Wood-fired Boiler Ambient Impact Analysis

(0.2 versus 0.10 gr/dscf)

Plywood facility – 1944 Dutch Oven boiler with multiclone (35,000 lb steam/hr)

Current Standards: 0.2 gr/dscf, 20% opacity (changed from 40% to 20% in Klamath Falls PM2.5 attainment rules)

Modeling analysis performed for Klamath Falls attainment plan:

PSEL = 65.9 tpy, 361.1 lbs/day

Boiler portion of PSEL = 26.39 tpy, 144.6 lbs/day (40% of PSEL)

Modeled impacts (total plant emissions) = 7.24 µg/m3

Boiler impacts = 7.24 x 0.4 = 2.9 µg/m3

Boiler actual emissions (source test average for PM) = 13.7 lb/hr = 328.8 lb/day

Boiler impacts based on actual emissions = 328.8/144.6 x 2.9 = 6.6 µg/m3 (18.8% of standard)

Estimated impacts based on current and recommended standards:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Avg. test results | Adjusted to 20% opacity\* | Adjusted to 40% opacity\* | Adjusted to 0.24 gr/dscf | Adjusted to 0.10 gr/dscf |
| Opacity (%) | 12.1 | 20 | 40 | 20.74 | 8.64 |
| Emissions (lb/hr) | 13.7 | 22.64 | 45.29 | 23.49 | 9.79 |
| Emissions (lb/day) | 328.8 | 543.47 | 1086.94 | 563.66 | 234.86 |
| Emissions (gr/dscf) | 0.14 | 0.23 | 0.46 | 0.24 | 0.10 |
| Ambient impacts (µg/m3) | 6.59 | 10.89 | 21.79 | 11.30 | 4.71 |
| Boiler impacts (% of NAAQS)\*\* | 18.83% | 31.12% | 62.24% | 32.28% | 13.45% |
| Background concentration (µg/m3)\*\*\* | 13.97 | 13.97 | 13.97 | 13.97 | 13.97 |
| Total impact (µg/m3)\*\* | 20.56 | 24.86 | 35.76 | 25.27 | 18.68 |
| Total impacts (% of NAAQS) | 58.74% | 71.04% | 102.16% | 72.19% | 53.36% |

\*assumes linear correlation between opacity and PM emissions rate (conservative approach)

\*\*assumes all PM is PM2.5 (conservative approach – according to AP-42, only 79% of PM is PM2.5)

\*\*\*Klamath Falls attainment plan modeling

Actual test data for boilers in Eastern Region:

| Test Date | Source | Boiler | Opacity(%) | PM(gr/dscf) | PM(lb/hr) | PM(lb/Mlb steam) |
| --- | --- | --- | --- | --- | --- | --- |
| 6/20/2001 | 18-0014 | N | 1 | 0.100 | 3.1 | 0.29 |
| 6/20/2001 | 18-0014 | S | 5 | 0.100 | 11.2 | 0.38 |
| 10/8/2002 | 18-0014 | S | 9 | 0.170 | 16.1 | 0.56 |
| 11/4/2003 | 18-0014 | S | 10 | 0.190 | 20.5 | 0.64 |
| 12/10/2004 | 18-0014 | S | 14 | 0.140 | 14.6 | 0.47 |
| 11/18/2005 | 18-0014 | S | 14 | 0.140 | 14.7 | 0.50 |
| 11/21/2006 | 18-0014 | S | 14 | 0.140 | 15.3 | 0.57 |
| 11/15/2007 | 18-0014 | S | 15 | 0.170 | 16.2 | 0.59 |
| 11/16/2007 | 18-0014 | N | 3 | 0.090 | 2.3 | 0.32 |
| 11/18/2008 | 18-0014 | S | 7 | 0.170 | 16.2 | 0.56 |
| 11/24/2009 | 18-0014 | S | 17 | 0.110 | 10.2 | 0.43 |
| 11/9/2010 | 18-0014 | S | 14 | 0.080 | 6.6 | 0.33 |
| 11/1/2011 | 18-0014 | N | 5 | 0.140 | 4.1 | 0.49 |
| 11/2/2011 | 18-0014 | S | 14 | 0.120 | 8.9 | 0.44 |
| 3/11/1997 | 18-0005 | I1 |  | 0.210 | 44.0 | 0.82 |
| 8/12/1997 | 18-0005 | I1 |  | 0.125 | 20.7 | 0.52 |
| 8/12/1997 | 18-0005 | I2 |  | 0.196 | 34.8 | 0.83 |
| 9/23/1998 | 18-0005 | I1 | 4 | 0.097 | 14.3 | 0.42 |
| 9/23/1998 | 18-0005 | I2 | 2 | 0.086 | 10.4 | 0.42 |
| 9/23/1999 | 18-0005 | I2 | 11 | 0.140 | 21.6 | 0.70 |
| 6/17/2004 | 18-0005 | I1 | 6 | 0.110 | 15.1 | 0.38 |
| 3/30/2010 | 18-0005 | I2 | 2 | 0.150 | 14.1 | 0.38 |
| 9/11/2012 | 18-0005 | I1 | 22 | 0.130 | 20.1 | 0.41 |
| 9/12/2012 | 18-0005 | I2 | 13 | 0.130 | 20.9 | 0.50 |
| 8/3/2004 | 30-0016 | BC1 | 2 | 0.080 | 4.2 | 0.23 |
| 8/4/2004 | 30-0016 | BC3 | 1 | 0.080 | 4.5 | 0.24 |
| 8/5/2004 | 30-0016 | BC4 | 0 | 0.060 | 2.1 | 0.27 |
| 7/12/2005 | 30-0016 | BC1 | 2 | 0.140 | 10.0 | 0.72 |
| 7/13/2005 | 30-0016 | BC3 | 1 | 0.180 | 13.3 | 0.81 |
| 7/12/2005 | 30-0016 | BC4 | 0 | 0.060 | 1.8 | 0.24 |
| 9/26/2006 | 30-0016 | BC1 | 4 | 0.170 | 12.1 | 0.86 |
| 9/27/2006 | 30-0016 | BC3 | 1 | 0.160 | 9.8 | 0.59 |
| 9/27/2006 | 30-0016 | BC4 | 2 | 0.100 | 3.0 | 0.41 |
| 11/8/2007 | 30-0016 | BC1 | 0 | 0.130 | 8.5 | 0.55 |
| 11/8/2007 | 30-0016 | BC3 | 0 | 0.140 | 9.7 | 0.54 |
| 11/20/2008 | 30-0016 | BC1 | 0 | 0.100 | 7.6 | 0.43 |
| 11/21/2008 | 30-0016 | BC3 | 0 | 0.160 | 9.7 | 0.49 |
| 12/15/2009 | 30-0016 | BC3 | 0 | 0.150 | 11.6 | 0.59 |
| 12/1/2010 | 30-0016 | BC3 | 0 | 0.190 | 11.9 | 0.65 |
| 10/25/2011 | 30-0016 | BC1 | 0 | 0.140 | 12.9 | 0.82 |
| 10/24/2011 | 30-0016 | BC3 | 1 | 0.170 | 14.6 | 0.79 |
| 10/25/2011 | 30-0016 | BC4 | 1 | 0.063 | 2.1 | 0.23 |
| 4/5/2006 | 19-0002 | B1 | 7 | 0.090 | 5.6 | 0.30 |
| 4/6/2006 | 19-0002 | B2 | 5 | 0.080 | 4.2 | 0.22 |
| 5/20/2008 | 19-0002 | B1 | 0 | 0.130 | 8.3 | 0.37 |
| 5/19/2008 | 19-0002 | B2 | 2 | 0.090 | 4.4 | 0.19 |

Summary of all source test data:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Opacity(%) | PM(gr/dscf) | PM(lb/hr) | PM(lb/Mlb steam) |
| Average | 5.4 | 0.128 | 11.9 | 0.49 |
| Standard deviation | 6.0 | 0.039 | 8.2 | 0.19 |
| Avg. + 1 Stdev | 11.3 | 0.167 | 20.1 | 0.67 |
| Average CFP S | 12.1 | 0.139 | 13.7 | 0.50 |
| Average CFP N | 3.0 | 0.110 | 3.2 | 0.37 |
| Average I1 | 10.7 | 0.134 | 22.8 | 0.51 |
| Average I2 | 7.0 | 0.140 | 20.4 | 0.57 |
| Average BC1 | 1.3 | 0.127 | 9.2 | 0.60 |
| Average BC3 | 0.5 | 0.154 | 10.6 | 0.59 |
| Average BC4 | 0.8 | 0.071 | 2.3 | 0.29 |
| Average B1 | 3.5 | 0.110 | 6.9 | 0.33 |
| Average B2 | 3.5 | 0.085 | 4.3 | 0.21 |
| Maximum | 22 | 0.210 | 44.0 | 0.86 |
| Minimum | 0 | 0.060 | 1.8 | 0.19 |

Range of results (gr/dscf):

|  |  |  |  |
| --- | --- | --- | --- |
| Source | Boiler | Minimum | Maximum |
| CFP | S | 0.080 | 0.190 |
| CFP | N | 0.090 | 0.140 |
| Interfor | I1 | 0.097 | 0.210 |
| Interfor | I2 | 0.086 | 0.196 |
| Boise | BC1 | 0.080 | 0.170 |
| Boise | BC3 | 0.080 | 0.190 |
| Boise | BC4 | 0.060 | 0.100 |
| Collins | B1 | 0.090 | 0.130 |
| Collins | B2 | 0.080 | 0.090 |

Total number of tests 46

Number ≤0.10 gr/dscf 16

Percent ≤0.10 gr/dscf 34.8%