



ENGINEERING CALCULATION SHEET

AIR RESOURCES DIVISION

29 Hazen Drive Concord, NH 03302-0095
Phone: 603-271-2630 Fax: 603-271-7053

PROJECT NAME:	Pinetree Power – Tamworth (3300300019)	ENGINEER: Gary Milbury, Jr.	
	Temporary Permit SIC Code: 4911 (Energy Production)	DATE: 02/06/2008	Page 1 of 5

DATE APPLICATION RECEIVED: December 14, 2007 (Application # FY07-0259)

FACILITY DESCRIPTION

Pinetree Power-Tamworth, Inc. (the Permittee) operates a 25 megawatt (MW) gross output, power generation facility located in Tamworth, New Hampshire. The primary sources of emissions at the facility are a wood-fired boiler, an emergency diesel generator, a 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.

Pinetree-Tamworth received a Prevention of Significant Deterioration (PSD) permit from the United States Environmental Agency (USEPA) on November 15, 1990. The requirements of the PSD Permit are now contained in Title V Operating Permit TV-OP-018 that was issued by the Division on October 17, 2005.

PROJECT DESCRIPTION

The Permittee has filed a Temporary Permit application requesting to install nitrogen oxide emission control equipment on the wood-fired boiler, identified as emission unit EU01. Specifically, the Permittee is proposing to install overfire air and flue gas recirculation technologies, as well as a selective non-catalytic reduction (SNCR) system and a selective catalytic reduction (SCR) system.

The SNCR and SCR systems require the use of ammonia (in the case of this project, urea, a form of ammonia, will be used), small amounts of which will be emitted from the boiler stack as “ammonia slip.” This permit limits the amount of ammonia slip from the SNCR and SCR systems. Initial stack testing on EU01 will be used to (1) determine whether ammonia slip complies with the permitted limit; and (2) to establish operating parameters to ensure that the ammonia slip limit will be met on an ongoing basis. Annual stack testing will be conducted to verify that the parameters used to monitor and control ammonia slip continue to be valid.

The facility currently operates under Title V Operating Permit TV-OP-018. This Temporary Permit includes new conditions associated with the project, and where necessary, identifies conditions of Title V Operating Permit TV-OP-018 that will either be modified or deleted as a result of the project. All terms and conditions of the Title V Operating Permit not specifically identified in this permit remain in effect unchanged. Upon issuance of this permit, the Permittee shall comply with all unchanged terms and conditions of Title V Operating Permit TV-OP-018 and all terms and conditions of this permit.

This permit covers the following devices:

ID	Description
EU01	Zurn Two Drum Waterwall Wood-fired Boiler



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The devices and/or processes identified in the table below are considered pollution control equipment or techniques for the Wood-fired boiler (EU01):

Pollution Control Equipment Identification		
Pollution Control Equipment Number	Description of Equipment	Activity
PCE3 (new)	Selective Non-Catalytic Reduction (SNCR) System	Control of nitrogen oxides
PCE4 (new)	Selective Catalytic Reduction (SCR) System	Control of nitrogen oxides

EMISSION CALCULATIONS (FROM EACH PERMITTED DEVICE)

The emission calculations presented for Boiler 1 (EU01) are similar to those presented in the Engineering Calculation Sheet dated June 20, 2005 which was prepared for the most recent Title V Operating Permit renewal application (application FY04-0428). The calculations presented below have been updated to include 2005 and 2006 actual emissions for EU01. Emission calculations for other devices have not changed as a result of this project and are not repeated here. See the Engineering Calculation Sheet dated June 20, 2005 prepared for application FY04-0428 for information regarding those devices.

Boiler 1 (EU01)

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)	
	2006	2005		2006	2005	2006	2005	lb/hr	TPY
TSP	0.005	0.005	Stack test ¹	318,545 (which is equivalent to 2,866,909 MMBTU/yr)	305,852 (which is equivalent to 2,752,667 MMBTU/yr)	7.17	6.88	10.10	44.23
PM ₁₀	0.004	0.004				5.30	5.09	-	-
SO ₂	0.0083	0.0083	AP-42 ²			11.95	11.47	-	-
NO _x	0.236	0.243	CEMS			338.56	335.02	107.10	469.07
CO	0.167	0.181	CEMS			239.49	249.59	202.10	885.20
VOCs ³	0.003	0.003	Stack test ⁴			4.30	4.13	38.80	169.94

¹ Stack test was conducted in May 2004. The new emission factors (0.005 lb/MMBTU for TSP and 0.004 lb/MMBTU for PM10) are used to calculate the TSP and PM10 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 Does not include exempt VOC compounds.

