

# U.S. Air Quality Management

## A Half-Century of Progress



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# Air Quality Management 101+

- 2020: the 50<sup>th</sup> anniversary of Earth Day, EPA, and the Clean Air Act
- A look at the the origins, development, evolution of U.S. AQM
  - Legislation, policies, and politics
  - A focus on National Ambient Air Quality Standards (NAAQS)
  - What worked and what didn't in US Air Quality Management
  - A look at the latest in air pollution accountability science
  - What's left? Continuing challenges for air quality management

## **2007 CRITICAL REVIEW**

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### Will the Circle Be Unbroken: A History of the U.S. National Ambient Air Quality Standards

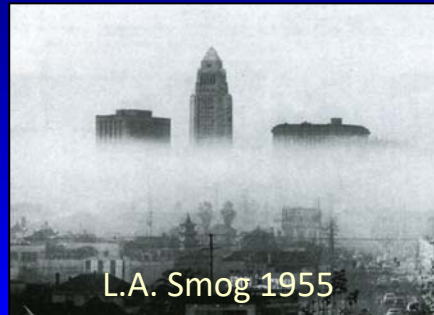
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# US Air Pollution Programs in 1960



Donora at noon 1948



L.A. Smog 1955

- Cities maintained major air pollution responsibility
  - 84 municipalities had air programs, only 8 state programs\*
  - California dominated resources (60% of \$10 million total city/state spending).
- Federal involvement limited to modest research, monitoring, and state assistance programs
  - PHS opposed federal involvement in air control programs
  - New PHS Division of Air Pollution: 251 employees, \$4 million
  - **National Air Sampling Network 60 urban, 20 nonurban particle (TSP) trends sites, many more non-trend sites**

# The 1960's – who can remember?

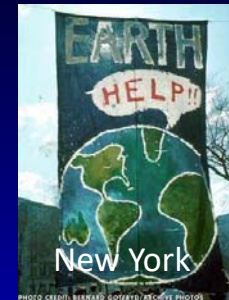


## Bad scenes from the 60's



# Earth Day April 22, 1970

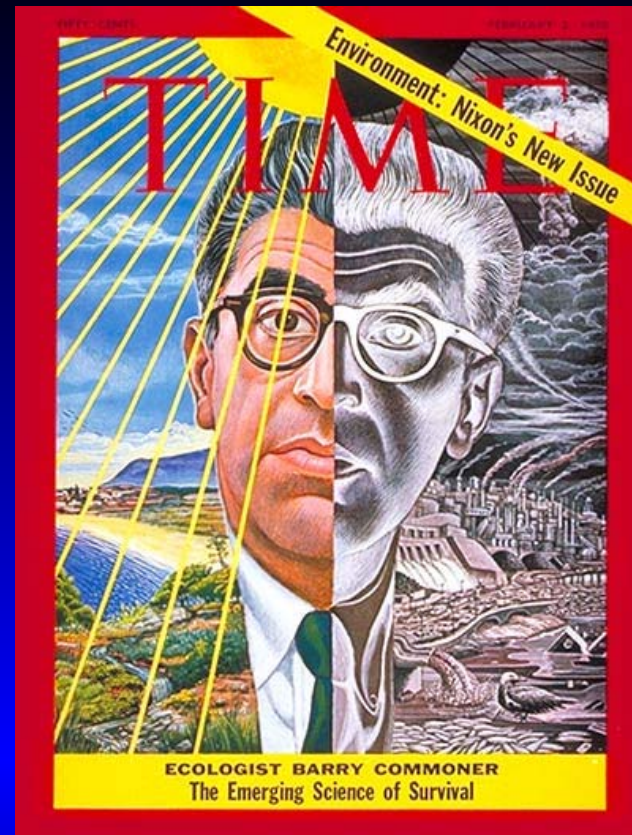
20 million people participated in a national teach-in



# Astute politicians took notice early



Gaylord Nelson – Earth Day 1995  
recalling his 1969 inspiration for the first  
Earth Day, a national “Teach-in” on the  
environment



February 2, 1970

- In 1963, 65, 67 new air pollution legislation, research and funding
- **In 1970 alone:**
  - National Environmental Policy Act (January 1)
  - Environmental Quality Improvement Act (April 3)
  - **Environmental Protection Agency formed (Dec 2)**
  - **Clean Air Act Amendments of 1970 (Dec 31)**

