2002 Ozone Summary

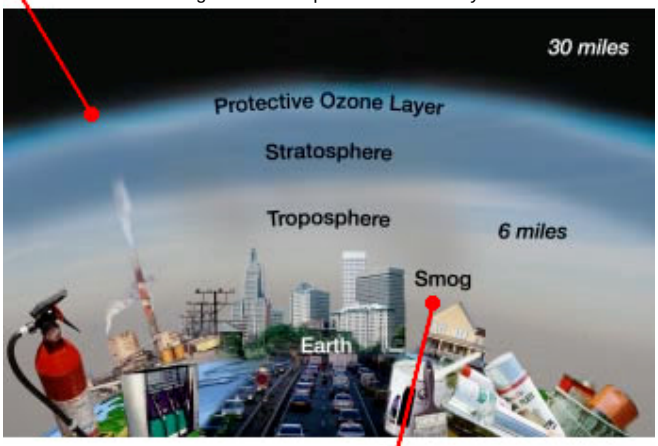
New Jersey Department of Environmental Protection

Nature and Sources

Ozone (O_3) is a gas consisting of three oxygen atoms. It occurs naturally in the upper atmosphere (stratospheric ozone) where it protects us from harmful ultraviolet rays (see Figure 1). However, at ground-level (tropospheric ozone) it is considered an air pollutant and can have serious adverse health effects. Ground-level ozone is created when nitrogen oxides (NOx) and volatile organic compounds (VOC's) react in the presence of sunlight and heat. NOx is primarily emitted by motor vehicles, power plants, and other sources of combustion. VOC's are emitted from sources such as motor vehicles, chemical plants, factories, consumer and commercial products, and even natural sources such as trees. Ozone and the pollutants that form ozone (precursor pollutants) can also be transported into an area from sources hundreds of miles upwind.

Figure 1: Good and Bad Ozone

Ozone is good up here…Many popular consumer products like air conditioners and refrigerators involve CFCs or halons during either manufacturing or use. Over time, these chemicals damage the earth's protective ozone layer.



Ozone is bad down here… Cars, trucks, power plants and factories all emit air pollution that forms ground-level ozone, a primary component of smog.

Source: EPA

Since ground-level ozone needs sunlight to form, it is mainly a daytime problem during the summer months. Weather patterns have a significant effect on ozone formation and hot, dry summers will result in more ozone than cool, wet ones. In New Jersey, the ozone season runs from April 1st to October 31st, although unhealthy conditions are rare before mid-May or after the first few weeks of September. For a more complete explanation of the difference between ozone in the upper and lower atmosphere, see the U.S. Environmental Protection Agency (EPA) publication "Ozone: Good Up High, Bad Nearby".

Environmental Effects

Ground-level ozone damages plant life and is responsible for 500 million dollars in reduced crop production in the United States each year. It interferes with the ability of plants to produce and store food, making them more susceptible to disease, insects, other pollutants, and harsh weather. "Bad" ozone damages the foliage of trees and other plants, sometimes marring the landscape of cities, national parks and forests, and recreation areas. The black areas on the leaves of the blackberry bush and sassafras tree shown in Figure 2 and Figure 3 is damage caused by exposure to ground-level ozone. (Figure 2 and 3 Photos by: Teague Prichard, Wisconsin Department of Natural Resources)

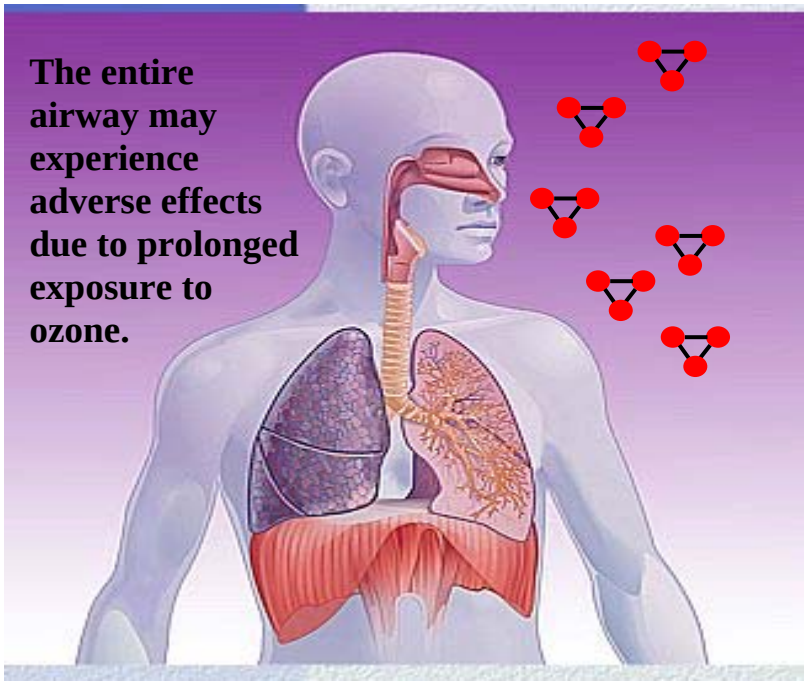
Figure 2: Ozone Damage to Blackberry Bush

Figure 3: Ozone Damage to Sassafras Tree

Health Effects

Repeated exposure to ozone pollution may cause permanent damage to the lungs. Even when ozone is present in low levels, inhaling it can trigger a variety of health problems including chest pains, coughing, nausea, throat irritation, and congestion. Ozone also can aggravate other health problems such as bronchitis, heart disease, emphysema, and asthma, and can reduce lung capacity. People with pre-existing respiratory ailments are especially prone to the effects of ozone. For example, asthmatics affected by ozone may have more frequent or severe attacks during periods when ozone levels are high. As shown in Figure 4 ozone can irritate the entire respiratory tract. Children are also at risk for ozone related problems. Their respiratory systems are still developing and they breathe more air per pound of body weight than adults. They are also generally active outdoors during the summer when ozone levels are at their highest. Anyone who spends time outdoors in the summer can be affected and studies have shown that even healthy adults can experience difficulty in breathing when exposed to ozone. Anyone engaged in strenuous outdoor activities, such as jogging, should limit activity to the early morning or late evening hours on days when ozone levels are expected to be high.

Figure 4



Area of the Respiratory Tract that may be Affected by Ozone

Ambient Air Quality Standards for Ozone

National and state air quality standards have been established for ground-level ozone. There are both primary standards, which are based on health effects, and secondary standards, which are based on welfare effects (e.g. damage to trees, crops and materials). For ground-level ozone, the primary and secondary National Ambient Air Quality Standards (NAAQS) are the same (see Table 1). The ozone NAAQS were revised in 1997 because EPA had determined that the old standard of 0.12 parts per million (ppm) maximum daily one-hour average was not sufficiently protective of public health. They set a revised standard of 0.08 ppm maximum daily eight-hour average. The standard changes were challenged in court but eventually upheld. As many people are accustomed to the old standards, summary information relative to that standard will be provided in this report along with summaries based on the new standard.

