

An Overview of EPA's Mobile Source Air Toxics Programs

Air Toxics Summit

EPA Region III

June 15-16, 2004

Brian Rehn

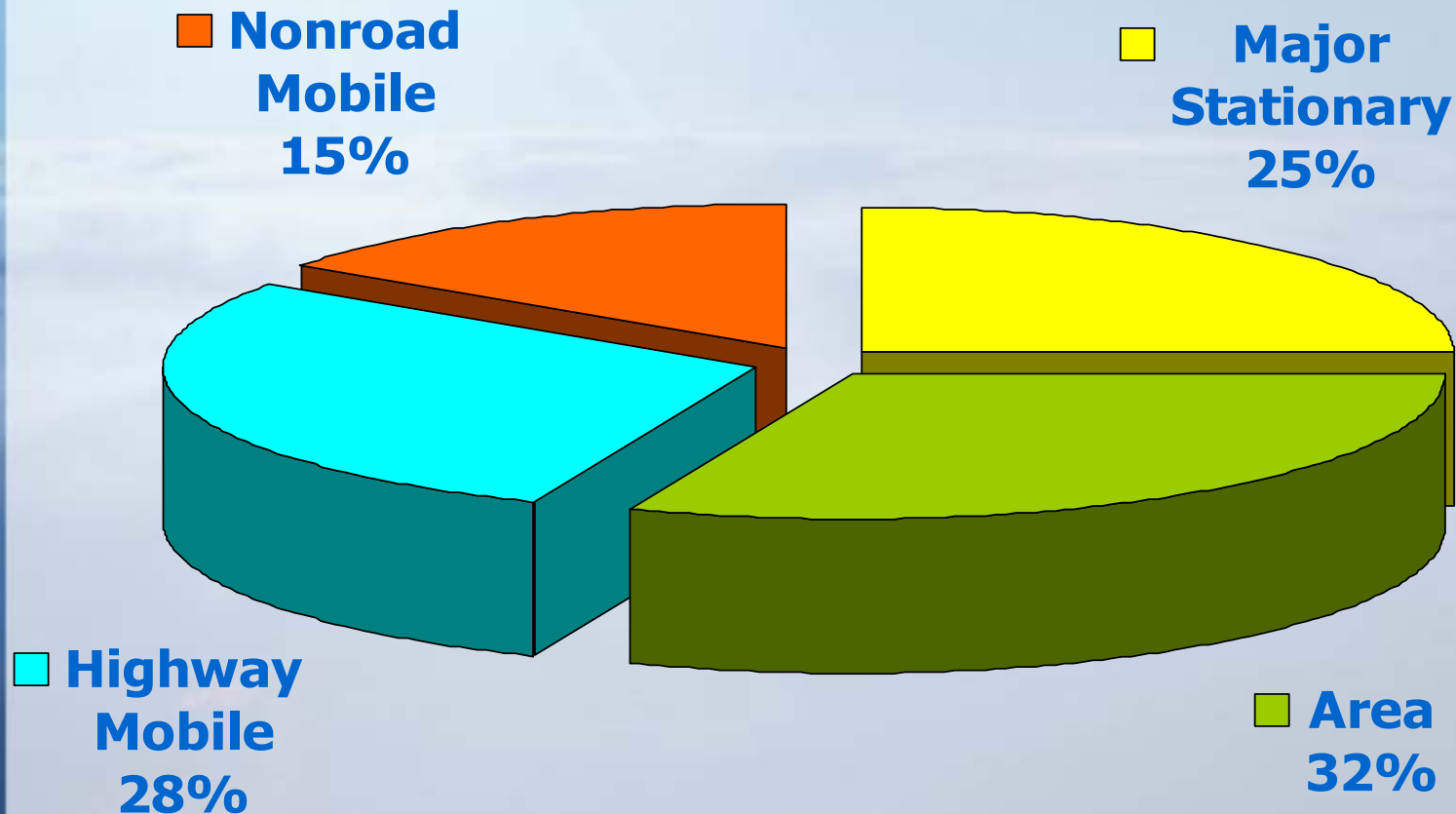
The Problem...

Air Toxics From Mobile Sources

How much do mobile sources contribute to air toxic emissions?

1999 National Toxics Inventory -- 188 HAPs*

*Does not include diesel PM.



Toxics vs. Ozone and PM

- Toxics and ozone/PM programs overlap
- Many mobile source air toxics are VOCs (ozone precursor)
 - e.g., benzene, aldehydes
- Other mobile source air toxics are PM
 - Diesel exhaust

EPA-Designated Mobile Source Air Toxics

- Acetaldehyde
- Diesel PM + OG
- MTBE*
- Acrolein
- Ethylbenzene*
- Naphthalene*
- Arsenic Compounds
- Formaldehyde
- Nickel Compounds
- Benzene*
- n-Hexane*
- POM
- 1,3-Butadiene
- Lead Compounds
- Styrene
- Chromium Compounds
- Manganese Compounds
- Toluene*
- Dioxins/Furans
- Mercury Compounds
- Xylene*

*Found in evaporative as well as exhaust emissions.

Which Mobile Source Air Toxics Pose the Greatest Potential Risk?

- Diesel exhaust (PM and organic gases)

National drivers

- Acrolein
- Benzene
- Formaldehyde

Important national contributors

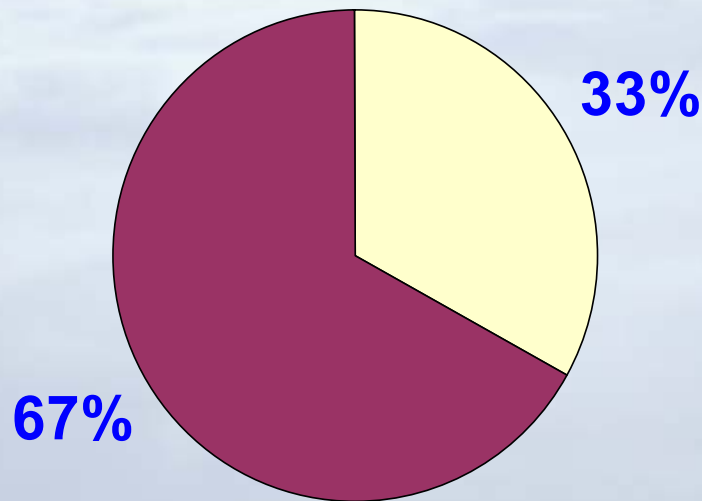
- Acetaldehyde
- 1,3-butadiene

Which Mobile Source Air Toxics Present the Greatest Potential Risks?

- Cancer risks from benzene and formaldehyde in NATA exceed 1×10^{-5} for more than half the U.S. population & exceed 1×10^{-6} for most of the U.S.
- Cancer risks from acetaldehyde and 1,3-butadiene exceed 1×10^{-6} in areas including more than half the U.S. population.
- Exposures to acrolein exceed reference concentration (RfC) for noncancer (respiratory effects) for nearly the entire U.S. population

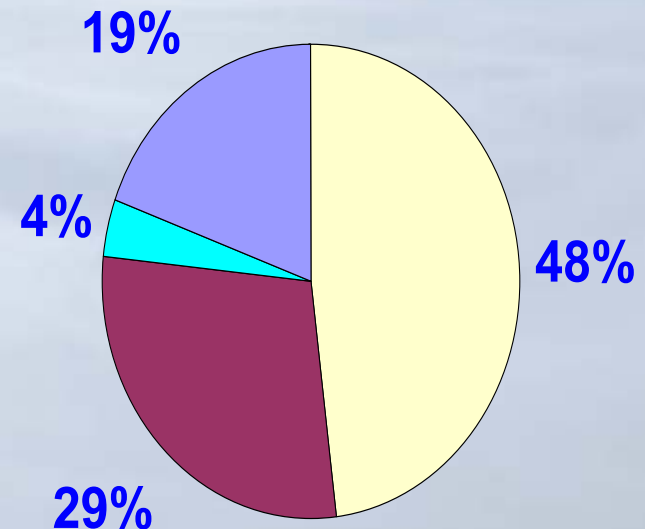
How much of the total exposure comes from mobile sources?

