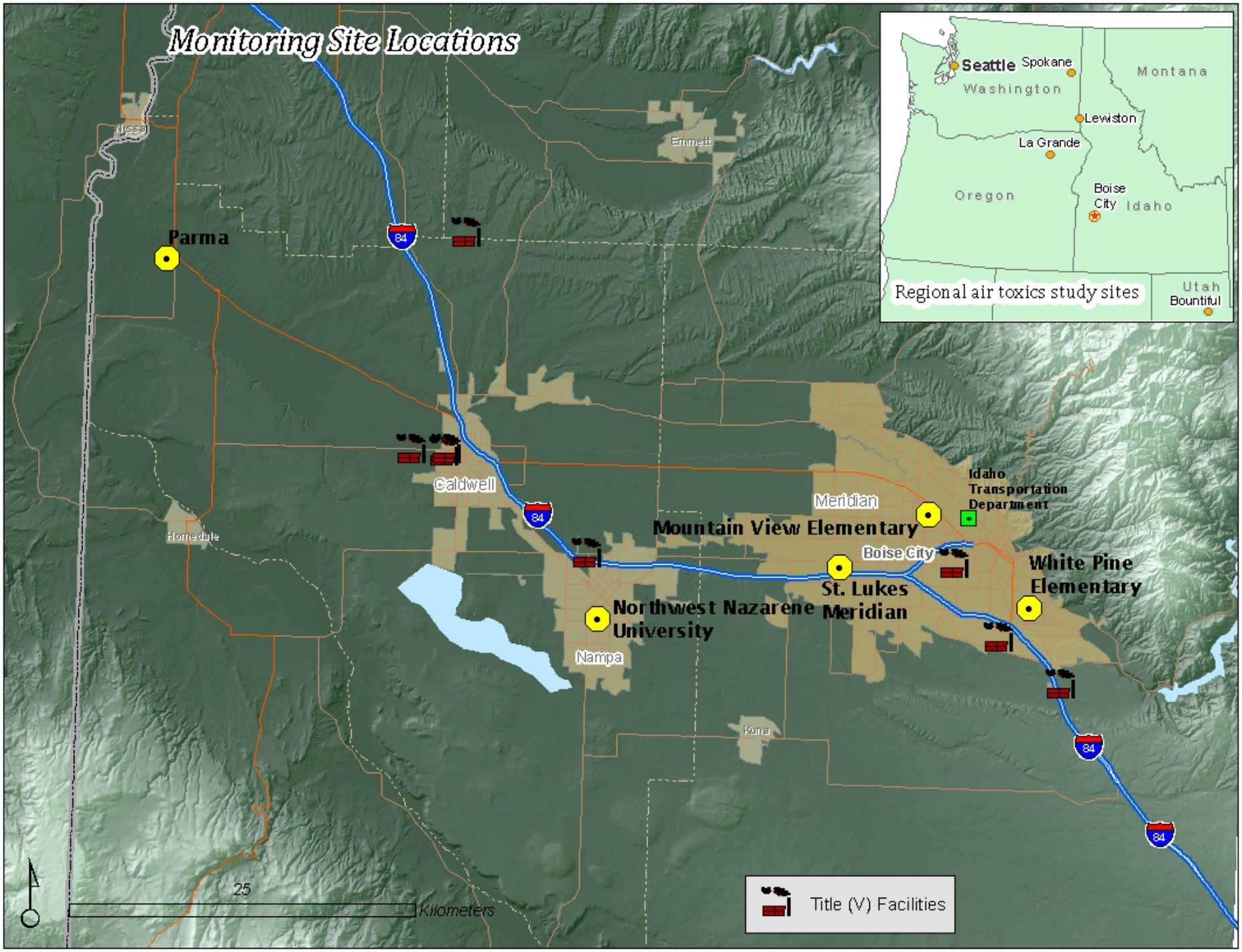
2007 Treasure Valley Idaho Community Scale Air Toxics Monitoring Study

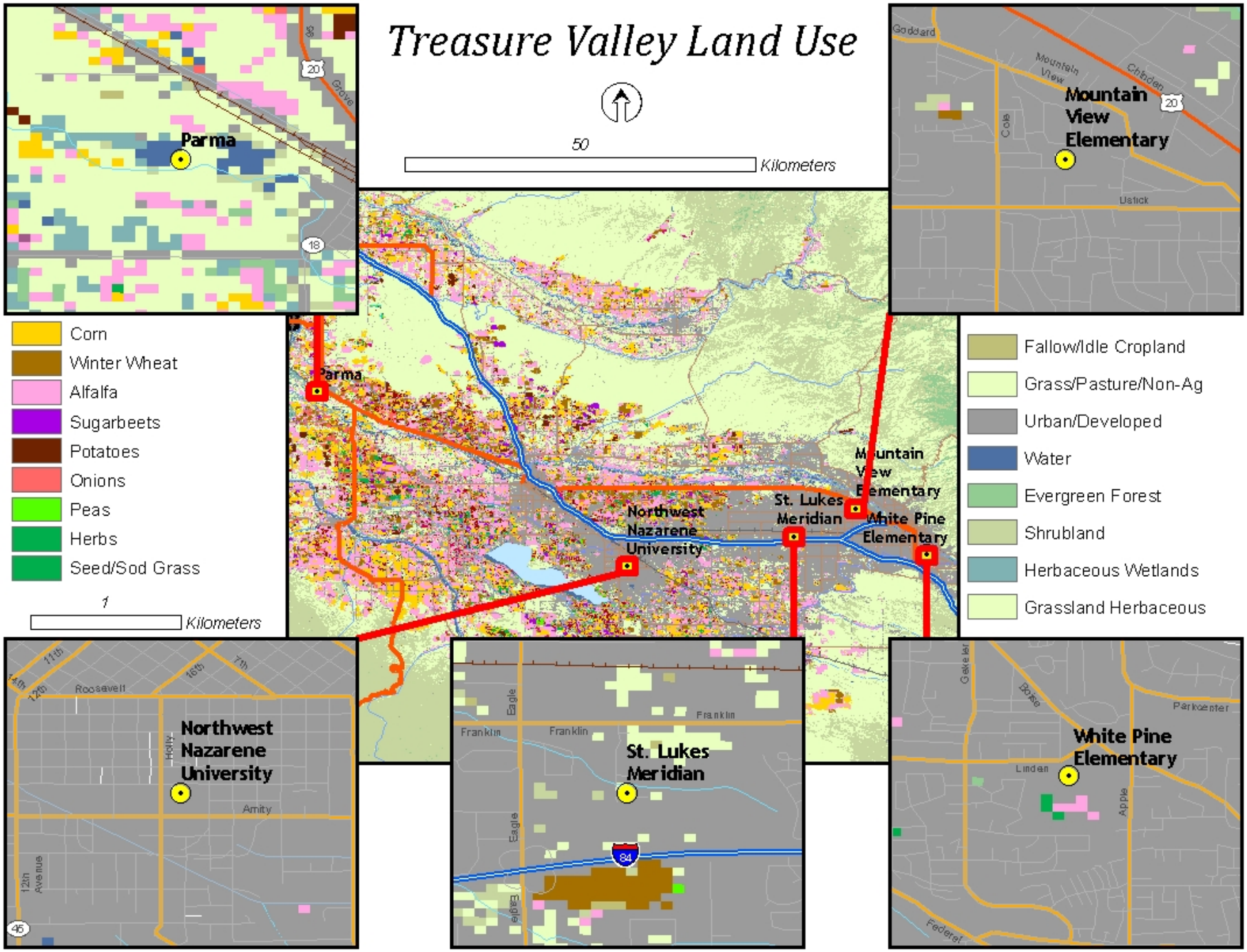
Idaho Department of Environmental Quality

To be covered today:

- Background/Description of sites
- Preliminary Risk Screening Analysis
- Comparison to NATA 2002
- Source identification
- Comparison to national datasets


Monitoring Site Locations
Parma
Caldwell
Homedale
Nampa
Kuna
Meridian
Boise City
Emmett
Mountain View Elementary
St. Lukes Meridian
Northwest Nazarene University
Idaho Transportation Department
White Pine Elementary
84
Seattle
Spokane
Washington
Montana
Lewiston
La Grande
Oregon
Boise City
Idaho
Utah
Bountiful
Regional air toxics study sites
25
Kilometers
Title (V) Facilities

Treasure Valley Land Use



Sampling and Analysis Methods

- Metal/Trace Element Hazardous Air Pollutants
  - Quartz PM10 Hi-vol filters
  - Metals analysis by EPA IO-3.5 (ICP analysis)
- Volatile Organic Carbon Compounds (VOCs)
  - Whole-air samples in evacuated Summa Cans
  - EPA Method 15A (GC/FID)
- Carbonyls (aldehydes and ketones)
  - Sample adsorbed on DNPH cartridge
  - Analysis by EPA Method 11A (HPLC)
- 1 in 6 sampling schedule (02/2007 – 02/2008)

Data Quality Assessment

- % > MRL
- Precision
- Completeness
- MRL QAPP requirements

Risk Screening Process

- Remove species with low data quality
- Determine maximum measured concentration
- Compare to conservative benchmarks
  - Hazard quotient > 0.1:
    - The ratio of the potential exposure to a substance and the level at which no adverse effects are expected.
  - 1 in a Million Cancer Risk:
    - A risk level of 1 in a million implies a likelihood that 1 person, out of a population of one million equally exposed people would contract cancer if exposed continuously (24 hours per day) to the specific concentration over 70 years (an assumed lifetime).

