Appendix B

SUPPORTING CALCULATIONS
This page intentionally left blank.
<table>
<thead>
<tr>
<th>Assumption</th>
<th>Value</th>
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<tbody>
<tr>
<td>Number of Ovens</td>
<td>100</td>
</tr>
<tr>
<td>Maximum coal charge tonnage</td>
<td>50 wet tons/oven</td>
</tr>
<tr>
<td>Coal moisture</td>
<td>8.0%</td>
</tr>
<tr>
<td>Coal sulfur</td>
<td>1.30%</td>
</tr>
<tr>
<td>Calculated emission factor = 23.92 lbs SO2/wet ton coal</td>
<td></td>
</tr>
<tr>
<td>Furnace coke dry yield</td>
<td>68.0%</td>
</tr>
<tr>
<td>Breeze fraction (of dry coal)</td>
<td>4.5%</td>
</tr>
<tr>
<td>Coke moisture</td>
<td>7.0%</td>
</tr>
<tr>
<td>Ovens/HRSG</td>
<td>20</td>
</tr>
<tr>
<td>Calculated HRSGs = 5</td>
<td></td>
</tr>
<tr>
<td>Ovens/waste heat stack</td>
<td>20</td>
</tr>
<tr>
<td>Calculated waste heat stacks = 5</td>
<td></td>
</tr>
<tr>
<td>Days HRSG offline/year</td>
<td>15</td>
</tr>
<tr>
<td>HRSG maintenance days/year = 10</td>
<td></td>
</tr>
<tr>
<td>SO2 removal in spray dryer/baghouse</td>
<td>90%</td>
</tr>
<tr>
<td>SD/BH maintenance days/year = 5</td>
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<tr>
<td>Coke Pile</td>
<td>1.5 acres</td>
</tr>
<tr>
<td>Coal pile #1 (Dead Pile)</td>
<td>1.2 acres</td>
</tr>
<tr>
<td>Coal pile #2 (Live Pile)</td>
<td>1.3 acres</td>
</tr>
<tr>
<td>Emergency Breeze Pile</td>
<td>0.2 acres</td>
</tr>
<tr>
<td>Emergency Screened Coke Storage Pile</td>
<td>0.3 acres</td>
</tr>
<tr>
<td>Emission Unit</td>
<td>Pollutant</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Coal unloading</td>
<td>PM</td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{10}</td>
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<tr>
<td></td>
<td>PM\textsubscript{2.5}</td>
</tr>
<tr>
<td>Coal crushing</td>
<td>PM</td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{10}</td>
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<tr>
<td></td>
<td>PM\textsubscript{2.5}</td>
</tr>
<tr>
<td>Coal Pile</td>
<td>PM</td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{10}</td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{2.5}</td>
</tr>
<tr>
<td>Coal bin load-in and loadout</td>
<td>PM</td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{10}</td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{2.5}</td>
</tr>
<tr>
<td>Coal transfer</td>
<td>PM</td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{10}</td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{2.5}</td>
</tr>
<tr>
<td>Charging</td>
<td>PM (fug)</td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{10} (fug)</td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{2.5} (fug)</td>
</tr>
<tr>
<td></td>
<td>PM (BH)</td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{10} (BH)</td>
</tr>
<tr>
<td></td>
<td>PM\textsubscript{2.5} (BH)</td>
</tr>
<tr>
<td></td>
<td>VOC</td>
</tr>
<tr>
<td></td>
<td>SO\textsubscript{2}</td>
</tr>
<tr>
<td></td>
<td>CO</td>
</tr>
<tr>
<td></td>
<td>Lead</td>
</tr>
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</table>
## Emission Factors and Pollution Control Efficiencies and Mechanisms for Heat Recovery Coke Battery

<table>
<thead>
<tr>
<th>Emission Unit</th>
<th>Pollutant</th>
<th>Uncontrolled EF Units</th>
<th>Control Mechanism</th>
<th>Control Efficiency</th>
<th>Controlled EF Units</th>
<th>Reference</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste gas</td>
<td>PM</td>
<td>0.049 gr/dscf</td>
<td>baghouse</td>
<td>99.00%</td>
<td>0.005</td>
<td>Uncontrolled is Haverhill Limit. Engineering Estimate. Particulate from spray dryer also removed in baghouse.</td>
<td>Emission factor is grain loading which is a controlled value; therefore the percent control is given for informational purposes only and is not used in the calculation.</td>
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<tr>
<td></td>
<td>PM(_{10})</td>
<td>0.083 gr/dscf</td>
<td>baghouse</td>
<td>99.00%</td>
<td>0.111</td>
<td>Engineering estimate. Particulate from spray dryer also removed in baghouse. Includes estimate for condensable PM (GIECC limit).</td>
<td>Emission factor is grain loading which is a controlled value; therefore the percent control is given for informational purposes only and is not used in the calculation.</td>
</tr>
<tr>
<td></td>
<td>PM(_{2.5})</td>
<td>0.049 gr/dscf</td>
<td>baghouse</td>
<td>99.00%</td>
<td>0.005</td>
<td>Engineering estimate. Particulate from spray dryer also removed in baghouse.</td>
<td>Emission factor is grain loading which is a controlled value; therefore the percent control is given for informational purposes only and is not used in the calculation.</td>
</tr>
<tr>
<td></td>
<td>SO(_2)</td>
<td>23.92 lb/ton coal</td>
<td>dry scrubber</td>
<td>90.00%</td>
<td>2.39</td>
<td>Material balance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NO(_x)</td>
<td>1.00 lb/ton coal</td>
<td>Haverhill limit</td>
<td></td>
<td></td>
<td>Provided by Sun Coke Co.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VOC</td>
<td>10.0 ppm</td>
<td></td>
<td></td>
<td></td>
<td>Provided by Sun Coke Co.</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>H(_2)SO(_4)</td>
<td>1.22 lb/ton coal</td>
<td>dry scrubber</td>
<td>98.00%</td>
<td>0.024</td>
<td>Haverhill data. Uncontrolled = 0.051 lb H(_2)SO(_4)/lb SO(_2).</td>
<td></td>
</tr>
</tbody>
</table>

**Pushing**

| PM | See Note | lb/ton coke | flat car push / multicyclone | 98.00% | 0.04 | MACT standard for pushing into mobile device that captures emissions during travel. |

**Quenching**

| PM | See Note | lb/ton coal | baffles, cleaned make-up water | 0.12 | AP-42, Coke Production Section, Table 12.2-12. Filterable PM. No data for condensable PM. |

**Coke screening**

| PM | See Note | gr/dscf | baghouse | 99.00% | 0.008 | Engineering estimate. |

**Coke/screened coke storage pile**

<p>| PM | 2.19 lb/day/acre | none | 0.00% | AP-40, Section 4, Equation (5) | k = 0.5 for PM(<em>{10}) |
| PM(</em>{10}) | 1.10 lb/day/acre | none | 0.00% | AP-40, Section 4, Equation (5) | k = 0.2 for PM(<em>{10}) |
| PM(</em>{2.5}) | 0.44 lb/day/acre | none | 0.00% | AP-40, Section 4, Equation (5) | |</p>
<table>
<thead>
<tr>
<th>Emission Unit</th>
<th>Pollutant</th>
<th>Uncontrolled EF</th>
<th>Units</th>
<th>Control Mechanism</th>
<th>Control Efficiency</th>
<th>Controlled EF</th>
<th>Reference</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coke pile load-in</td>
<td>PM</td>
<td>1.69E-03 lb/ton coke</td>
<td>Partial enclosure, stacking tube</td>
<td>70.00%</td>
<td>5.07E-04 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM&lt;sub&gt;10&lt;/sub&gt;</td>
<td>7.99E-04 lb/ton coke</td>
<td>Partial enclosure, stacking tube</td>
<td>70.00%</td>
<td>2.40E-04 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM&lt;sub&gt;2.5&lt;/sub&gt;</td>
<td>2.51E-04 lb/ton coke</td>
<td>Partial enclosure, stacking tube</td>
<td>70.00%</td>
<td>7.53E-05 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11</td>
<td></td>
</tr>
<tr>
<td>Coke breeze bin</td>
<td>PM</td>
<td>1.69E-03 lb/ton coke</td>
<td>Enclosure, wet material</td>
<td>70.00%</td>
<td>5.07E-04 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74</td>
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<tr>
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<td>PM&lt;sub&gt;10&lt;/sub&gt;</td>
<td>7.99E-04 lb/ton coke</td>
<td>Enclosure, wet material</td>
<td>70.00%</td>
<td>2.40E-04 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35</td>
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<tr>
<td></td>
<td>PM&lt;sub&gt;2.5&lt;/sub&gt;</td>
<td>2.51E-04 lb/ton coke</td>
<td>Enclosure, wet material</td>
<td>70.00%</td>
<td>7.53E-05 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11</td>
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<tr>
<td>Coke transfer</td>
<td>PM</td>
<td>1.69E-03 lb/ton coke</td>
<td>Enclosure, wet material</td>
<td>70.00%</td>
<td>5.07E-04 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74</td>
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</tr>
<tr>
<td></td>
<td>PM&lt;sub&gt;10&lt;/sub&gt;</td>
<td>7.99E-04 lb/ton coke</td>
<td>Enclosure, wet material</td>
<td>70.00%</td>
<td>2.40E-04 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35</td>
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</tr>
<tr>
<td></td>
<td>PM&lt;sub&gt;2.5&lt;/sub&gt;</td>
<td>2.51E-04 lb/ton coke</td>
<td>Enclosure, wet material</td>
<td>70.00%</td>
<td>7.53E-05 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11</td>
<td></td>
</tr>
<tr>
<td>Breeze loadout</td>
<td>PM</td>
<td>1.69E-03 lb/ton coke</td>
<td>Enclosure, wet material</td>
<td>70.00%</td>
<td>5.07E-04 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74</td>
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</tr>
<tr>
<td></td>
<td>PM&lt;sub&gt;10&lt;/sub&gt;</td>
<td>7.99E-04 lb/ton coke</td>
<td>Enclosure, wet material</td>
<td>70.00%</td>
<td>2.40E-04 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35</td>
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</tr>
<tr>
<td></td>
<td>PM&lt;sub&gt;2.5&lt;/sub&gt;</td>
<td>2.51E-04 lb/ton coke</td>
<td>Enclosure, wet material</td>
<td>70.00%</td>
<td>7.53E-05 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11</td>
<td></td>
</tr>
<tr>
<td>Breeze Pile</td>
<td>PM</td>
<td>10.74 lb/day/acre</td>
<td>none</td>
<td>0.00%</td>
<td>0.09%</td>
<td>AP-40, Section 4, Equation (5)</td>
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<tr>
<td></td>
<td>PM&lt;sub&gt;10&lt;/sub&gt;</td>
<td>5.37 lb/day/acre</td>
<td>none</td>
<td>0.00%</td>
<td>0.09%</td>
<td>AP-40, Section 4, Equation (5)</td>
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<tr>
<td></td>
<td>PM&lt;sub&gt;2.5&lt;/sub&gt;</td>
<td>2.15 lb/day/acre</td>
<td>none</td>
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<td>0.09%</td>
<td>AP-40, Section 4, Equation (5)</td>
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</tr>
<tr>
<td>Coke loadout</td>
<td>PM</td>
<td>1.69E-03 lb/ton coke</td>
<td>Enclosure, wet material</td>
<td>70.00%</td>
<td>5.07E-04 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.74</td>
<td></td>
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<tr>
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<td>PM&lt;sub&gt;10&lt;/sub&gt;</td>
<td>7.99E-04 lb/ton coke</td>
<td>Enclosure, wet material</td>
<td>70.00%</td>
<td>2.40E-04 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.35</td>
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<tr>
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<td>PM&lt;sub&gt;2.5&lt;/sub&gt;</td>
<td>2.51E-04 lb/ton coke</td>
<td>Enclosure, wet material</td>
<td>70.00%</td>
<td>7.53E-05 lb/ton coke</td>
<td>AP-42 Fifth Edition, Table 13.2.4-1 and Equation (1)</td>
<td>per transfer pt.; 4.8% moisture (maximum for use of equation); k = 0.11</td>
<td></td>
</tr>
</tbody>
</table>

Wind speed: 9.9 mph
% time wind speed exceeds 12 mph: 29%
Actual coal moisture content: 4.8%
Coke moisture content: 7.0%
Coal silt content: 4.6%
Coke breeze silt content: 4.9%
Days with >=0.01 in rain per year: 130 days

Summary calcs 100 ovens Rev 11
Control 7/9/2008
**Middletown Coke Company**

**100 Ovens**

0.6 MM tons furnace coke/year

### Assumptions

<table>
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<th>% moisture</th>
<th>MM wet tons/yr</th>
<th>MM dry tons/yr</th>
<th>Based on</th>
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<tbody>
<tr>
<td>7.0%</td>
<td>0.6138</td>
<td>0.5709</td>
<td>2,500</td>
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</tbody>
</table>

