Fine Particle, Ozone, Regional Haze and Air Toxics Implementation Policy – Clear Skies Ahead?

Presentation to 5th International Symposium on Gas Cleaning at High Temperature
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Presentation Overview

- **Significant air quality issues**
  - Complexity of regulations (e.g., multi-pollutant, NSR, etc.)
  - Fine Particles (e.g., $PM_{2.5}$)
    - The importance of $PM_{2.5}$ - a multiple pollutant
    - Air Administrator – "my highest priority"
  - Ozone
  - Air Toxics (e.g., mercury)
  - Acid Deposition (e.g., NOx and SOx, eutrophication, acidification)
  - Regional Haze/Visibility
- **Implementing the $PM_{2.5}$ and 8-hour ozone air quality standards**
  - Overview of schedules for review and implementation
- **We are moving to implement the new NAAQS**
  - Most cost-effective approaches first
  - What we know best
  - This means regional strategies first
- **Two paths for regional approaches**
  - A new regulatory baseline for power generation- Clear Skies
  - A regional transport rule

Timeline: Electric Power Sector Faces Numerous CAA Regulations

NSR Permits for new sources & modifications that increase emissions

Ozone

1-hr Serious Area Attainment Date

OTC NO_x Trading

NO_x SIPs Due

Designate areas for 8-hr Ozone NAAQS

Section 126 NO_x Controls [1]

1-hr Severe Area Attainment Date

NO_x SIP Call Reductions

Marginal 8-hr Ozone NAAQS Attainment Date

8-hr Ozone Attainment Demonstration SIPs due

Assess Effectiveness of Regional Ozone Strategies

Possible Regional NO_x Reductions ? (SIP call II) [2]

Moderate 8-hr Ozone NAAQS Attainment Date

Serious 8-hr Ozone NAAQS attainment Date

99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18

Phase II Acid Rain Compliance

Mercury Determination

Proposed Utility MACT

Final Utility MACT

Designate Areas for Fine PM NAAQS

New Fine PM NAAQS Implementation Plans

Regional Haze SIPs due

Interstate Transport Rule to Address SO_2/ NO_x Emissions for Fine PM NAAQS and Regional Haze

Compliance with Utility MACT

Latest attainment date for Fine PM NAAQS [3]

Additional Hg regulation under 112(d) and (f)

Compliance for BART Sources

Compliance for BART sources under the Trading Program

Second Regional Haze SIPs due

Acid Rain, $PM_{2.5}$, Haze, Toxics

Note: Dotted lines indicate a range of possible dates.

[1] The D.C. Circuit Court has delayed the May 1, 2003 EGU compliance date for the section 126 final rule

[2] Further action on ozone would be considered based on the 2007 assessment.

[3] The SIP-submittal and attainment dates are keyed off the date of designation; for example, if PM or ozone are designated in 2004, the first attainment date is 2009

EPA is required to update the new source performance standards (NSPS) for boilers and turbines every 8 years

In developing the timeline of current CAA requirements, it was necessary for EPA to make assumptions about rulemakings that have not been completed or, in some case, not even started. EPA's rulemakings will be conducted through the usual notice-and-comment process, and the conclusions may vary from these assumptions.

Clean Air Act Implementation

8-hr Ozone Standards

2003 States recommend nonattainment designations

- EPA makes nonattainment designations

2005-09 New NOx Rule?

2007-08 SIPs due

2008-09 EPA finalizes SIPs

Regional Haze Program

2007-08 States submit regional haze SIPs

2008-09 EPA approves SIPs

2013-18 Plants must install BART or comply with backstop trading program

$PM_{2.5}$ Standards

2003 States recommend nonattainment designations

2004-05 EPA makes nonattainment designations, completion of NAAQS review

2005 EPA Issues SOx/NOx transport rule

2004-08 States develop/submit SIPs

2008-09 EPA finalizes SIPs

Mercury

2003 Propose MACT standard

2004 Finalize MACT standard

2004 New plants must begin to comply

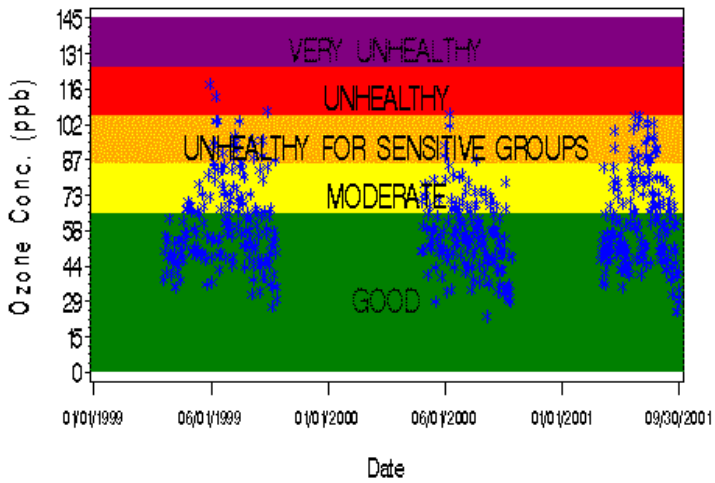
- Existing plants must begin to comply

What's new in PM science?

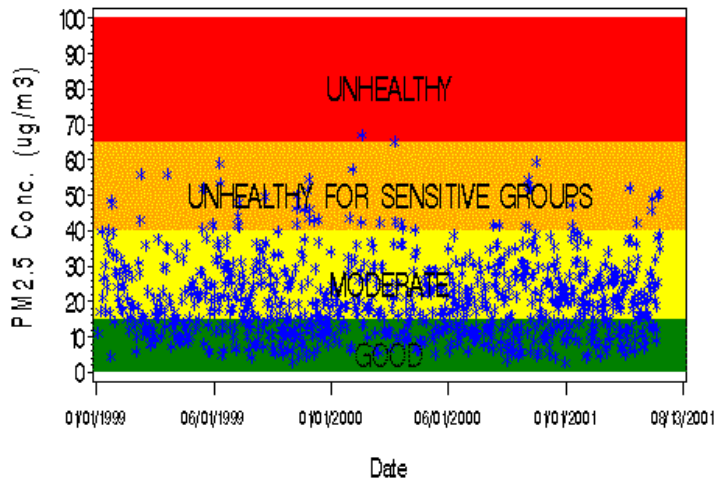
- New PM Criteria Document: comprehensive evaluation of hundreds of new health studies www.epa.gov/ncea/partmatt.htm
  - Generally consistent with studies from previous PM NAAQS review, some exceptions
  - 3rd draft in May 2002, review schedule extended to address statistical issues with a number of short-term studies
  - About 90% of studies in 1997 review unaffected by statistical issues
- 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
    - *Recent findings on statistical problems with the effects estimates, but reanalyses finds same qualitative results*
    - 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) *Statistical approach not an issue*
  - New JAMA 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)

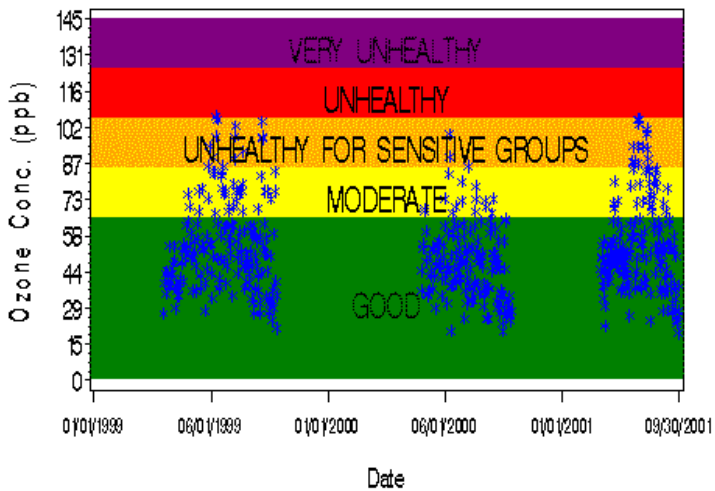
New $PM_{2.5}$ AQI Health Messages: A Pollutant for All Seasons

