CoaLogix Inc. is a company formed to find, acquire, integrate and optimize technologies to improve the environmental footprint of coal fired power plants.

SCR-Tech LLC provides SCR management through a number of services including a proprietary regeneration technology proven in Germany & the US. This technology restores full performance to SCR catalyst for 40% less than purchasing new catalyst.
Positive Reactions:
No\textsubscript{x} Reduction \quad NO + NH\textsubscript{3} + 1/4 O\textsubscript{2} \rightarrow N\textsubscript{2} + 3/2 H\textsubscript{2}O

Hg Oxidation \quad Hg + 2 HCl + 1/2 O\textsubscript{2} \rightarrow HgCl\textsubscript{2} + H\textsubscript{2}O

Negative Reactions:
SO\textsubscript{2} Oxidation \quad SO\textsubscript{2} + 1/2O\textsubscript{2} \rightarrow SO\textsubscript{3}
SCR Reactor Terminology

Meeting the World Energy Challenge.

Gas Inlet

Ammonia Injection Grid (AIG)

Catalyst Module

Catalyst Layer

Gas Outlet
### SCR System Performance

#### Meeting the World Energy Challenge.

<table>
<thead>
<tr>
<th>Catalyst Performance</th>
<th>Primarily Affected By</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flue Gas Impurities</td>
</tr>
<tr>
<td></td>
<td>Operating Conditions</td>
</tr>
<tr>
<td>Catalyst Decay Rate</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
</tr>
<tr>
<td>Flue Gas Velocity</td>
<td></td>
</tr>
<tr>
<td>(SO_3) Concentration - 0 to 10ppm</td>
<td></td>
</tr>
<tr>
<td>(NH_3) Concentration &lt; 1.0 Mole Ratio</td>
<td></td>
</tr>
<tr>
<td>% Catalyst Pluggage</td>
<td></td>
</tr>
<tr>
<td>% Flue Gas By-pass</td>
<td></td>
</tr>
<tr>
<td>Ammonia to NOx Distribution</td>
<td></td>
</tr>
<tr>
<td>Flow and Temperature Distribution</td>
<td></td>
</tr>
</tbody>
</table>
SCR Pluggage

Difficult to Accurately Predict System Performance when Pluggage is Primary Decay Mechanism

System performance is reduced significantly with pluggage, not actual catalyst deactivation.
Factors to Consider

- Environmental requirements now and future
- Plant limitations now and future
- Pluggage, flow and temperature imbalances
- Outage schedule
- Total costs and budgets
- Risks
Balanced Approach

Must meet environmental requirements
Must not exceed plant limitations
Purchase new
- Sell existing
- Store for future use
- Dispose
Regenerate
- “Hot” regeneration
- Store for future use in same or different plant
- Purchase from inventory
How to Select the Right Catalyst

Meeting the World Energy Challenge.

- Determine minimum “Reactor Potential” based on
  - DeNOx requirements - 80%, 90%, etc.
  - NH3 slip limits - < 2 to 4ppm
  - Life required to meet your outage schedule
  - Estimate deactivation rate
  - Risks consequences

- Select smallest pitch that will not plug in the reactor

- Select catalyst volume and number of layers to balance:
  - Pressure drop
  - Required DeNOx life “Outage Schedule”
  - SO2 conversion
## Dust Loading vs. Pitch Selection

Meeting the World Energy Challenge.

<table>
<thead>
<tr>
<th>Ash Dust Loading gr/dscf</th>
<th>Honeycomb Pitch</th>
<th>Open Area, %</th>
<th>Plate-type Pitch</th>
<th>Open Area, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2.5</td>
<td>6.9 mm (22 Cell)</td>
<td>80</td>
<td>4.9 mm</td>
<td>84.9</td>
</tr>
<tr>
<td>3 – 6</td>
<td>7.4 mm (20 Cell)</td>
<td>77</td>
<td>5.6 mm</td>
<td>86.5</td>
</tr>
<tr>
<td>7 – 10</td>
<td>8.2 mm (18 Cell)</td>
<td>78.3</td>
<td>6.0 mm</td>
<td>87.4</td>
</tr>
<tr>
<td>10 – 11</td>
<td>9.2 mm (16 Cell)</td>
<td>79.8</td>
<td>6.5 mm</td>
<td>88.3</td>
</tr>
<tr>
<td>&gt;12</td>
<td>Largest pitch is 9.2mm</td>
<td>79.8</td>
<td>7.0 mm</td>
<td>89</td>
</tr>
</tbody>
</table>

(grains per dry standard cubic foot)
How to improve SCR performance?

- Ammonia Injection Grid (AIG) tuning twice a year

- Select catalyst pitch to minimize pluggage. May require:
  - Larger pitch near boiler wall
  - Smaller pitch in remainder of SCR
  - Different catalyst types in different layers

- Vacuum catalyst at every opportunity

- Maintain soot blower and sonic horn systems

- Regular catalyst testing to determine Reactor Potential
Customized Regenerations

Meeting the World Energy Challenge.

DeNOx activity (m/hr) and SO2 conversion

<table>
<thead>
<tr>
<th>State</th>
<th>DeNOx Activity</th>
<th>SO2 Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>47.8</td>
<td>0.28</td>
</tr>
<tr>
<td>Deactivated</td>
<td>22.4</td>
<td>0.14</td>
</tr>
<tr>
<td>Regenerated</td>
<td>52.3</td>
<td>0.36</td>
</tr>
</tbody>
</table>
What to Expect from Regeneration?

• Performance similar to the original catalyst
  • DeNO\textsubscript{x} Potential
  • SO\textsubscript{2} conversion
  • Hg oxidation – Need more data!
  • Pressure drop - % pluggage < 5% per layer

• Customized Performance
  • Adjust active ingredient(s) for proposed operating conditions
  • Can normally improve performance by placing active ingredient(s) in the preferred reaction zone

Re-impregnate catalyst based on where it is going
Regenerated Catalyst Works: Technical Aspects

SCR-Tech Regeneration

✓ Removes poisons
✓ Pre-conditions TiO₂ support for optimal V₂O₅ up-take
✓ V₂O₅ impregnation is on the catalytic surface ~60,000,000 m² / module not the visible surface ~900 m² / module

Re-impregnated V₂O₅ does not abrade off in use

Performance ≥ Original Catalyst

✓ NOx reduction occurs preferentially on pore-mouth and in larger macro-pores
✓ SO₂ oxidation occurs preferentially inside micro-pores

SCR-Tech maximizes V₂O₅ deposition in macro-pore and pore mouth which improves NOₓ activity while maintaining S0₂ conversion
Summary

- SCR catalyst is a durable highly engineered asset
- Lower life-cycle costs requires:
  - Proper catalyst selection upfront
  - Proactive SCR management program
  - Regeneration, brokering and new catalyst
- SCR Management is good for your bottom line
- SCR Management is good for the environment
Thank You. Questions