Table 1
National and New Jersey Ambient Air Quality Standards for Ozone

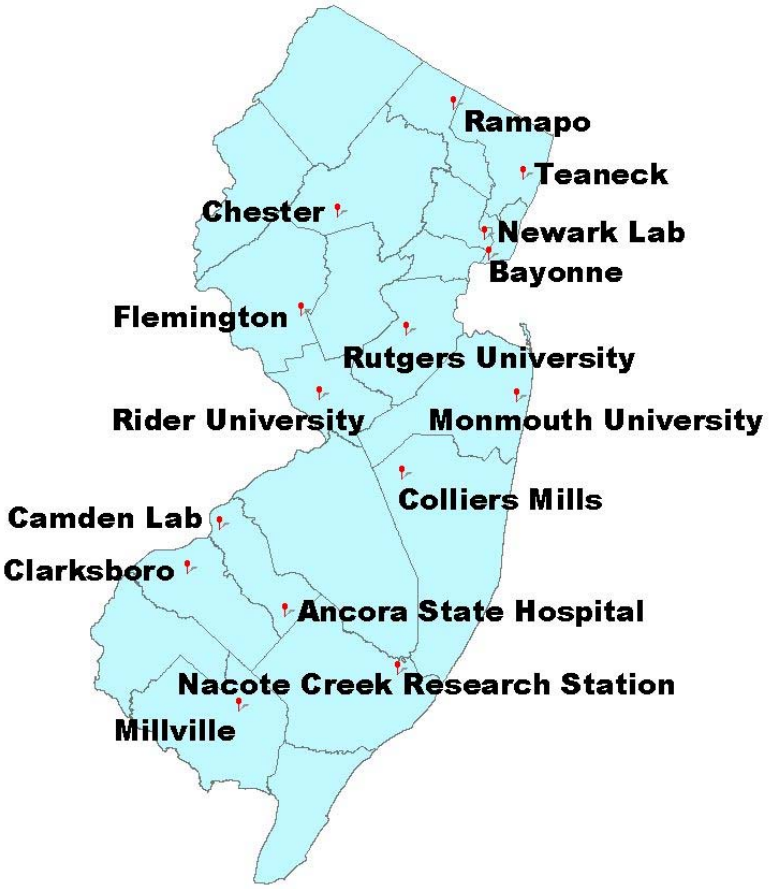
ppm = Parts per Million

Averaging Period	Type	New Jersey	National
1-Hour	Primary	0.12 ppm	0.12 ppm
1-Hour	Secondary	0.08 ppm	0.12 ppm
8-Hour	Primary	-----	0.08 ppm
8-Hour	Secondary	-----	0.08 ppm

Ozone Network

Ozone was monitored at 15 locations in New Jersey during 2002. Of those 15 sites, 12 operated year round and 3 operated only during the ozone season (April 1st through October 31st). The location of the sites are shown in Figure 5.

Figure 5
2002 Ozone Monitoring Network



Design Values

The NAAQS for ozone are set in such a way that determining whether they are being attained is not based on a single year. For example, an area was considered to be attaining the old 1-hour average standard if the average number of times the standard was exceeded over a three-year period was 1 or less (after correcting for missing data). Thus it was the fourth highest daily maximum 1-hour concentration that occurred over a three-year period that determined if an area would be in attainment. If the fourth highest value was above 0.12 ppm then the average number of exceedances would be greater than 1. The fourth highest value is also known as the design value.

Under the new standard, attainment is determined by taking the average of the 4th highest daily maximum 8-hour average concentration that is recorded each year for three years. This becomes the design value for an area under the new standard. When plans are developed for reducing ozone concentrations, an area must demonstrate that the ozone reduction achieved will be sufficient to ensure the design value will be below the NAAQS, as opposed to ensuring that the standards are never exceeded. This avoids having to develop plans based on extremely rare events.

Figure 6 and 7 show the design value for the 1 and 8-hour standards starting with the 1986-1988 period. Design values are calculated for all ozone sites in the network and the median, maximum and minimum for each year were used in the graphics.

Figure 6

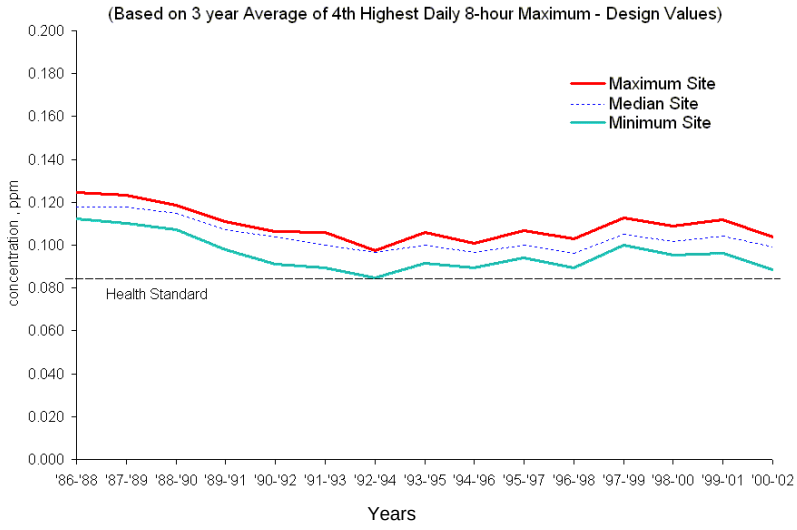
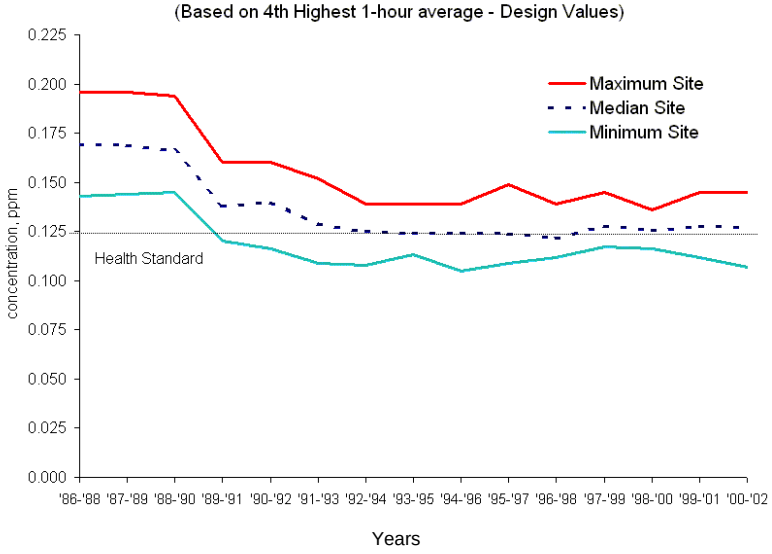


Figure 7



How the Changes to the Ozone Standards Affect Air Quality Ratings

In 2002 there were 16 days on which the old standard was exceeded in New Jersey and 44 days on which the new standard was exceeded. Significant progress was being made towards meeting the old standards (see Figure 8 below). There are fewer days on which that standard is exceeded, and when it is, fewer sites tend to be involved. Also, the maximum levels reached are not as high as they were in the past. The maximum 1-hour average concentration recorded in 1988 was 0.218 ppm, compared to a maximum of 0.153 ppm in 2002.

It is apparent, however, that the current standard is significantly more stringent than the old one (compare Figure 8 to Figure 9 below). As a result, additional control measures to reduce ozone levels will be needed. These measures will have to be implemented over a wide area and will require the cooperative effort of many states and the federal government if they are to be successful.

