

**“What Studies are Appropriate to Use
to Estimate Health Impacts from
Specific Sources Such as Diesel PM?”**

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Many Uncertainties with the PM 2.5 Epidemiology (Ecological) Studies

- Model selection
- Treatment of co-pollutants
- Correction for seasonal trends
- Exposure misclassification / measurement error
- Effect modifiers [e.g., educational achievement]
- Corrections for seasonal and day-to-day variations in risk factors. etc., etc.

Because of these uncertainties and because the relative risks are weak, other lines of evidence are necessary to demonstrate causality, e.g., toxicology studies and human clinical studies.

No Valid Markers for Diesel Exhaust PM

- HEI report—no specific markers for Diesel Exhaust
- Ambient PM from monitoring sites are largely dominated by emissions on surface streets—mostly autos
- Ratio of PM to NOx emissions from diesel trucks not consistent
- NOx decreases on weekends but not PM (JAWMA, 2003)
- After 2007, PM from diesel is reduced by 99%, thus any relationship between PM and NOx will change

Laboratory Inhalation Studies Have Some Utility

- Traditional DE (TDE) causes only mild pulmonary and cardiovascular effects in 6-month sub-chronic study at high exposure levels (NERC study)
 - Exposures were to whole DE, so even mild effects observed may have been from other non-PM components in DE
 - Other combustion sources (gasoline exhaust, wood smoke, etc.) produced similar mild effects at high exposures
- Particle trap, simulating New Technology Diesel Exhaust (NTDE) completely eliminated even mild effects seen with TDE
- DE causes cancer in rats only at “overload” levels
 - Orders of magnitude higher than occupational or environmental levels

Human Volunteer Studies May be Useful

- Little or no consistent adverse impact observed at exposure levels one to two orders of magnitude higher than ambient DEP levels (i.e., 100 or 300 $\mu\text{g}/\text{m}^3$),
- Possible cardiovascular effects observed at high exposures to 18 year old Volvo diesel engine exhaust
 - Mild effects observed may have been from other non-PM components of DE
- Particle trap, simulating NTDE, completely eliminated the mild effects seen with TDE

Future Focus Should be on New Technology Diesel Exhaust (NTDE)

- In 10 years, virtually all exposures from mobile source diesel engines will be from NTDE engines
- NTDE emissions closer to CNG emissions than to TDE
- An example is the ACES study of NTDE

Summary

“What Studies are Appropriate to Use to Estimate Health Impacts from Specific Sources Such as Diesel PM?”

- Epidemiology studies have many uncertainties
- No marker for diesel exhaust
 - Need independent re-examination of data
- Other studies have some utility
 - Sub-chronic and chronic animal inhalation studies
 - Human volunteer studies
- Future focus should be on NTDE