RESUME OF MICHAEL D. CANNATA, JR., P. E.

Michael D. Cannata, Jr., P. E.

Areas of Specialization

Investigations of safety, reliability, and implementation of public policy in the electric and gas industries; investigations of unit outage and system outage causes, electric utility operations and planning; bulk power system planning; interconnections; transmission system design.

Relevant Experience

Accion Group, Inc.

- Provides Transmission and Engineering services to the New Hampshire Public Utilities Commission.
- Evaluated the appropriateness of the proposed Storm Fund Adjustment Factor and the Inspection and Maintenance Program Basis Service Adjustment Mechanism for Power Option, a load aggregator in Massachusetts Electric Company's first delivery rate case in 10 years.

Innovative Alternatives, Incorporated

- Technical advisor to the Maine Public Utilities Commission regarding the public convenience and necessity of 37 projects totaling more than 350 miles of 115 kV and 345 kV facilities.
- Technical advisor for Structal Bridge Corporation regarding electrical interconnection requirements for its plant expansion making it the largest bridge manufacturer in North America

The Liberty Consulting Group

- Lead consultant for Liberty's review of the transmission system of Nova Scotia Power for The Nova Scotia Utility and Review Board. Liberty's review examined (1) system maintenance, inspection, structural design, materials, staffing, and related matters, (2) system planning, operations, system design, lessons learned, and other matters, and (3) utility communications, call center operations, staffing, outage management system, lessons learned, and related matters after the collapse of multiple transmission lines in November 2004.

- A lead investigator in the management audit of Consolidated Edison Company of New York reviewing adequacy of multi-area transmission planning and resource adequacy within the multi-area system for the New York Public Service Commission. Also included was a review of the electric and gas system designs.
- Lead investigator reviewing the adequacy of system interconnection requirements of a major renewable fuel resource for the Nova Scotia Utility and Review Board.
- Technical advisor to the Maine Public Utilities Commission, Vermont Public Service Board, Kentucky Public Service Commission, and the District of Columbia Public Service Commission regarding the public necessity and convenience for a multitude of 345 kV, 230 kV, 161 kV, 138 kV, 115 kV, and 69 kV facilities.
- A lead investigator monitoring Commonwealth Edison's implementation of T&D system reliability improvement recommendations resulting from major system outages for the Illinois Commerce Commission.
- A lead investigator in the prolonged outage of Ameren T&D facilities following severe wind and ice events in 2006 for the Illinois Commerce Commission.
- A lead investigator monitoring Ameren's implementation of T&D system reliability improvement recommendations resulting from major system outages for the Illinois Commerce Commission.
- A lead investigator in the investigation of transmission grid security in Illinois after the August 2003 blackout for the governor's blue ribbon committee.
- Lead investigator reviewing the operation and outage of the fossil power plants of Arizona Public Service Company for the Arizona Public Service Commission.
- Lead investigator reviewing the operation and outage of the fossil power plants of Duke Energy – Ohio for the Ohio Public Utilities commission.
- A lead investigator in the in-depth root cause analysis of a fire at a major Commonwealth Edison substation for the Illinois Commerce Commission.
- Lead investigator of the reliability of the T&D systems of four electric utilities in Maine.
- Served as a lead investigator in the review of distribution and transmission practices at Alabama Power and Georgia Power Company.
- Advisor for the New Hampshire Public Utilities Commission in the merger of National Grid and Key Span and the sale of Verizon assets to Fair Point Communications.
- Served as lead investigator in prudence reviews of major fossil and nuclear plant outages and power purchases for the New Hampshire Public Utilities Commission.
- Served as the principal technical and analytical member in the Seabrook nuclear unit sale team acting for the New Hampshire Public Utilities Commission.
- Investigated the causes of overlapping unit outages at a major Reliant generation facility.

New Hampshire Public Utilities Commission - Chief Engineer

- Managed a professional staff of engineers and analysts engaged in investigations regarding safety, reliability, emergency planning, and the implementation of public policy in the electric, gas, telecommunications and water industries.

- Prime architect of the settlement between the State of New Hampshire and Public Service Company of New Hampshire (PSNH) that ended years of litigation and allowed state-wide competition in the electric industry to proceed.
- Investigated the operation and outages of the fossil and nuclear facilities of the Public Service Company of New Hampshire.
- Advisor to the Commission on utility system and operational issues including those of alternative energy generation.
- Decision-maker on the Site Evaluation Committee responsible for siting major electric and gas production and transmission facilities.
- Sat as decision maker at the New Hampshire Office of Emergency Management's Emergency Operations Center.
- Re-drafted the state's Bulk Power Siting Statute and facilitated resolution of widespread legislative tensions.
- Instrumental in achieving quality of service levels among the highest in Verizon's service territory.

Public Service Company of New Hampshire (PSNH)

- As Director - Power Pool Operations and Planning, PSNH
    - Responsible for the operation and dispatch of PSNH transmission and generation facilities through the New Hampshire Electric System Control Center.
    - Core participant in the merger/acquisition team activities culminating in the corporate reorganization of PSNH. Recognized and developed a successful employee retention program used during the acquisition.
    - Core Task Force Member for the DC electrical interconnection between Hydro Quebec and the New England Power Pool.
    - Developed real time integrated transmission system loading capabilities for the New Hampshire Electric System Control Center.
    - Represented PSNH at all major relevant national and regional reliability organizations including:
        - New England Power Pool
            - System planning Committee
            - System Operations Committee
            - All technical planning and operations task forces conducting regional and inter-regional studies and analyses
        - Northeast Power Coordinating Council
        - Joint Coordinating Council
        - Edison Electric Institute
            - System Planning Committee

- As Director - System Planning/Energy Management, PSNH

- Coordinated the company's capital planning requirements for generation and transmission. Integrated its load forecasting and energy management activities.
- A lead participant in the development and implementation of response strategies addressing the negative financial impacts associated with the proliferation of non-utility generation.
- Ensured that the interconnections of non-utility generation met utility reliability requirements.
- Re-designed the corporate budgeting system to allocate available resources by economic and need prioritization.
- Driving force in re-directing corporate economic evaluations towards competitive business techniques.

- As Manager - Computer Department and System Planning, PSNH
  - Responsible for the Engineering Division's computer applications support and transmission system planning functions.
  - Principal in the development, design and implementation of the first-in-the-nation application of 345/34.5 kV distribution. Resolved daytime corporate-wide computer throughput logjam.
  - Integrated the Engineering Department's computer applications into the corporate computer organization.

Education

M.B.A., Northeastern University - 1975
M.S.E.E., Power System Major, Northeastern University - 1970
B.S.E.E., Power System Major, Northeastern University - 1969

Registration

Registered Professional Engineer - New Hampshire #5618

2009 Capacity/Energy Transactions

Background

Public Service Company of New Hampshire (PSNH) retains load serving responsibility for customers who have not selected a competitive supplier. PSNH's monthly peak load for 2009 ranged from 893 MW in October, to 1,305 MW during August. On-peak monthly energy ranged from 241 GWH in November to 353 GWH in January, and off-peak monthly energy ranged from 222 GWH in September to 349 GWH in January. During 2009 PSNH met part of its system need by purchases from other suppliers. In 2009 these external supplies provided 21% of monthly on-peak requirements in March and 66% during September. Off-peak supplies from the market in 2009 equaled 8% of system need in March and 56% in August. For the year, the market supplied a total of 37% of PSNH's on-peak energy requirements and 27% of its off-peak requirements.

Source of 2009 System Need

Period	System Peak	System Need		Market Supply (percentage)	
		On-Peak	Off-Peak	On-Peak	Off-Peak
January		353 GWH	349 GWH		
March				21%	8%
August	1,305 MW				56%
September			222 GWH	66%	
October	893 MW				
November		241 GWH			
Total for 2009				37%	27%

PSNH Sources of Energy and Capacity

In 2009 and at summer ratings[1], PSNH owned approximately 528 MW of coal-fired units at two stations, 419 MW of oil-fired plants in two units, 65 MW of hydro-electric plants from nine stations, 43 MW of wood-fired generation in a single unit, and 83 MW of combustion turbine generation in five units at four locations. PSNH also purchased 20 MW of nuclear capability from a single unit, 55 MW from various PURPA-mandated purchases, and 10 MW (no capacity) from Independent Power Provider (IPP) buyout replacement contracts.[2] The PSNH portfolio totals approximately 1,213 MW of summer capability, and 1,278 MW of winter capability. [3, 4]

In addition, PSNH received variable monthly capacity credits from the Hydro Quebec interconnection. PSNH must meet its share of the Independent System Operator – New England (ISO-NE) monthly capacity requirement, which ranged from 1,752 MW in September, to 2,212 MW in March. The difference between PSNH resources and the ISO-NE monthly requirement, including reserve requirements, must be made met through supplemental capacity purchases. The market represented approximately 23% and 41% of PSNH monthly capacity requirements in September and January respectively and varied from 404 MW during September to 882 MW in January 2009.

Load obligation requirements remained difficult to forecast in 2009. At the beginning of January, approximately 125 MW (8 %) of PSNH's large customers were turning to market or self supply. By the end of December, the load obligation loss was 468 MW (28 %). The energy related to customer migration was 74 GWH in January and 193 GWH in December. For the 2009 calendar year, energy migration totaled 1,503 GWH, compared to the 596 GWH PSNH forecasted at the December 2008 Energy Service update[5]. Accion notes that in mid-2008, PSNH was using 6% migration, the current level at the time, and that many of the 2009 purchases were made in or prior to that time period.

[1] In New England, generating units have winter and summer capability ratings. The summer ratings are generally lower to reflect higher ambient and cooling water temperatures.
[2] These figures do not include Lempster Wind or unit contingent contracts.
[3] These figures do not include any capability from the Bethlehem, Tamworth, or Lempster Wind power purchase agreements.
[4] The units that are owned by PSNH, along with capacity under firm contract are, collectively, referred to as "PSNH Generation" in this Exhibit.
[5] PSNH does not do a migration forecast per se, but uses the then actual value at a constant level for the future.

Allocation of Wholesale Marketing Department FTEs

	2005		2006		2007		2008		2009[2]	
Bidding & Scheduling	2.00	1.75	2.00	1.75	2.00	1.75	2.00	1.75	2.00	1.99
Resource Planning/Analysis	4.00	2.00	4.00	2.00	4.00	2.00	4.00	2.00	4.00	1.45
Energy & Capacity Purchasing	1.00	0.50	1.00	0.50	1.00	0.50	2.00	0.50	2.00	0.74
Standard Offer & Default Service Procurement	2.00	0.00	2.00	0.00	2.00	0.00	3.00	0.00	2.00	0.00
Contract Administration	3.00	0.00	3.00	0.00	3.00	0.00	3.00	0.00	3.00	0.00
Administrative Support	1.00	0.25	1.00	0.25	1.00	0.25	1.00	0.25	1.00	0.33
Management	1.00	0.25	1.00	0.25	1.00	0.25	1.00	0.25	1.00	0.11
Total	14.00	4.75[1]	14.00	4.75	14.00	4.75	16.00	4.75	16.00	4.62

1 - In 2004, PSNH was allocated 5.75 FTEs.
2 – In 2009, FTE allocation by function was by time sheet allocation.

PSNH Management of Procurements

PSNH's energy procurement is managed in coordinated by Northeast Utilities (NU). During 2009 NU dedicated the equivalent of employed 16 full time employees (FTEs) [6] in the Wholesale Marketing Department, which was up from 14 in 2007. In 2008 the department employed 16 FTEs. In 2008, 4.75 FTEs were allocated to PSNH, which was unchanged from 2008. The remaining 11.25 FTEs were allocated to two other NU subsidiaries without load-serving responsibilities.

The 2009 FTE allocation to PSNH totaled 4.62 FTEs, down slightly from the 4.75 FTEs allocated to PSNH in 2008. From June 2003 until 2009 PSNH had on-site full time capacity/energy planning personnel in New Hampshire dedicated to New Hampshire power

[6] In actuality because of an open position, that figure was 15.25 FTEs.

supply. In 2010, that person was replaced with a new individual based in Connecticut. The new person has many years of energy market experience. From an organizational viewpoint, the New Hampshire position reports to a Connecticut manager. PSNH personnel informed Accion that they do not see the home base of the individual as an issue at this time as the individual is spending considerable time in the field at PSNH and, according to PSNH; the field time spent was comparable to historic levels.

PSNH Reliance on Supplemental Supplies

To meet its load responsibility, PSNH requires supplemental on-peak and off-peak (defined by ISO-NE as weekends, holidays, and weekday hours 1-7 and hour 24) energy purchases that change hourly. During on-peak periods, purchases vary from 0 MW during low load months to 400 MW in high load months. During off-peak periods, purchases vary from 0 MW to 400 MW in the overnight hours and from 0 MW to 600 MW during weekend days. The reason for such high purchases in off-peak periods is that Newington Station (Newington) is not generally economic to dispatch. Accion considers these requirements to be "fixed," as their requirement is based on the assumed absence of specific contingencies occurring, but does include planned unit maintenance. PSNH stated that the unit capacity value used by PSNH includes a reduction in unit capacity factor reflecting estimated unpredictable forced outages and estimated reserve shutdowns between the planned maintenance periods. The supplemental energy and capacity requirements are increased if any of PSNH's generation portfolio is unavailable when needed to serve load, or if loads are higher than planned due to variation in the weather or customer migration. Likewise, these requirements are reduced when loads are less than planned due to variation in the weather or customer migration. Accion considers this portion of the energy supply to be "variable."

In general, PSNH supplemented the PSNH Generation with monthly, weekly, and daily bilateral purchases to meet the "fixed" portion of its supplemental on-peak requirements and used the ISO-NE spot market combined with daily bi-lateral purchases to meet the "variable" portion of its supplemental requirements. The table below shows how PSNH on-peak and off-peak energy requirements have been supplied by its own resources and the bilateral and ISO-NE spot markets. Of note is the increasing reliance on market energy generally due to load growth through time and the relatively constant value of PSNH generation through time. Actual weather and major unit outages that do not occur every year can also alter these percentages.

Percent Supply of PSNH Energy Requirements from PSNH and Market Sources[7]

	PSNH Owned Generation (Percent)		Bilateral and Spot Energy (Percent)	
	On-Peak	Off-Peak	On-Peak	Off-Peak
2004	83	90	17	10
2005	74	85	26	15
2006	67	80	33	20
2007	66	80	34	20
2008	56	71	44	29
2009	63	73	37	27

The following table shows how PSNH units and the markets supplied PSNH energy requirements for 2009.

Percent of PSNH 2009 On-Peak and Off-Peak Energy Requirements Supplied by PSNH and the Markets[7]

Source	On-Peak (Percent)	Off-Peak (Percent)
Merrimack & Schiller	43	51
Hydro	5	7
Vermont Yankee	2	3
IPP's	7	9
Buyout Contracts	1	1
Newington & Wyman	4	1
Combustion Turbines	0	0
Bilateral Purchases	34	22
ISO-NE Spot Purchases	3	5
Total	99	99

[7] Percent figures may not total 100 due to rounding.

The following table depicts PSNH's historical market purchases and their source by percent.

Historical PSNH Supplemental Purchases and Source[7]

	Sup. Purchases (GWH)	LT Bilateral (%)	ST Bilateral (%)	ISO-NE Spot (%)
On-Peak				
2004	900	52	22	26
2005	1,424	83	4	13
2006	1,815	85	10	5
2007	1,642	78	9	13
2008	2,046	81	7	12
2009	1,703	90	3	7
Off-Peak				
2004	431	0	33	67
2005	847	79	3	18
2006	1,106	79	6	15
2007	945	73	5	22
2008	1,210	64	5	31
2009	1,139	85	2	13

1 – The percent figures may not total 100 due to rounding.