Figure 8
Days on which the *Old* Ozone Standard (1-hour) was Exceeded in New Jersey 1988-2002

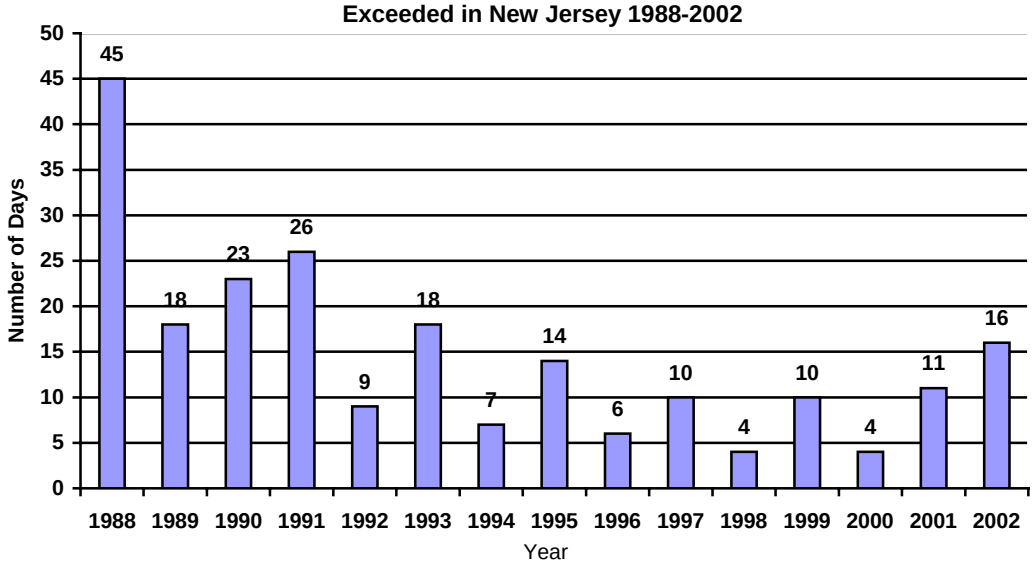
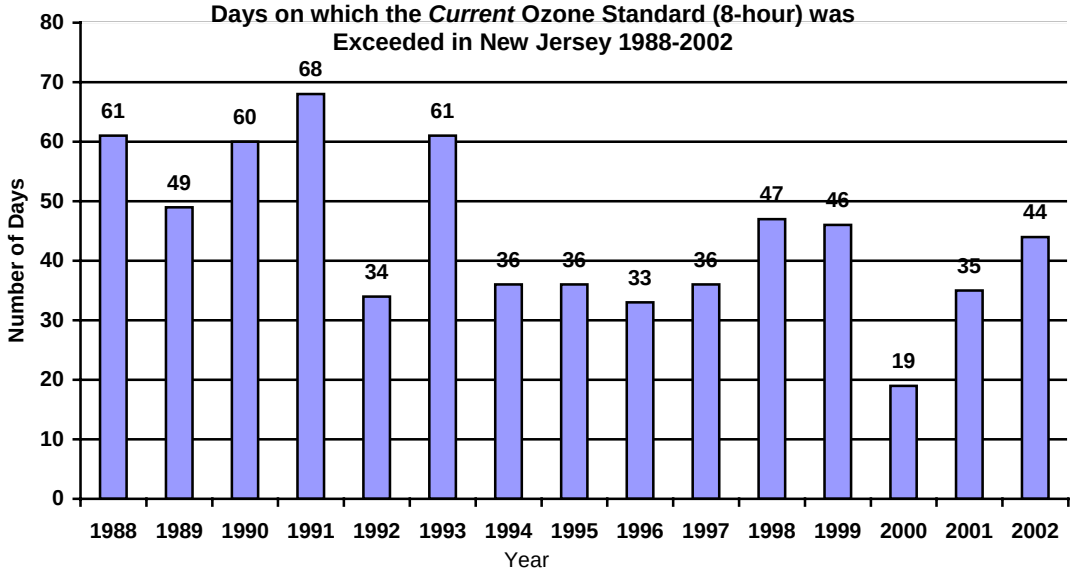


Figure 9
Days on which the *Current* Ozone Standard (8-hour) was Exceeded in New Jersey 1988-2002

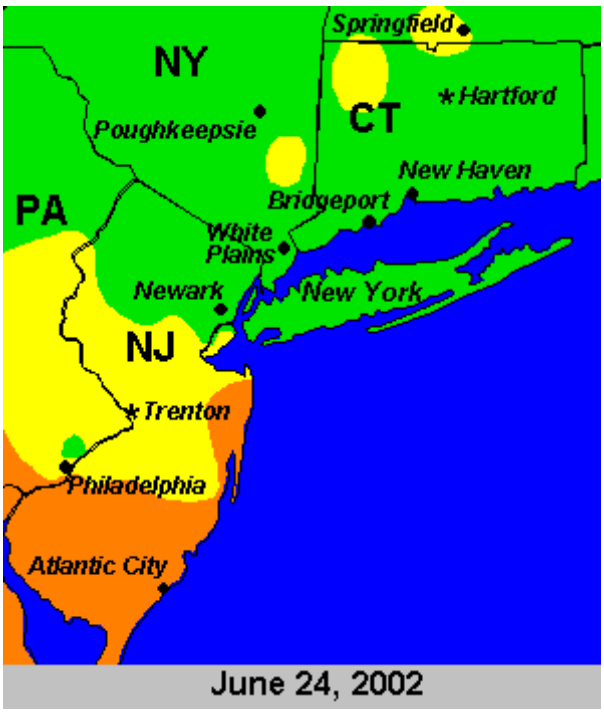


MAJOR OZONE EPISODES

June 20 - 26 - This was the longest uninterrupted episode of 2002, resulting in 7 consecutive days on which the 8-hour standard was exceeded.

Conditions on June 20th and 21st were not ideal for ozone formation. There was a maritime flow that resulted from high pressure settling off of Maine, and temperatures were in the 80's. Nonetheless, five sites (Rutgers University, Rider University, Flemington, Colliers Mills, and Chester) recorded 8-hour exceedances on the 20th, with the maximum of 0.094ppm occurring at the Rutgers University site. On the 21st, only the Flemington site exceeded the 8-hour standard with a maximum concentration of 0.089ppm. These two days of the episode may have been the result of a stagnant air mass and/or re-circulation. Also, the high-pressure system over Maine originated over the Great Lakes region where it may have picked up more than normal amounts of ozone precursors. When winds shifted around to the southwest on June 22nd, ten sites exceeded the 8-hour standard. The change was brought about by a high-pressure system that settled over southern Delaware. Temperatures began to increase into the upper 80's, and within the next few days of this episode rose to the mid-90's. June 23rd saw nine sites exceed the 8-hour standard, while sites along the eastern portion of the state remained in the moderate range due to the cleaner southern winds coming off the ocean and bay. On June 24th a cold front pushed its way down through northern New Jersey / Central Pennsylvania and a major gradient can be seen throughout the state's ozone concentrations (Figure 10 to right). The site at the Ancora State Hospital recorded an 8-hour exceedance of 0.104ppm while concentrations at the Newark Lab site only reached a maximum 8-hour average of 0.048ppm. On June 25th the frontal boundary reached just below Interstate Route 195 in central New Jersey in the morning and eventually retreated back north by mid-afternoon. This instability caused a wide variety of ozone values for the day, as the southern portion of the state continued to be under the influence of warm southwest winds, while the northern portion of the state, for several hours was receiving cooler, cleaner maritime air out of the north-northeast. This may explain why Bayonne, Teaneck, and the Newark Lab recorded maximum 8-hour values of 0.054ppm, 0.044ppm, and 0.041ppm respectively, while sites in the southern half of the state recorded 8-hour exceedances as high as 0.109 ppm at Clarksboro and 0.105 ppm at the Camden Lab. All together there were 8 sites throughout the state that exceeded the 8-hour standard. Only the Clarksboro site recorded levels above the 1-hour standard, with a maximum 1-hour value of 0.125 ppm. Temperatures remained warm on the 26th, low to mid 80's, but the episode began to break up as stronger winds blanketed the state and a front finally pushed through taking the stagnant, polluted air mass off to the northeast. The Chester, Flemington, Rider University, and Rutgers University monitoring sites still recorded 8-hour exceedances on the 26th while the remaining sites stayed within the moderate range.

