PERMIT APPLICATION FOR TITLE V OPERATING PERMIT
AIR RESOURCES DIVISION

29 Hazen Drive, PO Box 95, Concord, NH 03302-0095
Phone: 603-271-1370 Fax: 603-271-7053

PROJECT NAME:	Public Service of New Hampshire, Merrimack Station, Bow, NH Title V Operating Permit SIC Code: 4333 Electric Utility Application #: FY96-TV048	**ENGINEER:** Doug Laughton **DATE:** 07/30/09	Page 1 of 14

APPLICATION RECEIVED:

Application # FY96-TV048 received on July 1, 1996 with additional information received on August 29, 1996, April 28, 1998, January 16, 2003, June 13, 2003, May 15, 2009, and July 28, 2009.

FACILITY DESCRIPTION:

Merrimack Station is a fossil fuel-fired electricity generating facility, owned and operated by Public Service of New Hampshire (PSNH), a subsidiary of Northeast Utilities. The facility is composed of two utility boilers, two combustion turbines operating as load shaving units, an emergency generator, an emergency boiler, and coal handling systems including primary and secondary coal crushers, coal piles, coal conveyor systems, and coal unloading from railcars. The facility operations also include various activities that are classified as insignificant or exempt activities.

The two utility boilers (MK1 and MK2) primarily burn bituminous coal and use No. 2 fuel oil in the cyclone burners on startups of the boilers; the two combustion turbines primarily burn No. 1 fuel oil or JP-4 aviation fuel; the emergency generator burns No. 2 fuel oil or diesel fuel, and the emergency boiler burns No. 2 fuel oil or on road low sulfur diesel fuel. Merrimack Station emits nitrogen oxide (NOx), sulfur dioxide (SO2), carbon monoxide (CO), volatile organic compounds (VOCs), particulate matter (PM), carbon dioxide (CO2), state regulated toxic air pollutants (RTAPs), and federal hazardous air pollutants (HAPs).

Each utility boiler is equipped with selective catalytic reduction (SCR) systems to control NOx emissions. Each utility boiler is also equipped with two electrostatic precipitators (ESP) to control PM emissions. Each utility boiler stack is equipped with continuous emissions monitoring systems (CEMS) for NOx, SO2, CO, and O2 or CO2, and a continuous opacity monitoring system (COMS).

Merrimack Station receives bituminous coal by railcar and by trucks. The coal conveyor systems are enclosed, where practical, and coal crushing occurs inside a building.

Merrimack Station operates a flyash reinjection system on each utility boiler.

FACILITY LOCATION:

Merrimack County is an attainment area for ozone, NO_2, PM_{10}, CO, and lead. Merrimack County is located in the Ozone Transport Region.

PURPOSE OF PERMIT:

- To streamline existing separate permits for permitted sources into one Title V Operating Permit.

SIGNIFICANT ACTIVITIES:

See Table 1 below.

29 Hazen Drive, PO Box 95, Concord, NH 03302-0095
Phone: 603-271-1370 Fax: 603-271-7053

Table 1 – Significant Activity Identification			
Emission Unit Number	**Description of Emission Unit**	**Maximum Gross Heat Input or Maximum Power Output**	**Maximum Operating Conditions**
MK1	Utility Boiler (Installed in 1960) Cyclone Burner, Front wall firing	Bituminous Coal: 1,238 MMBtu/hr; 113 MW	A) Maximum fuel consumption rate of bituminous coal shall be limited to 48.5 tons/hr, not to exceed 425,289 tons during any consecutive 12-month period.[1] B) No. 2 fuel oil consumption shall not exceed 14.5 million gallons during any consecutive 12 month period.[2]
MK2	Utility Boiler (Installed in 1968) Cyclone Burner, Opposed wall firing	Bituminous Coal: 3,473 MMBtu/hr; 320 MW	A) Maximum fuel consumption rate of bituminous coal shall be limited to 136.2 tons/hr, not to exceed 1,193,078 tons during any consecutive 12-month period.[3] B) No. 2 fuel oil consumption shall not exceed 14.5 million gallons during any consecutive 12 month period.[4]
MKCT1	Combustion Turbine #1 (Installed in 1968) One-end only firing	No. 1 fuel oil or JP-4 aviation fuel: 319 MMBtu/hr	Maximum fuel consumption rate shall not exceed 2,279 gal/hr.[5]
MKCT2	Combustion Turbine #2 (Installed in 1969) One-end only firing	No. 1 fuel oil or JP-4 aviation fuel: 319 MMBtu/hr	Maximum fuel consumption rate shall not exceed 2,279 gal/hr.[6]
PCC	Primary Coal Crusher (Installed in 1960)	NA	Maximum operating rate of the Primary Coal Crusher shall be limited to 885 ton/hr coal
SCC	Secondary Coal Crusher (Installed in 1960)	NA	Maximum operating rate of the Secondary Coal Crusher shall be limited to 690 ton/hr coal

[1] The heating value of bituminous coal is assumed to be 12,750 Btu/lb. The fuel consumption limits may vary based on the actual heat content of the fuel burned.
[2] No. 2 fuel oil is only used to initially ignite the coal in the 3 cyclone burners in MK1 during startup of the Boiler.
[3] The heating value of bituminous coal is assumed to be 12,750 Btu/lb. The fuel consumption limits may vary based on the actual heat content of the fuel burned.
[4] No. 2 fuel oil is only used to initially ignite the coal in the 7 cyclone burners in MK2 during startup of the Boiler.
[5] The heating value of JP-4 and No. 1 fuel oil is assumed to be 140,000 Btu/gal. The fuel consumption limits may vary based on the actual heat content of the fuel burned.
[6] The heating value of JP-4 and No. 1 fuel oil is assumed to be 140,000 Btu/gal. The fuel consumption limits may vary based on the actual heat content of the fuel burned.

