Ozone Attainment Issues in Light of Transport Across the eastern US

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Purpose

- Provide some historical Perspective about how far we have come
- Challenges Ahead for the State and the Ozone Transport commission
- The issues in achieving attainment

Perspective

- **Ozone Transport not a new issue in the Eastern US**

- First identified in the 1970's by Stasiuk and Coffey (Adirondack Studies), and Wolff, Lioy , et al (Metropolitan Area Studies)
- Eastern US started to address the issues with the outcome of the 197? Moodis Conference
- Activities cut short by the change in the then standard from 80ppb for one hour to 120 ppb for one hour by the Carter Administration
- OTC formed after the 1990 Clean Air Act Amendments
- **To reflect the Science the ozone standard was changed from at 1 hour standard to an 8 Hour Average Standard, and values have been lowering based upon new health effects data**

Table of Historical Ozone NAAQS History of the National Ambient Air Quality Standards for Ozone During the Period 1971-2008

Final Rule/Decision	Primary/ Secondary	Indicator [(1)]	Averaging Time	Level [(2)]	Form
1971 36 FR 8186 Apr 30, 1971	Primary and Secondary	Total photochemical oxidants	1-hour	0.08 ppm	Not to be exceeded more than one hour per year
1979 44 FR 8202 Feb 8, 1979	Primary and Secondary	O_3	1-hour	0.12 ppm	Attainment is defined when the expected number of days per calendar year, with maximum hourly average concentration greater than 0.12 ppm, is equal to or less than 1
1993 58 FR 13008 Mar 9, 1993	EPA decided that revisions to the standards were not warranted at the time				
1997 62 FR 38856 Jul 18, 1997	Primary and Secondary	O_3	8-hour	0.08 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged ove 3 years
2008 73 FR 16483 Mar 27, 2008	Primary and Secondary	O_3	8-hour	0.075 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged ove 3 years

Proposed a revised 8 hour standard to between 70 and 60 ppb

Ozone – Some summary information

- It is a constituent of the troposphere (it is also an important constituent of some regions of the stratosphere commonly known as the ozone layer)

- Photochemical and chemical reactions involving it drive many of the chemical processes that occur in the atmosphere by day and by night.

- As constituent of smog abnormally high concentrations brought about by human activities (largely incomplete combustion of fossil fuels, such as gasoline, diesel, etc.),

- . Ozone is a powerful oxidizing agent readily reacting with other chemical compounds to make many possibly toxic oxides.

- The majority of tropospheric ozone formation occurs when nitrogen oxides (NOx), carbon monoxide (CO) and volatile organic compounds (VOCs), such as xylene, react in the atmosphere in the presence of sunlight. NOx, CO, and VOCs are called ozone precursors. Motor vehicle exhaust, industrial emissions, and chemical solvents are the major anthropogenic sources of these chemicals. Although these precursors often originate in urban areas, winds can carry NOx hundreds of kilometers, causing ozone formation in less populated regions as well.

- Ozone irritates the respiratory system, causing coughing, throat irritation, and/or discomfort in the chest. Also, reduced lung function, Aggravation of asthma. Inflammation and damage to the lining of the lungs..

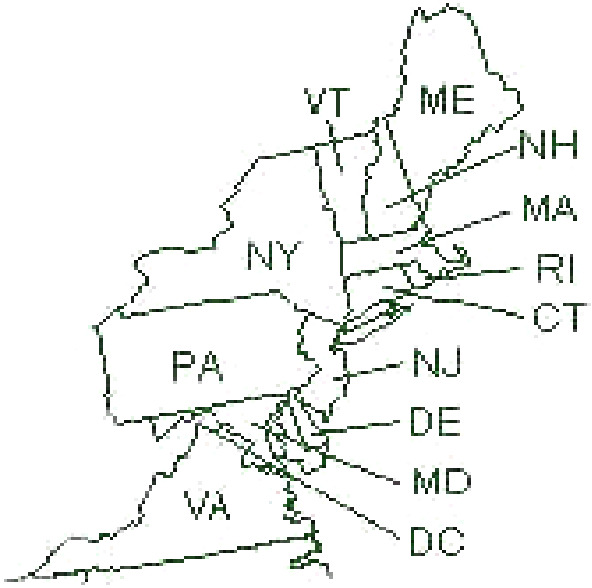
Ozone transport Commission

- The Clean Air Act in Section 110, known as the "good neighbor" provision was designed to prevent one state significantly contributing to a National Ambient Air Quality Standards (NAAQs) violation in another state. Section 176A authorizes the EPA administrator to establish a transport region for a pollutant where the EPA administrator believes that the interstate transport of such air pollutants from one or more states contributes significantly to a violation of a NAAQS in one or more other states.
- In the 1990 Clean Air Act Amendments, Congress established a specific 12-state transport region for ozone (OTR), extending from Maine south to northern Virginia. Section 176A enables EPA administrator to add a state to the transport region or a state may be added by a petition to the administrator.
- The Ozone Transport Commission (OTC) responsible for advising the EPA on transport issues and developing and implementing solutions to address ground-level ozone problems.

