

# **Regional Composition of PM<sub>2.5</sub> Measured at Urban, Rural and "Background" Sites in the Tennessee Valley**

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# Scientific Issues

- What is the chemical composition of fine particles at urban, rural, and background locations in the Tennessee Valley?
- How does the chemical composition at these sites vary by season?
- How does the chemical composition vary from urban to rural to remote sites?
- What are the regulatory implications of these variations by site and season?

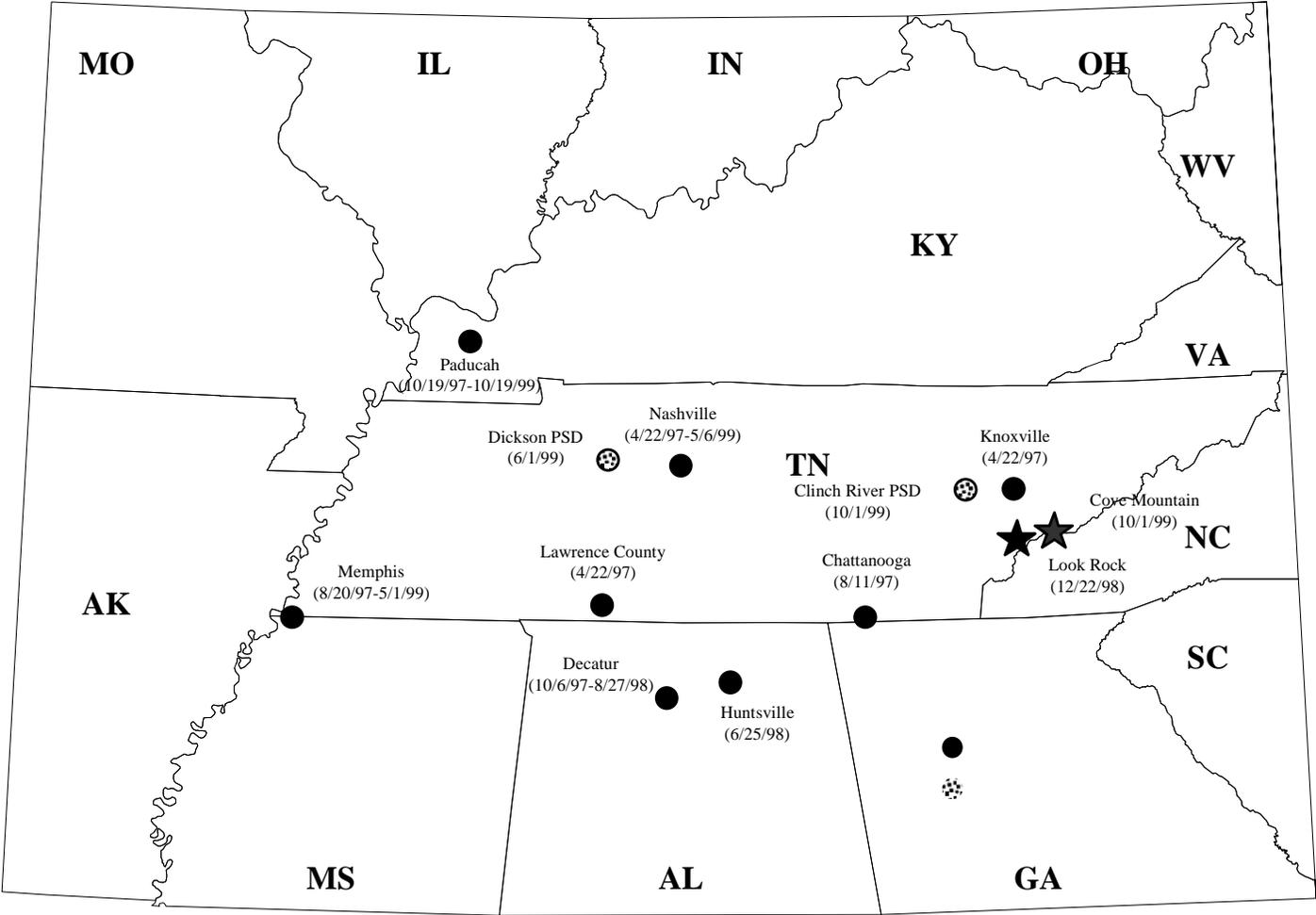
## What did we already know about PM<sub>2.5</sub> composition in the Tennessee valley?

- Data from the “Partners” network indicated that the annual NAAQS for PM<sub>2.5</sub> mass was likely to be exceeded broadly in urban areas across the valley.
- The 24-h NAAQS for PM<sub>2.5</sub> mass was likely to be exceeded only rarely.
- The largest components of fine mass are organic aerosols and sulfates.
- Nitrate levels are likely to be a small fraction of mass in all seasons, except possible winter.

