

Major Energy and Air Related Environmental Issues for the 21st Century

(The Environment of the State)

Environmental Monitoring, Evaluation, and Protection in
New York: Linking Science and Policy

Albany, NY

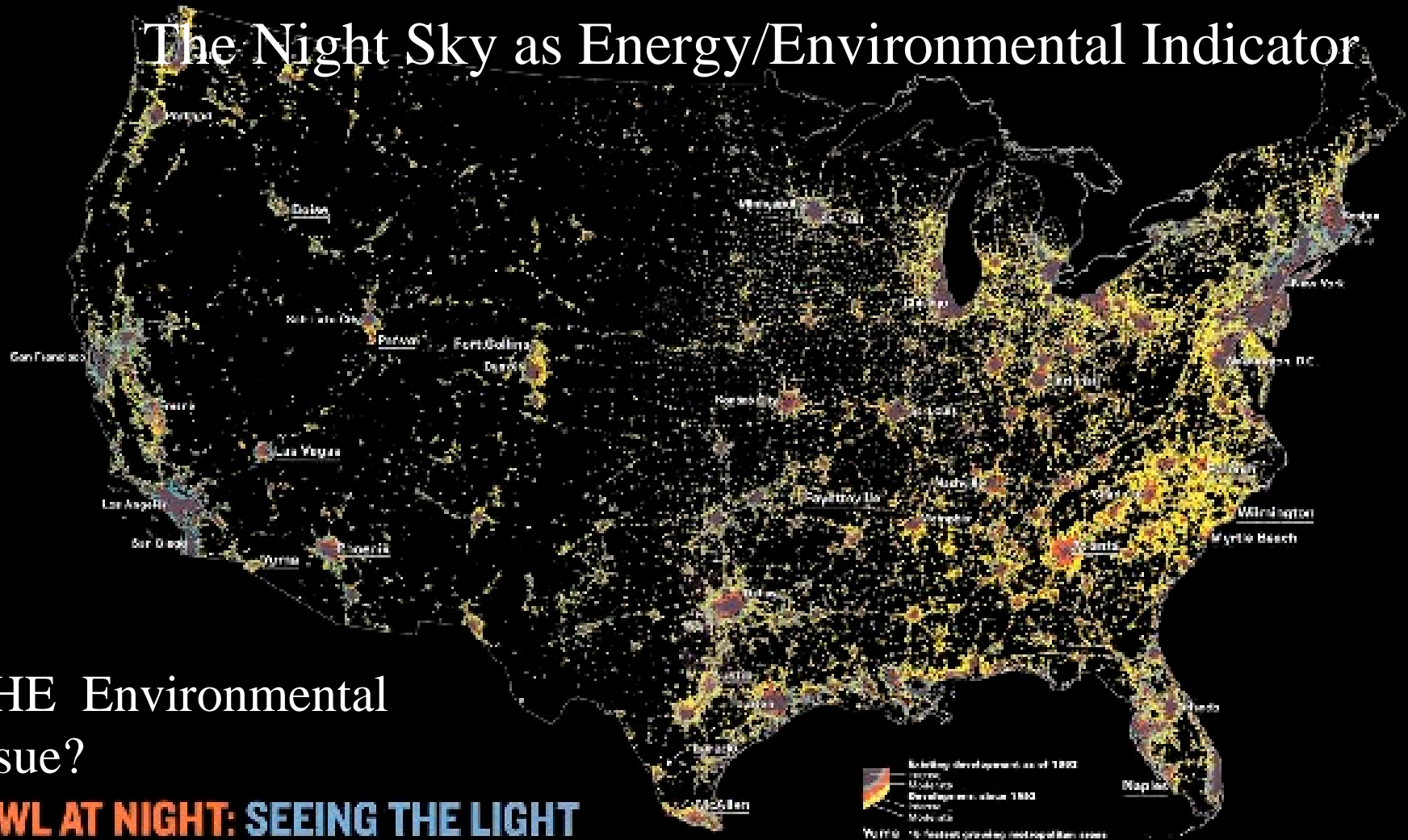
7 October 2003

John Bachmann

Associate Director for Science/Policy and New Programs
Office of Air Quality Planning and Standards

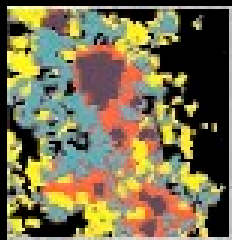


The Night Sky as Energy/Environmental Indicator

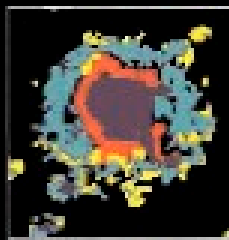


THE Environmental Issue?

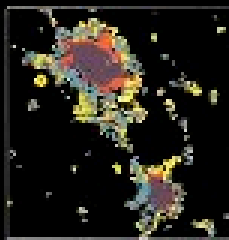
SPRAWL AT NIGHT: SEEING THE LIGHT



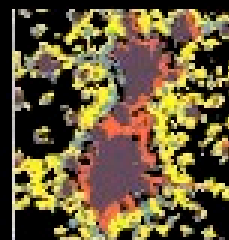
FRESNO, CALIF.



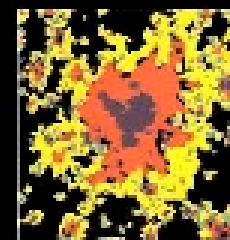
LAS VEGAS, NV



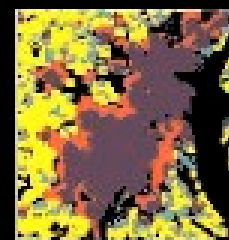
PHOENIX, ARIZONA, AZ



CINCINNATI, OHIO, OH



ATLANTA, GA

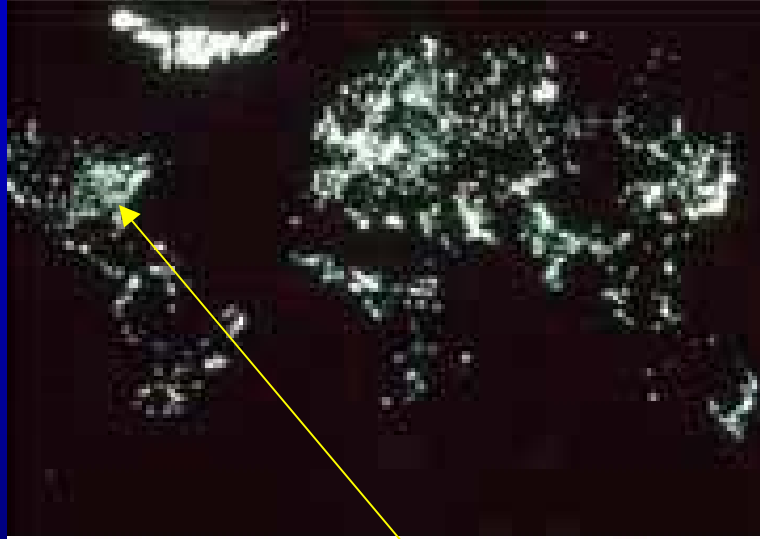


WASHINGTON, DC, BALTIMORE, MD

Air Pollution/Energy Connections

- An overview of some key air related issues
- Multiple links to energy, other media, related societal goals and impacts
- Interlocking scales of influence
- Where we have succeeded/what challenges remain
- Focus on PM/ozone futures
- Highlight links to other major societal issues, science/policy questions

Air Pollution Scales of Influence

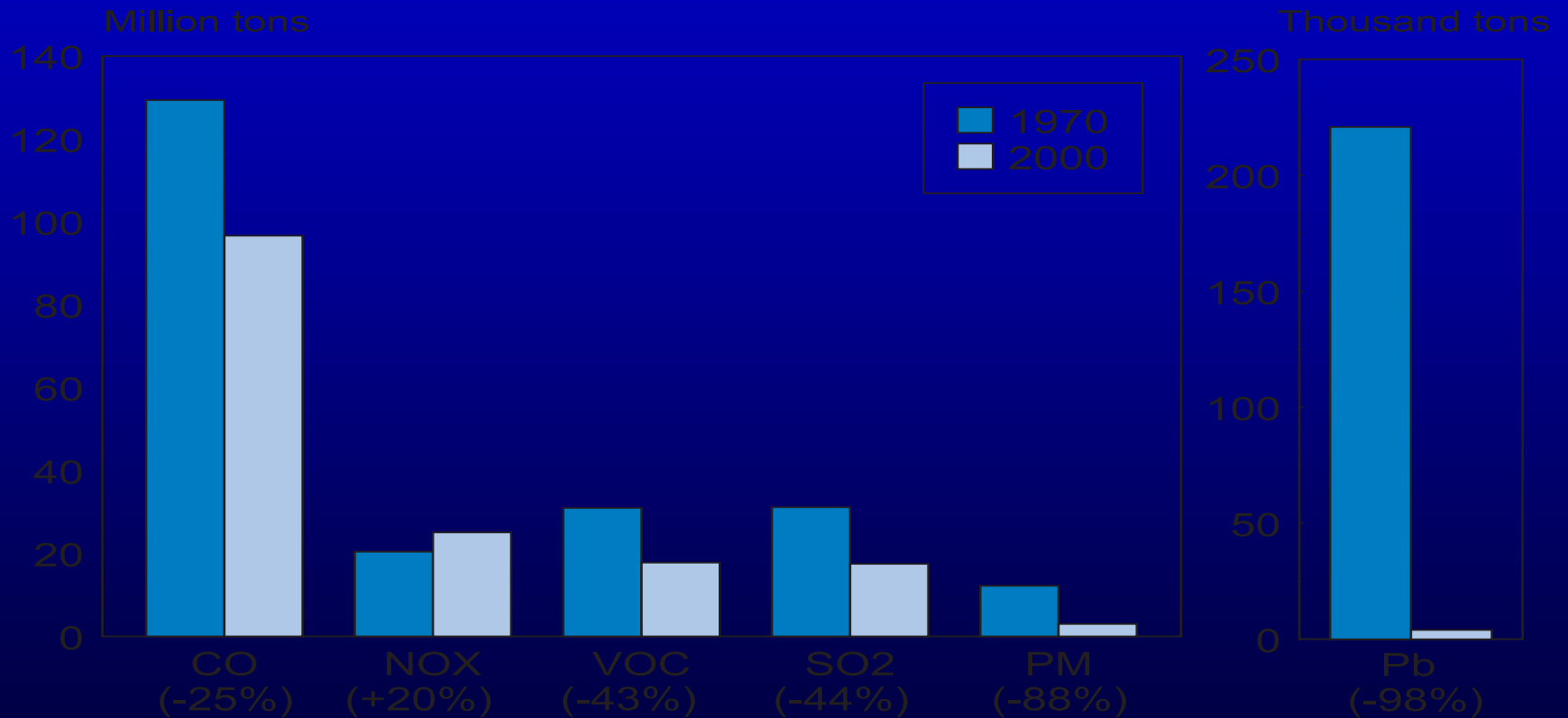


- Global – e.g. climate change, stratospheric ozone, persistent-bioaccumulative toxic pollutants (Hg, dioxins)
- Regional** – e.g. ozone, fine particles health, acid rain, visibility, nutrient loadings
- Local** –e.g. ozone, PM health, air toxics
- Personal – indoor air/outdoor penetration, asthma



