

# Mobile Source Air Toxics: Control Options

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# Background

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- Provide preliminary analysis of future technologies to control mobile source air toxics in preparation for the Mobile Source Air Toxics rule reevaluation in 2003-2004

# Air Toxics Inventories

- Focus on six mobile source air toxics
  - Benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, and diesel PM/diesel exhaust organic gases
  - These toxics meet two criteria:
    - Characterized as “risk drivers” under NSATA
    - Mobile source emissions account for a substantial portion of the total inventory (1996)

# National-Scale Air Toxic Assessment (NSATA)

<u>Draft NSATA Mobile Source Risk Drivers</u>	<u>Mobile Contribution to 1996 Inventory</u>
– Benzene	76%
– Acetaldehyde	70%
– 1,3-Butadiene	60%
– Formaldehyde	49%
– Acrolein	39%
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– POM	6%
– Chromium	4%
– Arsenic	1%
– Manganese	1%
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– Diesel PM/ DEOG	99%

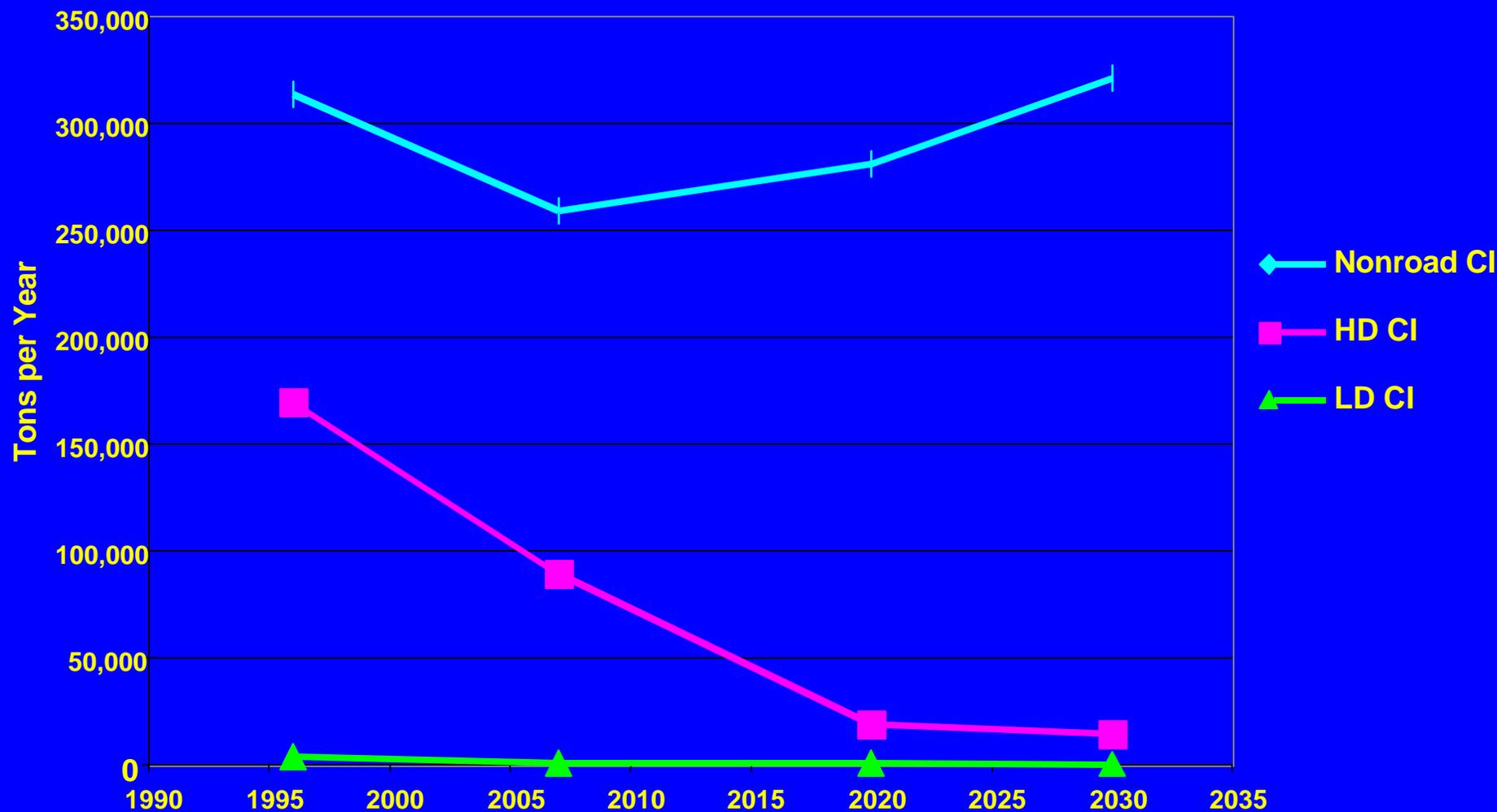
(Note: In a separate section, the Draft NSATA concludes that diesel PM ranks with the other substances that pose the greatest relative risk).