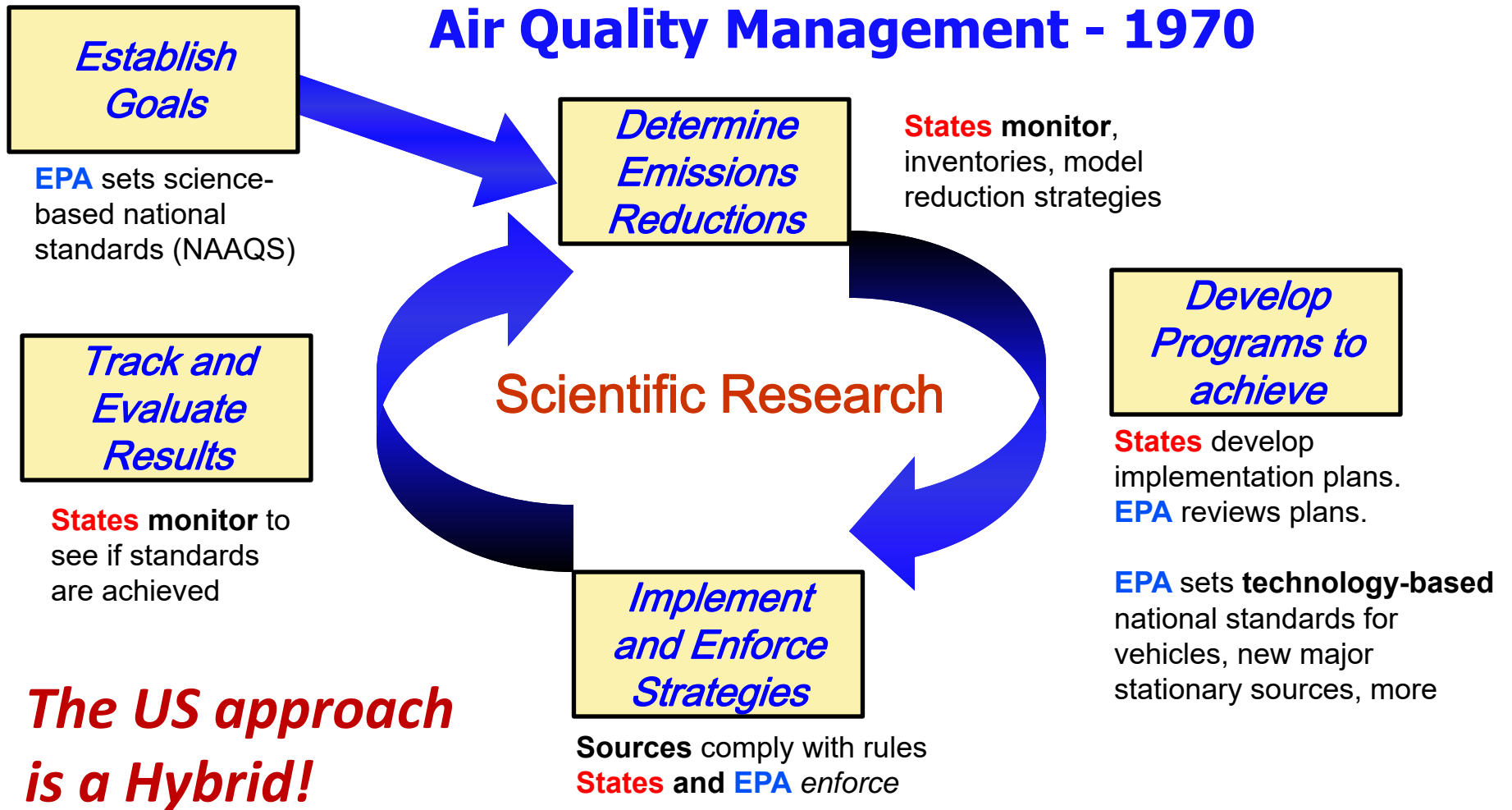




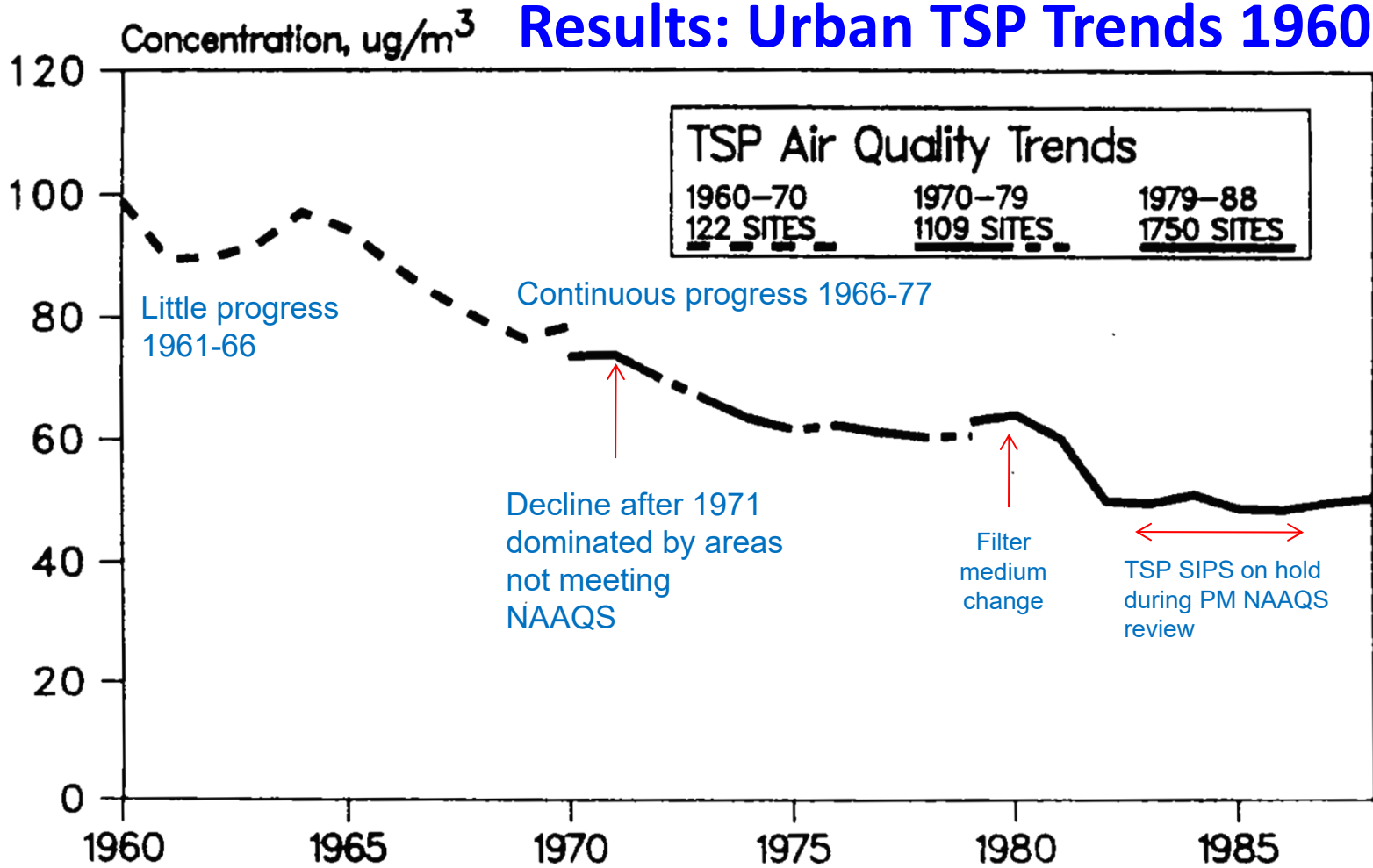
# Alternative Pollution Control Theories

