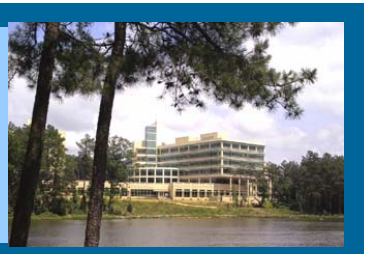
Tracking and Evaluating Air Quality Programs



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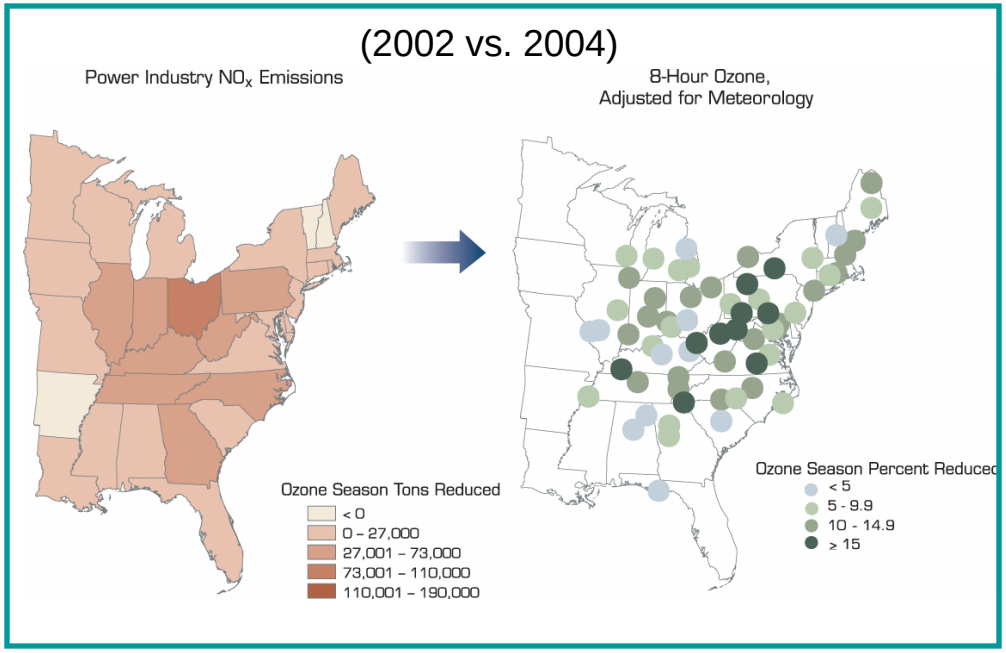
Background

- EPA documented assessment of the regional program to reduce ozone in the eastern U.S.(http://www.epa.gov/airmarkets/fednox/index.html)
  - Oxides of nitrogen multi-state implementation plan (NO_xSIP Call)
  - Large reductions in NO_x emissions from large utilities & boilers, 38% (2002 vs. 2004)
  - On average 10% decrease in ozone across the east
  - Strong association between areas with the greatest NOx emission reductions and areas exhibiting the greatest improvement in ozone
  - Other programs contributed to ozone improvement



