Clear Skies and $PM_{2.5}$ – Regional Haze Implementation Policy

Presentation to the NETL Conference

PM2.5 and Electric Power Generation: Recent Findings and Implications

9 April 2002
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EPA/OAQPS

Presentation Overview

- Status of the NAAQS and NAAQS Review
- Likely course of $PM_{2.5}$ implementation
  - The problem
  - Update on schedule
- General Principles for Implementation
  - Most cost-effective approaches first
  - What we know best
  - Regional to local
- Potential role of the Clear Skies Initiative
  - A new regulatory baseline for power generation
  - Overview of expected reductions

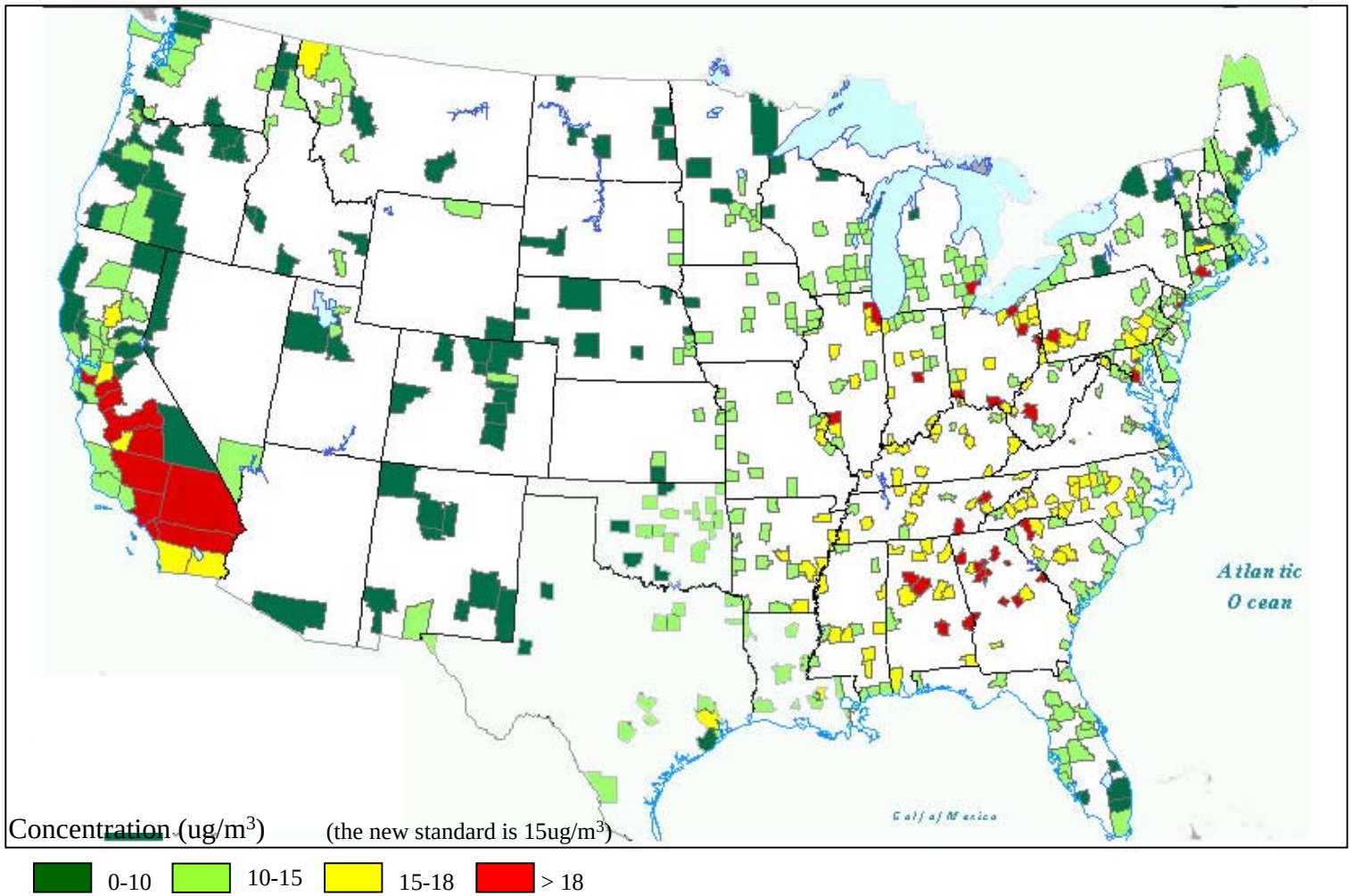
NAAQS Status

- EPA set “fine” particle standards July 1997
  - Primary: based on epidemiological studies
  - Secondary: based on urban/suburban visibility
  - Multiple challenges on scientific basis, approach, cost, more
- After 5 years of litigation, on 26 March 2002 the DC Circuit ruled (3-0) for EPA
  - “finding the challenged air quality standards neither arbitrary nor capricious, we deny the petitions for the review….”
- Current review completion planned for end of 2003
  - Revised CD draft released in May, CASAC review in July
  - Draft staff paper end of June, CASAC review in September
  - Proposal, public comment
- Moving towards designation, implementation

What's new in PM science?

- New PM Criteria Document will include a comprehensive evaluation of hundreds of new health studies
  - Some exceptions, but generally appear to be consistent with studies from previous PM NAAQS review
  - 3rd draft due in May 2002, www.epa.gov/ncea/partmatt.htm
- Selected examples of important emerging studies that will be included in this ongoing evaluation of the evidence:
  - HEI's NMMAPS reported association between premature death and PM10 across 90 largest U.S. cities (Samet et al. , 2000)
    - Results can't be explained by other pollutants, weather, or statistics
    - Some variability in PM effects estimates with region
  - HEI reanalysis of Harvard Six City and American Cancer Society studies confirmed findings of link between long-term $PM_{2.5}$ /sulfate exposure and premature mortality from heart and lung diseases (Krewski et al., 2000)
  - Major new Journal of American Medical Association study of ACS data expands and supports previous link between $PM_{2.5}$ /sulfate exposure and cardiopulmonary deaths; new evidence of link with lung cancer deaths (Pope et al., 2002)
  - Several new studies have reported links between ambient PM and specific cardiac effects, e.g., risk of heart attacks (Peters et al., 2001)

Potential $PM_{2.5}$ Non-Attainment -- Current Data*



Nationwide:

- 173 counties (82 million people) > $PM_{2.5}$ NAAQS

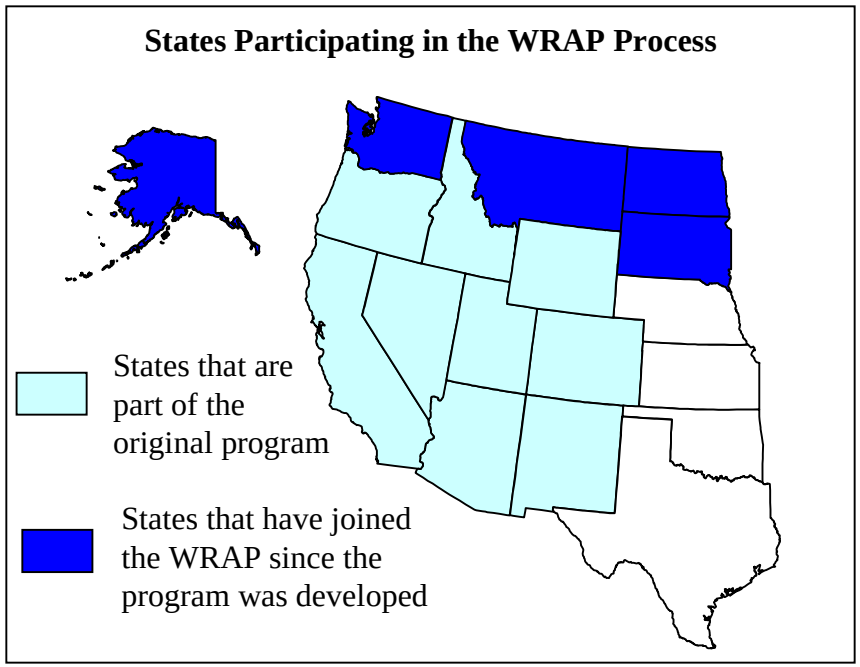
East:

- 157 counties (59 million people) >$PM_{2.5}$ NAAQS

*Based on 1999-2000 incomplete data, 3 years data required for attainment determination

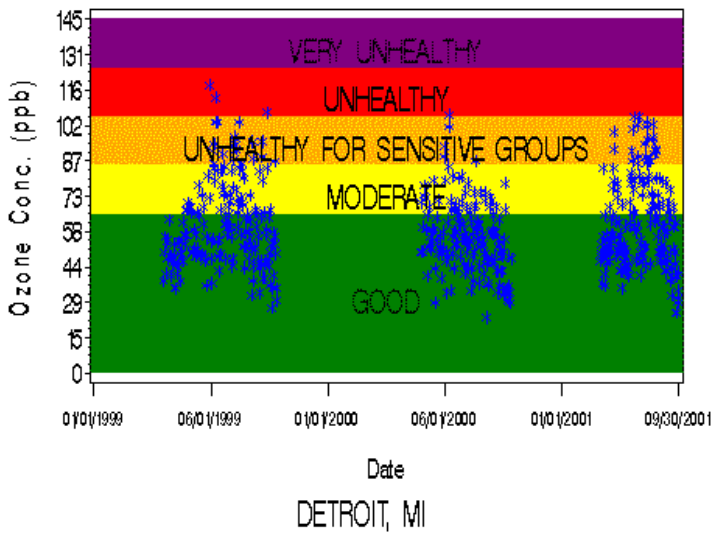
The WRAP Program

- 9 Western States participated in the development of a program to reduce their SO_2 emissions to improve visibility in national parks and other areas.
- Since the development of the program, five additional States have joined the WRAP planning efforts.

