The Air Quality Myth

John Wargo, Yale University
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Environmental Politics and Law
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"The nation's air quality has improved dramatically in the past 25 years."

…EPA 2007

It Depends...

What pollutants you choose to measure. (e.g. PM)

What you know about the toxicity of the pollutants.

Where you measure pollutants.

Where you spend your time...

How you behave....

Types of Legal Standards to Control Air Quality

- Zoning: Land Use Segregation
- Ceilings or Limits for Specific Chemicals
- Precautionary: Prevention of Significant Deterioration
- Staionary vs. Mobile Sources
- Trans-boundary Flows of Pollution
- Property Rights to Pollute: Cap and Trade Programs
- Technology Forcing Standards
- Fuel Content Regulations
- Indoor Behavioral Regulation
- Building Certification Standards

Air Quality Control Regions

- Each State Must Designate Areas As:
  - Attainment: Meeting NAAQS
  - Non attainment
  - Unclassifiable
- State Implementation Plans
  - Enforceable emissions limits
  - Methods for acquiring air quality data
  - Boundaries for the SIP
  - Enforcement program
  - Plans to control interstate & international pollution
  - Source monitoring and Reporting requirements

CLEAN AIR ACT PROVISIONS

- National Ambient Air Quality Standards
- Primary NAAQS: acceptable levels that protect health
- Secondary NAAQS: Protect environmental quality & property
- Criteria Pollutants: Listing Statute (SDWA, End. Sp.)
- Hazardous Air Pollutants
- Technological Feasibility: Act is "technology forcing" and EPA may not consider economic and technological feasibility in setting air quality standards.

CLEAN AIR ACT POLLUTANT TYPES

Criteria Pollutants (Dangerous to Health)	**Hazardous Air Pollutants**
Particulates	Asbestos Beryllium
SO2	Mercury Arsenic
NOx	Vinyl chloride
CO	Benzene
Ozone	Radionuclides
Lead	Coke oven emissions

CLEAN AIR ACT POLLUTANTS CLASSIFICATIONS

POLLUTANT	*NAAQS*
Particulates	
• *PM10*	*50 µg/m3 (annual) / 150 µg/m3 (24hr)*
• *PM2.5*	*15 µg/m3 " / 65 µg/m3 "*
SO2	
• *annual*	*0.030 ppm(80 µg/m3)*
• *24 hr*	*0.14 ppm(365 µg/m3)*
NOx	*0.053 ppm(100 µg/m3)*

CLEAN AIR ACT POLLUTANTS

Science and Politics of Averaging

POLLUTANT	*NAAQS (primary)*
Ozone (O3)	
• *1-hour Average*	*0.12 ppm(235 µg/m3)*
• *8-hour Average*	*0.08 ppm(157 µg/m3)*
Carbon Monoxide (CO)	
• *8-hour Average*	*9 ppm(10 mg/m3)*
• *1-hour Average*	*35 ppm(40 mg/m3)*
Lead (Pb) Quarterly Average	*1.5 µg/m3*

HAZARDOUS AIR POLLUTANTS

- 1970 CAA AUTHORIZED REGULATION OF HAP'S
- BY 1990, 7 CHEMICALS WERE REGULATED
- CONGRESS IN 1990 LISTED 189 CHEMICALS
- 1990 CAAA: ESTABLISHES CATEGORIES OF SOURCES
  POWER PLANTS, GAS STATIONS, DRY CLEANERS
- CATEGORIES: MAJOR AND MINOR SOURCES
- MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY REQ'D
- OFFSETS ALLOWED TO REDUCE HAP'S WITHIN PLANTS

Addiction to Movement

- 235 million vehicles in US
- 3 trillion miles traveled in US 2007
- 200 billion gallons of fuel consumed
- $600 billion per year @ $3 / gallon
- 17.2 miles per gallon

Lag in Adoption of Tech Forcing Stds

EPA: 2000 Diesel Standards

- 95% reduction in NOx
- 90% reduction in PM

•To Be Phased in 2006-2010 as engine design changes…

- When will they make a difference in air quality?