29 Hazen Drive, PO Box 95, Concord, NH 03302-0095
Phone: 603-271-1370 Fax: 603-271-7053

Table 1 – Significant Activity Identification			
Emission Unit Number	**Description of Emission Unit**	**Maximum Gross Heat Input or Maximum Power Output**	**Maximum Operating Conditions**
MKEG	Emergency Generator (Installed in 1988)	Diesel fuel (with a maximum sulfur content of 0.4% by weight): 3.932 MMBtu/hr	Maximum fuel consumption rate of diesel fuel shall not exceed 28.7 gal/hr.[7]
MKEB	Emergency Boiler (Temporary – Each installation[8])	No. 2 fuel oil (with a maximum sulfur content of 0.4% by weight or on-road low sulfur diesel oil (with a maximum sulfur content of 0.05% by weight): 96 MMBtu/hr	A) Maximum fuel consumption rate of No. 2 fuel oil shall not exceed 520 gal/hr and 11,760 gal/day[9]; or B) Maximum fuel consumption rate of on-road low sulfur diesel oil shall not exceed 701 gal/hr.

POLLUTION CONTROL EQUIPMENT:

Table 2 – Pollution Control Equipment/Method Identification		
Pollution Control Equipment Number	**Description of Equipment/Method**	**Emission Unit Number**
MK1-PC1	Electrostatic Precipitator (ESP) #1 on MK1 (Included with original boiler installation in 1960)	MK1
MK1-PC2	ESP #2 on MK1 installed in 1989	MK1
MK1-PC3	Selective Catalytic Reduction (SCR) System (Operational in 1999, replacing the SNCR installed in 1995)	MK1
MK2-PC4	ESP #1 on MK2 (Included with the original boiler installation in 1968)	MK2
MK2-PC5	ESP #2 on MK2 installed in 1999	MK2
MK2-PC6	SCR System installed in 1995	MK2

[7] The heating value of diesel fuel is assumed to be 137,000 Btu/gal. The fuel consumption limits may vary based on the actual heat content of the fuel burned.
[8] The facility has a Temporary Permit TP-B-0490 issued on March 6, 2003, which allows for seasonal installation of a temporary boiler for providing back-up heat and steam for the startup of MK1 and MK2 during winter months after an unplanned outage.
[9] The heating value of No. 2 fuel oil is assumed to be 140,000 Btu/gal. The fuel consumption limits may vary based on the actual heat content of the fuel burned.

29 Hazen Drive, PO Box 95, Concord, NH 03302-0095
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STACK INFORMATION:

Table 3 – Stack Information

Emission Unit Number	Emission Unit Description	Minimum Stack Height (Feet) Above Ground Level	Maximum Inside Stack Diameter @ Exit (Feet)	Minimum Exhaust Air Flow (acfm)
MK1	Utility Boiler #1	225	8.6	480,000 at 300 deg F full load[10]
MK2	Utility Boiler #2	317	14.5	1,200,000 at 335 deg F at full load[11]
MKCT1	Combustion Turbine #1	20	10.5” X 14”	821,000 at 840 deg F at full load[12]
MKCT2	Combustion Turbine #2	20	10.5” x 14”	821,000 at 840 deg F at full load[13]
MKEG	Emergency Generator	12	0.5	NA
MKEB	Emergency Boiler	22.33	4.0	NA

INSIGNIFICANT ACTIVITIES:

Table 4 – Insignificant Activities

Activity	Basis
Solvent Cold Cleaning Station 1	Env-A 609.04(d)(2)
Solvent Cold Cleaning Station 2	Env-A 609.04(d)(2)
Solvent Cold Cleaning Station 3	Env-A 609.04(d)(2)
Solvent Cold Cleaning Station 4	Env-A 609.04(d)(2)
Solvent Cold Cleaning Temporary Units (3 Units < 60 days each unit)	Env-A 609.04(d)(2)
Slag Tank Warm-up Lines MK1 and MK2	Bypass of boiler exhaust to warm the Slag Tanks. Emissions accounted for in Boiler Emissions.
600 Gallon Gasoline Tank – Vehicle Fueling	Env-A 609.04(d)(2)
Shot Hoppers Ash Dumping	Env-A 609.04(d)(2)
SCR Economizer Hoppers Ash Dumping	Env-A 609.04(d)(2)
SCR Reactor Hoppers Ash Dumping	Env-A 609.04(d)(2)

[10] When operating MK1 below full load, operate the boiler and maintain volumetric air flows in a manner not to cause an exceedance of any emission limitation or operational limitation contained in this permit.
[11] When operating MK2 below full load, operate the boiler and maintain volumetric air flows in a manner not to cause an exceedance of any emission limitation or operational limitation contained in this permit.
[12] When operating MKCT1 below full load, operate the combustion turbine and maintain volumetric air flows in a manner not to cause an exceedance of any emission limitation or operational limitation contained in this permit.
[13] When operating MKCT2 below full load, operate the combustion turbine and maintain volumetric air flows in a manner not to cause an exceedance of any emission limitation or operational limitation contained in this permit.

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Table 4 – Insignificant Activities	
Activity	**Basis**
Chemical Lab Hood Vents	Env-A 609.04(d)(2)
House Vacuum System with Baghouse	Env-A 609.04(d)(2)
Crusher House Propane Heating System	Env-A 609.04(d)(2)
Warehouse A Fuel Oil Heating Furnace System (2 propane unit)	Env-A 609.04(d)(2)
Yard Services Building #2 Fuel Oil Heating System	Env-A 609.04(d)(2)
Diesel/#2 Fuel Oil Storage Tanks (2 Tanks at 8,000 gallons each)	Env-A 609.04(d)(2)
Jet Fuel Storage Tanks (4 Tanks at 40,000 gallons each tank)	Env-A 609.04(d)(2)
Fly Ash Disposal Tank	Env-A 609.04(d)(2)
Fly Ash Silo Dust Collectors (2 Silos)	Env-A 609.04(d)(2)
Limestone Silo Dust Collector	Env-A 609.04(d)(2)
Vermiculite Silo Dust Collector	Env-A 609.04(d)(2)
PAC Silo Dust Collector	Env-A 609.04(d)(2)
Ammonia Storage and Distribution Systems	Env-A 609.04(d)(2)
Fly Ash Tank Unloading (Two unloading stations)	Env-A 609.04(d)(2)
Coal Handling and Unloading Systems	Env-A 609.04(d)(2)

EMISSIONS INFORMATION

Table 5 – Summary of Potential Emissions and Major Source Status			
Pollutant	**Potential Emissions (tpy)**	**Title V Major Source Thresholds**	**Title V Major Source?**
SO_2	113,222	100 tpy	yes
NOx	13,171	50 tpy	yes
CO	515	100 tpy	yes
VOC	116	50 tpy	yes
TSP	4981	100 tpy	yes
HAPs	1,260 (mostly HCL & HF)	10 tpy of individual HAPs; 25 tpy for all HAPs combined	yes

Notes:

1. See calculation sheet for detailed calculations of the criteria pollutant emissions.
2. Potential emissions are based on maximum operational and emission limitations contained in the draft Title V operating permit and/or AP-42 emission factors.
3. SO2 emissions for MK1 and MK2 are based on the ton/hr coal consumption limit on an annual basis.

