



Minnesota  
Pollution  
Control  
Agency

# Minnesota Statewide Air Toxics Monitoring Study

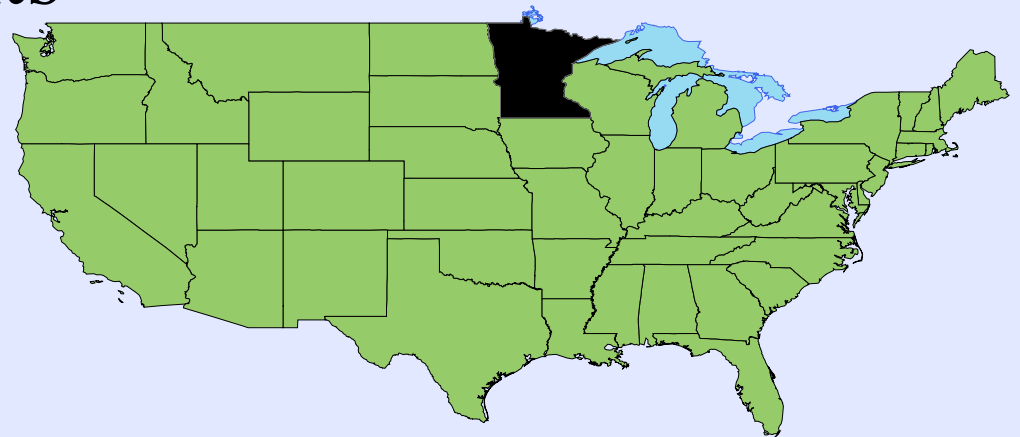
Kari Palmer

November 2006



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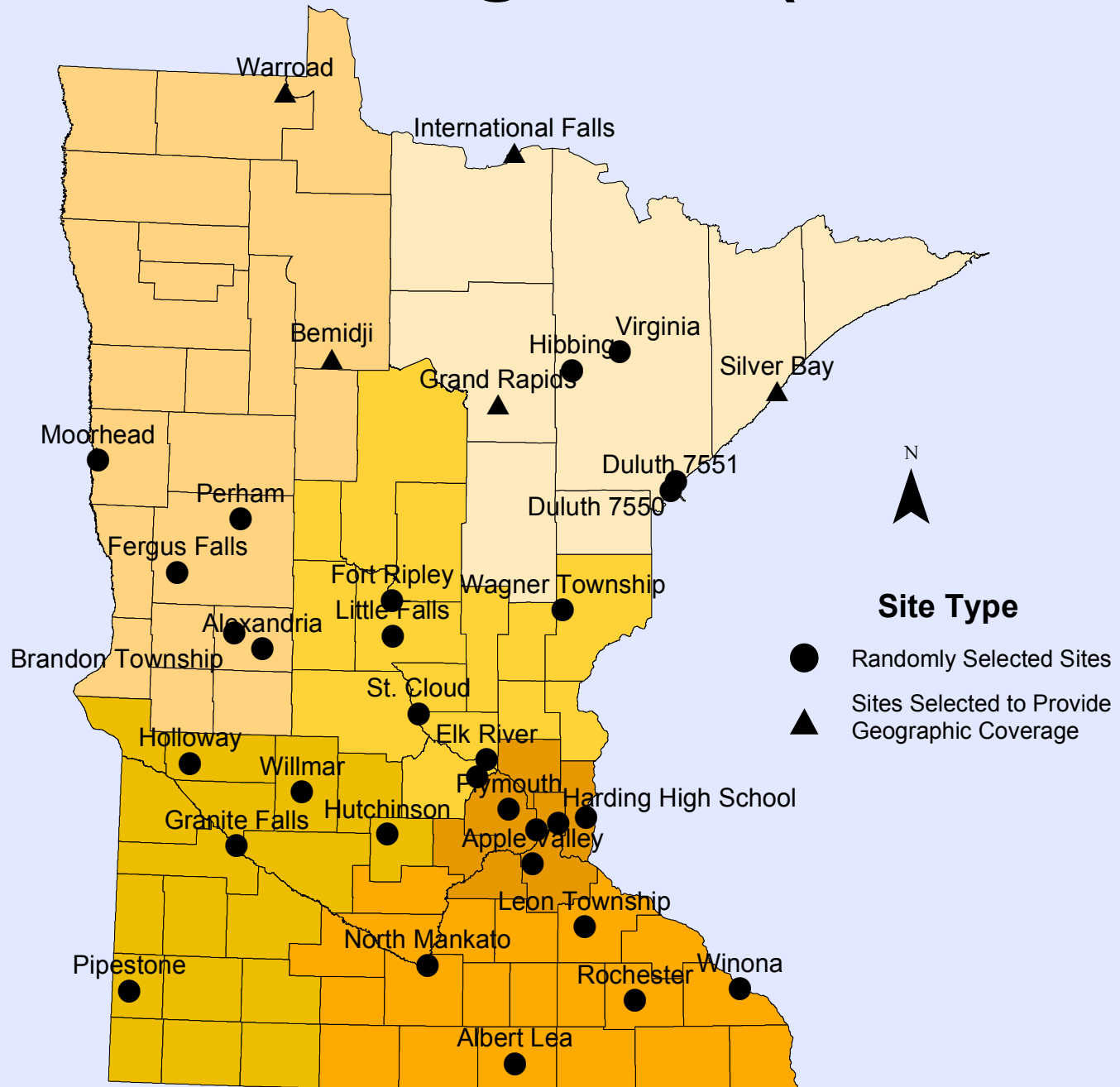
- 30 randomly selected monitoring sites.
  - 5 additional sites for geographic coverage
  - 7 sites per year
  - 5 year study (1996-2001)
- 74 air toxic pollutants
  - 37 volatile organic compounds
  - 7 carbonyls
  - 30 metals



