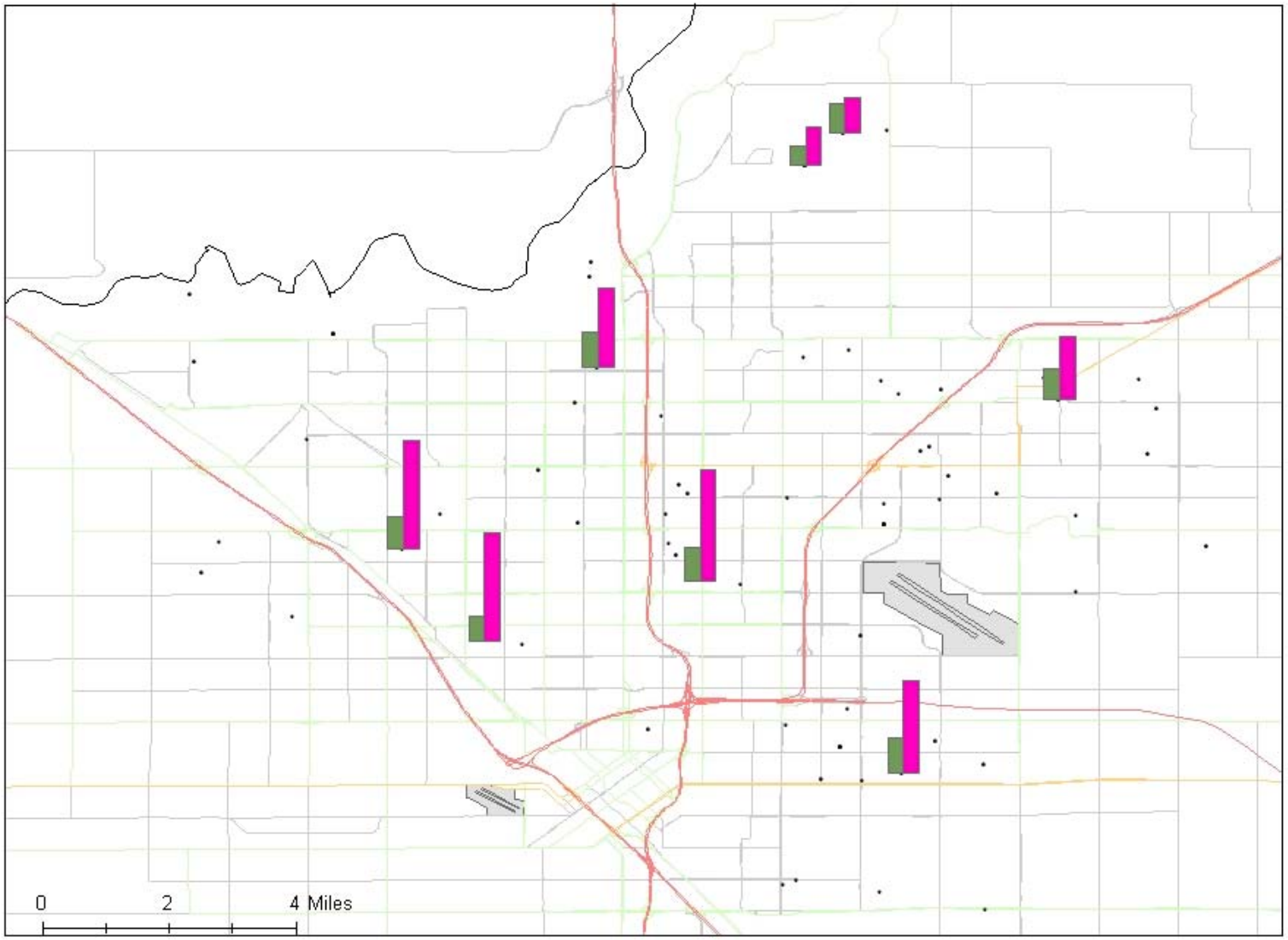
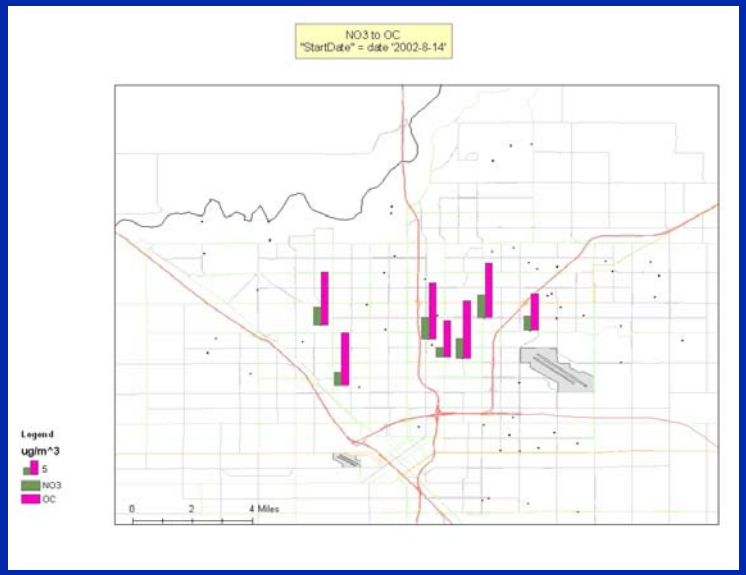
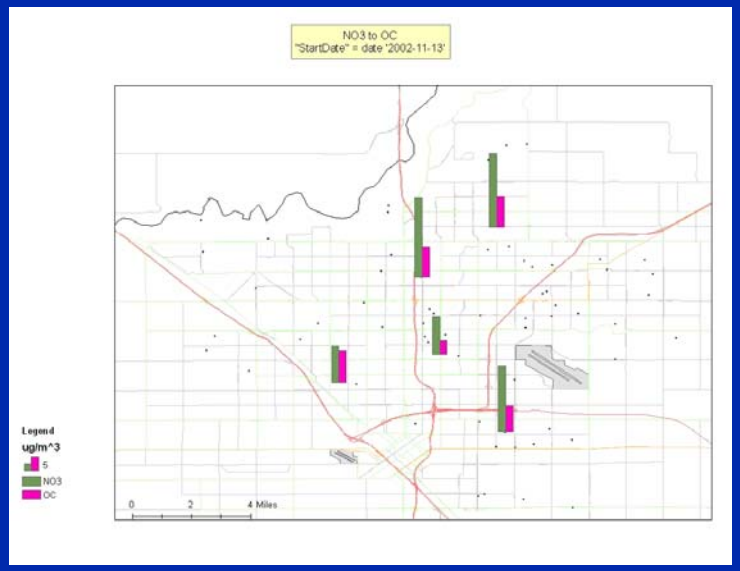
PM2.5 NO3 and OC on 1/1/2003

