East vs. West in the US: Chemical Characteristics of $PM_{2.5}$ during the Winter of 1999.

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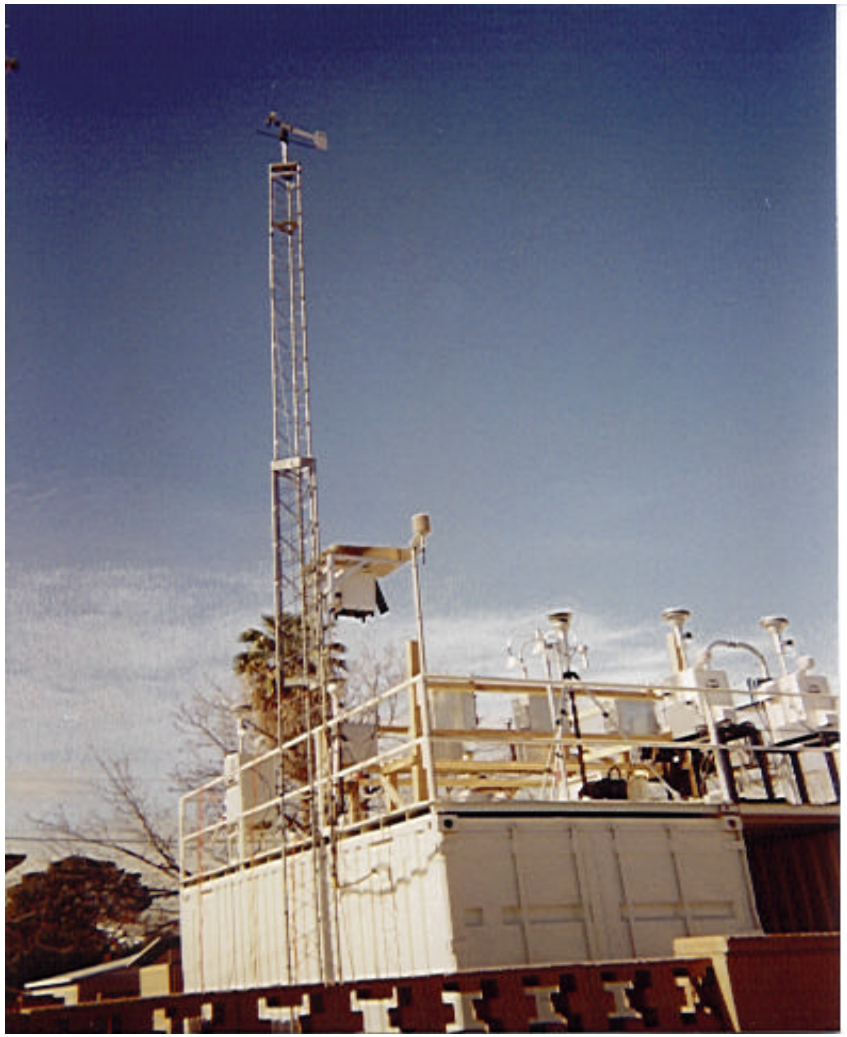
Objective

- **To examine** the magnitude of potential biases or sampling artifacts associated with use of the FRM across the different locations under wintertime conditions.
  - Rubidoux, CA (high nitrate and carbon and low sulfate; moderate cool temperatures),
  - Phoenix, AZ (high crustal material and moderate carbon and nitrate; moderate cool temperatures),
  - Philadelphia, PA (high sulfate, moderate carbon, and low nitrate; cool to cold temperature, some snow), and
  - Research Triangle Park (RTP), NC (low $PM_{2.5}$ concentrations, moderate cool temperatures).

