STATE OF NEW HAMPSHIRE
PUBLIC UTILITIES COMMISSION

DE 10-261

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
2010 LEAST COST INTEGRATED RESOURCE PLAN

MOTION TO COMPEL

New Hampshire Sierra Club [NHSC] moves, pursuant to Puc 203.09 (i) for an Order requiring Public Service Company of New Hampshire [PSNH] to fully respond to the First NHSC Data Requests.

INTRODUCTION

On July 9, 2010, in response to a Request for Additional Information from New Hampshire Department of Environmental Services- Air Resources Division [NHDES-ARD] regarding the Best Available Retrofit Technology [BART] for MK2 to ensure NOx compliance with the pending Regional Haze State Implementation Plan [SIP], PSNH provided a cost analysis to reduce NOx emissions from .37#/mmBTU to .34#/mmBTU. PSNH represented to NHDES-ARD that because of "increased maintenance costs and replacement power costs", the increased cost of replacement power could range from $720,000 to $3,300,000 assuming a $30/mwhr difference between the cost of Merrimack Station and replacement power costs at market. PSNH calculated that the cost per ton of NOx reduction would be extremely costly ranging from $1,578 to $3,068 per ton. The calculations also showed that the duration of the outages, the number of outages, and, an increase in the cost delta would significantly increase the costs of compliance. Exhibits 1 and 2 attached hereto.

On August 16, 2010, PSNH provided "supplemental" calculations to NHDES-ARD regarding the cost of reducing the emission limit from .37#/mmBTU to .34#/mmBTU again assuming the $30/mmhr cost delta. PSNH argued again that adjusting the NOx rate "will significantly increase the incremental costs of compliance without significantly decreasing total NOx emissions." In the August 16, 2010, calculations PSNH asserted that the cost per ton would be $7,359.[1] Exhibit 3 attached hereto.

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[1] The July 9, 2010, and August 16, 2010, PSNH submissions to NHDES-ARD were filed as "Confidential Business Information". NHSC objected. NHDES-ARD ordered release of the documents on November 3, 2010.

On December 15, 2010, PSNH submitted a response to a NHDES-ARD request for information that asked for an analysis of a NOx reduction to .30#/mmBTU calculated on a 30 day rolling average.[2] In this calculation, PSNH asserted that the cost per ton to reduce NOx emissions to .30#/mmBTU would be $826 per ton, an amount $6,533 less than the calculation provided on August 16, 2010, for the reduction to .34#/mmBTU. PSNH further calculated that a reduction to .25#-.30#/mmBTU would cost $7,600 per ton. Exhibit 4 attached hereto.

PSNH, on March 4, 2011, objected to NHSC Data Requests 1, 2 and 3.

MEMORANDUM IN SUPPORT OF MOTION TO COMPEL

1. PSNH argues, in paragraph 2 of its Objection, that it need not respond to the NHSC Data Requests because RSA 378:38 requires a review of the plans in "order to evaluate the planning process", and, that "any regulations, laws or orders promulgated subsequent to that filing date [September 30, 2010] are irrelevant to the determination of the adequacy of the planning process'.

The irrelevancy argument is nonsense. First, RSA 378:39 expressly states that the Public Utilities Commission shall consider potential environmental, economic and health related impacts of each proposed option. Second, on the date that PSNH filed its least cost plan, it had previously submitted two versions of its Regional Haze MK2 compliance costs to NHDES-ARD. Exhibits 1 and 2 attached hereto. NHDES-ARD forwarded its final version of the Regional Haze SIP to Region 1, United States Environmental Protection Agency on January 14, 2011.[3] NHDES-ARD used the PSNH MK2 NOx compliance cost calculations in its Regional Haze SIP submission to Region 1 as provided to NHDES-ARD by PSNH on December 15, 2010. Exhibit 4 attached hereto.

The PSNH compliance cost calculations are not only relevant to this planning docket, the calculations are important to an understanding of the pollution control costs for Merrimack Station.

PSNH should not be permitted to avoid an examination of the integrity of its own cost data in this least cost planning docket.

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[2] The earlier calculations were made on a calendar monthly average.

[3] The Regional Haze SIP emission limit for NOx from MK2 was incorporated into Env-A 2300 without objection from PSNH.

2. PSNH argues, in paragraphs 3 of its Objection, that the Public Utilities Commission "is not in a position nor is it qualified to whether the filing of environmental data with NHDES-ARD complies with any statutes, laws or regulations which the Commission does not oversee"; that the Commission "need not listen to a battle of environmental experts over issues not relevant to the adequacy of PSNH planning".[4]

The NHSC Data Requests do not ask for information regarding environmental data. The Requests ask for information regarding the integrity of the cost data submitted by PSNH to NHDES-ARD to comply with the Regional Haze MK2 NOx emission limit. The Commission is empowered, indeed mandated, by RSA 378:37-41 to examine costs in this planning docket. The Commission is uniquely qualified to conduct such review.

A review of the Data Requests illustrates:

Data Request 1. Please fully explain the assumptions used to establish the $30/mmwh difference between the cost of Merrimack Station and the costs of replacement power on the market used throughout the Regional Haze BART emission limit calculations;

Data Request 1 asks PSNH to explain the assumptions it used to establish the $30/mmwh difference between the cost of operating Merrimack Station and the replacement power costs during outages. PSNH used this cost differential to argue that the cost of certain NOx control options would not be cost effective. NHSC needs the information to verify and understand the underlying assumptions.

Data Request 2. Please reconcile the inconsistent cost per ton compliance calculations in the July 9, 2010, August 16, 2010, and December 15, 2010, submissions to NHDES-ARD.

Data Request 2. is self explanatory. As noted in the Introduction above, the three PSNH submissions to NHDES-ARD have inconsistent cost calculations that PSNH must explain.

3. Data Request 3. In order for the public to ensure the factual integrity of the PSNH Regional Haze MK2 BART cost calculations by independent analysis, please

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[4] NHSC has retained an expert witness; Ranajit Sahu, Ph.D. Dr. Sahu has provided NHSC expert advice regarding the Data Requests and is expected to be a witness at the merit hearing of this docket.

provide the following information [in electronic format, native language, to the extent feasible][5].

a. Coal specifications for last 5 years and coal expected to be burned in the future.

Data Request 3.a. asks for coal specifications for the last 5 years and expected to be burned in the future. NOx emissions depend on the coal and its properties, including nitrogen content, heating value, volatile content, etc. Certain NOx control options also require knowledge of the mineral content [which becomes ash] in the coal. NHSC needs to know the historical and projected coal types that will be burned at MK2.

b. NERC GADS data [design, event, performance] for the last 5 years.

