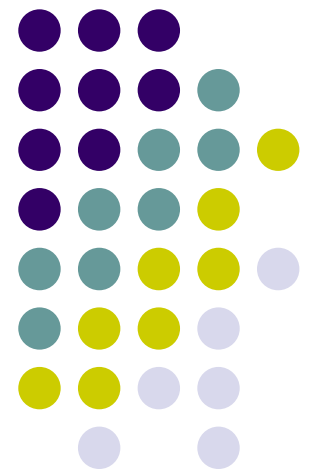


# PM<sub>2.5</sub> Speciation Data Analysis

---

Louisville Metro  
Air Pollution Control District

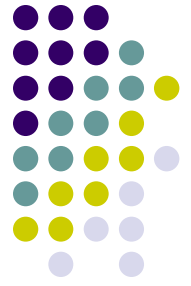


# National Ambient Air Quality Standards for PM<sub>2.5</sub>



- The annual PM<sub>2.5</sub> standard is met when the annual standard design value is less than or equal to 15 µg/m<sup>3</sup>.
- The 24-hour PM<sub>2.5</sub> standard is met when the 24-hour design value at each monitoring site is less than or equal to 35 µg/m<sup>3</sup>.

# Louisville Metro Annual Design Values



Sites	Annual Design Value 2002-2004	Annual Design Value 2003-2005	Annual Design Value 2004-2006
Southwick	15.9	15.6	15.4
Barret	15.2	15.3	15.0

# Louisville Metro 24-hour Design Values



Sites	2004 98 <sup>th</sup> percentile value	2005 98 <sup>th</sup> percentile value	2006 98 <sup>th</sup> percentile value	3-year design value
Southwick	30.6	42.9	36.0	37
Barret	28.8	43.2	36.7	36

# Physical and Chemical Speciation Data Provide Information for:



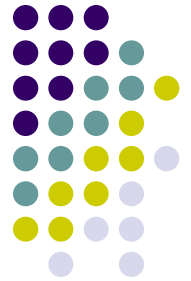
- Helping implement the PM<sub>2.5</sub> standard by providing data as input into air quality modeling analysis.
- Determining the effectiveness of implementation control strategies.
- Assessing trends in mass component concentrations and related emissions, including specific source categories.
- Aiding in interpreting health studies.
- Characterizing annual and seasonal variation of aerosols.
- Understanding the effects of atmospheric constituents on visibility impairment.
- Aiding in monitoring network design and siting adjustment.



# Characteristics of PM<sub>2.5</sub>

- Composition
  - Sulfate
  - Nitrate
  - Ammonium
  - Elemental Carbon
  - Organic Compounds
  - Metals (Pb, Cd, V, Ni, Cu, Zn, Mn, Fe, etc.)

# Characteristics of PM<sub>2.5</sub>



- Largely soluble, hygroscopic
- Atmospheric lifetime may be days to weeks
- Travel distance may be 100s to 1000s of km



# Federal Reference Method

- Regulatory method used for determining attainment status with National Ambient Air Quality Standards for  $PM_{2.5}$
- Measures only the total mass of the sample via gravimetric method
- Sampling Schedules may be daily, 1 in 3 day or 1 in 6 day.



# Speciation Sampling

- Not a Federal Reference Method (FRM) for PM<sub>2.5</sub>
  - Mass Measurements May not Agree with FRM sampling
- Uses multiple types of sample media
- Requires different analytical techniques and the use of contract laboratories
  - Techniques may include Ion Chromatography, XRF, Gravimetric, Thermal Optical Analysis, GC/MS
- Expensive
  - Not all FRM Sites have samplers
  - Sampling schedule is typically limited to 1/6 day

# FRM Measurement vs Speciation Measurement

## Annual Averages

Concentration  $\mu\text{g}/\text{m}^3$



Year	FRM Southwick	Speciation Southwick	FRM Barret	Speciation Barret
2006	15.0	14.6	14.0	Site discontinued in 2006
2005	16.7	18.8	16.8	19.7
2004	14.5	14.5	13.7	15.0
2003	16.0	17.3	15.5	16.6
2002	17.2	16.7	16.4	15.4

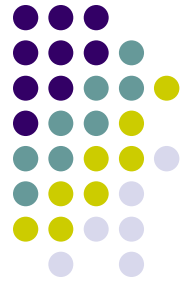
# Target Compounds for Speciation



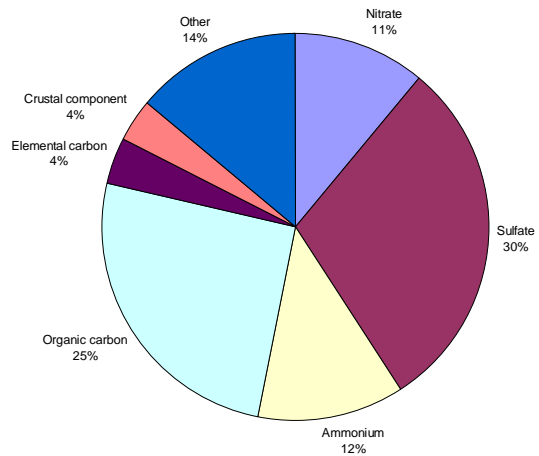
- Nitrate
- Sulfate
- Ammonium
- Organic Carbon
- Elemental Carbon
- Crustal Component (trace elements, fine soil)
- Other ( $PM_{2.5}$  mass unaccounted for by analytical methods)

# Speciation Data

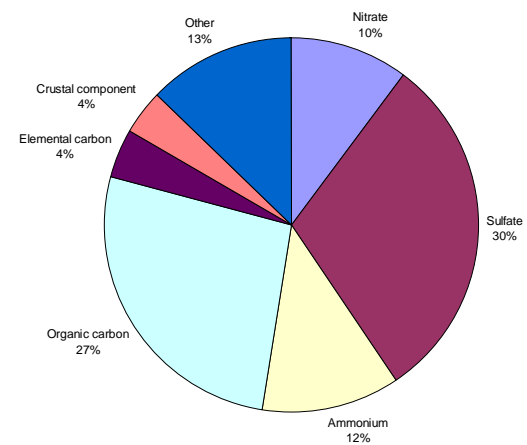
## 4 year average 2002-2005



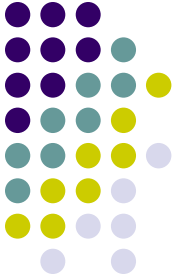
APCD (Barret)  
AIRS Code 211110048 POC 5 (ROUTINE)  
Date(s): 1/14/2002 - 12/30/2005  
Average Concentration ( $\mu\text{g}/\text{m}^3$ )



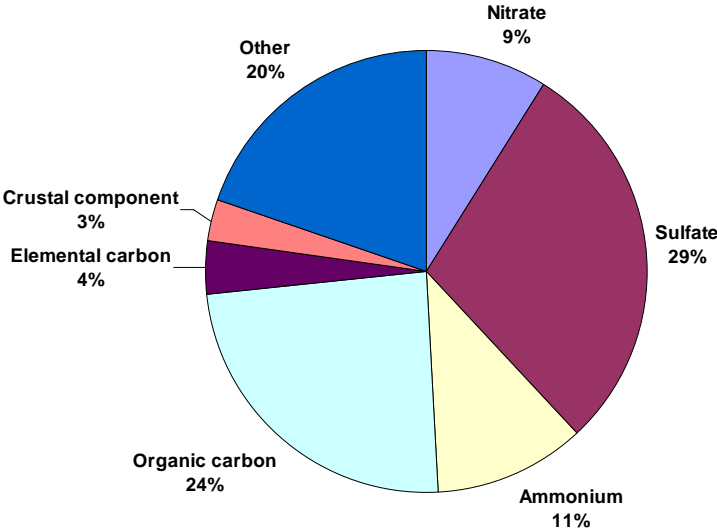
Southwick Community Center  
AIRS Code 211110043 POC 5 (ROUTINE)  
Date(s): 1/14/2002 - 12/30/2005  
Average Concentration ( $\mu\text{g}/\text{m}^3$ )



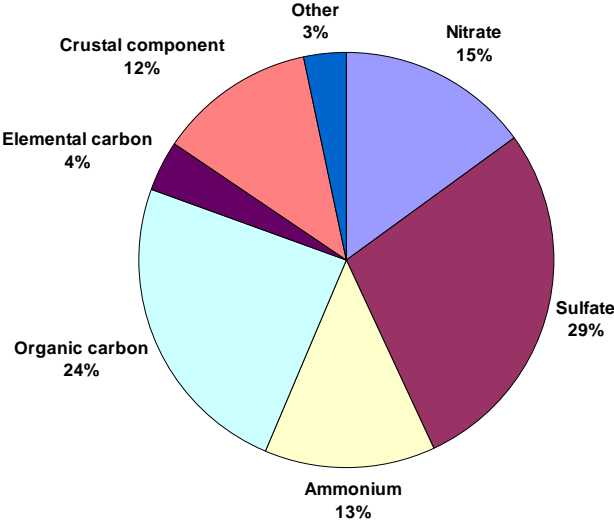
# Kentucky and Indianapolis Indiana



Kentucky 2004-2006 Averages



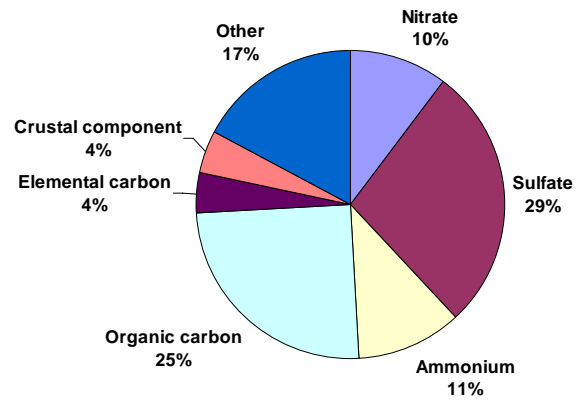
Indianapolis 2004-2006



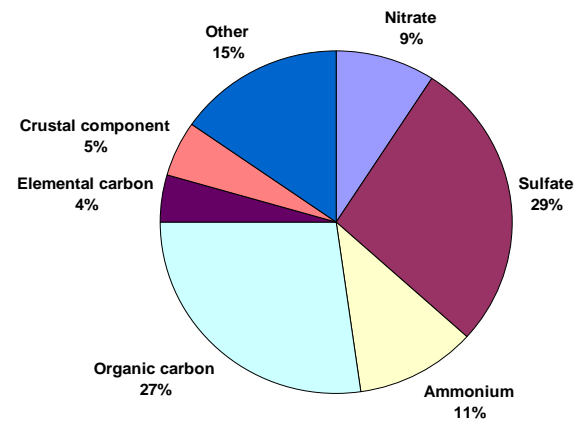
# Annual Averages 2004-2006 Southwick Site