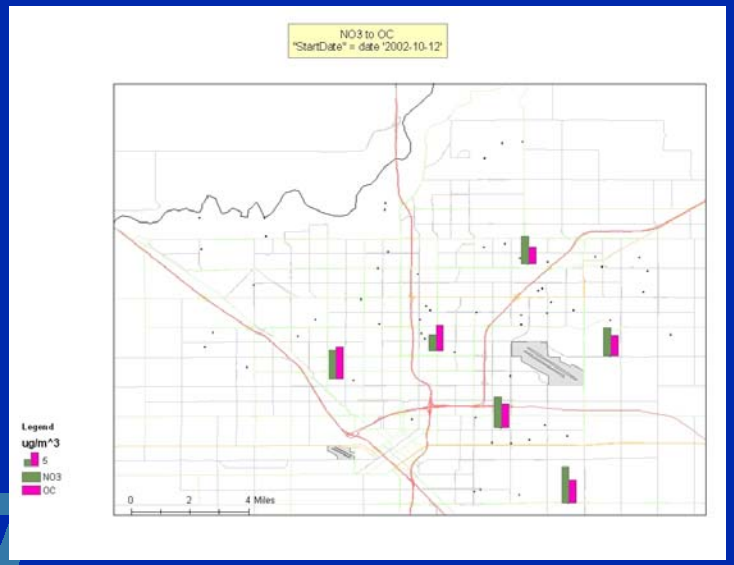


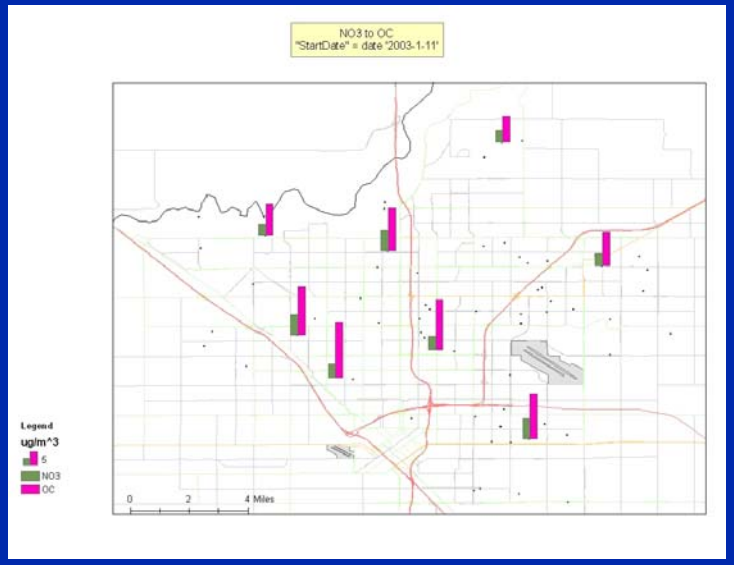
Legend
ug/m^3
5
NO3
OC

PM2.5 NO3 and OC

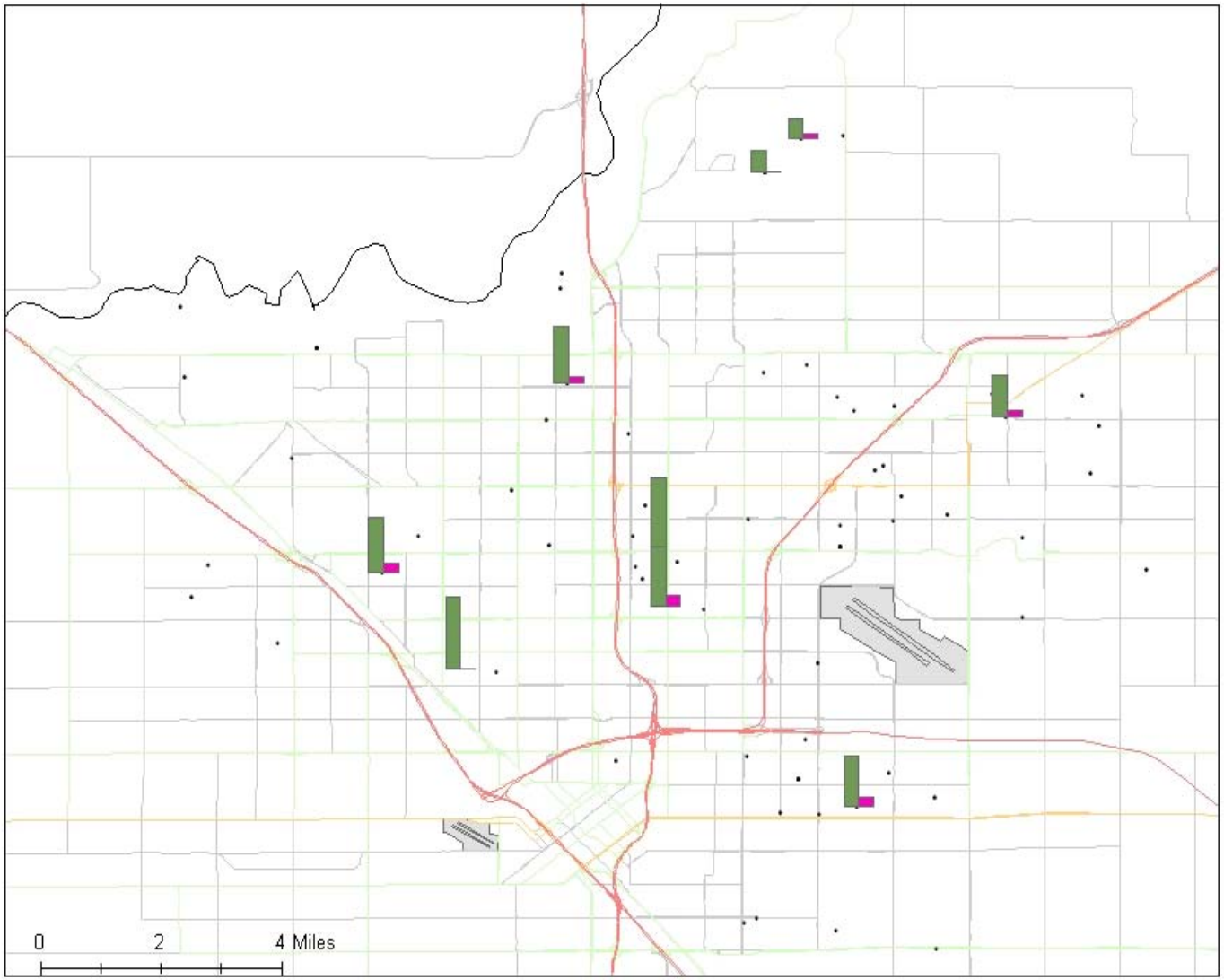






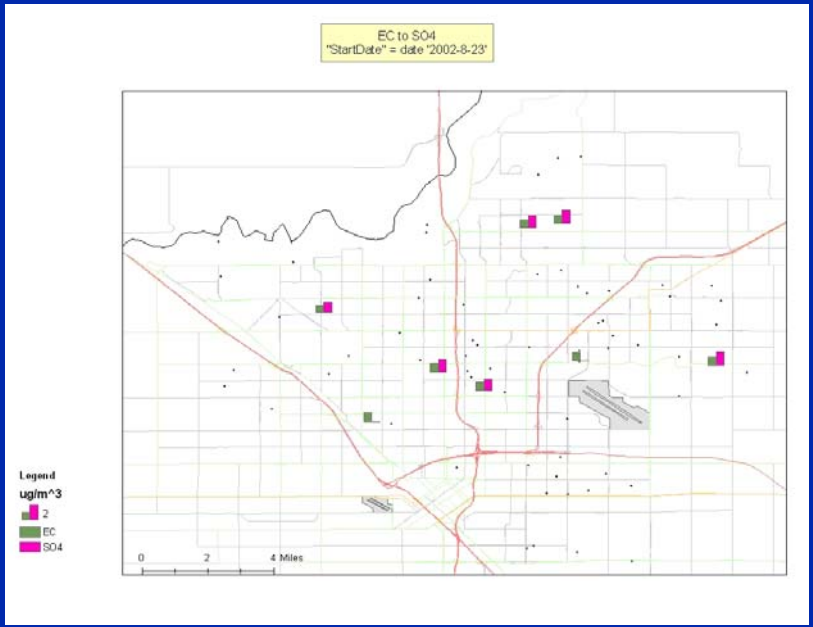