# 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.

# Statewide Monitoring Sites (1996-2001)



# Silver Bay (1999-2000)

PM<sub>10</sub> →

Air Toxics

PM<sub>2.5</sub>



# Health Benchmarks

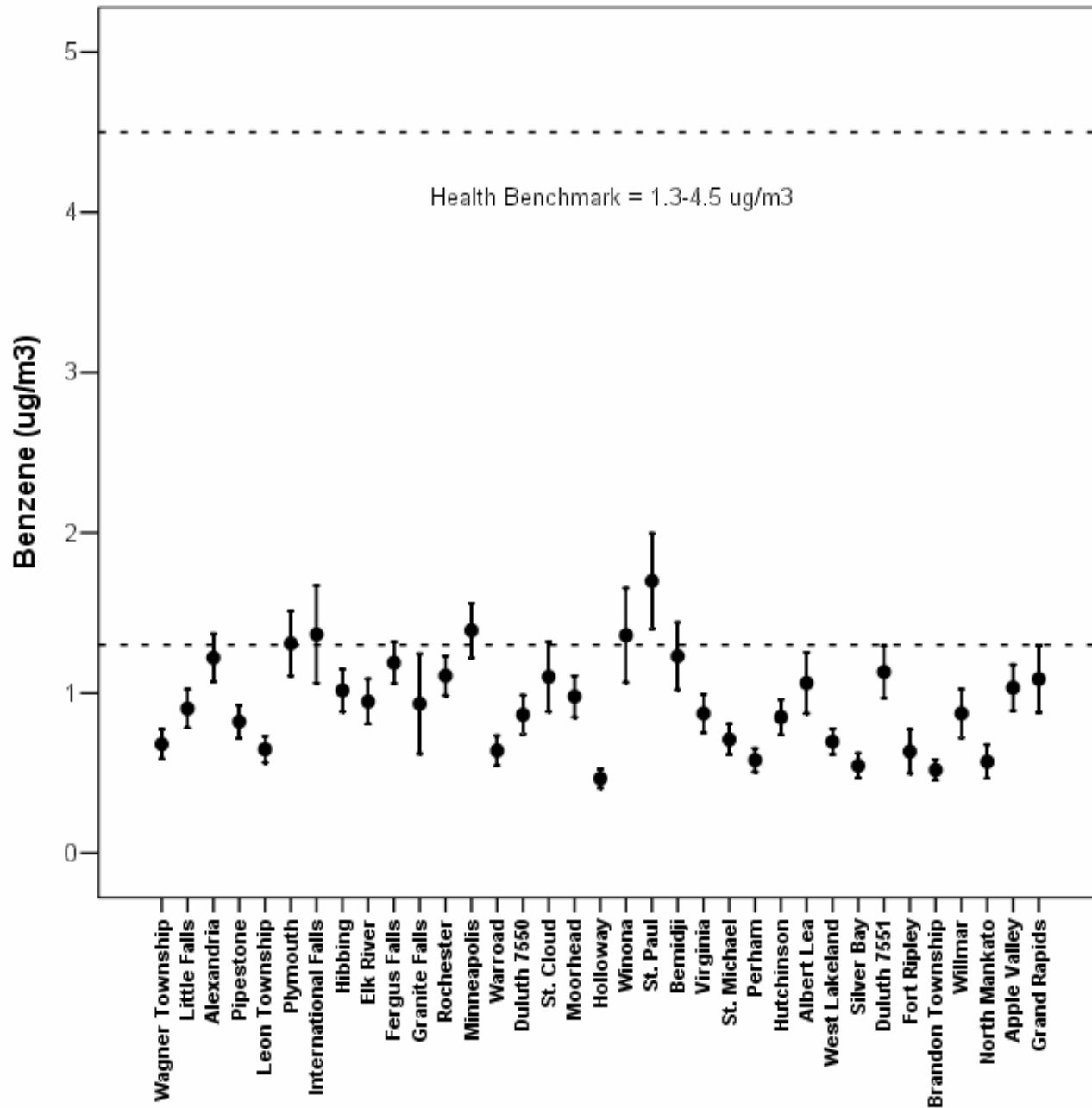
- Concentrations of chemicals emitted to air that are unlikely to pose a significant risk of harmful effects when humans are exposed to those concentrations over a specified time.
- Minnesota uses a negligible upper bound cancer risk of 1 in a 100,000 and non-cancer hazard quotient of 1.