- The Clean Air Act Amendments of 1990 established the northeast Ozone Transport Region (OTR).
- The Act requires "reasonably available control technology" (RACT) for many existing pollution sources in certain nonattainment areas and throughout the OTR
- established was the Ozone Transport Commission (OTC) to coordinate the regional development of control plans for ground-level ozone in the Northeast and Mid-Atlantic States
- *Will need Regional cooperation achieve the next round of SIP call for a new standard*.

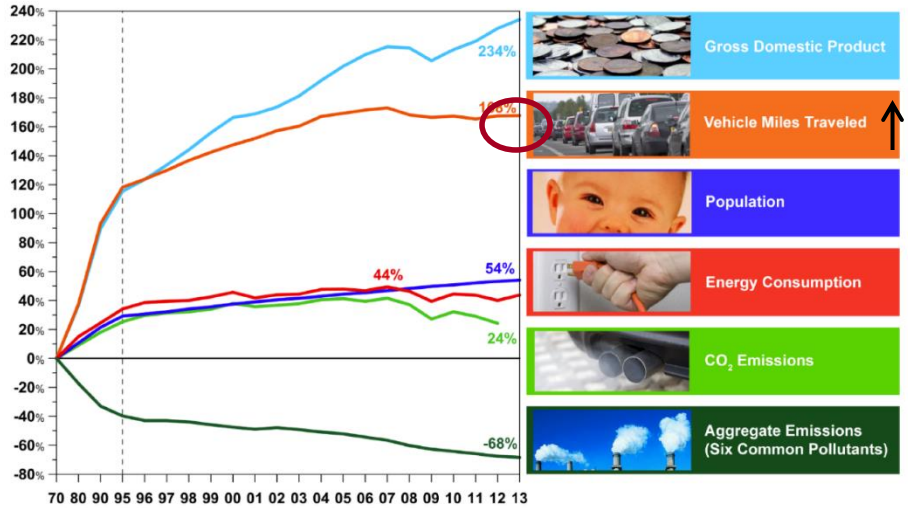
Members of OTC

- Connecticut
- Delaware
- District of Columbia
- Maine
- Maryland
- Massachusetts
- New Hampshire
- New Jersey
- New York
- Pennsylvania
- Rhode Island
- Vermont
- Virginia
- U.S. Environmental Protection Agency



Over the past four decades air pollution metrics in the US have been substantially reduced while socioeconomic indicators continue to rise

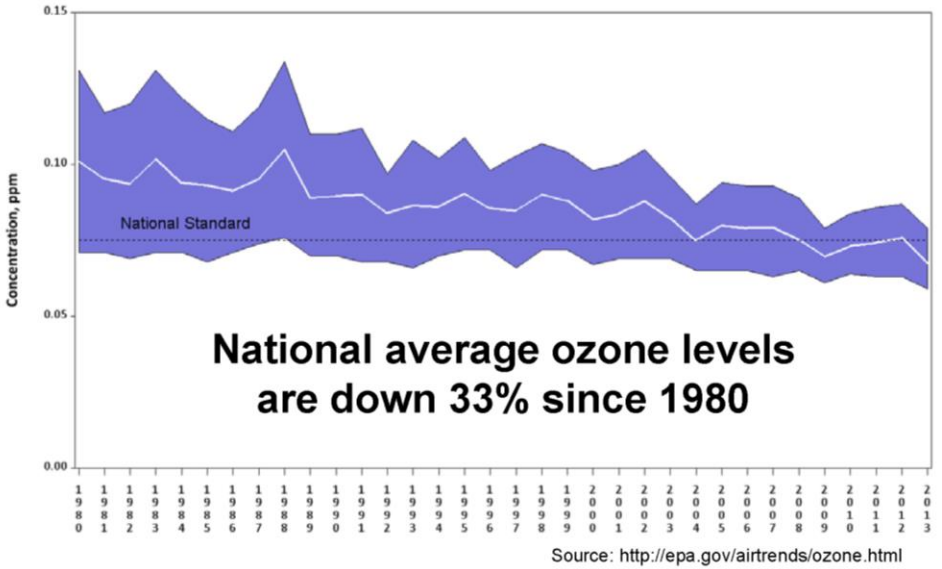
Comparing growth and emissions, 1970-2013



Source: http://epa.gov/airtrends/aqtrends.html#comparison

Ozone Air Quality, 1980-2013

(Annual 4th Maximum of Daily Max 8-hour Average)
National trend based on 222 sites