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Table 6A – Emission Limitations for the Boilers (MK1 and MK2)

Pollutant	Emission Limit	Averaging Time	Authority
NOx	1.22 lb/MMBtu for MK1	7 consecutive 24-hour averages summed and divided by 7	NOx RACT Order ARD-97-001
	15.4 tons/day for MK2	24-hr calendar day average	Env-A 1211.03(d)(1)
	0.86 lb/MMBtu for MK2	Annual average	40 CFR 76.6(a)(2)
	29.1 tons/day combined from MK1 & MK2	24-hr calendar day average	NOx RACT Order ARD-97-001
	18.1 tons/day for MK1 when MK2 is not in full operation	24-hr calendar day average	NOx RACT Order ARD-97-001
	NOx Allowance Allocation for the Ozone Season in Table 9 below	Ozone Season (tons for May 1st through August 31st)	Env-A 3200
SO_2	See State and Federal Acid Rain Program Limits below in Tables 7 and 8		Env-A 400, Env-A 2900, 40 CFR 72, 73, 76, 77
Sulfur Content for Coal	2.0 lb/MMBtu	3-month rolling average	Env-A 1606.01(b)
	2.8 lb/MMBtu	At any time	Env-A 1606.01(a)
Sulfur Content for No. 2 Fuel Oil	0.40 percent by weight	Each delivery	Env-A 1604.01(a)
TSP	0.27 lb/MMBtu for MK1 including periods of flyash injection, use formula in Env-A 2003.06 when below 1,238 MMBtu/hr		Env-A 2003.06 & Temporary Permit FP-T-0054
	1,463.1 tons for MK1	Consecutive 12 month period	Temporary Permit FP-T-0054
	0.227 lb/MMBtu for MK2 including periods of flyash injection, use formula in Env-A 2003.06 when below 3,473 MMBtu/hr		Env-A 2003.06 & Temporary Permit TP-B-0462
	3,458.6 tons for MK2	Consecutive 12 month period	Temporary Permit TP-B-0462
Opacity	30% - Normal Operations, except during periods of startup or shutdown	Hourly average	Temporary Permits FP-T-0054 & TP-B-0462

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Table 6A – Emission Limitations for the Boilers (MK1 and MK2)			
Pollutant	**Emission Limit**	**Averaging Time**	**Authority**
	During periods of startup, shutdown, malfunction, soot blowing, grate cleaning, and cleaning of fires, the 6-minute average opacity may exceed 40% opacity for a non-overlapping set or sets of time up to 60 minutes in any 8-hour period.	6-minute block average in any calendar hour	Temporary Permits FP-T-0054 & TP-B-0462
Ammonia slip	10 ppmvd @ 3% O_2	Average of three one-hour test runs	Env-A 1405.02

Table 6B – Emissions Limitations for Other Combustion Devices			
Emission Unit	**Pollutant**	**Emission Limit**	**Authority**
MKCT1 & MKCT2	NOx	0.90 lb/MMBtu for each unit on an hourly average	NOx RACT Order ARD-97-001
	Opacity	40% for any continuous 6 minute period	Env-A 2002.01
MKEG	Opacity	20% for any continuous 6 minute period	Env-A 2002.02
MKEB	SO2	38.96 lb/hr and 40.0 tons per consecutive 12 month period	Temporary Permit TP-B-0490
	NOx	13.72 lb/hr and 25.0 tons per consecutive 12 month period	
	CO	3.43 lb/hr and 100.0 tons per consecutive 12 month period	
	PM10	2.26 lb/hr and 15.0 tons per consecutive 12 month period	
	VOC	0.14 lb/hr and 25.0 tons per consecutive 12 month period	
	Opacity	20%, except during startup, shutdown, and malfunctions	40 CFR 60 Subpart Dc Section 60.43c(c) and Env-A 2002.02

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EMISSIONS TRADING PROVISIONS:

Table 7 – State Acid Rain Program and Multiple Pollutant Budget Trading Program (Env-400 and Env-A 2900)	
Annual Emissions/ Allowances	**Schiller Station (SR4, SR5, SR6), Merrimack Station (MK1 & MK2) and Newington Station (NT1) Combined**
SO_2 Emissions Cap	55,150 tons per calendar year
SO_2 Initial Allowance Allocation (2007 and after)	7,289 allowances (tons)
NOx Allowance Allocation (2007 and after)	3644 allowances (tons)

Table 8 – Federal Annual SO2 Allowance Allocation (tons)		
	2000 - 2009	**2010 and Beyond**
MK1	4288	4296
MK2	9242	9257

Table 9 – State NOx Allowance Allocation for the Ozone Season (tons) Env – A 3200 (Note: Seasons beyond 2010 to be determined in acordance with Env-A 3207.04)		
Emission Unit	**2009**	**2010**
MK1	203	184
MK2	531	458
MKCT1	0	0
MKCT2	0	0

29 Hazen Drive, PO Box 95, Concord, NH 03302-0095
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Table 10 - CO_2 Allowance Allocation for 3-Year Compliance Periods (Env- A 4600) 2009 and Beyond*	
MK1	**0**
MK2	**0**

*All CO_2 allowances must be acquired.

