ADDENDUM TO BEST AVAILABLE RETROFIT TECHNOLOGY APPlicability ANALYSIS AND DETERMINATION REPORT
PORT TOWNSEND PAPER CORPORATION • PORT TOWNSEND, WA

Prepared for:
PORT TOWNSEND PAPER CORPORATION

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October 2008

Project 064801.0033
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APPENDIX A
1. INTRODUCTION

Port Townsend Paper Company (PTPC) submitted a Best Available Retrofit Technology (BART) Applicability and Determination Report (BART Report) to the Washington Department of Ecology (Ecology) on December 19, 2008. In August through October of 2008, Mr. Robert Burmark requested additional information regarding the control equipment on the BART-eligible equipment at the PTPC Mill.\(^1\) Mr. Burmark also requested further information regarding SO\(_2\) emissions from PTPC’s No. 10 Power Boiler, including a discussion of how the SO\(_2\) emissions relate to the firing of waste water solids in the boiler.\(^2\)

This addendum provides clarification and additional details regarding the control equipment installed on each of the BART-eligible units at the PTPC Mill. Additionally, further information regarding SO\(_2\) emissions from the No. 10 Power Boiler are included to demonstrate that the SO\(_2\) emission rates used for the boiler in the BART analysis were sufficiently conservative to account for the sulfur content from waste water solids firing.

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2. CONTROL EQUIPMENT DESCRIPTION

Table 2-1 below summarizes the control devices used to control emissions from the BART-eligible emission units at the PTPC Mill. Each control device is further described in the subsequent paragraphs.

**TABLE 2-1. SUMMARY OF CONTROL DEVICES SERVING BART-ELIGIBLE EMISSION UNITS**

<table>
<thead>
<tr>
<th>Emission Unit</th>
<th>Control Device</th>
<th>Installation Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovery Furnace</td>
<td>Research Cottrell ESP (2)</td>
<td>Rebuilt 1993</td>
<td>Three ESPs total; parallel single chamber, dry bottom</td>
</tr>
<tr>
<td></td>
<td>Environmental Elements ESP(1)</td>
<td>1986-1987</td>
<td></td>
</tr>
<tr>
<td>Smelt Tank</td>
<td>Ducon UW4Model 4 scrubber</td>
<td>1970s</td>
<td>Modified by APTech in 2003 for MACT II compliance</td>
</tr>
<tr>
<td>No. 10 Power Boiler</td>
<td>Multiclones and Turbotak Scrubber</td>
<td>Turbotak installed in 1988</td>
<td>Multiclones for coarse PM and Turbotak for fine PM</td>
</tr>
<tr>
<td>Lime Kiln</td>
<td>Venturi scrubber</td>
<td>Modified 2003</td>
<td>Scrubber showers modified for MACT II compliance</td>
</tr>
</tbody>
</table>

PTPC’s Recovery Boiler is equipped with three Electrostatic Precipitators (ESPs). Each ESP is a parallel single chamber, dry bottom ESP. Two of the ESP units, manufactured by Research Cottrell, were rebuilt in 1993. The third ESP, manufactured by Environmental Elements, was installed as part of a Prevention of Significant Deterioration (PSD) permitting effort in approximately 1986 to 1987.

The Smelt Tank is controlled with a Ducon UW4 Model 4 scrubber. The scrubber was originally installed during the 1970’s and was modified by APTech in 2003. The modification in 2003 included the installation of new spray header and nozzles, spin breakers, and chevrons in order to further reduce particulate matter emissions and allow for compliance with MACT II requirements.

The No. 10 Power Boiler employs multiclones and a Turbotak scrubber to control particulate matter emissions. The multiclones remove the coarse particulate using centrifugal action. The Turbotak was installed in 1988 as a replacement of an existing venturi scrubber. The Turbotak scrubber is a wet scrubber that exposes the exhaust gas stream to a series of atomized water sprays. The multiple water sprays allow for optimizing the ratio between the water droplet diameter and the particulate matter diameter. The Turbotak also employs removal equipment including a knockout chamber, a fan, and chevrons.

The Lime Kiln employs a venturi scrubber to control particulate matter emissions. The showers of lime kiln’s venturi scrubber were modified in 2003 for MACT II compliance.
3. No. 10 Power Boiler SO₂ Emissions

PTPC fires waste water solids from the primary clarifier in their No. 10 Power Boiler. The primary clarifier waste water solids are referred to as primary sludge. This section addresses how the firing of primary sludge in PTPC’s No. 10 Power Boiler may affect the SO₂ emissions and whether the sulfur content in the sludge should be considered in PTPC’s BART determination analysis.