# Compounds Posing $>1$ in 100,000 Additional Cancer Risk

- Benzene: 5 sites
- Formaldehyde: 35 sites
- Carbon tetrachloride: 23 sites

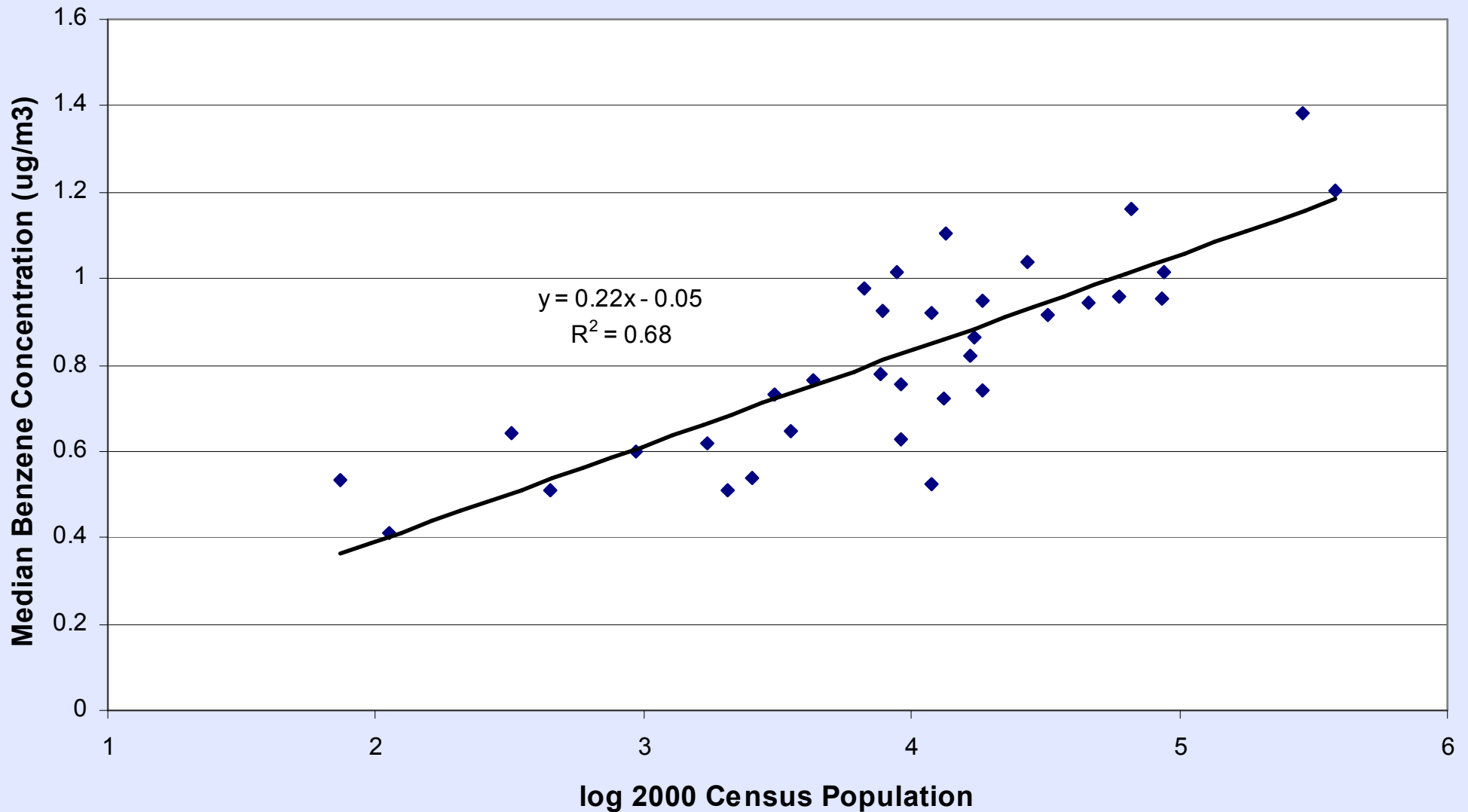