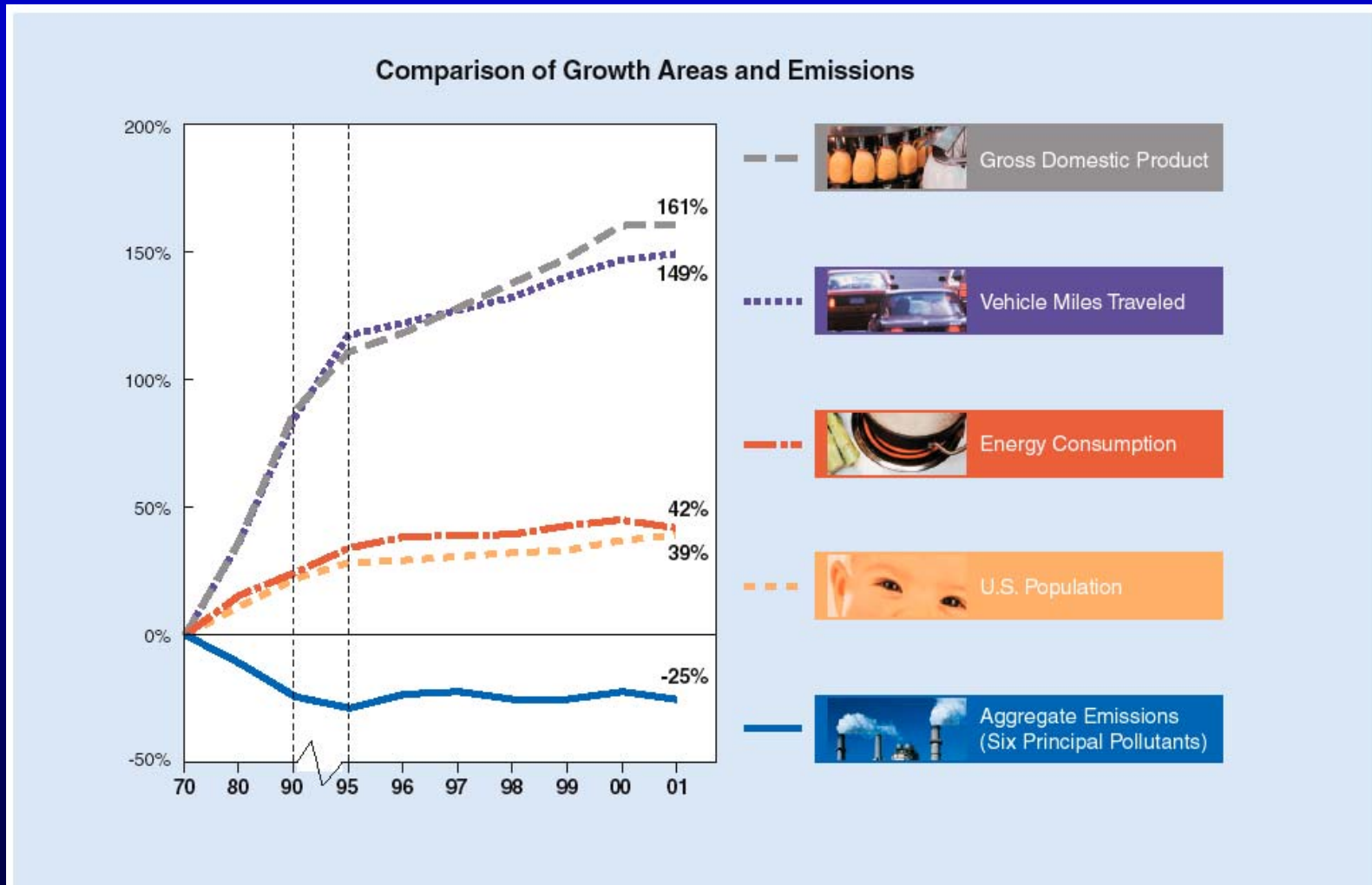
What's worked? The CAA

1970 vs 2000 emissions for criteria pollutants



Progress Toward Clean Air 1970-2001

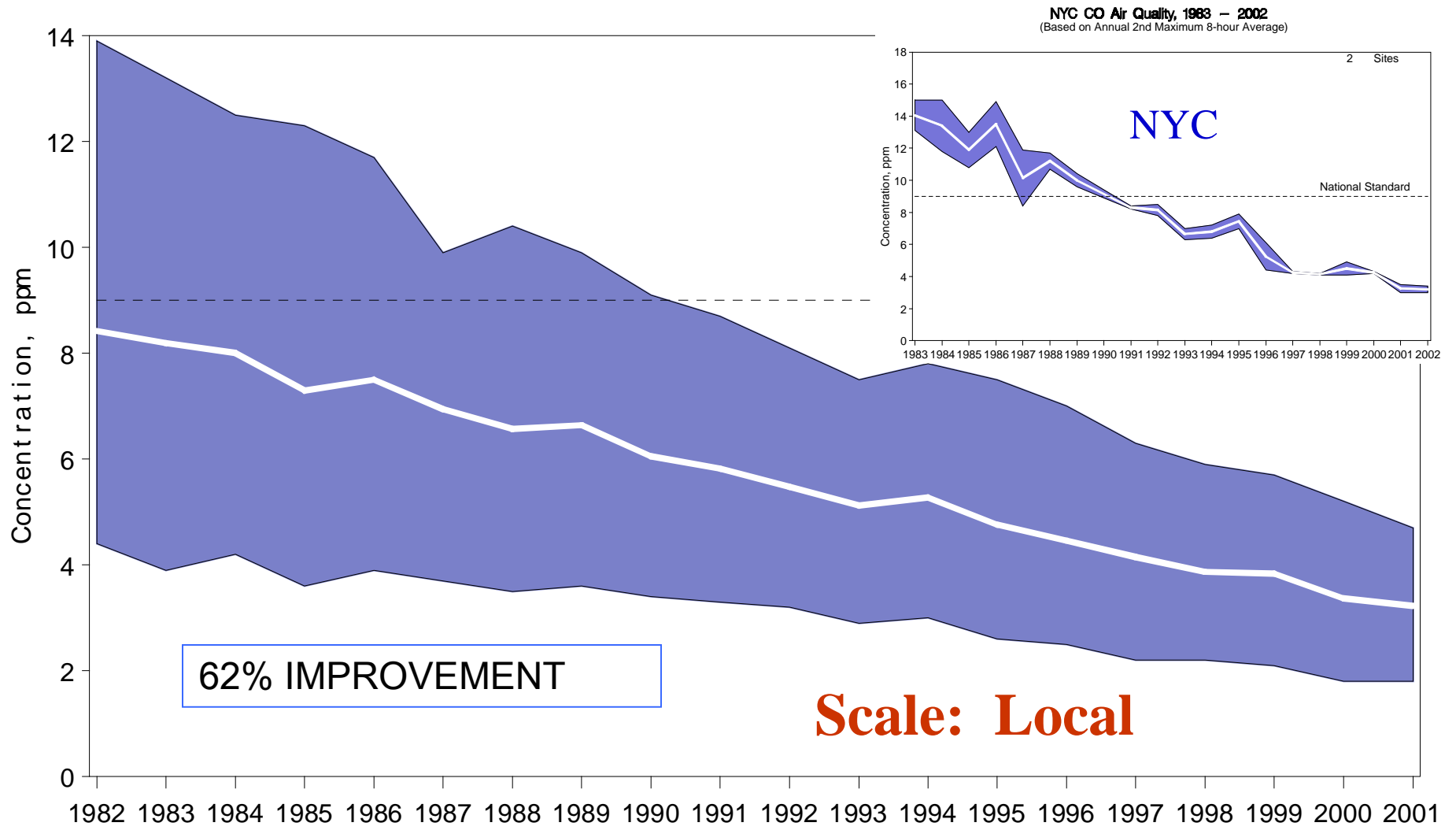
Pollution Down While Growth Continues



Between 1970 and 2001, gross domestic product increased 161 percent, vehicle miles traveled increased 149 percent, energy consumption increased 42 percent, and U.S. population increased 39 percent. At the same time, total emissions of the six principal air pollutants decreased 25 percent.