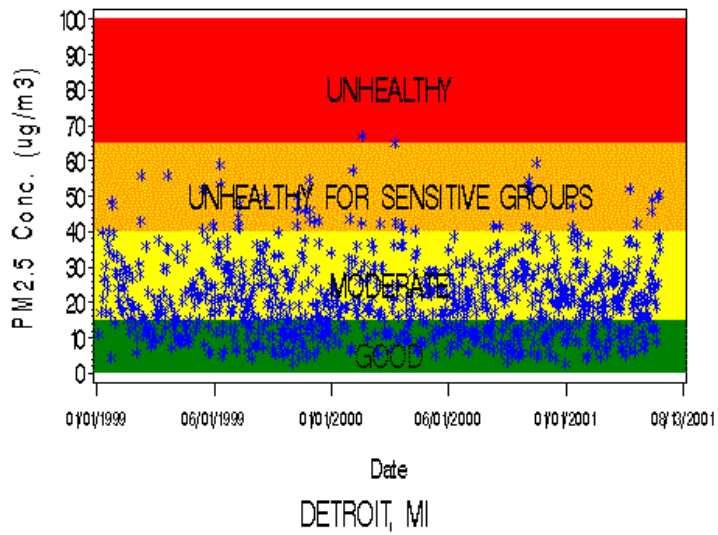


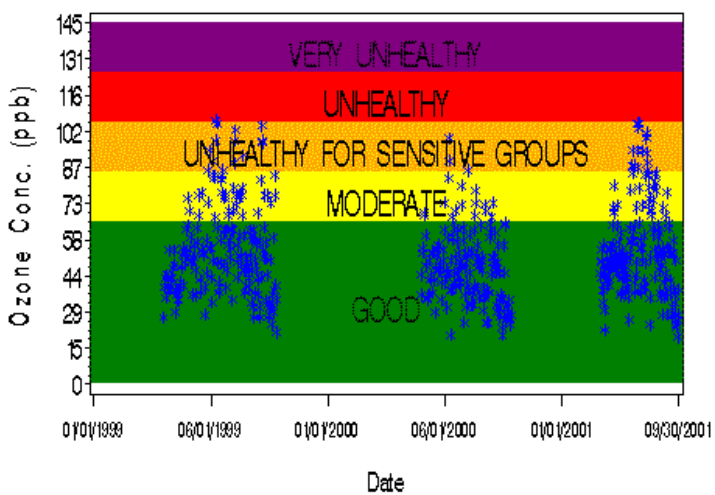
New $PM_{2.5}$ AQI Health Messages: A pollutant for all seasons

