

# Adverse Health Effects of Diesel Particle Air Pollution

An Overview for the DEM Clean Diesel Workshops

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# EPA

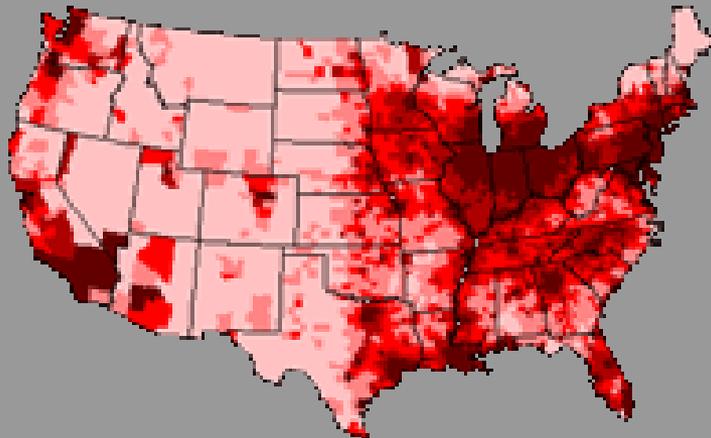
“Reducing emissions from diesel engines is one of the most important air quality challenges facing the country. Even with EPA’s more stringent heavy-duty highway and nonroad engine standards set to take effect of the next decade and clean up new engines, millions of diesel engines already in use will continue to emit large amounts of nitrogen oxides, particulate matter and air toxics, which contribute to serious public health problems. These emissions are linked to thousands of premature deaths, hundreds of thousands of asthma attacks, millions of lost work days, and numerous other health impacts every year (EPA).”

# Health and the Environment

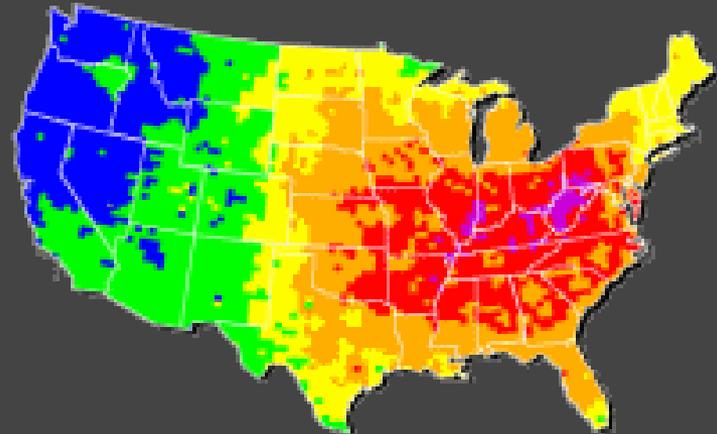
- Environmental Dilemmas
  - If we don't take steps now we will be faced with increased health care expenditures later.
  - It's like infections in hospitals...it is not just control but prevention
  - It is the same with public health and environmental justice...doing what's right now and for our individual and collective future
  - Lets take a closer look at environmental air quality issues

