

Air toxics measurements in a Seattle neighborhood

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Primary Goals

- **Characterize ambient air toxics concentrations**
- **Evaluate spatial and temporal variability of ambient air toxics**
- **Evaluate modeled results**
- **Support health effects studies**

Long Term Goals

- Estimate source apportionment (statistical and air quality models)
- Assess long term trends
- Evaluate effectiveness of air toxics reduction strategies

Outline

- I. Introduction
 - A. Urban Air Toxics
 - B. Common Sources
- II. Methods
 - A. Site
 - B. Analytical Methods
- III. Data (2004)
- IV. Results
- V. Conclusions and Recommendations

Introduction

- Continuation of the monitoring started in 2000
- Seattle is one of the original 4 large cities in the 10-site Pilot Monitoring Project
- Currently, one of the 23 sites in the National Air Toxic Trends (NATTS) network
- Neighborhood-scale measurements (0.5 – 4 km²)
- Volatile organic compound (VOC), carbonyl and PM-10 measurements will be presented (although metals were also measured)

Sampling Site: Beacon Hill



- 24-hr integrated samples collected every 6th day
- Duplicates also collected for VOCs and carbonyls



Analytical Methods

TO-14A (GC with FID/ECD)

- benzene
- 1,3-butadiene
- CCl_4
- Chloroform
- Trichloroethylene (TCE)
- Tetrachloroethylene (PCE)



TO-11A (DNPH cartridge with HPLC)