- Risk-based approach
  - e.g. Air quality management based on health and environmental goals
  - Emission limits based on residual risk
- Technology-based approach
  - e.g. 'Best' technology on all major source categories regardless of risk
- Market approaches
  - e.g. Cap and trade, emissions taxes/fees
- The U.S. system?

# Air Quality Management - 1970

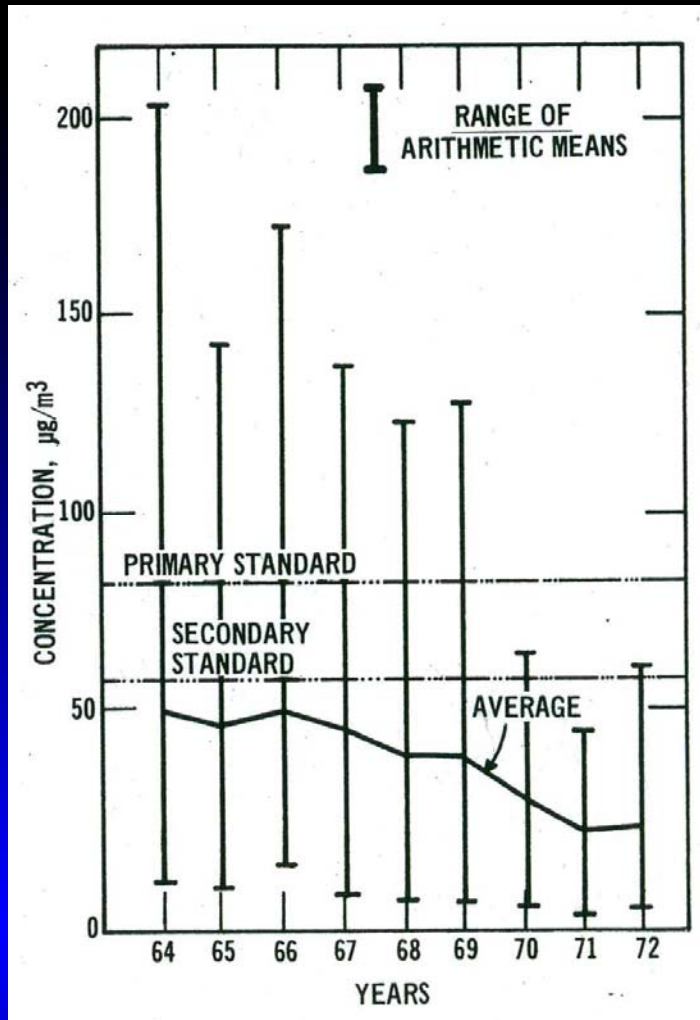