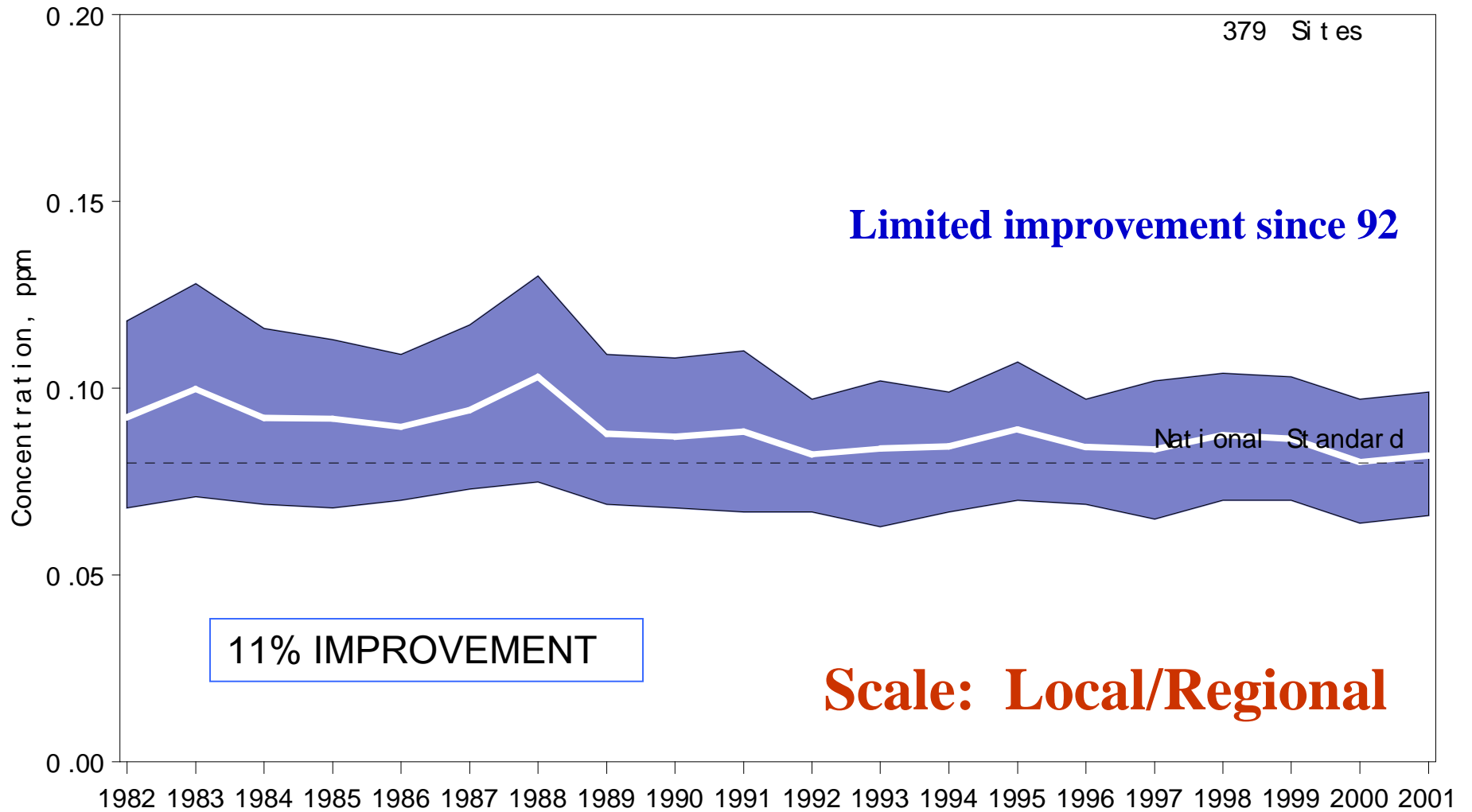
CO Air Quality, 1982 – 2001

(Based on Annual 2nd Maximum 8-hour Average)

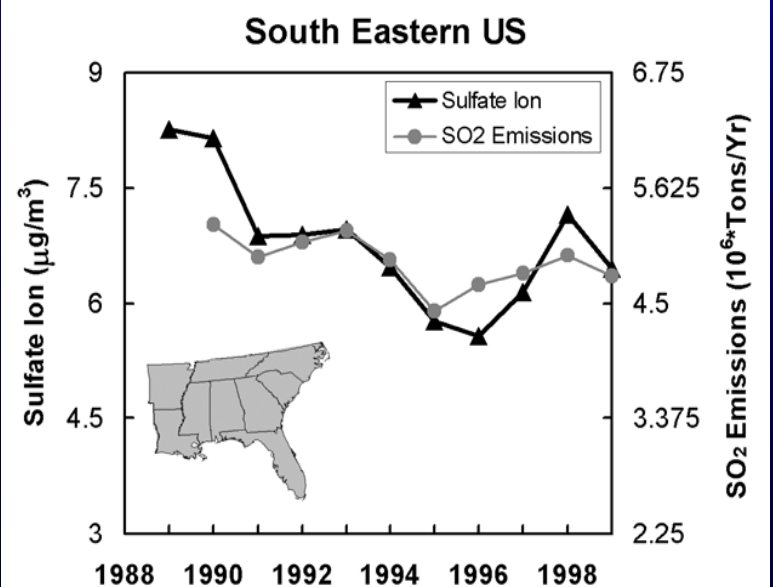
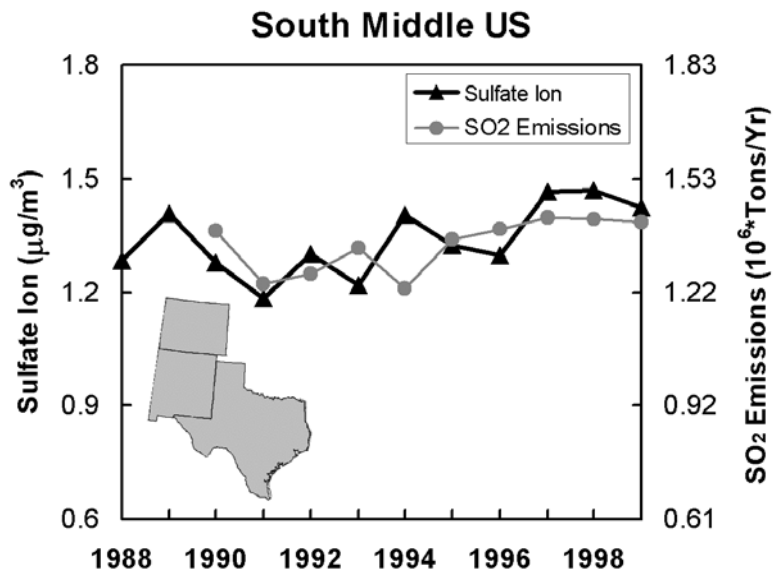
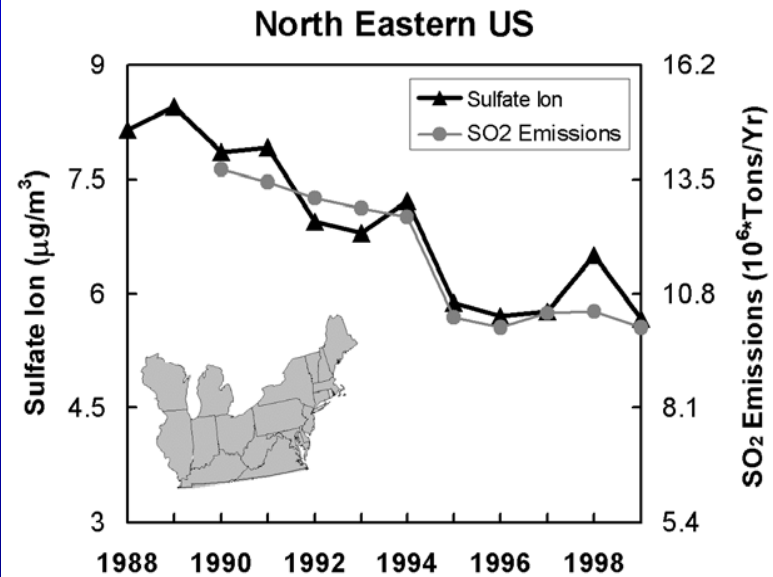
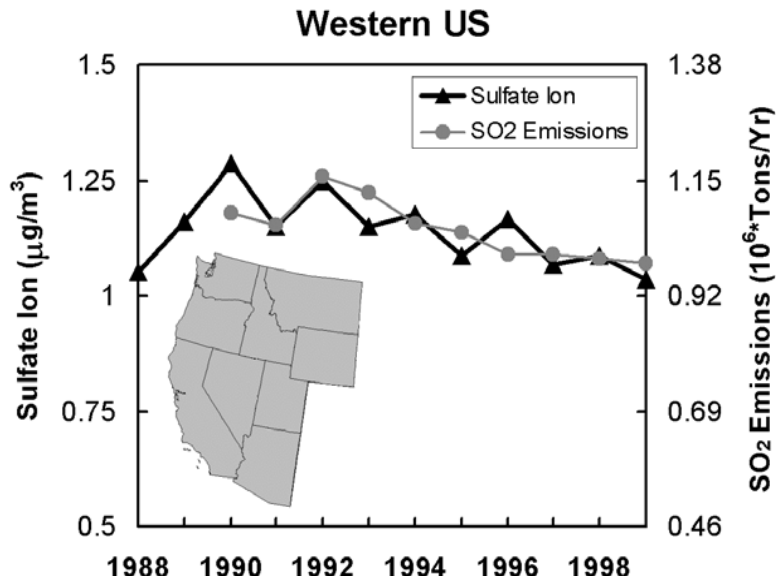


Ozone Air Quality, 1982 – 2001

(Based on Annual 4th Maximum 8-Hour Average)



