

# DAIMLERCHRYSLER

**HEI Annual Conference 2005**

**Air Toxics Exposure and Health Effects**  
**Regulatory Issues and Legal Concerns**

**Baltimore, Maryland**  
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## Regulatory Issues and Legal Concerns

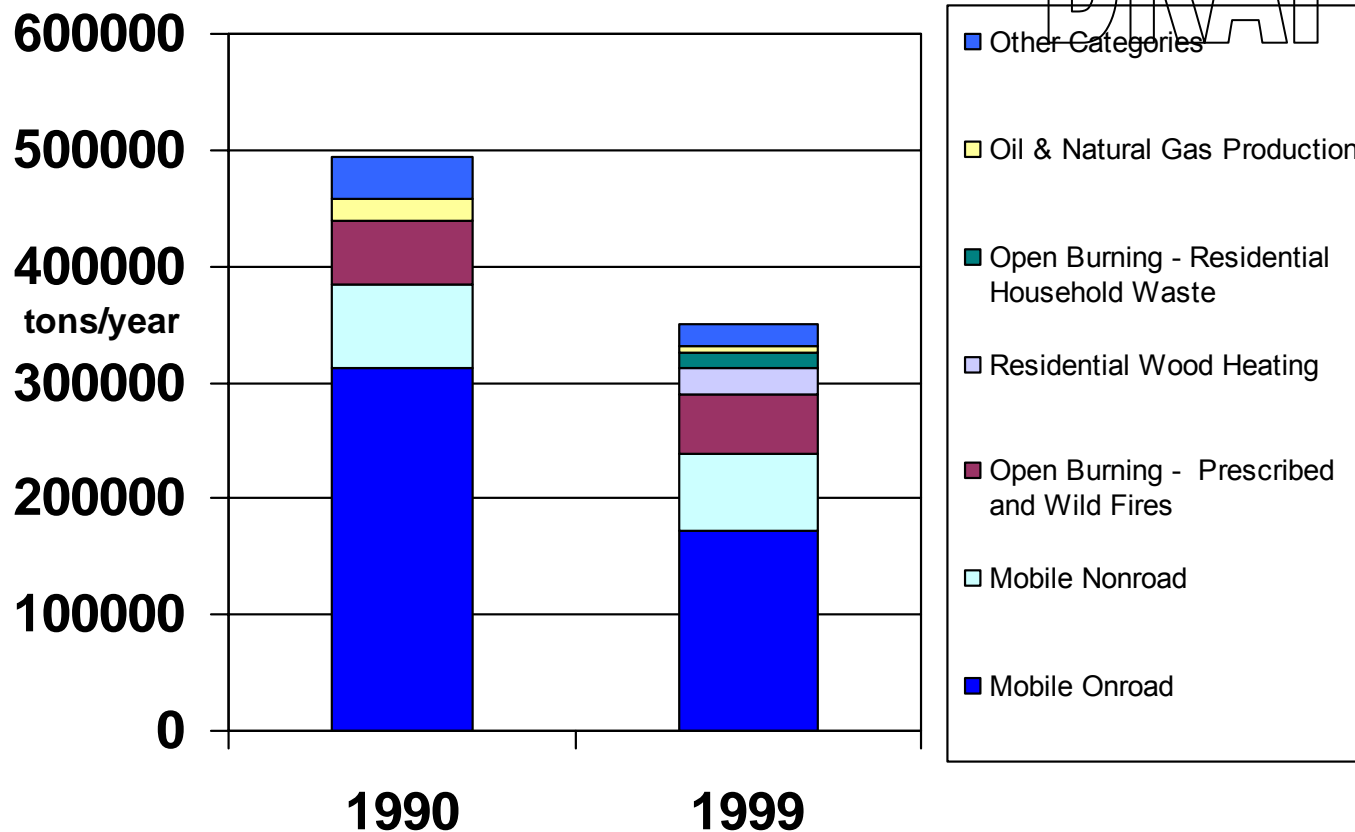
- Understanding the contribution of mobile source air toxics to population air toxics exposure
  - **NATA – National Air Toxics Assessment**
    - > **Best-available tool from EPA for estimating toxics inventories**
      - **National Scale Assessment of inventory, exposure, risk**
      - **Includes Source Sector Contributions**
      - **Estimates provided by county and census tract level**
  - **What does the NATA tell us at the macro level regarding the mobile source contribution to air toxics?**