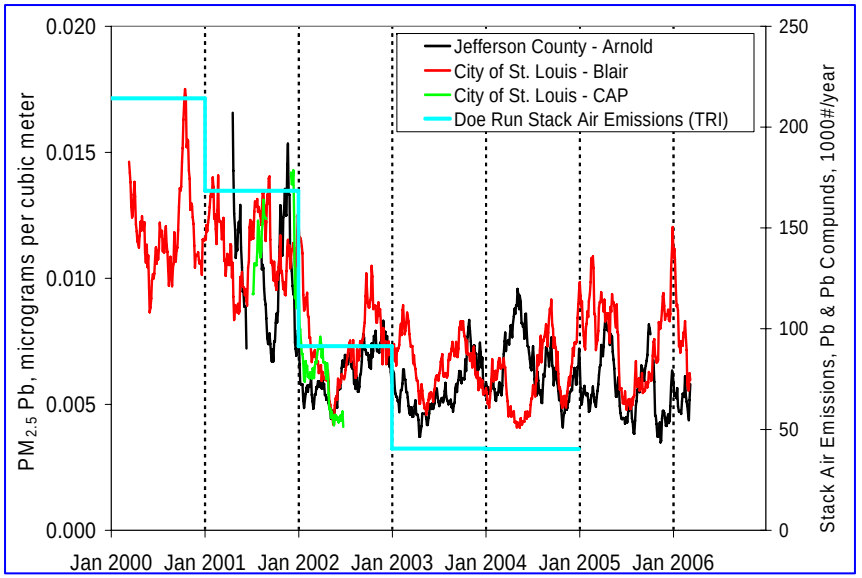
Introduction

- Three examples presented consider the spatial scale of influence, timing and magnitude of emission changes, as well as expected air quality changes.
  - Lead concentrations in the St. Louis area in response to lead regulations;
  - Sulfur concentrations (and related species) in Detroit in response to the Acid Rain Program; and
  - Toxic pollutant concentrations, including benzene, in the Baltimore area in response to reformulated gasoline (RFG);
- All three examples, as well as the NO_x SIP Call assessment have data limitations

….Understanding the impacts of our current programs will help us with the design of new programs.

Lead Regulations: St. Louis

- Doe Run - a primary lead (Pb) smelter located approximately 40 kilometers south of St. Louis, Missouri.
- Major source of airborne lead emissions
- 2001 Administrative Order of Consent by the EPA, the Missouri Department of Natural Resources, and Doe Run required controls implemented by July 2002.
- Results:
  - Annual emissions of lead from Doe Run reduced by ~80% (2000 vs. 2005)
  - Decrease in ambient $PM_{2.5}$ STN lead concentrations in St. Louis

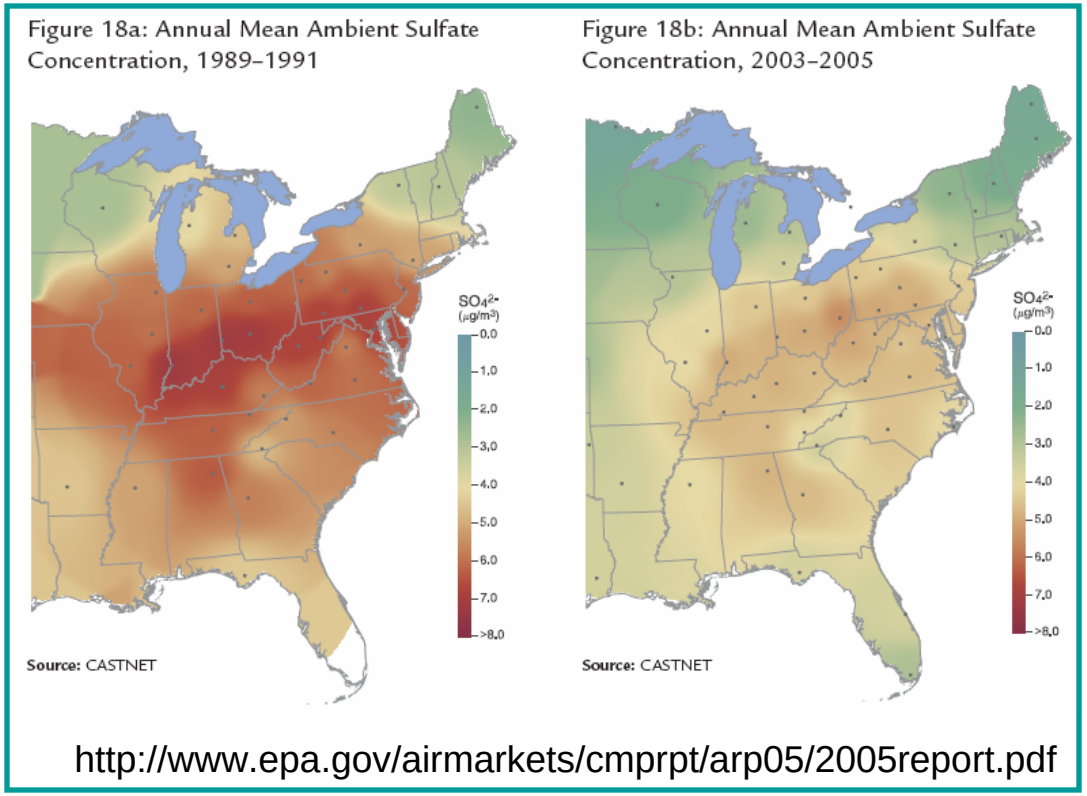


NOTE: Ambient concentrations are running 63-day geometric means

Acid Rain Program: Overview

- Title IV of CAA
- National Program
- Aimed at reducing emissions of SO2 and NOx air pollution from fossil-fuel fired power plants
- Phase I began in 1995 (445 units, mostly in the East)
- Phase II began in 2000 (over 2,000 units)
- Currently over 3,000 units

