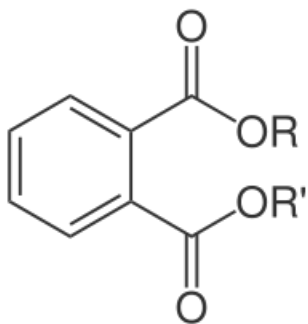
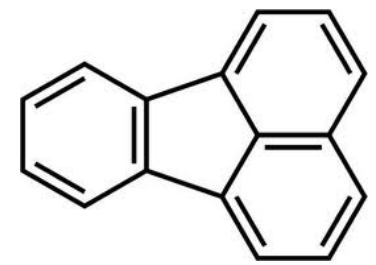
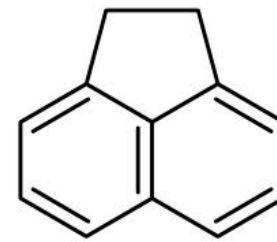
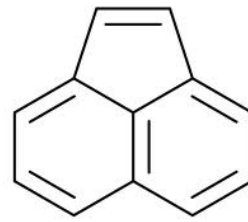


Quantifying PAHs and Phthalates in Air Collected in the Tacoma Tideflats



Juliana Bertin

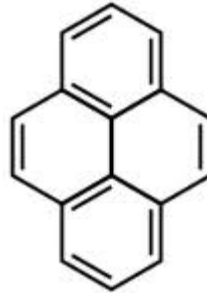
Background



▶ Polycyclic Aromatic Hydrocarbons (PAHs):

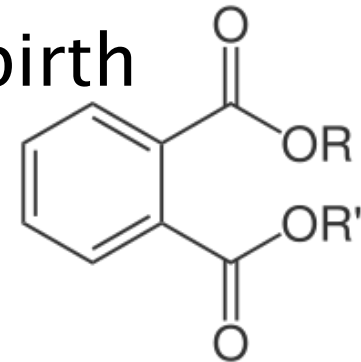


- nonpolar
- carcinogenic, mutagenic, teratogenic
- organic pollutants
- markers of (incomplete) combustion processes



▶ Phthalates—plasticizers in products such as PVC (poly vinyl chloride) piping¹

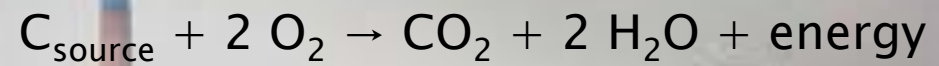
- change hormone levels and cause birth defects in high concentrations



PAHs sources



Combustion



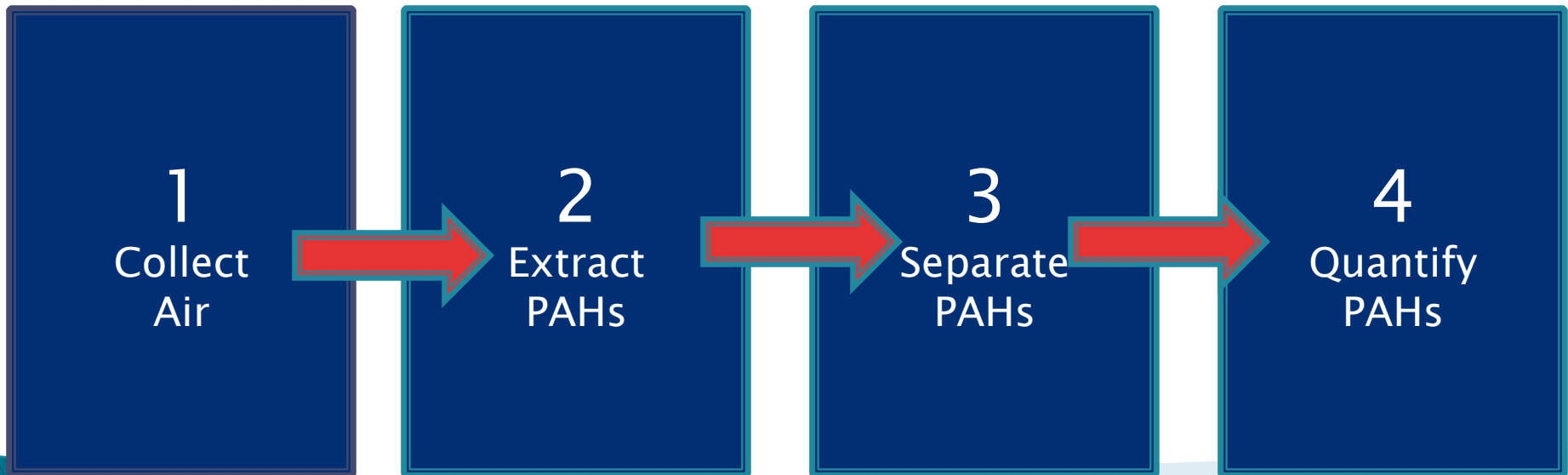
Purpose -to determine how much in Sound is from the air

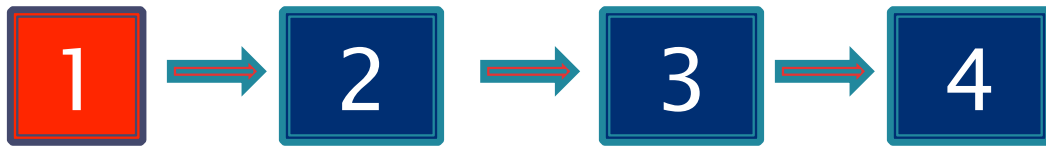
- ▶ Part of the Puget Sound Partnerships's Action Agenda is to 'Reduce the Source of Toxic Chemical Entering Puget Sound'
 - PAH levels in fish explicitly stated as part of this goal
 - Atmospheric deposition and surface runoff have been estimated to be a significant source of PAHs in Puget Sound

Study design

- ▶ Quantify PAHs and phthalates in local air over 1 year period (every 6 days)
- ▶ Analysis of PAHs in gas and particulate phase to calculate total PAH concentration
- ▶ Use seasonal variation in PAH concentrations in combination with the observed variation in meteorology to estimate source strength