# Average Benzene Concentrations (1996-2001)

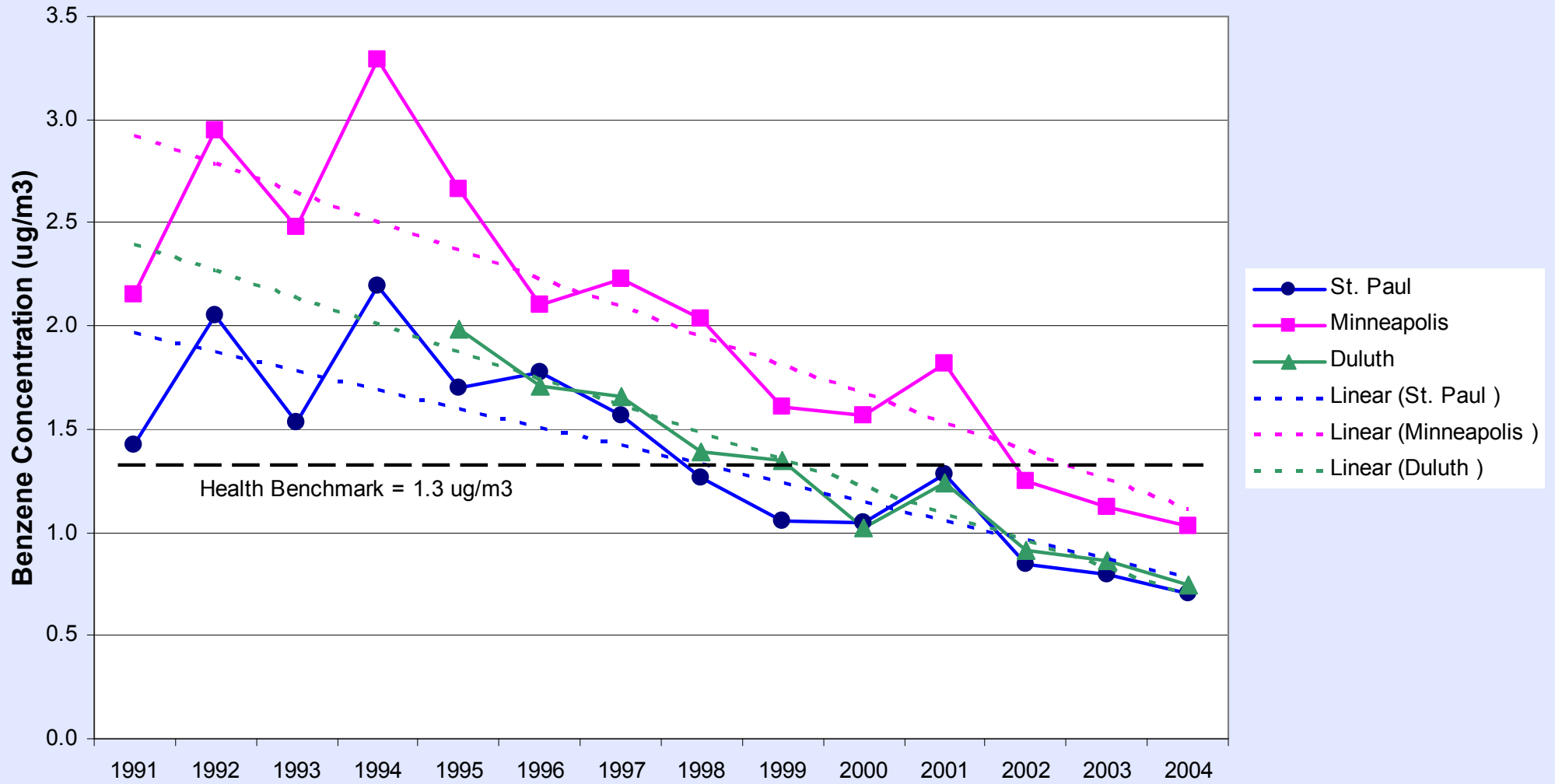




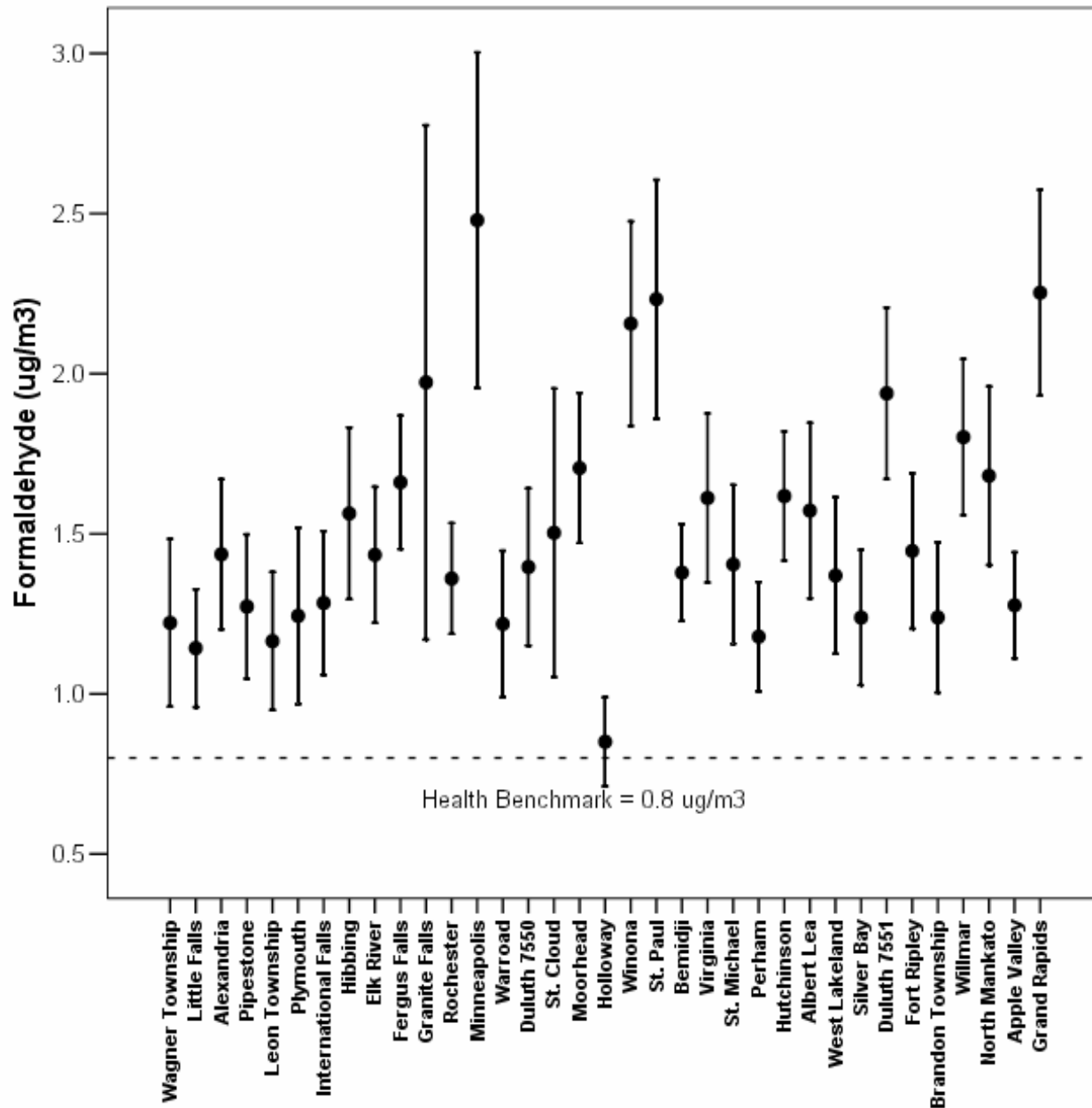
# Median Benzene Concentrations Compared to log Population (1996-2001)