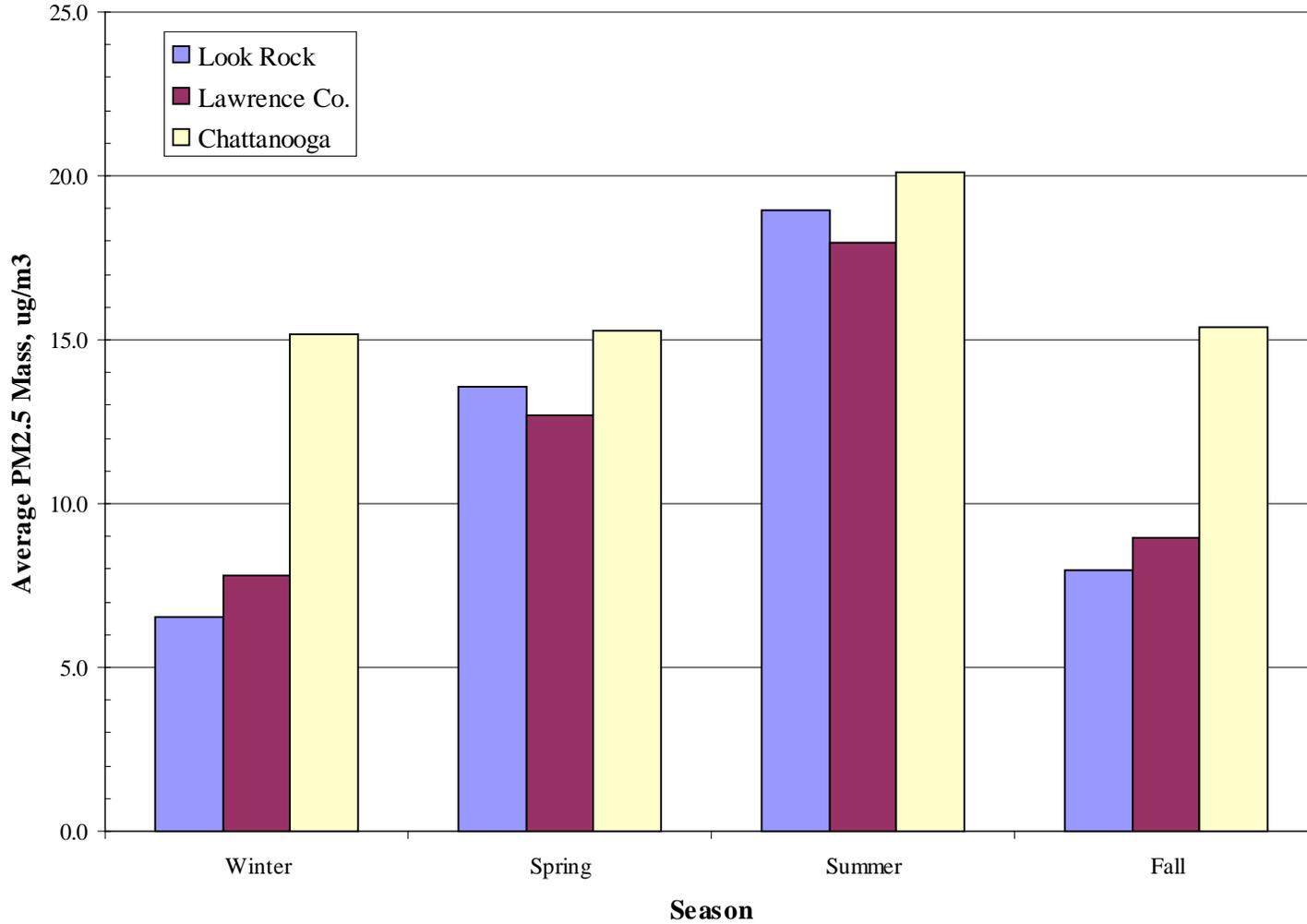
# Experimental Design

- Collect 24-h  $PM_{2.5}$  mass samples at 3 sites (Look Rock, Chattanooga, and Lawrence County) .
- Collect during winter, spring, summer and fall seasons of calendar 2001.
- Collect for 10 sampling periods each season with collocated quartz and Teflon FRMs.
- Determine  $PM_{2.5}$  mass concentrations
- Analyze Teflon samples for elements by XRF and (xc LC) soluble ions.
- Analyze quartz samples for OC and EC by TOR and then for soluble ions by IC

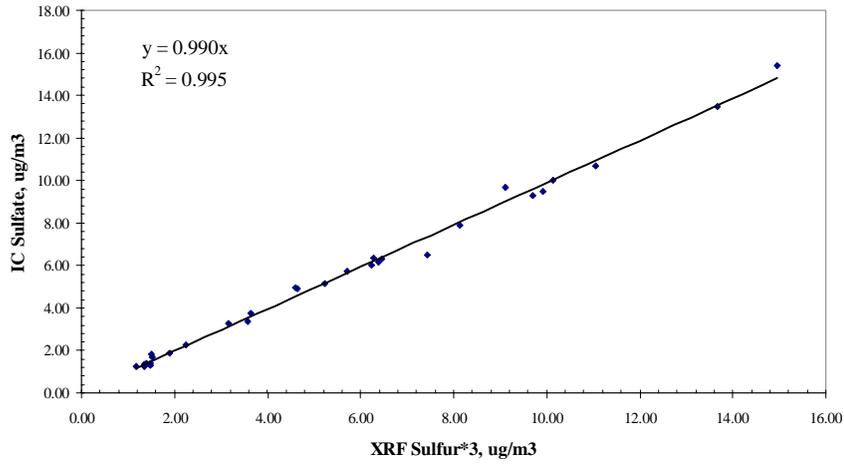
# Tennessee Valley PM2.5 Monitoring Network



