Reconnaissance of Coal-Slurry Deposits in Indiana

Denver Harper
Chris Dintaman
Maria Mastalerz
Sally Letsinger

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Indiana Geological Survey
Bloomington, Indiana

IGS Web Report

http://igs.indiana.edu/survey/projects/Coal_Fines/index.cfm
**Definitions**

Spoil = displaced overburden

Gob = coarse-grained refuse

Slurry (tailings) = fine-grained refuse

**Objectives**

Map areal extents of coal-slurry deposits

Estimate thicknesses

Calculate volumes

Collect preexisting chemical analyses

Statistically analyze chemistry values

“Loss of slurry or fines in washeries...is a step in the march of progress and eventually some method of utilization will be found.”

- Coal Age, 1936
Mapping - Data Sources

Historical aerial photographs
  Dates: 1937 to 1980
  Source: IGS archive (160 photos)

Digital Orthophoto Quarter Quads (1998)

National Agricultural Imagery Program (2003)

Indiana Orthophotography Project (2005)

Mapping - Feature Identification

Coal-preparation plants

Old Ben No. 2 2003
Tecumseh 1953
Pre 1978
Post 1978
Mapping – Feature Identification
Coal slurry deposits

Friar Tuck Mine
1974

Mapping – Depositional Settings

Berms
Minnehaha - 1954

Final-cut pit
Airline - 1949

Spoil
Chieftain

1946
1954
Mapping - Complex Histories

Results - Areal Extents

<table>
<thead>
<tr>
<th>Area (acres)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Berms</td>
<td>1,213</td>
</tr>
<tr>
<td>Final-cut pits</td>
<td>764</td>
</tr>
<tr>
<td>Spoil deposits</td>
<td>788</td>
</tr>
<tr>
<td>Total</td>
<td>2,765</td>
</tr>
</tbody>
</table>

Legend:
- Berm
- Final-cut pit
- Spoil
- Impoundment
- Not slurry
**Thickness Estimates - Data Sources**

- Digital Line Graphs (USGS)
- Coal Mine Information System (IGS)
- National Coal Resource Data System (USGS)
- Historical aerial photographs

**Thickness Estimations - Berms**

Air Quality No. 1 2003

(NOTE: Active operation. Impoundment not yet filled. Not included in final calculations.)

- Elevation of top of berm ~ 545 ft
- Elevation of bottom of impoundment ~ 445 ft
- Total height of Impoundment ~ 100 ft
**Thickness Estimations - Final-cut pits**

Lynnville Mine

- Elevation of coal ~ 395 ft
- Elevation of top of final-cut pit ~ 470 – 500 ft
- Depth of final-cut pit ~ 75 to 105 ft

**Thickness Estimations - Spoil deposits**

Assumptions: (1) Troughs completely filled. (2) Angle of draw = 30 degrees. (3) Average thickness = 1/8 ridge spacing.

Latta Mine

- 1954
- Average depth of troughs ~ 8 – 9 ft
**Results - Thickness Estimations**

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berms</td>
<td>0 to 54</td>
<td>10 to 14</td>
</tr>
<tr>
<td>Final-cut pits</td>
<td>0 to 125</td>
<td>38 to 56</td>
</tr>
<tr>
<td>Spoil deposits</td>
<td>0 to 49</td>
<td>6 to 8</td>
</tr>
</tbody>
</table>

**Results - Volumetric Calculations**

<table>
<thead>
<tr>
<th>Volumetric estimates (million cubic yards)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berms</td>
</tr>
<tr>
<td>Final-cut pits</td>
</tr>
<tr>
<td>Spoil deposits</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

“...volume of mapped CSDs represents from 22 to 69 million tons of recoverable coal. This compares with an earlier estimate made by Miller and Eggert (1982) of about 20 million tons.”