Rural Sulfate Trends track *Regional SO_x* Emissions

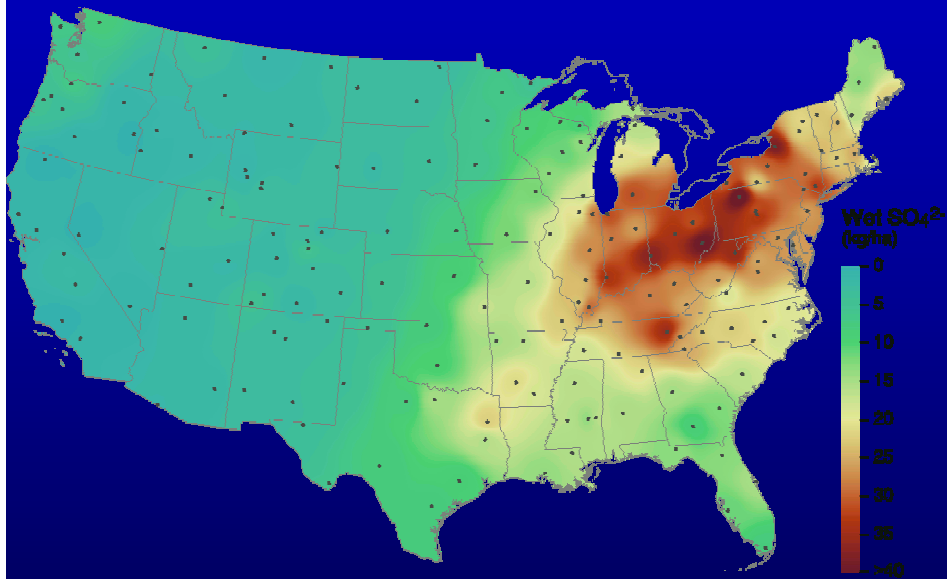


Progress on long-term acidification



Wet Sulfate Deposition

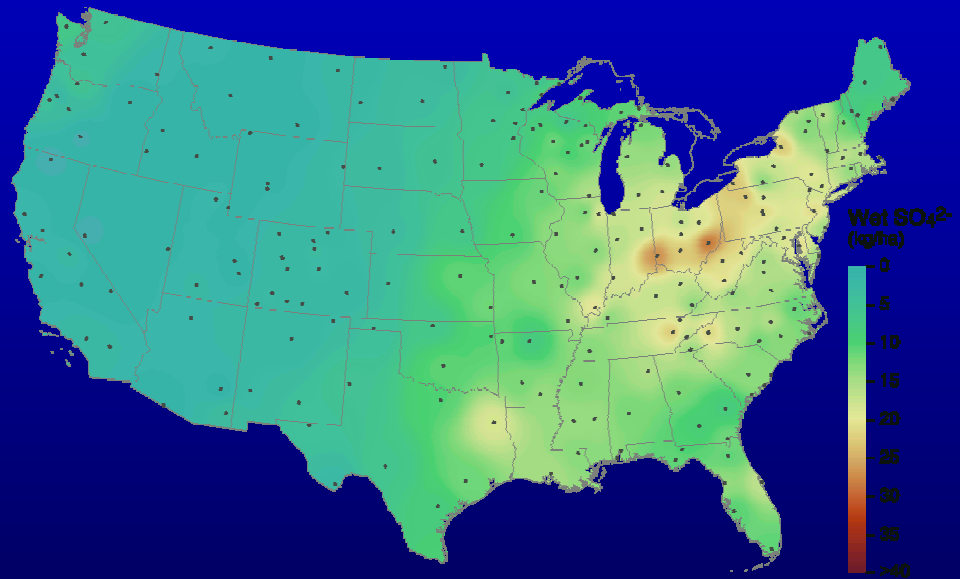
1989-1991



Source: National Atmospheric Deposition Program

USEPA/CAMD 08/24/03
H:\data\atdep\atdep_0301-04.gif

2000-2002



Source: National Atmospheric Deposition Program

USEPA/CAMD 08/24/03
H:\data\atdep\atdep_0301-04.gif

Scale: Regional

Focus: PM – alone and with gases

- Significant effects associations:
 - Premature death from heart and lung disease
 - Aggravation of heart and lung diseases, including asthma
 - Cardiac arrhythmias and heart attacks
 - Coughing, wheezing and chronic bronchitis
 - And *possibly* lung cancer mortality, infant mortality
- Is PM composition important?
 - Probably, but likely multiple “bad” actors
 - A number of studies found effects of PM components, e.g. sulfate; few OC, many black carbon (i.e. black smoke)
- Implications for future NAAQS/Control approaches
 - Short-term (hours)/long-term/ composition-sources

Visibility and quality of life



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

Urban Visibility - Secondary NAAQS



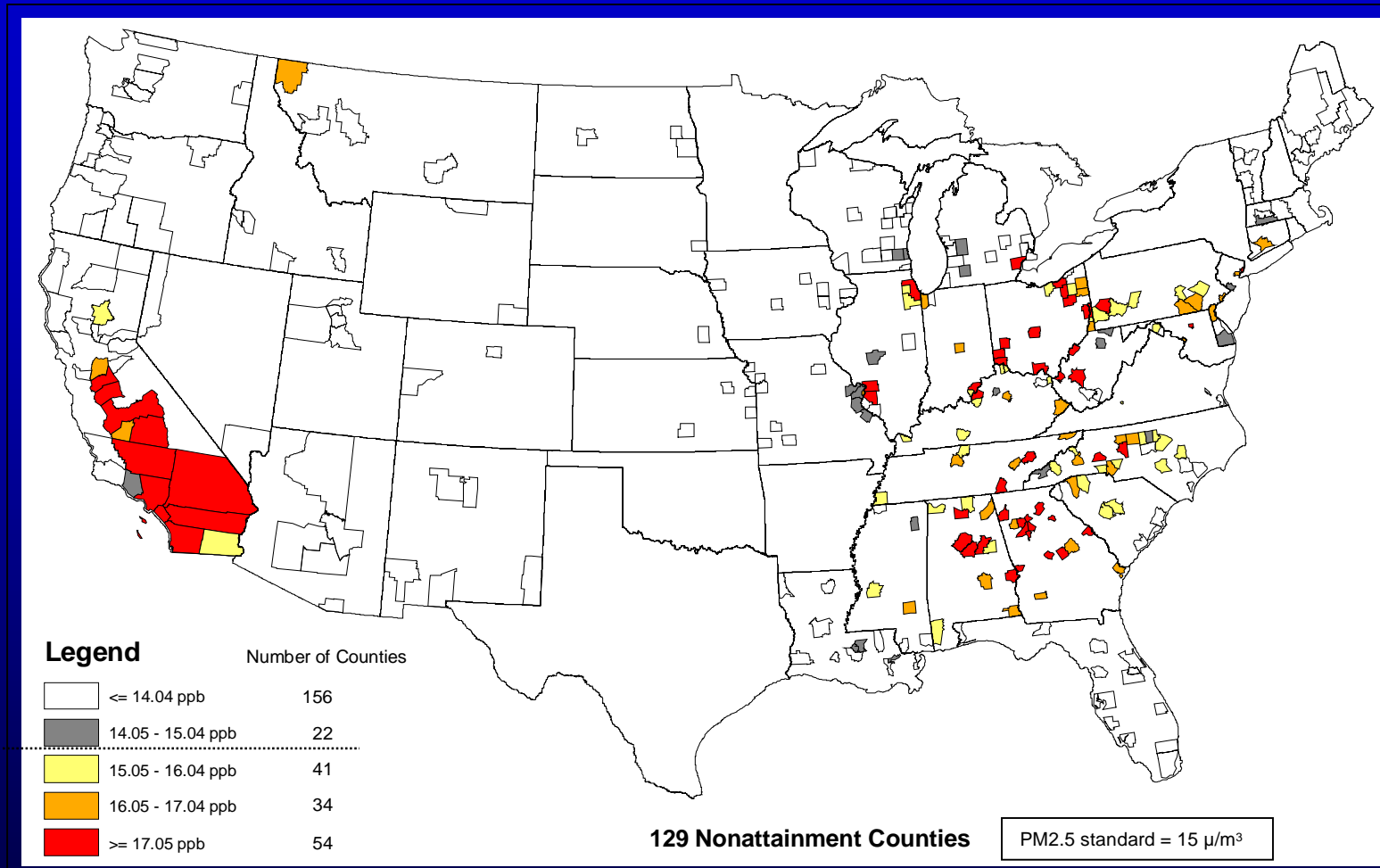
Class I Areas: Regional Haze



Emerging health effects evidence on ozone

- Premature mortality in elderly
- Relationship between ozone levels and respiratory hospital admissions in children
- Incidence of newly diagnosed asthma in children associated with outdoor activity & living in areas with high ozone exposures
- Higher ozone exposures related to increased school absenteeism

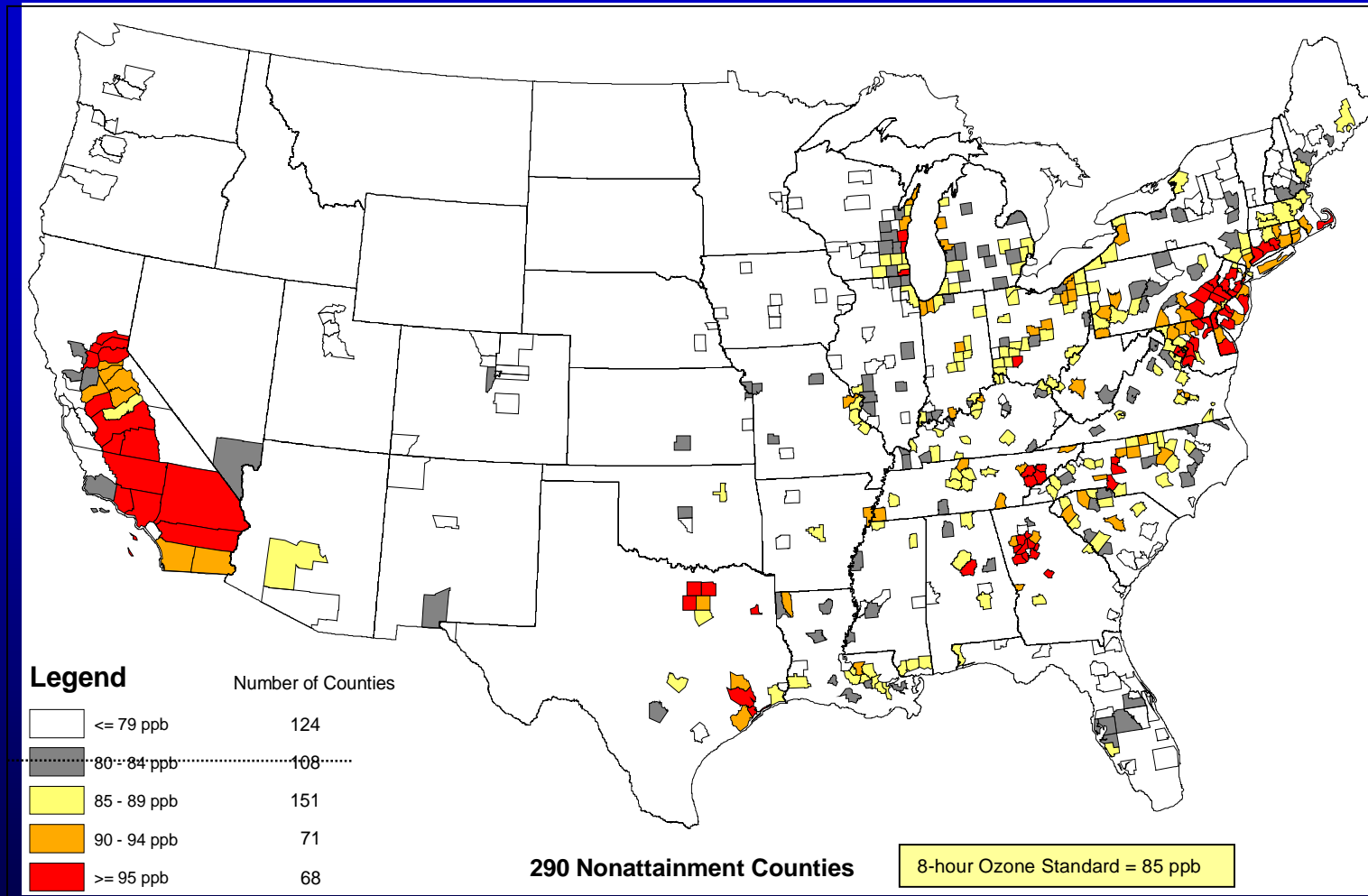
Current Fine Particle (PM_{2.5}) Concentrations (1999-2001)



Note: Based on 1999-2001 monitoring data of counties with monitors that have three years of complete data.

