



ENGINEERING CALCULATION SHEET AIR RESOURCES DIVISION

6 Hazen Drive Concord, NH 03302-0095
Phone: 603-271-0905 Fax: 603-271-7053

PROJECT NAME:	Pinetree Power - Tamworth, Tamworth, NH Title V Operating Permit (Renewal) SIC Code: 4911 (Energy Production)	ENGINEER: Padmaja Baru	DATE: 06/20/2005	Page 1 of 6
----------------------	---	-------------------------------	-------------------------	-------------

DATE APPLICATION RECEIVED: March 31, 2004 (Application # FY04-0428)

FACILITY DESCRIPTION

Pinetree - Tamworth (the Permittee) operates a 25 megawatt (MW) gross output, power generation facility located in Tamworth, New Hampshire. The facility began operation in 1987. The primary sources of emissions at the facility are wood-fired boiler, emergency diesel generator, fire pump and a cooling tower. The facility is a major source for nitrogen oxides and carbon monoxide and is therefore required to obtain a Title V Operating Permit.

PROJECT DESCRIPTION

The purpose here is to renew the facility's Title V operating permit. TV-OP-018 expired on September 30, 2004. Pinetree-Tamworth filed a complete Title V renewal application on March 31, 2004 and has been granted application shield on May 7, 2004 in accordance with Env-A 609.07. A site visit was conducted on January 11, 2005. This permit covers the following devices:

ID	Description
EU01	Zurn Two Drum Waterwall Wood-fired Boiler
EU02	745 hp Caterpillar Emergency Diesel Generator, Model #3412
EU03	Cooling Tower
EU04	187 hp Fire pump

EMISSION CALCULATIONS

Boiler 1

Pollutant	Emission factor (lbs/MMBTU)		Source of the emission factor	Actual Usage of wood chips (tons)		Actual emissions (tons)		Potential Emissions (based on PSD permit limits)	
	2003	2002		2003	2002	2003	2002	lb/hr	TPY
TSP	0.009	0.009	Stack test ¹	304,033 (which is equivalent to 2,736,297 MMBTU/yr)	299,900 (which is equivalent to 2,699,100 MMBTU/yr)	12.31	12.15	10.1	44.25
PM ₁₀	0.007	0.007	Stack test			9.11	8.99		
SO ₂	0.025	0.025	AP-42 ²			34.2	33.7	-	40
NO _x	0.241	0.231	CEMS			330	312.24	107.1	469.1
CO	0.179	0.145	CEMS			244.22	196.32	202.1	885.1
VOCs	0.003	0.003	Stack test ³			4.1	4.05	38.8	170

745 HP Emergency Generator (EU02 - 39.9 gal/hr of Diesel)

¹ Conducted in April 1991. Based on June 2004 stack test results, TSP emission factor = 0.005 lb/MMBTU. The new emission factor will be used to calculate the TSP emissions for the year 2004 and later.

² Table 1.6-2 *Emission factors for NO_x, SO₂ and CO from Wood Residue Combustion*, Chapter 1.6 of AP-42 September 2003 Edition.

³ Conducted in April 1991.



ENGINEERING CALCULATION SHEET AIR RESOURCES DIVISION

6 Hazen Drive Concord, NH 03302-0095
Phone: 603-271-0905 Fax: 603-271-7053

PROJECT NAME:	Pinetree Power - Tamworth, Tamworth, NH Title V Operating Permit (Renewal) SIC Code: 4911 (Energy Production)	ENGINEER: Padmaja Baru	DATE: 06/20/2005
			Page 2 of 6

Pollutant	AP-42 Emission factor (for Large Stationary Internal Combustion Engines > 600 HP)	Emission rate	Potential emissions
	Diesel	(Based on 39.9 gal/hr of diesel)	(based on 500 hours/yr)
	lb/1000 gal	lb/hr	TPY
TSP	8.5	0.34	0.08
SO ₂	55.36	2.21	0.55
NO _x	438.5	17.50	4.37
CO	116.5	4.65	1.16
VOCs	11.2	0.45	0.11