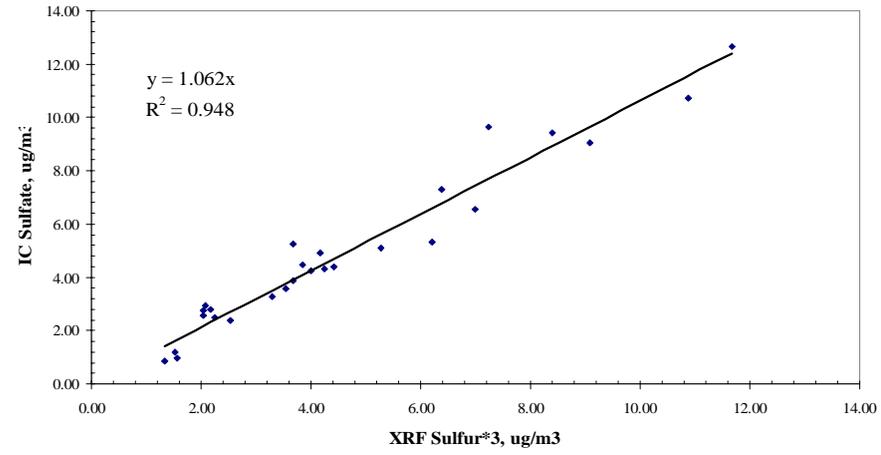
# Average PM2.5 Mass by Season, 2001



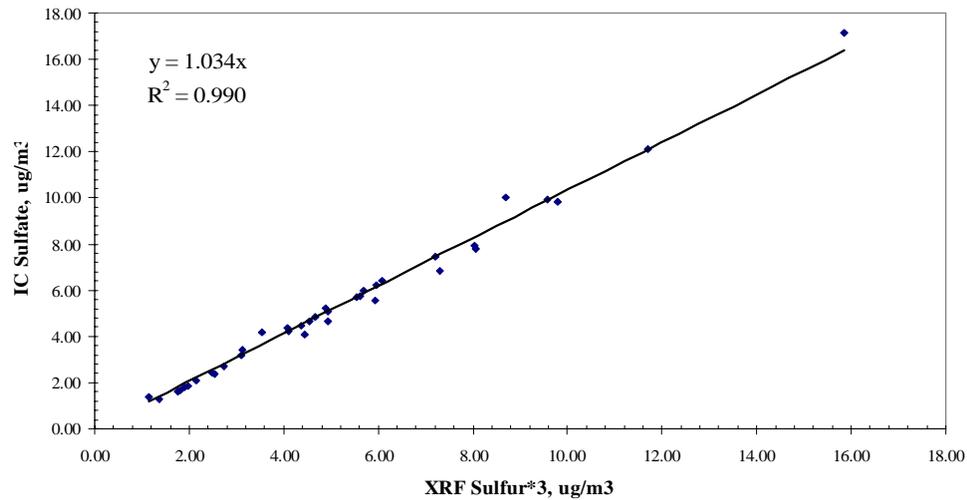
**Sulfate vs. XRF Sulfur\*3**  
**Look Rock, 2001**



