Air Pollution in NJ: Past ,Present and thoughts about the Future

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Purpose

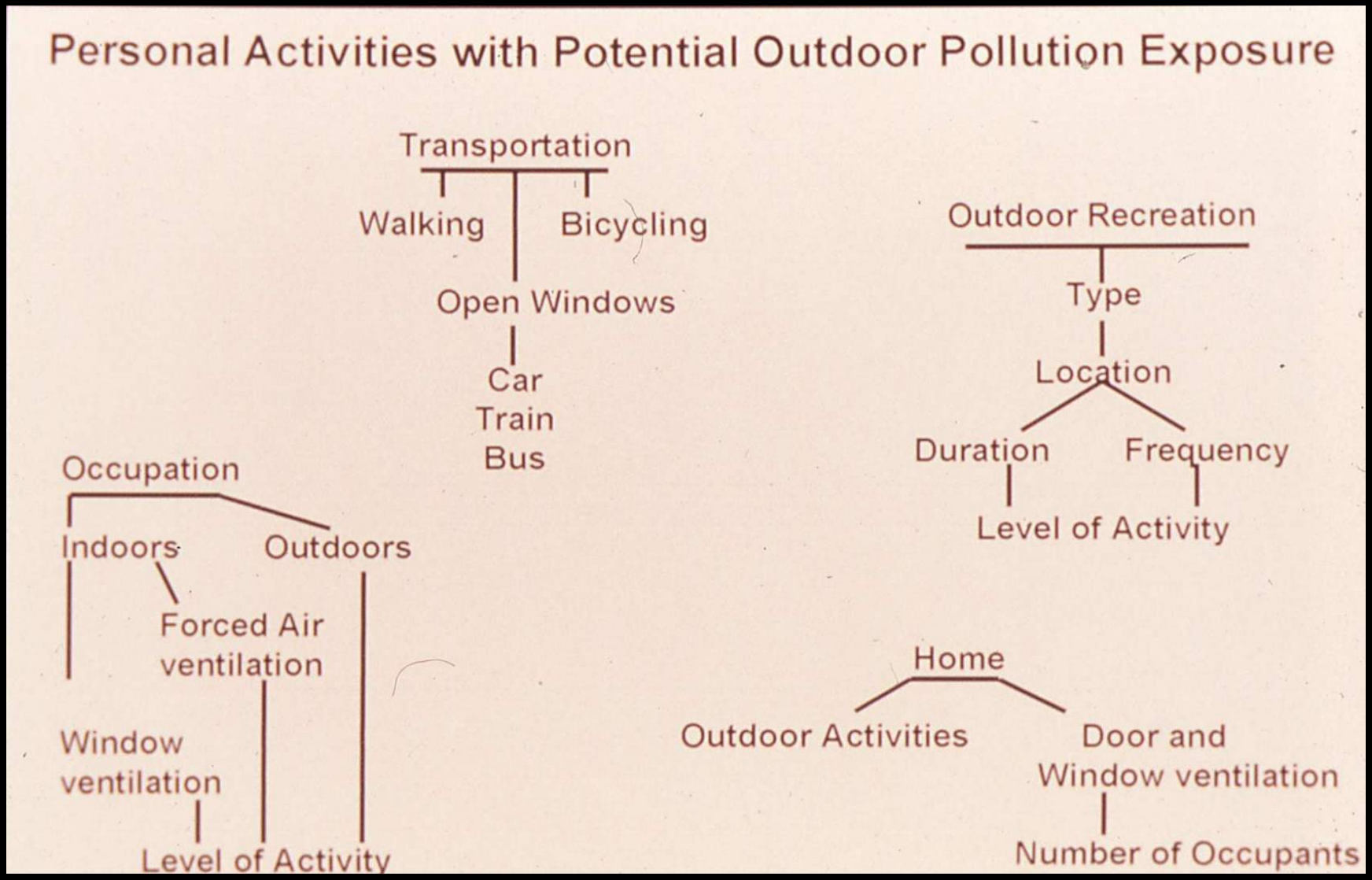
- Provide
  - my perspective about NJ air pollution in the past and progress toward reductions
  - a view of the current issues that face NJ and other States
  - some observations about my view of air pollution issues during the next 10 to 20 years

Air Pollution: Where does it come from?

(Direction of Growth in NJ <,>,=)

- Natural Sources
  - Combustion
  - Vegetation
  - Soil and Water Re-suspension, and erosion
  - Chemical Reactions
- Anthropogenic Sources
  - Manufacturing – Stationary Source <
  - Industry <
  - Energy =
  - *On road and off road vehicles – Mobile Sources >*
  - Chemical Reactions
  - Incineration <
  - Other ?

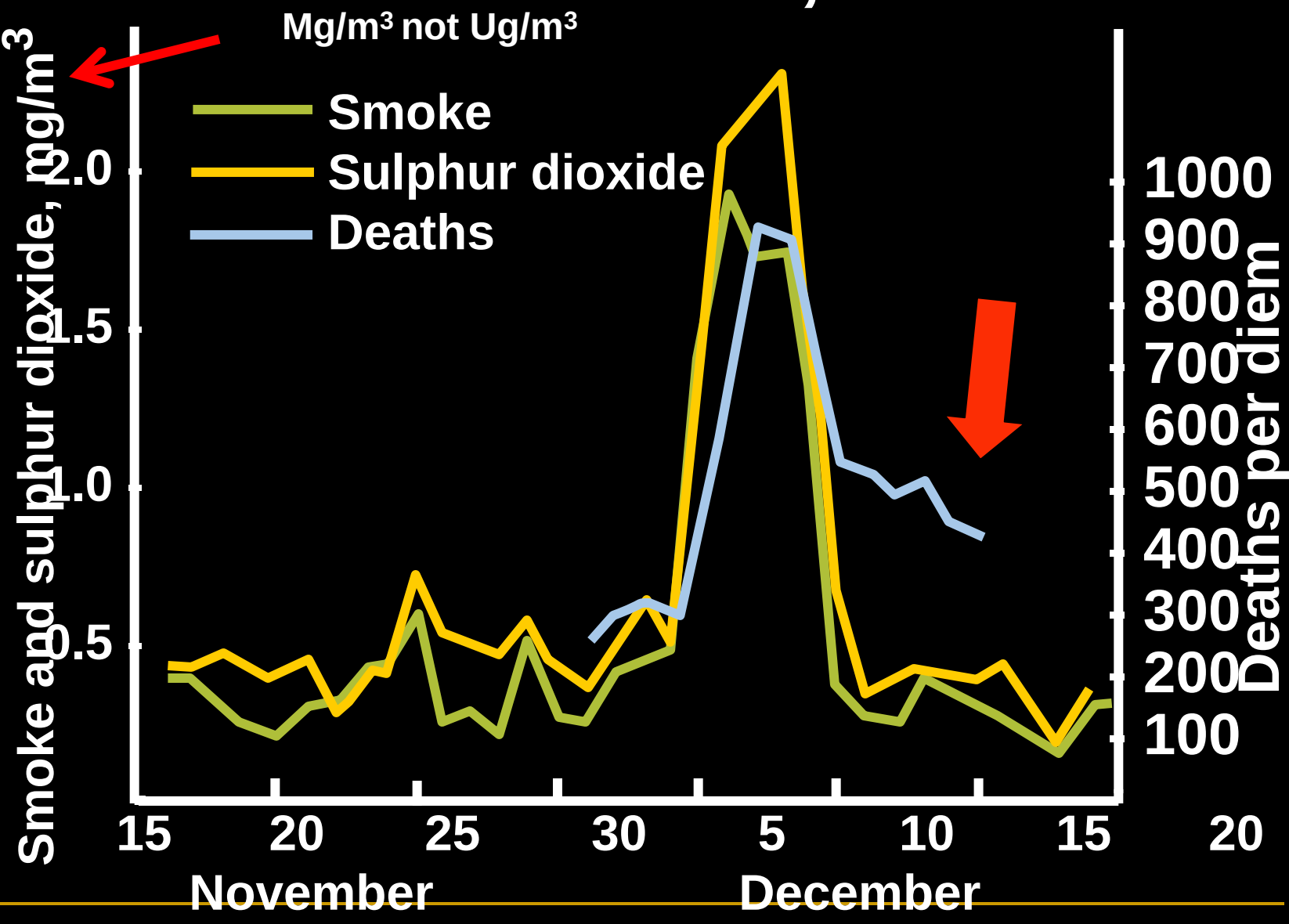
Air Pollution: Where to you come in contact with it?



