

Attachment A
Yellow Pine HAPs/Toxics Emissions
85% Biomass/15% Pet Coke Feedstock

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Yellow Pine HAPs/Toxics Emissions
85% Biomass, 15% Pet Coke Feedstock

BFB Boiler	
Operating Scenario	85% Biomass, 15% Pet Coke
Heat Input (MMBtu/hr)	1,529

HAPs/Toxics Pollutant	Emission Factors (lb/MMBtu)		Emission Rate (lb/hr)
	Biomass ¹	Pet Coke ²	
1,1,1-Trichloroethane	3.10E-05	0.00E+00	4.03E-02
1,2-Dichloroethane	2.90E-05	0.00E+00	3.77E-02
1,2-Dichloropropane	3.30E-05	0.00E+00	4.29E-02
2,3,7,8-Tetrachlorodibenzo-p-dioxins	8.60E-12	0.00E+00	1.12E-08
2,3,7,8-Tetrachlorodibenzo-p-furans	9.00E-11	0.00E+00	1.17E-07
2,4,6-Trichlorophenol	2.20E-08	0.00E+00	2.86E-05
2,4-Dinitrophenol	1.80E-07	0.00E+00	2.34E-04
2,4-Dinitrotoluene	0.00E+00	0.00E+00	0.00E+00
2-Chloroacetophenone	0.00E+00	0.00E+00	0.00E+00
4-Nitrophenol	1.10E-07	0.00E+00	1.43E-04
5-Methyl chrysene	0.00E+00	0.00E+00	0.00E+00
Acenaphthene	9.10E-07	4.61E-08	1.19E-03
Acenaphthylene	5.00E-06	2.71E-08	6.50E-03
Acetaldehyde	8.30E-04	0.00E+00	1.08E+00
Acetone	1.90E-04	0.00E+00	2.47E-01
Acetophenone	3.20E-09	0.00E+00	4.16E-06
Acrolein ³	7.80E-05	0.00E+00	1.01E-01
Aluminum	0.00E+00	0.00E+00	0.00E+00
Ammonia	0.00E+00	1.54E-02	3.53E+00
Anthracene	3.00E-06	1.35E-08	3.90E-03
Antimony	7.90E-06	0.00E+00	1.03E-02
Arsenic	2.20E-05	3.33E-06	2.94E-02
Barium	1.70E-04	0.00E+00	2.21E-01
Benzene	4.20E-03	5.67E-07	5.46E+00
Benzo(a)anthracene	6.50E-08	1.40E-08	8.77E-05
Benzo(a)pyrene	2.60E-06	7.94E-09	3.38E-03
Benzo(b)fluoranthene	1.00E-07	2.46E-08	1.36E-04
Benzo(b,j,k)fluoranthene	0.00E+00	0.00E+00	0.00E+00
Benzo(g,h,i)perylene	9.30E-08	8.12E-09	1.23E-04
Benzo(j,k)fluoranthene	1.60E-07	0.00E+00	2.08E-04
Benzo(k)fluoranthene	3.60E-08	0.00E+00	4.68E-05
Benzyl chloride	0.00E+00	0.00E+00	0.00E+00
Beryllium	1.10E-06	1.44E-07	1.46E-03
Biphenyl	0.00E+00	0.00E+00	0.00E+00
bis(2-Ethylhexyl)phthalate	4.70E-08	0.00E+00	6.11E-05
Bromoform	0.00E+00	0.00E+00	0.00E+00
Cadmium	4.10E-06	9.57E-07	5.55E-03
Carbon disulfide	0.00E+00	0.00E+00	0.00E+00
Carbon tetrachloride	4.50E-05	0.00E+00	5.85E-02
Chlorine	7.90E-04	0.00E+00	1.03E+00
Chlorobenzene	3.30E-05	0.00E+00	4.29E-02
Chloroform	2.80E-05	0.00E+00	3.64E-02
Chromium	2.10E-05	6.35E-07	4.69E-03
Chromium (Hex)	3.50E-06	4.68E-07	2.74E-02
Chrysene	3.80E-08	4.33E-08	5.93E-05
Cobalt	6.50E-06	0.00E+00	8.45E-03
Copper	4.90E-05	5.92E-06	6.50E-02
Crotonaldehyde	9.90E-06	0.00E+00	1.29E-02
Cumene	0.00E+00	0.00E+00	0.00E+00
Cyanide	0.00E+00	0.00E+00	0.00E+00
Dimethyl sulfate	0.00E+00	0.00E+00	0.00E+00
Ethyl chloride	0.00E+00	0.00E+00	0.00E+00
Ethylbenzene	3.10E-05	0.00E+00	4.03E-02