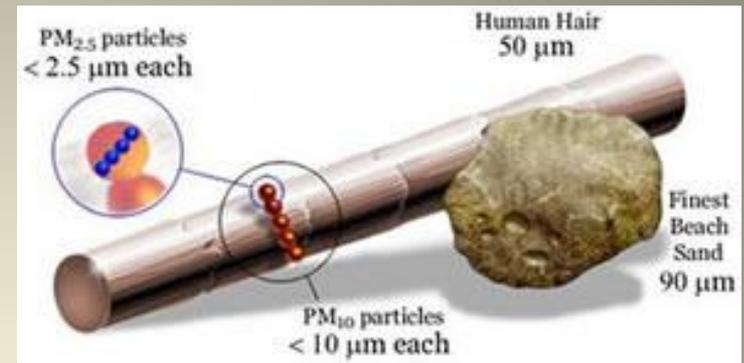
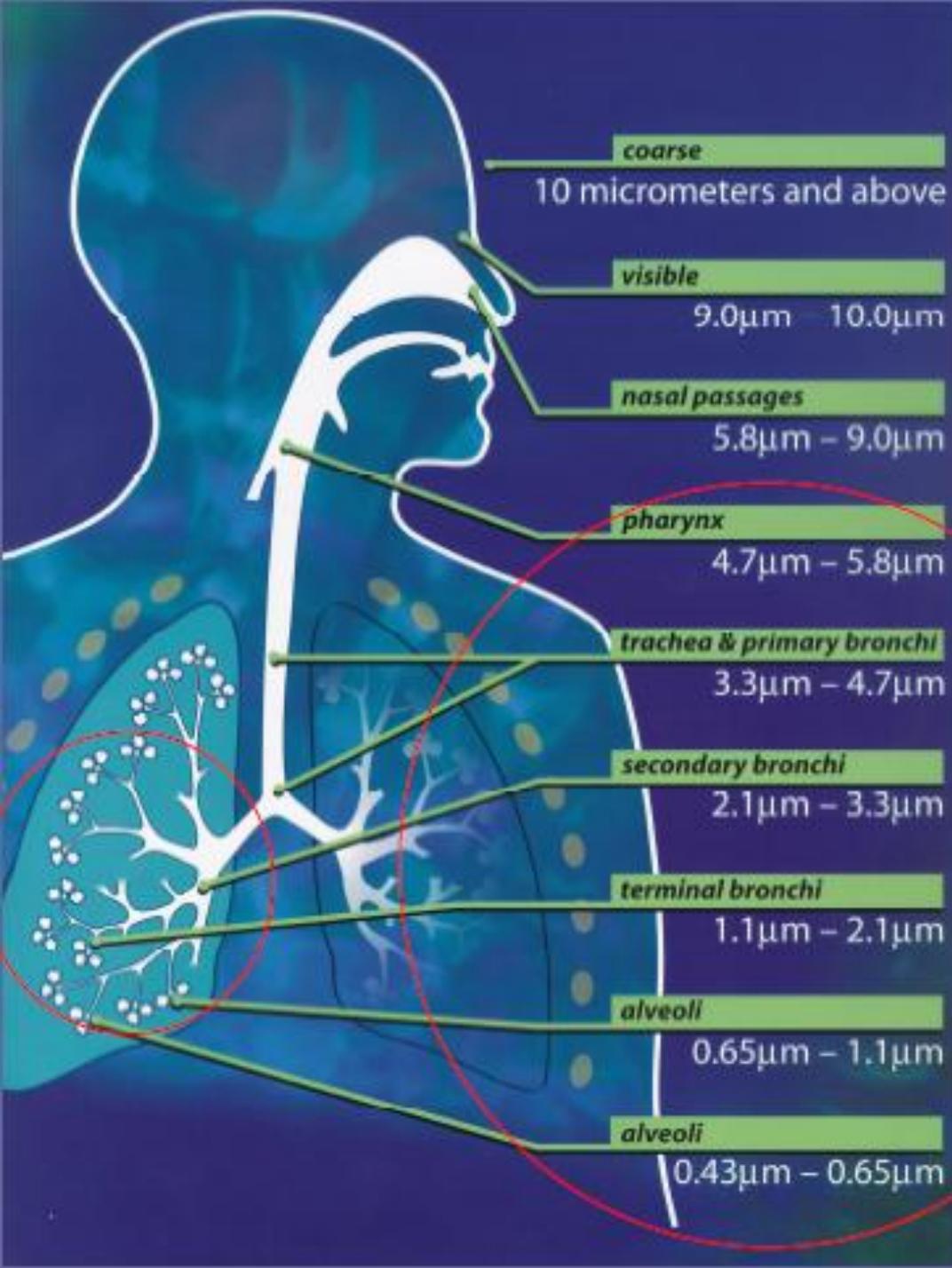
# Public Health Risk