Historical Air Pollution Problems

The Most Infamous Air Pollution Episode since WW II: London Smog, December 1952

Greater London, 1952



Pittsburgh During the Pre-EPA Industrial Era

Pittsburgh in 2009

1966 NYC “Thanksgiving” Smog Episode

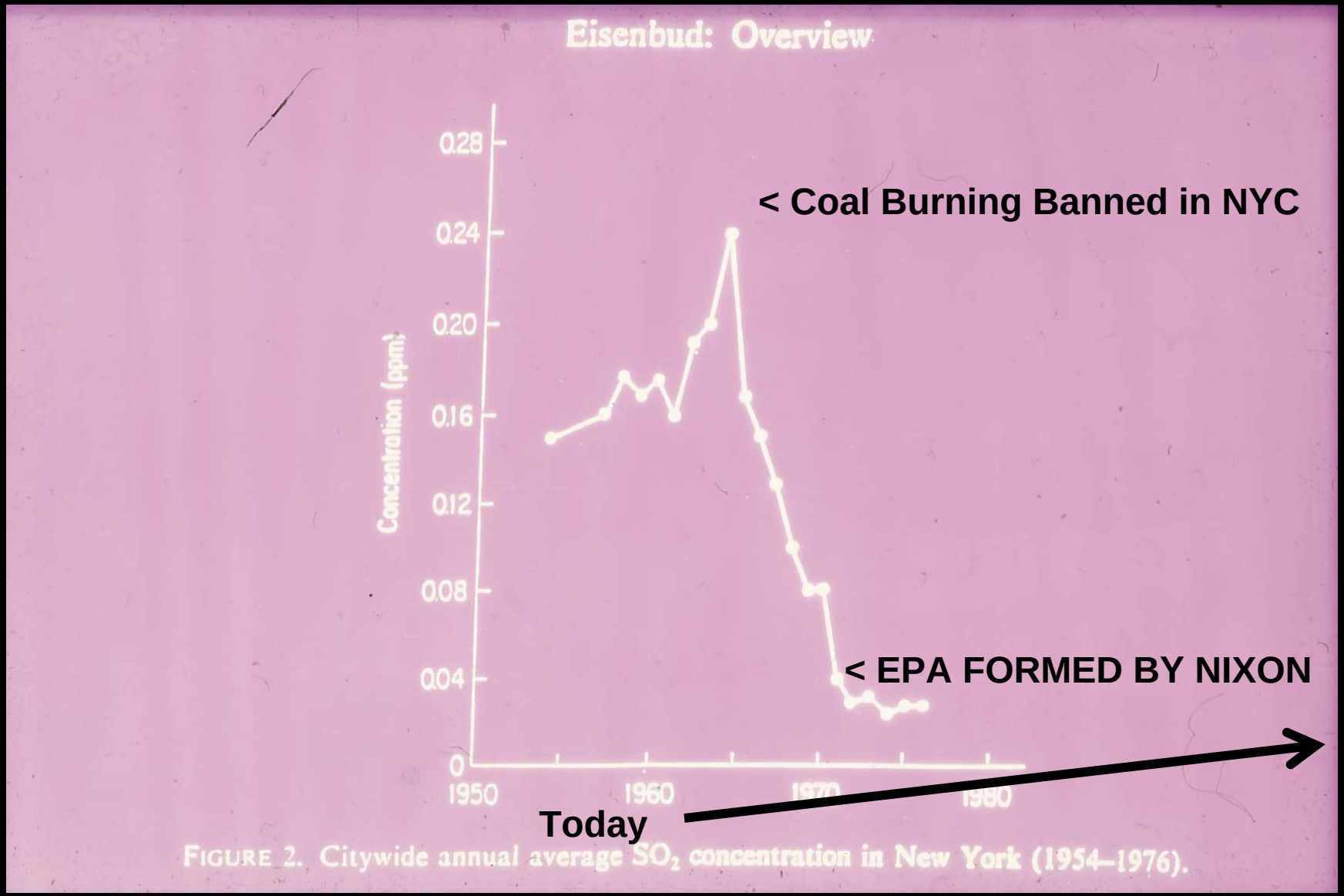
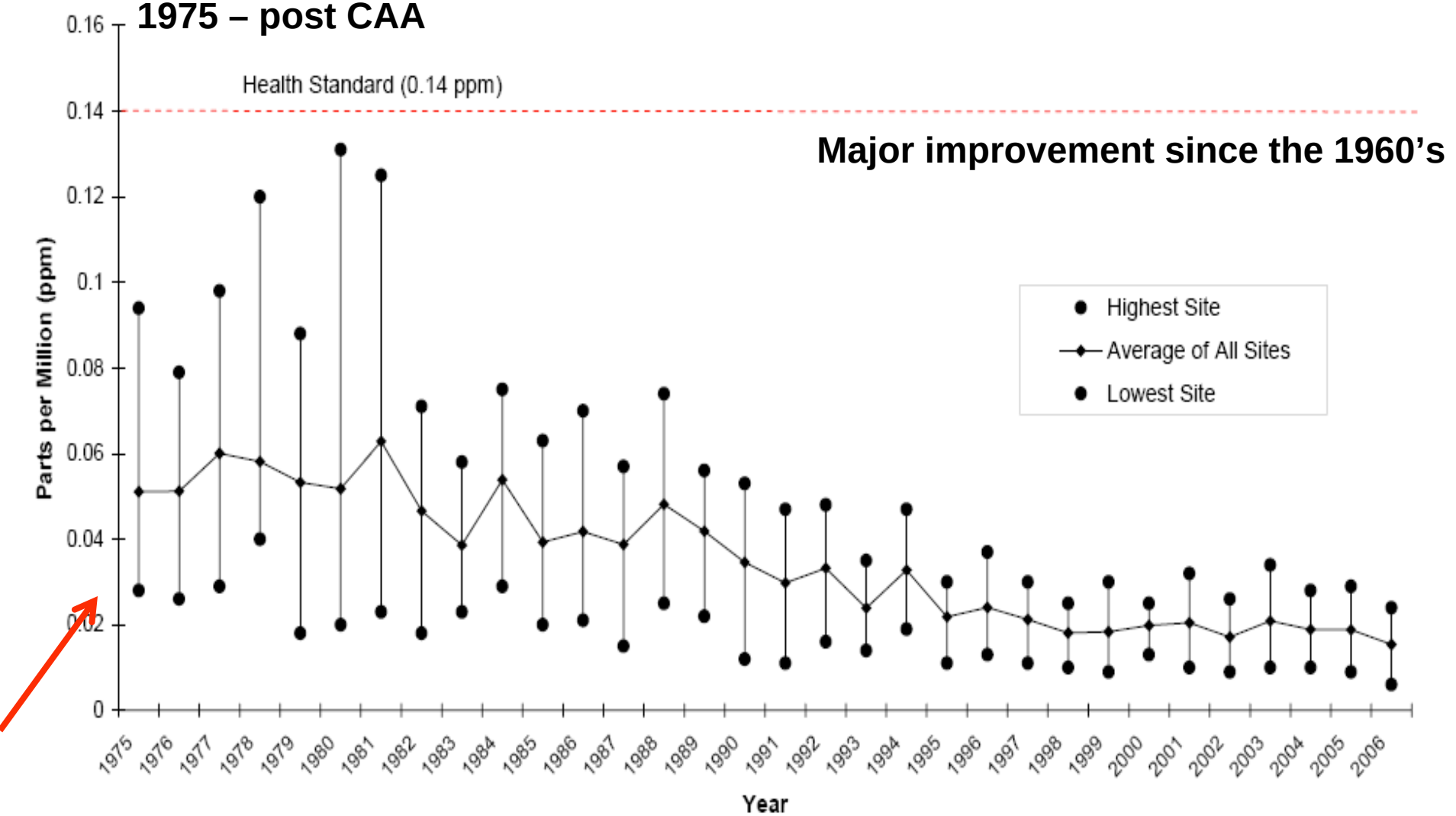
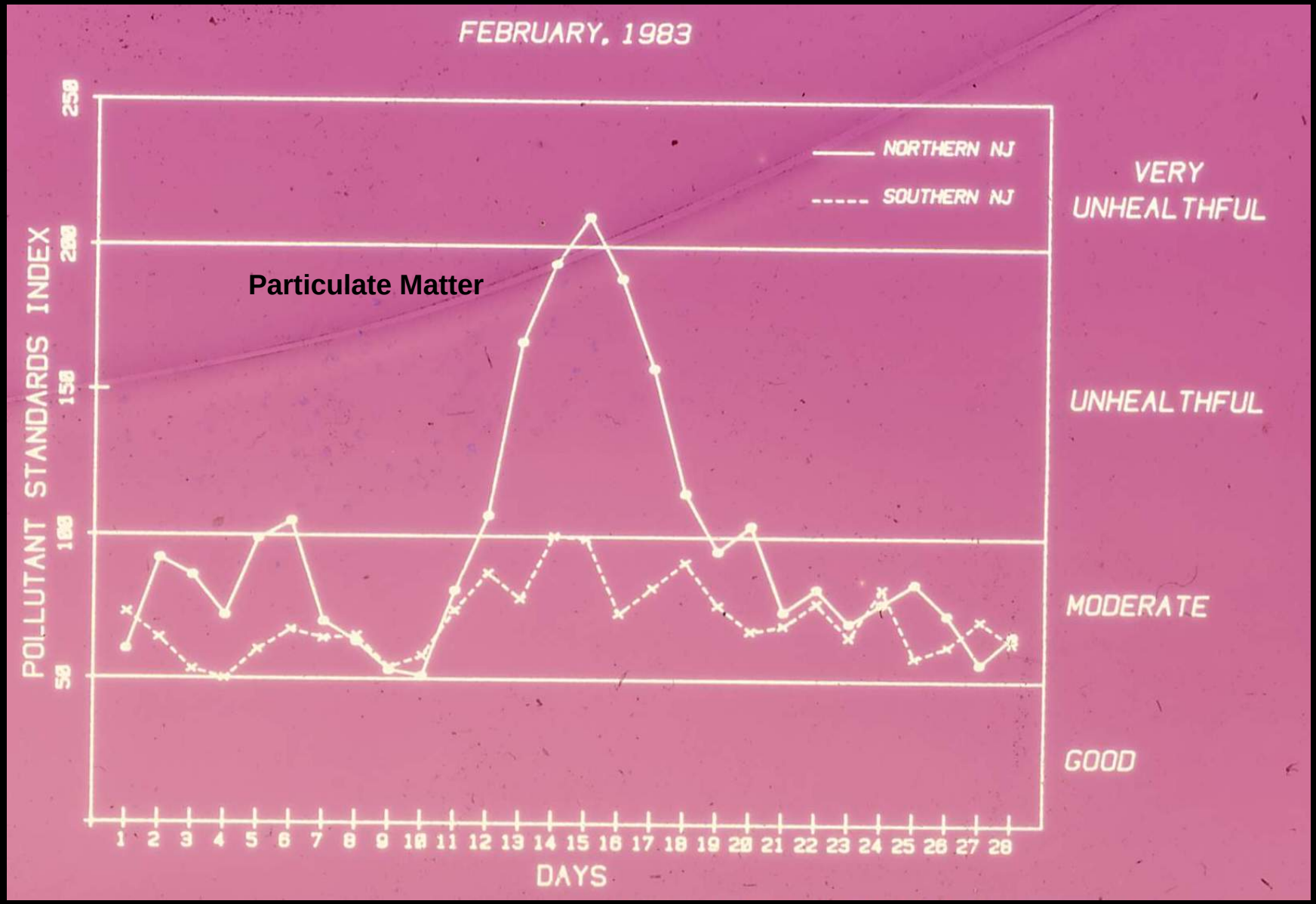

Eisenbud: Overview
0.28
0.24
0.20
0.16
0.12
0.08
0.04
0
Concentration (ppm)
1950
1960
1970
1980
< Coal Burning Banned in NYC
< EPA FORMED BY NIXON
Today
FIGURE 2. Citywide annual average SO_2 concentration in New York (1954–1976).

