Camden, NJ: An Example of an Air Toxics “Hotspot”

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Environmental Hotspot for Air Pollution Exposure

- Definition: a “hot spot” is a small area (e.g., community or neighborhood) with dense sources of air toxics, and the average or upper bound concentrations of one or more air pollutants are much higher than those in surrounding areas and other locations.

- Residents living in a hot spot may be at greater health risk due to exposure to air pollutants.
Gaps in Understanding Health Effects of Air Toxics

- Exposure to air toxics and health risks for people located in “hotspots” may be under-estimated based on results of routine ambient air monitoring.

- Limited ambient concentration and personal exposure data of air toxics in community level.
Why Waterfront South (WFS) Neighborhood of Camden, NJ

- High density of local emission sources
- Suspected “hotspot” of air toxics
- Predicted High carcinogenic risk
- Depressed economic conditions

An issue that can be transposed to many locations around the globe
“Hotspot” of Air Toxics
WFS Neighborhood in Camden, NJ

△ Industrial facilities
○ Subject homes

☆ : current fixed sampling sites
Reported Local Emission Sources of Air Pollution in the WFS

- **Industrial sources**
  A total of 26 industrial and manufacturing facilities, e.g. Camden sewage treatment plant, recycling factory, St. Lawrence Cement Company, Camden Iron and Metal, etc.

- **Mobile sources**
  diesel trucks, >150,000 trucks/year travel through this community.
Cement & Sewage Treatment Plants & HWY 676, and Industrial Facilities in WFS
Industrial Facilities in WFS
Objectives of the Main Study

- To characterize local ambient and personal concentrations of air toxics using measurements and simulations in a suspected “hotspot” - Waterfront South (WFS) Camden, NJ.

- To assess the impact of local industrial and mobile sources on measured neighborhood ambient concentrations and personal exposures and risk in WFS and CDS.
Main Study Design

Neighborhood Ambient and Personal Measurements

WFS (60 subjects)
- Winter
  - Weekday
  - Weekend
- Summer
  - Weekday
  - Weekend

CDS (40 subjects)
- Winter
  - Weekday
  - Weekend
- Summer
  - Weekday
  - Weekend

A. 24-h outdoor and personal samples of Fine particles, Volatile Organic Compounds, carbonyls, & Polycyclic Aromatic Hydrocarbons
B. Baseline and Activity questionnaires and Time/Activity Diaries
C. Modeling Exposure -- \nD. 107 Subjects participated
Personal Sampling Pack
Benzene Ambient and Personal Monitoring

Ambient Benzene Concentration (μg/m³)

- Summer: 0.01, 0.1, 1, 10, 100
- Winter: 0.01, 0.1, 1, 10, 100

Personal Benzene Concentration (μg/m³)

- Summer: 0.01, 0.1, 1, 10, 100, 1000
- Winter: 0.01, 0.1, 1, 10, 100, 1000

N=49 Summer
N=57 Summer
N=37 Winter
N=42 Winter

N=86 Summer
N=104 Summer
N=79 Winter
N=96 Winter

Graphs showing the distribution of benzene concentrations for ambient and personal monitoring in summer and winter, with data points and error bars indicating the range of concentrations.
HEXANE Ambient and Personal Monitoring

**Ambient Hexane Concentration (μg/m³):**
- Summer: N=46
- Winter: N=53

**Personal Hexane Concentration (μg/m³):**
- Summer: N=42
- Winter: N=45

Charts show box plots comparing CDS and WFS concentrations for Summer and Winter periods.
Toluene: Ambient and Personal

![Graph showing ambient and personal toluene concentration](image)
Formaldehyde Ambient and Personal Monitoring

![Box plots showing formaldehyde concentrations](image_url)
Analysis of Ambient Source Contributions for the 24-Hour Averages of ISCST3 predictions – AN Example: 20060715
Comparison of Personal Benzene Levels in CDS vs. WFS Using Measurements, and Modeling with activity Diaries

![Benzene Levels Graph](graph.png)
“Saturation Sampling”

- A total of 38 locations were selected as sampling sites for the “saturation sampling” study.
  - 22 in the WFS and 16 in the CDS
- Sampling duration: 24 and 48 hours
- Two summer and one winter sampling campaigns
- Target compounds
  - VOCs (3M OVM badge)
  - Carbonyls (PAKS)
Formaldehyde – (μg/m³)
Formaldehyde spatial distributions (annual and seasonal) and sample hourly time series predicted by CMAQ (at 4 km resolution) for 2001

EPA's CMAQ-4km predicted 2001 hourly formaldehyde in Central Philadelphia

Seasonal_Average_winter 4km_grid_resolution

Seasonal_Average_summer 4km_grid_resolution

20ppb ~ 24.5 ug/m3
Summary

- WFS can have higher levels of formaldehyde, MTBE and toluene on individual days.

- Typically Benzene evenly distributed between CDS and WFS

- Levels of formaldehyde were high in both areas, indicating significant impact of diesel emissions on the ambient and personal air of people living in both WFS and CDS.
Summary

- Very high MTBE and aromatic VOC levels were found close to industrial/commercial facilities in WFS, indicating major contributions to neighbors <300 m from a source under certain meteorology
  - Significant for source control
  - Significant for the design of future Health Studies

- In contrast, both WFS and CDS exhibit exposures that can classify the entire area as a “Hot spot” for Formaldehyde from MOBILE SOURCES

- **General Conclusion:** Air Toxics saturation and/or personal monitoring can identify impact of industrial or other point sources near residential neighborhoods, and are recommended as a tool to better examine the impact on human risk to Carcinogens and other toxicants.

- **General Conclusion:** Exposure modeling is a very important component of defining Hot spots in mobile source investigations
Acknowledgments

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