Source: http://epa.gov/airtrends/ozone.html

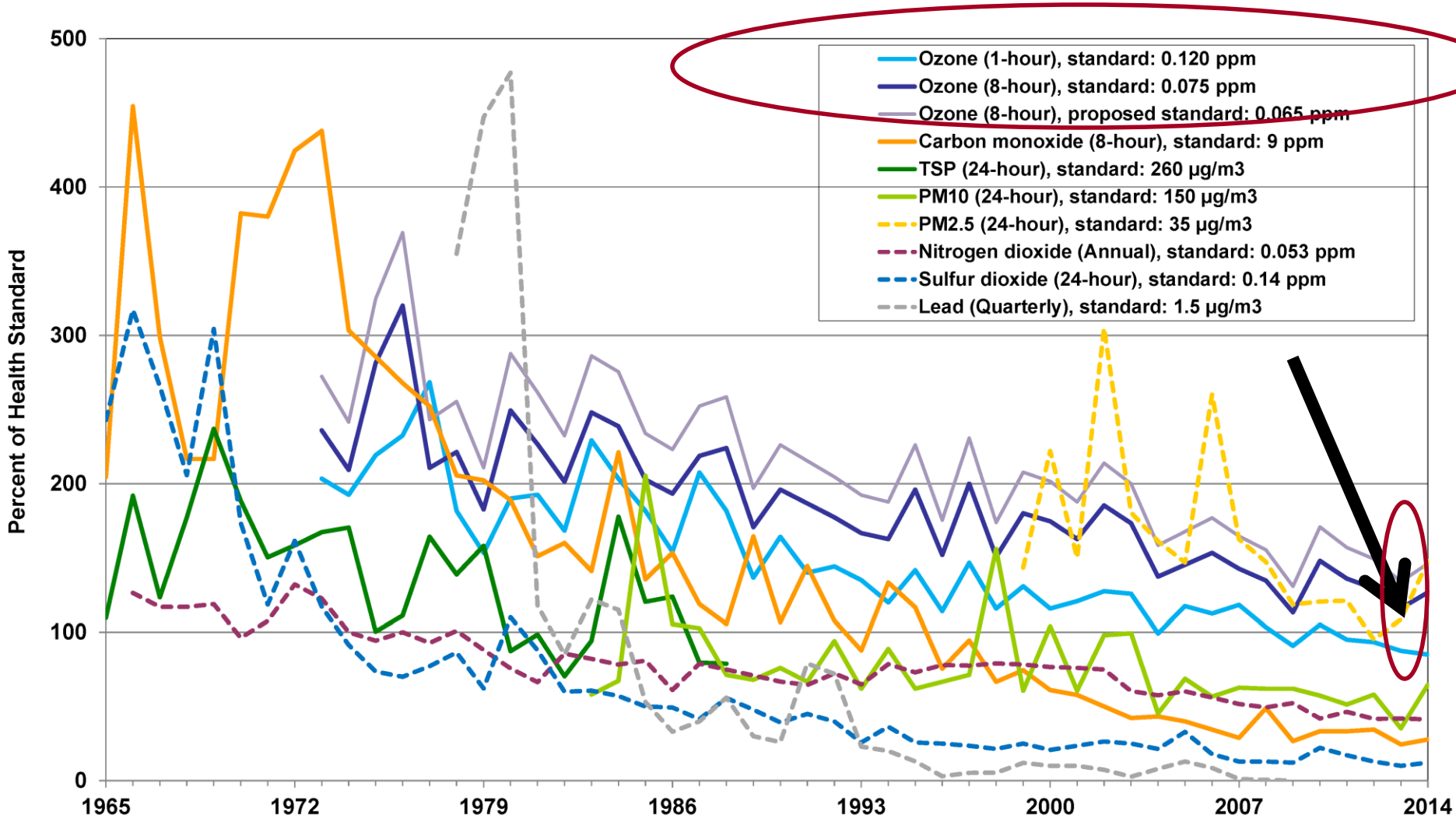
90% of areas designated nonattainment for the (old) 1997 ozone standards now meet those standards.

1. In NJ 204 million miles per day in 2013, does not reflect the drop in Gasoline prices
2. Some bad news: January 2015 National Traffic Volume Trends

Travel on all roads and streets changed by 4.9% (11.1 billion vehicle miles) for January 2015 as compared with January 2014.Travel for the month was estimated to be 237.4 billion vehicle miles

3. Some good news for NJ Though Most still drive alone to work, but younger residents are more likely to ride bikes, take trains or buses, or even walk – and 4 percent telecommute