Diesel PM (Mobile Contribution)



On-Road Non-Road

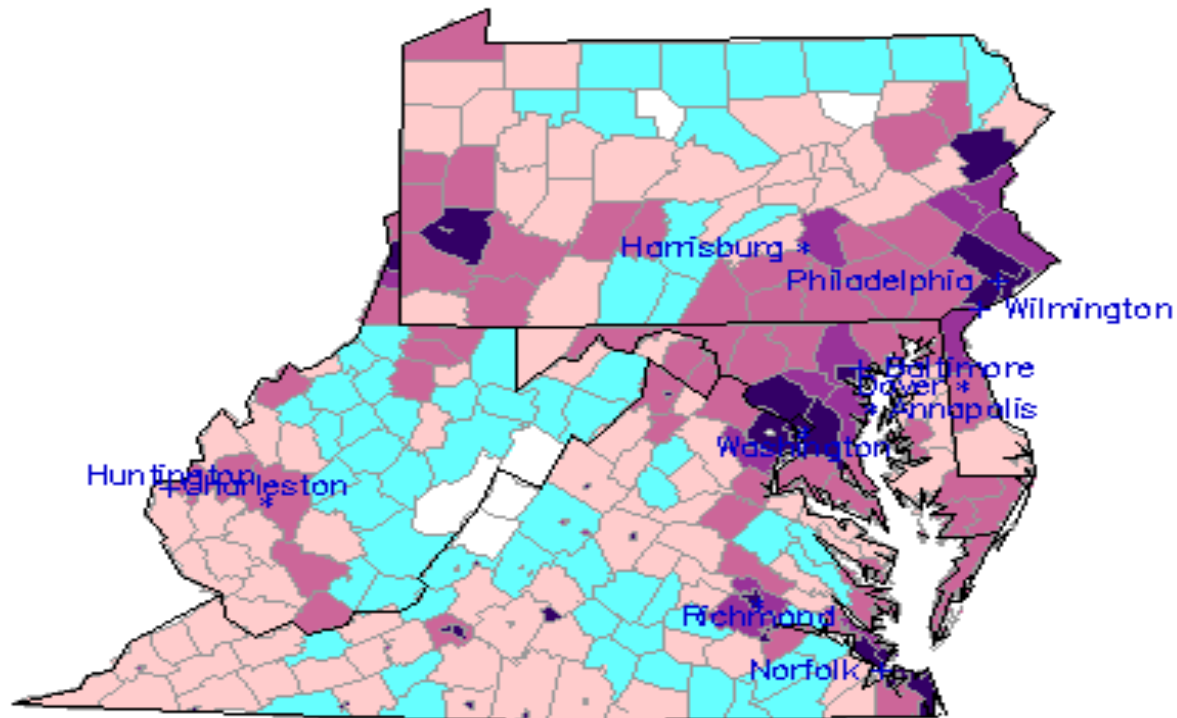
Benzene



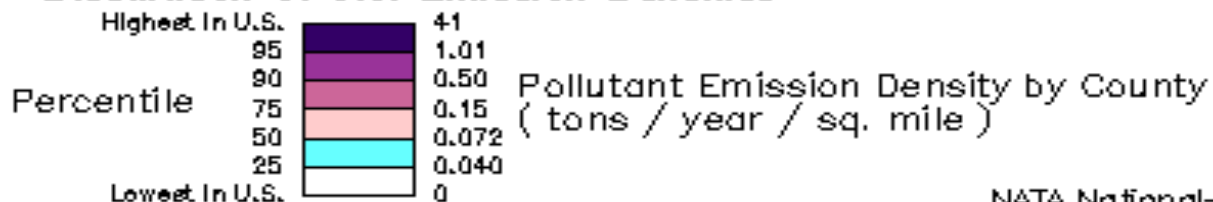
On-Road Non-Road Stationary Area

NATA Primary Benzene Emission Densities

1996 County Emission Densities
Benzene — EPA Region 3 Counties



Distribution of U.S. Emission Densities

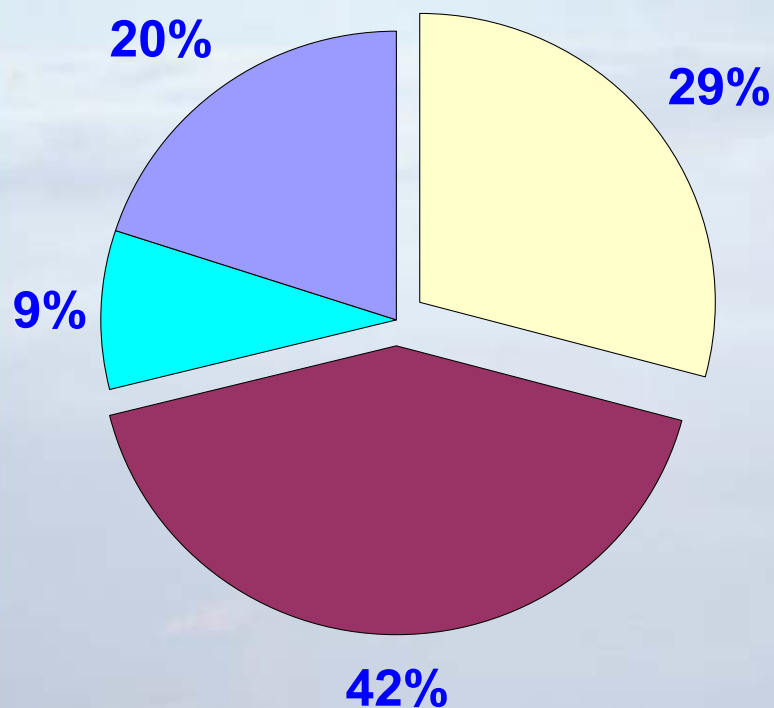


Benzene: Current and Future Trends

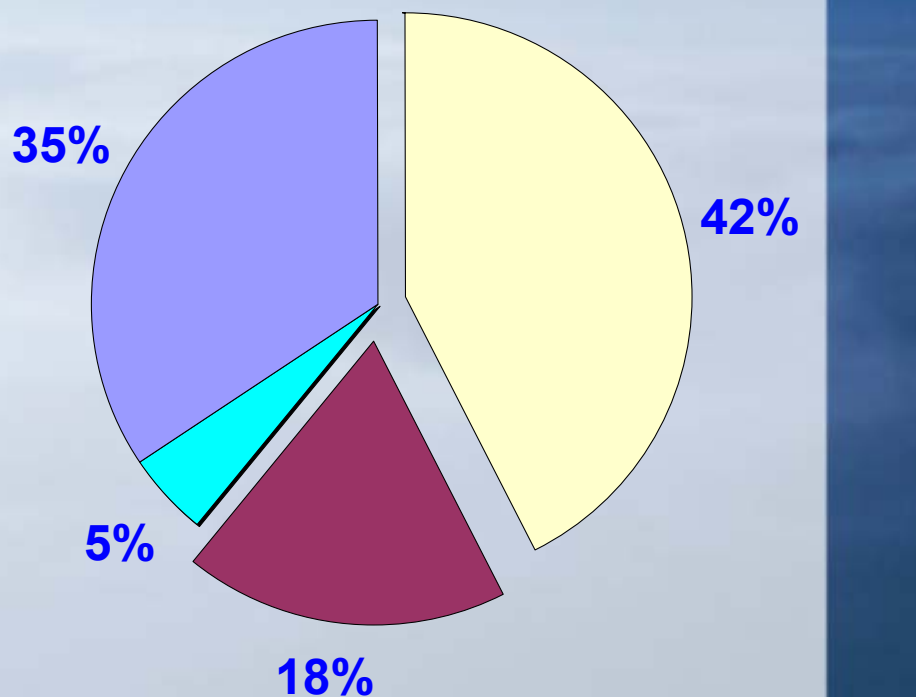
- Mobile sources dominate benzene inventory
 - About 59% in both 1999 and 2020
- Despite significant future decreases
 - Mobile source benzene to decrease 63% between 1996 and 2020
- Increasing importance of nonroad by 2020
 - Nonroad sources contribute as much benzene as onroad
 - Small gasoline equipment largest nonroad category
- Projected 2020 mobile source benzene inventory
 - Light-duty vehicles: 52%
 - Small gasoline equipment: 21%
 - Recreational marine: 9%

How much of the total exposure comes from mobile sources?