## Mobile Source trends

- **1990 vs. 1999 NATA (DRAFT)**
  - > **Mobile source inventories are declining**
  
  - > **Most significant factors in this reduction are new emissions standards and fleet turnover**
    - **Tier 1, NLEV, California LEV programs**
  
  - > **Emissions will continue to decline beyond 1999**
    - **Tier 2 / LEV 2 emissions standards phasing in through 2007 (light-duty) and through 2009 (heavier LD trucks)**
      - + **Full turnover of the light-duty fleet by 2040**
  
    - **2004 and 2007 Heavy-Duty gasoline and diesel engine standards**

# Benzene emission trends in the 1990's

DRAFT

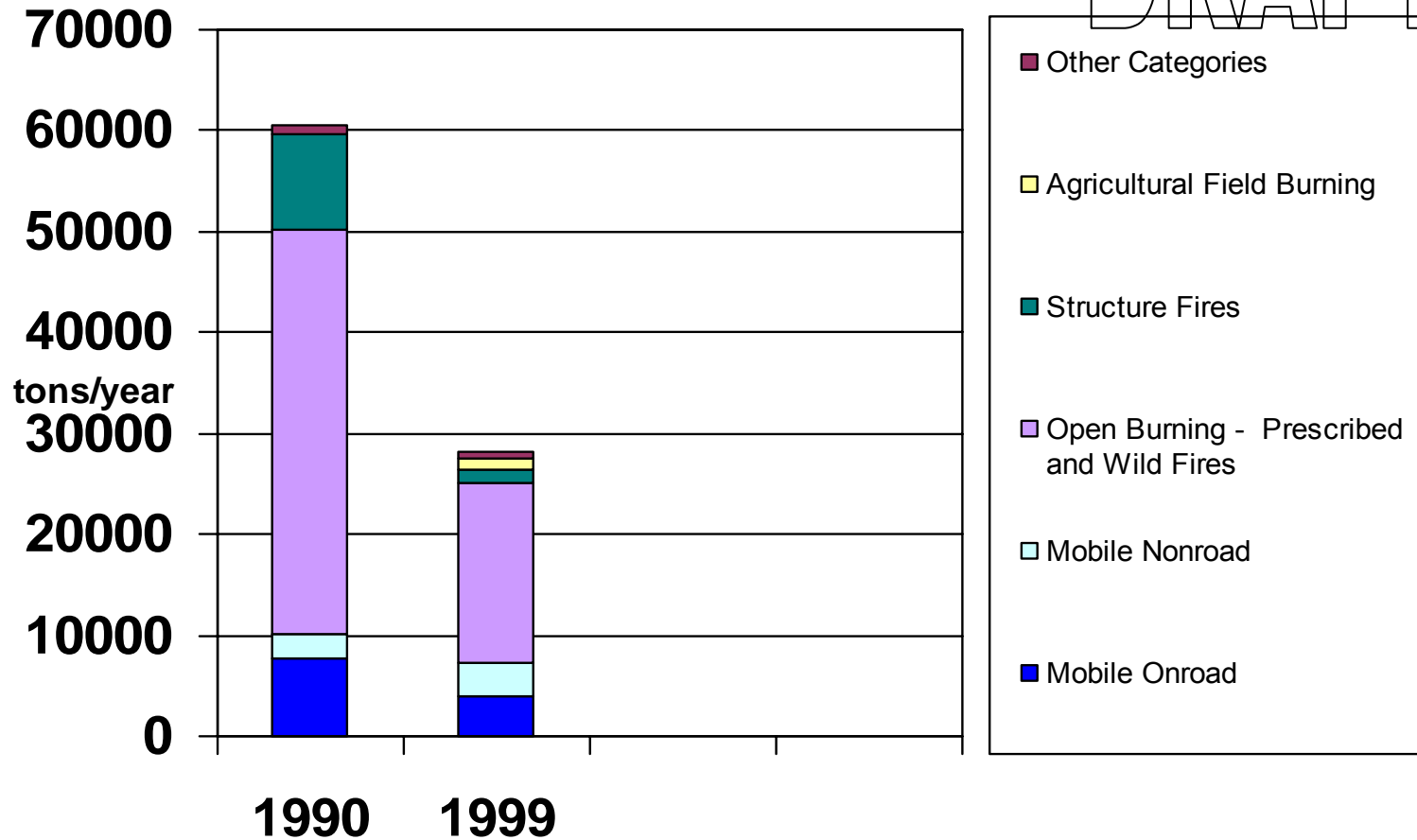


### Emissions reductions from 1990 to 1999

Mobile Onroad:	140,343 tons
Oil & Natural Gas:	11,892 tons
Petroleum Refineries:	5,654 tons
Mobile Nonroad:	4,591 tons
All Categories	142,657 tons