**Coal Used:**
8.0% 0.9125 tons wet coal/day charge rate

**Coke Breeze:**
7.0% 0.0406 0.0378

**Yield:**
68.0% (dry coke to dry coal) 4.5% dry coal to dry breeze

**Individual waste heat stacks:**
- Days per year / individual wh stack: 15
- Days with 20.0% gas through wh stack: 50
- Days with 100% gas through main stack: 310

### Emission Units

<table>
<thead>
<tr>
<th>Emission Units</th>
<th>Filterable PM</th>
<th>Total PM</th>
<th>Filterable PM</th>
<th>Estimated Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EF Emissions (tons/yr)</td>
<td>EF Emissions (tons/yr)</td>
<td>EF Emissions (tons/yr)</td>
<td>EF Emissions (tons/yr)</td>
</tr>
<tr>
<td>Coal Unloading, Storage, and Handling</td>
<td>9.51</td>
<td>4.56</td>
<td>4.56</td>
<td>1.53</td>
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<tr>
<td>Coal Crushing</td>
<td>0.0016</td>
<td>0.0008</td>
<td>0.0008</td>
<td>0.00024</td>
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<tr>
<td>Charging (fugitive)</td>
<td>0.0027</td>
<td>1.23</td>
<td>0.000181</td>
<td>0.37</td>
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<tr>
<td>Charging (baghouse)</td>
<td>0.0081</td>
<td>3.40</td>
<td>0.0061</td>
<td>6.72</td>
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<td>Main stack</td>
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<td>46.93</td>
<td>0.011</td>
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<td>Individual waste heat stacks</td>
<td>0.049</td>
<td>18.90</td>
<td>0.083</td>
<td>32.01</td>
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<td>Pushing (collector)</td>
<td>0.040</td>
<td>13.09</td>
<td>0.080</td>
<td>26.18</td>
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<td>Coke screening</td>
<td>0.12</td>
<td>54.75</td>
<td>0.044</td>
<td>20.08</td>
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<tr>
<td>Lime Silo</td>
<td>0.008</td>
<td>15.02</td>
<td>0.008</td>
<td>15.02</td>
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<tr>
<td>FGD Silo</td>
<td>0.01</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
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<tr>
<td>Paved Roads &amp; Parking</td>
<td>21.57</td>
<td>4.21</td>
<td>4.21</td>
<td>1.05</td>
</tr>
<tr>
<td>Total</td>
<td>195.04</td>
<td>217.54</td>
<td>131.71</td>
<td>114.15</td>
</tr>
</tbody>
</table>

**Notes for emissions spreadsheet:**

1. EF lb/wet ton coal, particulate lb/dry ton coal
2. EF lb/wet ton coal, particulate grains/dscf, CO and VOC ppm
3. EF lb/wet ton coal, particulate lb/dry ton coke
4. EF lb/wet ton coal
5. EF grains/dscf
6. Lead emissions include 20% buffer that recognizes the EF are based on AP-42 emission factors that can change or limited test data but still establishes a limit that maintains the facility’s status as a minor source for lead emissions.
### Material Handling and Vehicles Fugitive PM / PM$_{10}$/PM$_{2.5}$

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Conv.</th>
<th>PM (lb/hr)</th>
<th>PM$_{10}$ (lb/hr)</th>
<th>PM$_{2.5}$ (lb/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>x1</td>
<td>Coal Unloading</td>
<td>Controlled</td>
<td>0.0125</td>
<td>0.0062</td>
<td>0.0019</td>
</tr>
<tr>
<td>x2</td>
<td>Coke from Hot Car to Quench Car</td>
<td>Partial</td>
<td>0.0379</td>
<td>0.0179</td>
<td>0.0056</td>
</tr>
<tr>
<td>x3</td>
<td>Coke from Quench Car to Wharf</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x4</td>
<td>Transfer to Silo Feed Conveyors</td>
<td>Unc</td>
<td>0.1959</td>
<td>0.0968</td>
<td>0.0323</td>
</tr>
<tr>
<td>x5</td>
<td>Transfer to Slag Reclaim Hopper</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x6</td>
<td>Coke Transfer #1</td>
<td>Unc</td>
<td>0.0125</td>
<td>0.0062</td>
<td>0.0019</td>
</tr>
<tr>
<td>x7</td>
<td>Coke Emergency Storage Pile</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x8</td>
<td>Coke Emergency Storage Pile Unc</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x9</td>
<td>Coke to Slag Reclaim Hopper</td>
<td>Unc</td>
<td>0.1262</td>
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<td>0.0188</td>
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<tr>
<td>x10</td>
<td>Coke Transfer Plant Feed Conveyor</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
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<tr>
<td>x11</td>
<td>Coke to screening station</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x12</td>
<td>Coke to screening station Unc</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x13</td>
<td>Coke Emergency Storage Pile Unc</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x14</td>
<td>Coke Emergency Storage Pile</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x15</td>
<td>Coke Emergency Storage Pile</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x16</td>
<td>Coke to screening station</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x17</td>
<td>Coke to screening station Unc</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x18</td>
<td>Coke Emergency Storage Pile</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x19</td>
<td>Coke Emergency Storage Pile Unc</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x20</td>
<td>Coke from Hot Car to Quench Car</td>
<td>Partial</td>
<td>0.0379</td>
<td>0.0179</td>
<td>0.0056</td>
</tr>
<tr>
<td>x21</td>
<td>Coke from Quench Car to Wharf</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x22</td>
<td>Coke Transfer Plant Feed Conveyor</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x23</td>
<td>Coke to screening station</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x24</td>
<td>Coke to screening station Unc</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x25</td>
<td>Coke Emergency Storage Pile</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x26</td>
<td>Coke Emergency Storage Pile Unc</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x27</td>
<td>Coke Emergency Storage Pile</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x28</td>
<td>Coke Emergency Storage Pile Unc</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
<tr>
<td>x29</td>
<td>Coke Emergency Storage Pile</td>
<td>Unc</td>
<td>0.1262</td>
<td>0.0597</td>
<td>0.0188</td>
</tr>
</tbody>
</table>

**Maximum Production data:**
- **Maximum daily rate:** 2500 tons wet coal/day
- **Maximum daily furnace coke:** 1682 tons wet coke/day
- **Maximum ROV coke:** 1793 tons wet coke/day

**Summary calculations:**
- **PM (tons/yr)**: 41.58
- **PM$_{10}$ (tons/yr)**: 13.79
- **PM$_{2.5}$ (tons/yr)**: 4.20

**Vehicles:**
- **Summary:** 4.92
- **Total fugitive:** 9.49

**Annual (tpy):**
- **Coal Piles:** 4.19
- **Coal handling:** 6.05
- **Coke Piles:** 3.32
- **Coke handling:** 6.46
- **Vehicles:** 21.57

**Total annual fugitive (tpy):**
- 41.58
### Revised July 2008

### Middletown Coke Company

**Maximum Annual Production**

- **912,500 tons wet coal/year**
- **37,500 tons individual wg stacks**
- **4.1% Gas through ind wg stacks**

### Maximum Annual Production

- **912,500 tons wet coal/year**
- **Tons individual wg stacks**
- **37,500**

### Ind WG Stack Main Stack [b] Main Stack [c] Total Charging [a,d] Charging Pushing [e] Pushing Quenching [f] Quenching

### AP-42

- **Annual Stack Annual Test Data Annual Total**

### Compound CAS AP-42 [a] Emission Factor (lbs/ton) Ind WS Stack Emissions (tons/yr) Spray Dryer/BH (% ) Main Stack (b) Emissions (tons/yr) Removal (%) Main Stack (c) Total Emissions (tons/yr) Charging [a,d] Emission Factor (tons/yr) Charging [a,d] Emission Factor (tons/yr) Pushing [e] Test Date Emission Factor (tons/yr) Pushing [e] Emission Factor (tons/yr) Quenching [f] Test Date Emission Factor (tons/yr) Quenching [f] Emission Factor (tons/yr)

#### Benzene

- 106-95-2
- **4.80E-04**
- **9.00E-03**
- **0%**
- **2.19E-01**
- **2.28E-01**
- **3.60E-05**
- **1.64E-02**

#### Bromobenzene

- 108-91-0
- **8.00E-04**
- **1.50E-02**
- **0%**
- **2.97E-02**
- **3.15E-02**
- **3.60E-05**
- **1.64E-02**

#### Chlorobenzene

- 106-95-2
- **5.60E-04**
- **1.00E-02**
- **0%**
- **2.97E-02**
- **3.15E-02**
- **3.60E-05**
- **1.64E-02**

#### Chloroform

- 75-09-2
- **7.30E-04**
- **1.40E-02**
- **0%**
- **2.97E-02**
- **3.15E-02**
- **3.60E-05**
- **1.64E-02**

#### CNN

- 80-28-6
- **1.20E-05**
- **2.00E-04**
- **0%**
- **2.97E-02**
- **3.15E-02**
- **3.60E-05**
- **1.64E-02**

#### Ethyl Benzene

- 104-14-4
- **3.20E-06**
- **6.00E-05**
- **0%**
- **2.97E-02**
- **3.15E-02**
- **3.60E-05**
- **1.64E-02**

#### Hydrogen Chloride [g]

- **3.94E-04**
- **7.30E-04**
- **1.50E-02**
- **2.97E-02**
- **3.15E-02**
- **3.60E-05**
- **1.64E-02**

#### Kerosene

- 74-84-8
- **5.00E-04**
- **1.00E-02**
- **0%**
- **2.97E-02**
- **3.15E-02**
- **3.60E-05**
- **1.64E-02**

#### Methylene Chloride

- 75-09-2
- **7.30E-04**
- **1.40E-02**
- **0%**
- **2.97E-02**
- **3.15E-02**
- **3.60E-05**
- **1.64E-02**

#### n-Hexane

- 106-95-2
- **1.50E-05**
- **2.81E-04**
- **0%**
- **2.97E-02**
- **3.15E-02**
- **3.60E-05**
- **1.64E-02**

#### Methylcyclopentane

- 106-95-2
- **8.90E-06**
- **1.68E-04**
- **0%**
- **2.97E-02**
- **3.15E-02**
- **3.60E-05**
- **1.64E-02**

#### Methylcyclohexane

- 106-95-2
- **8.90E-06**
- **1.68E-04**
- **0%**
- **2.97E-02**
- **3.15E-02**
- **3.60E-05**
- **1.64E-02**

#### Methanol

- 74-84-8
- **1.50E-05**
- **2.81E-04**
- **0%**
- **2.97E-02**
- **3.15E-02**
- **3.60E-05**
- **1.64E-02**

### Lead

- 7439-92-1
- **4.56E-02**
- **8.55E-02**
- **95.0%**
- **1.04E-01**
- **1.90E-01**
- **1.00E-07**
- **4.56E-05**
- **1.53E-02**
- **3.96E-05**
- **2.36E-01**

### Manganese

- 7439-96-5
- **3.00E-04**
- **5.63E-03**
- **95.0%**
- **6.84E-03**
- **1.25E-02**
- **4.60E-07**
- **2.10E-04**
- **2.10E-06**
- **9.58E-04**
- **3.24E-05**

### Phosphorus

- 7723-14-0
- **1.40E-02**
- **2.63E-01**
- **95.0%**
- **3.19E-01**
- **5.82E-01**
- **7.77E-05**
- **3.55E-02**
- **7.30E-07**
- **3.33E-04**
- **1.85E-03**

### Selenium

- 7782-49-2
- **3.20E-04**
- **6.00E-03**
- **95.0%**
- **7.30E-03**
- **1.33E-02**
- **7.77E-05**
- **3.55E-02**
- **7.30E-07**
- **3.33E-04**
- **1.85E-03**

### Total HAPs (tons/yr)

- **53.73**
- **66.95**
- **120.70**
- **0.11**
- **0.21**
- **121.91**

### Total HAPs (except HCl) with 20% buffer (tons/year)

- **3.64**

---


**b** - Estimated 0% removal for organic compounds; 95% removal for all metals except mercury.

**c** - Controlled emission factors; uses average of uncontrolled emission factors from maximum coal blend specification.

**d** - Minimum 50% mercury removal expected.

**e** - Jewell test data, October 1989. Lead from AP-42


**g** - Uncorrected coking emission factor from maximum coal blend specification.

**h** - Minimum 50% mercury removal expected.

**i** - Total HAPs (except HCl) emissions include 20% buffer that recognizes the EF are based on AP-42 emission factors that can change and limited test data.