Attachment A
Yellow Pine HAPs/Toxics Emissions
85% Biomass, 15% Pet Coke Feedstock

HAPs/Toxics Pollutant	Emission Factors (lb/MMBtu)		Emission Rate (lb/hr)
	Biomass ¹	Pet Coke ²	
Ethylene dibromide	0.00E+00	0.00E+00	0.00E+00
Ethylene dichloride	0.00E+00	0.00E+00	0.00E+00
Fluoranthene	1.60E-06	7.06E-08	2.10E-03
Fluorene	3.40E-06	8.65E-08	4.44E-03
Formaldehyde	4.40E-03	4.01E-08	5.72E+00
Hexane	0.00E+00	0.00E+00	0.00E+00
HF	0.00E+00	5.82E-06	1.33E-03
Hydrogen chloride	1.90E-02	4.86E-03	2.58E+01
Indeno(1,2,3,c,d)pyrene	8.70E-08	7.94E-09	1.15E-04
Iron	9.90E-04	0.00E+00	1.29E+00
Isophorone	0.00E+00	0.00E+00	0.00E+00
Lead			2.75E-02
Manganese	1.60E-03	9.93E-06	2.08E+00
Mercury			1.47E-03
Methane	2.10E-02	0.00E+00	2.73E+01
Methyl bromide	1.50E-05	0.00E+00	1.95E-02
Methyl chloride	2.30E-05	0.00E+00	2.99E-02
Methyl ethyl ketone	5.40E-06	0.00E+00	7.02E-03
Methyl hydrazine	0.00E+00	0.00E+00	0.00E+00
Methyl methacrylate	0.00E+00	0.00E+00	0.00E+00
Methyl tert butyl ether	0.00E+00	0.00E+00	0.00E+00
Methylene chloride	0.00E+00	0.00E+00	0.00E+00
Molybdenum	2.10E-06	0.00E+00	2.73E-03
Naphthalene	9.70E-05	4.43E-06	1.27E-01
Nickel	3.30E-05	9.54E-06	4.51E-02
PAH	0.00E+00	0.00E+00	0.00E+00
PCB	0.00E+00	0.00E+00	0.00E+00
Pentachlorophenol	5.10E-08	0.00E+00	6.63E-05
Phenanthrene	7.00E-06	5.43E-07	9.22E-03
Phenol	5.10E-05	0.00E+00	6.63E-02
Phosphorus	2.70E-05	0.00E+00	3.51E-02
Propionaldehyde	6.10E-05	0.00E+00	7.93E-02
Pyrene	3.70E-06	1.65E-07	4.85E-03
Selenium	2.80E-06	6.06E-06	5.03E-03
Silver	1.70E-03	0.00E+00	2.21E+00
Styrene	1.90E-03	0.00E+00	2.47E+00
Tetrachloroethylene	3.80E-05	0.00E+00	4.94E-02
Tin	2.30E-05	0.00E+00	2.99E-02
Toluene	9.20E-04	0.00E+00	1.20E+00
Trichloroethene	3.00E-05	0.00E+00	3.90E-02
Vanadium	9.80E-07	0.00E+00	1.27E-03
Vinyl acetate	0.00E+00	0.00E+00	0.00E+00
Vinyl Chloride	1.80E-05	0.00E+00	2.34E-02
Xylenes	2.50E-05	0.00E+00	3.25E-02
Yttrium	3.00E-07	0.00E+00	3.90E-04
Zinc	4.20E-04	6.60E-04	6.97E-01
Total			8.15E+01

Notes:

¹ AP-42 Chapter 1.6 - Table 1.6-3 & 1.6-4

² California Air Toxics Emission Factors Search Result. *Coke in Fluidized Bed Combustor*. http://www.arb.ca.gov/app/emsinv/catef_list.php

³ Technical Memorandum dated November 1, 2005 from David Dixon to the Maine Air Toxics Initiative Emissions Inventory Subcommittee references a NCASI acrolein emission factor of 7.8 E-05 lb/MMBtu for wood-fired boilers.

