Conclusions

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Overall Conclusions (1 of 2)

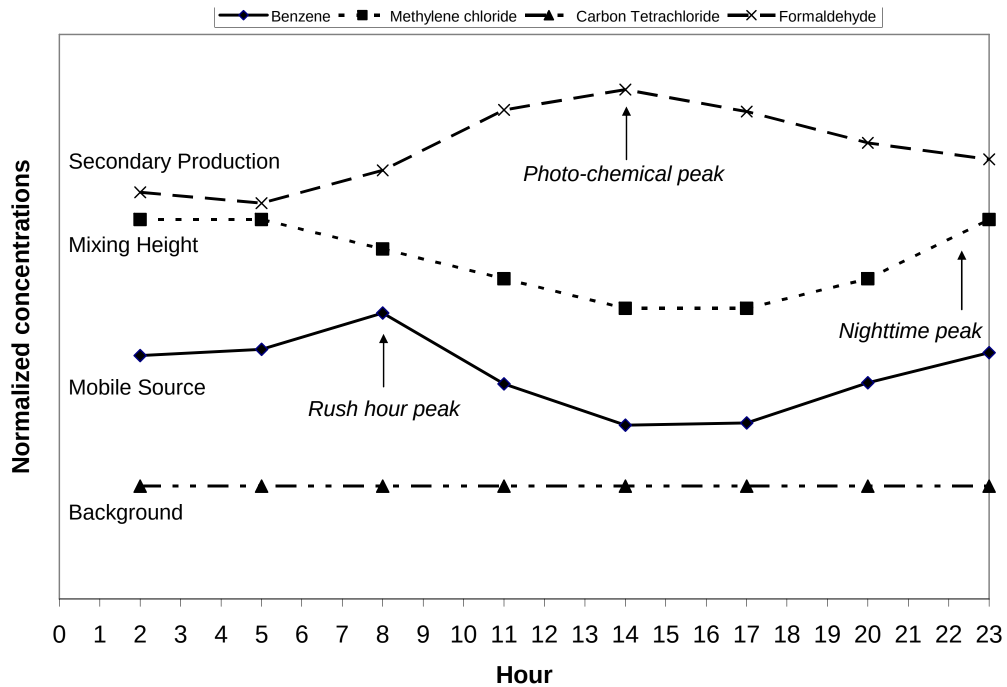
- Air toxics data are adequate to investigate national spatial and temporal trends
  - This project quantified annual trends for 15 air toxics—more than previously reported in the literature (just benzene and lead)
  - More air toxics data are available to be mined
- Detection limits are still an issue
  - More improvement is still needed

Overall Conclusions (2 of 2)

- Air toxics are much more complicated than ozone and $PM_{2.5}$ with respect to diurnal, seasonal, annual, and spatial trends
  - There is no single, representative national urban trend for air toxics
  - Spatial and temporal trends are pollutant- and location-specific

Conclusions – Diurnal Variability

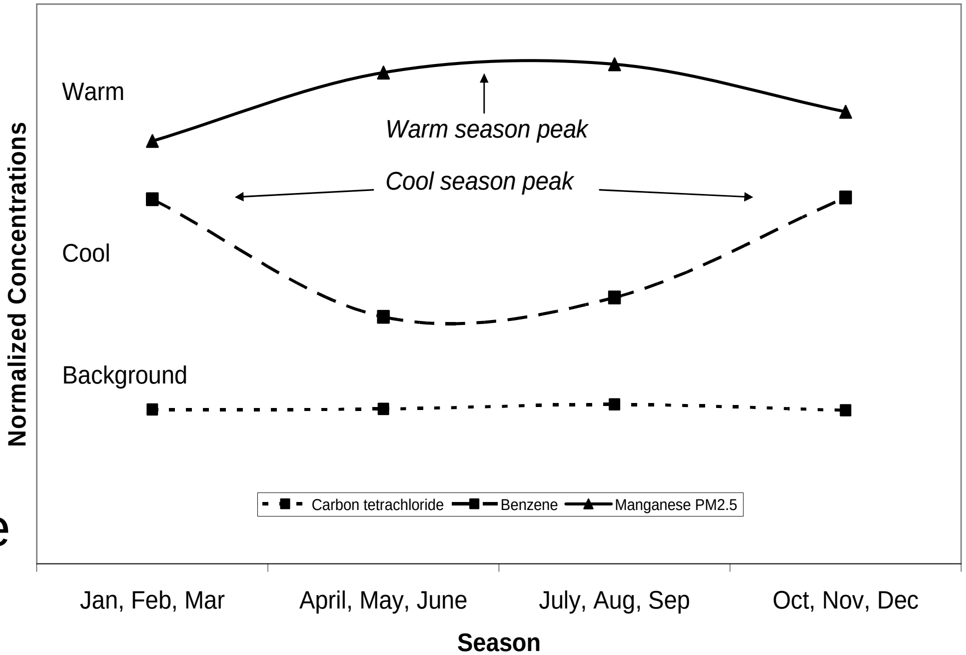
- Most HAPs diurnal patterns fit a model that gives us confidence that we can predict the diurnal patterns of other HAPs
- Practical uses of findings
  - Exposure models using 24-hr measurements may be able to adjust concentrations diurnally.
  - Patterns may be used to adjust completeness criteria for calculating 24-hr averages from subdaily measurements.