# Acrolein emission trends in the 1990's

DRAFT



**Emissions reductions from 1990 to 1999**

Mobile Onroad:	3,730 tons
All Categories	31,273 tons

# NATA

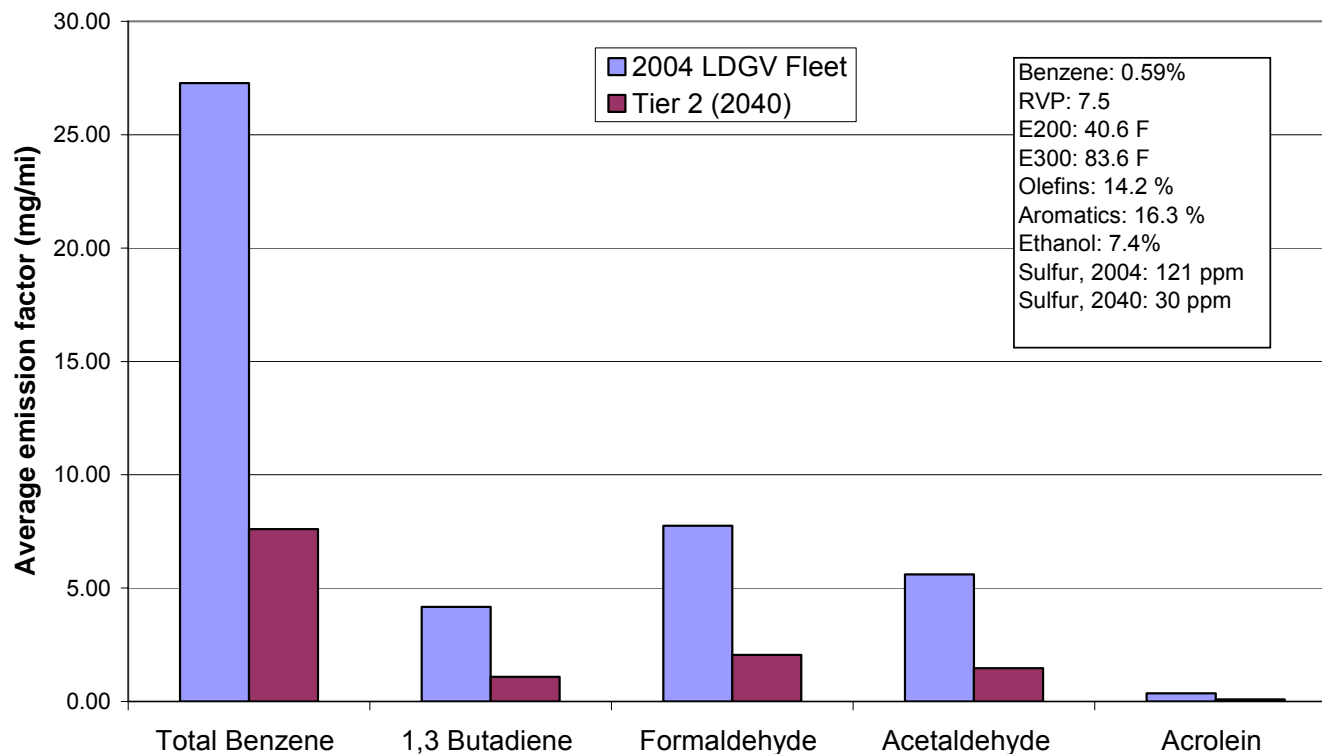
- What NATA doesn't tell us
  - **Many of the details we would need to know for exposure estimates**
    - > **Spatial/temporal distributions on a fine scale**
    - > **Personal exposure parameters of interest**
      - **Concentrations**
      - **Exposure time**
      - **Peak vs. average**
  - **Important to understand the origin of mobile sector emission estimates as they input to the larger NATA inventory to have a better understanding of:**
    - > **Limitations of these estimates**
    - > **Sources of uncertainties in these estimates**
    - > **Usefulness of these estimates**