Acetaldehyde



1,3-Butadiene

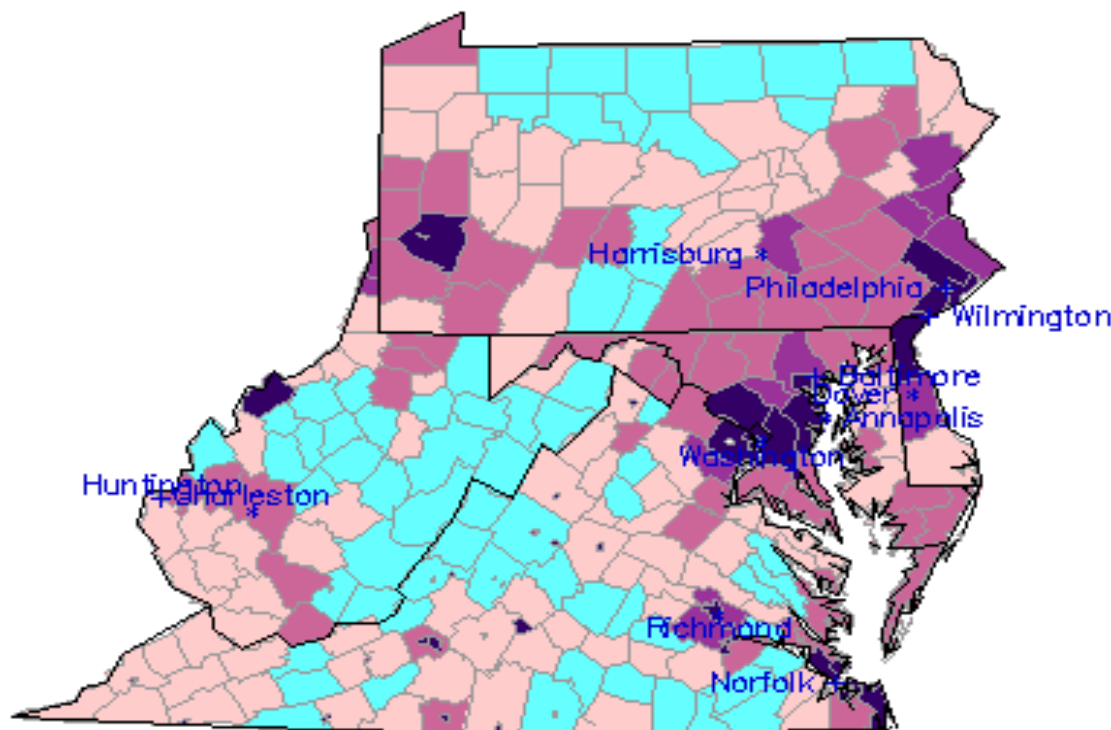


On-Road Non-Road Stationary Area

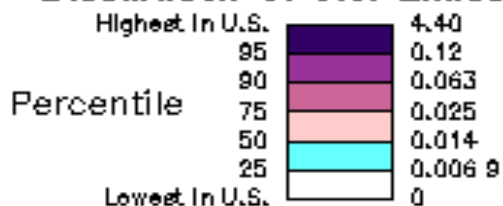
On-Road Non-Road Stationary Area

NATA 1,3-Butadiene Emission Densities

1996 County Emission Densities 1,3-Butadiene — EPA Region 3 Counties

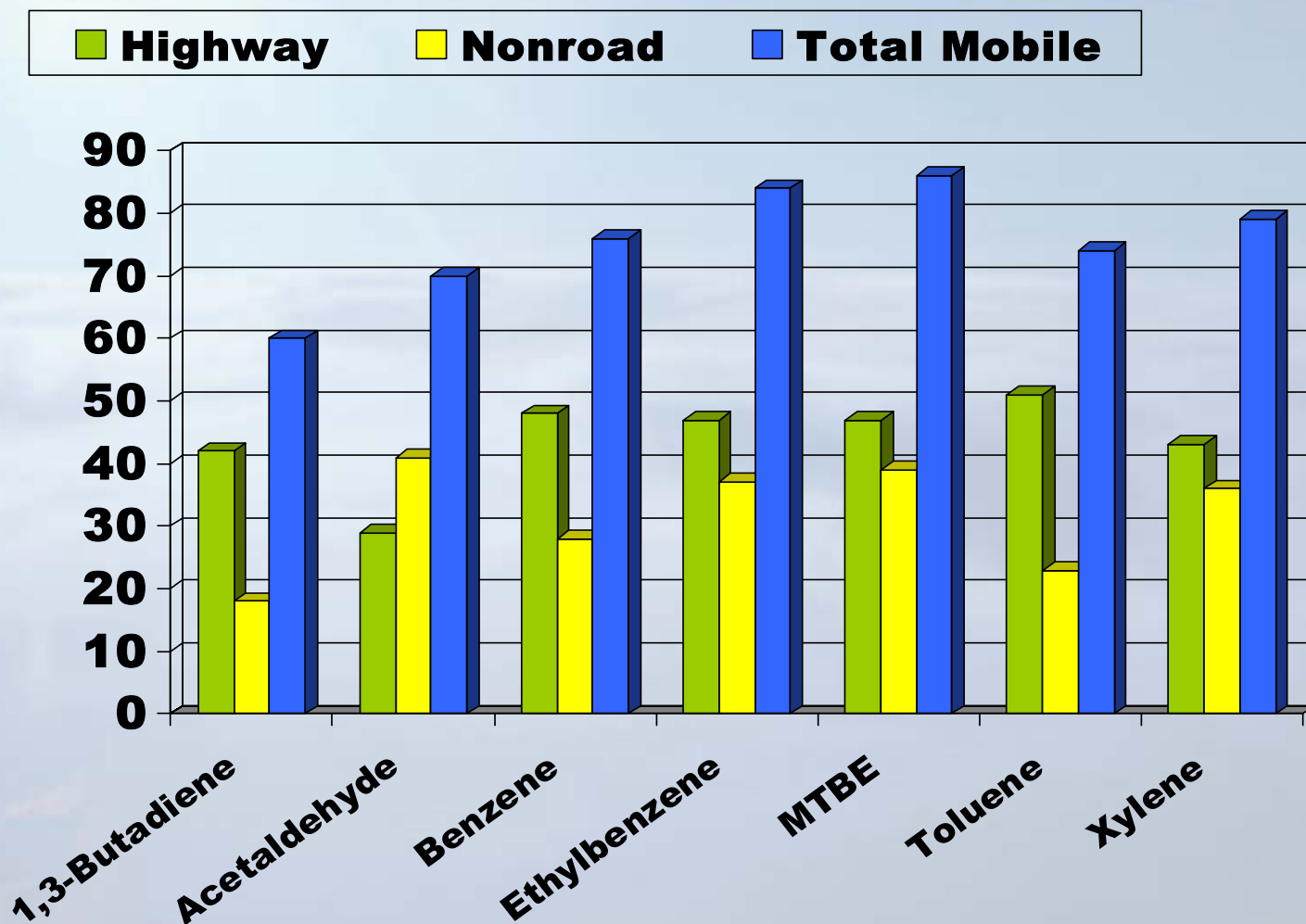


Distribution of U.S. Emission Densities



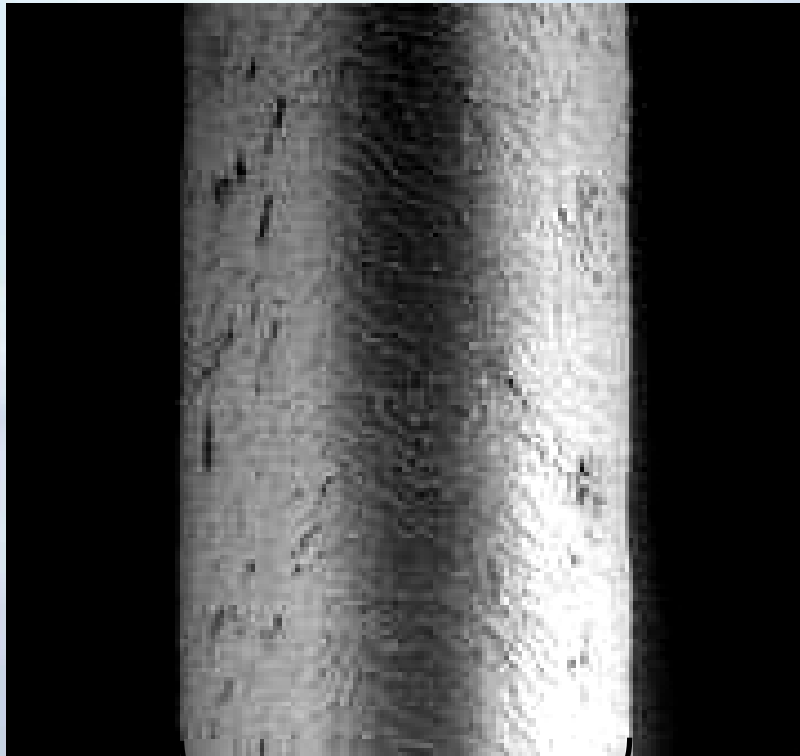
Pollutant Emission Density by County
(tons / year / sq. mile)

Highway/Nonroad Split of Select MSATs & Portion of Total National Emissions



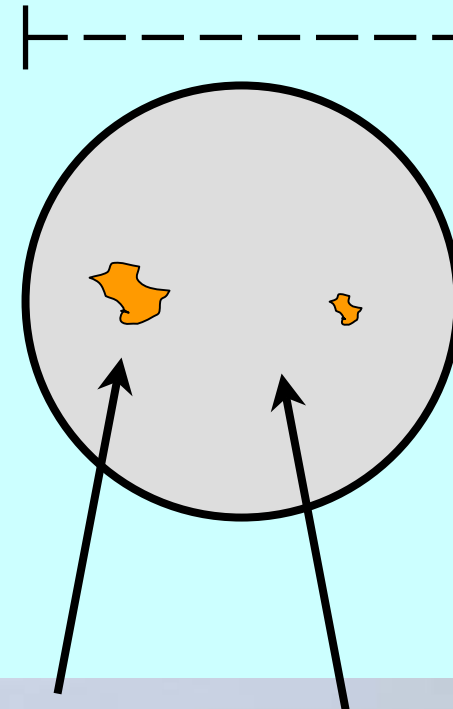
Mobile Source Diesel Exhaust / Direct Particulate Matter Emissions