Attachment A

Table 7-10
Air Toxics Impact Analysis
Yellow Pine Energy
Clay County, Georgia

HAPs/Toxics Pollutant ¹	Emission Rate (lb/hr)		Total Emission Rate	Averaging Period	Maximum Predicted Concentration	AAC ²
	FB Boiler	Aux. Boiler	(lb/hr)		(ug/m ³)	(ug/m3)
1,1,1-Trichloroethane	4.74E-02	0.00E+00	4.74E-02	24-hr 15-min	2.75E-03 9.08E-03	4.52E+03 2.46E+04
1,2-Dichloroethane	4.43E-02	0.00E+00	4.43E-02	24-hr 15-min	2.57E-03 8.50E-03	4.82E+02 4.05E+04
1,2-Dichloropropane	5.05E-02	0.00E+00	5.05E-02	Annual 24-hr 15-min	5.86E-04 2.93E-03 9.67E-03	4.00E+00 8.33E+02 5.08E+04
2,3,7,8-Tetrachlorodibenzo-p-dioxins	1.31E-08	0.00E+00	1.31E-08	24-hr	7.63E-10	6.90E-02
2,4-Dinitrotoluene	3.06E-06	0.00E+00	3.06E-06	24-hr	1.78E-07	3.57E+00
2-Chloroacetophenone	7.65E-05	0.00E+00	7.65E-05	Annual 24-hr	8.88E-07 4.44E-06	3.00E-02 7.52E-01
Acenaphthene	1.39E-03	0.00E+00	1.39E-03	24-hr	8.08E-05	4.76E-01
Acetaldehyde	1.27E+00	0.00E+00	1.27E+00	Annual 24-hr 15-min	1.47E-02 7.37E-02 2.43E-01	9.00E+00 2.86E+02 4.50E+03
Acetone	2.91E-01	0.00E+00	2.91E-01	24-hr 15-min	1.69E-02 5.57E-02	5.85E+03 1.84E+05
Acetophenone	1.68E-04	0.00E+00	1.68E-04	24-hr	9.75E-06	1.17E+02
Acrolein ³	1.19E+00	0.00E+00	1.19E+00	Annual 24-hr 15-min	1.38E-02 6.91E-02 2.28E-01	2.00E-02 5.45E-01 2.29E+01
Aluminum	5.28E-03	0.00E+00	5.28E-03	24-hr	3.07E-04	3.57E+01
Ammonia	3.96E+01	0.00E+00	3.96E+01	Annual 24-hr 15-min	4.60E-01 2.30E+00 7.58E+00	1.00E+02 8.28E+01 2.43E+03
Anthracene	4.59E-03	0.00E+00	4.59E-03	24-hr	2.66E-04	4.76E-01
Antimony	1.21E-02	0.00E+00	1.21E-02	24-hr	7.01E-04	1.19E+00
Arsenic ⁴	3.36E-02	1.00E-04	3.37E-02	Annual 24-hr	1.40E-04 1.60E-03	2.00E-04 7.94E-03
Barium	2.60E-01	0.00E+00	2.60E-01	24-hr	1.51E-02	1.19E+00