Historic PSNH Supply Approach

Historically, PSNH has altered its approach to supply procurement each year to deal with changing conditions. In the summer of 2005, PSNH continued to cover its position and purchased blocks of bilateral power for 2006 to bring stability to pricing and to limit potential under-recoveries in every month, rather than just the peak months and months of unit outages as was done for 2004. In June 2006 PSNH also supplemented its bilateral purchased for July and August. In addition, PSNH did more hedging in 2006 for both on-peak and off-peak load periods to better reflect the forced outage rates of the coal units. In 2007, PSNH intended to establish a fixed annual energy service rate that is subject to minimal under or over recovery. PSNH established its monthly purchase targets in the first quarter of the prior year and made a series of purchases of bi-lateral energy through November to cover these targets. In addition, PSNH purchased short-term bilateral energy to cover forced outages and the high load periods. All other energy was either procured from its own units or from the spot market. In 2008, PSNH followed the same purchase pattern that it used in 2007.

In 2005, PSNH purchased 500 MW of its 2006 capacity requirement via an annual contract. The capacity market was scheduled to switch to the new Forward Capacity Market (FCM) in October 2006, however, the switch over did not take place until December 2006. Uncertainty regarding the start date of the new FCM rules virtually precluded further capacity contracts after June 1,

2006. When the FCM transition period rules took effect in December 2006, each load serving entity was responsible for meeting its percentage of the total ISO-NE qualified capacity resources. ISO-NE qualified capacity resources are reduced by their individual forced outage rates. The seasonal capability of PSNH units is also discounted for their forced outage rate to meet its percentage of the ISO-NE supply obligation. The FCM took effect in December 2006 and was in full effect for 2007 and beyond.

PSNH uses Financial Transmission Rights (FTRs) in all hours where it expects its units to run to protect against congestion pricing in the pool. In essence, FTRs trades a known price for a potentially high variable congestion price. These rights are limited by actual system capability, function much like a hedge, and bring certainty to the price of generation with regard to congestion. FTRs are purchased between the major PSNH Generation (that is, Vermont Yankee, Merrimack, Newington, Schiller, and the Mass. Hub) for the months they are expected to run or in which purchases are made from the market (collectively these are known as the source locations) and the New Hampshire load zone (referred to as the sink location). In 2009, PSNH purchased 6,480 MW-months of on-peak FTRs and 3,197 MW-months of off-peak FTRs. The table below shows PSNH's historical FTR purchases, their value regarding avoided congestion costs, and their cost to PSNH customers.

PSNH Historical FTR Costs and Savings

Year	Auction Cost (Thousands)	Avoided Congestion Costs (Thousands)	Net Cost (Thousands)
2003	414	488	(74)
2004	1,341	1,417	(76)
2005	777	896	(119)
2006	301	133	168
2007	973	1,133	(160)
2008	827	237	590
2009	10	122	(112)

Historical Performance

The historical performance of PSNH units is considered when determining when to procure supply from supplemental sources

PSNH Major Unit Historical Unit Heat Rates [8]

Unit	Average Annual Heat Rate (BTU/kWh)					Full Load Heat Rate (BTU/kWh)
	2005	2006	2007	2008	2009	2009
Merrimack-1	10,184	10,376	10,264	9,933	10,211	9,900
Merrimack-2	10,071	10,328	10,157	9,723	9,919	9,520
Newington	11,522	12,270	11,723	11,690	12,382	10,900
Schiller-4	12,558	12,832	13,405	12,244	13,019	12,900
Schiller-5	12,871	9,398(1)	15,565	16,689	17,122	15,800
Schiller-6	12,379	12,460	12,528	12,072	12,644	12,300

Historic Unit Capacity Factors

The table below shows the historical capacity factors and the projected capacity factors used for the 2008/2009 period.[9]

Actual and Projected Annual Capacity Factors for PSNH Major Units

(Annual Generation/Winter Rating/8760)

Unit	Actual Capacity Factor (Percent)									Forecasted
	2001	2002 (1)	2003 (2)	2004	2005	2006	2007	2008	2009	2009
Merrimack-1	81.6	74.7	93.3 (3)	86.8	90.6 (3)	80.6	95.7(3)	79.8	84.1 (3)	88.3
Merrimack-2	72.7	75.7	73.9	80.3	79.1	84.1	82.9	72.8	56.1	55.7
Schiller-4	66.5	65.4	73.9	73.7	76.5	71.1	84.2	78.5	59.5(6)	76.4
Schiller-5	59.3	68.2	73.5	74.0 (4)	72.4 (4)	42.0(5)	76.7	79.8	79.6	75.7
Schiller-6	62.8	71.6	75.1	76.6	81.4	77.6	74.6	80.7	56.9(6)	70.4
Newington	12.6	19.0	55.9	50.3	33.5	8.0	9.3	3.3	5,2	6.9

(1) - Seabrook removed from PSNH mix for November and December due to sale.
(2) - First full year Seabrook is not in PSNH mix.
(3) - No unit overhaul in this year.
(4) - Very minor outage this year due to wood conversion.
(5) - Coal to wood boiler conversion project.
(6) – Actuals reflect reserve shut down periods.

2009 Energy Market

Where much of PSNH generation is either base load or peaking generation, it is not expected that they will have significant interaction with the market. The remaining unit, Newington, is the unit

[8] Coal to wood conversion took place in 2006.
[9] Calendar 2009 is in this period.

most likely to interact with the market because of its cost. The following paragraphs estimate the range of Newington's cost and the market prices produced for the price range of oil and gas by quarter.

In the first quarter of 2009, price volatility dominated the marketplace. Gas varied in price from $6 to $15 per MMBTU, or 6 cents to 15 cents per kWh, assuming a 10,000 BTU/kWh heat rate (approximately the full load heat rate of Newington), and #6 oil remained stable at approximately $6.00 per MMBTU or 6 cents per kWh again assuming a 10,000 BTU/kWh heat rate. These fuel prices produced an on-peak bilateral energy market in New England that varied from 4 cents to 6 cents per kWh during the same time period.

Stability returned to the market in the second quarter of 2009. During that period, gas remained at approximately $4 per MMBTU, or 4 cents per kWh, again assuming a 10,000 BTU/kWh heat rate, and #6 oil rose from $6 to $10 per MMBTU, or 6 cents to 10 cents per kWh, again assuming a 10,000 BTU/kWh heat rate. These fuel prices produced an on-peak bilateral energy market in New England of approximately 4 cents per kWh during the same time period.

In the third quarter of 2009, there was little market volatility and prices continued to fall. Gas ranged from $2 to $4 per MMBTU, or 2 cents to 4 cents per kWh, again assuming a 10,000 BTU/kWh heat rate, and #6 oil stabilized in the $10 to $11 per MMBTU range or 10 cents to 11 cents per kWh again assuming a 10,000 BTU/kWh heat rate. These fuel prices produced an on-peak bilateral energy market in New England that generally ranged from 3 cents to 5 cents per kWh during the same time period.

In the fourth quarter of 2009 gas price rose from $3 to $10 per MMBTU, or 3 cents to 10 cents per kWh, again assuming a 10,000 BTU/kWh heat rate, and #6 oil stabilized at approximately $12 per MMBTU, or 12 cents per kWh, again assuming a 10,000 BTU/kWh heat rate. These fuel prices produced an on-peak bilateral energy market in New England that generally varied from 4 cents to 8 cents per kWh.

The above data is summarized in the following table.

Newington Energy Price Versus New England On-Peak Bilateral Market (Cents/kWh)[1]

	2009 – Q1	2009 – Q2	2009 – Q3	2009 – Q4
Newington on Gas	6 - 15	4	2 - 4	3 - 10
Newington on Oil	6	6 - 10	10 - 11	12
NE On-Peak Bilateral Market	4-6	4	3 - 5	4 - 8

1 – Fuel per MMBTU converted at Newington full load heat rate of approximately 10,000 BTU/kWh.

In 2009, PSNH continued to rely on the market for a significant portion of its energy requirements which included an 18-week outage to repair the Merrimack-2 HP/IP turbine. Loads generally were lower than forecast and up to 25 percent of monthly energy requirements of large customers met their needs from the market or self supply, resulting in a reduced supplemental purchase requirement. Although market prices were high during the beginning and end of the year, market prices were low between these periods. With low market energy prices, PSNH continued to be very susceptible to both market price volatility and to fluctuations in the supplemental purchase volume created by changing economic conditions and the degree to which customers migrate to and from competitive supply options.

PSNH 2009 Supply Approach

In 2009, PSNH altered its procurement strategy in three areas. The first was that PSNH began its supplemental purchases for 2009 in the fourth quarter of 2007, rather than the first quarter of 2008, with the purchase of unit contingent PPA contracts. Late in the first quarter and in the second quarter of 2008, PSNH's review of the forward energy market showed that the peak period prices for calendar year energy were rising and began to procure its 2009 supplemental energy requirements. These purchases continued until early in the third quarter of 2008. At that time, the run up in peak period calendar energy prices reversed. At that point PSNH altered its procurement strategy by markedly reducing its purchases for 2009. After July 2008, PSNH made just a few monthly purchases and after August 2008, and only one additional monthly purchase was made in 2008[10] for 2009. The third change in market procurement was related to the Merrimack turbine repair. Once the outage requirements and anticipated repair time were known, PSNH revisited its supply requirements. In January 2009, with the December 2008 updated load forecast, PSNH purchased additional energy to cover the August – early December Merrimack-2 turbine outage. PSNH stated that it did not purchase full outage requirements at that time because of reduced loads forecasted in the December 2008 update. PSNH further notes that even though additional purchases might have been justified with the mid-year update forecast, that such purchases were not made due to the severity of the recession and migration levels. PSNH made daily purchases as warranted. PSNH personnel also stated that once future supplemental energy is purchased, the company rarely sells that energy into the longer term market. Rather, sales of supplemental energy are generally made only into the spot market.

Under the FCM rules, PSNH was billed at the transition capacity rate of $3.75 per kW-month through May 2009, and $4.10 per KW-month from June through December 2009, for its 4.68 to 5.90 monthly percent share of the 35,363 MW to 39,076 MW of qualified unforced monthly capacity in ISO-NE or 1,752 MW to 2,212 MW per month, less the value of its own resources. The ISO-NE transition rates produced a bill for $92.8 million for capacity and PSNH unit capacity produced a $64.1 million credit, leaving PSNH with a $28.7 million capacity cost for 2009.

[10] The global financial crisis erupted in September of 2008.

PSNH conducts biweekly phone calls with generating station, fuels, operations, and bidding/scheduling personnel. Plant personnel keep capacity/energy planning informed of impending developments at the plants. PSNH views Newington as the major unit on its system that interacts with the market, as all other owned units are either hydro, coal, wood, or long-term resources that are almost always economic or must take contracts[11] or peaking units that are rarely expected to run. The net monthly on-peak energy requirements of PSNH were 9 to 17 GWH of bilateral purchases and 1 to 32 GWH of spot market purchases. PSNH monthly off-peak energy requirements were 4 to 10 GWH of bilateral purchases and 3 to 36 GWH of spot market purchases. The incremental energy needs from the market are determined by the actual weather that occurred, rather than the forecasted average weather in the energy forecast and actual unit operation.

Purchases were based on monthly analysis. PSNH modeled hourly forecasts by month including a hydro schedule, hourly load forecast, IPP forecast, and its own resources. PSNH modeled its own resources as follows. Combustion turbines and Wyman #4 were excluded because they have extremely low capacity factors and the market price tends to mimic their cost when they do run. Coal units have planned outages specifically modeled and are derated to their annual forced outage rate for the periods in which they run. PSNH's modeling will reduce the unit forced outage rate if it is projected to be in reserve shut down, but continues to apply historical forced outage rates to remaining generation. PSNH also discretely models the short planned reliability outages for each unit. Newington costs were modeled as the projected market cost of oil corrected for SOX and NOX calculations and at a full load dispatch rate. If the cost of Newington was lower than the blocks of power to be purchased, Newington was run as loaded for that block. The remainder of the energy requirements was assumed to be supplied by the spot market as recognition of the risk that PSNH may be wrong in making additional purchases.

PSNH purchased 1,589 GWH of on-peak bilateral energy and 994 GWH of off-peak bilateral energy in 2009. PSNH also spot purchased 114 GWH of on-peak energy and 145 GWH of off-peak energy. PSNH made two types of sales into the New England market. It sold 1 GWH of on-peak energy and 90 GWH of off peak energy from surplus generation from owned units that lost $2.2 million. PSNH also sold unneeded bilateral and spot energy on the spot market because loads failed to materialize as or when expected. PSNH resold 400 GWH of on-peak bilateral energy and 299 GWH of off-peak bilateral energy. These sales resulted in a loss on on-peak energy sales of $23.1 million and a loss on the sale of off-peak energy of $14.6 million for a total net loss of $37.7 million. Total PSNH on-peak sales activity of 401 GWH resulted in revenue of $17.7 million and total PSNH off-peak sales activity resulted in revenue of $14.1 million. Total PSNH energy purchases cost $248.8 million and total PSNH energy sales amounted to $31.8 million resulting in a net cost of energy purchases of $217.0 million.

[11] Although forecasted to be economic in 2009, all PSNH base-load units except Schiller-5 were placed on reserve shutdown at least once during 2009.

PSNH based the 2009 projected unit capacity factors by explicitly modeling planned annual maintenance and consultation with plant personnel. Short term planned reliability outages were also discretely modeled and are not included in the overall annualized forced outage factor between outages. The table shows that PSNH base load units performed near or better than forecasted, except where reserve shutdowns became a factor due to the reduced price of energy in the ISO-NE market. PSNH modeled Merrimack and Schiller units as base load. PSNH personnel reported that their projections produced no reserve shutdowns for these units. PSNH personnel also stated that in 2009, load forecasts and supplemental purchase needs were evaluated at the time of the December 2008 and July 2009 updates[12].

Evaluation

Accion reviewed the capacity/energy planning testimony filed by PSNH, conducted an on site interview with knowledgeable personnel responsible for the capacity/energy planning function at PSNH, submitted follow-up data requests, and reviewed detailed backup information of the summary results supplied by PSNH.

Accion concluded that the PSNH filing is an accurate representation of the process that took place in 2009. Accion believes that PSNH made sound management decisions with regard to capacity and energy purchases in its market environment, consistent with its least cost plan as modified on March 28, 2008. Accion also concluded that the capacity factor projections used by PSNH in its purchase projections were reasonable.

At the same time, Accion believes that improvements can be made to the process. PSNH made few or no sales except into the spot market. Possible improvements are described in the recommendations below.

Load Migration

With regard to migration, Accion concluded that it is difficult to do realistic forward looking market purchases when approximately 30% of the load to be served can come and go at will. This is due to customer response to pricing. Customers see higher costs when other customers migrate away from the system as the departing customers seek lower power costs. Any excess energy resulting from the outward migration is generally worthless when resold because the market price is low enough to have caused the migration. Likewise, customers remaining on the system also see higher costs when migration into the system occurs when migrating customers seek lower power costs. Any shortage of energy resulting from the inward migration is generally worth more when purchased, because the market price is higher and caused the migration. In addition, PSNH's lower cost generation is diluted over a larger MWH load.

[12] During a technical conference, PSNH indicated that it is now updating its load forecast on a quarterly basis. Accion does not know how formal the process is.

Price Volatility

Market price volatility would be expected to decrease in ISO-NE in the future as loads remain depressed due to the 2008 deterioration of economic conditions. Also, it appears the lower demand for gas keeps downward pressure on the price of gas, except for the two quarters where peaks occur. This depressed demand can be expected to continue until load requirements and resources come more into balance, resulting in upward pressure on the price of gas. Accion also believes that the cost of gas in New England may remain depressed beyond the recovery of the current recession, due to the planned expansion of wind turbines and planned increased transmission capability from outside of ISO-NE into New England. This development in new generation and expanded transmission can be expected to mainly replace gas-fired generation, because gas is on the margin much of the time in New England.

Recommendations

PSNH began its supplemental purchases for 2009 at an earlier time than was done for prior years. Accion believes this was done in response to criticism leveled at PSNH in prior years regarding the timing for making short term purchases. For example, PSNH was faulted for having short term energy commitments when the effects of Hurricanes Katrina and Rita resulted in higher prices than if longer term contracts had been employed. In 2009, the converse was true. PSNH entered into long term contacts in 2008 and the floor fell from beneath the financial markets, resulting in lower energy market prices. Customers again had higher energy prices than if short term contracts were used.