Rubidoux, CA

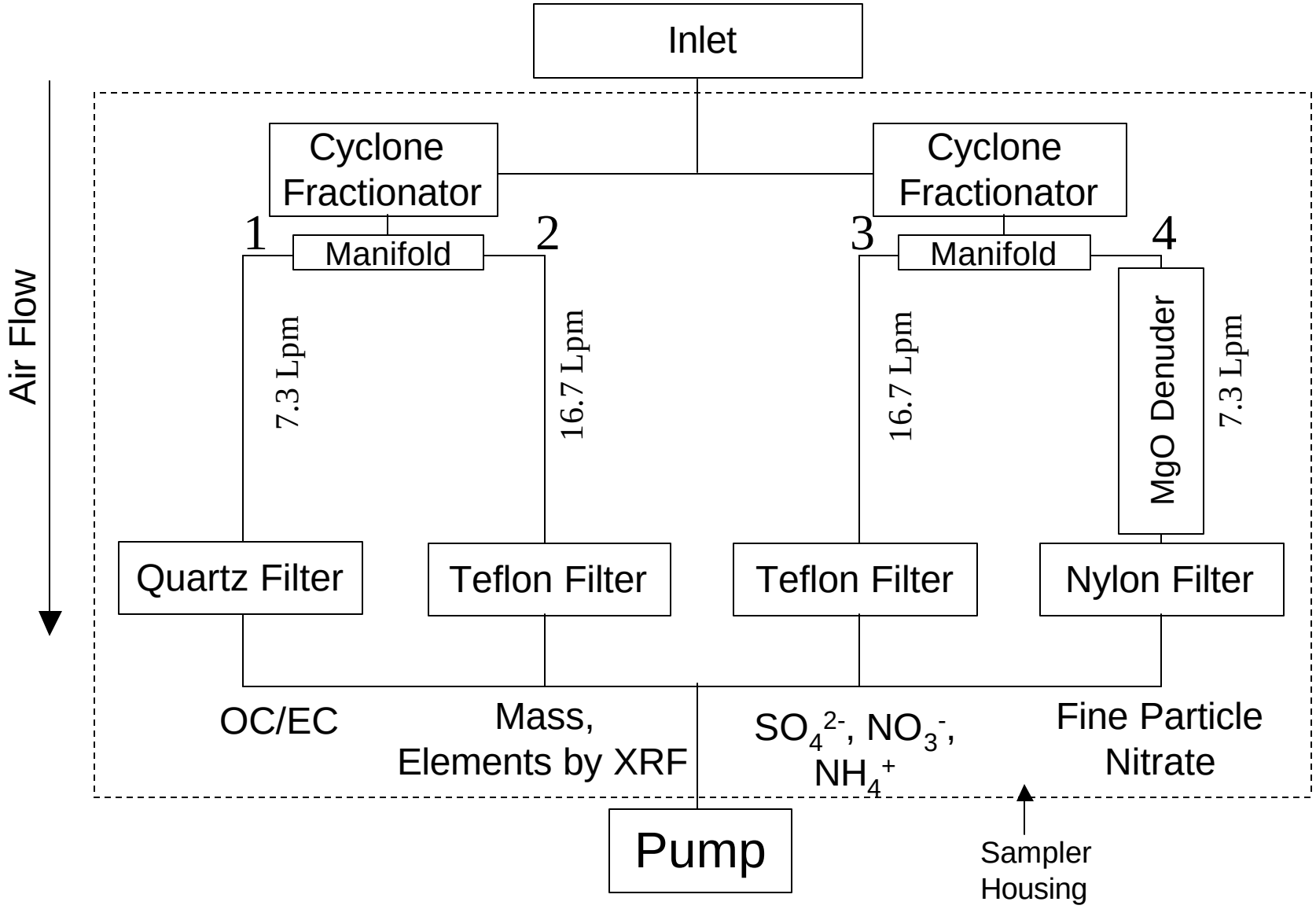
Phoenix, AZ



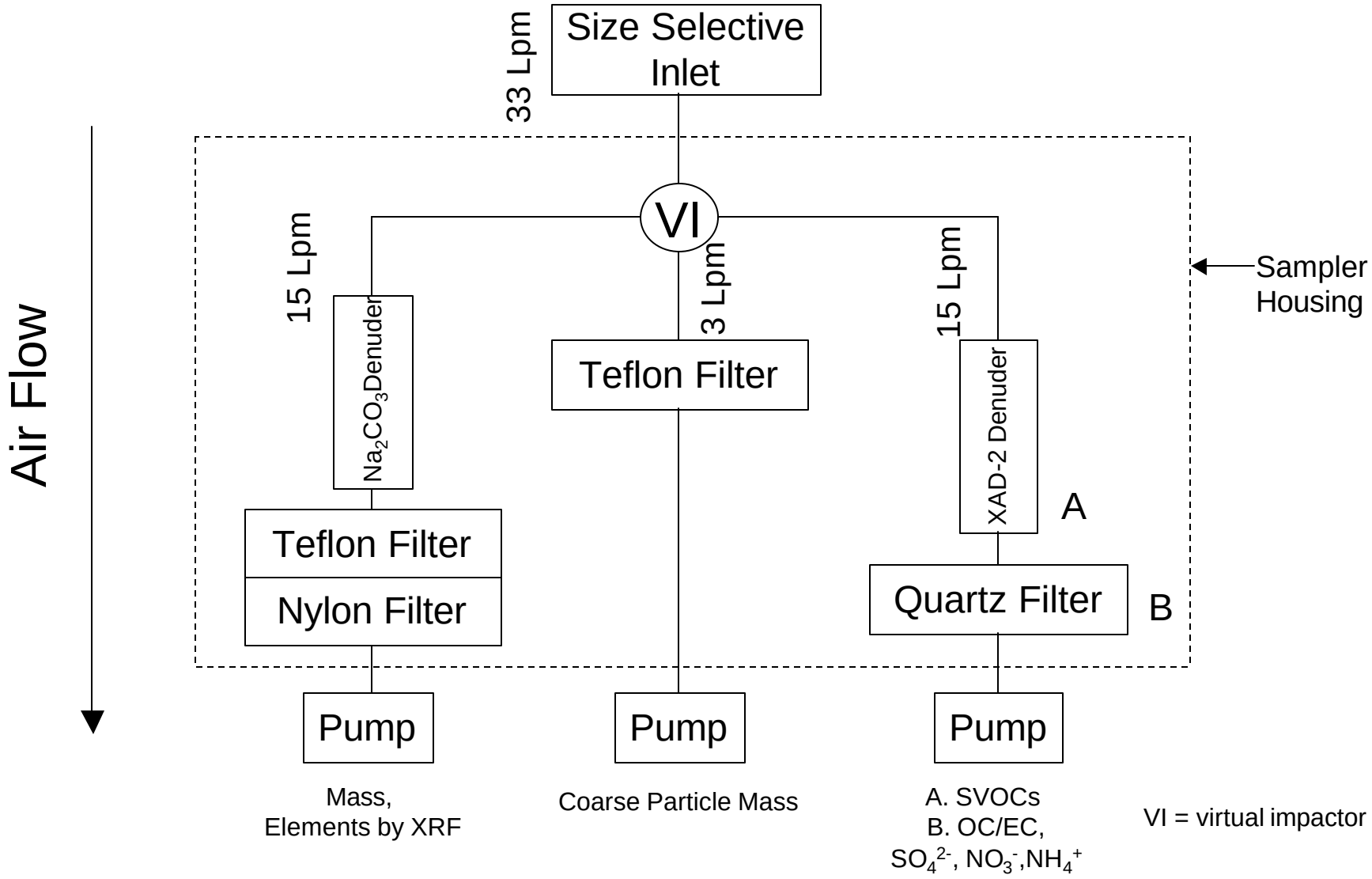
Philadelphia, PA

Research Triangle Park, NC

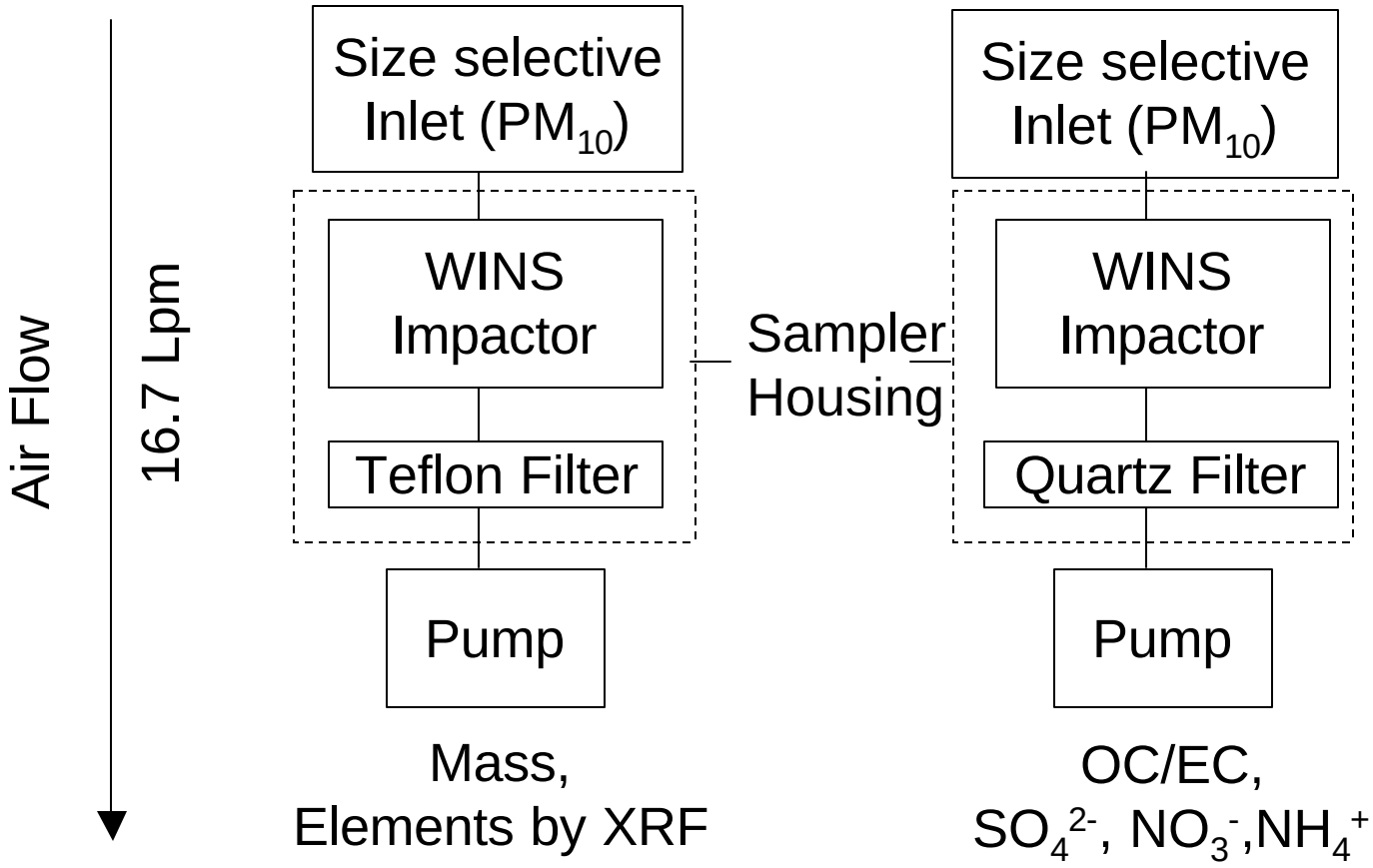
Anderson RAAS Sampler



URG VAPS Sampler



FRM Samplers

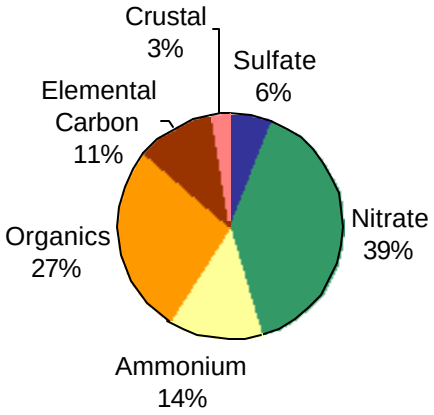


	Average				Maximum				Minimum			
	Rubidoux	Phoenix	Philadelphia	RTP	Rubidoux	Phoenix	Philadelphia	RTP	Rubidoux	Phoenix	Philadelphia	RTP