STACK TESTING ACTIVITIES:

Table 11 – NOx RACT Testing on MKCT1 & MKCT2						
	May 17, 1995	**May 22, 1998**	**May 17 & 18, 2001**	**June 8, 2004**	**April 12 & 16, 2007**	**NOx RACT Limit**
MKCT1 NOx (lb/MMBtu)	0.68 @ 18.1 MW	0.74 @ 18.3 MW	0.62 @ 19.7 MW	0.72 @ 19.5 MW	0.84 @ 20.2 MW	0.90
MKCT2 NOx (lb/MMBtu)	0.73 @ 19.5 MW	0.78 @ 19.1 MW	0.62 @ 18.9 MW	0.63 @ 16.1 MW	0.74 @ 20.2 MW	0.90

Table 12 – TSP Testing on MK1 & MK2						
	MK1 3/7/90	**MK1 2/27&28/90 No flyash reinjected**	**MK2 11/09/99**	**MK2 11/10/99**	**MK2 3/14&15/2000**	**Limit**
TSP (lb/MMBtu)	0.111[14]	0.031[15]	0.043[16]	0.041[17]	0.021[18]	NA
TSP Allowed (lb/MMBtu)	0.276	0.277	0.231	0.231	0.231	NA

Table 13 – Ammonia Slip Testing on MK1 & MK2			
	MK1 6/14/2000	**MK2 6/13/2000**	**Limit**
Ammonia ppmdv @ 3% O2	0.06	0.18	10

[14] Unable to determine the number of fields in service in the original or supplemental ESPs.
[15] Unable to determine the number of fields in service in the original or supplemental ESPs.
[16] Testing on 11/09/99 was with 7 of the 12 fields in service in the original ESP and 22 of 24 fields in service in the supplemental ESP.
[17] Testing on 11/10/99 was with 11 of the 12 fields in service in the original ESP and 21 of 24 fields in service in the supplemental ESP.
[18] Testing on 3/14&15/2000 was with 7 of the 12 fields in service in the original ESP and all 24 of 24 fields in service in the supplemental ESP.

29 Hazen Drive, PO Box 95, Concord, NH 03302-0095
Phone: 603-271-1370 Fax: 603-271-7053

Table 14 – Baseline Mercury Emissions Testing on MK1			
Date	**Ave. Hg lb/TBtu**	**Ave. Hg lb/hr**	**Ave. Hg lb/yr**
20-Jan-07	14.90	1.46E-02	127.91
6-Feb-07	8.42	9.82E-03	86.05
22-Feb-07	10.38	1.17E-02	102.66
11-Apr-07	5.33	6.38E-03	55.87
31-May-07	5.16	6.39E-03	55.96
Average	**8.84**	**9.78E-03**	**85.69**

Table 15 – Baseline Mercury Emissions Testing on MK2			
Date	**Ave. Hg lb/TBtu**	**Ave. Hg lb/hr**	**Ave. Hg lb/yr**
31-Jan-07	11.24	3.46E-02	303.01
21-Feb-07	9.81	3.11E-02	272.28
10-Apr-07	8.76	2.92E-02	255.71
4-Jun-07	7.51	2.56E-02	224.50
5-June-07	7.78	2.71E-02	237.44
Average	**9.02**	**2.95E-02**	**258.59**

PSNH has submitted baseline mercury emissions information as required by RSA 125-O:14,II.(a), which is shown in Table 16 below:

Table 16 – Baseline Mercury Emissions			
Unit ID	**Average Hg Emission Rate (lb Hg/ton of coal fired)**	**Average Annual Coal Throughput (2003 through 2005) in tons/yr**	**Average Annual Hg Emissions in lb/yr**
MK1	0.0002320	352,320	81.7
MK2	0.0002370	826,927	196.0
SR4	0.0000312	154,766	4.8
SR5	0.0000312	159,815	5.0
SR6	0.0000312	159,693	5.0
		Baseline Total Hg Emissions in lb/yr	293

Note that these numbers presented above had a 20% safety factor added to the average Hg emission rate/ton of coal fired.

NEW SOURCE REVIEW APPLICABILITY DETERMINATION

On February 4, 2008, PSNH Merrimack submitted a letter providing information regarding the applicability of New Source Review (NSR) to modifications at PSNH Merrimack. The submittal included PSNH's estimate of future actual emissions to support PSNH's assessment that NSR is not applicable to modifications to the steam turbine and generator for MK2.

On March 31, 2008, DES issued a conditional New Source Review applicability determination concerning modifications at PSNH Merrimack. DES' concurs with PSNH's determination that the 24-month period from January 2006 through December 2007 is the representative emissions baseline period.

To verify that future actual emissions do not exceed the baseline emission levels as a result of these modifications, PSNH is required to submit actual emissions data for five years (up to 10 years, at DES' option). The Title V operating permit includes monitoring, recordkeeping, and reporting of the actual emissions for the five-year period commencing in 2008.

29 Hazen Drive, PO Box 95, Concord, NH 03302-0095
Phone: 603-271-1370 Fax: 603-271-7053

PROJECT NAME:	Public Service of New Hampshire, Merrimack Station, Bow, NH Title V Operating Permit SIC Code: 4333 Electric Utility Application #: FY96-TV048	**ENGINEER:** Doug Laughton **DATE:** 07/30/09	Page 11 of 14

MODELING:

PSNH initially submitted an air quality modeling analysis to EPA in 1992 to determine the potential impacts of sulfur dioxide from the burning of coal. To obtain more accurate data for the analysis, PSNH constructed a meteorological tower in 1993 and used on-site meteorological data from 1994-1995 to refine the modeling. Further evaluations were performed in 1996 and a detailed analysis was proposed to address the effects of buildings on plume dispersion. Additional modeling was done in 1999, and in 2003 PSNH worked with DES and EPA to develop a modeling strategy to address outstanding modeling issues.

On December 11, 2008, DES concluded review of an ambient air quality impact analysis for the PSNH – Merrimack Station in support of a permit application for a proposed wet flue gas desulphurization system, which would result in decreases in sulfur dioxide and mercury emissions from the MK1 and MK2 boilers. The air dispersion modeling demonstrated compliance with the NAAQS for NOx, CO, SO2, and PM10. In addition, the modeling showed compliance with the ambient air limits for ammonia. Please see the attached modeling memo dated December 11, 2008 for further details.

On July 28, 2009, PSNH submitted a revised RTAP analysis to demonstrate compliance with the ambient air limits for coal dust. (See below for further discussion)

RTAP COMPLIANCE:

- Env-A 1400 is not applicable to combustion devices (MK1, MK2, MKCT1, MKCT2, MKEG, MKEB) because they burn virgin fossil fuels, exempted by Env-A 1402.01(b)(4). However, Env-A 1400 does apply to the SCR systems on MK1 and MK2, since there are ammonia slip emissions from these add-on pollution control devices for NOx emissions. Demonstration of compliance with the ambient air limit for ammonia was based on adjusted in stack concentrations for each of the two boilers.
- Env-A 1400 is not applicable to coal piles because no supportable method for conducting air dispersion modeling exists. EPA's AP-42 document provides emission factors for calculating PM emissions from storage piles, but it states however, that "calculated emissions represent intermittent events and should not be input directly into dispersion models that assume steady state emission rates." DES's air quality dispersion models assume steady state emission rates; therefore, no method for modeling the coal pile emissions exists. Thus, Env-A 1400 is not applicable to the piles, because practical methods of modeling emissions to assess compliance is not available.
- Env-A 1400 is applicable to the coal handling operations[19], specifically the railcar unloading, truck unloading, and coal load-out to the piles. PSNH conducted air dispersion modeling to demonstrate compliance with the ambient air limit for coal dust.