Data Request 3.b. GADS data contains a summary design data for the unit, a history of the performance of the unit, including the variability of its load and causes for outages. As such, it will help define the operating characteristics [load factor] for the unit which affects the NOx emitted from the boiler. The NOx emitted and its variability affects the design and NOx performance of the SCR.

c. Design information on current low NOx burners, over-fire air, and combustion controls;

Data Request 3.c. asks for design information on the current low NOx burners, over-fire air and combustion controls. This information, together with that requested at 3.b. is part of the baseline NOx emissions at MK2. NHSC needs this information and how implemented to assess why the baseline is what it is.

d. Copies of all performance test reports involving low-NOx burners, over-fire air, combustion controls for the last 5 years;

Data Request 3.d. asks for quantitative data to establish boiler-out NOx levels and is related to 3.c.
e. Design information on current SCR catalysts, including catalyst degradation information;

f. Name and address of SCR catalyst supplier;

g. Copy of SCR catalyst management plan;

[5] MK2 is a BART eligible generating unit.

h. Dates when SCR catalysts were changed in each of the layers in the last 5 years;

Data Requests 3.e., f., g. and h. will provide information to verify SCR design, operation and NOx reduction capacity, the frequency of catalyst change outs and the reason [rate of activity loss], all to verify SCR NOx performance.

i. Status of catalyst by-pass dampers and current manner in which they are operated and copies of work orders or projects undertaken to fix any damper bypass problems in the last 5 years;

j. Details of SCR temperature permissive and logic when catalyst bypass is used;

Data Requests 3.i. and j. will provide information on the fraction of the exhaust gas that is treated by the catalyst as well as the fraction that bypasses the catalyst. Bypass information is needed to establish overall NOx emissions.

k. Details of all air pre-heater cleaning events in last 5 years together with details of logic used to trigger the cleaning;

Data Request 3.k. Ammonia slip from the SCR can cause salt deposition on the downstream air pre-heater. Cleaning the pre-heater is an operating cost.

l. Copies of all stack tests in the last 5 years in which the NOx at boiler outlet (i.e., SCR inlet) was measured;

Data Request 3.l. calls for emissions data that is part of SCR design.

m. Copies of plant process data showing SCR inlet NOx data, ammonia feed data, and ammonia slip data;

Data Request 3.m. calls for operating data showing SCR performance showing SCR control efficiency and operating costs.

n. Soot-blowing details – figure showing locations and names of all soot-blowers in boiler and for each SCR catalyst later, and elsewhere; logic that is used to trigger soot-blowing events in boiler and for SCR catalysts; and, compilation of soot-blowing events (start, duration) for last 5 years;

Data Request 3.n. asks for soot blowing events in the boiler. The events can be disruptive to SCR operations. Soot blowing at the SCR catalyst is used to clean the catalysts. NHSC wants to verify how often and why soot blowing occurs in the boiler and in the SCR for catalyst cleaning. Both affect the operating costs for the SCR catalyst.

o. Copies of all CEMS RATA tests for NOx, SO2, CO, O2, etc. for last 5 years;

Data Request 3.o. will verify the accuracy of the CEMS data.

p. Copies of any ASTM boiler efficiency tests conducted in last 5 years;

Data Request 3.p. will show overall boiler efficiency from a thermal stand point. It helps understand temperature maldistribution, flow maldistributions which affect NOx emissions from the boiler.

q. Copies of boiler operating manual and SCR operating manual;

Data Request 3.q. asks for background documents to understand the boiler and the SCR.

The information requested in Data Request 3.a.-q. will establish NOx reductions and the capital and operating costs associated with the NOx reductions. The information is necessary to determine the cost effectiveness of the NOx reduction methodology and to verify the cost data that PSNH submitted to NHDES-ARD in support of the Regional Haze NOx emission limit for MK2.

3. PSNH argues in paragraph 4 of its Objection that the Public Utilities Commission may not examine the inconsistent cost data it submitted to NHDES-ARD for compliance with proposed NOx emission limits.

The costs, capital and operating, of NOx emissions limits <u>are</u> the business of the Public Utilities Commission. The integrity of those cost claims is central to the public process in this least cost docket. RSA 378:37: "The general court declares that it shall be the energy policy of this state to meet the energy needs of the citizens and businesses of the state at the lowest reasonable cost while providing for the reliability and diversity of energy sources; the protection of the safety and health of the citizens, the physical environment of the state, and the future supplies of nonrenewable resources; and consideration of the financial stability of the state's utilities."

4. Finally, PSNH makes the sweeping argument that producing the information is burdensome, contains confidential information and is a fishing expedition.

The argument is frivolous in its entirety.

PSNH does not identify what information it deems confidential or why. PSNH knows full well that NHDES-ARD ordered that the NOx emission limit costs be public information and, in fact, abandoned any claim of confidentiality in its December 15, 2010, submission to NHDES-ARD. Exhibit 4 attached hereto.

The PSNH representation to the Public Utilities Commission that information requested by NHSC is confidential, in view of the history of the development of that information at NHDES-ARD, is a breach of the duty of candor to the tribunal.

CONCLUSION

PSNH must be ordered to provide the information as requested, together with such other relief proper in the premises.

3/10/11

Respectfully submitted,

Arthur B. Cunningham
Attorney for the New Hampshire Sierra Club
PO Box 511, Hopkinton, NH 03229
603-746-2196 [o]; 603-491-8629 [c]
gilfavor@comcast.net

No.18301

Certificate of Service

New Hampshire Sierra Club served this Motion pursuant to Puc 203.09.

3/10/11

Arthur B. Cunningham

DRAFT   DRAFT

PSNH MK2
NOx Control Cost Analysis

CONFIDENTIAL

Released Nov 3, 2010 per letter to PSNH

Given:

Uncontrolled NOx emission rate at full load, average	2.4 lb/MMBtu
Uncontrolled NOx emission rate at full load, maximum	2.66 lb/MMBtu
NOx removal efficiency of existing SCR, average	> 0.86
Controlled NOx emission rate at full load, average	(1 – 0.86) x 2.4 = 0.34 lb/MMBtu
Controlled NOx emission rate at full load, maximum	(1 – 0.86) x 2.66 = 0.37 lb/MMBtu
Uncontrolled NOx emission rate at reduced load (during start-ups and shutdowns)	1.0 - 1.5 lb/MMBtu
Maximum effect of start-ups and shutdowns on 30-day average NOx emission rate, single event	0.04 lb/MMBtu
Maximum effect of start-ups and shutdowns on 30-day average NOx emission rate, multiple events	0.08 lb/MMBtu

Calculation of reduced-load time required to increase 30-day avg. NOx emission rate by 0.04 lb/MMBtu:

Assumptions: Controlled emission rate = 0.34 lb/MMBtu
Uncontrolled emission rate = 1.25 lb/MMBtu (midpoint of range)
30-day average emission rate after increase = 0.34 + 0.04 = 0.38 lb/MMBtu

Solve two equations in two unknowns:

$$0.34a + 1.25b = 0.38(100\%)$$
$$a + b = 100\%$$
$$a = 100\% - b$$
$$0.34(100\% - b) + 1.25b = 38\%$$
$$34\% - 0.34b + 1.25b = 38\%$$
$$0.91b = 4\%$$

$b = 4.4\%$ of the time, or about 30 hours/month

Calculation of estimated increase in annual maintenance costs to assure reduction in average NOx emission rate from 0.37 lb/ to 0.34 lb/MMBtu (Δ = -0.03 lb/MMBtu):

Assumptions: The essential costs are 1) the costs of additional scheduled outages for maintenance cleaning, 2) the costs of replacement power during those outages, and 3) the costs of accelerated replacement of catalyst to ensure performance.

