Hemphill Power & Light Company
Springfield, NH

Engineering Calculation Sheet-NHDES/ARD

SIC Codes: 4931 Electricity Generation
AFS #3301900031
Application Number: FY04-0171

August 30, 2005
Engineer: Danuta Lempert
Date Application Received: 11/3/03

1. Facility Description

Hemphill Power & Light Company owns and operates a 16 MWe net output, power generation facility. The primary sources of emissions at the facility are the wood-fired boiler, a chipper engine, an emergency diesel generator, a fire pump and a cooling tower. The facility is a major source of NOx and CO emissions and therefore requires a Title V Permit.

2. Project Description

Renewal of Title V Permit.

Description of Emission Unit	Install Date	Emissions Unit Maximum Allowable Permitted Capacity
Babcock & Wilcox Wood - fired Boiler Serial No. 756601	1987	1. Maximum firing rate-220 MMBTU/hr for wood equivalent to: a. 160,000lb/hr of steam averaged over 24- hour period at 900° F and 885 psig assuming boiler efficiency of 68% and feedwater temp of 443° F; and b. 252,000 tpy for wood chips at 55% moisture and (heating value for wood chips=3,825 BTU/lb) 7.65 MMBTU/ton heat input value;
Caterpillar 3412 Diesel Chipper Engine Serial No. 38513653	1987	4.3 MMBTU/hr equivalent to 31.4 gal/hr; 625 HP; EU3 shall be limited to less than 500 hours during any consecutive 12-month period.
Cummins Emergency Diesel Generator Serial No. 11416173	1987	3.5 MMBTU/hr equivalent to 25.5 gal/hr; 470 HP; EU4 shall be limited to less than 500 hours during any consecutive 12-month period.
Cummins Diesel Fire Pump Serial No. 20245491 (the device is no longer in use)	1987	Maximum Firing Rate-2.4 MMBTU/hr equivalent to 17.5 gal/hr; Rated Output-187 HP EU4 shall be limited to less than 500 hours during any consecutive 12-month period.
Cooling Towers	1987	Drift Factor = 0.00088% Circulation Rate=11,473 gpm

3. Insignificant Activities:

Description of Emission Unit	Install Date	Emissions Unit Maximum Capacity
Clarke Diesel Fire Pump Serial No. 91B-02856	5/11/2005	1.5 MMBTU/hr equivalent to 10.6 gal/hr; 165 HP

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4. Pollution Control Equipment:

Pollution Control #	Description of Equipment	Activity
PCE1	Multicyclone (Multiclone)	Primary particulate matter control for EU1.
PCE2	Electrostatic Precipitator (ESP)	Secondary particulate matter control for EU1.

5. Emission Calculations:

a. Fuel Burning Devices

i. Criteria Pollutants

220 mmBtu/hr/0.003825 mmBtu/lb=57,516 lb/hr=251,922 tpy of wood

Boiler/Wood-fired

Heat input	220	mmBtu/hr
Wood chips usage in 2003	201,669	tons/yr
Wood chip max usage	252,000	tons/yr
Moisture	55	%

Pollutant	EF lb/mmBtu	EF lb/ton	Actual lb/hr	Actual tpy	Potential lb/hr	Potential tpy
	(1-01-009-03)	(1-01-009-03)				
PT*	0.015	0.12	3.30	12.10	3.45	15.12
SO_2	0.025	0.19	4.40	19.28	5.50	24.10
NOx**		1.99	45.88	200.96	57.00	249.66
CO**		2.22	51.15	224.05	57.00	249.66
VOC	0.013	0.10	2.29	10.03	2.86	12.53

* Stack test done on 5/27/04 ({0.015 lb/mmBtu/2000lb/mmBtu}*[7.65 mmBtu/ton* 2000 lb/ton])=0.11475 lb/ton
**NOx and CO values are based on 2002 CEM data.

Chipper 624 HP

Heat input		4.29	mmBtu/hr
Fuel usage in 2003		10.046	kgal/yr
Fuel flow rate		31.2	gal/hr
Fuel HV	Diesel	0.137	mmBTU/gal

Pollutant	EF lb/kgal	Actual lb/hr	Actual tpy	Potential lb/hr	Potential tpy
	(2-02-004-01)				
PT	8.5	0.01	0.04	0.27	1.17
SO_2	5.536	0.01	0.03	0.17	0.76
NOx*	176.73	0.20	0.89	5.53	24.23
CO*	66.17	0.08	0.33	2.07	9.07
VOC	11.2	0.01	0.06	0.35	1.54

* Stack test done on 7/18/01
All other emission factors are AP-42 (5th ed)

Emergency Generator 470 HP

Heat input	3.49	mmBtu/hr	
Fuel usage in 2003	0.451	kgal/yr	diesel
Fuel flow rate	25.5	gal/hr	
Fuel Diesel	0.137	mmBTU/gal	

Pollutant	EF lb/kgal (2-02-001-02)	Actual lb/hr	Actual tpy	Potential lb/hr	Potential tpy*
PT	42.47	0.00	0.01	1.08	0.27
SO_2	39.73	0.00	0.01	1.01	0.25
NOx	604.2	0.03	0.14	15.41	3.85
CO	130.15	0.01	0.03	3.32	0.83
VOC	0	0.00	0.00	0.00	0.00

All emission factors are AP-42 (5th ed)
*Based on 500 hrs/yr.