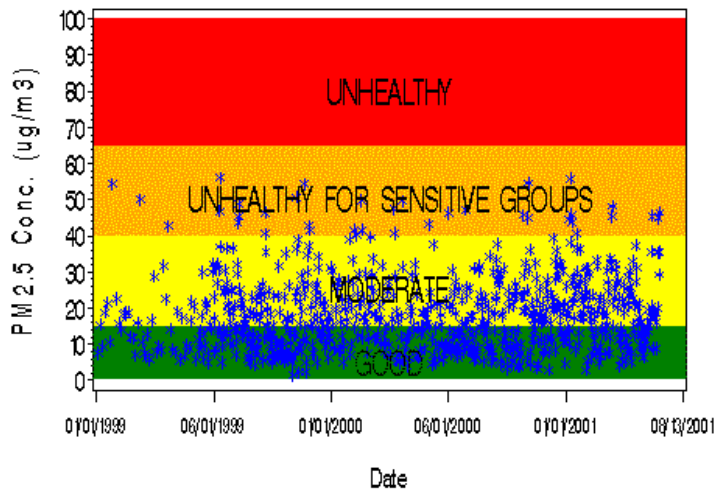
Ozone



$PM_{2.5}$





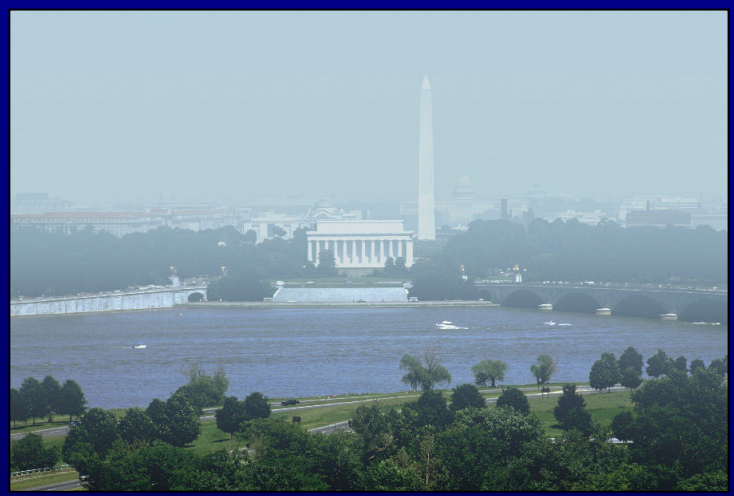


M. Rizzo, R5

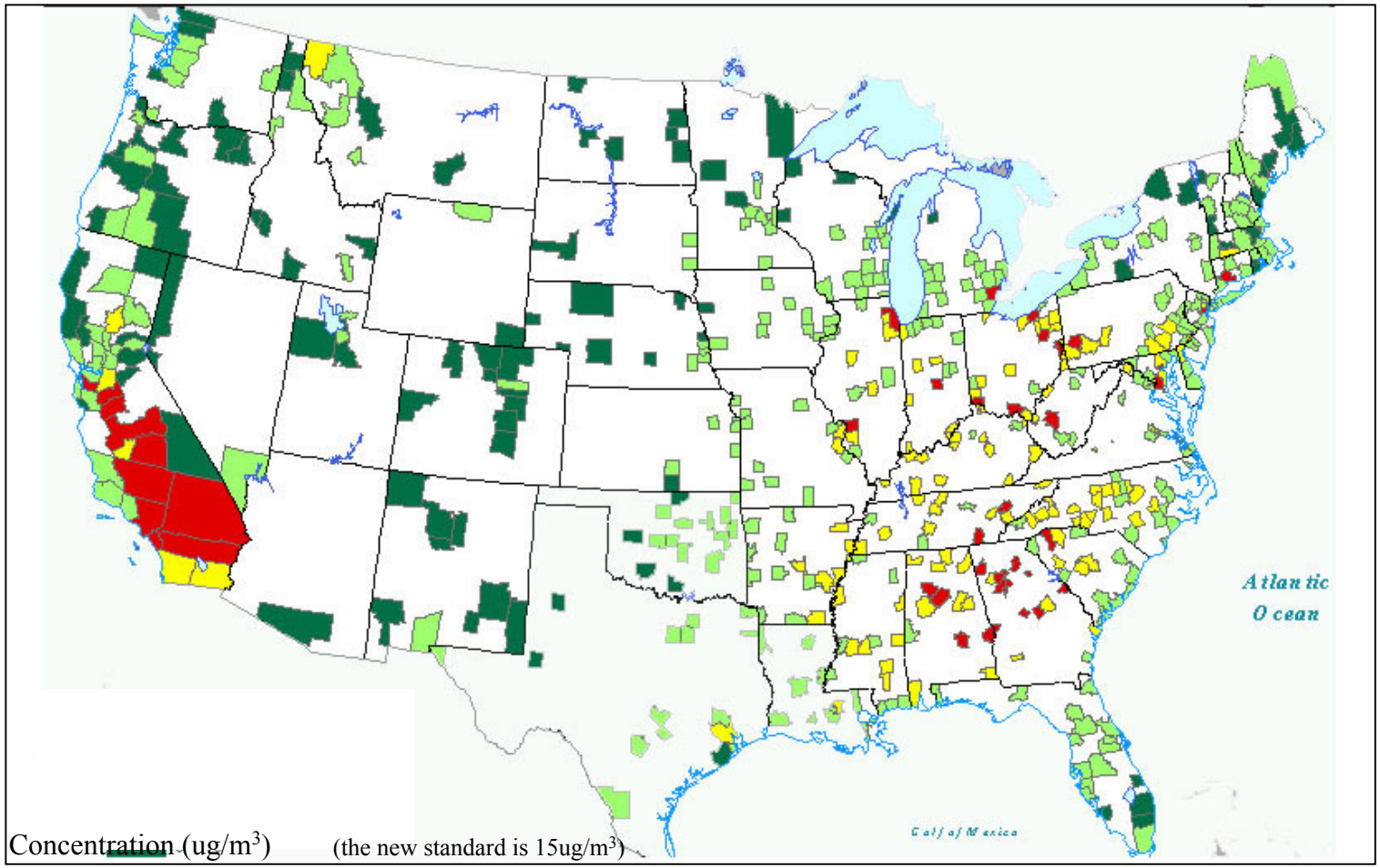
How Adequate are Secondary $PM_{2.5}$ NAAQS?

← Washington circa the 1970 Act

Below: Winhaze model for Washington, DC. Left: Fine mass at the level of the current 24-hr NAAQS of 65 ug/m^3 , 5-mile visual range, 39 deciviews. Right: ~ Natural conditions, 90-mile visual range, 12 deciviews, less than 2.5 ug/m^3.



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



Nationwide:

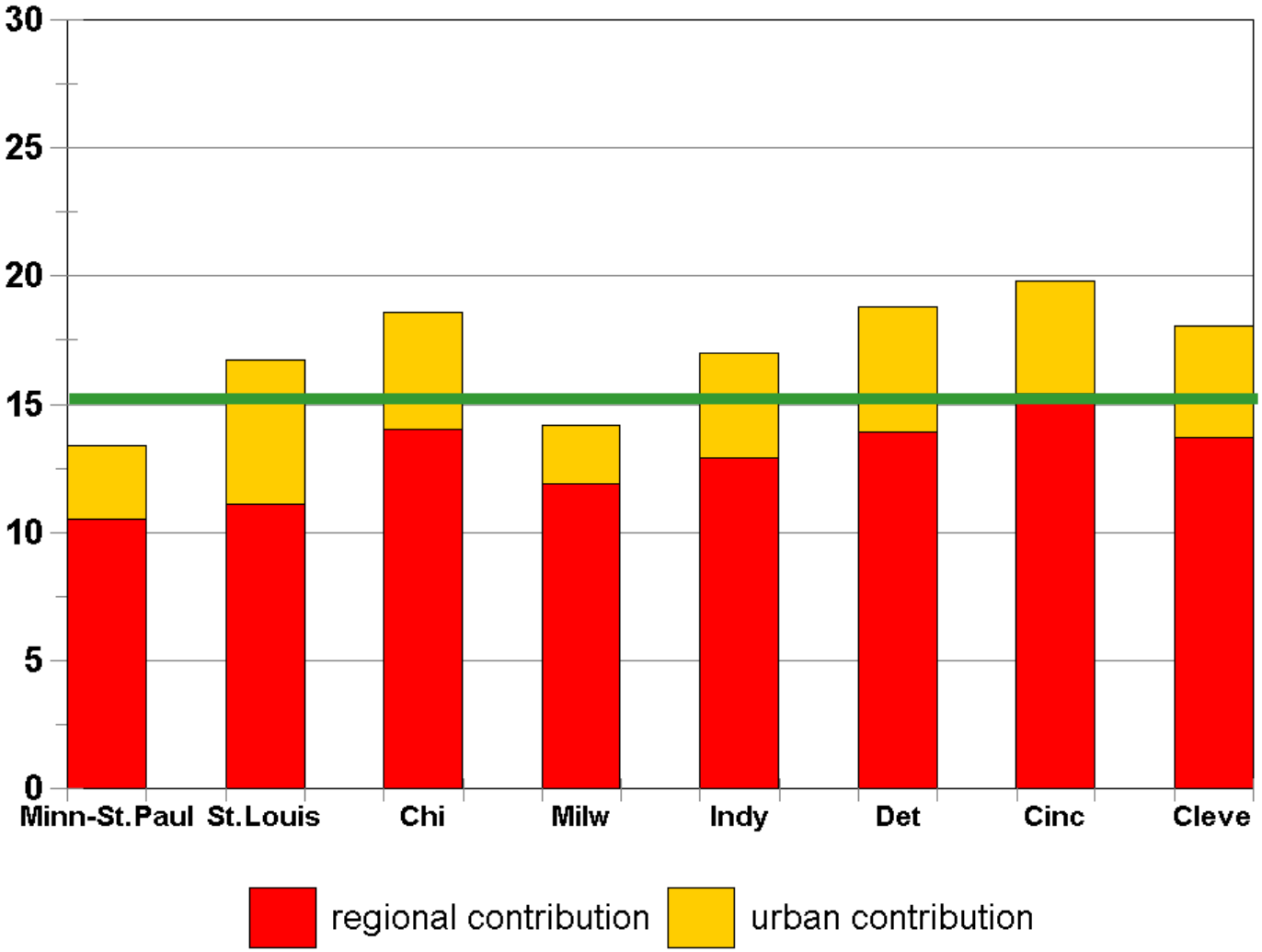
- 173 counties (82 million people) > $PM_{2.5}$ NAAQS

East:

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

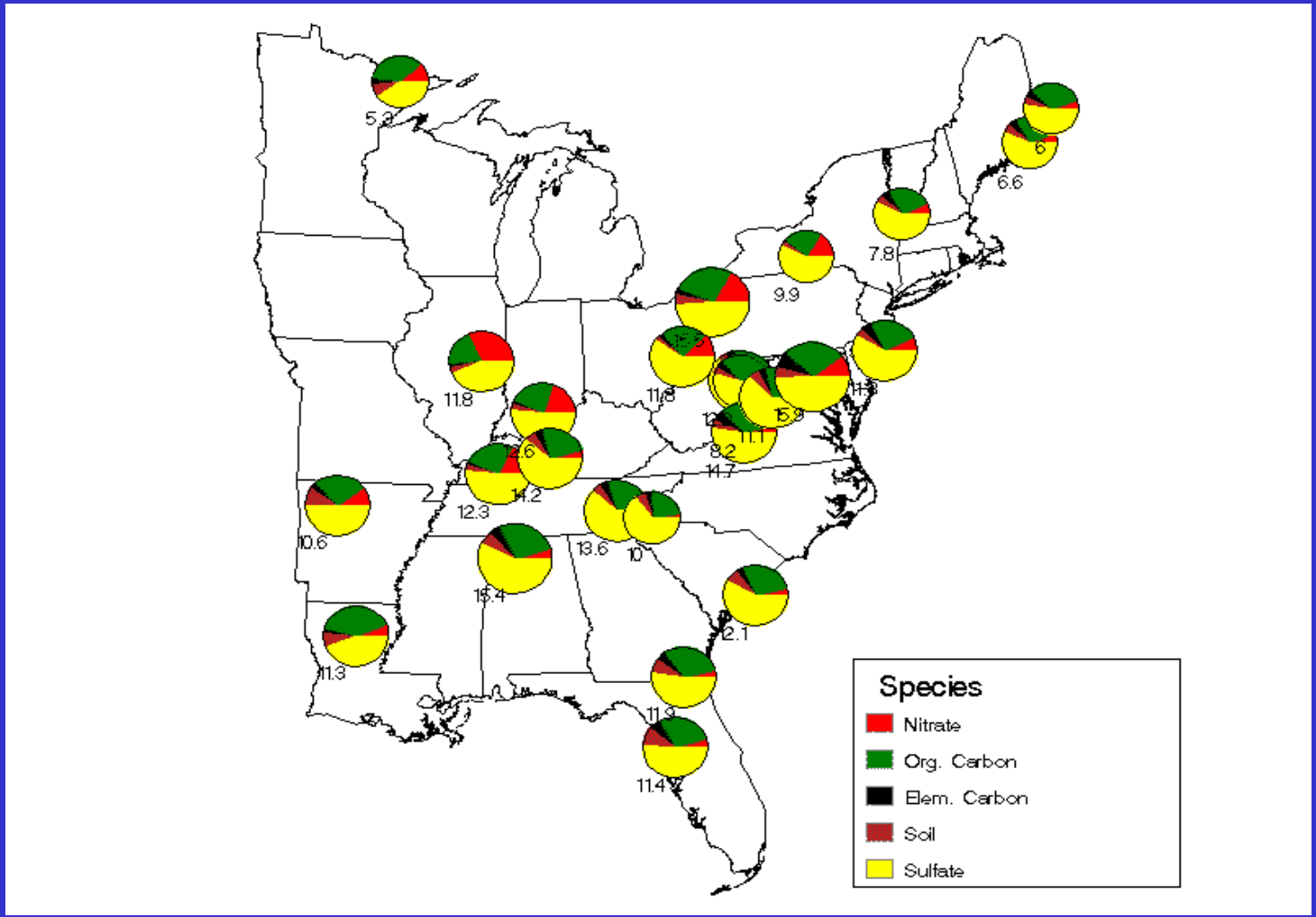
*Based on 1999-2000 incomplete data, 3 years data required for attainment determination