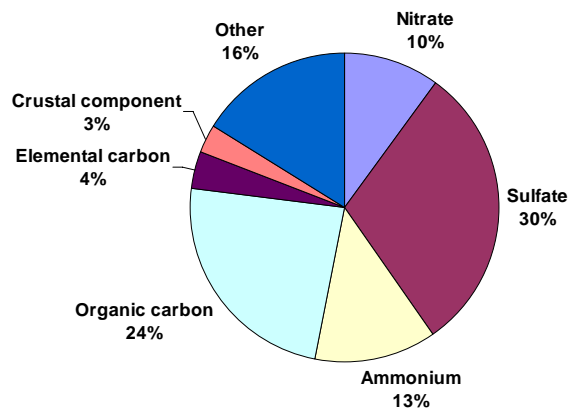
2004



2006



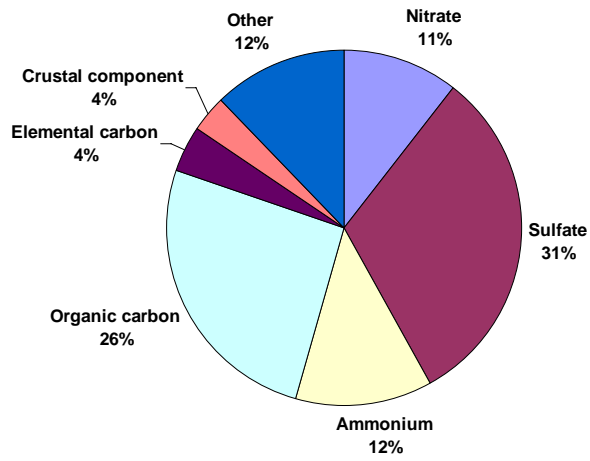
2005



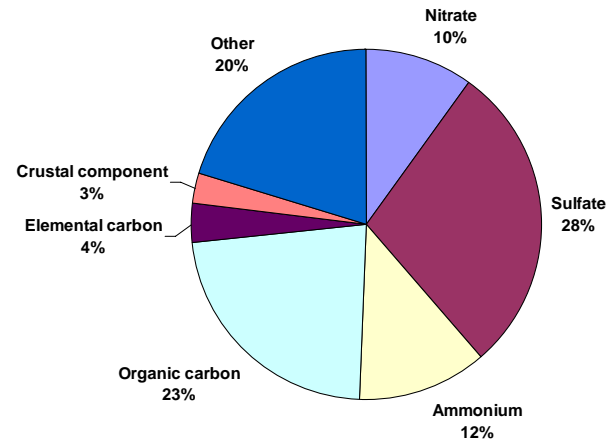
# Annual Averages 2003-2005 Barret Avenue Site