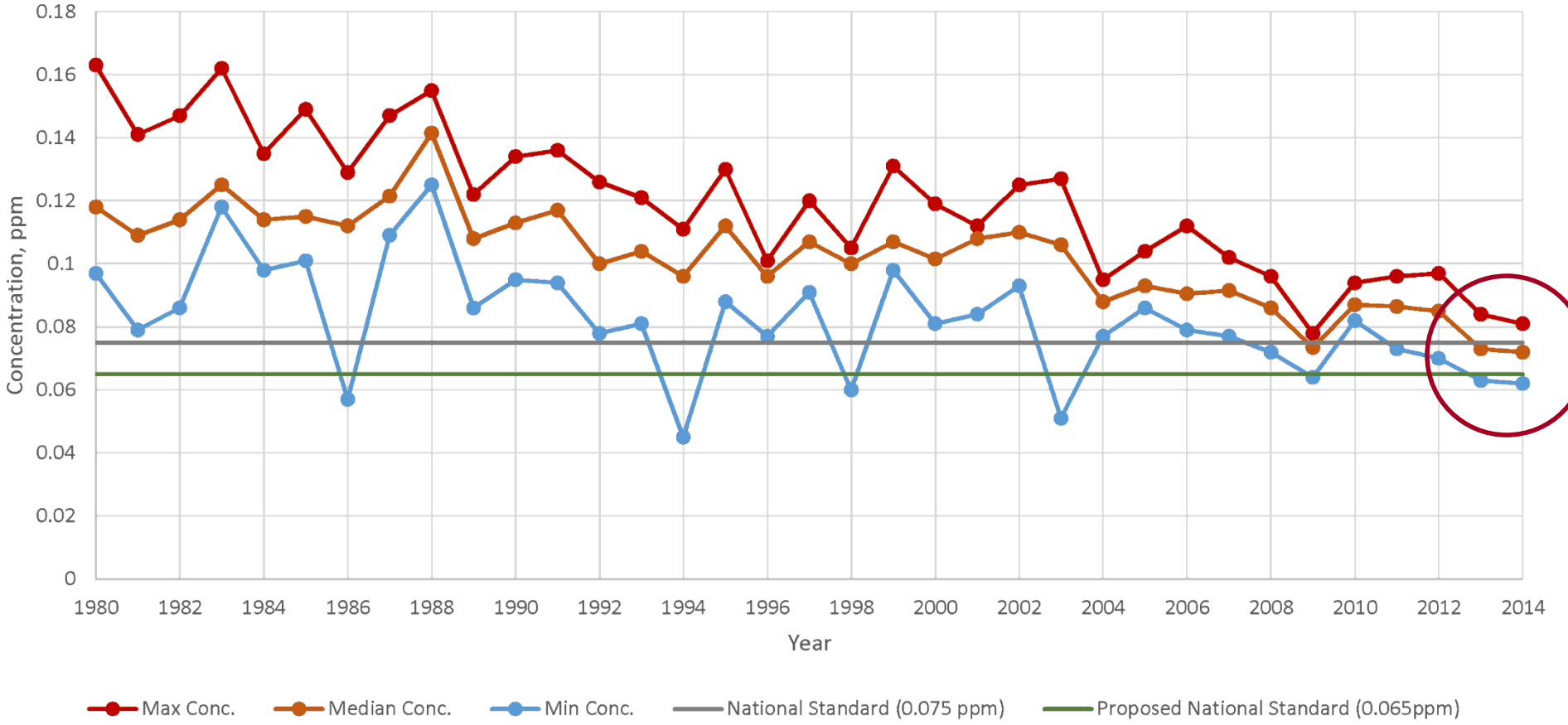
Maximum Pollutant Concentrations in New Jersey, 1965-2014



Source: NJDEP Air Monitoring Network and EPA AirData

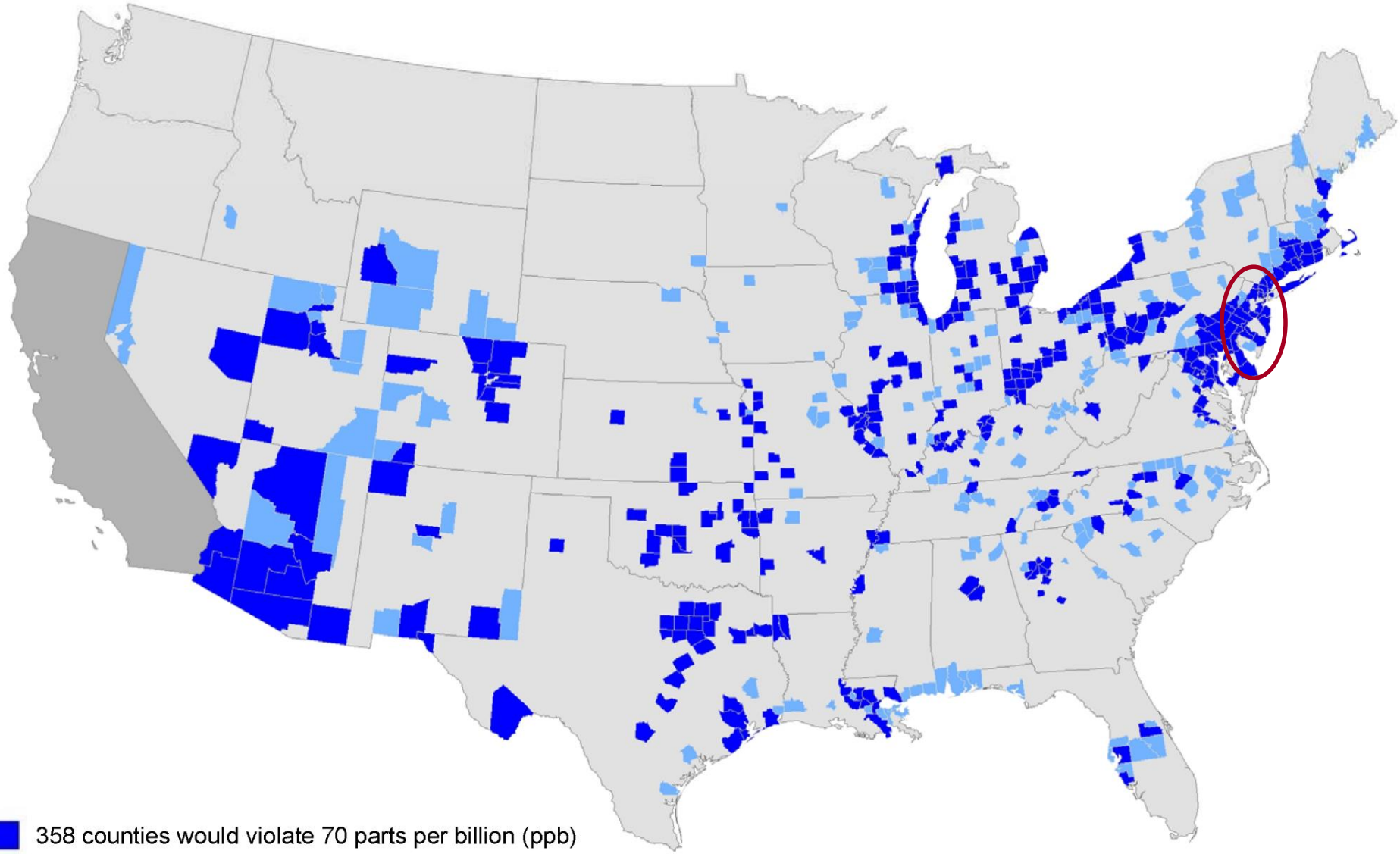
New Jersey Ozone Air Quality, 1980 - 2014