Benzene	6.42E+00	0.00E+00	6.42E+00	Annual 24-hr 15-min	7.46E-02 3.73E-01 1.23E+00	4.50E-01 2.54E+00 1.60E+03
Benzo(a)anthracene	9.94E-05	0.00E+00	9.94E-05	24-hr	5.77E-06	4.76E-01
Benzo(a)pyrene	3.98E-03	0.00E+00	3.98E-03	24-hr	2.31E-04	4.76E-01
Benzo(b)fluoranthene	1.53E-04	0.00E+00	1.53E-04	24-hr	8.88E-06	4.76E-01
Benzo(j,k)fluoranthene	2.45E-04	0.00E+00	2.45E-04	24-hr	1.42E-05	4.76E-01
Benzo(k)fluoranthene	5.50E-05	0.00E+00	5.50E-05	24-hr	3.20E-06	4.76E-01
Benzyl chloride	7.65E-03	0.00E+00	7.65E-03	24-hr 15-min	4.44E-04 1.47E-03	4.11E+00 5.00E+02
Beryllium	1.68E-03	7.50E-05	1.76E-03	Annual 24-hr 15-min	3.71E-05 1.85E-04 6.12E-04	4.00E-03 4.76E-03 5.00E-01
Biphenyl	1.86E-05	0.00E+00	1.86E-05	24-hr	1.08E-06	3.00E+00
bis(2-Ethylhexyl)phthalate	7.19E-05	0.00E+00	7.19E-05	24-hr 15-min	4.17E-06 1.38E-05	1.19E+01 1.00E+03
Bromoform	4.26E-04	0.00E+00	4.26E-04	Annual 24-hr	4.95E-06 2.47E-05	9.00E+00 4.10E+00
Cadmium	6.27E-03	7.50E-05	6.34E-03	Annual 24-hr	9.03E-05 4.52E-04	6.00E-03 1.19E-02
Carbon disulfide	1.42E-03	0.00E+00	1.42E-03	Annual 24-hr 15-min	1.65E-05 8.24E-05 2.72E-04	7.00E+02 1.48E+02 9.34E+03
Carbon tetrachloride	6.88E-02	0.00E+00	6.88E-02	Annual 24-hr 15-min	7.99E-04 3.99E-03 1.32E-02	7.00E-01 4.99E+01 6.29E+03
Chlorine	1.21E+00	0.00E+00	1.21E+00	24-hr 15-min	7.01E-02 2.31E-01	3.45E+00 1.45E+02
Chlorobenzene	5.05E-02	0.00E+00	5.05E-02	24-hr	2.93E-03	8.21E+02
Chloroform	4.28E-02	0.00E+00	4.28E-02	Annual 24-hr 15-min	4.97E-04 2.49E-03 8.20E-03	4.00E-01 1.16E+02 9.78E+02
Chromium	3.21E-02	7.50E-05	3.22E-02	24-hr 15-min	1.95E-03 6.44E-03	1.19E+00 1.00E+01
Chromium VI	5.41E-03	0.00E+00	5.41E-03	Annual 24-hr	6.28E-05 3.14E-04	8.00E-05 7.94E-03
Chrysene	5.93E-05	0.00E+00	5.93E-05	24-hr	3.44E-06	4.76E-01
Cobalt	9.94E-03	0.00E+00	9.94E-03	24-hr	5.77E-04	2.38E-01