- Acetaldehyde
- Formaldehyde



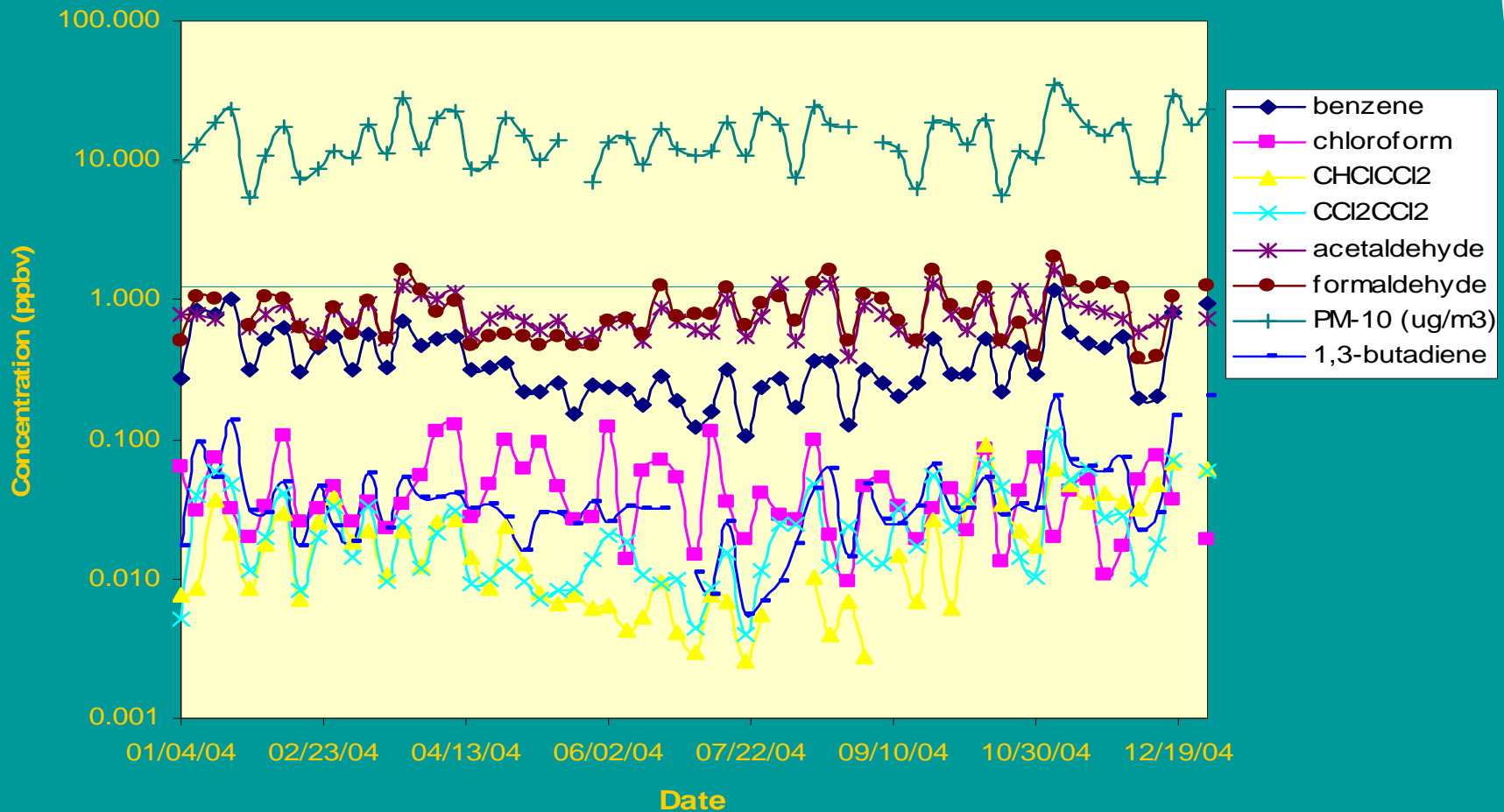
Gravimetric

- PM-10

Common Sources

1,3-butadiene	rubber manufacturing processes, combustion, cigarette smoke
benzene	industrial solvent, gasoline, auto exhaust, tobacco smoke
chloroform	chlorinated water, pulp and paper mills, hazardous waste sites, sanitary landfills
TCE	degreasing of metals, dry cleaning
PCE	degreasing of metals, dry cleaning
acetaldehyde	oxidation product of tropospheric photochemistry and microbial degradation of organic materials, fruit and fish preservative, solvent in rubber, tanning and paper industries
formaldehyde	natural sources, insulating foams, plywood resin, carpet materials, tobacco smoke
PM-10	natural sources, dust, combustion

Daily concentrations at Beacon Hill



Results: Summary Statistics

	<i>1,3- butadiene</i>	<i>benzene</i>	<i>chloroform</i>	<i>TCE</i>	<i>PCE</i>	<i>acetaldehyde</i>	<i>formaldehyde</i>	<i>PM-10</i>
Mean	0.044	0.394	0.047	0.021	0.025	0.799	0.868	14.913
Median	0.032	0.315	0.036	0.014	0.018	0.740	0.780	13.446
Minimum	0.006	0.108	0.010	0.003	0.004	0.400	0.380	5.360
Maximum	0.205	1.179	0.127	0.091	0.111	1.640	2.030	35.260
n	59	60	60	57	60	59	59	59
CI (95.0%)	0.010	0.060	0.008	0.005	0.005	0.066	0.095	1.638
benchmark	0.018	0.046	0.008	0.037	0.029	0.508	0.081	
background	0.005	0.046	0.008	0.004	0.003	0.127	0.163	

Precision

	S-D ARPD(%)	Rep ARPD (%)	S/D/R ARSD (%)	MDL (ppbv)
1,3-butadiene	17.6	19.2	13.5	0.021
benzene	8.0	6.8	5.7	0.014
chloroform	27.9	10.5	17.4	0.010
TCE	24.8	11.2	16.1	0.015
PCE	15.1	7.0	13.2	0.012
acetaldehyde	5.5	0.6	3.2	0.045
formaldehyde	8.5	1.6	4.9	0.108

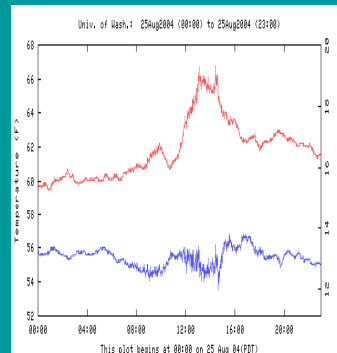
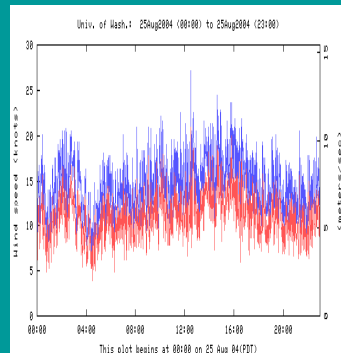
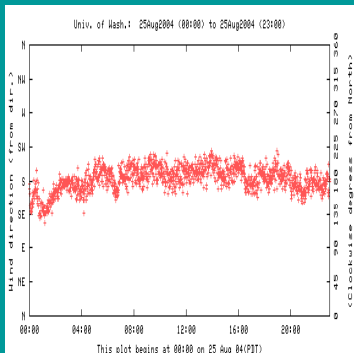
Results: Correlation Coefficients