**Sulfate vs. XRF Sulfur\*3**  
**Lawrence County, 2001**

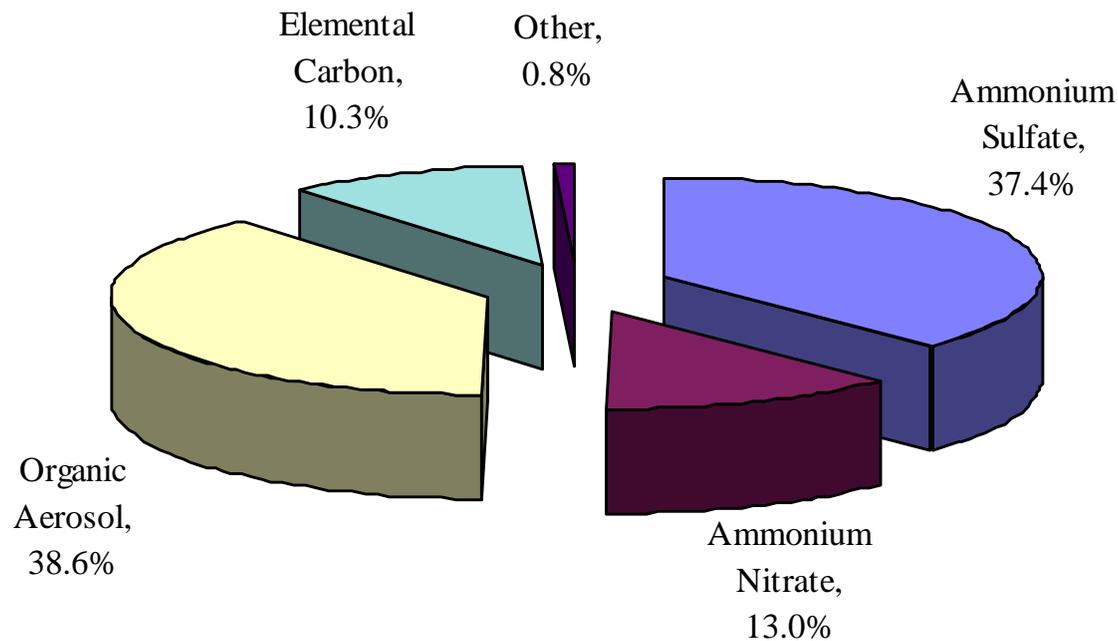


**Sulfate vs. XRF Sulfur\*3**  
**Chattanooga, 2001**



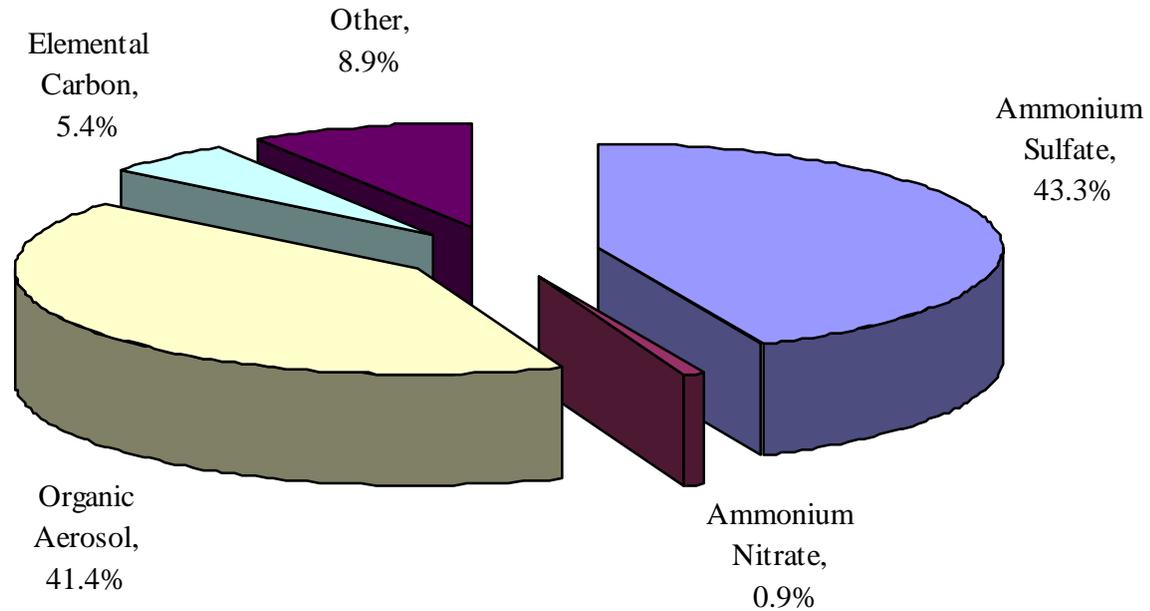
# Average Chemical Composition of Fine Particles at Look Rock, Winter, 2001

Average Mass Concentration = 7.3 ug/m<sup>3</sup>



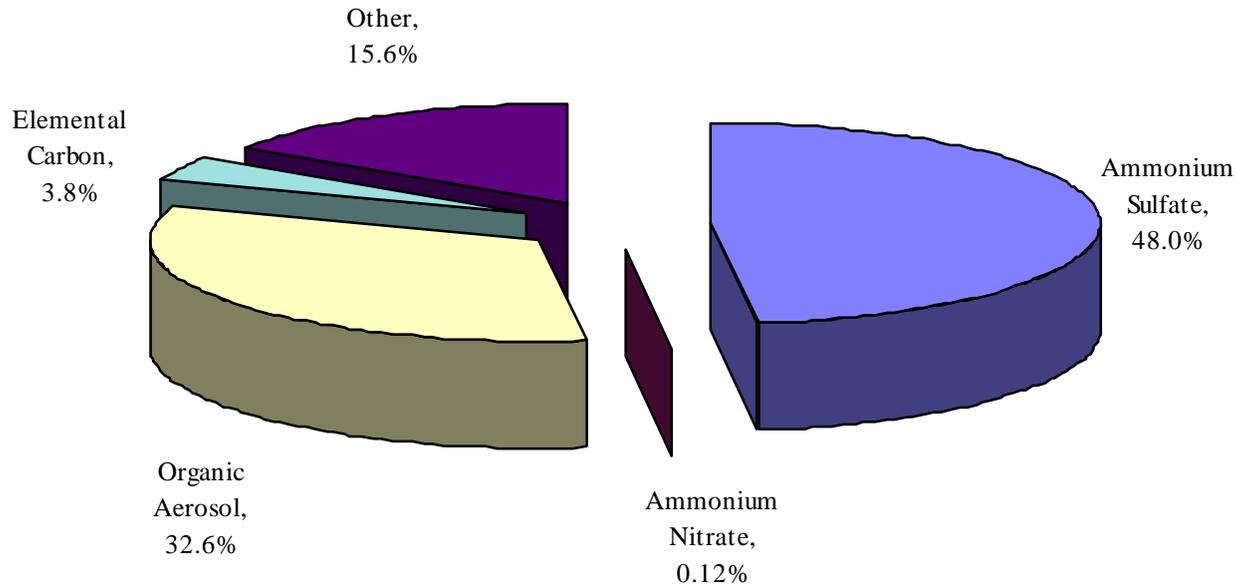
# Average Chemical Composition of Fine Particles at Look Rock, Spring 2001

Average Mass Concentration = 13.6 ug/m<sup>3</sup>



# Average Chemical Composition of Fine Particles at Look Rock, Summer, 2001

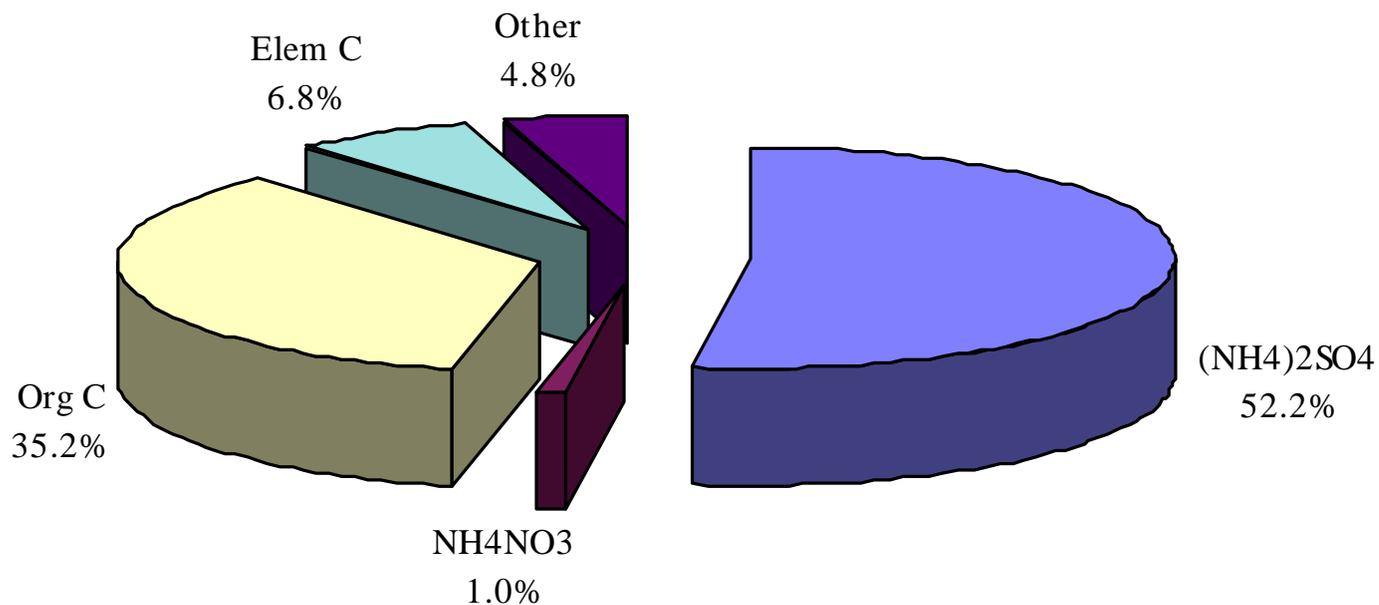
Average Mass Concentration = 19.0 ug/m<sup>3</sup>