**From Diesel Exhaust**



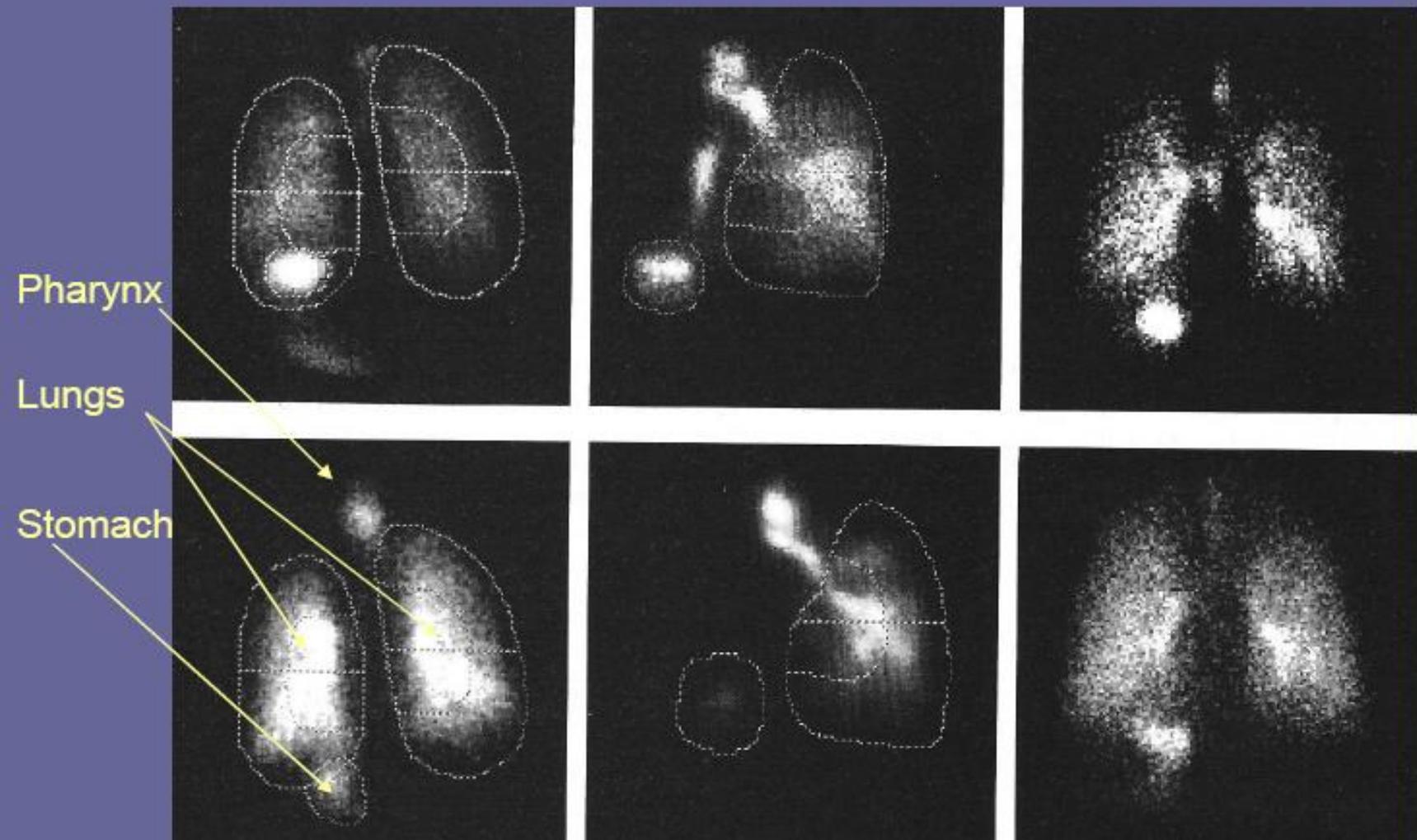
**From Power Plants**





In a study of small particle deposition in the respiratory system, particles at 2.4 microns have (around the size of diesel PM 2.5 particles) increased lung deposition (bottom) compared to larger 5 micron particles (top)