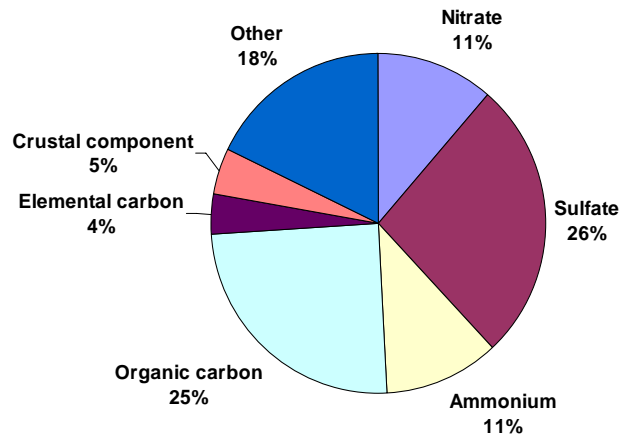
2003



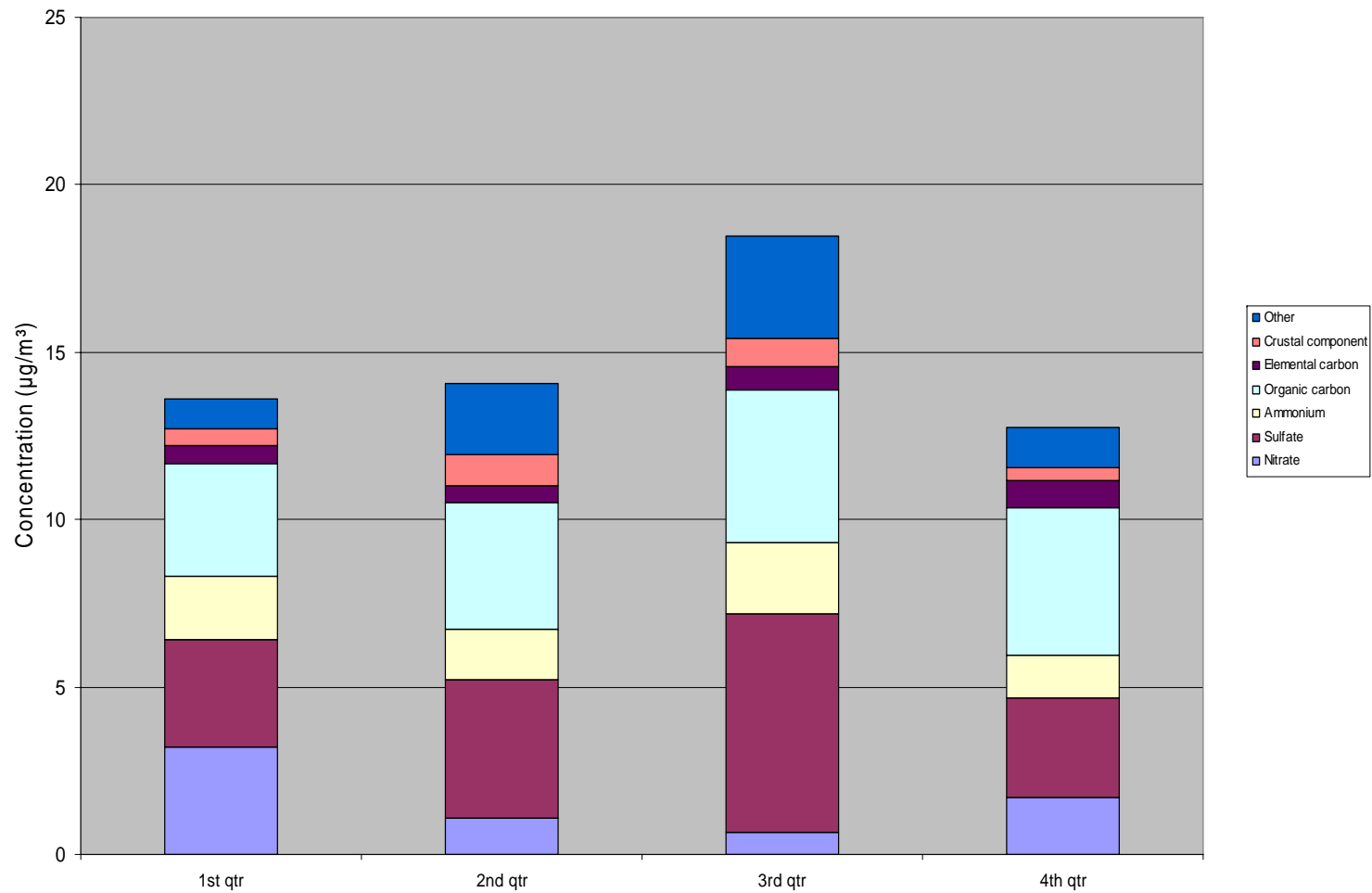
2005



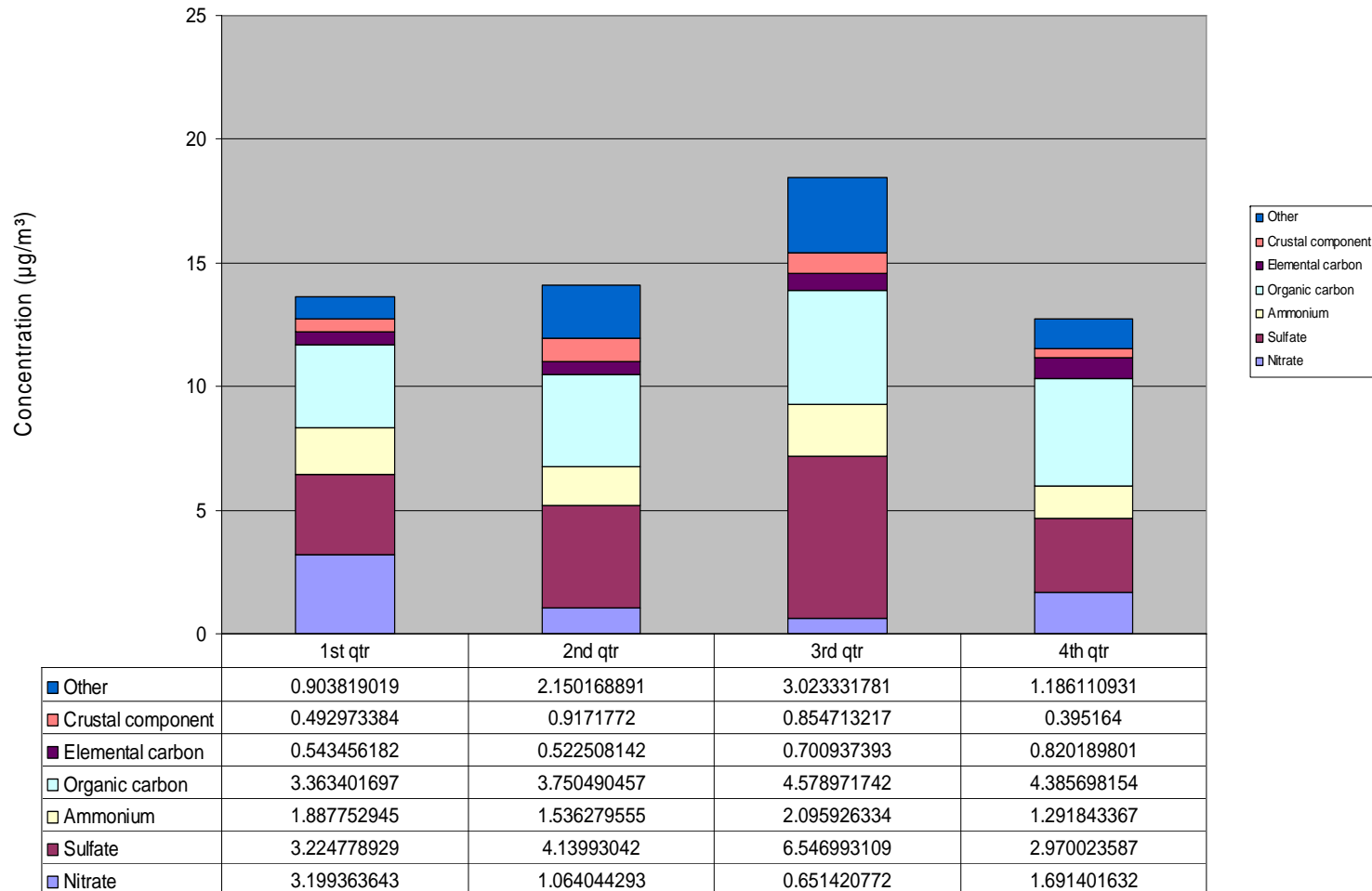
2004



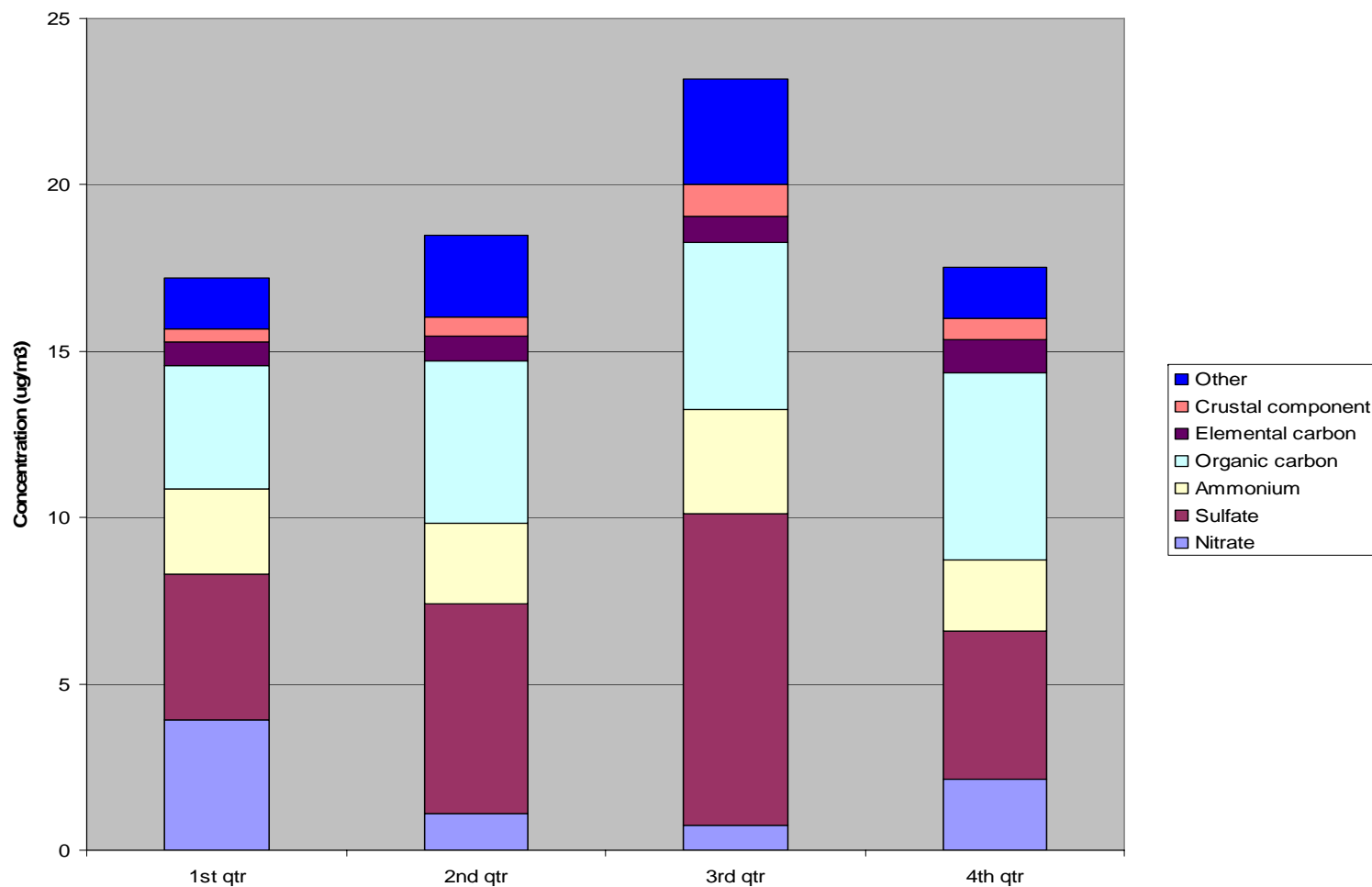
# Southwick Community Center 2004 Quarterly Averages



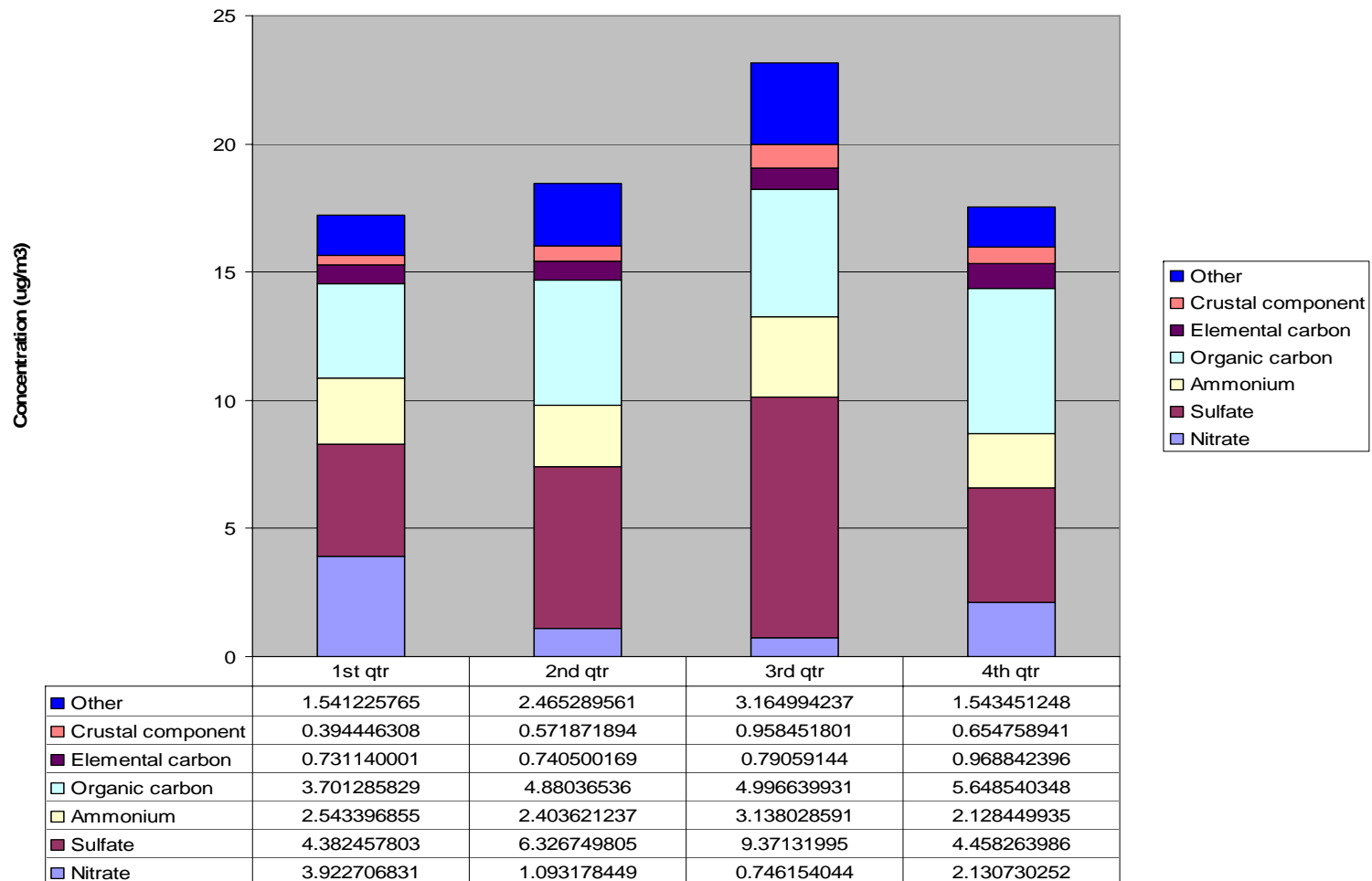
# Southwick Community Center 2004 Quarterly Averages