Fire Pump 187 HP

Heat input	2.40	mmBtu/hr	
Fuel usage in 2003	0.255	kgal/yr	diesel
Fuel flow rate	17.5	gal/hr	
Fuel Diesel	0.137	mmBTU/gal	

Pollutant	EF lb/kgal (2-02-001-02)	Actual lb/hr	Actual tpy	Potential lb/hr	Potential tpy*
PT	42.47	0.00	0.01	0.74	0.19
SO_2	39.73	0.00	0.01	0.70	0.17
NOx	604.2	0.02	0.08	10.57	2.64
CO	130.15	0.00	0.02	2.28	0.57
VOC	0	0.00	0.00	0.00	0.00

All emission factors are AP-42 (5^{th} ed)
*Based on 500 hrs/yr.

ii. HAPs

Based on Hemphill's stack testing for HCl and the similar facility (Bridgewater Power Co.) testing for benzene, acrolein and styrene it was concluded that the facility is a true minor source of HAPs.

b. Cooling Towers

i. Particulate Matter

c. Conductivity=20,000 micro-mhos

Circulation rate=11,473 gpm or 16.521 mmgal/day

Total liquid drift=0.00088% or 0.073 lb drift/kgal, based on AP-42 factors

(Eq 1) Conductivity x2/3 is essentially TDS in ppm

20,000 micro-mhos *2/3=13.333 ppm TDS= 13.333 ppm/1x10^{6}=0.013 fraction of TDS in water

(Eq 2) Annual Drift= Circulation rate* Drift factor =

11,473 gpm*60 min/hr*8760 hrs/yr* 7.3x10^{-5} lb drift/gal=440,190 lb drift/yr or 1,206 lb drift/day

(Eq 3) PT emissions =Annual Drift * TDS =

440,190 lb drift/yr * 0.013=5722.47 lb/yr= 2.86 tpy

i. RTAPs

Sulfuric Acid Drift Losses

H_2SO_4 Consumption-1500 gal/yr or 4.1 gal/day

% by wt of H_2SO_4 =93%

Daily drift=1,206 lb drift/day

TDS (H_2SO_4 concentration in ppm)=Daily consumption/Daily flow rate=

(4.1 gpd*0.93)/16.521 mmgpd=0.23 ppm

Daily H_2SO_4 emissions= Daily drift * TDS

= 1,206 lb drift/day*(0.23 ppm/1x$10^{6)}$ =2.8x10^{-4} lb/day

Sodium Hydroxide Drift Losses

Caustic Soda consumption-4,000 gal/yr or 10.96 gal/day

50% by wt of NaOH

Inhibitor AZ8104 consumption-1,000 gal/yr or 2.74 gal/day

100%by wt of NaOH

Daily Drift-1,206 lb drift/day

TDS (NaOH concentration in ppm)={(10.96 gpd*0.5) +2.74 gpd}/16.521 mmgpd=0.498 ppm

Daily NaOH emissions= Daily drift * TDS

= 1,206 lb drift/day *0.498 ppm/1x10^{6} =6.0x10^{-4} lb/day

CAS #	Compound	Emissions lb/day	Emissions lb/yr	24-hr Deminimus lb/day	Annual Deminimus lb/yr
7664-93-9	Sulfuric Acid	2.8x10^{-4}	0.102	0.028	10
1310-73-2	Sodium Hydroxide	6.0x10^{-4}	0.22	0.26	95

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6. Stack Information:

Stack #	Emission Unit #	Minimum Stack Height Above Base Elevation (Ft)	Maximum Stack Diameter or (Ft)
Stack 1	Boiler	212	6.5
Stack 2	Chipper Diesel Engine	24	0.67

7. Modeling:

CAS #	Compound	Emissions lb/day	Emissions lb/yr	24-hr Deminimus lb/day	Annual Deminimus lb/yr
7664-93-9	Sulfuric Acid	$2.8x10^{-4}$	0.102	0.028	10
1310-73-2	Sodium Hydroxide	$6.0x10^{-4}$	0.22	0.26	95

8. Emission Testing:

Wood Boiler stack test date-5/27/2004

Pollutant	Stack Test Data		NSPS Limit
	lb/mmBtu	lb/hr	lb/mmBtu
HCl	0.0001	0.02	
Particulates	0.015	3.59	**0.10**

