PM2.5 Concentrations in Urban and Rural Areas

Karen Magliano, Theresa Najita, and Kasia Turkiewicz
California Air Resources Board
AAAR Supersites Conference

California Environmental Protection Agency
Air Resources Board
Atlanta, February 2005
California Regional PM$_{2.5}$/PM$_{10}$ Air Quality Study (CRPAQS)

- Monitoring in central and northern California for 14 months (December 1999 through February 2001)
- Integrated effort
  - Air quality and meteorological measurements (100 monitoring locations, 500 instruments, 600 parameters)
  - Emissions characterization
  - Data analysis and modeling
CRPAQS Monitoring Sites

Sacramento
San Francisco
Stockton
Modesto
Fresno
Angiola
Bakersfield
Bakersfield
Overview

• PM2.5 concentrations
  – Annual average
  – Peak days
  – Temporal patterns

• Chemical composition
  – Annual average
  – Peak days
  – Temporal patterns
PM2.5 Peak Concentrations
Dec 2000/Jan 2001 Episode

PM2.5 Maximum

- Light gray: Urban Site
- Green: Rural Site
- Red: NAAQS
PM2.5 Concentrations
Fresno Area, 12/2/1999 - 2/3/2001

Urban

Rural

Concentration Range in µg/m³

Count Of Observations

Cumulative %
PM2.5 Concentrations
Fresno Area, Dec 2000/Jan 2001 Episode

Concentrations (ug/m³)

12/18/00 12/20/00 12/22/00 12/24/00 12/26/00 12/28/00 12/30/00 1/1/01 1/3/01 1/5/01 1/7/01

Fresno  Helm  Selma  Feedlot  Standard
Temporal Patterns
Bakersfield Area

Concentrations (ug/m3)

Dec 00/Jan 01
Jan 01

12/14/00 12/21/00 12/28/00 1/4/01 1/11/01 1/18/01 1/25/01

0 20 40 60 80 100 120 140 160 180

Bakersfield
Pixley
Angiola
Chemical Speciation
2000 Annual PM2.5 Concentrations

Trace Elements
Geological
Organic Carbon
Elemental Carbon
Ammonium Sulfate
Ammonium Nitrate
Chemical Speciation
Average PM2.5 Exceedance Day

Concentrations (ug/m3)

Urban

Rural

Other
Trace Elements
Geological
Organic Carbon
Elemental Carbon
Ammonium Sulfate
Ammonium Nitrate
Average PM2.5 Exceedance

Concentrations (ug/m³)

Urban

Fresno
Bakersfield

Rural

Fresno
Bakersfield

Ammonium Nitrate
Total Carbon
Differences Among Components at Fresno
Diurnal Pattern
PM2.5 Concentrations, January 1-6, 2001
Conclusions

• Annual average PM2.5 concentrations
  – Urban higher than rural
• Peak PM2.5 concentrations
  – Urban sites have more high days
  – Rural sites can have higher peaks
• Temporal patterns: Different scenarios depending on the weather
  – Rural delayed by few days or no delay
Conclusions
Chemical Composition

• Annual average
  – Carbon responsible for the difference in concentrations

• Peak day
  – Fresno: Dominated by carbon
  – Bakersfield: Dominated by ammonium nitrate
  – Rural: Heavily dominated by ammonium nitrate