These two examples illustrate the difficulty in forecasting future pricing when events beyond the control of the company have a significant and direct impact on pricing from the market. At the same time, PSNH can be expected to identify opportunities and balance supplemental purchasing based on reasonable expectations for market trends. For example, Accion recommends that while market prices remain depressed due to economic conditions PSNH should focus on maximizing the benefits of short term arrangements and spot market prices during the two non-peak quarters.

Similarly, PSNH's strategy for supplemental energy purchases as a hedge against market fluctuations during the two peak period quarters and to reduce the possibility of large quantities of excess power is unclear, leaving the company vulnerable to retrospective second guessing after purchases are made. Accion recommends that PSNH provide a clear plan for peak period procurements prior to the executing contracts. For example, PSNH should establish the percentage of its on-peak monthly needs will be procured from supplemental sources with an established point of measurement, such as an approved load forecast. Also, Accion recommends that PSNH have a clearly defined the basis for making short term purchases or sales that fall outside of the established projected needs.

Accion recommends that PSNH explicitly and formally factor reserve shut downs into its projection of operation of its units in determining supplemental energy needs if it does not

already do so. If reserve shut downs are projected for its base load units, the between planned outage capacity factor should be adjusted to reflect those reductions similar to the manner done for the short reliability unit outages.

Accion recommends that supplemental needs should be reviewed each quarter as the new load forecast is produced. Because econometric inputs to the load forecast are lagging variables, the load forecast is slow to pick up faltering or improving economic conditions. Accion recommends that in each quarterly review PSNH should factor into its supplemental energy purchase decision making process the lagging impact of the econometric input to the load forecast.

Accion recommends that PSNH establish formal criteria governing the sales of purchased surplus supplemental energy into the spot market. PSNH appears to be inconsistent in the treatment of supplemental energy supplies when deciding to sell perceived surplus, when compared how the company employs purchases. Accion recommends that the Commission employ the same prudence review of sales of purchased supplemental energy by PSNH, as is done for supplemental energy purchases. The prudence review should include analysis of PSNH decisions to retain purchased supplemental energy, in addition to review of sales actually made.

Merrimack Outages For 2009 (Without MK-2 Turbine Repair Outage)

Merrimack-1

The following outages occurred at Merrimack-1 during 2009. This unit is on a two-year overhaul schedule and will not have an overhaul until 2010.

A - (Outage Report OR-2009-06)
4/20 – 4.0 days
The unit was taken off line for this planned outage due to increased pressure drop across the air heaters. The unit was on line for 127 days (3rd longest unit run) and required an air heater wash. This is a common outage for this unit after over 3 months of continued operation. If the unit is out of service for other reasons, the air heaters are washed at that time so that a special unit outage is not required.

This was the first air heater wash since the new enamel cold end air heater baskets were installed in the fall 2008 overhaul. The enamel coating retards the buildup of ash on the air heaters thus increasing the time between required air heater washes. PSNH evaluated the performance of the air heater seals and found that they did not need replacement after 5 months of operation.

B
4/27 – 0.3 days
ISO-NE did not call for the unit after it returned to service from Outage A above. The unit was performing a cold start at this time. During startup, the turbine is run at 2,300 rpm until the reheater reaches 500° F and the unit is held at these conditions according to the cold start curve until the turbine differential expansion (delta distance between the rotor and its casing) stabilizes. While the delta is generally in alarm during a cold start-up (above 0.032 inches), it crept towards the 0.036 inch trip point and the unit start was aborted. The turbine differential was allowed to decline, the heat soak was completed, and the unit phased on line. Also see Outage C below.

C
4/27 – 0.2 days
After being on line for one hour from Outage B above, but while still in start-up mode, the turbine differential expansion again alarmed. The unit was taken off line, the turbine expansion differential was allowed to decline, and the unit was rephased without incident.

PSNH states that it is not unusual to have differential expansion issues during a cold start-up. PSNH stated that they followed their start-up loading curves. No changes were made to the start-up curves or start-up procedures, but PSNH installed additional insulation to the turbine in an effort to accelerate the turbine casing expansion and improve the turbine differential expansion relationship.

D
5/27 – 0.9 days
The operator observed vibration in the 1B air heater motor. The vibration of the coupling was monitored for a couple of days. This outage was scheduled to be done at night and the coupling was replaced. In addition, the inboard forced draft fan bearing was also being monitored. That bearing was checked during this outage and found to be okay. The unit returned to service without incident.

E – (Outage Report 2009-10)
7/21 – 2.8 days
This outage was planned to take place prior to the MK-2 turbine outage to ensure maximum operability during that long outage. This outage is similar to what PSNH does prior to the summer season for operability improvement.

F - (Outage Report OR-2009-13)
10/26 – 4.2 days
The unit was taken off line for this planned outage due to increased pressure drop across the air heaters. This is a common outage for this unit after almost 3 months of continued operation. No other opportunity availed itself to perform the air heater wash in conjunction with another outage. During this outage, the boiler was inspected and leaks were repaired. Also during outage the 1LA and 1LB 480V load centers were replaced due to a high (level 4) arc flash risk.

G
11/2 – 0.4 days
The unit was requested to start by ISO-NE. During the previous outage, the oil operated air pilot valve was serviced. Upon completion of the service, the valve was tested to ensure proper operation. During this testing, some oil had leaked below the elevation of the oil operated air pilot valve onto the hot reheat, cold reheat, and main steam lines. The oil leak was cleaned up, but oil had seeped behind the cold reheat line lagging (metal sheet cover) seam and impregnated the inner insulation. During startup, this area began to smoke and the Bow Fire Department was called as a precaution. PSNH found that an approximate 4 foot section of insulation had been contaminated by the oil, the insulation was replaced, and the unit returned to service.

PSNH investigation found that the lagging used in this area is of an older style with two seams. Workers involved in the cleanup did not suspect that oil had seeped through the seam. Newer style lagging with one seam is now being used. PSNH identified other areas of two seam lagging and will replace targeted sections (sections that might be problematic if spilled upon) during the 2011 overhaul. PSNH also states that the replacement one seam lagging employed much better seaming technology so that orientation of the seam is not an issue.

H
11/1 – 0.2 days
The unit tripped due to loss of fires. Frances Harvey, the foundation contractor building foundations for the limestone silos for the clean air project, was bracing foundation forms and hit a 4.16kV cable with a hand installed bracing spike. PSNH investigation revealed that the presence of the 4.16kV cable in the area was discussed every morning at tailboard safety meetings except at the meeting held the morning of the incident. By coincidence, the day of the incident was the first day on the job for the individual who hit the power cable with the bracing spike. A new cable was installed and all capital costs and expenses were back charged to the contactor in a separate account. The contractor has since fully reimbursed PSNH for all costs except replacement power costs.

PSNH states that Dig Safe was called prior to construction, a Dig Safe ticket was issued, and that marking of the line was performed and maintained as required. PSNH investigated the outage and concluded that the incident was not reportable by itself or the contractor as the event occurred on private property, no personal injury occurred, and that the damaged facilities where those of PSNH.

It is Accion's understanding that all underground damage is reportable to Dig Safe as required in the PUC 800 Rules. In this case, both the contractor (as the excavator) and PSNH (as the operator) had reporting requirements under Dig Safe. This matter has been referred to the NHPUC Safety Division.

I – (Outage Report 2009-15)
12/1 – 3.4 days
The unit tripped due to tube leaks in the reheater section of the boiler. This section of the boiler is scheduled to be replaced during the 2010 major overhaul. Repairs were made and the unit returned to service.

Merrimack-2

The following outages occurred at Merrimack-2 during 2009. The major projects for this unit were the repair of the HP/IP turbine and the replacement of the horizontal reheater stubs. The reheater project was scheduled during the next major overhaul; however, PSNH was able to

logistically bring this project back into the turbine repair outage to make that future outage more efficient. Other capital projects at MK-2 did not have adequate time to be rescheduled, but PSNH was able to schedule work required to tie in the clean air project during the turbine outage.

A - (Outage Report OR-2009-03)
2/12 – 4.6 days
The unit was removed from service to replace the portable exciter (rental unit) collector ring brushes following the recommendation of the vendor (Siemens). Other priority backlog work and work found necessary during the inspection of the boiler at the beginning of the outage were also completed. The collector ring brushes were replaced and the unit returned to service.

Accion notes that the "normal" exciter for MK-2 is a brushless exciter and does not require regular replacement of the collector ring brushes.

B
2/17 – 0.2 days
After starting up from Outage A above, a spike drop in the governor pressure occurred causing the governor valves to close and tripped the unit. PSNH investigation found nothing that would account for the spike and restarted the unit without incident. Siemens was engaged and they too found no cause for the spike. PSNH decided to take a thorough look at the issues during the next outage (See Outage C below)

C – (Outage Report OR 2009-04)
2/25 – 2.1 days
The unit was removed from service due to excessive water usage. Cyclones C, E, and G required repairs with the E cyclone requiring the most repairs. The cyclone leaks were repaired, and the unit returned to service.

Also during this outage (As noted in Outage B above), Siemens did a thorough examination of the governor and found minor rust and scale in the governor speed changer area that they believed may have caused the governor pressure spike. The governor speed changer area is open to the atmosphere which can account for the formation of the scale. The equipment was cleaned and no problems have been reported since. PSNH notes that this area was inspected during the 2010 overhaul and no issues were found.

D – (Outage Report OR 2009-05)
4/2 – 3.0 days
The unit was removed from service due to high vibration on the 2A forced draft fan. PSNH found that 1/3 of the inlet cone to the fan had failed and passed through the fan. Further investigation found additional cracks in the 2A forced draft inlet cone. PSNH

determined that the vibration was caused by an unbalanced air flow resulting from the missing inlet cone section. PSNH also determined that no damage had occurred to the 2A forced draft fan. Weld repairs were made to the inlet cone and the unit returned to service.

This inlet cone had been weld repaired in 2005, 2006, and 2007. No cracking was found during the 2008 inspection. Accion notes that PSNH replaced both the 2A forced draft fan inlet and outlet cones during the August 2009 MK-2 turbine outage.

E
4/6 – 0.5 days
The unit had phased returning to service from Outage D above. On the way to full load, PSNH found that the recirculation valve went to 60 percent open when it should have stayed at 100 percent open. This valve had been changed during the 2008 overhaul due to leak by problems. In Outage D above, new trim (moving parts) had been installed in this valve as, when full open, marginal flow existed. The new trim was to correct that issue without spring tension adjustment required. The old trim was reinstalled to get the unit back into service.

The valve manufacturer recommended an adjustment to the spring tension on the actuator. During a subsequent outage, the new trim and spring tension adjustment for the actuator were installed. The cause of the outage was determined to be that the new trim actuator needed adjustment for proper operation. The valve manufacturer performed all work at no cost.

F
4/22 – 0.5 days
The unit tripped due to a sudden pressure relay operation on the RT-2 running transformer. The transformer was checked and found to be okay. PSNH found that the sudden pressure relay had failed due to moisture intrusion into the relay. The relay was replaced and the unit returned to service.

Water intrusion should not be an issue for the sudden pressure relay as it is designed for outdoor operation. PSNH suspects that when the RT-2 transformer was replaced in 2005, that the relay was not properly installed at the factory. PSNH checked all sudden pressure relays of the same design at Merrimack and found all to be okay. Other stations were also made aware of the event.

G – (Outage Report OR-2009-08)
5/11 – 4.9 days
The unit was losing water due to boiler leaks. PSNH informed the ISO-NE that the unit would be coming down when an opportunity presented itself. PSNH secured replacement

power and took the unit off line. Leaks were found in the A, C, F, and G cyclones with the A and G cyclones requiring the most repair. During the outage, furnace wall leaks were also repaired. After the leaks were repaired, the unit returned to service.

Accion notes that MK-2 is on a one year overhaul schedule mainly due to the harsh environment in the cyclones. PSNH deferred the normal spring outage of MK-2 until August so that the 4 weeks of outage time could be saved by performing the overhaul in conjunction with the turbine replacement which could not be scheduled any earlier. PSNH realized from experience that there was a higher probability of cyclone outages to do so.

H – (Outage Report OR 2009-09)
6/26 – 2.1 days
The unit was taken out of service due to high water usage. PSNH found 5 leaks in the G cyclone and two minor leaks in the superheater floor. The leaks were repaired and the unit returned to service.

I
7/20 – 1.6 days
The unit was taken out of service due to high water usage. PSNH found leaks in the A and G cyclones. The leaks were repaired and the unit returned to service.

J
8/1 – 127.2 days
This outage is discussed in Exhibit MDC-3A.

K
12/6 – 0.0 days
The unit was returning to service from Outage J above when the operator noticed that the no load steam alarm was not clearing in its normal 15 to 30 second time frame. The operator tripped the generator breaker, preventing a full trip and longer unit down time. PSNH investigation found that the no load steam flow sensing valve steam line was in the closed position when it was supposed to be in the open position. The steam line was placed into the open position and the unit returned to service without incident.

The no load steam flow sensing valve is not part of the formal Merrimack lock-out tag-out equipment procedures. PSNH spoke to the Instrument Control Technician who recalibrated the valve during the outage and could not find another similar instance where a similar incident took place or a reason why opening the line was not performed. PSNH added a return to service check box to all its Instrument and Control calibration procedures. Accion views this incident to be an isolated employee error.

Evaluation (Except for Outage MK 2–J)

Accion reviewed the outages above and found them either to be reasonable and not unexpected for these units and their vintage, or necessary for proper operation of the unit. Accion concluded that PSNH conducted proper management oversight during these outages.

Evaluation of Outage MK 2–J

The evaluation for this outage appears in Exhibit MDC-3A.

Merrimack 2009 Turbine Repair Outage

Merrimack-2

The following outage occurred at Merrimack-2 during 2009, was the major project for this unit in 2009, and centered on the repair of the HP/IP turbine. PSNH extended the annual over haul of Unit-2 from the spring of 2009 until the fall of 2009 which allowed for logistical support both at PSNH and at Siemens to support the outage to take place. In addition to the repair of the HP/IP turbine, PSNH was able to bring forward the replacement of the horizontal reheater stubs which was scheduled during the next major overhaul (a 4 week project in itself). The movement of this major critical path project back into the turbine repair outage made that future outage more efficient by shortening its duration. Other future major capital projects at MK-2 did not have adequate time to be rescheduled into this outage.

J
8/1 – 127.2 days
This outage was scheduled to perform repairs to the HP/IP turbine which was damaged by foreign material when installed in 2008. Prior to the outage and during the outage, PSNH increased employee and contractor awareness regarding formal material exclusion issues. In addition, PSNH hired a third party whose sole duty was to address foreign material intrusion into the unit through out the outage.

The turbine outage was scheduled with an ISO-NE window of 8/1/09 through 12/7/09 and with the turbine on critical path for the entire outage. Siemens had contracted to have the HP/IP turbine and associated components shipped from Siemens by 11/16/09. With the contracted delivery of the HP/IP turbine dates, PSNH schedule showed that the unit would phase to the system on 12/3/09. The actual schedule resulted in a return to service date of 12/6/09 due to start up problems discussed below.

With the duration of the outage determined by the contractual delivery of the HP/IP turbine, PSNH was able to contain the cost of the outage at the approximate cost of the regularly scheduled spring 4-week annual overhaul by performing virtually all work not on critical path at straight time rates without paying overtime and weekend salary premiums.

Accion notes that during this outage, the Merrimack-2 rental exciter was removed and replaced with the Siemens exciter from the seed exciter program which was actually the Newington exciter refurbished as part of the Siemens seed exciter program (Merrimack-2 and Newington have the exact same exciter).