Diurnal patterns, from presentation of Temporal Trends in Air Toxics

Conclusions – Seasonal Variability

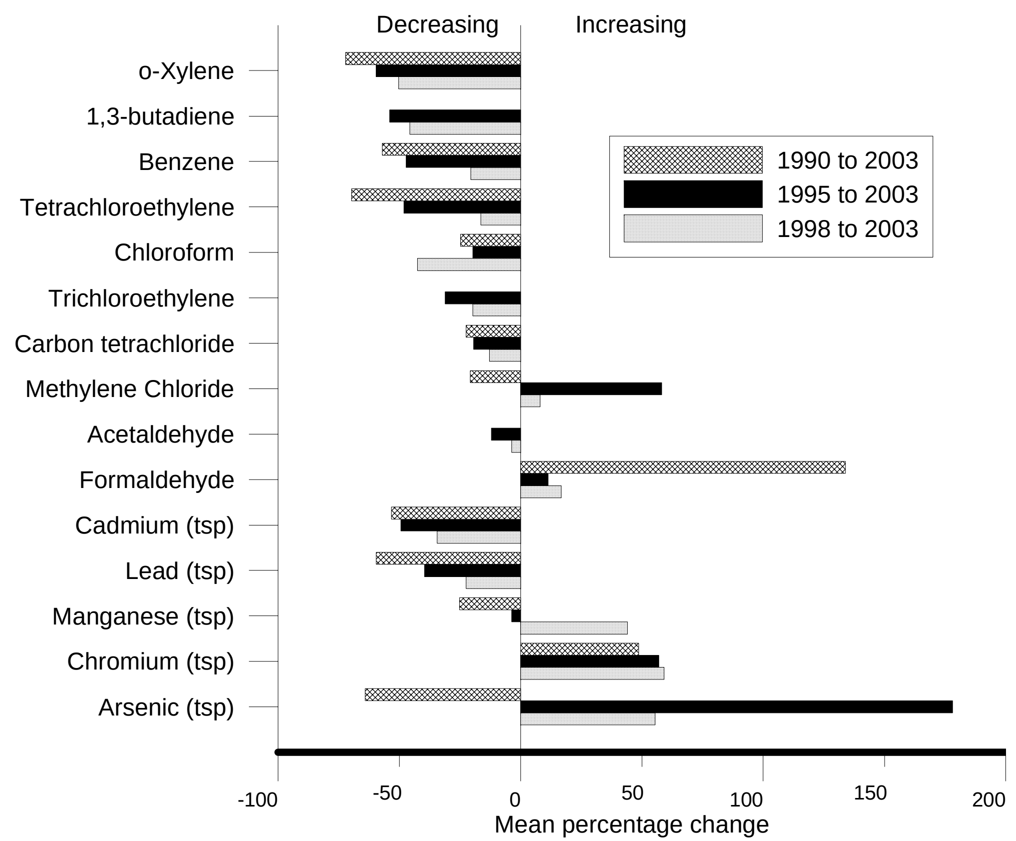
- Most HAPs seasonal patterns fit a model that gives us confidence we can predict the seasonal patterns of other HAPs
- Practical uses of findings
  - Exposure models using annual averages may be able to adjust concentrations for seasonal variations
  - Patterns may be used to adjust completeness criteria for calculating annual averages from seasonal averages