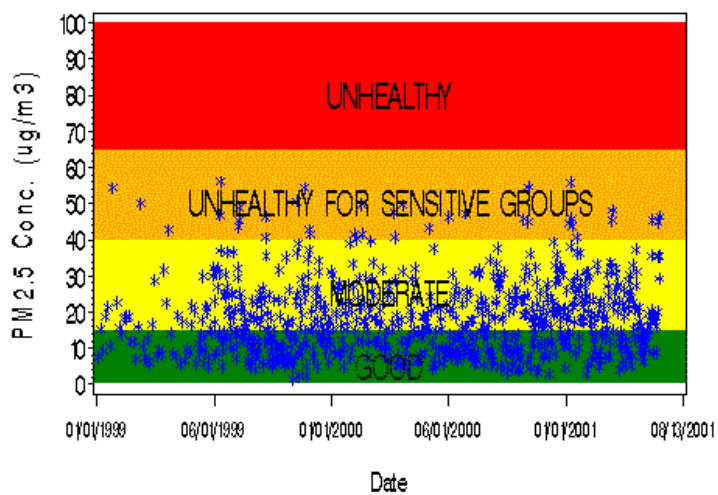
Ozone



$PM_{2.5}$

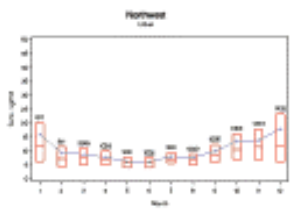




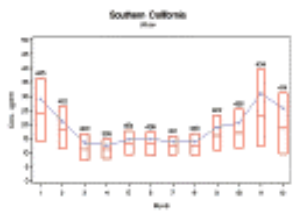


M. Rizzo, R5

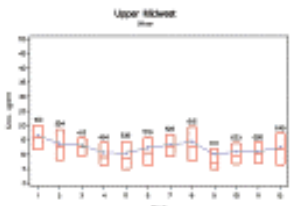
Urban Sites



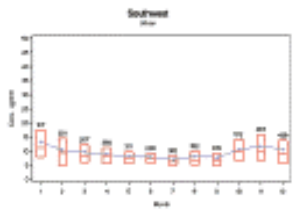

Northwest



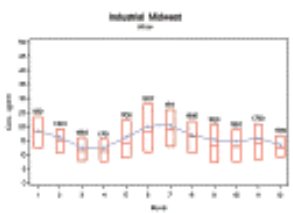

Southern
California



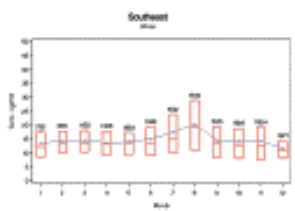

Upper Midwest



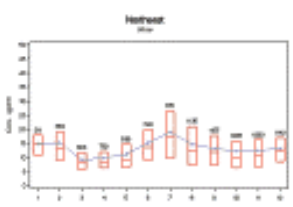

Southwest



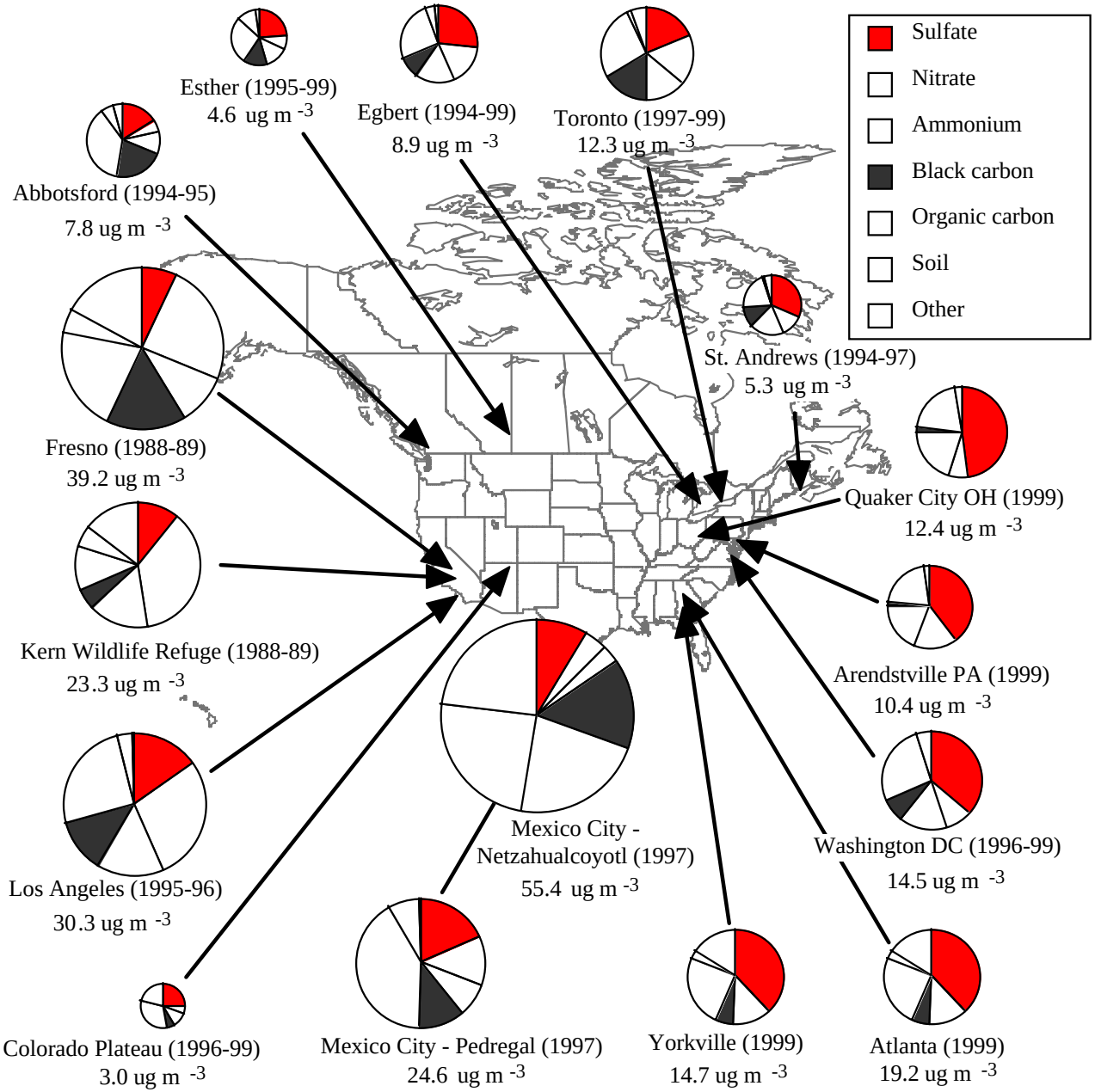

Industrial Midwest




Southeast




Northeast



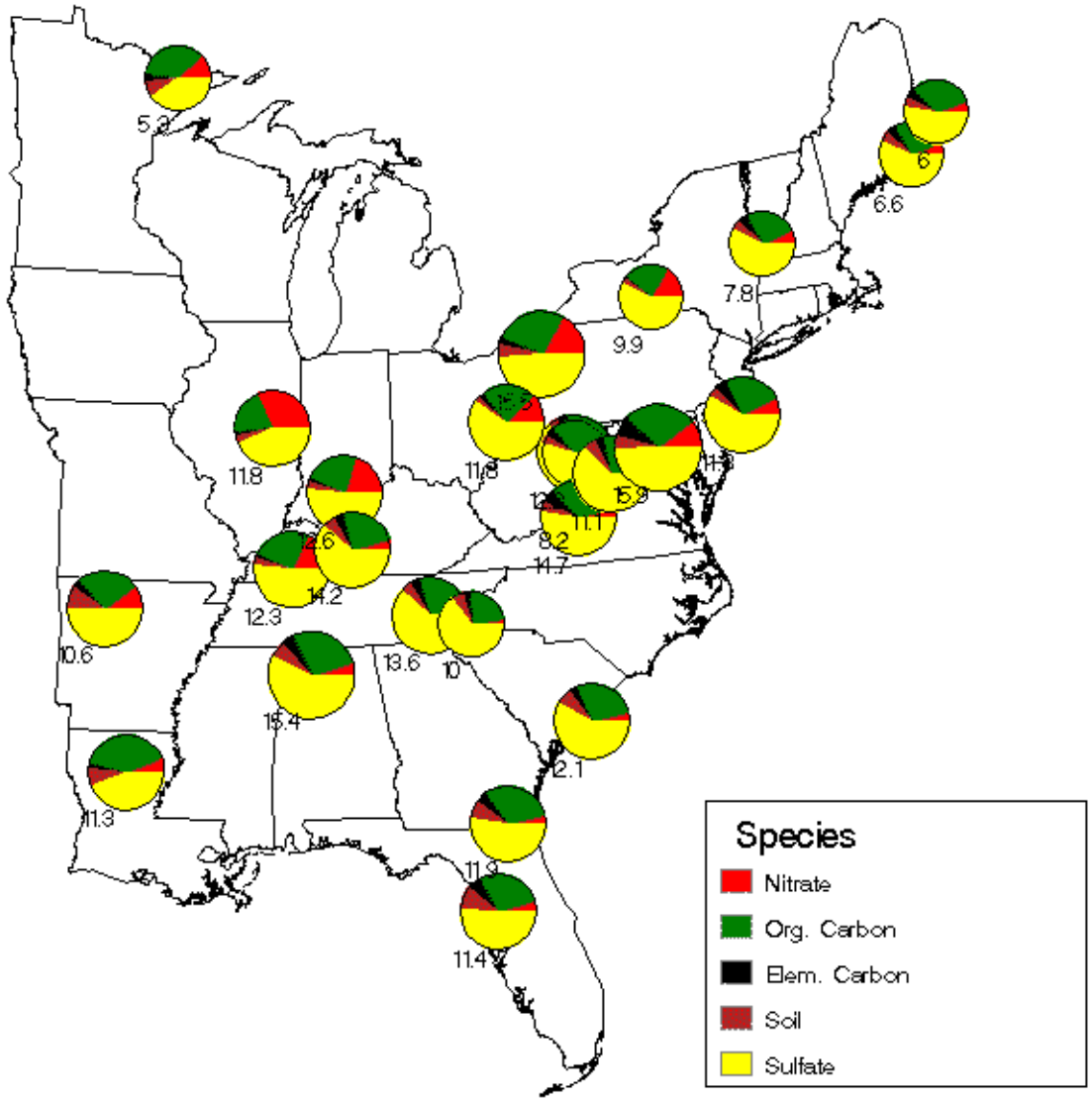
Why regional SOx/NOx from power generation?

Sulfate + ammonium makes up a large part of fine PM across eastern North America

But annual nitrates less significant in East

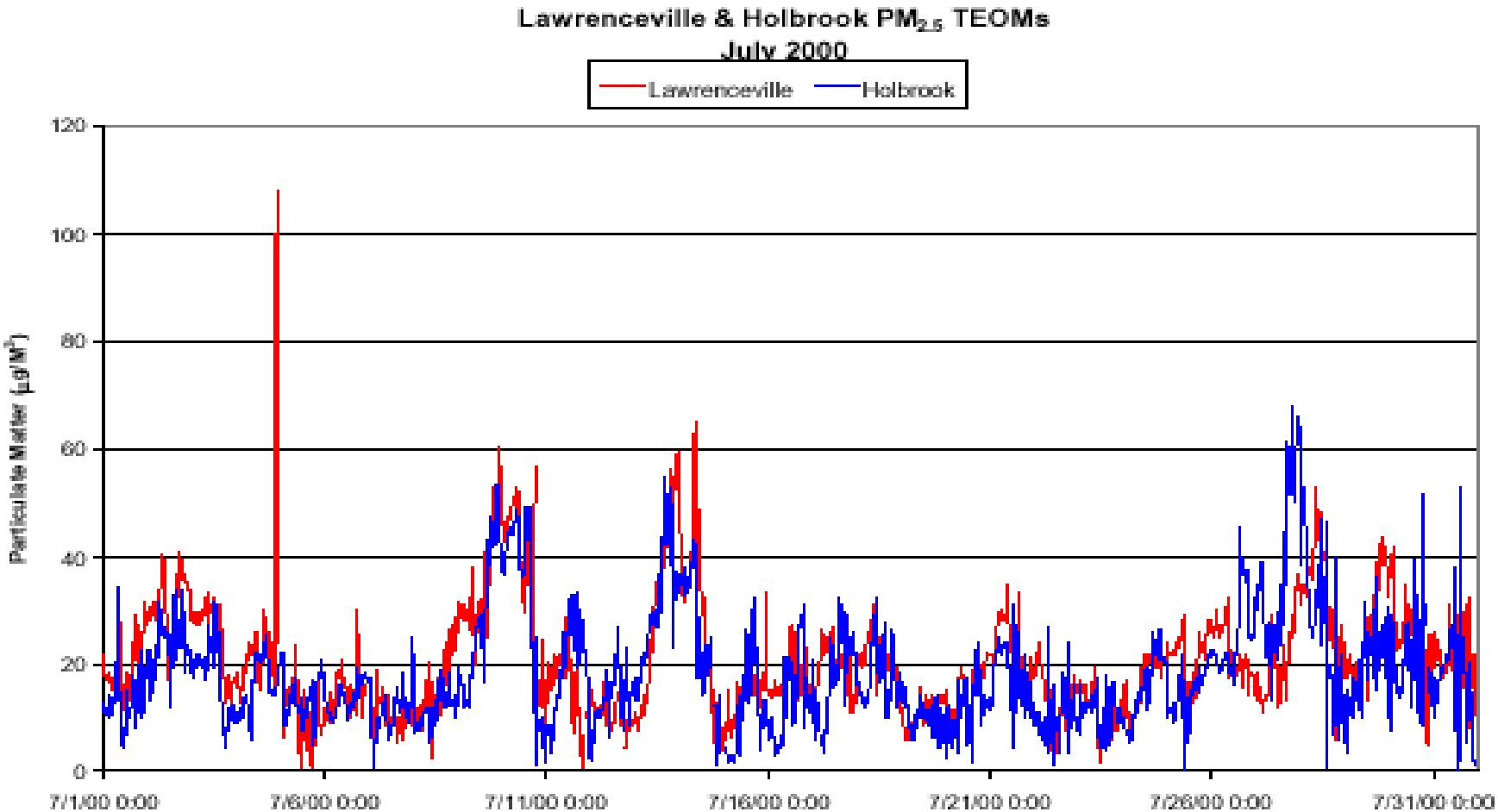
Chemical Composition - Rural Sites

IMPROVE/CASTNet Data (1997 - 1999)



Urban v. Rural

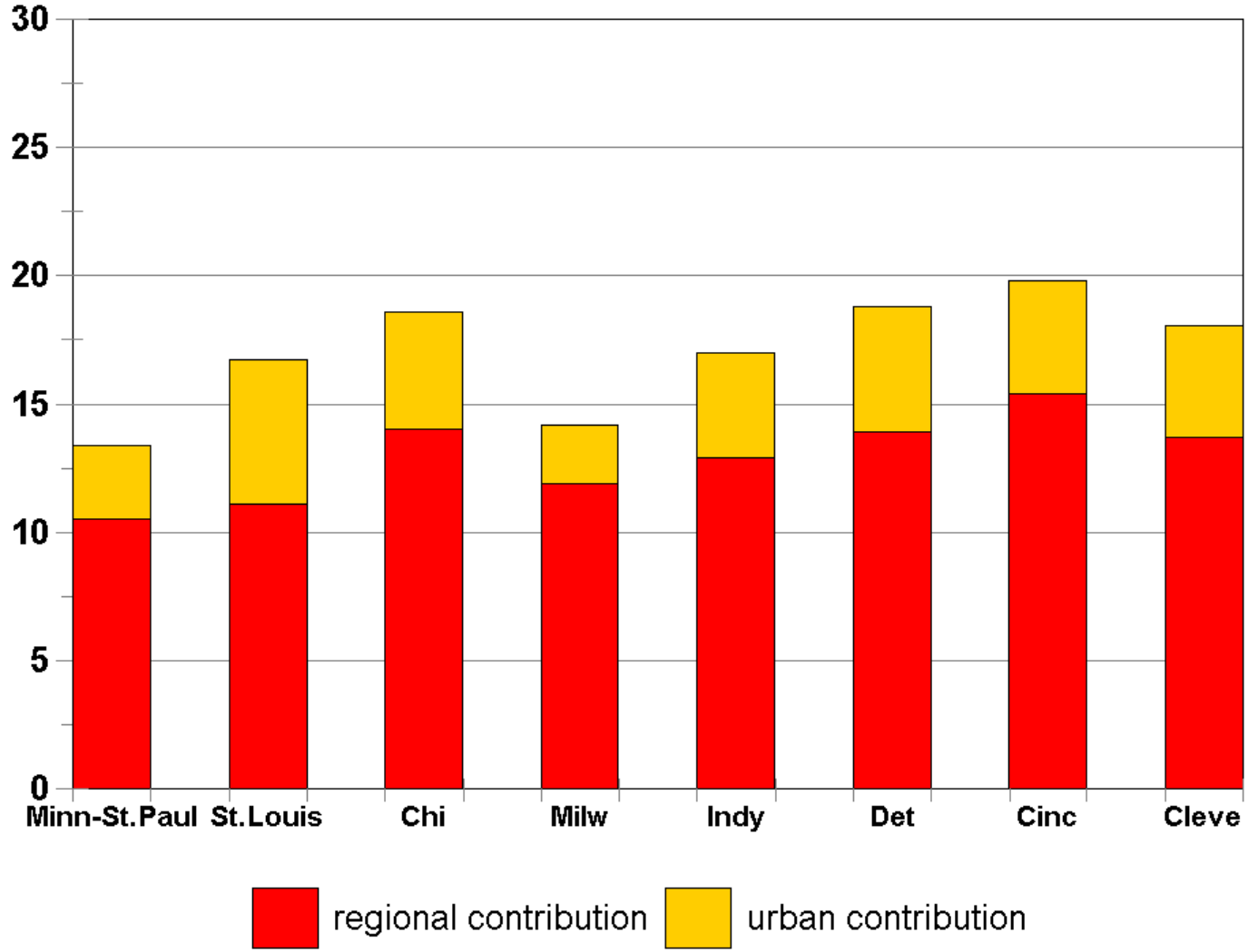
(DOE Upper Ohio River Valley Study)