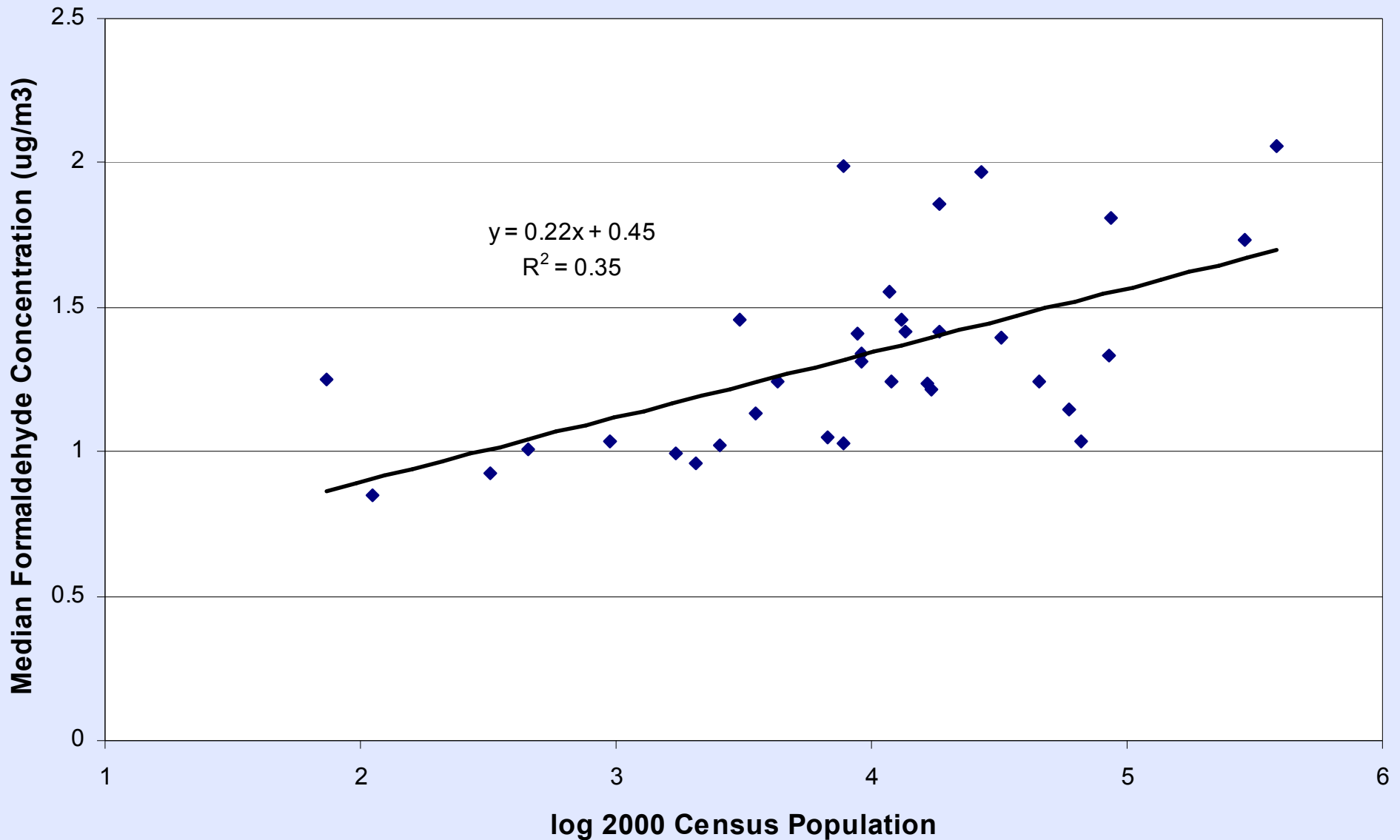
# MN Benzene Trends (1991-2004)



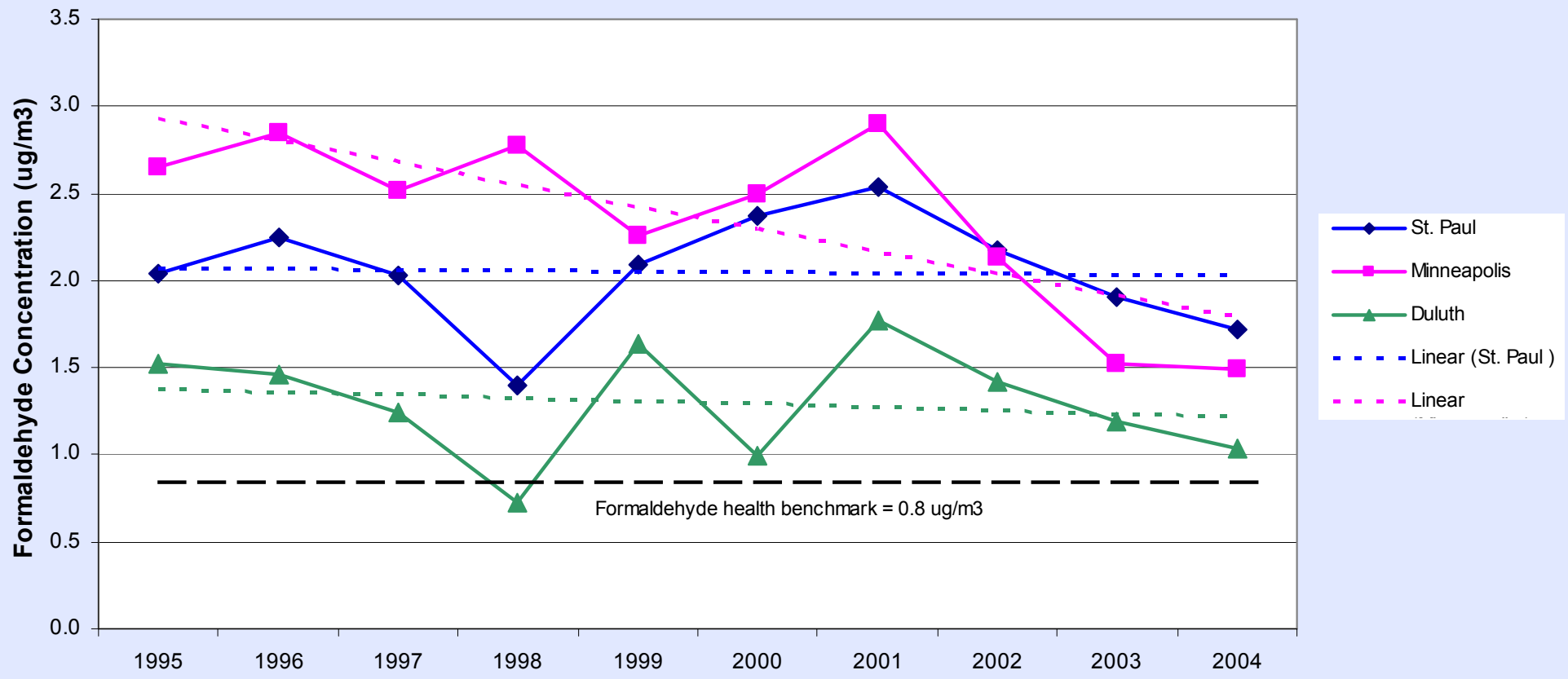
# Average Formaldehyde Concentrations (1996-2001)