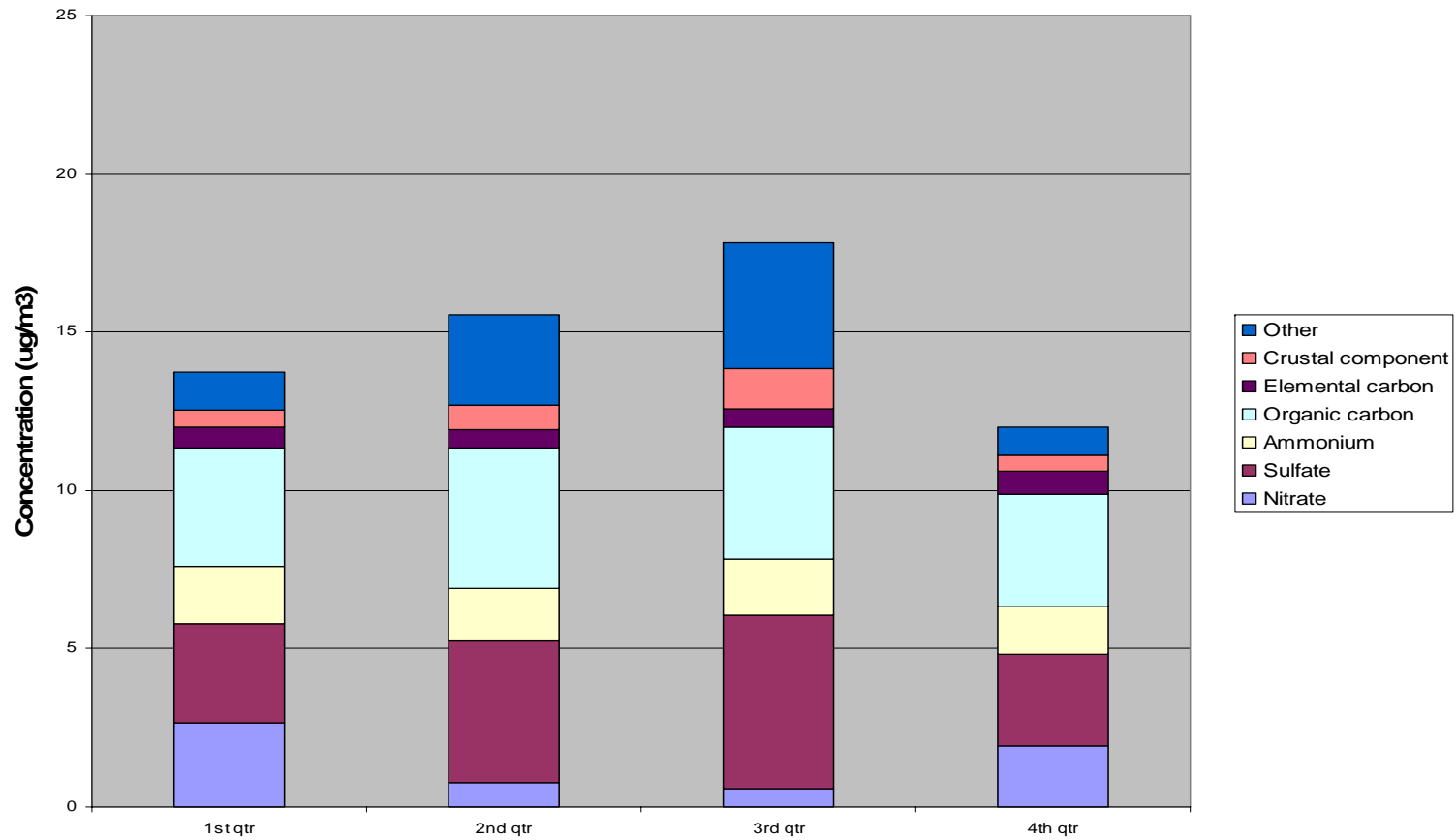
# Southwick Community Center 2005 Quarterly Averages



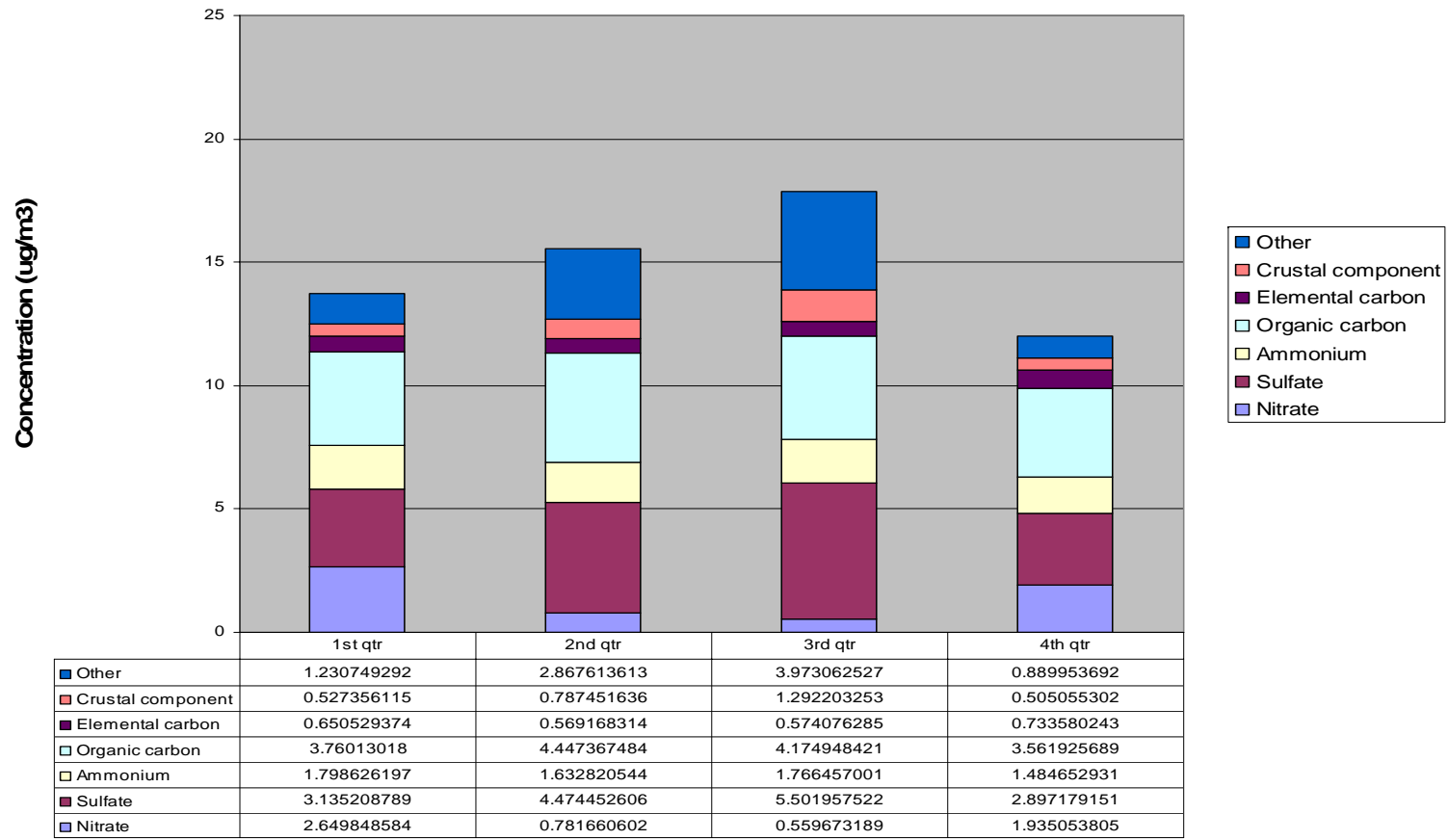
# Southwick Community Center 2005 Quarterly Averages



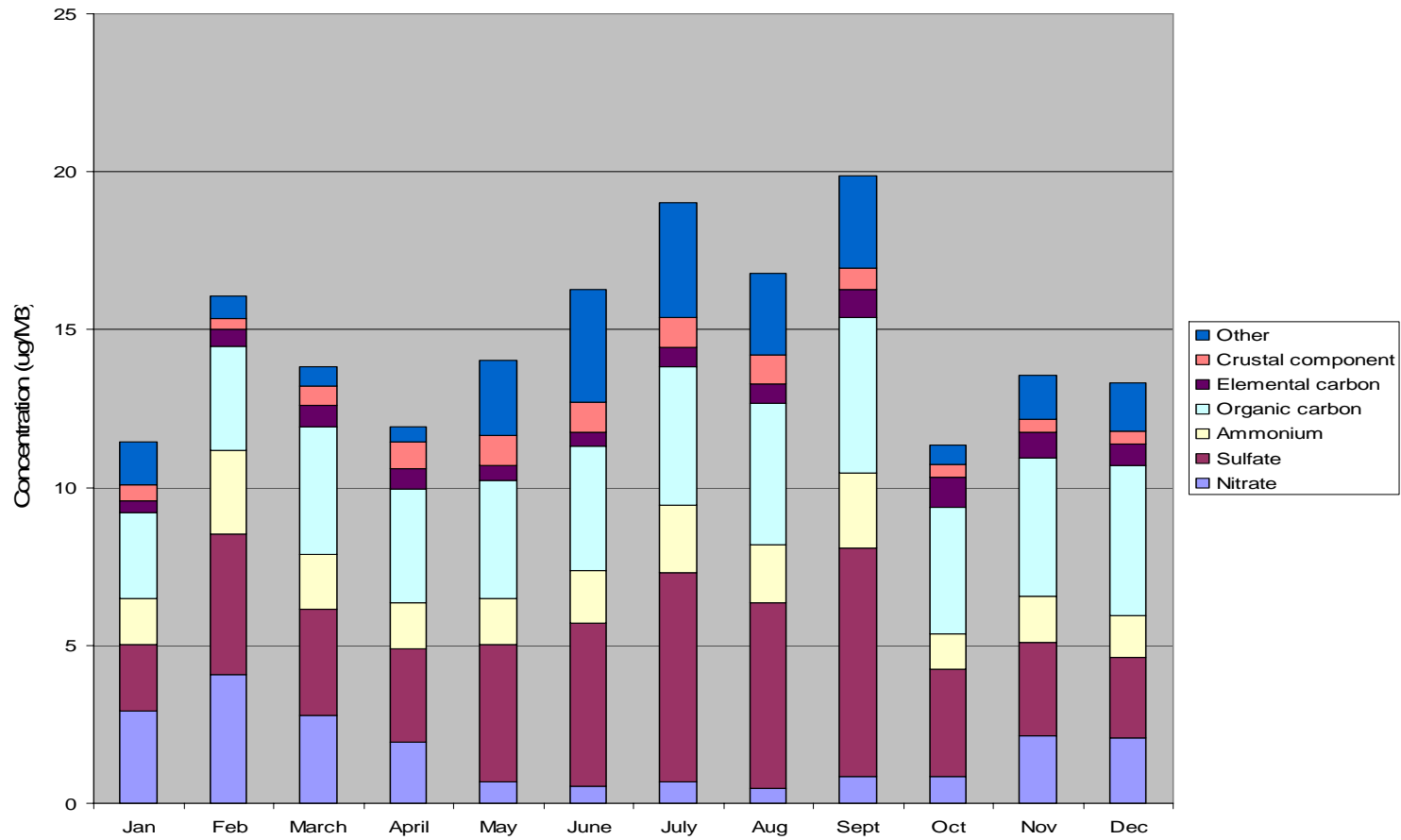
# Southwick Community Center 2006 Quarterly Averages