	1,3-butadiene	benzene	chloroform	TCE	PCE	acetaldehyde	formaldehyde
benzene	0.863	1					
chloroform	-0.173	-0.025	1				
TCE	0.593	0.599	0.042	1			
PCE	0.767	0.769	-0.047	0.756	1		
acetaldehyde	0.416	0.569	0.172	0.307	0.464	1	
formaldehyde	0.603	0.666	-0.069	0.380	0.628	0.784	1
PM-10	0.638	0.676	0.122	0.454	0.665	0.696	0.770

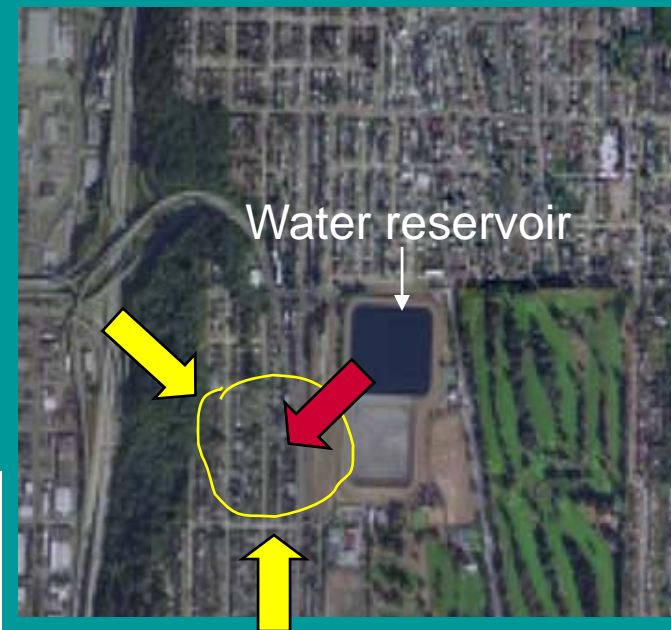
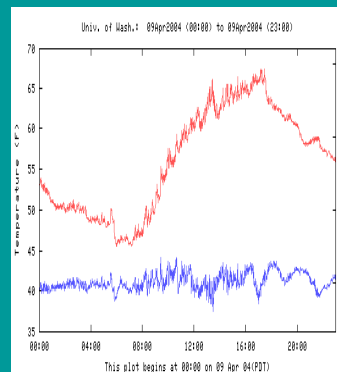
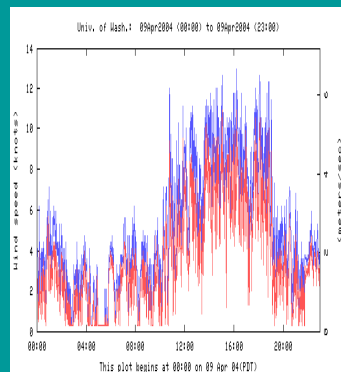
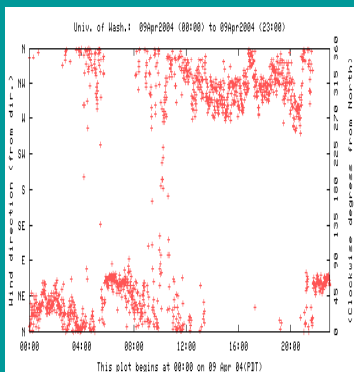
Chloroform has very poor correlation with other VOCs