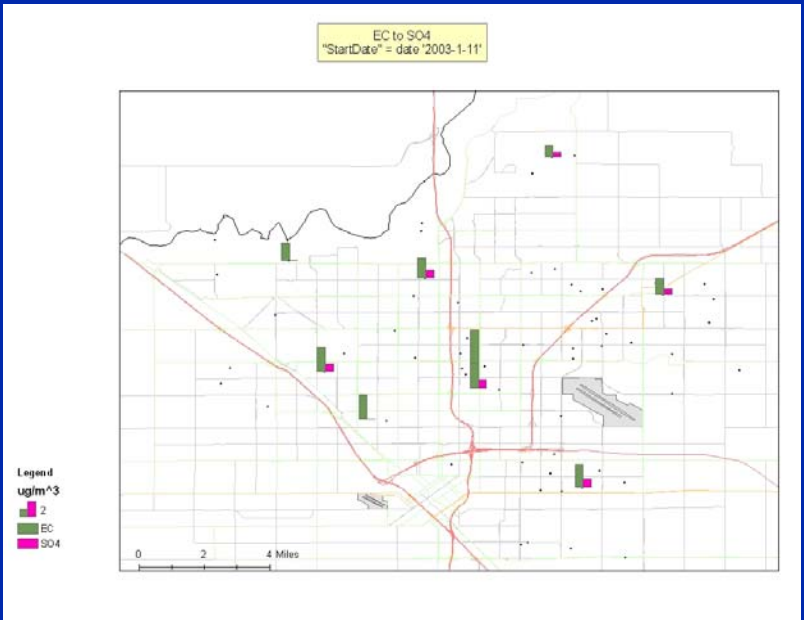
PM2.5 EC and SO4 on 1/1/2003

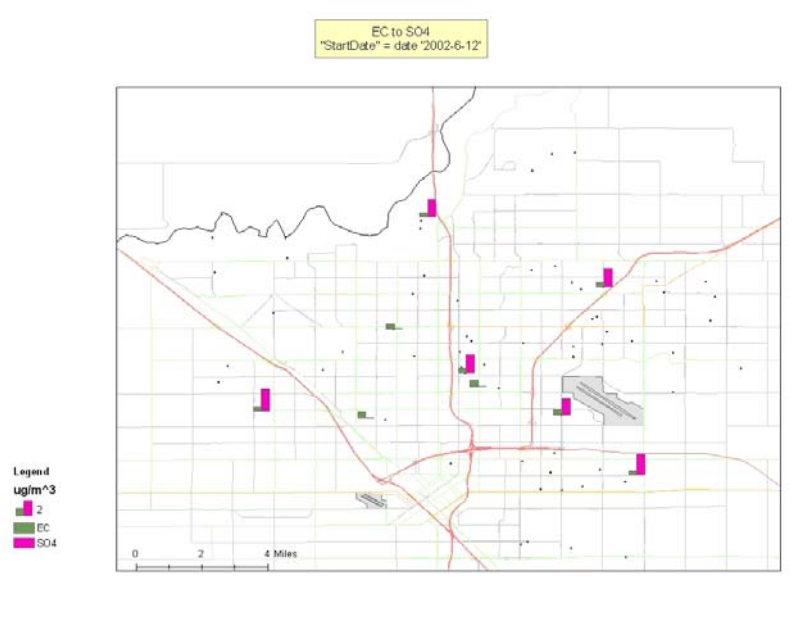


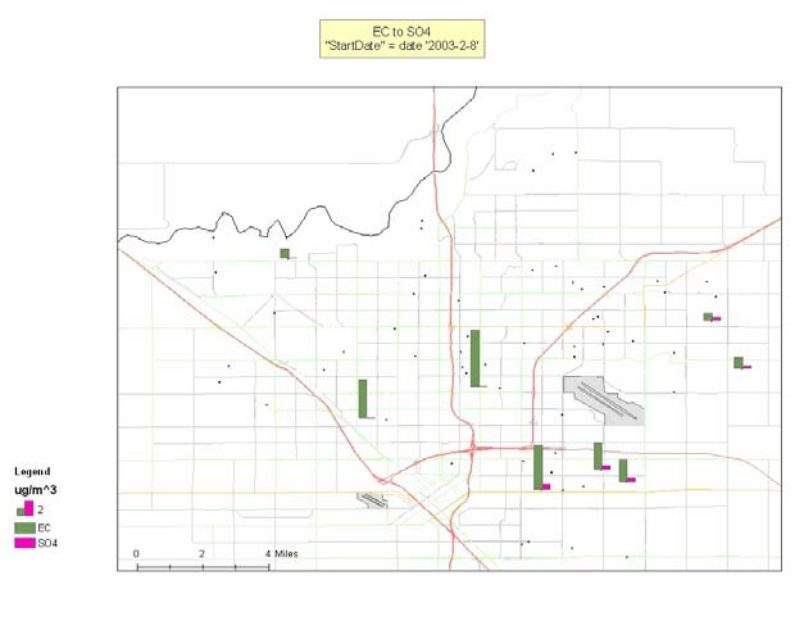
Legend
ug/m^3
2
EC
SO4

PM2.5 EC and SO4

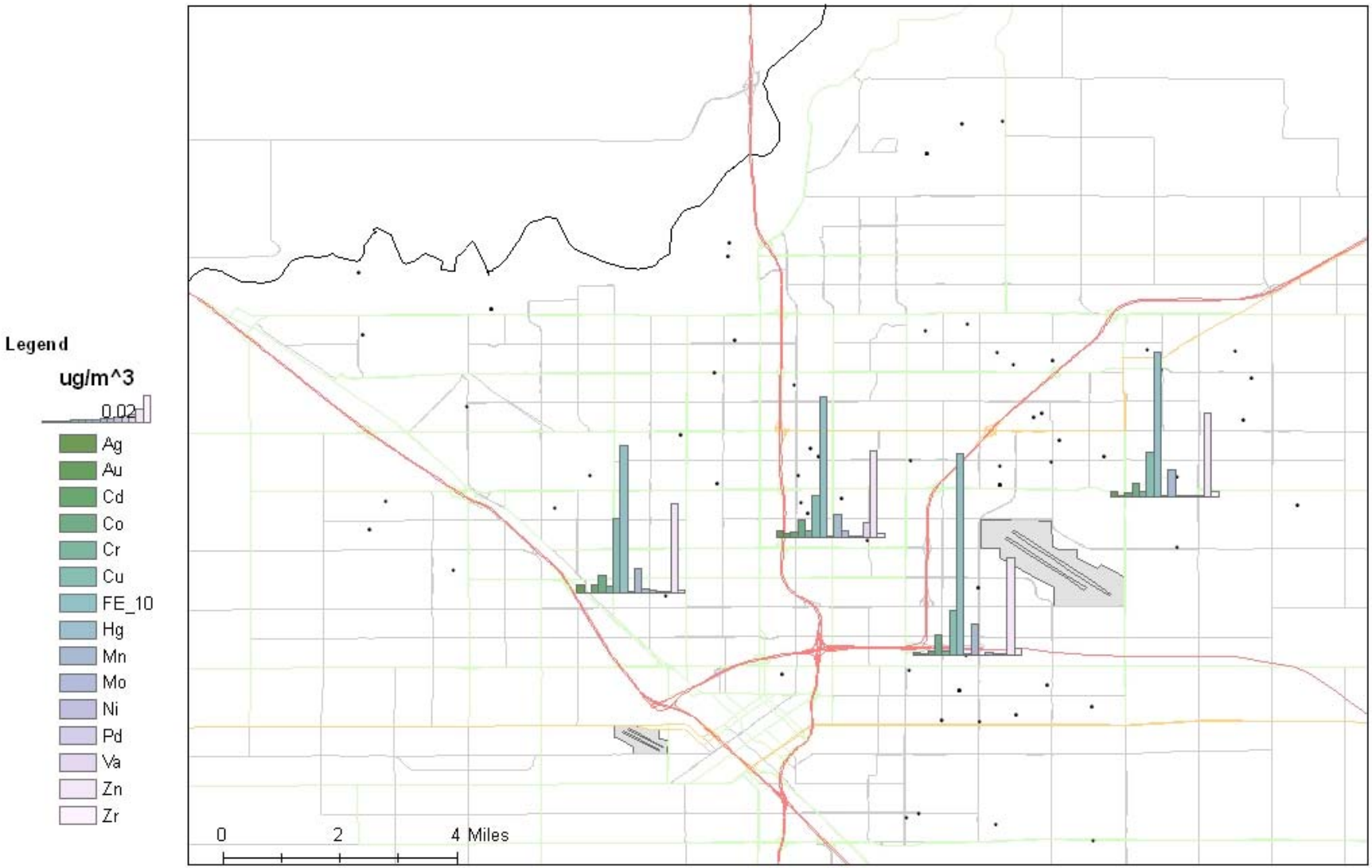