Large regional reductions achieved in eastern US



Acid Rain Program: Michigan

- Results show local and regional impact on multiple air quality pollutants, affected by SO_2 emissions
  - decreases in SO_2 emissions correlate well with the decrease in sulfur deposition (acid rain);
  - decreases in particle sulfate; and
  - reductions in haze caused by sulfate.
- Ambient and emissions data analyzed -
  - SO_2 utility emissions from CEMS (1995-2005) for Michigan and regional (IL,IN, MI, OH); (*http://www.epa.gov/airmarkets/emissions/prelimarp/index.html)*
  - Detroit ambient SO_2 from AQS at Warren, Pt. Hurron, East 7 Mile, Southwest High School, and Linwood sites (1993-2005);
  - Detroit ambient sulfate from $PM_{2.5}$ STN at Allen Park (2001-2005);
  - Ann Arbor ambient weekly integrated $PM_{2.5}$ sulfate, sulfur deposition, relative humidity and temperature from CASTNET (1991-2005).

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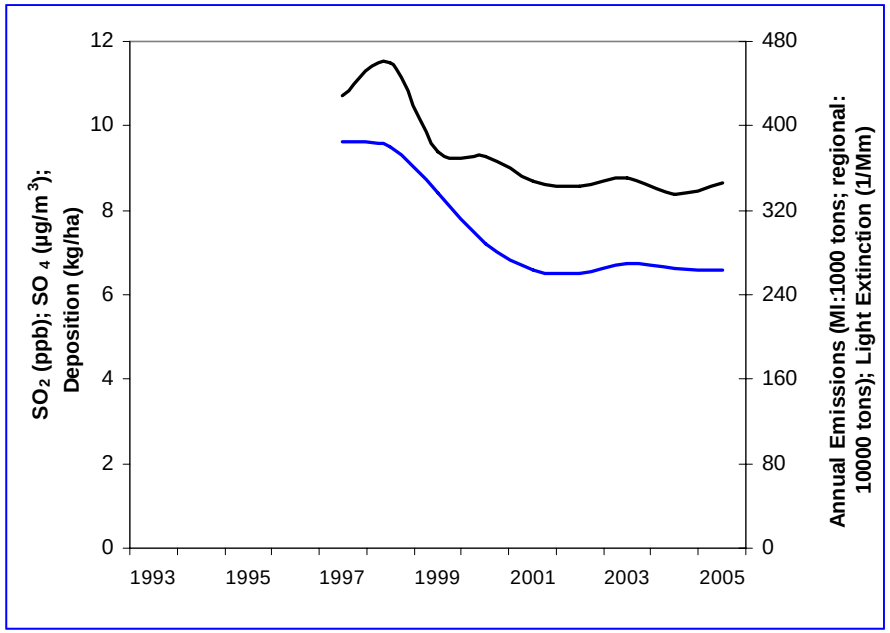
Acid Rain Program: Michigan
Reductions Observed



3-year averages – ending year

- 14% decrease in SO_2 utility emissions in Michigan (1995-1997 vs 2003-2005)
- 26% decrease in SO_2 utility emissions, region-wide (IL, IN, OH, MI) (1995-1997 vs 2003-2005)

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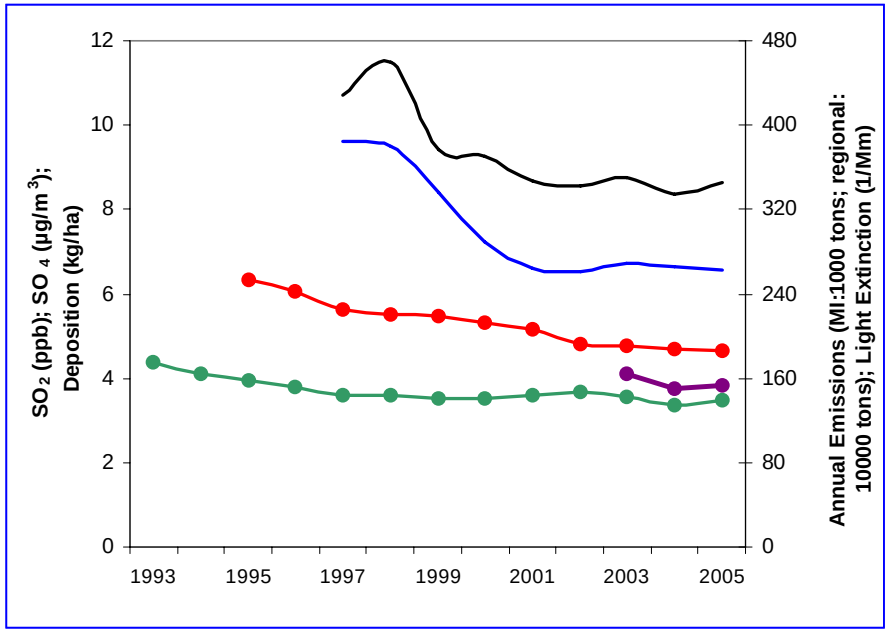