- There are 129 counties nationwide (114 counties in the East) that are likely to exceed the annual fine particle standard of 15 µ/m³.
- 65 million people (43 million people in the East) live in counties that would not meet this standard.

Current 8-hour Ozone Concentrations (1999-2001)



Note: Based on 1999-2001 monitoring data of counties with monitors that have three years of complete data.

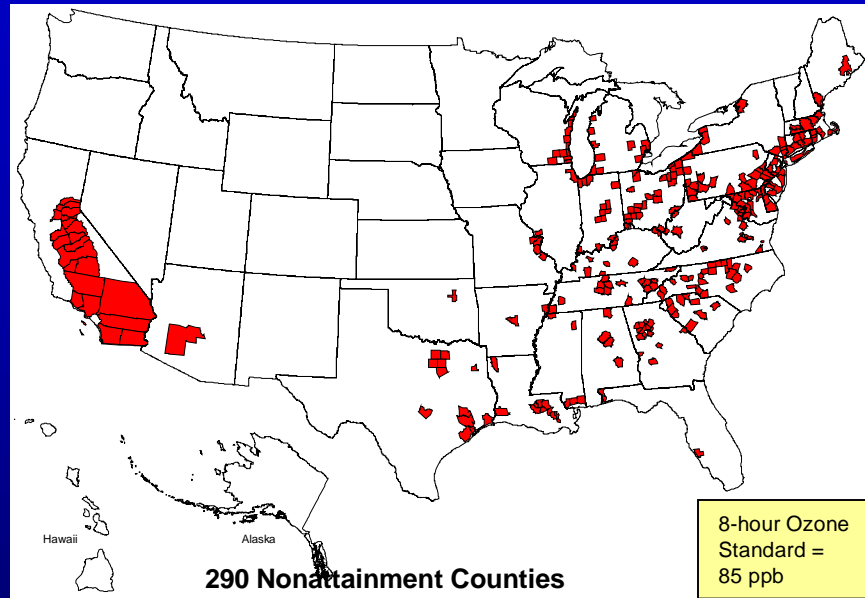
- There are 290 counties nationwide (268 counties in the East) estimated to exceed the 8-hour ozone standard.
 - 111 million people (87 million people in the East) live in counties that would not meet this standard.

Addressing Regional Transport

- EPA is pursuing two mechanisms to address transport in the future:
 - Clear Skies Act
 - Legislation that addresses transported air pollution from power plants in addition to other environmental concerns (e.g., mercury).
 - Transport Rule
 - Regulatory approach that uses existing CAA mechanisms to address transported air pollution from all potential transport sources.
 - Alternative: Legislation for power plants and a Transport Rule for other sectors
 - Regional Haze long-term strategies

Clear Skies with other air programs can improve ozone attainment significantly – but residual ‘sub-regional’ problems

Counties Exceeding the 8-hour Ozone Standard in 2001



- There are 290 counties nationwide (268 counties in the East) currently estimated to exceed the 8-hour ozone standard.
 - 111 million people (87 million people in the East) currently live in counties with projected ozone concentrations greater than the 8-hour ozone standard of 85 ppb.

Most counties would be brought into attainment with the ozone standard by 2020 :

- Clear Skies and existing programs (primarily the NOx SIP Call and vehicle rules, including the proposed non-road rule) will bring 263 counties (home to approximately 77 million people) into attainment with the 8-hour ozone standard (compared to current conditions).

Remaining Counties Likely to Exceed the 8-hour Ozone Standard with Base Program/Clear Skies 2020

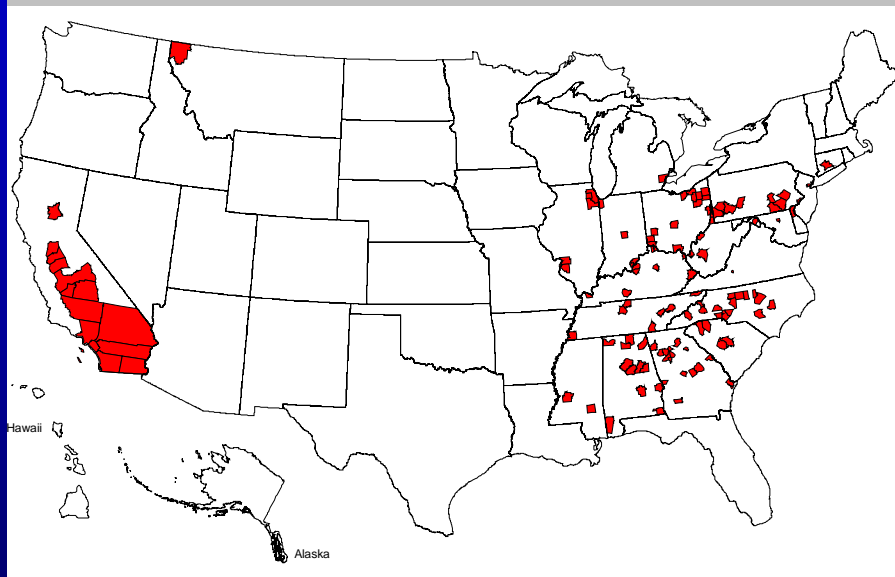


27 Nonattainment Counties

Notes: Based on 1999-2001 data of counties with monitors that have three years of complete data. Additional federal and state programs must bring all counties into attainment between 2007 and 2021. The methodology used to predict nonattainment status in the West is different than that used for the East.

Widespread improvement in attaining PM_{2.5} NAAQS with current mobile rules/Clear Skies (or transport rule)

Counties Exceeding the Annual Fine Particle Standard in 2001

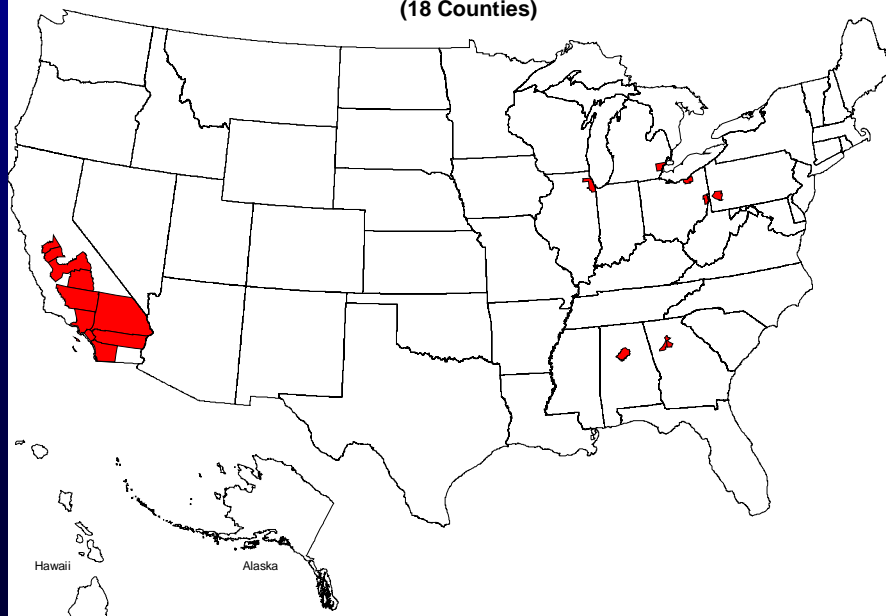


Widespread PM_{2.5} attainment in 2020:

- Tier 2, HD Diesel, NO_x SIP call, other programs
- Projected regional SO_x/NO_x reductions from Clear Skies Act, or regional transport rule/regional haze programs
- Doesn't include SIP local/regional measures

Remaining Counties Likely to Exceed the Annual Fine Particle Standard with Clear Skies in 2020

(18 Counties)