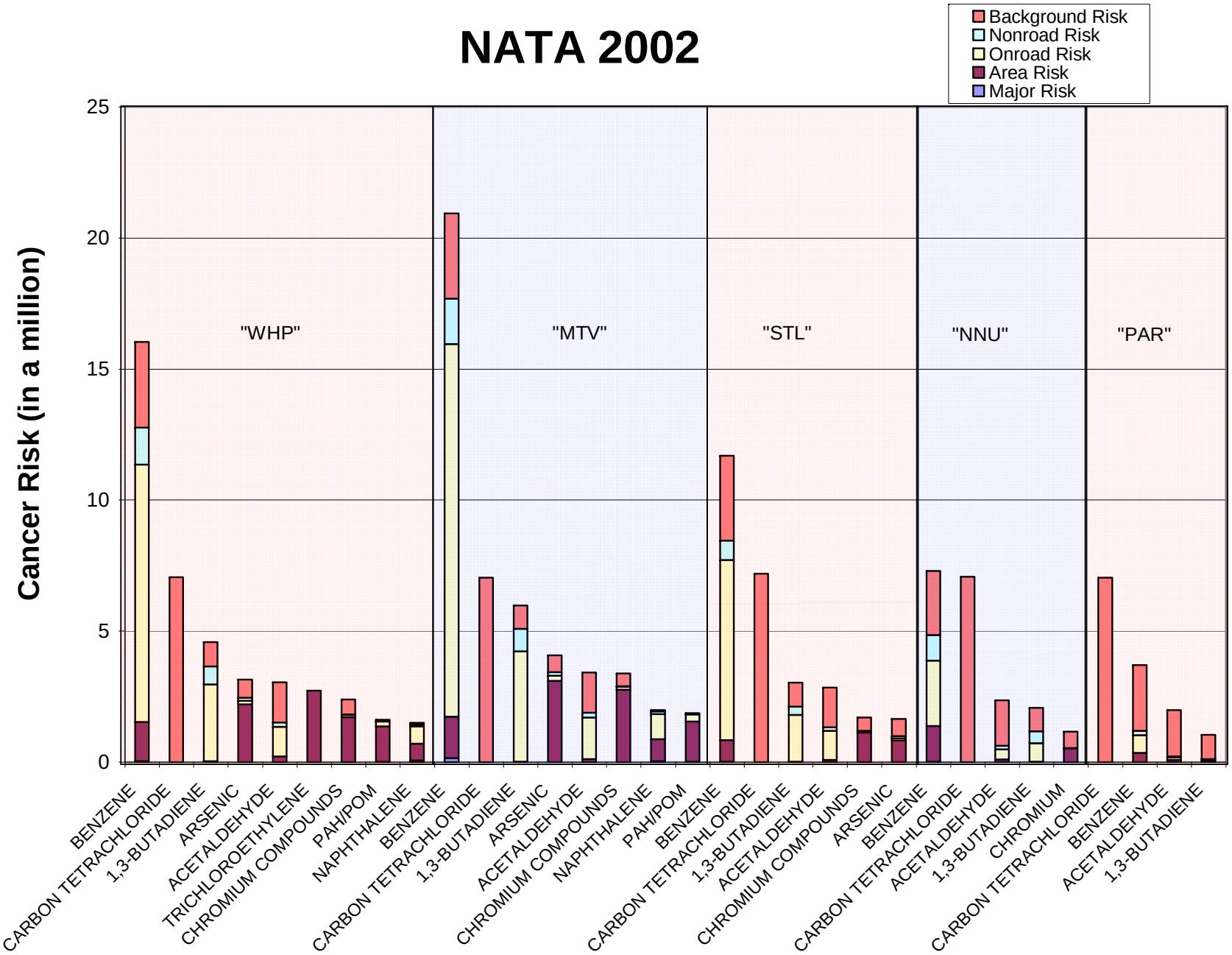
Risk Screening

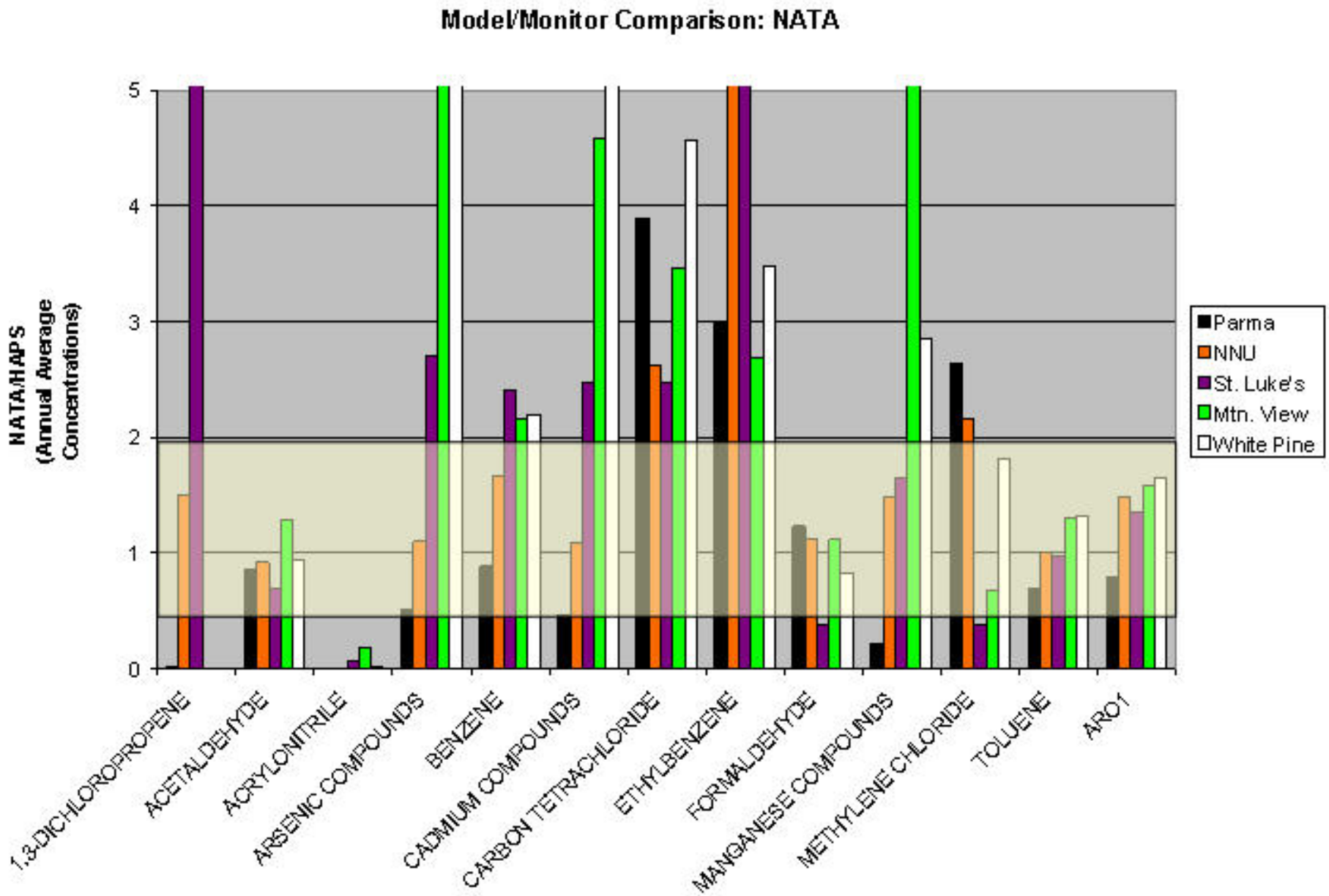
After removing the compounds measured with a low confidence, the following species are the remaining contaminants of concern:

- acetaldehyde
- arsenic
- benzene
- cadmium
- (*cis*- and *trans*-)1,3-dichloropropene
- ethyl benzene
- formaldehyde
- manganese
- methylene chloride

Carcinogenic Risk Drivers

White Pine	Mountain View	St. Luke's	NNU	Parma
benzene	benzene	formaldehyde	benzene	dichloropropene
formaldehyde	formaldehyde	benzene	formaldehyde	benzene
acetaldehyde	acetaldehyde	acetaldehyde	dichloropropene	formaldehyde
	ethyl benzene	arsenic	acetaldehyde	acetaldehyde
	arsenic		arsenic	arsenic


NATA 2002
Background Risk
Nonroad Risk
Onroad Risk
Area Risk
Major Risk
Cancer Risk (in a million)
25
20
15
10
5
0
"WHP"
"MTV"
"STL"
"NNU"
"PAR"
BENZENE
CARBON TETRACHLORIDE
1,3-BUTADIENE
ARSENIC
ACETALDEHYDE
TRICHLOROETHYLENE
CHROMIUM COMPOUNDS
PAH/POM
NAPHTHALENE
BENZENE
CARBON TETRACHLORIDE
1,3-BUTADIENE
ARSENIC
ACETALDEHYDE
CHROMIUM COMPOUNDS
NAPHTHALENE
PAH/POM
BENZENE
CARBON TETRACHLORIDE
1,3-BUTADIENE
ACETALDEHYDE
CHROMIUM COMPOUNDS
ARSENIC
BENZENE
CARBON TETRACHLORIDE
ACETALDEHYDE
1,3-BUTADIENE
CHROMIUM
CARBON TETRACHLORIDE
BENZENE
ACETALDEHYDE
1,3-BUTADIENE