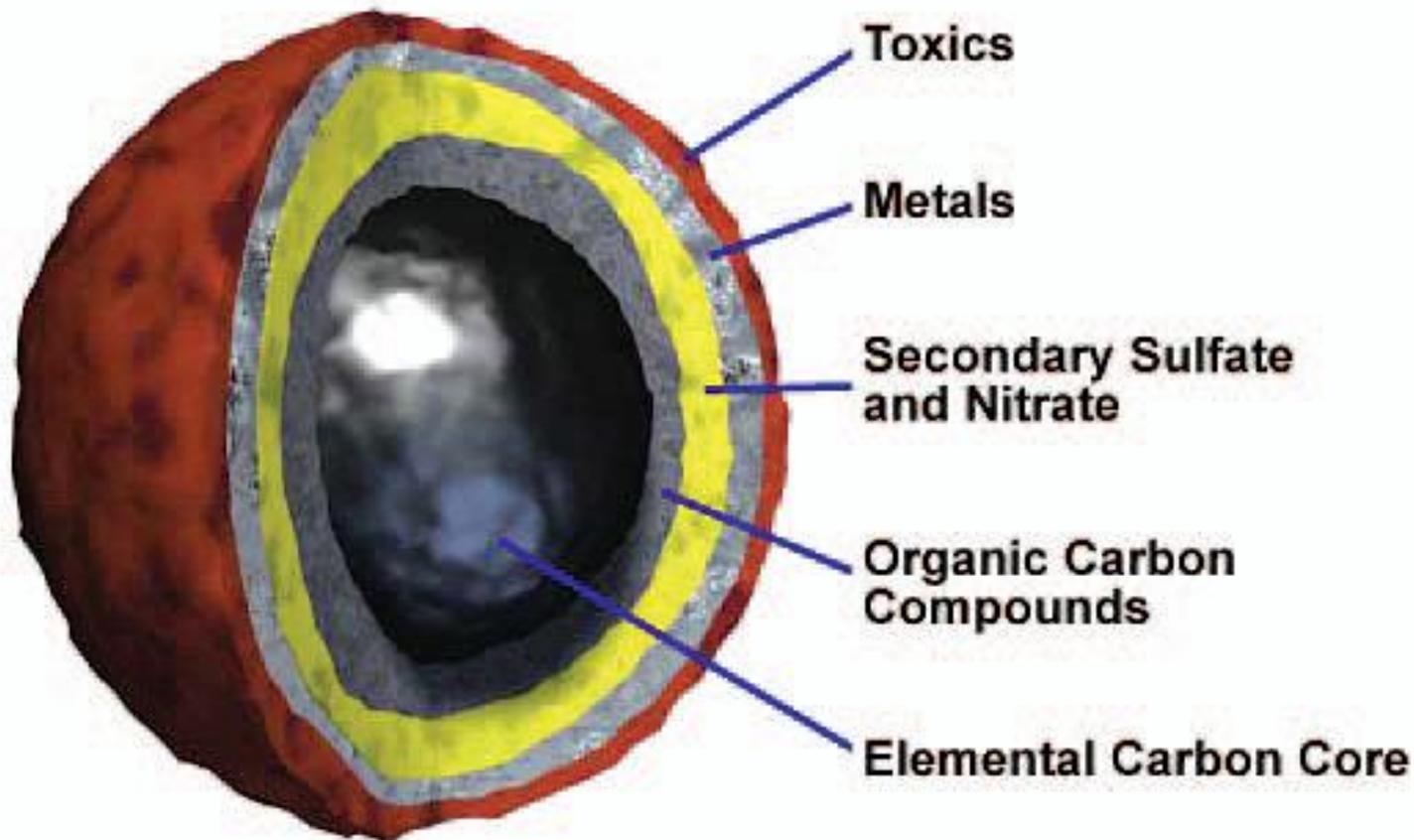
# Studying Deposition of Medical Aerosols



