Development of a 1999 National Air Toxics Inventory for Highway Mobile Sources Using MOBILE6.2

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Introduction

- 1999 NEI uses MOBILE6.2 to develop inventory estimates for 35 pollutants
  - calculation of emission factors for several HAPs fully integrated into MOBILE6 framework
    - benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, MTBE
    - modeling process much more simplified than for previous highway vehicle HAP model, MOBTOX5b
  - emissions of other HAPs estimated based on user provided information

Outline

- Data sources and methods used to develop 1999 highway vehicle NEI HAP estimates
  - HAPs integrated into model
  - Additional HAPs
- Results
  - nationwide inventory totals
  - Comparisons to 1996 totals

HAPs Estimated Using MOBILE6.2

- 13 Gaseous Compounds
- 16 particulate and vapor phase PAHs
- 5 particulate phase metal compounds

Methods

- Benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, MTBE explicitly modeled
  - benzene and MTBE: component of evaporative and exhaust emissions
  - air toxic/VOC ratio multiplied by MOBILE6.2 VOC
    - vary by technology group, vehicle type, normal versus high emitter, fuel characteristics

Methods

- Ratios determined from fuel parameter inputs using algorithms
- Required fuel parameters:
  - % aromatics
  - % olefins
  - % benzene
  - E200 (percentage of vapor produced at 200 degrees F)
  - -E300
  - Oxygenate type and content

Methods

- Sources of fuel parameter data:
  - Alliance of Automobile Manufacturers
  - TRW Petroleum Technologies
  - EPA reformulated gasoline surveys

Methods

- Other pollutants modeled using "ADDITIONAL HAPs" command
  - User provided inputs:
    - ratios of toxics to TOG or VOC (gaseous HAPs)
    - ratios of toxics to PM (PAHs)
    - basic emission rates (metals)
  - Additional HAPs files developed for several fuel types
    - baseline, MTBE oxygenated, ethanol oxygenated

Methods

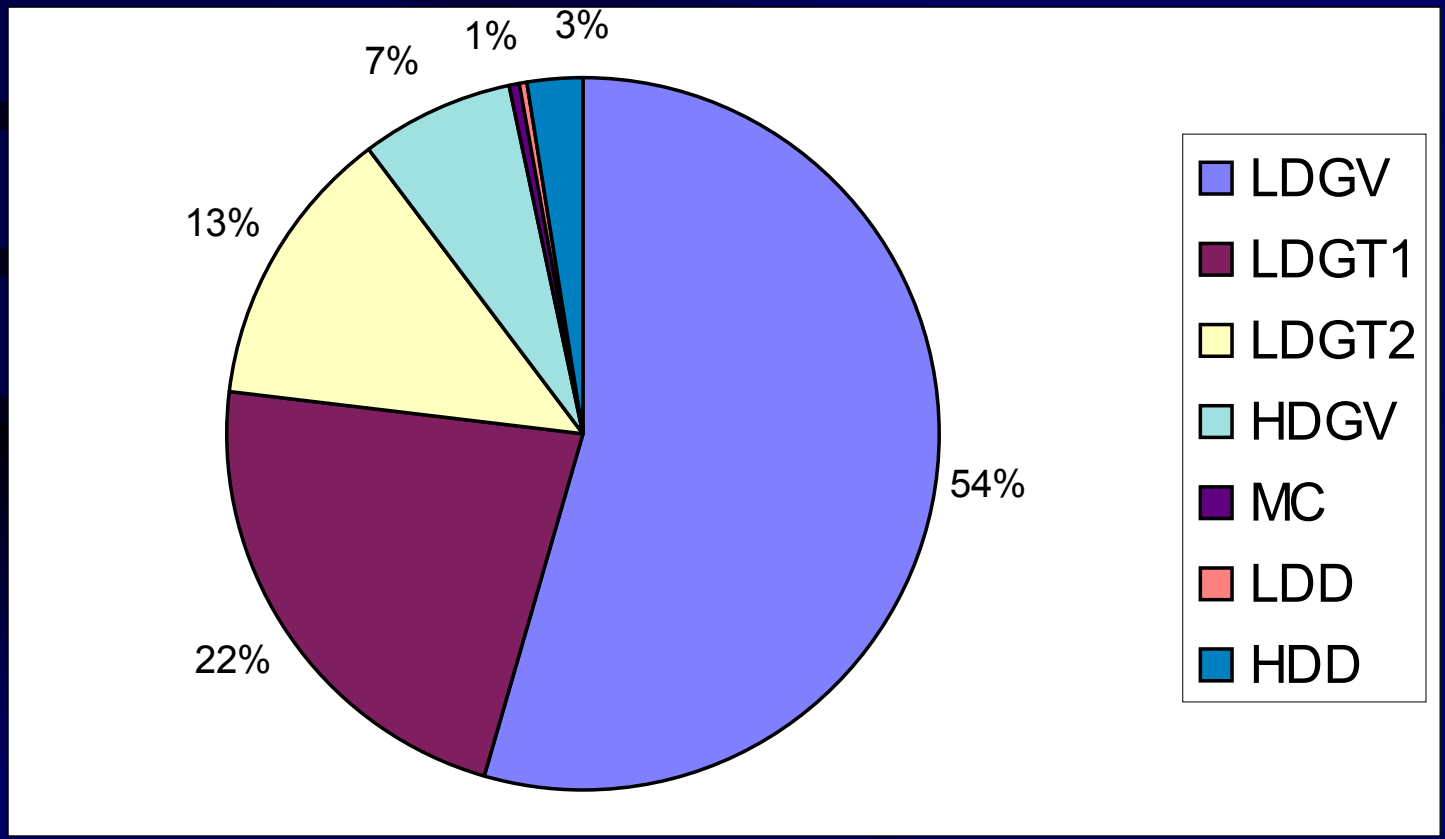
- Creation of the HAP inventory from MOBILE6.2 runs
  - four seasonal scenarios
  - county level emission factors multiplied by VMT from HPMS
  - for several HAPs, California provided its own estimates