Results: Chloroform

August 25, 2004 [chloroform] = 0.010 ppbv
 WD = S WS = 6 m/s T = 16C



April 9, 2004 [chloroform] = 0.127 ppbv
 WD = NE, NW WS = 2 m/s T = 10C



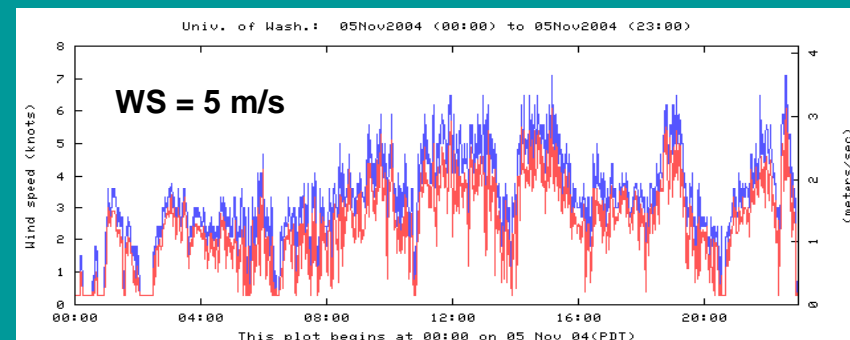
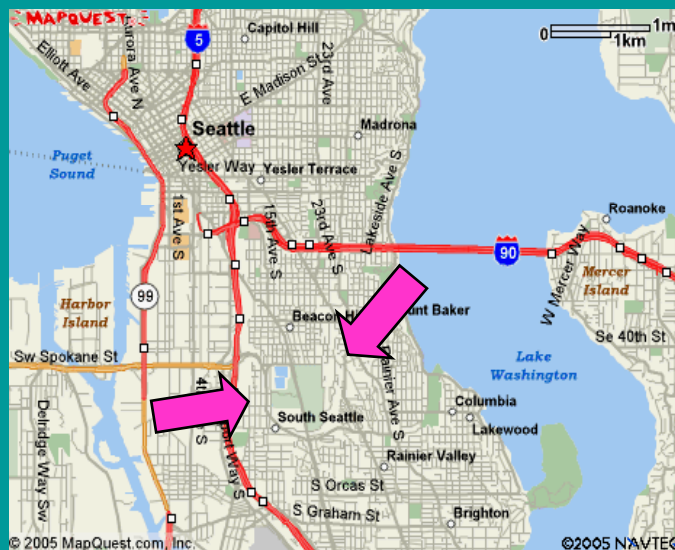
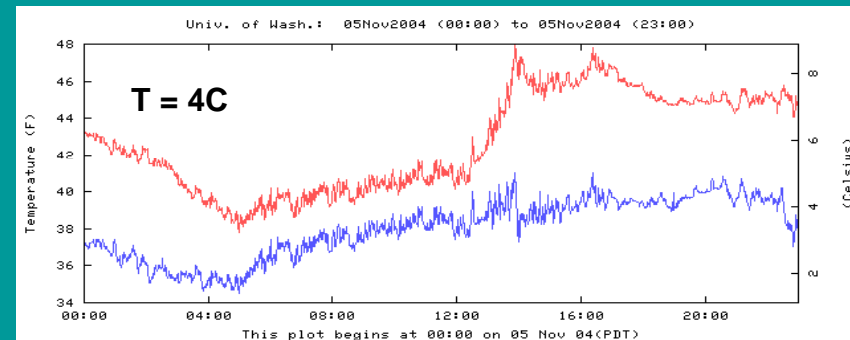