PARTICULATE STANDARDS:

Glacial Pace of Reform

- EPA issued revised particulate and ozone standards in 1997.
- Agency focused health concerns on mortality studies,
- PM 10: a 4% increase in daily mortality with a 50 ug/m3 increase in average daily levels.
- PM 2.5 Finer particles are more dangerous.

What are the Latest PM 2.5 standards?

- Annual: 15 $\mu g/m^3$ (Daily averages, averaged over 3 years.
- 24 Hour: 65 $\mu g/m^3$ (98^{th} % levels averaged over 3 years.

Whitman v. American Trucking Associations 2001

U.S. Supreme Court *No. 99-1257*

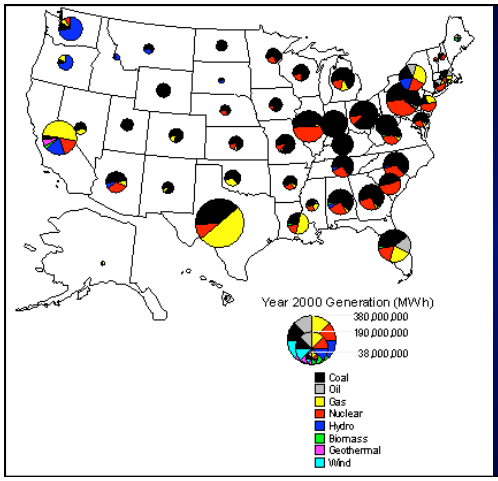
The Clean Air Act "unambiguously bars cost considerations from the standard setting process."

Further, it requires EPA to set standards "requisite to protect the public health", "allowing an adequate margin of safety."

HEALTH BENEFITS:

EPA estimated that the new standards, *when fully implemented in 2010*, would result in

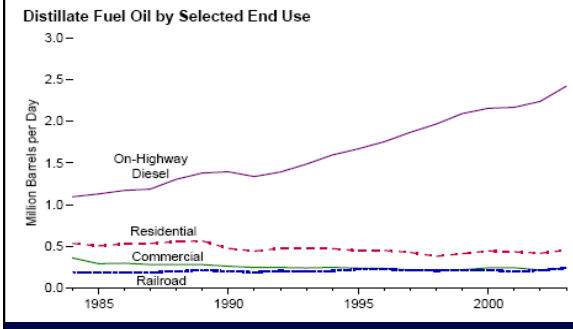
- 8,300 fewer premature deaths,
- 17,600 cases of childhood acute bronchitis,
- 360,000 fewer asthma attacks.



US Power Plants By Location and Type of Fuel Consumed 2000

US EPA

www.epa.gov/cleanenergy.



CT Fuel Oil vs. Diesel 660 vs. 230 million g/yr

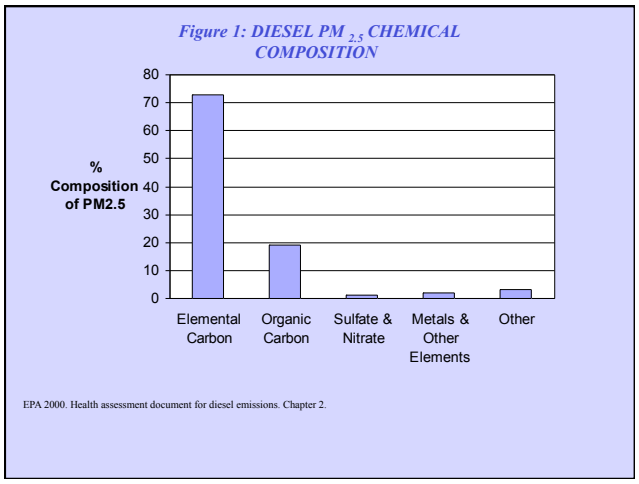
- Home heating fuel is essentially the same as diesel fuel, although the sulfur content is higher.
- Connecticut is exceptionally dependent on No. 2 fuel oil for heating purposes, and last year ranked 4th in the nation in raw consumption at more than 660 million gallons.
- By contrast, 230 million gallons of diesel fuel were used for transport purposes.
- Connecticut ranks 1st in the nation in fuel oil consumption per square mile of state area.