$PM_{2.5}$[†]	26.7	14.9	17.4	11.0	74.3	25.3	37.6	23.8	2.2	3.9	5.0	4.4
Sulfate	1.7	0.9	4.1	3.3	6.0	1.8	8.4	6.2	0.3	0.2	1.5	0.7
Nitrate	11.8	3.1	3.8	0.7	38.0	7.4	8.6	2.3	0.1	0.2	0.9	0.1
Ammonium	4.0	1.2	2.6	1.3	13.2	2.5	5.8	2.3	0.1	0.1	0.8	0.2
OC	5.7	7.6	4.3	3.4	10.0	12.5	9.6	8.5	2.1	4.0	2.3	1.5
EC	3.3	3.3	2.5	1.5	7.7	5.7	5.7	3.7	0.6	1.5	0.8	0.6
S[‡]	600	300	1380	1120	1930	640	2790	2080	110	71	390	260
Si	160	280	47	72	378	480	130	230	16	50	19	19
K	80	140	55	67	125	250	120	180	24	30	29	32
Ca	160	110	35	32	360	220	110	150	34	26	13	13
Fe	170	210	100	52	386	420	300	120	55	57	18	11
Cu	7	9	5	8	31	38	13	64	0	2	1	0
Zn	70	18	32	16	255	48	83	55	4	2	5	5
Pb	14	6.6	12	4.3	49	22	39	16	1.8	0	2.6	0
As	0.3	1.1	0.7	0.5	1.4	3.5	3.6	2.9	0	0	0	0