**ND** - Not detected or not reported

**NM** - Not measured

**NDR/NR** - Not detected or not reported
## MIDDLETOWN COKE COMPANY

### UR5 Corporation

**CALCULATION SHEET**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Project: Preliminary Calculation - Middletown Coke Company</td>
<td></td>
<td>Project No.: 39400297-26000</td>
<td></td>
</tr>
<tr>
<td>Subject: Process Data Used in Sample Calculations</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **No. of waste heat stacks**: 5
- **% moisture**:
  - MM wet tons/yr
  - MM dry tons/yr
- **No. of days/yr with waste heat exhausted through each individual waste heat stack**: 15 days/yr
- **Furnace Coke Production**:
  - 7.00% 0.6138 0.5709 100 Ovens
- **Coal Used**: 8.00% 0.0125 0.0395 50.0 Short Tons per Charge
- **Coke Breeze**: 7.00% 0.0406 0.0378 46.0 Dry Tons per Charge
- **Total Coke (Coke + Breeze)**: 0.6544 0.6086 35.9 Wet Tons per Push
- **912,800 Tons Coal per Year**
- **654,449 Tons Coke per Year**
- **912,800 Tons Coal per Year**
- **654,449 Tons Coke per Year**

<table>
<thead>
<tr>
<th>% moisture</th>
<th>MM wet tons/yr</th>
<th>MM dry tons/yr</th>
<th>No. of days/yr with waste heat exhausted through each individual waste heat stack</th>
<th>Days per year</th>
<th>Days with no gas through individual waste heat stacks</th>
<th>Days with partial (20%) gas through individual waste heat stacks</th>
<th>Days with 100% gas through individual waste heat stacks</th>
<th>Total gas through individual waste heat stacks</th>
<th>4.1%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furnace Coke Production:</td>
<td>7.00% 0.6138 0.5709 100 Ovens</td>
<td></td>
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</tr>
<tr>
<td>Total Coke (Coke + Breeze):</td>
<td>0.6544 0.6086 35.9 Wet Tons per Push</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum daily rate =</td>
<td>2,500 tons wet coal/day</td>
<td>2,268 tons wet coal/day</td>
<td>2,300 tons dry coal/day</td>
<td>2,087 tons dry coal/day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum daily coke produced =</td>
<td>1,682 tons wet coke/day</td>
<td>1,526 tons wet coke/day</td>
<td>1,564 tons dry coke/day</td>
<td>1,419 tons dry coke/day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum daily breeze produced =</td>
<td>111 tons wet breeze/day</td>
<td>101 tons wet breeze/day</td>
<td>104 tons dry breeze/day</td>
<td>94 tons dry breeze/day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total max. coke and breeze produced =</td>
<td>1,793 tons wet coke and breeze/day</td>
<td>1,627 tons wet coke and breeze/day</td>
<td>1,668 tons dry coke and breeze/day</td>
<td>1,513 tons dry coke and breeze/day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 oven FGD gas stack flowrate =</td>
<td>250,000 dscfm (main stack)</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Yield:**

- 68.0% (dry coal to dry furnace coke)
- 4.5% dry coal to dry breeze

**Short Tons**

- Maximum daily rate:
  - 2,500 tons wet coal/day
  - 2,268 tons wet coal/day
  - 2,300 tons dry coal/day
  - 2,087 tons dry coal/day
- Maximum daily coke produced:
  - 1,682 tons wet coke/day
  - 1,526 tons wet coke/day
  - 1,564 tons dry coke/day
  - 1,419 tons dry coke/day
- Maximum daily breeze produced:
  - 111 tons wet breeze/day
  - 101 tons wet breeze/day
  - 104 tons dry breeze/day
  - 94 tons dry breeze/day
- Total max. coke and breeze produced:
  - 1,793 tons wet coke and breeze/day
  - 1,627 tons wet coke and breeze/day
  - 1,668 tons dry coke and breeze/day
  - 1,513 tons dry coke and breeze/day

0.9072 Metric ton per Short ton
Purpose
To estimate criteria pollutant emissions due to coal unloading.

Basis
Total number of coal transfer points = 1
Maximum annual coal charge = 912,500 tons wet coal/yr

Control method: wet suppression or baghouse. Control efficiency = 70% (based on Ohio RACM Table 2.2.1-2)

Calculation
Use emission factors for coal handling from AP-42, 5th edition, Table 13.2.4-1 Equation (1)

\[
EF\ (lb/ton) = k \times 0.0032 \times \left( \frac{U}{5} \right)^{1.3} \left( \frac{M}{2} \right)^{1.4}
\]

where:
- \( k \), particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM10 = 0.35 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM2.5 = 0.11 (from AP-42, 5th edition)
- \( U \), mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
- \( M \), moisture content = 4.80% (for coal - max for equation)

PM EF (lb/ton coal) = 0.00169
PM10 EF (lb/ton coal) = 0.00080
PM2.5 EF (lb/ton coal) = 0.00025

Potential emissions estimation:

PM (tons/yr) = PM EF * # transfer points * tons coal transferred * (1 - control efficiency/100) * (ton/2000 lb) 
= (0.00169 lb/ton coal) * [(number transfer points) * (tons coal handled/transfer point)] * (ton/2000 lb) * (1-control efficiency / 100)
= 0.23 tons PM/yr

PM10 (tons/yr) = PM10 EF * # transfer points * tons coal transferred * (100% - control efficiency)/100% * (ton/2000 lb)
= (0.00080 lb/ton coal) * [(number transfer points) * (tons coal handled/transfer point)] * (ton/2000 lb) * (1-control efficiency / 100)
= 0.11 tons PM10/yr

PM2.5 (tons/yr) = PM2.5 EF * # transfer points * tons coal transferred * (100% - control efficiency)/100% * (ton/2000 lb)
= (0.00025 lb/ton coal) * [(number transfer points) * (tons coal handled/transfer point)] * (ton/2000 lb) * (1-control efficiency / 100)
= 0.03 tons PM2.5/yr
Purpose
To estimate criteria pollutant emissions from the coal storage piles.
(Includes coal load-in, fugitives from the pile itself, and coal loadout)
Emissions are broken down by part.
Total emissions for all storage piles included.

Part I. Coal Load-In

Purpose
To estimate criteria pollutant emissions due to coal load-in.

Basis
Two storage piles (Open storage piles)
Total number of coal transfer points = 2 (one each)  One "live" pile (Pile #2) with underpile conveyors
One "dead" pile (Pile #1)
Load-in by radial stacker

Maximum annual coal charge = 912,500 tons wet coal/yr

Assumptions
Coal load in to Open storage piles
Coal is loaded onto only 1 pile at a time
Assume the maximum annual coal charge for a conservative estimate of emissions
50% of coal loaded to each pile
Control efficiency for fully enclosed points for PM, PM$_{10}$ and PM$_{2.5}$ = 95% (estimated from Ohio RACM Table 2.2.1-2)

Calculation
Use emission factors for coal handling from AP-42, 5th edition, Table 13.2.4-1 Equation (1)

\[
EF_{PM} (lb/ton) = k \times 0.0032 \times \left( \frac{U}{5} \right)^{1.3} \left( \frac{M}{2} \right)^{1.4}
\]

where:
- k, particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
- k, particle size multiplier for PM$_{10}$ = 0.35 (from AP-42, 5th edition)
- k, particle size multiplier for PM$_{2.5}$ = 0.11 (from AP-42, 5th edition)
- U, mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
- M, moisture content = 4.80 % (for coal - max for equation)

PM EF (lb/ton coal) = 0.00169
PM$_{10}$ EF (lb/ton coal) = 0.00080
PM$_{2.5}$ EF (lb/ton coal) = 0.00025

Potential emissions estimation:

\[
PM (tons/yr) = PM EF \times \text{tons coal transferred}
\]
\[
= (0.00169 \text{ lb/ton coal}) \times \text{(tons coal handled) \times (ton/2000 lb)}
\]
\[
= 0.39 \text{ tons PM yr} \quad \text{Coal Pile #1}
\]
\[
= 0.39 \text{ tons PM yr} \quad \text{Coal Pile #2}
\]

PM$_{10}$ (tons/yr) = PM$_{10}$ EF \times \text{tons coal transferred}
\[
= (0.00080 \text{ lb/ton coal}) \times \text{(tons coal handled) \times (ton/2000 lb)}
\]
\[
= 0.18 \text{ tons PM$_{10}$ yr} \quad \text{Coal Pile #1}
\]
\[
= 0.18 \text{ tons PM$_{10}$ yr} \quad \text{Coal Pile #2}
\]

PM$_{2.5}$ (tons/yr) = PM$_{2.5}$ EF \times \text{tons coal transferred}
\[
= (0.00025 \text{ lb/ton coal}) \times \text{(tons coal handled) \times (ton/2000 lb)}
\]
\[
= 0.06 \text{ tons PM$_{2.5}$ yr} \quad \text{Coal Pile #1}
\]
\[
= 0.06 \text{ tons PM$_{2.5}$ yr} \quad \text{Coal Pile #2}
\]
Part II. Coal Storage Piles

Purpose
To estimate criteria pollutant emissions from the coal storage piles.

Basis
Total Coal Storage acres =
1.2 acres Coal Pile #1 (Dead Pile)
1.3 acres Coal Pile #2 (Live Pile)

Assumptions
Number days pile worked in = 365 days (worst case - work both piles everyday)
Control efficiency for Open storage pile = 50% (watering)

Calculation
Use emission factors for storage pile fugitive emissions from AP-40, Section 4, Fugitive Emissions, p. 136, Equation (5)

\[
EF (\text{lb/day/acre}) = k \times 1.7 \times \left(\frac{s}{1.5}\right) \times \left(\frac{365 - p}{235}\right) \times \left(\frac{f}{15}\right)
\]

where:
- \(k\), particle size multiplier for PM = 1
- \(k\), particle size multiplier for PM10 = 0.5
- \(k\), particle size multiplier for PM2.5 = 0.2
- \(s\), silt content for coal = 4.6 % (from AP-42, 5th edition, Table 13.2.4-1)
- \(f\), percentage of time that the unobstructed wind speed exceeds \(\geq\) 5.4 m/s at mean pile height = 29
- \(p\), number of days with \(\geq\) 0.01 inch of precipitation per year = 130 days (for Middletown, Ohio from AP-42, 5th edition, Figure 13.2.2-1)

\[
PM \text{ EF (lb/day/acre)} = 10.08
\]

\[
PM_{10} \text{ EF (lb/day/acre)} = 5.04
\]

\[
PM_{2.5} \text{ EF (lb/day/acre)} = 2.02
\]

Potential annual emissions:
\[
PM \text{ (tons/yr)} = PM \text{ EF } \times \text{ Acres of pile } \times \text{ days pile worked in } \times (1 \text{- control efficiency/100})
\]

\[
= (10.08 \text{ lb/day/acre}) \times (\text{acre}) \times (365 \text{ days/yr}) \times (\text{ton/2000 lb}) \times (1 \text{- control efficiency/100})
\]

\[
= 1.10 \text{ tons PM/yr} \quad \text{Coal Pile #1}
\]

\[
= 1.20 \text{ tons PM/yr} \quad \text{Coal Pile #2}
\]

\[
PM_{10} \text{ (tons/yr)} = PM_{10} \text{ EF } \times \text{ Acres of pile } \times \text{ days pile worked in } \times (1 \text{- control efficiency/100})
\]

\[
= (5.04 \text{ lb/day/acre}) \times (\text{acre}) \times (365 \text{ days/yr}) \times (\text{ton/2000 lb}) \times (1 \text{- efficiency/100})
\]

\[
= 0.55 \text{ tons PM10/yr} \quad \text{Coal Pile #1}
\]

\[
= 0.60 \text{ tons PM10/yr} \quad \text{Coal Pile #2}
\]

\[
PM_{2.5} \text{ (tons/yr)} = PM_{2.5} \text{ EF } \times \text{ Acres of pile } \times \text{ days pile worked in } \times (1 \text{- control efficiency/100})
\]

\[
= (2.02 \text{ lb/day/acre}) \times (\text{acre}) \times (365 \text{ days/yr}) \times (\text{ton/2000 lb}) \times (1 \text{- efficiency/100})
\]

\[
= 0.22 \text{ tons PM2.5/yr} \quad \text{Coal Pile #1}
\]

\[
= 0.24 \text{ tons PM2.5/yr} \quad \text{Coal Pile #2}
\]
Part III. Coal Loadout

Purpose
To estimate criteria pollutant emissions due to coal loadout.