Number of additional maintenance cleanings required = 2 (midpoint of range)
Additional annual cleaning cost = 2 x $65,000/cleaning = $130,000 (midpoint of range)
Duration of cleaning outage = 4.5 days per cleaning (midpoint of range)
Power replacement cost during maintenance outages ≈ $30/MWh
Annual power replacement cost @ 2 cleaning outages/year = $2,200,000
Annual cost of accelerated catalyst replacement = $1,000,000

Total annual cost = $130,000 + 2,200,000 + 1,000,000 = $3,330,000
Annual heat input = 3,473 MMBtu/hr x 8,760 hr/yr = 30,423,000 MMBtu @ 100% capacity factor
Annual NOx benefit = 30,423,000 MMBtu/yr x 0.03 lb/MMBtu / 2,000 lb/ton = 456 tons removed*
Cost-effectiveness = $3,330,000/456 = $7,300/ton**

* This benefit is assumed constant, regardless of number and frequency of maintenance cleanings.

** The calculated cost-effectiveness could vary by about ±40% of the indicated cost per ton, based on the following: Cleaning costs could range from $30,000-$110,000 per cleaning, maintenance outages could be as few as 1 or as many as 4 per year and last 3-6 days each, and power replacement during outages could cost $700.000-$3.300.000 annually.

Exhibit #1

Public Service
of New Hampshire

PSNH Energy Park
780 North Commercial Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000
www.psnh.com

The Northeast Utilities System

CONFIDENTIAL

Released per Nov 3, 2010 letter to PSNH

July 9, 2010

Rcvd via e-mail on July 16, 2010

Michele Roberge
Administrator, Permitting and Environmental Health Bureau
NH Department of Environmental Services, Air Resources Division
29 Hazen Drive
PO Box 95
Concord, NH 03302-0095

RECEIVED
NEW HAMPSHIRE
JUL 16 2010
AIR RESOURCES DIVISION

CONFIDENTIAL BUSINESS INFORMATION

Public Service of New Hampshire
Best Available Retrofit Technology (BART)
Response to Request for Additional Information

Dear Ms. Roberge:

As requested, PSNH provides the following information to support the Merrimack Unit #2 (MK2) NOx limits and the Newington (NT1) fuel oil sulfur content for New Hampshire's Regional Haze SIP. We are providing this information as confidential business information since it contains various operating scenarios and financial costs which are competitively sensitive in nature and could be harmful if disclosed.

Merrimack Station Unit #2: Merrimack Station was the first investor owned utility in the nation to install an SCR to achieve NOx reductions. Given the operation of the SCR, it is PSNH's position that maintaining operational flexibility is a critical priority in order to ensure continued and cost-effective compliance while simultaneously achieving significant reductions in NOx emissions. The following information summarizes the primary drivers and the associated costs that would be incurred in ensuring attainment of NOx emissions rates lower than the current NOx emission limits set in the NH Regional Haze SIP

1. Operating Temperature of SCR

As previously provided, the SCR has a temperature permissive that must be met in order for the SCR to be put in service or kept in service. During start-ups, shut-downs, and low load operation of Merrimack Unit #2, the temperature is lower than that permissive temperature and the SCR cannot be operated. For example, Merrimack Unit 2 typically has 10 to 15 outages per year and approximately 8 low load operations per year. During these events, SCR operating temperatures are less than the permissive temperature rendering the SCR inoperable. The timing of these events is not predictable; the estimate of occurrences provided reflects historical performance.

Examples of low load situations include, but are not limited to, the following:

- Forced and planned outage start ups and shutdowns;

Exhibit #2

- Loss of one of any equipment pair. Both pieces are necessary for full load operation and the loss of one results in half load operation (such as forced draft fans, condensate pumps);
- Loss of the main boiler feed pump;
- Loss of coal feeders, condenser waterbox cleaning, etc.; and
- Any condition which results in the flue gas temperatures to be below the SCR permissive temperature will result in the SCR not able to be put in service.

2. Malfunction and Fouling of the SCR and/or Associated Equipment

In addition to boiler operations and load conditions that affect SCR operation, malfunctions of the SCR system and/or associated equipment can also affect the operation of the SCR. Malfunctions of the SCR system and/or associated equipment can result in partial or complete reduction of SCR performance.

Also as part of normal service, the SCR performance degrades over time. One reason this occurs is due to blinding of the catalyst with fly ash. This condition will cause the SCR process control settings to compensate by increasing SCR loading to maintain the set point. This is necessary because the reagent distribution becomes less uniform as less surface area of the catalyst is exposed to the flue gas. To manage this condition from developing to the point that a maintenance outage is necessary, the SCR is cleaned on-line utilizing soot blowers and cleaned during outages, as needed. Increased SCR loading will lead to more frequent maintenance outages. Reagent injection grid nozzles are directly exposed to the flue gas and become fouled over time. This can affect reagent distribution, compounding the effect of a fouled catalyst. The reagent injection grid is cleaned, as needed, during outages. Also as catalyst ages, it becomes less reactive. This causes a reduction in ability for NOx conversion to take place. This in itself does not typically result in higher NOx emissions because the SCR has four layers of catalyst, intentionally staggered in age. However, it will compound the effect of a fouled catalyst and can result in the SCR being unable to perform continually at its maximum capability. As a result, PSNH needs flexibility to operate the SCR based on current operating conditions. Currently the SCR averages greater than 86% efficiency. The uncontrolled NOx rate at normal full load is as high as 2.66 lb NOx/mmBTU, with an average of 2.4 lb NOx/mmBTU. The uncontrolled NOx rate at reduced load and during start ups and shut-downs is typically 1.0 - 1.5 lb NOx/mmBTU.

With these short-term challenging operational conditions, PSNH's greatest concern is ensuring consistent compliance. We have reviewed historical data and concluded that start-ups and shut downs can significantly impact both a calendar month and a rolling 30-day average emission rate by up to 0.04 lb NOx/mmBTU. If there is more than 1 outage during the averaging period, the impact to the average emission rate could be as high as 0.08 lb NOx/mmBTU. To allow for this potential operating occurrence, Merrimack Station would need to operate to maintain a much lower average NOx rate. Reviewing the historical monthly averages, this leaves little margin for typical operating fluctuations in NOx controls. For example, if a unit is off for a longer period of time, there are less valid operating days available to be included in average rate. This analysis is particularly interesting, because in this specific scenario, the total tons of emissions are less than full load operation for the same averaging period, but could have a high emission rate. An extreme example of this scenario was observed in August 2009 when the monthly average emission rate was 0.813 lb NOx/mmBTU and yet total emissions for that month were approximately 1 ton. This was primarily due the unit operating only a short amount of time in that month.

3. Potential Costs Associated with Proposed Reduction in NOx emission rate

Merrimack Station will need to consider a number of additional compliance efforts if not provided the necessary flexibility to deal with short-term events as described above and the operational restrictions of the SCR. Each has an additional cost as outlined below.

There will be increased maintenance costs to maintain peak NOx reduction capability. For example, air heater cleanings will be required more frequently because of increased loading of the SCR. This scenario results in additional maintenance costs and replacement power costs associated with the required outages.

Maintenance (Cleaning) Costs: $30,000 to $100,000 per cleaning

Replacement Power Costs: The table below uses an assumption of ~ $30/mwhr difference between the cost of Merrimack Station and the market cost. This number can vary greatly depending on energy market prices.