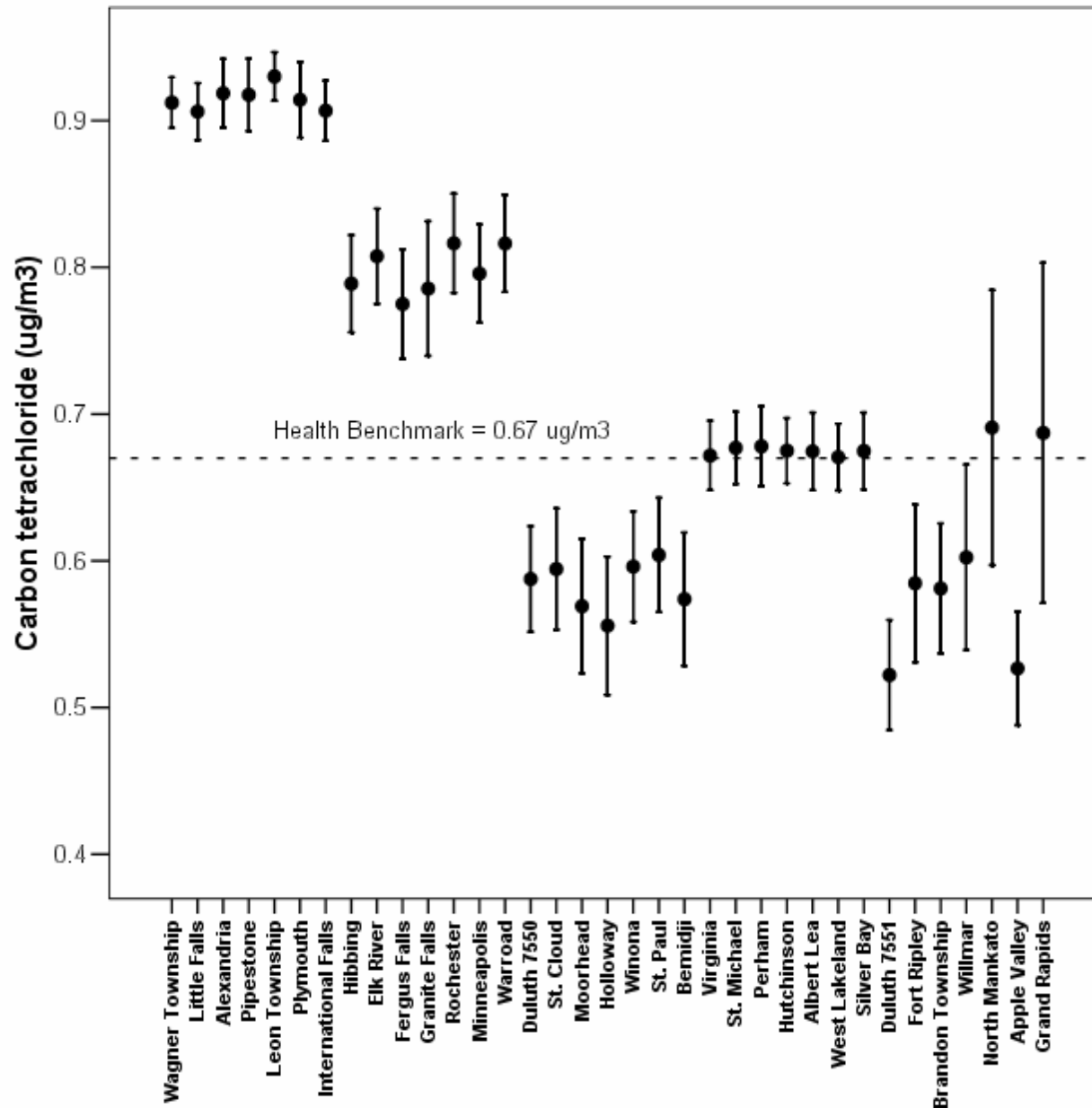
# Median Formaldehyde Concentrations Compared to log Population (1996-2001)