Seasonal patterns, from presentation of Temporal Trends in Air Toxics

Conclusions – Annual Trends

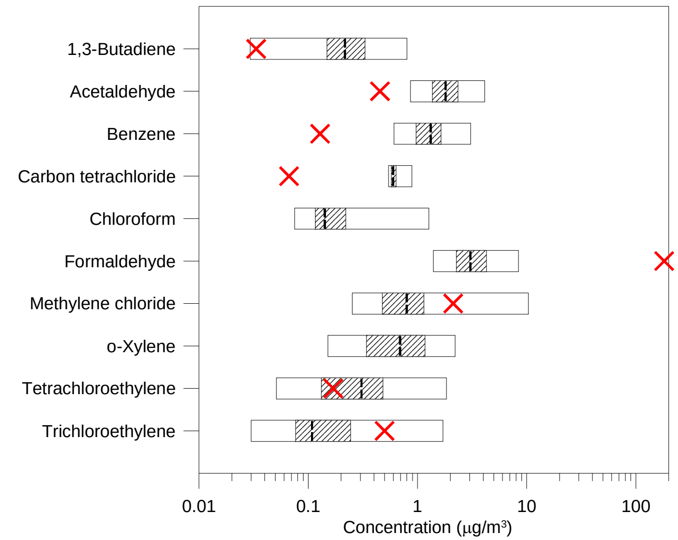
- Concentrations of about half the air toxics have significantly decreased
- Other air toxics showed changes that were increasing, decreasing, or both, but were not statistically significant

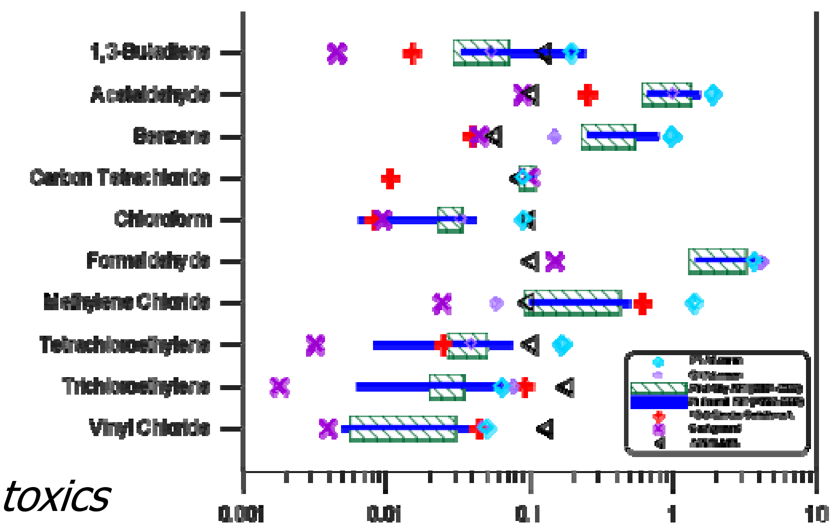


Annual trends, from presentation of Temporal Trends in Air Toxics

Conclusions – National Urban Concentration Ranges

- Urban concentrations of about half the air toxics examined were above 10^{-6} cancer benchmark values.
- MDLs for many air toxics are too high to characterize the low end of urban concentration ranges.

