Dry Cleaning of A High Sulfur Coal Case Study

B.K.Parekh, Ron Tschantz *, and Joey Pilcher**
FGXSepTech, LLC, Lexington, KY
*Imperial Technologies, Inc., Canton, Ohio
**Eagle River Coal, LLC, Harrisburg, IL
Coal Preparation Equipment used with respect to size of the coal
Coal Preparation Equipment used with respect to size of the coal
**Introduction**

- Wet cleaning plants and processes are:
  - More Efficient;
  - Effectively clean from coarse to ultrafine;
  - Not impacted by feed moisture.

- WHY DRY CLEANING?
  - Scarcity of water;
  - Particle degradation in wet cleaning plants;
  - Dewatering issues avoided;
  - Reduced capital and operating costs;
  - Reduced environmental impacts.

Dry cleaning is making a global comeback in the 21st century

(McCulloch et al., 1968)
Dry, Fluidized Bed Table Separator

- Earliest air tables date back to 1850’s.
- Major development during 1910-1930.
- Major technology developments in China over the last two decades.
What’s FGX?

- A completely dry coal preparation method.
- A simple, efficient & cost-effective separation process.
- A **GREEN** and energy efficient technology.
Benefits

- Saving transportation costs.
- Saving water costs.
- Saving processing costs & increasing plant productivity. (Less maintenance, less chemical, less headache for water treatment...)
- Permitting is relatively easier.
Eagle River Coal, LLC
Harrisburg, IL

• High sulfur coal and about 20% ash

• Operating for the last 12 months
At a rate of ~ 250 tph
FGX Dry Coal Separator Specifications at Eagle River Coal LLC

- Total capacity of the plant 250 tph – 3” raw feed
- Major equipment includes 2 x 125 tph vibrating tables
- Plant produces Coarse and small size clean coal, middlings, refuse, and fine dust
- Cleaning set-up at a cut point density of 1.8
Process Flow Diagram of FGX Dry Coal Processing System for Eagle River Coal LLC
Process Flow Diagram for the Eagle River Coal LLC
Raw Coal Screening & Sizing at Eagle River Coal LLC
Raw Coal Feed & Sizing at Eagle River Coal LLC
Imperial Technologies
Accelerator

- Variable Speed Vertical Impact Breaker
- Fractures Coal without breaking rock, so screening separation is made
- Processes 10” x 3” ROM Coal to Uniform Sized, Cleaner Coal Product
- Liberates coal from pyretic material to improve FGX processing efficiency
Accelerator Benefits

Accelerator @ FGX Plant

- Liberate Coal From Rock/Shale with screening (Lower Ash & Sulfur)
- Improve Raw Coal Quality
- Uniform Sized Raw Coal Feed
- Increases FGX Plant Recovery as compared to crushing everything
- Maximize Coal Throughput
- Reduce Plant Wear
Eagle River Coal, LLC  
Raw Coal Data:  

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash</td>
<td>16 –18%</td>
</tr>
<tr>
<td>Sulfur</td>
<td>~6.0 % St</td>
</tr>
<tr>
<td>Total moisture</td>
<td>4.5%</td>
</tr>
<tr>
<td>Surface moisture</td>
<td>1.5%</td>
</tr>
<tr>
<td>HGI</td>
<td>52-60</td>
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</tbody>
</table>
Eagle River Coal, LLC
Product Data

<table>
<thead>
<tr>
<th>Product</th>
<th>Ash%</th>
<th>Sulfur%</th>
<th>Heating Value(Btu/lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROM</td>
<td>16-18</td>
<td>5-5.5</td>
<td>12,000-12,200</td>
</tr>
<tr>
<td>Clean Coal</td>
<td>8.5-9.5</td>
<td>3.5-3.8</td>
<td>12,800-13,000</td>
</tr>
<tr>
<td>Middlings</td>
<td>10.0-12.0</td>
<td>3.8-4.5</td>
<td>11,850-12,250</td>
</tr>
<tr>
<td>Refuse</td>
<td>20-28</td>
<td>~8.00</td>
<td>8,000-8,500</td>
</tr>
</tbody>
</table>
Yield (two products clean coal and middlings) ~ 80%

Combustible Recovery ~ 92%
Particles smaller than 6mm require different operating conditions.
Dry Coal Cleaning Scheme

Coal Operation

Accelerator

Dry Coal Cleaner

Screening

+6mm Product

Loading

Market

Rock

Dry Coal Cleaner

-6mm Feed

Feed

Dry Coal Cleaner

Product
Economic Benefit

• Unit capacity = 500 tph

• Yield to reject = 36.4%

• Reject Amount = 500 x 0.364 = 182 tph
- Annual Operating Hours = 6000 hrs/yr

- Total reject left at mine = 182 tph x 6000 hrs/yr = 1,092,000 tons

- Transportation cost = $0.50/t mile

- Mine-to-plant distance = 20 miles

- Transportation cost/ton = $10.00/ton
  - Annual transportation savings = 1,092,000 x $10 = $ 10,092,000
Lost Coal Cost

- Total reject = 182 tph
- % 1.60 float in reject = 0.78%
- Total coal loss = 182 x 0.0078 = 1.42 tph
- Annual coal loss = 1.42 x 6000 hrs/yr
  = 8518 tons
- Sale price = $ 50/ton
- Lost coal cost = 8518 x 50 = $ 425,880/yr
Summary Economic Benefit

• FGX operating cost = $1.50/ton

• Annual operating cost = $1.50 x 500 x 6000
  = $ 4,500,000/yr

• Summary
  Transportation savings  = $ 10.09 M
  Coal loss           = $  0.43 M
  Operating cost      = $  4.50 M

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Net profit gain  = $ 5.66 M
Commercial Dry Table Separators

- Over 1000 installations of dry-air table separators worldwide.
  - Brazil
  - China
  - Mongolia
  - South Africa
  - South Korea
  - India
  - USA
- Table capacity = 10 to 250 TPH
- Plus 6 mm material
- Less than 10% surface moisture
Applications

- Steam coal deshaling;
- Pit cleaning/rib coal recovery;
- Gob pile processing;
- Deshaling of metallurgical coal;
- Dry separation of high sulfur coal;
- High wall mining coal on-site processing;
- Coal prep in regions with water scarcity;
- Processing of low-rank coal, e.g. lignite;
- De-stoning of coal in utilities and cement plants.
Easy to install;
Easy to operate;
Low maintenance;
- Commercial installation from 10 to 480 tph on a single unit;
- Over 1,000 clients in China;
- Sold in more than a dozen of countries worldwide: China, Indonesia, Kazakhstan, Mongolia, Russia, South Korea, South Africa, The Philippines, Turkey, Ukraine, United States, Vietnam, etc.
THANK YOU
ANY QUESTIONS?