Carbonxt Advanced Coal Products

Clear Carbon Innovations

Coal-Fired Power Plant Wastewaters & Treatment Issues

CCI Results
Carbonxt

- Australian company with US Operations in:
  - Charleston, WV (Plant Operations)
  - Gainesville, FL (R&D Operations)

- Premium carbon products from coal

- Activated carbon for mercury capture
  - Non-halogenated
  - Tailored based on flue gas chemistry
  - Suitable for all coal types
Clear Carbon Innovations

- 100% Owned Subsidiary of Carbonxt, Inc.
- Development of Activated Carbon for Mercury Removal
  - Portable Testing Services Via ACI Skid
  - Testing with Multiple Utilities
  - Product Development and Customization
  - Proprietary Processes & Patented Solutions

Water Treatment Solutions

- Surface Mine Discharge Water
  - Aluminum and Selenium Removal
  - Pilot Study, Summer 2012

- FGD Wastewater
  - Mercury and Selenium Removal
  - Testing with Multiple Utilities
Coal-Fired Power Plant (CFPP)
Wastewaters &
Treatment Issues
CFPP Wastewater Treatment Issues

- Cooling Tower
- Coal Yard Runoff
- Flyash Ponds
- Wet Scrubber Wastewater
Coal Yard Runoff Contaminants

CCI focus:
- Selenium
- Mercury
Wet Scrubber, CFPP

- **Purpose:** Flue Gas Desulfurization (FGD)
- **Wastewater Constituents:** focus
  - Selenium
  - Mercury
  - Arsenic
  - Boron
  - Bromide
- **Challenges in Treating:**
  - Large Flows (> 600 gpm)
  - Resilient dissolved metals
  - Complex matrix
    - High TDS
    - High Chlorides
New Regulations, CFPP

- EPA Mercury and Air Toxics Standards (MATS)
  - Finalized December 21st
  - Requiring about 90% mercury removal

- Effluent Limitation Guidelines (40CFR 423)
  - Guidelines: July 23, 2012
  - Final Rule: January 31, 2014
Scrubber Wastewater Treatment

Methods
- Physical/Chemical Processes
- Biological Treatment (Se removal)

Drawbacks
- Ineffective in meeting discharge limits
- Prone to upset with changing chemistry
- Expensive
- Not Comprehensive
Scrubber Wastewater Treatment

- Difficulty of Selenium Removal
  - Present in Multiple Forms
    - Selenate \((\text{SeO}_4^{-2})\)
    - Selenite \((\text{HSeO}_3^- \text{ or SeO}_3^{-2})\)
    - Selenide \((\text{H}_2\text{Se})\)
    - Elemental Selenium (grey/red solid material)
      - Color dependent on crystallinity
  - Selenate and Selenite: Very Soluble

- Typical Treatment
  - Reduction to elemental selenium (solid)
CCI Results
Se Removal from Secondary Treatment Effluent

CCI's proprietary process can be integrated following conventional waste water treatment to remove Se.
### Bench-Scale Results: Scrubber Wastewater

<table>
<thead>
<tr>
<th>Water Source</th>
<th>Initial Se Conc.</th>
<th>Final Se Conc.</th>
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<tbody>
<tr>
<td></td>
<td>(mg/L)</td>
<td>(mg/L)</td>
</tr>
<tr>
<td>Utility A</td>
<td>0.3</td>
<td>BDL</td>
</tr>
<tr>
<td>Utility B</td>
<td>0.3</td>
<td>BDL</td>
</tr>
<tr>
<td>Utility C</td>
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<td>0.005</td>
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</tbody>
</table>

*BDL – Below Detection Limit*