CRPAQS Initial Data Analysis of Field Program Measurements - Task 6.4 Near-Term and Low Wind Dispersion Measurements of Plumes from Steam Generators During the CRPAQS

Thomas Rappolt, Program Manager
Tracer Environmental Sciences & Technologies, Inc.
970 Los Vallecitos Blvd., Suite 100
San Marcos, CA 92069
Phone: (760) 744-9611 / Fax: (760) 744-8616
www.tracer-est.com
Overview

- Research Objectives
- Funding
- Methodology
- Results
- Conclusions
Research Objectives

Dispersion and Transport Processes

- Identify where fossil energy plumes interact with ambient ammonia in the atmosphere.
- Attain field data pertaining to how plumes disperse in stagnant fog.
- Provide information on the significance of fossil energy plumes to the formation of secondary aerosols.
Research Objectives

\[
\begin{align*}
\text{HNO}_3 + \text{NH}_3 & \rightarrow \text{NH}_4\text{NO}_3 \quad \text{(Ammonium Nitrate)} \\
\text{NO}_x + \text{H}_2\text{O} & \rightarrow \text{HNO}_3 \quad \text{(Nitric Acid)}
\end{align*}
\]
Funding

Field Program
- United States Department of Energy
- Western States Petroleum Agency
- Tracer ES&T

Data Analysis
- California Air Resources Board
Methodology

- Satellite GPS
- Ground Based Technology
  - Flight Control
  - Position Data
  - Plume Data (Real Time)
# Results

## 28 Flights

<table>
<thead>
<tr>
<th>Date</th>
<th>No. of Flights</th>
<th>General Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/16/2000</td>
<td>3</td>
<td>Clear, light winds</td>
</tr>
<tr>
<td>12/17/2000</td>
<td>4</td>
<td>Cool, low ceiling</td>
</tr>
<tr>
<td>12/18/2000</td>
<td>1</td>
<td>Low, thin fog, cool</td>
</tr>
<tr>
<td>01/04/2001</td>
<td>6</td>
<td>Clear, light winds</td>
</tr>
<tr>
<td>01/05/2001</td>
<td>4</td>
<td>Clear, light winds</td>
</tr>
<tr>
<td>01/06/2001</td>
<td>4</td>
<td>Clear, very dry</td>
</tr>
<tr>
<td>01/07/2001</td>
<td>1</td>
<td>Clear, light winds</td>
</tr>
<tr>
<td>01/31/2001</td>
<td>2</td>
<td>Clear, warm, some high winds</td>
</tr>
<tr>
<td>02/01/2001</td>
<td>3</td>
<td>Very clear, light winds</td>
</tr>
</tbody>
</table>
Results

Flight #06 Plume Infiltration
Red: Stable Layer    Green: ISC Plume Height

SF6 Concentration (ppt)

Altitude (ft)
Results

Flight #10 Plume Infiltration
Red: Stable Layer   Green: ISC Plume Height

SF6 Concentration (ppt)
Altitude (ft)
Results

Flight #11 Plume Infiltration
Red: Stable Layer  Green: ISC Plume Height

Altitude (ft)

SF6 Concentration (ppt)
Results

Flight #21 Plume Infiltration
Red: Stable Layer    Green: ISC Plume Height
Results

Flight #28 Plume Infiltration
Red: Stable Layer     Green: ISC Plume Height

SF6 Concentration (ppt) vs. Altitude (ft)
Conclusions

- Observations show tracer plume is entrained significantly into stable layers aloft, well above the ISCST model predictions.

- While vertical dispersion rates of plumes are over predicted by models, actual plume heights are significantly under predicted by ISCST, even in the presence of a low lifted inversion.