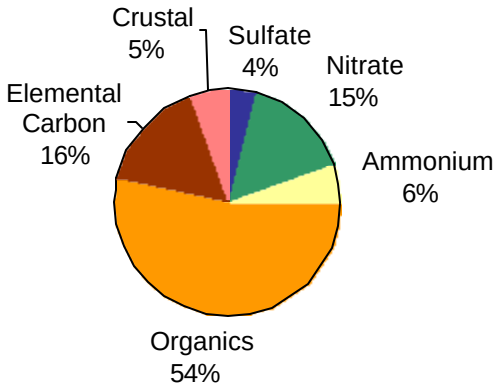
[†]The following concentrations are in $\mu g/m^3$
[‡]The following concentrations are in ng/m^3

Average Day

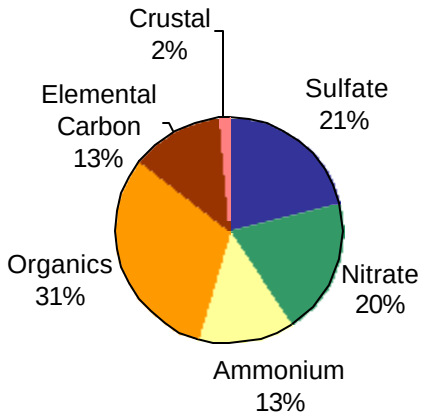
Rubidoux,CA



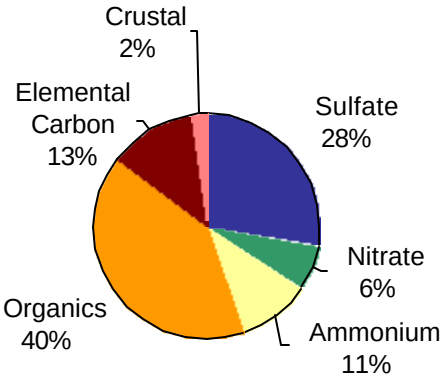
Phoenix, AZ



Philadelphia, PA

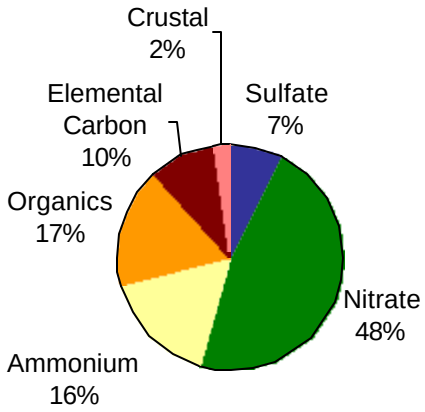


Research Triangle Park, NC

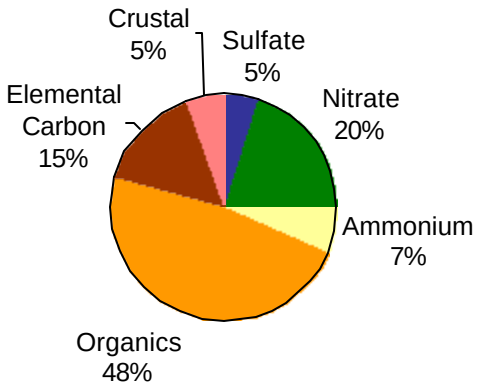