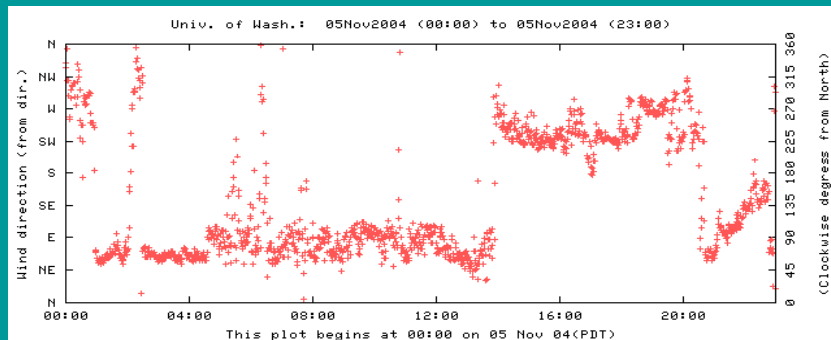
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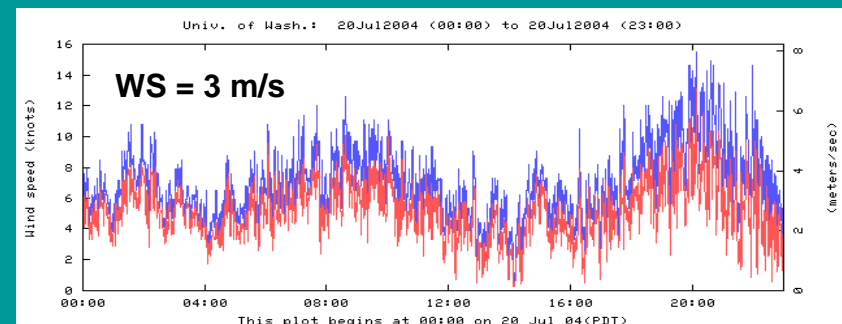
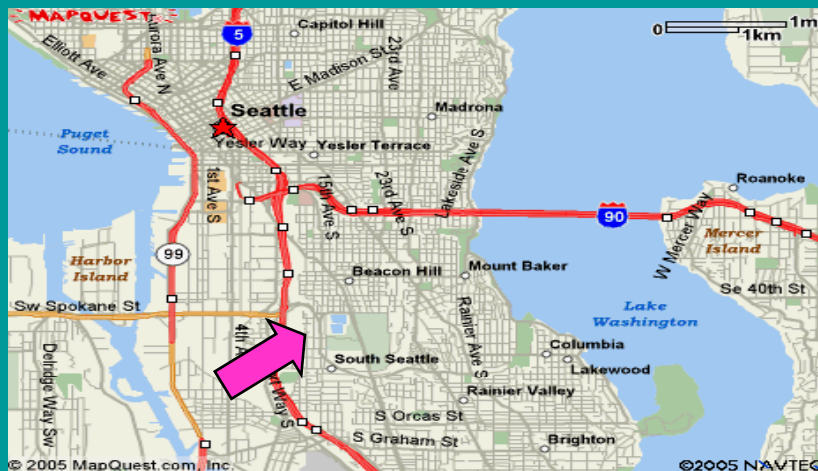
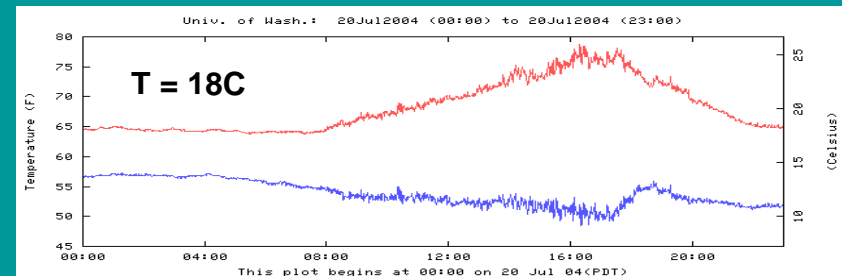
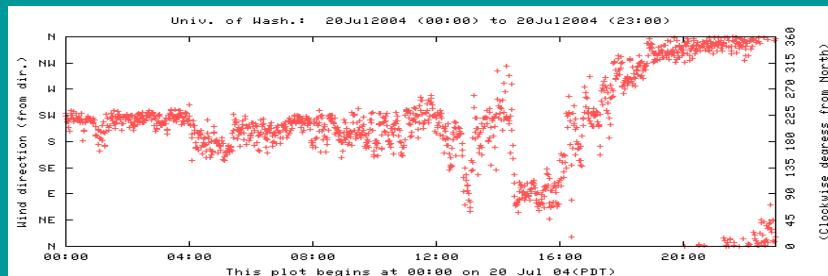
Results: Nov. 5, 2004 (high levels)