Duration of Cleaning/Outage	Replacement Power Cost per Outage	Number of outages per year	Total Cost per Year
Short (3 days)	$720,000	1	$720,000
		2	$1,440,000
		3	$2,160,000
		4	$2,880,000
Mid (4.5 days)	$1,100,000	1	$1,100,000
		2	$2,200,000
		3	$3,300,000
Long (6 days)	$1,400,000	1	$1,400,000
		2	$2,800,000

If air heater washings were routinely necessary to comply with a step change in the NOx rate, the cost per ton of NOx reduction would be extremely costly, as illustrated below. This cost can increase greatly if an air heater cleaning was completed during a high priced market.

Emission Rate Lb NOx/mm BTU	NOx tons emitted per year	Incremental tons per year	Incremental tons per day
0.37	5628.34		
0.34	5171.99	456.35	1.25

Duration of Cleaning/Outage	Replacement Power Cost per Outage	Incremental tons per year	Cost per Ton
Short (3 days)	$720,000	456.35	$1,578
Mid (4.5 days)	$1,100,000	456.35	$2,410
Long (6 days)	$1,400,000	456.35	$3,068

Examples of other compliance measures that would be necessary include accelerating the catalyst replacement in the SCR management plan. Currently, one layer of catalyst is exchanged every 2 years. To revise this plan by exchanging one layer every year would result in a project expense of approximately $2 million every other year. Increasing the frequency of catalyst replacement would result in approximately $12 million over the period 2013 thru 2025. This revised replacement plan would not likely result in additional total reduced tons of NOx for the year, but rather help manage the brief periodic increased emission rates associated with the events described above.

It should be reiterated that these compliance measures are focused solely on the shorter duration events that typically occur at lower loads with less heat input and for a discreet period of time--and thus do not result in the emission of a significant amount NOx emissions. For example, the flexibility of partial load operation during high demand periods is important to the electrical reliability of the grid and can significantly protect customers from high energy costs during these peak events. It would not be in the public interest to require the unit to come off line since such action would be extremely costly to both reliability and to customers. A half day of no operation when energy prices are over $100mwh will be $250,000, $350,000 or greater; a cost that would yield a NOx reduction of only approximately 10 – 15 tons.

This discussion demonstrates that the implementation of a calendar month and rolling 30 day lb/mmbtu NOx emission rate can result in significant cost to our customers with little environmental benefit. To avoid permit exceedences due to a short-term NOx rate excursion, would require running the SCR harder, more frequent air heater cleaning, extended outages, and forced outages.

Replacement power cost associated with outages:

	Cost delta with the Market	Total cost of Outage for customers	Cost per Ton *
1 day	$30	$239,040	$15,936
	$40	$318,720	$21,248
	$50	$398,400	$26,560
2 days	$30	$478,080	$15,936
	$40	$637,440	$21,248
	$50	$796,800	$26,560

*assumes saving of 15 tons per day

As you are aware, Merrimack Station has aggressively reduced NOx emissions for the past 15 years. The total annual emissions reflect that laudable effort. Going forward, Merrimack Station anticipates continuing that effort, while maximizing customer value and providing reliable, affordable power, but to do that successfully, we do require operational flexibility. It is critical to understand that such operational flexibility will ensure consistent compliance with the monthly average emission rate while not significantly increasing total NOx emissions.

Newington Station- additional fuel oil information

In your June 15, 2010 email, you also requested information regarding Newington Station's current oil stocks, storage capacity, fuel usage rates, and operational considerations and costs associated with switching to lower sulfur fuels required by the NH Regional Haze SIP. That information is provided below.

Please describe the current oil stocks (type and quantity) and storage capabilities.

Newington Station has the capacity to store approximately 732,500 barrels (31 million gallons) of fuel oil in four separate above ground storage tanks (identified as NT-1, NT-2, SR-2, and SR-3). Currently, these four tanks contain approximately 485,000 barrels (20 million gallons) of No. 6 fuel oil with an average sulfur concentration of approximately 1%.

How many hours of operation would this supply at current usage rates? What are the rates that this estimate is based on?

Due to various economic conditions, including the rising cost of No. 6 fuel oil, lower natural gas prices and electric demand, Newington Station has burned only a limited volume of oil in the past couple years. Current conditions are not expected to change considerably in the short term, therefore, Newington does not anticipate consuming a significant volume of oil in the next couple of years.

It is difficult to assess how long it would take to deplete this fuel oil inventory since fuel oil usage is dependent on market conditions and the demand for electricity. Newington Station will choose the fuel or blend of fuel (oil, natural gas, or natural gas and oil) based on the desired electrical output and the cost of fuel. As you are aware, Newington Station will use the most cost effective fuel to maintain its electric costs for the customer.

In an effort to understand how this inventory relates to future operating conditions, PSNH has looked at different operating scenarios to estimate the length of time it may take to deplete this inventory. The scenarios include different operating loads, a fuel mix of 75% natural gas and 25% fuel oil, and an operating capacity factor of 5% (see table below). Although, PSNH can not reliably predict with any certainty how Newington Station will operate in the next couple years, for purposes of this evaluation, PSNH has assumed an average output level of 150 MW with a heat rate of 11,750 Btu/kWh, 75% natural gas/25% oil blend, and a capacity factor of 5%.

Based on current fuel oil inventory levels, and the scenario presented above, Newington Station would deplete its existing fuel supply in 16 years.

MW	Btu/kWh	Btu/gal Oil	Capacity Factor %	BBl/yr	75% gas/25% oil BBl/yr	Projected depletion of current inventory (yrs)
400	10,793	153,846	5	292,645	73,161	7
150	11,750	153,846	5	119,533	29,883	16
100	13,860	153,846	5	93,951	23,488	21
60	16,560	153,846	5	67,352	16,838	29

Note:
Assuming an average output level of 150 MW with a heat rate of 11,750 Btu/kWh, a 75%/25% gas/oil blend, and a capacity factor of 5%, the current inventory would be depleted in 16 years. This scenario is Newington Station's best estimate based on current operating history.

What are the specific operational considerations in switching to 0.3% S oil that do or do not make it feasible and costly?

PSNH understands that the Regional Haze SIP will require Newington Station to burn 0.5% or 0.3 % sulfur oil as part of its compliance strategy as early as 2013. In order to prepare for this requirement, Newington Station would need to have the available capacity to store the lower sulfur oil. Due to a variety of factors that affect the availability and cost of natural gas, PSNH believes it would be necessary to empty one of the larger bulk fuel oil storage tanks, at a minimum, to provide the storage capacity of the lower sulfur fuel. Our largest tanks (NT1 and NT-2) currently contain approximately 160,000 barrels each of fuel oil. Based on the likely operating scenario presented above, it will take more than 5 years to empty one of the larger tanks.

In this scenario, Newington would either need to operate and utilize the on-hand fuel or sell some of its current inventory if an acceptable process could be identified. It is difficult to estimate what the cost to PSNH would be if this were required, since the value of this oil in 3 years is unknown.