Urban v. Rural
(Annual Average Concentrations)



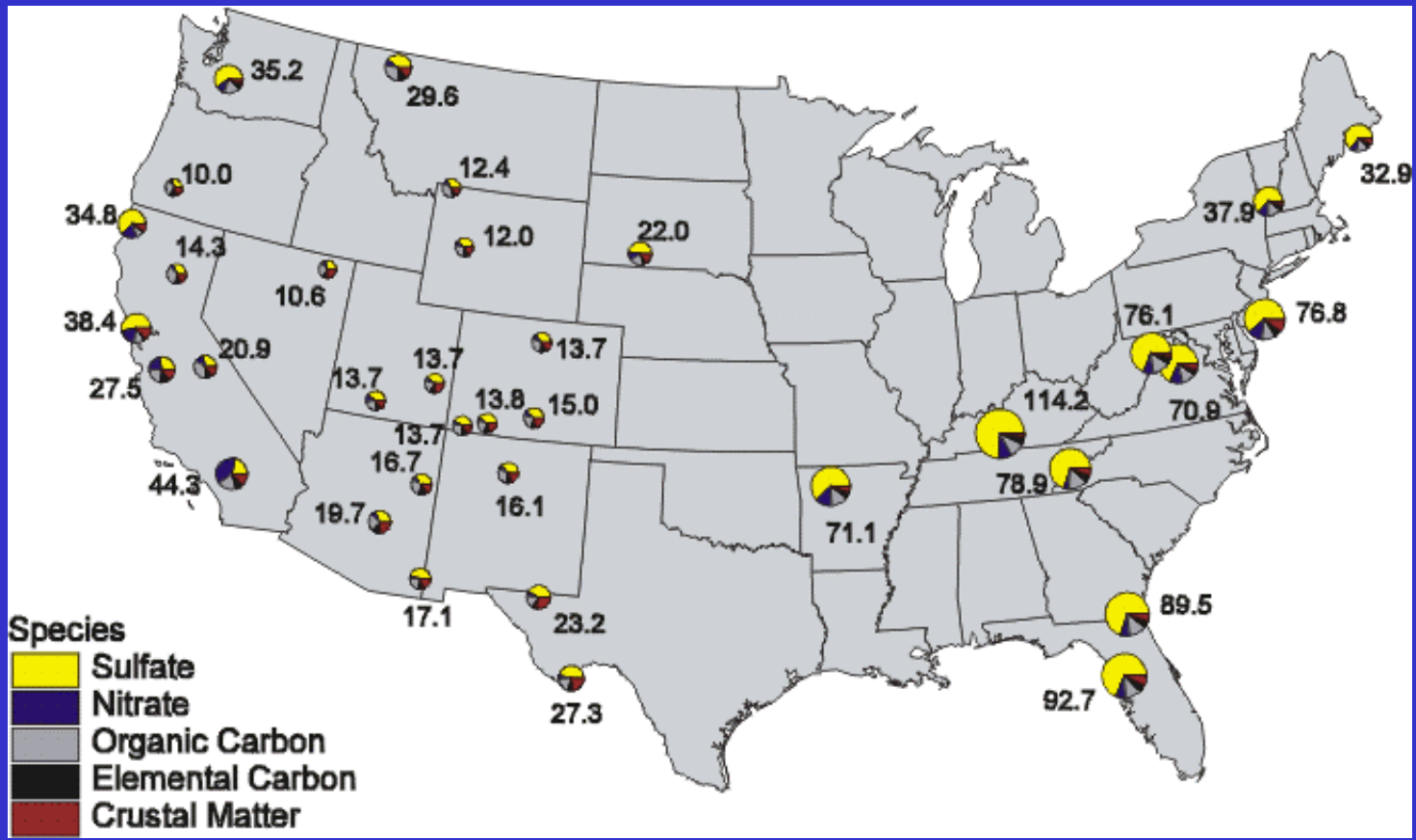
Chemical Composition - Rural Sites

IMPROVE/CASTNet Data (1997 - 1999)

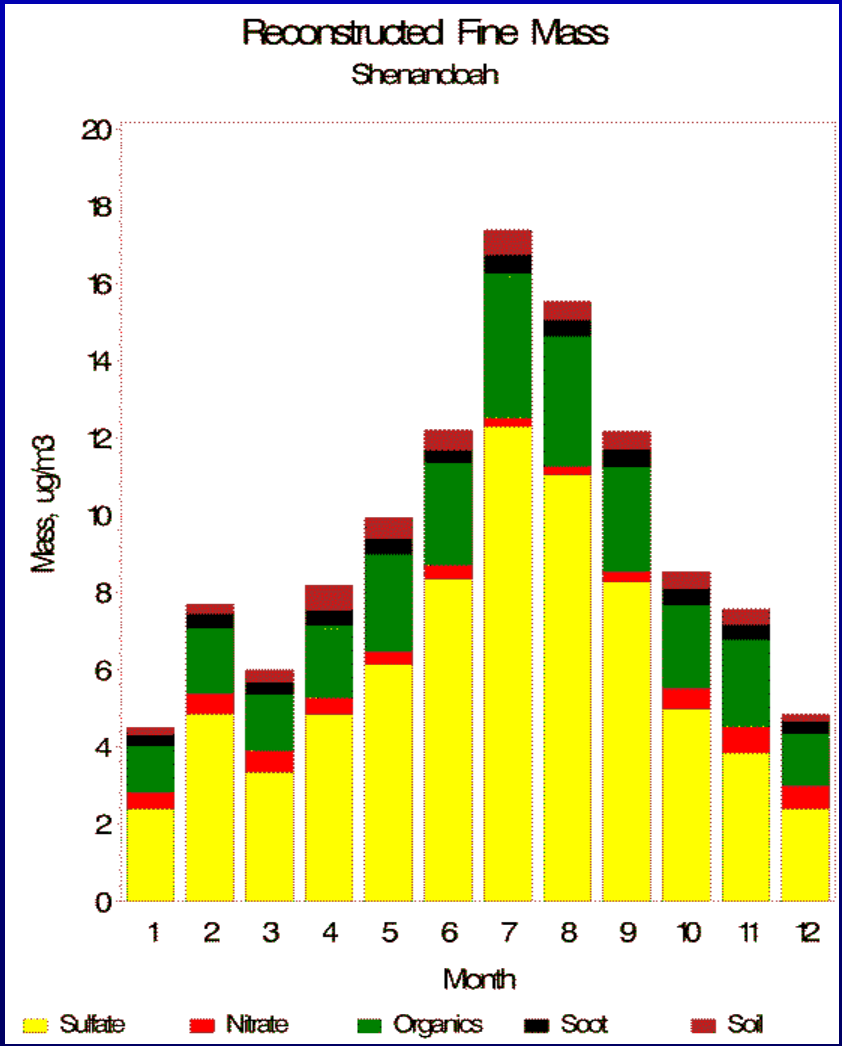


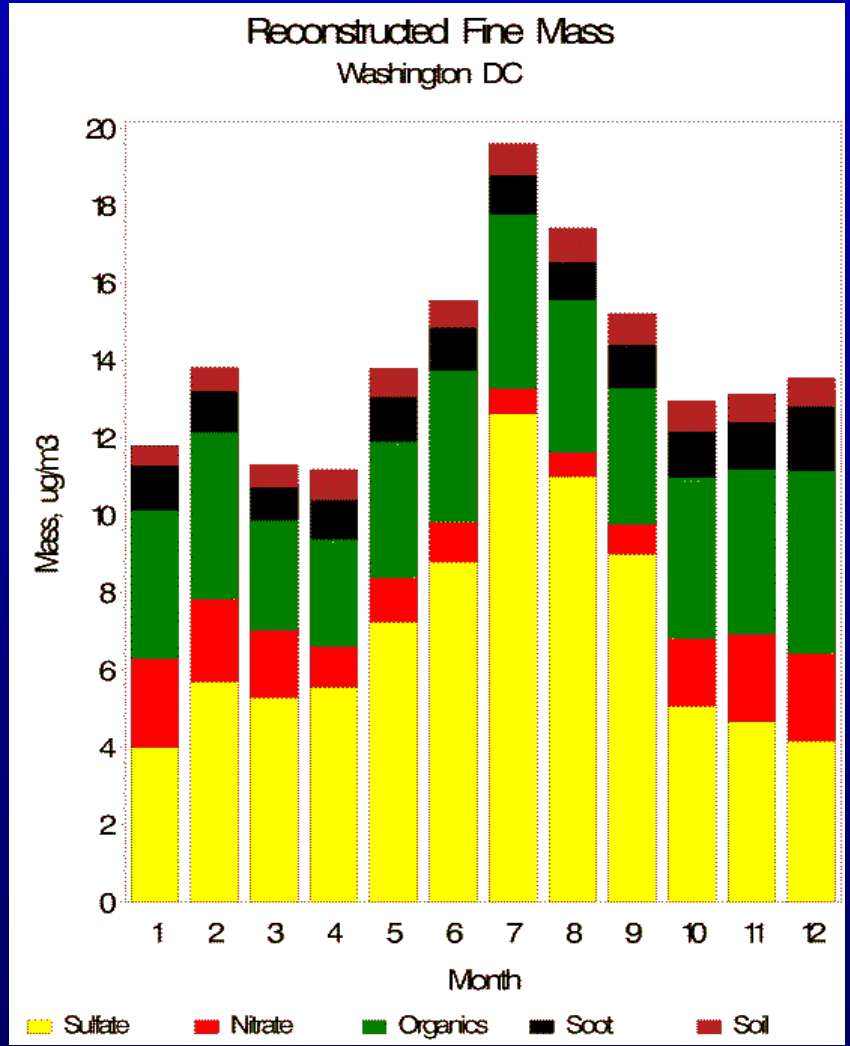
Light Extinction Budget - Rural Sites

IMPROVE (1997 - 1999)