From the Air to the Analysis

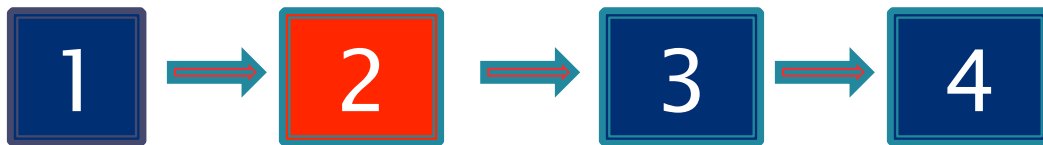




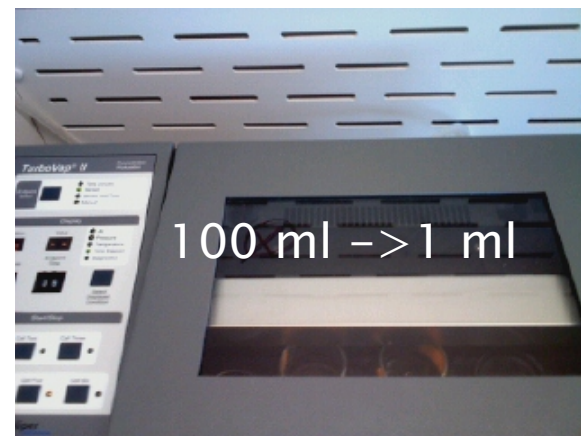
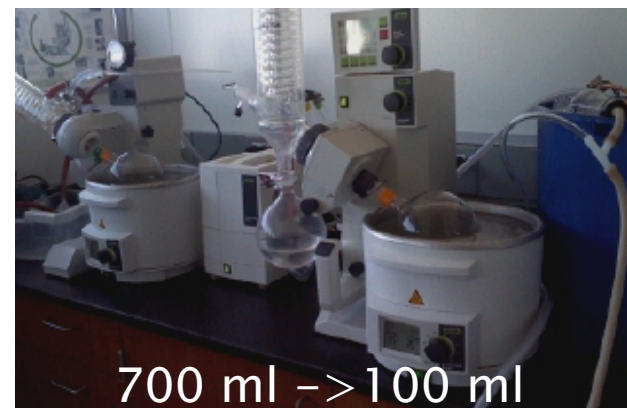
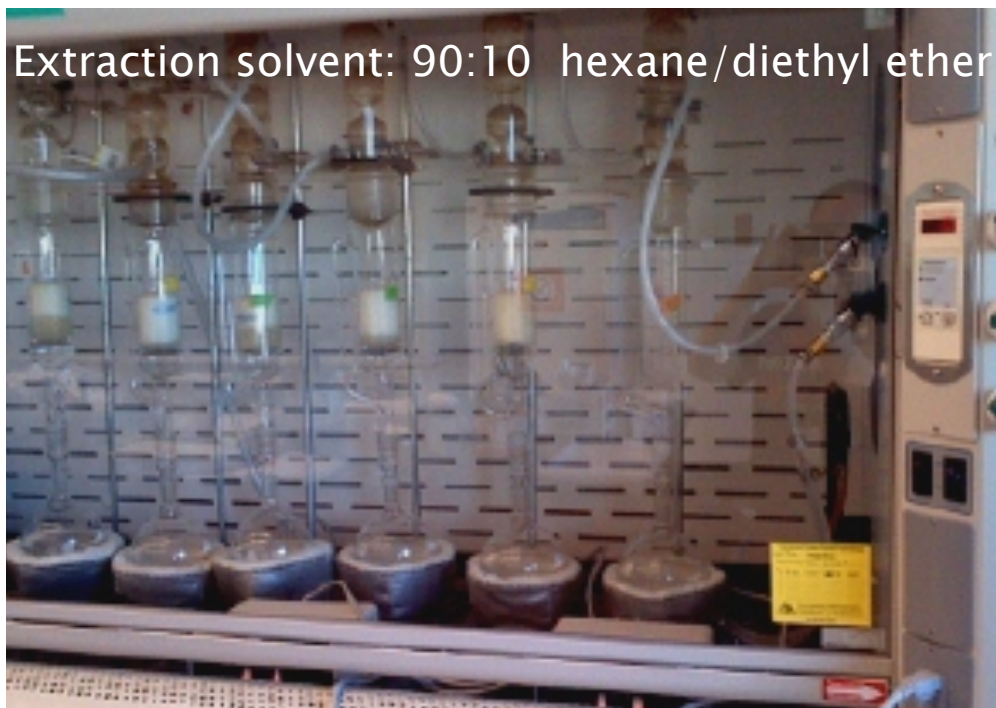
Air Sampling

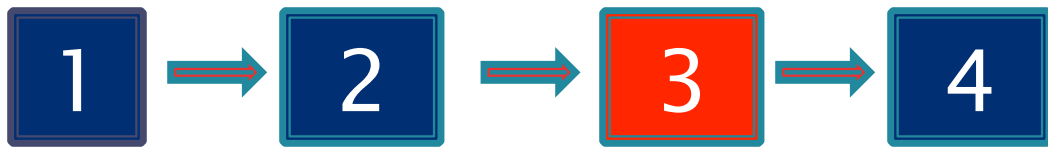


- ▶ TISCH Corp Hi-Vol Air Sampler located on roof of Center for Urban Waters
 - Approximate height of sampler=16.8m above sea level
- ▶ Two Phases of Samples Collected:
 - Total suspended particulate (TSP) w/ quartz filters for particulate-phase species
 - Gas-phase w/ polyurethane foam (PUF) media for gas-phase species