PSNH currently knows of no way other than consuming oil in the unit to dispose/deplete our current inventory. Although offloading oil from the tanks to a barge or ship is being considered, Newington's oil terminal was designed to accept deliveries of oil from fuel vessels and was not designed to load vessels from the oil tanks. Newington Station also does not have the capability for loading trucks from the oil tanks. Any risk to personnel safety or the environment would need to be fully eliminated to consider a transfer of oil to a vessel or truck. Therefore, at this point, it is assumed that Newington Station would be required to burn the oil in the unit at a potential incremental cost to NH customers. Consistent with the numbers above, to burn 160,000 barrels of oil to empty one of the larger tanks, the unit would have to operate an equivalent of 24 hours/day for approximately 10 days at 400 MWs. Also, as stated above, due to economic conditions, Newington Station has been reserved to protect customers from high priced market excursions. If we assume consumption of the inventory of oil is required, then it will be necessary for Newington to operate at rates higher than market rates. In this case, based on an incremental cost of $80 per MWH, the total cost to customers will be approximately $8 million. This is a significant cost to customers which has no associated environmental benefit.

Blending this higher sulfur fuel with lower sulfur fuel or natural gas over time is a more cost effective option and will not result is greater emissions as compared to a targeted depletion effort described in the above scenario. Although it is possible to consider the depletion of current fuel oil inventories by blending with natural gas, natural gas is not always available and could not be relied upon as a sole compliance option.

What are the estimated costs of making the switch; both capital and operating costs?

As presented in our earlier December 4, 2009 letter, the cost to PSNH in going from a 1% sulfur oil to a 0.5% sulfur oil could be as high as $42/bbl (based on fuel oil prices from 2005-2009). Similarly, the cost to PSNH in going from 1% sulfur oil to 0.3% sulfur oil could be as high as $51/bbl. Using the same operating scenario presented above, this equates to an additional cost to PSNH customers of $1.2 million/year for the use 0.5% sulfur fuel and $1.5 million/year for the use 0.3%.

PSNH would be happy to meet with you and your staff to discuss the information provided above. If you have questions or require additional information, please contact me at 634-2440 or Sheila Burke at 634-2512.

Sincerely,

Elizabeth H. Tillotson

Elizabeth H. Tillotson
Technical Business Manager – Generation

cc:
Sheila Burke, Generation Staff
Tara Olson, Newington Station

Released Per Nov 3, 2010 Letter to PSNH

August 16, 2010

CONFIDENTIAL BUSINESS INFORMATION

Public Service of New Hampshire
Best Available Retrofit Technology (BART)
Response to Request for Additional Information

SUPPLEMENTAL INFORMATION to PSNH's July 16 Letter, Response to Request for Additional Information re: BART

As requested, PSNH provides the following information to support the Merrimack Unit #2 (MK2) NOx limits for New Hampshire's Regional Haze SIP. We are providing this information as confidential business information since it contains various operating scenarios and financial costs which are competitively sensitive in nature and could be harmful if disclosed.

Merrimack Station Unit #2: Merrimack Station was the first investor owned utility in the nation to install an SCR to achieve NOx reductions. Given the operation of the SCR, it is PSNH's position that maintaining operational flexibility is a critical priority in order to ensure continued and cost-effective compliance while simultaneously achieving significant reductions in NOx emissions. The following information summarizes the primary drivers behind the increased costs that would be incurred in ensuring attainment of NOx emissions rates lower than the current NOx emission limits set in the NH Regional Haze SIP.

1- Operational Impacts

Based on historical data MK2 typically has 10 to 15 outages per year and approximately 8 low load operations per year. During these events, SCR operating temperatures are reduced and in some instances below the SCR permissive temperature limit. The SCR temperature permissive must be met in order for the SCR to be put in service or kept in service. During start-ups, shut-downs, and partial load operation the temperature could be lower than the permissive temperature and the SCR cannot be operated. In most cases the timing of these events is not predictable.

Examples of low load situations include, but are not limited to, the following:

- Forced and planned outage start ups and shutdowns;
- Loss of one of any equipment pair. Both pieces are necessary for full load operation and the loss of one results in half load operation (such as forced draft fans, condensate pumps);
- Loss of the main boiler feed pump;
- Loss of coal feeders, condenser waterbox cleaning, etc.; and
- Any condition which results in the flue gas temperatures to be below the SCR permissive temperature will result in the SCR not able to be put in service.

A more stringent limit could result in the unnecessary shutdown of the unit rather than operating at partial load. An example of this scenario has occurred in the past when a critical pump failed which restricted full load operation. While the pump was repaired the unit remained operating

Exhibit #3

but at a reduced capacity, the duration of this event was approximately 240 hours. PSNH's customers received significant benefit from this partial load operation. Replacement power costs associated with this type of event are shown in the Table 1.

Replacement Power Costs: The table below uses an assumption of $30/mwhr difference between the cost of MK2 and the market cost. This number can vary greatly depending on energy market prices.

Table 1a. Cost Associated with De-rate Flexibility at 0.37 lb/MMBtu Assumes 0.64 tons per hr				
Duration of De-Rate	De-rate Capacity	Remaining Capacity Online	Avoided Replacement Power Cost	Cost per ton
240 hr	132 MW	200 MW	$1,440,000	$0
100 hr	132 MW	200 MW	$ 600,000	$0
50 hr	132 MW	200 MW	$ 300,000	$0

Table 1b. Cost Associated with limited De-rate Flexibility at 0.34 lb/MMBtu Assumes 0.59 ton per hr				
Duration of De-Rate	De-rate Capacity	Remaining Capacity Online	**Un-avoided** Replacement Power Cost	Cost per ton
240 hr	132 MW	200 MW	$1,440,000	$10,169
100 hr	132 MW	200 MW	$ 600,000	$10,169
50 hr	132 MW	200 MW	$ 300,000	$10,169

The opportunity for partial load operation during high demand periods would be even more costly to both reliability and to customers. The example mentioned above resulted in a long duration of partial load operation but it is important to note that during periods of high energy prices a much shorter event could also have significant cost. For example, assuming a $100 per MWh market price, operating at 200MW partial load for a period of 12-hours would avoid $240,000 of replacement power cost. During this period a NOx reduction of approximately 7 tons would be realized which equates to $34,000 per ton NOx. Under some of these scenarios partial load operation would be eliminated to ensure consistent compliance with the proposed NOx limit reduction.

<u>2 – Maintenance Impacts</u>

PSNH's highest priority is ensuring compliance with all emission limits. PSNH has reviewed historical data and concluded that start-ups, shut downs partial load operating conditions and upsets can significantly impact a calendar month average emission rate. To account for these events PSNH operates NOx control equipment to maintain a NOx emission rate of approximately 0.25 lb/MMBtu calendar month average. In order to ensure compliance with the 15.4 ton/day limit or the equivalent 0.37 lb/MMBtu emission rate, PSNH targets a 0.15 lb/MMBtu difference between the average NOx emission rate and the specific limit. Further limitations would impact operation and increase incremental maintenance and capital cost.

In addition to boiler operation and load conditions that affect SCR operation, malfunctions of the SCR system and/or associated equipment can also affect the operation of the SCR. Malfunctions of the SCR system and/or associated equipment can result in partial or complete reduction of SCR performance.