Max. fuel flow rate = 39.9 gal/hr of diesel

Sulfur = 0.4% by wt

187 HP Fire Pump (EU04 - 10.2 gal/hr of Diesel)

Pollutant	AP-42 Emission factor (for Small Stationary Internal Combustion Engines)	Emission rate	Potential emissions
	Diesel	(Based on 10.2 gal/hr of diesel)	(based on 500 hours/yr)
	lb/1000 gal	lb/hr	TPY
TSP	42.47	0.43	0.11
SO ₂	39.73	0.41	0.10
NO _x	604.2	6.16	1.54
CO	130.15	1.33	0.33
VOCs	--		

Max. fuel flow rate = 10.2 gal/hr of diesel

Note: The fire pump was listed as an exempt activity (based on Env- A 609.03(c)(16)) in the previous Title V application. However, the intention of this rule was not to include fire pumps as exempt activities and is therefore included in Table 1 of the Title V permit.

Cooling Tower -- Calculations

Pinetree-Tamworth facility has an induced draft cooling tower to cool the process water. Water conditioners are added to the cooling tower and due to drift loss, some of these conditioners are emitted to the ambient air. The water additives include sulfuric acid, Nalco 8305 Corrosion inhibitor and sodium hypochlorite 15%.

Particulate emissions

Circulation rate=26,000 gpm or 37,444,000 gal/day

Total liquid drift=0.002%, based on manufacturer's data

Total dissolved solids content of the water = 1200 ppm (this value is taken from previous Title V permit TV-OP-018)

Hourly PM emissions = (0.00002 gal/gal drift) x (26,000 gal/min*60 min/hr) x (8.34 lb/gal) x 1200 ppm TDS x 1/10⁶ = 0.312 lb/hr

Annual PM emissions = 1.37 TPY

RTAP Emissions



ENGINEERING CALCULATION SHEET AIR RESOURCES DIVISION

6 Hazen Drive Concord, NH 03302-0095
Phone: 603-271-0905 Fax: 603-271-7053

PROJECT NAME:	Pinetree Power - Tamworth, Tamworth, NH Title V Operating Permit (Renewal) SIC Code: 4911 (Energy Production)	ENGINEER: Padmaja Baru	DATE: 06/20/2005	Page 3 of 6
----------------------	---	-------------------------------	-------------------------	-------------

Sulfuric Acid

H₂SO₄ Consumption = 7 gal/day

% by wt of H₂SO₄ = 100%

Concentration of H₂SO₄ in the solution = (7 gal/day)/(37,444,000 gal/day) = 0.1869 ppm

H₂SO₄ drift concentration in ppm = 0.00002 gal/gal drift x 0.1869 ppm = 3.738 x 10⁻⁰⁶ ppm

Convert ppm to mg/m³

H₂SO₄ concentration in drift = (ppm H₂SO₄ x MW H₂SO₄)/24.45 = 3.738 x 10⁻⁰⁶ ppm x 98.1/24.45 = 1.55 x 10⁻⁰⁵ mg/m³
= 0.015 µg/m³

Annual emissions of H₂SO₄ = (0.015 µg/m³) x (1 m³/264.2 gal) x (1g/10⁶µg) x (1 lb/454 g) x (365 days/yr) x (1ton/2000 lbs) x (37,444,000 gal/day) = 8.54 x 10⁻⁰⁷ TPY (i.e., 4.69 x 10⁻⁰⁶ lbs/day)

MW = Molecular weight

Potassium Hydroxide Drift Losses

Nalco 8305 usage = 1 gal/day

Nalco 8305 contains 0.1-1% potassium hydroxide

Concentration of Nalco 8305 = (1 gal/day)/(37,444,000 gal/day) = 0.0267 ppm

Potassium hydroxide drift concentration in ppm = 0.00002 gal/gal drift x 0.0267 ppm x 1% = 5.3413 x 10⁻⁰⁹ ppm