Figure 6
Sulfur Dioxide Concentrations in New Jersey
1975 - 2006
Second Highest Daily Average



TYPICAL NJ AIR POLLUTION IN THE 1950’s



URBAN NJ WINTER TIME POLLUTION: During the1980's

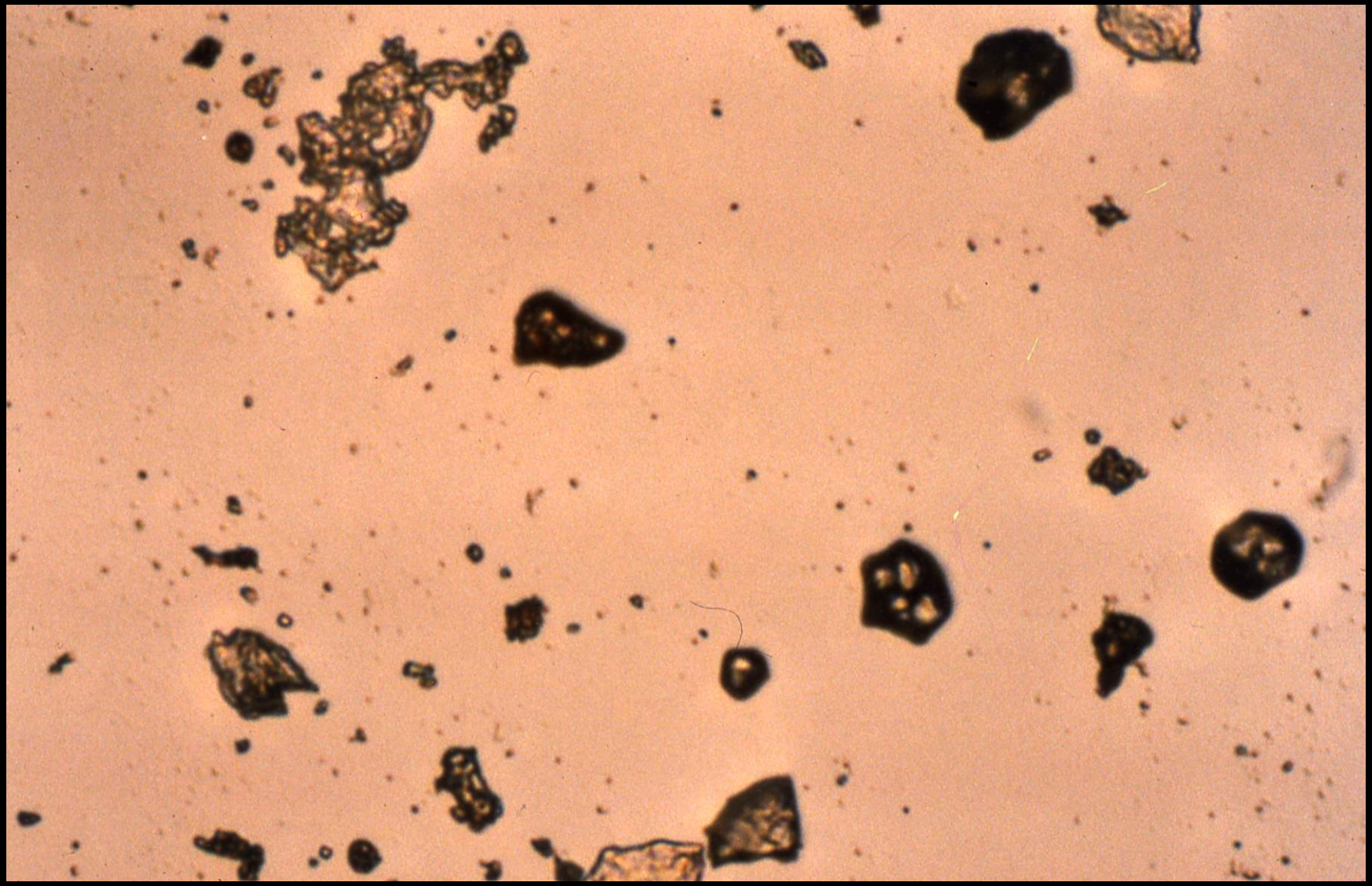
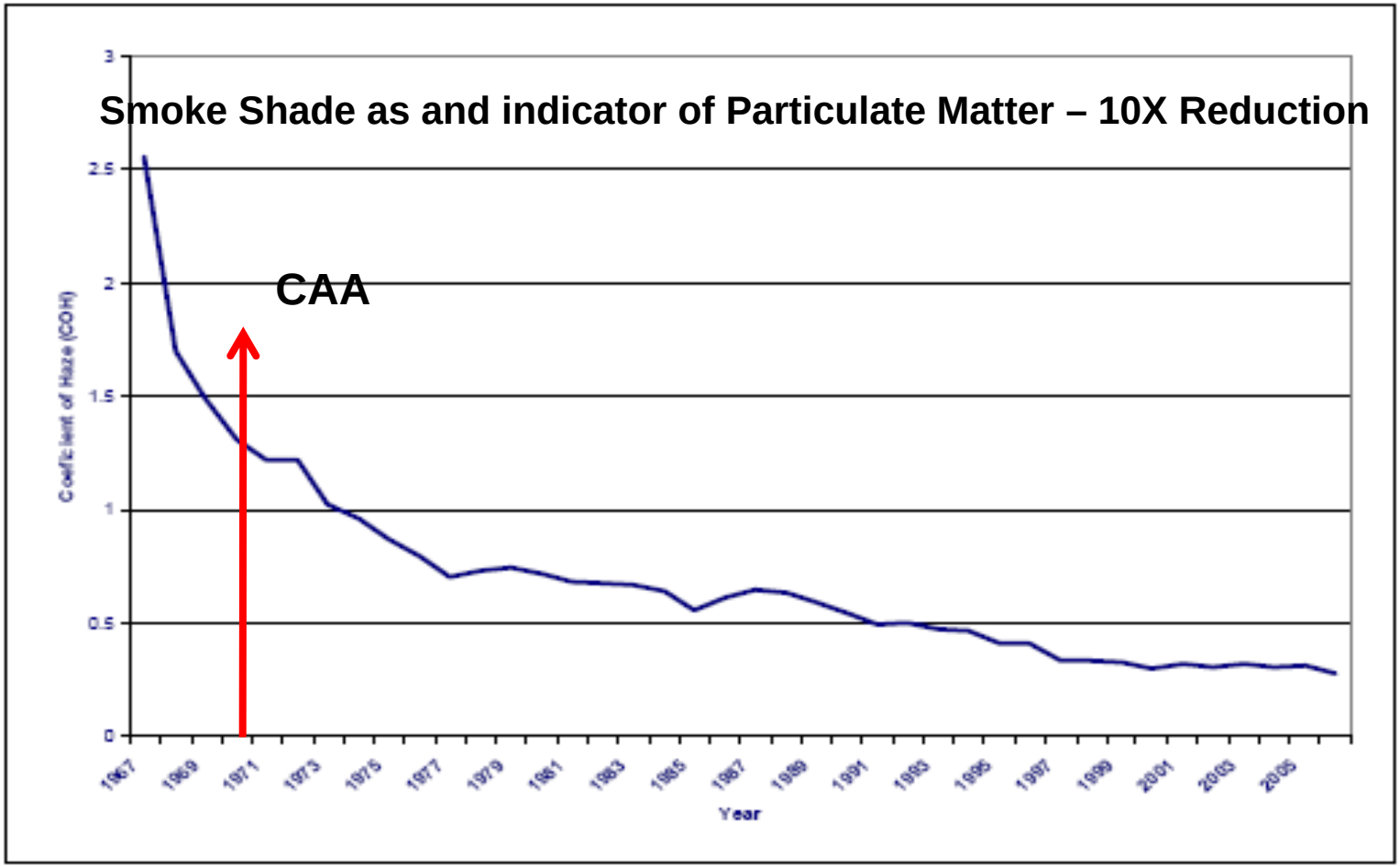