Figure 10



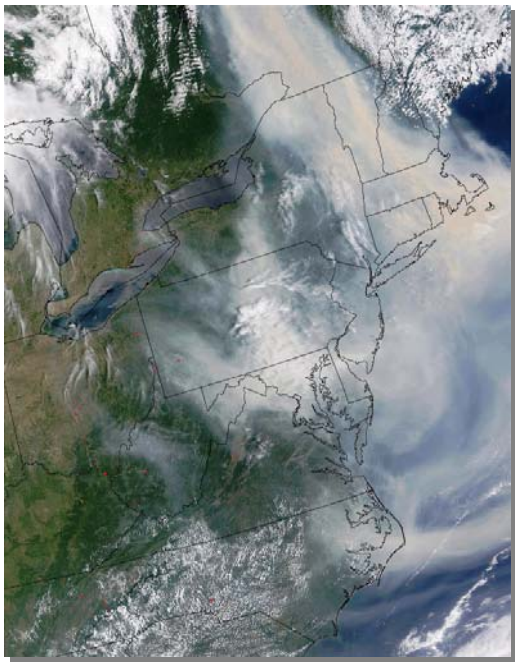
July 7 - 9 - This episode occurred in conjunction with elevated levels of fine particulates that were the result of extensive forest fires in Quebec, Canada. Two of the three days on which all of the state's ozone monitors recorded exceedances occurred during this episode, and although it was not lengthy, it resulted in the highest 1-hour and 8-hour concentrations of the year.

(*Analysis abstracted from Dr. Bill Ryan's Summary of 2002 Ozone Season.)* The intense fires located in northern Quebec began early July 5th and the first noticeable plumes began moving south. The fires died down over night and by July 6th the first plume had become detached from its source and made its way into northern New York. The flames flared up again on July 6th and a plume began to form over southern Ontario. By mid-afternoon on July 6th the original plume had made its way into southeastern

MAJOR OZONE EPISODES (CONT.)

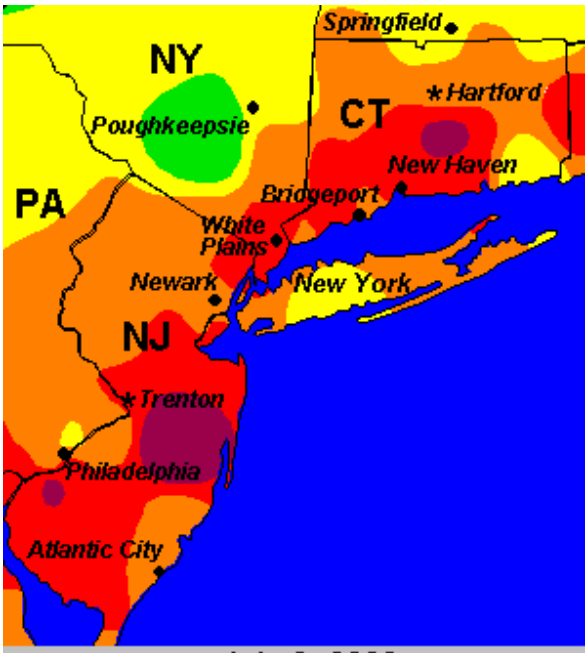
Pennsylvania and New Jersey. By Sunday a strong cold front moved into the fire regions of northern Quebec and cutoff the southern flowing plume. At this time there were three distinct plumes affecting the northeastern United States. The first plume, by Sunday July 7th, had made its way off the coast of the Carolinas, while the other plumes had drifted through the mid-Atlantic and New England states. A high-pressure system positioned off the Mid-Atlantic States pushed the first plume back northward, where it dissipated onshore impacting New Jersey's southern and eastern regions most directly. This swirling motion can be seen in the satellite picture in Figure 11 and is most noticeable off the southeast coast of New Jersey. Organic compounds in the fire's plume may have enhanced ozone formation during this event.

Figure 11



On July 7th, two of the southern monitors - Millville and the Ancora State Hospital, recorded 8-hour exceedance values of 0.086ppm and 0.097ppm respectively. The other southern site, the Nacote Creek Research Station, recorded a maximum 8-hour concentration of 0.084ppm - just shy of the standard. July 8th was a statewide 8-hour exceedance day. Temperatures were not extremely warm, averaging in the mid to upper 80's and there was a high-pressure system off the Carolina coast pumping southwesterly breezes into the region. The Camden Lab, Clarksboro, and Colliers Mills sites recorded ozone concentrations above the 1-hour standard, and the 0.153 ppm 1-hour value recorded at Colliers Mills was the highest 1-hour value for the entire 2002 season. Colliers Mills also recorded the highest 8-hour value of the day at 0.128 ppm and Clarksboro the second highest with a 0.125 ppm 8-hour value. Similar conditions remained in place on July 9th and there was another statewide exceedance day of the 8-hour standard (see Figure 12). Temperatures were a bit higher on the 9th and most of the state reached the mid-90's. The maximum 8-hour concentration for the 2002 season of 0.138ppm was recorded at Colliers Mills this day, and six sites recorded exceedances of the 1-hour standard - the most for one day in 2002. The passing of a cold front that brought along cloud cover and thunderstorms broke up the episode and there were no recorded exceedances on July 10th.

Figure 12



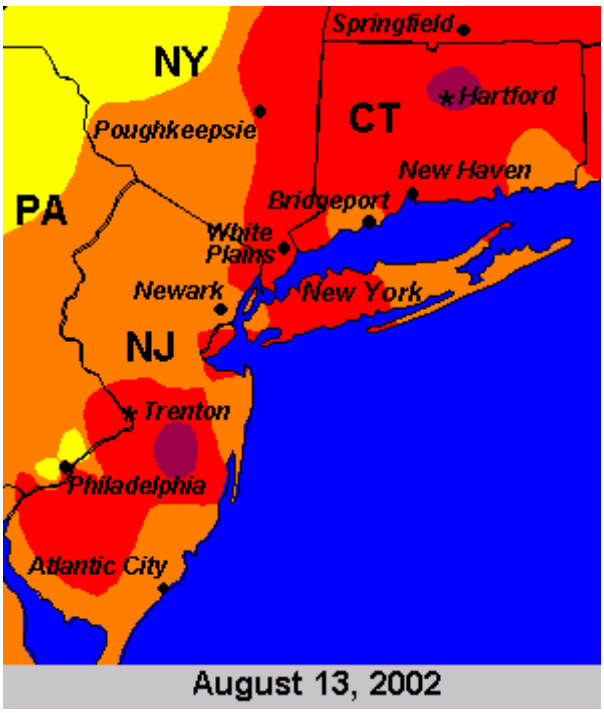
July 28 - August 5 - This nine-day episode would have been the longest of the year, except for a break that occurred on July 30th when all sites stayed within the moderate range. Although July 30th was still a warm day with temperatures in the mid-90's, a shift in winds to the northwest-brought clean Canadian air to the region throughout the day.