Basis
Storage piles (Open storage piles) 1 Coal Pile #1 (Dead Pile) 1 Coal Pile #2 (Live Pile)
Maximum annual coal charge = 912,500 tons wet coal/yr

Assumptions
Assume coal from coal pile #1 (50% coal) is loaded out to coal pile #2 and emissions are the same as 2 uncontrolled transfer points
Assume 100% coal load out from coal pile #2 from underpile conveyor to the ovens
Assume additional 20% loadout from front end loader (2 uncontrolled points)
Assume the maximum annual coal charge for a conservative estimate of emissions
Control efficiency for load out using Underpile conveyor for PM, PM10 and PM2.5 = 95% (Coal Pile #2 only)

Calculation
Use emission factors for coal handling from AP-42, 5th edition, Table 13.2.4-1 Equation (1)

\[
EF (lb/ton) = k \cdot 0.0032 \cdot \frac{U}{5} \cdot \frac{1.3}{M/2} \cdot \frac{1}{4}
\]

where:
- \( k \), particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM10 = 0.35 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM2.5 = 0.11 (from AP-42, 5th edition)
- \( U \), mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
- \( M \), moisture content = 4.80 % (for coal - max for equation)

PM EF (lb/ton coal) = 0.00169
PM10 EF (lb/ton coal) = 0.00080
PM2.5 EF (lb/ton coal) = 0.00025

Potential emissions estimation:

PM (tons/yr) = (EF lb/ton coal) \cdot (tons coal handled) \cdot (# transfer points) \cdot (ton/2000 lb) \cdot (1 - efficiency/100)
= 0.771 tons PM/yr Coal Pile #1 to Coal Pile #2
= 0.039 tons PM/yr Coal Pile #2
= 0.308 tons PM/yr Front end loader

PM10 (tons/yr) = (EF lb/ton coal) \cdot (tons coal handled) \cdot (# transfer points) \cdot (ton/2000 lb) \cdot (1 - efficiency/100)
= 0.365 tons PM10/yr Coal Pile #1 to Coal Pile #2
= 0.018 tons PM10/yr Coal Pile #2
= 0.146 tons PM10/yr Front end loader

PM2.5 (tons/yr) = (EF lb/ton coal) \cdot (tons coal handled) \cdot (# transfer points) \cdot (ton/2000 lb) \cdot (1 - efficiency/100)
= 0.115 tons PM2.5/yr Coal Pile #1 to Coal Pile #2
= 0.006 tons PM2.5/yr Coal Pile #2
= 0.046 tons PM2.5/yr Front end loader

Part IV. Total Coal Emissions:

Storage Piles
PM (tons/yr) = coal load-in (tons/yr) + coal pile (tons/yr) + coal loadout (tons/yr) = 2.26 tons PM/yr total Coal Pile #1
= 1.62 tons PM/yr total Coal Pile #2
= 0.31 tons PM/yr total Front end loader

PM10 (tons/yr) = coal load-in (tons/yr) + coal pile (tons/yr) + coal loadout (tons/yr) = 1.10 tons PM10/yr total Coal Pile #1
= 0.80 tons PM10/yr total Coal Pile #2
= 0.15 tons PM10/yr total Front end loader

PM2.5 (tons/yr) = coal load-in (tons/yr) + coal pile (tons/yr) + coal loadout (tons/yr) = 0.39 tons PM2.5/yr total Coal Pile #1
= 0.30 tons PM2.5/yr total Coal Pile #2
= 0.05 tons PM2.5/yr total Front end loader
### Part V. Total Emissions from All Storage Piles (F002):

#### PM

<table>
<thead>
<tr>
<th>Component</th>
<th>Emissions (tons PM/yr)</th>
<th>Calculation No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Coal Storage Piles</td>
<td>4.19</td>
<td></td>
</tr>
<tr>
<td>Total Run of Oven Coke Storage Pile</td>
<td>1.71</td>
<td>(from Calculation No. 10)</td>
</tr>
<tr>
<td>Total Emergency Coke Breeze Storage Pile</td>
<td>0.46</td>
<td>(from Calculation No. 16)</td>
</tr>
<tr>
<td>Total Emergency Screened Coke Storage Pile</td>
<td>1.16</td>
<td>(from Calculation No. 17)</td>
</tr>
<tr>
<td>Total Storage Piles</td>
<td>7.51</td>
<td></td>
</tr>
</tbody>
</table>

#### PM10

<table>
<thead>
<tr>
<th>Component</th>
<th>Emissions (tons PM10/yr)</th>
<th>Calculation No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Coal Storage Piles</td>
<td>2.04</td>
<td></td>
</tr>
<tr>
<td>Total Run of Oven Coke Storage Pile</td>
<td>0.82</td>
<td>(from Calculation No. 10)</td>
</tr>
<tr>
<td>Total Emergency Coke Breeze Storage Pile</td>
<td>0.23</td>
<td>(from Calculation No. 16)</td>
</tr>
<tr>
<td>Total Emergency Screened Coke Storage Pile</td>
<td>0.55</td>
<td>(from Calculation No. 17)</td>
</tr>
<tr>
<td>Total Storage Piles</td>
<td>3.64</td>
<td></td>
</tr>
</tbody>
</table>

#### PM2.5

<table>
<thead>
<tr>
<th>Component</th>
<th>Emissions (tons PM2.5/yr)</th>
<th>Calculation No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Coal Storage Piles</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>Total Run of Oven Coke Storage Pile</td>
<td>0.28</td>
<td>(from Calculation No. 10)</td>
</tr>
<tr>
<td>Total Emergency Coke Breeze Storage Pile</td>
<td>0.09</td>
<td>(from Calculation No. 16)</td>
</tr>
<tr>
<td>Total Emergency Screened Coke Storage Pile</td>
<td>0.16</td>
<td>(from Calculation No. 17)</td>
</tr>
<tr>
<td>Total Storage Piles</td>
<td>1.29</td>
<td></td>
</tr>
</tbody>
</table>
Purpose
To estimate criteria pollutant emissions due to coal handling and crushing.

Basis
Total number of coal transfer points = 18 enclosed = 12 unc. = 6
Maximum annual coal charge = 912,500 tons wet coal/yr

Assumptions
Control eff. for fully enclosed transfer points and wet suppression/wet material for PM, PM10, and PM2.5 = 95% (estimated from Ohio RACM Table 2.2.1-2)
Control eff. for fully enclosed coal crushing operations for PM, PM10, and PM2.5 = 99% (estimated from AP-40 and Ohio RACM)

Calculation
Use emission factors for coal handling from AP-42, 5th edition, Table 13.2.4-1 Equation (1)
EF (lb/ton) = k * 0.0032 * (U/5)1.3/(M/2)1.4
where:
k, particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
k, particle size multiplier for PM10 = 0.35 (from AP-42, 5th edition)
k, particle size multiplier for PM2.5 = 0.11 (from AP-42, 5th edition)
U, mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
M, moisture content = 4.80% (for coal - max for equation)

PM EF (lb/ton coal) = 1.69E-03 for Coal Handling
PM10 EF (lb/ton coal) = 7.99E-04 for Coal Handling
PM2.5 EF (lb/ton coal) = 2.51E-04 for Coal Handling

Use emission factors for coal sizing from AP-40, Coal Processing Section, Table 1 (same as RACM)
PM EF (lb/ton coal) = 0.16 for Coal Crushing
PM10 EF (lb/ton coal) = 0.08 for Coal Crushing (PM10 assumed to be 50% of PM)
PM2.5 EF (lb/ton coal) = 0.024 for Coal Crushing (PM2.5 assumed to be 15% of PM)

PM Emissions estimation for Coal Handling
<table>
<thead>
<tr>
<th>No. points</th>
<th>Throughput</th>
<th>Efficiency</th>
<th>Emissions (ton/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>100%</td>
<td>95%</td>
<td>0.4825</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>0%</td>
<td>4.6249</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>5.087</td>
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</tbody>
</table>

PM10 Emissions estimation for Coal Handling
<table>
<thead>
<tr>
<th>No. points</th>
<th>Throughput</th>
<th>Efficiency</th>
<th>Emissions (ton/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>100%</td>
<td>95%</td>
<td>0.2187</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>0%</td>
<td>2.1875</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>2.406</td>
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</table>

PM2.5 Emissions estimation for Coal Handling
<table>
<thead>
<tr>
<th>No. points</th>
<th>Throughput</th>
<th>Efficiency</th>
<th>Emissions (ton/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>100%</td>
<td>95%</td>
<td>0.0687</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>0%</td>
<td>0.6875</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>0.756</td>
</tr>
</tbody>
</table>

PM Emissions estimation for Coal Crushing
<table>
<thead>
<tr>
<th>No. points</th>
<th>Efficiency</th>
<th>Emissions (ton/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99%</td>
<td>0.730</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>0.730</td>
</tr>
</tbody>
</table>

PM10 Emissions estimation for Coal Crushing
<table>
<thead>
<tr>
<th>No. points</th>
<th>Efficiency</th>
<th>Emissions (ton/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99%</td>
<td>0.365</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>0.365</td>
</tr>
</tbody>
</table>

PM2.5 Emissions estimation for Coal Crushing
<table>
<thead>
<tr>
<th>No. points</th>
<th>Efficiency</th>
<th>Emissions (ton/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99%</td>
<td>0.110</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>0.110</td>
</tr>
</tbody>
</table>
Maximum Emissions for points with 100% of coal throughput - Coal Handling

Enclosed Transfer points

PM (ton/yr) = PM EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1 - control efficiency/100) = 0.0385 TPY PM

PM10 (ton/yr) = PM10 EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1 - control efficiency/100) = 0.0182 TPY PM10

PM2.5 (ton/yr) = PM2.5 EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1 - control efficiency/100) = 0.0057 TPY PM2.5

Maximum Emissions for Coal Crushing

TSP (tons/yr) = TSP EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1 - control efficiency/100) = 0.73 TPY PM

PM10 (tons/yr) = PM10 EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1 - control efficiency/100) = 0.365 TPY PM10

PM2.5 (tons/yr) = PM2.5 EF (lb/ton) * (tons/yr) * (ton/2000 lb) * (1 - control efficiency/100) = 0.110 TPY PM2.5

Total Emissions from Coal Handling & Processing (F003):

PM
Coal Unloading = 0.23 tons PM/yr (from Calculation No.1)
Total Coal Handling = 5.09 tons PM/yr
Total Coal Crushing = 0.73 tons PM/yr
Total Coal Handling & Processing = 6.05 tons PM/yr

PM10
Coal Unloading = 0.11 tons PM10/yr (from Calculation No.1)
Total Coal Handling = 2.41 tons PM10/yr
Total Coal Crushing = 0.37 tons PM10/yr
Total Coal Handling & Processing = 2.88 tons PM10/yr

PM2.5
Coal Unloading = 0.03 tons PM2.5/yr (from Calculation No.1)
Total Coal Handling = 0.76 tons PM2.5/yr
Total Coal Crushing = 0.11 tons PM2.5/yr
Total Coal Handling & Processing = 0.90 tons PM2.5/yr
Purpose
To estimate criteria pollutant emissions due to the charging of the ovens with coal.

Basis
Maximum annual coal charge = 912,500 tons wet coal/yr
Maximum daily coal charge = 3,750 tons wet coal/day
Number Pusher/Charger machines = 1
Charges per typical day = 50

Note: Each oven can only be charged every 48 hours.

Maximum charge rate = 10 ovens/hour
Typically charge 50 ovens/day. For maximum daily charge, assume possible to charge 75 ovens/day

PM = PM10 (total, filterable plus condensable)
PM2.5 = PM2.5 filterable

Emission Factors:
PM EF (lb/tons coal charged) = 0.027 (uncontrolled)
(From AP-42 Coke Production section, Table 12.2-21 uncontrolled)
PM EF (lb/tons coal charged) = 0.0027 (assuming 90% capture efficiency for emissions controlled by traveling hood and baghouse)
VOC EF (lb/ton coal charged) = 0.0020 Jewell stack test data, Vansant, VA
SO2 EF (lb/ton coal charged) = 0.0003 Jewell stack test data, Vansant, VA
CO EF (lb/ton coal charged) = 0.0028 Jewell stack test data, Vansant, VA
Lead (lb/ton coal charged) = 1.00E-07 (from AP-42 Coke Production section, Table 12.2-21 controlled) Add 20% to lead EF for buffer

PM10 : Assume PM10 = 30% of PM fugitives
Assume PM10 = 100% of PM stack
PM2.5 : Assume PM2.5 = 15% of PM fugitives
Assume PM2.5 = 100% of PM stack

PM EF = 0.0081 lb/ton (MACT Standard 40 CFR 63, Subpart L = 0.0081 lb/dry ton coal)
Total PMEF = 0.016 lb/ton (MACT Standard 40 CFR 63, Subpart L = 0.0081 lb/dry ton coal - Total PM with Condensible estimated as 0.016 lb/dry ton coal )

Charges per hour = 10

Emissions Estimation
Fugitive PM
0.027 lb PM/ton coal charged * 50 wet tons coal/charge * 10 charges/hr * (1-.90) = 1.35 lbs/hr fugitive PM max. hourly
0.027 lb PM/ton coal charged * 3,750 tons coal charged/day * day/24 hrs * (1-.90) = 0.42 lbs/hr fugitive PM daily restriction
0.027 lb PM/ton coal charged * 912,500 tons coal charged/yr * 1 ton / 2000 lbs = 1.23 TPY fugitive PM annual restriction

Fugitive PM10 (30% of PM)
0.3 * max hourly PM = 0.41 lbs/hr fugitive PM10 max. hourly
0.3 * daily PM = 0.13 lbs/hr fugitive PM10 daily restriction
0.3 * annual PM = 0.37 TPY fugitive PM10 annual restriction

Fugitive PM2.5 (15% of PM)
0.15 * max hourly PM = 0.20 lbs/hr fugitive PM2.5 max. hourly
0.15 * daily PM = 0.06 lbs/hr fugitive PM2.5 daily restriction
0.15 * annual PM = 0.18 TPY fugitive PM2.5 annual restriction