⁴ Stack test was conducted in April 1991. This emission factor (0.003 lb/MMBTU) will be used to calculate the VOC emissions.



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Regulated Toxic Air Pollutant (RTAP) Emissions

Ammonia Slip Emissions from the SNCR and SCR Systems

As a result of the use of urea or ammonia in SNCR or SCR systems, there will be emissions of ammonia in excess of what is required for the chemical reactions to occur or from ammonia which does not completely react with the NOx during the reaction process, called “ammonia slip.” An analysis has been performed by DES to ensure that the worst-case ammonia emissions comply with New Hampshire’s ammonia Ambient Air Limits (AAL) specified in Env-A 1400, *Regulated Toxic Air Pollutants*.

CAS #	RTAP	Emissions lb/day	Emissions lb/yr	24-hr Deminimus lb/day	Annual Deminimus lb/yr
7664-41-7	ammonia	117.6	42,580	0.79	287

As shown above, the potential daily and annual ammonia emissions are above the daily and annual deminimus values for ammonia as established under Env-A 1400. Therefore, ammonia emissions were then converted into ambient air concentrations to determine if the applicant could demonstrate compliance with Env-A 1400 using the in-stack or adjusted in-stack concentration methods provided in Env-A 1400.

Calculations to convert 20 ppmvd ammonia into units of micrograms per cubic meter (the units in which AALs are expressed) to determine the “in-stack concentration” are demonstrated below:

$$\text{micrograms/cubic meter NH}_3 \text{ (ug/m}^3\text{)} = (\text{ppmvd NH}_3 = 20) * (\text{Molecular Weight of NH}_3 = 17.01 \text{ lb/lb-mole}) * (41.56 \text{ (ug/m}^3\text{)/(ppm} * \text{lb NH}_3\text{/lb-mole NH}_3\text{)})$$

→ $\text{NH}_3 = \underline{14,139 \text{ ug/m}^3}$

The above in-stack concentration of 14,139 ug/m³ is above the 24-hour and annual ammonia AALs of 100 ug/m³. Therefore (in accordance with Env-A 1406.05, *Adjusted In-Stack Concentration Method*), the adjusted in-stack concentration was determined by dividing the in-stack concentration by a factor of 400:

→ $\text{NH}_3 \text{ adjusted in-stack concentration} = (14,139 \text{ ug/m}^3)/400 = \underline{35.35 \text{ ug/m}^3}$

24-hour and annual AALs for ammonia: **24-hour = 100 ug/m³ Annual = 100 ug/m³**

Based on the above, the source will be in compliance with the 24-hour and annual AALs for ammonia.

STACK INFORMATION

There are no changes to stack information associated with this project. See the Engineering Calculation Sheet dated June 20, 2005 prepared for application FY04-0428 for stack information.

MODELING

Modeling was not required as part of this project. As noted in the Engineering Calculation Sheet dated June 20, 2005 prepared for application FY04-0428, modeling was performed at the time of PSD application review and is described in the preliminary BACT determination dated February 14, 1990.



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EMISSION TESTING

Past emission testing was described in the Engineering Calculation Sheet dated June 20, 2005 prepared for application FY04-0428. No additional emission testing has been performed.

Ammonia slip testing is required for demonstrating compliance with the 20 ppmvd at 6% oxygen emission limit when EU03 and EU04 are in use. Ammonia slip testing is required within 60 days of achieving the maximum production rate of EU01 after the installation of the SNCR system (PCE3) and SCR system (PCE4), and annually thereafter.

The testing shall follow all requirements specified in Env-A 802, Compliance Stack Testing for Stationary Sources, which includes but is not limited to the following:

1. Submission of a Pre-test Protocol as specified in Env-A 802.04;
2. Holding a pretest meeting between DES, the owner or operator, and the contractor stack testing company at the facility as specified in Env-A 802.05; and
3. Submission of a stack testing report no later than 60 days following the successful completion of the stack test as specified in Env-A 802.11.

SITE VISITS/INSPECTIONS

<u>Date</u>	<u>Description</u>
Sept 6, 2007	Full Compliance Evaluation. Facility determined to be in compliance.