# Results: Urban TSP Trends 1960-88

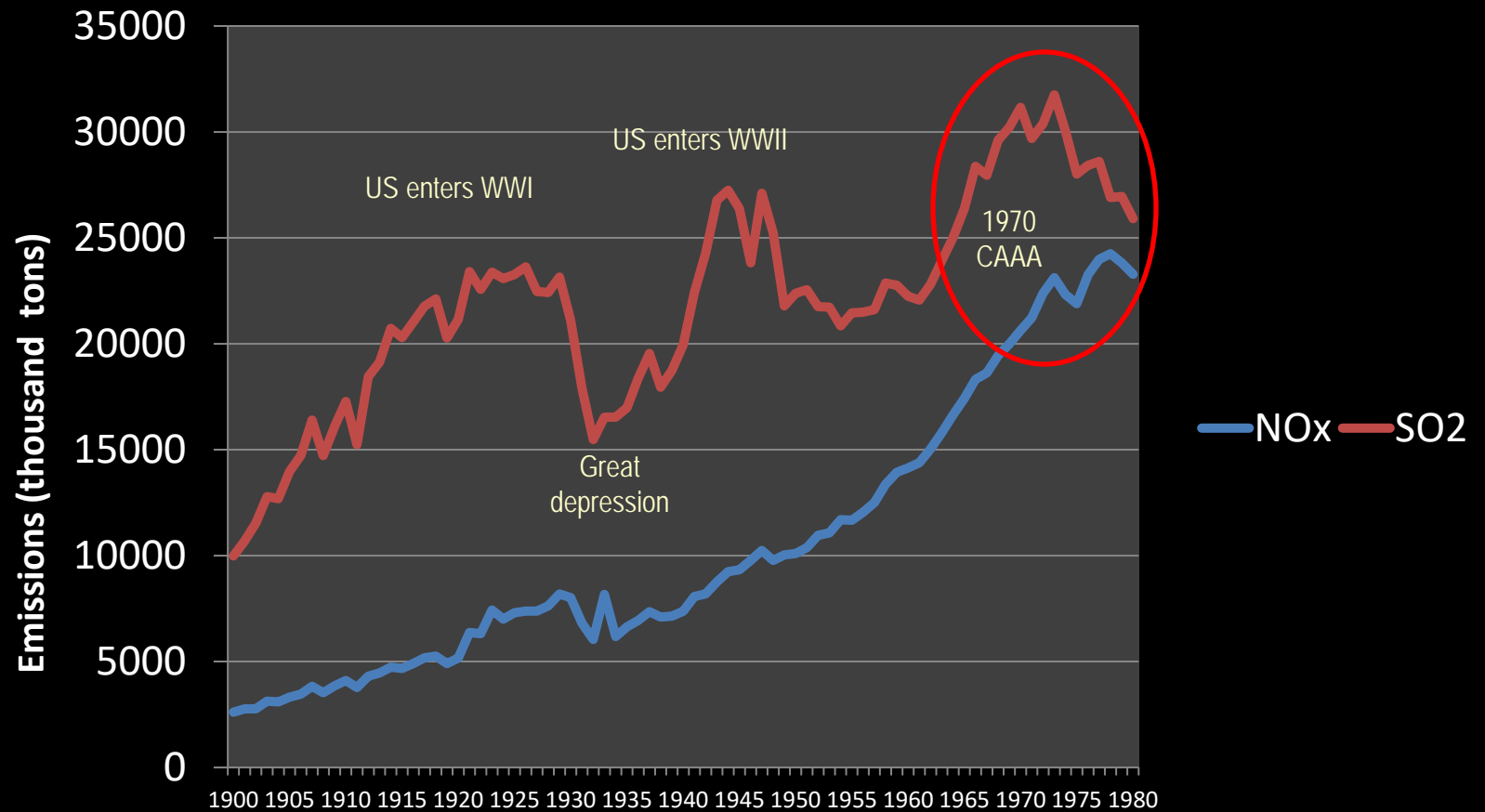


## SO<sub>2</sub> Trends

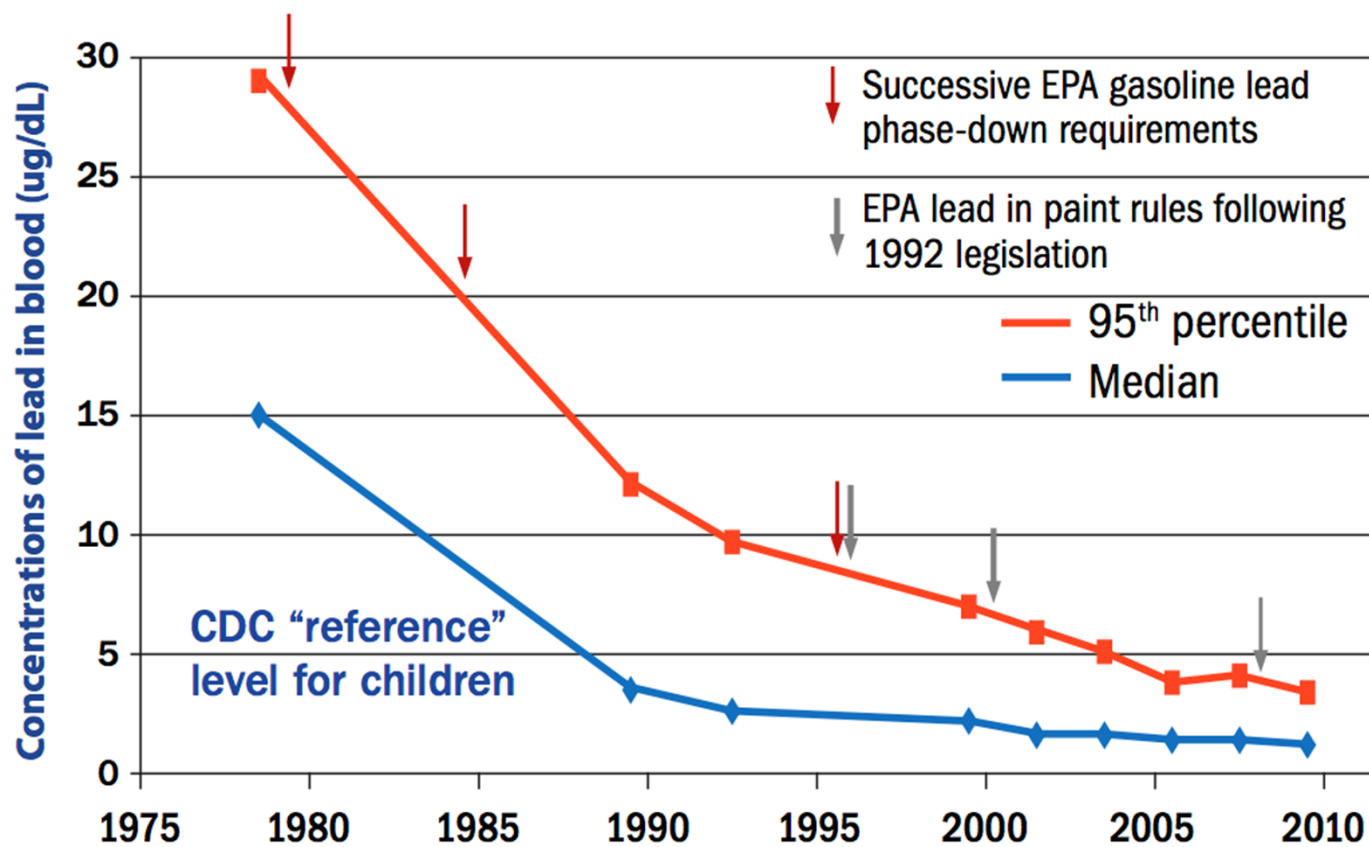
- 32 NASN urban sites
- Improvements begin in 67, accelerate 69-71
- This suggests 1963 Interstate studies, 1967 CAA AQM requirements produced results, continuing after the 1970 amendments