3.1 Clarifier Sludge Description

Secondary sludge has been shown to contribute significantly to SO₂ emissions from boilers firing secondary sludge. However, the characteristics of primary sludge differ considerably from secondary sludge. Primary sludge generally contains fiber escaping the pulping and papermaking areas as the main constituent, while secondary sludge is generally made up of biological solids.

3.2 Modeled SO₂ Emissions from the No. 10 Power Boiler

As described in Section 3.2 of the BART Report, the modeled emission rate of SO₂ from the No. 10 Power Boiler was calculated using a NCASI correlation based on the daily firing rate of hog fuel and of fuel oil. The NCASI correlation was applied for each day using measurements of fuel oil sulfur content and the amounts of hog fuel and fuel oil fired that day. The maximum estimated daily SO₂ emission rate over 2003 to 2005 calculated using this correlation was used as the maximum 24-hour average SO₂ emission rate modeled in the BART analysis. This modeled SO₂ emission rate was 1,713 pounds SO₂ per day (71.39 lb/hr).

Because the sulfur content in the fuel oil is typically considerably higher than the average sulfur content in the hog fuel, it is no surprise that the day with the highest calculated SO₂ emissions is also the day with the highest fuel oil firing rate. The modeled SO₂ emission rate used in the BART analysis conservatively accounts for the maximum amount of sulfur fired in the boiler by applying the NCASI factor on the day with the highest calculated SO₂ emission rate resulting from a high fuel oil firing rate on that day. The oil firing rate of 619 barrels (3,686 MMBtu) on the day with the maximum estimated SO₂ emission rate results in 1,370 pounds of sulfur per day fed to the boiler from the fuel oil. This amount of sulfur would likely outweigh any contribution of sulfur from waste water solids.

3.3 Source Test SO₂ Emissions from the No. 10 Power Boiler

In order to provide additional supporting documentation that the SO₂ emission rates from the No. 10 Power Boiler used in the BART analysis were sufficiently conservative to account for the sulfur content from waste water solids firing, the available SO₂ emissions source tests on the No.10 Power Boiler are presented in this section. These source tests were conducted during normal boiler

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operation when primary sludge was being fired. Therefore, the results of these tests represent normal SO$_2$ emissions from the boiler operating under normal primary sludge firing rates.

The NCASI SO$_2$ emission correlation was used to determine the maximum 24-hour SO$_2$ emissions for the BART analysis because source test data during the 2003-2005 BART analysis period are not available. However, the results from three source tests measuring SO$_2$ from the No. 10 Power Boiler that were conducted since the installation of the Turbotak scrubber are presented below. These source test emission rates indicate that the actual SO$_2$ emission rate from the No. 10 Power Boiler is lower than the modeled SO$_2$ emission rate (i.e., that the modeled SO$_2$ emission rate is conservative). Copies of the source test results summarized below are provided in Appendix A.

<table>
<thead>
<tr>
<th>Source Test Description</th>
<th>Date</th>
<th>SO$_2$ Emission Rate $^a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Results, Inc.</td>
<td>September 16, 1997</td>
<td>10.29 lb/hr</td>
</tr>
<tr>
<td>Valid Results, Inc.</td>
<td>September 17, 1997</td>
<td>25.55 lb/hr</td>
</tr>
<tr>
<td>Big Horn Environmental</td>
<td>February 22, 2006</td>
<td>7.37 lb/hr</td>
</tr>
</tbody>
</table>

$^a$ Average SO$_2$ emission rate from three runs conducted during each source test.

As presented in Table 3-1 above, the maximum SO$_2$ emission rate from the No. 10 Power Boiler based on source testing is 25.55 pounds per hour, well below the modeled SO$_2$ emission rate of 71.39 pounds per hour. During the source tests presented above, the firing rate of the boiler was near maximum capacity. Therefore, if the results from these source tests are scaled to represent the maximum firing rate of the boiler during the 2003 to 2005 BART analysis period, the maximum emission rate based on testing still would be well below the modeled SO$_2$ emission rate. Thus, the source test results indicate that the modeled SO$_2$ emission rate from the No. 10 Power Boiler used in the BART analysis was conservative compared to source test results for which the firing of primary sludge was accounted.
APPENDIX A

SOURCE TEST RESULTS
AIR EMISSIONS TEST
(O₂, CO₂, SO₂, NOₓ, CO & TOC)