Fine Particles – How Small are They?



Human Hair
(60 μm diameter)

Hair cross section (60 μm)



PM10
(10 μm)

PM2.5
(2.5 μm)

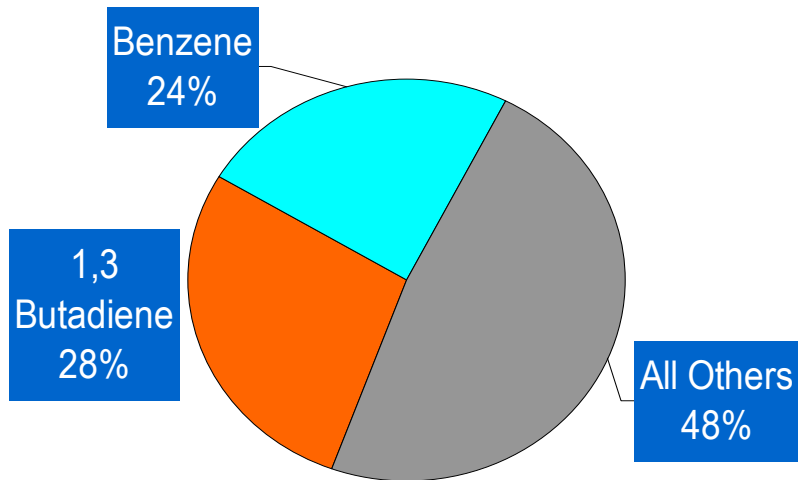
Diesel Exhaust

- Gaseous and PM phases are both designated mobile air toxics
- Likely human carcinogen at environmental exposure levels
 - Too many uncertainties to assign a cancer unit risk estimate (potency)
 - Precludes specific quantitative estimates of potential cancer risk
 - Ranks with other air toxics posing greatest relative risk
- Diesel PM also contributes to PM-2.5 non-cancer concerns
 - Respiratory effects
 - Cardiovascular impacts
 - Premature mortality

