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THE STATE OF NEW HAMPSHIRE
before the
PUBLIC UTILITIES COMMISSION

Public Service Company of New Hampshire
Merrimack Station Scrubber Project

ORIGINAL	
N.H.P.U.C. Case No.	DE 11-250
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Witness	Panel 1
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Docket No. DE 08-103

Progress Report

November 10, 2011

Public Service Company of New Hampshire ("PSNH") is pleased to provide this status update regarding the Clean Air Project ("Project") involving the legislatively mandated installation of a Wet Flue Gas Desulfurization ("FGD") System (i.e., "Scrubber" technology) by PSNH at its Merrimack Generating Station. This report will provide:

- I. A status report on Project construction, equipment installation and start-up progress to date.
- II. A summary of the Project's in-service status and performance to date.
- III. An update on Project cost.
- IV. A summary of operational and maintenance activities of the Project.
- V. Review of Legislative Mandate.

This Report is an update on the substantive Project itself, and does not include a discussion of the Project's effect on rates. That information is included in the on-going PSNH Proposed Default 2012 Energy Service Rate proceeding, Docket No. DE 11-215.

I. SCRUBBER CONSTRUCTION, EQUIPMENT INSTALLATION AND START-UP PROGRESS

Since our previous report provided last October, 2010, exceptional progress has been made on the Project. The quick and successful construction program has led to the early commissioning, start-up, and operation of the Project, with an official in-service date for the Scrubber of September 28, 2011. This milestone was achieved in accordance with the statutory mandate and finding that "It is in the public interest to achieve significant reductions in mercury emissions at the coal-burning electric power plants in the state as

soon as possible” (RSA 125-O:11, I) via the installation of wet flue-gas desulfurization technology (i.e., Scrubber).



Scrubber in Operation

All contracts associated with the Clean Air Project have been issued. Over the course of this Project, approximately 60 purchase orders and contracts were issued for equipment, supplies, or services needed to complete the Project.

The Project has progressed very well with completion of engineering, design, and procurement. Since October 2010, field engineering and construction has continued positively. Craft labor has diminished from peak levels in late 2010 and early 2011 of over 350 workers on site to approximately 150 at present.

Although the Scrubber is in-service and operating as anticipated by statute to produce “significant emissions reduction benefits” (RSA 125-O:11, II), field activities continue on with punchlist tasks as well as a few construction and testing and tuning activities representing the remaining items to be completed. The

remaining Project work does not impact the ability of the Project to be in commercial operation and the Project is in fact providing to customers the benefits anticipated by the Mercury Emissions Reduction Law contained in RSA Chapter 125-O. Section II below provides details regarding the plant which is in service.

A. Activities Performed in the Fourth Quarter, 2010

i. Quarter 4:

750,000 cumulative Project working manhours were completed without a lost time accident this quarter.

State permit activities were initiated including an application for the quench water pump diesel engine. Numerous local building permit applications were initiated or received including the limestone truck delivery area foundation and the booster fan enclosure electrical permit.

Engineering activity included work on specifications for the Site Finalization and Performance Testing package. Drawings and technical documents were issued for relay coordination, arc-flash calculations, burner management system conduit, control design, and other work.

The work associated with the four large island contracts continued satisfactorily:

- The Scrubber Island focused on the absorber outlet duct installation, ball mill, limestone feeders, fire detection system, field erected tanks, hydro testing, installation of power and instrument cabling, and piping systems. The FGD building enclosure was completed.
- The Material Handling Systems work continued satisfactorily with work on cable tray and conduit, silos, and conveyor systems being performed. The limestone truck unloading facility contract was awarded.
- The chimney was substantially completed and slated to undergo final preparedness work prior to start-up activities.
- The Wastewater Treatment System effort concentrated on installing pipe, conduit, cabling, platforms, and miscellaneous equipment.



Absorber Vessel

Other interconnection systems such as the Balance of Plant Mechanical and Balance of Plant Electrical work progressed well with pipe and equipment installation as well as associated power and control cabling work.

The FGD substation was energized and power was made available for testing the FGD building electrical equipment.