HP/IP turbine components were guaranteed to ship from Siemens by 11/16/09. Siemens formally advised PSNH of changes to the return dates for the HP/IP turbine and associated components at least twice a week as changes took place at the Siemen's plant on the PSNH work and its relationship with the multitude of similar projects being performed in tandem with the PSNH work including the two LP rotors. A similar process was conducted for the LP turbine components which were not on critical path and scheduled to be returned earlier. In parallel, the Siemens transportation department which is dedicated to secure road routes and permits for the heavy loads updated transportation requirements so that PSNH would have arrival dates of the various components that utilize available transport days efficiently. As Siemens gave these updated delivery dates to PSNH, Siemens continued to stress that guaranteed ship dates remained as contracted and the potential ship dates reported to PSNH on an ongoing basis were not guaranteed.

During the course of the outage, Siemens revised the HP/IP ship dates many times moving the anticipated ship date as far forward as 11/6/09 for some components (the final HP/IP turbine component was actually shipped on 11/10/09). PSNH responded by adjusting its extremely flexible work schedule to accommodate the early return of the HP/IP turbine components and on 11/22/09 was 303 hours ahead of the original PSNH schedule (384 hours ahead of the ISO-NE schedule).

After the HP/IP turbine components were installed, start up activities began. The unit start-up activities began on Saturday 11/21/09, well ahead of schedule. During startup when the unit was rotating at 2700 rpm, the exciter bearing #9 went into high temperature alarm and the operators tripped the unit. Investigation found that the bearing had wiped (tin based bearing material reaches melting temperature thus ruining the bearing) due to high temperature. The bearing was required to be sent off site to Siemens for repair and became critical path until 11/28/09 when the start up boiler feed pump halted start up activities (See details below). Accion notes that the #9 bearing was a package component of the exciter replacement.

Siemens made its best efforts to expedite the PSNH work. For example, when the LP rotors were opened and inspected after work was well along on the critical path HP/IP turbine (Siemens has only one gantry crane), it was found that blade repairs were required. Siemens had developed contingency plans for repairs not identified by visual inspection prior to leaving Merrimack Station. Another instance where Siemens responded to maintain the shortest turn around time possible was when the blades for the HP/IP turbine were being assembled. All blades had been dimensionally checked upon fabrication and were within tolerance. What was noticed during assembly and another dimensional check was that a portion of some blades were at the high end of their tolerance. Blade assembly continued with dimensional checks, and Siemens manufactured one row of blades in parallel with the assembly work in case blade

tolerances were not maintained. None of the extra blades were required and the blades are located at the PSNH warehouse.

The exciter bearing is required to have a 10 mil clearance. Siemen's shop records indicate that the beariung had a 10 mil clearance. PSNH measurements indicated that the bearing had only a 4 mil clearance from measurements of the lost material in the bearing. Strong push back from PSNH resulted in Siemens absorbing all the costs of this repair.

During the 11/21/09 start up activities, a vibration was noted in the start up boiler feed pump. The start up boiler feed pump had been serviced by Siemens during the 2008 annual overhaul. The vibration was not large enough to curtail start up activities at that time. Testing revealed that the vibration of the start up boiler feed pump was 8 mils which is a value higher than desired but below the tolerance level of 12 mils. Because the exciter bearing had failed and unit start up was delayed, that and a spare balance drum for the start up boiler feed pump was in stock, PSNH took the opportunity to replace the balance drum at this time as a precautionary action. The pump work was completed on 11/26/09.

Start up activities began again on 11/27/09 with the installation of the repaired #9 exciter bearing. Six hours into start up, the vibration on the recently repaired start up boiler feed pump increased to 19 mils and the unit was taken off line. On 11/28/09, investigation found that the start up boiler feed pump balance drum was damaged beyond repair because a metallic O-ring was not installed during assembly during the overhaul by Siemens. Siemens personnel had just plainly missed the installation of the O-ring. At this point in time the start up boiler feed pump path became critical path.

PSNH installed its second balance drum from stock and required direct supervision of a Siemens field engineer. Concurrently, PSNH ordered two additional balance drums (one each from two fabricators) on an expedited basis. Testing revealed that the start up boiler feed pump had a vibration of 9 mils with the new balance drum installed. Investigation found that the balance drum's rotating components had made contact with its stationary components and was damaged beyond repair.

In addition to the fabrication of new balance drums, PSNH requested that Siemens search its customer base for a balance drum to reduce the outage time below what it would otherwise be if it waited for expedited fabrication. Siemens found a suitable balance drum at an idle facility in Texas and had it shipped to Merrimack station on an expedited basis. In the repair process, PSNH also replaced the pump's rotating element (to rule out any potential issue with that component) with a spare. The start up boiler fed pump remained critical path until 12/5/09 when a successful test of the start up boiler feed pump was made. Start up activities commenced on 12/5/09 and the unit phased on 12/6/09 without incident.

Evaluation for MK-2 – J

Accion reviewed the outage above and found it either to be reasonable and not unexpected for this unit and its vintage, or necessary for proper operation of the unit. Accion concluded that PSNH conducted proper management oversight during this outage.

PSNH was reimbursed for time and material costs related to 2 out of the 3 repairs to the start up boiler feed pump because one repair was required without Siemens workmanship issues. PSNH's insurance policy covered the replacement power costs of any extension of the HP/IP repair outage resulting from the problems with the start up boiler feed pump.

Accion understands that discussions have taken place between PSNH and Siemens regarding Siemens workmanship issues. Accion recommends that PSNH file a report with the Commission within one month after the issuance of a final order in this docket describing the efforts taken and results achieved in addressing workmanship issues.

Newington Outages For 2009

Newington-1

The major projects for Newington in 2009 were the removal and inspection of the station's 6 largest motors and two of its medium sized motors. For 2009, Newington's overall availability was about 95 percent and in excess of 97 percent excluding planned maintenance. For 2009, Newington's capacity factor was approximately 6 percent. Historically Newington's heat rate has been between 11,500 Btu/kWh and 12,300 Btu/kWh. In 2009, the unit heat rate was approximately 12,400 Btu/kWh. Newington's full load heat rate is approximately 10,800 Btu/kWh. The increase in heat rate is due to the manner in which the unit is operated.

The following outages took place at Newington during 2009:

A
1/8 – 0.1 days
The unit tripped due to a boiler pressure excursion during startup. The induced draft fan was started and the boiler excursion occurred during the startup of the forced draft fan. Newington installed 2 new electric drives for the induced and forced draft fans in 2008 to replace aging pneumatic controls. The fan controls were tuned when the unit was cold in December of 2008, but were not fine tuned when the unit was running hot due to unit economics at that time. PSNH considered the cold condition tuning to be close to final tuning values and decided not to expend the money for a full start up of the unit to do so. In January of 2009, the unit was in startup when the incident occurred. Adjustments were made to the forced and induced fan controls and the unit returned to service.

B
3/6 – 12.5 days
This was a planned outage to perform the annual inspection and overhaul of the unit, was scheduled for 24 days with the ISO, and was completed in just over 12 days per PSNH's internal schedule. During this outage, both forced draft fan motors, both induced draft fan motors, and both circulating pump motors were sent out for a complete inspection. In addition, the "B" train condensate pump and closed cooling water pump motors were sent out for inspection. During the outage, as a result of the problems found with the "B" condensate pump motor, the "A" condensate pump motor was sent out for inspection and also found to have cracked bar connections. This was the second year that crack in the rotor bar connection straps of the "A" motor were found. PSNH ordered a spare condensate pump motor after the outage.

The “B” closed cooling water pump motor had a low megger reading when inspected. The low megger reading either was a result of the motor picking up moisture during transit, or the cracks found in the motor lead during inspection. The cracked motor lead was replaced at the motor shop and PSNH is reviewing motor protection practices during transit. Employees are required to inspect motors for weather protection prior to shipment. The cracked motor lead most the most likely cause. Motor repairs were the critical path for the outage. The additional repair of the “A” condensate pump motor did not add time to the critical path of the outage. Some motors were returned early from the motor shop, but their early return also had no critical path impact.

During the outage, seven expansion joints were replaced in the precipitator, Section B03 of the 480V AC critical AC Bus distribution panel board was replaced (unrelated to flash hazard issue), and other cleaning, inspection, and non-destructive examination tasks were performed.

C
6/25 – 0.3 days
The unit was being operated to make ready for availability to run in the summer market. A leak developed in the main steam valve packing. The unit had not run since the annual inspection in March and a full start was not done at that time, however all major systems worked on were sufficiently tested to ensure operation. The main steam valve was not worked on during the annual outage. Since the annual inspection, fires were put into the boiler at two week intervals to assure personnel readiness. The unit was cooled, the packing was replaced, and the unit returned to service.

The packing material for the main steam valve has been in use for 35 years. However, PSNH contacted the packing supplier and has since changed the packing material to one that is moister and thought to be longer lasting.

D
8/18 – 0.2 days
The unit was operating on 100 percent gas and following load when the main gas control valve stopped responding. The boiler master control called for more fuel and none was forthcoming. The unit tripped on low drum level as a result. PSNH determined that the valve signal was verified and repeatedly stroked the main gas control valve noting that it stroked slowly at first. PSNH suspects a speck of debris was in the valve’s pneumatic positioner although no debris (or determination of cause) was ever found. The valve positioner was cycled several times and it is suspected that any debris cleared the positioner valve ports. The unit returned to service.

Accion notes that PSNH has since bought an electric master fuel control valve to replace the pneumatic valve because of improved reliability and valve position feedback for the operator.

E
10/6 – 5.6 days
The unit was taken out of service on planned maintenance to perform safety work. OSHA has promulgated new standards to calculate the arc flash potential of electrical equipment requiring adherence to IEEE equations as presented in NFPA70E-2004 (National Fire Protection Association). Studies were required at all PSNH generating stations, and the Newington evaluation was completed after the annual inspection. The results of the Newington analysis showed that there were five electrical busses that had a high potential for arc flash with potential catastrophic results, are considered dangerous, and mitigation techniques could not be implemented. PSNH could not wait to perform this safety work until the next annual outage, so it was scheduled as soon as possible. Administrative controls were put into place to protect personnel until the outage could be taken. Prior to this outage, PSNH determined that the lube oil piping to the induced draft fan was leaking and needed replacement. That work was also performed during this outage.

F
10/21 – 0.1 days
The unit tripped on low drum level during a cold startup. Normally during unit startup, the unit will phase and the drum pressure drops and stabilizes when under automatic control. During this startup, the unit tripped. PSNH investigation could not find anything wrong. The unit was restarted and phased without incident (See Outage G below). PSNH noted that similar, but less severe, low drum pressure indications were observed during startup. PSNH continued to investigate the problem as the unit was brought back on line. The problem was traced to the startup boiler feed pump recirculation valve. The valve was subsequently repaired (See Outage H below).

G
10/21 – 0.1 days
The unit was in the startup process to go to full load after returning to service from Outage F above. While preparing to put the fourth burner in service, one of the operating burners tripped causing a gas pressure increase in the other burners. The pressure increase resulted because the fuel control system was still calling for the same volume of gas. The boiler control system limits gas pressure. The high limit gas pressure setting was set to 14 psi by Emerson during the recent control system replacement. Gas pressure reached 16 psi during this event. When the high limit was reached, the flow control valve automatically closed to reduce pressure. When the flow control valve closed, the boiler

pressure began to oscillate and eventually tripped on low drum level. PSNH noted that such an event had never occurred at Newington for the loss of a single burner. With that knowledge, PSNH reset the gas pressure to 20 psi and continued to start the unit.

Subsequently, PSNH more thoroughly reviewed gas pressures for burner loss during startup and again reset the gas pressure high limit to 21 psi. The PSNH analysis showed that if 2 burners were lost out of 4, the gas pressure remains below the 21 psi gas pressure high limit.

H
10/21 – 0.1 days
During startup from Outage G above, the unit tripped on low drum pressure in a similar manner as in Outage F described above. The Feedwater controls were placed on manual operation, water was force fed into the boiler at peak water level (to avoid a unit trip), and when the drum level got to the drum set point, the feedwater control valve was placed in automatic operation. The feedwater control valve operated properly and controlled the unit. PSNH investigation (this is the more thorough investigation referred to in Outage F above) found that the startup boiler feed water recirculation valve (required to maintain a minimum flow through the feedwater pump) was leaking water by, thus robbing flow to the boiler drum. The valve was repaired.

I
11/6 – 0.2 days
The unit had operated the day before and shut down at 10:30 at night. When the “A” induced draft fan shut down, it did not go onto turning gear as it should have. PSNH uses turning gear here for conservatism, but it is only required for 90 minutes prior to starting the motor. This mode of operation minimizes the amount of time required for a restart of the motor. The event alarmed and PSNH verified that the motor was not on turning gear. PSNH found that shear pins had failed between the coupling and the motor. PSNH was in the process of fixing the “A” shear pins and was required to start the unit. The “B” induced draft fan was used to start the unit. When the “B” induced draft fan started, the unit tripped on high furnace pressure. PSNH investigation found that one inlet vein control circuit board was bad and replaced the circuit board. The work on the “A” induced draft fan was completed sooner than the work on the “B” fan and the “A” fan was used to start the unit.

J
12/2 – 0.1 days
During startup, the exciter field breaker was closed at 3,600 rpm and the unit tripped with a late phase (timing delay) indication. A communication problem in the voltage regulator was indicated. In the voltage regulator, a “mother” board and 2 “daughter” boards control

adjust the voltage base adjuster that tunes the voltage on the generator. Specifically, the "mother" board and one of the "daughter" boards are required to control the base adjuster. The manufacturer was consulted and recommended that the system be given a hard reboot. The hard reboot was performed, the communication problem cleared, and the unit was started. Subsequently, PSNH has made a hard reboot part of its procedure in responding to this alarm.

K
12/13 – 1.7 days
ISO-NE requested that Newington remain in operation on a Friday night. The unit ran all day Saturday and into Sunday, developed a condenser leak early Sunday morning, and was taken off line. PSNH observed that contamination occurred quickly indicating that the leak was significant. PSNH verified intrusion into the condenser and its investigation found that 3 stoppers plugging previous leaking condenser tubes were loose. PSNH soaped the tubes and did not find the leak so that the loose stoppers did not account for the leak. PSNH then used florescent dye and black lights to find the leak, but none was found. The loose stoppers were tightened, one was replaced, and the unit was put back into service without incident.

Subsequently during the 2010 annual inspection, the condenser tubes were eddy current tested for wall thickness and all were found to be serviceable. PSNH has retained a consultant expert in this matter and has scheduled additional testing for October 2010.

Evaluation for Newington

Accion reviewed these outages and found them either to be reasonable and not unexpected for this unit and its vintage or necessary for proper operation of the unit. Accion concluded that PSNH conducted proper management oversight during these outages.

Schiller Unit Outages For 2009

Schiller-4

The following outages occurred at Schiller-4 during 2009.

A – (Outage Report OR 2009-01)
1/5 – 5.1 days
The unit tripped off line due to the failure of a generator tube. The failure was caused by external corrosion and was particularly violent and damaged approximately 30 feet of refractory. PSNH stated that new generator tubes were installed in 1984 when the unit was converted back to coal operation. Failures of the generator tubes started in the 1990s and PSNH believes that the fly ash composition of the coal used at that time plus fly ash reinjection is the cause. PSNH no longer reinjects fly ash unless the fly ash disposal system has a problem. Repairs were made and the unit returned to service.

B
3/3 – 3.9 days
The unit tripped due to a failure of a generator tube. Repairs were made and the unit returned to service.

C
6/10 – 2.5 days
The unit was on reserve shut down status at the time. PSNH took a maintenance outage to inspect the boiler. Tube repairs were made and the unit returned to service.

D
7/21 – 1.0 day
This outage and Outage 6-F below were initiated by the events described in Outage 5-D which is explained below.

E – (Outage Report OR 2009-16)
12/8 – 4.8 days
The unit tripped due to a rupture of a generator tube and adjacent tubes were damaged. An approximate 18 foot section of the generator tube was replaced, damaged tubes repaired, and the unit returned to service.