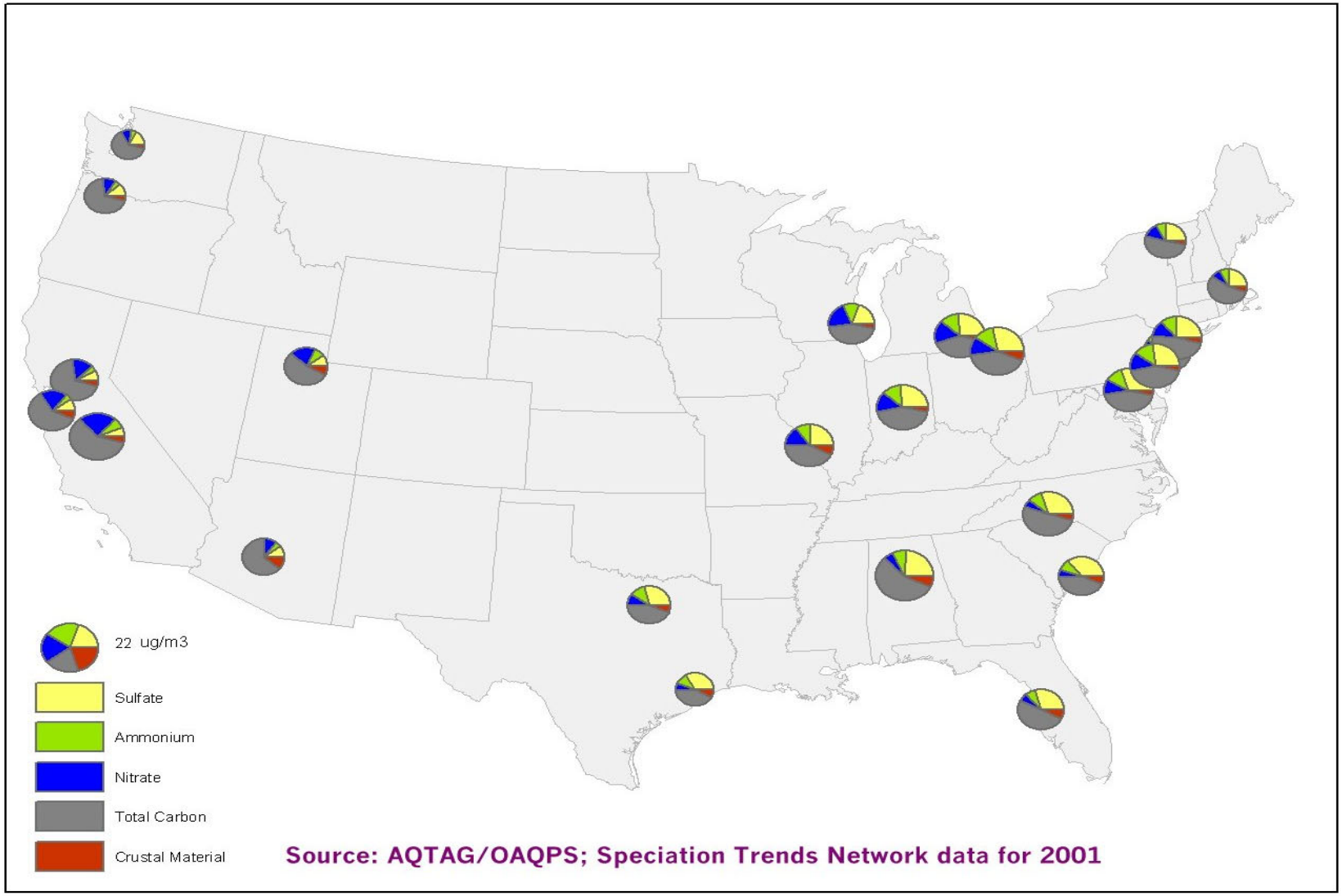
Chemical Composition - Rural/Urban



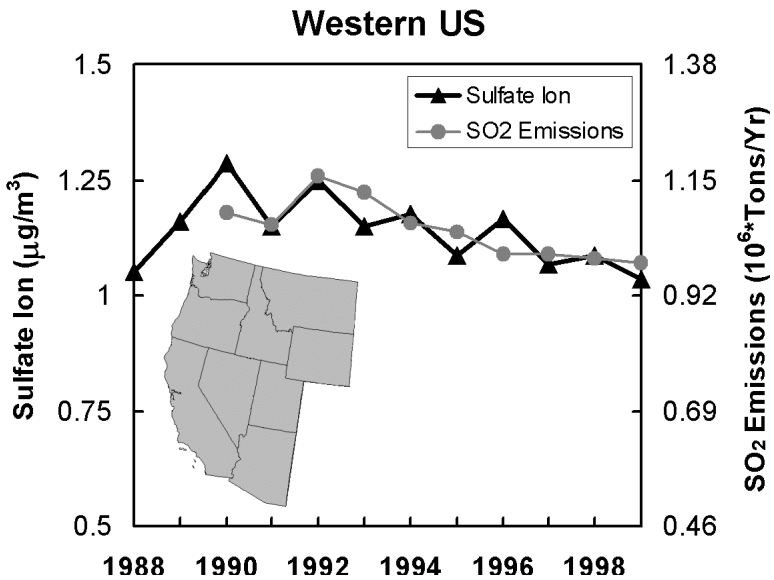


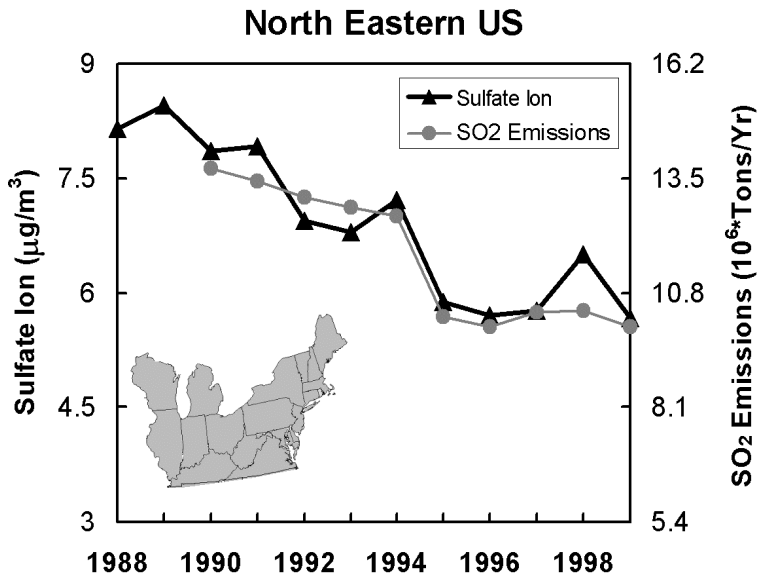
Chemical Composition - Urban Sites

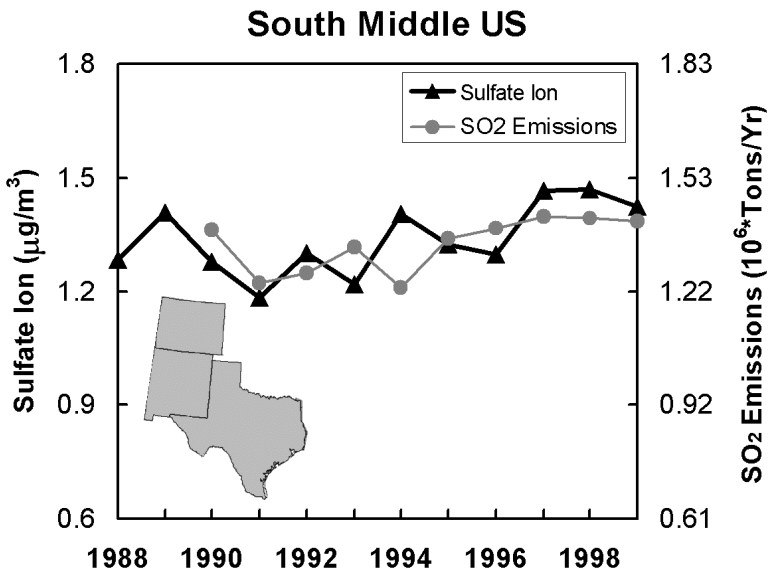
Speciation Trends Network (2001)