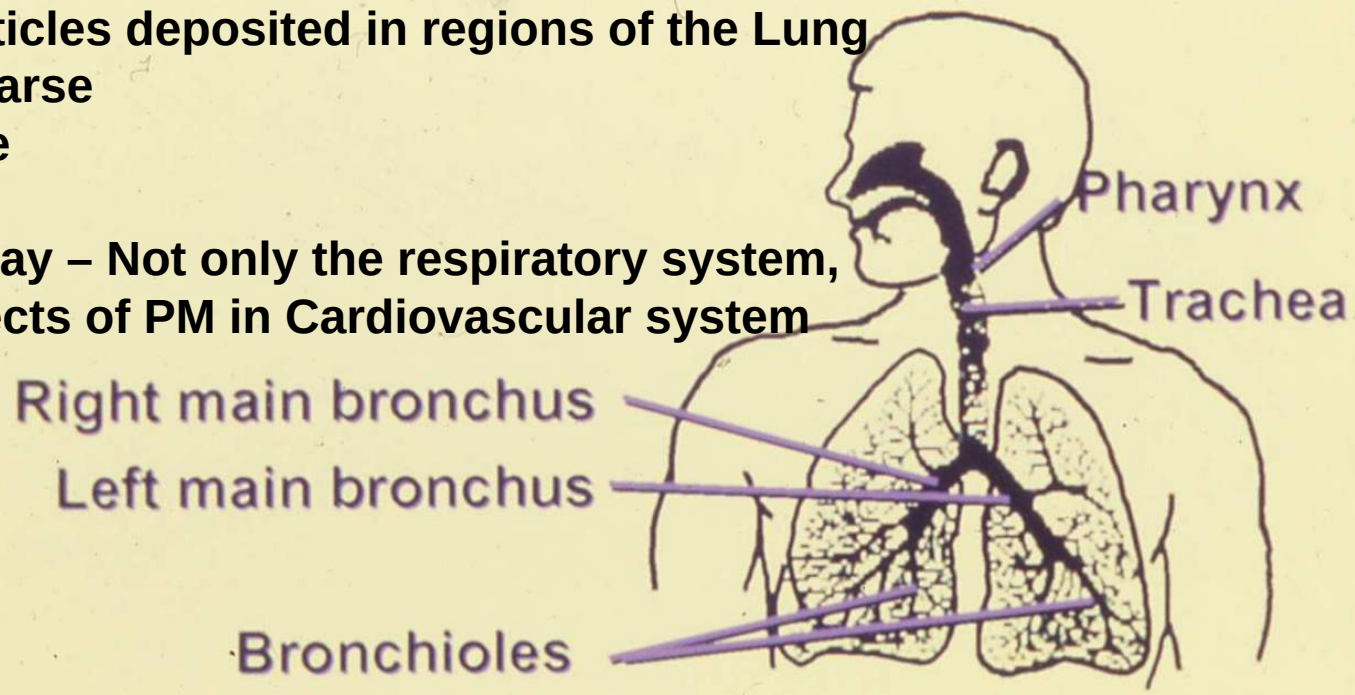
Figure 11
Long Term Trend in Particulate Levels
State Average
1967- 2006



The human respiratory tract

-Gases absorbed throughout the Lung
-Particles deposited in regions of the Lung
- coarse
-Fine

-Today – Not only the respiratory system,
-Effects of PM in Cardiovascular system



Modern Air Pollution in NJ

- The emission and accumulation of *chemical, physical or biological agents* in the atmosphere that can lead to adverse health effects, ecological or environmental effects. Characterized by:
  - Gases
    - Inorganic
    - Organic
  - Particles
    - Fine (<2.5 um)
      - Organic
      - inorganic
    - Coarse (10 – 2.5 um)
      - inorganic
- Missing
  - Super Coarse Particles (>10 um, and part of street dust and grit)

*Nano and Ultrafine – not a new issue

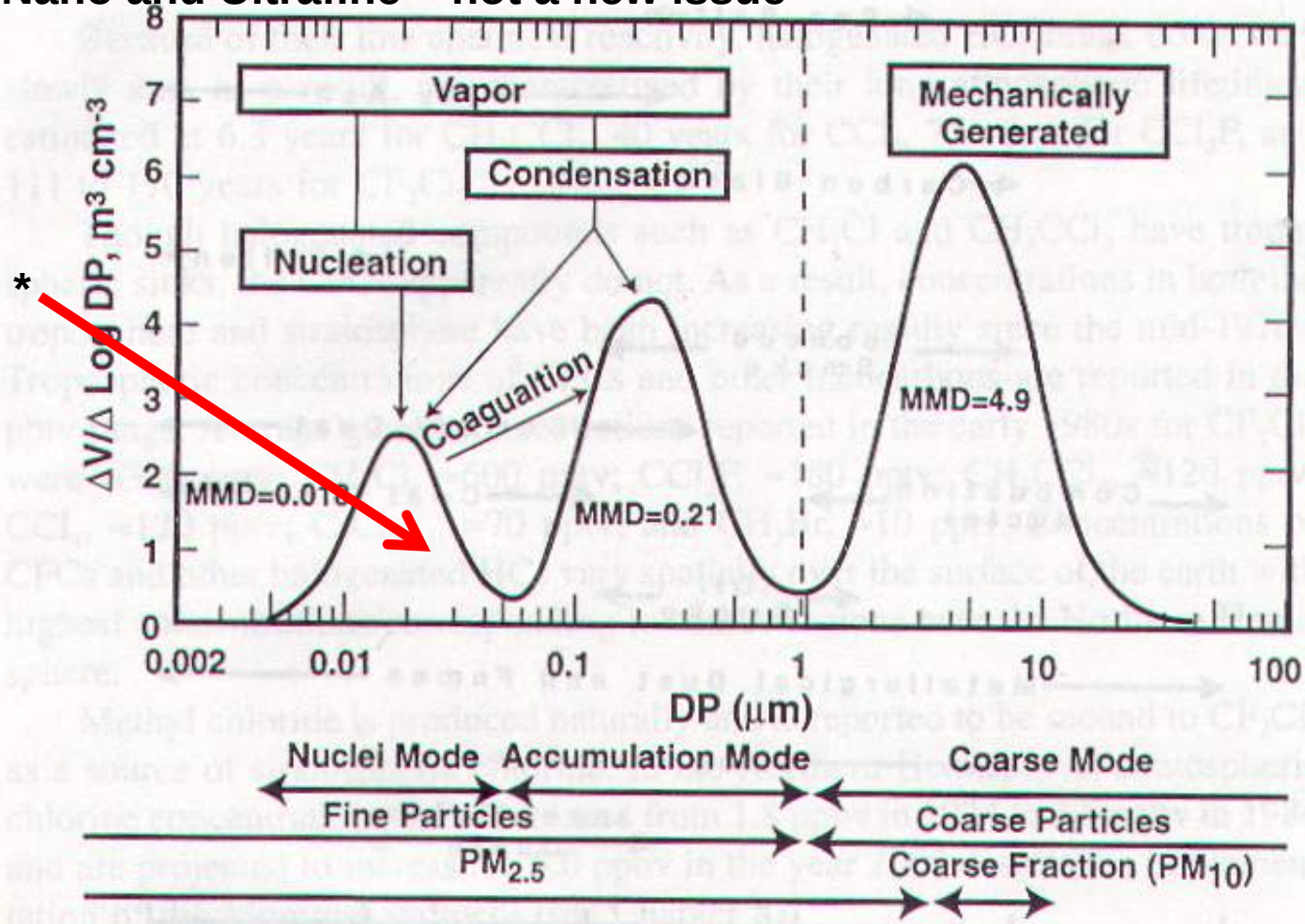


Figure 2.14 Size characteristics of atmospheric particles. (From USEPA. 1995. EPA/600/AP-95/001c.)