On July 31st the winds continued to arrive from the northwest over most of the state and the shore regions were located on the northeastern most side of the high-pressure system that had settled in Illinois and Indiana, producing winds directly out of the north. Thus, the two sites recording 8-hour exceedances that day were Monmouth University and the Ancora State Hospital, which were receiving winds that were traveling through the metropolitan New York region. The winds produced on the southeast side of the high, which by August 1st had moved into Ontario, is now exposing most of New

MAJOR OZONE EPISODES (CONT.)

Jersey to metropolitan New York air. Although this is not the traditional setup for producing ozone exceedances it has proven to cause high concentrations in our southern most monitors as the air travels from New York, through the Route 1 corridor on into the southern region of the state. August 1st produced six 8-hour exceedances with Colliers Mills and Millville recording the highest 8-hour values of the day with 0.114ppm and 0.107ppm respectively. Both sites also exceeded the 1-hour standard that day. By August 2nd another high-pressure system settled off of the North Carolina coast and introduced south-southwest winds into New Jersey by mid-morning. So, the dirty air that had moved from northeast to southwest the previous two days was now once again moving back through the region from the opposite direction. This air parcel had become dirtier as it passed over the Baltimore-Washington corridor on its way back up through New Jersey. Add in temperatures in the upper 90's, and 11 sites exceeded the 8-hour standard with the maximum at Camden of 0.116ppm. Camden also recorded a 1-hour exceedance value of 0.133 ppm on August 2nd. The high moved further off the Carolina coast and pushed north, setting up winds from the south across the eastern part of the state, while the high-pressure system located over the Great Lakes influenced the western part of New Jersey. This explains the variations in ozone concentrations for the day with the western sites such as the Camden Lab, Chester, and Flemington recording 8-hour exceedances while the sites under the influence of maritime flow over the Delaware Bay (Ancora State Hospital, Millvile, Nacote Creek Research Station) stayed well within the moderate range. Nacote Creek Research Station recorded a maximum 8-hour concentration of just 0.060 ppm while the highest 8-hour maximum value of 0.096ppm was produced at the Camden Lab, as northwesterly winds flowing over the metropolitan Philadelphia region affected that site. August 4th was yet another day of variability across New Jersey as 1-hour exceedances were recorded at the Rider University and Rutgers University sites and nearly at the Camden Lab. These high concentrations were the result of a stationary cold front that stalled northwest of Philadelphia and helped produce 1-hour exceedances all along the I-95 corridor from Washington, D.C. to New York City. August 5th is the last day of the episode and as a result of a passing cold front just three sites in New Jersey exceeded the 8-hour standard, with Clarksboro and Millville just reaching the 0.085ppm standard. The site at the Ancora State Hospital recorded the highest 8-hour value with 0.094 ppm. The cloud cover associated with the passing cold front blanketed the state, leaving just a small clearing in the southern portion of the state, coinciding with the sites that recorded the exceedances for August 5th. The cold front makes its way through the region by August 6th bringing with it strong northerly winds and scattered showers. The maximum 8-hour value for August 6th was 0.037ppm - an significant deviation from the previous week's ozone values.

Figure 13



August 10 -14 - This episode produced the 3rd of the statewide exceedance days, where all 15 monitors exceeded the 8-hour standard.

August 12th, 13th, & 14th produced 1-hour exceedances at four sites on each day. On August 10th the episode begins when a high-pressure system over West Virginia produced light southwest winds throughout New Jersey and exceedances along the Route 1 corridor. Rider University recorded a 1-hour exceedance of 0.126 ppm, just above the 1-hour standard. Rutgers University and Flemington recorded the highest ozone concentrations of the eight sites that exceeded the 8-hour standard. The high dropped south into South Carolina and the southwest winds continued across the state on August 11th. Although maximum temperatures barely made it into the 90's, the skies over most of the state were very clear allowing maximum solar intensity. The dew points at Philadelphia International Airport were in the mid-60's on August 11th, unusually low for this time of year. Nine sites across New Jersey exceeded the 8-hour standard, with the maximum concentrations falling along the Route 1 corridor. Rider University recorded the maximum 8-hour value of the day with a 0.110 ppm.

MAJOR OZONE EPISODES (CONT.)

August 12th brought competing high-pressure systems throughout the region. The high that had been influencing the region moved off the coast of Georgia while another high pressure system settled into the West Virginia area. The result was a strong westerly influence compounded by the existing southwest winds. Clear skies and temperatures in the mid 90's produced 8-hour exceedances at 11 sites throughout the state. The two northerly sites that did not exceed the 8-hour standard were Bayonne and the Newark Lab and is mostly likely a result of local NOx scavenging. The other two sites not exceeding the standard were Monmouth University and the Nacote Creek Research Station, likely resulting from a sea breeze influence. Four sites also exceeded the 1-hour standard; Teaneck, Rider University, the Camden Lab, and Colliers Mills. On August 13th all of the state's monitoring sites recorded exceedances of the 8-hour standard (see Figure 13, page 8). Winds throughout the region were still coming out of the southwest, but were very calm. Temperatures throughout the state were in the mid to upper 90's and clear skies again promoted maximum solar intensity. Four sites exceeded the 1-hour standard; the Camden Lab, Clarksboro, Colliers Mills, and Teaneck as high ozone values were recorded from Raleigh, North Carolina, up into the coastal regions of Maine. August 14th produced four more 1-hour exceedances - the 4th day in a row - and 11 exceedances of the 8-hour standard. This episode begins to unwind as some of the coastal sites receive relief in the form of a sea breeze. The Nacote Creek Research Station, Monmouth University, and Bayonne did not exceed the 8-hour standard on August 14th, while the remainder of the sites still under the southwest flow, produce 8-hour exceedances as high as 0.123ppm at Chester.

This episode ends in a very different manner than the standard high ozone episode. Instead of the passage of a sharp cold front, this episode ends gradually as cleaner air sweeps north, wind speeds increase and the atmosphere steadily destabilizes. On August 15th, concentrations fall across the region as low level flow becomes more southeast and the Bermuda high fills in westward. Cloud cover spreads over the region on August 16th with regional ozone falling further. (Ryan, 2003)

SUMMARY OF 2002 Ozone Data Relative to the 1-HOUR STANDARD

Of the 15 monitoring sites that were operated during the 2002 ozone season, 13 recorded levels above the old 1-hour standard of 0.12 ppm at least once during the year. Seven sites had at least two exceedances while the Camden Lab and Colliers Mills recorded the most exceedances with seven. The highest 1-hour concentration was 0.153 ppm at the Colliers Mills site on July 8, 2002. In the 2001 ozone season there were nine sites that recorded levels above the standard and the maximum was 0.145 ppm, recorded at Rider University.