Stack Filterable PMPM2.5
0.0081 lb/dry ton coal * 46 tons dry coal/charge * 10 charges/hr = 3.73 lbs/hr max. hourly
Annual rate = 0.016 lb/dry ton coal charged * 839,500 wet tons coal/yr * 1 ton/2000 lbs = 3.40 TPY annual restriction

Stack Total PM10
0.016 lb/dry ton coal * 46 tons dry coal/charge * 10 charges/hr = 7.36 lbs/hr max. hourly
Annual rate = 0.016 lb/dry ton coal charged * 839,500 wet tons coal/yr * 1 ton/2000 lbs = 6.72 TPY annual restriction

SO2
0.0003 lb SO2/wet ton coal charged * 50 wet tons coal/charge * 10 charges/hr = 0.15 lbs SO2/hr max. hourly
0.0003 lb SO2/wet ton coal charged * 3,750 tons coal charged/day * 24 hrs = 0.05 lbs SO2/daily restriction
0.0003 lb SO2/wet ton coal charged * 912,500 tons coal charged/yr * 1 ton/2000 lbs = 0.14 TPY SO2 annual restriction

VOC
0.0020 lb VOC/wet ton coal charged * 50 wet tons coal/charge * 10 charges/hr = 1.00 lbs VOC/hr max. hourly
0.0020 lb VOC/wet ton coal charged * 3,750 tons coal charged/day * 24 hrs = 0.31 lbs VOC/daily restriction
0.0020 lb VOC/wet ton coal charged * 912,500 tons coal charged/yr * 1 ton/2000 lbs = 0.91 TPY VOC annual restriction

CO
0.0028 lb CO/wet ton coal charged * 50 wet tons coal/charge * 10 charges/hr = 1.40 lbs CO/hr max. hourly
0.0028 lb CO/wet ton coal charged * 3,750 tons coal charged/day * 24 hrs = 0.44 lbs CO/daily restriction
0.0028 lb CO/wet ton coal charged * 912,500 tons coal charged/yr * 1 ton/2000 lbs = 1.26 TPY CO annual restriction

Pb
0.0000001 lb Pb/wet ton coal charged * 50 wet tons coal/charge * 10 charges/hr = 0.0000001 lb Pb/hr max. hourly
0.0000001 lb Pb/wet ton coal charged * 3,750 tons coal charged/day * 24 hrs = 0.0000001 lb Pb/daily restriction
0.0000001 lb Pb/wet ton coal charged * 912,500 tons coal charged/yr * 1 ton/2000 lbs = 0.548E-05 TPY Pb annual restriction

7/9/2008 Middletown Detailed calcs 100 ovens Rev 11 Charging
To estimate criteria pollutant emissions due to the coking process.

The waste gas from the HRSGs goes to a lime spray dryer which then exhausts to a baghouse except during HRSG or SD/BH maintenance.

### Basis

<table>
<thead>
<tr>
<th></th>
<th>Main Stack</th>
<th>Individual Waste Heat Stack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum annual coal charge</td>
<td>912,500</td>
<td>7,500 tons wet coal/year</td>
</tr>
<tr>
<td>Maximum daily coal charge</td>
<td>2,500</td>
<td>500 tons wet coal/day</td>
</tr>
<tr>
<td>Max Airflow (dscfm)</td>
<td>250,000</td>
<td>50,000 dscfm total</td>
</tr>
<tr>
<td>No. of main stacks</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>No. of waste heat stacks</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>*No. of days/yr with waste gas exhausted through each individual waste heat stack</td>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

#### Emission factors:

<table>
<thead>
<tr>
<th>Emission factor</th>
<th>Main Stack</th>
<th>Waste Heat Stack</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM EF (grains/dscf)</td>
<td>0.005</td>
<td>0.005 (Engineering estimate - Filterable PM - Waste Heat Stack Haverhill Limit)</td>
</tr>
<tr>
<td>Total PM EF (grains/dscf)</td>
<td>0.011</td>
<td>0.011 (Engineering estimate - Total PM EF with condensable)</td>
</tr>
<tr>
<td>PM2.5 EF (grains/dscf)</td>
<td>0.005</td>
<td>0.005 (Engineering estimate - Filterable PM2.5)</td>
</tr>
<tr>
<td>SO2 EF (lb/ton charged)</td>
<td>23.92</td>
<td>23.92 (Material Balance)</td>
</tr>
<tr>
<td>NOx EF Coking (lb/ton charged)</td>
<td>1</td>
<td>1 (Haverhill Limit)</td>
</tr>
<tr>
<td>CO EF (ppm)</td>
<td>20</td>
<td>20 (Provided by Sun Coke)</td>
</tr>
<tr>
<td>VOC EF (ppm)</td>
<td>10</td>
<td>10 (Provided by Sun Coke)</td>
</tr>
<tr>
<td>H2SO4 (lb/ton charged)</td>
<td>2.84</td>
<td>2.84 (Maximum coal blend specification)</td>
</tr>
<tr>
<td>Uncontrolled Lead EF (lb/ton wet coal charged)</td>
<td>0.00456</td>
<td>0.00456 (Haverhill April 2006 Stack Test) - Add 20% to lead EF for buffer</td>
</tr>
</tbody>
</table>

#### Assumptions

- Main stacks annual emissions based on maximum hourly rate and 8760 hours/year
- Lime spray scrubber control efficiency for SO2= 90% (engineering estimate)
- Lime spray scrubber control efficiency for HCl= 95% (engineering estimate)
- Baghouse control efficiency for lead = 95% (engineering estimate)
- Baghouse control efficiency for H2SO4 = 98% (engineering estimate)

#### Emissions Estimation

<table>
<thead>
<tr>
<th>Emission factor</th>
<th>Main Stack</th>
<th>Individual Waste Heat Stack</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filterable PM/PM2.5</td>
<td>10.71</td>
<td>21.00 lbs/hr Filterable PM/PM2.5</td>
</tr>
<tr>
<td>Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb</td>
<td>46.93</td>
<td>3.78 18.90 TPY Filterable PM/PM2.5</td>
</tr>
<tr>
<td>Total PM0</td>
<td>23.57</td>
<td>lbs/hr Total PM0</td>
</tr>
<tr>
<td>Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb</td>
<td>103.24</td>
<td>6.40 32.01 TPY Total PM0</td>
</tr>
<tr>
<td>SO2</td>
<td>249.17</td>
<td>lbs SO2/hr</td>
</tr>
<tr>
<td>Annual = Hourly (lbs/hr) * Operating hours / yr * ton/2000 lb</td>
<td>1091.35</td>
<td>89.70 448.50 TPY SO2</td>
</tr>
<tr>
<td>3-Hour maximum hourly rate = daily average * 1.2</td>
<td>299.00</td>
<td>lbs SO2/hr</td>
</tr>
<tr>
<td>Uncontrolled SO2</td>
<td>2491.67</td>
<td>lbs SO2/hr</td>
</tr>
</tbody>
</table>

7/9/2008 Middletown Detailed calcs 100 ovens Rev 11 Coking 100 ovens
### NO\textsubscript{X} Emissions

Coking - \( \text{lb NO}_x/\text{ton coal charged} \times \text{tons charged/day} \times \frac{1}{24} \text{hr} \)  
\begin{align*}
\text{Coking annual} &= \text{Hourly (lbs/hr)} \times \text{Operating hours / yr} \times \frac{\text{tons charged/day}}{2000} \\
&= 456.25 \times 3.75 = 18.75 \text{ TPY NO}_x
\end{align*}

### CO Emissions

\( \text{dscf/min} \times \text{ppm CO} \times \frac{(28/385100000) \text{ lb/dscf}}{} \)  
\begin{align*}
\text{Annual} &= \text{Hourly (lbs/hr)} \times \text{Operating hours / yr} \times \frac{\text{ton}}{2000} \\
&= 21.81 \times 4.36 = 3.93 \text{ TPY CO}
\end{align*}

### VOC Emissions

\( \text{dscf/min} \times \text{ppm VOC} \times \frac{(12/385100000) \text{ lb/dscf}}{} \)  
\begin{align*}
\text{Annual} &= \text{Hourly (lbs/hr)} \times \text{Operating hours / yr} \times \frac{\text{ton}}{2000} \\
&= 4.67 \times 0.93 = 0.84 \text{ TPY VOC}
\end{align*}

### HCL Emissions

Daily = \( \text{lb HCL/ton coal} \times \text{tons charged/day} \times \frac{1}{24} \text{hr} \times (1 \text{-eff.}) \)  
\begin{align*}
\text{Annual} &= \text{Hourly (lbs/hr)} \times \text{Operating hours / yr} \times \frac{\text{ton}}{2000} \\
&= 14.79 \times 59.17 = 53.25 \text{ TPY HCL}
\end{align*}

### Pb Emissions

\begin{align*}
\text{Pb} &= \text{lb Pb/ton coal charged} \times \text{tons charged/day} \times \frac{1}{24} \text{hr} \times (1 \text{-eff.}) \\
&= 0.029 \times 0.114 = 0.0103 \text{ TPY lead}
\end{align*}

### Uncontrolled Pb

\begin{align*}
\text{Pb} &= \text{lb Pb/ton coal charged} \times \text{tons charged/day} \times \frac{1}{24} \text{hr} \times (1 \text{-eff.}) \\
&= 0.570 \text{ TPY lead}
\end{align*}

### H\textsubscript{2}SO\textsubscript{4} Emissions

\begin{align*}
\text{H}_2\text{SO}_4 &= \text{lb H}_2\text{SO}_4/\text{ton coal charged} \times \text{tons charged/day} \times \frac{1}{24} \text{hr} \times (1 \text{-eff.}) \\
&= 2.54 \times 25.42 = 22.88 \text{ TPY H}_2\text{SO}_4
\end{align*}
To estimate criteria pollutant emissions due to the pushing process.

### Basis

- **Maximum annual coal charge**: 912,500 tons wet coal/yr (100 Ovens)
- **Maximum annual production**: 654,449 tons wet coke/yr (100 Ovens)
- **Maximum daily coal charge**: 3,750 tons wet coal/day (100 Ovens)
- **Maximum daily production**: 2,690 tons wet coke/day (100 Ovens)
- **No. of coke cars per push**: 1
- **No. of tons coke per push**: 35.9 wet tons

**Note:** Each oven can only be charged every 48 hours.

**Typically charge 50 ovens/day.** For maximum daily charge, assume possible to charge 75 ovens/day

### PM

- **PM**: PM filterable
- **PM10**: PM10 total (filterable plus condensable)

**Typical charge 50 ovens/day.** For maximum daily charge, assume possible to charge 75 ovens/day

**Maximum charge rate = 10 ovens/hour**

**Maximum daily coal charge = 3,750 tons wet coal/day**

**Maximum daily production = 2,690 tons wet coke/day**

**No. of coke cars = 1**

**No. of tons coke per push = 35.9 wet tons**

### Potential emissions estimation:

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Emission Factor</th>
<th>Maximum Annual Emission</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM</td>
<td>0.04 lb/ton coke</td>
<td>13.09 tons PM/yr annual restriction</td>
</tr>
<tr>
<td>PM2.5</td>
<td>0.04 lb/ton coke</td>
<td>14.34 lbs PM/hr max. hourly</td>
</tr>
<tr>
<td>PM10</td>
<td>0.08 lb/ton coke</td>
<td>28.74 lbs CO/yr annual restriction</td>
</tr>
<tr>
<td>NOx</td>
<td>0.02 lb/ton coal</td>
<td>9.13 lbs NOx/hr max. hourly</td>
</tr>
<tr>
<td>SO2</td>
<td>0.098 lb/ton coal</td>
<td>44.71 tons PM2.5/yr annual restriction</td>
</tr>
<tr>
<td>VOC</td>
<td>0.02 lb/ton coal</td>
<td>10.00 lbs VOC/hr max. hourly</td>
</tr>
<tr>
<td>Pb</td>
<td>0.000153 lb/ton coal</td>
<td>2.50 lbs H2SO4/hr max. hourly</td>
</tr>
<tr>
<td>H2SO4</td>
<td>0.098 lb/ton coal</td>
<td>49.00 lbs SO2/hr max. hourly</td>
</tr>
</tbody>
</table>

**Uncontrolled Emission Factors**

- **PM (uncontrolled)**: 1.96 lbs PM/ton coke
- **PM10 (uncontrolled)**: 0.86 lbs PM10/ton coke
- **PM2.5 (uncontrolled)**: 0.34 lbs PM2.5/ton coke

**Maximum daily coal charge = 3,750 tons wet coal/day**

**Maximum daily production = 2,690 tons wet coke/day**

**Maximum annual coal charge = 912,500 tons wet coal/yr**

**Maximum annual production = 654,449 tons wet coke/yr**
Purpose
To estimate criteria pollutant emissions due to quenching.

