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# AIR TOXICS FROM MOTOR VEHICLES

# WHAT ARE AIR TOXICS?

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- ▼ These are air pollutants that cause cancer and non-cancer health effects such as reproductive and neurological problems
- ▼ Some air toxics have been shown to cause cancer in humans while others have shown health impacts only in laboratory animals at higher doses than people breathe
- ▼ However, because exhaust enters the air in the breathing zone, exposure is high

# AIR TOXICS FROM VEHICLES AND FUELS

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## ▼ TOXIC COMPOUNDS

- Benzene is a known human carcinogen. It is present in gasoline and is found in exhaust and evaporative emissions
- formaldehyde, acetaldehyde, 1,3 butadiene, and diesel particulate matter are probable human carcinogens
- EPA is working with industry groups to assess oxygenates, MMT, biodiesel from soy, and dioxin

# MOBILE SOURCE CONTRIBUTION

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- ▼ EPA estimates that emissions from cars, trucks and buses cause as much as half of all cancer cases attributed to outdoor sources of air toxics
- ▼ Nonroad mobile sources (tractors, snowmobiles) emit air toxics as well

# HOW ARE AIR TOXICS FROM VEHICLES FORMED?

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- ▼ Emissions are greatly dependent on the fuel that is used:
  - lead was purposely added to increase octane and is now banned
  - volatility of fuel (evaporation) increases the presence of aromatics in the air such as benzene. Limits have been placed on volatility to control hydrocarbons in order to reduce smog and to lower toxics (most toxics are hydrocarbons)

# HOW ARE AIR TOXICS FROM VEHICLES FORMED?

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- Reformulated gasoline was introduced into the most polluted cities in 1995. From 1995-1999, this gasoline required a minimum reduction in toxics of 15% over typical 1990 gasoline. Benzene is limited to 1% maximum in this fuel
- In 1993, diesel sulfur was limited to 500 ppm from about 2500 ppm to reduce particulates and air toxics

# HOW ARE AIR TOXICS FROM VEHICLES FORMED?

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- ▼ There are no specific standards for motor vehicles in the United States to control air toxics. Thus far, EPA has relied on reductions in tailpipe particulate matter, exhaust and evaporative hydrocarbon control, and fuel controls to reduce toxics
- ▼ Today's cars are capable of emitting 90% less air toxics on a per mile basis than the uncontrolled models of 1970. Trucks and

# AIR TOXICS

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buses are designed to emit less than half of their 1970 levels.

- air toxics will continue to decrease as older vehicles leave the fleet and new regulatory programs take effect
- however, the growth in vehicle miles travelled will eventually offset this reduction unless new requirements take place

# ARE ADDITIONAL CONTROL PROGRAMS NEEDED?

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- ▼ Diesel particulate standard for buses has recently been decreased to 0.07 g/bhp-hr in use and 0.1 g/bhp-hr for new trucks
- ▼ In 2000, reformulated gasoline will increase its toxic reduction from 15 to 20%
- ▼ California has limits on formaldehyde produced by cars (0.008 gpm for ULEVs)

# ARE ADDITIONAL CONTROL PROGRAMS NEEDED?

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- ▼ Nonroad diesel engines will be regulated for PM once a transient test is agreed upon
- ▼ Highway diesels will produce 7% less secondary particulate as a result of lower NOx standards in 2004
- ▼ Nonspecific HC programs will also reduce toxics such as: onboard refueling, new evaporative test, oxyfuels, I/M, RFG 2 and LEV and Tier 2 vehicle standards

# ARE ADDITIONAL CONTROL PROGRAMS NEEDED?

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## ▼ FUELS REGISTRATION AND HEALTH TESTING

- over 2300 fuels and 4800 fuel additives were registered in 1994
- each produces emissions that are potentially harmful
- in 1994, EPA established rules that require producers to identify and evaluate the potential adverse health effects of fuels and fuel additives

# HEALTH TESTING OF FUELS AND ADDITIVES

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- ▼ Purpose:
  - to determine the potential health impact of fuel/fuel additive exhaust and evaporative emissions
- ▼ Producers must conduct short-term (90 day) toxicology testing of subchronic inhalation exposures. Animals are exposed to evaporative and exhaust emissions (when possible)

# HEALTH TESTING OF FUELS AND ADDITIVES

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- ▼ Evaluation is made of general organ/systemic toxicity
- ▼ Typical endpoints are:
  - carcinogenicity and mutagenicity
  - developmental and fertility effects
  - pulmonary and neurotoxic effects
- ▼ Long term (2 year) animal toxicity tests may be required

# AIR TOXICS STUDY

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- ▼ In 1993, EPA published a study on the control of air toxics from mobile sources
  - Five compounds were studied: benzene, formaldehyde, 1,3 butadiene, diesel particulate, and acetaldehyde
  - it confirmed that the continued phasing-in of the motor vehicle program will reduce toxics
  - cancer incidences will decrease and then level off after 2000 due to vehicle growth without new regulatory programs

# AIR TOXICS STUDY

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- little information was available on noncancer health effects
- nonroad mobile sources needed further evaluation

# COST-EFFECTIVENESS OF AIR TOXIC CONTROL

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- ▼ **FUELS:** limit sulfur, benzene, and aromatics nationwide.
  - Sulfur could reduce air toxics by 5,000 to 8,000 tons/year and cancer cases by 5 - 8/year
  - aldehydes may increase (O<sub>2</sub>) but a net toxic decrease
  - NO<sub>x</sub>, VOC, CO, SO<sub>x</sub>, H<sub>2</sub>S, H<sub>2</sub>SO<sub>4</sub>, and PM would decrease. Catalyst efficiency would increase
  - more cost-effective than olefin or aromatic control but very expensive compared to controlling NO<sub>x</sub> or HC even when their benefits are accounted for

# COST- EFFECTIVENESS

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- ▼ Relying on existing future motor vehicle control programs to also control toxics is generally the most cost- effective approach
- ▼ Removal of sulfur can be justified due to its impact on catalysts of advanced vehicles and because it presents a barrier to enabling future technologies to come to market