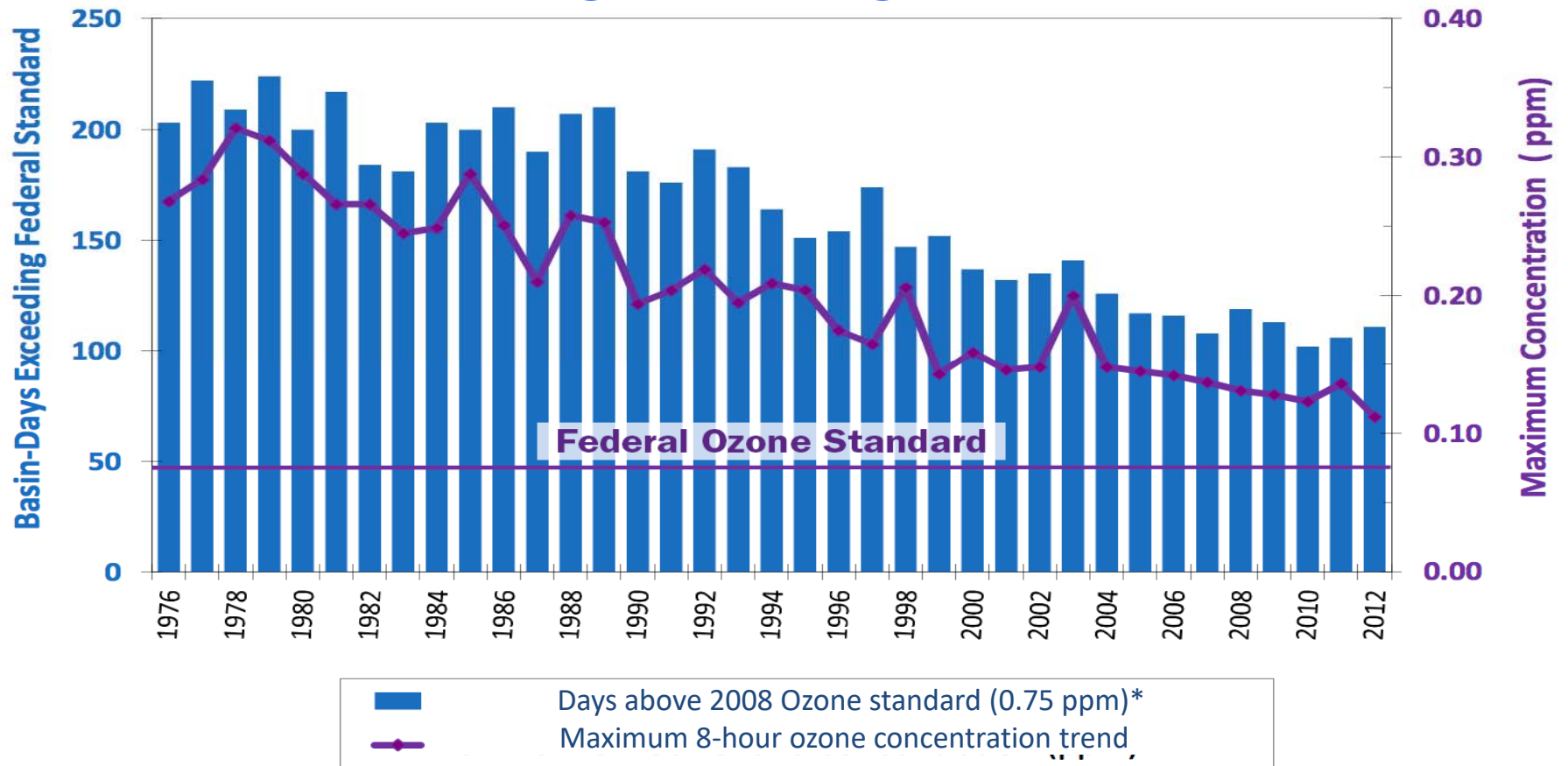
# National SO<sub>2</sub> and NO<sub>x</sub> trends