Basis
Maximum annual coal charge = 912,500 tons wet coal/yr (100 Ovens)
Maximum daily coal charge = 3,750 tons wet coal/day (100 Ovens)
No. of tons per charge = 50

Filterable PM EF (lb/tons coal charge) = 0.12 (Emission factor with baffles as controls; 0.448 lb/ton emission factor from AP-42 with TDS = 1100 mg/l, 73% additional PM control with improved baffle design. Refer to Calc. No. 8A)

Filterable PM\(_{10}\) EF (lb/tons coal charge) = 0.044 (AP-42 5th edition, Coke Production Section, Table 12.2-12, with clean water and baffles)

Filterable PM\(_{2.5}\) EF (lb/tons coal charge) = 0.027 (AP-42 5th edition, Coke Production Section, Table 12.2-12, with clean water and baffles)

Number of quench towers = 1
Charges per hour = 10

Potential Emissions estimation:

Filterable PM
\[
(0.12 \text{ lb/ton coal}) \times (50 \text{ tons/charge}) \times (10 \text{ charges/hr}) = 60.00 \text{ lbs PM/hr max hourly}
\]
\[
(0.12 \text{ lb/ton coal}) \times (\text{tons coal charged/day}) \times (\text{day/24 hours}) = 18.75 \text{ lbs PM/hr daily restriction}
\]
\[
(0.12 \text{ lb/ton coal}) \times (\text{tons coal charged/yr}) \times (\text{ton/2000 lb}) = 54.75 \text{ tons PM/yr annual restriction}
\]

Filterable PM\(_{10}\)
\[
(0.044 \text{ lb/ton coal}) \times (50 \text{ wet tons/charge}) \times (10 \text{ charges/hr}) = 22.00 \text{ lbs PM}_{10}/\text{hr max hourly}
\]
\[
(0.044 \text{ lb/ton coal}) \times (\text{tons coal charged/day}) \times (\text{day/24 hours}) = 6.88 \text{ lbs PM}_{10}/\text{hr daily restriction}
\]
\[
(0.044 \text{ lb/ton coal}) \times (\text{tons coal charged/yr}) \times (\text{ton/2000 lb}) = 20.08 \text{ tons PM}_{10}/\text{yr annual restriction}
\]

Filterable PM\(_{2.5}\)
\[
(0.027 \text{ lb/ton coal}) \times (50 \text{ wet tons/charge}) \times (10 \text{ charges/hr}) = 13.50 \text{ lbs PM}_{2.5}/\text{hr max hourly}
\]
\[
(0.027 \text{ lb/ton coal}) \times (\text{tons coal charged/day}) \times (\text{day/24 hours}) = 4.22 \text{ lbs PM}_{2.5}/\text{hr daily restriction}
\]
\[
(0.027 \text{ lb/ton coal}) \times (\text{tons coal charged/yr}) \times (\text{ton/2000 lb}) = 12.32 \text{ tons PM}_{2.5}/\text{yr annual restriction}
\]
Improved Quench Tower Baffle Performance

<table>
<thead>
<tr>
<th>Particle Diameter (um)</th>
<th>% less than Diameter (%)</th>
<th>Size Range (um)</th>
<th>% in range</th>
<th>Average Diameter (um)</th>
<th>Fractional Removal Eff (%)</th>
<th>Fraction Removed (%)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;100</td>
<td>100</td>
<td>&gt;100</td>
<td>50</td>
<td>100</td>
<td>50</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>50</td>
<td>80-100</td>
<td>50</td>
<td>100</td>
<td>98</td>
<td>4.9</td>
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</tr>
<tr>
<td>80</td>
<td>45</td>
<td>60-80</td>
<td>6</td>
<td>70</td>
<td>93</td>
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<td>39</td>
<td>40-60</td>
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<td>50</td>
<td>77</td>
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<td>20-40</td>
<td>12</td>
<td>30</td>
<td>45</td>
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<td>19</td>
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<td>5.3</td>
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<td>5-10</td>
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<td>7.5</td>
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<td>1.5</td>
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<tr>
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<td>6</td>
<td>1-2.5</td>
<td>4.8</td>
<td>1.75</td>
<td>0.5</td>
<td>0.02</td>
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<tr>
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<td>0-1</td>
<td>1.2</td>
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<td>0.05</td>
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</table>

Graphically Estimated From EPA Data

Estimated Particle Size Data in AP-42

<table>
<thead>
<tr>
<th>Particle Diameter (um)</th>
<th>Fractional Removal Eff (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<tr>
<td>5</td>
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</tr>
<tr>
<td>10</td>
<td>6.5</td>
</tr>
<tr>
<td>20</td>
<td>23.2</td>
</tr>
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<td>60</td>
<td>90.6</td>
</tr>
<tr>
<td>100</td>
<td>99.9</td>
</tr>
<tr>
<td>150</td>
<td>100</td>
</tr>
</tbody>
</table>

Quenching Emissions Particle Size Distribution

Fractional Efficiency Curve for Case 5

Fractional Efficiency Curve
Improved Baffle Design
Purpose
To estimate criteria pollutant emissions due to coke screening. The emissions are controlled by a baghouse and are emitted through the baghouse exhaust stack.

Basis
Maximum annual coal charge (requested limit) = 912,500 tons coal/yr
= 654,449 tons coke/yr
Operating hours = 8760 hrs/yr (24 hrs/day, 365 days/yr)
PM Grain loading = 0.008 gr/dscf
PM\textsubscript{10} grain loading = 0.008 gr/dscf
PM\textsubscript{2.5} grain loading = 0.008 gr/dscf
Airflow = 50,000 scfm

Potential emissions estimation:
PM (tons/yr) = (grain loading grains/dscf) * (lb/7,000 gr) * (ton/2000 lb) * (airflow scfm) * (60 min/hr) * (operating hrs/yr)
= (0.008 gr/dscf) * (1 lb/7000 gr) * (ton/2000 lb) * (50,000 scfm) * (60 min/hr) * (hr/yr)
= 15.02 tons PM/yr

PM\textsubscript{10} (tons/yr) = (grain loading grains/dscf) * (lb/7,000 gr) * (ton/2000 lb) * (airflow scfm) * (60 min/hr) * (operating hrs/yr)
= (0.008 gr/dscf) * (1 lb/7000 gr) * (ton/2000 lb) * (50,000 scfm) * (60 min/hr) * (hr/yr)
= 15.02 tons PM\textsubscript{10}/yr

PM\textsubscript{2.5} (tons/yr) = (grain loading grains/dscf) * (lb/7,000 gr) * (ton/2000 lb) * (airflow scfm) * (60 min/hr) * (operating hrs/yr)
= (0.008 gr/dscf) * (1 lb/7000 gr) * (ton/2000 lb) * (50,000 scfm) * (60 min/hr) * (hr/yr)
= 15.02 tons PM\textsubscript{2.5}/yr

Maximum Hourly Emissions:
PM (lb/hr) = (grain loading grains/dscf) * (lb/7,000 gr) * (airflow scfm) * (60 min/hr)
= 3.43 lb PM/hr

PM\textsubscript{10} (lb/hr) = (grain loading grains/dscf) * (lb/7,000 gr) * (airflow scfm) * (60 min/hr)
= 3.43 lb PM\textsubscript{10}/hr

PM\textsubscript{2.5} (lb/hr) = (grain loading grains/dscf) * (lb/7,000 gr) * (airflow scfm) * (60 min/hr)
= 3.43 lb PM\textsubscript{2.5}/hr

Total Emissions from Coke Handling, Screening & Processing (F004):

PM
Coke Screening = 15.02 tons PM/yr
Total Breeze Loadout = 0.02 tons PM/yr (from Calculation No.11)
Total Coke Handling = 6.44 tons PM/yr (from Calculation No.12)
Total Coke Handling, Screening & Processing = 21.47 tons PM/yr

PM\textsubscript{10}
Coke Screening = 15.02 tons PM\textsubscript{10}/yr
Total Breeze Loadout = 0.01 tons PM\textsubscript{10}/yr (from Calculation No.11)
Total Coke Handling = 3.04 tons PM\textsubscript{10}/yr (from Calculation No.12)
Total Coke Handling, Screening & Processing = 18.07 tons PM\textsubscript{10}/yr

PM\textsubscript{2.5}
Coke Screening = 15.02 tons PM\textsubscript{2.5}/yr
Total Breeze Loadout = 0.003 tons PM\textsubscript{2.5}/yr (from Calculation No.11)
Total Coke Handling = 0.96 tons PM\textsubscript{2.5}/yr (from Calculation No.12)
Total Coke Handling, Screening & Processing = 15.98 tons PM\textsubscript{2.5}/yr
Purpose
To estimate criteria pollutant emissions from 1 run of oven coke storage pile.
(Includes coke load-in, fugitives from the pile itself, and coke loadout.)
Emissions for each are broken down by part.

Note: This is an emergency coke stockpile and coke ground storage. However emissions are calculated as though the pile is used 365 days/year.

Basis
Run of plant coke storage = 1.5 acres total

Part I. Coke Load-In

Purpose
To estimate criteria pollutant emissions due to coke loading into run of oven coke storage pile

Basis
Total number of coke transfer points = 1
Maximum annual coal charge = 912,500 tons wet coal/yr
= 654,449 tons wet coke/yr

Assumptions
Assume 1 load-in transfer point.

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

\[
EF \text{ (lb/ton)} = k \times 0.0032 \times \left( \frac{U}{5} \right)^{1.3} \left( \frac{M}{2} \right)^{1.4}
\]

where:
- \( k \), particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM\(_{10} \) = 0.35 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM\(_{2.5} \) = 0.11 (from AP-42, 5th edition)
- \( U \), mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
- \( M \), moisture content = 4.8%

PM EF (lb/ton coke) = 1.69E-03 for coke load-in
PM\(_{10} \) EF (lb/ton coke) = 7.99E-04 for coke load-in
PM\(_{2.5} \) EF (lb/ton coke) = 2.51E-04 for coke load-in

Potential emissions estimation:

\[
PM \text{ (tons/yr)} = PM \text{ EF} \times \# \text{ transfer points} \times \text{tons coke transferred}
\]

\[
= (0.00169 \text{ lb/ton coke}) \times [(1 \text{ transfer points}) \times \text{tons coke handled/transfer point}] \times \text{ton/2000 lb}
\]

\[
= 0.5528 \text{ tons PM/yr}
\]

\[
PM_{10} \text{ (tons/yr)} = PM_{10} \text{ EF} \times \# \text{ transfer points} \times \text{tons coke transferred}
\]

\[
= (0.00080 \text{ lb/ton coke}) \times [(1 \text{ transfer points}) \times \text{tons coke handled/transfer point}] \times \text{ton/2000 lb}
\]

\[
= 0.2615 \text{ tons PM}_{10}/\text{yr}
\]

\[
PM_{2.5} \text{ (tons/yr)} = PM_{2.5} \text{ EF} \times \# \text{ transfer points} \times \text{tons coke transferred}
\]

\[
= (0.00025 \text{ lb/ton coke}) \times [(1 \text{ transfer points}) \times \text{tons coke handled/transfer point}] \times \text{ton/2000 lb}
\]

\[
= 0.0822 \text{ tons PM}_{2.5}/\text{yr}
\]
Part II. Coke Pile

Purpose
To estimate emissions due to working in the run of oven coke storage pile.

Assumptions
Number days pile worked in = 365 days

Calculation
Use emission factors for storage pile fugitive emissions from AP-40, Section 4, Fugitive Emissions, p. 136, Equation (5)

\[
EF \text{ (lb/day/acre)} = k \times 1.7 \times (s/1.5) \times ((365-p)/235) \times (f/15)
\]

where:
- \(k\), particle size multiplier for PM = 1
- \(k\), particle size multiplier for PM \(_{10}\) = 0.5
- \(k\), particle size multiplier for PM \(_{2.5}\) = 0.2
- \(s\), silt content for coke = 1%
- \(f\), percentage of time that the unobstructed wind speed exceeds ≥5.4 m/s at mean pile height = 29%
- \(p\), number of days with ≥0.01 inch of precipitation per year = 130 days

(For Middletown, Ohio from AP-42, 5th edition, Figure 13.2.2-1)

PM EF (lb/day/acre) = 2.19 for coke pile
PM\(_{10}\) EF (lb/day/acre) = 1.10 for coke pile
PM\(_{2.5}\) EF (lb/day/acre) = 0.44 for coke pile

Potential emissions estimation:

PM (tons/yr) = PM EF * Acres of pile * days pile worked in
= (2.19 lb/day/acre) * (acres) * (365 days/yr) * (ton/2000 lb)
= 0.5998 tons PM/yr

PM\(_{10}\) (tons/yr) = PM\(_{10}\) EF * Acres of pile * days pile worked in
= (1.10 lb/day/acre) * (acres) * (365 days/yr) * (ton/2000 lb)
= 0.2999 tons PM\(_{10}\)/yr

PM\(_{2.5}\) (tons/yr) = PM\(_{2.5}\) EF * Acres of pile * days pile worked in
= (0.44 lb/day/acre) * (acres) * (365 days/yr) * (ton/2000 lb)
= 0.1200 tons PM\(_{2.5}\)/yr
Part III. Coke Loadout from pile.

Purpose
To estimate criteria pollutant emissions due to coke loadout from run of oven coke storage pile.