F
12/15 – 0.4 days
Units 4 and 6 use a pneumatic system to transport fly ash to the silo. Valves dump the fly ash into the transport system. PSNH noticed that fly ash was not getting to the silo and took the unit off line. PSNH investigation found that the pipe was plugged. One of the dump valves had a piece fall off and plugged the pipe due to erosion in the fly ash environment. The worn components were replaced, the pluggage was cleared, and the unit returned to service.

PSNH noted that the dump valves for Unit 6 were replaced in 2009 and the dump valves for Unit 4 were replaced in 2010.

Schiller-5

The following outages occurred at Schiller-5 during 2009.

A - (Outage Report OR-2009-02)
1/26 – 4.6 days
The unit was taken off line due to low air flow causing the bed temperature to decrease which in turn allowed the bed to agglomerate (crust over). Air heater leaks (See also Outage H on 12/7 2008) caused high currents in both the forced draft fan and the induced draft fan motors. In order to control fan loading, unit output was reduced. Running at reduced loads tends to cause the bed material to crust. The bed material was replaced, repairs were made, and the unit returned to service.

B
3/29 – 23.0 days
This outage was the planned annual overhaul for the unit. The ISO-NE outage window was 31 days from 4/3 to 5/4, the PSNH schedule was 24 days from 4/3 to 4/27, and the actual outage time was 23 days from 3/29 to 4/21. Initial critical path for the outage was modification to the control system. Major projects included during the outage were the replacement of over 3,500 air heater tubes and the replacement of over 2,800 fabric bags in the bag house. During the outage, PSNH found significant wear in the cyclone wall refractory (where bed sand is separated from wood chips) and the replacement of one cyclone refractory wall became critical path until the end of the outage. The unit came off line early due to bed crusting issues. PSNH had anticipated that the unit might come off line prior to schedule, prepared for an early outage start, and no time was lost. The outage went smoothly and the unit returned to service.

C
5/19 – 0.1 days
PSNH personnel went to rack out an air compressor breaker and when they did, the adjacent breaker (MCC 101) tripped. The MCC 101 breaker operation tripped the unit as the function on that breaker is required to run the unit (Motor control center). PSNH could find no explanation why the breaker tripped but suspects vibration from operation of the adjacent breaker was the cause. PSNH replaced the breaker rather than to investigate the cause because the investigation would take a longer period of time, required that the unit be out of service, and the cost of the breaker is small. The unit returned to service without incident.

D
7/18 – 0.3 days
The explanation of this outage also explains Outage 4-D above and Outage 6-F below as they are related.

On Saturday 7/18, the unit tripped due to a bad Volt/Hertz relay power supply card in the exciter. Both Unit 4 and Unit 6 were on reserve shutdown. Unit 6 was scheduled for a minor maintenance outage on Monday 7/20 to repair a hydrogen cooler leak. All the Schiller exciters are identical. PSNH declared Unit 6 on outage on Saturday and used its relay power supply card for Unit 5 as Unit 5 is more economical to operate. Unit 5 returned to service on Saturday 7/18. In order to return to service, Unit 4 was fired up to produce auxiliary steam.

A leak developed on a Unit 4 safety valve flange. The unit was taken out of service on Tuesday 7/21 and the relay power supply card from Unit 4 was installed in Unit 6 which returned to service on Tuesday 7/21. Unit 4 returned to service on Wednesday 7/22 when a new card was obtained.

E
7/18 – 0.5 days
Coming back on line from Outage D above on Saturday, the unit had to supply its own auxiliary steam (Needed for start-up operations) Unit 4 and Unit 6 were both off line. A high drum level was experienced because an unstable deaerator pressure did not allow a stable feed flow to be maintained which in turn caused the unit to come off line until another unit could be started to supply auxiliary steam. As explained in Outage D above, Unit 4 was started and used to supply the auxiliary steam.

PSNH was aware of the insufficient auxiliary steam issue from previous events. PSNH made modifications the Unit-5 control valve to address this issue, tested the valve to the extent it could, but could not test the valve operation under actual operating conditions.

This was the first occasion where PSNH could verify their contemplated solution to the auxiliary steam issue.

PSNH notes that it is evaluating the installation of a new control valve with greater flow pass capability that would prevent this issue from occurring in the future.

F
10/1 – 0.1 days
The unit had been on a long run and the bed temperature began to fluctuate due to the failure of the bed removal valve, V-112. This valve is used to add or take away bed material. In this case, the valve failed such that bed material could be added, but bed material could only be removed very slowly. Valve operation in this reduced capacity is adequate unless you have a boiler excursion such as a fuel event. The unit had a fuel excursion and the unit tripped. Operators tried to bring the unit back on line but soon realized that the bed had agglomerated resulting in Outage G below.

G - (Outage Report OR-2009-11)
10/1 – 4.8 days
The unit was taken off line due to bed agglomeration. The unit had run for 166 days since the spring overhaul with 4 unit trips. Bed material was changed, the valve was repaired, and the unit returned to service.

PSNH notes that the V-112 valve was replaced with a valve of improved design during the spring 2010 outage and the unit returned to service.

H
11/4 – 0.2 days
The unit tripped due to the trip of the forced draft fan. PSNH investigation found that the forced draft fan trip was a result of a faulty vibration probe on the forced draft fan. All other fans go to alarm for similar conditions. PSNH changed the logic for the failure of the forced draft fan vibration probe to alarm rather than trip. The switch was replaced, the logic was changed, and the unit returned to service.

PSNH noted that Alstom had set up the trip logic for this fan and that it was different than the trip logic for the other fans. The changes made by PSNH made all trip logics identical (Alarm rather than trip mode).

I
11/19 – 0.6 days
The V-112 bed material removal valve failed again. This valve removes 1,500 degree sand from the bed. Condenser cleaning was required and this action required the unit load to be reduced to approximately 50% loading. Upon reducing load, it was evident that the

V-112 valve had again failed and bed material could not be removed. When the valve failure was recognized, the unit was taken off line electrically. The valve was repaired and the unit returned to service.

PSNH noted that the V-112 valve was replaced with one of a new design in 2010.

J - (Outage Report OR-2009-14)
11/20 – 4.2 days
The unit was taken off line due to low bed temperatures and bed agglomeration that had occurred during the excursion experienced the previous day. The bed temperature did not recover from the boiler upset in Outage I above indicating agglomeration. Bed material was replaced and the unit returned to service.

PSNH stated that bed thermocouples indicated that a problem had occurred during the condenser cleaning in Outage I above. Instead of initiating an immediate shut down, an attempt was made to recover the bed temperature. The effort was unsuccessful requiring the unit to be taken off line.

K - (Outage Report OR-2009-17)
12/13 – 4.2 days
This planned maintenance outage was taken to perform repairs to the attemperator (sprays feedwater to steam) and main steam valves which were problematic, perform condenser cleaning which was eminent, and to inspect the cyclones. PSNH cleaned pluggage from the cyclones, cleaned seasonal debris from the condenser, repaired the main steam valve, and rebuilt the attemperator valve. The unit returned to service after work was completed.

L
12/31 – 0.1 days
The unit tripped due to high boiler pressure. The bag house for the unit has 8 compartments. Each compartment has a poppet valve (Isolates bag house section from the flue gases) that sequentially closes and air is injected to clean the bags. In this instance, all 8 valves closed at once causing the unit to trip. PSNH found a blown fuse which explained the outage. The fuse was replaced and the unit returned to service.

PSNH notes that the same fuse has blown since this event without similar consequences. Such action indicates that the fuse was not the cause of the instant outage. The cause of the blown fuse and the outage remains undetermined

Schiller-6

The following outages took place at Schiller-6 during 2009:

A
4/2 – 0.4 days
The unit was taken out of service when a fire broke out on the outside of burner #2. The unit was on oil at the time and PSNH did not know what was feeding the fire. PSNH investigation found the nozzle fouled due to accumulated oil drip. Repairs were made and the unit returned to service.

PSNH noted that even though operators conduct burner checks on each shift, that the physical location of burner #2 is between Burners #1 and #3 and required the operator to see past the flames of those burners. In addition, if burners are in operation in excess of 24 hours, they must be pulled for cleaning and inspection on each 12-hour shift. In this instance the #2 burner was not pulled on the prior shift as it had not been in operation for 24 hours. PSNH is conducting a review of historical fouling to determine if procedural changes are warranted.

B
4/11 – 0.0 days
The unit was at reduced load and preventative maintenance was being performed on one of the two flame scanner blowers (blows air to keep the fire eye clean). The north blower was shut down TO clean the filter and hot gas came out of the burner when the filter was removed. The operator restarted the blower for his own protection without the filter and dirt was sucked into the burner. The unit tripped at this point as only 1 fire eye failure indication is needed to trip the unit at low load. Two fire eye failure indications are needed for a trip when at full load. PSNH investigation found a faulty check valve that allowed the hot gas to exit the burner. The valve was replaced and the unit returned to service.

C- (Outage Report OR-2009-07)
5/4 – 4.3 days
The unit was removed from service when an operator noticed a waterwall tube leak near one of the soot blowers. The soot blower goes into the burner and blows steam back at the wall tubes. If the soot blower does not fully insert as was the case in this instance, the blast pressure on the tubes is higher thus causing the leak. PSNH also found worn tubes in the area of the leak and the soot blower. The tube leak and other worn tubes were repaired and the unit returned to service. PSNH noted that all soot blowers were maintained during the fall 2008 overhaul.

D
6/30 – 1.0 day
The unit was taken off line due to a hydrogen cooler leak PSNH investigation found three leaking tubes. The tubes were plugged and the unit returned to service.

E
7/6 – 1.2 days
The unit was taken off line due to high conductivity of the boiler water (pure water does not conduct electricity). The high conductivity indicated that there was a leak in the condenser. PSNH conducted a dye test without finding any leaks. PSNH then conducted a soap bubble test and found one small leak. The tube was plugged and the unit returned to service. PSNH noted that approximately 10% of the condenser tubes in the areas of the failure were eddy current tested (determines wall thickness) during the fall 2008 overhaul and no thinning was noted.

F
7/18 – 3.2 days
This outage and Outage 4-D above were initiated by the events described in Outage 5-D which is explained above.

G
8/12 – 2.2 days
During his rounds, an operator heard a tube leak in the primary super heater. Unit operation was managed until a more economic time was available to take the unit down. PSNH investigation found 3 tubes damaged by erosion. Repairs were made and the unit returned to service.

H
8/18 – 2.0 days
The unit tripped due to a generator tube leak. Rather than fully repair the generator tube, PSNH shortened the outage and plugged the tube instead. PSNH plugged the tube as the unit was coming down for its 18 month overhaul in 10 day's time and was not prepared to start the outage this early. The unit returned to service and ran until its planned overhaul in Outage I below.

I
8/28 – 37.1 days
This outage was the planned overhaul for the unit. The ISO-NE outage window was 38 days from 8/28 to 10/5, the PSNH schedule was 37 days from 8/28 to 10/4, and the actual outage time was 37 days from 8/28 to 10/4. The critical path for the outage was

replacement of HP turbine blades which remained on critical path until the turbine was returned from Siemens. At that point, turbine installation, and boiler start up activities became critical path until the unit was returned to service. The outage went smoothly and the unit returned to service.

J

10/6 – 0.1 days

The unit was returning to service from Outage I above and was being fired on oil. The burner management system would not let the operator switch from oil to coal. During the overhaul just completed, the burner management system (No longer supported by Allen Bradley) was upgraded to the latest model including control logic. Much of the input/output logic could be checked off line, but some of the more complex logic could not be checked out until the unit was in service. In addition, logic changes to the burner management system cannot be made unless the controller is in program mode rather than run mode. The logic changes were made and the unity returned to service without incident.

K

11/27 – 2.1 days

When the unit was being started when called by the ISO-NE to operate, water was coming out of the air heater hoppers and the start up was halted. PSNH investigation found that 2 rolls at the mud drum and 4 rolls at the steam drum were leaking. PSNH has had problems in maintaining good seals with the rolls on these drums and now makes weld repairs instead of making roll repairs. An additional hydro test found that 4 more rolls on the mud drum needed to be weld repaired. Repairs were made and the unit returned to service.

L

12/1 – 0.0 days

The unit had been in reserve shut down. When starting the unit, the operator put the voltage regulator switch in the auto position (so that AC and DC voltages are matched) and when the voltage regulator was put into auto mode, the unit tripped. The starting sequence was repeated and the unit started without incident. PSNH investigated the incident, found that the starting sequence was correct, and found nothing that could explain what caused the unit trip. PSNH noted that a similar incident has not occurred since this outage.

Evaluation

Accion reviewed the outages at Schiller and found them either to be reasonable and not unexpected for these units and their vintage or found them necessary for proper operation of the units. Accion concluded that PSNH conducted proper management oversight for these outages.

Recommendations

Related to Outage SCH 4-D, Outage SCH 5-D, and Outage SCH 6-F

With market energy prices depressed in the ISO-NE market, PSNH units have become subject to reserve shutdowns where they are not economic to run, but able to do so. In these circumstances, PSNH strives to do as much repair work during normal straight time hours to minimize operating costs. At times, expenditures of overtime might be beneficial. Accion recommends that PSNH review its policy and practices regarding overtime expenditures versus reserve shutdown on unit-by-unit basis at all of its major stations to ensure that units are in an operational state that maximizes customer benefits.

Related to Outage SCH 6-H

There are many considerations that must be made to make the decision to start a planned outage early. Some of which are contractor availability, material availability, market price, cause of the outage, time between the outage and the planned outage, status of other economical units, day of the week the outage occurs, and the ability to gain ISO-NE approval for the schedule change. In addition, each unit has its own characteristics that can influence how early a planned outage can be started such as start-up and shut-down times. Once a decision is made to start an outage early, PSNH should be in a position that maximizes its ability to start an outage early if that is the correct decision for the conditions presented in that outage. If not, outage time may be increased. Because of unit differences, Accion believes that the amount of time that a planned outage could be started early varies by unit. Accion recommends that PSNH review its practices etc. on its ability to start planned outages early on a unit-by-unit basis to ensure that it maximizes the ability to do so while minimizing potential increase in outage duration.

Hydroelectric Unit Outages For 2009

The following describes the outages at PSNH's hydroelectric (hydro) units during 2009. The outage durations listed have been stated as the actual duration of the total outage regardless whether there was water to run the unit. Accion indicates water availability during any portion of the outage by a "Y" or "N" next to the outage designation.

In 2009, due to the increased rainfall experienced, the PSNH hydro fleet generated 413,300 MWH of energy, 21.6 percent more than an average water year. The increase in water flow required that maintenance schedules and work plans be shifted to accommodate additional flow wherever possible.

Amoskeag Station

Major planned projects at this station in 2009 included the installation of a new portage take-out area, the finishing of the dam resurfacing project, and the beginning of the G-2 generator rewind which continued into 2010.

Amoskeag - 1

A
1/26 – 4.16 days – N
This planned outage was taken to perform the scheduled annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

B – (Related to a T&D event)
7/27 – 0.08 days – Y
The unit tripped and locked out when lightning struck the 312 34.5kV line between the Eddy and Blaine Street substations. PSNH noted that a line crew had to remove a picnic table umbrella from the primaries at the Blaine Street Substation before the line could be re-energized indicating that either could be the cause for the line trip. Line operation was proper, however, the Amoskeag unit tripped when it should not have. PSNH stated that the under voltage relays at the hydro plants across the system where found to be set approximately 33% higher than they should be making the units more susceptible to trips for remote faults. The Relays at Amoskeag were not reset until the fall of 2009.

C – (Related to a T&D event)
8/20 – 0.08 days – Y
The unit was taken off line to perform emergency system repairs. The 0354 34.5kV circuit breaker at Eddy Substation had a leaking oil valve and this line is the sole system interconnection for Amoskeag Station. PSNH considered reconfiguration of the system to keep

the hydros on during the repair, but determined that reconfiguration would be too extensive and place customers in a less desirable configuration from an outage stand point. Repairs were made to the valve and the unit returned to service. Please also see Outage-3C below.

D
12/9 – 0.02 days – Y
This planned outage was taken to perform the ISO-NE annual required Black Start test for the unit. The test was completed and the unit returned to service.