## On-road vehicle inventory estimates

- **MOBILE6.2**
  - **Mobile source toxics emissions for 1999 NATA derived from EPA's on-road model, MOBILE6.2**
  - **EPA's best-available tool for generating toxics emissions factors for on-road vehicles**
  - **This model is best used in the context of fleetwide estimates of changes in emissions from:**
    - > **fuel**
    - > **driving cycle**
    - > **vehicle standards**
    - > **fleet turnover effects**
  - **Absolute values of toxic emissions factors are less certain**

# Impact of Tier 2 emissions standards

Figure 1. 2004 LDGV Fleet vs Tier 2  
(uses MOBILE6.2 as is)



Source: Air Improvement Resource, Inc.

## On-road vehicle emissions inventory estimates

- Use of MOBILE6.2 for toxics emissions factors has some key limitations:
  1. **Estimates are based on a small sampling of the fleetwide vehicle population**
  2. **Tier 2/LEV 2 and 2007 compliant HDDEs have not been tested/modeled**
  3. **MOBILE6.2 only provides point estimates of toxics emissions factors**
    - No standard error or uncertainty estimates
    - Cycle-weighted average only (cold start + cold transient + hot start)
    - Each “trip” includes a start, with associated start emissions

**For toxics exposures, what really matters is not fleet averages over driving cycles but rather concentrations and individual exposures**

**Difficult to apply MOBILE6.2 factors to location-specific modeling domains**

## On-road vehicle emissions inventory estimates

- Future improvements to mobile source toxics emissions inventory?

**EPA MOVES model to provide modal (second-by-second) emissions factors by operating mode, by vehicle source type**

Availability currently projected for 2007

**Capability to provide finer scale estimates of criteria pollutant emissions, maybe toxic emissions factors**

### **Key limitations:**

**MOVES currently planned to incorporate the same toxic emission fractions from MOBILE6.2**

**Data needs? MOVES is heavily dependent upon large data sets to populate operating mode bins. Speciated modal emissions data harder to generate than criteria pollutant emissions.**

## Health Effects of air toxics exposure

- Understanding the health effects of air toxics exposure at environmentally relevant concentrations:
  - **Toxicity testing is important, but it is:**
    - > Important to avoid unrealistically high exposures
    - > Important to test characteristic emissions from vehicles/engines with representative aftertreatment systems in place
  - **Important programs which can add to our understanding of health effects at relevant concentrations :**
    - > **ACES**
      - Characterization and health effects testing of 2007/2010 compliant heavy-duty diesel engines
    - > **National Environmental Respiratory Center (NERC)**

## Implications for a mobile source regulatory control program

- Efficient, cost-effective regulation needs to account for the largest sources of toxics exposure and for those factors most effectively controlled
  - **Fuels have an important role in overall toxic emissions rates and profiles from current and future vehicles**
    - > Olefins have a significant impact on 1,3-butadiene emissions
    - > RVP has a significant impact on evaporative emissions (benzene)
    - > Ethanol as an oxygenate has a significant impact on acetaldehyde
    - > MOBILE6.2 model predicts that RVP control and lower benzene could reduce total toxics by as much as 25% (exhaust + evaporative)
  - **Any regulatory approach must consider vehicles/engines and fuels together as a system**

## High priority

- The role of high emitters in mobile source air toxics
  - **Likely to be the most important factor in the overall mobile source contribution to toxics emissions and inventories**
    - > **EPA's analysis of toxics emissions from Tier 2 fleet using MOBILE6.2 indicates:**
      - ~ 70% of total VOC emissions from high-emitters in the fleet
      - ~ 70% of toxic emission from high-emitters in the fleet.
    - > **Absolute levels of emissions can be 30X higher than comparable normally functioning Tier 2 vehicles**
    - > **Toxics emission profiles different than normal emitters**
      - Partial products of combustion
      - Gasoline high emitters tend to have higher fractions of 1,3-butadiene and benzene
  - **What fraction of the fleet is likely to degrade to high emitter levels?**
    - > **This fraction has been changing over time with the reliance on on-board diagnostic systems.**