SUPPLEMENTAL INFORMATION ON MONITORING

- DES streamlined the monitoring requirements for the Federal Acid Rain Program (40 CFR 75), the NOx Budget Program (Env-A 3200), the Multi-pollutant Budget Program (Env-A 2900), and State Monitoring Requirements (Env-A 800). See below for a comparison of the duplicative provisions.
- PSNH does not monitor for moisture; therefore, no moisture monitoring requirements were included.
- PSNH monitors SO2 for compliance with the state acid rain program by using the CEM data (not coal analysis data) PSNH also uses CEM data to determine compliance with the Federal Acid Rain Program.
- The combustion turbines (MKCT1 & MKCT2) applied for and received approval for an alternative monitoring plan for compliance with the NOx Budget Program (Env-A 3200). PSNH uses the stack testing data obtained during NOx RACT testing conducted every 3 years and the actual operating hours and fuel consumption data or default values to

[19] Note that New England Wood Pellet (NEWP) did not regulate the wood dust storage piles on the grounds that DES does not have the authority to regulate the "unloading, handling and storage of raw materials" and no supportable emission estimation methods exist. The Findings of Fact for the temporary permit for NEWP argues that DES only has the authority to regulate the RTAPs from devices and processes. The unloading, handling and storage of raw materials at NEWP and PSNH do not include similar operations. PSNH's coal handling activity is a process because it combines the operation of equipment (e.g., conveyors), devices (e.g., crusher) and raw materials (e.g., coal). In contrast, NEWP wood dust unloading, handling, and storage is not a process or device because no devices or equipment are involved.

determine compliance.

- Env-A 808.03(d) is applicable to MK1 & MK2 because the stack volumetric flow measuring devices installed after January 1, 1992. PSNH installed and completed certification of the stack volumetric flow measuring devices in 1998.
- PSNH meets the NOx mass emission monitoring requirements (NOx Budget Program) on annual basis for MK1 and MK2 and on an ozone season basis for MKCT1 & MKCT2.
- The definition of excess emissions of opacity in the Temporary Permits for MK1 and MK2 are less stringent than Env-A 2002.01. Env-A 2002.01 requires opacity to not exceed 40% for any continuous 6 minute period. In this Title V Operating Permit and the Temporary Permits, the average opacity may exceed 40% for a non-overlapping set or sets of time up to 60 minutes in any 8-hour period during startup, shutdown, malfunction, soot blowing, grate cleaning, and cleaning of fires. The operating permits defined excess emission of opacity as "any air pollutant, which for a period or periods aggregating more than 60 minutes in any 8-hour period, exhibits 40% opacity or greater."

COMPARISON OF MONITORING REQUIREMENTS (ENV-800 VS 40 CFR 75)

- Out of control period: Concerning calibration drift, 40 CFR 75.24(a)(1) is more stringent than Env-A 808.01(g)(1)(a) and (b). 40 CFR 75.24(a)(1) says that the out of control period begins when the calibration drift exceeds the specification, and the out of control period according to Env-A 808.01 begins when the calibration check exceeds twice the allowable limit for 5 consecutive days. For relative accuracy test audits (RATAs), cylinder gas audit (CGAs), relative accuracy audits (RAAs), both 40 CFR 75.24, which refers to 40 CFR 75 Appendix A, and Env-A 808(g)(1)(c), which refers to 40 CFR 60 Appendix F, say that the out of control period begins when the sampling is completed.
- Valid hour of data: According to Env-A 808.01(i), a valid hour is a minimum of 42 minutes of CEM readings taken in any calendar hour. According to 40 CFR 75.10(d), a valid hour is one data point in each fifteen-minute quadrant of an hour, where the unit combusted fuel during that quadrant of an hour. An hourly average may be computed from at least two data points separated by a minimum of 15 minutes (where the unit operates for more than one quadrant of an hour) if data are unavailable because of calibration, quality assurance, or preventative maintenance performed on the CEM.
- One cycle of operation for gaseous emissions: 5 minutes (Env-A 808.03(c)(2)) vs 15 minutes (40 CFR 75.10(d))
- One cycle of operation for opacity: 10 second for measuring analyzing and recording (Env-A 808.03(c)(2)) and 10 second for measuring and analyzing and 6-minute for recording (40 CFR 75.10(d))
- Percent data availability requirements: 40 CFR 75.32 is more stringent than Env-A 808.10 because Env-A 808.10 takes out any operating hours during daily calibrations and quarterly audits. Env-A 808.02(c)(2) requires that facilities in the NOx budget program meet the percentage data availability requirements of Env-A 808.10 (a)-(d) in addition to 40 CFR 75. 40 CFR 75.30 through 75.37 and 75.50(f) contain provisions for missing data substitution procedures whereas Env-A 808.10 requires submittal of a plan to DES of how to deal with non-compliance with percentage data availability requirements.
- Relative Accuracy: For RATAs, 40 CFR 75.24 and 40 CFR 75 Appendix A appear to be more stringent than 40 CFR 60 (except for lb NOx/hr, which is not calculated by Part 75) at 10% relative accuracy versus calculated relative accuracy. For RATAs, 40 CFR 75 Appendix B also provides for an incentive for an annual RATA if the relative accuracy is less than or equal to 7.5%. For the lb NOx/hr, PSNH must use the relative accuracy of 40 CFR 60.

APPLICABLE REGULATIONS:

Federal Regulations

- 40 CFR 60 Subpart D – NSPS for Fossil-Fuel-Fired Steam Generators for Which Construction, Modification, or Reconstruction is Commenced After August 17, 1971 – NA – PSNH is an electric utility steam generating facility.
- 40 CFR 60 Subpart Da – NSPS for Electric Utility Steam Generating Units for Which Construction, Modification, or Reconstruction is Commenced After September 18, 1978 – NA – The MK1 and MK2 Boilers were installed in 1960 and 1968 respectively and the MKCT1 and MKCT2 Combustion Turbines were installed in 1968 and 1969 respectively, and none of these units have undergone any physical or operational modifications after September 18, 1978.