Model/Monitor Comparison: NATA
NATA/HAPS
(Annual Average
Concentrations)
0
1
2
3
4
5
1,3-DICHLOROPROPENE
ACETALDEHYDE
ACRYLONITRILE
ARSENIC COMPOUNDS
BENZENE
CADMIUM COMPOUNDS
CARBON TETRACHLORIDE
ETHYLBENZENE
FORMALDEHYDE
MANGANESE COMPOUNDS
METHYLENE CHLORIDE
TOLUENE
ARO1
Parma
NNU
St. Luke's
Mtn. View
White Pine

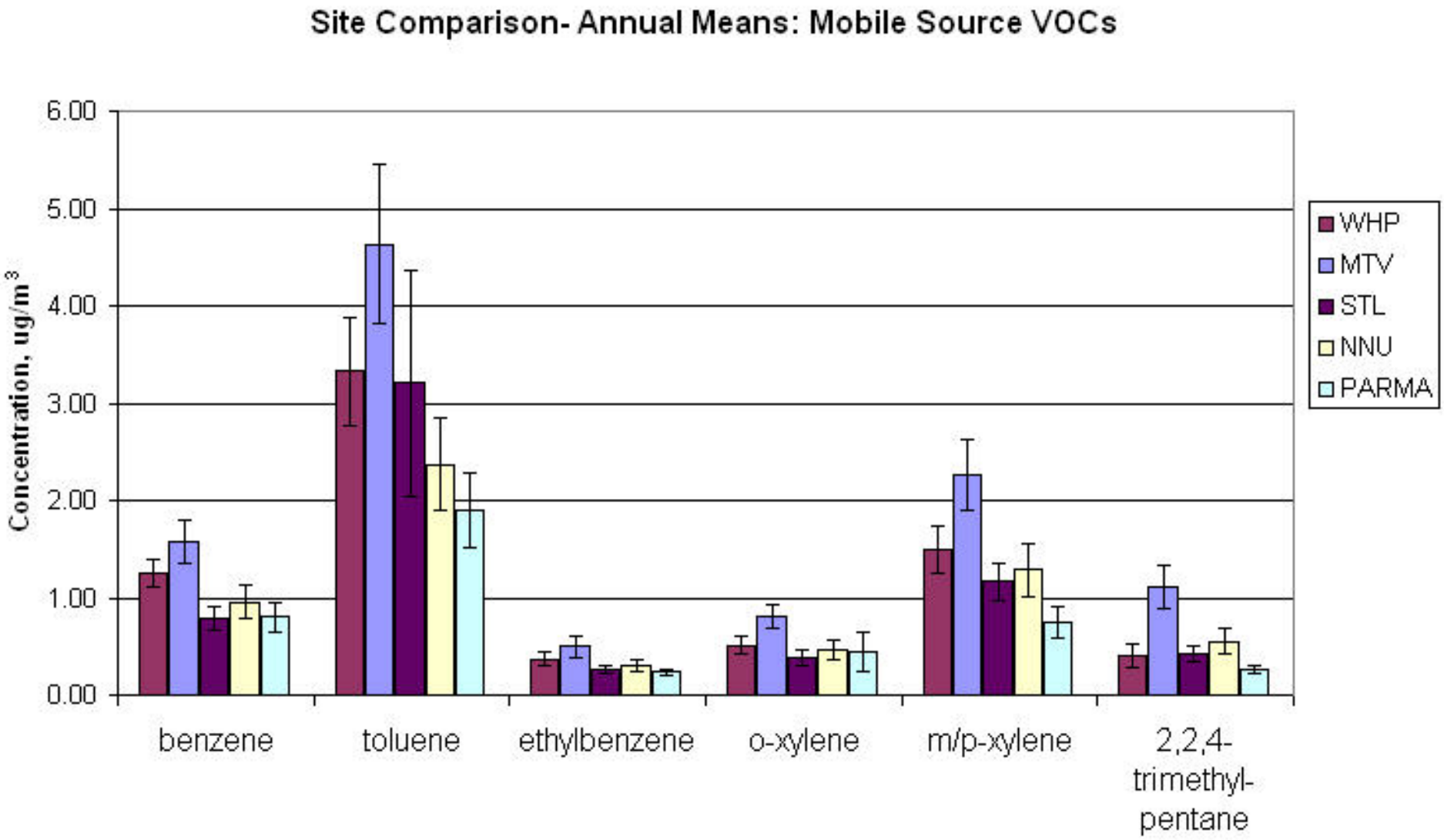
Source Identification Methods

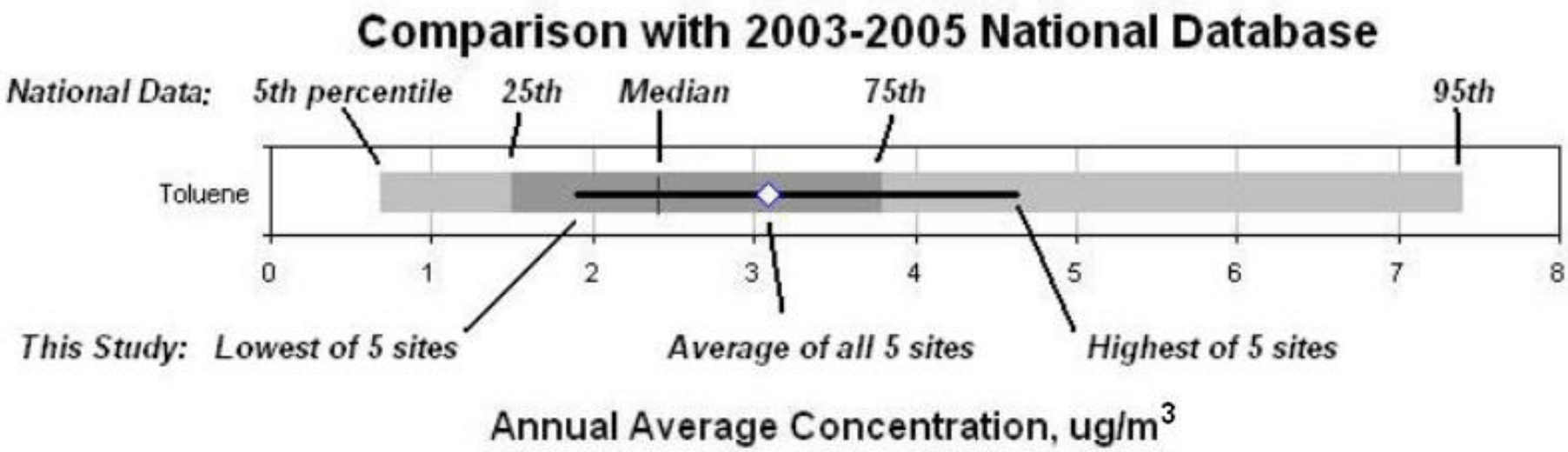
- Statistical “Receptor Modeling” methods
  - Principal Component Analysis – PCA
  - Positive Matrix Factorization – PMF
- Temporal patterns
- Correlations with other species/tracers
- Seasonal-spatial trends
- Experience with typical source categories
  - Other studies/literature
- Source investigation