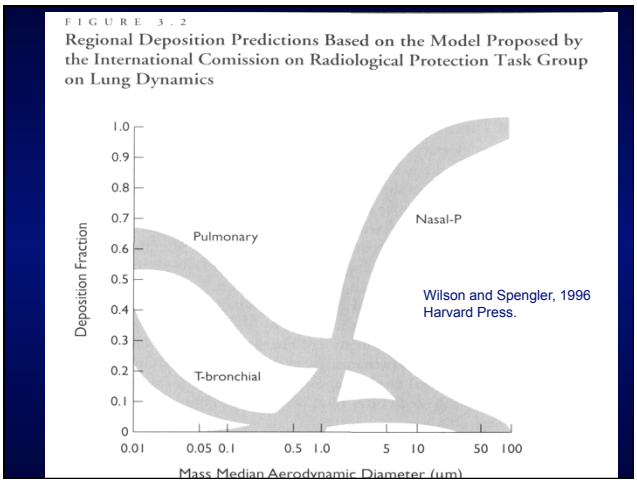
PARTICLE SIZE

A. COARSE (>2.5 um): from soil and crustal materials

B. FINE: (<2.5 & > .1 um): combustion byproducts

C. ULTRA FINE: (<.1 um): quickly coagulate to larger particles





7 Million US Children Have Asthma

Asthma Is Number 1 Reason For School Absenteeism

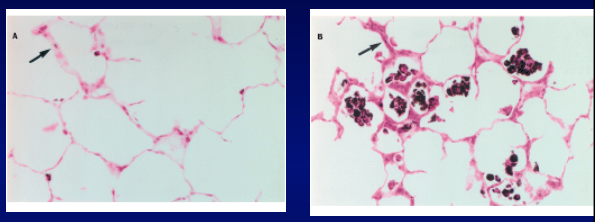
Other Effects…Performance?
Socialization? Depression?

Mark Cullen, M.D. School of Medicine

3-22% of Children in CT Schools

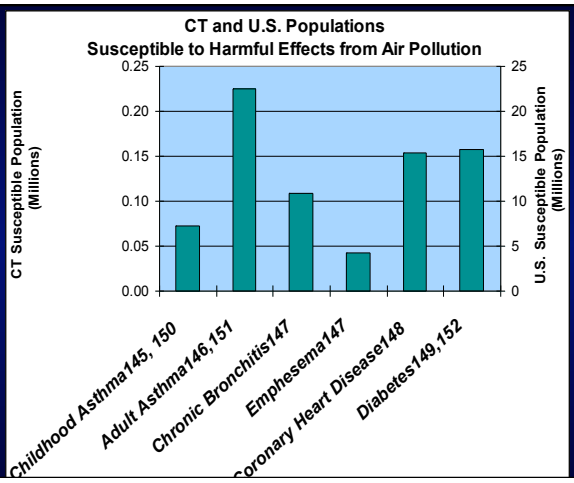
Have M.D. Diagnosed Asthma

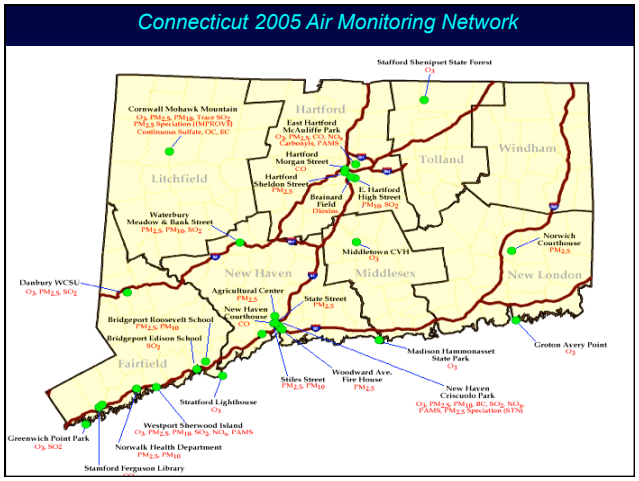
Lung sections from rats exposed to diesel exhaust.