- 40 CFR 60 Subpart Db – NSPS for Industrial-Commercial-Institutional Steam Generating Units for Which Construction, Modification, or Reconstruction is Commenced After June 19, 1984 – NA – PSNH does not have any boilers which are in the 100 to 250 mmBtu/hr gross heat input range.
- 40 CFR 60 Subpart Dc – NSPS for Small Industrial-Commercial-Institutional Steam Generating Units for Which Construction, Modification, or Reconstruction is Commenced After June 9, 1989– Applicable to the MKEB – Each temporary package boiler installation at the Merrimack Station will be subject to Subpart Dc as the facility can bring in boilers with gross heat input rates of up to 96.0 MMBtu/hr.
- 40 CFR 60 Subpart K – NSPS for Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After June 11, 1973, and Prior to May 19, 1978 – NA
- 40 CFR 60 Subpart Ka – NSPS for Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After May 18, 1978, and Prior to July 23, 1984 – NA
- 40 CFR 60 Subpart Kb – NSPS for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984 – NA
- 40 CFR 60 Subpart Y – NSPS for Coal Preparation Plants – NA – Installed prior to October 24, 1974.
- 40 CFR 60 Subpart GG -- NSPS for Stationary Gas Turbines (applicable to turbines greater than 10 MMBtu/hr and that commenced construction, modification, or reconstruction after October 3, 1977)– NA, combustion turbines installed in 1968 and 1969.
- 40 CFR 61 Subpart M – NESHAP for Asbestos – Applicable when removing asbestos materials.
- 40 CFR 63 Subpart Q – MACT for Industrial Cooling Towers -- NA
- 40 CFR 63 Subpart EEEE – MACT for Organic Liquid Distribution (non-gasoline) – NA, No. 1 and No. 2 Fuel Oil and On-road low sulfur diesel fuel is below the vapor pressure threshold for existing tanks for controls, .
- 40 CFR 63 Subpart YYYY – MACT for Stationary Combustion Turbines -- Merrimack Station's 2 Combustion Turbines, MKCT1 and MKCT2, are existing sources, i.e., constructed and operated prior to January 14, 2003, therefore the MACT is applicable; however, there are no requirements for existing sources, including the requirements of Subpart A of 40 CFR 63 or the initial notification requirements as stated in 40 CFR 63 Subpart YYYY Section 63.6090(b)(4).
- 40 CFR 63 Subpart DDDDD- MACT for Industrial, Commercial and Institutional Boilers and Process Heaters – fossil-fuel fired electric utility steam generating units – This rule was vacated by the D.C. Circuit Court and will not be applicable to MK1 or MK2 or MKEB.
- 40 CFR 60 and 63 – NSPS and MACT for New and Existing Stationary Sources: Electric Utility Steam Generating Units and Clean Air Mercury Rule (CAMR). – This regulation addresses mercury emissions from coal-fired utility boilers. In March 2005, EPA de-listed electric utilities as a MACT source category, and issued the Clean Air Mercury Rule instead, which was applicable to PSNH Merrimack Station (40 CFR 60 Subparts B, HHHH, and Da); however this rule was vacated. Therefore, any applicable provisions will be incorporated into the Title V permit at a later date.
- 40 CFR Part 68 – Chemical Accident Prevention – Applicable – Ammonia stored for use in the SCR systems is above the threshold quantities.
- 40 CFR 72 – Permits Regulation (Acid Rain permits) – Applies to MK1 and MK2.
- 40 CFR 73 – Sulfur Dioxide Allowance System - Applicable to MK1 and MK2, but not MKCT1 and MKCT2.
- 40 CFR 74 – Sulfur Dioxide Opt-Ins – NA
- 40 CFR 75 – Continuous Emission Monitoring – Applicable to MK1 and MK2.
- 40 CFR 76 – Acid Rain Nitrogen Oxides Emission Reduction Program - Applicable to MK1 and MK2, but not MKCT1 and MKCT2.
- 40 CFR 77 – Excess Emissions – Applicable to MK1 and MK2.
- 40 CFR 96 – NOx Budget Trading Program for SIPs – NA (New Hampshire is not part of the program.)

State Regulations

- Env-A 400 Acid Deposition Control Program – This is only applicable to MK1 and MK2.
- Env-A 504.01(d) – NESHAP for Asbestos
- Env-A 600 Statewide Permit System
- Env-A 700 Permit Fee System
- Env-A 800 Testing and Monitoring Procedures
- Env-A 901 Owner or Operator Recordkeeping and Reporting Obligations