Identified Source Categories for Contaminants of Concern

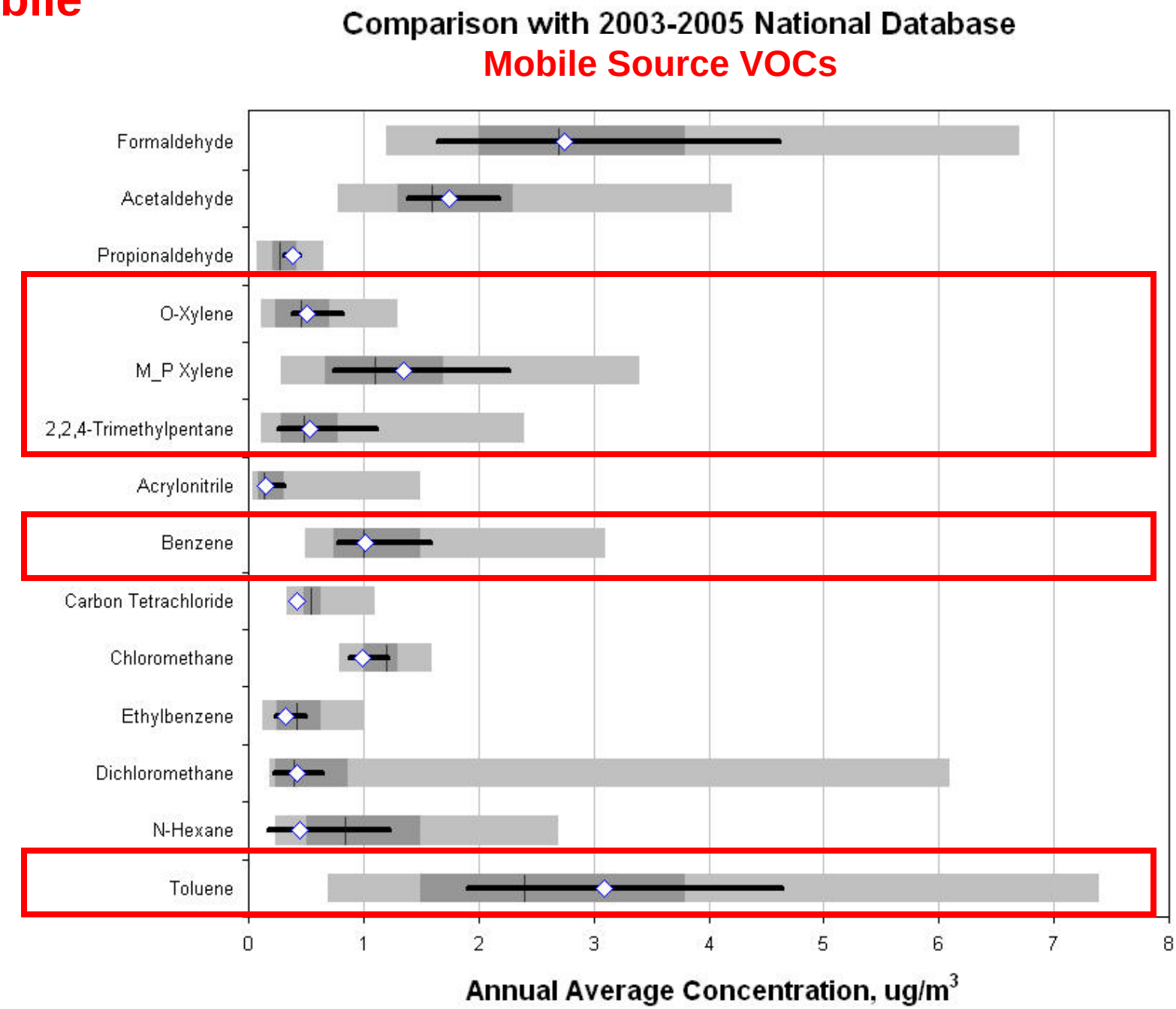
	Mobile Sources	Photo-chemical Production	Biomass Burning	Geologic/ Wind Erosion	Mixed Sources / Stagnation	Solvents	Agricultural Pesticide
Benzene	Major		Minor		Minor	Minor	
Ethyl Benzene	Major		Minor		Minor	Minor	
Formaldehyde	Minor	Major	Major			Minor	
Acetaldehyde	Minor	Major	Major				
Arsenic	Minor		Major	Major	Minor		
Cadmium	Minor		Minor	Minor	Major		
Manganese				Major			
Methylene Chloride					Major		
1,3-Dichloropropene							Major
Other species associated with source category:	toluene xylenes Lead Carbon (DPM)	Propionald & other aldehydes, ketones	potassium OC/EC (carbon)	beryllium cobalt silicon Iron selenium	sulfur ammonium nitrate sulfate MeCl3	Chloro-ethane Cyclo-hexane	No other species

Mobile

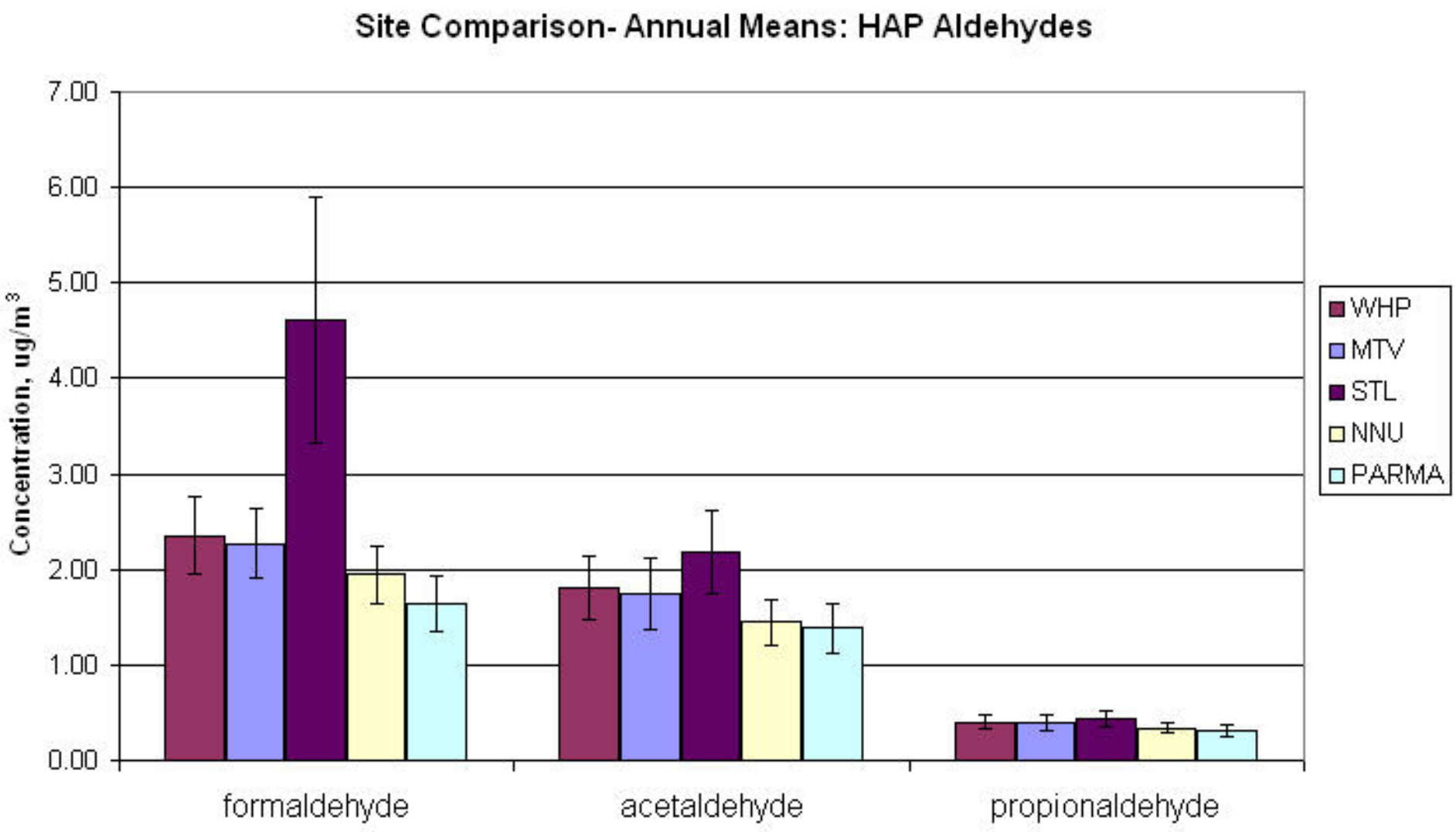

Site Comparison- Annual Means: Mobile Source VOCs
Concentration, ug/m3
6.00
5.00
4.00
3.00
2.00
1.00
0.00
benzene
toluene
ethylbenzene
o-xylene
m/p-xylene
2,2,4-trimethyl-pentane
WHP
MTV
STL
NNU
PARMA


Comparison with 2003-2005 National Database
National Data:
5th percentile
25th
Median
75th
95th
Toluene
0
1
2
3
4
5
6
7
8
This Study:
Lowest of 5 sites
Average of all 5 sites
Highest of 5 sites
Annual Average Concentration, ug/m3