Amoskeag – 2

A
2/2 – 4.21 days – N
This planned outage was taken to perform the scheduled annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

The generator was found to be very dirty and a fall outage was planned to thoroughly clean the unit. Please see Outage-C below.

B
9/13 – 0.04 days – Y
The unit tripped off line due to a high lower guide bearing temperature. PSNH investigation found that the lower guide bearing sump level was low because the lower guide bearing oil pump on and off Mercoid switch (Brand name mechanical level indicator switch) had stuck in the off position. The pump started when the operator touched the switch. Both Mercoid switches and those on G-2 and G-1 and G-3 were lubricated and the unit returned to service. PSNH noted that all Mercoid switches are cleaned and lubed during the unit's annual inspection. PSNH also noted that there have been no historical problems of this nature and that none have occurred since.

C
11/23– 38.69 days – Y (Days out of service are to the end of the year – Outage ended 5/13/10)
This planned outage was scheduled for 5 weeks to do the through cleaning discussed in Outage A above. When the unit was disassembled and inspected, it found that a generator rewind and core restacking was required.

PSNH noted that it wanted to do a generator rewind in 2008, but dam resurfacing work at that time required that all 3 units remain in operation in order to keep the pond level reduced to facilitate the dam resurfacing project and not to waste water. PSNH decided to monitor the unit and not waste the water.

It has been convention to analyze an over lapping outage in the year where the majority of the outage occurs. Where the majority of the outage occurs in 2010, it will be analyzed during the 2010 SCRC review.

Amoskeag – 3

A
2/9 – 4.08 – N
This planned outage was taken to perform the scheduled annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

B
7/21 – 0.44 days – N
The unit tripped off line due to the failure of the governor control coil. PSNH noted that all coils are tested during the annual inspection. The coil was replaced and the unit returned to service.

C – (Related to a T&D event)
8/21 – 0.13 days – Y
The description of this outage is identical to that of Outage 1-C above.

D
11/22 – 0.70 days – Y
The unit tripped due to the failure of the field control coil. A spare coil was tested and it too failed tests. Where G-2 was scheduled to shut down for cleaning, its coil was removed and installed in G-3 and the unit returned to service. A new coil was subsequently ordered and installed in G-2.

PSNH states that spare parts were stored at Garvins Hydro in an uncontrolled environment. PSNH suspects that the quality of the spare coil deteriorated in storage. With the replacement of the generator step-up transformers with a unit of much smaller size at Garvins, PSNH has since set up a formal storage room for spare hydro parts at that location.

E
12/9 – 0.02 days – Y
The description of this outage is identical to that of Outage 1-D above.

Ayer's Island

Major projects at Ayer's Island for 2009 included the replacement of the TB-19 circuit breaker and disconnect switch, replacement of unreliable brown glass station insulators, installation of animal guards throughout the substation, and extensive discussions with the FERC regarding changing earthquake remediation measures.

Ayer's Island – 1

A
3/11 – 0.02 days – Y
The unit was taken off line to replace two worn collector ring brushes observed by the operator during his weekly rounds. The brushes were not worn to the point where they were arcing, but arcing was eminent. The brushes were replaced, other brushes were cleaned, and the unit returned to service.

PSNH noted that brushes in the other units were not cleaned at this time as brush replacement is an on going requirement. Normally brushes are replaced during other events, but will only last approximately 4 months if a replacement opportunity window does not appear.

B
4/3 – 0.01 days – N
The unit was taken off line to replace one worn collector ring brush observed by the operator during his weekly rounds. The brushes were not worn to the point where they were arcing. The brush was replaced, other brushes were cleaned, and the unit returned to service.

PSNH noted that early 2009 was a heavy water period and there were not many opportunities to replace brushes when the units were not running.

C – (Related to a T&D event)
6/19 – 0.02 days – Y
The unit tripped when the A-111 115kV line between the Ashland and Pemigewasset substations tripped. For this fault, PSNH uses a transfer trip function to trip the Ayers Island Station and the Alexandria biomass plant to prevent infeed current from the generators from causing relay misoperations and to prevent unintentional islanding (system protective devices operate in a manner that smaller isolated systems are created) within the area. The cause of the fault was a tree growing into the line. All relaying functioned as intended.

PSNH stated that this line had been side trimmed in 2004 and mowed in 2007. Additionally, the line was aerial patrolled for vegetation issues in August 2008. This was considered deferred work at this time. An aerial patrol was also done in early June 2009 by a contractor just prior to the incident. PSNH investigation into the incident found that the contractor noted the vegetation, but failed to pass on the information to PSNH. PSNH also stated that the section of line where the contact took place only had access through a wetland area and was planned and permitted to be mowed during frozen ground conditions during the winter of 2010.

PSNH investigation found that the subject section of the A-111 115kV line was not mowed in 2007 as it should have been. PSNH foresters are responsible for the integration and coordination of all vegetation maintenance requirements on a prescribed schedule for each line. PSNH has a coordinated vegetation management plan to ensure that the complete right-of-way for a line is completed on schedule. PSNH noted that since 2009, PSNH has been able to secure

an annual blanket wetland permit making individual applications unnecessary. With this blanket permit and changes to wetland rules, PSNH states that beginning in 2010, there will be no deferred vegetation work. Also see Outage 2-B and Outage 3-C below.

D
9/14 – 30.17 days – Y
This scheduled outage was taken to replaced the TB-19 transformer breaker and disconnect switch. Substation brown glass insulators were also replaced.

PSNH also performed the scheduled annual inspection of the unit during this outage. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

Ayer's Island – 2

A
2/24 – 4.43 – N
This planned outage was taken to perform the scheduled annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

B – (Related to a T&D event)
6/19 – 0.03 days – Y
The description of this outage is identical to that of Outage 1-C above.

C – (Related to a T&D event)
8/21 – 0.04 – Y
The unit tripped on overspeed when the 345 34.5kV breaker at Pemigewasset Substation tripped and reclosed due to a suspected lightning strike. The unit should not have tripped for this event. PSNH stated that the under voltage relays at the hydro plants across the system where found to be set approximately 33% higher than they should be making the units more susceptible to trips for remote faults. The Relays at Ayers Island were not reset until the fall of 2009. In addition to the PSNH outage, the lightning strike failed a Fair Point telecommunications circuit board interrupting SCADA communications to the station for four days until repairs could be made by Fair Point.

D
9/14 – 29.36 days – Y
The description of this outage is identical to that of Outage 1-D above.

Ayer's Island – 3

A
1/5 – 17.53 days – Y
The unit was taken off line due to collector ring brush arcing observed by the operator during his weekly rounds. Arcing with ample brush material generally indicates a moisture or surface issue. PSNH investigation found a rust deposit on the brushes indicating moisture.

PSNH installed additional ventilation louvers in a nearby entry door in 2008 to mitigate outages due to elevated bearing temperatures. PSNH suspects that moisture accumulated on the collector ring when the louvers were open during hot and humid days and when the unit was idle. The collector ring was removed, cleaned, and reinstalled, the brushes were replaced, and the unit returned to service. PSNH installed a new cover for the louver which would only be removed during the warmest days.

B
1/26 – 4.28 days – N
This planned outage was taken to perform the scheduled annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

PSNH stated that the annual inspection was performed after only 4 months since the last inspection as there was no other time to do the work and to take advantage of the low flow conditions at this time.

C – (Related to a T&D event)
6/19 – 0.03 days – Y
The description of this outage is identical to that of Outage 1-C above.

D
9/14 – 29.33 days – Y
The description of this outage is identical to that of Outage 1-D above.

Canaan

PSNH received its new FERC license for the station in 2009. Included in the license were provisions to increase by-pass flows to 165 cfs, submissions of a host of studies and management plans, and negotiation with Vermont of the requirement in the Vermont Water Quality Certificate to require upstream passage of native non-anadromous brook trout. In terms of construction, 1,300 feet of wood stave penstock were replaced with a steel penstock.

Canaan – 1

A – (Related to a T&D event)
4/11 – 0.08 days – Y
The unit tripped due to a disturbance on the 355 34.5kV line. The targets at Canaan were overspeed and lockout (required on an overspeed trip). PSNH records showed that there were no dispatcher interruption reports or area work center trouble reports generated at this time indicating that no distribution protective devices operated. The event recorder at Lost Nation Substation did record a single phase voltage dip (less than .93 pu). The voltage dip, coupled with no trip of the line indicates a high impedance fault most likely caused by vegetation contact to the 355 34.5kV line. The 355 34.5kV line was both side trimmed and machine mowed in 2007. The unit returned to service when released by the dispatcher.

B
4/19 – 0.09 days – Y
The unit tripped off on overspeed relay action due to an unknown cause. PSNH investigation found that no distribution problems or substation problems occurred at this time. The overspeed relay targets were reset and the unit returned to service.

C – (Related to a T&D event)
4/23 – 0.18 days – Y
The unit tripped off on overspeed relay operation due to an unknown cause. PSNH records showed that there were no dispatcher interruption reports or area work center trouble reports generated at this time indicating that no distribution protective devices operated. The overspeed relay targets were reset and the unit returned to service.

D – (Related to a T&D event)
4/28 – 0.07 days – Y
The unit tripped due to operation of the time over current relays which tripped the Canaan 357 34.5kV breaker. A fault occurred on the 376 34.5kV line between Lost Nation and Whitefield. For this fault, the Whitefield end cleared first. The time over current settings for both the 357 breaker at Canaan and the Lost Nation breaker for the 376 34.5kV line are approximately the same because the 357 breaker at Canaan has to be able to operate for faults as far away as Lost Nation and the 376 line breaker has to be able to operate for faults as far away as Whitefield, however they do coordinate. PSNH investigation confirmed that the 357 breaker at Cannan should not have tripped for this event.

E – (Related to a T&D event)
5/14 – 0.06 days – Y
The unit tripped off on overspeed and time over current relay operations due to an unknown cause. PSNH records showed that there were no dispatcher interruption reports or area work center trouble reports generated at this time indicating that no distribution protective devices

operated. Windy conditions and vegetation contact are suspected as the cause for the outage. The relay targets were reset and the unit returned to service.

F – (Related to a T&D event)
7/3 – 0.19 days – Y
Lightning struck the 355 34.5kV line causing the 355 recloser at Colebrook to trip and reclose. PSNH found 2 blown bus pot fuses. The fuses were replaced and the unit returned to service. The unit is expected to trip for a fault on the 355 34.5kV line.

G – (Related to a T&D event)
7/16 – 0.07 days – Y
Lightning struck the 355 34.5kV line causing the 0355 breaker at Lost Nation to trip and reclose. The unit is expected to trip for a fault on the 355 34.5kV line.

H
7/17 – 0.08 days – Y

I
7/21 – 126.21 days – Y
This planned outage was taken to perform the in place replacement of 1,300 feet of wood stave penstock with a steel penstock and was planned for 144 days. The original schedule was to start the outage on 8/7/09, but PSNH was able to get a schedule change approved by ISO-NE. The early start eliminated winter working conditions. Also completed during this outage was the annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. The work was completed and the unit returned to service.

J
11/23 – 0.03 days – Y
The unit was taken off line shortly after start up from Outage I above when the lube oil switch was intermittently indicating low oil flow. PSNH believes that the length of Outage was the cause. The switch was recalibrated and the unit returned to service.

K – (Related to a T&D event)
11/28 – 0.09 days – Y
The unit tripped off on overspeed and time over current relay operations due to an unknown cause. PSNH records indicated that there were no dispatcher interruption reports generated at this time, however, there were many area work center trouble reports. The relay targets were reset and the unit returned to service.

PSNH noted that there was no information from Lost Nation available as the event recorder at Lost Nation failed on 11/22/09 and was in the process of being repaired.

L – (Related to a T&D event)
12/9 – 0.84 days – Y
The unit tripped on overspeed relay operation due to what at the time was an unknown cause. PSNH investigation found that the 39X coil in the starting chain relay failed. The coil was replaced, but the unit could not return to service due to a subsequent pole accident occurring on the 355 34.5kV line. When the pole accident was repaired, the unit returned to service.

PSNH noted that there was no information from Lost Nation available as the event recorder at Lost Nation failed on 11/22/09 and was in the process of being repaired.

Eastman Falls

The major projects completed at this station for 2009 included completion of the dam resurfacing project and de-leading and painting of the waste gate as recommended by the FERC.

Eastman Falls-1

A
1/1 – 25.36 days – Y
This outage was the completion of the G-1 rewind project. Its evaluation was completed in the 2008 SCRC review. No further analysis is presented here.

B
3/8 – 0.05 days – Y
The unit tripped off due to a high spider bearing (main shaft bearing under the generator rotor) temperature occurring during a high building temperature event (outside air ambient was 39 degrees F). PSNH stated that their old policy was to set the spider bearing trip temperature just above normal operating temperatures. PSNH was in the process of reviewing the logic and coordination of all bearing alarm and trip points and settings. Eastman Falls-1 had its bearing temperature review completed in 2009 when new bearings were installed. PSNH had a condition of new bearings with old settings and had scheduled recalibration before summer operating conditions. This incident occurred before the temperature recalibration could take place. The operator increased ventilation and when the high temperature alarm cleared, the unit returned to service.

Bearing temperature settings were historically based on information received from the manufacturer and normal, alarm, and trip temperatures were based on the bearing operating temperature on the hottest day of operation. PSNH realized that the historic method of setting bearing temperature trip points was not ideal, requested maximum operating temperatures for the bearing from the manufactures, and increased bearing trip temperatures for the bearing. PSNH notes that even though the trip settings are at a higher temperature, the trip settings are below the maximum bearing operating temperatures. PSNH anticipates all temperature set points for all units will be completed in 2010.

C
3/9 – 0.06 days – Y
The unit again tripped on a high spider bearing temperature. The operator aligned the generator cooling duct to expel air directly outside and again increased ventilation into the building. When the high temperature alarm cleared, the unit was returned to service.

D – (Related to a T&D event)
4/3 – 0.10 days – Y
A fault occurred on the 337 34.5kV line fed radialy out of the Webster Substation causing the 337 breaker at Webster to trip and reclose. Eastman Falls is expected to trip for this fault. The line was patrolled and nothing was found. In conjunction with the investigation of the line fault, a cracked station insulator at Eastman Falls was found. Repairs were made and the unit returned to service. Also see Outage 2-A below.

E
5/21 – 0.07 days – Y
The unit tripped due to a high spider bearing temperature. The outside ambient temperature had risen to 92 degrees F. PSNH adjusted the spider bearing alarm temperature from 72 degrees F to 80 degrees F and increased the bearing trip temperature to 90 degrees F. The spider bearing was installed as part of the 2008/2009 generator rewind project. At that time relay settings were changed to those recommended by the manufacturer and they were different than the historical settings. After discussion with the manufacturer, PSNH changed the relay settings to coordinate with the temperature that the bearing can continuously operate at and not the ambient temperature. Please also see the discussion in Outage 1-C above.

Eastman Falls – 2

A – (Related to a T&D event)
4/3 – 0.11 days – Y
The description of this outage is identical to that of Outage 1-D above

B
4/20 – 0.04 days – Y
This was a scheduled outage to repair the anchor point for the fish directional louvers which had been damaged by underwater debris during spring flow conditions. The anchor point was repaired, the broken cable was spliced, the louver line was attached, and the unit returned to service.

C
7/20 – 15.07 days – Y
This planned outage was taken to perform the scheduled annual inspection of the unit and planned to last 13 days. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

The turbine Bestobell seal (this is the wet to dry turbine to generator shaft seal for a horizontal turbine that is lubricated by water) was disassembled and inspected to determine a cause for water intrusion into the lube oil system. No cause was found, but all internal seals were replaced. This emergent work extended the outage by 2 days. The unit returned to service. PSNH notes that the water intrusion stopped after this service was performed.

D
8/26 – 0.17 days – Y
The unit tripped when PSNH was troubleshooting a high temperature stator temperature indication on probe #7. The operator disabled the CH #7 trip circuit in the programmable logic controller which normally disables all the trips and alarms associated with the logic point. When the operator lifted CH #8 for a comparison check, the unit tripped on remote temperature device burnout.