Training activities continued for the Station workforce. This included focus on both operations and maintenance functions. All employees participated in this effort to transfer knowledge to the physical workforce as well as supervision and management. Training was provided by equipment supplier experts and the materials used were retained by each person to serve as their working notes for future reference. An overall program structure is managed by URS (our Program Manager) and PSNH.

The Project Team, with support from URS, concluded over one year of discussion and detailed review with the NHDES Water Division concerning the wastewater flow planned from the Clean Air Project's state-of-the-art Wastewater Treatment System. The NHDES

applied stringent analysis of the Project's technology and expected effluent. The conclusions reached by the NHDES required the installation of additional treatment equipment for certain constituents in order to meet the State's effluent requirements.

These strict State-developed water discharge limits have traditionally been acceptable to the U.S. EPA. However, the EPA chose not to issue a permit modification to the Station's existing permit, nor to issue a separate permit, nor to utilize any other means to allow this cleaned effluent to be discharged. Rather, the EPA informed PSNH that it would only authorize this new discharge as part of its then-ongoing effort associated with issuance of the renewed NPDES permit for the Station. PSNH filed its application for renewal of the station's NPDES permit with EPA in 1997, and as of the Fourth Quarter of 2010, was still waiting for EPA action.

The EPA, in subsequent discussions, reaffirmed their refusal to allow any discharge by means of modification to the current permit. To meet the statutory schedule mandate for Scrubber installation, and to minimize potential cost impacts to customers, PSNH assessed various alternate solution paths to ensure timely operation of the Scrubber in a manner that complies with all environmental requirements. Impact to Project cost and schedule were key elements considered, combined with the State mandate to construct and operate the Scrubber as soon as possible and early completion incentives contained in RSA 125-O:16 that would benefit customers

URS began to de-staff its home office project team as engineering and procurement activities declined. Field construction activities were near peak with local staff sizing matched to the work and overall building trades work force numbers.

B. Activities Performed During 2011

i. Quarter 1:

1,000,000 cumulative Project working manhours were completed without a lost time accident this quarter.

Construction activities continued at high levels in early 2011 with over 300 construction employees, on average, daily.

Various activities took place related to applications and preparation for permits required from Town boards and State agencies. All tasks remained on schedule to meet the statutory goal of placing the Scrubber into operation as soon as possible.

Engineering activities during this period focused on a number of items related to testing and operational preparedness, including: flue gas system operational modes, final conduit cable and termination schematic diagrams, CEMS (continuous emissions monitoring) equipment, NHDES monitoring plans, limestone truck delivery general arrangement and

foundation drawings, etc. Final project specifications for Performance Testing and Site Finalization were in various stages of review and bid preparedness.

Activity on the four major Project islands (Scrubber, Material Handling, Wastewater Treatment, and Chimney) continued with hydro testing and painting activities as well as installation of platforms, hand rails and other finalization efforts associated with the installed equipment. In addition, various contractors continued to perform cable and piping installations. Extra effort and manhours were directed at critical path items that had the potential of affecting the overall Project schedule. The gypsum storage building was completed.

Analysis of numerous pieces of equipment was initiated by the URS lead commissioning team in order to ensure equipment had been installed properly and in accordance with design drawings. Testing and operations of specific pieces of equipment and systems followed. This effort had a very methodical process associated with it which included numerous detailed assessments, records of alignment and vibration, as applicable, and recording of operational condition data. These construction turnover documentation packages were presented by URS construction personnel to URS commissioning personnel for acceptance to begin detailed commissioning activities.

Numerous piping and pneumatic systems were flushed or blown free of debris and hydro tested and many electrical pieces of equipment were energized and commissioned. The electric power supply equipment and systems were fully tested and placed into service. This included the 115kV switchyard tie-in and the 115kV to 4160V substation and all related equipment. The FGD building electrical equipment testing was completed and electric power was made available to the Island Contractors for their testing.



Substation

Training activities were conducted for plant operations and maintenance personnel on various mechanical systems, electrical systems, and control systems.