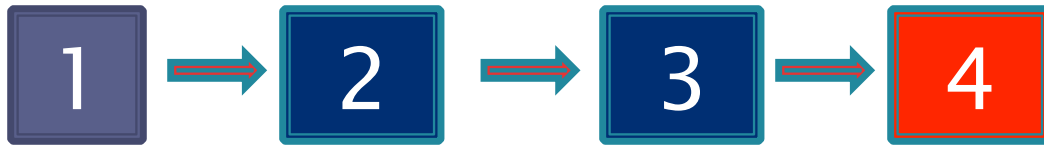
Extraction





Chemical Analysis

- ▶ 1 mL final extract
- ▶ Gas Chromatography–Mass Spectrometry (GC–MS)
- ▶ Analyze solutions of known concentration to calibrate the instrument response
- ▶ Use calibration curve to determine mass of PAHs in sample extracts
- ▶ In order to evaluate laboratory contamination and instrument performance, blanks and standard spikes are analyzed as part of each batch



Data Analysis

- ▶ Method Limit of Detection (LOD) is calculated using PAH concentrations in lab blanks
- ▶ PAH mass per sample is converted to concentration in sampled air

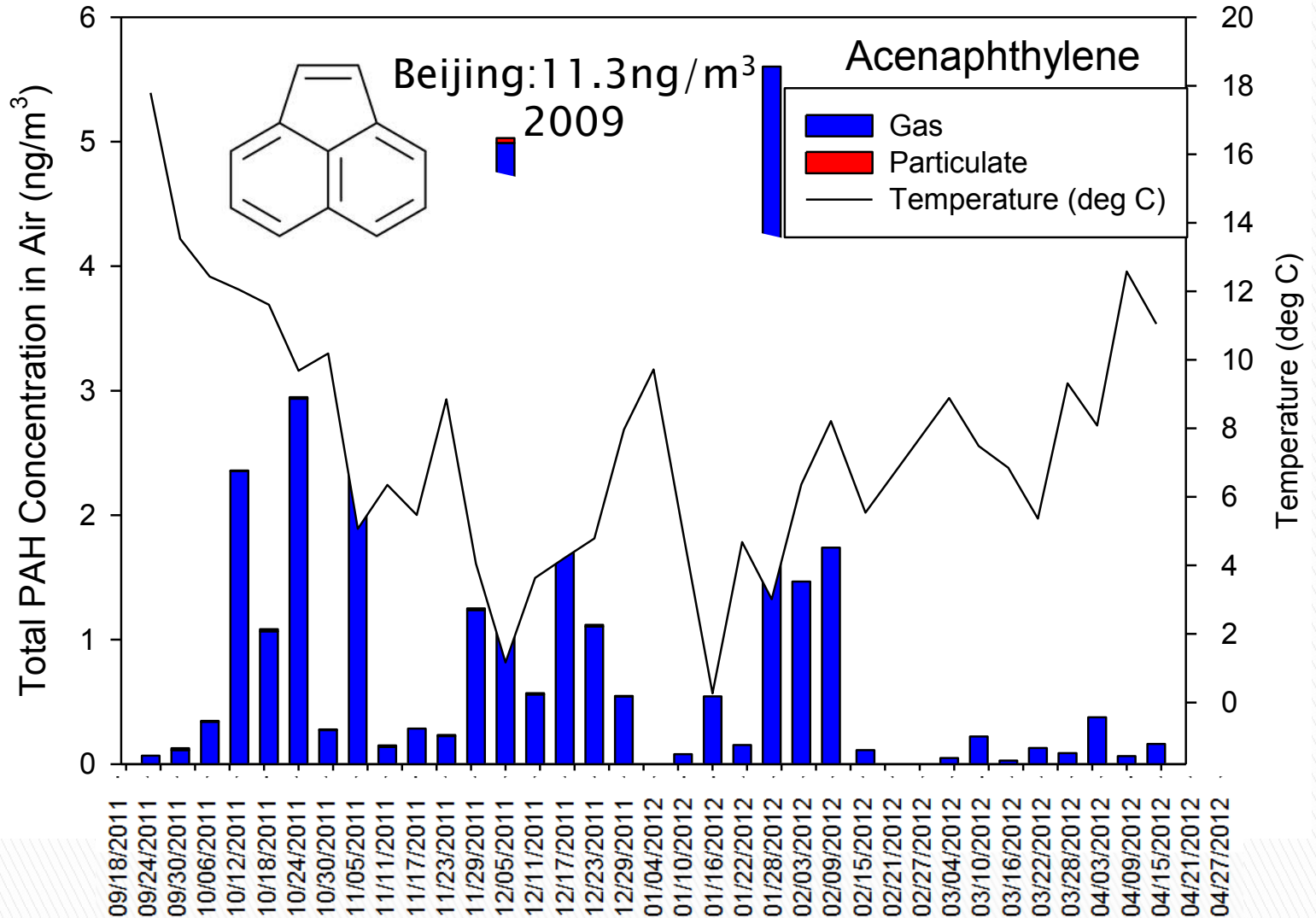
>25% RED; >60% YELLOW; >85% GREEN

Gas phase Limit of Detection (ng/m ³)	% Above Limit of Detection (LOD) (ng/m ³)	Target Compound	Particulate Phase Limit of Detection (ng/m ³)	% Above Limit of Detection (LOD) (ng/m ³)
0.234	100	1-Methyl Naphthalene	0.147	12
0.109	100	2-Methyl Naphthalene	0.062	12
0.019	97	Acenaphthylene	0.004	88
0.041	88	Acenaphthene	0.016	24
0.131	100	Phenanthrene	0.110	35
0.040	100	Anthracene	0.044	41
0.069	100	Fluoranthene	0.060	76
0.048	100	Pyrene	0.041	82
0.009	61	Benzo (a) Anthracene	0.004	88
0.092	21	Chrysene	0.004	94
0.029	6	Benzo (a) Pyrene	0.004	47
0.118	0	Indeno (1,2,3-c,d) Pyrene	0.013	100
0.333	0	Dibenz (a,h) Anthracene	0.011	88
0.116	0	Benzo (g,h,i) Perylene	0.017	100