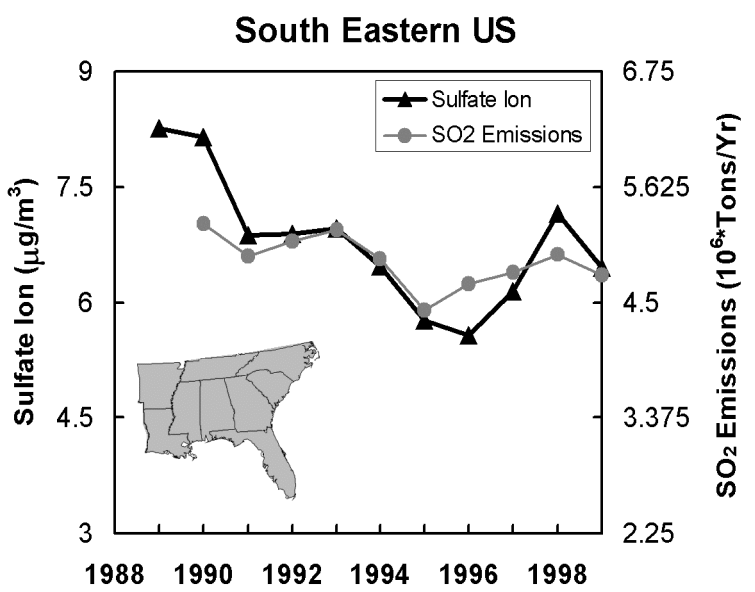


Rural Sulfate Trends Track Regional SO_x Emissions



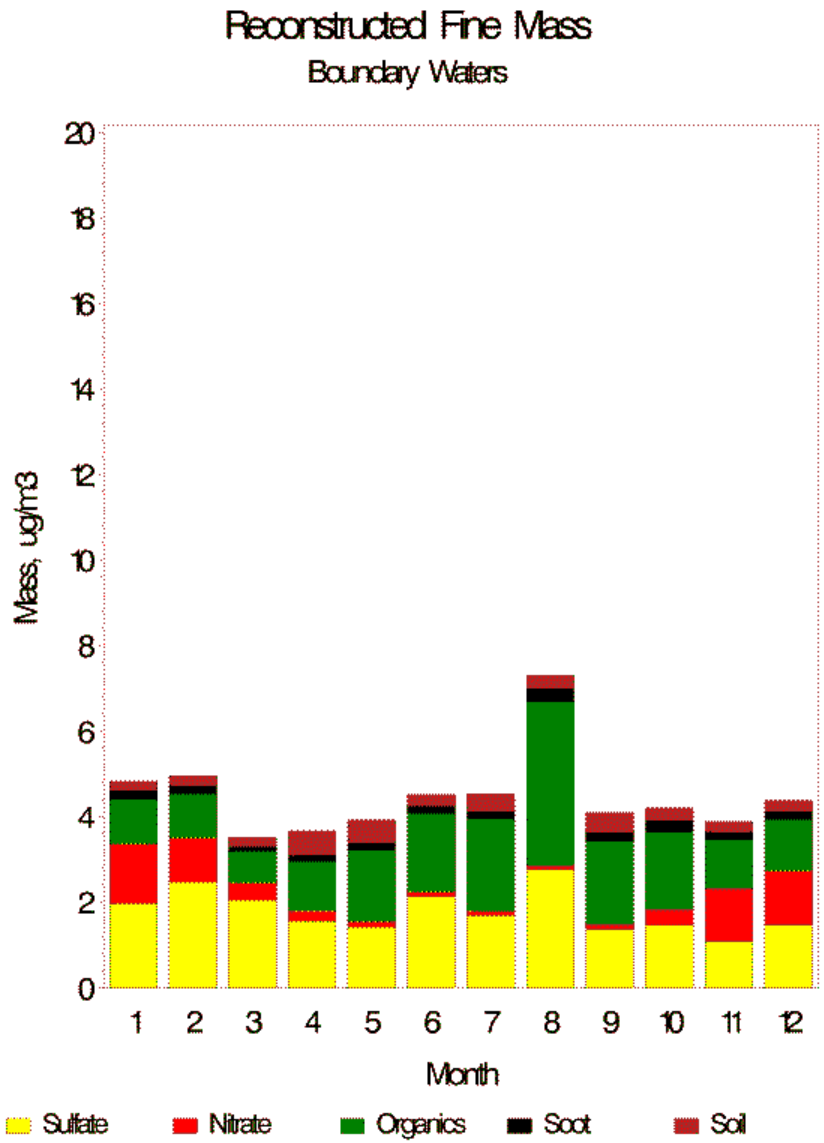


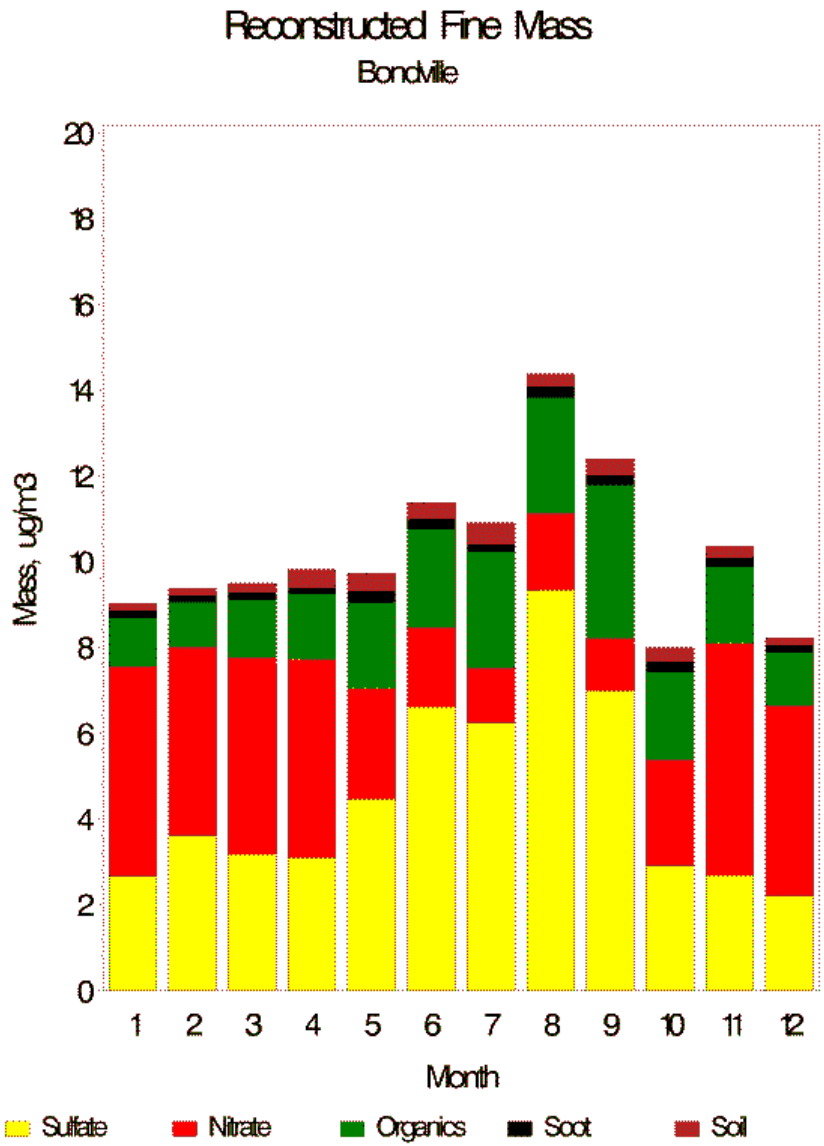




Early Signs of Nitrate Substitution in Wintertime

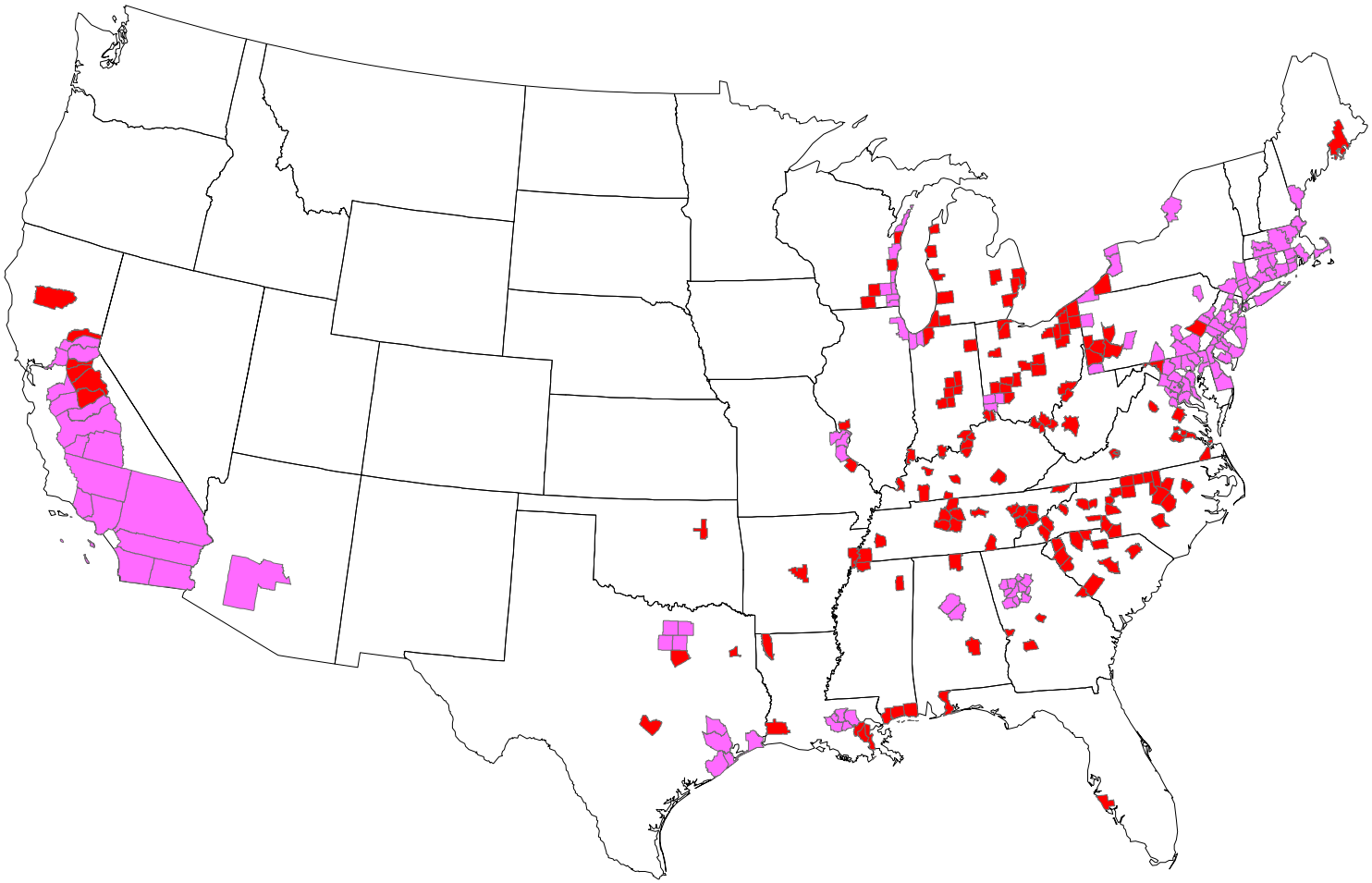
Chemical Composition - Rural





Counties Violating the 8-hour Ozone Standard

1999-2001 Air Quality Data



There Are a Total of 291 Counties Violating the 8-hour Ozone Standard Using 1999-2001 Data

155 of Those Counties Are Designated Attainment for the 1-hour Standard

136 of Those Counties Are Designated Nonattainment for the 1-hour Standard

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An Alternative Future for Power - Clear Skies

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

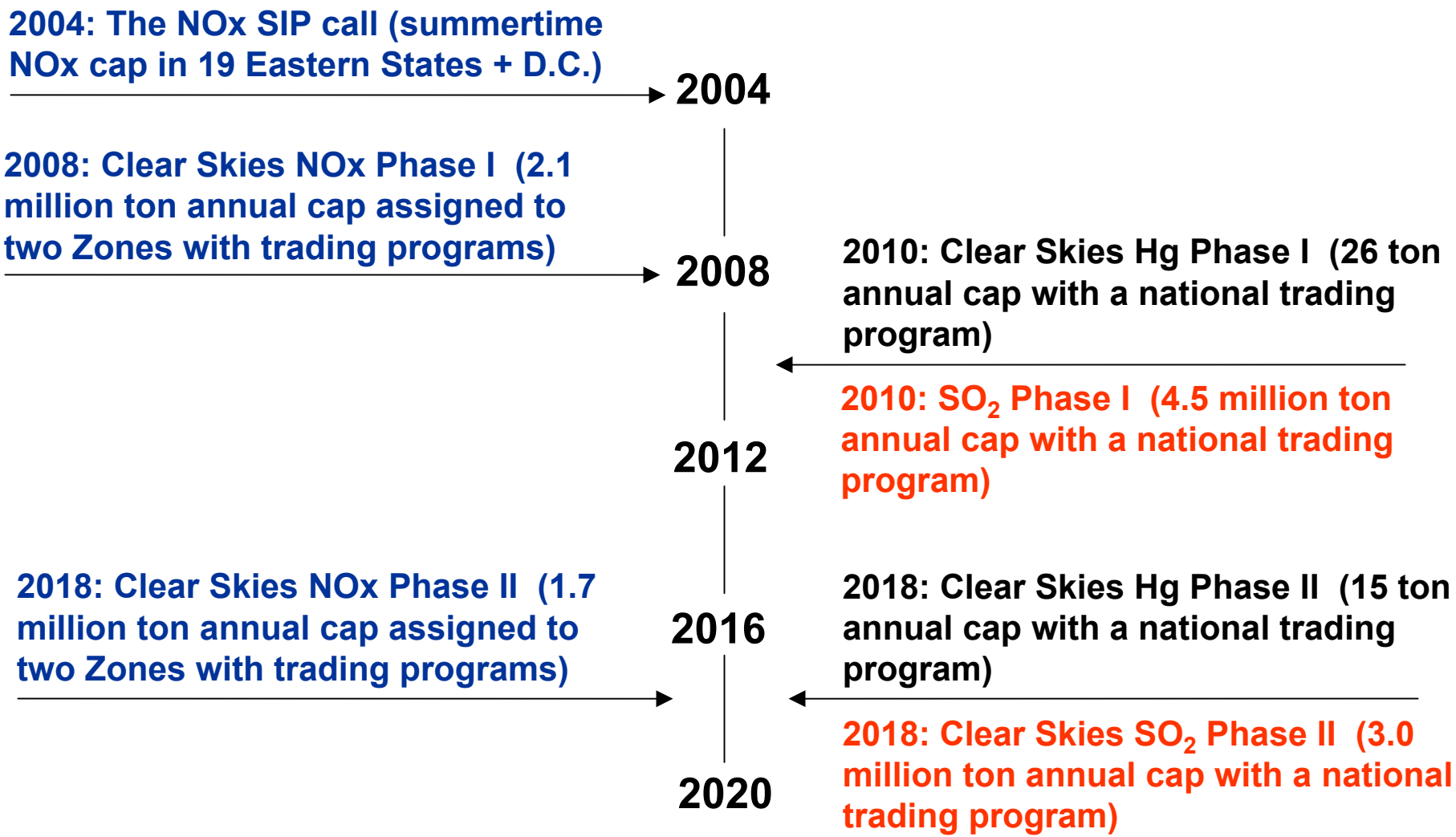
Introduction

- On February 14, 2002, President Bush proposed the Clear Skies Initiative, a mandatory program for the control of sulfur dioxide (SO_2), nitrogen oxides (NO_x) and mercury (Hg) from the electricity generation sector.