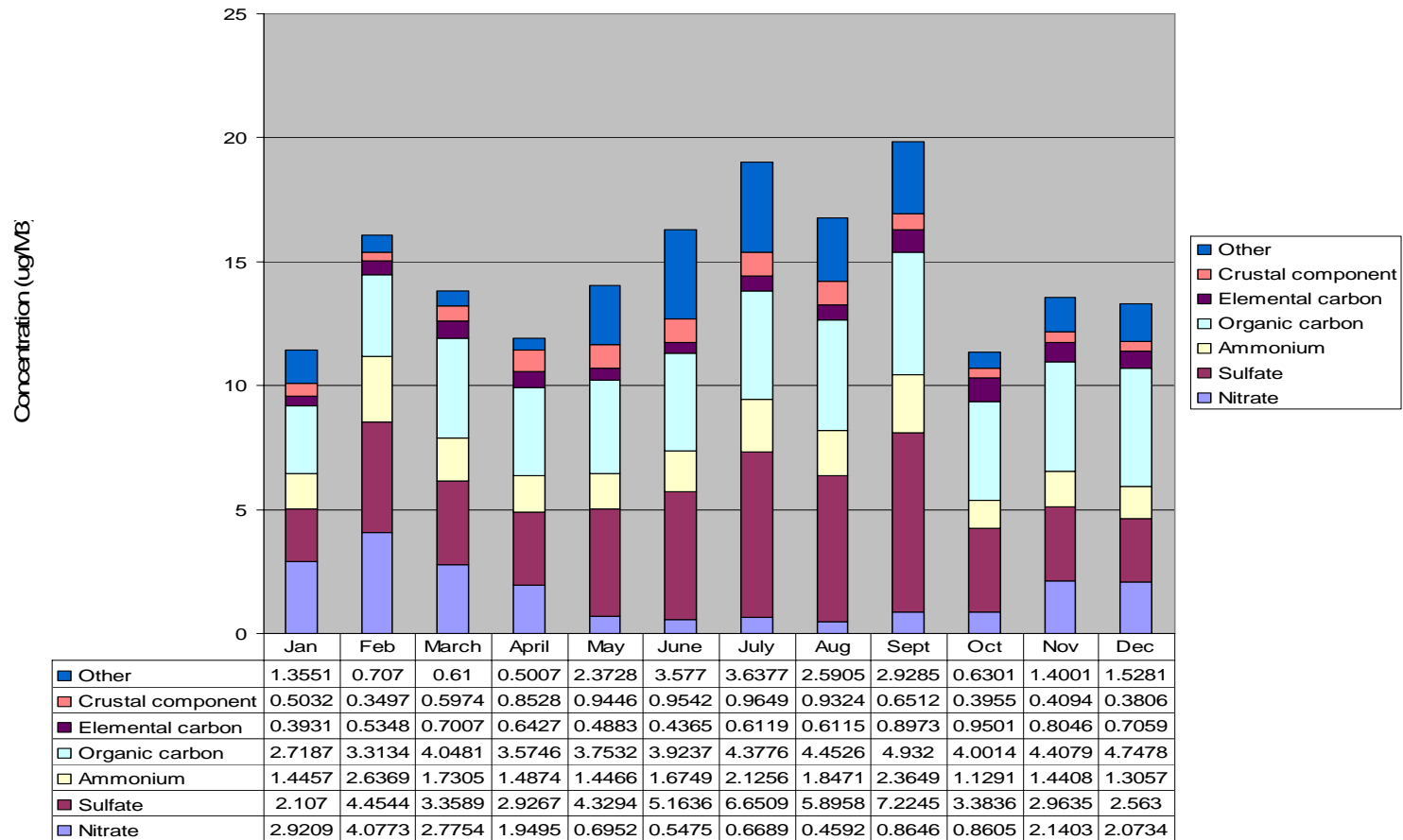
# Southwick Community Center 2006 Quarterly Averages



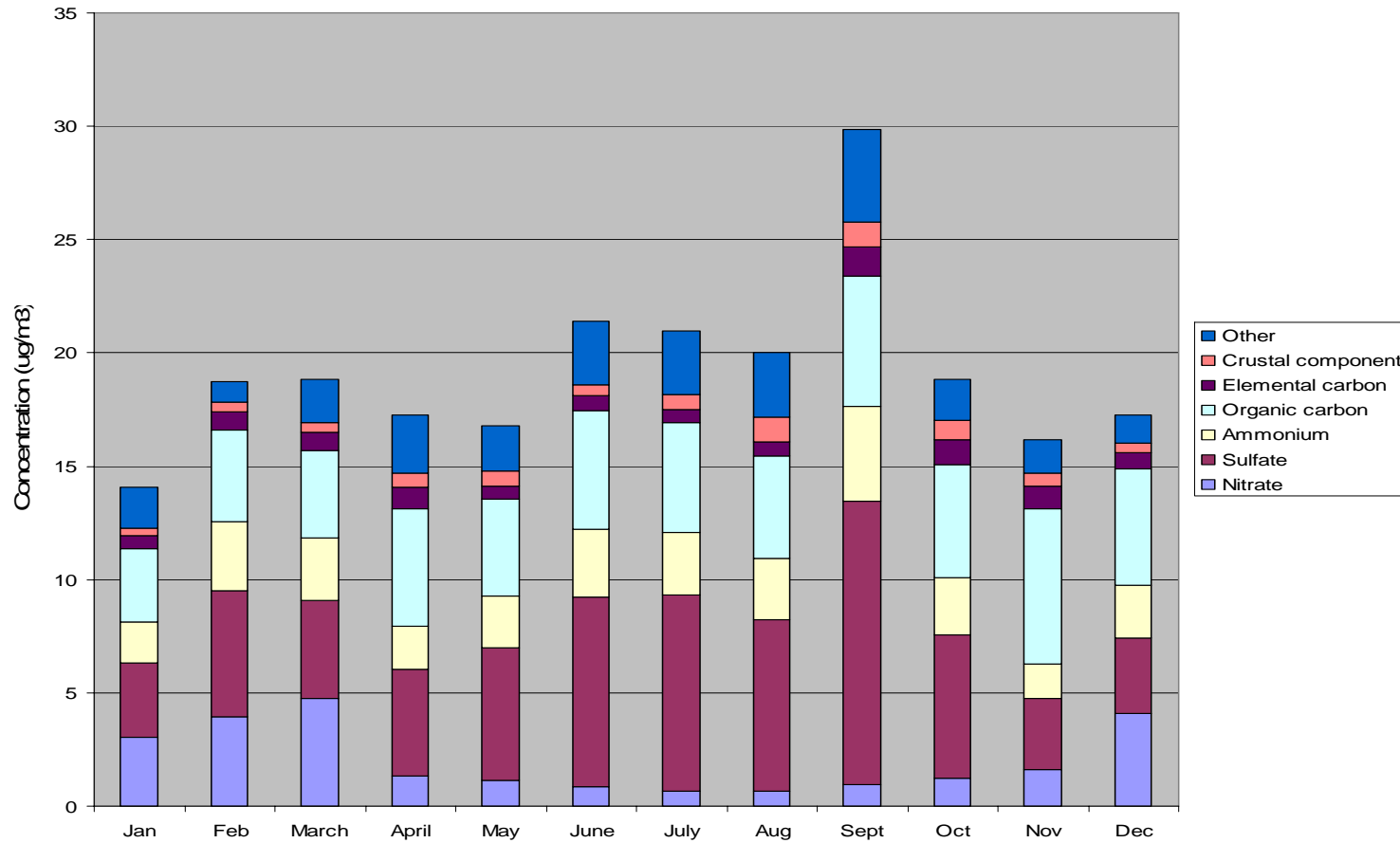
# Southwick Community Center Monthly Averages 2004