Maximum Day

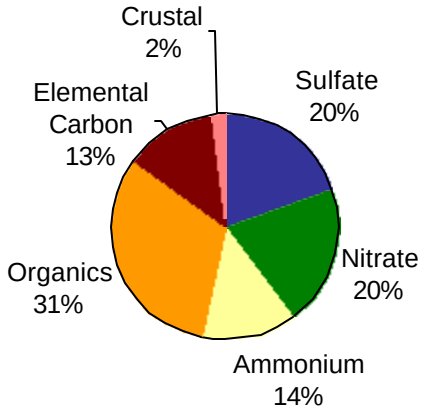
Rubidoux, CA



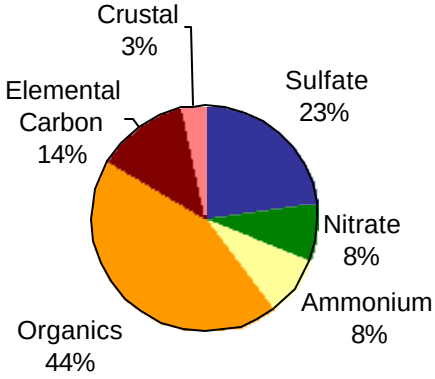
Phoenix, AZ



Philadelphia, PA

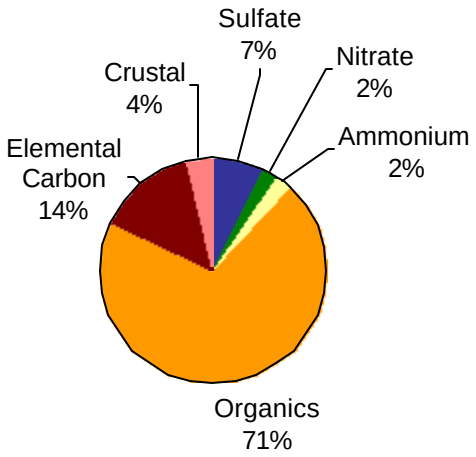


Research Triangle Park, NC

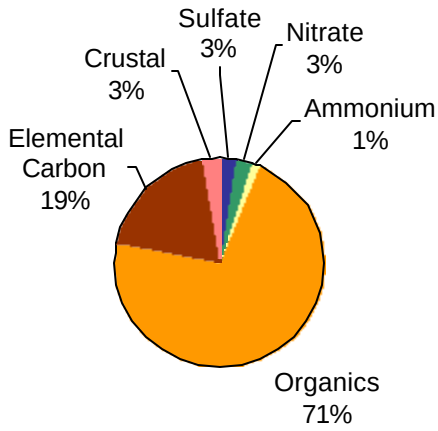


Minimum Day

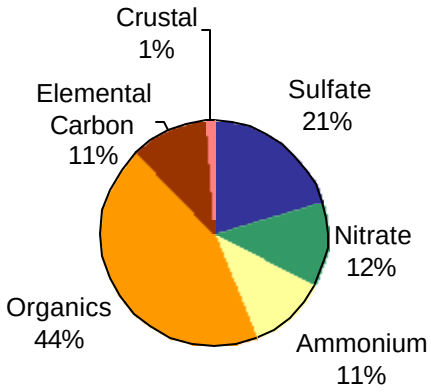
Rubidoux, CA



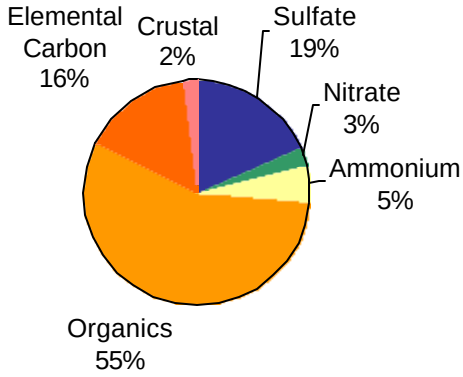
Phoenix, AZ



