pollutants to a previously polluted air mass, allowed for numerous ozone exceedances across the nonattainment area.

A large Bermuda high pressure circulation extending west covered much of the eastern United States on Thursday for the third day in a row. This once again provided mostly sunny skies, persistent high temperatures, and very light winds out of the south-southwest. Patchy fog and calm winds were noted in the early morning hours, with a surface trough in place across the I-95 corridor from the previous day. Although the surface trough dissipated by late-morning, it helped to mix any residual ozone aloft down to the surface and cause a rapid spike in ozone levels throughout the morning. Elevated ozone levels were observed overnight at the higher elevation monitors (Chester and Ramapo), indicating that residual ozone from the day prior was lingering aloft, and was transported to the surface under the influence of high pressure and the surface trough. As the day progressed, temperatures quickly soared into the low to mid 90's for the majority of New Jersey, with very light winds observed generally out of the south-southwest. This light flow allowed for the localized transport and gradual buildup of emissions from cars, trucks, and industry from the I-95 corridor and New York City metropolitan area.

With these conducive meteorological conditions present and a previously polluted air mass in place, ozone levels were able to drastically increase across the nonattainment zone. As a result, widespread unhealthy for sensitive groups (USG) was observed throughout the I-95 corridor, NYC metropolitan area, and Long Island, with 3 monitors in coastal Connecticut reaching unhealthy ozone levels.

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 26th shows that the exceedances were influenced by a high-pressure system along with 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 26, 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	72
NJ	Leonia	84
NJ	Newark Firehouse	72
NJ	Rutgers University	72
NJ	Rider University	72
NY	Queens	74
NY	Holtsville	81
CT	Westport	99
CT	Madison-Beach Road	85
PA	NEA	72

The surface-level back trajectories (Figure 2) show that air originated throughout various locations to the west, with some originating over the Chesapeake Bay, and others over far eastern Pennsylvania. The trajectory paths are very short, suggesting that air was stagnant leading up to the exceedances, allowing for a buildup of pollutants. From their points of origin, trajectories then moved in an easterly direction over New Jersey, with others moving just offshore of Delaware and over the Delaware Bay. Trajectories then made a sharp turn northward as a surface trough developed over the area, turning winds southerly. Air continued to move in a north-northeasterly direction, where trajectories with endpoints in Philadelphia, New Jersey, and New York traveled over New Jersey and along the I-95 corridor before reaching their destinations. Meanwhile, the trajectories with endpoints in Long Island and Connecticut traveled along the coast and into Long Island, where one trajectory reached its destination and two others traveled over the Long Island Sound and onto the Connecticut coastline. There was also little vertical motion present, indicating that air at this level traveled mainly along the surface, picking up localized emissions from cars, trucks, and industry along the way.

The mid-level back trajectories (Figure 3) show that air originated over many locations along the Mid-Atlantic. Some of the trajectories started in eastern Pennsylvania and slowly moved southeastward until, under the influence of a surface trough, they quickly turned clockwise over the Chesapeake Bay. From here, they traveled in a northeastward direction before reaching their endpoints in various places along the I-95 corridor in Pennsylvania, New Jersey, New York, and Connecticut. The rest of the trajectories started in Maryland, with one trajectory originating as far south as South Carolina. These trajectories then traveled northward through the Chesapeake Bay and along the I-95 corridor, where they reached their final destinations, again at various places along the I-95 corridor. Air continued to move slowly over the area, with a gentle sinking motion present, suggesting that previously polluted air transported aloft from upwind states was able to mix down to the surface, and gather additional emissions from local industry.