PSNH stated that new controls were installed for this unit about 8 years ago and that testing procedures on the controls at Eastman Falls are different than at other stations. PSNH investigated the logic circuits causing this event, found them to be in working order, and the unit was returned to service.

PSNH notes that these control circuits are not worked on frequently and because of this incident, PSNH informed all electric control mechanics of the unique programmable logic control configuration at Eastman.

E
9/14 – 0.20 days – N
The unit tripped due to a high oil level in the hydraulic/lubrication unit that positions the turbine blades and lubricates the turbine bearings. The trip signal is sent when the reservoir level rises 3 inches. The operator found that approximately 20 gallons of oil had to be drained (out of approximately 250 gallons) in order to clear the alarm and restart the unit. Over the next two weeks, approximately 16 gallons of water was removed from the lube system indicating that river water had indeed seeped past the shaft seals.

PSNH realizes that using one reservoir for both hydraulic and lube oil functions is a problem and has been working on solutions to the Bestoball seal to prevent that water intrusion, but has had limited success. In 2010, PSNH stated that it is investigating the separation of the hydraulic system and the lube oil system for this unit as an alternative to raising the high oil level alarm setting which will introduce more risk for equipment damage.

Garvin's Falls

Major work at the station in 2009 included the replacement of the station boat barriers, building a new portage facility on the east side of the river, repairs to the G-1 head gate, and converting the station to run-of-river operations.

Garvin's Falls-1

A
3/15 – 1.25 days – N
This outage was scheduled to repair a leaking seal inside the servo piston (adjusts the blades in horizontal turbines). The seal was replaced and the unit returned to service.

B
3/19 – 0.01 days – Y
The unit was taken out of service when the operator noticed that temperature indication on the oil head servo (servo motor that actuates the shaft that pitches the turbine blades) was lost. PSNH investigation found a broken solid strand wire on the remote temperature device. In order to safely access the area, the unit was taken off line. The wire was repaired with a multi strand wire to make it less prone to cracking from vibration, and the unit returned to service. PSNH notes that a new wire has been pulled into position for installation during the 2010 annual inspection.

C
5/22 – 0.04 days – N
The unit tripped due to loss of oil to the generator bearing. Loss of oil was caused because the generator lube oil pump motor tripped. PSNH tested the lube oil pump motor and found it to be okay, but the overloads (acts like a breaker for motor protection) were replaced since the overloads may have been worn resulting in a premature trip of the motor. Repairs were completed and the unit returned to service.

D
6/29 – 32.22 days – Y
This planned outage was taken to perform the scheduled annual inspection of the unit and was planned for 34 days. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. All the head gate wheel bushings, seals, and rails for this unit were also replaced during this outage.

E
10/5 – 8.33 days – N
This was a scheduled outage to repair an oil leak in the nose cone bearing. These seals and O-rings are replaced approximately every 3 to 5 years or when work is being performed on the

nose cone and were replaced during the annual inspection in Outage-D above (Approximately 3 months earlier). PSNH investigation found the seals damaged. The seals and O-rings were replaced and the unit returned to service. PSNH O-ring replacement is covered by a procedure that includes the use of a jig, glue curing time, but the installation is blind. Once the O-ring is installed, it can not be seen or inspected after installation. PSNH does not believe that this is a material issue.

The O-rings are 19" (in diameter) and are not a stock size. The O-rings must be handmade using a splice kit. The ends are glued together with a super-glue type of material. PSNH has contacted the manufacturer with regard to this issue but the company has been bought out and the new owner gives little attention to this issue. PSNH is also active in discussing this issue with other owners of similar units.

F
10/22 – 0.02 days – Y
This planned outage was taken to perform the ISO-NE annual required Black Start test for the unit. The test was completed and the unit returned to service.

G
12/15 – 0.04 – Y
This outage was scheduled to remove the fish louver line for the winter months. PSNH found that the lower section had separated from the upper section and a large amount of debris was trapped in the louver line. PSNH deferred this repair until warmer weather, but prior to the 2010 fish passage season.

Garvin's Falls – 2

A
3/9 – 0.04 days – Y
The unit failed to phase on line when requested to do so by the E-SCC dispatcher. PSNH investigation found targets on the excessive VAR relay. The unit was checked and nothing was found wrong. The relay targets were reset and the unit started without incident. Please see also Outage-B, Outage-D, Outage-H, and Outage-I below.

B
3/17 – 0.03 days – Y
The unit tripped off line due to excessive VARs. PSNH investigation which included testing the excess VAR relay found nothing out of order, but noted that the relay setting had drifted (changed) but was still within tolerance. The relay setting was increased 10 percent in an effort to stop the unit trips while a longer term solution was sought. The unit was returned to service.

C
3/24 – 0.04 days – Y
The unit tripped due to loss of AC power that powers the excess VAR relay. PSNH found that the AC breaker in this circuit failed. The breaker was replaced and the unit returned to service. Accion notes that this outage is independent of the other outages of this unit regarding excessive VARs.

D
4/30 – 0.08 days – Y
The unit tripped again due to excessive VARs. PSNH found that the relay setting had drifted from its set point and suspected the relay to be bad. There was no spare relay to install. The relay was adjusted and the unit returned to service. PSNH ordered 2 new relays on 5/1 which were received in early August. One of the new relays was installed during Outage-I below.

E
6/29 – 0.26 days – Y
The unit was taken off line for safety considerations while divers installed tailrace panels in Unit-1.

F
6/30 – 0.02 days – Y
The unit was taken off line for safety considerations while divers installed tailrace panels in Unit-1.

G
7/1 – 0.01 days – Y
The unit was taken off line for safety considerations while divers installed tailrace panels in Unit-1.

H
7/27 – 0.06 days – Y
The unit again tripped due to excessive VARs. The excess VAR relay continued to drift out of calibration. New relays had not yet been received, so the relay was recalibrated and the unit was returned to service.

I
8/24 – 0.04 days – Y
The unit again tripped due to excessive VARs. The new relay was received in early August. The relay was replaced and the unit returned to service. PSNH notes that the incidents have ceased.

J
10/13 – 7.29 days – N
This planned outage was taken to perform the scheduled annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. Work was performed on a straight time basis as there was insufficient water to run the unit.

K
10/22 – 0.02 days – Y
The description of this outage is identical to that of Outage 1-F above.

L
12/15 – 0.04 days – Y
The description of this outage is identical to that of Outage 1-G above.

Garvin's Falls – 3

A
10/22 – 0.02 days – Y
The description of this outage is identical to that of Outage 1-F above.

B
12/15 – 0.03 days – Y
The description of this outage is identical to that of Outage 1-G above.

Garvin's – 4

A
4/25 – 0.09 days – Y
The unit tripped and locked out without any target indication except lock out because the target indicator coil failed. The weather was quite warm and the operator thought that high bearing temperature might have initiated the trip. The operator checked unit temperatures, opened the station vents, and restarted the unit. Please see Outage-B below.

B
4/25 – 0.07 days – Y
The unit again tripped and locked out without relay target indication. Due to the fact that this was the second trip that day (Saturday), PSNH called in the Electrical and Control working foreman. When the working foreman arrived, he noticed that the thrust bearing temperature appeared high for the amount of time the unit had been off line. Further investigation found that the coil for the bearing temperature drop on the annunciator panel (targets) had failed. The coil failure accounted for no target indication for the two unit trips. The coil was replaced, additional ventilation was provided, and the unit returned to service.

C
7/18 – 0.24 days – Y
The unit tripped when the 39 relay coil failed in service. The 39 relay coil is part of the permissive start chain and is a series component. The circuitry of the start chain is also required for continued operation as designed for this unit. The coil was replaced and the unit was returned to service.

D
9/8 – 3.24 days – N
This planned outage was taken to perform the scheduled annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

E
10/22 – 0.02 days – Y
The description of this outage is identical to that of Outage 1-F above.

F
12/15 – 0.04 days - Y
The description of this outage is identical to that of Outage 1-G above.

Gorham

Major projects at Gorham in 2009 included the replacement of the G-1 draft tube, replacement of the canal retaining wall, and replacement of the five canal head gates.

Gorham – 1

A
5/26 – 0.61 days – Y
The E-SCC dispatcher received a low by-pass flow (minimum flow requirement) alarm and took Unit-1 and Unit-2 off line. When the operator arrived, he found that the pond level was low, but the 200 cfs flow requirement around the units was being met. The operator set the pond level control higher to assure water passage over the dam. The units were started later in the day when the pond reached the new control level.

B
10/13 – 34.16 days – Y
This planned outage was taken to perform the scheduled annual inspection of the unit and was planned for 13 days. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. The replacement of the G-1 draft

tube, the 5 canal head gates, and the canal retaining wall were also completed during this outage. Inspection of the bearings found significant casting damage which extended the outage.

Gorham – 2

A – (Related to a T&D event)
2/8 – 0.03 - Y
Lost Nation Substation has two 115/34.5kV transformers installed. One of the units is out of service. PSNH did not need to replace the failed transformer due to the reduction of load associated with the closing of paper mills. The transformer was isolated from the system. The high side motor operated disconnect switch on the unit in service failed causing the D-142 115kV line between the Lost Nation and Whitefield substations to trip. The initial operation was correct, however, the S-136 breaker on the other 115kV line into Berlin over tripped for this fault. PSNH investigation found that the loss of paper mill load in the area had created infeed and other protection issues in the area resulting in the over trip. PSNH was aware of this condition in 2005 and initiated projects in 2006, 2007, 2008, and 2009 (to take place later in the year) to correct the situation. New settings were issued and implemented as a short term solution. In addition, new and more sophisticated relaying was installed in October 2009 to correct the protection issue as planned. The unit returned to service when released by the dispatcher. Also see Outage 3-A and Outage 4-A directly below and Smith Outage 1-B below.

B
5/8 – 4.23 days – Y
The unit was taken off line by the operator when he noticed arcing on the upper collector ring and brushes. Investigation found that the collector ring was scorched and pitted caused by a breakdown of a collector ring insulator. The collector ring assembly was disassembled, refurbished, and reinstalled. The unit was returned to service without incident.

C
5/26 – 0.45 days – Y
The description of this outage is identical to that of Outage 1-A above.

D
6/2 – 2.33 days – Y
The unit tripped due to the failure of the 65S2 governor coil. The coil failure caused an unfused potential transformer to overload which in turn resulted in a small fire within the potential transformer enclosure. An operator who happened to be at the station extinguished the fire. The relay coil and enclosure wiring were replaced and the unfused potential transformer was replaced with a fused potential transformer. The unit was returned to service without incident.

The potential transformer cabinet is too small to install fuses on the primary side of the transformers so as an interim measure, PSNH installed fuses on the secondary side of the transformers for both Unit-1 and Unit-2. Unit-3 and Unit-4 do not use potential transformers in

this manner so this is not an issue with those units. PSNH will be installing larger potential transformer enclosures in 2010 and installed fused potential transformers. As a result of this issue, PSNH identified other stations that have a similar potential transformer configuration issues and is looking into an alternative design.

E
6/23 – 1.00 day – N
The unit was taken off line when the operator noticed that the flyball governor motor was warmer than usual on his rounds. Investigation revealed that the motor was okay. Two potential transformers feed power to the flyball governor to supply feedback to the governor (Generator speed varies with potential transformer voltage), but that the newly installed potential transformer (Outage-D above) was configured differently than the other transformer. In the installation of the new PT, polarity could not be determined without asbestos abatement taking place and there was no diagram indicating the correct polarity connections. The transformer connections were properly reconfigured and the unit was returned to service.

F
10/13 – 34.16 days – Y
This planned outage was taken to perform the scheduled annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. Due to the fact that Unit-2 shares the same wheel pit with Unit-1 (out of service for draft tube replacement), PSNH accomplished many other maintenance items during this outage including measurement of the wicker gate openings and inspection of the runner.

Gorham – 3

A – (Related to a T&D event)
2/8 – 0.03 days – Y
The description of this outage is identical to that of Outage 2-A above.

B
4/9 - 0.04 days – Y
The unit tripped due to loss of field. PSNH found that the field contactor dropped out. No apparent reason was found upon investigation. The unit was restarted without incident. PSNH noted that they placed a recording meter to monitor the unit for 3 weeks. No activity took place during the three week period and there have been no further incidents.

C
6/2 – 0.01 days – Y
The unit tripped off at the same time as the Unit-2 potential transformer fire (Outage 2-D above). PSNH states that Unit-2 and Unit-3 share no exciter circuitry so that it is unknown why

the unit tripped at that time. The unit was checked, nothing was found, and the unit returned to service.

PSNH has yet to find the circuitry link between Unit-2 and Unit-3 or the reason for the unit trip.

D
6/8 – 8.22 days – Y
This planned outage was taken to perform the scheduled annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. PSNH accomplished many other maintenance items during this outage including inspection of the runner and replacement of the turbine bearing.

E
9/15 – 0.07 days – N
The unit tripped due to no oil pressure on the actuator cylinder. PSNH investigation found a factory installed broken wire on the actuator controller. The motor starter for the actuator pump was replaced thus also replacing the broken wire and the unit returned to service.

F
10/14 – 0.01 days – N
The unit was taken off line by the E-SCC dispatcher when a low by-pass flow alarm was received. PSNH states that a control mechanic called the E-SCC 15 minutes before the incident to inform them that false by-pass flow alarms might be received as work was being performed to install a new pond level sensor. Before the message was passed to the hydro desk at the E-SCC, the incident occurred.

The operator at the station immediately called the E-SCC to start the unit, but the unit failed to phase when started. PSNH found a bad auxiliary coil which is supposed to pick up the gate lock mechanism. It is believed that coil failure occurred on the request to the restart the unit. Another unit was started in its place. The coil was replaced and the unit returned to service.

G
10/20 – 0.27 days – Y
The unit was taken off line to float the new draft tube being installed in Unit-1 across the tailrace area. When the draft tube cleared the tailrace area, the unit returned to service.

H
10/21 – 0.22 days – Y
During the annual thermographic inspection of the station, a hot spot was detected on disconnect switch DX5303. Unit-3 and Unit-4 were taken off line to clean and exercise the

disconnect switch. Once the work was completed, the unit returned to service. Please also see Outage 4-G below.

I
10/24 – 0.03days – Y
The E-SCC followed procedure when a low by-pass flow alarm was received. Upon arriving at the station, the operator found that one flash board was down as required to meet minimum flow requirements. Under the conditions found, the low by-pass flow alarm triggered because of false indication from the by-pass flow transducer, but upon field investigation, PSNH determined that the required minimum flow was more than satisfied. PSNH also adjusted the pond level indicator higher and the unit returned to service. Please also see also Outage 4-H below that occurred later in the day.

J – (Related to a T&D event)
10/31 – 0.02 days – Y
A tree contact to the 352 34.5kV line between Gorham and Whitefield substations caused the Gorham 0352 breaker to trip and reclose. The unit tripped on under voltage and over current relay operation. The unit should not have tripped for this fault. PSNH stated that the under voltage relays at the hydro plants across the system where found to be set approximately 33% higher than they should be making the units more susceptible to trips for remote faults. The Relays at Gorham were immediately reset after this incident. The unit was returned to service when released by the dispatcher. Also see Outage 4-I below.

Gorham – 4

A – (Related to a T&D event)
2/8 – 0.04 days – Y
The description of this outage is identical to that of Outage 2-A above.

B
5/14 – 0.00 days – Y
The unit tripped off line during calibration of the wicker gate actual position to that of the control computer indication. The mechanic closed the gate too close to the 0/10 (full closed) position and the unit tripped. This adjustment is a coarse adjustment and the operator made an error by getting too close to the 0/10 gate position (within 3%). The unit was checked over and returned to service and the mechanic completed the calibration at higher gate openings. To prevent similar occurrences, PSNH has prepared a list of all the minimum gate positions for use at all its hydro stations during calibration.