Figure 14
Highest and Second Highest Daily 1-Hour Averages

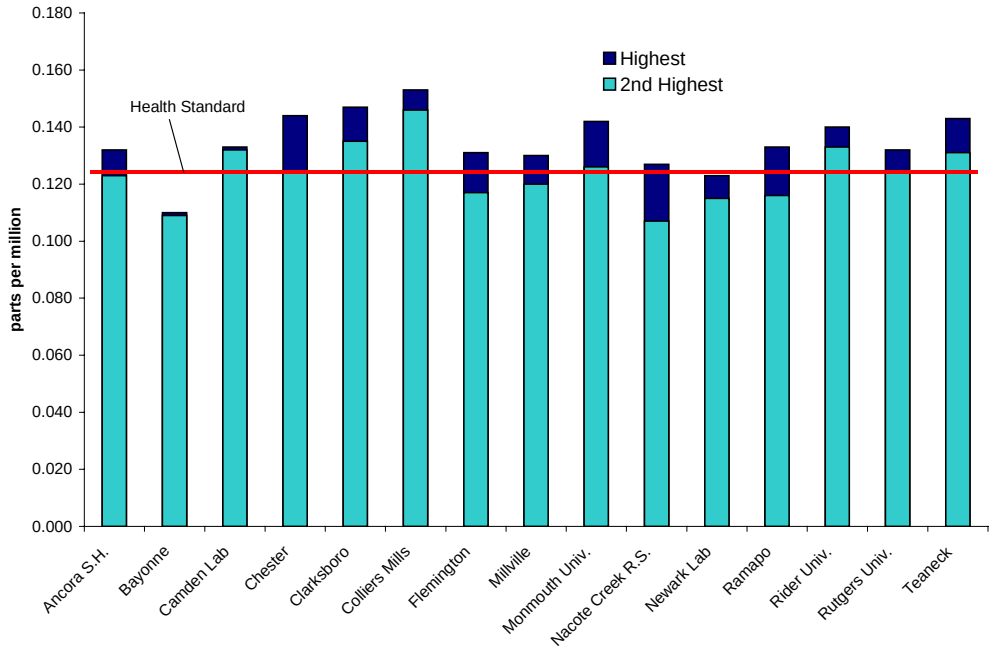


Table 3
Ozone Data – 2002
1-Hour Averages

Parts Per Million (ppm) **1-hour standard is 0.12 ppm**

Monitoring Site	1-hr Max	2nd Highest 1-hr Max	1-hour Average Design Value 2000-2002[1]	# of days with 1-hour Averages above 0.12ppm
Ancora S.H.	0.132	0.123	0.122	1
Bayonne	0.110	0.109	0.116	0
Camden Lab	0.133	0.132	0.131	7
Chester	0.144	0.124	0.121	2
Clarksboro	0.147	0.135	0.125	6
Colliers Mills	0.153	0.146	0.136	7
Flemington	0.131	0.117	0.128	1
Millville	0.130	0.120	0.127	1
Monmouth Univ.	0.142	0.126	0.126	2
Nacote Creek R.S.	0.127	0.107	0.107	1
Newark Lab	0.123	0.115	0.114	0
Ramapo	0.133	0.116	0.114	1
Rider University	0.140	0.133	0.133	4
Rutgers University	0.132	0.124	0.132	1
Teaneck	0.143	0.131	0.127	4
Statewide	0.153	0.146		16

[1] Design Value calculations exclude data affected by the July 2002 Canadian forest fire episode

SUMMARY OF 2002 OZONE DATA RELATIVE TO THE 8-HOUR STANDARD

All of the 15 monitoring sites that were operated during the 2002 ozone season recorded levels above the new 8-hour standard of 0.08 ppm. Colliers Mills recorded the most exceedances with 30. The highest 8-hour concentration recorded was 0.138 ppm at the Colliers Mills site on July 9, 2002. All sites recorded levels above the 8-hour standard in 2001 as well, with a maximum concentration of 0.121 ppm, recorded at the Colliers Mills site. Design values for the 8-hour standard were also above the standard at all sites, indicating that the ozone standard is being violated throughout New Jersey.

Figure 15
Ozone Design Values for 2000-2002
3 Year Average of the 4th Highest 8-Hour Value

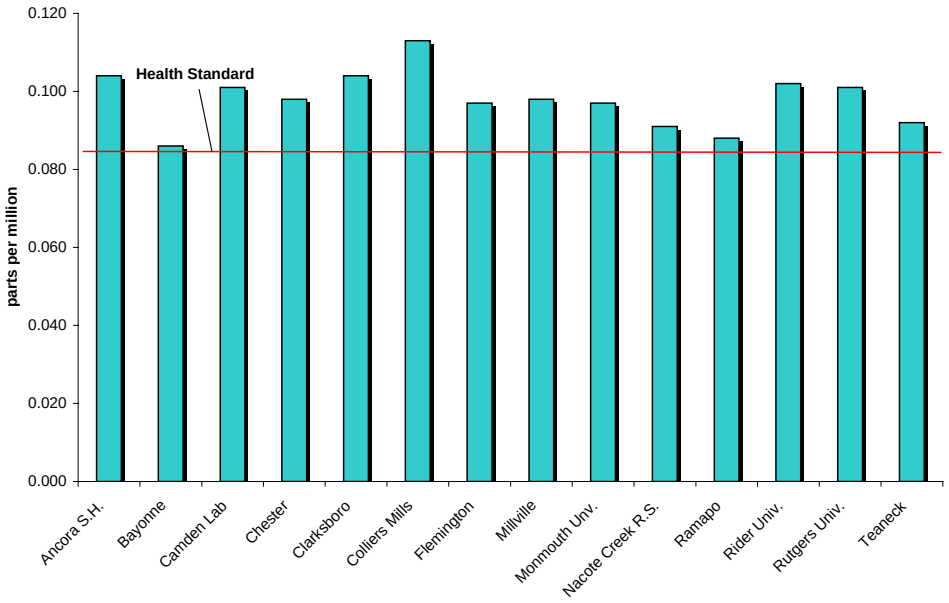
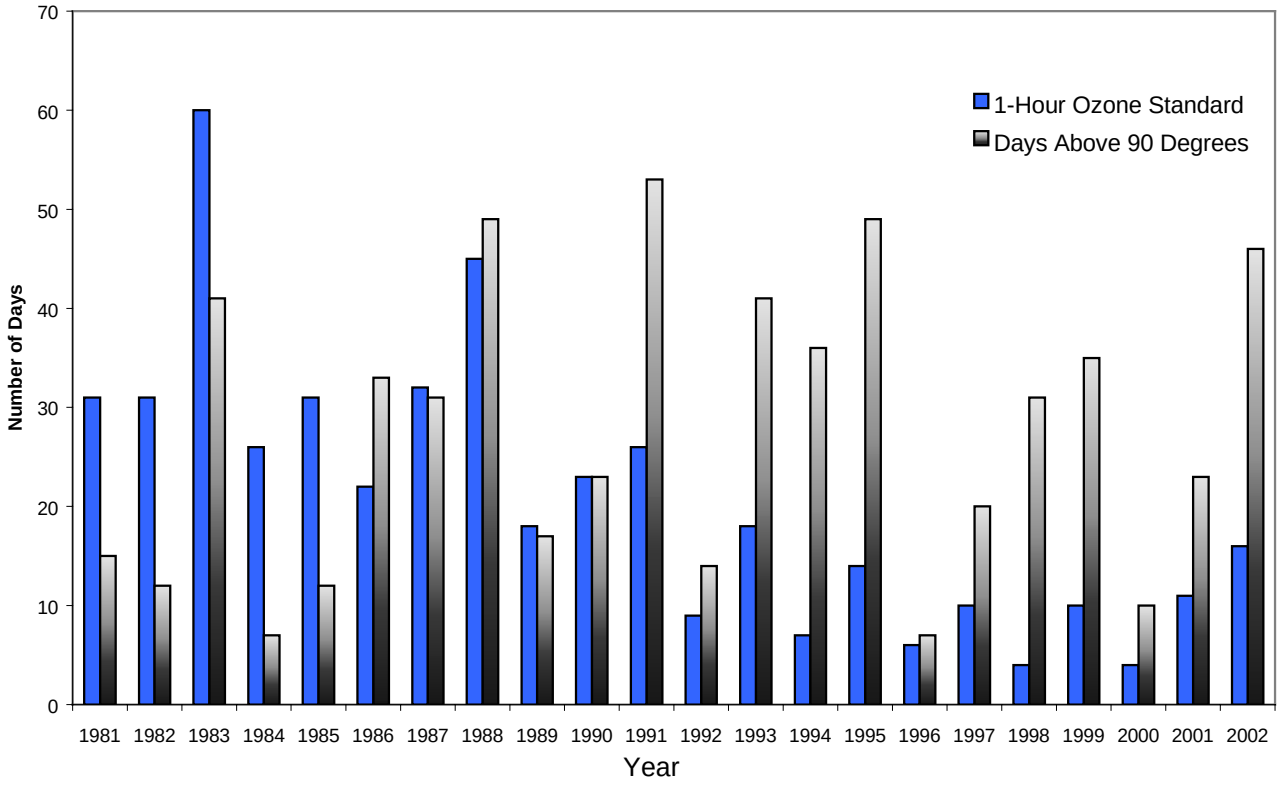