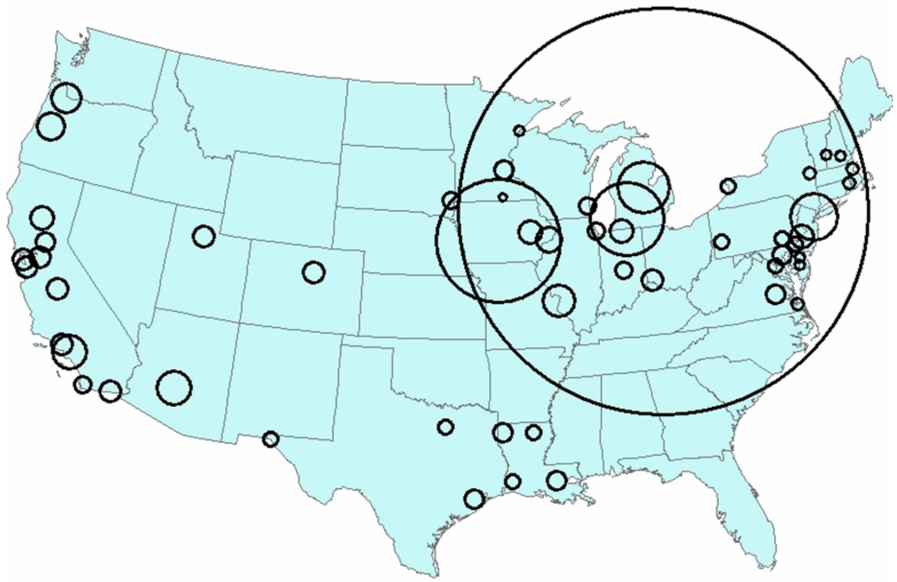




No one region had high concentrations of all air toxics

Conclusions – Between-City Variability

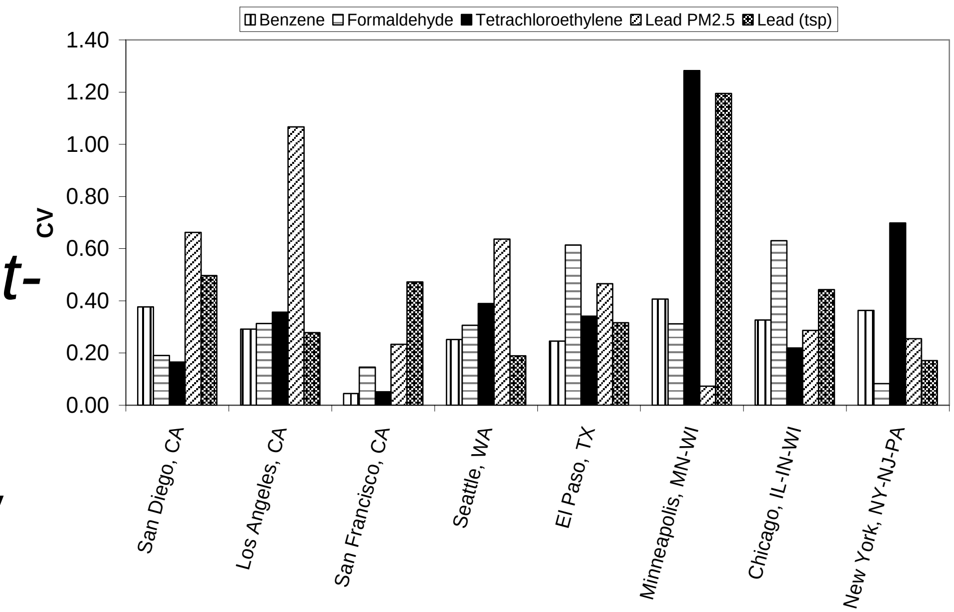
- Concentrations of air toxics are more variable between cities than ozone or $PM_{2.5}$ concentrations
- More monitors may be necessary to characterize air toxics concentrations



Spatial variability in citywide average concentrations (μg/m^3) of methylene chloride, from presentation National, Regional, Between-City, and Within-City Spatial Variability in Air Toxics.

Conclusions – Within-City Variability

- The within-city representativeness of a given monitor is *pollutant-* and *location-specific* for air toxics.
- The within-city variability of a given pollutant
  - is not consistent across cities, and
  - is not necessarily consistent with other chemically similar pollutants.



Within-city variability by pollutant and city. From the spatial variability presentation.

- The within-city variability of air toxics may require more monitors than criteria pollutants for adequate characterization.

Conclusions – Exploratory Analyses

- Meteorological trends adjustment appeared to be important for trend detection in benzene and lead (tsp), and may be important for other air toxics as well.
- Using a simple approach, most air toxics did not correlate well with ozone, $PM_{2.5}$, or other air toxics.
- Trends in concentrations can be correlated with trends in emissions and MACT regulations, but cannot be verified without speciated inventories of major nearby emissions sources and local knowledge of why these changes occurred