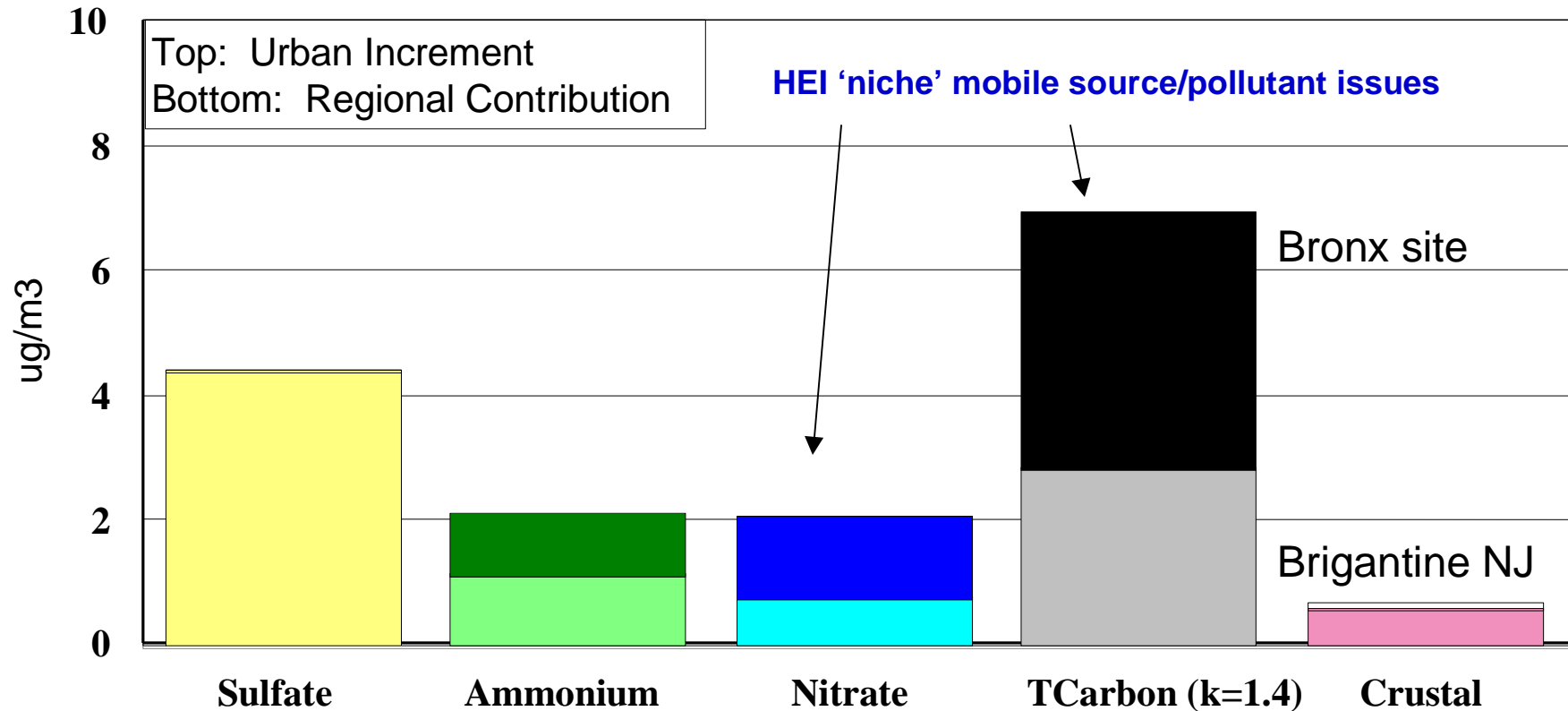
A significant change in the regional/background chemical climate

- Additional pressure on remaining local sources for VOC/PM control
- The 'Post sulfur' era?

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.

Local PM Sources: EC/Organic Carbon, Nitrates, other

NYC urban excess



New findings on roadway pollution

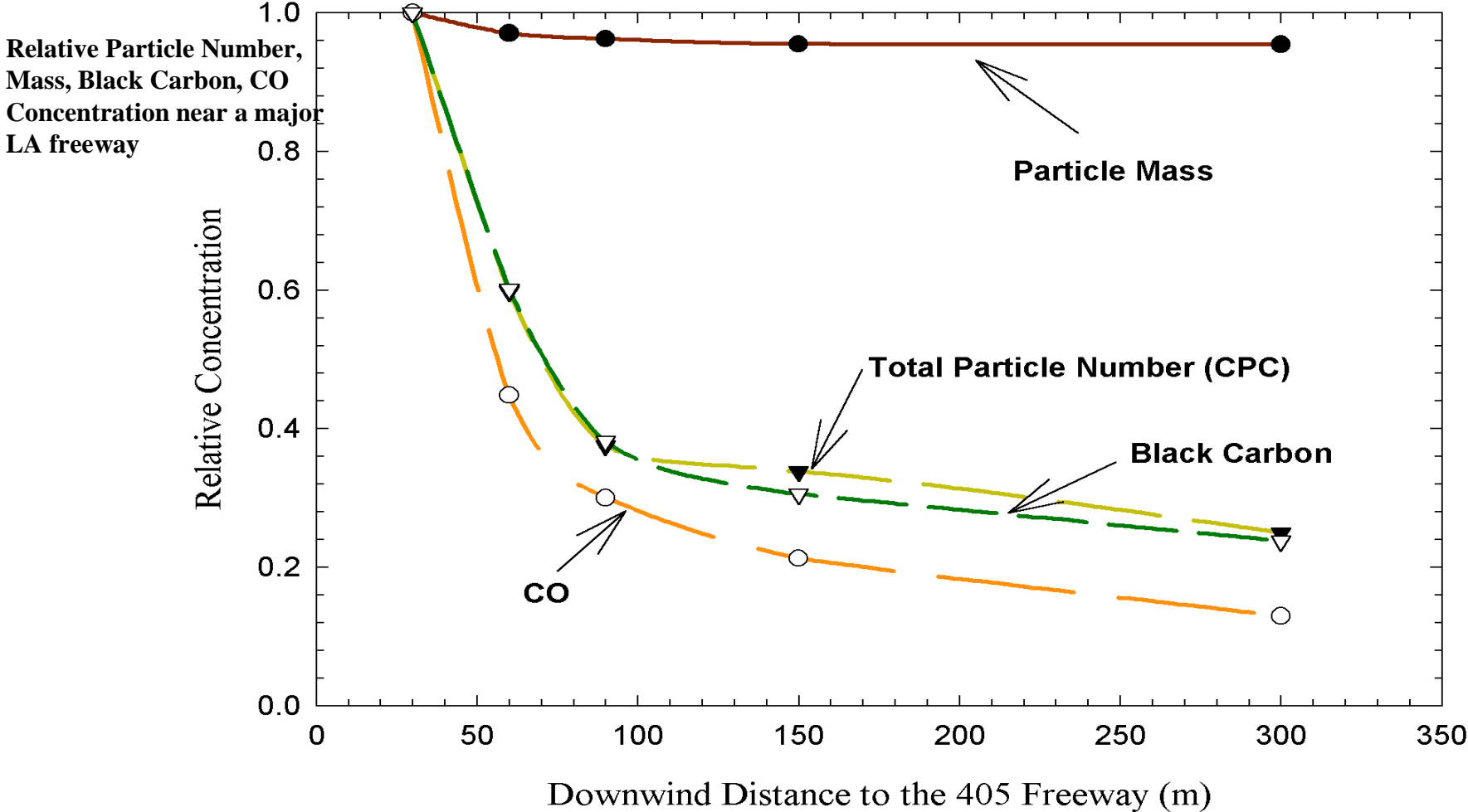


High exposure to ultrafine particles, CO, other pollution near roadway

Increased risk near and on roadways

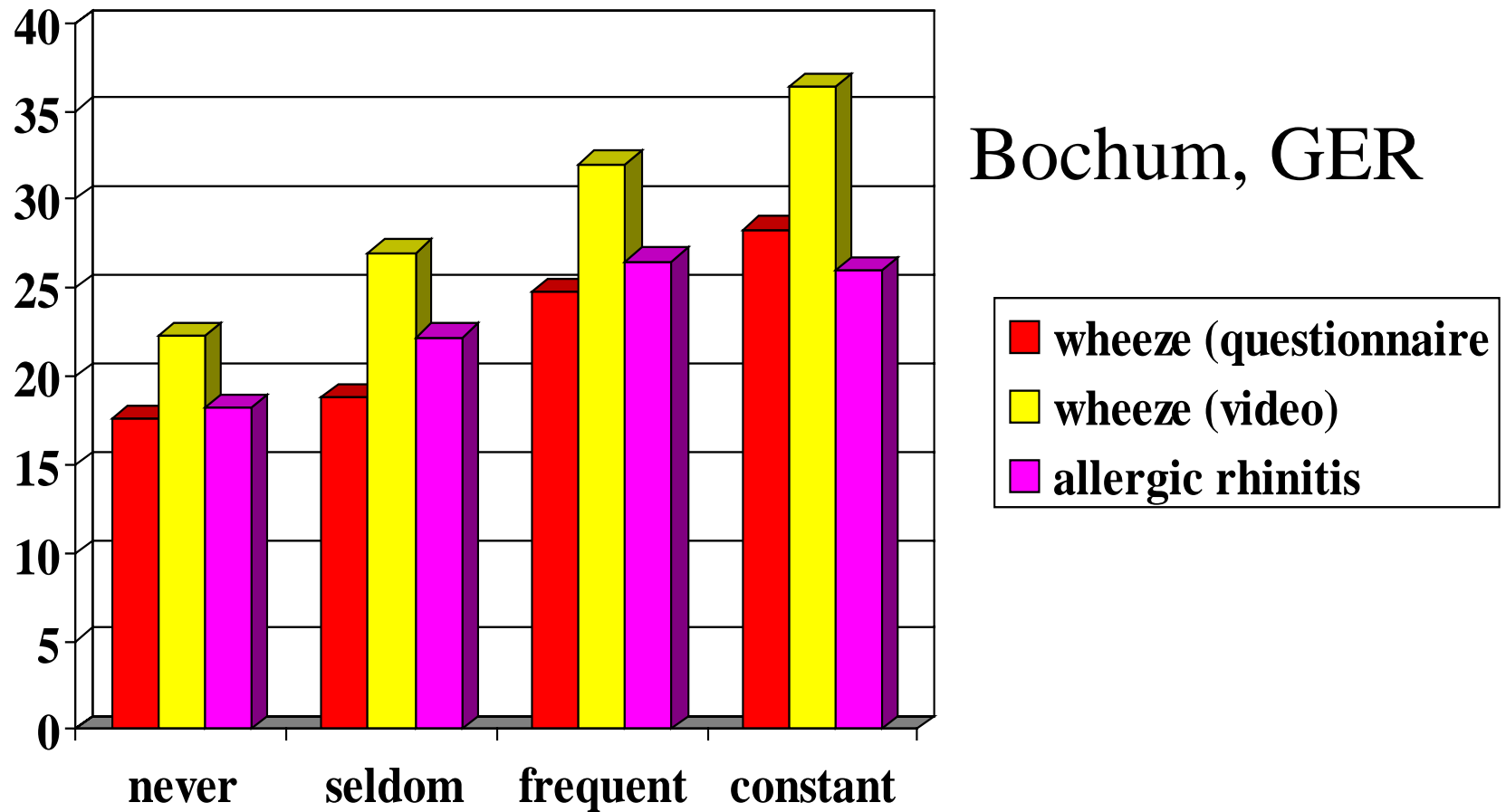


Extreme exposure in near highway environment



Respiratory Symptoms and traffic

Weiland, Ann Epidemiol 1994;4:243



Frequency of Truck Traffic

You can run – *but can you hide?*

Air pollution and the ‘built’ environment – design/planning for health, air quality, and sustainability



“Cool” Cities

- Trees aren't just good to look at – they remove air pollution (ozone and PM)
 - They also emit VOC's
 - And cool the environment reducing evaporative emissions from manmade sources
- Air Policy Issue
 - Credit for enhancing tree cover
 - Penalty for eliminating trees?