- On July 26, 2002, Chairman Billy Tauzin and Chairman Joe Barton introduced the Clear Skies Act in the U.S. House of Representatives (H.R.5266), and on July 29, 2002 Senator Bob Smith introduced the legislation in the Senate (S.2815) by request of the Administration.

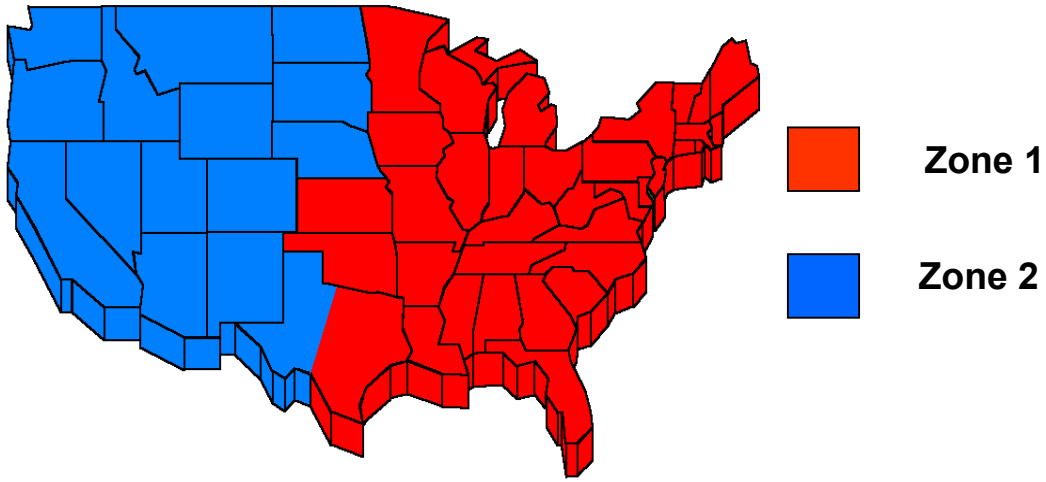
- Extensive information on Clear Skies is currently available on EPA's website at www.epa.gov/clearskies.

Overview: Caps and Timing for the Electric Power Sector under the Clear Skies Act



The Clear Skies Nitrogen Oxides (NOx) Program

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

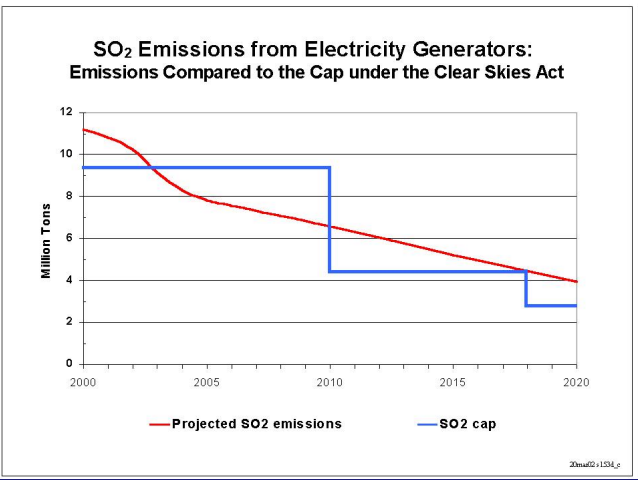


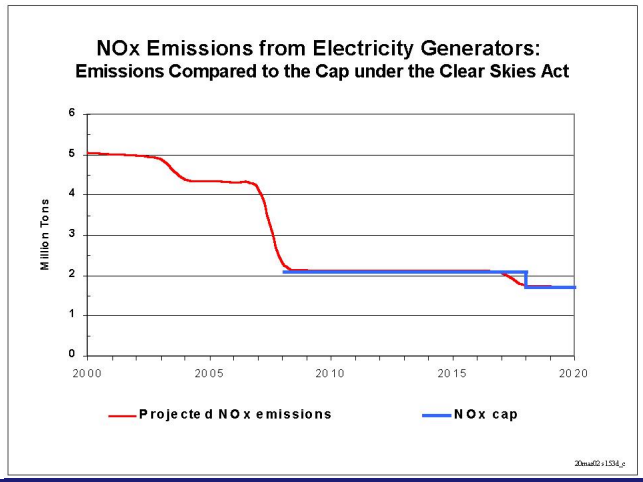
NOx Caps under the Clear Skies Initiative					
		2008		2018	
	2000 Emissions	Zone 1	Zone 2	Zone 1	Zone 2
Caps (Effective emissions rates)	5.1 million tons	1.562 million tons (0.15 lbs/mmBtu)	538,000 tons (0.24 lbs/mmBtu)	1.162 million tons (0.11 lbs/mmBtu)	538,000 tons (0.24 lbs/mmBtu)

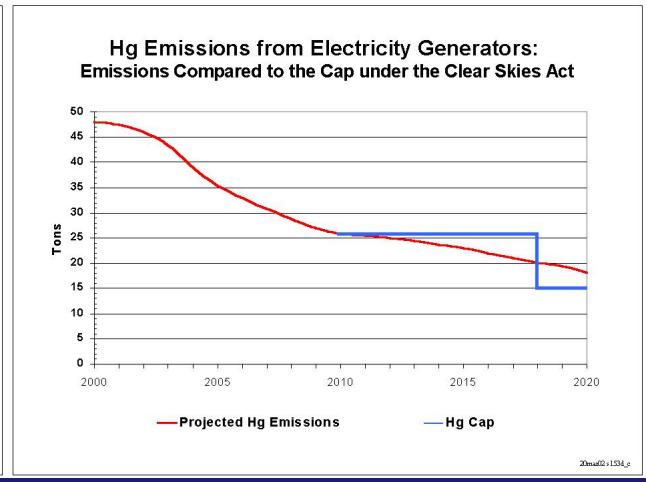
- To preserve the health and environmental benefits of the Zone 1 cap, there would be no trading between the zones.

Projected Emissions from the Electric Generating Units Covered by Clear Skies

- The Clear Skies Act will result in significant over-compliance in the early years, particularly for SO_2, because sources are allowed to bank excess emissions reductions and use them later. The use of these banked allowances for compliance in the later years of the program (e.g., 2020) results in SO_2 and mercury emissions initially above the second phase cap, gradually declining to the cap level.

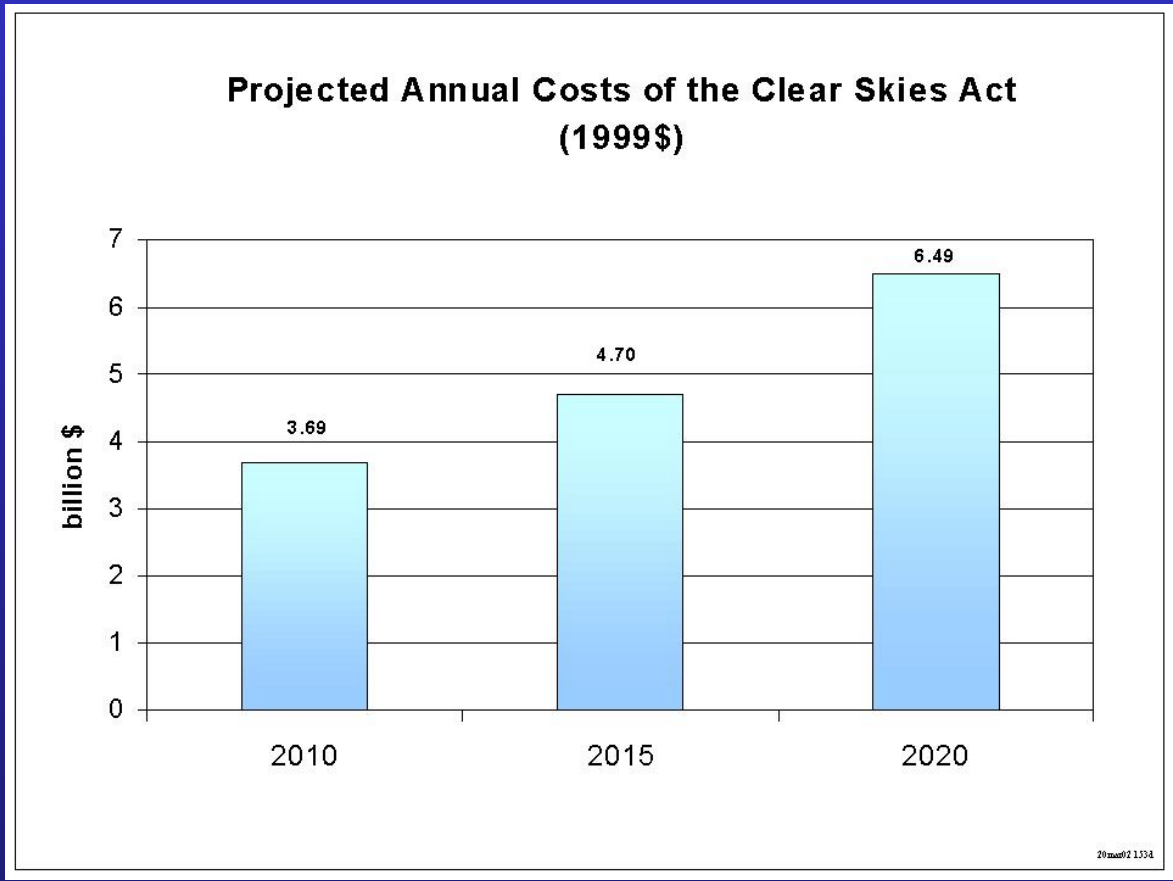






Note: Projected emissions data for SO_2, NOx and mercury are from IPM.