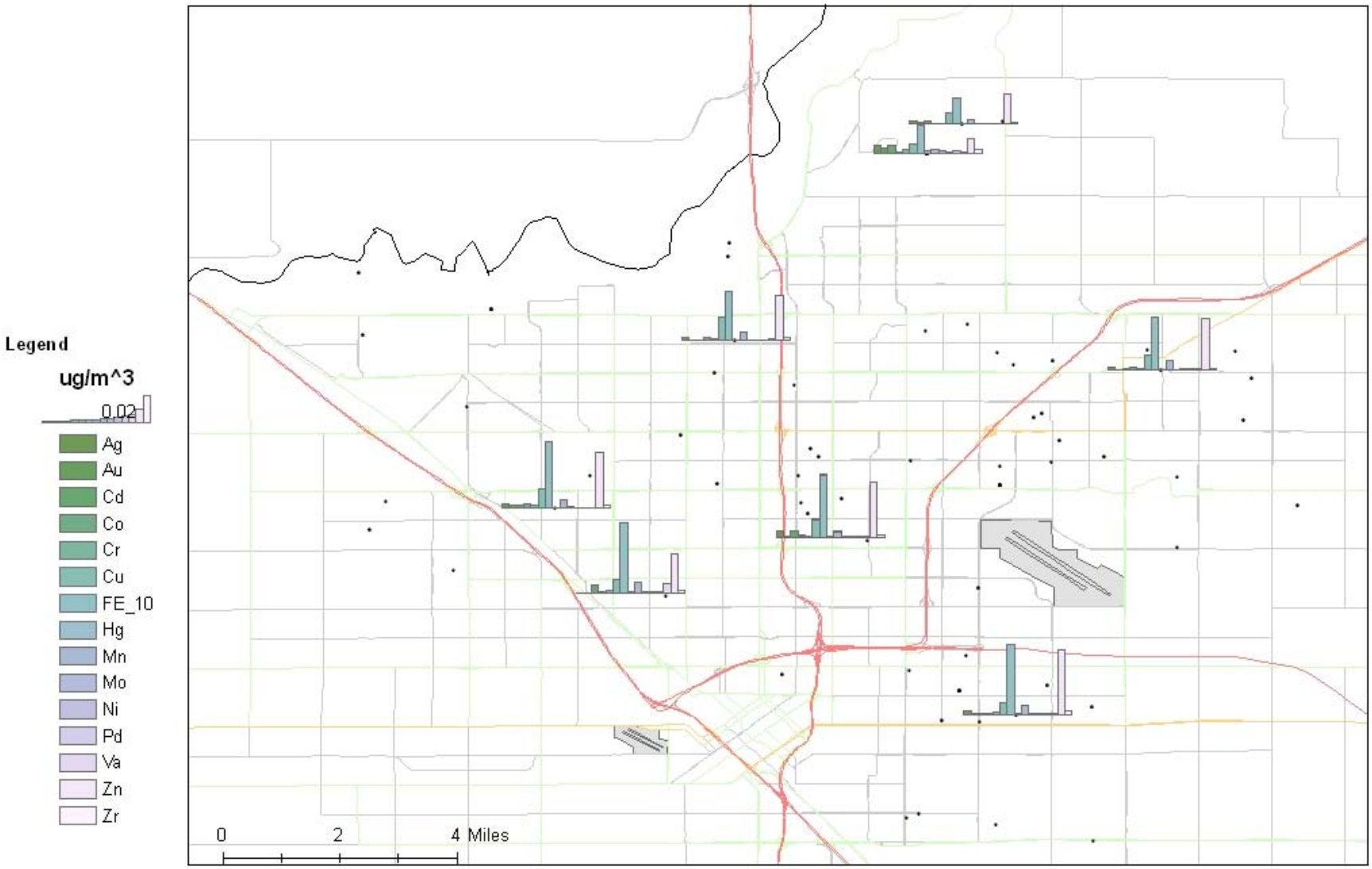




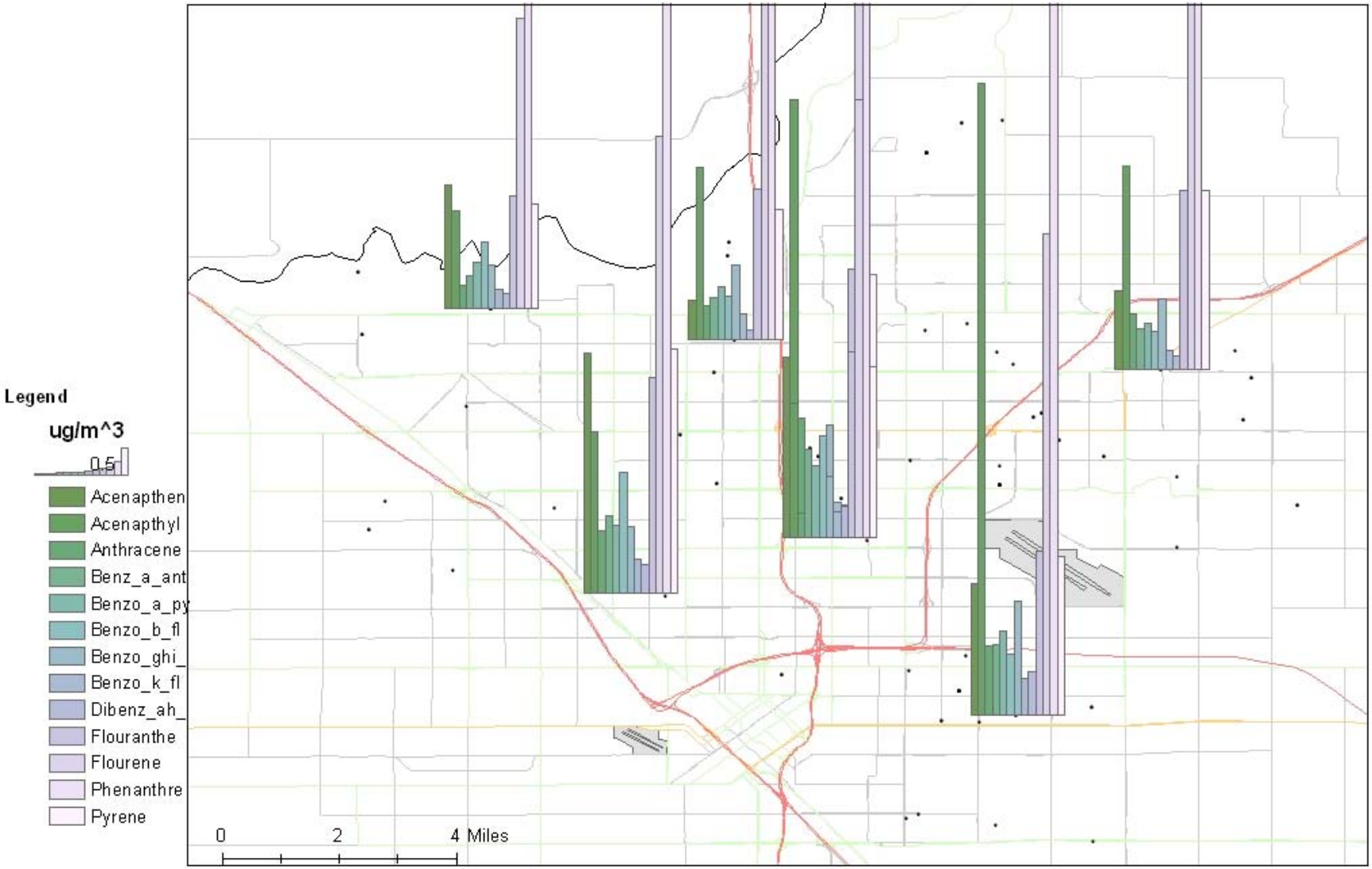
Ag to Zr
"StartDate" = date '2002-11-20'



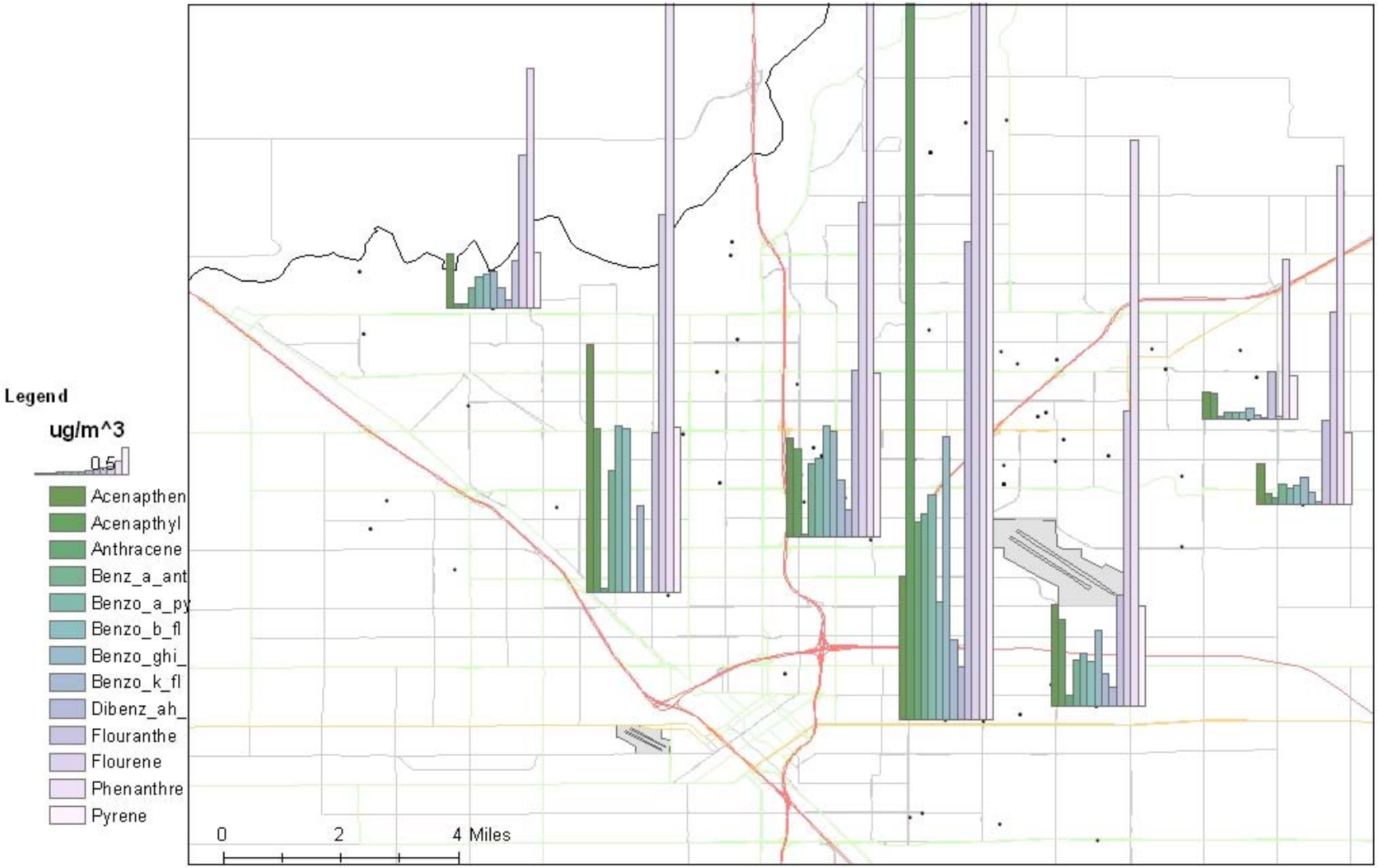
Ag to Zr
"StartDate" = date '2003-1-11'