Attachment A

Table 7-10
Air Toxics Impact Analysis
Yellow Pine Energy
Clay County, Georgia

HAPs/Toxics Pollutant ¹	Emission Rate (lb/hr)		Total Emission Rate	Averaging Period	Maximum Predicted Concentration	AAC ²
Copper	7.49E-02	1.50E-04	7.51E-02	24-hr 15-min	4.53E-03 1.49E-02	2.38E-01 1.00E+01
Crotonaldehyde	1.51E-02	0.00E+00	1.51E-02	24-hr 15-min	8.79E-04 2.90E-03	1.37E+01 8.61E+01
Cumene	5.79E-05	0.00E+00	5.79E-05	Annual 24-hr	6.72E-07 3.36E-06	4.00E+02 5.85E+02
Dimethyl sulfate	5.24E-04	0.00E+00	5.24E-04	24-hr	3.04E-05	1.23E+01
Ethyl chloride	2.00E-06	0.00E+00	2.00E-06	Annual 24-hr	2.32E-08 1.16E-07	1.00E+04 6.28E+03
Ethylbenzene	4.74E-02	0.00E+00	4.74E-02	Annual 24-hr 15-min	5.50E-04 2.75E-03 9.08E-03	1.00E+03 1.04E+03 5.45E+04
Ethylene dibromide	1.31E-05	0.00E+00	1.31E-05	Annual 24-hr 15-min	1.52E-07 7.61E-07 2.51E-06	2.00E-02 1.22E+02 2.31E+04
Ethylene dichloride	4.37E-04	0.00E+00	4.37E-04	Annual 24-hr 15-min	5.07E-06 2.54E-05 8.37E-05	4.00E-01 1.61E+02 4.05E+04
Fluoranthene	2.45E-03	0.00E+00	2.45E-03	24-hr	1.42E-04	4.76E-01
Formaldehyde	6.73E+00	0.00E+00	6.73E+00	Annual 24-hr 15-min	7.81E-02 3.91E-01 1.29E+00	8.00E-01 2.19E+00 2.45E+02
Hexane	7.32E-04	0.00E+00	7.32E-04	Annual 24-hr	8.50E-06 4.25E-05	7.00E+02 4.29E+03
	5.77E-03	0.00E+00		24-hr 15-min	3.35E-04 1.11E-03	5.85E+00 1.64E+02
Hydrogen chloride	2.91E+01	0.00E+00	2.91E+01	Annual 15-min	3.37E-01 5.57E+00	2.00E+01 7.46E+02
Indeno(1,2,3,c,d)pyrene	1.33E-04	0.00E+00	1.33E-04	24-hr	7.72E-06	4.76E-01
Iron	1.51E+00	0.00E+00	1.51E+00	24-hr	8.79E-02	2.38E+01
Isophorone	6.33E-03	0.00E+00	6.33E-03	24-hr 15-min	3.68E-04 1.21E-03	1.12E+02 2.83E+03
Lead	2.75E-02	2.25E-04	2.77E-02	24-hr	1.86E-03	1.19E-01
Manganese	2.45E+00	1.50E-04	2.45E+00	Annual 24-hr 15-min	2.84E-02 1.42E-01 4.69E-01	5.00E-02 4.76E-01 5.00E+02
Mercury ⁵	1.47E-03	7.50E-05	1.55E-03	Annual 24-hr 15-min	3.46E-05 1.73E-04 5.71E-04	3.00E-01 5.95E-02 1.00E+01
Methane	3.21E+01	0.00E+00	3.21E+01	24-hr	1.86E+00	1.56E+03
Methyl bromide	2.29E-02	0.00E+00	2.29E-02	Annual 24-hr 15-min	2.66E-04 1.33E-03 4.39E-03	5.00E+00 9.26E+00 7.77E+03
Methyl chloride	3.57E-02	0.00E+00	3.57E-02	Annual 24-hr 15-min	4.15E-04 2.07E-03 6.84E-03	9.00E+01 1.64E+02 4.13E+04
Methyl ethyl ketone	1.13E-02	0.00E+00	1.13E-02	Annual 24-hr 15-min	1.31E-04 6.56E-04 2.17E-03	5.00E+03 1.40E+03 8.85E+04
Methyl hydrazine	1.86E-03	0.00E+00	1.86E-03	24-hr 15-min	1.08E-04 3.56E-04	4.49E-02 3.77E+01
Methyl methacrylate	2.18E-04	0.00E+00	2.18E-04	Annual 24-hr 15-min	2.53E-06 1.27E-05 4.18E-05	7.00E+02 9.75E+02 4.10E+04
Methyl tert butyl ether	3.82E-04	0.00E+00	3.82E-04	Annual 24-hr	4.44E-06 2.22E-05	3.00E+03 4.29E+02
Methylene chloride	3.17E-03	0.00E+00	3.17E-03	24-hr 15-min	1.84E-04 6.07E-04	4.14E+02 4.34E+04
Molybdenum	3.21E-03	0.00E+00	3.21E-03	24-hr	1.86E-04	1.19E+01
Naphthalene	1.48E-01	0.00E+00	1.48E-01	Annual 24-hr 15-min	1.72E-03 8.61E-03 2.84E-02	3.00E+00 1.25E+02 7.86E+03
Nickel	5.05E-02	7.50E-05	5.05E-02	24-hr	3.02E-03	3.57E-02
Pentachlorophenol	7.80E-05	0.00E+00	7.80E-05	24-hr	4.53E-06	1.19E+00
Phenanthrene	1.07E-02	0.00E+00	1.07E-02	24-hr	6.21E-04	4.76E-01
Phenol	7.80E-02	0.00E+00	7.80E-02	24-hr 15-min	4.53E-03 1.49E-02	4.58E+01 6.00E+03
Phosphorus	4.13E-02	0.00E+00	4.13E-02	24-hr	2.40E-03	2.38E-01
Propionaldehyde	9.33E-02	0.00E+00	9.33E-02	24-hr	5.42E-03	1.13E+02
Pyrene	5.66E-03	0.00E+00	5.66E-03	24-hr	3.28E-04	4.76E-01