PORT TOWNSEND PAPER COMPANY
#10 BOILER

September 16-17, 1997

Prepared for
Port Townsend Paper Company

By
Valid Results, Inc.
Seattle, WA

November 13, 1997
VALID RESULTS, INC.: EPA Method 6C: Sulfur Dioxide (SO2) Emission Rate Calculation Sheet

Client: Port Townsend Paper  
Date: 9/16/97  
Operator: T. Prevo  
Plant Location: Port Townsend, WA  
Source: #10 Boiler  
Standard Pressure (P_m): 29.92  
Standard Temperature (T_m): 68

MAXIMUM LOAD (100% - 240,000 LBS OF STEAM/HR) COMPLIANCE TEST

<table>
<thead>
<tr>
<th>Test Run Number</th>
<th>Barometric Pressure (P_m) &quot;Hg</th>
<th>Stack Gas Volumetric Flow Rate (dscfm)</th>
<th>SO2 Concentration (ppm)</th>
<th>O2 Concentration (%)</th>
<th>SO2 Concentration (ppm) @ 7% O2</th>
<th>SO2 Concentration (mg/dscm)</th>
<th>SO2 Concentration (lbs/dscf)</th>
<th>SO2 Emission Rate (lbs/hour)</th>
<th>SO2 Emission Rate (tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29.67</td>
<td>107,900</td>
<td>8.16</td>
<td>8.26</td>
<td>9.74</td>
<td>21.70</td>
<td>1.35E-06</td>
<td>8.74</td>
<td>38.28</td>
</tr>
<tr>
<td>2</td>
<td>29.67</td>
<td>99,790</td>
<td>13.31</td>
<td>9.39</td>
<td>16.07</td>
<td>35.39</td>
<td>2.20E-06</td>
<td>13.17</td>
<td>57.68</td>
</tr>
<tr>
<td>3</td>
<td>29.47</td>
<td>101,000</td>
<td>8.91</td>
<td>9.72</td>
<td>11.08</td>
<td>23.69</td>
<td>1.46E-06</td>
<td>8.97</td>
<td>39.29</td>
</tr>
<tr>
<td>&lt;Average&gt;</td>
<td>&lt;29.57&gt;</td>
<td>&lt;102,897&gt;</td>
<td>&lt;10.13&gt;</td>
<td>&lt;8.46&gt;</td>
<td>&lt;12.30&gt;</td>
<td>&lt;26.93&gt;</td>
<td>&lt;1.68E-06&gt;</td>
<td>&lt;10.29&gt;</td>
<td>&lt;45.08&gt;</td>
</tr>
</tbody>
</table>

Stack Gas Volumetric Flow Rate (dscfm) = calculated on Volumetric Flow Rate Calculation Sheet

SO2 Concentration (ppm) = bias calibration corrected value

SO2 Concentration (ppm @ 7% O2) = (ppm) * ((20.9 - 7.0)/(20.9 - stack O2))

SO2 Concentration (mg/dscm) = ((ppm) * (64.07 gr/g-mole) * (41,500) / (1,000,000))
by 40CFR60, Subpart A, Section 60.45, Paragraph F(2)

SO2 Concentration (lbs/dscf) = ((mg/dscm) * (0.01543 grains/mg) / (7,000 grains/lb) * (35.32 cubic feet/cubic meter))

SO2 Emission Rate (lbs/hr) = ((lbs/dscf) * (dscfm/hr) * 60 min/hr)

SO2 Emission Rate (tons/yr) = ((lbs/hr) * (24 hr/day) * (365 day/yr) / (2,000 lb/ton))

SO2 Emission Rate (lbs/MMBtu) = ((lbs/dscf) * (Mixed Fuel F-Factor) * (20.9) / (20.9 - Stack Oxygen))
by 40CFR60, Appendix A, Method 19, Equation 19-1

dry standard cubic feet per minute
parts per million
parts per million at seven percent oxygen
milligrams per dry standard cubic meter
pounds per dry standard cubic foot
pounds per hour
tons per year
pounds per million Btu
VALID RESULTS, INC.:  EPA Method 6C: Sulfur Dioxide (SO2) Emission Rate Calculation Sheet

Port Townsend Paper
9/17/97
T. Prevo
ation: Port Townsend, WA
#10 Boiler
Pressure (P(m)): 29.82
Temperature (T(m)): 68