Reactive VOC and NOx the precursors -

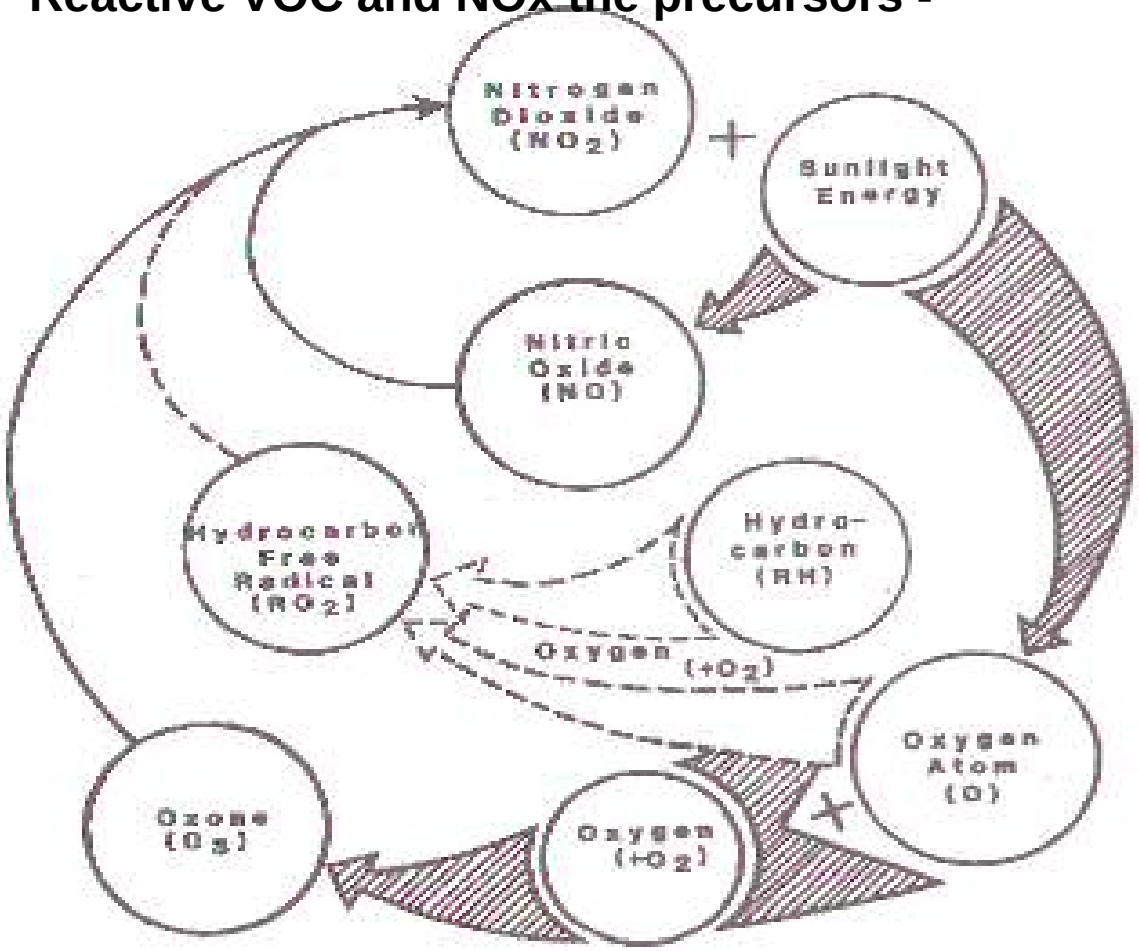
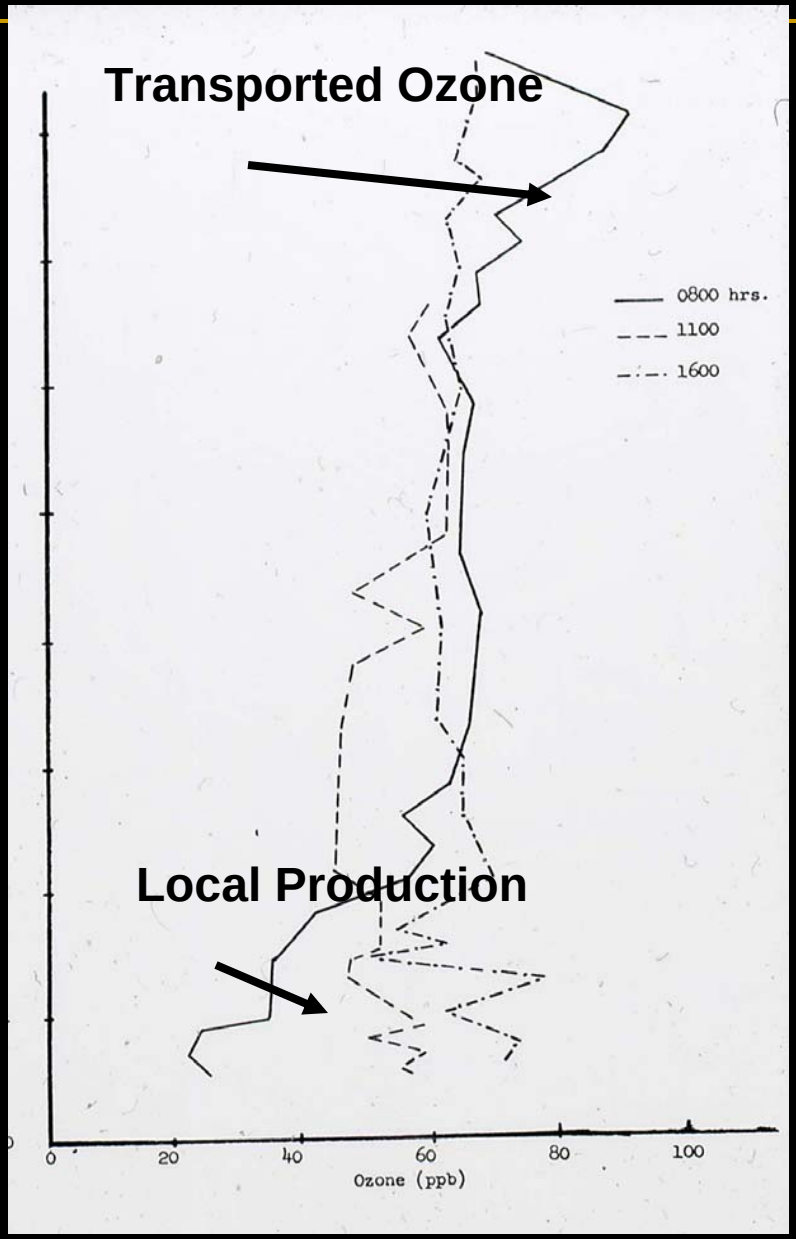
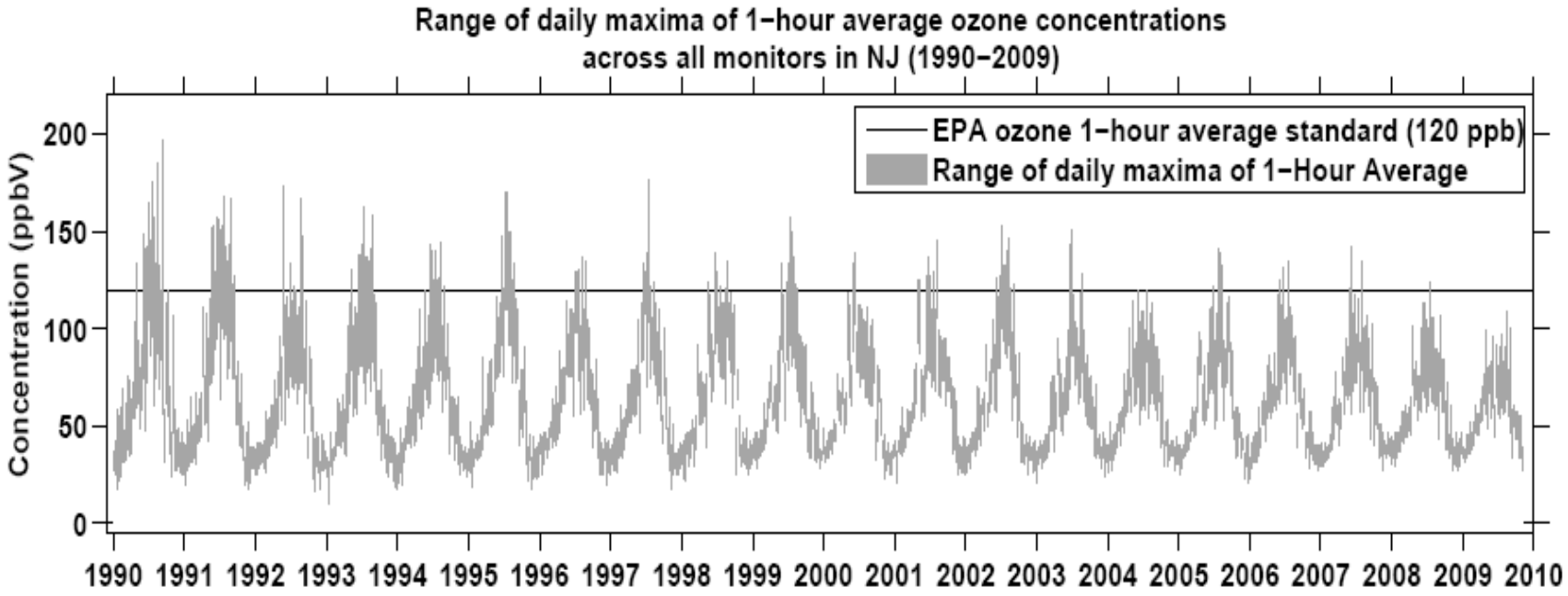
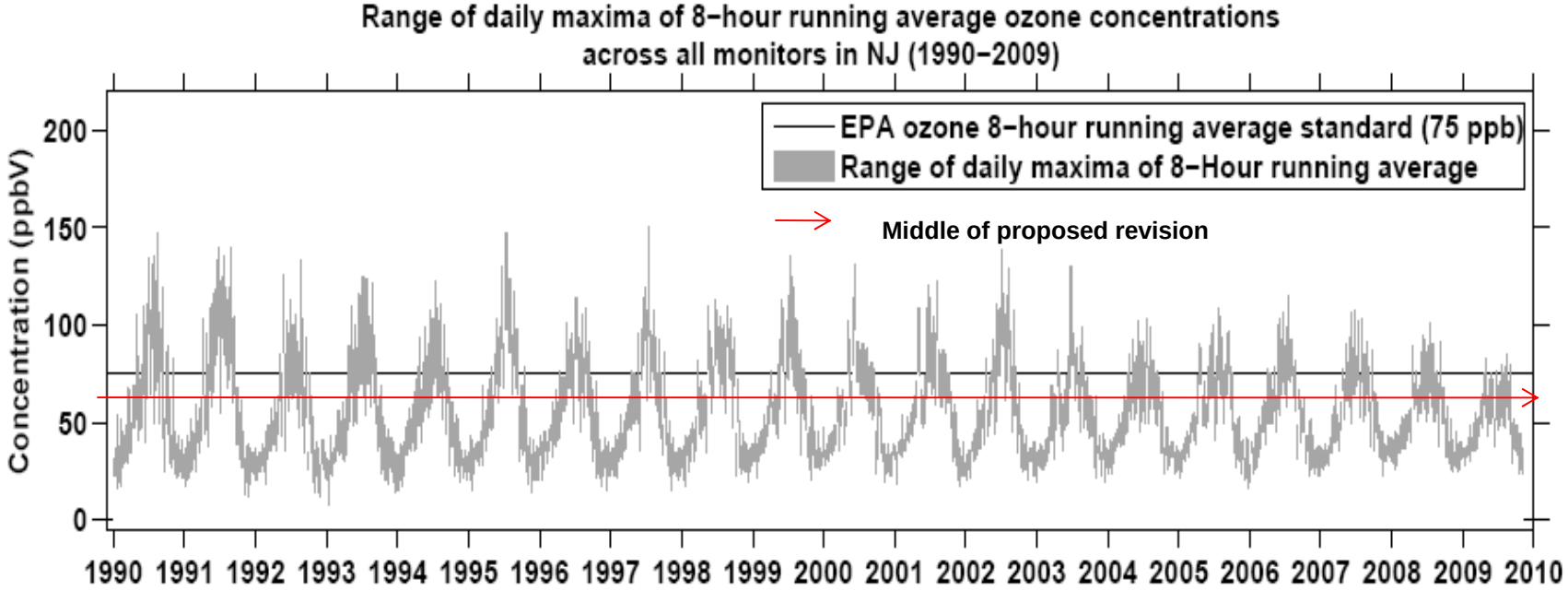


Figure 2.12 Interaction of NO_x, HCs, and sunlight in the production of elevated tropospheric O_3 levels. (From NAPCA, USDHEW, 1969. Publication No. AP-63.)