# Average Chemical Composition of Fine Particles

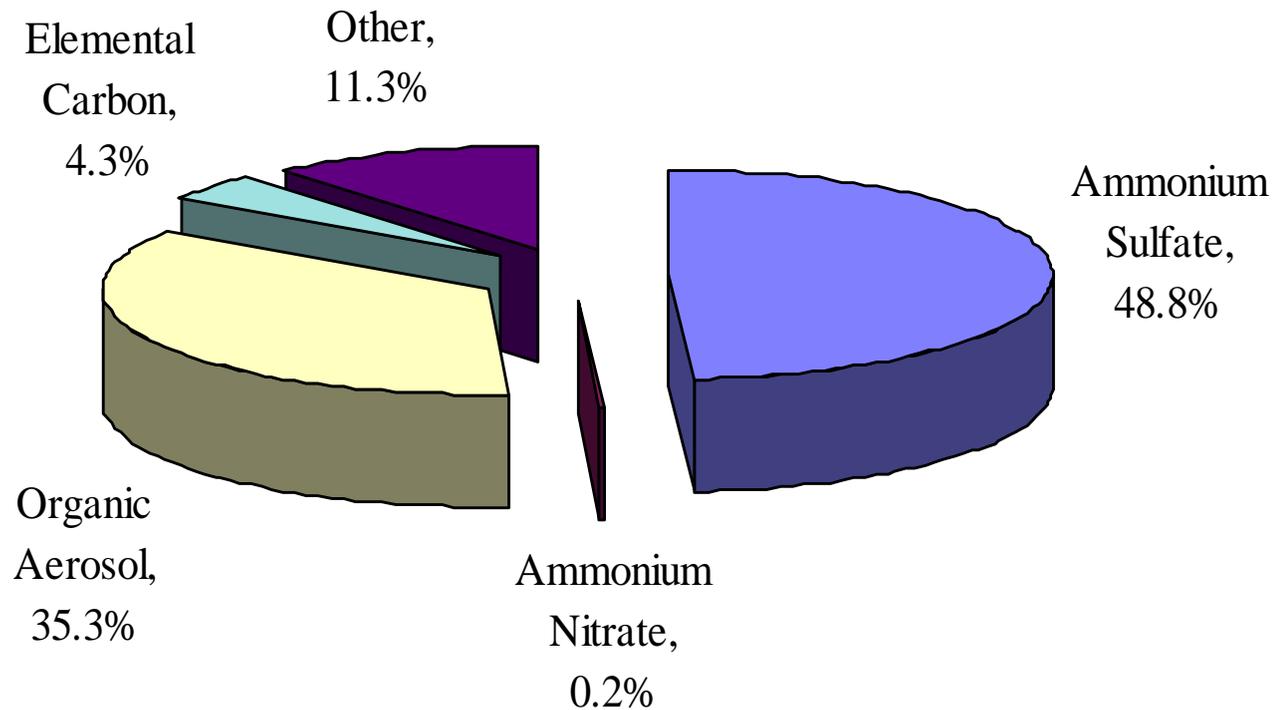
at Look Rock, Summer, 2000

Average Mass Concentration = 17.1  $\mu\text{g}/\text{m}^3$



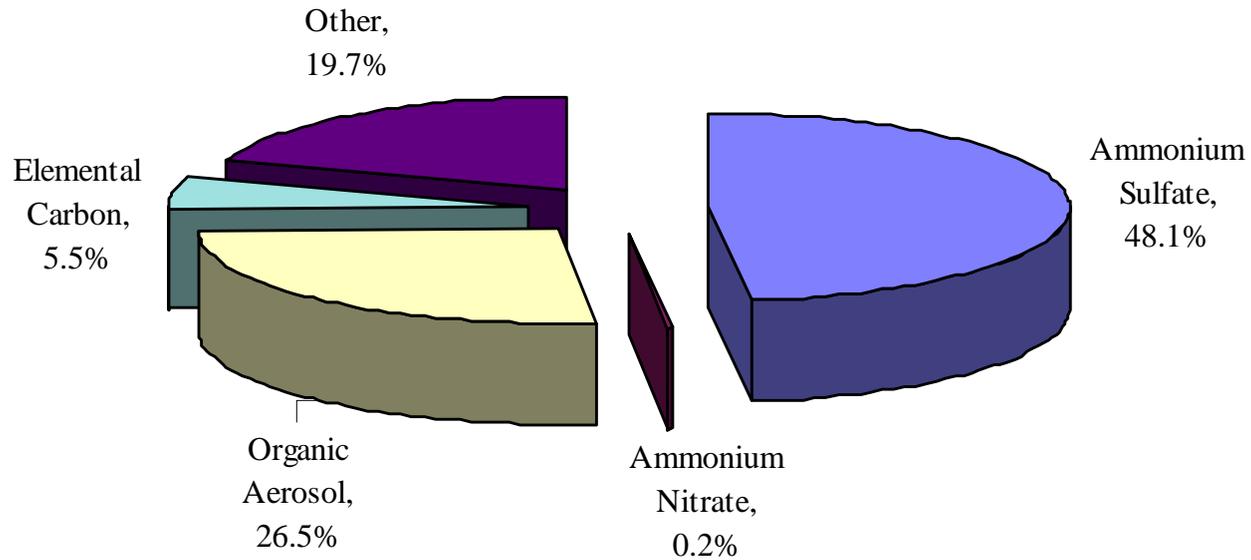
# Average Chemical Composition of Fine Particles at Lawrence County, Summer, 2001