As a result of EPA's refusal to grant a near-term permit modification regarding the wastewater treatment discharge flow, decisions were made and work initiated associated with adding secondary water treatment equipment to reduce the waste stream volume as well as interim means for disposal of any liquid generated in order to ensure compliance with the statutory schedule mandates included in RSA 125-O. Engineering efforts were engaged and conceptual designs and layouts created and specifications and contracts for equipment were developed. Trucking and disposal of liquid on an interim basis to existing

permitted wastewater treatment facilities was identified as a means to allow operation of the Scrubber “as soon as possible” in a manner that complied with all legal requirements. All necessary approvals and agreements were obtained for this effort which avoided substantial and unnecessary customer costs by proactively preventing prolonged delays of the Project’s schedule and ensured the near-term reduction in air emissions consistent with the legislative mandate to have the Scrubber operational as soon as practicable.

ii. Quarter 2:

Final contract bid packages for Site Finalization Phase 2 and Performance Testing were prepared and bids received and analyzed for selection of the successful bidders. Other engineering activities during this period included control system testing and installation, final CEMS monitoring plans, and test protocols, control design logic reviews with the control system supplier, as-built drawing finalization, etc. Staff engineering at URS continued to be reduced in proportion to reduced engineering activities.

Construction activities on the Project also began to diminish with associated downsizing of engineering and construction oversight support personnel and demobilization of some Project contractors.

NHDES extended the Project’s Temporary Air Permit to September 30, 2012. Various local Planning Board approvals and Building Permits were received that were associated with various structures and equipment.

Work associated with the four major island contracts continued on schedule with system walk-downs, start-up, and commissioning activities occurring throughout the Project. Punchlists associated with all contracts were used to track open items. While items continued to be added to such punchlists, the overall number of outstanding issues diminished during this period. Filling of the Absorber vessel began.

Classroom training and hands-on operational training of systems continued to take place throughout this period. Large pieces of equipment were tested and run by equipment supplier field representatives in conjunction with URS commissioning personnel and Station personnel.

Overall field supervision and engineering support associated with various contractors continued to transition from construction to start-up activities. The numbers of technical overseeing and support management personnel diminished over this period, as did the number of field craft labor. The total number of employees on-site including craft labor was under 200 at the end of Quarter 2.

Supplemental water treatment system activities included placing of orders for equipment and finalization of design for construction and bidding purposes.

The first partial delivery of limestone was received via truck. This allowed for testing of the limestone receiving, conveying and storage systems. A second delivery of limestone via rail was received during the third quarter.



Limestone

iii. Quarter 3:

Contracts for the Site Finalization Phase 2 and Performance Testing were awarded. Quarter 3 was primarily focused on completion of many system punchlist activities with heavy focus on operational commissioning and operational preparedness for the planned fall tie-in outages. The overall Project schedule continued to be met, consistent with the overall plan and statutory directive.

Numerous system design parameters continued to be reviewed and refined in preparation of operations. External painting, internal coating activities, and the installation of agitators and other elements were completed on all field tanks. Fireproofing of structural steel was finalized and other miscellaneous systems moved toward completion including those associated with mechanical elements, electrical control, structural, and grounds.

The FGD contract and primary Wastewater Treatment contracts attained Mechanical Completion and were ready for their tie-ins to Merrimack Units 1 and 2. Unit 1 and Unit 2 tie-in outages had been previously scheduled with ISO-New England with Unit 1 coming off in September with start-up estimated in early October and Unit 2 being removed from service later in October with start-up in mid-November.

Unit 1 began its tie-in outage on September 6, 2011, with the critical path being the removal of the existing ductwork to the Unit 1 stack and completion of connections to the new Scrubber ductwork to the new booster fan. The tie-in of Unit 1 to the Scrubber systems was successfully completed in late September, and Unit 1 start-up began on September 24 and start-up was finished on September 25 when the Unit was phased to grid with the Scrubber system on-line and in operation. Unit 1 achieved full load on September 25 and after two days of full load operation with the Scrubber demonstrating that it was operating with all support systems as designed and performing its intended functions, the Scrubber was declared in-service and the accrual of AFUDC for those portions of the Project (that are common to both units and those specific to Unit 1) ceased.