- Env-A 1002 Fugitive Dust – This is applicable facility wide. For coal dust emissions, PSNH must implement Best Management Practices. See Standard Operating Procedures submitted by PSNH.
- Env-A 1211.01 (j) – NOx RACT Exemption for Emergency Generators – Applicable to MKCT1 and MKCT2.
- Env-A 1211.03 NOx RACT for Utility Boilers – Applicable to MK1 and MK2.
- Env-A 1211.04 NOx RACT for Steam Electric Boilers – NA – PSNH Merrimack Station is not a small power production facility, they are capable of operating at a capacity greater than 30 MW
- Env-A 1211.06 NOx RACT for Combustion Turbines – Applicable to MKCT1 and MKCT2
- Env-A 1211.13 NOx RACT for Load Shaving Units – Not Applicable to MKCT1 and MKCT2
- Env-A 1211.11 – NOx RACT for Emergency Generators – NA unless the hours of operation exceed 500 hours per consecutive 12-month period
- Env-A 1211.16 Multiple Sources Under Common Ownership (Bubble)
- Env-A 1211.17 Emissions Averaging Equation
- Env-A 1211.19 Seasonal Control of NOx Emissions
- Env-A 1211.20 NOx Testing
- Env-A 1211.21 NOx monitoring
- Env-A 1400 Regulated Toxic Air Pollutants
- Env-A 1604.01(a) and (d) Fuel Sulfur Content Specifications for No. 1 fuel oil, No. 2 Fuel Oil, JP-4 aviation fuel, and on-road low sulfur diesel oil.
- Env-A 1606.01 Fuel Sulfur Content Specifications for Coal
- Env-A 1800 – Asbestos Management and Control
- Env-A 2002.01, 2002.02, and 2002.04 Visible Emission Standards for Fuel Burning Devices
- Env-A 2002.06 and 2002.07 Particulate Emission Standards
- Env-A 2107 - Visible Emission Standards for Non-Fuel Burning Devices – NA - The requirements of Env-A 2100 are not applicable to PSNH Merrimack Station because it is not a process, manufacturing, and service-based industry, and it is regulated by other provisions. The fugitive emissions are regulated under Env-A 1002, *Fugitive Dust*.
- Env-A 2103 – Emission Standards for Particulate Matter – NA - The requirements of Env-A 2100 are not applicable to PSNH Merrimack Station because it is not a process, manufacturing, and service-based industry, and it is regulated by other provisions. The fugitive dust requirements of Env-A 1002 require controls for the particulate matter, and Env-A 1400 regulates the toxic particulate matter, such as coal dust.
- Env-A 2900 Multi-pollutant Annual Budget and Trading Program
- Env-A 3000 Emission Reduction Credits Trading Program
- Env-A 3100 Discrete Emission Reduction Trading Program
- Env-A 3200 NOx Budget Trading Program
- Env-A 3700 NOx Emission Reduction Fund - NA
- Env-A 3800 – Voluntary Greenhouse Emission Reduction Registry – NA
- Env-A 4000 – Portable Fuel Container Spillage Control – NA
- Env-A 4100 – Consumer Products – NA
- Env-A 4200 – Architectural and Industrial Maintenance Coatings – NA
- Env-A 4300 – Other Solid Waste Incineration – NA
- Env-A 4600 – Carbon Dioxide (CO_2) Budget Trading Program – Applicable to MK1 and MK2
- RSA 125-O:11 - 18 – Mercury Emissions – Applicable to MK1 and MK2

NA = Not Applicable

SUMMARY AND CONCLUSIONS:

PSNH Merrimack Station is in compliance with all air quality requirements. After taking into consideration any public comments, DES will issue, amend, or deny the Title V Operating Permit for PSNH Merrimack Station.

STATE OF NEW HAMPSHIRE
Department of Environmental Services
Air Resources Division

Intraoffice Memorandum

TO: Gary Milbury, Program Manager
Permitting and Environmental Health Bureau

DATE: December 11, 2008

FROM: Jim Black, Dispersion Modeler
Permitting and Environmental Health Bureau

AFS #: 3301300026
Application #: FY07-0103

SUBJ: PSNH Merrimack Station – 97 River Road, Bow
Modeling for Proposed FGD System

UTM E: 299333
UTM N: 4779440

Modeling Project Summary

- **Purpose:** proposed wet Flue Gas Desulfurization (FGD) system
- **Initial assumptions (modeling input):** 8760 hrs/yr
- **Pass/Fail (if failed for what):** passed for all pollutants
- **Restrictions resulting from modeling (if failed):** none needed

DES has reviewed an ambient air quality impact analysis for the PSNH Merrimack Station electric generating facility in Bow. The analysis, as performed by TRC, was done in support of a permit application for a proposed wet Flue Gas Desulfurization (FGD) system, which will result in reductions of sulfur dioxide and mercury emissions. The facility currently operates two coal-fired steam generating units (MK1 and MK2), two combustion turbines (CT1 and CT2) which are used for load shaving and an emergency boiler (EB). Each unit was modeled by TRC using a number of possible operating scenarios to reflect potential future conditions. The facility also operates an emergency generator, two coal crushers and a number of other devices which are not required to be modeled for this application.

The future operating conditions reflect the addition of the FGD system and include scenarios to address a normal operating case as well as four alternative cases which are possible during maintenance of the steam generating units and/or the FGD system. The possible operating scenarios are listed below:

1. MK1 and MK2 exhausting through the FGD stack (normal operating case)
2. MK1 exhausting through the FGD stack, with MK2 not operating
3. MK1 exhausting through the MK2 stack, with MK2 not operating
4. MK2 exhausting through the FGD stack, with MK1 not operating
5. MK1 exhausting through the MK2 stack and MK2 exhausting through the FGD stack

The FGD stack will need to be constructed as part of the desulfurization project while the existing MK1 and MK2 stacks will remain in place (though the MK1 stack will no longer be used once the FGD system is operational). Additional structures will also be added to support the FGD project. The stack and emissions data for all scenarios are given in Table 1.

Table 1
Modeled Emission Rates and Stack Parameters for all Proposed Operating Scenarios
(based on maximum load conditions)

Parameter	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5*
SO_2 Emission Rate (lb/hr)	2538.9	684.1	6835.8	1854.8	8690.6
PM10 Emission Rate (lb/hr)	1123.8	334.1	334.1	789.7	1123.8
NOx Emission Rate (lb/hr)**	2425.5	1508.0	1508.0	1283.6	2791.6
CO Emission Rate (lb/hr)	92.1	24.6	24.6	68.3	92.9
Ammonia Emission Rate (lb/hr)	30.2	9.5	9.5	20.6	30.1
Stack Height (ft)	445	445	317	445	317 / 445
Exit Diameter (ft)	21.5	21.5	14.5	21.5	14.5 / 21.5
Flow Rate (ACFM)	1304420	379831	475647	924589	475647 / 924589
Exhaust Temp (^oF)	130	127	343	131	343 / 131
Stack Orientation	vert./unobs.	vert./unobs.	vert./unobs.	vert./unobs.	vert./unobs.
Scenario Explanation	MK1 and MK2 through FGD	MK1 through FGD	MK1 through MK2 stack	MK2 through FGD	MK1 thru MK2 MK2 thru FGD

* emission rates for Scenario 5 are combined from two stacks
** NOx emission rates were reduced 25% in the modeling analysis from the amounts shown in Table 1 to account for the conversion to NO2

TRC used AERMOD to perform the modeling analysis, as was proposed in their *Air Quality Modeling Protocol*, dated February, 2008. The use of this model was approved by both DES and EPA for this project. In addition to the model selection, the protocol described the building data and GEP analysis, the meteorological data and processing, the receptors to be modeled and other details. DES commented on the protocol on March 21 of this year and provided additional comments to PSNH on July 23. PSNH responded to all comments to DES' satisfaction and transmitted the *Air Quality Modeling Report*, with accompanying data files, on November 21, 2008. It should be noted that PSNH collected on-site meteorological data from January, 1994 up to November, 1995. These data were processed by TRC and used in the modeling analysis.