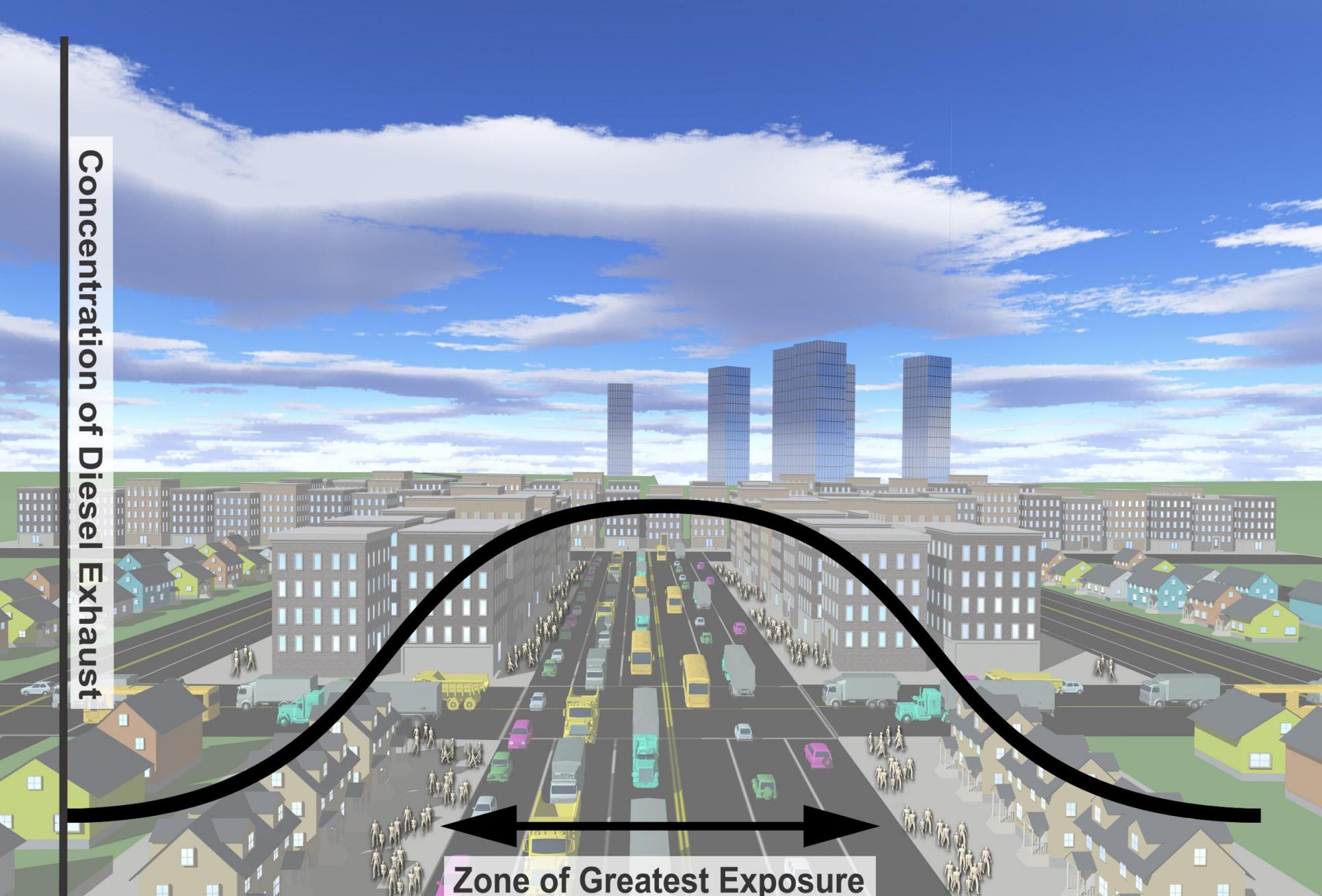
$^{133}\text{Xe}$  Equilibrium Scan, Conventional SVN (Above); Aero-Eclipse BAN (Below)