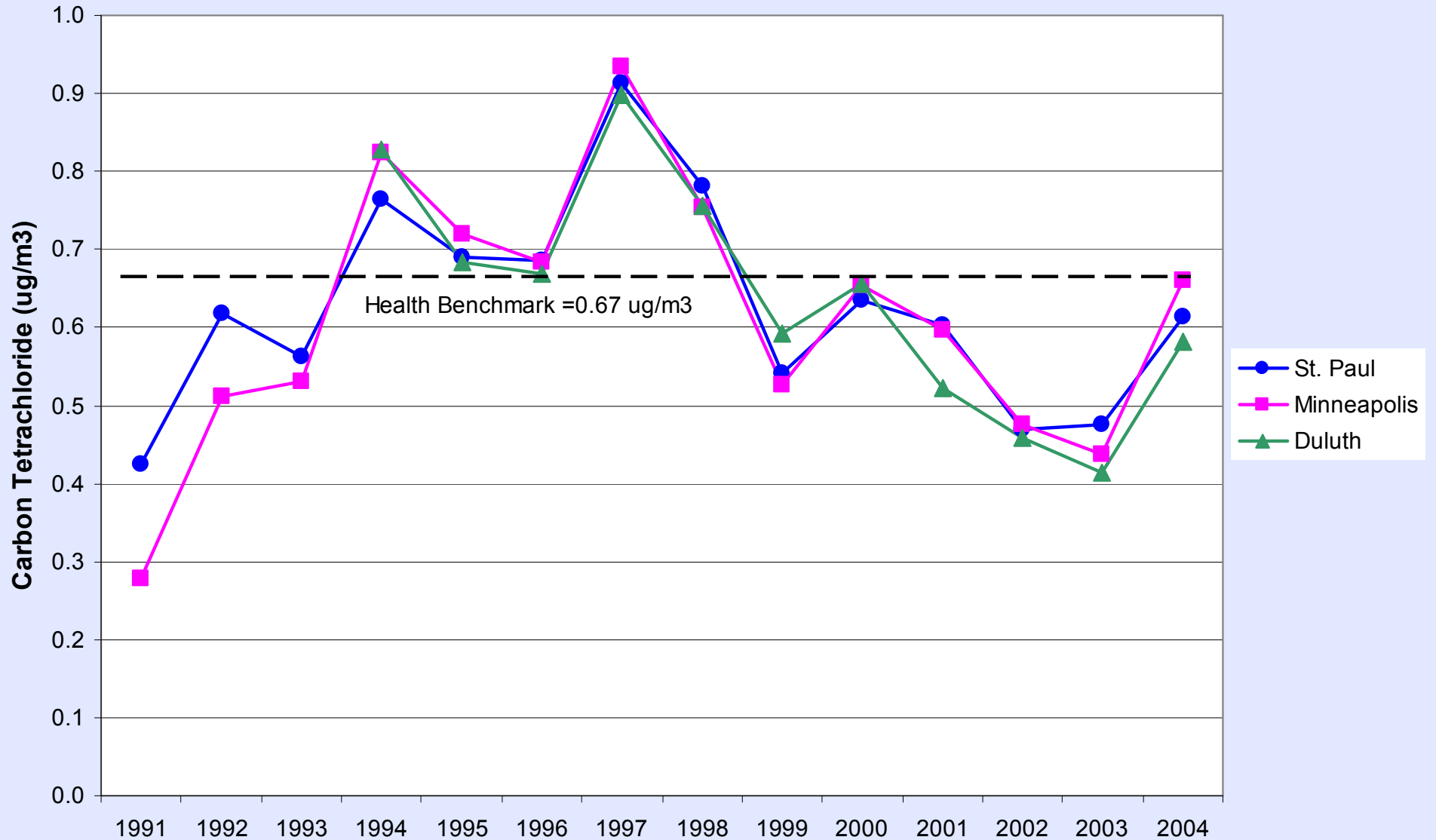
# MN Formaldehyde Trends (1995-2004)



# Average Carbon Tetrachloride Concentrations (1996-2001)



# MN Carbon Tetrachloride Trends (1991-2004)



# 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

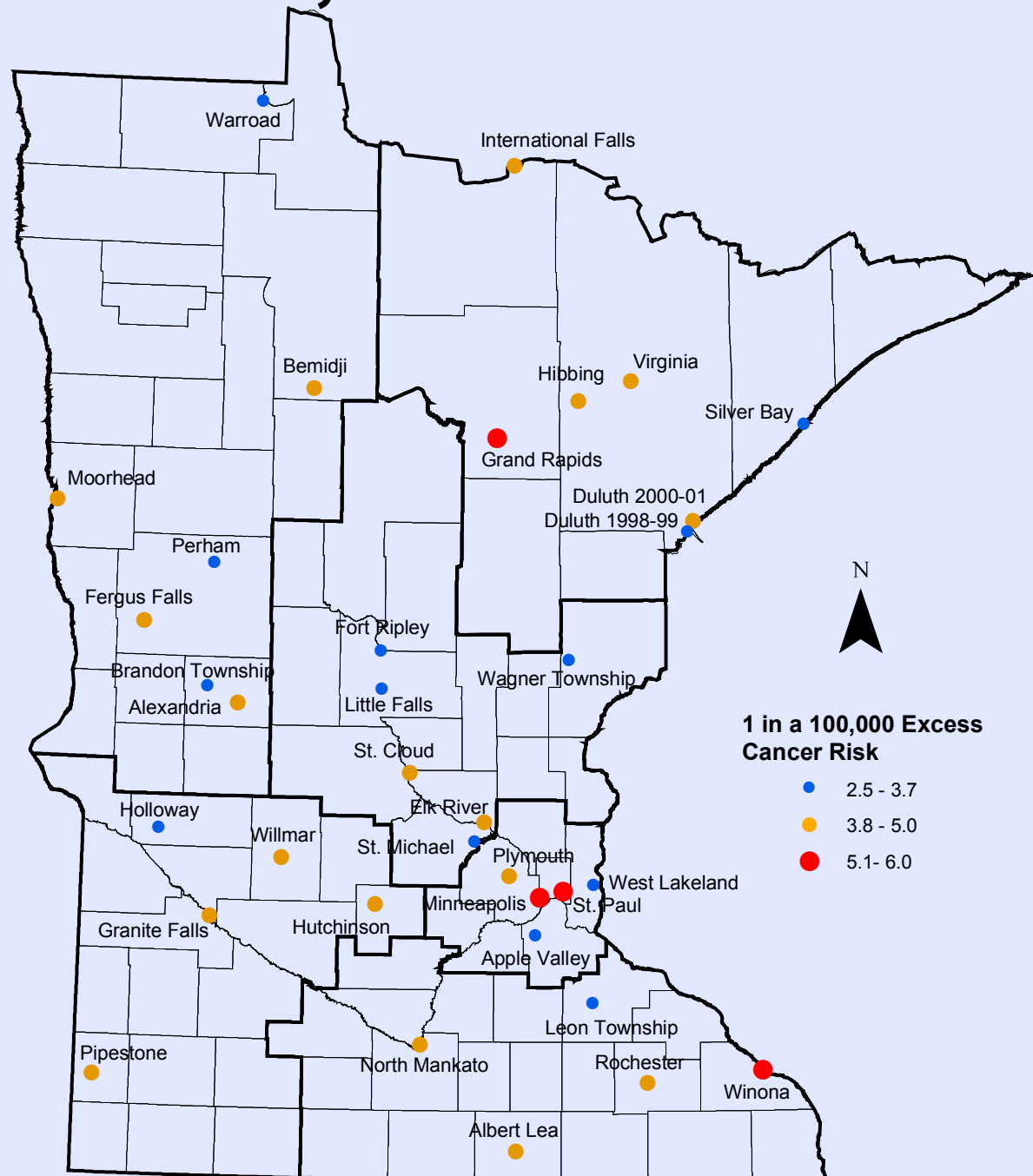
\*Current ICP data does not show these compounds above benchmarks.