## Blood Lead Levels in Children, 1976–2010

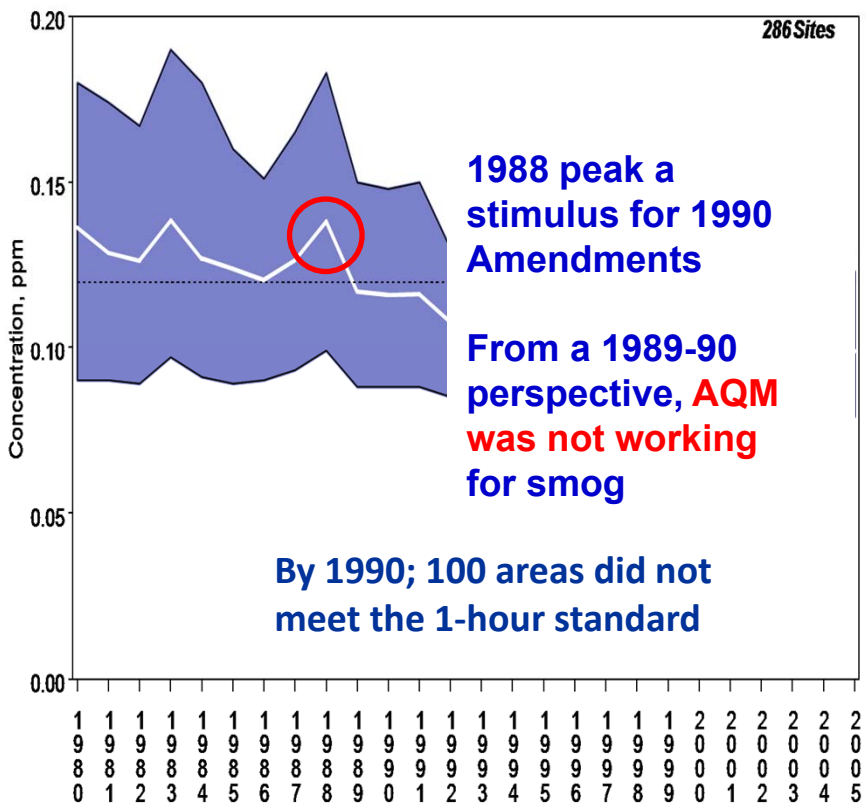


# Los Angeles Smog levels



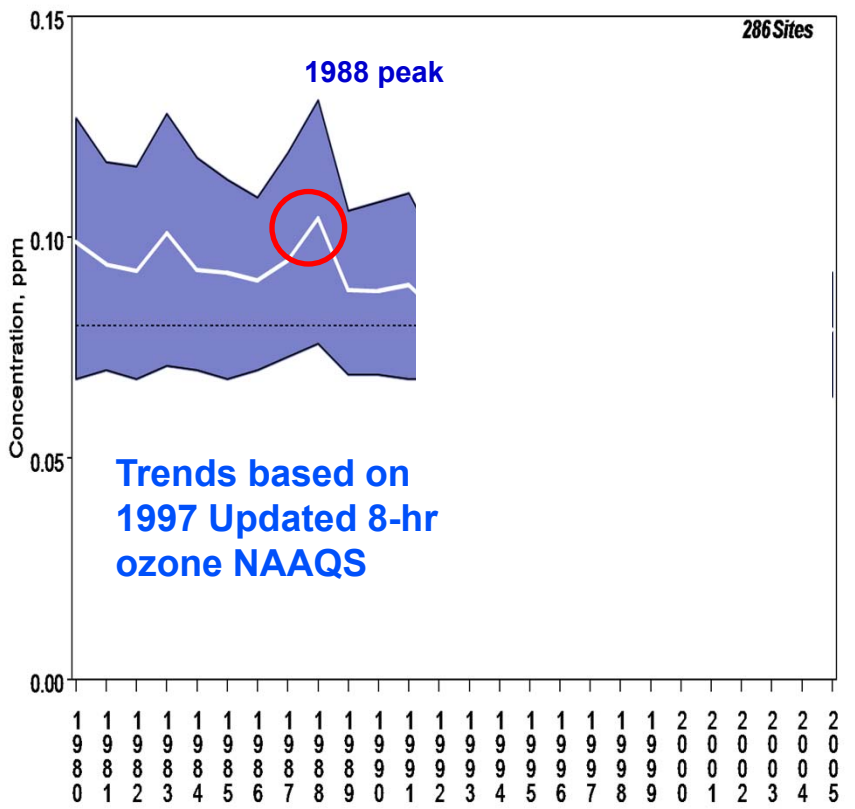
### Ozone Air Quality, 1980- 2005

Annual 2<sup>nd</sup> maximum 1-hr average



### Ozone Air Quality, 1980- 2005

Annual 4<sup>th</sup> maximum 8-hr average



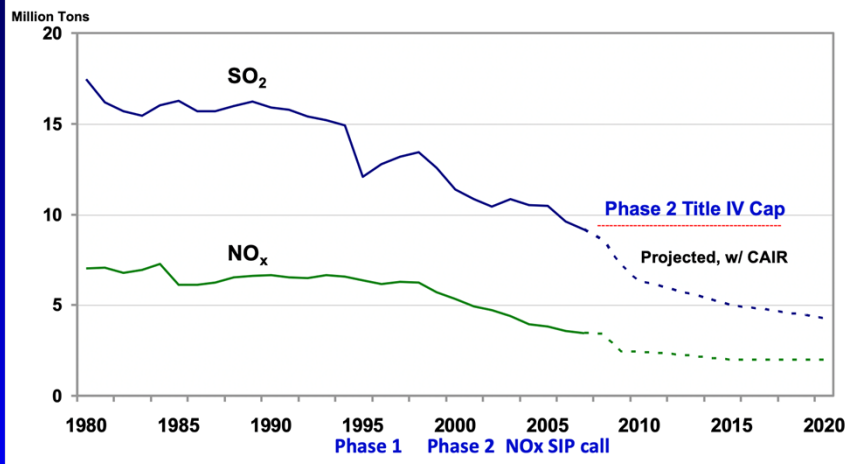


## An interim scorecard 1980-1994

- Unfinished business:
  - Acid rain - regional scale SO<sub>x</sub> and NO<sub>x</sub> emissions
  - Ozone - Rethinking- regional scale NO<sub>x</sub> and biogenic VOC
    - New science suggests stronger standards
  - PM – New fine particle health science
    - Regional scale SO<sub>x</sub>, NO<sub>x</sub>, diesel emissions
- Impetus for the 1990 Clean Air Act amendments