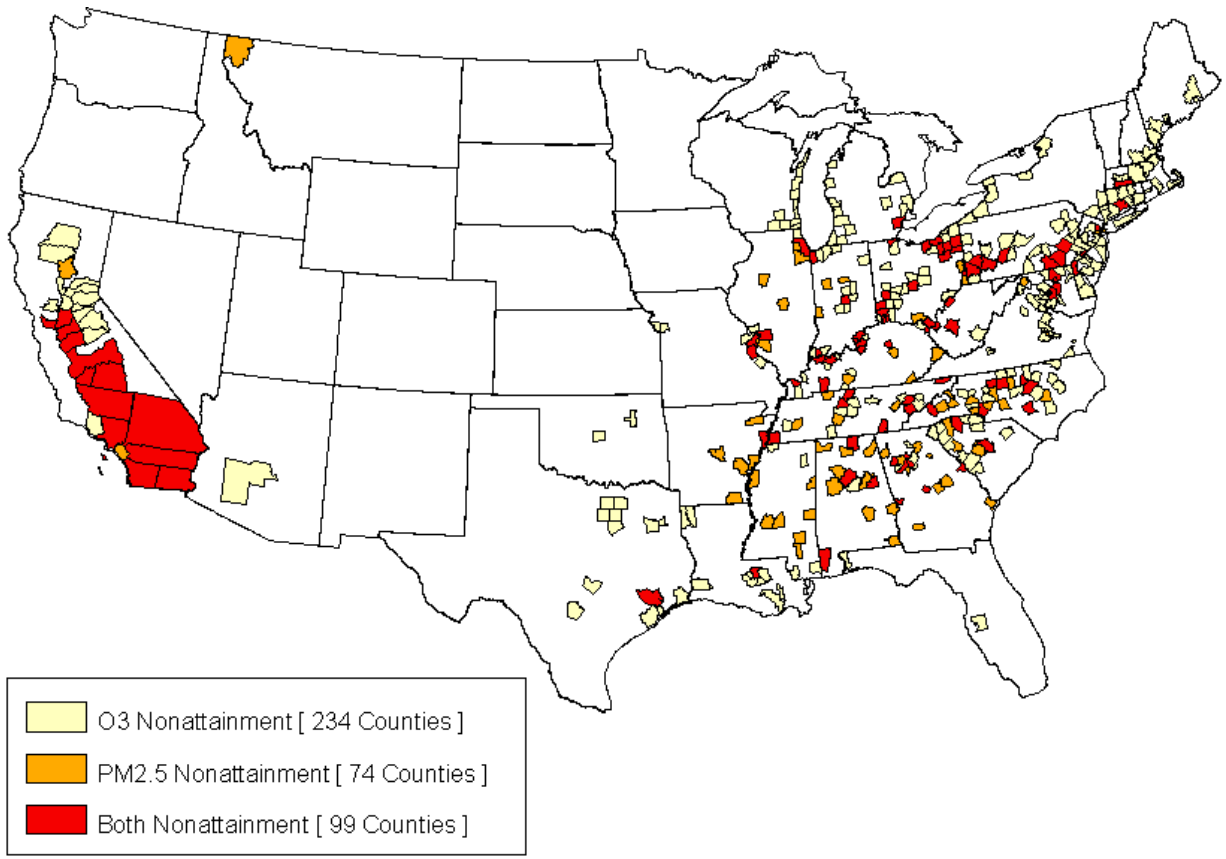
Projected Costs of the Clear Skies Act



Note: Cost projections are based on modeling using IPM. These projections show the costs to power generators over and above the costs they will incur to meet statutory and regulatory requirements that are already in effect. In the absence of Clear Skies legislation, there are existing statutory provisions that will, in the future, require EPA and states to impose additional requirements (and thus additional costs) on power generators between now and 2020. When compared to existing Clean Air Act requirements, Clear Skies may actually result in cost savings because a cap-and-trade approach is much more efficient than existing regulatory programs. When the Acid Rain Program was implemented using a cap-and-trade program, compliance costs were significantly lower than predicted as sources took advantage of the flexibility provided by a cap and trade program.

Attainment with $PM_{2.5}$ and 8-hour Ozone Standards (Current Data*)

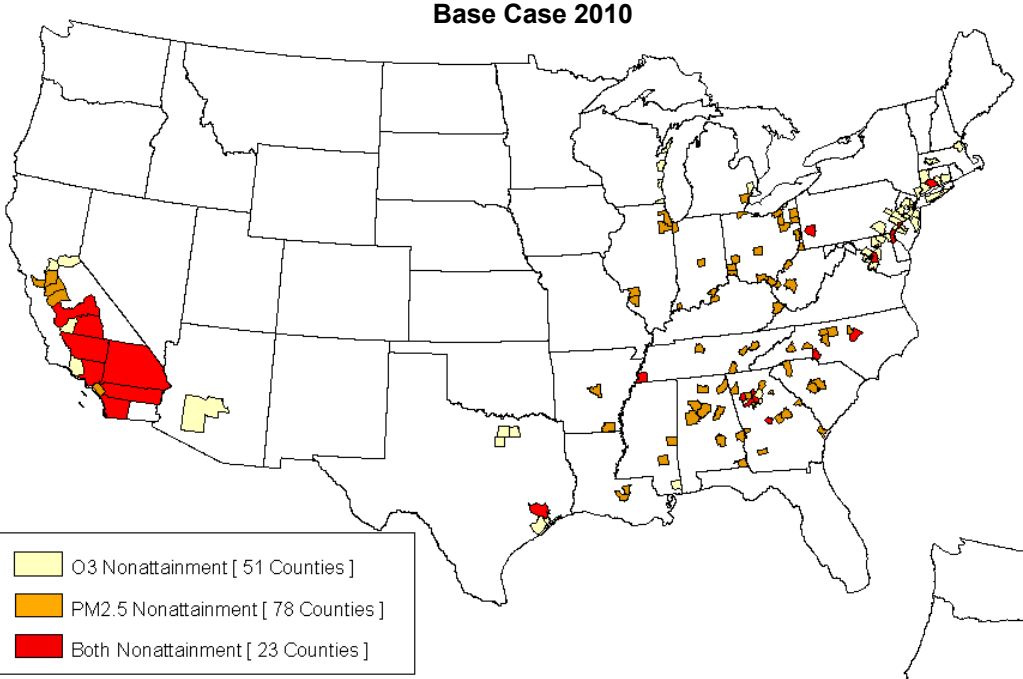
- Based on available 1999-2000 $PM_{2.5}$ data, 157 counties in the East and 173 counties nationwide are likely to exceed the fine particle standard (projected concentrations greater than 15 μ/m^3, which is the annual fine particle standard).
  - Currently 82 million people nationwide, including 59 million in the East, live in counties that would not meet the standard.
- There are currently 333 counties (306 counties in the east) estimated to exceed the 8-hour ozone standard.
  - Currently 120 million people live in counties with projected ozone concentrations greater than 85 ppb (the 8-hour ozone standard).



Note: To permit comparisons among various analyses, the air quality data were the most complete and recently available as of mid-2001 (1997-1999 ozone monitoring data and 1999-2000 PM2.5 data). More complete and recent air quality data for ozone and fine particles (1999-2001 data) is now available. This updated data indicate differences in the likely attainment status of some counties compared to what is shown here. Future analyses of Clear Skies will incorporate the most recent data available.

Projected Attainment with $PM_{2.5}$ and 8-hour Ozone Standards under Clear Skies (2010)

Base Case 2010

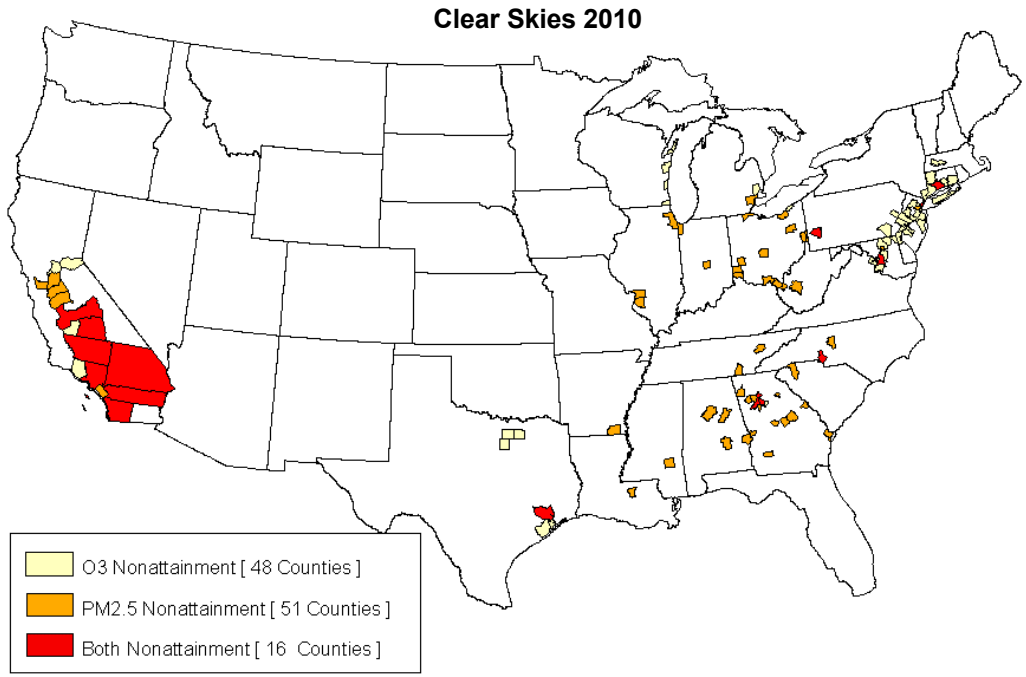


The Clear Skies Act would result in a substantial number of counties meeting the $PM_{2.5}$ and 8-hour ozone standards sooner than they would under the existing Clean Air Act.

$PM_{2.5}$ attainment status in 2010:

- The Clear Skies Act would bring 34 additional counties (home to approximately 10 million people) into attainment with the fine particle standard (as compared to the Base Case).

Clear Skies 2010



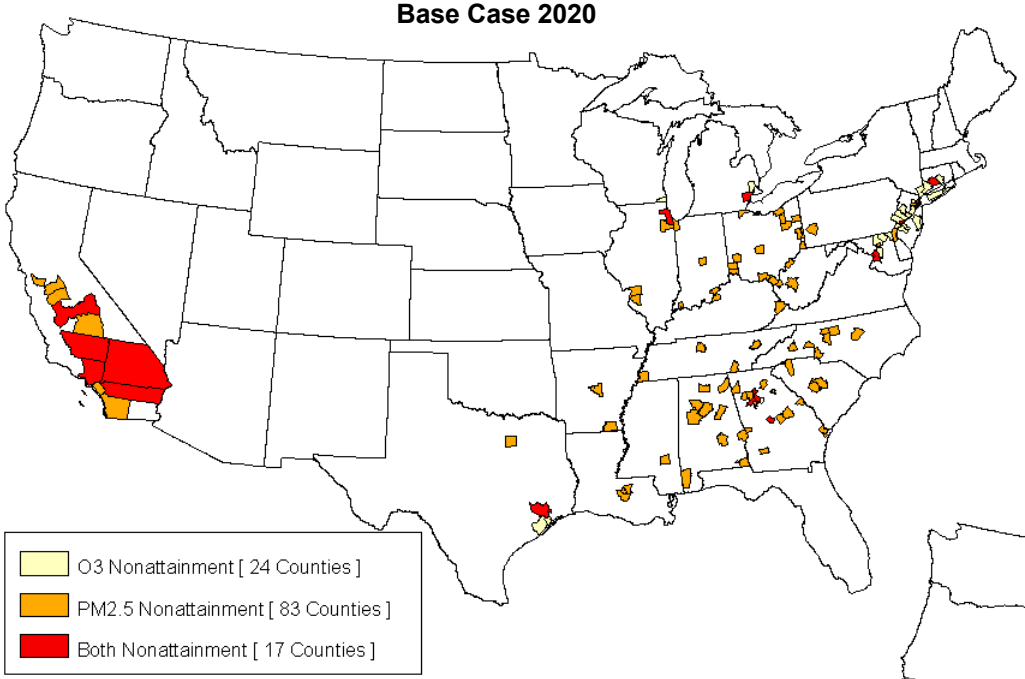
Ozone attainment status in 2010:

- The Clear Skies Act would bring 10 additional counties (home to over 7 million people) into attainment with the 8-hour ozone standard in 2010 (as compared to the Base Case).

