What are the Contributions to Ambient PM and Ozone Concentrations from On-road Diesel and Gasoline Vehicles?

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Science Question

What are the contributions to ambient PM and O3 concentrations from on-road diesel and gasoline vehicles?

Research Goals

- Characterize "real-world" PM and ozone primary and precursor emissions from on-road mobile sources to improve emission factors and improve emissions and air quality models.
- Identify mobile source emission profiles and markers for use in air quality receptor models.
- Assess spatial and temporal variability in pollutant concentrations of PM and PM constituents near mobile source "hot spots" such as urban roadways.
- Determine the impact of emerging technologies (fuels and engine systems) on emissions and exposures to primary and precursor pollutants.

Methods/Approach

- Heavy- and light-duty chassis dynamometers
- On-road, near-road, and in-vehicle monitoring equipment
- In-house capabilities for physical and chemical characterization of emissions
- Expertise for conducting control technology demonstrations

On-Road Emission Study

- PM emissions from low sulfur diesel fuel and 20% biodiesel fuel blend were evaluated by plume sampling.
- Complete speciation of PM emissions for organic and inorganic constituents to develop chemical source profiles for the two fuels.

Near Roadway Testing

- Traffic-Related Exposure (T-REX) study: This study will evaluate concentration gradients related to motor vehicle traffic in the New York and Detroit metro areas. Data will be used to improve dispersion modeling techniques and assess exposure of affected populations.
- Kansas City construction dust study: Impacts of mudflap carryover PM-2.5 emissions were evaluated including physical/chemical characterization. Not only were the emissions lower than prior estimates, they contained a major vehicle exhaust component in the nanometer particle size range.

Results/Conclusions

- Vehicle operating characteristics affect emission rates and chemical source profiles of PM and ozone precursor compounds.
- Distribution of PM emissions from the light-duty fleet may be dominated by a small fraction of "high emitting" vehicles.
- Gasoline vehicles may contribute a larger percentage to ambient PM-2.5 concentrations than diesel vehicles in certain regions of the U.S.
- Mobile source activities result in elevated concentrations of PM and PM constituents near major roads which may lead to adverse health effects.

Future Directions

- Better characterize heavy duty diesel and light duty gasoline vehicle modal emissions under varying operating and environmental conditions.
- Assess traffic and environmental conditions that lead to elevated pollutant concentrations near major roadways.
- Support near-road epidemiological investigations.
- Identify secondary chemical reactions during transport and dispersion of mobile source emissions.
- Assess the toxicological potency of gasoline vehicle PM emissions.

Impacts and Outcomes

- Better information for mobile source regulatory development activities.
- Produced chemical source profiles that have increased capability to determine mobile source contribution to NAAQS concentrations.
- Supplied new information for model development and evaluation.
- Data to support national monitoring network design and implementation.
- Supported studies to assess and better understand the human health effects associated with on-road mobile sources.
- Informed urban and transportation planning activities (e.g., NEPA, Conformity, Smart Growth).

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