During this quarter, the Unit 2 tie-in outage was planned to begin mid-October and be completed in mid-November.

iv. Quarter 4 (to date):

The Unit 2 tie-in outage is proceeding successfully with an expected return to service during the 3rd week of November.

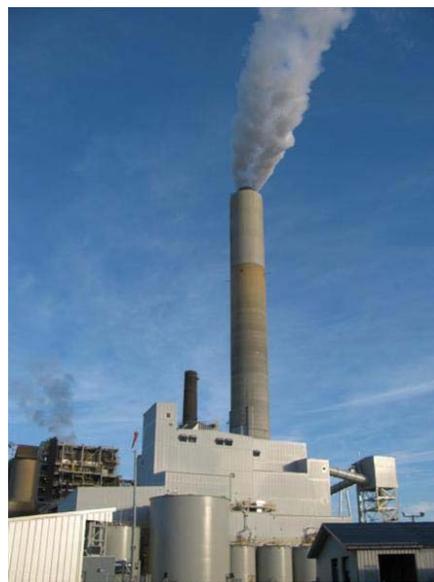
II. SUMMARY OF PROJECT'S IN-SERVICE STATUS

Unit 1 initiated a very successful start-up Saturday, September 24 and start-up was completed on Sunday, September 25. In parallel, the Clean Air Project was prepared for operations. At 3:18 PM Sunday, September 25, the Unit was phased on-line, was providing power to the Grid, and was released to ISO-NE for dispatch. At about 10 PM on Sunday, the Unit attained full load operations.

Upon Scrubber start-up, the emissions from Unit 1 were ducted into the absorber vessel where they were “scrubbed” with a limestone slurry. The chemical reaction between the emissions and the limestone reagent slurry produces calcium sulfate, which is synthetic gypsum. The gypsum produced has commercial value, and will be sold.

The new CEMs have indicated that the Scrubber is achieving initial SO₂ reductions of 90% or more with Unit 1 on-line; however, it is early in the project operating life with tuning and testing to occur later in 2011 and early 2012. The new CEMs will be RATA (Relative Accuracy Test Audit) tested later in 2011.

With full load operation, a clear demonstration of successful operation of the Scrubber was recorded. The systems and equipment associated with the Scrubber were operating and performing the intended emissions reduction function as designed in support of Unit 1 operation. Significant portions of the Project that began commercial operation upon Unit 1 start-up include the Scrubber vessel and associated equipment, the Material Handling Systems, the Scrubber and all its support equipment and systems, the Chimney, and the base Wastewater Treatment System. All other sub-systems and equipment in support of these four large island contract systems were also successfully placed into operation and began performing their intended functions with the Unit 1 start-up.



New Chimney

Following two days of observation and successful operations, the Scrubber equipment was officially deemed to be in-service and “used and useful in the generation of electricity” on September 28, 2011. At the declaration of that milestone, the Project ceased the accrual of AFUDC on those items that were placed into service.

The table below provides a list of the Project’s major islands and supporting work that have been installed and which were operating and placed in-service on or before September 30, 2011. Also listed are the costs incurred and placed in-service consistent with completion of this work.

Clean Air Project – including	Total Dollars In-service as of 9/30/11 (in millions)
Scrubber system	
Chimney Island	
Material Handling systems	
Wastewater Treatment system	
BOP- Civil / Structural	
BOP Electrical	
BOP Mechanical	
	\$324.6
Warehouse	\$1.1
Yellow Meeting Place Building	\$2.0
FGD 115 kV switchyard and sub-station	\$17.0
TOTAL	\$344.7

The Unit 2 outage is expected to be completed during the third week of November, 2011. Upon that Unit’s start-up the ductwork and booster fan equipment associated with Unit 2 will be placed into operation, and officially placed in-service upon their respective successful operational demonstration. PSNH will notify the Commission upon the successful placement in-service of the Project’s Unit 2 facilities.