The upper-level back trajectories (Figure 4) originated, again, in various locations. One trajectory originated over the Great Lakes Region, and traveled over New York and into Connecticut where it reached its destination along the coast. Another trajectory originated over the Maryland and West Virginia border, moving south before making a clockwise turn toward the northeast and reaching its

destination in Philadelphia. The rest of the trajectories originated in Pennsylvania, moving in a southeastward direction until making a clockwise turn toward the north over the Chesapeake Bay, similar to the paths taken by the air at other levels. After traveling over Philadelphia, the air traveled over the I-95 corridor where trajectories reached their endpoints in New Jersey, New York, and Connecticut, with one ending over Long Island. Air at this level traveled very slowly, allowing for pollutants to build up from the previous days, and for even more local and regional pollutants to build up as the day progressed.

Figure 5 shows the National Air Quality Index observed on August 25th, 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 category, 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 26th.

Figure 2. 48-hour Back Trajectories for August 26, 2021 at 10 meters

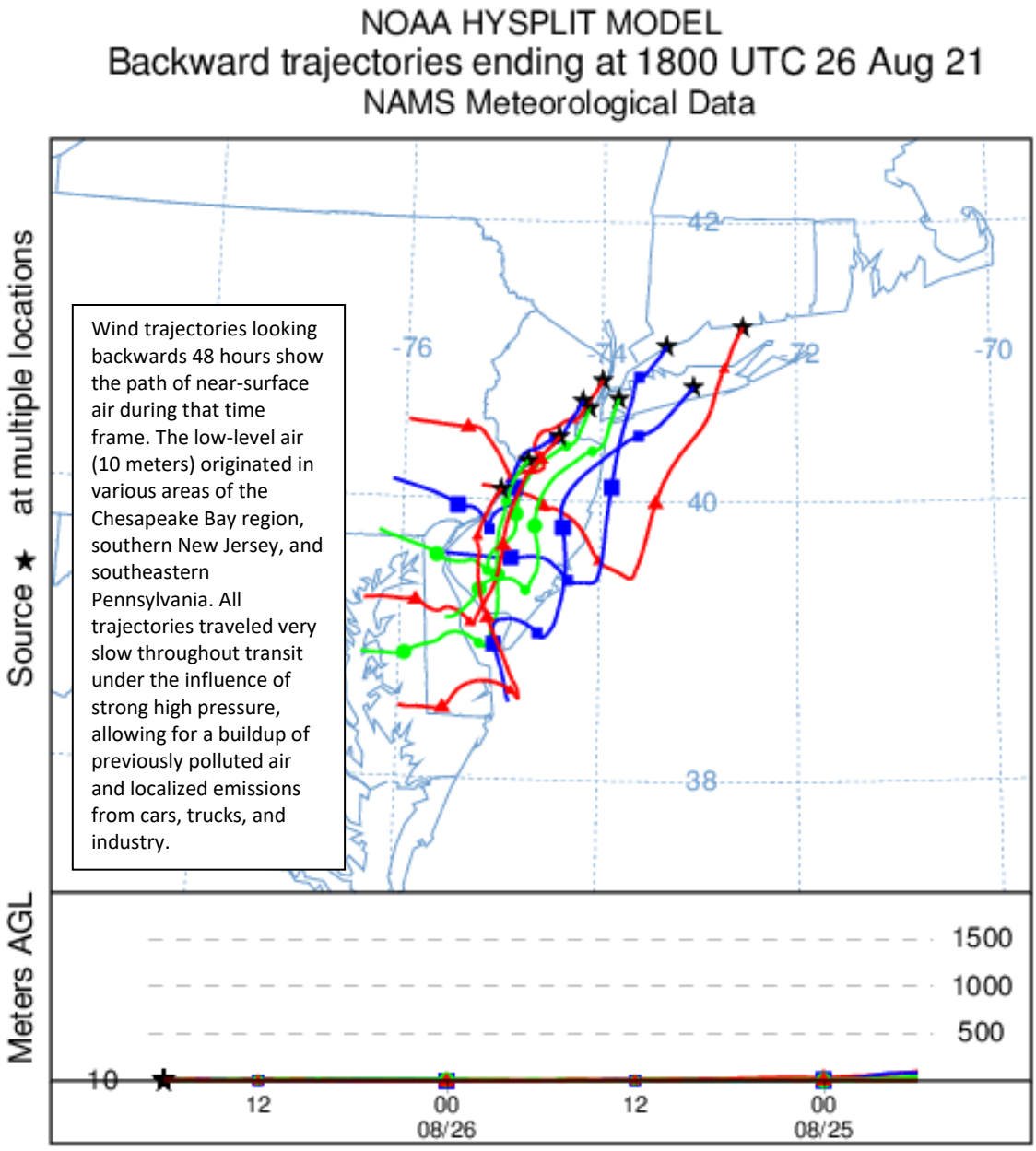


Figure 3. 48-hour Back Trajectories for August 26, 2021 at 500 meters

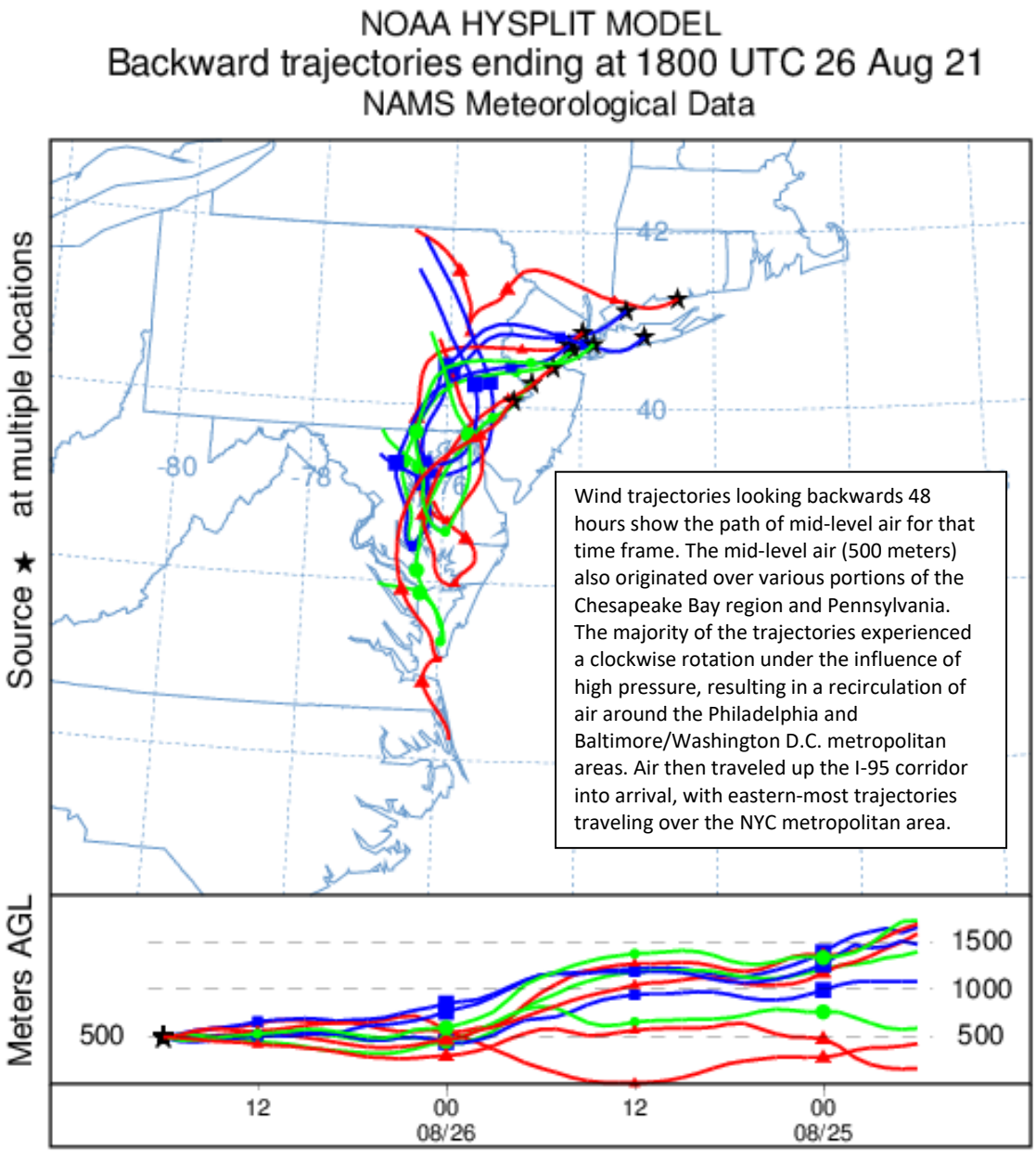


Figure 4. 48-hour Back Trajectories for August 26, 2021 at 1500 meters

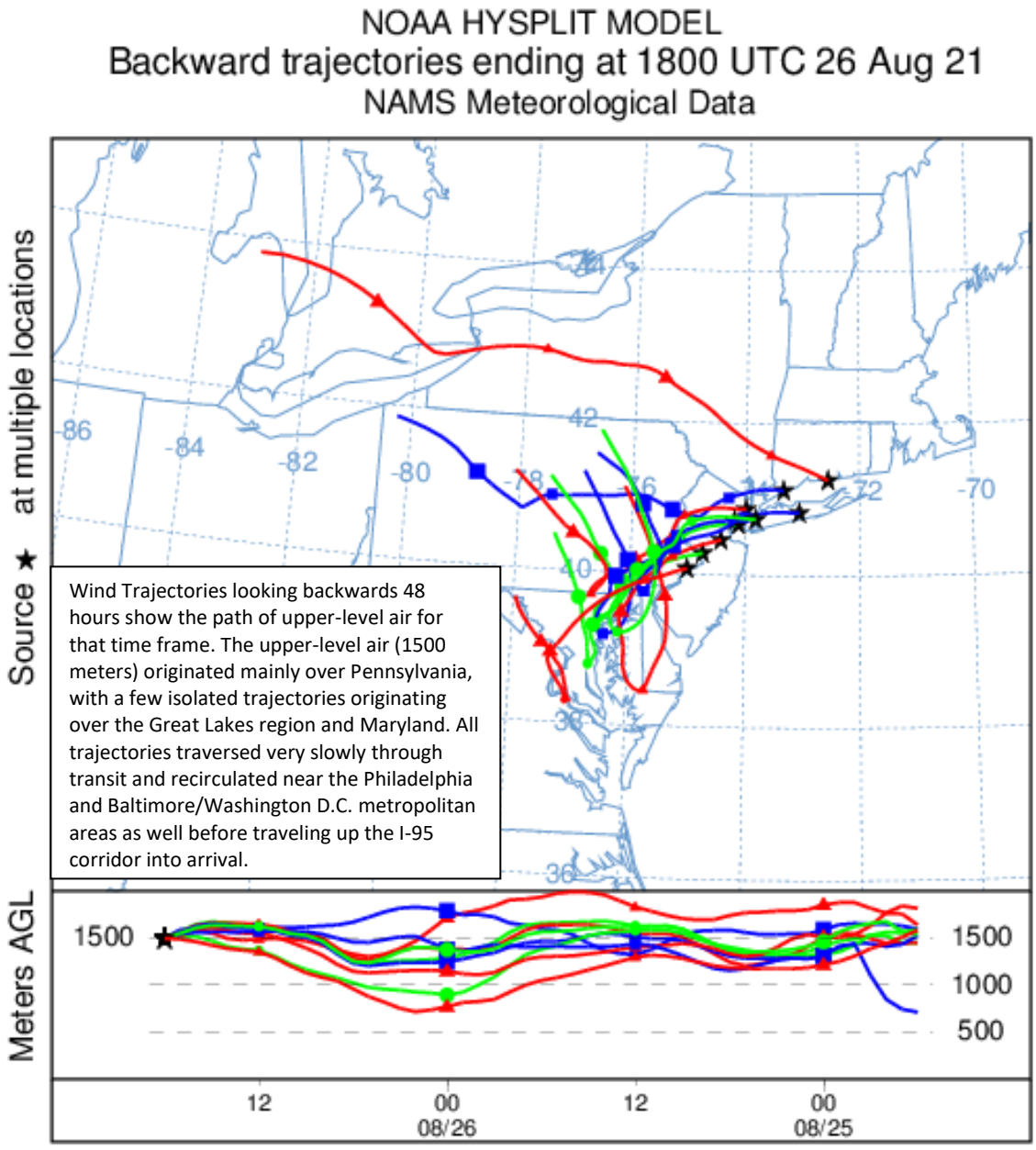
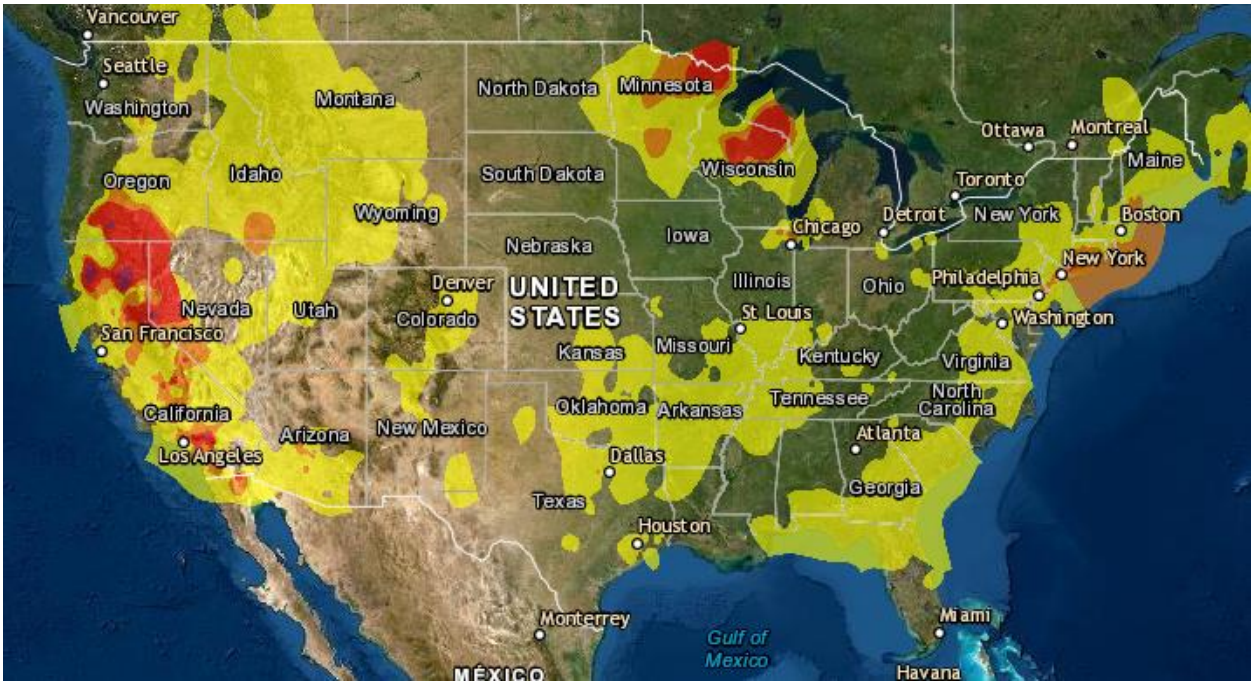


Figure 5. Combined Air Quality Index for the United States on August 25, 2021



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/ .