VERTICAL OZONE PROFILE OVER TRENTON NJ AS A FUNCTION OF TIME OF DAY DURING A “PHOTOCEMICAL SMOG EVENT


Range of daily maxima of 1−hour average ozone concentrations
across all monitors in NJ (1990−2009)
EPA ozone 1−hour average standard (120 ppb)
Range of daily maxima of 1−Hour Average
Concentration (ppbV)
0
50
100
150
200
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010


Range of daily maxima of 8−hour running average ozone concentrations
across all monitors in NJ (1990−2009)
EPA ozone 8−hour running average standard (75 ppb)
Range of daily maxima of 8−Hour running average
Middle of proposed revision
Concentration (ppbV)
0
50
100
150
200
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

Contact with Air Pollution

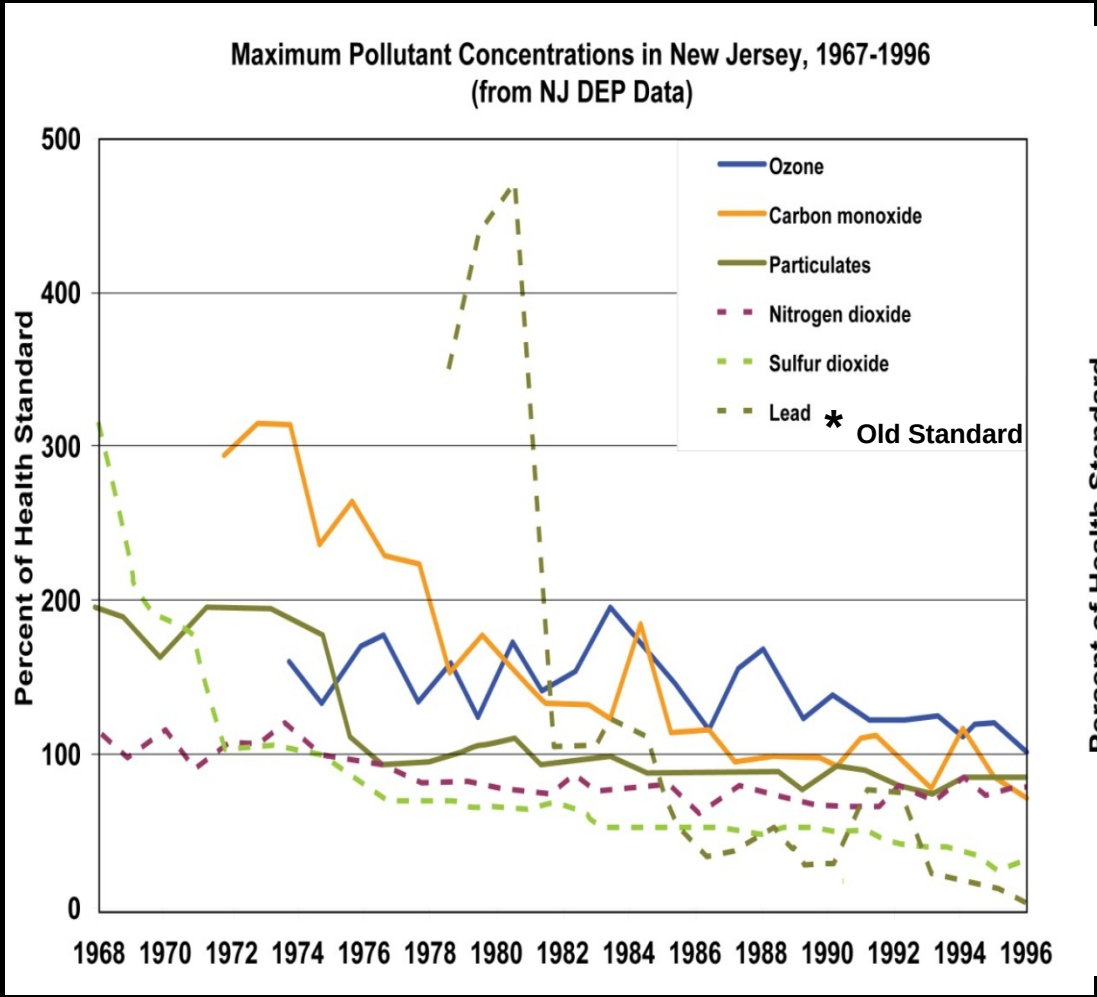
- Historically – Just about anywhere
  - Outdoors – very high pollution levels – An important consideration Since:
    - Houses were not well insulated – High AER led to high indoor levels from outdoor air
    - No Air Conditioning increased Outdoor Air Pollution indoors and increased exposure to outdoor air pollution
    - More Urban living in NJ
    - Less Travel

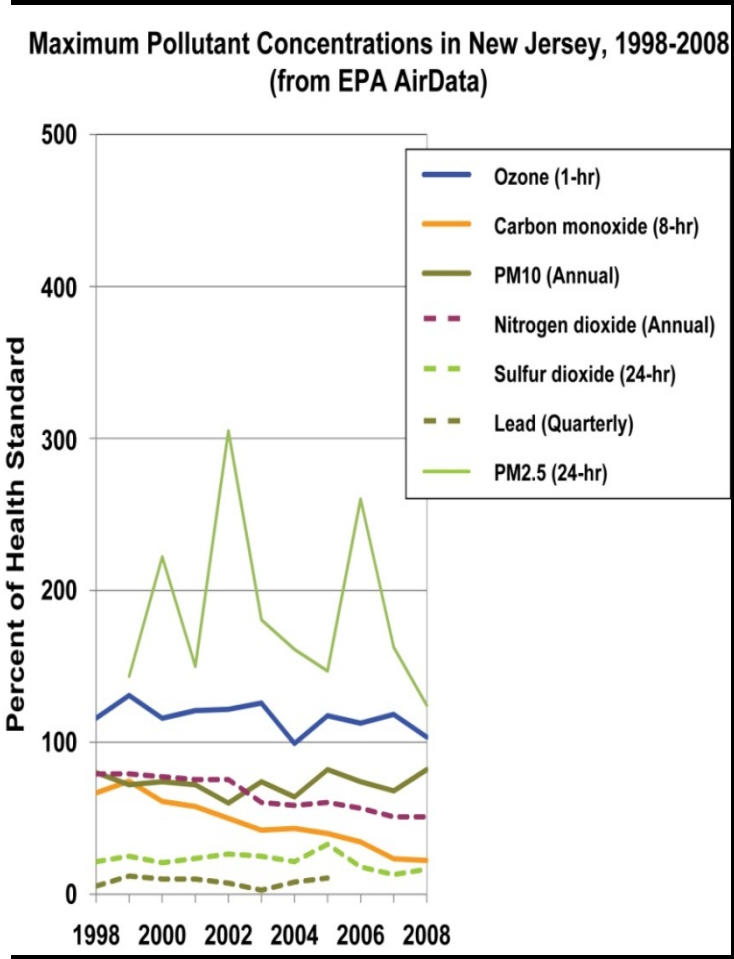
Contact with Air Pollution

- Currently
  - Outdoors is still dominant for some pollutants but at much lower levels
  - Indoors -- -- especially for VOC and SVOC's the levels will be higher for the same agents measured outdoors
  - Transportation – Amount of time spent in transit, types of transportation
    - Cars
    - Trucks
    - Off Road

Pollutant	Standard Value	Standard Type
Carbon Monoxide (CO)		
8-hour average	9 ppm (10mg/m^3)	Primary
1-hour average	35 ppm (40mg/m^3)	Primary
Nitrogen Dioxide (NO_2)		
Annual arithmetic mean	0.053 ppm (100 µg/m^3)	Primary & Secondary
Ozone (O_3)		
1-hour average *(retired)*	0.12 ppm (235 µg/m^3)	Primary & Secondary
8-hour average	(0.065?) 0.075 ppm (146 µg/m^3)	Primary & Secondary
Lead (Pb)		
Quarterly average	(0.15) 1.5 µg/m^3	Primary & Secondary
Particulate (PM_{10})		
Annual arithmetic mean	50 µg/m^3	Primary & Secondary
24-hour average	150 µg/m^3	Primary & Secondary
Particulate ($PM_{2.5}$) - ***Under review***		
Annual arithmetic average	15 µg/m^3	Primary & Secondary
24-hour average	(35) 65 µg/m^3	Primary & Secondary
Sulfur Dioxides (SO_2)		
Annual arithmetic mean	0.030 ppm (80 µg/m^3)	Primary
24-hour average	0.14 ppm (365 µg/m^3)	Primary
3-hour average	0.50 ppm (1300 µg/m^3)	secondary

The Relative Change in Air Pollution levels in NJ 1968- 2008





Verdict

- NJ has substantially improved Air Quality and reduced unhealthy levels of Air Pollution
  - Criteria Pollutants
    - Reductions to meet the original standards
    - Reductions to meet mandates of Revised Standards
  - Reasons
    - Sound implementation Plans
    - Regional and Local strategies

Future Contact with Air Pollution

- Future – Crystal Ball? Did anyone predict the Computer in 1900?
  - Types of Sources Outdoors – for the forseeable future most will be the same
    - Energy sources may change ***if*** the country finally gets focused on energy independence
      - Clean Coal, Nuclear power: Issues:
        - Power demand
        - Electric cars – Not environmentally neutral –

Contact with Air Pollution

- Renewable energy
  - Solar
  - Wind
  - Biofuels – Need to understand the Health Implications
  - Incineration
- Gasoline until ??
- Engineering solutions needed to reduce emissions – all types of sources