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- 26% decrease in SO_2 utility emissions, region-wide (IL, IN, OH, MI) (1995-1997 vs 2003-2005)
- 26% decrease in average ambient SO_2 in Detroit (1993-1995 vs 2003-2005)
- 7% decrease in ambient $PM_{2.5}$ sulfate, at Allen Park in Detroit (2001-2003 vs 2003-2005)
- 12% decrease in ambient $PM_{2.5}$ sulfate in Ann Arbor (1993-1995 vs 2003-2005)

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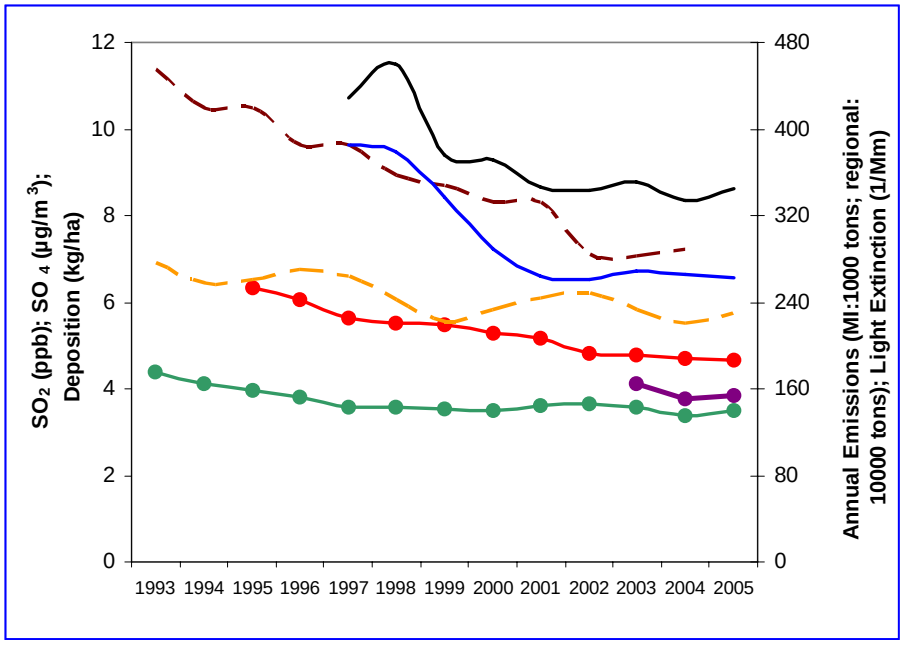

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- 12% decrease in ambient $PM_{2.5}$ sulfate in Ann Arbor (1993-1995 vs 2003-2005)
- 31% decrease in total sulfur deposition in Ann Arbor (1993-1995 to 2002-2004)
- 12% decrease in light extinction estimates (1993-1995 to 2003-2005)