# Cancer and Non-Cancer Risk Estimates\*

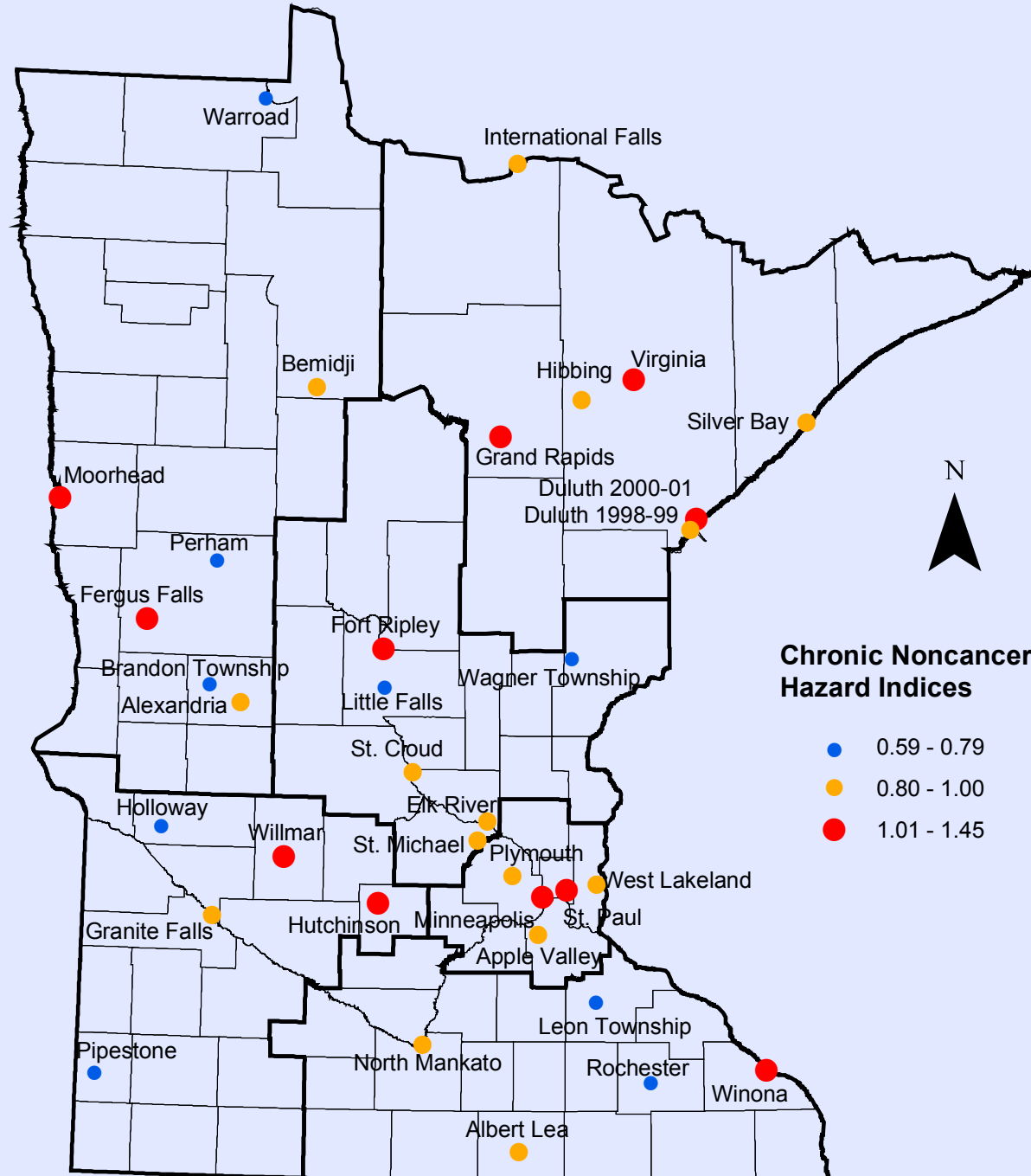
- Additional upper-bound cancer risk per 100,000
- 2.5-6
- Non-cancer chronic hazard index
- 0.6-1.4

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

# 1 in a 100,000 Cancer Risk



# Chronic Non-Cancer Hazard Indices



# 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>

## ■ Summary Environmental Bulletin

- <http://www.pca.state.mn.us/publications/environmentalbulletin/index.html>

## ■ Contact Information

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