Houston Air Conference:
Introduction

Daniel Cohan
Assistant Professor, Civil & Environmental Engineering, Rice University
The Air Quality Challenge in Texas
Ozone Non-attainment: New standard

Counties With Monitors Violating Alternate 8-hour Ozone Standards
0.070 and 0.075 parts per million

- 398 counties violate 0.075 ppm
- 135 additional counties violate 0.070 ppm
  for a total of 533

Estimates are based on the most recent data (2003 – 2005). EPA will not designate areas as nonattainment on these data, but likely on 2006 – 2008 data which we expect to show improved air quality.
Ozone Non-Attainment: 2020

Counties With Monitors Projected to Violate Alternate 8-hour Ozone Standards of 0.070 and 0.075 parts per million in 2020

- 52 counties violate 0.075 ppm
- 121 additional counties violate 0.070 ppm for a total of 203

EPA cannot project future levels for these counties with monitors at this time.
Ozone in Texas

Current 8-hour NAAQS of 75 ppb

Previous NAAQS of 85 ppb

Beaumont-Port Arthur
dallas-Fort Worth
Houston-Galveston-Brazoria
San Antonio
Austin-Roundrock
El Paso
Fine Particulate Matter in Texas

PM2.5 Design Values (ug/m3)


Annual NAAQS of 15ug/m3

Houston-Clinton Dr
Bowie-Montague County
El Paso
Houston - Aldine
Dallas-Convention Ctr
Dallas-Boys Club
Air Quality Research in Texas

Civil & Environmental
Earth Sciences
Economics
Baker Institute
Shell Center
Research at Rice
Multi-pollutant, multi-objective air quality planning

<table>
<thead>
<tr>
<th>Source</th>
<th>Emission</th>
<th>Ambient Impact</th>
<th>Societal Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO\textsubscript{x}</td>
<td>Ozone</td>
<td>Human health</td>
</tr>
<tr>
<td></td>
<td>VOC</td>
<td>PM\textsubscript{2.5}</td>
<td>Attainment</td>
</tr>
<tr>
<td></td>
<td>SO\textsubscript{2}</td>
<td>Ecosystems and crops</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{10}</td>
<td>Visibility</td>
<td></td>
</tr>
</tbody>
</table>

Uncertainty
Influence of Uncertainty on Ozone Sensitivity

O3 Sens to NOx: Photolysis -30%
Time of Daily Max 8-hr Ozone

June 23, 2005 0:00:00
Min= -0.039 at (16.36), Max= 0.012 at (17.45)

Ozone Sens to NOx: Photolysis +30%
Time of Daily Max 8-hr Ozone

June 23, 2005 0:00:00
Min= -0.032 at (18.34), Max= 0.025 at (11.39)
Integrated modeling of power systems

- Alternative Scenarios
  - Market Conditions
  - Power System Structure
    - Load Curves
    - Power Flow Model
      - Static & Dynamic Optimization of Economic and Societal Net Benefits
      - Generation & Transmission Costs & Benefits
  - Meteorology, Non-EGU emissions
    - Air Quality Model
      - Ambient & Health Impacts
    - EGU Emissions
SOA From Cl-VOC Reactions

![Graph showing the relationship between $M_o$ (μg m$^{-3}$) and Y with data points for beta-pinene and alpha-pinene, along with a fit line.](image)
Aerosol Mass Spectrometry

Particle Beam Generation

Aerodynamic Sizing

Particle Composition

Quadrupole Mass Spectrometer

Chopper

TOF Region

Aerodynamic Lens (2 Torr)

Particle Inlet (1 atm)

Turbo Pump

Turbo Pump

Turbo Pump

Thermal Vaporization & Electron Impact Ionization

Mass Loading (µg/m³)

NH₄

NO₃

SO₄

Organic

0 5 10 15 20 25 30


Date and Time
Studies of Atmospheric Organic Chemistry

Field studies of particle size and composition

Computational simulation

Generation of laboratory data