Shaw
Enhanced Mercury Oxidization (EMO™)
EMO™ Overview

• Post-combustion chemical injection: liquid brominated oxidant
  ➢ Mercury Oxidization: Hg(0) → Hg(2+)
  ➢ Hg(2+) absorption in existing FGD
  ➢ Add powder activated carbon (PAC) or Trona/alkaline sorbent for the non-scrubbed systems

• Generally speaking, the Hg(0)/Hg(2+) ratio at the stacks:
  ➢ Bituminous: 40% Hg(0) / 60% Hg(2+)
  ➢ Sub- Bituminous: 90% Hg(0) / 10% Hg(2+)

• E.g., For a PRB coal-fired application:
  
  **PRB coal: 8.5 lb/TTBtu → 4.25 lb/TTBtu**

  Need to achieve ~50% Hg oxidation

• Injection location: Economizer outlet (450°F - 800°F)
Even Distribution Applying the Effective Chemical

EMO™ System
Application 1: 660 MW PC Boiler

- Sub-bituminous testing results
  - PC Unit burning PRB coal
  - SCR + ESP
- Testing performed on Duct A (one side)
  - Baseline tests
  - Vary EMO™ chemical injection rate at SCR inlet
  - Vary Trona injection rate at the SCR outlet
Application 1: 660 MW PC Boiler

- Flue gas Hg(T) was 6.5 µg/dscm
- > 95% as Hg(0) due to low coal chlorine content
Application 1: 660 MW PC Boiler

- **Unit at low load**

1. **SO2 (ppm)**
   - EMO with no Trona
   - Hg Total (ug/dscm)

1. 5 ppmvd EMO (8GPH), 8000 lb/hr of Trona
2. 10 ppmvd EMO (16GPH), 8000 lb/hr of Trona
3. 15 ppmvd EMO (24GPH), 8000 lb/hr of Trona
4. 15 ppmvd EMO (24GPH), NO Trona

- **Baseline Hg:** 6.5 µg/dscm
- **Post EMO Hg:** 1.3 µg/dscm

- **3.5 µg/dscm**
Application 2: ICI Boiler

- Sub-bituminous coal
  - BFB/HRSG – 150 kpph steam burning PRB
  - SNCR + Trona DSI + FFBH

- Testing performed
  - Baseline tests
  - Vary EMO™ chemical injection rate at the boiler outlet
  - Vary Trona injection rate at the FFBH inlet
## Application 2: ICI Boiler

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>With Trona</th>
<th>With EMO</th>
<th>%RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hg(T) (lb/TBtu)</td>
<td>5.63</td>
<td>5.51</td>
<td>2.64</td>
<td>53%</td>
</tr>
<tr>
<td>Hg(0) / Hg(T)</td>
<td>88%</td>
<td>91%</td>
<td>84%</td>
<td></td>
</tr>
<tr>
<td>HCl (lb/MMBtu)</td>
<td>0.054</td>
<td>0.002</td>
<td>---</td>
<td>96%</td>
</tr>
<tr>
<td>SO₂ (lb/hr)</td>
<td>27.6</td>
<td>2.5</td>
<td>2.0</td>
<td>&gt; 90%</td>
</tr>
<tr>
<td>Trona Rate (lb/MMacf)</td>
<td>0</td>
<td>45</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>Trona Rate (lb/hr)</td>
<td>0</td>
<td>300</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>EMO Rate (lb/hr)</td>
<td>0</td>
<td>0</td>
<td>7.0</td>
<td></td>
</tr>
</tbody>
</table>
Application 3: 350 MW Utility Boiler

• PC Boiler
  – Bituminous coal (CAAP)
  – APH / ESP

• Test Program
  – Baseline
  – Vary EMO™ oxidant injection rates at the economizer outlet
Application 3: 350 MW Utility Boiler

Baseline Hg(0) = 3.0 µg/dscm

EMO™ Injection at 60 ppmvd

EMO™ Injection at 25 ppmvd

Avg = 0.3 µg/dscm
Application 3: 350 MW Utility Boiler

- At 2.5 ppmvd =>
  \[ \text{Hg}(0) = 0.95 \text{ lb/TBtu} \]
  21.4 lb/hr EMO™ oxidant

- At 7.5 ppmvd =>
  \[ \text{Hg}(0) = 0.55 \text{ lb/TBtu} \]
  64.3 lb/hr EMO™ oxidant
Questions

Bobby I.T. Chen
Client Program Manager
865.670.2687 (direct)
270.799.6833 (cell)
bobby.chen@shawgrp.com

Terry Marsh
Vice President
865.690.3211 (office)
865.599.3274 (cell)
terry.marsh@shawgrp.com