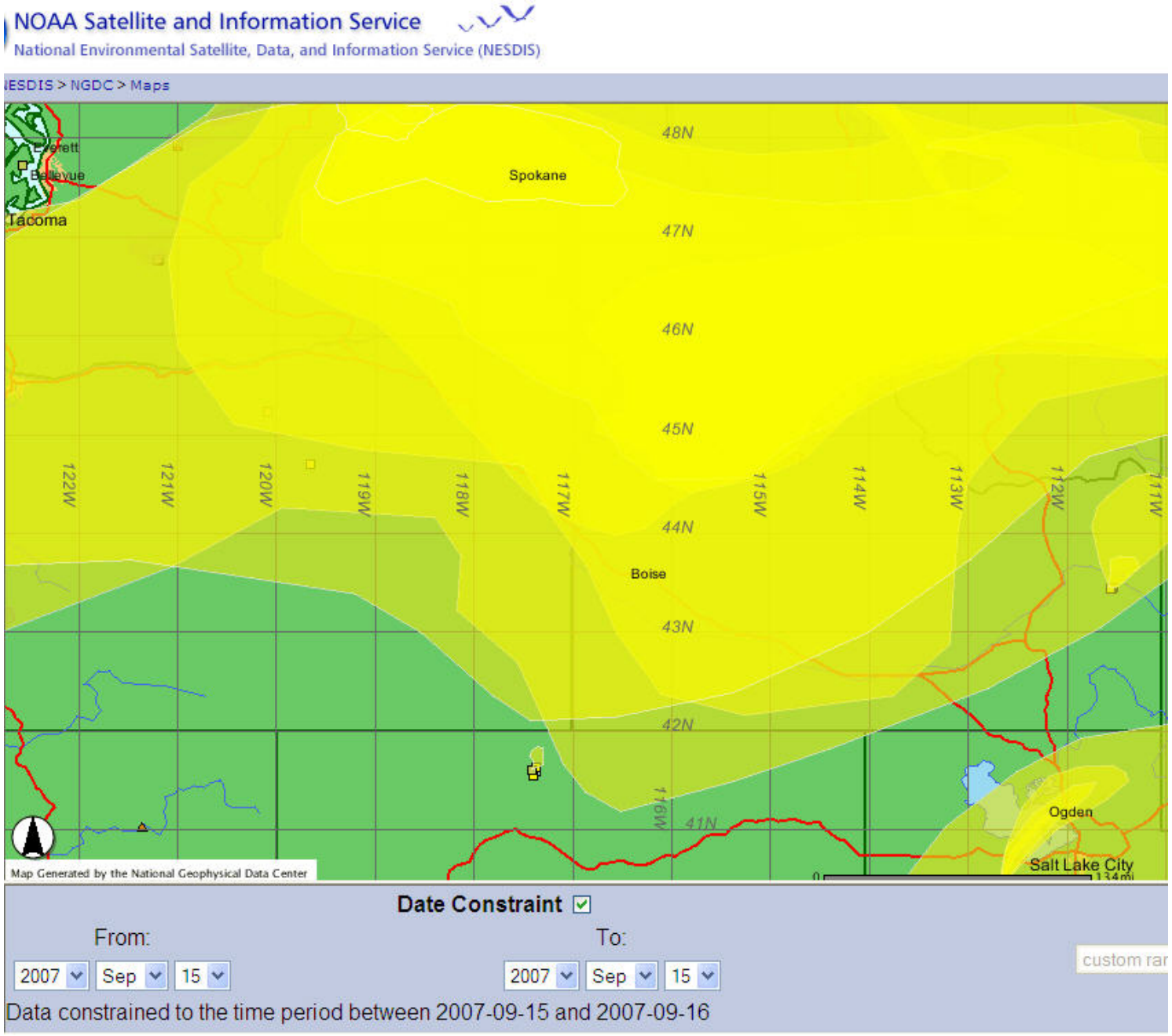
Mobile


Comparison with 2003-2005 National Database
Mobile Source VOCs
Formaldehyde
Acetaldehyde
Propionaldehyde
O-Xylene
M_P Xylene
2,2,4-Trimethylpentane
Acrylonitrile
Benzene
Carbon Tetrachloride
Chloromethane
Ethylbenzene
Dichloromethane
N-Hexane
Toluene
0
1
2
3
4
5
6
7
8
Annual Average Concentration, ug/m3