Diesel Exhaust and Air Toxics

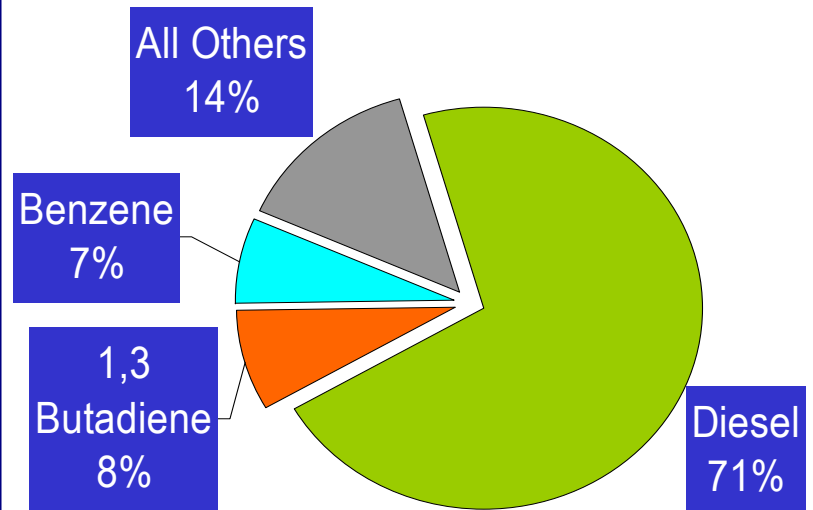
- Diesel may be posing the greatest air toxics risk
- From South Coast Air Quality Management District's Cumulative Toxic Risk Assessment:

Without Diesel



406
in a million

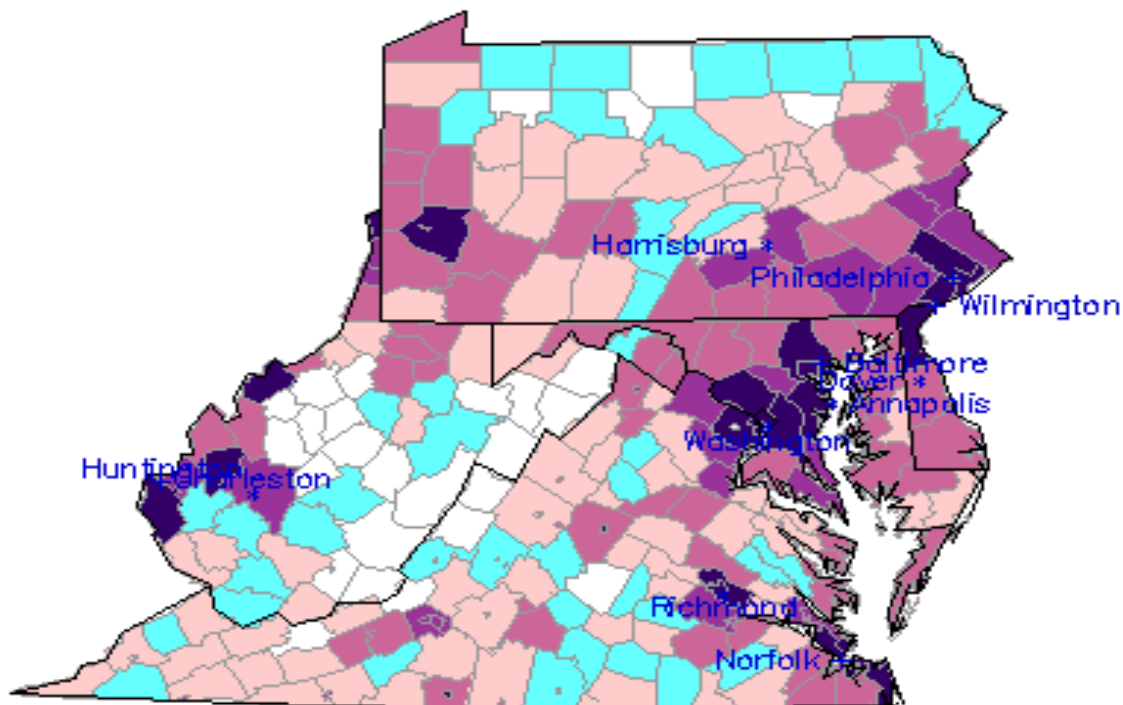
With CA Diesel Toxicity



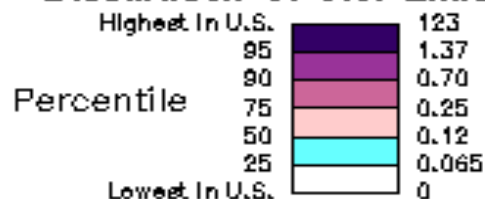
1,400
in a million

NATA Diesel PM Emissions Density

1996 County Emission Densities Diesel Particulate Matter — EPA Region 3 Counties



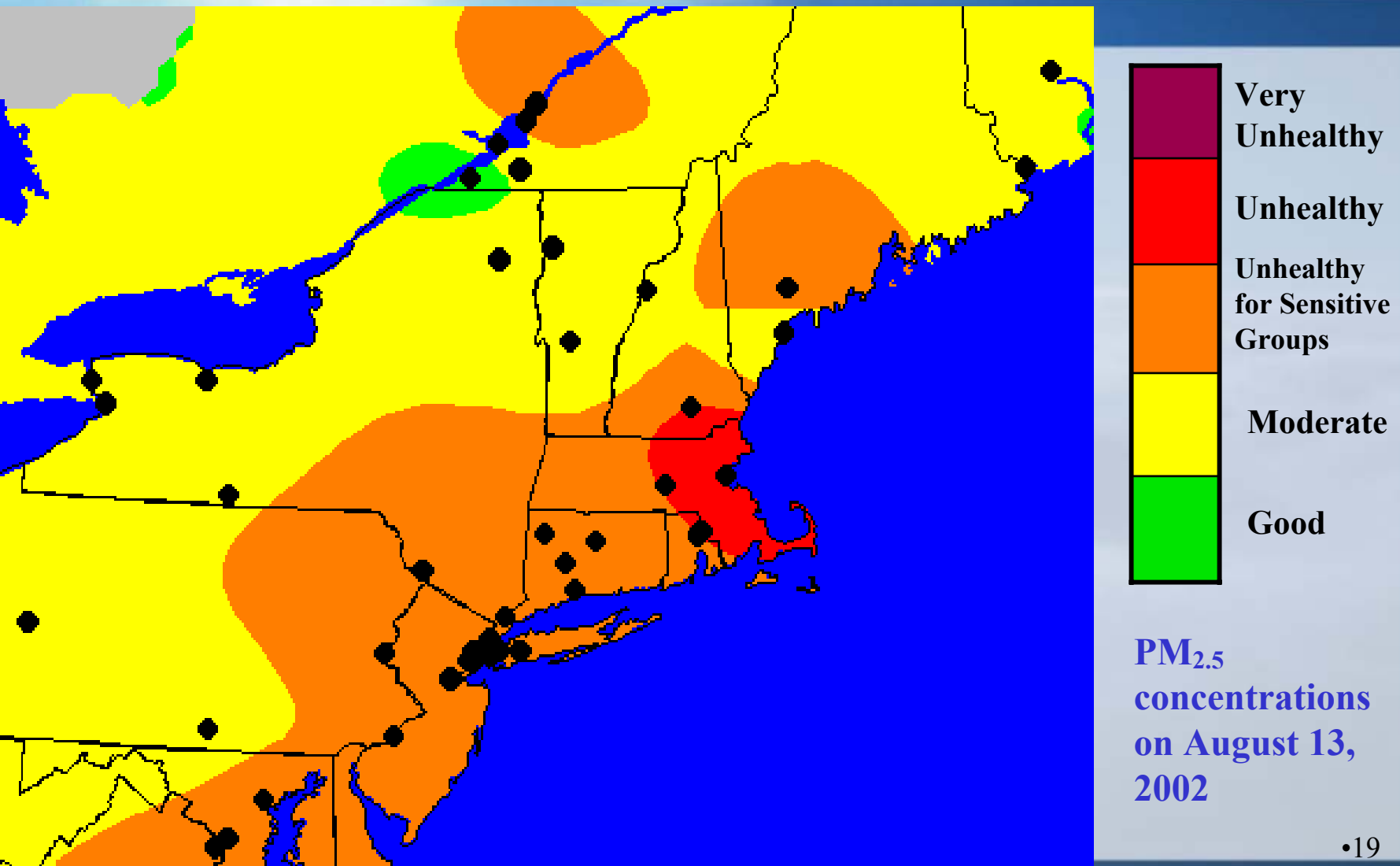
Distribution of U.S. Emission Densities



Pollutant Emission Density by County
(tons / year / sq. mile)