Basis
Total number of coke transfer points = 1
Maximum annual coal charge = 912,500 tons wet coal/yr
= 654,449 tons wet coke/yr

Assumptions
Assume 1 loadout transfer point

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

\[ EF (lb/ton) = k * 0.0032 * \left( \frac{U}{5} \right)^{1.3} \left( \frac{M}{2} \right)^{1.4} \]

where:
- \( k \), particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM10 = 0.35 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM2.5 = 0.11 (from AP-42, 5th edition)
- \( U \), mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
- \( M \), moisture content = 4.8 %

PM EF (lb/ton coke) = 1.69E-03 for coke load-out
PM10 EF (lb/ton coke) = 7.99E-04 for coke load-out
PM2.5 EF (lb/ton coke) = 2.51E-04 for coke load-out

Potential emissions estimation:

PM (tons/yr) = PM EF * # transfer points * tons coke transferred
= (EF lb/ton coke) * [(# transfer points) * (tons coke handled/transfer point)] * (ton/2000 lb)
= 0.553 tons PM/yr

PM10 (tons/yr) = PM10 EF * # transfer points * tons coke transferred
= (EF lb/ton coke) * [(# transfer points) * (tons coke handled/transfer point)] * (ton/2000 lb)
= 0.261 tons PM10/yr

PM2.5 (tons/yr) = PM2.5 EF * # transfer points * tons coke transferred
= (EF lb/ton coke) * [(# transfer points) * (tons coke handled/transfer point)] * (ton/2000 lb)
= 0.082 tons PM2.5/yr

Part IV - Total Emissions from Coke Loadin, Coke Pile, and Coke Loadout from Pile:

Annual Emissions:
PM (tons/yr) = 1.71 tons PM/yr
PM10 (tons/yr) = 0.82 tons PM10/yr
PM2.5 (tons/yr) = 0.28 tons PM2.5/yr
Purpose
To estimate criteria pollutant emissions due to the coke breeze bunker.

Basis
Total number of coke transfer points = 2
Coke breeze = 40,621 tons wet breeze/yr

Assumptions
Assume coke bin emissions are the same as emissions from two coke transfer points.
The two transfer points represent the loadin and loadout since emissions occur at those times.
Emissions from the bin are negligible when loadin and loadout are not occurring due to the enclosure.
Control efficiency for enclosed points = 70% (estimated from Ohio RACM Table 2.2.1-2)

Calculation
Use emission factors for coke handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

\[ EF (lb/ton) = k \times 0.0032 \times U/(5)^{3/4} \times M/(2)^{4/4} \]

where:
- \( k \), particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM10 = 0.35 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM2.5 = 0.11 (from AP-42, 5th edition)
- \( U \), mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
- \( M \), moisture content = 4.8 %

PM EF (lb/ton coke) = 1.69E-03
PM10 EF (lb/ton coke) = 7.99E-04
PM2.5 EF (lb/ton coke) = 2.51E-04

Potential emissions estimation:

\[ PM (tons/yr) = PM EF \times \# \text{ enclosed transfer points} \times \text{tons coke breeze transferred/yr} \times (1 - \text{control efficiency}) \times (\text{tons/2000 lb}) \]

\[ = (EF \text{ lb/ton coke}) \times [(\text{number enclosed transfer points}) \times (\text{tons coke breeze/yr})] \times (\text{ton/2000 lb}) \times (1 - \text{efficiency}) \]

\[ = 0.0206 \text{ tons PM/yr} \]

PM10 (tons/yr) = PM10 EF \times \# \text{ enclosed transfer points} \times \text{tons coke breeze transferred/yr} \times (1 - \text{control efficiency}) \times (\text{tons/2000 lb})

\[ = (EF \text{ lb/ton coke}) \times [(\text{number enclosed transfer points}) \times (\text{tons coke breeze/yr})] \times (\text{ton/2000 lb}) \times (1 - \text{efficiency}) \]

\[ = 0.0097 \text{ tons PM10/yr} \]

PM2.5 (tons/yr) = PM2.5 EF \times \# \text{ enclosed transfer points} \times \text{tons coke breeze transferred/yr} \times (1 - \text{control efficiency}) \times (\text{tons/2000 lb})

\[ = (EF \text{ lb/ton coke}) \times [(\text{number enclosed transfer points}) \times (\text{tons coke breeze/yr})] \times (\text{ton/2000 lb}) \times (1 - \text{efficiency}) \]

\[ = 0.0031 \text{ tons PM2.5/yr} \]
Purpose
To estimate criteria pollutant emissions due to coke handling transfer.

Basis
Total number of coke transfer points = 26
Number of enclosed transfer points = 20
Maximum annual coal charge (requested limit) = 912,500 tons wet coal/yr
= 654,449 tons wet coke/yr

Assumptions
Assume each transfer point handles the maximum annual coke produced based on the maximum annual coal charge rate.

Control efficiency for enclosed points = 70% (based on Ohio RACM Table 2.2.1-2)

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

\[ EF (lb/ton) = k * 0.0032 * (U/5)^{1.3} \cdot (M/2)^{1.4} \]

where:
- \( k \), particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM_{10} = 0.35 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM_{2.5} = 0.11 (from AP-42, 5th edition)
- \( U \), mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
- \( M \), moisture content = 4.8%

PM Emissions
<table>
<thead>
<tr>
<th>No. points</th>
<th>Throughput</th>
<th>Efficiency</th>
<th>Emissions (tons/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>100%</td>
<td>70%</td>
<td>2.654</td>
</tr>
<tr>
<td>2</td>
<td>120%</td>
<td>70%</td>
<td>0.398</td>
</tr>
<tr>
<td>2</td>
<td>20%</td>
<td>70%</td>
<td>0.066</td>
</tr>
<tr>
<td>6</td>
<td>100%</td>
<td>0%</td>
<td>3.317</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>6.435</strong></td>
</tr>
</tbody>
</table>

PM_{10} Emissions
<table>
<thead>
<tr>
<th>No. points</th>
<th>Throughput</th>
<th>Efficiency</th>
<th>Emissions (tons/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>100%</td>
<td>70%</td>
<td>1.255</td>
</tr>
<tr>
<td>2</td>
<td>120%</td>
<td>70%</td>
<td>0.139</td>
</tr>
<tr>
<td>2</td>
<td>20%</td>
<td>70%</td>
<td>0.031</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>100%</td>
<td>0%</td>
<td><strong>1.569</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>3.044</strong></td>
</tr>
</tbody>
</table>

PM_{2.5} Emissions
<table>
<thead>
<tr>
<th>No. points</th>
<th>Throughput</th>
<th>Efficiency</th>
<th>Emissions (tons/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>100%</td>
<td>70%</td>
<td>0.394</td>
</tr>
<tr>
<td>2</td>
<td>120%</td>
<td>70%</td>
<td>0.059</td>
</tr>
<tr>
<td>2</td>
<td>20%</td>
<td>70%</td>
<td>0.010</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>100%</td>
<td>0%</td>
<td><strong>0.493</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>0.957</strong></td>
</tr>
</tbody>
</table>

Maximum Emissions for points with 100% of coke throughput

Enclosed Transfer points

PM (ton/yr) = PM EF (lb/ton) \cdot (tons/yr) \cdot (ton/2000 lb) \cdot (1 - control efficiency/100) = 0.1659 TPY PM

PM_{10} (ton/yr) = PM_{10} EF (lb/ton) \cdot (tons/yr) \cdot (ton/2000 lb) \cdot (1 - control efficiency/100) = 0.0784 TPY PM_{10}

PM_{2.5} (ton/yr) = PM_{2.5} EF (lb/ton) \cdot (tons/yr) \cdot (ton/2000 lb) \cdot (1 - control efficiency/100) = 0.0247 TPY PM_{2.5}
To estimate criteria pollutant emissions due to paved roads and parking lot

**Data**

1. Use emission factors developed using Section 13.2.1, AP-42, Paved Roads, Equation (2)

   \[ \text{EF (lb/VMT)} = k \times (sL/2)^{0.65} \times (W/3)^{1.5} \times (1-p/4N) \]

   where:
   - \( sL \) = road surface silt loading (g/sq. meter), 9.7 for Iron and Steel Industry, Table 13.2.1-4, AP-42
   - \( W \) = mean vehicle weight (tons)
   - \( p \) = number of "wet" days with at least 0.01 in of precipitation during the averaging period
   - \( N \) = number of days in the averaging period (e.g. 365 for annual)

   Considering annual averaging period, \( N = 365 \), and \( p = 130 \) days from Figure 13.2.1-2, AP-42

**Emission Factors and Calculation:**

<table>
<thead>
<tr>
<th>Vehicle type</th>
<th>Mean Vehicle Weight (tons)</th>
<th>Vehicle Miles Traveled (VMT)</th>
<th>Percent Use</th>
<th>sL</th>
<th>W</th>
<th>p</th>
<th>N</th>
<th>PM EF (lb/VMT)</th>
<th>PM10 EF (lb/VMT)</th>
<th>PM2.5 EF (lb/VMT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy Trucks</td>
<td>27.5</td>
<td>5000</td>
<td>7%</td>
<td>9.7</td>
<td></td>
<td></td>
<td>365</td>
<td>0.616</td>
<td>0.120</td>
<td>0.030</td>
</tr>
<tr>
<td>Maintenance</td>
<td>7.5</td>
<td>30000</td>
<td>43%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal</td>
<td>2.0</td>
<td>35000</td>
<td>50%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Fleet average weight (tons/vehicle) = 0.10 * 27.5 tons + 0.30 * 7.5 tons + 0.6 * 2 tons = 6.18**

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Silt Loading (g/m²)</th>
<th>Fleet Average Weight (tons)</th>
<th># days with &gt;= 0.01 in. rain in the averaging period</th>
<th>Fleet Average Weight (tons)</th>
<th># days in the averaging period</th>
<th>PM Emission Factor (lb/VMT)</th>
<th>PM10 Emission Factor (lb/VMT)</th>
<th>PM2.5 Emission Factor (lb/VMT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fleet Average</td>
<td>9.7</td>
<td>6.2</td>
<td>130</td>
<td>365</td>
<td>0.616</td>
<td>0.120</td>
<td>0.030</td>
<td>\</td>
</tr>
</tbody>
</table>

**Example calculations (Other trucks)**

**PM Emissions (tons/yr)**

\[ \text{PM Emissions (tons/yr)} = \text{VMT} \times \text{PM EF (lb/VMT)} \times (\text{ton/2000 lb}) \]

\[ = 50,000 \text{ VMT} \times 0.619 \text{ lb/VMT} \times 2000 \text{ lb} \]

\[ = 21.57 \text{ tons PM/yr} \]

**PM10 Emissions (tons/yr)**

\[ \text{PM10 Emissions (tons/yr)} = \text{VMT} \times \text{PM10 EF (lb/VMT)} \times (\text{ton/2000 lb}) \]

\[ = 50,000 \text{ VMT} \times 0.121 \text{ lb/VMT} \times 2000 \text{ lb} \]

\[ = 4.21 \text{ tons PM10/yr} \]

**PM2.5 Emissions (tons/yr)**

\[ \text{PM2.5 Emissions (tons/yr)} = \text{VMT} \times \text{PM2.5 EF (lb/VMT)} \times (\text{ton/2000 lb}) \]

\[ = 50,000 \text{ VMT} \times 0.030 \text{ lb/VMT} \times 2000 \text{ lb} \]

\[ = 1.05 \text{ tons PM2.5/yr} \]
Purpose
To estimate criteria pollutant emissions from lime silos.

Basis
Total number of lime silos = 2
Amount of lime handled per silo = 1,400 lb/hr/silo
Operating hours = 8,760 hrs/yr (worst case = 24 hours/day, 365 days/yr)

Assumptions
Bin vent filter control efficiency = 99% engineering judgment

Calculation
Use emission factor for lime transfer and conveying from AP-42, 5th edition, 2/98, Table 11.17-4
EF (lb/ton) = 2.2 lb/ton

Potential emissions estimation:
PM (tons/yr) = PM EF * lime transferred per silo, lb/hr * operating hours/year * # of silo * (1 - % control efficiency)
= 2.2 lb/ton * 1400 lb/hr * ton/2000 lb * 8760 hr/yr * ton/2000 lb * 2 * (1-0.99)
= 0.135 tons PM/yr for facility
Purpose
To estimate criteria pollutant emissions from flue gas desulfurization dust silos.