Also, as part of normal service, the SCR performance degrades overtime. One reason this occurs is due to blinding of the catalyst with fly ash. This condition will cause the SCR process control settings to compensate by increasing SCR loading to maintain the set point. This is necessary because the reagent distribution becomes less uniform as less surface area of the catalyst is exposed to the flue gas. To manage this condition from developing to the point that a maintenance outage is necessary, the SCR is cleaned on-line utilizing soot blowers and cleaned during outages, as needed. Increased SCR loading could lead to more frequent maintenance outages. It is anticipated that a minimum of three additional SCR cleanings and air heater washes would be necessary to maintain compliance with the 0.34 lb/MMBtu proposed NOx limit. Cleanings are expected cost between $30,000 and $100,000 as noted below in item 3. Replacement power costs associated with the necessary maintenance outages are also described in item 3 below.

Additionally, reagent injection grid nozzles are directly exposed to the flue gas and become fouled over time. This can affect reagent distribution, compounding the effect of blinded catalyst. The reagent injection grid is cleaned, as needed, during outages. Also as catalyst ages, it becomes less reactive. This causes a reduction in ability for NOx conversion to take place. This in itself does not typically result in higher NOx emissions because the SCR has four layers of catalyst, intentionally staggered in age. However, increased loading of the SCR catalyst would be necessary to maintain compliance with the proposed reduction in NOx limit and accelerate catalyst degradation. For example, the SCR is unable to perform continually at its maximum capability. As a result, PSNH needs flexibility to operate the SCR based on current operating conditions. Currently the SCR averages greater than 86% efficiency.

Each catalyst layer has an anticipated functional life of 8 years and each layer is staggered in age to accommodate replacing one layer every 24 –months. Further NOx limitation would increase loading of the SCR and could result in accelerated catalyst degradation requiring premature replacement. This would result in a loss of investment. Even if minor catalyst degradation occurred reducing the catalyst useful life from 8 years to 7.5 years the replacement schedule would need to be adjusted. The change in replacement schedule is necessary because catalyst replacement projects must coincide with MK2's overhaul schedule which is on a 12-month cycle. PSNH would incur a loss of investment of approximately $143,000 annually due to the early replacement. It is also important to note that the revised replacement plan would result in minimal reductions to the total reduced tons of NOx for the year, but rather be put in place to avoid the periodic increased emission rates at the end of the catalyst life. As shown below in Table 2, PSNH believes minimal catalyst replacement and maintenance cost are associated with the 0.37 lb/MMBtu rates provided certain exceptions for start-up and shutdown and malfunctions.

Table 2. Incremental Maintenance and Capital Cost				
Emission Limit (lb/MMBtu)	Calendar Month Control Target (lb/MMBtu)	Annual Loss of Investment of SCR Catalyst	Increase Maintenance (Cost of Air heater and SCR Maintenance)	Predicted Incremental Cost
0.37	0.22	$0	$0	$0
0.34	0.19	$143,000	$195,000	$338,000

3 –Replacement Power Costs associated with the Proposed Reduction in NOx Emission Rate

Merrimack Station will need to consider a number of additional compliance efforts if not provided the necessary flexibility to deal with short-term events as described above and the operational restrictions of the SCR. Each has an additional cost as outlined below.

There will be increased maintenance costs to maintain peak NOx reduction capability. For example, air heater and SCR cleanings will be required more frequently because of increased loading of the SCR. This results in additional maintenance costs and replacement power costs associated with the required outages. It is anticipated that at least one additional 4.5 day (mid) maintenance outage would be necessary to maintain compliance with the 0.34 lb/MMBtu proposed limit. In addition to the maintenance outage additional cleaning will be completed as a proactive measure during forced outages resulting in delayed start-ups. Outage duration is from time offline until the unit is phased.

If air heater washing were completed to comply with a step change in the NOx rate as shown below, the cost per ton of NOx reduction would be extremely costly. Again this number can increase greatly if an air heater cleaning was completed during a high priced market.

Table 3. **Potential** Emission Summary (8760 hrs)		
Emission Rate Lb NOx/mm BTU	NOx tons emitted per year	Incremental reduction in **Potential** emissions tons per year
0.37	5628.34	0
0.34	5171.99	456

Maintenance (Cleaning) Costs: $30,000 to $100,000 per cleaning

Replacement Power Costs: The table below uses an assumption of $30/mwhr difference between the cost of MK2 and the market cost. This number can vary greatly depending on energy market prices.

Table 5. Impact of 0.34 lb/MMBtu Limit	
Duration of Cleaning/Outage	Replacement Power Cost per Outage
Short (3 days)	$720,000
Mid (4.5 days)	$1,100,000
Long (6 days)	$1,400,000

It should be reiterated that these compliance measures are focused solely on the shorter duration events that typically occur at lower loads with less heat input and for a discreet period of time thus do not result in the emission of a significant amount of NOx emissions. To meet the proposed rates of 0.34 lb NOx/MMBtu, under the conditions referenced above, PSNH may be forced to shutdown for air heater/SCR cleaning and also may be forced to shutdown rather than operate at partial load. Each of these aforementioned scenarios has significant cost as described above.

Also, with out exceptions for short term operational conditions additional incremental costs may be incurred when considering a calendar month averaging period. PSNH may be forced to delay start-up to maintain a 0.34 lb/MMBtu calendar month average. It is important to note that start-up shutdowns, and partial load operating scenarios may bias a lb/MMBtu rate but typical result in low tonnage emission total. To manage for this situation it may be necessary for PSNH to adjust the current operating strategy by delaying start-ups or to prevent a short operating periods during the calendar month. Table 6., below illustrates the potential cost with delaying an outage start-up.

Table 6. Replacement power cost associated with delayed start-up			
	Cost delta with the Market	Total cost of Outage for customers	Cost per Ton *
1 day	$30	$239,040	$15,936
	$40	$318,720	$21,248
	$50	$398,400	$26,560
2 days	$30	$478,080	$31,872
	$40	$637,440	$42,496
	$50	$796,800	$53,120

*assumes saving of 15 tons per day

4 - Summary of Analysis

Merrimack Station has had a program in place to reduce NOx emissions for the past 15 years. The reductions in total annual emissions reflect that laudable effort. Going forward, Merrimack Station anticipates continuing that effort, while maximizing customer value and providing reliable and affordable power. It is critical to understand adjusting the NOx rate will significantly increase the incremental costs of compliance without significantly decreasing total NOx emissions. This effort will have virtually no effect on MK2's actual emissions and is focused on limiting MK2's potential emission which results in eliminating operational flexibility and increasing operating costs. Table 7. below is a summary of the incremental costs that PSNH will incur when considering the 0.34 lb/MMBtu proposed NOx emission rate.

Table 7. Summary of Additional Predicted Annual Cost

Emission Limit (lb/MMBtu)	Calendar Month Control Target (lb/MMBtu)	Loss of Investment of SCR Catalyst per year	**Un-avoidable** Replacement Power cost (Partial Load) @ 240 hrs	Increase Maintenance (Cost of Air heater and SCR Maintenance) 3 per year	Replacement Power Cost For Maintenance Outage at $30 MWH	Delayed start-up to clean SCR and Air Heater 2days (One day each for two outages)	Incremental reduction in **Potential** tons per year	Predicted Incremental Cost Increase $/yr	Cost per ton
0.37	0.22	$0	$0	$0	$0	$0	0	$0	$0
0.34	0.19	$143,000	$1,440,000	$195,000	$1,100,000	$478,080	456	$3,356,080	$7,359

This analysis demonstrates that the implementation of a 0.34 lb/MMBtu or more stringent rate will result in significant cost to our customers with little environmental benefit. This is true because a lb/MMBtu rate could result in running the SCR harder, more frequent air heater cleaning, extended outages, and forced outages, and limit partial load operation.