Attachment A

Table 7-10
Air Toxics Impact Analysis
Yellow Pine Energy
Clay County, Georgia

HAPs/Toxics Pollutant ¹	Emission Rate (lb/hr)		Total Emission Rate	Averaging Period	Maximum Predicted Concentration	AAC ²
Selenium	5.03E-03	3.75E-04	5.41E-03	24-hr	7.31E-04	4.76E-01
Silver	2.60E+00	0.00E+00	2.60E+00	24-hr	1.51E-01	2.38E-01
Styrene	2.91E+00	0.00E+00	2.91E+00	Annual	3.37E-02	1.00E+03
				24-hr	1.69E-01	1.01E+03
				15-min	5.57E-01	8.53E+04
Tetrachloroethylene	5.81E-02	0.00E+00	5.81E-02	24-hr	3.37E-03	1.61E+03
				15-min	1.11E-02	1.36E+05
Tin	3.52E-02	0.00E+00	3.52E-02	24-hr	2.04E-03	4.76E+00
Toluene	1.41E+00	0.00E+00	1.41E+00	Annual	1.63E-02	5.00E+03
				24-hr	8.17E-02	1.79E+03
				15-min	2.70E-01	1.13E+05
Trichloroethene	4.59E-02	0.00E+00	4.59E-02	24-hr	2.66E-03	1.28E+03
				15-min	8.79E-03	1.07E+05
Vanadium	1.50E-03	0.00E+00		24-hr	8.70E-05	2.38E-01
				15-min	2.87E-04	5.00E+00
Vinyl acetate	8.30E-05	0.00E+00	8.30E-05	Annual	9.64E-07	2.00E+02
				24-hr	4.82E-06	8.38E+01
				15-min	1.59E-05	5.28E+03
Vinyl Chloride	2.75E-02	0.00E+00	2.75E-02	Annual	3.20E-04	2.30E-01
				24-hr	1.60E-03	2.03E+00
				15-min	5.27E-03	1.28E+03
Xylenes	3.82E-02	0.00E+00	3.82E-02	Annual	4.44E-04	1.00E+02
				24-hr	2.22E-03	1.03E+03
				15-min	7.32E-03	6.51E+04
Yttrium	4.59E-04	0.00E+00		24-hr	2.66E-05	2.38E+00

	FB Boiler	Aux. Boiler
Maximum Predicted Concentration from SCREEN3 Model (ug/m ³) (based on 1 gram/sec)	1.152	23.2

Note:

- ¹ Some of the the air toxic emissions are based on U.S. EPA AP-42 emission factors. Details on air toxic emission factors and emission calculations can be found in Appendix E.
- ² AACs for annual averaging period are from U.S. EPA's Integrated Risk Information web site. AACs for 24-hr and 15-min averaging periods are from from OSHA/NIOSH TWAs and STELs (or ceiling limits).
- ³ Technical Memorandum dated November 1, 2005 from David Dixon to the Maine Air Toxics Initiative Emissions Inventory Subcommittee references a NCASI acrolein emission factor of 7.8 E-05 lb/MMBtu for wood-fired boilers.
- ⁴ Maximum predicted concentrations of arsenic were obtained using the U.S. EPA's short-term Industrial Source Complex Model (ISCST3).
- ⁵ Lead and Mercury emission rates are based on BACT determination.