Philadelphia, PA

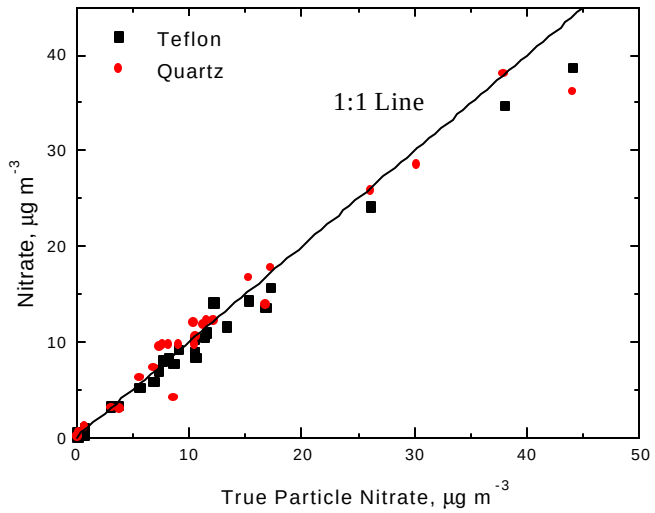


Research Triangle Park, NC

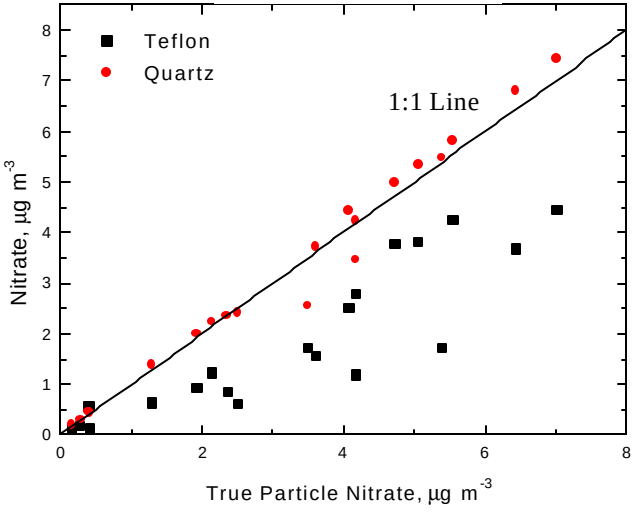


Heat-Treated Quartz vs. Teflon® Nitrate Measurements

Rubidoux, CA



Phoenix, AZ



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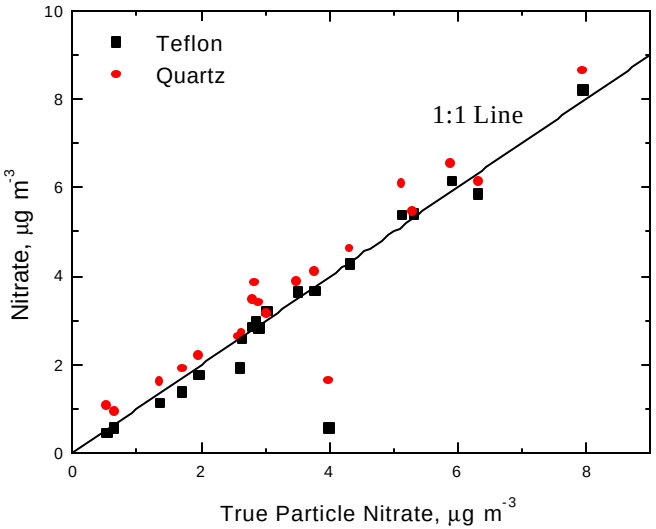
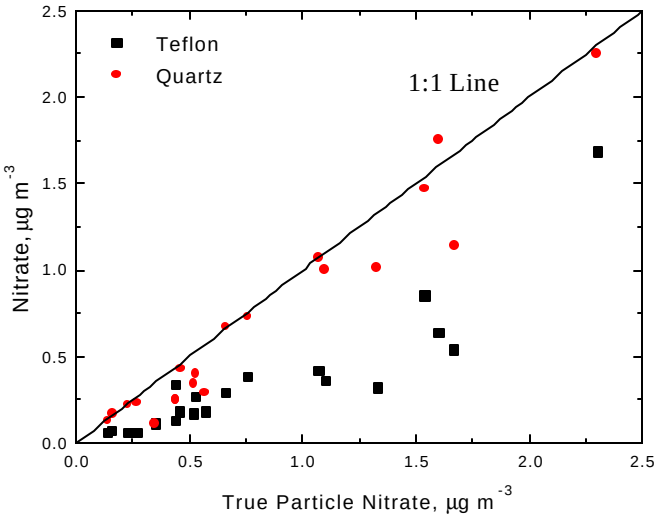
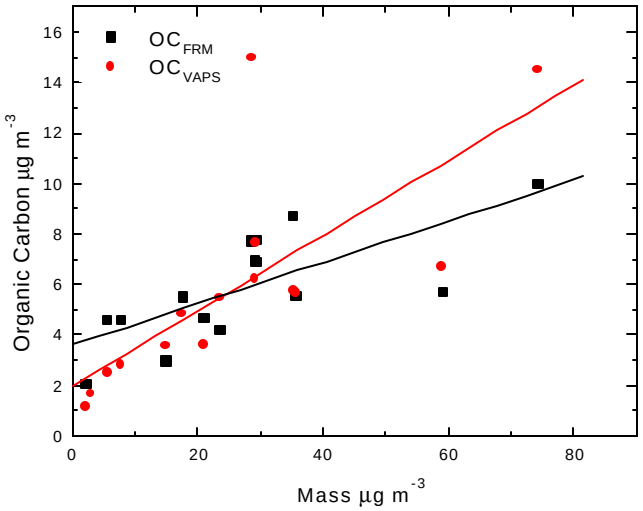