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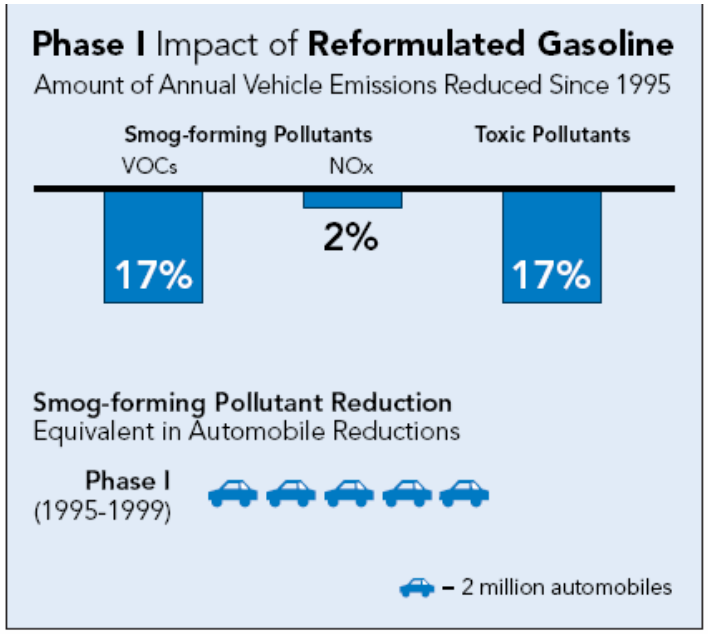
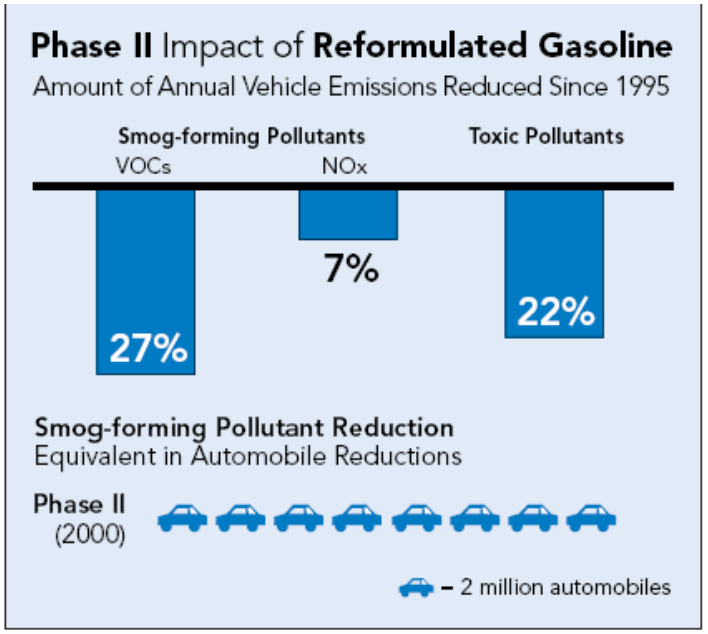
Reformulated Gasoline: Overview

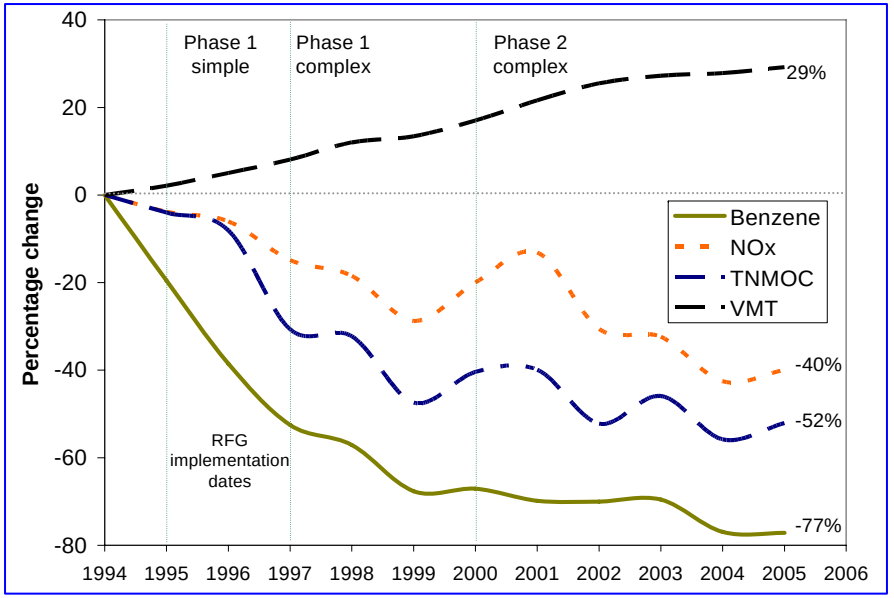




- Originally, mandated for nine cities (Los Angeles, San Diego, Chicago, Houston, Milwaukee, Baltimore, Philadelphia, Hartford, and New York City).
- In 1999, implemented in 17 States and DC.