Convert ppm to mg/m³

Potassium hydroxide concentration in drift = (ppm Potassium hydroxide x MW KOH)/24.45 = 5.3413 x 10⁻⁰⁹ ppm x 56.1/24.45 = 1.2256 x 10⁻⁰⁸ mg/m³ = 1.2256 x 10⁻⁰⁵ µg/m³

Annual emissions of H₂SO₄ = (1.2256 x 10⁻⁰⁵ µg/m³) x (1 m³/264.2 gal) x (1g/10⁶µg) x (1 lb/454 g) x (365 days/yr) x (1ton/2000 lbs) x (37,444,000 gal/day) = 6.98 x 10⁻¹⁰ TPY (i.e., 4.69 x 10⁻⁰⁶ lbs/day)

Sodium Hydroxide

Sodium hypochlorite Consumption = 7 gal/day

% by wt of sodium hydroxide=1%

Concentration of sodium hydroxide in the solution = (7 gal/day)/(37,444,000 gal/day) = 0.1869 ppm

Sodium hydroxide drift concentration in ppm = 0.00002 gal/gal drift x 0.1869 ppm x 1% = 3.738 x 10⁻⁰⁸ ppm

Convert ppm to mg/m³

Sodium hydroxide concentration in drift = (ppm sodium hydroxide x MW NaOH)/24.45 = 3.738 x 10⁻⁰⁸ ppm x 40/24.45 = 6.115 x 10⁻⁰⁸ mg/m³ = 0.0001 µg/m³

Annual emissions of sodium hydroxide = (0.0001 µg/m³) x (1 m³/264.2 gal) x (1g/10⁶µg) x (1 lb/454 g) x (365 days/yr) x (1ton/2000 lbs) x (37,444,000 gal/day) = 5.7 x 10⁻⁰⁹ TPY (i.e., 3.12 x 10⁻⁰⁸ lbs/day)

CAS #	RTAP	Emissions lb/day	Emissions lb/yr	24-hr Deminimus lb/day	Annual Deminimus lb/yr
7664-93-9	Sulfuric Acid	4.69 x 10 ⁻⁰⁶	0.00171	0.028	10
1310-58-3	Potassium Hydroxide	3.83 x 10 ⁻⁰⁹	1.396 x 10 ⁻⁰⁶	0.089	32
1310-73-2	Sodium Hydroxide	3.123 x 10 ⁻⁰⁸	1.14 x 10 ⁻⁰⁵	0.26	96



ENGINEERING CALCULATION SHEET AIR RESOURCES DIVISION

6 Hazen Drive Concord, NH 03302-0095
Phone: 603-271-0905 Fax: 603-271-7053

PROJECT NAME:	Pinetree Power - Tamworth, Tamworth, NH Title V Operating Permit (Renewal) SIC Code: 4911 (Energy Production)	ENGINEER: Padmaja Baru
		DATE: 06/20/2005 Page 4 of 6

INSIGNIFICANT ACTIVITIES

- Two liquid propane heaters;
 - Unit 1 - Ready heater is rated at 155,000 BTU/hr
 - Unit 2 - Air universal space heater is rated at 80,000 BTU/hr.
- Maintenance shop degreasing unit - This unit uses approximately 7-8 gallons of Safety Kleen 105 parts washing solvent. Actual emissions are less than 1000 lbs/yr. Also based on Env-A 607.01(x), no permit is required for this unit.

PERMITTING HISTORY

- PSD Permit 040-149NH06 was issued on November 15, 1990. PSD limits are as follows:
 - NO_x - 107.1 lb/hr & 0.265 lb/MMBTU averaged over any consecutive 24-hr period
 - CO - 0.5 lb/MMBTU/hr & 202.1 lb/hr averaged over any consecutive 24-hr period
 - PM - 0.025 lb/MMBTU & 10.1 lb/hr
 - SO₂ - 40 TPY
 - VOCs - 0.096 lb/MMBTU & 38.8 lb/hr
 - Opacity - 15%
 - Maximum steam production - 220,000 lbs/hr at 900⁰F and 700 psig.
 - CEMS for NO_x and CO, COMS, Stack volumetric flow monitor and Steam flow meter.
- Title V permit TV-OP-018 was issued on September 15, 1999. Minor modification to the permit was issued on April 5, 2001.
- State operating permits PO-B-1706 (for the Wood fired boiler) and PO-B-1779 (for the 745 hp Caterpillar Emergency Generator) were issued on March 11, 1996.