PSNH would be happy to meet with you and your staff to discuss the information provided above. If you have questions or require additional information, please contact Lynn Tillotson at 634-2440 or Sheila Burke at 634-2512.

cc:
Elizabeth H. Tillotson, TBM, Generation Staff
Sheila Burke, Generation Staff
Tara Olson, Newington Station

Hoffman, Barbara

From: Monroe, Pamela
Sent: Friday, July 16, 2010 3:21 PM
To: Hoffman, Barbara
Subject: FW: Additional Information Regarding BART

CONFIDENTIAL Released per Nov 3, 2010 letter to PSNH

We should maybe attach this e-mail with the letter to show when it came in.

Pamela G. Monroe
Compliance Bureau Administrator
N.H. Department of Environmental Services
Air Resources Division
29 Hazen Drive
Concord, NH 03302
Phone (603) 271-0882
Fax (603) 271-7053
Pamela.Monroe@des.nh.gov

-----Original Message-----
From: Wright, Craig
Sent: Friday, July 16, 2010 3:13 PM
To: Monroe, Pamela
Subject: FW: Additional Information Regarding BART

-----Original Message-----
From: tilloeh@nu.com [mailto:tilloeh@nu.com]
Sent: Friday, July 16, 2010 2:45 PM
To: Roberge, Michele
Cc: Wright, Craig; burkesa@nu.com; landilt@nu.com; olsonte@nu.com; cribbdj@nu.com
Subject: Additional Information Regarding BART

Attached please find additional information requested specific to proposed BART compliance items.

If you have additional questions, please let us know.

Thanks
Lynn

Elizabeth H. Tillotson
Public Service Company of New Hampshire
email: tilloeh@nu.com
Tele: 603-634-2440
Fax: 603-634-2703

Public Service of New Hampshire

PSNH Energy Park
780 North Commercial Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000
www.psnh.com

The Northeast Utilities System

December 15, 2010

Robert Scott
Director
NH Department of Environmental Services, Air Resources Division
29 Hazen Drive
PO Box 95
Concord, NH 03302-0095

Public Service of New Hampshire
Best Available Retrofit Technology (BART)
Response to Request for Additional Information

Dear Mr. Scott:

As requested in your December 8, 2010 letter, PSNH provides the following additional information to support the Merrimack Unit #2 (MK2) NOx limits for New Hampshire's Regional Haze SIP.

Merrimack Station Unit #2:

Merrimack Station was the first investor owned utility in the nation to install an SCR to achieve NOx reductions. Given the operation of the SCR, it is PSNH's position that maintaining operational flexibility is a critical priority in order to ensure continued and cost-effective compliance while simultaneously achieving significant reductions in NOx emissions. The following information summarizes the primary drivers behind the increased costs that would be incurred in ensuring attainment of NOx emissions rates lower than the current NOx emission limits set in the NH Regional Haze SIP.

This submittal will analyze the 0.30 lb/MMBtu emission rate averaged on a 30-day rolling basis as well as the impact of a more stringent limit. A 30-day rolling average is defined as the arithmetic average of all hourly rates for the current boiler operating day and the previous 29 boiler operating day[1]. This definition is consistent with November 22, 2010 comments provided by EPA pertaining to the draft rule.

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[1] *Boiler operating day* for units constructed, reconstructed, or modified on or before February 28, 2005, means a 24-hour period during which fossil fuel is combusted in a steam-generating unit for the entire 24 hours. (40 CFR 60 Subpart Da)

OS6161 REV. 11-09

Exhibit #4

The summary of the analysis is provided in the following table, all supporting calculations and basis for this determination are detailed in the items below.

Summary of Analysis			
Emission Limit (lb/MMBtu)	Incremental reduction in **Potential** tons per year[2]	Predicted Incremental Cost Increase $/yr	Cost per ton
0.37	0	$0	$0
0.30	1,065	$880,000	$826
0.25 – 0.30	380	$2,888,000	$7,600

1- Operational Impacts

Based on historical data MK2 typically has 10 to 15 outages per year and approximately 8 low load operations per year. During these events, SCR operating temperatures are reduced and in some instances below the SCR permissive temperature limit. The SCR temperature permissive must be met in order for the SCR to be put in service or kept in service. During start-ups, shut-downs, and partial load operation the temperature could be lower than the permissive temperature and the SCR cannot be operated.

Examples of low load situations include, but are not limited to, the following:

- Forced and planned outage start ups and shutdowns;
- Loss of one of any equipment pair. Both pieces are necessary for full load operation and the loss of one results in half load operation (such as forced draft fans, condensate pumps);
- Loss of the main boiler feed pump;
- Loss of coal feeders, condenser waterbox cleaning, etc.; and
- Any condition which results in the flue gas temperatures to be below the SCR permissive temperature will result in the SCR not able to be put in service.

The ability to manage these events is beneficial to our customers. Adequate flexibility allows the high cost of replacement power to be minimized. Limiting operational flexibility could result in the unnecessary shutdown of the unit rather than operating at partial load. Tables 1a. and 1b. below demonstrate the replacement power cost associated with a 0.30 lb/MMBtu, 30-day rolling average emission rate. The opportunity for partial load operation during high demand periods would be even more valuable to both reliability and to customers.

[2] Incremental reduction of Potential emissions is the calculated mean of the 0.25-0.30 range.

Replacement Power Costs: The table below uses an assumption of $30/mwhr difference between the cost of MK2 and the market cost.

Table 1a. Cost Associated with De-rate Flexibility at 0.37 lb/MMBtu Assumes 0.64 tons per hr			
Avoided Cost			
Duration of De-Rate	De-rate Capacity	Remaining Capacity Online	Avoided Replacement Power Cost
240 hr	132 MW	200 MW	$1,440,000
100 hr	132 MW	200 MW	$600,000
50 hr	132 MW	200 MW	$300,000

Table 1b. Cost Associated with limited De-rate Flexibility at 0.30 lb/MMBtu Assumes 0.51 ton per hr			
Un-Avoided Cost			
Duration of De-Rate	De-rate Capacity	Remaining Capacity Online	Un-avoided Replacement Power Cost
240 hr	132 MW	200 MW	$1,440,000
Avoided Cost			
Duration of De-Rate	De-rate Capacity	Remaining Capacity Online	Avoided Replacement Power Cost
100 hr	132MW	200 MW	$600,000
50 hr	132MW	200 MW	$300,000

The table is based on a steady state NOx emission rate of 0.22 lb/MMBtu and a NOx emission rate of 0.8 lb/MMBtu during partial load operation. The maximum number of days MK2 can operate in a partial load is 4.2 days (100 hrs) when considering a 0.30 lb/MMBtu 30-day rolling emission limit.

