Filter Media Selection for Utility Baghouse Applications

Prepared for McIlvaine Hot Topic Hour
Zachary J. Arndt
Sargent & Lundy LLC
Zachary.J.Arndt@sargentlundy.com
August 11, 2011
Agenda

- US EPA Policies
- Required Flue Gas Design Conditions
- Typical Flue Gas Design Conditions
- Fabric Filter (FF) Bag Concerns
- FF Bag Materials for Utility Baghouse Applications
- Typical PPS FF Bag Specifications
- Questions
Recent USEPA Policies will require more baghouse installations on utility boilers in order to be in compliance with the following:

- **Utility MACT**
  - Emission limits on Hg, Acid Gases, Non-Hg Metals
- **Cross-State Air Pollution Rule**
  - Reduce NO\textsubscript{x}, SO\textsubscript{2}, PM\textsubscript{2.5}
- **BART (Best Available Retrofit Technology) or Regional Haze Rule**
  - Protect visibility in Class I Areas
Required Flue Gas Design Conditions

• Design Flow (acfm)
• Inlet Gas Temperature
  – Normal
  – Excursion
• Solid loading to baghouse
• Acid Concentrations
• Alkali Concentrations
• Oxygen Concentration
• Moisture Level
• Bag Cleaning Preference (Reverse Air; Pulse Jet)
• Method for bag protection during temperature excursions
## Typical Flue Gas Design Conditions @ Air Heater Outlet

<table>
<thead>
<tr>
<th>Design Condition</th>
<th>Units</th>
<th>Powder River Basin Coal</th>
<th>Eastern Bituminous Coal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet flue gas temperature</td>
<td>F</td>
<td>275 to 330</td>
<td>300 to 330</td>
</tr>
<tr>
<td>Inlet N₂ level</td>
<td>vol%</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td>Inlet O₂ level</td>
<td>vol%</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Inlet H₂O level</td>
<td>vol%</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Inlet CO₂ level</td>
<td>vol%</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Inlet SO₂ level</td>
<td>ppmv</td>
<td>350</td>
<td>1400</td>
</tr>
<tr>
<td>Inlet SO₃ level</td>
<td>ppmvd@3%O₂</td>
<td>10</td>
<td>25 to 55</td>
</tr>
<tr>
<td>Inlet NH₃ level</td>
<td>ppmvd@3%O₂</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Inlet Mercury level</td>
<td>lb/TBtu</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>DSI feed</td>
<td>lb/hr</td>
<td>Site Specific</td>
<td>Site Specific</td>
</tr>
<tr>
<td>ACI feed</td>
<td>lb/hr</td>
<td>Site Specific</td>
<td>Site Specific</td>
</tr>
</tbody>
</table>

*Baghouse System Numbers are approximate concentrations dependent on the fuel selection*
Fabric Filter Bag Concerns

- Chemical degradation due to acid attack
  - Molecular deterioration and weight change

- Thermal degradation due to elevated temperature and oxygen levels
  - Separation and reaction with one another to change the properties of the polymer
  - Reduction of ductility and embrittlement
  - Cracking, elongation, and porous openings
**Fabric Filter Bag Concerns**

- High temperature and Oxygen Concentration Level affects on Bag Life
# Fabric Filter Bag Materials for Utility Baghouse Applications

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PPS</td>
<td>Felted</td>
<td>375</td>
<td>425</td>
<td>Very Good</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>PTFE w/PTFE Membrane</td>
<td>Woven</td>
<td>450</td>
<td>500</td>
<td>Average</td>
<td>Fair</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Fiberglass w/PTFE Membrane</td>
<td>Woven</td>
<td>450</td>
<td>550</td>
<td>Excellent</td>
<td>Fair</td>
<td>Good</td>
<td>Fair</td>
</tr>
<tr>
<td>P84®</td>
<td>Felted</td>
<td>500</td>
<td>550</td>
<td>Very Good</td>
<td>Excellent</td>
<td>Very Good</td>
<td>Fair</td>
</tr>
</tbody>
</table>
Typical PPS PJFF Bag Specifications

- Thermal Resistance
  - Max. Cont. Operating – 375°F
  - Max. Surge Operating – 425°F
- Tensile Strength
  - Warp Direction - The 0° direction to the edge of the cloth (Width)
    » 145 lbs/inch minimum
  - Fill Direction - The 90° direction to the edge of the cloth (Length)
    » 195 lbs/inch minimum
- Needle felt
- Bag Length
  - 8-10 Meters
- Weight
  - 16-18 oz/sq. yd.
- Thickness
  - .06 inch minimum
- Density
  - 0.3 g/cm³ minimum
- Mullen Burst - Amount of pressure required to puncture a bag
  - 350 psi minimum
Questions?