1,3-butadiene	benzene	chloroform	TCE	PCE	acetaldehyde	formaldehyde	PM-10
0.205	1.179	0.020	0.061	0.111	1.640	2.030	35.260 (ug/m3)

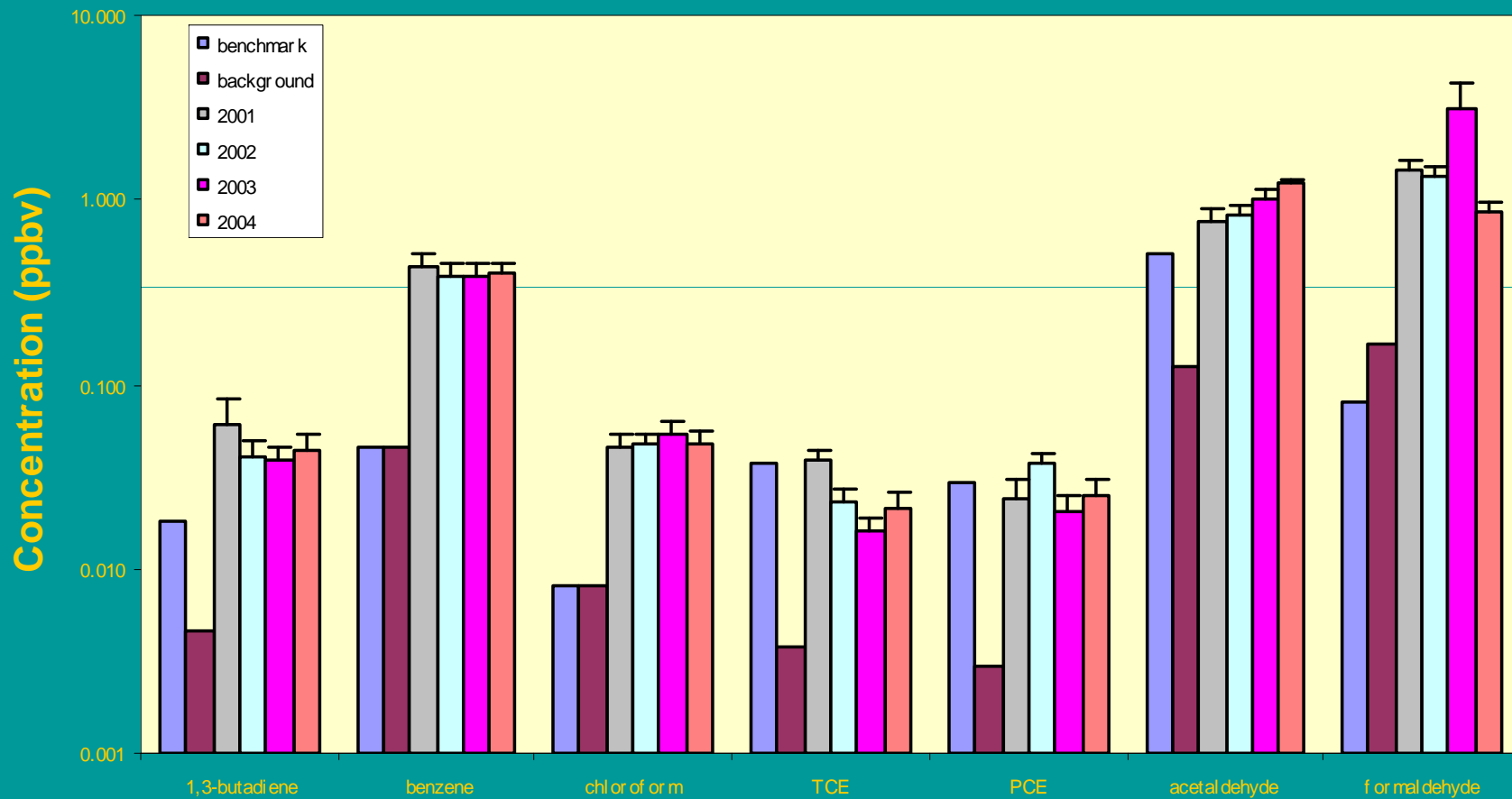


Results: July 20, 2004 (low levels)

1,3-butadiene	benzene	chloroform	TCE	PCE	acetaldehyde	formaldehyde	PM-10
0.006	0.108	0.019	0.003	0.004	0.550	0.660	10.670 (ug/m3)



Trends: 2001 - 2004



Conclusions and Recommendations

- Chloroform does not correlate with the other VOCs, implying a unique source
- Trends observed in previous years still present
 - High benzene, 1,3-butadiene, TCE and PCE during winter
 - High acetaldehyde and formaldehyde during summer
- Ambient concentrations almost an order of magnitude greater for most species
- Evaluate spatial and temporal variability
- Compare with modeled results

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