It should be noted previous submittals did not consider the rolling averaging method, because the existing Data Acquisition and Handling System (DAHS) is not configured for this averaging period. Based on EPA comments of the proposed Env-A 2300 Rule, PSNH has consulted the software vendor which supplies the DAHS and is reviewing the best available option to manage this averaging period. Current method of achieving this is through a new "Smart Reporting" software trial program. PSNH is confident in working with the vendor that the rolling average period will be achievable. Preliminary information suggests that implementing the new software has an estimated cost of $10,000 and an annual recurring cost of $2,000.

<u>2 – Maintenance Impacts</u>

<u>Calendar Month Analysis (Previously Submitted):</u>

PSNH's highest priority is ensuring compliance with all emission limits. PSNH has reviewed historical data and concluded that start-ups, shut downs partial load operating conditions and upsets can significantly impact average emission rates. PSNH's current method of operation to account for these events is to operate NOx control equipment to maintain an emission rate of approximately 0.25 lb/MMBtu calendar month average to ensure compliance with the 15.4 ton/day limit or the equivalent 0.37 lb/MMBtu emission rate. This method of operation results in approximately a 0.15 lb/MMBtu difference between the average NOx emission rate and the limit, this allows for operational flexibility as described above (i.e. start-up, shutdown, partial load operation etc). Further limitations based on a calendar month would impact operation and increase incremental maintenance and capital cost. For complete breakdown of the costs represented in Table 2a. and a calendar month analysis reference PSNH's August 16, 2010, submittal.

Table 2a. Incremental Maintenance and Capital Cost				
Emission Limit (lb/MMBtu)	**Calendar** Month Control Target (lb/MMBtu)	Annual Loss of Investment of SCR Catalyst	Increase Maintenance (Cost of Air heater and SCR Maintenance)	Predicted Incremental Cost
0.37	0.22	$0	$0	$0
0.34	0.19	$143,000	$195,000	$338,000

30-Day Rolling Average analysis:

In addition to the above analysis and based on EPA comments to the draft rule and DES's request for additional information, PSNH further analyzed the impact of changing its current method which is based on a calendar month average and reviewed a 30-day rolling emission limit, as well as the incremental cost associated with this limit. PSNH agrees with EPA that the 30-day rolling average method addresses flexibility for start-up, shutdown, emergency and malfunction. However, additional flexibility is necessary to maintain short term partial load capability.

PSNH has determined that a 0.30 lb/MMBtu emission rate on a 30-day rolling average will accommodate reasonably anticipated operating scenarios while achieving approximately 20% reduction in potential emissions. The maintenance costs that will be incurred by complying with this limit is estimated to be $30,000 per year, and can be attributed to additional cleaning and inspection of the SCR and air heater. PSNH also analyzed more stringent limits and determined costs similar to those represented in Table 2a above would be incurred. The increase cost associated with a more stringent limit can be attributed to the cascading effect of increased loading of the SCR.

Increased loading of the SCR results in the following conditions each more impactful as loading increases. More detail associated with these conditions can be found in the August 16, 2010, PSNH submittal.

1) Blinding of Catalyst;
2) More Frequent Maintenance Outages;
3) Fouled reagent distribution nozzles;
4) Accelerated catalyst derogation; and
5) Loss of Investment of catalyst.

Table 2b Incremental Maintenance and Capital Cost based on 30-day Rolling Average			
Emission Limit (lb/MMBtu)	Annual Loss of Investment of SCR Catalyst	Increase Maintenance (Cost of Air heater and SCR Maintenance)	Predicted Incremental Cost
0.37	$0	$0	$0
0.30	$0	$30,000	$30,000
0.25-0.30	$143,000	$195,000	$338,000

As noted in condition 2 above there will likely be additional maintenance outages to ensure optimum SCR performance. Replacement power costs that customers would incur from an additional maintenance outage are described in Item 3.

<u>3 – Replacement Power Costs associated with more stringent limit than 0.30 lb/MMBtu NOx Emission Rate</u>

Merrimack Station will need to consider a number of additional compliance efforts if not provided the necessary flexibility to deal with events as described above.

Increased maintenance costs to maintain peak NOx reduction capability could be signifcant. For example, air heater and SCR cleanings will be required more frequently because of increased loading of the SCR. This results in additional maintenance costs and replacement power costs associated with the required outages. In addition to the maintenance outages additional cleaning will be completed as a proactive measure during forced outages resulting in delayed start-ups. Outage duration is from time offline until the unit is phased.

If air heater washing were completed to comply with a step change in the NOx rate as shown below, the cost per ton of NOx reduction would be extremely costly. Again this number can increase greatly if an air heater cleaning was completed during a high priced market.

Table 3. Impact of more stringent Limit	
Duration of Cleaning/Outage	Replacement Power Cost per Outage
Short (3 days)	$720,000
Mid (4.5 days)	$1,100,000
Long (6 days)	$1,400,000

Replacement Power Costs: The table uses an assumption of $30/mwhr difference between the cost of MK2 and the market cost. This number can vary greatly depending on energy market prices.

It should be reiterated to meet more stringent emission rate than 0.30 lb NOx/MMBtu, under the conditions referenced above, PSNH may be forced to shutdown for air heater/SCR cleaning and also may be forced to shutdown rather than operate at partial load. Each of these aforementioned scenarios has significant cost as described above in Table 5.

4 - Summary of Analysis

Merrimack Station has aggressively reduced NOx emissions for the past 15 years. The total annual emissions reflect that laudable effort. Going forward, Merrimack Station anticipates continuing that effort, while maximizing customer value and providing reliable and affordable power. Table 4. below is a detailed summary of the incremental costs that PSNH will incur when considering the 0.30 lb/MMBtu proposed NOx emission rate and a more stringent limit.

Table 4. Summary of Additional Predicted Annual Cost[3]

Emission Limit (lb/MMBtu)	Un-**avoidable** Replacement Power cost (Partial Load) @ 240 hrs	New DAHS Implementation	Increase Maintenance (Cost of Air heater and SCR Maintenance 3 per year	Loss of investment of the SCR Catlyst	Replacement Power Cost For Maintenance Outage at $30 MWH	Delayed start-up to clean SCR and Air Heater (Two days)	Incremental reduction in **Potential** tons per year	Predicted Incremental Cost Increase $/yr	Cost per ton
0.37	$0	$0	$0	$0	$0	$0	0	$0	$0
0.30	$840,000	$10,000	$30,000	$0	$0	$0	1,065	$880,000	$826
0.25-0.30	$1,440,000	$10,000	$165,000	$143,000	$1,100,000	$0	380	$2,888,000	$7,600

[3] Values represented in Table 4 are net values.

PSNH understand the cost per ton of complying with the 0.30 lb/MMBtu calculated on a 30-day rolling average is under the BART threshold and is willing to accept this limit, which results in approximately 20% reduction of MK2's potential NOx emissions. This analysis demonstrates that the implementation of a more stringent limit than 0.30 lb/MMBtu will result in significant cost to our customers with little environmental benefit. With running the SCR harder, more frequent air heater cleaning, extended outages, and forced outages, and limit partial load operation.

If you have questions or require additional information, please contact me at 634-2440 or Sheila Burke at 634-2512.

Sincerely,

Elizabeth H. Tillotson
Technical Business Manager – Generation

cc:
Sheila Burke, Generation Staff
David Cribbie, Generation Staff