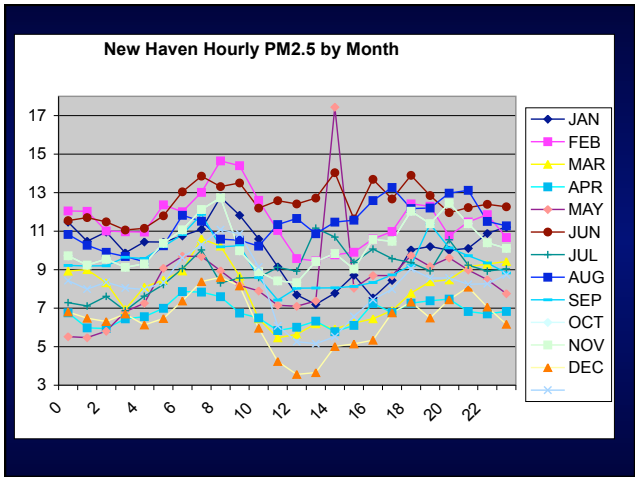


(A) rats exposed to low concentrations of diesel exhaust.
(B) (*B*) Rats exposed to high concentrations of diesel exhaust. Regardless of exposure concentration, most of the particulate material is located in macrophages in the lumens of alveoli and alveolar ducts. Arrows point to particulate material in the interstitium.

Influence of Exposure Concentration or Dose on the Distribution of Particulate Material in Rat and Human Lungs
Kristen J. Nikula,[1] Val Vallyathan,[2] Francis H. Y. Green,[2] and Fletcher F. Hahn[1]