PAH Level, Largely in Gas Phase

*Filter samples only analyzed through 1/10/2012

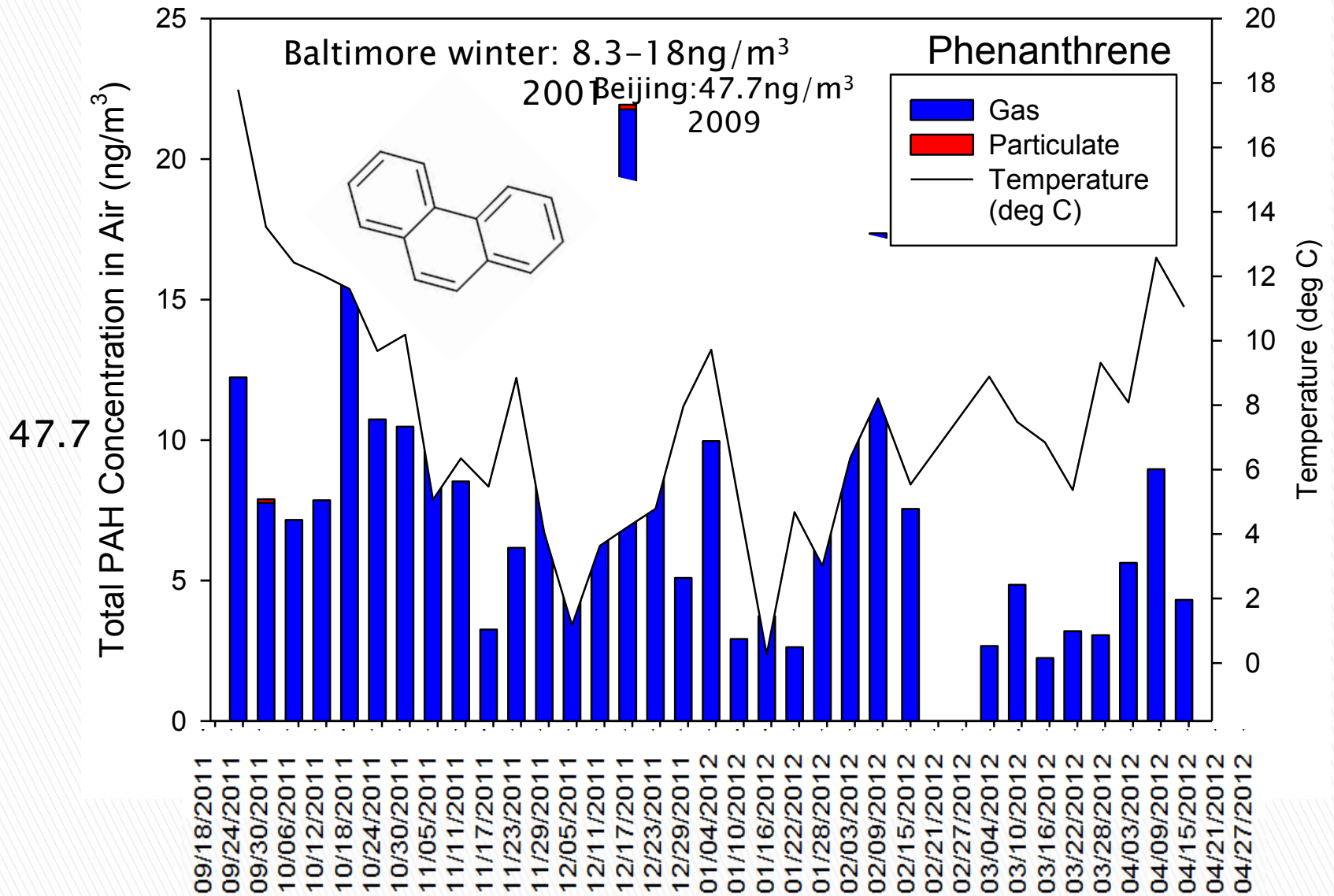
*No data collected 2/17/2012 -3/3/2012



PAH Level, Largely in Gas Phase

*Filter samples only analyzed through 1/10/2012

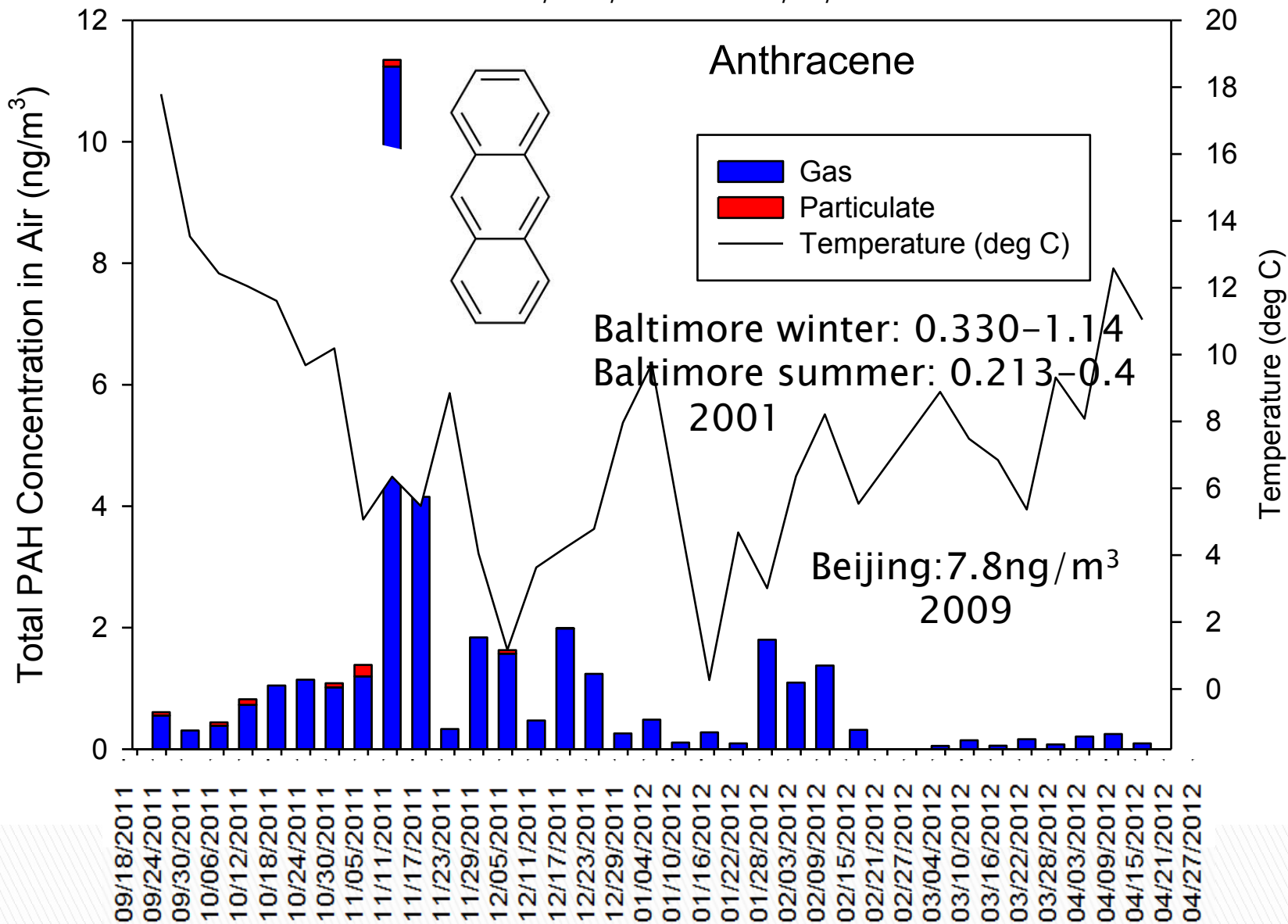