Source: U.S. EPA / QAQPS
NATA National-Scale Air Toxics Assessment

Unhealthy PM_{2.5} Levels Can Occur Over Broad Areas Across New England



PM 2.5 AQI August 13, 2002

Direct PM-2.5 Emissions

- Stationary sources dominate inventory
 - Mobile sources 26% in 1996 and 16% in 2020
- Mobile source inventory in 2020...
 - Significant reductions in highway diesel and land-based nonroad diesel
 - Commercial marine most significant diesel
 - Gasoline PM almost 50% of mobile inventory

Mobile Source Direct PM-2.5 Projections

- **2020 Mobile Source Direct PM Inventory**
 - Nonroad gasoline: 24%
 - Commercial marine diesel: 23%
 - Highway gasoline vehicles: 16%
 - Nonroad diesel: 16%
 - Aircraft: 9%
 - Highway diesel: 6%
 - Locomotives: 5%

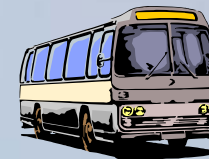
What Control Measures Can We Take to Reduce Mobile Source Air Toxics?

What Is Being Done to Reduce Risks From Mobile Source Air Toxics?

- Existing mobile source control programs will significantly reduce toxic emissions
 - Tier 1, NLEV and Tier 2 standards on light duty cars & trucks / ultra-low sulfur gasoline
 - 2004 and 2007 highway diesel standards/ultra low sulfur diesel fuel (& heavy duty diesel consent decree)
 - Nonroad diesel standards (phase-in from 2008-2015) / ULS diesel
 - Reformulated gasoline
 - Enhanced evaporative emission standards for vehicles
 - Inspection/Maintenance (I/M) program
 - On-Board Diagnostics (OBD)
 - Nonroad emission standards

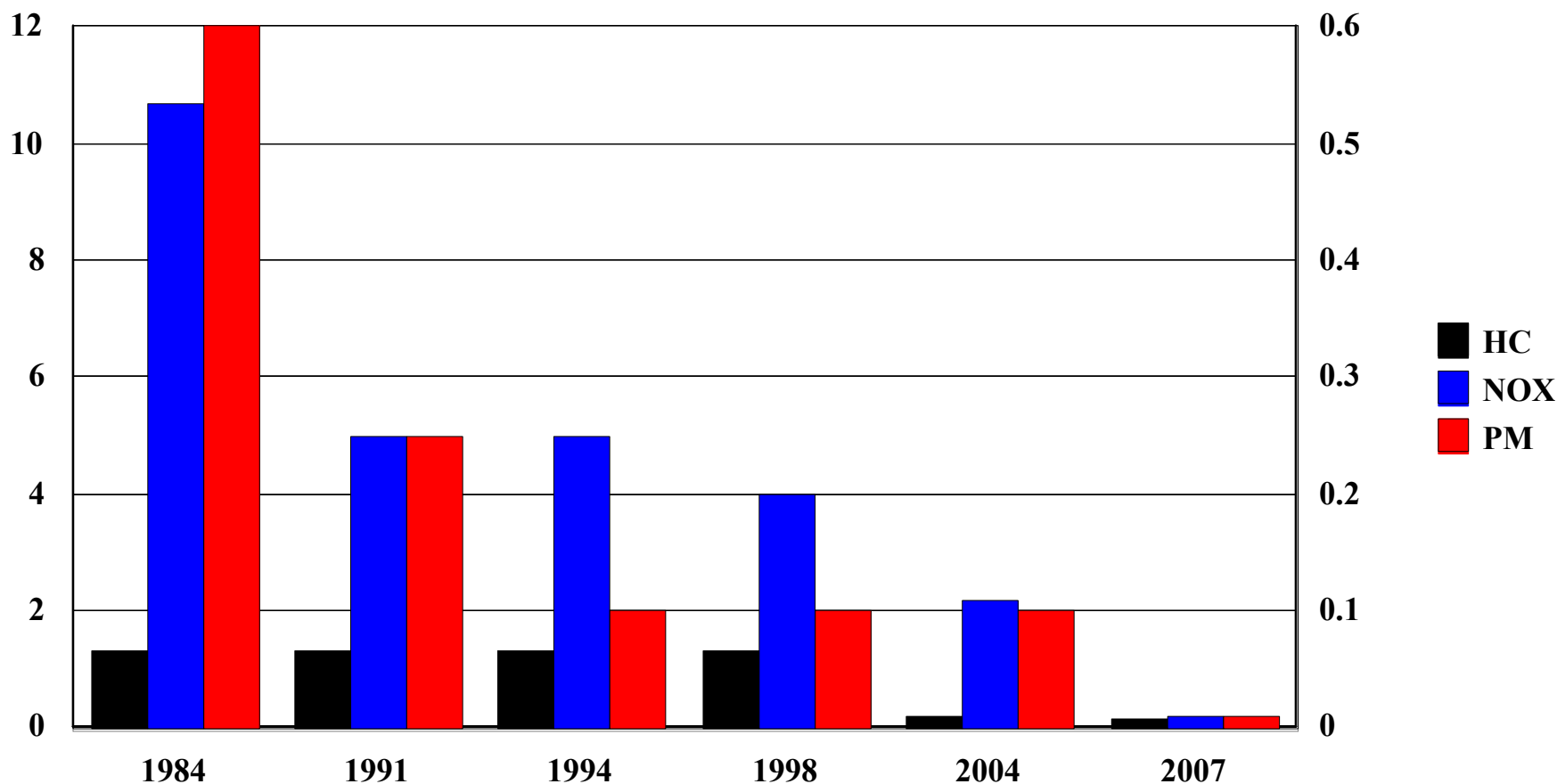


EPA Emission Standards for Trucks & Buses



HC, NO_x
(g/bhp-hr)

PM
(g/bhp-hr)

