Whenever the air quality in a state or region does not meet National Ambient Air Quality Standards (NAAQS), the area is designated by the U.S. EPA as a non-attainment area. Any state with at least one non-attainment area must submit a State Implementation Plan (SIP) that demonstrates how the state will meet the NAAQS. The Second Texas Air Quality Study (TexAQS II), an 18-month-long field campaign in Texas, from 2005 through 2006, was conducted to supply the needed scientific and air-quality information.

### Instrumentation and Methods

To understand the background particulate conditions and evaluate air-quality trends in Houston, average particulate properties were calculated from the data. The whole study average provides insight into the composition and levels of ambient PM2.5 in Houston. Daily averages can be used to evaluate if there are any clear population-related trends in the particulate concentrations. Hourly averages help to show the diurnal variations in the background levels and can be compared to emission inventories, traffic data, and meteorological data to understand the impact of these sources on the Houston area. Comparison of CRD5N results with other instruments is not in the scope of this paper, but calibrations help in estimating the potential of the CRD5N technique for regulatory use.

As part of the TexAQS II study, TRAMP (TexAQS II Radial and Aerosol Monitoring Project), the Adkinson research group used a tandem pulsed cavity ringdown transmitter/receiver (CRD5N) to make aerosol optical property measurements on the 200-hill block. The CRD5N is located at the University of Houston (Houston, TX) since August 14, 2006 to September 27, 2006. (Figure 1) The optical property data from this well-mixed site can serve as an indication of the local background concentrations of fine aerosols (PM2.5) and help determine the effect of regional transport on the air quality of non-attainment areas in the downtown Houston area. In addition, the real-time optical property measurements can be used to determine urban air quality patterns and as an input to develop predictive and exposure models.

The optical property time series data for the TRAMP study in Figure 4 show that the particulate matter concentrations in HGA both daily and long term trends. Since ambient measurements of pollutants are thought to be an indicator of emissions, analysis of the data for cycles can help determine major sources of particulate matter. Spectral analysis of this data reveals that the particulate patterns and concentrations exist on a five day periodicity, but a longer sampling time is needed for further understanding of the trend for HGA. Smaller 24-hour and 12-hour cycles were also indicated by the analysis.

A typical seven day cycle with weekday highs and weekend lows is expected in a densely populated urban area. Houston's deviation from this pattern could be due to either high levels of industrial emissions that mask trends due to transportation, wind patterns and other variable meteorological conditions or a combination of both. Further analysis and models on larger data sets would help to clarify the emission sources responsible for the observed trends.

### Summary

- Spectral analysis indicated a five day optical property trend that was dominated by levels of absorbing particulates.
- The daily average particle extinction at 552 nm from Houston from August 14 to September 28, 2006 varied between 79.1 ± 4.8 μm⁻¹ and 57.5 μm⁻¹. The average extinction coefficient for the TRAMP study was 530 μm⁻¹.
- The percentage of aerosol extinction that is due to absorbing particles was calculated from the data. Extinction trends were similar to absorption. Scattering trends were less obvious, an indication that the cycles noted in the extinction measurements are caused primarily by absorbing particles. The major trend that could be determined was approximately a five day optical property trend that was dominated by levels of absorbing particles.

### Table: Daily Averaged Measured Values With Calculated Absorption and Mass Concentrations

<table>
<thead>
<tr>
<th>Day</th>
<th>Absorption</th>
<th>Extinction</th>
<th>Scattering</th>
<th>Mass Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>7.3 μg/m³</td>
<td>53.0 μm⁻¹</td>
<td>10.5 μg/m³</td>
<td>7.3 μg/m³</td>
</tr>
<tr>
<td>Tuesday</td>
<td>7.5 μg/m³</td>
<td>53.2 μm⁻¹</td>
<td>10.6 μg/m³</td>
<td>7.3 μg/m³</td>
</tr>
<tr>
<td>Wednesday</td>
<td>7.7 μg/m³</td>
<td>53.3 μm⁻¹</td>
<td>10.7 μg/m³</td>
<td>7.3 μg/m³</td>
</tr>
<tr>
<td>Thursday</td>
<td>7.8 μg/m³</td>
<td>53.4 μm⁻¹</td>
<td>10.8 μg/m³</td>
<td>7.3 μg/m³</td>
</tr>
<tr>
<td>Friday</td>
<td>7.9 μg/m³</td>
<td>53.5 μm⁻¹</td>
<td>10.9 μg/m³</td>
<td>7.3 μg/m³</td>
</tr>
</tbody>
</table>

The calculated scattering and absorbing particle concentrations indicate that the data has an average particle concentration of 174 μg/m³ during the six week TexAQS II study.

### References


### Acknowledgments

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