*No data collected 2/17/2012 -3/3/2012



PAH Level, Largely in Gas Phase

*Filter samples only analyzed through 1/10/2012

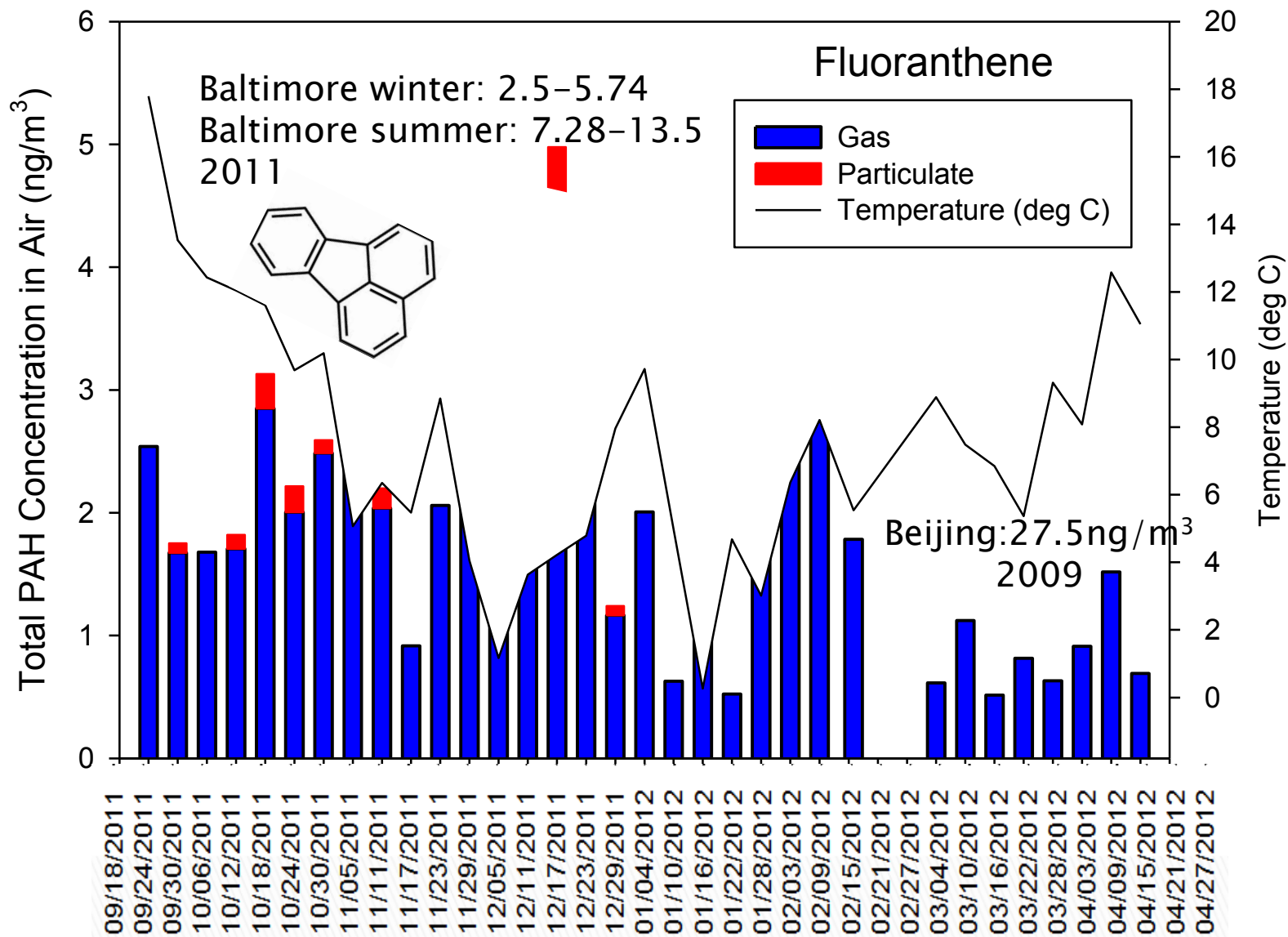
*No data collected 2/17/2012 -3/3/2012



PAH Contributions From Gas and Particulate Phases

*Filter samples only analyzed through 1/10/2012