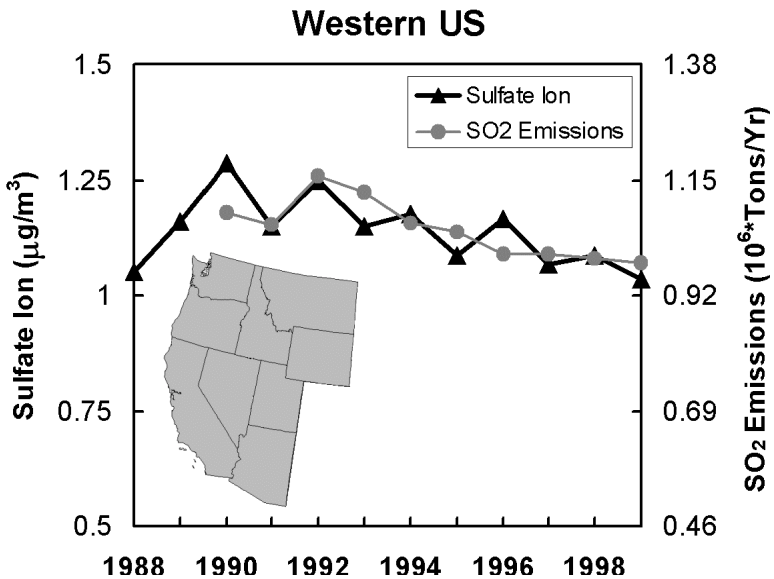
Cite: Semi-Annual Technical Progress Report, ATS, Oct. 31, 2001

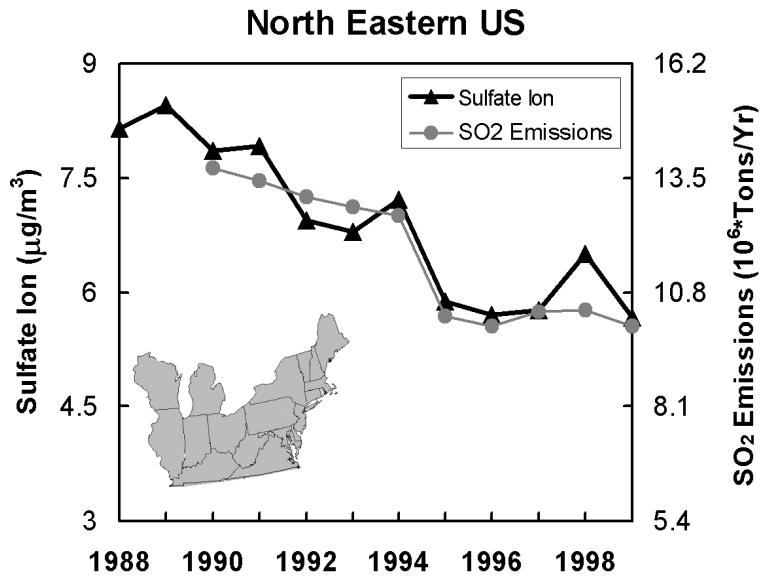
Urban v. Rural

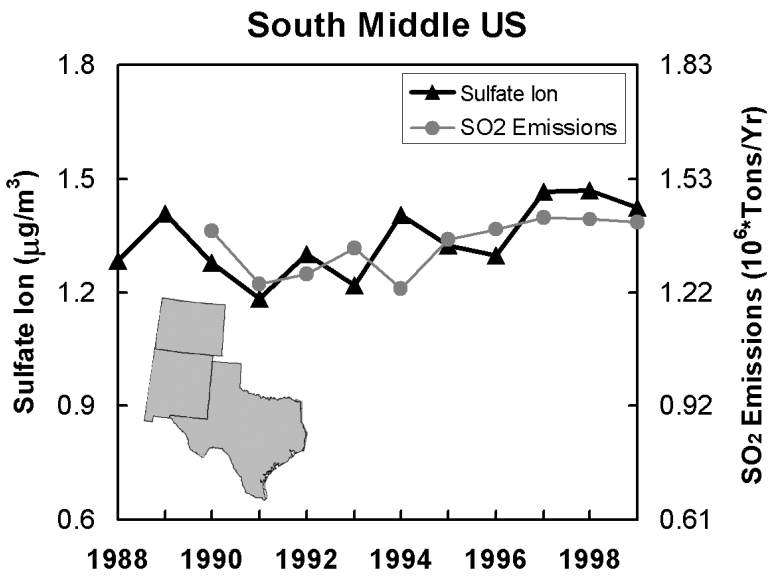
(Annual Average Concentrations)