Average Mass Concentration = 17.7 ug/m<sup>3</sup>



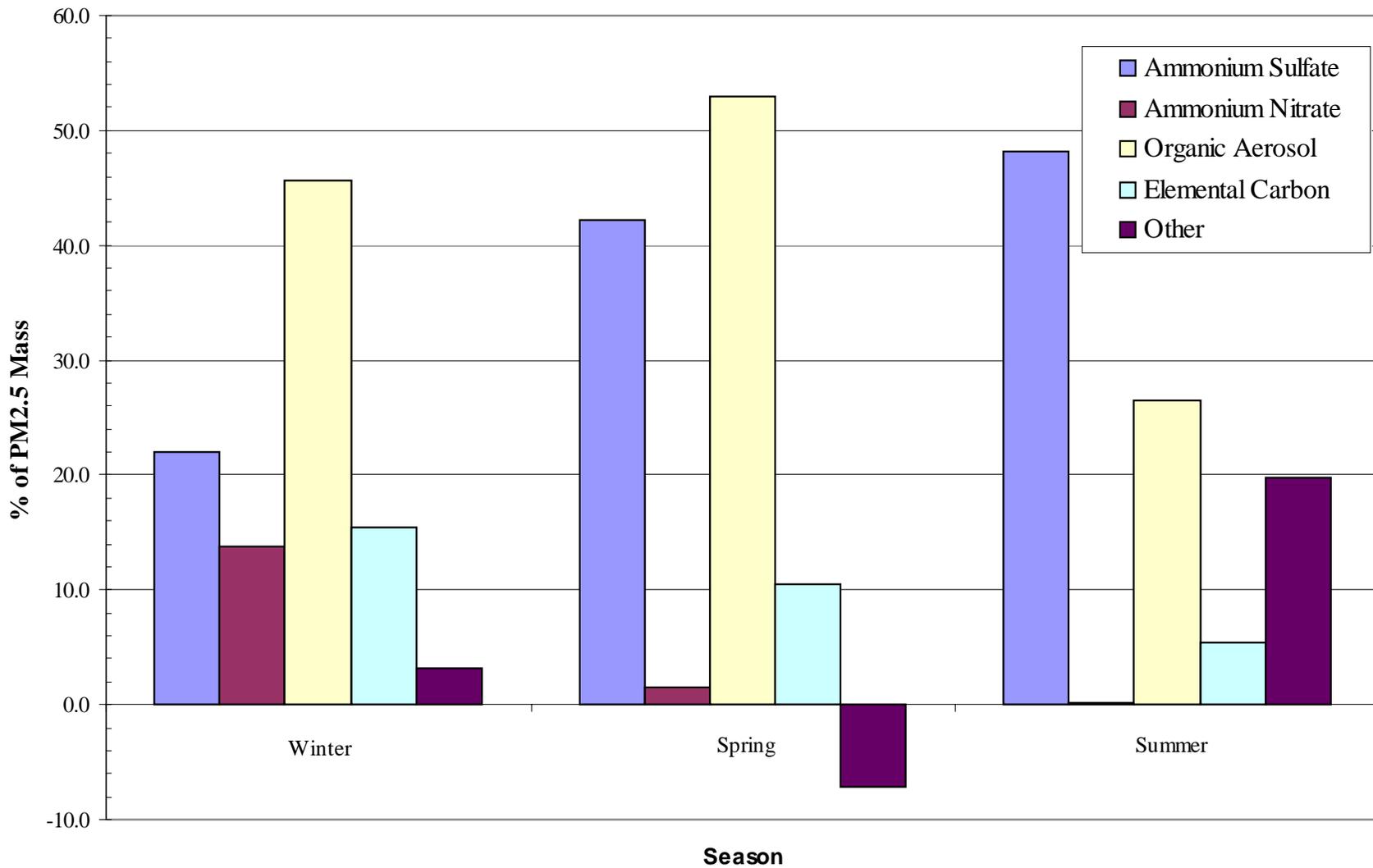
# Average Chemical Composition of Fine Particles at Chattanooga, Summer, 2001