Though material and equipment is installed and functioning, the majority of the Project’s contracts have a number of performance requirements to be demonstrated, operational requirements to be fulfilled, and resolution of any remaining punchlist items before final payments will be made. This effort will continue through 2012. By contract, at least one performance payment is not scheduled until early 2013, following at least 1 year of successful operation.

Construction efforts that are on-going as of September 30, 2011 include: tie-in and start-up of the Unit 2 specific equipment (ductwork, booster fans, etc.), the truck wash building, and the truck scales. These items are all expected to be in-service in 2011. The secondary wastewater treatment equipment is expected to be completed and placed in-service in phases during the last quarter of 2011 and the first half of 2012.

III. UPDATE OF PROJECT COST

The original project cost estimate of \$457 Million was revised downward to \$430 Million in the fall of 2010. Upon a recent review of the Project status and budget as well as the few remaining risks associated with start-up and commissioning the estimated final cost has been further reduced. With the reduction of reserve funds and anticipated AFUDC costs by \$8 Million, as of September 30, 2011, the Project cost forecast was revised to be \$422 Million.

\$344.7 M of the \$422 M Project budget is accounted for in the table provided in Section II, above. Of the remaining \$77.3 M, the Project budget forecasts that \$28.8 M will be in service by December 31, 2011; an additional \$9.2 M will be in-service by March 31, 2012; and \$32.3 M will be in-service by June 30, 2012. The remaining \$7 M will be spent and eligible to be placed into rates during the second half of 2012/first quarter of 2013. Final project costs will be determined in 2012 when final bills are paid subsequent to completion of performance tests and other contract obligations.

IV. SUMMARY OF OPERATIONAL AND MAINTENANCE ACTIVITIES

Upon being placed in service, the Project became part of station operations and as such begins to incur operations and maintenance costs charged to Station expense accounts. The station expense budget has dollars allocated to account for operations and maintenance costs including limestone material, gypsum sales, trucking and handling, waste disposal, etc. These O&M costs for 2011 and 2012 are included for ratemaking purposes in PSNH's routine energy service and reconciliation filings.

In preparation of the transition to an operating emissions reduction system, the Station identified key personnel in multiple departments to work directly with the Project team to review as-built conditions and be present to observe and participate in initial equipment

installation, testing and system commissioning, and initial start-up operations under the oversight of URS and manufacturers' experts. Operators participated in commissioning efforts in order to be involved firsthand with all testing, start-up, and initial operational activities of the new equipment and system. In this way, they could observe all critical equipment, control system functioning, and corrective actions.

To satisfy emissions monitoring requirements, PSNH worked with the New Hampshire Department of Environmental Services Air Resource Division (NHDES-ARD) for the better part of a year on the specification, installation, operations and maintenance, and reporting of the new continuous emission monitors. With the operation of the new



Limestone Conveying System

Scrubber, these new continuous emissions monitors have been commissioned and are undergoing the necessary testing and certification consistent with federal and state requirements. Initial testing on the Unit 1 and common stack CEM's has been completed. The CEMs currently show SO₂ reductions of 90% or greater at times with Unit 1 on-line.

NHDES will review, monitor and approve additional testing to be completed once Unit 2 is on line to confirm the accuracy of the newly installed CEMs and the associated emissions.

As noted in RSA 125-O:15, mercury emissions cannot currently be accurately measured by continuous emissions monitors (CEMs). Mercury quantities are so small that measurement tools are challenged to provide accurate, repeatable results. Presently, pursuant to RSA 125-O:15, mercury emissions are determined using stack testing methods. The Scrubber vendor is expected to conduct initial optimization and diagnostic stack testing in late November and December.

The baseline mercury input required by RSA 125-O:14 has not yet been determined. That determination is the subject of Air Resources Council Docket No. 11-10 ARC. Until a baseline is established, the compliance requirement established by RSA 125-O:13, II ("Total mercury emissions from the affected sources shall be at least 80 percent less on an annual basis than the baseline mercury input, as defined in RSA 125-O:12, III, beginning on July 1, 2013.") cannot be determined.