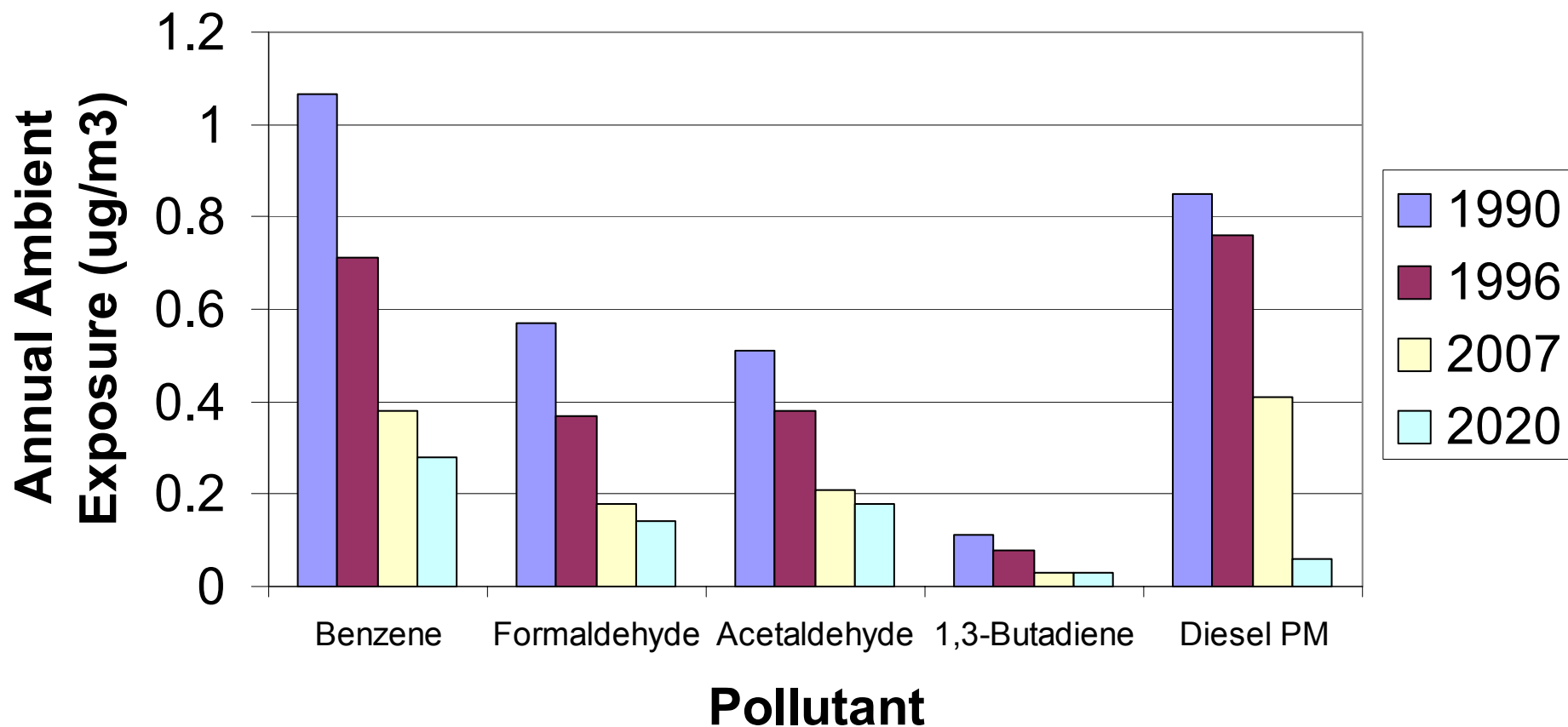


Effects of Existing Programs

- Existing program driven primarily by need for VOC and PM reductions to meet NAAQS
 - Toxics reductions were not a primary focus in their adoption
- By 2020, we predict on-highway emissions will be reduced by 67-94% from 1990 levels
 - For benzene, formaldehyde, 1,3-butadiene, acetaldehyde, diesel PM

Projected Impact On Exposure to Motor Vehicle Toxics from Current & Planned Controls

Between 1990-2020, 65-75% reductions in inhalation exposures to gaseous air toxics emitted from highway vehicles, 90% reduction for diesel PM



Mobile Source Air Toxic Initiatives Underway

- **Non-road emissions are key focus for future programs**
 - Non-road is dominant source of PM in the future
 - May 2004 nonroad diesel rule addresses this issue
- **New regs underway to address many of these sectors**
 - Locomotive and marine: ANPRM in May 2004
 - Small gasoline engines: NPRM expected December 2004
 - Lawn and garden equipment
 - Outboard marine engines, jet skis
 - Toxics issues and benefits will be identified
 - Lawn and garden poses potentially high exposure
 - Exposure study ongoing by ORD/National Exposure Research Laboratory (NERL)

Mobile Source-Related Voluntary Programs

- **Diesel retrofits**
 - Trucks, construction equipment, buses
- **Clean School Bus USA** (reduced school bus emissions)
- **Anti-idling programs**
 - Ordinances, education, truck stop electrification
- **VMT reduction strategies / TCMs**
 - Best Work Places for Commuters
- **Transportation planning**
 - New facilities
 - Operational improvements on existing facilities
- **Smartway Transport** (improved freight movement)

More Examples of Voluntary Programs for Consideration by State/Local Govts

- **Low emission fuel can programs/distribution**
- **Lawnmower and gas can buybacks**
- **Community-based programs**
- **Land use planning**
 - Schools, hospitals, nursing homes, residences
 - Terminals, garages, etc.
- **Improved Landscaping practices**

Incentives for Voluntary Programs

- **Ozone Early Action Compacts**
- **PM nonattainment areas**
- **Ozone nonattainment areas**
- **Children's health**
- **Fuel savings**
- **Employee productivity/retention**
- **Address public nuisance**
- **Quality of life issues**
 - Noise, traffic congestion, safety

Incentives for Voluntary Programs (cont')

- **Ripe for coalition building**
 - Wide variety of actors can implement voluntary programs
 - Governments, businesses, individuals
 - Wide variety of constituencies
 - Identify and leverage community concerns

EPA's Mobile Source Air Toxics Rule

General Clean Air Act Authority to Regulate Mobile Sources

- EPA has broad authority to regulate...
 - On-road vehicles and engines
 - Non-road engines and vehicles
(e.g., construction, agricultural equipment)
 - Fuels and fuel additives
- ...that cause or contribute to air pollution that may endanger public health or welfare

Specific Mobile Source Air Toxics Clean Air Act Authority

- **Section 202(l) specifically addresses mobile source-related air toxics, in two parts:**
 - Study the need for and feasibility of controlling air toxics from vehicles and fuels
 - Then, set standards for HAPs from vehicles and/or fuels
- **Requires vehicle and/or fuel standards that achieve greatest reductions available within cost and available technology constraints**
- **Specifically, 202(l)(2) states they must:**
 - “reflect the greatest degree of emission reduction achievable through the application of technology which will be available, taking into consideration the standards established under [section 202(a)], the availability and cost of the technology, and noise, energy, and safety factors, and lead time”

Mobile Source Air Toxics Rule - March 2001

- EPA issued 202(l) rule on March 29, 2001
- Identified 21 mobile source air toxics
- Toxic emissions performance standard for gasoline
 - Anti-backsliding
 - Applies to refiners
- Analyzed effects of existing programs
- Committed to future research and rulemaking
 - Reassess need for and feasibility of controls
 - Scheduled rulemaking - proposal July 2003; final July 2004
- Technical analysis plan identified data gaps

Next Mobile Source Air Toxics Rule- Key Remaining Needs / Status

- Technical analysis plan identified future issues
 - Hot spots and high-end exposure
 - Exposure in microenvironments
 - Emission factors for nonroad sources
 - Effectiveness and costs of controls
- EPA committed in 2001 rule to:
 - Re-evaluate need for & feasibility of additional controls
 - Emissions reductions, costs, cost-effectiveness
 - Now planning to propose in December 2004
- Environmental groups have filed deadline suit
 - Sierra Club and U.S. PIRG