# Diesel PM Inventories

- Diesel PM emissions are projected to decline from 500,000 tons in 1996 to 350,000 tons in 2007
  - Highway diesel
    - Accounts for 90,000 tons per year, or about 25% of total diesel PM in 2007
  - Nonroad diesel
    - Accounts for about 250,000 tons per year, or 75% of total diesel PM in 2007
  - For inventory purposes, diesel PM is used as a surrogate for Diesel PM/ Diesel Exhaust Organic Gases.

# Diesel PM Inventory

50 States, Includes 2007HDR Controls (iv2000.2)



# VOC Inventory

- In 2020, total VOC emissions are 16 million tons.
- Mobile sources account for 5.5 million tons, on-highway account for about 2 million and nonroad 3.5 million.
  - About half of on-highway emissions are attributable to a combination of start emissions (600,000 tons) and evaporative emissions (485,000 tons).
  - Evaporative emissions are ~ 38% resting loss, 38 % running loss, 18 % refueling, and 6 % crankcase.
- Nonroad VOC emissions are dominated by gasoline powered nonroad equipment.

# Diesel Retrofits: Lowering PM and VOCs

- Highway Heavy Duty Diesel PM standards are currently 0.1 g/bhp-hr (0.05 g/bhp-hr for buses) and will become 0.01 g/bhp-hr in 2007
- Nonroad Diesel PM standards are currently 0.15 to 0.3 g/bhp-hr depending on horsepower rating.
- Pre-2007 HD vehicles dominate fleet emissions inventory until 2011.
- There are existing technologies that can be applied to these engines, but some need low sulfur fuel.

# Diesel Retrofits: Lowering PM and VOCs

- Oxidation Catalysts tolerate current highway sulfur levels
  - Provide 30% reduction in PM, 50% in VOCs
  - Currently used in urban buses and mining equipment
- PM traps require very low sulfur fuel to be successful
  - Provide 90% reduction in PM, 90% in VOCs
  - Currently used in heavy duty and urban bus applications in Europe where low sulfur diesel fuel is used
  - Used on 50 of New York City Transit's newest buses

# Gasoline Fuel Cans

- Unregulated federally; CARB established standards in 1999 which went into effect in 2001.
  - The new CA standards will require: automatic shut-off valve to prevent overfilling; automatic close so cans will be sealed when not in use; elimination of secondary vent holes; reduction of vapor permeation.
- Based on CARB estimates from survey data and emissions testing:
  - Expected to provide a 73% reduction in ROG emissions from gas cans, according to California.
  - Expected to provide a 70 TPD reduction in ROG emissions from gas cans in California.

# Lowering Lawn Mower Emissions

- All 'new technology' Class I lawn mowers built after 2003 and all new mowers by 2008 shall meet a 16.1 g/kW-hr HC+NO<sub>x</sub> standard (the ratio of HC to NO<sub>x</sub> in these mowers is ~ 6 to 1)
  - The new mowers are expected to have 4 cycle overhead valve engines, but are not expected to need catalysts
- Nonroad inventories for these engines in 2020 are 400 k tons VOC
- Low cost and low efficiency catalysts could further lower VOC emissions by another 50%
  - Prototype catalysts exist and production models will be used on future handheld 2 -strokes in the near future

# Lowering Personal Water Craft Emissions

- Present rule (1996) for PWCs will result in a 75% reduction HC+NO<sub>x</sub> over the older models
  - their expected emission factor is ~45 g/kW-hr
  - their contribution to the 2020 inventory will be 274 k tons of VOC
- There is a good chance that PWCs shall fall under a Fed evap standard in the near future
- Adoption of the California exhaust standard for these craft would lower tail pipe VOC by 60%
  - promote their migration from 2 to 4 stroke OHV engines

# Lowering Light Duty Vehicle Start Emissions

- Tier 2 emission bin 2 standard is 0.090 g/mile for VOCs (120K miles).
- In 2020 start emission dominate tail pipe VOCs
  - Mobile 6 has a 0.05 g/mile emission factor for VOC where start emissions account for 60% of that
- Technologies exist to lower start emissions by 90%, but may not be cost-effective
  - Hydrocarbon Adsorber
  - Heat Storage Catalyst Insulator
  - Optimizing Tier 2 controls
  - Heated Catalysts

# Lowering Light Duty Vehicle Evaporative Emissions

- Tier 2 resting evaporation standards are 1.2 grams (2 day diurnal + hot soak) per test.
  - Mobile 6 provides an emission factor of 0.03 grams per day per vehicle for resting evaporative emissions from the “average” LDV vehicle in the year 2020 -resulting in 173 K tons of VOC
- Systems built with existing components but combined in the most optimal manner could lower resting emissions 54% to 62% over the Tier 2 Standard, but may not be cost-effective

# Fuels

- Mobile Source Air Toxics rule “locked in” current toxic performance requirements for refineries and importers of gasoline as a near-term fuel control.
- Agency is currently examining potential long-term controls with sufficient lead time for refineries given upcoming low sulfur gasoline and diesel standards.
  - Boutique Fuels Report examined a 0.95vol% benzene cap for conventional gasoline nationwide.
  - Estimated cost of 0.4 cents per gallon.

# Next Steps

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- Encourage stake holders to suggest possible control measures for EPA to consider
  - provide supporting data if it is available
- Encourage stake holders to participate with EPA in it's evaluation of possible control measures
  - we want to make the best decisions