International transport/climate interactions

Scale: global/regional

Asia a Priority: Air Quality/Health Improvements have climate benefits



Air Pollution (PM and O₃) significant Climate Forcers

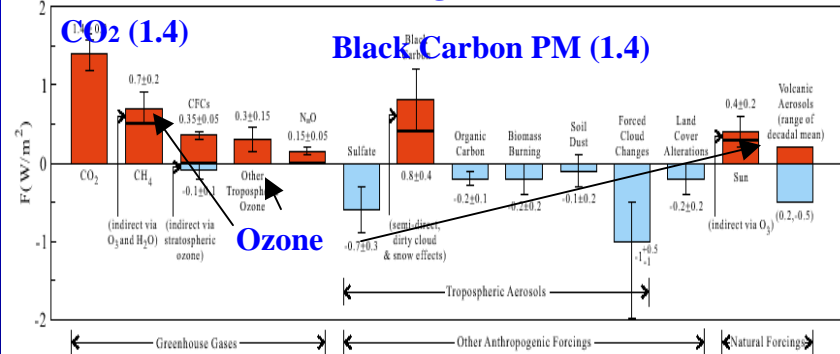
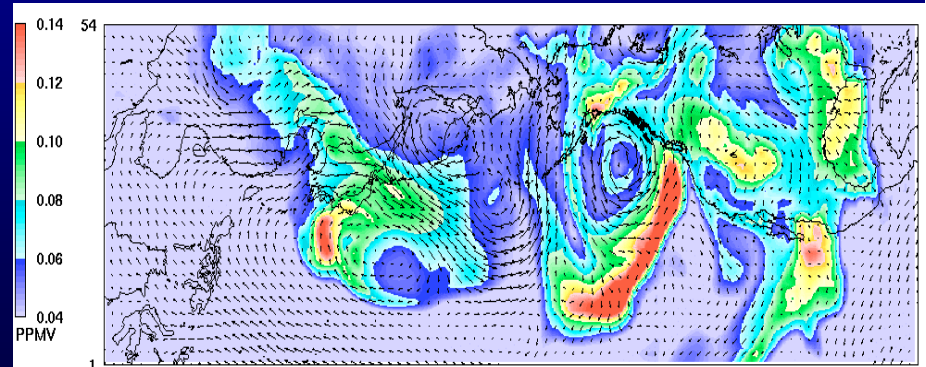
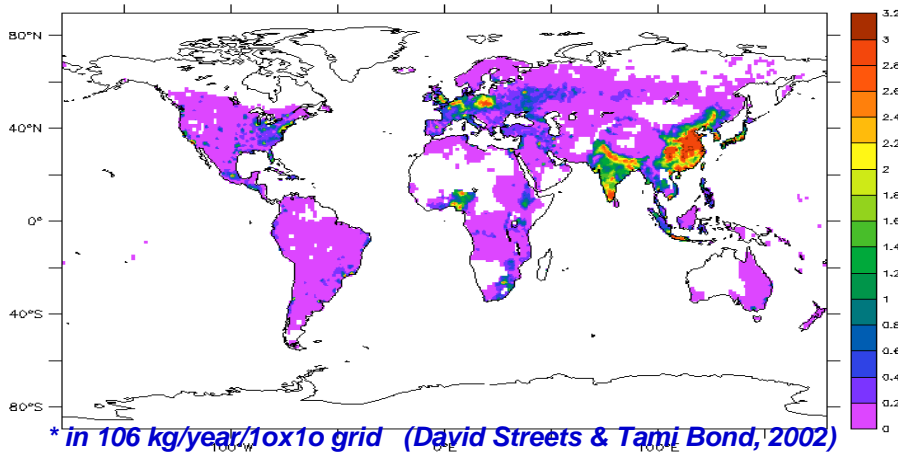


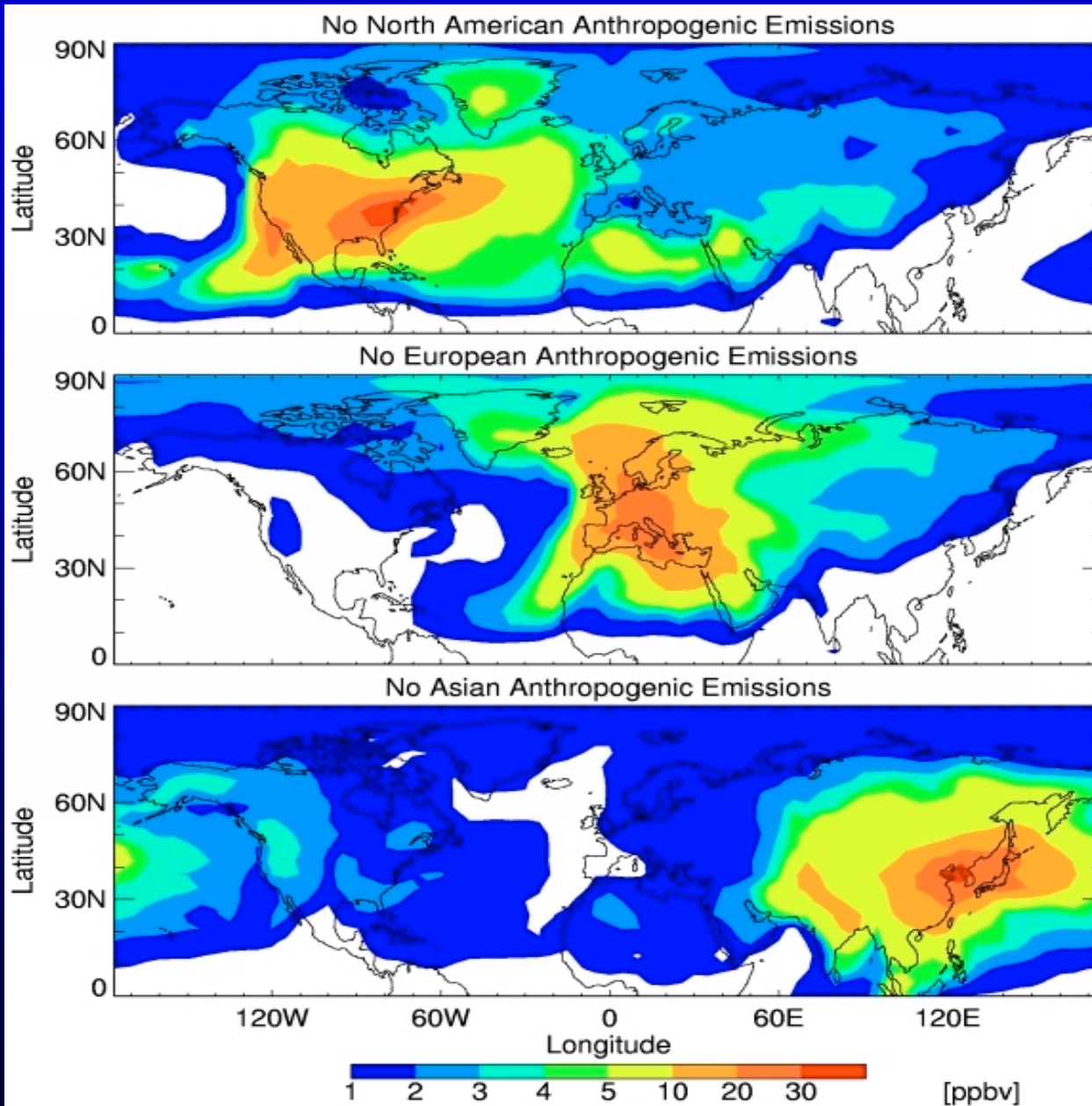
Figure 2. Estimated change of climate forcings between 1850 and 2000.