The Next Step – Issues For the Next Mobile Source Air Toxics Rule

Issue: Quantifying Health Benefits

- **Current limitations:**
 - Much existing work focuses on average exposure and risk across broad geographic areas
 - High-end exposures and populations not addressed
- **How to extrapolate from local data to draw national conclusions?**
 - Population and activity near roadways
 - Current and future projected
- **Concern: Magnitude of health benefits**
 - Future risk levels may still be in range of concern

Challenges and Research Needs

- We are taking into consideration:
- Ambient hot spots (their causes and impacts)
 - Monitoring network has limited ability to detect near-roadway hot spots (mobile source related)
 - Conducting near roadway exposure assessments
- Local toxics assessments
- Microenvironments (mobile or mobile impacted)
- Full range of personal exposure

Hot Spot Exposure Assessment

- Characterizing hot-spot exposures, risks
 - How do concentrations vary? (e.g. across a city, over a day)
 - How hot are hot spots? How prevalent are they? What do mobile sources contribute?
- Synthesis of info from several sources – real world personal exposure monitoring (at home, school & outdoors)
 - Hot spot exposure monitoring studies
 - GIS Analysis of RIOPA monitoring data set
 - Local-scale modeling assessments
 - Contrast with NATA and more regional monitors
- Need to consider effects of future controls on hot spot concentrations

Hot-Spot Exposure Monitoring Studies

- Indoor/outdoor monitoring & personal exposure monitoring
- **Fresno Asthmatic Children's Env. Study (FACES)**
 - Effect of PM on 450 asthmatic children
 - Monitoring ~100 homes, ~25 schools
 - Some near roadways
 - Analysis complete Fall 2004
- **Baltimore Traffic Study**
 - Focuses on a rowhouse on heavily traveled roadway
 - Traffic volume, speed, vehicle type
 - Vehicle counter and video
 - Final results August/Sept 2004



Sampling
Manifold

Vehicle
Counter

7/13/2004

Baltimore Traffic Study

Microenvironments

- **School bus study of in-vehicle exposure**
 - Final Report Dec. 2003
- **North Carolina highway patrol officers study (COPPS)**
 - Several papers published

Other Issues To Consider In the Upcoming Mobile Source Air Toxics Rule

Potential Control Measures Under the MSAT Rule *

- Fuels
- Gas cans (portable fuel containers)
- Vehicles / Nonroad Equipment

Potential Fuel Program Options

- Benzene and/or air toxics standards
- Extend RFG program to a wider area
 - Existing standards, or current actual levels
- More stringent toxics standards in RFG areas (or in an expanded program)

Portable Fuel Containers

- CARB adopted standards in 1999
 - OTC has model rule; all Region III OTR states have adopted
- Self-sealing spout to prevent spillage, evap emissions
- Single opening (no secondary vents)
- Low permeation
- CARB currently revising program
 - Adding certification program
 - Improving spout design

Portable Fuel Containers (cont')

- **Significant contributor to VOC inventory**
 - 500,000 tons of VOC in 2020
 - 13% of 2020 mobile source VOC inventory
 - 2% of 2020 mobile source benzene inventory
- **Controls could reduce gas can VOC by 73%**
- **Cost-effective**
 - \$400-\$700/ton VOC
- **Could have important exposure impacts**
 - Reduce indoor exposure from attached garages

Mobile Source Quantification Tools and Methods

Estimating Highway Mobile Source Emissions

- MOBILE6.2 finalized earlier this year
 - VOC, NO_x, PM, toxics capabilities
- User-friendly version of MOBTOX model used by EPA and others since 1993
- MOBILE6.2 estimates motor vehicle emissions of:
 - benzene (exhaust and evap)
 - formaldehyde
 - acetaldehyde
 - 1,3-butadiene
 - acrolein
 - MTBE (exhaust and evap)

Quantification Tools

- **Retrofit benefits calculator**
 - PM, but not VOCs or gaseous toxics
- **COMMUTER model**
 - VOCs, but not toxics specifically
- **SmartWay calculator**
 - Under development
- **...Broader scale / longer-term efforts**
 - Dispersion modeling
 - Health benefits of PM reductions

Quantification Methods

- Variety of guidance documents on estimating emission reductions
 - Locomotive and truck idling programs
 - Transportation control measures
 - Land use measures

Air Quality and Exposure

- Local-scale air quality modeling efforts
 - Provide local, more detailed motor vehicle emissions
 - Facilitate finer resolution air quality modeling
 - Improving our ability to capture spatial gradients
 - Houston – Technical report 2002; journal article January 2004
 - Portland, OR – Fall 2004
 - Philadelphia – 1999 modeling complete; 2010 in progress

Federal Grants and Other Funding for Mobile Source Air Toxics Programs

Clean School Bus USA

- EPA, in partnership with numerous organizations launched the Clean School Bus USA (CSB) initiative.
 - Goal: To ensure that by the year 2010, every public school bus on the road is clean, emitting less pollution and contributing to cleaner air.
 - Grant dollars will be provide to replace pre-1991 school buses with new clean school buses offering state-of-the-art emission control and safety features and to retrofit post-1990 school buses with similar advanced emission controls.

Clean School Bus USA (cont')

- Funding levels for grants of \$5 million in 2003 and an additional \$5 million in 2004 (nationwide):
 - **Region 3 2003 Projects:**
 - General McLean School District, Erie
 - North Allegheny School District, Pittsburgh
- President requested \$65 million in 2005 budget - a thirteen-fold increase from 2004

Supplemental Enforcement Project Grants

- VEPCO Mitigation Projects
 - R3 School Bus Retrofit Projects: VA, PA, MD and WV
 - Philadelphia Air Toxics Risk Reduction Program
 - Temple University Project
 - Coco-Cola Enterprises, Inc.
 - Waste Management
 - City of Philadelphia Waste Handling Vehicles
 - **\$4.5M in Projects**



Additional Funded Region 3 Projects

- EPA OTAQ Grant 2003:
 - Maryland Transit Administration Fuel Project: \$100K
- Allegheny County Health Dept.:
 - Penn Hill School District School Bus Retrofit \$185K
- In the works:
 - 2004 CSB grants \$5M
 - Sensitive Populations Grant 1.5M
- Diesel Difference grants



Map of EPA Funded Diesel Retrofit Projects



Smartways Transport Funding

- Idle reduction projects generating reductions
 - \$200K EPA reinvestment grant for fleets to install mobile idle reduction technologies on 80-100 trucks
 - EPA coordinating funding (using CMAQ funds + private investment) for 14 truck stop electrification projects in place, with more planned
- EPA is in its second round of idle reduction grants. EPA has an \$800k grant available for advanced truck stop electrification projects, to be awarded later this years

Idle Reduction Funding Opportunities

- EPA Grant Program
 - \$800,000 grant to States (envt., transp., or energy)
 - Deadline for Initial Proposals: May 21, 2004
 - Information: http://www.epa.gov/air/grants_funding.html
- DOT CMAQ
 - Stationary Idle Reduction projects eligible for CMAQ funds
 - Information:
<http://www.fhwa.dot.gov/environment/cmaqpgs/tsemem.htm>
- DOE Clean Cities Grant
 - Information
 - <http://www.ccities.doe.gov/support.html>
- DOT State Infrastructure Bank Loan Program
 - Information
 - <http://www.fhwa.dot.gov/innovativefinance/sib.htm>



Example of Truck Stop Electrification Technology

- Use of this device saves roughly .8 gallon/hour
- This translates to almost 2,000 gallons/year for each truck