(Annual 4th Maximum of Daily Max 8-Hour Average)
New Jersey Trend based on 17 sites



Source: NJDEP Air Monitoring Network and EPA AirData

Counties Where Measured Ozone is Above Proposed Range of Standards (65-70 parts per billion)



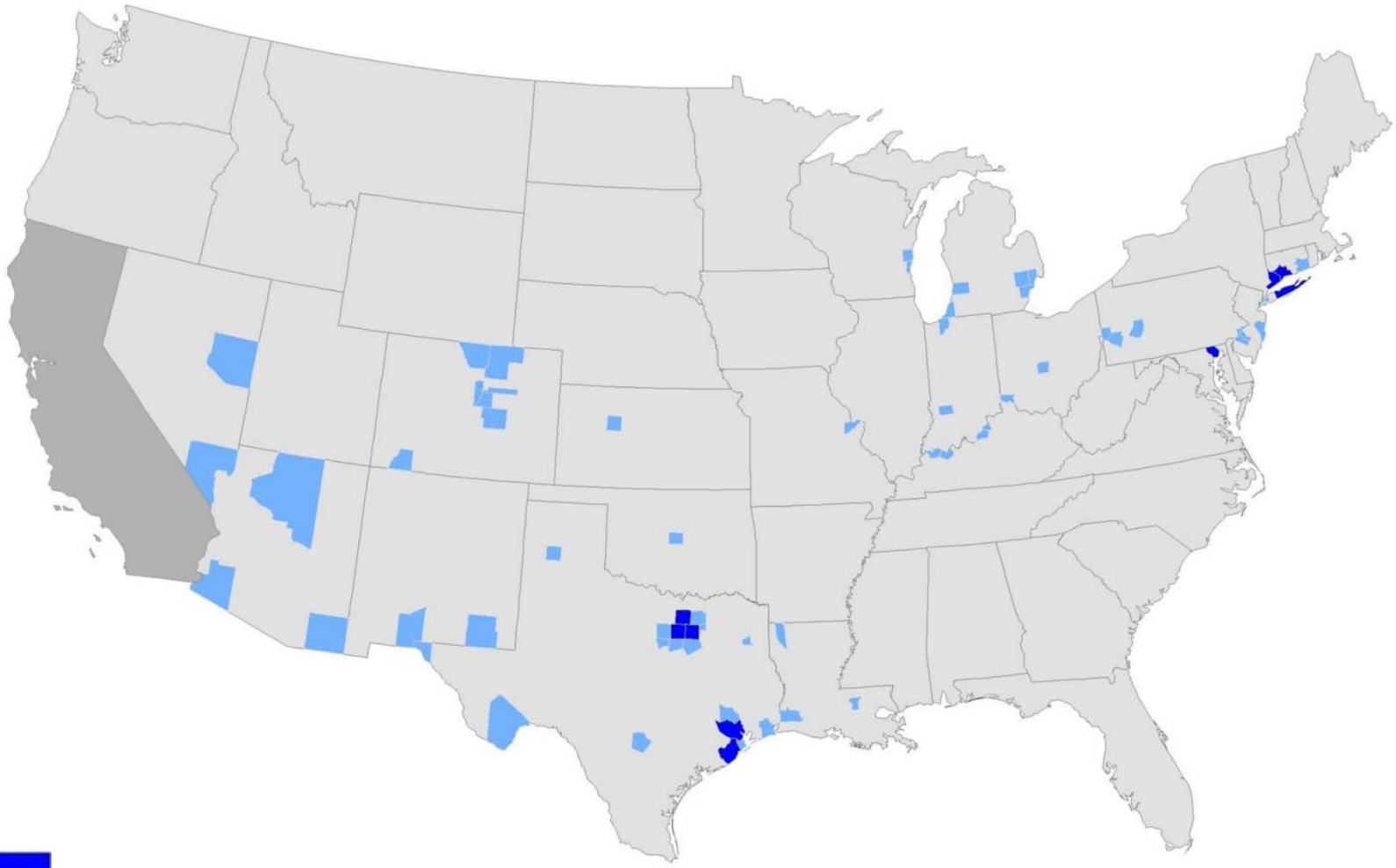
358 counties would violate 70 parts per billion (ppb)