Future Contact with Air Pollution

- Types of material for release
  - Nanoparticles and agglomerates from consumer products
    - Outdoors
    - Personal
    - Revised Air Quality Standards?
      - PM
      - Designer standards -components of PM
  - Organic Materials
    - Outdoors, e.g. cars and trucks
    - Indoor sources
  - Nitrogen Oxides
    - Combustion sources - Will expand with Electric Cars

Future Contact with Air Pollution

- Issues
  - Healthy Communities and Environmental Justice
    - Identifying problems , e.g . Sources, Brownfields
    - Characterizing the Air Pollution issues – “new pollutants”
    - Air Toxics Measurements
    - Determining meaningful approaches to solutions
    - Hot Spots (Camden, Paterson, Jersey City)
  - Near Road
    - Coarse particle and Super coarse particle exposure
    - Air Toxics
    - Brownfields

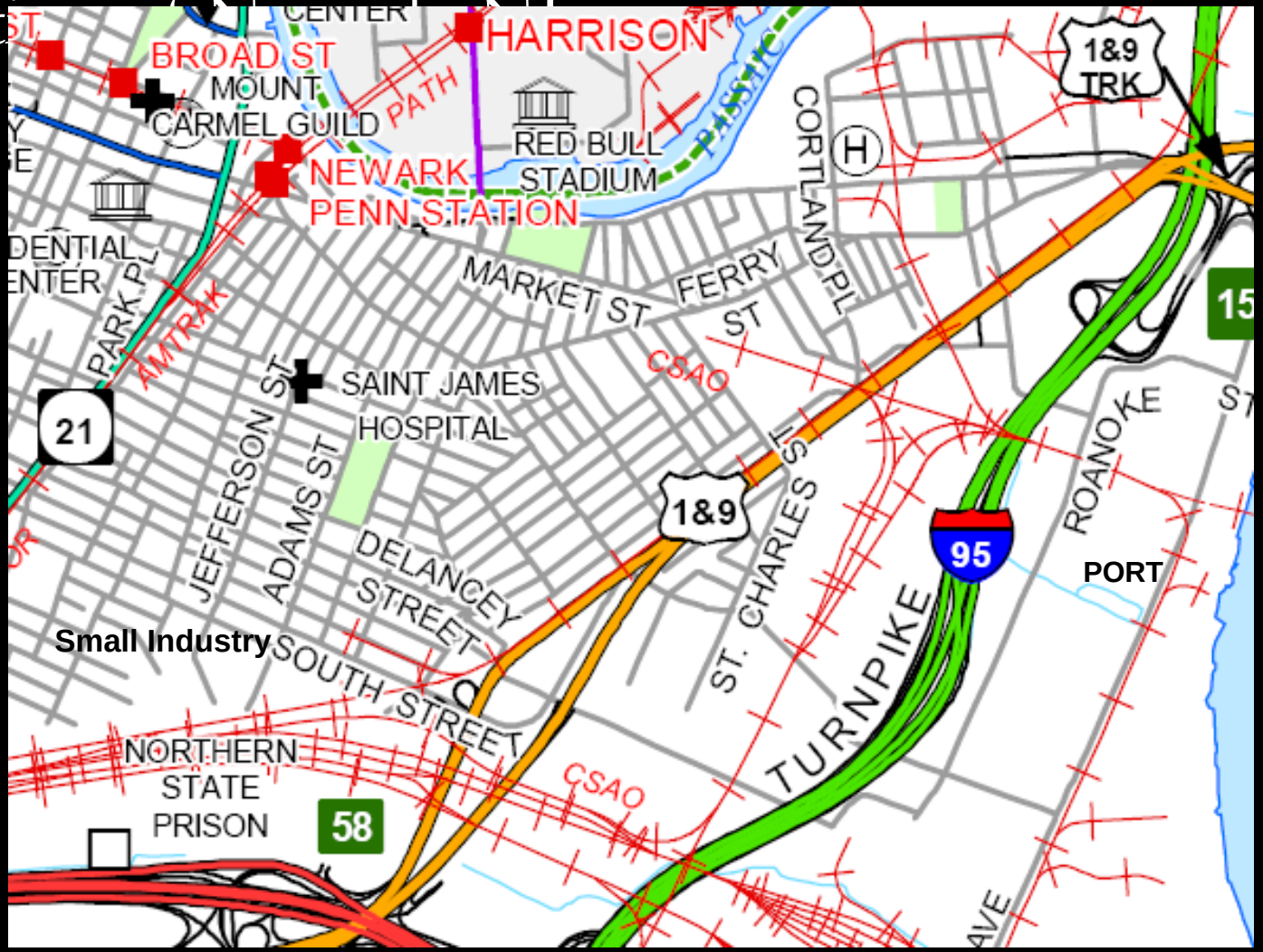
Hot Spot/EJ: Camden, NJ

Figure 1 Geographical locations of the subjects' homes in the neighborhoods of Waterfront South (WFS) and Copewood/Davis Streets (CDS) in Camden, NJ.

Environmental Justice – Paterson UCAMPP (DEP, EOHSI, EPA)

P-dichlorobenzene and benzene

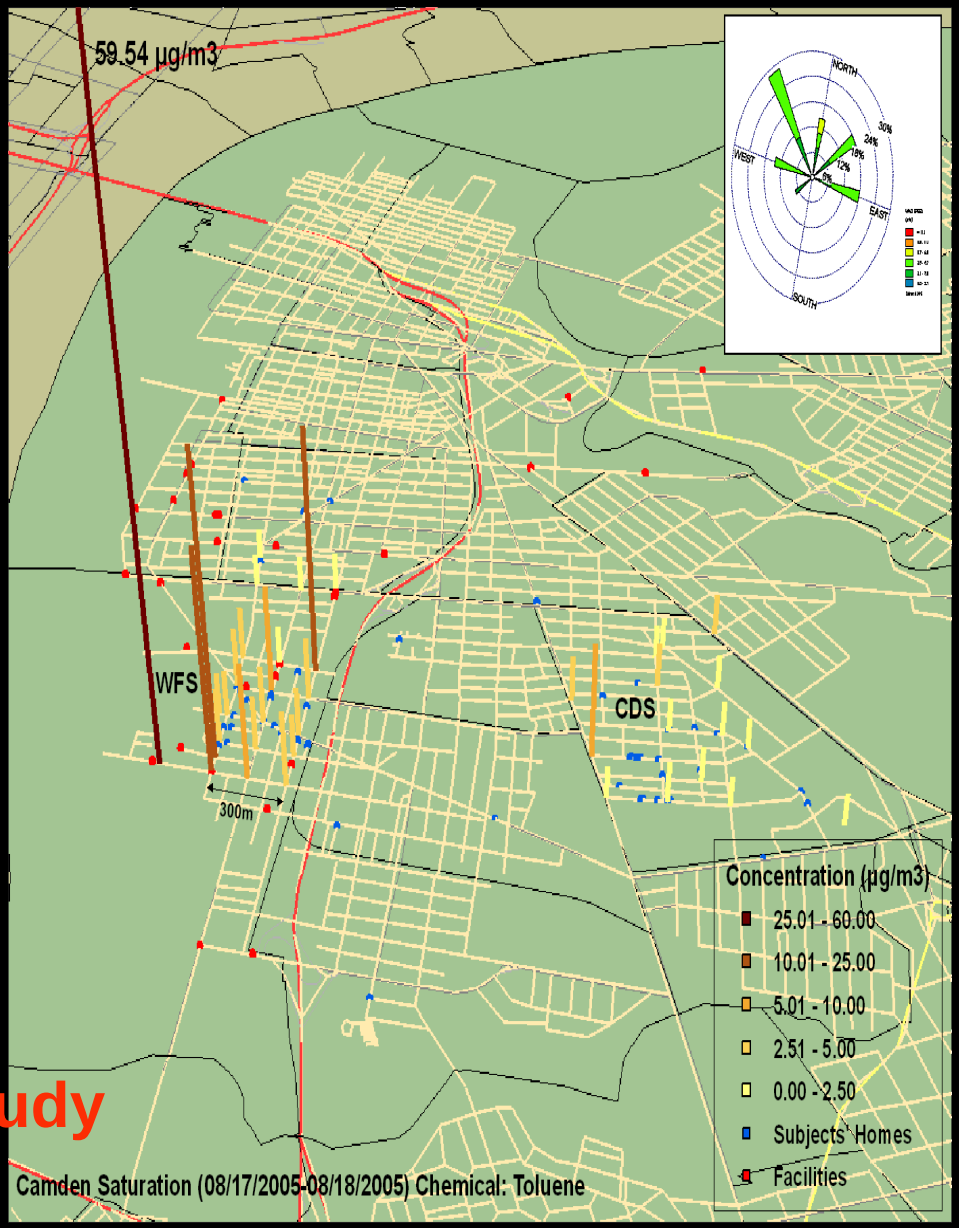
Near Road: Highways cut and boarder Iron Bound Sect



Future Contact with Air Pollution

- Near Field
  - Air toxics
  - nanoparticles
- Acute Releases
  - Highly toxic substances
    - Accidents
    - Terrorism
  - Near field
- Ozone
  - New State Implementation Plan
    - What can be controlled
      - NOX Versus Organics – the age old battle
      - Regional controls essential
      - Nitrogen oxides will be a problem in any mix of alternate fuels