# Diesel Emissions

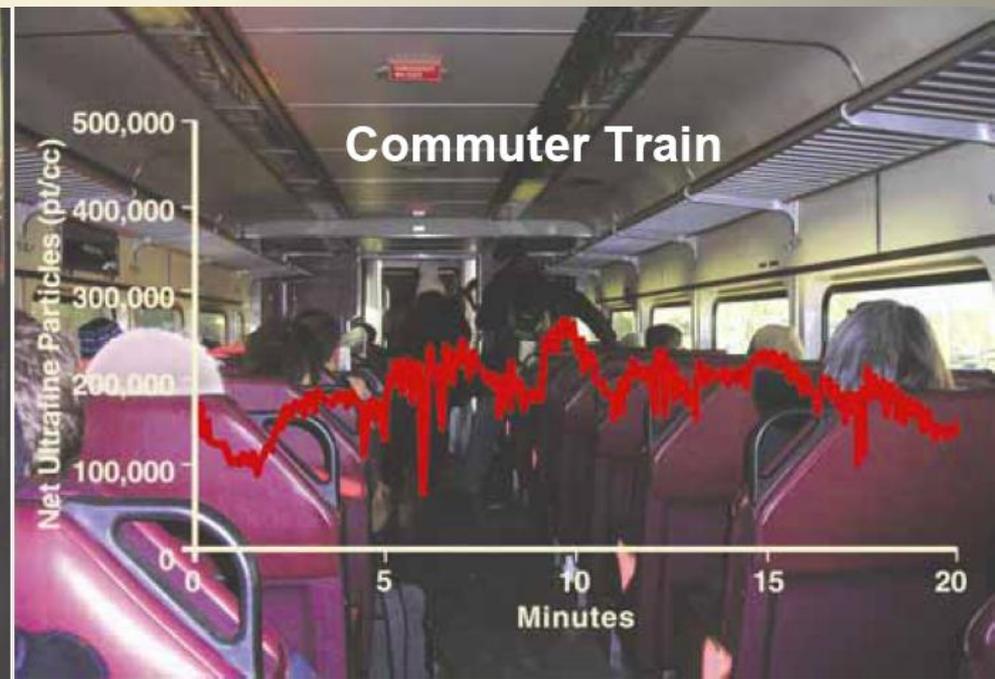
- Gaseous Pollutants
  - Carbon Monoxide
  - Nitrogen Oxides
  - Sulfur Dioxide
  - Ozone
- Particulate Matter Pollutants
  - Directly emitted (soot, black carbon)
  - Created as a result of transformation i.e. sulfur dioxide to sulfate
  - PM 10, PM 2.5, Ultra-Fine Particles



Concentration of Diesel Exhaust

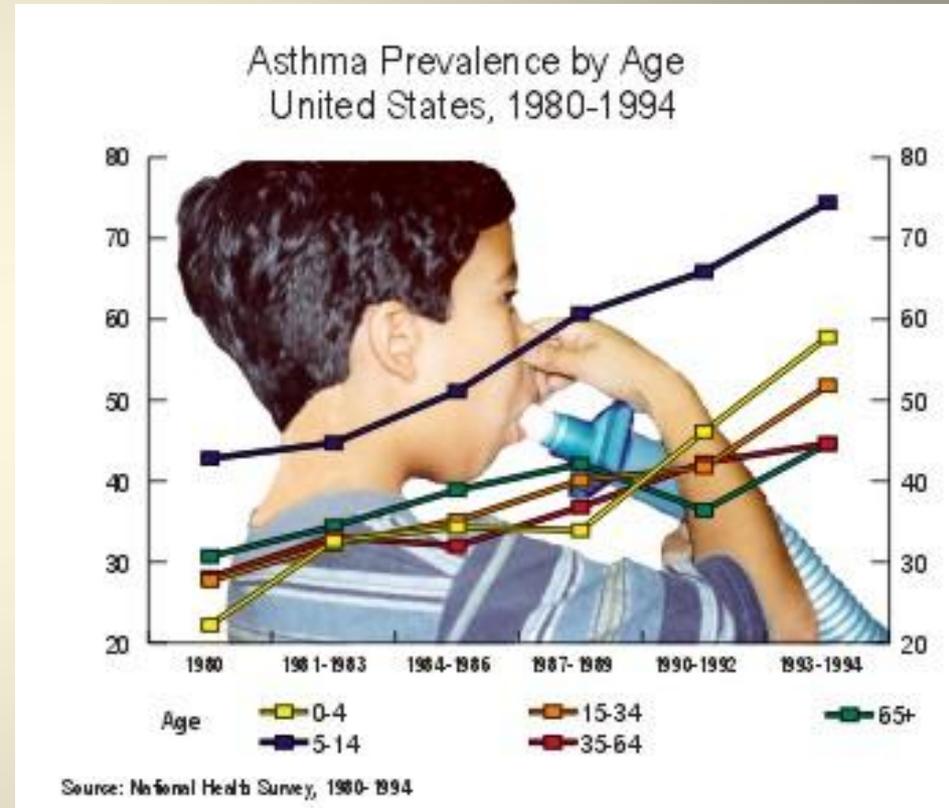


# High Levels of Diesel Exhaust inside Trains, Transit Buses and School Buses



# Acute Particle Pollution Exposure

- Irritation to the eyes, nose throat and lungs
- Neurological effects such as lightheadedness
- Cough
- Exacerbate asthma and difficulty breathing



# Chronic Particle Pollution Exposure

- Decreased lung function
- Development of chronic bronchitis
- Irregular heartbeat
- Nonfatal heart attacks
- Premature death in people with heart or lung disease
- Bladder Cancer
- Heart Disease
- Nervous System Impairment
- Stroke
- DNA Damage

# Sensitive Populations

- Children
- Elderly
- Truck drivers, bus drivers, dock workers, railroad workers, construction workers
  - A 1999 study published by the American Journal of Public Health concluded that workers exposed to diesel exhaust have a 47% higher risk of lung cancers relative to unexposed workers.