In addition to the five operating scenarios, TRC looked at load conditions for the MK1 and MK2 units since these devices have the potential to operate at less than full capacity. Criteria pollutants from fuel combustion were evaluated as well as ammonia resulting from operation of the SCR deNOx system (used to control nitrogen oxides emissions). The impacts of the criteria pollutants were evaluated against the NAAQS while ammonia impacts were compared to the New Hampshire Ambient Air Limits (AALs). PSNH performed a comparison of past baseline versus future projected emissions and determined that, due to emissions decreases, there would not be any increment consumption so those air quality standards are not required to be addressed as per federal regulations.

The PSNH property is bordered by the Merrimack River to the east, a fence from the river northward and westward to the storage piles and by a creek and wetlands north of the piles back to the river. Receptors were placed along these boundaries at 20m intervals. PSNH has stated that the property line is posted and patrolled and is therefore inaccessible to the public. For this reason, impacts from the facility were only calculated beyond the PSNH property boundary.

The maximum predicted impacts from the five operating scenarios outlined above are shown in Table 2. The highest impacts are a result of the alternative case where the MK1 unit exhausts through the MK2 stack and MK2 exhausts through the new FGD stack (Scenario 5). For the short-term averages (24-hours and less) the maximum impacts are dominated by the emergency boiler which, though its emissions are much less than the primary power units, has a very short stack, resulting in significant plume downwash. The maximum impacts from this device are within 1330 feet from the stack for all pollutants and averaging periods, illustrating the localized nature of the impacts under this scenario.

The maximum impacts from the normal operating case where MK1 and MK2 exhaust through the new FGD stack (Scenario 1) are shown in Table 3. These impacts are seen to be significantly less than the alternative case impacts given in Table 2. The high impact locations extend out as far as nearly six miles, which is a result of the 445 foot stack (constructed to GEP height to minimize downwash). The impacts from this operating scenario, as well as for all alternative cases, are predicted to be below the NAAQS. For all cases, the PSNH devices, with the exception of the emergency boiler, were assumed to operate 8760 hours per year.

In order to demonstrate compliance with air quality standards throughout the region, PSNH was required to model the impacts from interactive sources. Based on the impact areas calculated by TRC, DES determined that 46 additional sources (comprising 106 individual devices) would be needed in the final modeling analysis to insure that PSNH does not cause or contribute to an overall air quality violation. These sources were modeled in addition to the PSNH devices (for all operating scenarios) and the maximum impacts are presented in Table 4. The maximum overall impacts are dominated by the PSNH emergency boiler but are well below the NAAQS.

As mentioned earlier, ammonia is emitted by the PSNH facility as a result of the operation of NOx control equipment. The emissions were estimated based on an assumed 20 ppm ammonia slip rate and the maximum impacts were compared to the AALs. The results of this analysis are shown in Table 5 and demonstrate that the highest predicted ammonia impacts are well below the New Hampshire limits.

In summary, DES has reviewed the modeling analysis prepared by TRC for the PSNH FGD project and has determined that the maximum predicted impacts from all proposed operating scenarios are below federal and state air quality standards and limits.

Table 2
Maximum Impact Scenario from PSNH MK1 and MK2 Sources Only (ug/m^3)
(Scenario 5: MK1 exhausting through the MK2 stack
and MK2 exhausting through the FGD stack)

Pollutant	Avg Time	Contrib	Bckg*	Impact	NAAQS	Pass/Fail
SO_2	Annual	20.0	8	28.0	80	PASS
	24-Hour	174.3	42	216.3	365	PASS
	3-Hour	474.5	152	626.5	1300	PASS
PM10	Annual	2.1	20	22.1	50	PASS
	24-Hour	17.3	38	55.3	150	PASS
NO_2 **	Annual	4.3	22	26.3	100	PASS
CO	8-Hour	29.0	--	29.0	10000	PASS
	1-Hour	74.4	--	74.4	40000	PASS

* background data from Manchester, except SO_2 from Concord
** NO_2 impacts include 75% conversion rate of NOx to NO_2

Table 3
Maximum Impacts from Normal Operating Case Only (ug/m^3)
(Scenario 1: only MK1 and MK2 operating and exhausting through the FGD stack)

Pollutant	Avg Time	Contrib	Bckg*	Impact	NAAQS	Pass/Fail
SO_2	Annual	2.8	8	10.8	80	PASS
	24-Hour	28.2	42	70.2	365	PASS
	3-Hour	78.4	152	230.4	1300	PASS
PM10	Annual	1.2	20	21.2	50	PASS
	24-Hour	12.5	38	50.5	150	PASS
NO_2	Annual	2.0	22	24.0	100	PASS
CO	8-Hour	2.5	--	2.5	10000	PASS
	1-Hour	7.0	--	7.0	40000	PASS

Table 4
Maximum Impacts from All Modeled Sources - PSNH Plus Interactives (ug/m^3)
(assuming worst-case PSNH operating scenario – Scenario 5)

Pollutant	Avg Time	Contrib	Bckg*	Impact	NAAQS	Pass/Fail
SO_2	Annual	22.3	8	30.3	80	PASS
	24-Hour	178.1	42	220.1	365	PASS
	3-Hour	482.4	152	634.4	1300	PASS
PM10	Annual	2.4	20	22.4	50	PASS
	24-Hour	17.7	38	55.7	150	PASS
NO_2	Annual	8.2	22	30.2	100	PASS
CO	8-Hour	29.0	--	29.0	10000	PASS
	1-Hour	74.4	--	74.4	40000	PASS

Table 5
Maximum Ammonia Impacts from PSNH Devices (ug/m^3)
(Scenario 5: MK1 exhausting through the MK2 stack
and MK2 exhausting through the FGD stack)

Pollutant	24-Hour Impact	24-Hour AAL	Annual Impact	Annual AAL	Pass/Fail
Ammonia	0.59	100	0.06	100	PASS

Project Tracking and Details

- **Modeler(s):** J. Black **Reviewers:** L. Landry/
- **Site visit made on**: D. Healy
- **Hardcopy files returned to:**
- **Model:** AERMOD v. 07026, AERMET v. 06341
- **Met data:** 1994 – 1995 **Met site:** on-site
- **Analysis details:** all results are based on DES confirmation runs of the TRC modeling