Near Field



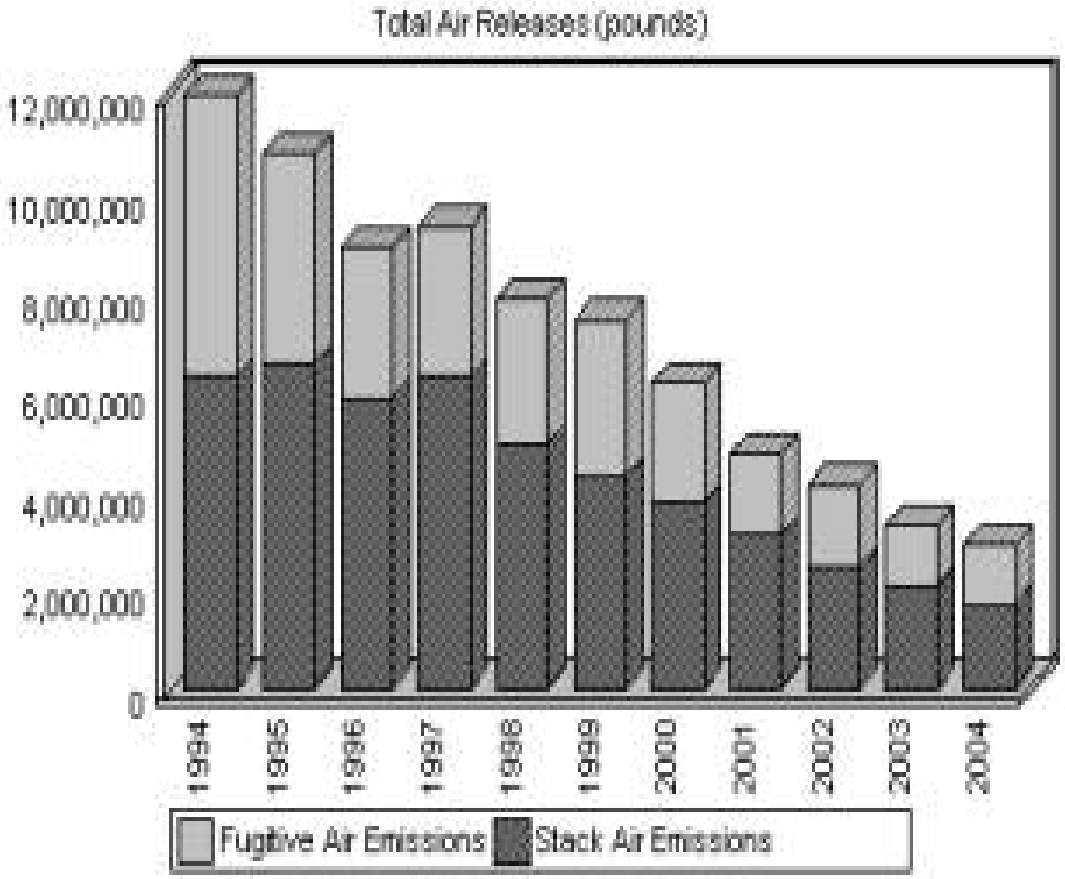
EOHSI/DEP Study
Funded by HEI

Hazardous Air Pollutants

- Toxic air pollutants are known or suspected to cause cancer or other serious health effects (reproductive effects or birth defects), or adverse environmental effects
- EPA is working to reduce the release of ~188 pollutants (www.epa.gov/ttn/atw/188polls.html)
- Toxic Release Inventory(www.epa.gov/triinter): this database includes information about release of toxic chemicals from sources to environments

Typical Air Toxics

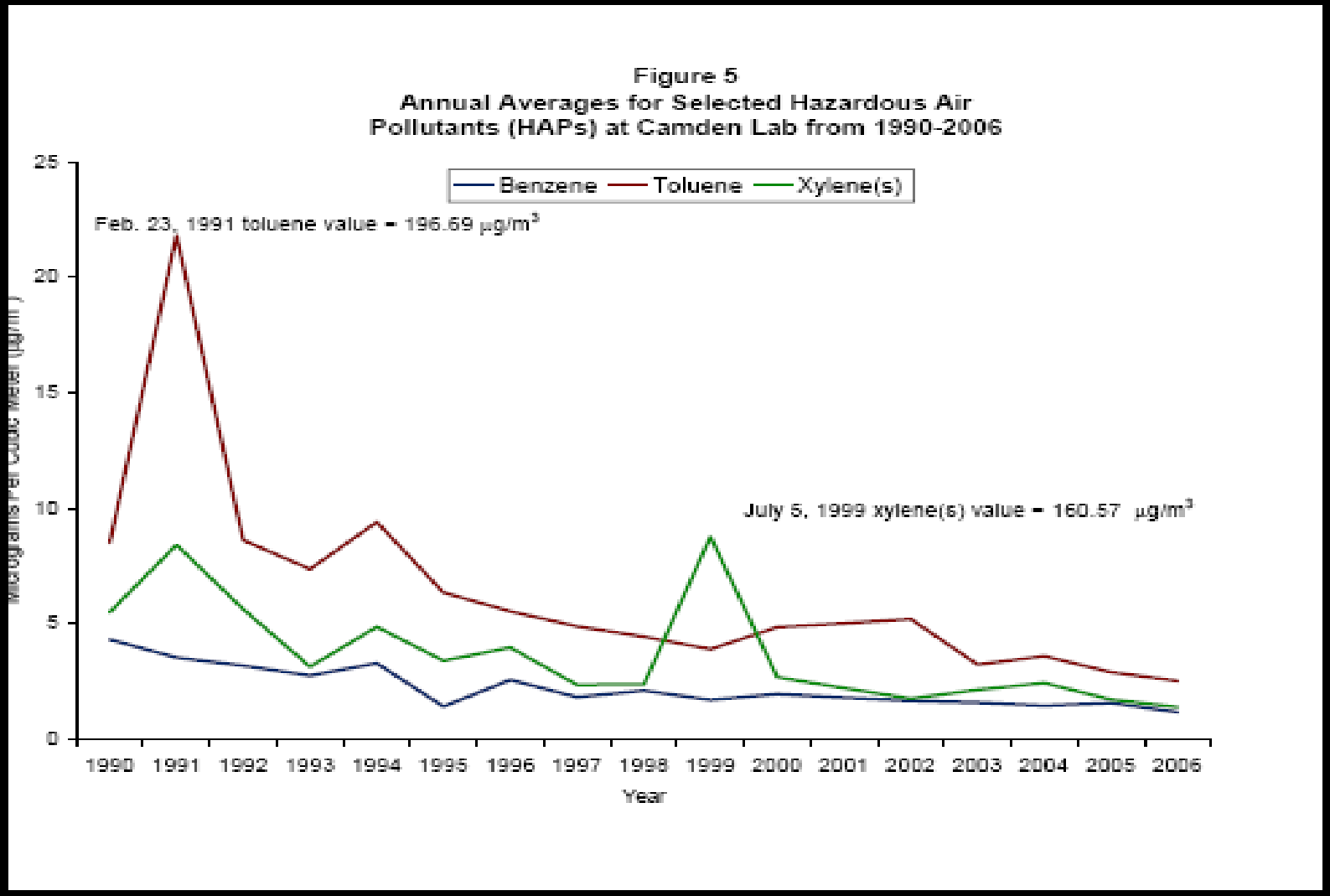
- Trichloroethylene
- Formaldehyde
- Benzene
- Perchloroethylene
- Styrene
- Xylenes
- Butadinene
- Methylene chloride
- Asbestos
- Mercury
- Chromium
- Arsenic
- Dioxin/Furans
- Phthalates
- cadmium



Year	Total Air Emissions	Stack Air Emissions	Fugitive Air Emissions
1994	11,979,349	6,299,527	5,679,822
1995	10,786,190	6,555,599	4,230,591
1996	8,908,965	5,875,795	3,033,170
1997	9,341,313	6,294,449	3,046,864
1998	7,856,988	4,920,663	2,936,325
1999	7,436,609	4,258,620	3,177,989
2000	6,173,503	3,753,185	2,420,318
2001	4,748,548	3,114,977	1,633,570
2002	4,110,512	2,463,201	1,647,310
2003	3,286,863	2,059,144	1,227,719
2004	2,886,686	1,685,917	1,200,770

solvents and in the production of other chemicals. These chemicals are used in the manufacture of paints, coatings, insecticides, pharmaceu
are not known to cause cancer.

Trends in Selected Air Toxics



Future Contact with Air Pollution

- PM?
  - Tightening of Annual Standard
    - PM2.5
  - Chemical Specific Standard
    - Nickel
    - Other
  - Coarse Particle Standard
    - PM10-2.5
    - 24h

Future Contact with Air Pollution

- Exposure
  - Regulations that revamp our appoach tp pollution prevention and control
    - Chemical Safety Program?
      - ToxCast
        - Uses data from state-of-the-art high throughput screening (HTS) bioassays.
        - Builds computational models to forecast potential chemical toxicity in humans.
        - Provides EPA regulatory programs with science-based information helpful in prioritizing chemicals for more detailed toxicological evaluations and more efficient use of animal testing

Future Contact with Air Pollution

- ExpoCast?
  - (1) inform chemical prioritization,
  - (2) understanding the systems response to chemical perturbations resulting from environmentally relevant exposures and how these translate to relevant biological changes at the individual and population levels,
  - (3) link information on potential toxicity of environmental contaminants to real-world health outcomes.
- The above need much innovation and development

- Total exposure estimates
- Personal contact with pollutants
  - Focus on us versus industry

Modeling - Essential tools in the 21st Century

- Planning
- Prediction
- Implementation
- Need Performance Testing
- Risk Assessment
  - Source to exposure
  - Exposure through effects

- Need a national/international Airing of the Energy issues
  - What are the facts
  - Best approach: Refocusing fto Energy Independence
    - Nuclear Power
    - Clean Coal
    - Alternate sources

When will the Clean Air Act be revised?

Probably not in the next 5 years!

Modifications will be added through federal energy or climate regulations

Missing links – Indoor and Personal Air Pollution – beyond Asbestos and Radon, and a few others