200 additional counties would violate 65 ppb for a total of 558

Source: USEPA

Based on 2011 – 2013 monitoring data

EPA Projects Most Counties Would Meet the Proposed Range of Standards in 2025

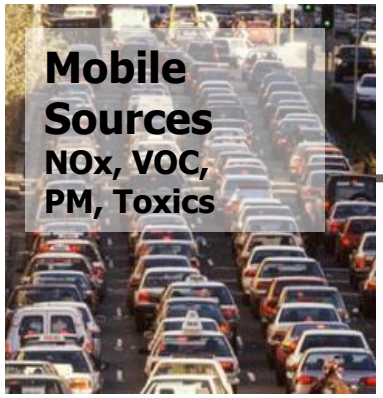


9 counties outside of California would violate 70 parts per billion (ppb)

59 additional counties outside of California would violate 65 ppb for a total of 68

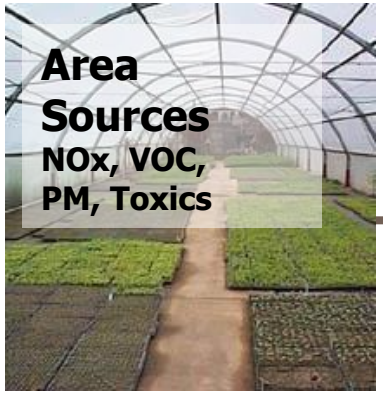
Because several areas in California are not required to meet the existing standard by 2025 and may not be required to meet a revised standard until sometime between 2032 and 2037, EPA analyzed California separately. Details are available in the Regulatory Impact Analysis for this proposal.

The "One-Atmosphere" concept provides consistency in environmental quality and health risk modeling and management that supports the efforts of the OTC and Regional Ozone reduction strategies



Cars, trucks, planes, boats, etc.

Power plants, refineries/ chemical plants, etc.



Residential, farming commercial, biogenic, etc.

Chemistry

Meteorology

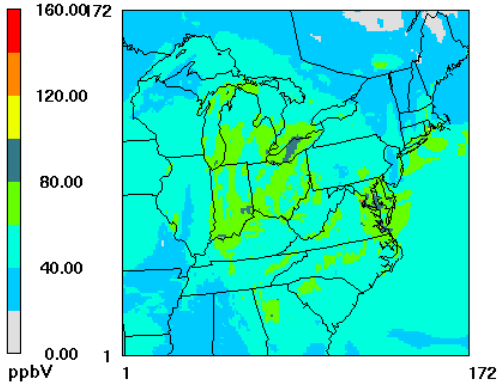
- Ozone
- PM
- Acid Rain
- Visibility
- Air Toxics
- Atmospheric Deposition
- Aeroallergens
- Climate Change