Average Mass Concentration = 20.1 g/m<sup>3</sup>



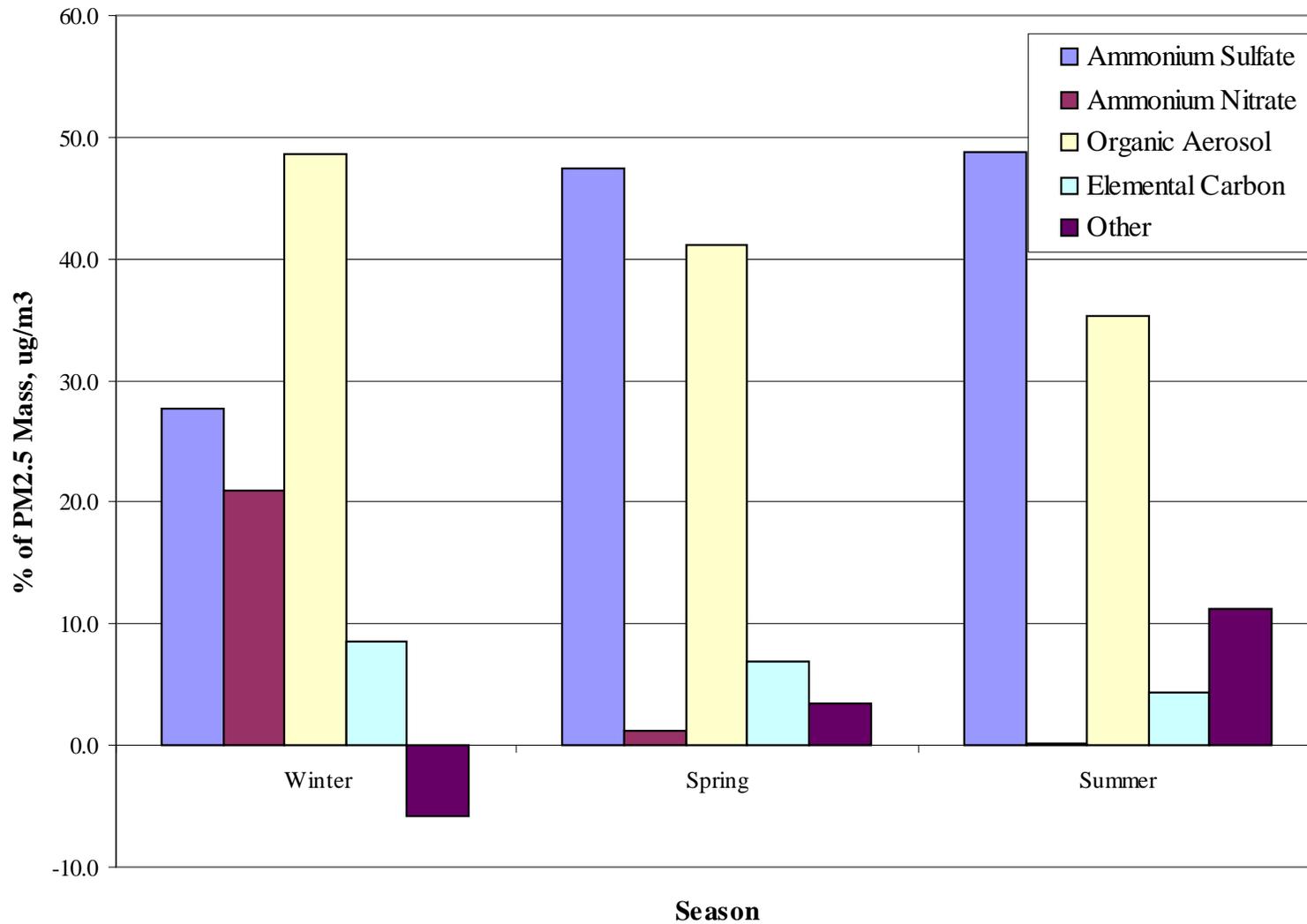
# Seasonal Variation in PM2.5 Aerosol Composition

Chattanooga, 2001



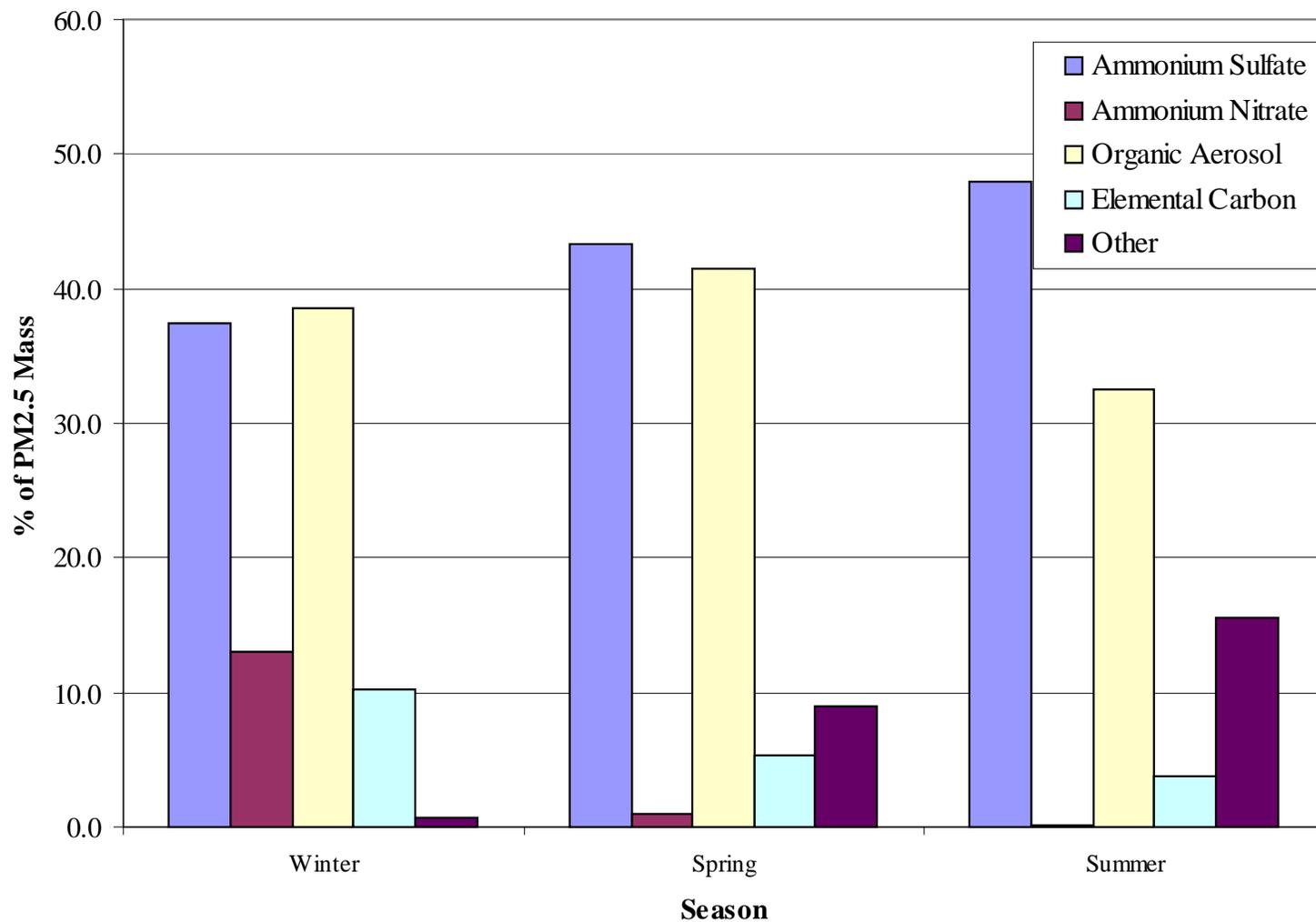
# Seasonal Variation in PM2.5 Aerosol Composition