Table 4
Ozone Data – 2002
8-Hour Averages

	Parts Per Million (ppm)					8-hour standard is 0.08 ppm
Monitoring Site	**1st Highest**	**2nd Highest**	**3rd Highest**	**4th Highest**	**8-hour Average Design Value 2000-2002[1]**	**# of days with 8-hour above 0.08ppm**
Ancora S.H.	0.118	0.112	0.111	0.106	0.104	27
Bayonne	0.098	0.094	0.093	0.091	0.086	6
Camden Lab	0.116	0.114	0.112	0.112	0.101	19
Chester	0.123	0.108	0.105	0.102	0.098	27
Clarksboro	0.126	0.125	0.115	0.113	0.104	24
Colliers Mills	0.138	0.128	0.125	0.125	0.113	30
Flemington	0.116	0.109	0.101	0.099	0.097	19
Millville	0.109	0.107	0.104	0.102	0.098	20
Monmouth Univ.	0.125	0.114	0.104	0.103	0.097	17
Nacote Creek R.S.	0.102	0.099	0.095	0.093	0.091	11
Newark Lab[2]	0.099	0.095	0.095	0.092	-------	8
Ramapo	0.109	0.101	0.097	0.097	0.088	13
Rider University	0.116	0.115	0.110	0.109	0.102	26
Rutgers University	0.115	0.110	0.104	0.104	0.101	26
Teaneck	0.112	0.105	0.104	0.104	0.092	18
Statewide	0.138	0.129	0.128	0.125	0.118	44

[1] Design Value calculations exclude data affected by the July 2002 Canadian forest fire episode
[2] Data not available prior to Aug. 6, 2001

Figure 16
Number of Days 1-Hour Ozone Standard Was Exceeded
and Number of Days Above 90 Degrees
New Jersey 1981 - 2002



ACCOUNTING FOR THE INFLUENCE OF WEATHER

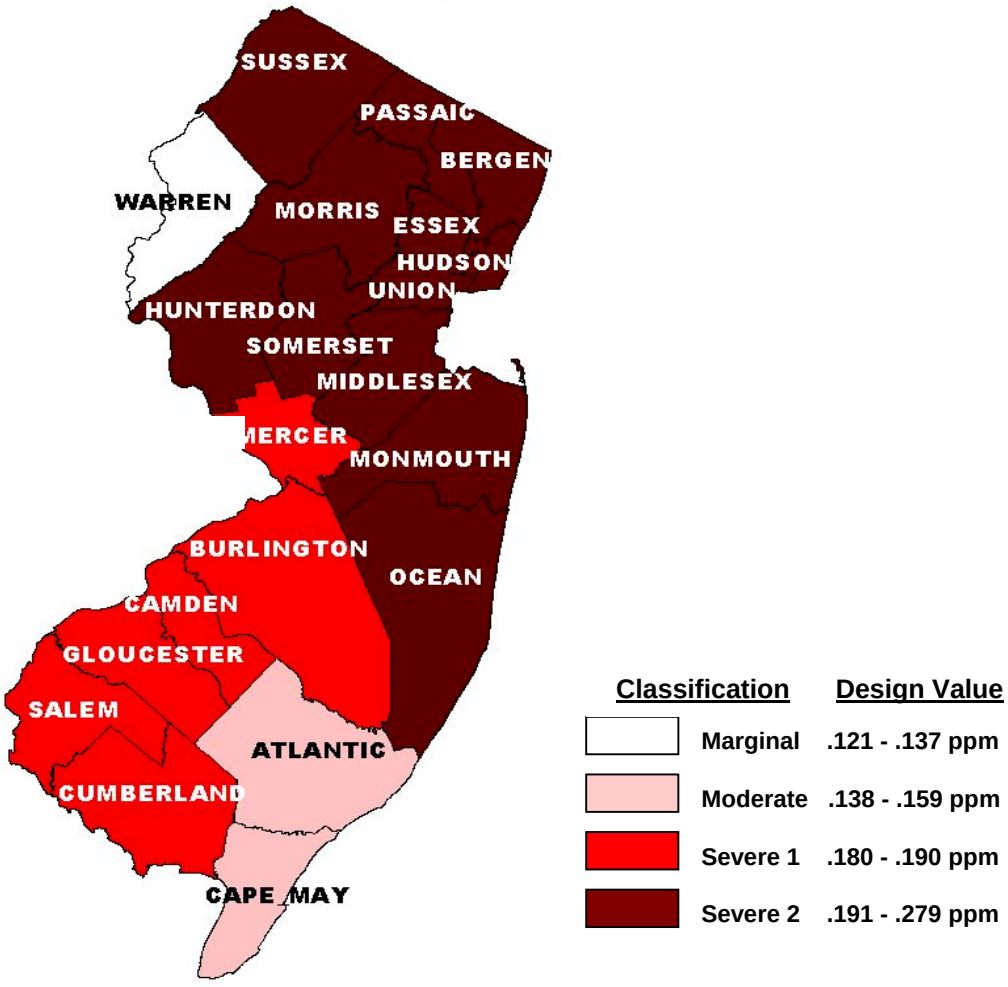
Trends in ground level ozone are influenced by many factors including weather conditions, transport, growth, and the state of the economy, in addition to changes brought about by regulatory control measures. Of these factors, weather probably has the most profound effect on year to year variations in ozone levels. Several methods have been developed to try to account for the effect of weather on ozone levels so that the change due to emissions could be isolated. While none of these methods are completely successful they do show that over the long term, real reductions in ozone levels have been achieved. A simple way of showing the changing effect of weather on ozone is shown above in Figure 16. The number of days each year on which the ambient temperature was 90 degrees or greater is shown next to the number of days the ozone standard was exceeded. In the earliest years shown (1981-1985) there are significantly more days with high ozone than days above 90 degrees. But this pattern gradually changes and for the most recent years there are more "hot" days than "ozone" days. This is an indication that on the days when conditions are suitable for ozone formation, unhealthy levels are being reached less frequently.