John Wargo, Yale University

David Brown, NESCAUM

Nancy Alderman, EHHI

Mark Cullen, M.D. Professor Stanford University

Susan Addis, Former CT Comm. Of Health

Robert LaCamera, M.D. Professor Yale University

Michael Triahotis, UCONN ERI

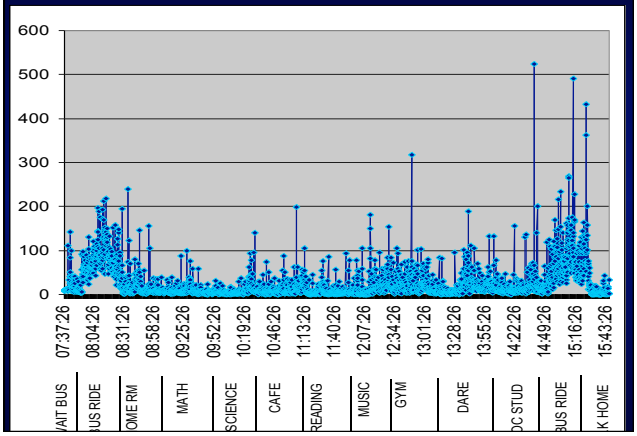
Kevin Hood, UCONN ERI

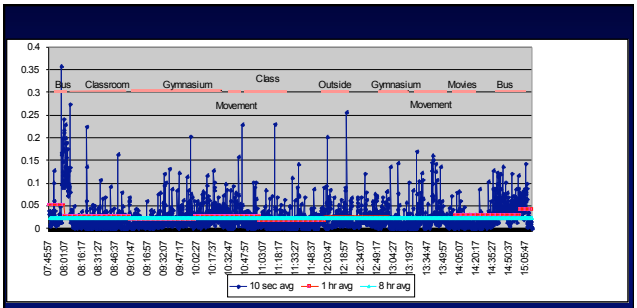
Jared Yellen, UCONN ERI

Open Yale courses

- 600,000 School Buses in US

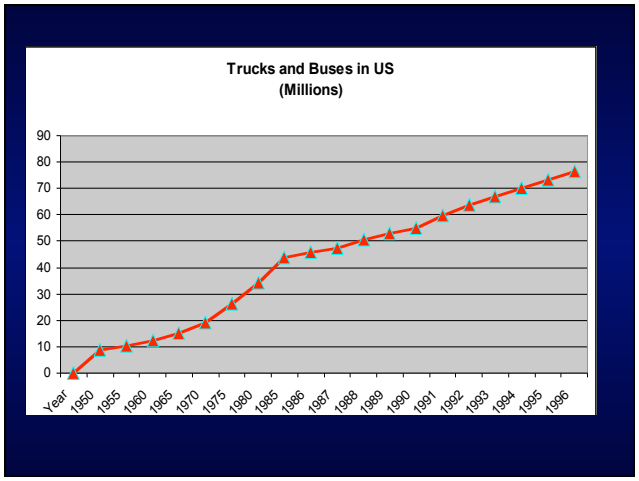
Figure 7: Student Exposure to PM_{10} (ug/m3)

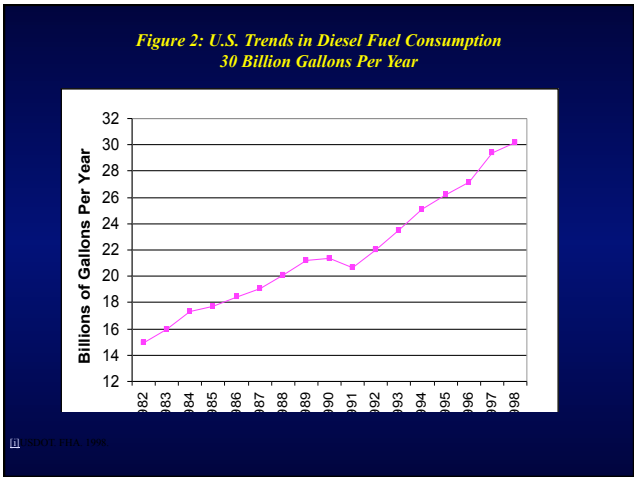


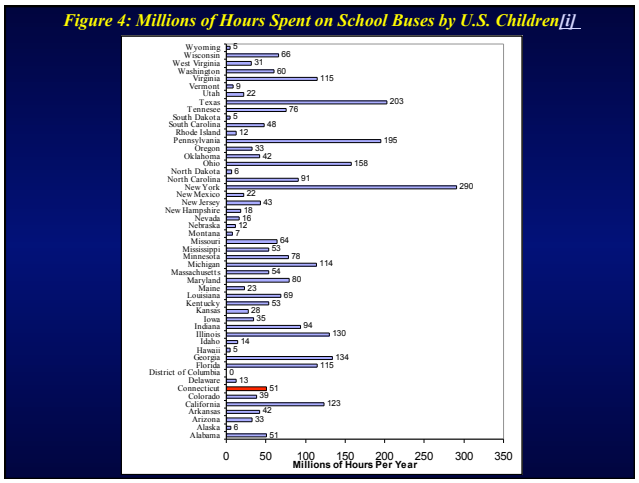


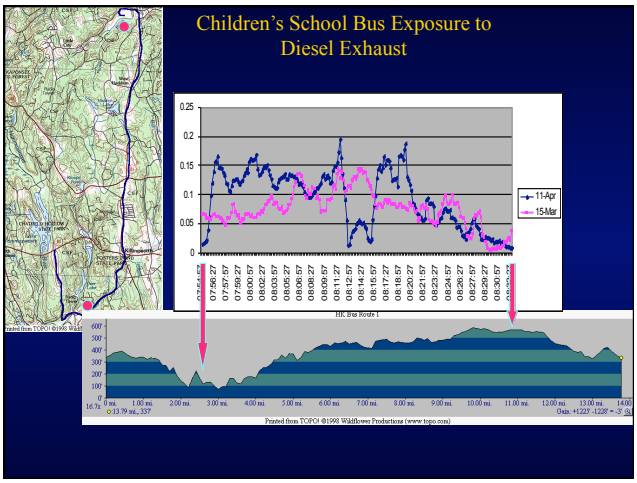
EFFECT OF AVERAGING PM2.5 OVER DIFFERENT PERIODS