CAM RULE

Compliance Assurance Monitoring (CAM) rule applies to Title V sources that operate emission units with pre-controlled potential emissions at or above the major source thresholds that rely on control devices to comply with applicable requirements. The purpose of CAM is to provide a reasonable assurance of compliance with the applicable requirements and emission standards. CAM rule establishes criteria for monitoring, record keeping and reporting that should be conducted by the facility to provide a reasonable assurance of compliance with the emission limits and standards.

Pinetree-Tamworth has pre-controlled PM emissions of greater than 100 TPY. A multiclone in series with an ESP is used to control PM emissions. Hence, the CAM rule is applicable to PM emissions from the wood fired boiler. Pinetree-Tamworth is also a major source for NO_x and CO. The facility has CEMS for NO_x and CO. Hence CAM is not required for CO and NO_x.

In the CAM plan submitted by the facility in the Title V application, Pinetree-Tamworth proposed to use opacity as an indicator of PM control device performance. A stack test was conducted in June 2004 to establish a correlation between PM and opacity. Pinetree-Tamworth has a very stringent PM limit of 0.025 lb/MMBTU (PSD limit) and an opacity limit of 15% (PSD limit). Tests were conducted at two different ESP loadings. In the first case, PM and opacity were measured with all the three fields of the ESP operating, i.e., normal full ESP power (this is also representative of normal facility operation). This resulted in a particulate matter emissions of 0.005 lb/MMBTU and an average stack opacity of 1%. In the second case, particulate matter emissions testing was conducted at reduced ESP loading. This yielded an opacity of 10% and a PM emission rate of 0.322 lb/MMBTU (which is well above the limit of 0.025 lb/MMBTU).

Based on stack tests and historical operational data for the ESP, as long as all the three ESP fields are operating, the facility will be in compliance with the PM limit. Also, the secondary voltage for each field must be maintained between 3 and 60 kv. The pressure drop across the multiclone must be maintained between 2-8 inches of water. Tables 6A and 6B of the Title V permit outline various monitoring requirements that will assure the facility's compliance with the PM limit.



ENGINEERING CALCULATION SHEET AIR RESOURCES DIVISION

6 Hazen Drive Concord, NH 03302-0095
Phone: 603-271-0905 Fax: 603-271-7053

PROJECT NAME:	Pinetree Power - Tamworth, Tamworth, NH Title V Operating Permit (Renewal) SIC Code: 4911 (Energy Production)	ENGINEER: Padmaja Baru	DATE: 06/20/2005	Page 5 of 6
----------------------	---	-------------------------------	-------------------------	-------------

STACK TEST SUMMARY

	TSP	SO ₂	NO _x	CO	VOC	HCl
	lb/MMBTU					
April 16, 1991	0.009	0.000	0.205	0.23	0.003	-
June 9, 2004	0.005					0.0001
Permit Limit	0.025	40 TPY	0.265	0.5	0.096	-