Lawrence County, 2001



# Seasonal Variation in PM2.5 Aerosol Composition

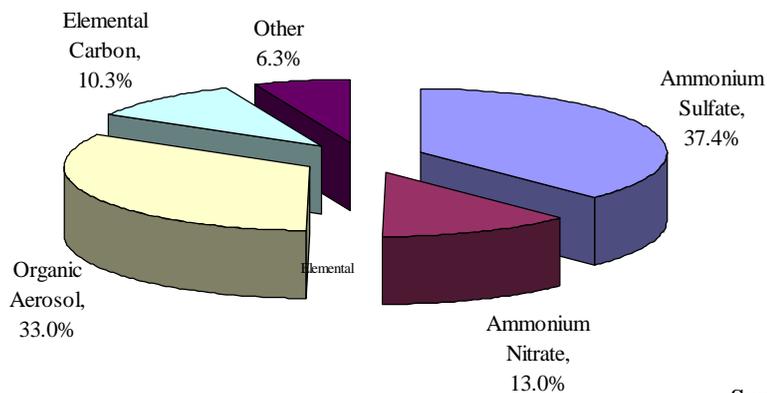
Look Rock, 2001



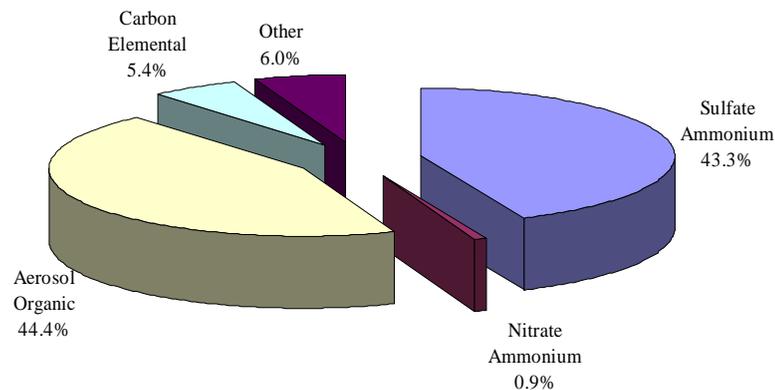
# Look Rock Composition, 2001

Winter: OC\*1.2; Spring: OC\*1.5; Summer: OC\*1.8

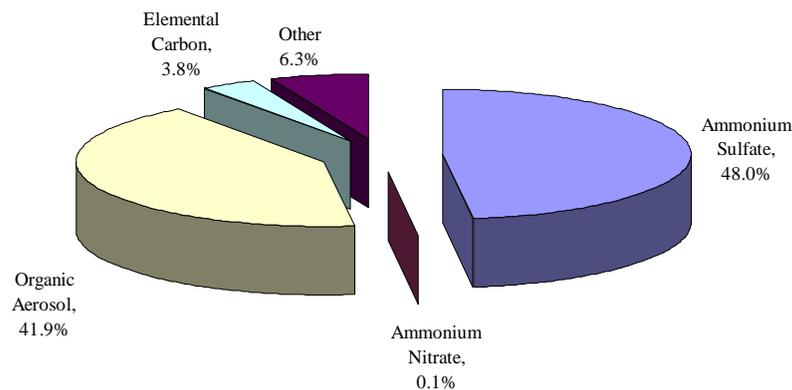
Winter



Spring



Summer



# Conclusions

- Organics and sulfates are always the two largest contributors to fine mass in the region
- There is a strong seasonal trend in mass and constituent levels at the rural and background site, with significant nitrate only in winter
- The 1.4 factor for conversion of OC to organic mass may not be appropriate for all seasons
- At the urban site, mass levels averaged from 15  $\mu\text{g}/\text{m}^3$  in winter to 20  $\mu\text{g}/\text{m}^3$  in the summer, with the largest component over all seasons being organic C
- There were small but significantly greater elemental carbon levels at the urban site than at either the rural or background sites, especially in winter