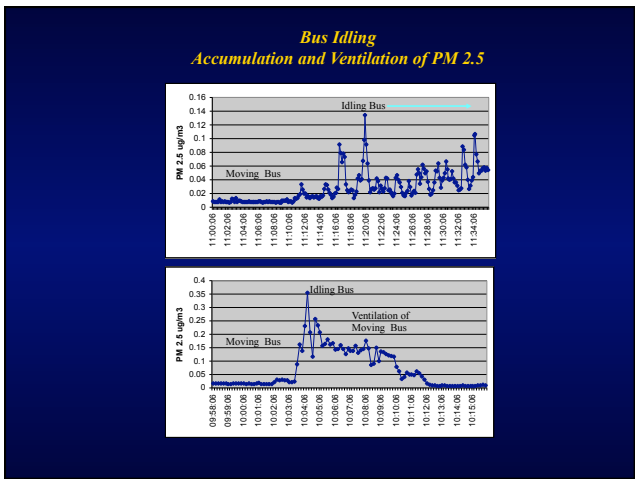
PM2.5 (mg/m3)

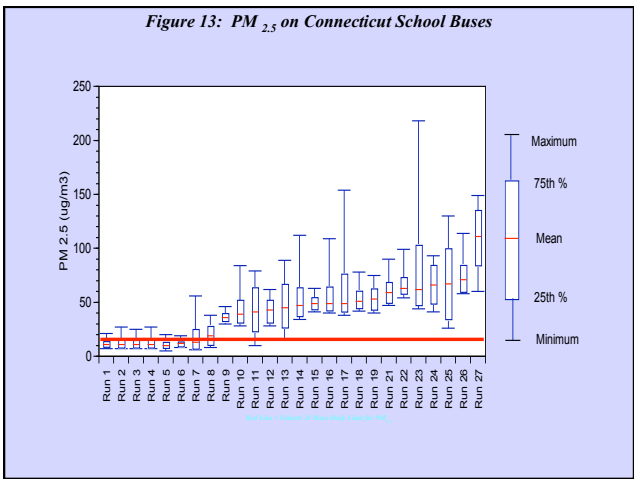


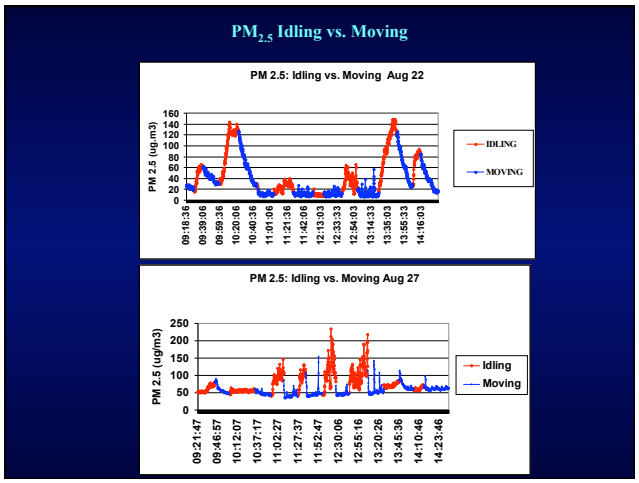








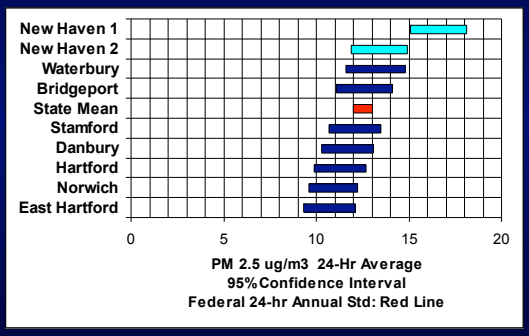




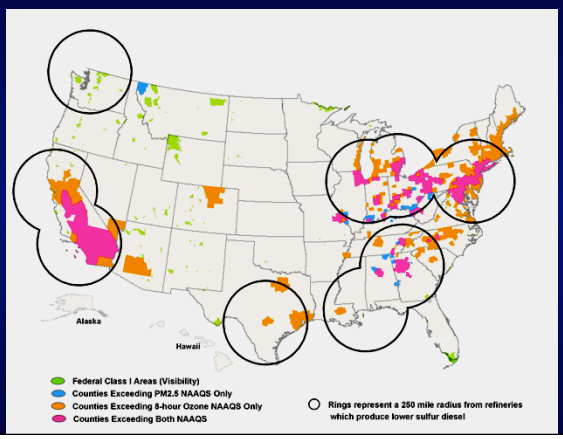
Factors Affecting Variability of Diesel Exhaust Within School Buses:

- Window configuration: Open v. Closed.
- Idling Practices of the drivers,
- School Queuing Practices
- Location of Sampling Equipment on the Bus
- Route Characteristics: Length; Traffic; Elevation; Stops
- Ambient Air Quality: Urban v. rural, proximity to polluters.
- Engine Type
- Engine Age
- Engine maintenance practices and schedule
- Condition of exhaust system
- Exhaust pipe location (left or right rear)
- Heating and Ventilation: Fans, Filters;
- Fuel Type: High v. Low Sulfur
- Climatic conditions Temperature, Humidity, and Wind

PM $_{2.5}$ Levels at Connecticut Monitoring Sites [II]
95th % Confidence Interval of Average Daily Levels

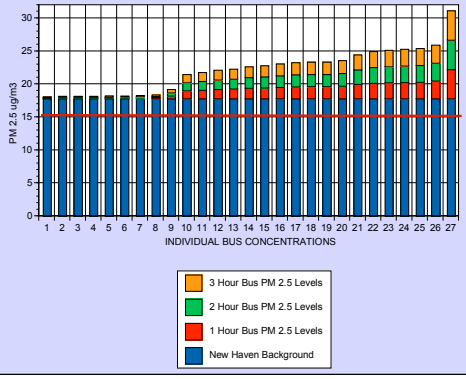


Non Attainment Areas: Within 250 Miles of ULS Diesel Refineries



Average Daily Concentrations During School Year
New Haven Background +School Bus PM $_{2.5}$ Levels

Red line depicts Federal PM $_{2.5}$ Standard of 15 ug/m3



Diesel Emissions

- **EU: promotes Diesel**
  - **to reduce CO2**
  - **> 20% of passenger vehicle fleet**
- **US: restricts Diesel**
  - **to reduce fine Particulate Matter (PM)**
  - **< 3% of passenger vehicle fleet**
- **Simultaneous precaution, but vs. conflicting risks**

Recommendations for the Federal Government

1. *Retrofit Diesel Buses To Lower Emissions*:
2. *Require Buses to Use Ultra Low Sulfur Fuels*:
3. *Replace Bus Fleet With Low Emission Vehicles*:
4. *Test Tailpipe Emissions:*
5. *Set Passenger Cabin Air Quality Standards*:
6. *Require School Bus Air Filtration Equipment*:
7. *Federal Standards Should Assume Indoor and Vehicular Exposures:*
8. *Expand Air Quality Monitoring Network*:

Recommendations for State Governments

1. *Prohibit School Bus Idling By Statute*
2. *Retrofit Diesel Buses To Lower Emissions*:
3. *Require School Buses to Use Low Sulfur Fuels*:
4. *Replace Bus Fleet With Low Emission Vehicles*:
5. *Set Priorities to Reduce Emissions and Exposure:*
6. *Require Routine Maintenance*:
7. *Test Tailpipe Emissions*:
8. *Expand $PM_{2.5}$ Monitoring Network:*

Recommendations for Local Governments

1. *Enforce State Prohibition of Bus Idling*:
2. *Adjust Contract Provisions to Lease Retrofitted Vehicles and Require Clean Fuels*:
3. *Set Priorities*: Newest Buses to Longest Routes
4. *Limit Bus Ride Duration*: More Buses
5. *Require Routine Maintenance*
6. *Location of Bus Parking Lots:*

EPA: 57% of Dioxin Emissions in US from Backyard Barrel Burning of Garbage, Especially Plastic Wastes

Credit: Air Force Times