Clean Air Task Force

# OCCUPATIONAL EXPOSURE

- Railway Workers
  - Workers in jobs with diesel exhaust exposure had a 2.5 increase of COPD mortality relative to those in unexposed jobs
  - An association between diesel exhaust exposure and lung cancer mortality was reported in a study of 55,000 US railroad workers
  - Nervous system impairment
- Trucking Industry Workers
  - A 2007 Harvard study of 54,000 workers in the trucking industry found a higher risk of in heart disease in the trucking industry compared to the general population
    - 49% higher for drivers
    - 32% higher for dock workers
    - 34% higher for shop workers
- All Diesel-Related Industry Workers
  - 50% increased risk of colon cancer in men related to diesel engine emissions exposure
  - 47% higher risk of lung cancers relative to unexposed workers
  - Premature death due to heart and lung disease
  - Risk of blood clots and stroke more than double within 2 hours exposure to high levels of fine particulates
  - Many studies link asthma, allergic sensitization, respiratory infections, and chronic bronchitis to exposure to diesel particles

# Nationwide Health Impact of Diesel Fine Particles

## Annual Cases in the U.S., 2010

Premature Deaths	21,000
Lung Cancer Deaths	3,000
Hospital Admissions	15,000
ED Visits for Asthma	15,000
Asthma Attacks	410,000
Chronic Bronchitis	12,000
Non-fatal Heart Attacks	27,000
Work Loss Days	2,400,000
Restricted Activity Days	14,000,000

## Local Impact: Rhode Islanders Suffer from Diesel Pollution Each Year

Premature deaths as a result of exposure to particulate matter: 50

Heart attacks: 80

Asthma attacks: 900

Child respiratory problems: 1,400

Missed days of work: 5,500

***-Providence County ranks among the worst six percent of all counties in the United States for health impacts from diesel pollution.*** The average lifetime cancer risk from diesel soot for Providence County residents is 330 times higher than the acceptable risk level determined by the United States Environmental Protection Agency. ***Other Rhode Island Counties rank, at best, in the worst twenty percent.***

***-Rhode Island has the 5<sup>th</sup> highest asthma rate in the country and the 3<sup>rd</sup> highest in the Northeast***

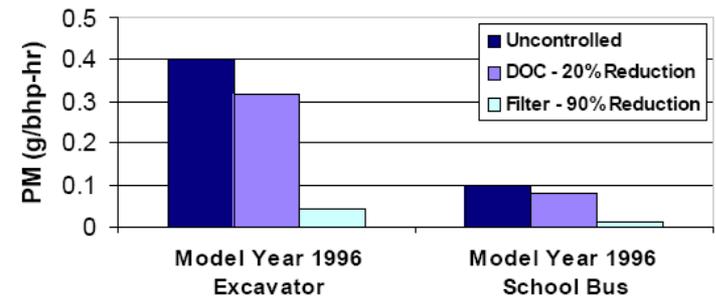
***-Those living in urban centers are affected most severely from exposure to diesel particles***

# Solutions

- Action
  - Anti-Idling
  - Retrofitting Existing Engines
  - Replacing vehicles with 2007 or newer engine models
  - Cleaner Fuels
- Process
  - Local Level Government Action
  - State and County Clean Diesel Programs
  - Private Company Investment



**Diesel Vehicle Emissions:  
Uncontrolled vs. With Retrofits**



*Retrofit filters used in conjunction with ultra-low sulfur fuel can reduce 90% of fine particulate matter pollution; a cheaper diesel oxidation catalyst (DOC) can cut 20%. "Uncontrolled" means the engine operates to the standard for the year in which it was sold (in this example, MY1996) absent any modifications to the engine or after-treatment emission controls.*

