### SO$_3$ Mitigation Economics

#### Sorbent Comparisons

<table>
<thead>
<tr>
<th>Sorbent Tested</th>
<th>Effectiveness</th>
<th>Relative O&amp;M Costs</th>
<th>Relative Capital Costs</th>
<th>Relative Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>Good for lower SO3 Concentrations</td>
<td>Low</td>
<td>Low - NH3 already in use w/ SCR</td>
<td>Low</td>
</tr>
<tr>
<td>Magnesium Hydroxide</td>
<td>Good Furnace Only</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Hydrated Lime</td>
<td>Good Limited by ESP performance</td>
<td>Low</td>
<td>Low</td>
<td>Moderate to Low Nightly POR required</td>
</tr>
<tr>
<td>Magnesite</td>
<td>Poor</td>
<td>Low to Moderate</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>SBS</td>
<td>Excellent</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>Morpholine</td>
<td>Inert</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Magnesium Silicate Hydroxide</td>
<td>Inert</td>
<td>Low to Moderate</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>OmniClear</td>
<td>Less Than Expected Furnace Only</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Soda Ash (Fuel additive)</td>
<td>Poor Furnace Only</td>
<td>Moderate</td>
<td>Low</td>
<td>High Furnace Slagging</td>
</tr>
<tr>
<td>High Surface Area Lime</td>
<td>Good to Excellent</td>
<td>Low</td>
<td>Low</td>
<td>Moderate ESP Concerns</td>
</tr>
<tr>
<td>Trona</td>
<td>Excellent</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>
Trona Testing Timeline

- **2002** Initial testing aborted, plugged up silo (Contamination)
- **2003 Initial Testing**
  - Trona demonstrated to be very reactive and effective
  - Injection system had to be modified to LOWER feed rate
- **2004 Trona System installed on Gavin 2**
  - Moisture problems identified and resolved
  - Deposition problems identified, solutions proposed
- **2005 Trona**
  - Low conversion catalyst
  - Deposition solutions tested successfully
- **2006 Trona**
  - Fixes implemented; No moisture or deposition problems encountered.
- **2007 Trona systems started up on Mitchell and Mountaineer**
Trona Use Within AEP

- **Current Users of Trona for SO3 control**
  - Gavin Units 1&2: 2600 MW
  - Mountaineer: 1300 MW
  - Mitchell Units 1&2: 1600 MW

- **Trona systems to be installed by 2010**
  - Amos 1-3: 2900 MW
  - Cardinal 1-3: 1830 MW
  - Kyger 1-5/ Clifty 1-6:
  - Conesville 4: 780 MW
Mercury Capture Technologies

- **SCR/WFGD Co-Benefits**
  - Proven Capture for Bituminous Coals, Capital Intensive

- **Activated Carbon Injection (ACI)**
  - Most Proven Hg-Specific Capture Method
  - Not Effective with All Fuel Types

- **Fuel Switching/Blending**
  - Lower Reductions, Fuel Variability

- **Boiler Chemical Additives (BCA)**
  - Limited Research, Varied Results

- **Non-Carbon Sorbents**
  - Some Promise, Still Developing Technologies
Activated Carbon Injection
In-House Test Program

- Full Scale Testing Performed at Three Facilities, 30-Day Long-Term Tests
  - Bituminous/PRB Blend
    - Standard Carbon
  - Texas Lignite
    - Brominated Carbon
  - 100% PRB
    - Brominated Carbon