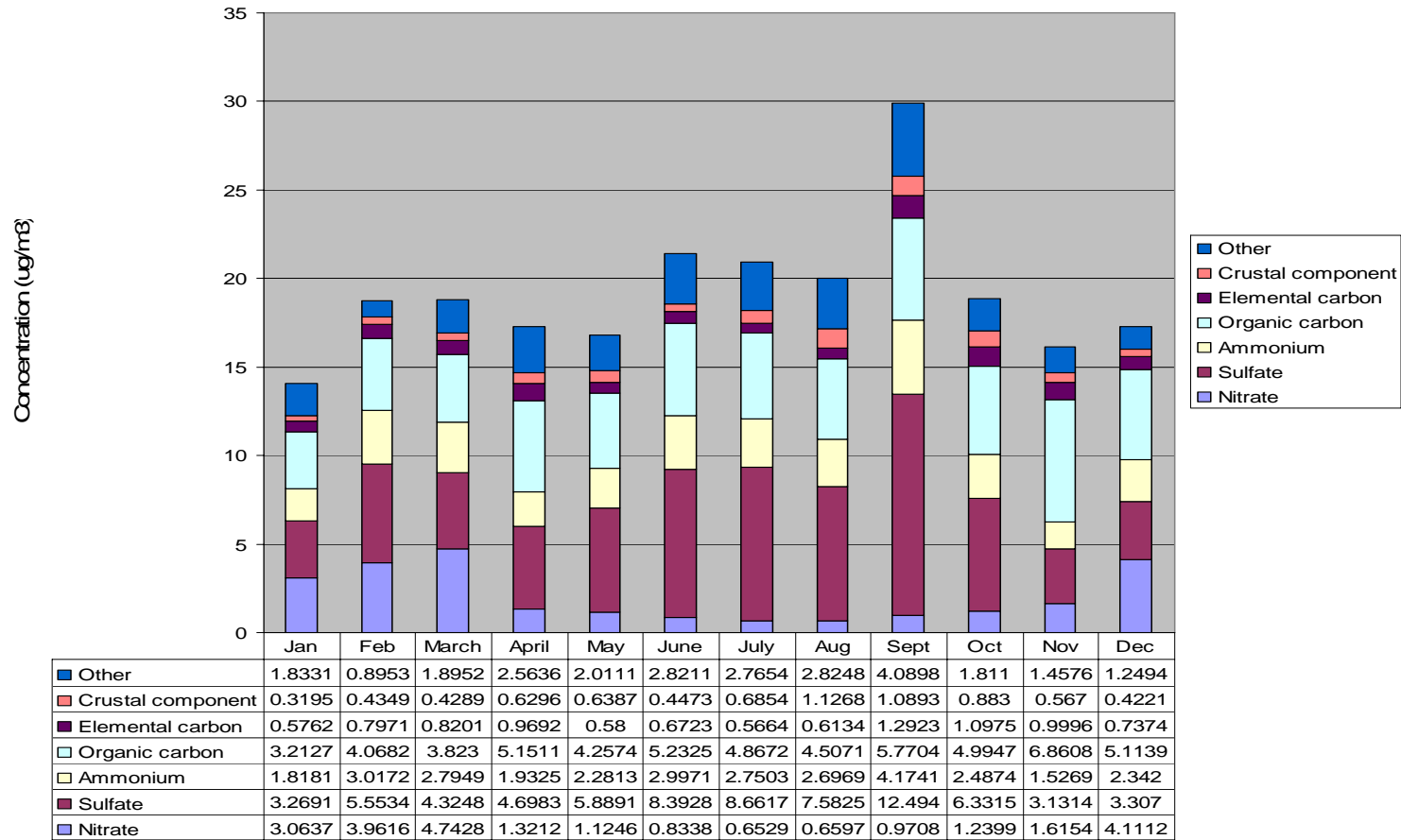
# Southwick Community Center Monthly Averages 2004



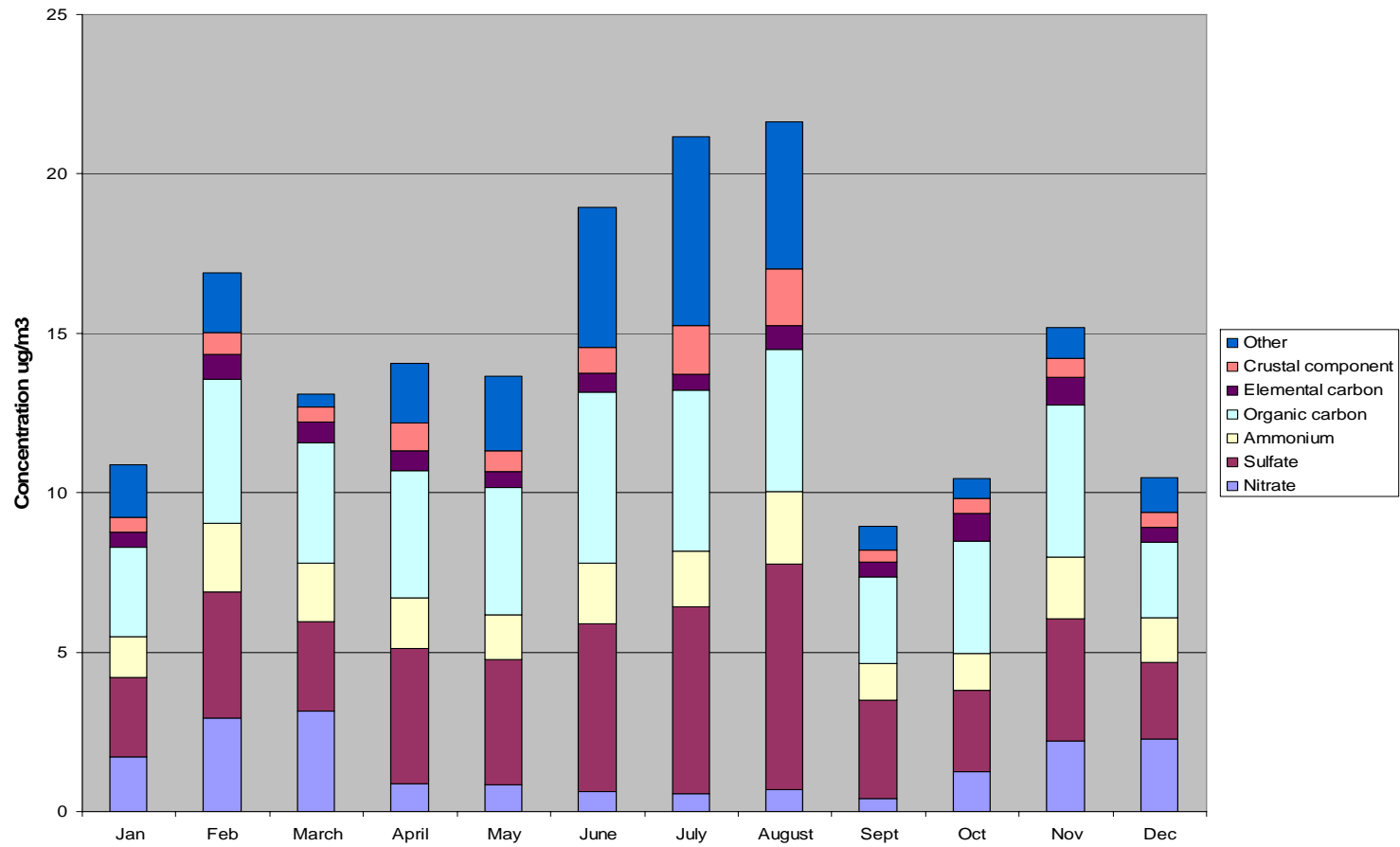
# Southwick Community Center Monthly Averages 2005



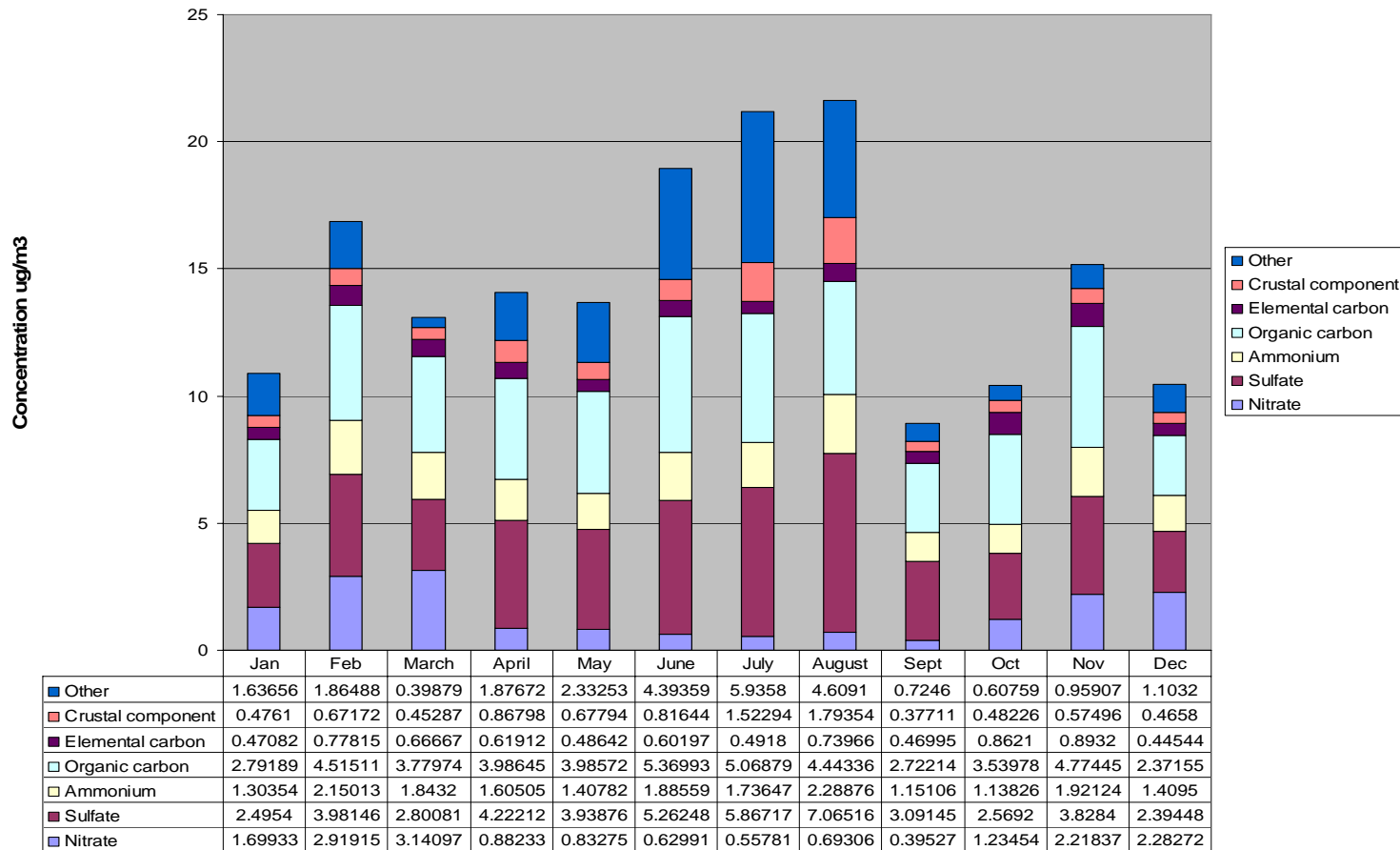
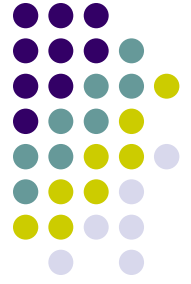
# Southwick Community Center Monthly Averages 2005