# AQM since the 1990 Amendments

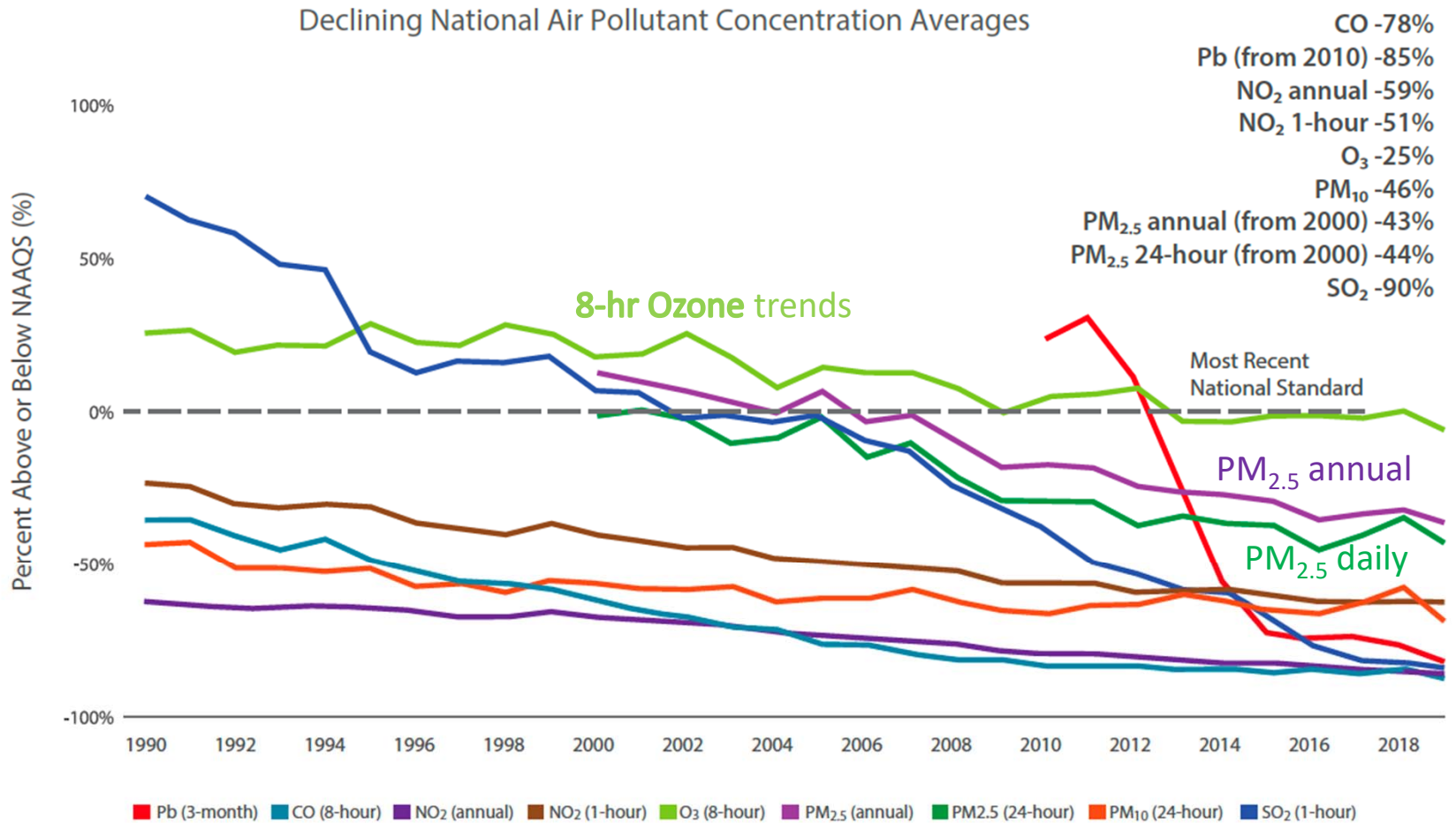
National SO<sub>2</sub> and NO<sub>x</sub> Power Plant Emissions



- Acid Rain Implementation
- The NAAQS reviews
  - Tightening O<sub>3</sub>, PM
- NAAQS Implementation
  - O<sub>3</sub> policy catches up with science, new PM<sub>2.5</sub> needs
  - New mobile regs, regional strategies
- Pressure on power generation
- Air Toxics

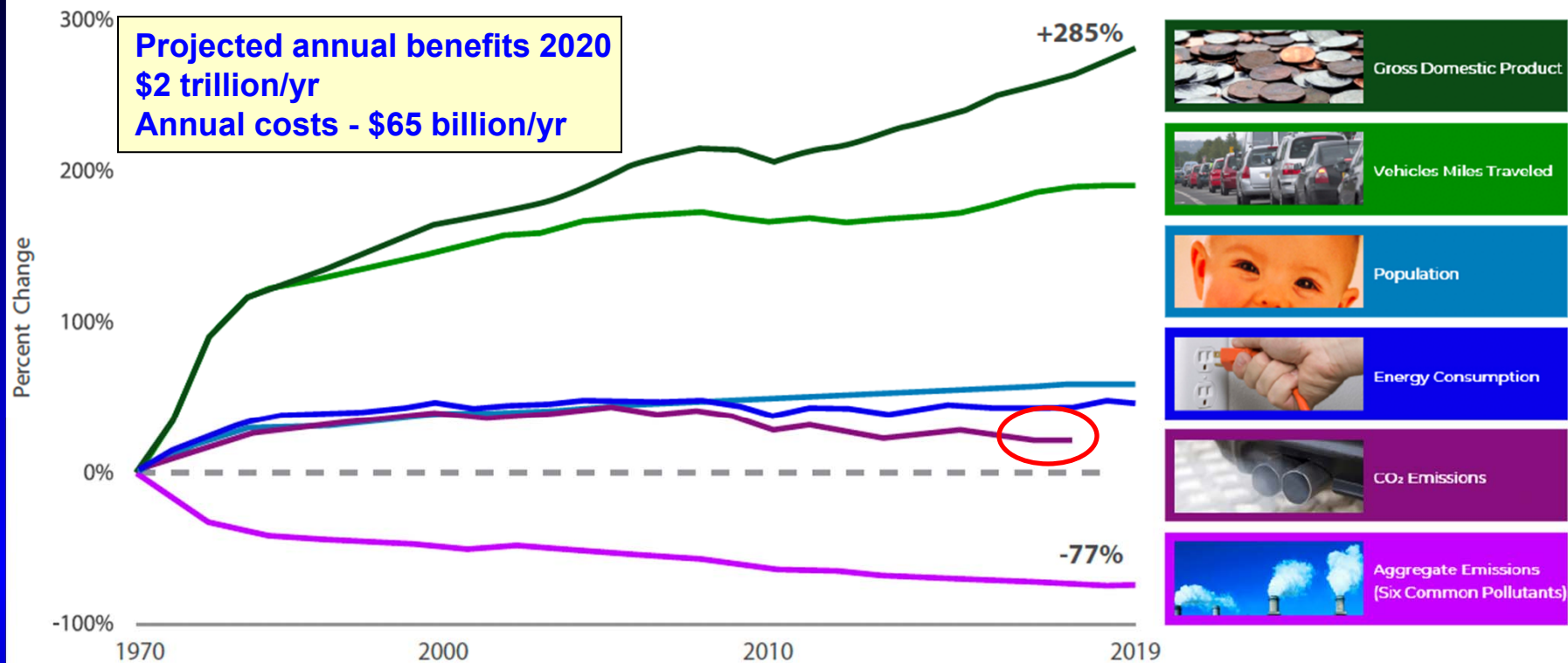
# Criteria pollutants continue to improve