- Final Report
Chemical Characterization

- Mine sites: 10
- Drill holes: 93
- Samples: 473

Collection dates: 1970s through early 1980s

Analyses:
- Sulfur (weight percent, as received)
- Ash (weight percent, as received)
- Btu per pound (as received, moisture- and ash-free)

Selected statistical values for 473 individual samples of coal slurry

<table>
<thead>
<tr>
<th></th>
<th>Ash, AR (wt %)</th>
<th>Sulfur, AR (wt %)</th>
<th>Btu/lb, AR</th>
<th>Btu/lb, MAF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>5.6</td>
<td>0.4</td>
<td>1069</td>
<td>3725</td>
</tr>
<tr>
<td>Maximum</td>
<td>76.8</td>
<td>23.7</td>
<td>11720</td>
<td>24975</td>
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<tr>
<td>Average</td>
<td>32.2</td>
<td>4.0</td>
<td>7095</td>
<td>12849</td>
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<tr>
<td>Mode</td>
<td>26.7</td>
<td>2.8</td>
<td>7540</td>
<td>13210</td>
</tr>
</tbody>
</table>
## Selected statistical values for samples from various mine sites

**AR**: as-received; **MAF**: moisture- and ash-free; **wt %**: weight percent

<table>
<thead>
<tr>
<th>Mine</th>
<th>IG</th>
<th>No. of drill holes</th>
<th>No. of samples</th>
<th>Ash AR (wt %)</th>
<th>Sulfur AR (wt %)</th>
<th>Btu/lb AR</th>
<th>Btu/lb MAF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minnehaha</td>
<td>D3</td>
<td>18</td>
<td>74</td>
<td>20.2</td>
<td>2.2</td>
<td>6893</td>
<td>13680</td>
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<tr>
<td>Green Valley</td>
<td>B4</td>
<td>9</td>
<td>23</td>
<td>20.9</td>
<td>5.1</td>
<td>9780</td>
<td>13305</td>
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<tr>
<td>Otter Creek</td>
<td>B1</td>
<td>4</td>
<td>4</td>
<td>26.7</td>
<td>2.6</td>
<td>8893</td>
<td>13025</td>
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<tr>
<td>Friar Tuck</td>
<td>D4</td>
<td>9</td>
<td>37</td>
<td>28.1</td>
<td>2.1</td>
<td>8092</td>
<td>13663</td>
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<tr>
<td>Buckskin</td>
<td>K3</td>
<td>7</td>
<td>17</td>
<td>29.0</td>
<td>2.7</td>
<td>8589</td>
<td>12873</td>
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<tr>
<td>Chinook</td>
<td>C1</td>
<td>14</td>
<td>81</td>
<td>30.5</td>
<td>3.2</td>
<td>5577</td>
<td>13310</td>
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<td>Lynville</td>
<td>K1</td>
<td>6</td>
<td>36</td>
<td>35.0</td>
<td>4.3</td>
<td>8150</td>
<td>13344</td>
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<tr>
<td>Tecumseh</td>
<td>K2</td>
<td>4</td>
<td>28</td>
<td>35.9</td>
<td>8.9</td>
<td>7168</td>
<td>11942</td>
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<td>Airline</td>
<td>E3</td>
<td>11</td>
<td>99</td>
<td>42.4</td>
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<td>7143</td>
<td>12657</td>
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<td>Hawthorn</td>
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<td>11</td>
<td>55</td>
<td>45.2</td>
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<td>6608</td>
<td>11920</td>
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<tr>
<td><strong>SUM</strong></td>
<td></td>
<td>93</td>
<td>454</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>AVERAGE</strong></td>
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<td></td>
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<td>31.4</td>
<td>4.1</td>
<td>7689</td>
<td>12972</td>
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</tbody>
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### Slurry Disposal

- **Preparation plant**
- **Pipeline**
- **Pipe discharge = “entry point”**

- **Cell 1**: Subaerial fan
  - Slurry pond
  - Large, dense fragments of coal and rock
  - Coarse coal
  - Ultrafine coal and clay

- **Cell 2**: "…a manmade prograding fan-delta system”

-- Eggert, Miller, and Irwin (1980)
Chemical Trends

Spatial trends –
  Mixed results. See final report.

Historical trends –
  Overall quality can not be predicted on basis of the age of the preparation plant.

Source coal beds –
  Overall quality can not be predicted on basis of the coal beds that were processed.

Type of mining –
  Overall quality in slurry deposits produced from underground mines might be somewhat better.