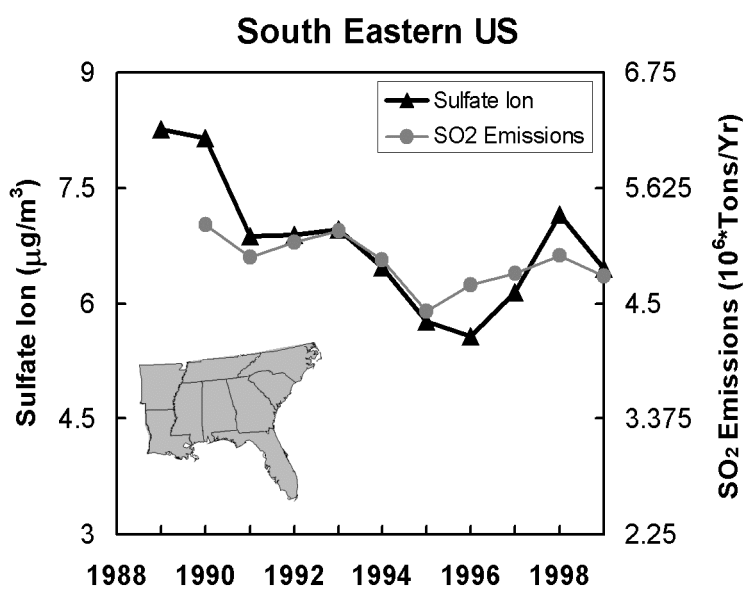


Rural Sulfate Trends track Regional SO_x Emissions

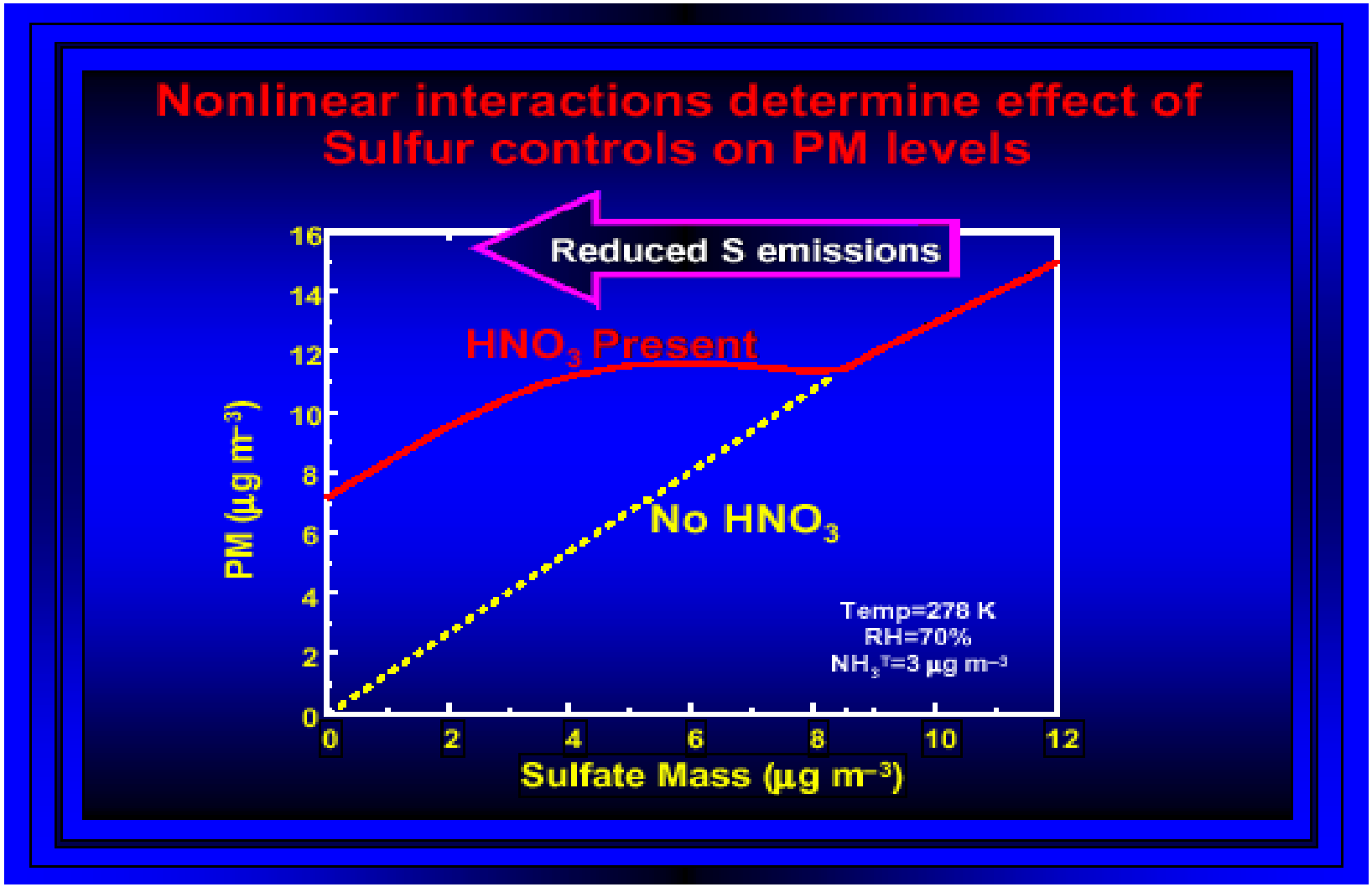








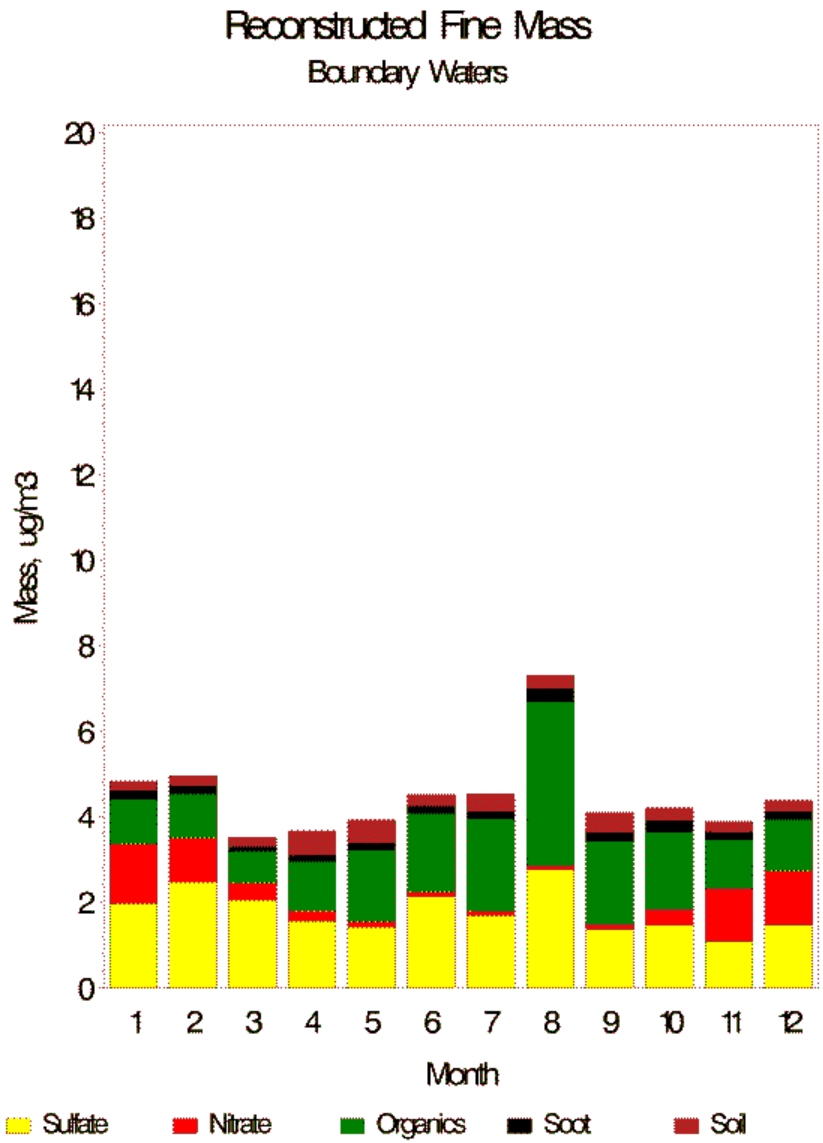
Role of NO_x/NH_3 after SO_x reductions

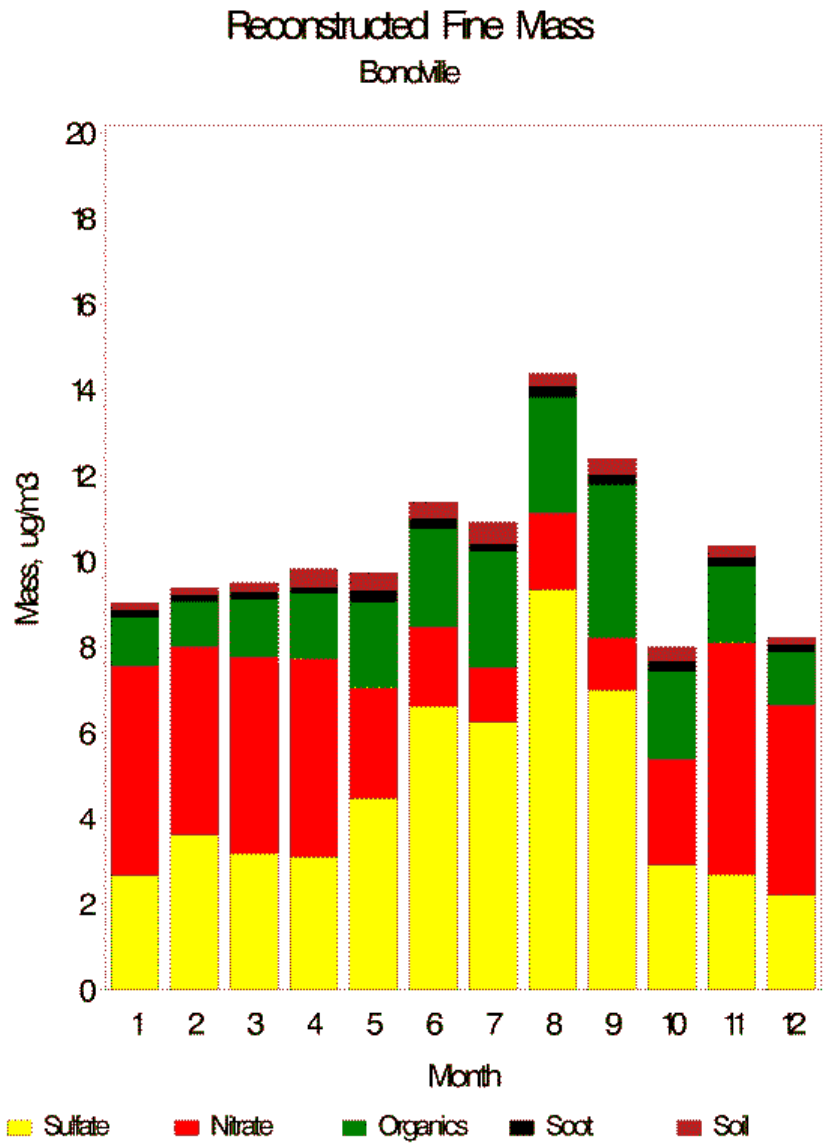


Cite: Robinson, Pandis, Davidson, DOE Meeting, March 2001

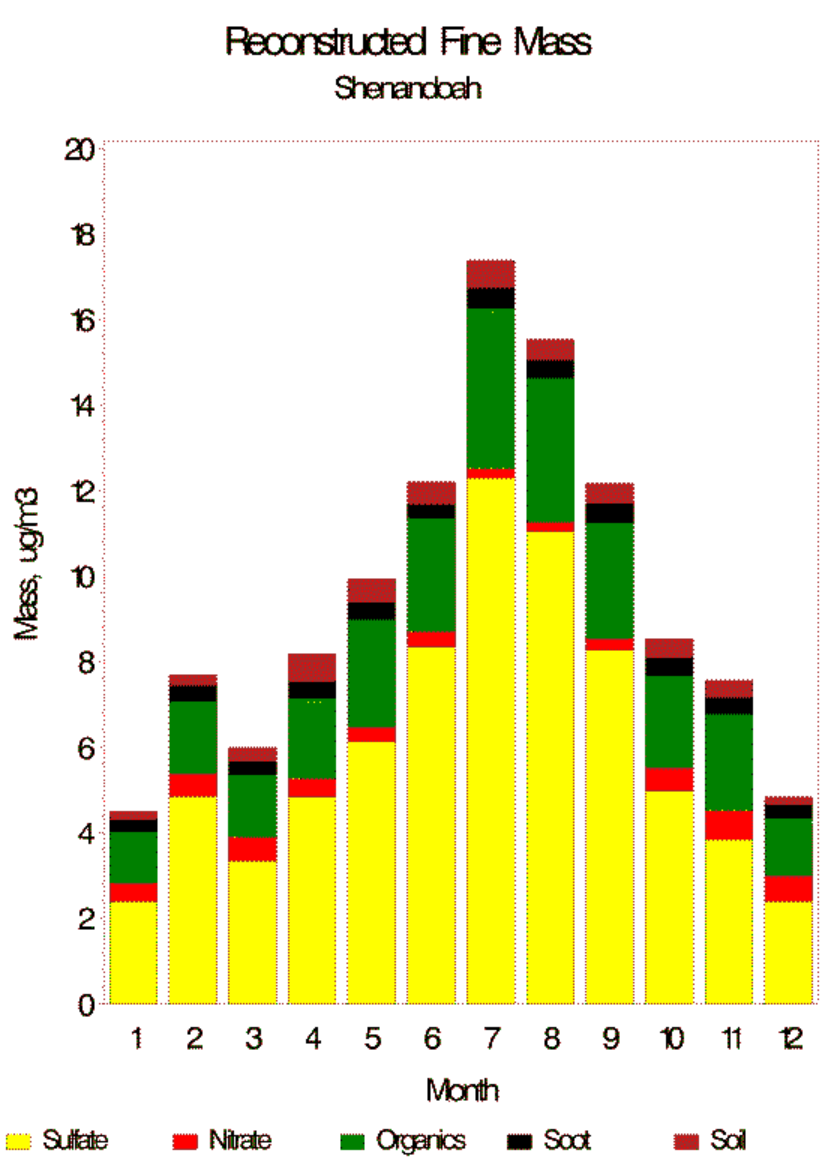
Early signs of nitrate substitution in wintertime