Note: This analysis shows the counties that would come into attainment due to Clear Skies alone in 2010. Additional federal and state programs are designed to bring all counties into attainment by 2017 at the latest.

Projected Attainment with $PM_{2.5}$ and 8-hour Ozone Standards under Clear Skies (2020)

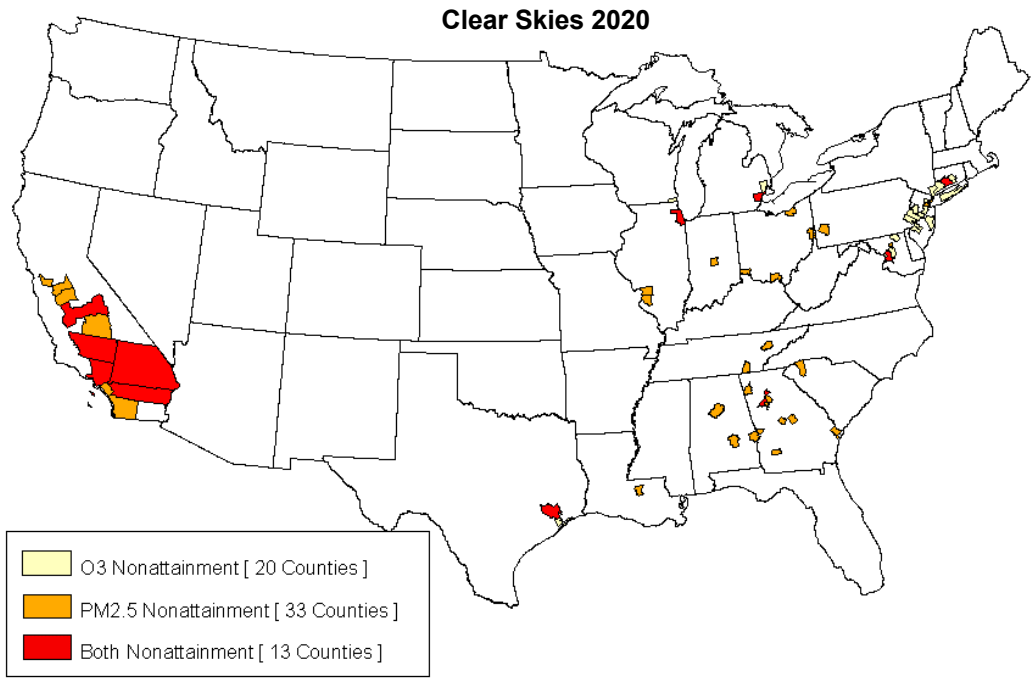
Base Case 2020



$PM_{2.5}$ attainment status in 2020:

- The Clear Skies Act would bring 54 additional counties (home to approximately 21 million people) into attainment with the fine particle standard (as compared to the Base Case).

Clear Skies 2020



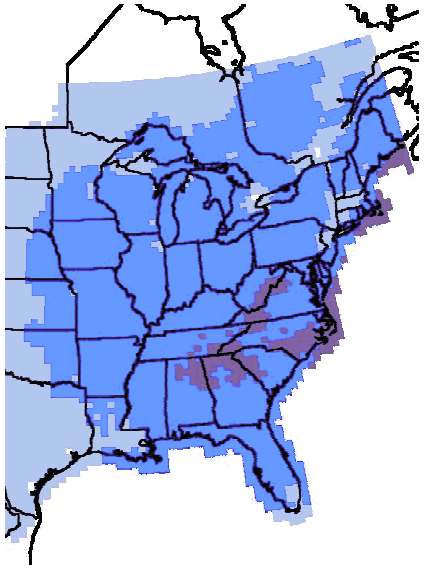
Ozone attainment status in 2020:

- The Clear Skies Act would bring 8 additional counties (home to over 4 million people) into attainment with the 8-hour ozone standard (as compared to the Base Case).

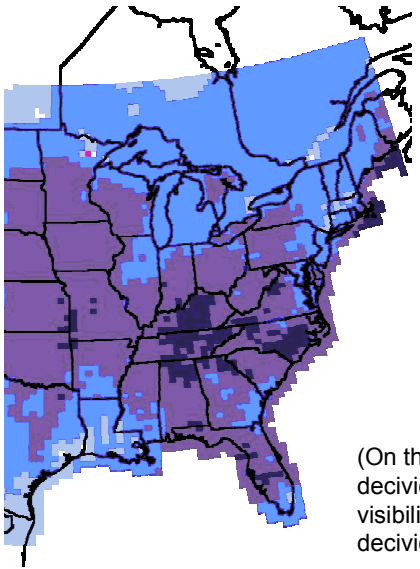
Note: This analysis shows the counties that would come into attainment due to Clear Skies alone in 2020. Additional federal and state programs are designed to bring all counties into attainment by 2017 at the latest.

Visibility (2020)

Deciview Change 2020 Base Case vs. Clear Skies



Deciview Change 1996 vs. 2020 with Clear Skies



Deciview Improvement

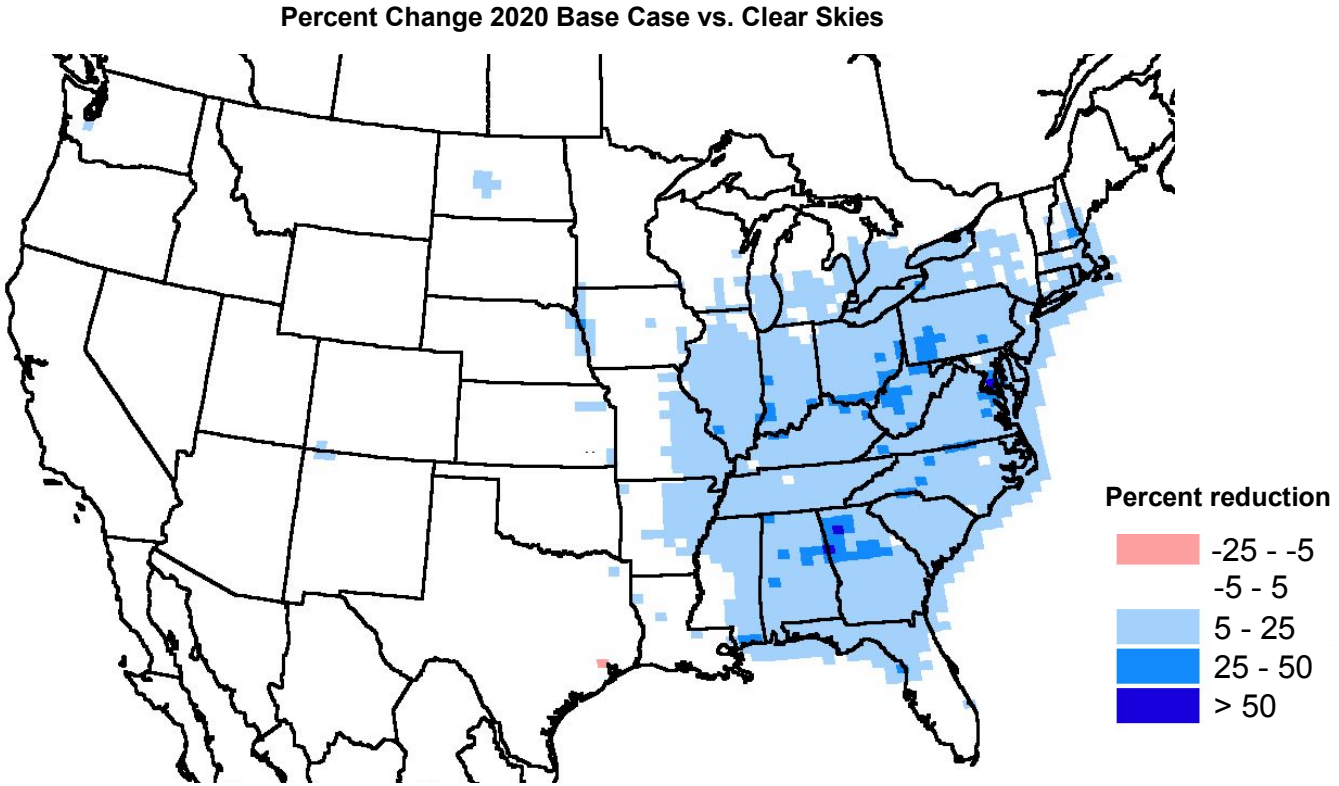
- -1 - -0.5
- -0.5 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- > 3

(On these maps, a positive change in deciviews is an improvement in visibility; a negative change in deciviews is a decrease in visibility.)

- Clear Skies would improve visibility over much of the East and Midwest 1-2 deciviews beyond what is expected under the Base Case in 2020.
  - The greatest improvements (2-3 deciviews) are projected along the Appalachians, including the Blue Ridge and Great Smoky Mountains - areas where visibility has been deteriorating.
- Under Clear Skies and existing programs, visibility in a large portion of the East and Midwest would improve 2-3 deciviews from current levels.
  - Visibility along the southern Appalachian Mountains would improve more than 3 deciviews.
- Under Clear Skies, the Western Regional Air Partnership agreement will be honored and the emissions reductions are expected to take effect.
  - This will allow future growth in the West to occur without degrading visibility.
- The EPA is also considering other actions, such as the non-road diesel rule, that will help reduce visibility-impairing fine particle concentrations throughout the western and eastern U.S.

Notes: Title IV reduced over 3 million tons of SO_2 between 1990 and 1996 that are not captured by the improvements shown on the map because the base year for the analysis was 1996. Emissions from certain sources, such as mining and metals processing, are expected to increase in the future. These sources, which are not affected by Title IV or Clear Skies, contribute to increases in fine particle concentrations in certain areas (e.g. Northern Minnesota). The western U.S. is not shown in these maps because the emissions reductions expected from the WRAP have not yet been included in the air quality modeling analysis.

Mercury Deposition (2020)



- This map demonstrates that Clear Skies would achieve significant additional reductions of up to 25% across much of the East beyond what is expected under the Base Case. These reductions are in addition to significant deposition reductions expected from implementation of existing programs such as the municipal waste combustor and medical waste incinerator MACT standards.
  - The greatest reductions of up to 50% would occur along the Ohio River, in portions of the mid-Atlantic region, and in northern sections of Georgia and Alabama.
  - The increase in mercury emissions in Texas is due to increases in emissions from non-power generation sources that are not affected by the Clear Skies Act.