9. Permitting History

1. On April 7, 1999, Title V Permit (TV-OP-016) was issued to Thermo Ecotek Corporation for Hemphill Power and Light facility for the following devices:
    a. Wood-fired Boiler;
    b. Emergency diesel generator; and
    c. Diesel chipper engine.
2. On November 15, 1999, the Title V permit was amended to correct typographical errors in the designation of authority for conditions 6, 7, and 8 in Sec. VIII.C. The three conditions (Env-A 2003.04, 2003.04(e)(2) and 2003.04(f) were moved to State-Only Section.
3. On April 13, 2000, the Title V permit was amended to correct typographical errors in the numbering scheme on pg 11, Sec. VIII.C. and the General Title V Operating Conditions.
4. On June 26, 2001, the Title V permit was amended to reflect the change in the name of the owner/operator and technical contact on pg. 1.

5. On November 16, 2001, the Title V permit was amended to reflect the change in the parent company from Hemphill Power and Light to AES Ecotec Holdings LLC.

10. Site Visits/Inspections:

Date	Brief Description
6/2/2004	Site visit purpose was to tour the facility and collect the missing information.

11. Compliance Report/Emission Fees

Reports	Year	Status
Emissions/Fees	2004	Paid
Annual Certification	1/26/2005	In compliance
Semi-annual Deviation/Monitoring	1/26/2005	In compliance
Compliance Inspection	6/1/2005	Facility was inspected and found to be in compliance.

12. Permit Updates/Revisions

Current TV Permit Issued on 4/7/99	Renewal	Reason for Change
Condition X.A.b.		Daily requirement for visible emission inspection for the Multiclone was taken out since the device is under negative pressure.
Condition X.D.3.		The quarterly fuel usage report was deleted since there is no regulatory basis for it.
Condition III.C.		The Modified Operation paragraph was deleted since the propane burner was never installed.
	Table 8, Item 2	The frequency of reporting of permit deviations was changed to "within 24 hours".
	Table 8, Item 8	The speciated emission report was added.
	Table 6A and 6B	CAM Plan was added in the monitoring section including the requirements for stack testing for particulates every 5 years.
	Table 1	The Cooling Towers were included in the Significant Activity table since the emissions from cooling towers are more than 1000 lb/yr.
Table 2-Stack Criteria		The emergency generator was removed from the Table 2-Stack Criteria,

		since this devices is exempt from modeling.
Table 1		The fire pump was added to Table 1 as a significant activity.
Condition VIII.B.9.		The facility is no longer burning on-site generated waste oil therefore all references to burning waste oil in the Boiler were removed. The facility hired Safty Kleen to properly dispose the on site-generated waste oil.
	Table 5, Item 6	The PSD avoidance limits were clarified, the 57 lb/hr limits for NOx and CO apply to the Boiler only but 250 tpy limit applies to the facility. The 225 lb/hr averaged over each calendar day limit for CO applies to the Boiler only.
Condition VIII.C.3.		The heat input rate for the diesel chipper engine was verified to be 4.3 mmBTU/hr and the NOx RACT requirements (Env-A 1211.07(c)(2)(b)) were deleted since the device is below the applicability threshold of 4.5 mmBtu/hr.
Condition VIII.C.4.		Env-A 1604.01(a) and Env-A 806.02 Sulfur Content of Diesel was deleted since only EPA has authority to regulate diesel.

13. Applicable Regulation

NSPS Applicable

40 CFR 60 Subpart Db, *Standard of Performance for Industrial-Commercial-Institutional Stem Generating Units*.

Part 60.44b *Standards for NOx.* The facility is not subject to this part in accordance with 60.44b(k) .

Part 60.42b *Standards for* SO_2 . The facility is not subject to this part.

Part 60.43b *Standards for PM.* The facility is subject to this part and shall limit the emissions from PM to 0.10 lb/mmBTU heat input in accordance with Part 60.43b(c)(1).

NESHAP No, True minor source of HAPs. Not applicable to Subpart DDDDD NESHAP for *Industrial, Commercial, and Institutional Boilers and Process Heaters* based on AP-42 emission factors.

40 CFR 64 CAM Applicable,

Title V Yes, major for NO_x and CO

Env-A 300 *AAQS* Not Applicable

Env-A 600 *Statewide Permit System* Applicable

Env-A 700 *Permit Fee System* Applicable

Env-A 800 *Testing & Monitoring Procedures* Applicable

Env-A 900 *Owner/Operator Obligations* Applicable

Env-A 1200 Nox RACT Applicable to Boiler

Env-A 1400 *RTAPs* Applicable

Env-A 1604 *Maximum Sulfur Content Allowable in Liquid Fuels* -Applicable

Env-A 2003 *Operational Requirements for Fuel Burning Devices*-Applicable

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14. Summary and Conclusion:

In summary, the operations as applied for will be capable of meeting all regulations and standards for air quality.