Results

- Total mass emissions of HAPs estimated by MOBILE6.2 is 1.4million tons
  - Does not include lead, dioxins and other HAPs estimated by California
    - if these are added, total increases to 1.5 million tons.
  - Toluene and xylenes account for 58% of total mass
  - 99% of mass from gaseous HAPs

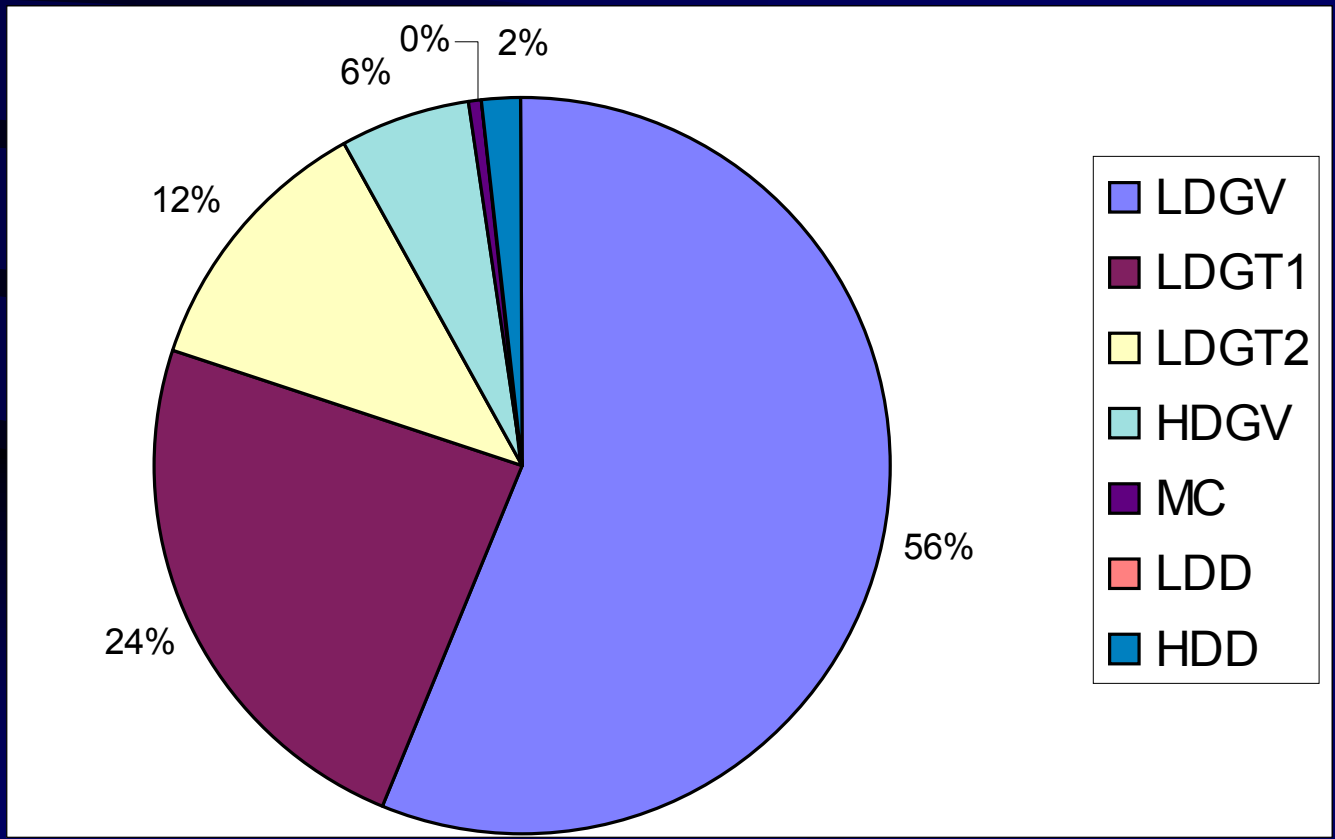
Results

Contribution of Vehicle Classes to Total Highway Vehicle HAP Emissions in the 1999 NEI