# Southwick Community Center Monthly Averages 2006



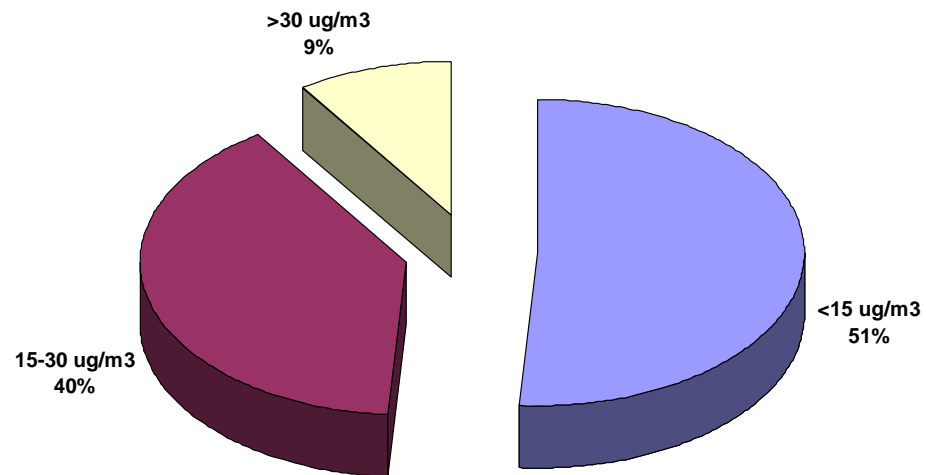
# Southwick Community Center Monthly Averages 2006



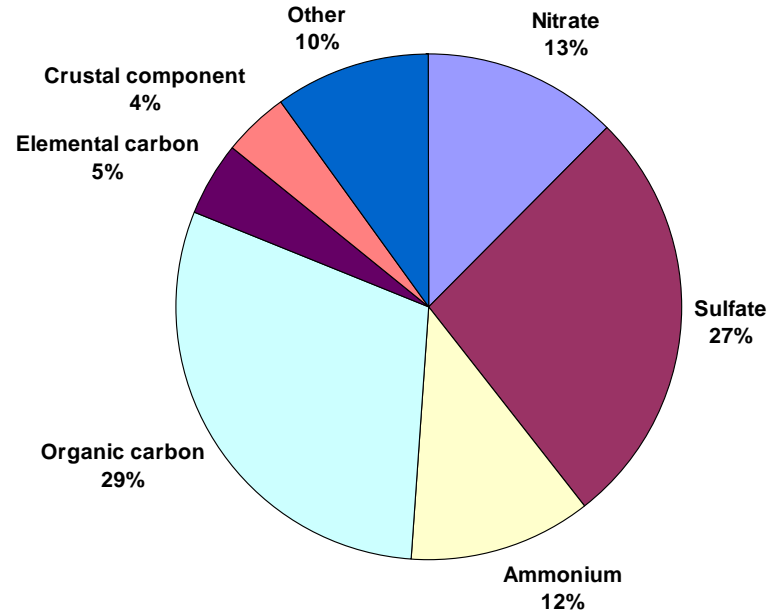
# Analysis by Concentration Ranges Southwick Site 2002-2006 Data



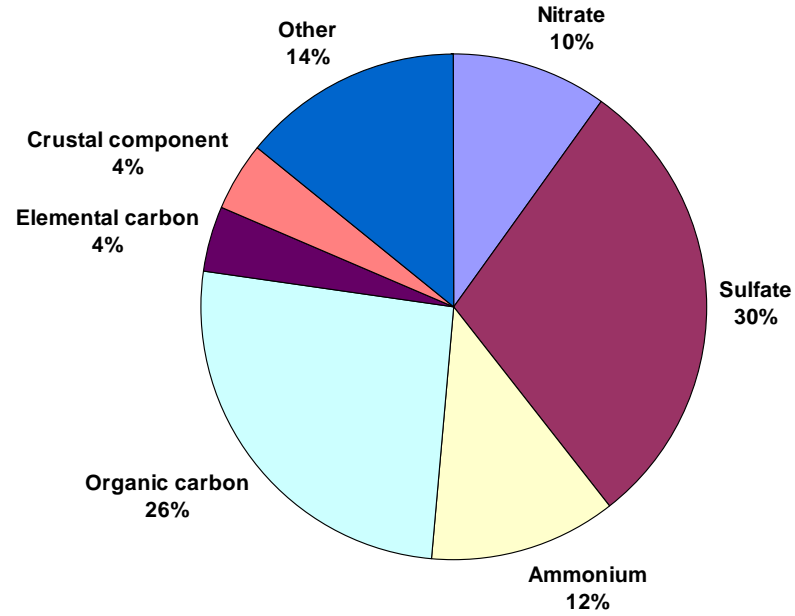
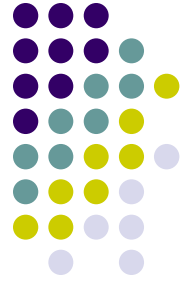
(Total 288)



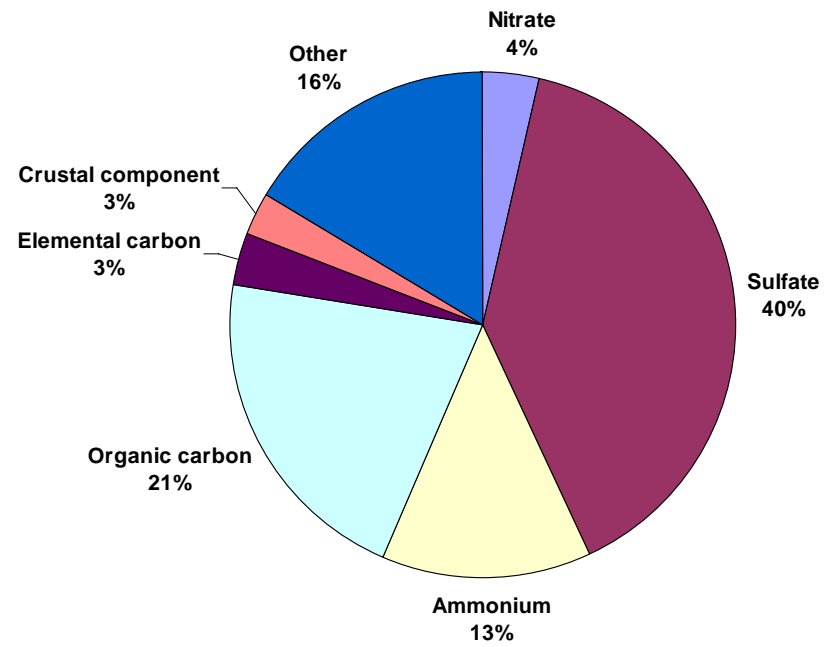
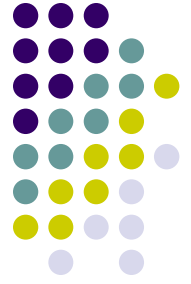
# % Contribution When Concentrations are Below $15 \mu\text{g}/\text{m}^3$