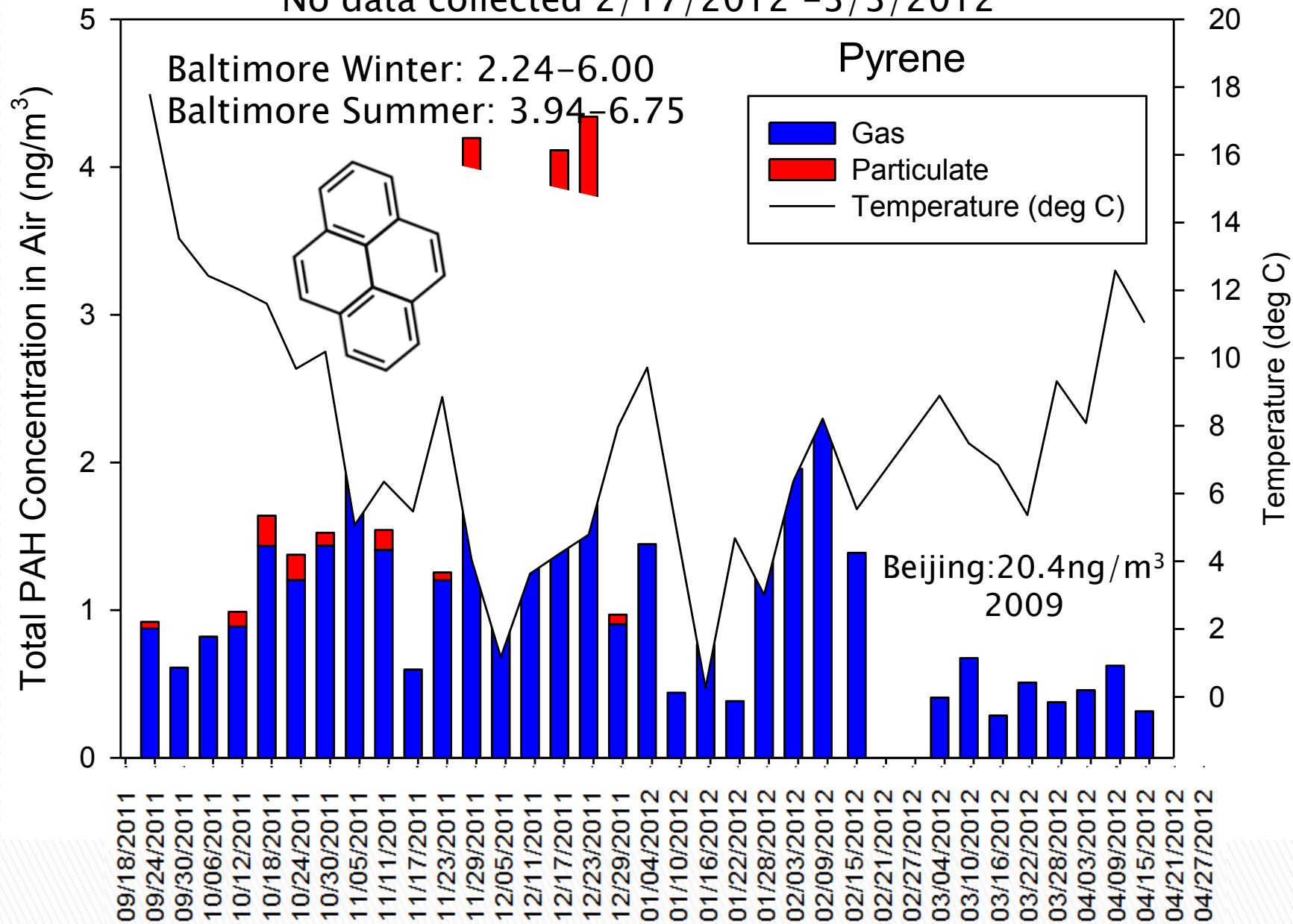
*No data collected 2/17/2012 - 3/3/2012



PAH Contributions From Gas and Particulate Phases

*Filter samples only analyzed through 1/10/2012

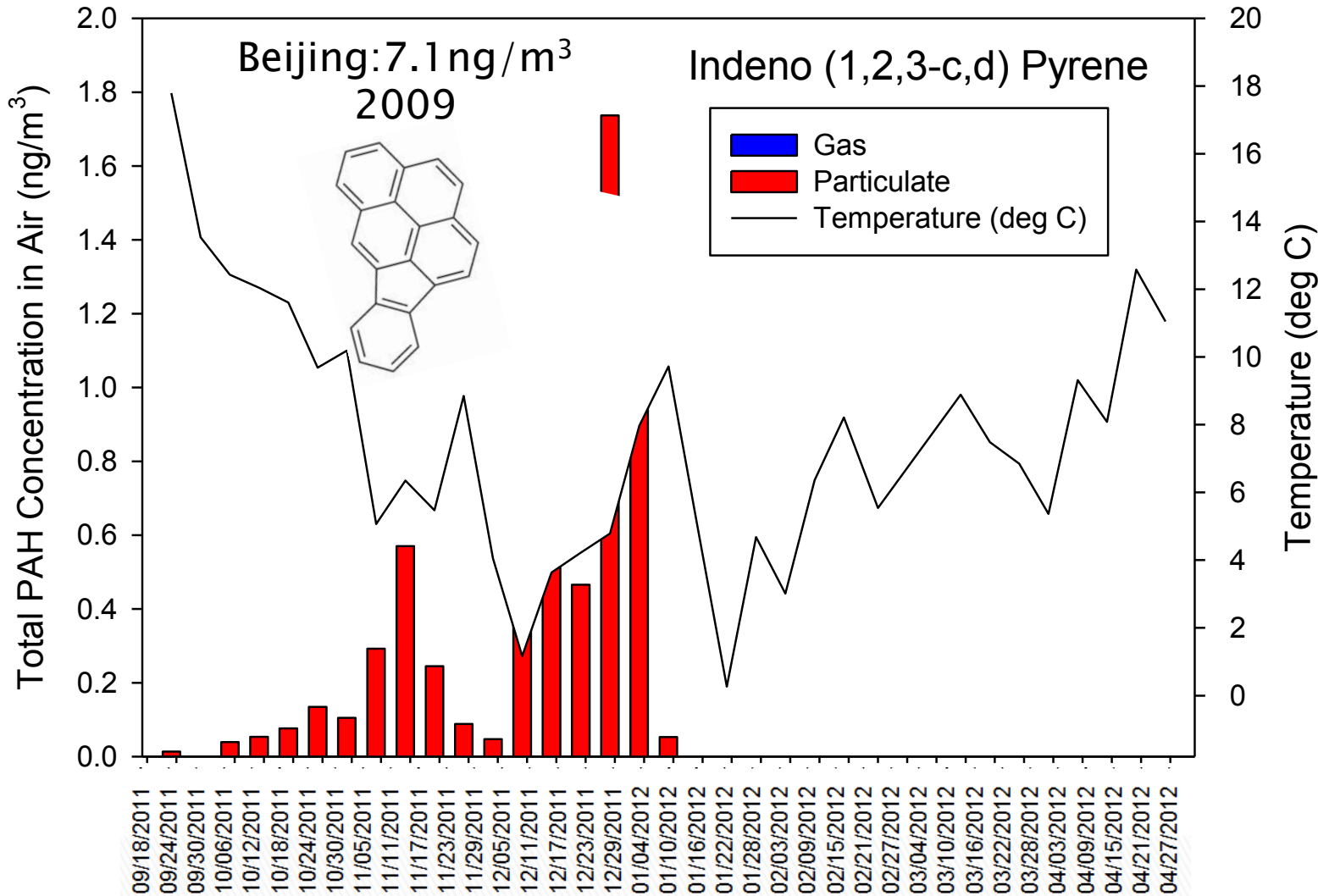
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PAH Level, Largely in Particulate Phase

