Minnesota Statewide Air Toxics Monitoring Study

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- 30 randomly selected monitoring sites.
  - 5 additional sites for geographic coverage
  - 7 sites per year
  - 5 year study (1996-2001)

- 74 air toxic pollutants
  - 37 volatile organic compounds
  - 7 carbonyls
  - 30 metals
Air Sampling and Analysis Protocol

- 24 hour integrated samples.
- Samples collected every 6th day.
- Sample analysis conducted at the MPCA air quality lab.
- Sites generally located away from point sources.
Health Benchmarks

- Concentrations of chemicals emitted to air that are unlikely to pose a significant risk of harmful effects when humans are exposed to those concentrations over a specified time.

- Minnesota uses a negligible upper bound cancer risk of 1 in a 100,000 and non-cancer hazard quotient of 1.
Compounds Posing >1 in 100,000 Additional Cancer Risk

- Benzene: 5 sites
- Formaldehyde: 35 sites
- Carbon tetrachloride: 23 sites
Average Benzene Concentrations (1996-2001)
Median Benzene Concentrations Compared to log Population (1996-2001)

$y = 0.22x - 0.05$

$R^2 = 0.68$

Benzene Concentration (ug/m³)

Health Benchmark = 1.3 ug/m³
Average Formaldehyde Concentrations (1996-2001)

Health Benchmark = 0.8 ug/m³
Median Formaldehyde Concentrations Compared to log Population (1996-2001)

\[ y = 0.22x + 0.45 \]

\[ R^2 = 0.35 \]

Formaldehyde health benchmark = 0.8 ug/m³
Average Carbon Tetrachloride Concentrations (1996-2001)

Health Benchmark = 0.67 ug/m³
# Compounds Posing >1 in a Million Additional Cancer Risk

- Acetaldehyde: 35 sites
- Benzene: 35
- Carbon tetrachloride: 35
- 1,4-Dichlorobenzene: 28
- Ethylene dibromide: 8
- Ethylene dichloride: 14
- Formaldehyde: 35 sites
- Hexachlorobutadiene: 16
- 1,1,2,2-Tetrachloroethane: 11
- Tetrachloroethylene: 18
- 1,1,2-Trichloroethane: 6
- Trichloroethylene: 9
Compounds with Non-Cancer Hazard Index >0.1

- Acetaldehyde: 25
- Barium: 17
- Chlorine: 7
- Formaldehyde: 35
- Manganese: 1
Potential Carcinogens Below Detection Limits*

- Arsenic
- 1,3-Butadiene
- Cadmium
- Chromium

*Current ICP data does not show these compounds above benchmarks.
Additional upper-bound cancer risk per 100,000: 2.5-6
Non-cancer chronic hazard index: 0.6-1.4

*Four compounds were included in the cancer risk assessment (acetaldehyde, benzene, carbon tetrachloride & formaldehyde). Fifteen compounds were included in the non-cancer assessment.
Conclusions

- Only benzene and formaldehyde continue above benchmarks.
- Not a lot of variation in risk between sites.
  - Chronic screening: HI ranged from 0.6-1.4.
  - Upper-bound cancer risk: ranged from 2.5-6 in a 100,000.
Conclusions

Compounds fell into three categories:

- **Mobile Source Pollutants**
  - Ubiquitous
  - Benzene, Formaldehyde and Acetaldehyde

- **Globally Distributed Pollutants**
  - Carbon Tetrachloride

- **Point Sources**
  - Manganese
Conclusions

- Pollutant concentrations generally varied with population density:
  - Large urban centers generally had highest concentrations.
  - Suburban sites and small cities generally had similar pollutant concentrations.
  - Rural areas had lowest pollutant concentrations.

- Within cities, location of monitor was important for calculating risk.
More Information

- **Full Report**
  - [http://www.pca.state.mn.us/air/toxics/at-monitoringstudy-9601.html](http://www.pca.state.mn.us/air/toxics/at-monitoringstudy-9601.html)

- **Summary Environmental Bulletin**
  - [http://www.pca.state.mn.us/publications/environmentalbulletin/index.html](http://www.pca.state.mn.us/publications/environmentalbulletin/index.html)

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