Basis
Total number of FGD dust silos = 2
Amount of FGD dust handled per silo = 3,150 lb/hr
Operating hours = 8,760 hrs/yr (worst case = 24 hours/day, 365 days/yr)

Assumptions
Number of transfer points per silo: 2 (one into silo and one out of silo)
Control efficiency due to enclosure = 80% Engineering estimate

Calculation:
Use emission factors for material handling from AP-42, 5th edition, Table 13.2.4-1 Equation (1)

\[
EF (\text{lb/ton}) = k \times 0.0032 \times \left(\frac{U}{5}\right)^{1.3} \times \left(\frac{M}{2}\right)^{1.4}
\]

where:
- \( k \), particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM10 = 0.35 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM2.5 = 0.11 (from AP-42, 5th edition)
- \( U \), mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
- \( M \), moisture content = 4.8% (engineering judgment)

PM EF (lb/ton) = 1.69E-03

Potential emissions estimation:
PM (tons/yr) = PM EF \times \# of transfer points per silo \times \text{FGD dust transferred per silo, lb/hr} \times \text{operating hours} \times \# of silo \times (1 - \text{control eff %})

\[
= (0.0017 \text{ lb/ton}) \times (2 \text{ transfer points}) \times (3150 \text{ lb/hr}) \times (8760 \text{ hours/yr}) \times (2) \times (1 - 0.8)
\]

\[
= 0.0093 \text{ tons PM/yr}
\]
Purpose
To estimate criteria pollutant emissions from 1 emergency coke breeze storage pile.
(Includes coke breeze load-in, fugitives from the pile itself, and coke breeze loadout.)
Emissions for each are broken down by part.

Note: This is an emergency coke breeze pile
Assume use = 365 days/year

Basis
Coke Breeze storage = 0.2 acres total

Part I. Emergency Coke Breeze Load-In

Purpose
To estimate criteria pollutant emissions due to emergency coke breeze loading into coke breeze storage pile

Basis
Total number of coke transfer points = 1
Coke breeze = 40,621 tons wet breeze/yr (total for 365 days)

Assumptions
Assume 1 load-in transfer point.

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

\[ EF = k \times 0.0032 \times \left( \frac{U}{5} \right)^{1.3} \times \left( \frac{M}{2} \right)^{1.4} \]

where:
- \( k \), particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM10 = 0.35 (from AP-42, 5th edition)
- \( k \), particle size multiplier for PM2.5 = 0.11 (from AP-42, 5th edition)
- \( U \), mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
- \( M \), moisture content = 4.8%

PM EF (lb/ton coke) = 1.69E-03 for emergency coke breeze load-in
PM10 EF (lb/ton coke) = 7.99E-04 for emergency coke breeze load-in
PM2.5 EF (lb/ton coke) = 2.51E-04 for emergency coke breeze load-in

Potential emissions estimation:

PM (tons/yr) = PM EF * tons wet breeze/year * ton/2000 lb
\[ = 0.0343 \text{ tons PM/yr} \]

PM10 (tons/yr) = PM10 EF * tons wet breeze/year * ton/2000 lb
\[ = 0.0162 \text{ tons PM10/yr} \]

PM2.5 (tons/yr) = PM2.5 EF * tons wet breeze/year * ton/2000 lb
\[ = 0.0051 \text{ tons PM2.5/yr} \]
Part II. Emergency Coke Breeze Pile

Purpose
To estimate emissions due to working in the emergency coke breeze storage pile.

Assumptions
Number days pile worked in = 365 days

Calculation
Use emission factors for storage pile fugitive emissions from AP-40, Section 4, Fugitive Emissions, p. 136, Equation (5)

\[
EF \ (\text{lb/day/acre}) = k \times 1.7 \times \left(\frac{s}{1.5}\right) \times \left(\frac{365-p}{235}\right) \times \left(\frac{f}{15}\right)
\]

where:
- \(k\), particle size multiplier for PM = 1
- \(k\), particle size multiplier for PM$_{10}$ = 0.5
- \(k\), particle size multiplier for PM$_{2.5}$ = 0.2
- \(s\), silt content for coke breeze = 4.9 
- \(f\), percentage of time that the unobstructed wind speed exceeds 5.4 m/s at mean pile height = 29 %
- \(p\), number of days with 0.01 inch of precipitation per year = 130 days

PM EF (lb/day/acre) = 10.74 for emergency coke breeze pile
PM$_{10}$ EF (lb/day/acre) = 5.37 for emergency coke breeze pile
PM$_{2.5}$ EF (lb/day/acre) = 2.15 for emergency coke breeze pile

Potential emissions estimation:

PM (tons/yr) = PM EF * Acres of pile * days pile worked in
\[
= (10.74 \text{ lb/day/acre}) \times (\text{acres}) \times (365 \text{ days/yr}) \times (\text{ton/2000 lb})
\]
\[
= 0.3919 \text{ tons PM/yr}
\]

PM$_{10}$ (tons/yr) = PM$_{10}$ EF * Acres of pile * days pile worked in
\[
= (5.37 \text{ lb/day/acre}) \times (\text{acres}) \times (365 \text{ days/yr}) \times (\text{ton/2000 lb})
\]
\[
= 0.1959 \text{ tons PM$_{10}$/yr}
\]

PM$_{2.5}$ (tons/yr) = PM$_{2.5}$ EF * Acres of pile * days pile worked in
\[
= (2.15 \text{ lb/day/acre}) \times (\text{acres}) \times (365 \text{ days/yr}) \times (\text{ton/2000 lb})
\]
\[
= 0.0784 \text{ tons PM$_{2.5}$/yr}
\]
Part III. Emergency Coke Breeze Loadout from pile.

Purpose
To estimate criteria pollutant emissions due to coke breeze loadout from emergency coke breeze storage pile.

Basis
Total number of coke transfer points = 1
Coke Breeze = 40,621 tons wet breeze/yr (total for 365 days)

Assumptions
Assume 1 loadout transfer point

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

\[
EF (\text{lb/ton}) = k \times 0.0032 \times (U/5)^{1.3} / (M/2)^{1.4}
\]

where:
- k, particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
- k, particle size multiplier for PM10 = 0.35 (from AP-42, 5th edition)
- k, particle size multiplier for PM2.5 = 0.11 (from AP-42, 5th edition)
- U, mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
- M, moisture content = 4.8 %

PM EF (lb/ton coke) = 1.69E-03 for emergency coke breeze load-out
PM10 EF (lb/ton coke) = 7.99E-04 for emergency coke breeze load-out
PM2.5 EF (lb/ton coke) = 2.51E-04 for emergency coke breeze load-out

Potential emissions estimation:

PM (tons/yr) = PM EF * tons wet breeze/year * ton/2000 lb
= 0.0343 tons PM/yr

PM10 (tons/yr) = PM10 EF * tons wet breeze/year * ton/2000 lb
= 0.0162 tons PM10/yr

PM2.5 (tons/yr) = PM2.5 EF * tons wet breeze/year * ton/2000 lb
= 0.0051 tons PM2.5/yr

Part IV - Total Emissions from Loadin, Pile, and Loadout from Emergency Coke Breeze Pile:

Annual Emissions:
- PM (tons/yr) = 0.46 tons PM/yr
- PM10 (tons/yr) = 0.23 tons PM10/yr
- PM2.5 (tons/yr) = 0.09 tons PM2.5/yr
Purpose
To estimate criteria pollutant emissions from 1 emergency screened coke storage pile.
(Includes coke load-in, fugitives from the pile itself, and coke loadout.)
Emissions for each are broken down by part.

Note: This is an emergency screened coke ground storage

Basis
Emergency screened coke storage = 0.3 acres total
Assume use = 365 days/year

Part I. Emergency Screened Coke Load-In

Purpose
To estimate criteria pollutant emissions due to coke loading into coke storage pile

Basis
Total number of coke transfer points = 1
Maximum annual coal charge = 912,500 tons wet coal/yr (total for 365 days)
Maximum furnace coke = 613,828 tons wet coke/yr (total for 365 days)

Assumptions
Assume 1 load-in transfer point.

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

\[
EF \ (lb/ton) = k \times 0.0032 \times \left( \frac{U}{5} \right)^{1.3} \times \left( \frac{M}{2} \right)^{1.4}
\]

where:
\( k, \) particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
\( k, \) particle size multiplier for PM\(_{10}\) = 0.35 (from AP-42, 5th edition)
\( k, \) particle size multiplier for PM\(_{2.5}\) = 0.11 (from AP-42, 5th edition)
\( U, \) mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
\( M, \) moisture content = 4.8 %

PM EF (lb/ton coke) = 1.69E-03 for coke load-in
PM\(_{10}\) EF (lb/ton coke) = 7.99E-04 for coke load-in
PM\(_{2.5}\) EF (lb/ton coke) = 2.51E-04 for coke load-in

Potential emissions estimation:

PM (tons/yr) = PM EF * tons wet coke/year * ton/2000 lb
= 0.5185 tons PM/yr

PM\(_{10}\) (tons/yr) = PM\(_{10}\) EF * tons wet coke/year * ton/2000 lb
= 0.2452 tons PM\(_{10}\)/yr

PM\(_{2.5}\) (tons/yr) = PM\(_{2.5}\) EF * tons wet coke/year * ton/2000 lb
= 0.0771 tons PM\(_{2.5}\)/yr
Part II. Emergency Screened Coke Pile

Purpose
To estimate emissions due to working in the emergency screened coke storage pile.

Assumptions
Number days pile worked in = 365 days

Calculation
Use emission factors for storage pile fugitive emissions from AP-40, Section 4, Fugitive Emissions, p. 136, Equation (5)

\[
EF \ (\text{lb/day/acre}) = k \times 1.7 \times (s/1.5) \times ((365-p)/235) \times (f/15)
\]

where:
- \(k\), particle size multiplier for PM = 1
- \(k\), particle size multiplier for PM10 = 0.5
- \(k\), particle size multiplier for PM2.5 = 0.2
- \(s\), silt content for coke = 1%
- \(f\), percentage of time that the unobstructed wind speed exceeds \(5.4 \text{ m/s}\) at mean pile height = 29%
- \(p\), number of days with \(\geq 0.01\) inch of precipitation per year = 130 days

(For Middletown, Ohio from AP-42, 5th edition, Figure 13.2.2-1)

PM EF (lb/day/acre) = 2.19 for emergency screened coke pile
PM10 EF (lb/day/acre) = 1.10 for emergency screened coke pile
PM2.5 EF (lb/day/acre) = 0.44 for emergency screened coke pile

Potential emissions estimation:

PM (tons/yr) = PM EF * Acres of pile * days pile worked in * ton/2000 lb
   = \((2.19 \text{ lb/day/acre}) \times (\text{acres}) \times (365 \text{ days/yr}) \times (\text{ton/2000 lb})\)
   = 0.120 tons PM/yr

PM10 (tons/yr) = PM10 EF * Acres of pile * days pile worked in * ton/2000 lb
   = \((1.10 \text{ lb/day/acre}) \times (\text{acres}) \times (365 \text{ days/yr}) \times (\text{ton/2000 lb})\)
   = 0.060 tons PM10/yr

PM2.5 (tons/yr) = PM2.5 EF * Acres of pile * days pile worked in * ton/2000 lb
   = \((0.44 \text{ lb/day/acre}) \times (\text{acres}) \times (365 \text{ days/yr}) \times (\text{ton/2000 lb})\)
   = 0.024 tons PM2.5/yr
Part III. Emergency Screened Coke Loadout from pile.

Purpose
To estimate criteria pollutant emissions due to coke loadout from screened coke storage pile.

Basis
Total number of coke transfer points = 1
Maximum annual coal charge = 912,500 tons wet coal/yr (total for 365 days)
Maximum annual furnace coke = 613,828 tons wet coke/yr (total for 365 days)

Assumptions
Assume 1 loadout transfer point

Calculation
Use emission factors for coal handling from AP-42, 5th edition, p.13.2.4-1 Equation (1)

\[
EF \ (lb/ton) = k \times 0.0032 \times \left( \frac{U}{5} \right)^{1.3} \times \left( \frac{1}{M} \right)^{1.4}
\]

where:
- k, particle size multiplier for PM = 0.74 (from AP-42, 5th edition)
- k, particle size multiplier for PM10 = 0.35 (from AP-42, 5th edition)
- k, particle size multiplier for PM2.5 = 0.11 (from AP-42, 5th edition)
- U, mean wind speed = 9.9 mph from Tanks 4.09 Meteorological database (Dayton, OH)
- M, moisture content = 4.8%

PM EF (lb/ton coke) = 1.69E-03 for coke load-out
PM10 EF (lb/ton coke) = 7.99E-04 for coke load-out
PM2.5 EF (lb/ton coke) = 2.51E-04 for coke load-out

Potential emissions estimation:

\[
PM \ (tons/yr) = PM \ EF \times tons \ wet \ coke/year \times \frac{1}{2000 \ lb}
\]

= 0.5185 tons PM/yr

\[
PM_{10} \ (tons/yr) = PM_{10} \ EF \times tons \ wet \ coke/year \times \frac{1}{2000 \ lb}
\]

= 0.2452 tons PM10/yr

\[
PM_{2.5} \ (tons/yr) = PM_{2.5} \ EF \times tons \ wet \ coke/year \times \frac{1}{2000 \ lb}
\]

= 0.0771 tons PM2.5/yr

Part IV - Total Emissions from Coke Loadin, Coke Pile, and Coke Loadout from Screened Coke Pile:

Annual Emissions:

PM (tons/yr) = 1.16 tons PM/yr
PM10 (tons/yr) = 0.55 tons PM10/yr
PM2.5 (tons/yr) = 0.18 tons PM2.5/yr