*Filter samples only analyzed through 1/10/2012

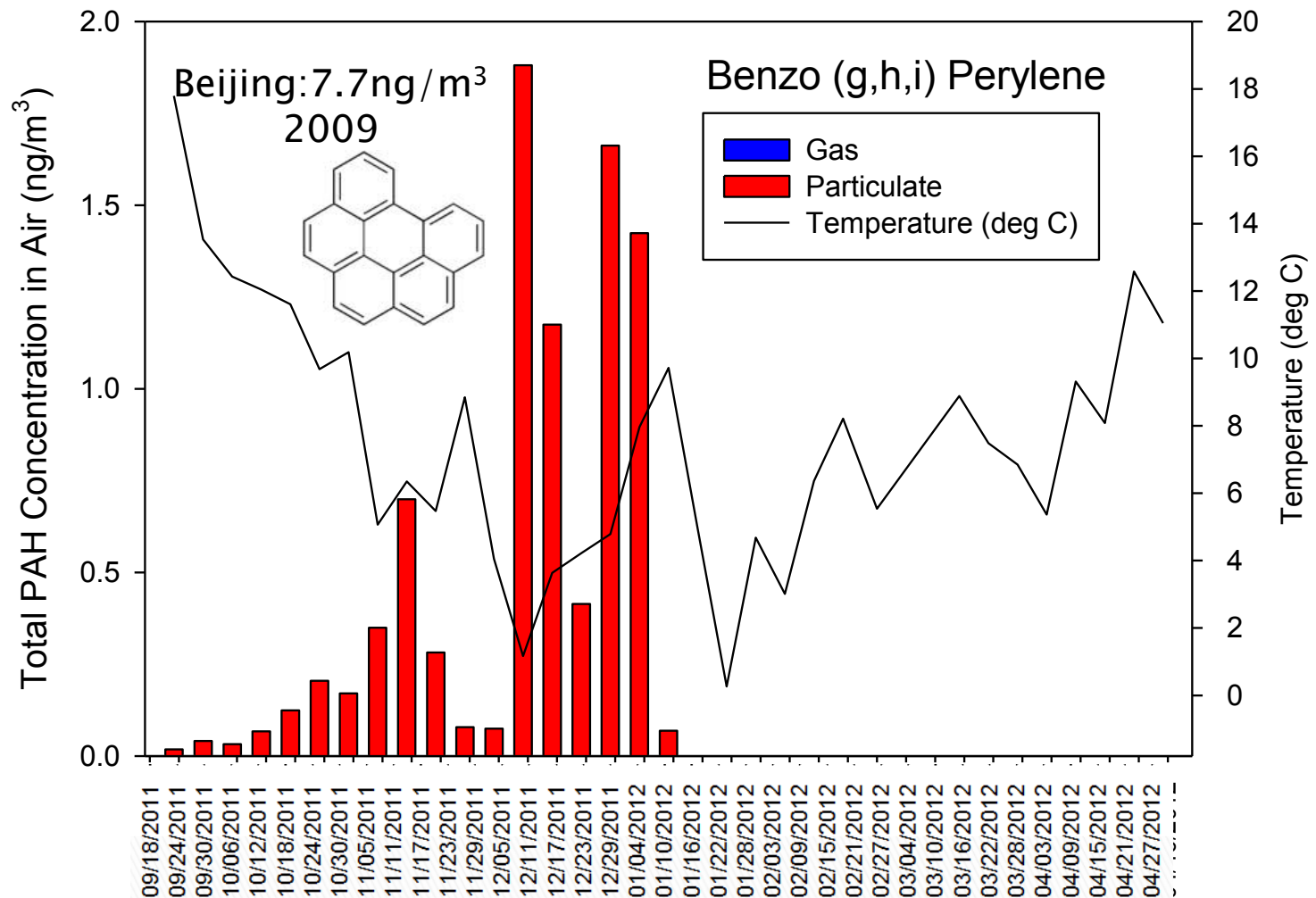
*No data collected 2/17/2012 - 3/3/2012



PAH Level, Largely in Particulate Phase

*Filter samples only analyzed through 1/10/2012

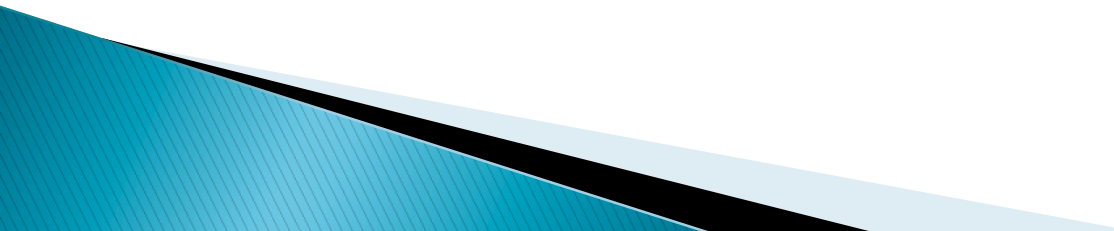
*No data collected 2/17/2012 -3/3/2012



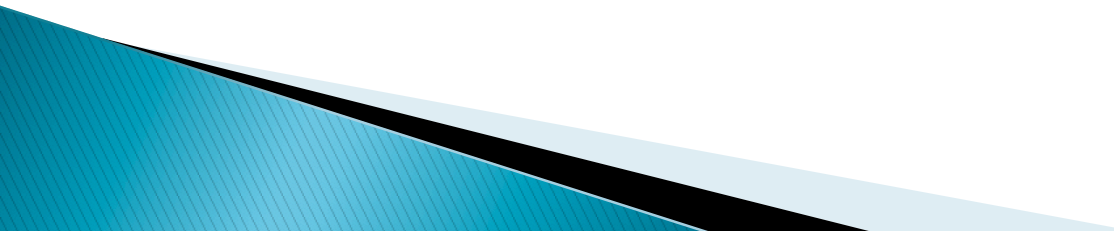
Conclusions

- ▶ Consistently observe all PAHs of interest in at least one phase
- ▶ Gas phase PAHs dominate total mass in the air
- ▶ LOD was consistently below $0.25\text{ng}/\text{m}^3$
- ▶ General range of “light” PAH concentrations: $0.5\text{--}5\text{ng}/\text{m}^3$
 - Tend to be found in gas phase
- ▶ General range of “medium” PAH concentrations: $0.5\text{--}3\text{ng}/\text{m}^3$
- ▶ General range of “heavy” PAH concentrations: $0.5\text{--}2\text{ng}/\text{m}^3$
 - Tend to be found in particulate phase

Next Steps

- ▶ Sampling (4 days, 7%)
 - ▶ Final soxhlet extractions (11 batches)
 - ▶ Run final sequences through GC/MS (~4 sequences)
 - ▶ Data analysis (~60%)–quantify PAH's and phthalates
 - ▶ Infer roots of contamination at different times of year and compare data to previous works
- 

Acknowledgements

- ▶ Justin Miller–Schulze, Ph.D.
 - ▶ Joel Baker, Ph.D.
 - ▶ City of Tacoma
 - ▶ Shristi Prakash
- 

Questions?



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Images

- ▶ http://www.google.com/imgres?num=10&um=1&hl=en&rlz=1C1SKPL_enES416&biw=1280&bih=679&tbm=isch&tbnid=dx_yw6gusMOcMM:&imgrefurl=http://yachtpals.com/biodiesel-boats-7035&docid=C5KATyhuUw3xvM&imgurl=http://yachtpals.com/files/news/boat-pollution.jpg&w=250&h=176&ei=_HJPUJ_YOevpiwLj44CIDg&zoom=1&iact=rc&dur=412&sig=100310049395220651334&sqi=2&page=1&tbnh=138&tbnw=177&start=0&ndsp=18&ved=1t:429,r:0,s:0,i:100&tx=59&ty=62