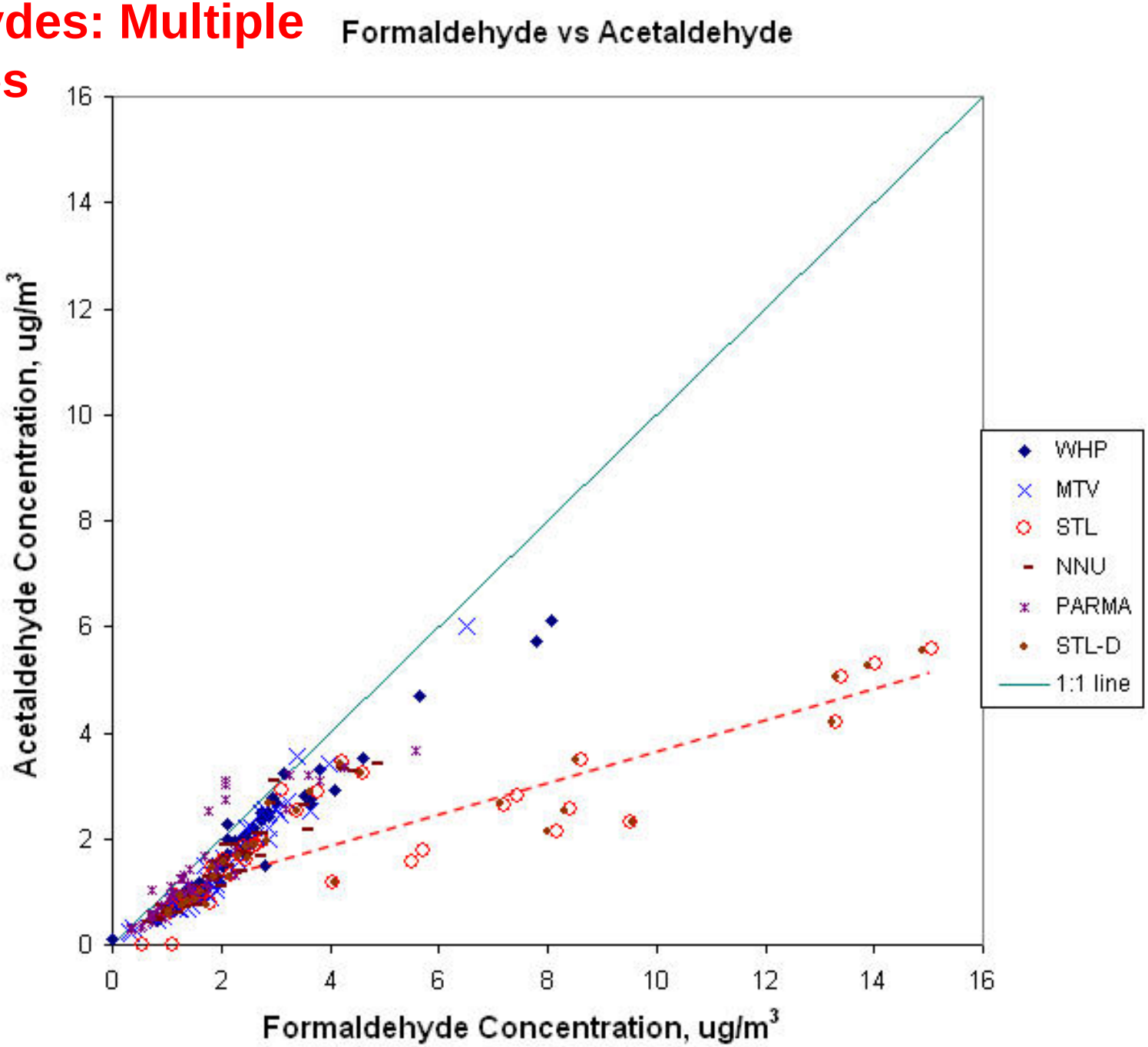
Aldehydes:Muliple sources



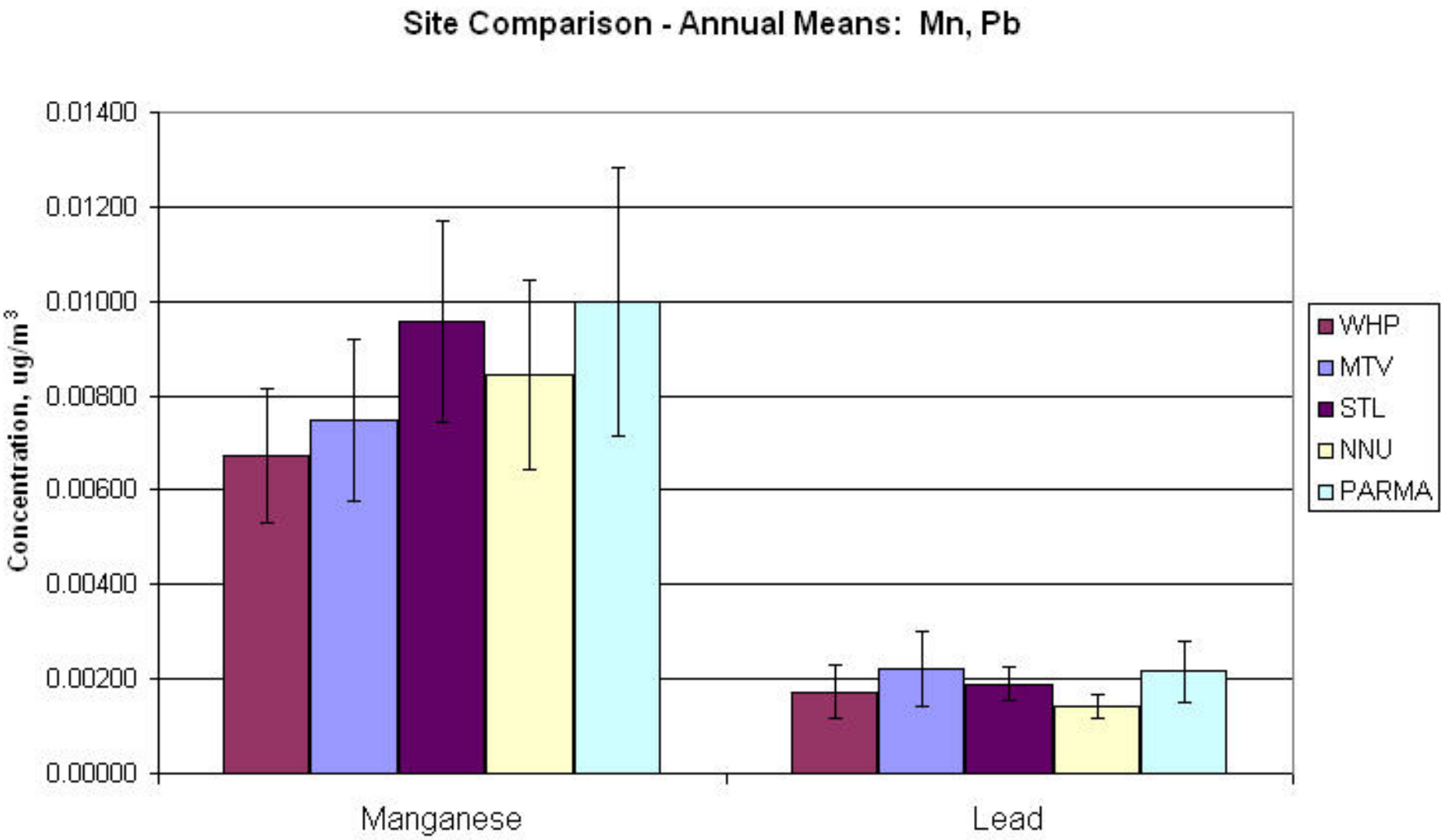
Aldehydes: Multiple sources



Aldehydes: Multiple sources



Geologic/Wind Erosion



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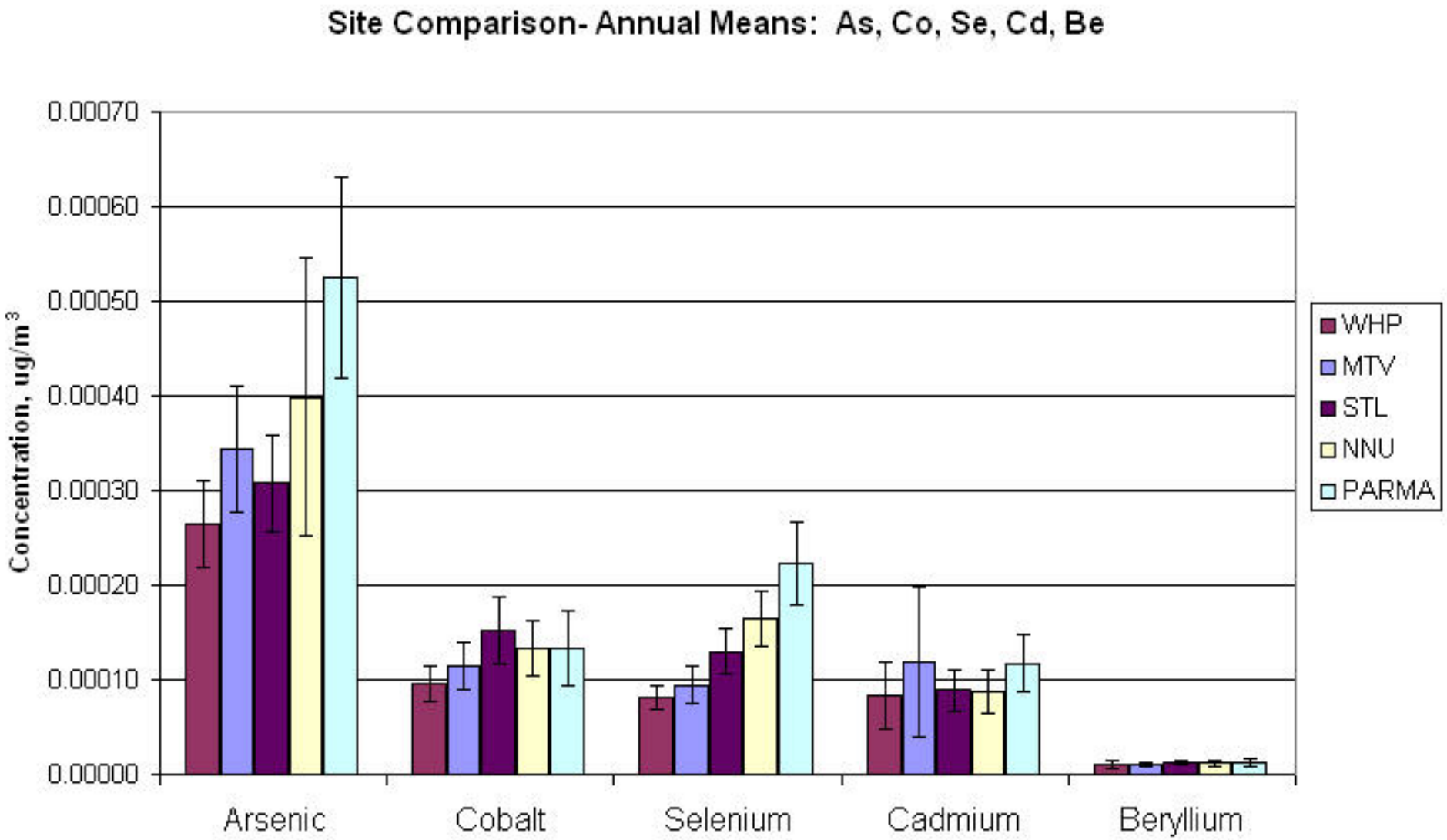
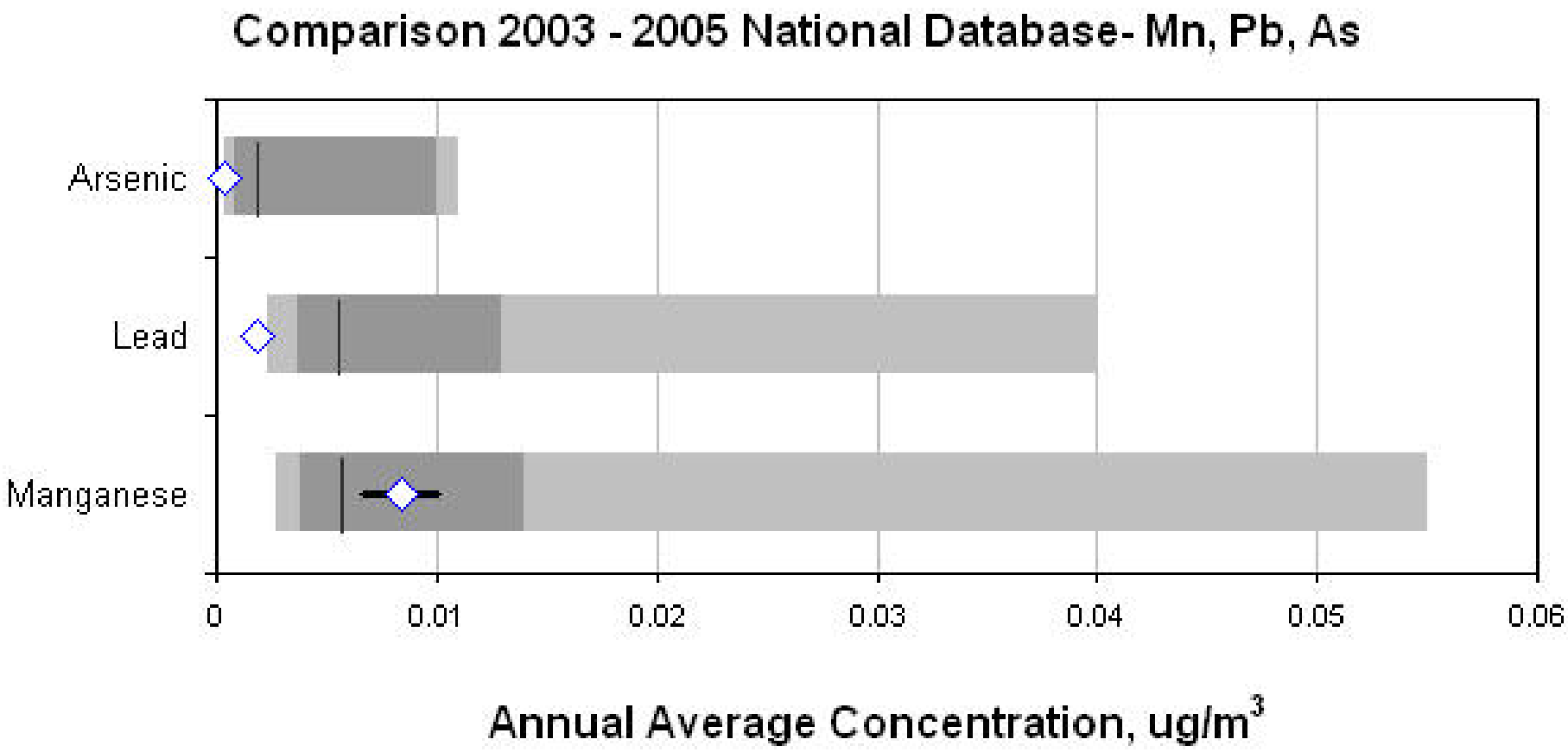
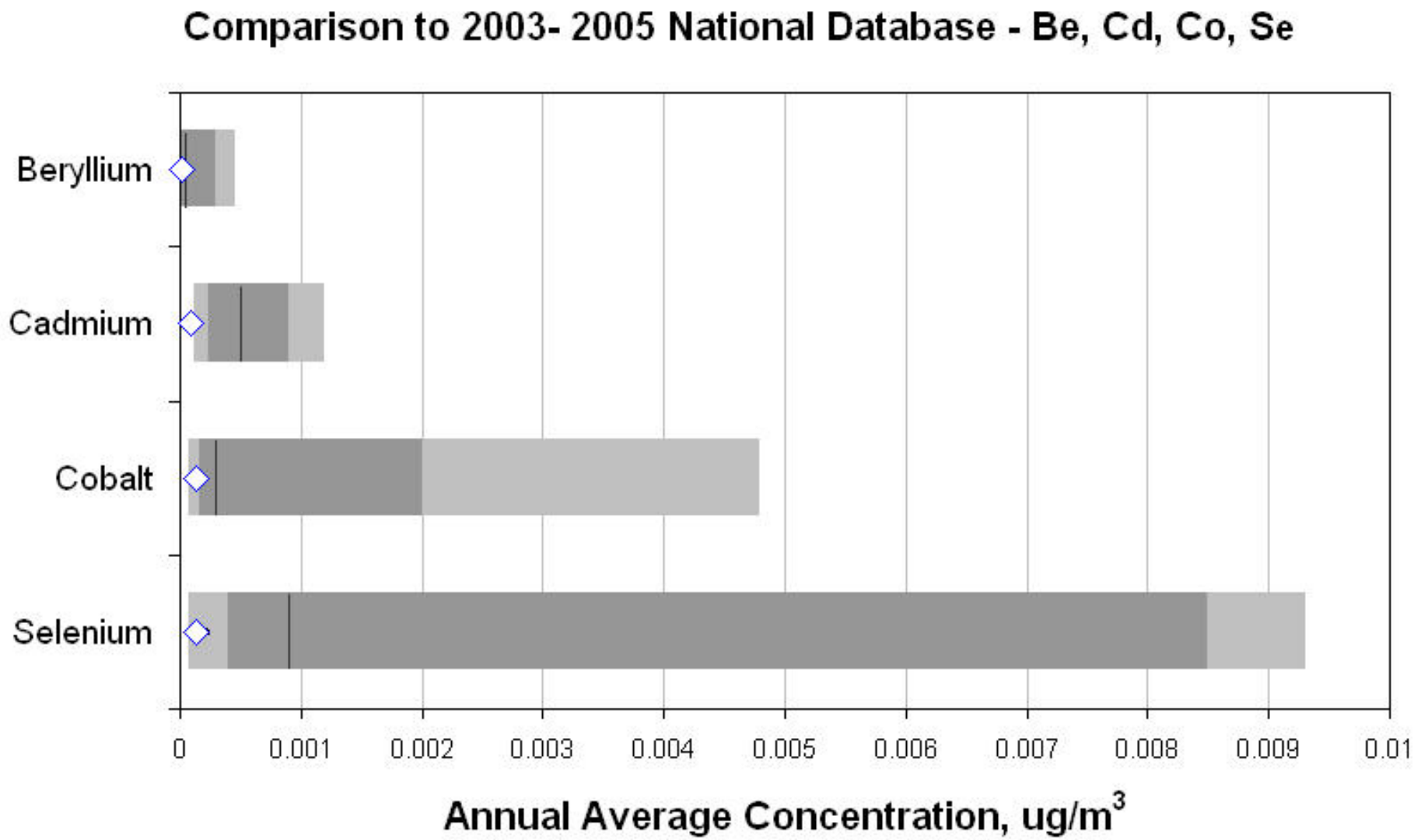