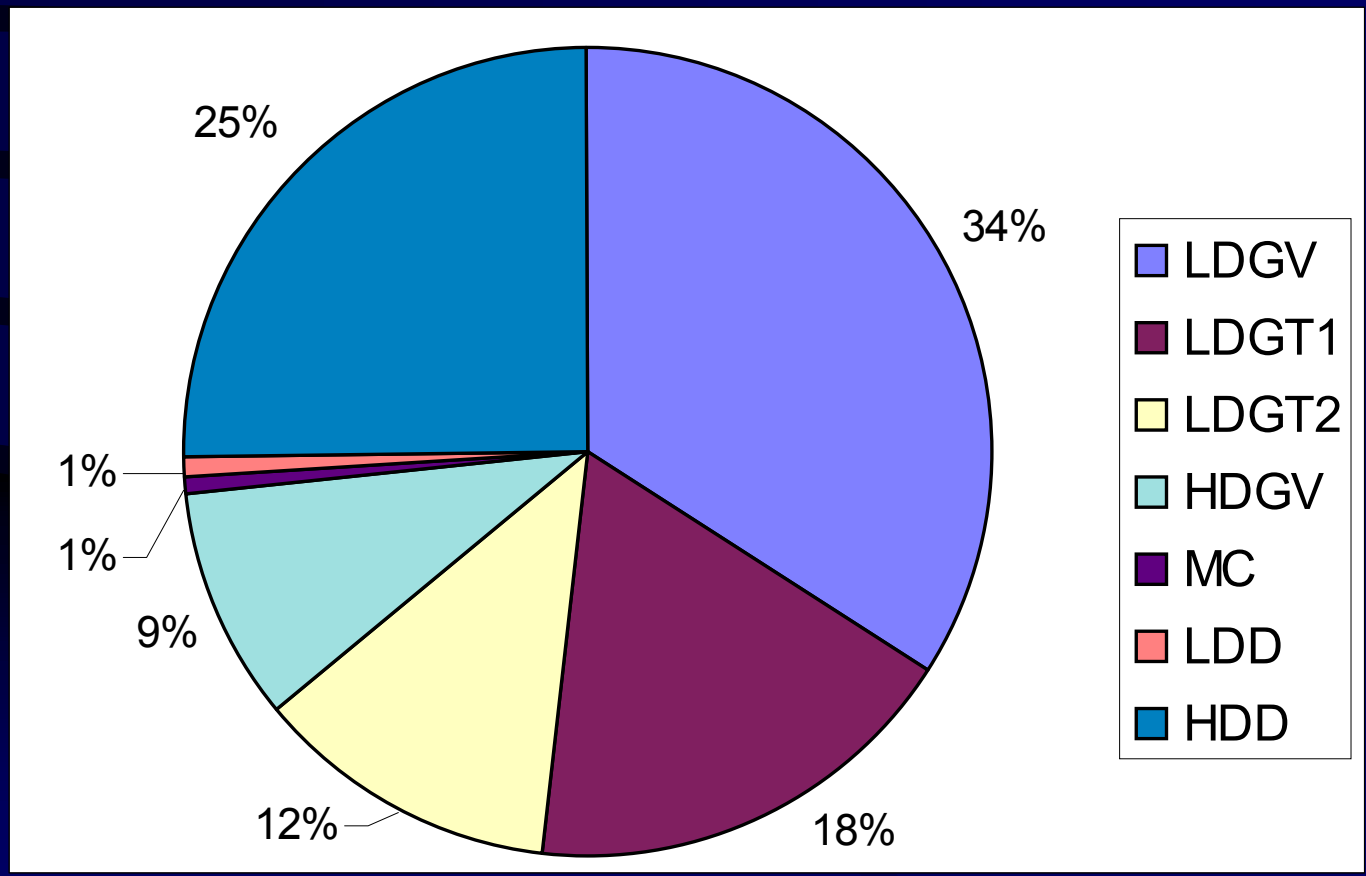
Results

Contribution of Vehicle Classes to Total Highway Vehicle Benzene Emissions in the 1999 NEI



Results

Contribution of Vehicle Classes to Total Highway Vehicle Formaldehyde Emissions in the 1999 NEI



Results

Comparison of MOBTOX5b Inventory Estimates (1996 NATA) and MOBILE6.2 Estimates for 1999

Pollutant	1996 Inventory	1999 Inventory	% Difference
1,3-Butadiene	23,500	23,568	+0.3
Acetaldehyde	28,700	29,490	+2.7
Benzene	168,200	174,723	+3.9
Formaldehyde	83,000	80,489	-3.0
MTBE	65,100	84,243	+29.4%

Results

- MOBTOX5b versus MOBILE6.2
  - 1999 emissions do not show decrease from 1996 estimates as expected
    - Because of model changes and improvements in processing methods
      - VOC higher in MOBILE6.2 versus MOBTOX5b for earlier years
      - accounting for average speeds for different roadway types
        - » In 1996 NATA inventory, all modeling assumed same average speed of 19.6 mph
      - More sophisticated mapping approach

Results

- Other Significant Differences Between 1996 NATA Inventory and 1999 NEI
  - Addition of gas phase PAHs
    - Increases Inventory from 90 to 4500 tons
      - most of additional mass is naphthalene
  - Mercury and arsenic based on one half detection limit in recent studies
    - arsenic increases from 0.25 to 19 tons
    - mercury increases from 0.2 to 20 tons

Limitations and Uncertainties

- Toxic to VOC ratios for heavy duty vehicles from only a few tests
- Impacts of fuel formulation not addressed in diesels
- Off-cycle effects based on limited data
- Toxic to VOC ratios assumed to be constant in all modes of vehicle operation

Conclusions

- Development of MOBILE6.2 has substantially improved the highway vehicle HAP inventory
- Integration of HAP and criteria pollutant emission factor modeling has streamlined inventory development
- Development of more refined, streamlined model facilitates development of refined, local scale inventories