Sorbent Enhancement Additive Mercury Capture Technology

Hot Topic Hour
04.11.13

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Plant Considerations
Hg Control Program Goals

* Meet Hg Capture Levels (MATS Rule)

* Program Economics - Lowest “Total” Cost Program

* Minimize impact to fly ash/gypsum sales

* Ability to adjust to high variability of Hg content

* Least Balance of Plant Effects
Mercury–Sorbent Interactions

The UND- EERC’s chemisorption model for mercury–flue gas interactions with sorbents is both descriptive and predictive.

Based on years of CATM research and empirical data, it shows the interactions involved in mercury capture by sorbents. Understanding competing flue gas interactions is critical.
ME2C Total Mercury Control Program

* Patented (2 Chemical) approach to Mercury Capture
  * (Key Patents #’s – 7,435,286; 8,168,147; & 8,312,822)

* **Sorbent Enhancement Additives** (Front End)
  * Proprietary Chemicals
  * Designed to Promote and Protect activated sites
  * Distribute chemical throughout furnace system

* **Sorbent** (Back End)
  * Proprietary Chemicals
  * Provide active capture sites for mercury adsorption
  * Protect activated capture sites
Challenging Scenarios for Hg Capture

* Case #1 – SO3 Injection for Fly Ash Resistivity

* Case #2 – Highly Variable Hg Concentration

* Case #3 – APC Design Challenges
Case #1 - Challenges

* SO3 Injection for Fly Ash Resistivity
* ESP Loading (Opacity Derates)
* Program Economics
Mercury Test Results - 180 Mw Subbituminous-Fired Power Plant
SO3 Set at 3 PPM

Test Condition (lb/Macf)

Mercury Emissions, lb/TBtu

MATS Limit
Case #1 - Summary

* ME2C Program Able to Meet MATS in presence of SO3
  * 0 ppm, 3 ppm, 6 ppm, & 12 ppm

* Reduced Material Loading on ESP – 50%
  * No Opacity Derates
  * Potential to lower SO3 injection rate

* Reduced Program Costs by 40%
Case #2 - Challenges

* Coal Mercury Concentration Levels

* Opacity Concerns (ESP Loading)

* APH Corrosion (Localized)

* Fly Ash Sales

* Program Economics – too high
Case #2 - Mercury Reduction

![Graph showing Mercury Reduction](image)

- Mercury Emissions
- Mercury Removal

Test Condition (lb/Macf)

Target

* Based on average data
Mercury Test Results – Feed Rates

* Based on average data
Case #2 - Summary

* Coal Mercury Concentration
  * (0.06 – 0.15 ppm)

* ESP Loading
  * Injected Material Reduced by 66%

* Fly Ash Sales
  * Reduced LOI from ~1.6% to ~0.9%

* Program Economics
  * Reduced Program Costs by 49% ($2,500,000 savings)
Case #3 - Challenges

* Lignite Blend
* Coal Mercury Concentration Levels
* Scrubber Bypass Operation
* Complex APC Design
Mercury Test Results – Scrubber Bypass

* Based on average data
Mercury Test Results Across APC Devices

* Based on average data

Test Condition (lb/Macf)

Coal-to-ESP Outlet
Across Scrubber
Coal-to-Stack
Load, Gross

Unit Gross Load, Mw

Mercury Removal*, %
Case #3 - Summary

* Unit was able to achieve MATS Compliance

* Dose Rate was Low – *Superior Economics*

* Incoming Hg Concentrations not a problem

* Scrubber Bypass is key – must remove in ESP

ME₂C
Midwest Energy Emissions Corp
Program Economic Summary

Case #1
- BAC: 1000000
- ME2C: 2000000
- Savings: 40%

Case #2
- BAC: 3000000
- ME2C: 5000000
- Savings: 49%

Case #3
- BAC: 4000000
- ME2C: 6000000
- Savings: 44%
Economic Summary

ME$_2$C vs. Brominated Activated Carbon (BAC)

<table>
<thead>
<tr>
<th>Plant</th>
<th>Type</th>
<th>Mercury Removal</th>
<th>Cost, US $Million/yr (7600 hr/yr)</th>
<th>80% removal</th>
<th>90% removal</th>
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<tbody>
<tr>
<td>1</td>
<td>Lignite</td>
<td>47%</td>
<td>ME2C BAC</td>
<td>6</td>
<td>4</td>
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<td>2</td>
<td>Subbit.</td>
<td>51%</td>
<td>ME2C BAC</td>
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<td>3</td>
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<td>ME2C BAC</td>
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<td>6</td>
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<tr>
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<td>28%</td>
<td>ME2C BAC</td>
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<td>Subbit.</td>
<td>57%</td>
<td>ME2C BAC</td>
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<td>3</td>
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</tbody>
</table>
ME2C
Program Summary

* Most Cost Effective Program
  * (~40 - 50% savings over BAC)
* Capture Rate over >92% Achieved

* Fly Ash/Gypsum Sales Preservation

* Ability to Respond to Coal Concentration Variations

* No Balance of Plant Impacts
Thank You

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