Acenapthen to Pyrene
"StartDate" = date '2003-1-11'



Acenapthen to Pyrene
"StartDate" = date '2003-2-8'



Representativeness

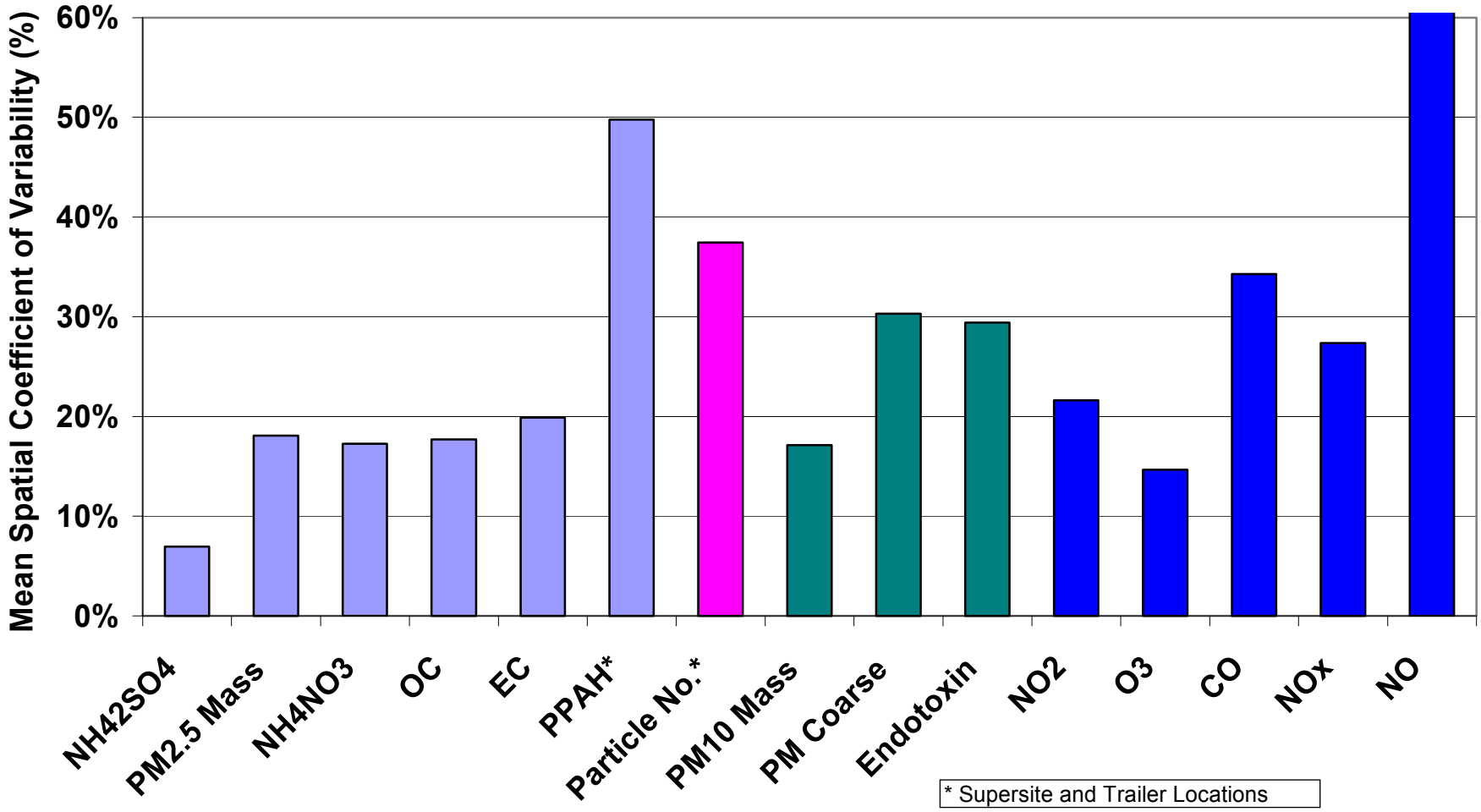
How much spatial variability?

$$\overline{CV} = \frac{1}{n}\sum_{n=1}^{ndays}\frac{StDev\,of\;C_{xn}}{Mean\,C_{xn}}$$

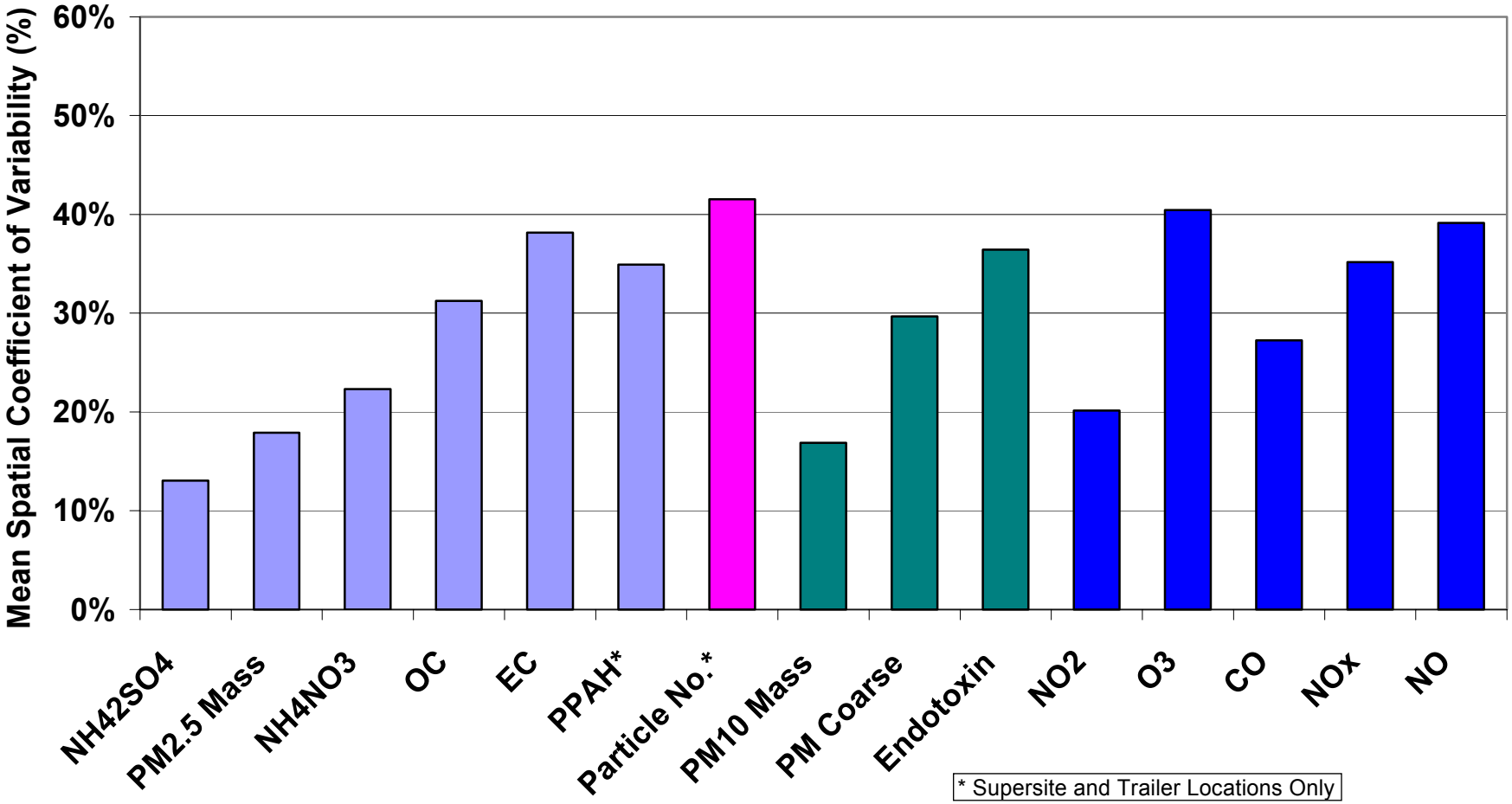
How much bias relative to central site?