Strategies to further reduce AP

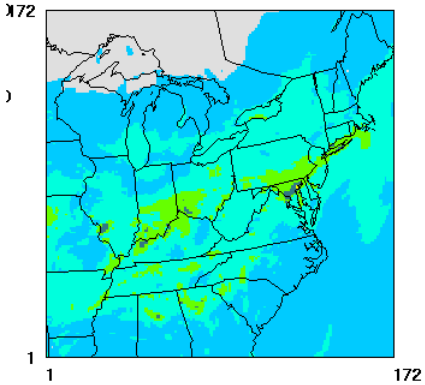
Slide adapted from EPA/OAQPS AQMG

Combination of Nitrogen Oxide and VOC emissions control

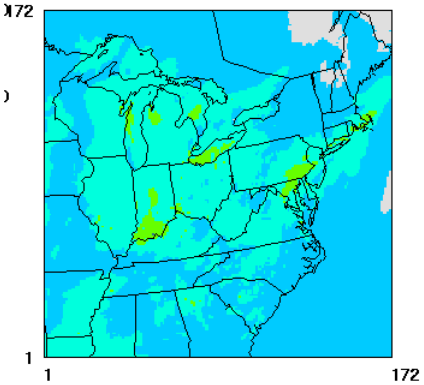
Example: Zeroing out NJ Emissions



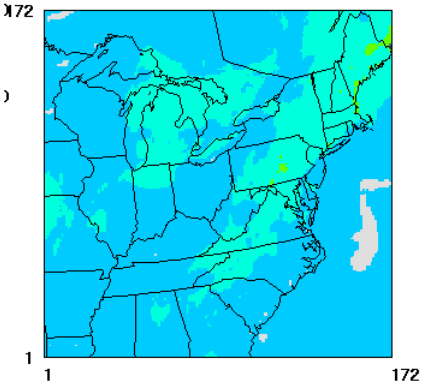
August 1,2002 15:00:00
Min= 16.27 at (156,166), Max= 127.18 at (129,65)



August 5,2002 15:00:00
Min= 7.14 at (53,172), Max= 110.02 at (125,85)

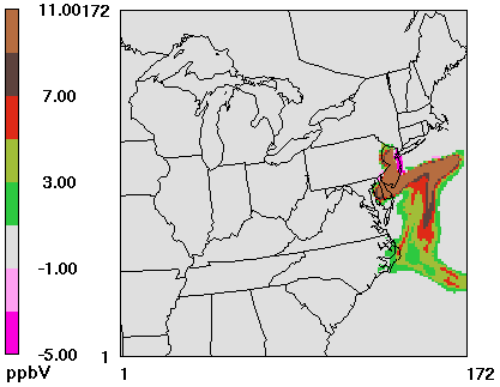


August 10,2002 15:00:00
Min= 13.21 at (129,171), Max= 80.22 at (55,61)

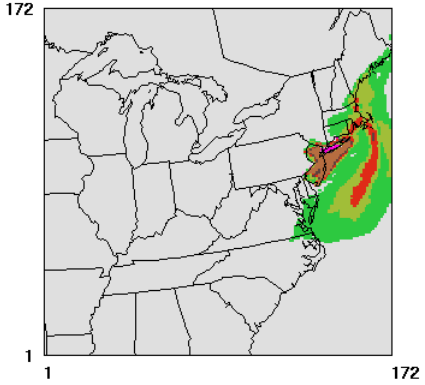


August 15,2002 15:00:00
Min= 13.15 at (110,21), Max= 84.01 at (172,155)

Differences between base case and control strategy



August 1,2002 15:00:00
Min= -36.89 at (139,97), Max= 61.61 at (135,85)



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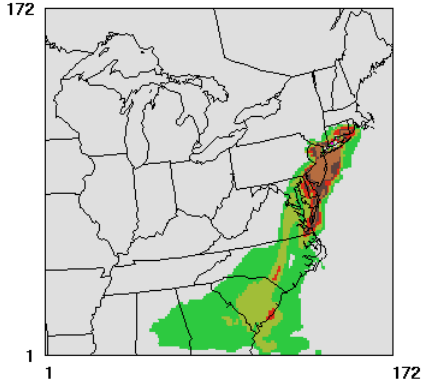
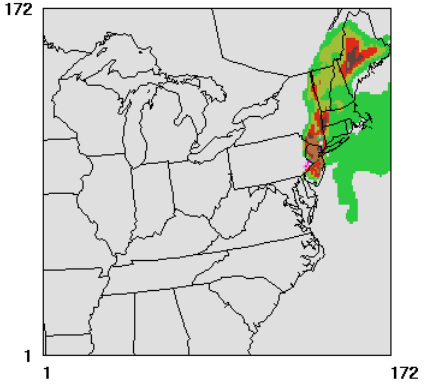
Min= -12.09 at (141,102), Max= 36.09 at (139,99)