Reformulated Gasoline: Baltimore

- Air toxics, such as benzene and toluene, emitted by motor vehicles, are major contributors to ozone formation
- Reformulated gasoline (RFG) reduces motor vehicle emissions of benzene and other ozone precursors
- Benzene decreased in Baltimore, MD after the 1995 implementation of RFG despite increase in number of vehicle miles traveled (VMT) by cars and trucks in the Baltimore area
- Most of the decreases in benzene are directly attributable to implementation of RFG.
- Other important pollutants emitted by motor vehicles and *other sources*, such as NOx and total non-methane organic compounds (TNMOC), also decreased during the same time period, though not as much as the targeted benzene.



Summer Averages for 6:00-8:00 am EST

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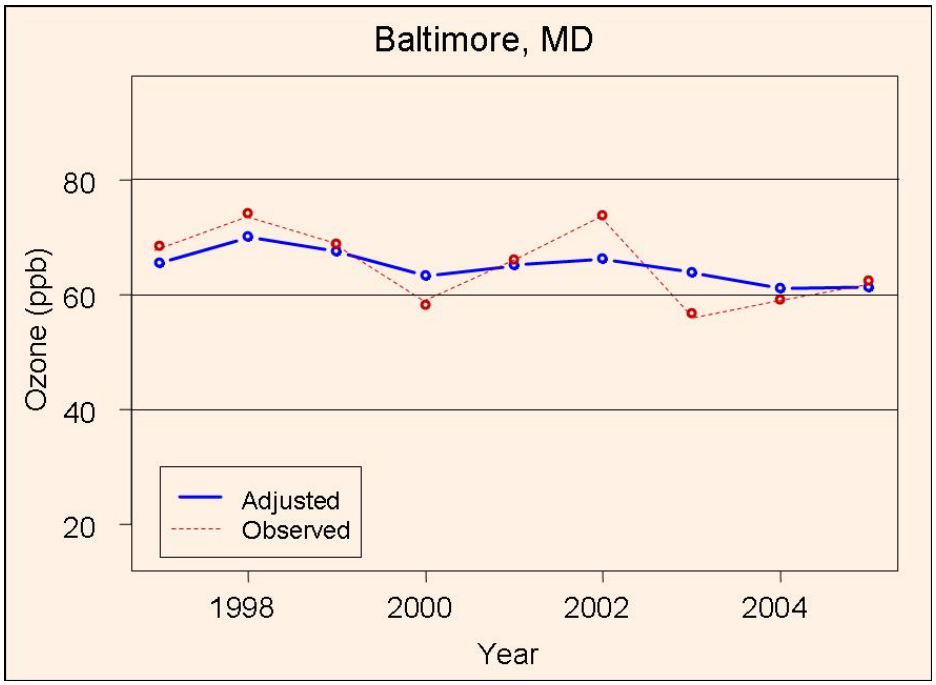
Weather Influences on Secondary Formation Pollutants: Ozone



- Weather conditions play an important role in the formation of ground-level ozone, a secondary formation pollutant.
- To reveal underlying trend, EPA adjusts ozone concentrations to account for the influences of weather
- After adjusting for year-to-year variations in weather conditions, a 6% decrease in ozone is seen (Cox, Camalier, 2006).
- Note the NO_x SIP Call and *other programs*, contributed to the decrease after 2002, not just RFG.
- More information on tracers, like CO, SO_2 and NO_y, is needed to separate contributions from individual programs.

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Ambient Monitoring, Data Limitations

- Must have
  - Ambient data (including tracers and precursor species, e.g., PAMS),
  - Accurate emission estimates, and
  - Meteorology.
- Data must be available both before and after a regulation.

Summary

- Long-term data record and significant, known change in emissions are critical to seeing a change in the ambient concentrations that corresponds to a change in emissions.
- Primary pollutant with strong source receptor configurations are easiest to track.
- Tracking secondary pollutants are confounded by mixture of sources, precursor species and weather conditions.
  - To better understand how these pollutants are changing, EPA assesses both the changes in precursor emissions as well as weather conditions.

Next Steps

- NCore Multipollutant Monitoring Network
  - will enable future assessments,
  - by providing more precursor information (such as NOy, CO and SO_2), and
  - on site weather conditions.
- Future assessments include
  - wood stove change outs,
  - diesel retrofits,
  - Clean Air Interstate Rule,
  - Mercury Rule, and
  - State/Tribal attainment and maintenance plans for air quality standards.