$$\overline{R} = \frac{1}{n}\sum_{n=1}^{ndays}\left[\sum_{x}^{sites}\frac{C_{xn}}{C_{CSn}}\right]$$

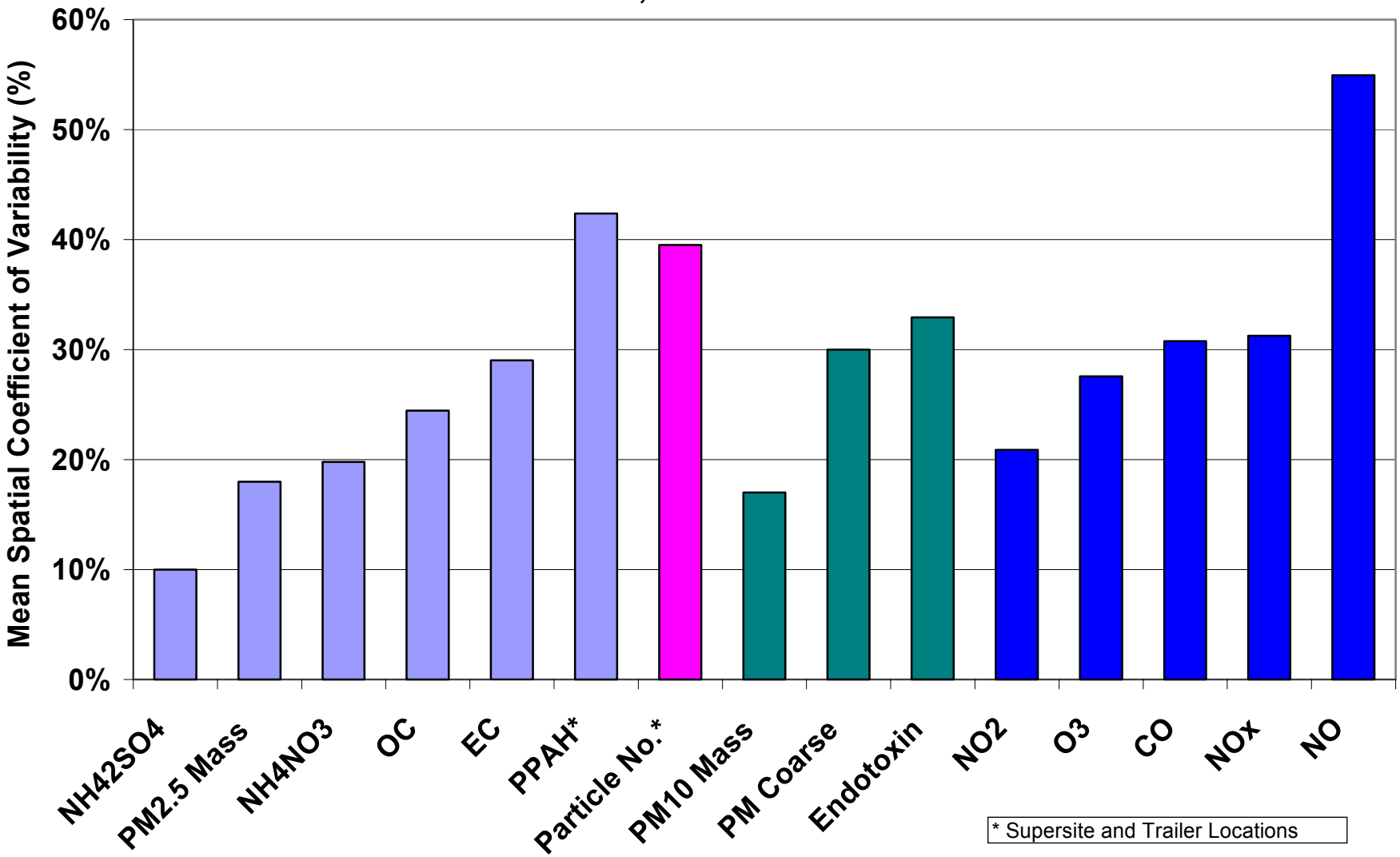
Warm Season (April – September)
Spatial Variability in 24-hr Average Concentrations
Fresno, CA 2002-2003



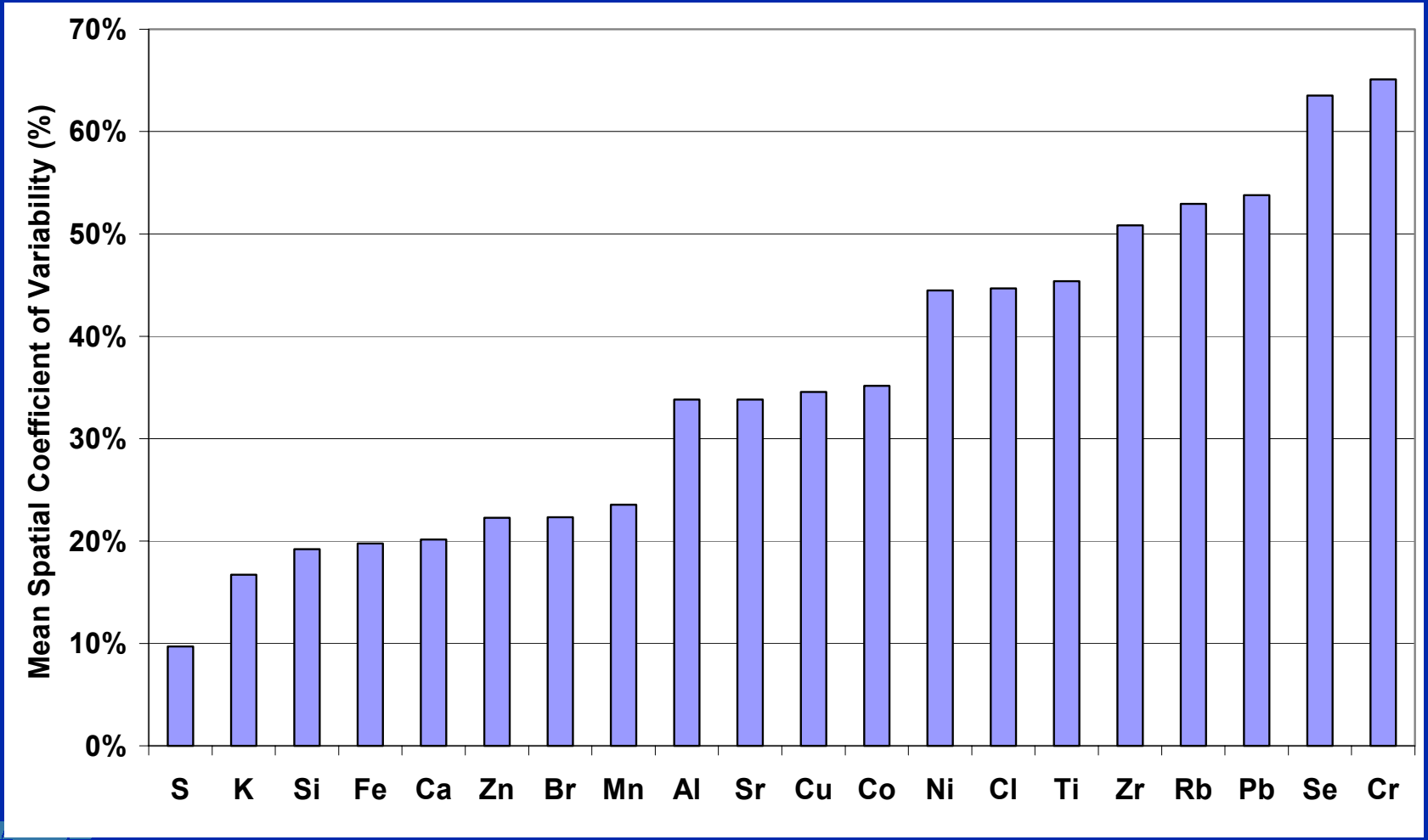
Cool Season (October – March)
Spatial Variability in 24-hr Average Concentrations
Fresno, CA 2002-2003



