HEI Special Report 16
A Layman’s View

SCOE Annual Meeting 2008

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MSATs: A Critical Review of the Literature on Exposure and Health Effects, Special Report 16

- Summarizes the health effects of exposure to 21 MSATs;
- Critically analyzes the literature for seven;
- Assesses and summarizes research gaps and unresolved questions;
- Released November 2007
What is the Health Effects Institute?

HEI

- is a nonprofit corporation chartered in 1980
- is an independent research organization to provide high-quality, impartial, and relevant science
- receives half of its core funds from EPA and half from the worldwide motor vehicle industry
- provides intensive independent review of HEI-supported and related research
AIR TOXICS REVIEW PANEL

- **Thomas Kensler, Chair**, Professor, Johns Hopkins Bloomberg School of Public Health
- **H. Ross Anderson**, Professor of Epidemiology and Public Health, University of London
- **Michael Brauer**, Professor, School of Occupational and Environmental Hygiene, University of British Columbia
- **Elizabeth Delzell**, Professor, Department of Epidemiology, University of Alabama–Birmingham
- **Mark Frampton**, Professor of Medicine and Environmental Medicine, University of Rochester
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- **Helmut A. Greim**, Professor, Institute of Toxicology and Environmental Hygiene, Technical University of Munich
- **Rogene Henderson**, Senior Scientist Emeritus, Lovelace Respiratory Research Institute
- **Brian Leaderer**, Professor and Vice Chair, Department of Epidemiology and Public Health, Yale University School of Medicine
- **William N. Rom**, Professor of Medicine and Environmental Medicine, New York University Medical Center
- **Debra Kaden**, Health Effects Institute Principal Scientist, Project Manager Air Toxics Review Panel
FHWA MSAT Policy

- Screening used to identify projects for assessment.
  - Minimal (CEs, conformity exempt) – NO ANALYSIS
  - Low (below “threshold”) - QUALITATIVE
  - Higher impacts - QUANTITATIVE
- Potential for mitigation should be assessed
- FHWA is revising the Interim Guidance
“Priority” MSATs vs NATA Risk Drivers

- Old
  - Acetaldehyde
  - Acrolein
  - Benzene
  - Diesel PM
  - 1,3 Butadiene
  - Formaldehyde

- New
  - Acrolein
  - Benzene
  - Diesel PM
  - 1,3 Butadiene
  - Formaldehyde
  - Naphthalene
  - POM
Health Impacts of MSATs
Benzene

- Mobile Sources?
  - An important contributor, highest at roadsides and in-vehicle

- Human Health?
  - Clear evidence of leukemia at occupational levels
  - Studies show increased cancer risk at lower exposures

- @ Ambient Levels?
  - Some studies show increased childhood leukemia risk with proximity to gas stations, etc.
  - Mixed evidence on traffic and leukemia
  - Biomarker studies show DNA changes and blood toxicity
Health Impacts of MSATs
1,3 Butadiene

- Mobile Sources?
  - Important contributors in most locales

- Human Health?
  - Limited human evidence, but consistent with a cancer impact at occupational exposures

- @ Ambient Levels?
  - No direct evidence but analysis is difficult
Health Impacts of MSATs
Formaldehyde

- Mobile Sources?
  - Indoor is 3-5x higher.
  - Important at roadside exposures (reactivity?)

- Human Health?
  - An irritant to eyes, skin, lungs
  - Classified as a carcinogen at occupational levels

- @ Ambient Levels?
  - Limited evidence regarding asthma
  - No evidence of health exposures outside
Health Impacts of MSATs Polycyclic Organic Matter

- **Mobile Sources?**
  - Hard to say (lack of standard definition)
  - Wood burning, cigarettes, road paving, roof tarring and food may be significant sources

- **Human Health?**
  - Some components cause cancer in animals
  - Cancer impact in some occupational settings

- **@ Ambient Levels?**
  - Some evidence of DNA changes, reproductive impacts
  - No direct evidence that POM causes health effects
Health Impacts of MSATs

Acrolein

- **Mobile Sources?**
  - Data not sufficient to apportion sources (reactivity; limited studies, methods)
  - Limited studies do not show elevated levels at roadsides or in-vehicle

- **Human Health?**
  - An irritant to the respiratory tract
  - Inadequate data on carcinogenicity

- **@ Ambient Levels?**
  - Insufficient data
Health Impacts of MSATs

Naphthalene

- **Mobile Sources?**
  - An important source
  - Limited evidence that it is higher at roadside
  - Indoor sources are 5-10x higher

- **Human Health?**
  - Cancer impact shown in rodents
  - No data on carcinogenicity in humans

- **@ Ambient Levels?**
  - No epidemiologic or other studies that assess the health effects of exposure
Health Impacts of MSATs
Acetaldehyde

- **Mobile Sources?**
  - 2-10x higher indoors and in-vehicle; present in foods

- **Human Health?**
  - An irritant to eyes, skin, lungs
  - Carcinogenic in rodents; data on humans are inadequate

- **@ Ambient Levels?**
  - Can not distinguish effects from other pollutants
  - Personal exposure and ambient levels are far below those producing irritation
  - “...doubtful that acetaldehyde...has adversely affected human health.”
Gaps and Recommendations

- Use of occupational studies to identify the risk/exposure relationship is problematic due to the magnitude of the exposure differences.
- Extrapolating cancer potency from animal models is troublesome.
- Animal and epi studies have insufficiently focused on non-cancer endpoints.
Gaps and Recommendations

- MSATs need better source apportionment
  - Exposure comes from many different sources
- Need to better characterize concentrations in micro-environments (home, out- vs indoor, etc.)
- Chemical reactivity needs to be better understood
- Need to compile better trend and spatial data
- Should improve NATA modeling
  - In some cases NATA under-estimates
- Need to assess MSATs from alt. fuels
Final Thoughts

- “Proximity” studies have not generally been MSAT specific
- Need to consider the entire literature
  - “negative” bias; reporting interest
  - Single studies usually don’t tell the tale
- Need the right skills
- A consideration of values
  - Transportation and health professionals will view the data thru different lenses