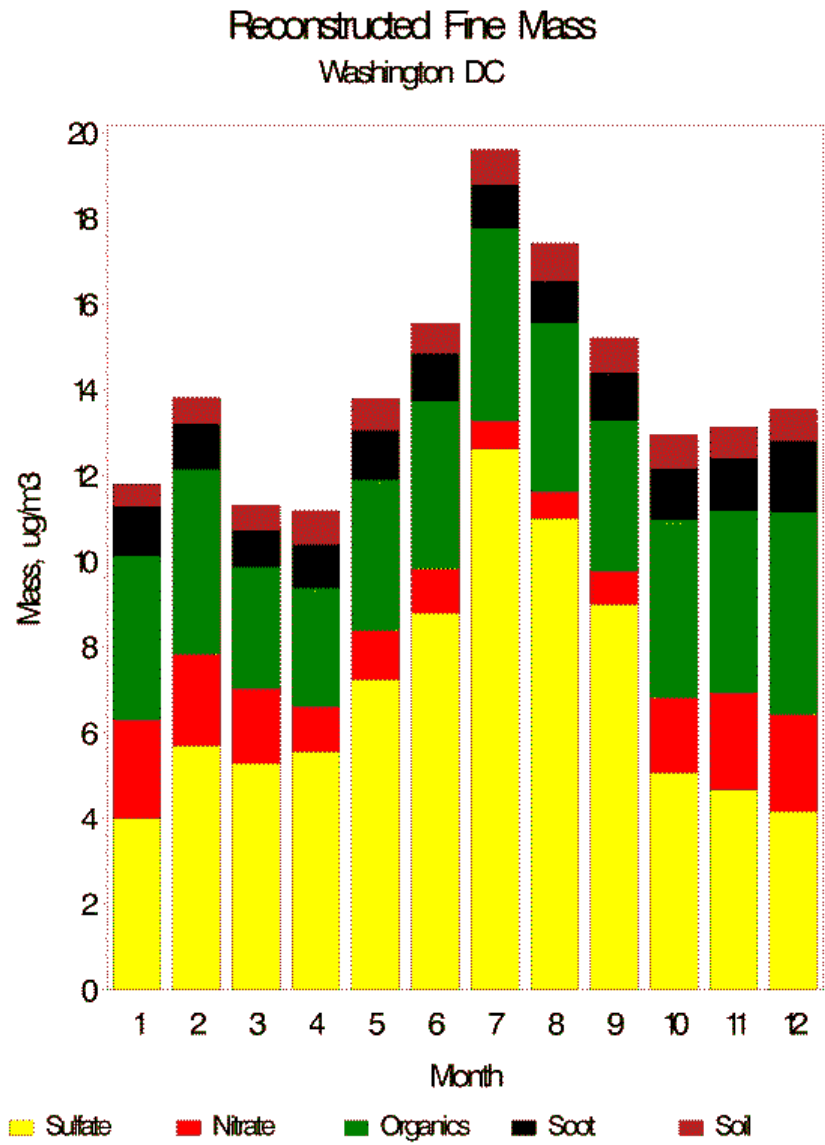
Chemical Composition - Rural



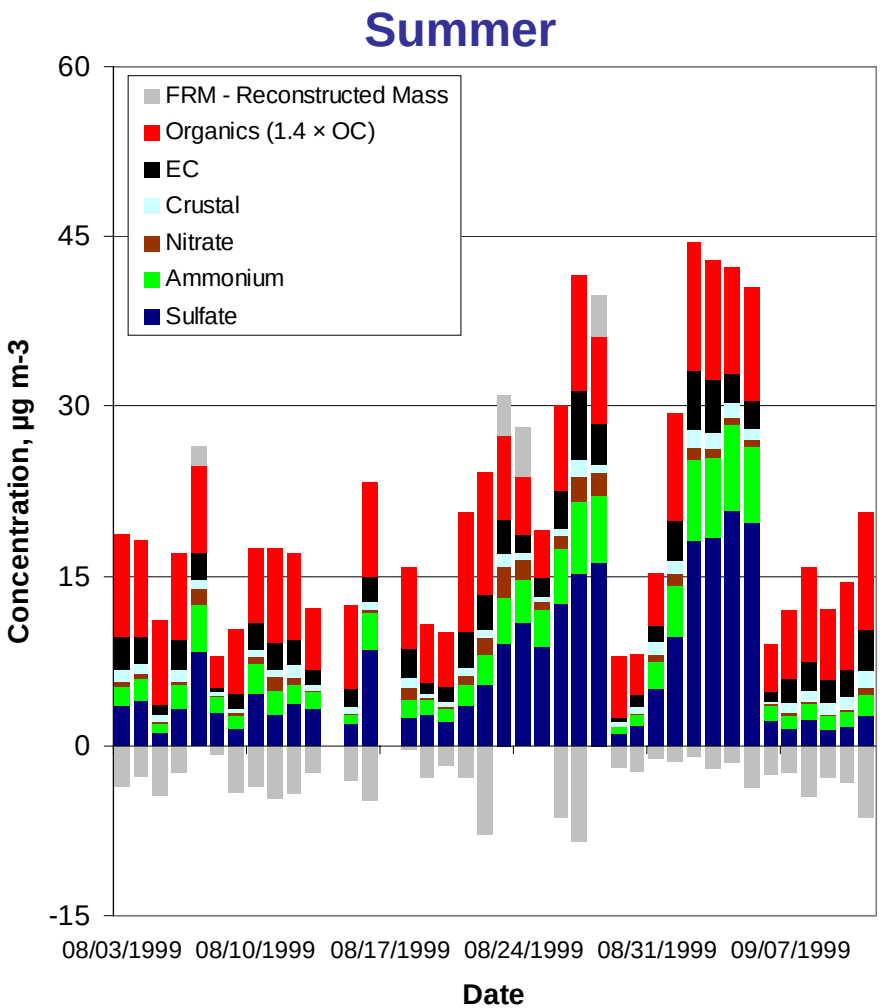


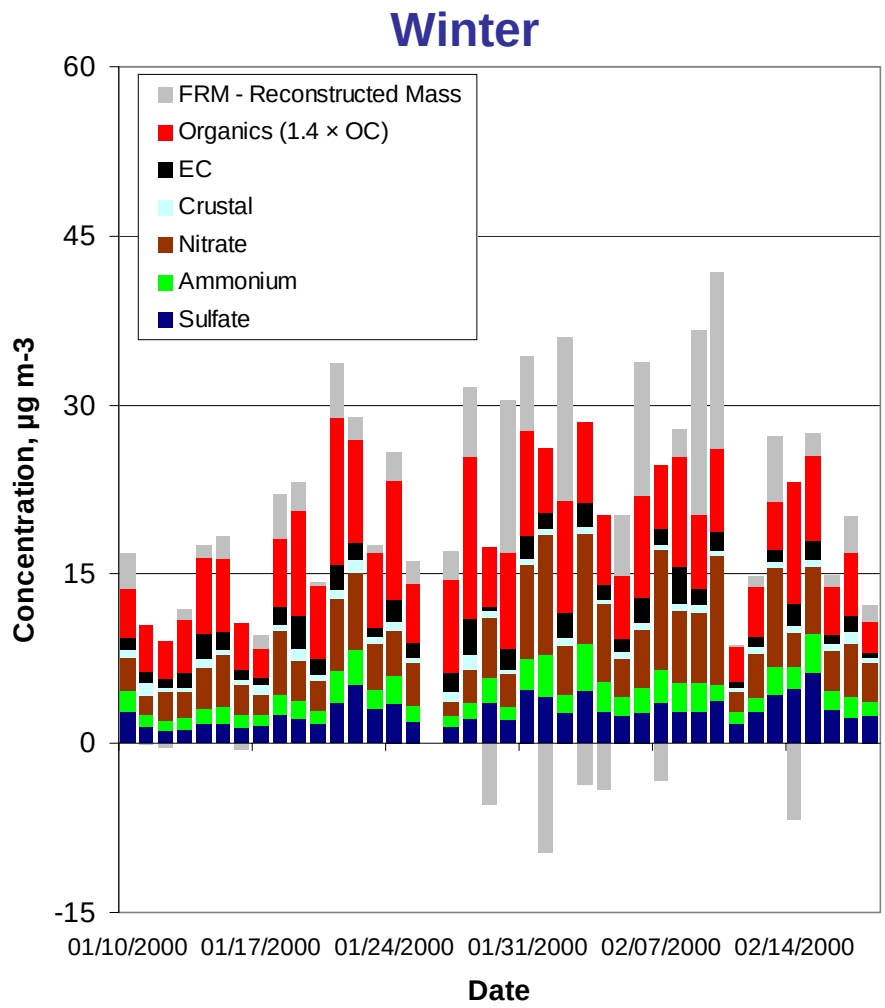
Chemical Composition - Rural/Urban





Daily $PM_{2.5}$ Composition Variability: Chicago

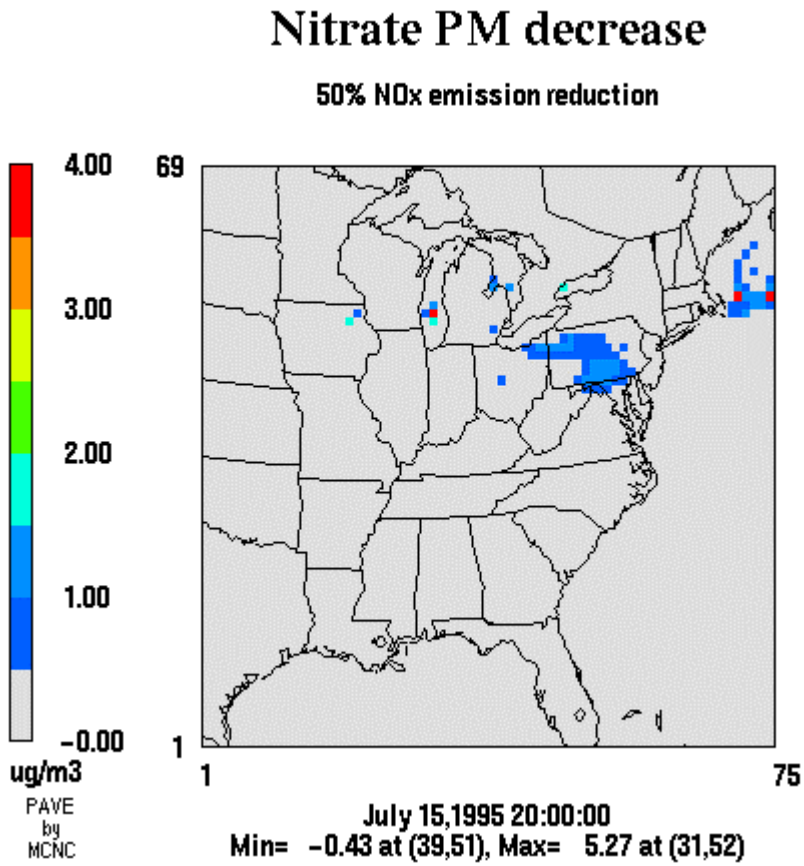


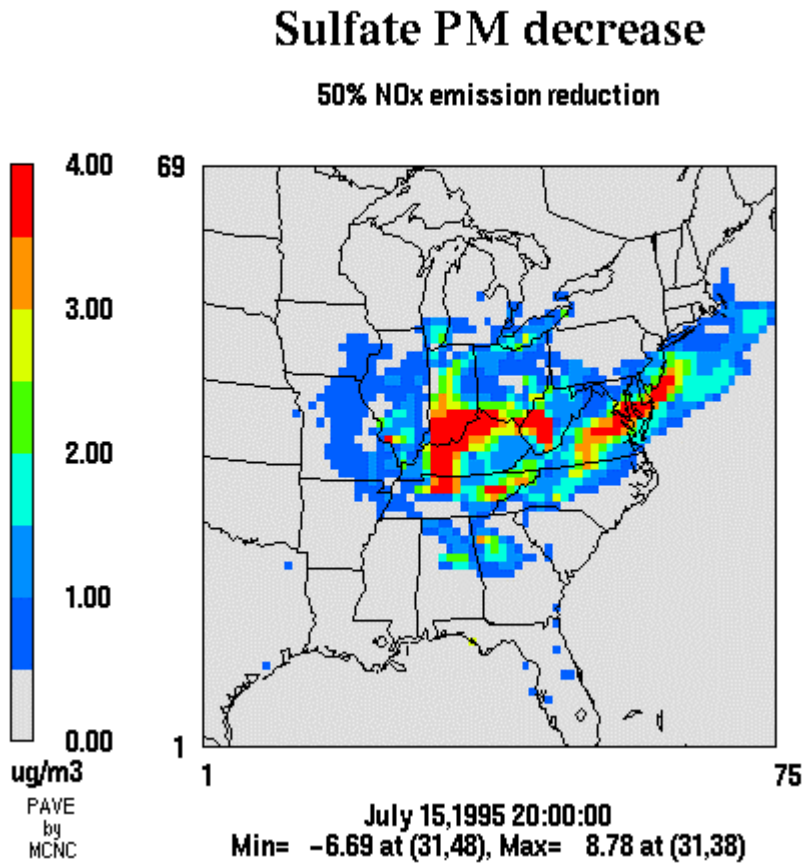


Cite: EPRI, March-MW Study, September 20, 2000

Summertime NOx control reduces $PM_{2.5}$ and Ozone by a different mechanism

Impact of 50% NOx emission reduction (CMAQ result)



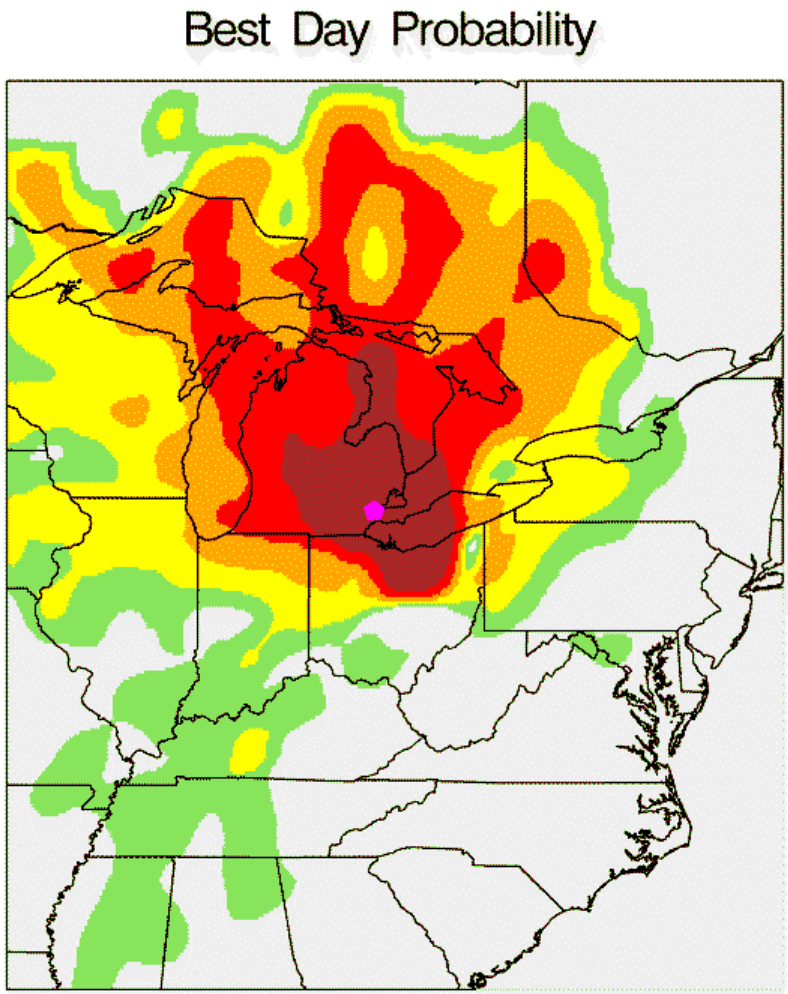


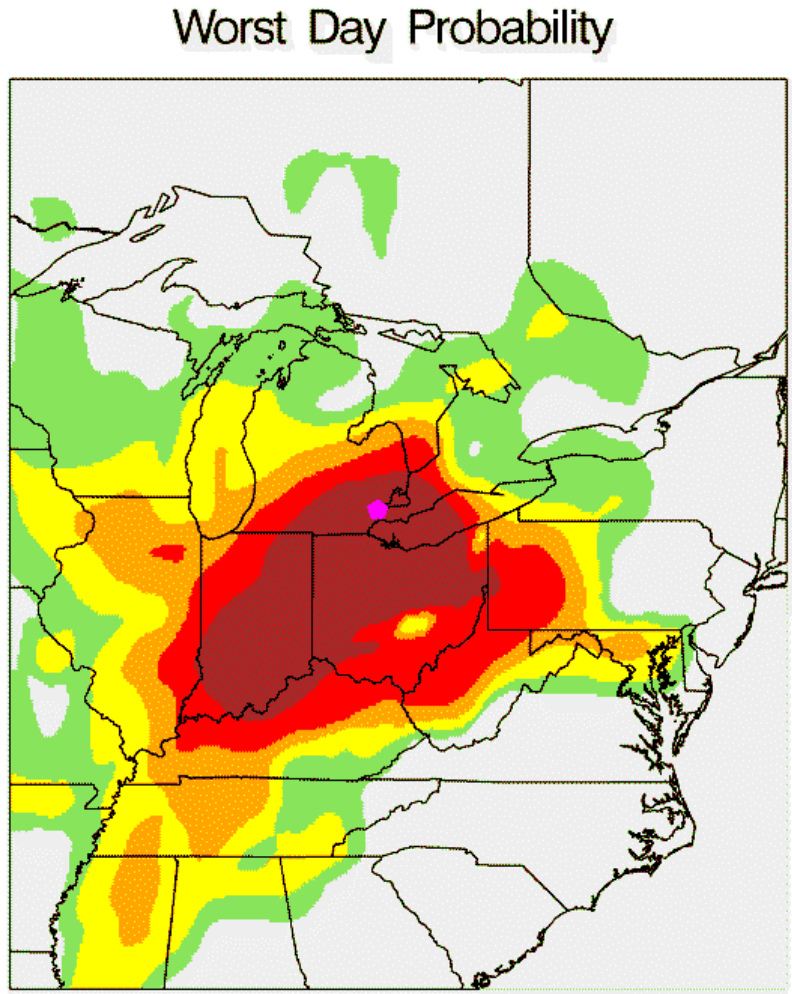
Nitrate PM decrease

Sulfate PM decrease

Contoured Trajectories:

Detroit





Recapping

- Regionally high eastern $PM_{2.5}$ today related to SOx, NH_3
- With major new SOx reductions, nitrate replacement likely; especially winter
- Annual regional NOx reductions an important component of balanced approach

Schedule for Implementing $PM_{2.5}$ NAAQS and Regional Haze Programs

12/2003	Complete review of PM criteria and standards
2002-4	Regional planning bodies model annual SOx/NOx PM strategies
2003	3 years of $PM_{2.5}$ air quality data compiled and assured
2004-5	**EPA designates areas for $PM_{2.5}$**
2005-6	**Interstate transport rule to address SOx/NOx emissions for $PM_{2.5}$ NAAQS and regional haze**
2007-8	Attainment and Regional Haze SIPs due for $PM_{2.5}$
2010	**5 year deadline for attainment of $PM_{2.5}$ NAAQS**