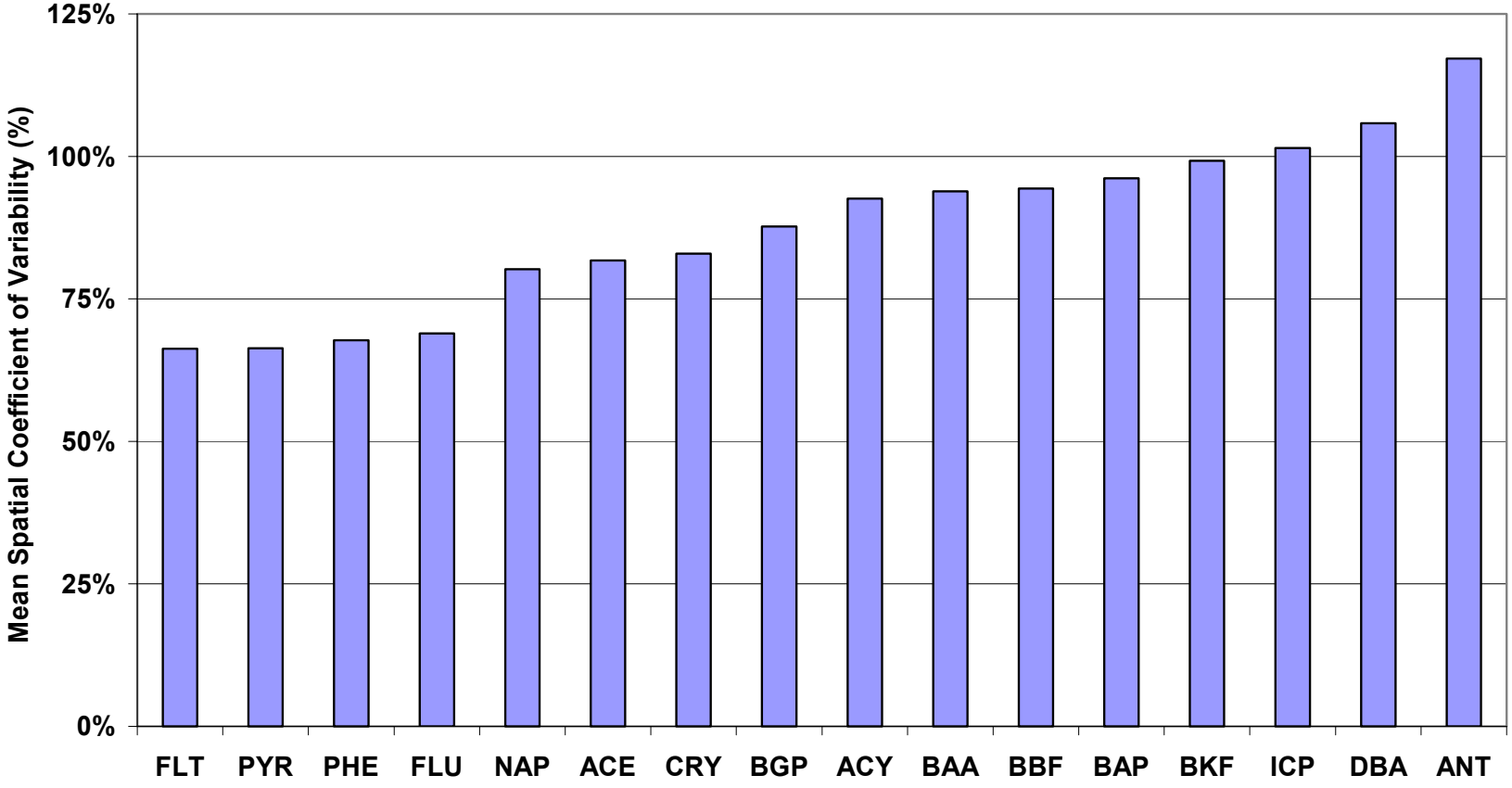
Spatial Variability in 24-hr Average Concentrations Fresno, CA 2002-2003



PM10 Elements by XRF
Spatial Variability in 24-hr Average Concentrations
Fresno, CA 2002-2003



Polycyclic Aromatic Hydrocarbons (Gas + Aerosol Phases) Spatial Variability in 24-hr Average Concentrations Fresno, CA 2002-2003

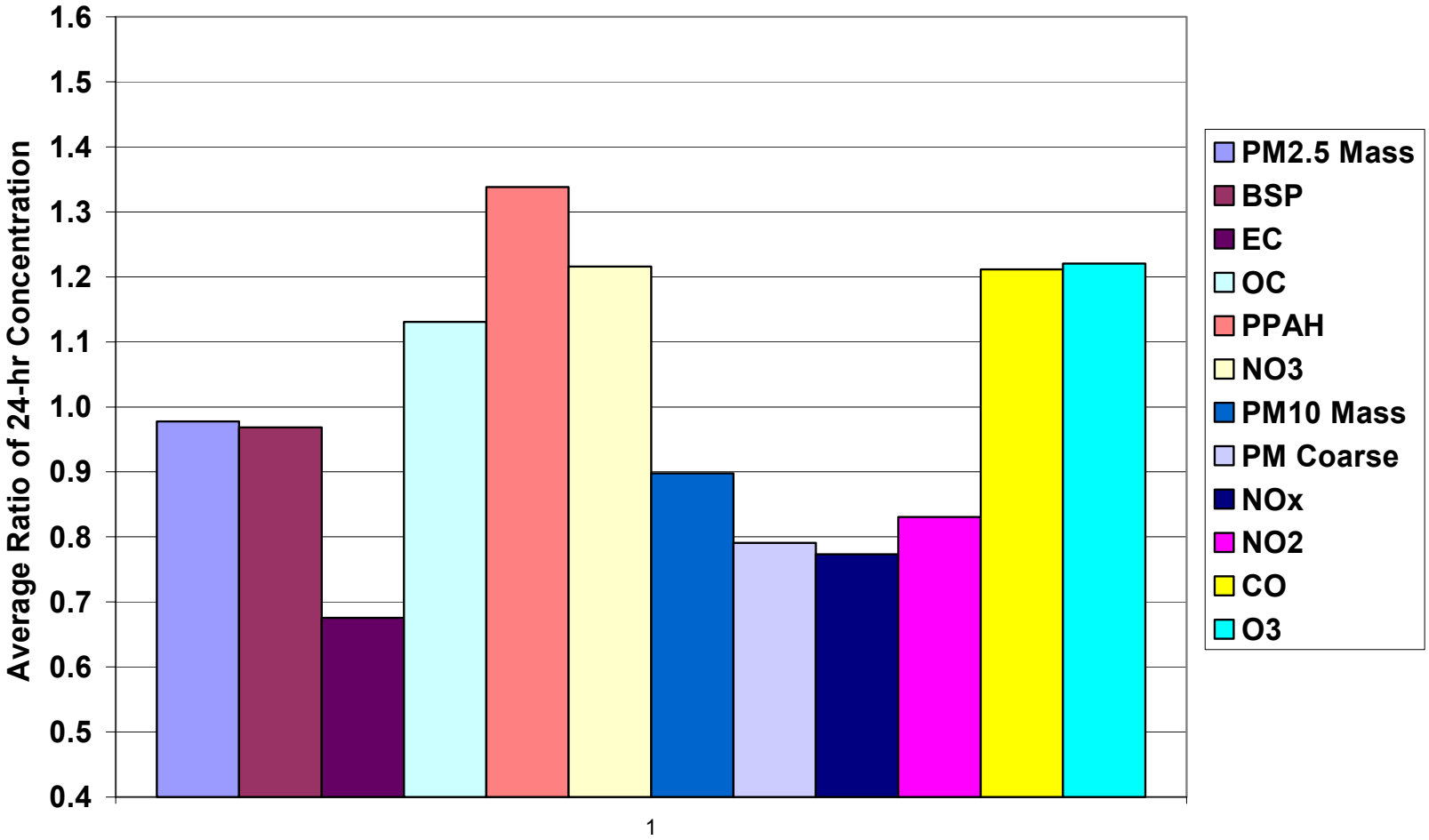


Flouranthene (FLT), Pyrene (PYR), Phenathrene (PHE), Flourene (FLU), Naphthalene (NAP), Acenaphthene (ACE), Chrysene (CRY), Benzo[ghi]perylene (BGP), Acenaphthylene (ACY), Benz[a]anthracene (BAA), Benzo[b]flouranthene (BBF), Benzo[a]pyrene (BAP), Benzo[k]flouranthene (BKF), Indeno[1,2,3-cd]pyrene (ICP), Dibenz[a,h]anthracene (DBA), Anthracene (ANT)