E LOAD (77% - 184,000 LBS OF STEAM/HR) COMPLIANCE TEST

<table>
<thead>
<tr>
<th>Barometric Pressure (P(m)) *Hg</th>
<th>Stack Gas Volumetric Flow Rate (scfm)</th>
<th>SO2 Concentration (ppm)</th>
<th>O3 Concentration (%)</th>
<th>SO2 Concentration (ppm) @ 7% O3</th>
<th>SO2 Concentration (mg/scf)</th>
<th>SO2 Emission Rate (lbs/hour)</th>
<th>SO2 Emission Rate (tons/year)</th>
<th>SO2 Emission Rate (lbs/MMBtu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.38</td>
<td>109,000</td>
<td>21.72</td>
<td>10.71</td>
<td>29.63</td>
<td>57.75</td>
<td>3.60E-06</td>
<td>23.54</td>
<td>103.11</td>
</tr>
<tr>
<td>29.41</td>
<td>106,800</td>
<td>29.05</td>
<td>11.46</td>
<td>42.77</td>
<td>77.24</td>
<td>4.81E-06</td>
<td>30.82</td>
<td>134.99</td>
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<tr>
<td>29.43</td>
<td>111,200</td>
<td>20.17</td>
<td>12.19</td>
<td>32.19</td>
<td>53.63</td>
<td>3.34E-06</td>
<td>22.28</td>
<td>97.59</td>
</tr>
</tbody>
</table>

* Volumetric Flow Rate (scf/m) = calculated on Volumetric Flow Rate Calculation Sheet

Concentration (ppm) = bias calibration corrected value

Concentration (ppm @ 7% O3) = (ppm) * ((20.9 - 7.0)/(20.9 - stack O3))

Concentration (mg/scf) = ((ppm)*(64.07 g/g-mole)*(41,500)/(1,000,000))
by 40CFR60, Subpart A, Section 60.45, Paragraph F(2)

Concentration (lbs/scf) = ((mg/scf)*(0.01543 grains/mg)*((7,000 grains/lb)*(35.32 cubic feet/cubic meter)))

Emission Rate (lbs/hr) = ((lbs/scf)*(scf/m)*60 min/hr))

Emission Rate (tons/yr) = ((lbs/hr)*(24 hr/day)*(365 day/yr)/(2,000 lb/ton))

Emission Rate (lbs/MMBtu) = ((lbs/scf)*Mixed Fuel F-Factor)*(20.9)/(20.9 - Stack Oxygen)
by 40CFR60, Appendix A, Method 15, Equation 19-1

dry standard cubic feet per minute
parts per million
parts per million at seven percent oxygen
milligrams per dry standard cubic meter
pounds per dry standard cubic foot
pounds per hour
tons per year
pounds per million Btu
April 13, 2006

Ms. Kristin Marshall
Port Townsend Paper Co.
Port Townsend, WA

RE: #10 Power Boiler TRS and SO₂ testing

Dear Ms. Marshall,

The table below summarizes the results of Bighorn Environmental's additional testing of the #10 Power Boiler on February 22, 2006. This testing was done to quantify the emissions of TRS and SO₂ from the boiler. The raw data are attached if you need more detailed information.

#10 Power Boiler TRS and SO₂ Emissions

<table>
<thead>
<tr>
<th>Units</th>
<th>Results</th>
<th></th>
<th></th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Run 1</td>
<td>Run 2</td>
<td>Run 3</td>
<td></td>
</tr>
<tr>
<td>TRS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-ppm</td>
<td>0.31</td>
<td>0.48</td>
<td>0.69</td>
<td>0.49</td>
</tr>
<tr>
<td>-lzs/hr</td>
<td>0.15</td>
<td>0.26</td>
<td>0.34</td>
<td>0.25</td>
</tr>
<tr>
<td>SO₂</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-ppm</td>
<td>5.38</td>
<td>8.28</td>
<td>9.58</td>
<td>7.74</td>
</tr>
<tr>
<td>-lzs/hr</td>
<td>4.91</td>
<td>8.25</td>
<td>8.94</td>
<td>7.37</td>
</tr>
</tbody>
</table>

Stack Parameters

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow, dscfm</td>
<td>91,591</td>
<td>100,026</td>
<td>93,577</td>
</tr>
<tr>
<td>Flow, acfm</td>
<td>131,591</td>
<td>136,043</td>
<td>128,313</td>
</tr>
<tr>
<td>Velocity, fpm</td>
<td>2,660</td>
<td>2,749</td>
<td>2,593</td>
</tr>
<tr>
<td>Temperature, °F</td>
<td>139</td>
<td>141</td>
<td>137</td>
</tr>
<tr>
<td>% Moisture</td>
<td>22.78</td>
<td>18.20</td>
<td>19.31</td>
</tr>
</tbody>
</table>

Please call me if you have any questions.

Sincerely,

Tim Homer