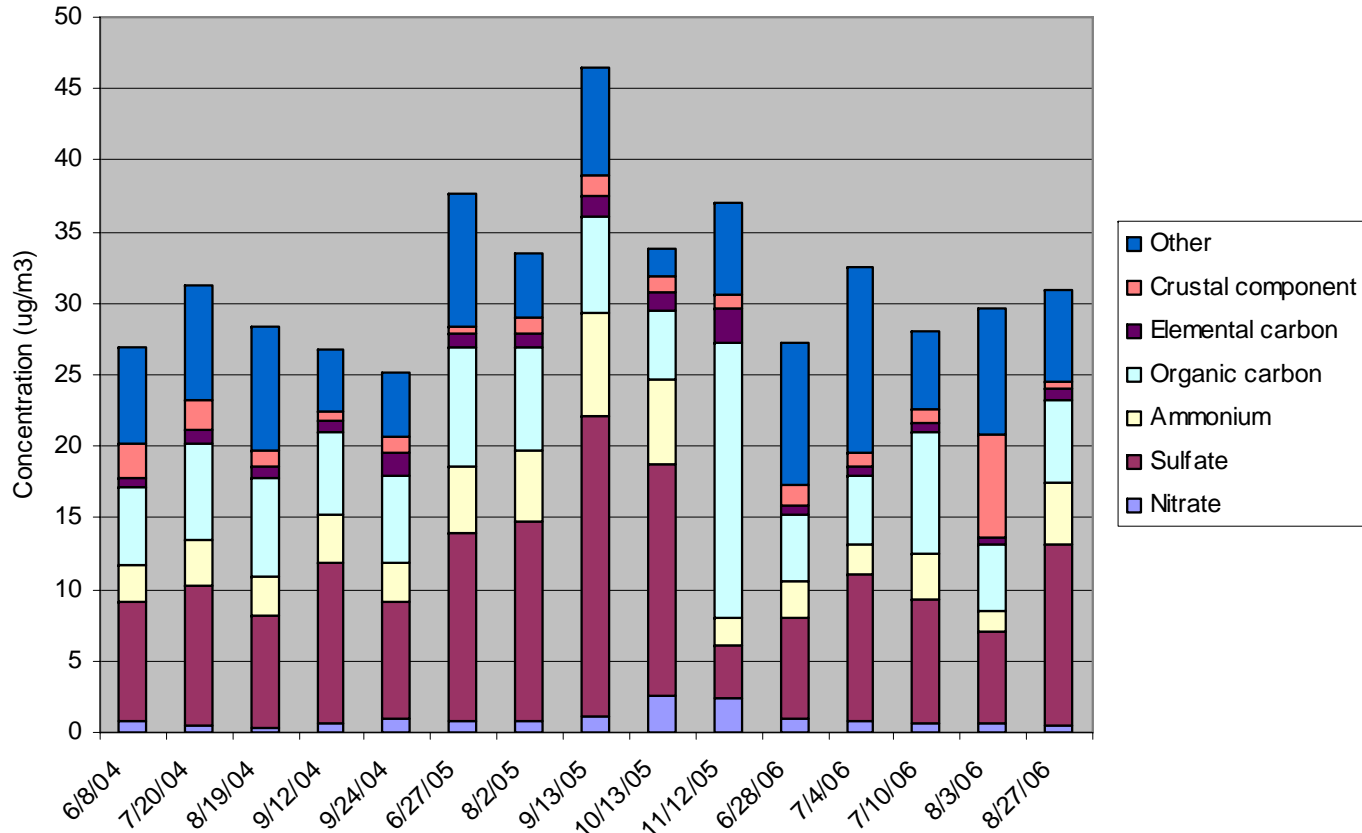
# % Contribution When Concentrations are Between 15 and 30 $\mu\text{g}/\text{m}^3$



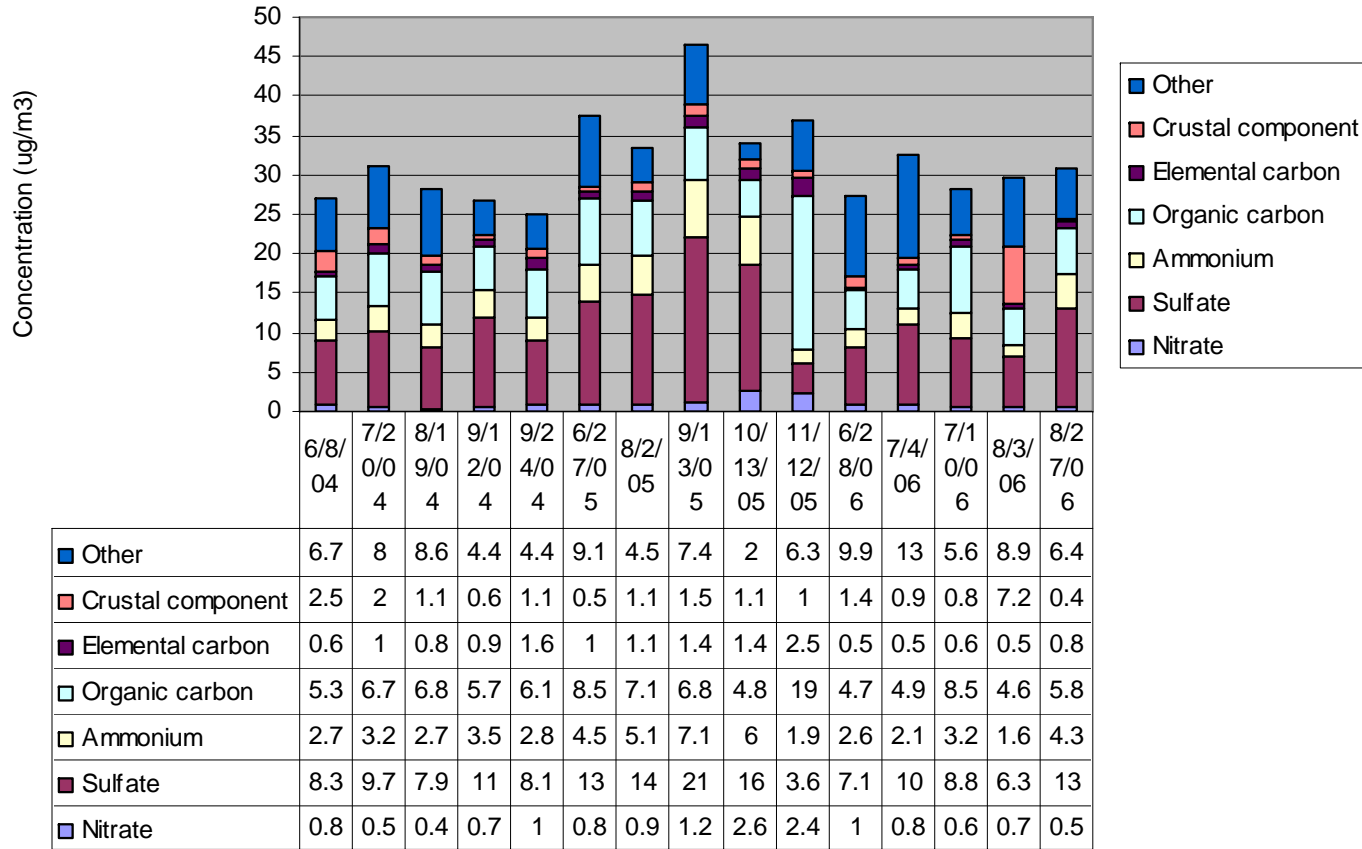
# % Contribution When Concentrations are Above $30 \mu\text{g}/\text{m}^3$



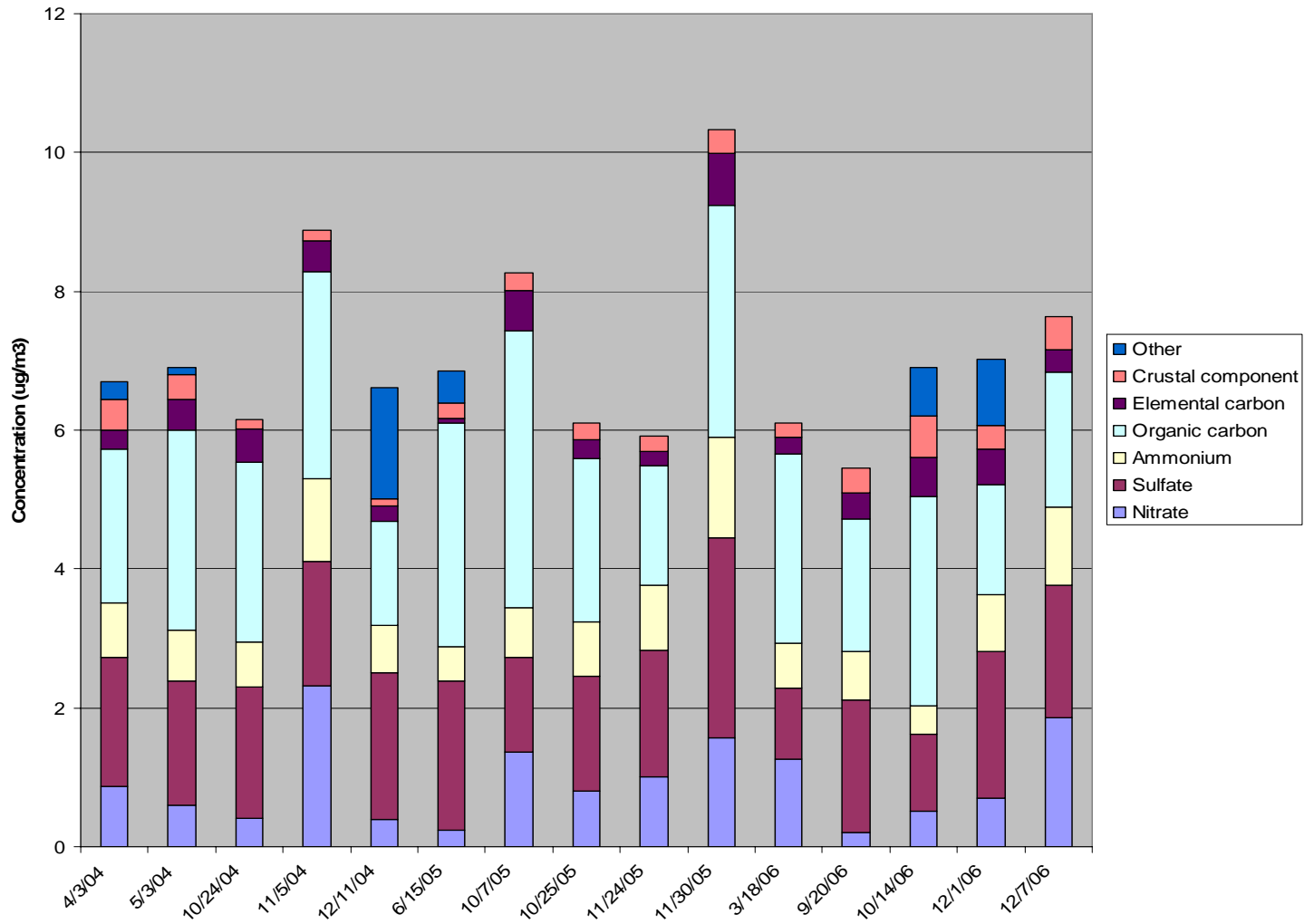
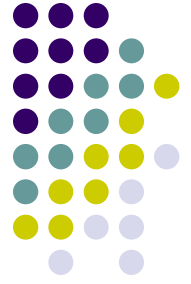
# Southwick 5 highest days each year 2004-2006



# Southwick 5 highest days each year 2004-2006



# Southwick 5 lowest days each year 2004-2006



# Southwick 5 lowest days each year 2004-2006