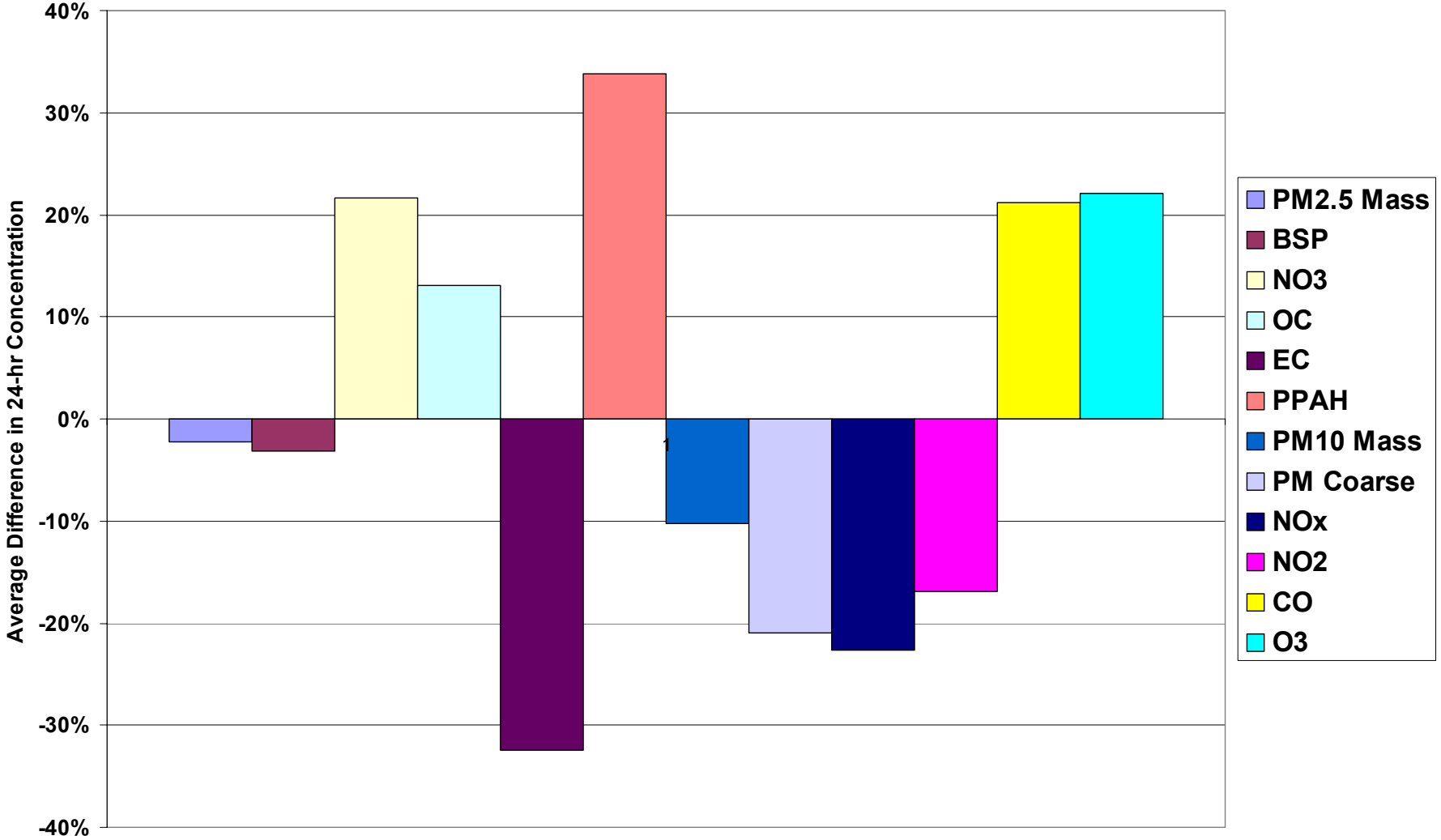
Spatial Variability Rankings

Low (CV<20%)	Moderate (20%<CV <40%)	High (CV>40%)
$PM_{2.5}$ Mass	OC, EC	NO
SO_4	PN	PAHs
NO_3	PM Coarse	Other Elements
NH_4	Endotoxin	
PM_{10} Mass	NO_2, NOx, O_3, CO	
PM_{10} K, Si, Fe, Ca	PM_{10} Zn, Br, Mn	
	PM_{10} Al, Sr, Cu, Co	

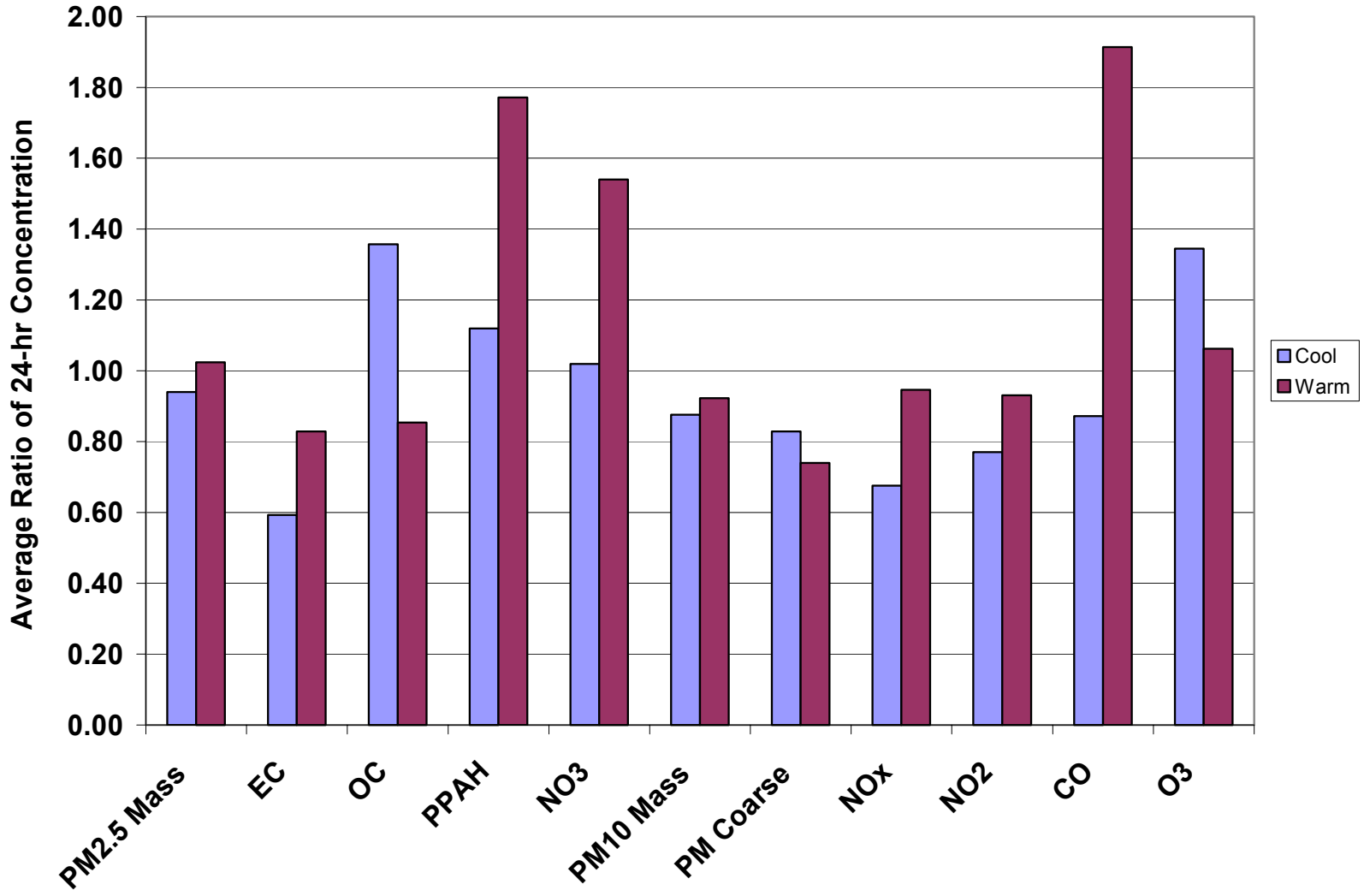
Spatial Bias
Average Ratio of 24-hr Concentrations at Schools and Residences to Supersite



Average Bias of 24-hr Concentrations at Schools and Residences Relative to Supersite



Average Ratio of 24-hr Concentrations at Schools and Residences to Supersite by Season



Conclusions

- The representativeness of Fresno supersite measurements varies by species; primary species are most variable
- Spatial variability is low for $PM_{2.5}$ Mass, SO_4, NO_3, NH_4, and PM_{10} Mass, and abundant elements (K, Si, Fe, Ca)
- Spatial variability is moderate for OC, EC, PN, PM Coarse, Endotoxin, and most gases and other elements
- Spatial variability is high for NO, PAHs, and scarce metals
- $PM_{2.5}$ mass concentrations at locations within 10 km of supersite show little bias on average; EC and PAH show the most bias
- Persistent spatial patterns are evident; concentrations lower than those at the supersite occur in northern and eastern Fresno for most species

Acknowledgement

- California Air Resources Board
- U.S. Environmental Protection Agency
- Desert Research Institute
- San Joaquin Valley Air Pollution Study Agency
- FACES Project TEAM (UCB & STI)