SUMMARY OF CHANGES

1. Pinetree-Tamworth is required to continuously monitor and record data from the gaseous, volumetric and steam flow CEM systems during all periods of operation, including startup, shutdown, malfunctions or emergency conditions, except when the stack flow is less than 39,384 DSCFM⁴. The COMS shall be continuously monitoring and recording opacity data during all periods of operation, regardless of the stack flow rate. The minimum flow rate is changed from 39,762 DSCFM to 39,384 DSCFM in the new permit.
2. Monitoring frequency for secondary voltage (ESP) and pressure drop (multiclone) is changed from once every two hours to once per shift. This is consistent with 40 CFR 64.3(b)(4)(iii).
3. In the old permit, condition X.E.3 required quarterly reporting of fuel usage. The new permit requires monthly recordkeeping and annual reporting of fuel usage. This is consistent with Env-A 901.03 and Env-A 901.08 (SIP approved rules).
4. In the old permit, condition X.B.8 required daily and consecutive 365-day averages for CEMS. However, consecutive 365-day CEM averages are not required because the NO_x and CO emission limits for Pinetree-Tamworth are averaged over a 24-hr basis. Hence the new permit requires only daily averages for CEMS. This is consistent with Env-A 808.13(a)(3).

REVIEW OF REGULATIONS

NSPS Yes; Subpart Db
 NESHAP N/A; Pinetree is a minor source for HAPs. Subpart DDDD for *Industrial, Commercial and Industrial Boilers and Process Heaters* and Subpart ZZZZ for *Stationary Reciprocating Internal Combustion Engines* are not applicable to the facility.

Stack tests conducted for this facility and similar facilities (i.e., wood fired boilers) showed that AP-42 emission factors (Chapter 1.6, *Wood Residue Combustion*, Table 1.6-3) over estimate the HAP emissions from the wood fired boiler. For example, the AP-42 emission factor for Hydrochloric acid is 0.019 lb/MMBTU. The stack test conducted in June 2004 at the Pinetree-Tamworth facility showed that HCl emissions were at non-detect levels. Stack test conducted on June 10, 2004 at the Bridgewater Power facility (which has a 250 MMBTU/hr wood fired boiler) provided the following emission rates for HAPS:

Benzene = 0.014 lbs/hr [compare this to 4.2×10^{-03} lbs/MMBTU (AP-42 factor) x 250 MMBTU/hr = 1.05 lbs/hr];
 Acrolein = 0.010 lbs/hr [compare this to 4.0×10^{-03} lbs/MMBTU (AP-42 factor) x 250 MMBTU/hr = 1 lbs/hr];
 Styrene = 0.004 lbs/hr [compare this to 1.9×10^{-03} lbs/MMBTU (AP-42 factor) x 250 MMBTU/hr = 0.475 lbs/hr].
 Hence based on stack test results, Pinetree-Tamworth facility is not a major source for HAPS.

⁴ This flow rate is based on a ΔP of 0.05 inches of water column, average temperature of 170°F and a stack moisture of 1%. The minimum flow rate is included in the Title V permit because at flow rates below this value, CEM readings are not accurate. The flow rate was calculated by Leigh Morrill using the equation 2-9 in 40 CFR 60, Appendix A, Method 2.



ENGINEERING CALCULATION SHEET

AIR RESOURCES DIVISION

6 Hazen Drive Concord, NH 03302-0095
Phone: 603-271-0905 Fax: 603-271-7053

PROJECT NAME:	Pinetree Power - Tamworth, Tamworth, NH	ENGINEER: Padmaja Baru
	Title V Operating Permit (Renewal)	DATE: 06/20/2005
	SIC Code: 4911 (Energy Production)	Page 6 of 6

- 40 CFR 64 CAM rule is applicable;
- Env-A 300 AAQS; Source is in compliance. (See modeling memo dated July 8, 1986)
- Env-A 609 Title V Permits
- Env-A 700 Permit Fee System
- Env-A 800 Testing & Monitoring Procedures
- Env-A 900 Owner/Operator Obligations
- Env-A 1000 Prevention, Abatement and Control of Open Source Air Pollution
- Env-A 1211 NOx RACT
- Env-A 1400 RTAPs are emitted from the cooling tower. Emissions are below de minimus levels.
- Env-A 1600 Fuel specifications
- Env-A 2000 Fuel burning devices
- Env-A 2100 Visible Emission Standard (is applicable to the Cooling Tower)

SUMMARY AND CONCLUSIONS

In summary, the operations as applied for will be capable of meeting all regulations and standards for air quality. Title V Operating Permit shall therefore be issued.