The Scrubber meets the statutory mandate for installation of a wet flue gas desulphurization system. In anticipation of the completion of the first mercury emission stack test to quantify the mercury reductions, all operational indicators associated with the Scrubber confirm effective operation of the Scrubber and the associated reduction in mercury is indicated. Limestone is being delivered and made into slurry for introduction into the Scrubber vessel. Gypsum has been produced. As previously stated, the CEMs confirm SO₂ reductions with Unit 1 on-line of 90% or better



Synthetic Gypsum in Storage Building

V. REVIEW OF LEGISLATIVE MANDATE

In 2006 the New Hampshire General Court mandated the installation of wet flue gas desulfurization technology at Merrimack Station by enactment of 2006 N.H. Laws Chapter 105, "AN ACT relative to the reduction of mercury emissions" (codified at RSA Chapter 125-O, sections 11 to 18).

RSA 125-O:11, I states: "It is in the public interest to achieve significant reductions in mercury emissions at the coal-burning electric power plants in the state as soon as possible. The requirements of this subdivision will prevent, at a minimum, 80 percent of the aggregated mercury content of the coal burned at these plants from being emitted into the air by no later than the year 2013. To accomplish this objective, the best known commercially available technology shall be installed at Merrimack Station no later than July 1, 2013."

PSNH successfully installed and tied-in Merrimack Unit 1 to the new Scrubber 21 months ahead of the July 1, 2013, deadline. Merrimack Unit 2 is expected to be tied-in mid-November, over 19 months ahead of the statutory deadline. The early operation of the Scrubber will result in over a year and a half of additional emissions reductions, along with receipt of the concomitant "Economic Performance Incentives" spelled out in RSA 125-O:16.

As required by RSA 125-O:13, PSNH has obtained all necessary permits to install and now operate the Scrubber. Construction of the Scrubber began with the issuance of the Temporary Air Permit on March 9, 2009. Numerous other federal, state and local construction permits were obtained including permits from the FAA, EPA, NHDES, and the Town of Bow.

On the same day that the Scrubber was declared to be in-service, by letter dated September 28, 2011, and after 14½ years of review, the EPA issued a draft NPDES permit for Merrimack Station. This draft Permit will not be finalized until the EPA considers all comments received during the public comment period (which now extends through February 28, 2012) and makes any revisions it deems appropriate; any provision of the final permit that are appealed will not take effect until such appeals are resolved. Due to EPA's refusal to modify or amend the Station's current water discharge permit, and the indeterminate time until a new permit becomes effective, alternate wastewater disposal arrangements have made to ensure compliance with the RSA Chapter 125-O requirements. These allow the immediate operation of the Scrubber to reduce air emissions while utilizing well-established industrial wastewater disposal options for the Scrubber wastewater.

Also as outlined in RSA 125-O:13, annual compliance with the mercury reduction requirements will begin on July 1, 2013. Prior to July 1, 2013, early mercury emission reduction credits will be earned as described in RSA 125-O:16 which states: "The department shall issue to the owner early emissions reduction credits in the form of credits or fractions thereof for each pound of mercury or fraction thereof reduced below the baseline mercury emissions, on an annual basis, in the period prior to July 1, 2013. Ratios of early reductions credits to pounds of mercury reduced shall be as follows: 1.5 credits per

pound reduced prior to July 1, 2008; 1.25 credits per pound for reductions between July 1, 2008 and December 31, 2010; and 1.1 credits per pound for reductions between January 1, 2011 and July 1, 2013.”

CONCLUSION

In conclusion, PSNH is pleased to report that it has met the mandate imposed by the General Court and that the vast majority of the Clean Air Project has been placed in service well ahead of schedule. It is expected that the remaining Project components will also to be placed in-service well ahead of the statutory deadline. The Project is successfully achieving significant reductions in emissions from the operation of Merrimack Station over 18 months in advance of the statutory deadline. The placement in-service of the Scrubber on September 28, 2011, was exceptionally successful and problem-free. All this was accomplished at lower cost than budgeted, with the Project cost estimate reduced to \$422 Million.