2013-14	Compliance for BART sources (2018-19 for trading)
2015-17	**Potential 5-year plus 2-year attainment date extensions for local problems**
2018	Second Regional Haze SIPs due

An Alternative Future for Power
The Clear Skies Initiative

- Proposed by the President February 14th
- A multi-pollutant market-based approach to regulating Power Generation under the Clean Air Act

Why a Multipollutant Approach?

- Power generation significantly contributes to emissions of sulfur dioxide (SO_2), nitrogen oxides (NOx), and mercury (Hg)
- Multiple pollutants contribute to multiple effects including
  - Fine particles (human health)
  - Visibility, particularly in Class I areas
  - Ozone (human health, forests, crops, materials)
  - Mercury (bioaccumulation)
  - Acid Deposition (lakes, streams, soils, forests, materials)
  - Coastal eutrophication
- Pollutants share common properties, interactions
  - long-range transport, multiple sources contribute to overall loadings
  - atmospheric chemistry (SO_4/NO_3), acidity/Hg relationship
- Co-benefits can be realized from simultaneous control
- Multipollutant approach can result in lower costs overall - - to industry and consumers

Clear Skies Initiative: Background

- Based on recommendations in the National Energy Policy, the Administration developed a three pollutant cap-and-trade proposal to control emissions from large power plants.