Geologic/Wind Erosion



Geologic/Wind Erosion



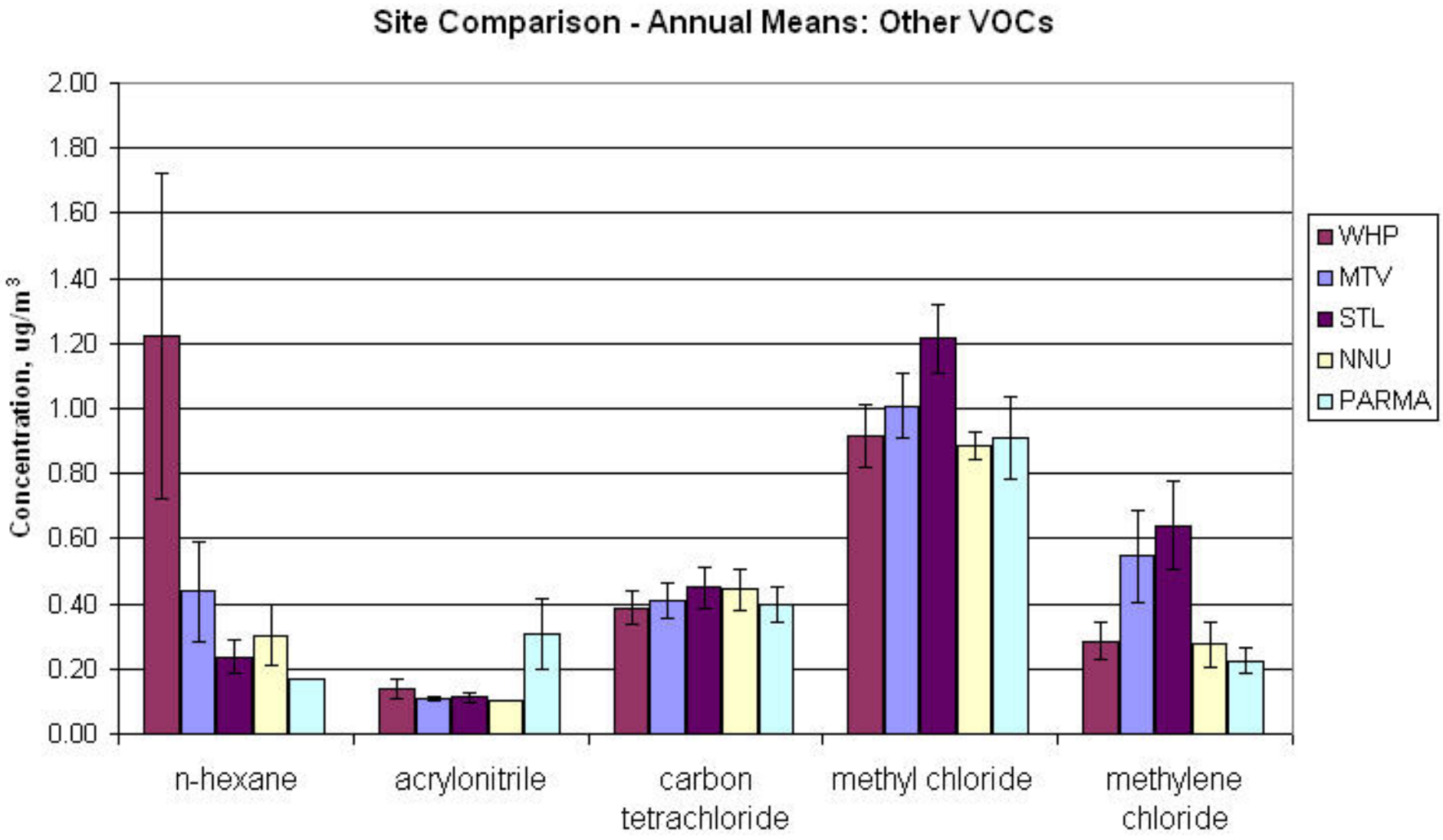
Mixed source/stagnation

Stagnation-Enhanced Pollutants

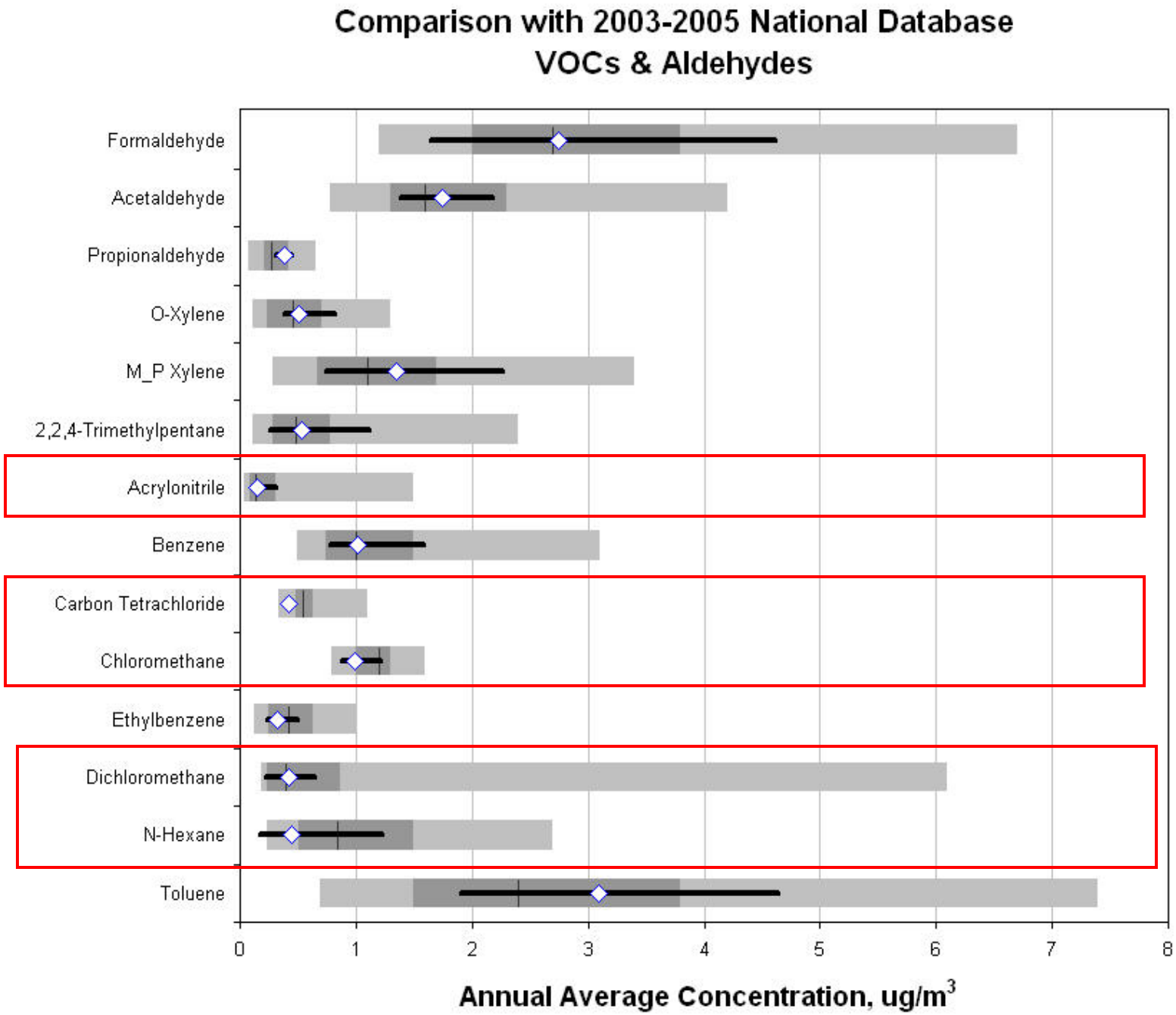
- Cadmium
- Sulfur
- Ammonium
- Nitrate
- Sulfate
- Solvents (methyl chloride, methylene chloride)
- Refrigerants