Declining National Air Pollutant Concentration Averages



# A Clean Air Success Story – benefits, costs, and growth

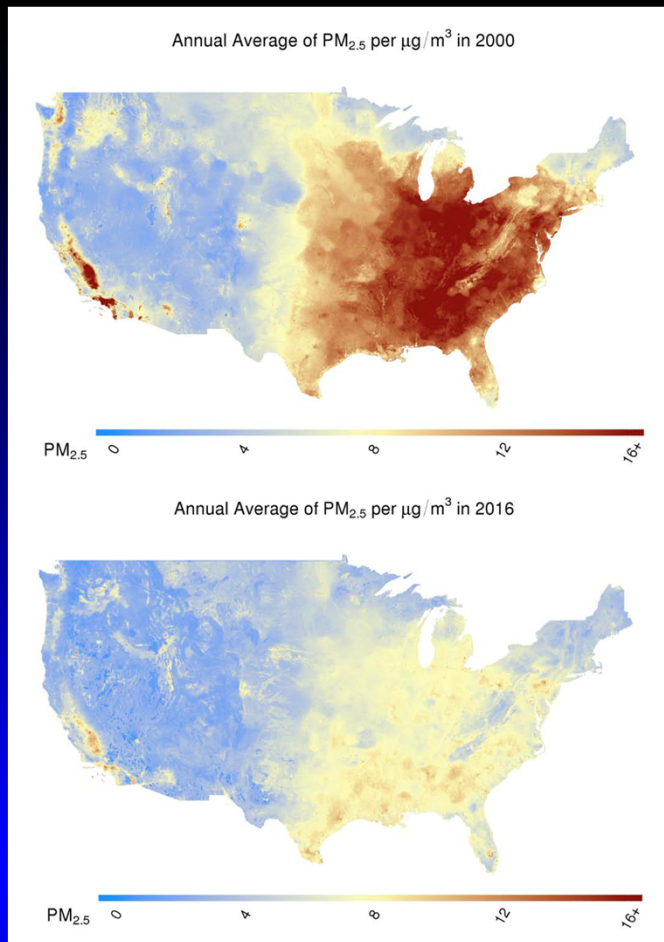
Comparison of Growth Areas and Declining Emissions  
1970-2019



# Accountability Science

## Evaluating the impact of long-term exposure to fine particulate matter on mortality among the elderly

X. Wu,<sup>1†</sup> D. Braun,<sup>1,2†</sup> J. Schwartz,<sup>3</sup> M. A. Kioumourtzoglou,<sup>4</sup> F. Dominici<sup>1\*</sup>

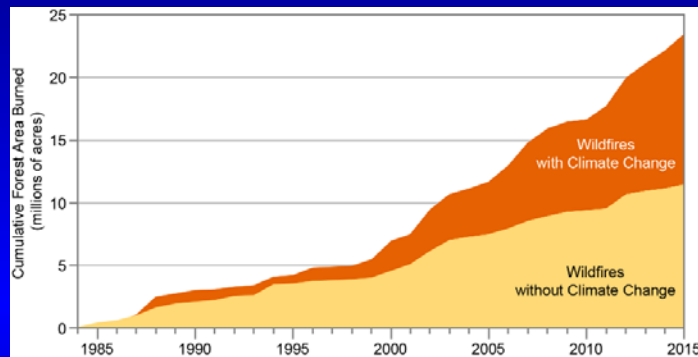


A massive health study using multiple advanced causal inference methods to assess the benefits of Reducing fine particles

*“we conclude that long-term PM<sub>2.5</sub> exposure is causally related to mortality”*

The effects estimates are in the range of those found in past EPA Benefit-cost assessments using multiple cohort studies.

# Despite progress, major challenges remain



- Continued improvements to maintain and increase the benefits achieved so far, and ensure they are distributed fairly to all Americans
- International transport
- Climate change
  - Drought/fires and  $PM_{2.5}$  are already here
  - Warming induced stagnation and other effects increase ozone
  - Climate strategies benefit air quality