- ▶ http://www.google.com/imgres?start=295&um=1&hl=en&rlz=1C1SKPL_enES416&biw=1280&bih=679&addh=36&tbm=isch&tbnid=GCTb7etpwboHM:&imgrefurl=http://www.fcfb.org/Action-Center/ARB-Proposed-Truck-Emission-Rule.php&docid=eB9X5Rqq1ynjeM&imgurl=http://www.fcfb.org/images/Action-Center/Diesel-Truck.jpg&w=300&h=217&ei=FHRPUOKxE6qZiALL3oCQDg&zoom=1&iact=hc&vpx=197&vpy=393&dur=2431&hovh=173&hovw=240&tx=133&ty=104&sig=100310049395220651334&page=16&tbnh=147&tbnw=194&ndsp=20&ved=1t:429,r:15,s:295,i:54
- ▶ http://www.google.com/imgres?um=1&hl=en&rlz=1C1SKPL_enES416&biw=1280&bih=679&tbm=isch&tbnid=T4z1ZrD7rxKkAM:&imgrefurl=http://www.geliosoft.com/fireplace-screensaver/&docid=JtYniBRGQHdUbM&imgurl=http://www.geliosoft.com/fireplace-screensaver/fpsh.jpg&w=400&h=320&ei=hXRPUMnIMKKxiwKGhYDQDQ&zoom=1&iact=hc&vpx=724&vpy=190&dur=524&hovh=172&hovw=218&tx=123&ty=97&sig=100310049395220651334&page=1&tbnh=135&tbnw=176&start=0&ndsp=19&ved=1t:429,r:3,s:0,i:161
- ▶ http://www.google.com/imgres?um=1&hl=en&rlz=1C1SKPL_enES416&biw=1280&bih=679&tbm=isch&tbnid=HkUwGgqD7FrJhM:&imgrefurl=http://thewe.cc/weplanet/news/air/co2_record_high_levels_in_the_atmosphere.htm&docid=lr0_J8tgplbFrM&imgurl=http://thewe.cc/thewei/%2526_/images6/environment/chemical_plant.jpe&w=380&h=312&ei=tnRPUOaMKYGDjALm5YHYAw&zoom=1&iact=rc&dur=222&sig=100310049395220651334&page=1&tbnh=137&tbnw=176&start=0&ndsp=15&ved=1t:429,r:8,s:0,i:112&tx=117&ty=58