Research Triangle Park, NC



Organic Carbon Comparison

Rubidoux, CA



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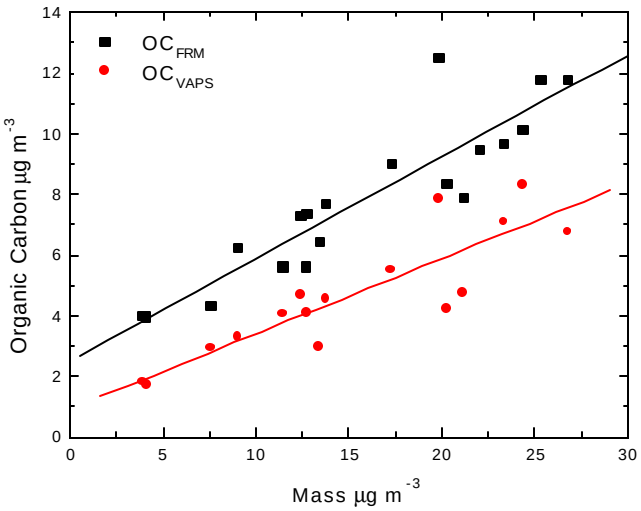

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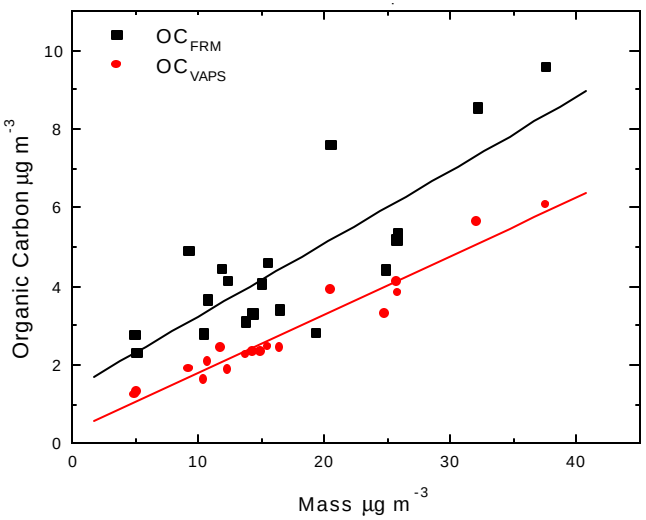

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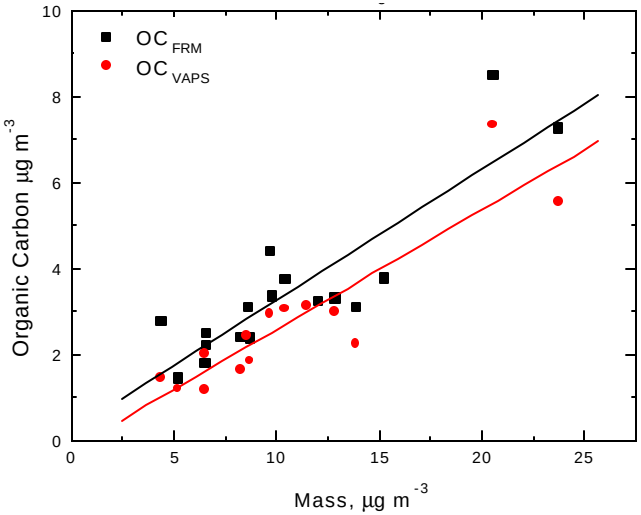

Discussion

- As is typically observed, the most abundant species, of those measured, were NO_3^-, $SO_4^=$, NH_4^+, OC, EC, and Si, Fe, and Ca; although relative abundances varied from site-to-site.
- Nitrate collected on heated (prior to sampling) quartz filters appears to be larger than that collected on Teflon filters indicating a positive bias.
- This difference varies amongst sites:
  - Rubidoux - greater gas phase concentrations of ammonia and NOx
  - Phoenix - same temperature as Rubidoux
    - less gas phase components-larger difference
  - Philadelphia - cold temperatures shift equilibrium to the condensed phase.
  - RTP - low overall levels of gas and condensed phase species.
- OC contributes in different amounts to the total mass by site.
  - Undenuded quartz filters have a consistently more organic mass than denuded samples with the exception of Rubidoux where they are similar.
  - There appears to be a consistent positive bias for each site for non-denuded samples.
- West Coast sample masses were dominated by OC and nitrate , while East Coast sample masses were dominated by OC and sulfate.
- OC dominated the sample mass for both sites on minimum days.

℗ **Disclaimer.** This work has been funded wholly or in part by the United States Environmental Protection Agency. Portions of the work were performed under Contract No. 68-D5-0040 by Research Triangle Institute. It has been subjected to Agency review and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.