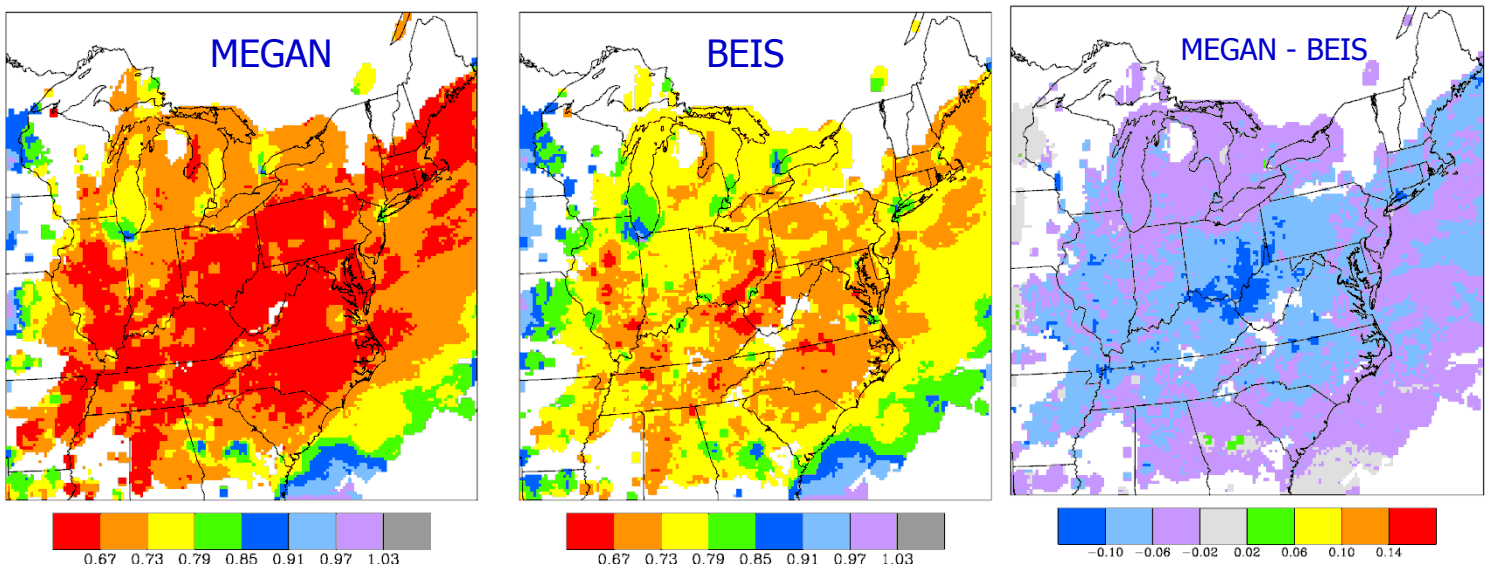
August 10,2002 15:00:00
Min= -3.24 at (143,105), Max= 32.03 at (139,99)



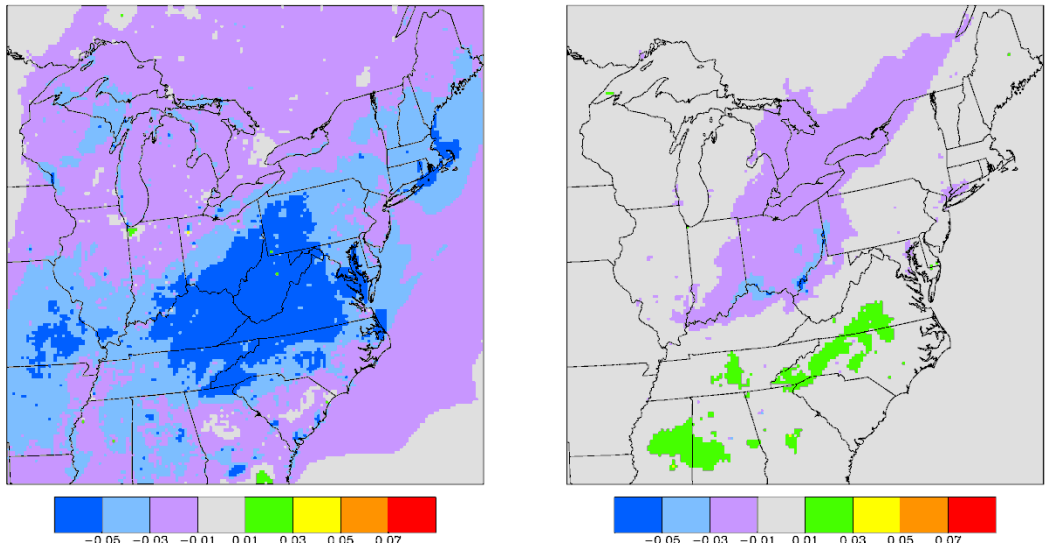
August 15,2002 15:00:00
Min= -5.55 at (138,103), Max= 27.22 at (137,99)

Impact of uncertainties in biogenic emissions on effectiveness of pollution control strategies

Relative Reduction Factors (RRF) for Ozone



- CMAQ simulations driven with outputs from MEGAN and BEIS emissions modeling systems
- Control scenario with 40% across the board anthropogenic NOx reductions for year 2012
- Impact on ozone (approximately 5%) and $PM_{2.5}$ levels (1-2%)
- Indirect impact on inorganic $PM_{2.5}$



RRF difference (MEGAN – BEIS) for $PM_{2.5}$ OM (left) and sulfate PM (right)

Conclusions

- Ozone is an air pollutant which is formed in the atmosphere that cannot be ignored – causes health effects ,and because it is an oxidant it leads to the formation of other products, including secondary particles, that can effect human health
- The bulk of measured ozone is formed after the oxidation of nitrogen oxides and highly reactive organic compounds.
- Ozone and ozone precursors can travel hundreds of miles that make it a regional and well as a local air pollution issue.
- Formation, accumulation and transport is a non-linear processes, and control strategies must take these into account in the design and implementation of control strategies
- The *GOOD* news is that ozone has been decreasing steadily since the early 1980s which indicate that strategies to date have been effective
- Large uncertainty for NJ is the change in number of vehicular miles driven each year both in NJ and east of the Mississippi River