Ozone Non-Attainment Areas in New Jersey

The Clean Air Act requires that all areas of the country be evaluated and then classified as attainment or non-attainment areas for each of the National Ambient Air Quality Standards. Areas can also be found to be "unclassifiable" under certain circumstances. The 1990 amendments to the act required that areas be further classified based on the severity of non-attainment. The classifications range from "marginal" to "extreme" and are based on "design values". The design value is the value that actually determines whether an area meets the standard. For the 1-hour ozone standard for example, the design value is the fourth highest daily maximum 1-hour average concentration recorded over a three year period. Note that these classifications did not take into account the transport of ozone and its precursors and missed the concept of multi-state controls.

New Jersey is part of four planning areas, the New York, Philadelphia, Atlantic City and Allentown/Bethlehem areas. Their classification with respect to the old 1-hour standard is shown on the map in Figure 17. Now that the new 8-hour average standard for ozone has been upheld by the courts, new designations will have to be made.

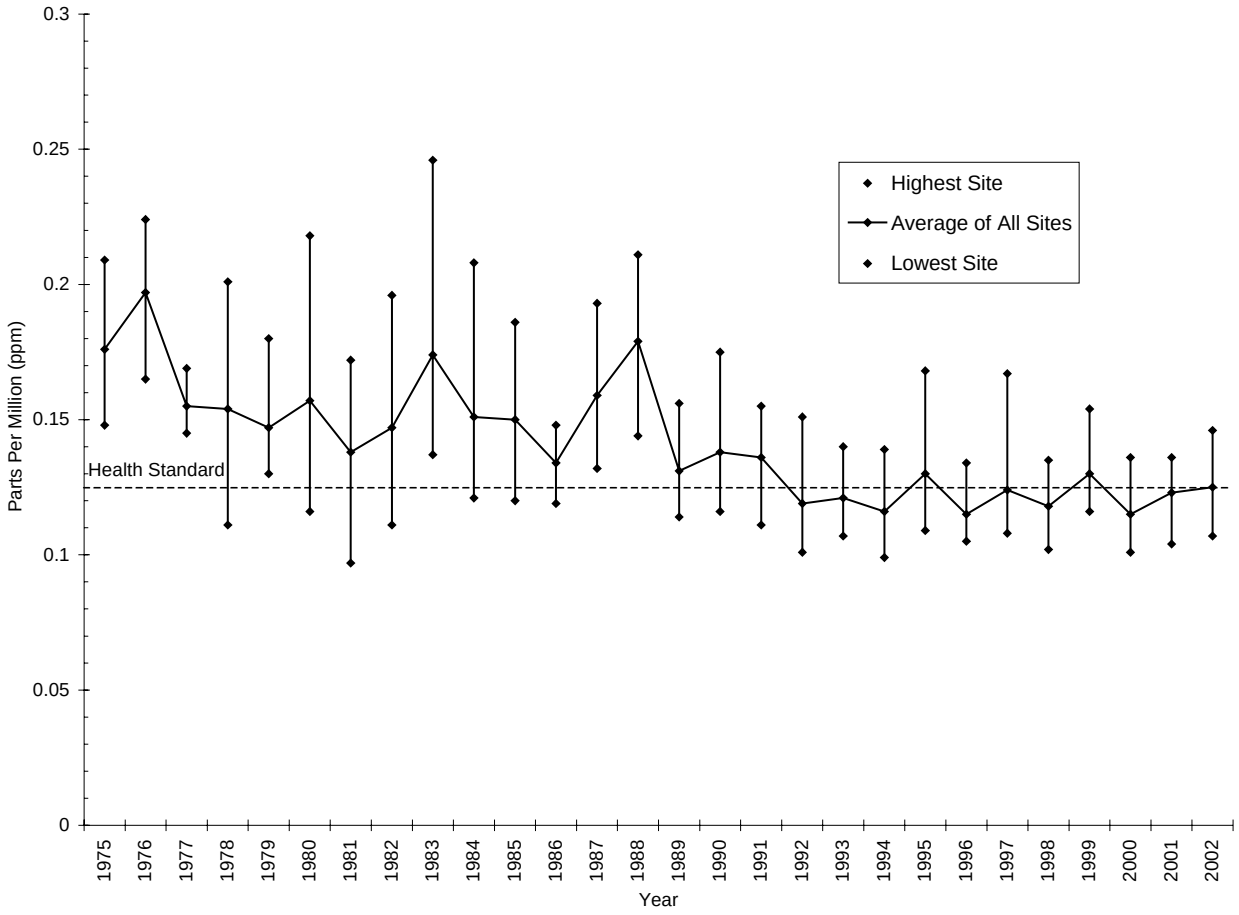
Figure 17
Ozone Non-Attainment Areas in New Jersey



OZONE TRENDS

The primary focus of efforts to reduce concentrations of ground-level ozone in New Jersey has been on reducing emissions of volatile organic compounds (VOCs). Studies have shown that such an approach should lower peak ozone concentrations, and it does appear to have been effective in achieving that goal. Maximum 1-hour concentrations have not exceeded 0.20 ppm since 1988 and the last time levels above 0.18 ppm were recorded was in 1990 in Figure 18. But improvements may have leveled off in recent years, especially with respect to maximum 8-hour average concentrations. Significant further improvements will require reductions in both VOCs and NOx. The NOx reductions will have to be achieved over a very large region of the country because levels in New Jersey are dependent on emissions from upwind sources.

Figure 18
Ozone Concentrations in New Jersey
1975 – 2002
Second Highest 1-Hour Averages



REFERENCES

Ozone: Good Up High, Bad Nearby, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC October 1997, URL: www.epa.gov/oar/oaqps/gooduphigh/

USEPA Fact Sheet: *Health and Environmental Effects of Ground Level Ozone*, USEPA, Office of Air and Radiation, July 1997, URL: www.epa.gov/ttn/oarpg/naaqsfin/o3health.html

Ryan, William, *Air Quality Forecast* Report Philadelphia Forecast Area 2002, Pennsylvania State University, Department of Meteorology, University Park, PA, March 2003, URL: http://www.meteo.psu.edu/~wfryan/phl_2002_final_report.htm

USEPA Ozone Map Archives, U RL: www.epa.gov/airnow/maparch.html

Enhanced Ozone Monitoring – PAMS General Information, USEPA,, 1994, URL: www.epa.gov/air/oaqps/pams/general. html

National Air Quality and Emissions Trend Report, 1999, EPA-454/R-01-004, USEPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC, March 2001, URL: www.epa.gov/oar/aqtrnd99/

Latest Findings on National Air Quality: 2000 Status and Trends, EPA-454/K-01-002, USEPA , Office of Air Quality Planning and Standards, RTP, September 2001, URL: www.epa.gov/oar/aqtrnd00/

Smog – Who Does it Hurt?, EPA-452/K-99-001, USEPA, Air and Radiation, Washington, DC, July 1999, URL: www.epa.gov/airnow/health/

Ozone and Your Health, EPA-152/F-99-000, USEPA, Air and Radiation, Washington, DC, September 1999, URL: www.epa.gov/airnow/brochure.html

Air Quality Guide for Ozone, EPA-456/F-002, Air and Radiation, Washington, DC, July 1999, URL: www.epa.gov/airnow/consumer.html