Mercury Measure and Capture: PAC Injection in the WFGD

Michelle Brown, PE & Dr. Christine Valcarce
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## Regulation Compliance

<table>
<thead>
<tr>
<th>Mercury and Air Toxics Standards (MATS)</th>
<th>Effluent Limitation Guidelines (ELGs)</th>
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</thead>
<tbody>
<tr>
<td><strong>Air Phase</strong></td>
<td><strong>Water Phase</strong></td>
</tr>
<tr>
<td>April 2015/2016</td>
<td>July 2017 (projected)</td>
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<tr>
<td>Mercury, Particulate Matter, HCl/SO$_2$, HF</td>
<td>Mercury, Arsenic, Selenium, Nitrate/Nitrite</td>
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</tbody>
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MATS Compliance Strategies

- Activated Carbon Injection (ACI)
  - With or without halogen addition
- Halogen Addition
  - Oxidized Hg captured by ACI, fly ash or WFGD
- Optimizing Existing Controls
  - e.g. SCR with targeted catalyst and WFGD
Fate of Contaminants

Contaminants from coal will transition into the flue gas during combustion then accumulate in particulate matter and liquids.
Several balance of plant issues must be considered with this strategy:

- Ensuring Compliance for MATS
- Salability of byproducts
- ELGs for WFGD wastewater

Powdered Activated Carbon (PAC) addition to the WFGD effectively addresses these concerns.
Ensuring Compliance

- WFGD efficiently captures Hg$^{2+}$

- WFGD chemistry may cause Hg re-emission:
  - Putting MATS compliance at risk

- PAC added to the WFGD adsorbs Hg$^{2+}$
  - Prevents re-emission
  - Decreases Hg in the wastewater effluent for compliance with proposed ELGs
Wastewater ELGs

- Bench-scale testing
- 700 MW Plant
  - Bituminous coal
  - SCR, ESP, WFGD
- Initial 250 ppb of Hg
By-Product Salability

• PAC adsorbs Hg$^{2+}$
  – Decreases Hg loading to gypsum products thereby increasing value

• PAC can be separated from by-products using a hydrocyclone
  – Preserves gypsum salability
Operational Benefits

• PAC will likely not change WFGD chemistry
  – No change to operating ranges

• Bromine concerns
  – Selenium oxidation
  – Potential corrosion
  – Impacts for downstream drinking water supplies
Bromine Concerns


PAC Addition Strategy

- PAC injection point options
  - Dilute pneumatic injection into the flue gas as with traditional ACI but upstream of the WFGD
  - Wet sluiced into WFGD slurry
PAC Addition Strategy

• Several companies offer injection strategies
  – Steag Energy Services, LLC
    • Claims patented processes for an enhanced system
      – U.S. Patent 7,727,307
      – U.S. Patent 6,090,355
      – U.S. Patent 5,811,066
      – U.S. Patent 5,405,812
  – URS Corporation (now AECOM)
  – Geosyntec
Environmental regulation compliance is an ongoing dynamic challenge. It is essential to understand how MATS compliance options may affect ELG compliance down the road.
Innovative Non-halogenated Powdered Activated Carbons

Gas and Liquid Phase Mercury Capture

Reduce Costs for MATS Compliance

Industry-leading R&D

Contract Flexibility and Partnership Philosophy
Thank You!

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