REPORTS/FEEES

The facility is up-to-date with all required reports and fees. Reported emissions (in tons) for the last 5 years are summarized below:

Year	Particulates	SO ₂	NO _x	CO	VOCs	Total
2006	7.17	11.95	338.57	239.49	4.30	601.47
2005	6.88	11.48	335.08	249.60	4.13	607.17
2004	7.04	11.74	330.51	278.39	4.23	631.92
2003	12.31	11.40	330.19	244.22	4.10	602.23
2002	12.15	11.25	312.28	196.33	4.05	536.07

INSIGNIFICANT ACTIVITIES

There are no changes to significant activities associated with this project. See the Engineering Calculation Sheet dated June 20, 2005 prepared for application FY04-0428 for information regarding insignificant activities.

PERMITTING HISTORY

1. PSD Permit 040-149NH06 was issued on November 15, 1990. PSD limits for EU01 are as follows:
 - NO_x - 107.10 lb/hr & 0.265 lb/MMBTU averaged over any consecutive 24-hr period
 - CO - 0.5 lb/MMBTU/hr & 202.10 lb/hr averaged over any consecutive 24-hr period
 - PM - 0.025 lb/MMBTU & 10.10 lb/hr
 - SO₂ - none (restricted to less than 40 tons/year for PSD avoidance)
 - VOCs - 0.096 lb/MMBTU & 38.80 lb/hr
 - Opacity - 15%
 - Maximum steam production - 220,000 lbs/hr at 900°F and 700 psig.
 - CEMS for NO_x and CO, COMS, Stack volumetric flow monitor and Steam flow meter.



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2. Original Title V permit TV-OP-018 was issued on 9/15/99. A minor modification to the permit was issued on 4/9/01.
3. Current (renewed) Title V Permit TV-OP-018 was issued on 10/17/05.

CAM RULE

There are no changes to Compliance Assurance Modeling (CAM) associated with this project. See the Engineering Calculation Sheet dated June 20, 2005 prepared for application FY04-0428 for information regarding CAM.

SUMMARY OF CHANGES/NEW PERMIT CONDITIONS

1. Addition of Selective Non-Catalytic Reduction (PCE3) and Selective Catalytic Reduction (PCE4) systems for NO_x control.
2. Added an ammonia slip emissions limit of 20 ppmvd at 6% oxygen (O₂).
3. Added requirement to conduct initial (and subsequent annual) performance testing for ammonia slip emissions and to establish operating parameters that will ensure that ammonia slip emissions remain under 20 ppm @6% oxygen on an ongoing basis.
4. Added requirement for facility to submit an annual emissions report pursuant to Env-A 907.01. This requirement was inadvertently omitted from Title V Operating Permit TV-OP-018.

REVIEW OF REGULATIONS

Only regulations pertinent to this project are included below. There are no changes to Compliance Assurance Modeling (CAM) associated with this project. For a description of regulations applicable to the facility, see the Engineering Calculation Sheet dated June 20, 2005 prepared for application FY04-0428.

Env-A 600	Statewide Permit System
Env-A 607.01	Temporary Permits – Applicable – A temporary permit is required under Env-A 607.01(v) to limit ammonia slip emissions to ensure compliance with Env-A 1400.
Env-A 607.08	Permit Expiration – Applicable. The facility will be required to apply for a Minor Modification to incorporate the requirements of this Temporary Permit into its Title V Operating Permit.
Env-A 700	Permit Fee System Applicable – The new pollutant ammonia will be subject to emission-based fees.
Env-A 800	Testing & Monitoring Procedures Applicable – Emission testing for ammonia slip is required by the Temporary Permit. Parametric monitoring for the SNCR and SCR are required.
Env-A 900	Owner/Operator Obligations Applicable:
Env-A 905.05	Recordkeeping is required for the SNCR and SCR since they are add-on NO _x controls.
Env-A 907.01	Annual emissions report added via this Temporary Permit. It was omitted in Title V Operating Permit.
Env-A 906&910	Parametric monitoring for the SNCR and SCR are required to be recorded and reported.
Env-A 1400	This project will add the RTAP ammonia. Ammonia emissions (emitted as ammonia slip) are below daily and annual AALs using the adjusted in-stack calculation method.

SUMMARY AND CONCLUSIONS

In summary, the operations as applied for will be capable of meeting all regulations and standards for air quality. A Temporary Permit has been prepared and proposed for issuance.