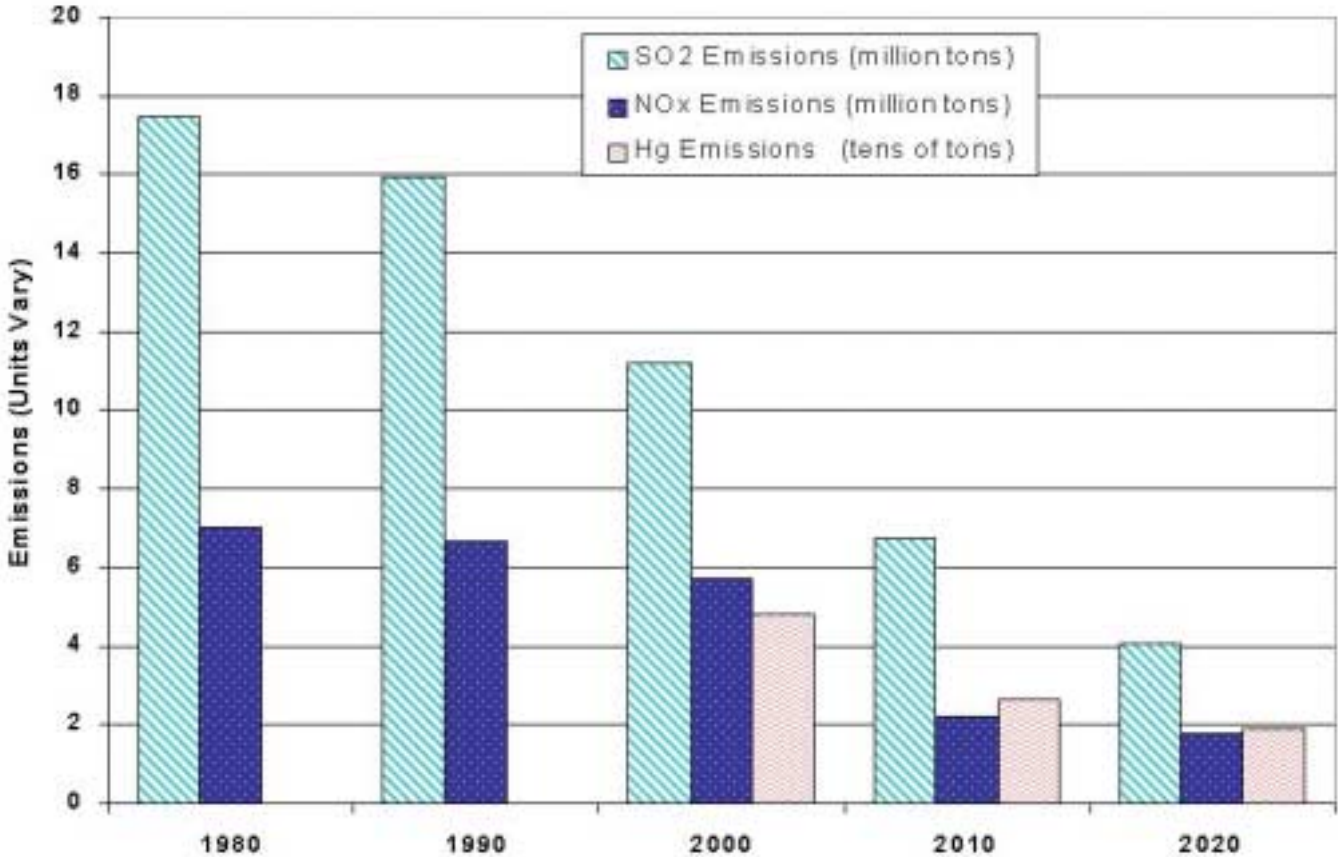
- The multi-pollutant approach would provide:
  - Build upon the success of the 1990 Clean Air Act's Acid Rain Program to cut pollution further, faster, cheaper
  - Provide faster protection to Americans, as well as wildlife and ecosystem health, than under the current Clean Air Act requirements

Proposed Requirements for Electric Generating Units

	Actual Emissions in 2000	Clear Skies Initiative Emissions Caps		Total Reduction at Full Implementation
		First Phase of Reductions	Second Phase of Reductions	
SO_2	11.2 million tons	4.5 million tons in 2010*	3 million tons in 2018*	73%
NO_x**	5.1 million tons	2.1 million tons in 2008*	1.7 million tons in 2018*	67%
Mercury	48 tons	26 tons in 2010	15 tons in 2018*	69%

*Because sources can reduce emissions early, earn allowances for those actions, and use those allowances later, actual emission levels will be higher than the cap in the first years of these phases.
**The NOx cap is divided between two zones with separate trading programs under each zone.

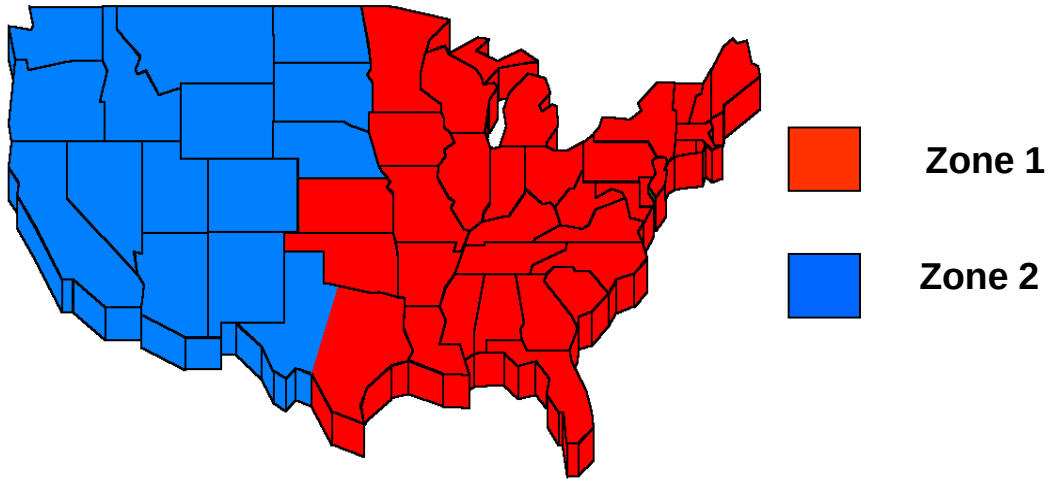
Resulting Emission Reductions in the Electric Power Sector*



* * Note: Emissions data include emissions from all fossil fuel-fired electricity generating units. 2020 emissions are based on a 3 million ton cap in 2018 for SO2, a 1.7 million ton cap in 2018 for NOx, and a 15 ton cap in 2018 for Hg. Emission levels assume presumptive Phase II cap.

The Clear Skies Nitrogen Oxides (NOx) Program

- The Clear Skies Initiative has two trading zones for NOx.



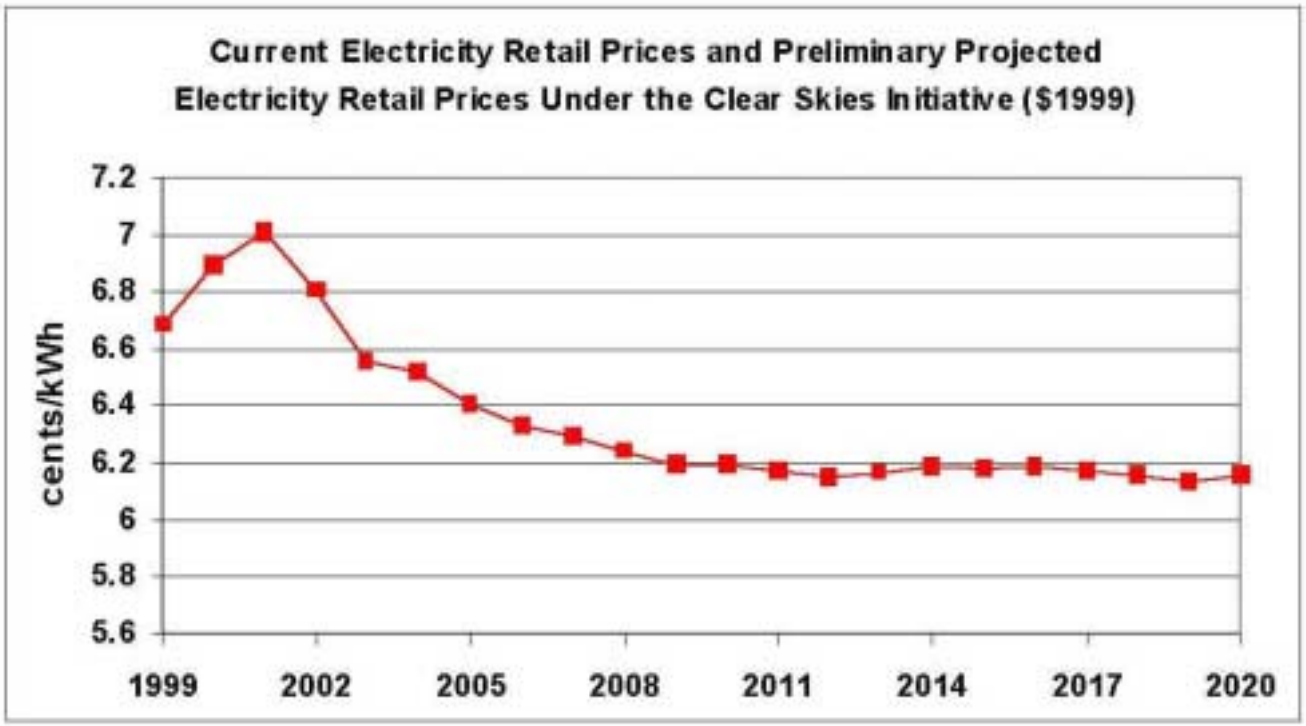
NOx Caps under the Clear Skies Initiative					
		2008		2018	
	2000 Emissions	Zone 1	Zone 2	Zone 1	Zone 2
Caps (Effective emissions rates)	5.1 million tons	1.562 million tons (0.15 lbs/mmBtu)	538,000 tons (0.24 lbs/mmBtu)	1.162 million tons (0.11 lbs/mmBtu)	538,000 tons (0.24 lbs/mmBtu)

- To preserve the health and environmental benefits of the Zone 1 cap, there would be no trading between the zones.

What will this do for PM?

- Based on earlier scenarios, substantial reduction in potential non-attainment
  - Current programs, e.g. Title IV, diesel, Tier 2, other produce a significant benefit
  - CSI likely to produce significant additional reductions
  - Reduced non-attainment and/or reduced residual non-attainment costs for local areas
- Substantial health and environmental benefits
- Analyses are underway

Electricity Prices for Residential, Commercial, and Industrial Customers



- Although reducing pollution will require expenditures by power companies, in 2020, net electricity prices are expected to be 10% lower under only the Clear Skies Initiative than recent (2000) prices.

Conclusions

- Fine particles present significant health/visibility issue
- We know regional reductions from power generation can provide important benefits for meeting NAAQS, regional haze targets
- The multi-pollutant debate has advanced significantly after years of false starts
  - An opportunity exists to significantly reduce the cost and improve the effectiveness of environmental policy
- However, a great deal of work lies ahead
  - Additional analysis
  - Resolving remaining issues/integration with existing programs
  - Legislative debate
- In the meantime, we will proceed with the process of designation and implementation of the fine particle standards
  - The kind of work reported at this conference will play an important role in shaping implementation policy decisions