Secondary Aerosol components of wintertime stagnation periods, w/ transportation and coal combustion contributions

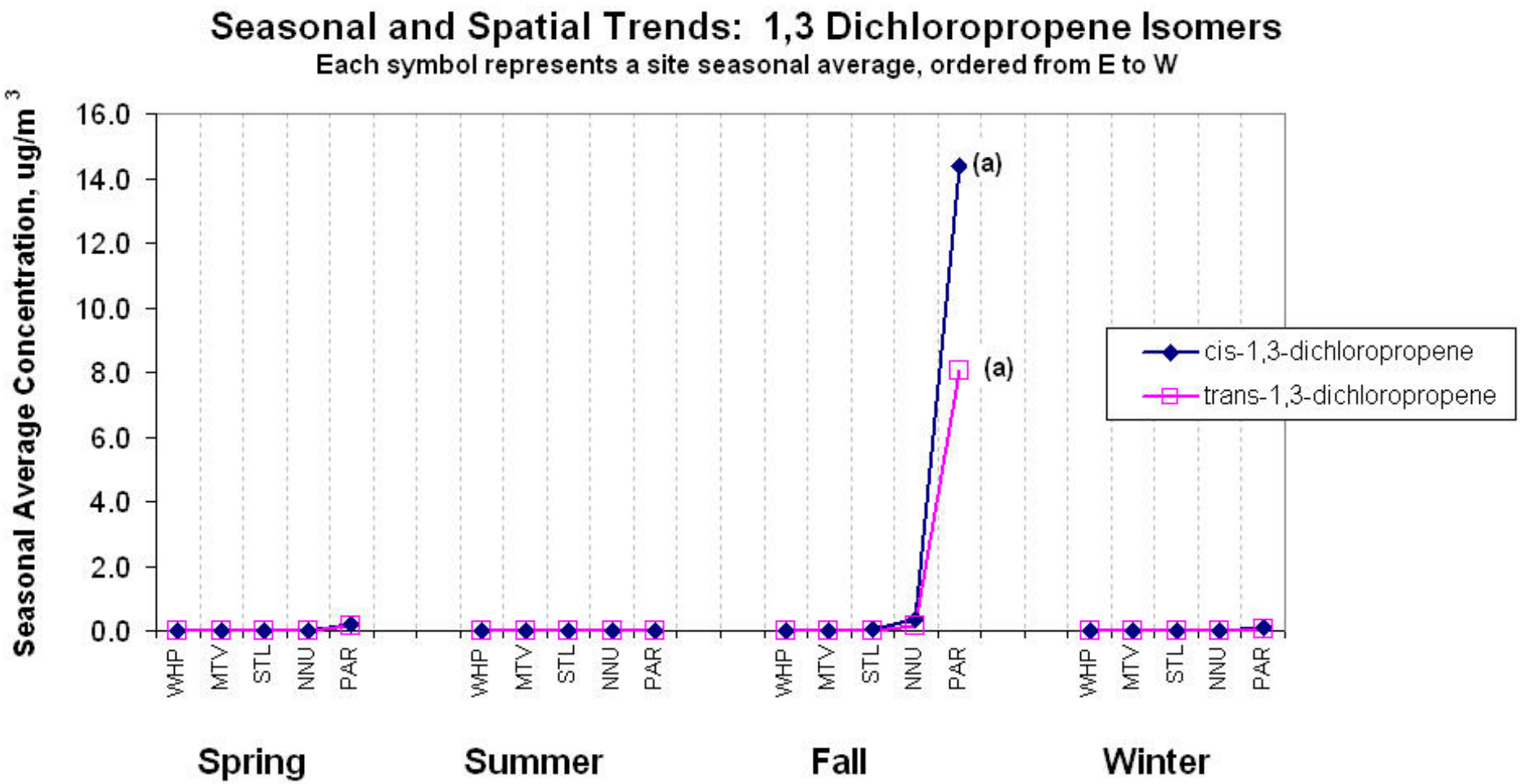
Mixed source/stagnation



Mixed source/stagnation



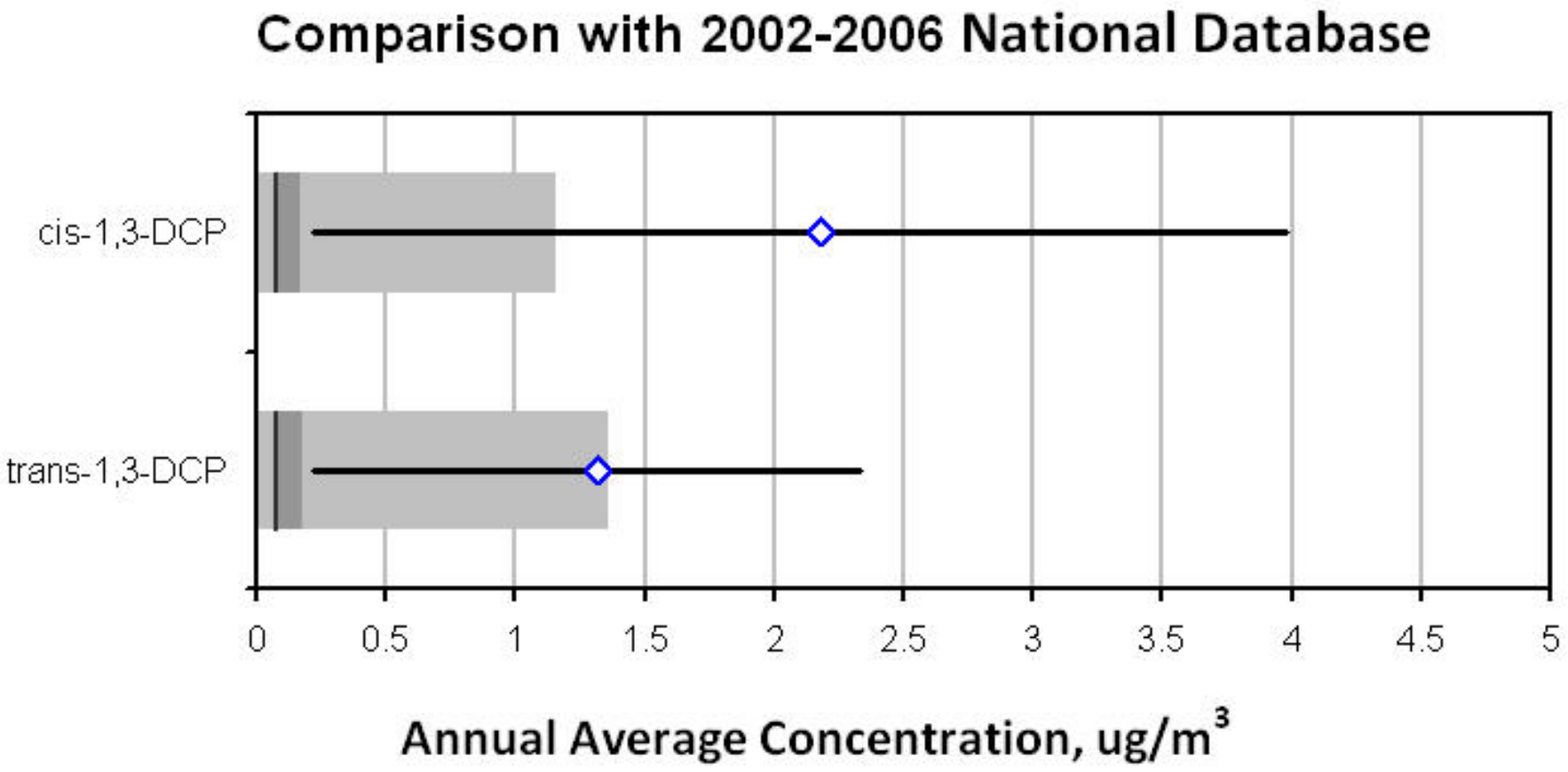
(1,3-DCP)


Seasonal and Spatial Trends: 1,3 Dichloropropene Isomers
Each symbol represents a site seasonal average, ordered from E to W
Seasonal Average Concentration, ug/m3
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
(a)
(a)
cis-1,3-dichloropropene
trans-1,3-dichloropropene
WHP
MTV
STL
NNU
PAR
Spring
Summer
Fall
Winter

What is 1, 3 DCP?

- Soil fumigant used mainly to control nematodes
  - Onions
  - Potatoes
  - Sugar beets
- Trade name Telone marketed exclusively by Dow
- State specific rules in CA limiting its use
- Based on EPA pesticide renewal process a number of BMP have been implemented

(1,3-DCP)


Comparison with 2002-2006 National Database
cis-1,3-DCP
trans-1,3-DCP
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Annual Average Concentration, ug/m3

Summary

- Monitored air toxics at 5 sites across the Treasure Valley
- Source attribution/risk screening
  - No significant major source
  - Mobile sources
  - Identified agricultural pesticide use
- Most species at or below national median