Global Black Carbon Emissions



Modeling intercontinental ozone transport – significant component of background

SURFACE OZONE ENHANCEMENTS CAUSED BY ANTHROPOGENIC EMISSIONS FROM DIFFERENT CONTINENTS



GEOS-CHEM model,
July 1997

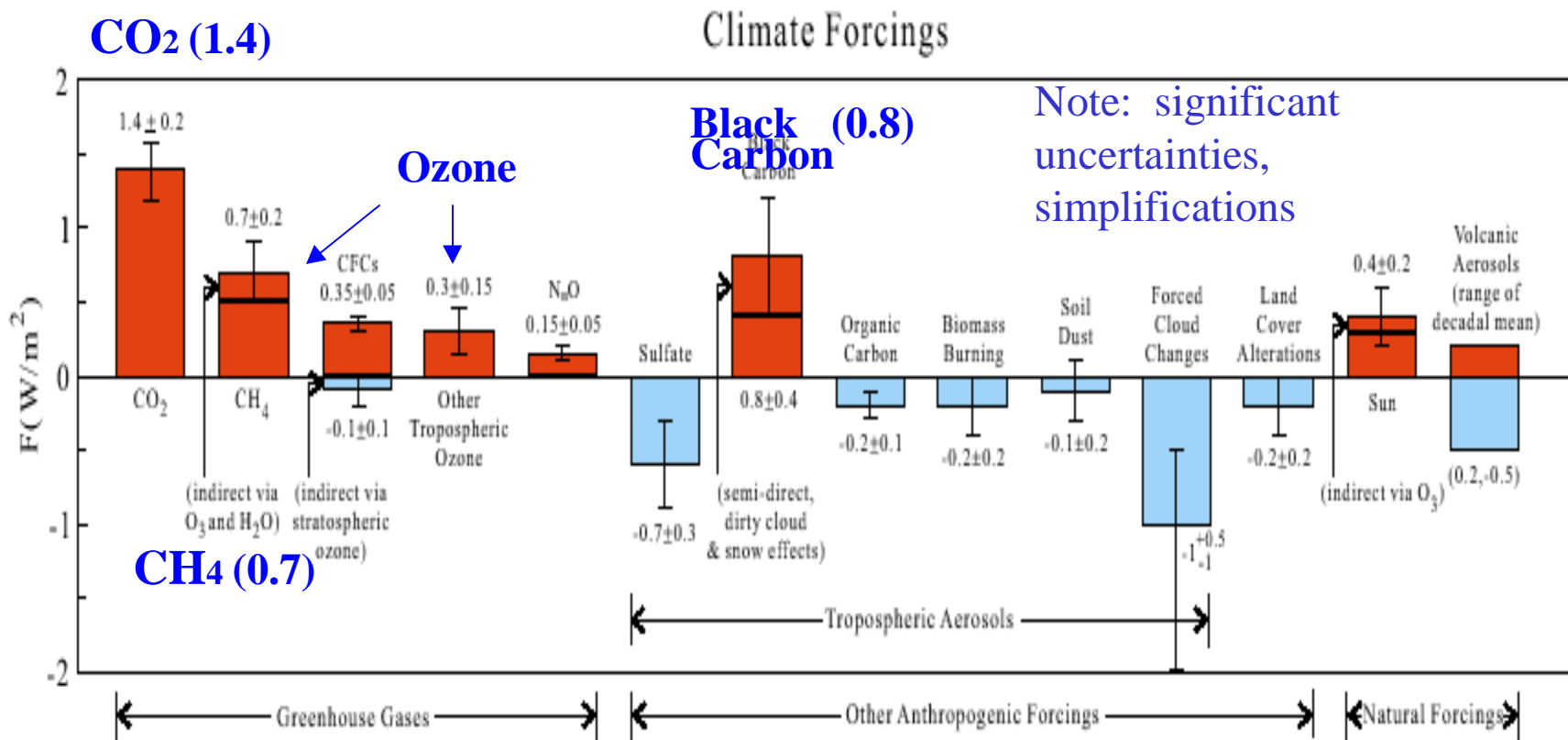
North America
(zero-out)

Europe
(zero-out)

Asia
(zero-out)

Li et al. [2001, JGR]

PM, Ozone and radiative forcing



Estimated Change of Climate Forcing between 1850 and 2000

(Hansen et al., PNAS, 2001)

And climate change is not always global

- INDOEX, other preliminary work suggest significant potential of BC aerosol for affecting hydrologic cycle on a regional basis
- Significant effects of Asian pollution on health, crops
- Short-life of conventional pollutants suggests rapid response to reductions



Wood-Burning Stoves



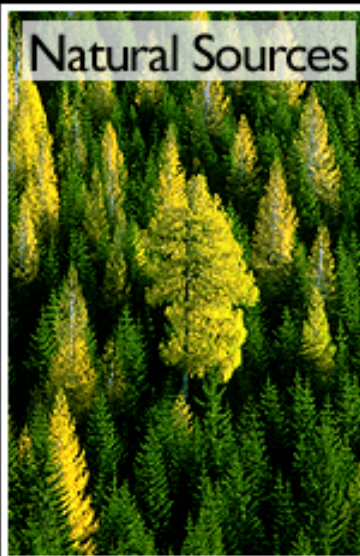
Power Plants



Heavy Duty Diesel Engines

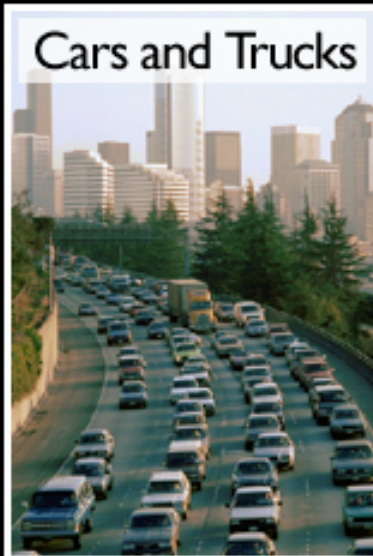


Natural Sources



Apportioning contributions, effects of major air sources

Cars and Trucks



Non-Road Vehicles



Forest Fires



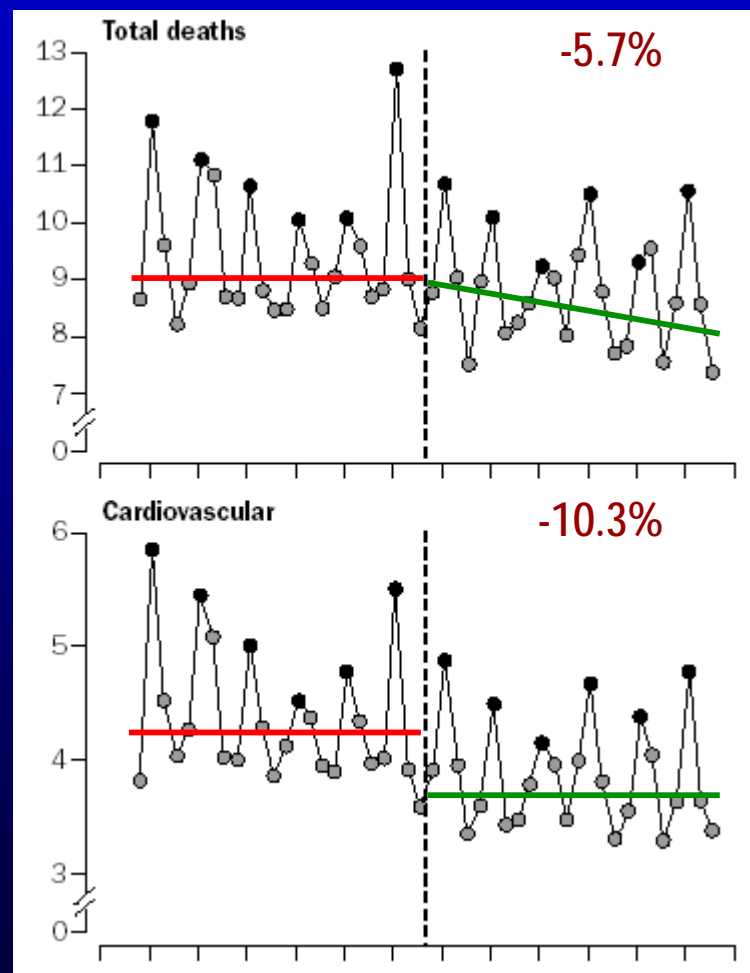
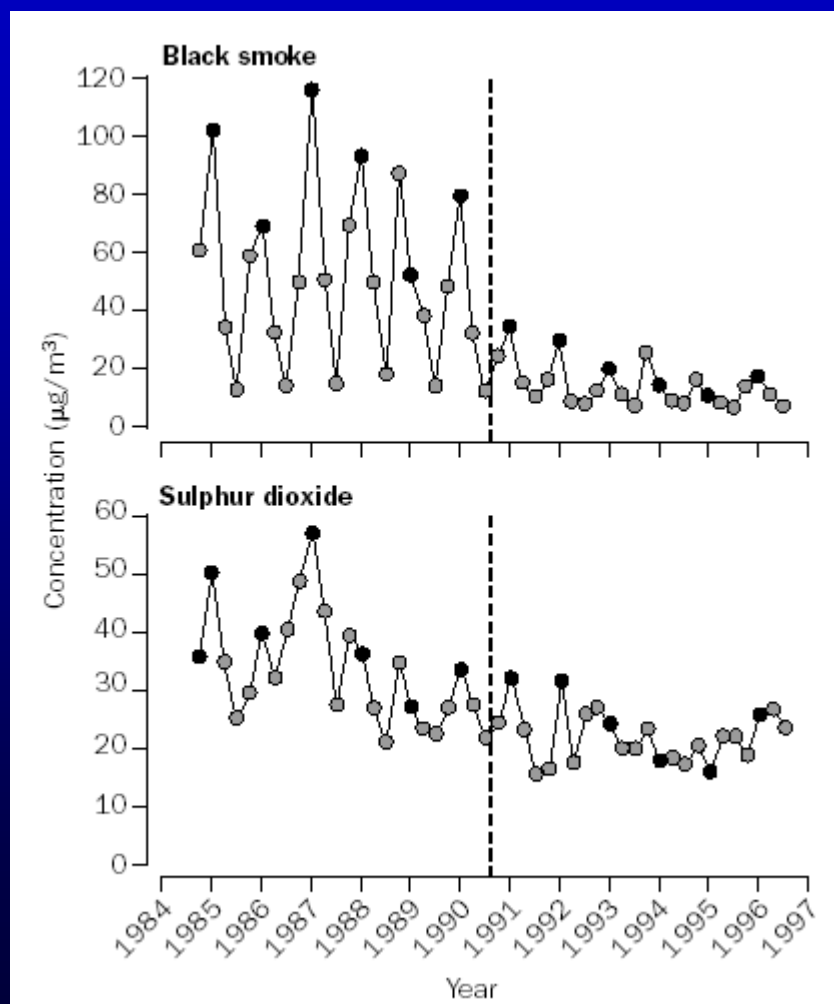
Industrial Sources



Demonstrating benefits of pollution reductions

Dublin, Ireland

Ban on bituminous coal: 9/1/90



Clancy et al. Lancet 2002; 360: 1210-1214

Alternative Futures

- Critical to look for opportunities for integration
 - Energy/agriculture/transportation/multi-media
- Integrated, market-oriented approaches must accelerate, not retard progress
- The 2010+ PM review a crossroads
 - Shorter averaging times/continuous monitoring
 - The pollutant indicator(s) – addition/subtraction?
- Some mega-trends
 - Increased focus on international/global air pollution/climate issues
 - Air quality management integrated into larger societal programs, e.g. smart growth, urban planning
 - Increasing importance of voluntary/local programs
 - Tracking results of initiatives is vital: e.g. compare success of indoor v. outdoor programs at reducing PM exposures

If a tree falls in the forest to a clean bulldozer, is there an impact?