C
6/29 – 0.03 days – Y
The unit tripped due to low actuator oil pressure. PSNH investigation found that the actuator (Supplies energy to perform a calculated value) pump had a bad contactor. The contactor was replaced and the unit returned to service.

D
8/31 – 3.24 days – N
This planned outage was taken to perform the scheduled annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. PSNH accomplished many other maintenance items during this outage including inspection of the runner and servicing the actuator.

E
10/5 – 0.03 days – Y
The unit was taken off line by the E-SCC dispatcher when a low by-pass flow alarm was received. While refurbishing the retaining wall, the buried milliamp transducer cable (in conduit) for the level sensor system was damaged by the contractor causing the low flow alarm. A temporary repair was made to the cable and the unit returned to service.

PSNH investigation found out that it had marked the cable for the contractor as required by Dig Safe Regulations, but the contractor failed to maintain his markings during the course of the work. In addition, the cable was buried only 10 inches deep. PSNH stated that it has spoken to the contractor who has a long standing good record with PSNH and chose not to pursue the matter further because of the minor damage and the fact that the unit quickly returned to service. This matter has been referred to the NHPUC Safety Division.

F
10/20 – 0.25 days – Y
The description of this outage is identical to that of Outage 3-G above.

G
10/21 – 0.22 days – Y
The description of this outage is identical to that of Outage 3-H above.

H
10/24 – 0.06 days – Y
The unit was taken off line by the E-SCC dispatcher when a low by-pass flow alarm was received. When the operator arrived, he found the pond level up and that adequate by-pass flow was occurring as one flash board was down. The unit was returned to service. Further investigation found that the by-pass flow level transducer was giving a false reading. The faulty

transducer and its surge protector were both replaced. PSNH also notes that an improved style transducer was installed on 11/16/09.

PSNH notes that since the new transducer was installed, there have not been any similar outages.

I – (Related to a T&D event)
10/31 – 0.03 days – Y
The description of this outage is identical to that of Outage 3-J above.

Hooksett

The major projects completed at Hooksett in 2009 included the replacement of the boat barriers, replacement of unreliable brown glass station insulators, and installation of animal guards throughout the substation.

Hooksett – 1

A
8/17 – 4.27 days – Y
This planned outage was taken to perform the scheduled annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. PSNH accomplished many other maintenance items during this outage including inspection of the runner and a complete inspection of all generator related components.

PSNH considered consolidation this annual inspection with the extensive switch yard work scheduled for October 2009. In the annual inspection, station service is necessary to provide pumps, tools, lights, ventilation, and testing power. The October outage required complete power isolation. PSNH decided for worker safety reasons to not perform the work concurrently. PSNH also noted that an additional two days would be required to consolidate the outages to assure safe conditions during hook-up and detachment from a temporary service.

B
8/31 – 0.02 days – Y
The unit was removed from service to repair a leaking sight glass on the governor causing oil to puddle on the floor. The sight glass gaskets were replaced and the unit returned to service.

C
10/19 – 11.31 days – Y
This was a scheduled outage to replace all the station brown glass insulators, add animal protection, and remove obsolete equipment. The work was completed on schedule.

Jackman

The major projects completed for this station in 2009 included repair of the spillway lip, and the installation of the new TB-9 step-up transformer.

Jackman-1

A – (Related to a T&D event)
3/27 – 0.01 days – N
This was a scheduled outage taken to verify wiring and contact arrangement for the design of the protection circuits for the installation of the new TB-9 transformer.

B – (Related to a T&D event)
4/6 – 0.03 days – N
The unit tripped when a fault occurred on the 311X1 34.5kV circuit and caused the 311X1 recloser to operate. The unit should not trip for this fault; however, it tripped on overspeed relay operation. The 311X1 circuit was patrolled and nothing was found that explained the fault. The patrol did find vegetation that should be trimmed and forwarded that information to vegetation management. The unit returned to service when released by the dispatcher.

C – (Related to a T&D event)
12/1 – 9.29 days – N
PSNH took this planned outage to install the new TB-9 step-up transformer which would be the replaced for the unit that failed in 2008. PSNH also performed the annual inspection of the unit during this outage. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

All costs related to the incident were covered by the contractor's insurance. Insurance did not cover the replacement of one 34.5kV breaker and the change out of two relay systems as these items are considered upgrades. The breakdown of the insurance payments appears below.

Total Transformer Replacement Cost - $1,100,000
Replacement Power Cost 2008 - $59,980
Replacement Power Cost 2009 - $ 103,615
Insurance - $900,000

The breakdown of the $900,000 insurance proceeds was $163,595 for replacement power costs and $736,405 offset to the transformer replacement. The remaining $363,595 was for the specific upgrades to the station.

Smith

Major projects at this station in 2009 included the replacement of the station battery and the painting of the steel access bridges to the dam.

Smith-1

A
9/12 – 5.24 days – Y
This planned outage was taken to perform the scheduled annual inspection of the unit. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. PSNH accomplished many other maintenance items during this outage including inspection of the runner and replacement of the high side bushings on the step-up transformer.

B – (Related to a T&D event)
10/17 – 0.29 days – Y
This scheduled outage was taken to perform protection testing requirements for Smith hydro in conjunction with the protection upgrades required at the Berlin Substation to correct the S-136 115kV line over trip coordination problem (Also see Outages Gorham 2-A, Gorham 3-A, and Gorham 4-A above). The work was coordinated with PSNH hydro personnel, distribution personnel, and required an 18 week ISO-NE lead time. The work was completed and the unit returned to service.

Evaluation for Hydro Units Except for Outage Amoskeag 2-C, Outage Eastman 1-A, Outage Jackman 1-A, Outage Jackman 1-C, Outage Ayers Island 1-B, Outage Ayers Island 2-C, and Outage Ayers Island 3-B, and Outage Gorham 3-F.
Accion reviewed these outages and found them either to be reasonable and not unexpected for these units and their vintage or necessary for proper operation of the units. Accion concluded that PSNH conducted proper management oversight.

Outage Amoskeag 2-C
It has been convention to analyze an over lapping outage in the year where the majority of the outage occurs. Where the majority of the outage occurs in 2010, it will be analyzed during the 2010 SCRC review.

Outage Eastman 1-A
This outage was the completion of the G-1 rewind project. Its evaluation was completed in the 2008 SCRC review. No further analysis is presented here.

Outage Jackman 1-A and 1-C

Outage 1-A was required to verify protection circuitry for the replacement of the TB-9 step-up transformer. Outage 1-C was the outage required to actually replace TB-9.

Both of these outages would not have been required but for the failure of TB-9 in 2008 due to contractor action where the NHPUC declined to allow PSNH to recover costs. Accion recommends that replacement power costs related to these outages also not be recovered. Accion further recommends that where the annual inspection was performed during Outage 1-C and that the annual inspection outage would have been taken regardless of the TB-9 transformer replacement, that normal inspection outage time (Approximately 4 days) be deducted from the length of Outage-C in determination of the replacement power costs.

Outage Ayers Island 1B, 2-C, and 3-B

This outage took place due to multiple breakdowns of PSNH's vegetation management process when dealing with line sections that deal with wetland areas. This area became deferred work in 2007, was not performed in 2008, assumed to be deferred work in the 2008 patrol, and not reported to PSNH in the 2009 patrol just prior to the incident. PSNH foresters are responsible for the integration and coordination of all vegetation maintenance requirements on a prescribed schedule for each line. PSNH has a coordinated vegetation management plan to ensure that the complete right-of-way for a line is completed on schedule. Such oversight was not exercised here. Accion recommends that replacement power costs associated with these outages not be recovered from customers.

Outage Gorham 3-F

The hydro operator called the E-SCC at least 15 minutes prior to the start of work and informed them that false by-pass flow indications might be received. The E-SCC did not pass this information on in a timely manner and as a result, incorrect action was taken by the dispatcher. Accion believes that insufficient dispatcher attention was given to this situation and that replacement power costs should not be recovered from customers.

Combustion Turbine Outages For 2009

The following outages took place at PSNH's combustion turbine units during 2009:

Lost Nation CT-1

Major work that was completed at Lost Nation during 2009 that included the installation of the ISO-NE RIG (Remote Interface Gateway[1]) control of the unit at the E-SCC.

Lost Nation – 1

A
4/13 – 4.10 days
This scheduled outage was taken to perform the annual inspection. Included in the work performed were a visual inspection, general cleaning, annual equipment tests and servicing the diesel starter engine. Testing and inspections revealed no abnormalities. The ISO-NE RIG was also installed at the E-SCC and the ISO-NE black start test was completed.

White Lake CT-1

Major work that was completed at Lost Nation during 2009 included the installation of the ISO-NE RIG control of the unit at the E-SCC.

White Lake – 1

A
1/26 – 0.07 days
The E-SCC dispatcher received a loss of flame alarm indicating that the unit failed to start when the unit was requested to meet its winter audit. Investigation could not determine a cause for this alarm. The unit was restarted without incident and completed its winter audit.

PSNH noted that after further investigation, adjustments were made to the inlet temperature sensing element which controls the logic for flame indication and the event has not been repeated.

[1] This remote access system allows ISO-NE direct access to PSNH's 3 fossil stations plus the combustion turbines at those stations, access to the Lost Nation and White Lake combustion turbine, plus the hydro stations through the E-SCC.

B
2/1 – 0.10 days
The unit was off line when the E-SCC dispatcher received a general and a unit “no go” alarm. PSNH found generator stator high temperature, fuel valve lockout, and loss of 125V DC targets at the station. Remote temperature devices were tested and their wiring connections were checked for tightness. Nothing was found wrong. The alarms were cleared and the unit was returned to service.

C
4/6 – 4.34 days
This scheduled outage was taken to perform the annual inspection. Included in the work performed were a visual inspection, general cleaning, and annual equipment tests and servicing the diesel starter engine. Testing and inspections revealed no abnormalities. The browser filters (fuel filters between the fuel tanks and the engine) were replaced, the ISO-NE RIG was installed at the E-SCC, and the ISO-NE black start test was completed during this outage.

D
7/1 – 0.03 days
The unit was off line at the time when the unit was removed from service to repair a loose oil pipe on the gear box that was causing an oil leak. The oil leak was detected during routine operator inspections conducted on 6/30. The pipe was tightened, necessary cleanup performed, and the unit was returned to service.

E
8/11 – 0.08 days
The unit failed to phase when requested to do so by the E-SCC for the summer audit. PSNH investigation found that there was no indication of line-side bus voltage for metering and instrumentation. PSNH found corrosion at the PT-11 fuse connections. The fuse connections are pulled (a requirement for isolation) and inspected during the annual inspection. The fuses were removed, cleaned, tested, reinstalled and power was restored to the control circuits. The unit started and the summer audit was completed.

PSNH suspected that the abnormal dampness occurring in 2009 may have been the cause. PSNH notes that a new and better heater was installed in 2010 and the problem has not reoccurred.

Schiller CT-1

A
3/9 – 3.6 days
This scheduled outage was taken to perform the annual inspection. Included in the work performed were a visual inspection, general cleaning, and annual equipment tests. Testing and inspections revealed no abnormalities.

B
9/12 – 0.4 days
This planned outage was taken to reconfigure the unit to the 34.5kV system to accommodate the replacement of 13.8kV switchgear at Schiller Station.

C
9/21 – 0.2 days
This planned outage was taken to reconfigure the unit back to the 115kV (its normal configuration) system after the replacement of 13.8kV switchgear at Schiller Station.

D
10/14 – 15.2 days
PSNH had just completed operation of the unit. An oil leak was reported at the exciter end of the generator. PSNH opened up the area between the generator and exciter and found that the the bearing between the generator and the exciter had been damaged. The bearing was removed and sent out for repair.

Once the bearing returned in a repaired state, PSNH could not install the bearing as the physical size of the repaired bearing is larger than the damaged bearing PSNH then determined that the generator physical location had shifted towards the exciter. PSNH opened the other end of the generator and found that bearing was also damaged. That bearing was also sent out for repair. PSNH believes that the generator shift caused the bearing damage. No alarms were received from either bearing during operation. As part of its investigation, PSNH checked the bearing alarms of both bearings and they were found to be in good working order.

In order to install the two repaired bearings, PSNH was required to do a complete alignment of the entire combustion turbine unit. PSNH states that the last time it was required to take the unit apart was approximately 10 to 15 years ago, that no vibration or other abnormal indications were noted during operation, and that the unit had seen little operation over the 10-year period.

Merrimack CT-1

CT-1 and CT-2 are connected to the 115 kV transmission yard via a common step-up transformer (MT-3) and have common fuel systems. Some of the concurrent outages listed below are a result of that configuration.

A
4/27 – 3.5 days
This scheduled outage was taken to perform the annual inspection. Included in the work performed were a visual inspection, general cleaning, and annual equipment tests. Testing and inspections revealed no abnormalities. Although not required to because of configuration, the CT-2 annual outage was performed at the same time in order to complete an inspection of the common MT-3 step-up transformer. (Also see Outage 2-A below)

B
10/1 – 0.0 days
While on scheduled rounds, an operator found that there was a zero voltage unbalance between the phases. A blown fuse was found on the on the CT-1 PT. The fuse was replaced and the unit was returned to service.

Accion notes that there have been other fuse events at this location and events related to lightning strikes.

Merrimack CT-2

A
4/27 – 3.5 days
This scheduled outage was taken to perform the annual inspection in conjunction with unit CT-1. Included in the work performed were a visual inspection, general cleaning, and annual equipment tests. Testing and inspections revealed no abnormalities. Please also see Outage 1-A above.

B
7/27 – 1.1 days
The unit was requested to start by the E-SCC. The unit would not phase automatically. The unit was started manually, but PSNH noted that the unit had poor voltage control. PSNH called in Eaton Electric who responded the next day. The voltage regulator was tested and monitored in the manual position. Eaton Electric found an undervoltage relay hung up. Eaton Electric repaired the relay and tested the voltage regulator in the automatic mode and it ran properly. The unit was returned to service.

C
10/5 – 0.5 days
The unit was called upon to run by the ISO. The unit failed to automatically phase to the system. The unit was successfully started on manual operation. PSNH noticed that the unit voltage was swinging. The undervoltage relay was checked (because it was suspect from Outage B above) and found to be okay. PSNH exercised the voltage regulator. No abnormalities were found.

PSNH notes that the voltage regulator is to be replaced in 2010 as it is original equipment and is no longer supported by the manufacturer.

D
10/19 – 0.1 days
Both combustion turbines were called to operate by ISO-NE. CT-2 did not start on command. PSNH investigation found that the control air valve was in the closed position when it should have been in the open position. This valve position irregularity explained the unit's failure to start.

PSNH notes that the unit responded as requested on 10/13/2009 without incident and that air conditioning work was performed on the air system prior to this event and after 10/13/2009. The isolation process for the air conditioning work did not involve this valve and did not involve tagging of any equipment. After the incident, PSNH questioned the personnel that performed the air system work, the Instrument and Control group, and the operations group. No other work was performed on the unit.

PSNH also noted that the computer at Merrimack Station used to track tag out operations was changed on February 10, 2010 and no tag out history was retained. The normal retention time for used tags is two weeks unless a safety incident occurs. Some of the above information came from personal archives.

Evaluation for Combustion Turbine Outages Except for Outage Merrimack CT 2-D
Accion reviewed the outages above and found them either to be reasonable and not unexpected for these units and their vintage, or necessary for proper operation of the unit. Accion concluded that PSNH conducted proper management oversight during these outages.

Evaluation for Merrimack CT 2-D
Operator error may have been the initiating cause for the event. However, PSNH was not able to determine a cause for the incident. As a result, the event cannot be reconstructed or have the root cause determined with a high degree of certainty. Although some events are saved for evaluation, there appears to be instances where events may not be able to be reconstructed after the fact. While Accion recommends that PSNH should be allowed to recover the replacement

power costs associated with this outage from its customers, it offers a recommendation in this regard below.

Recommendations

Related to Outage Merrimack CT 1-B

Accion recommends that fuse coordination, protection device placement, and lightning protection at this and surrounding locations be checked to ensure that optimum equipment protection is in place allowing the most reliable operation of these units.

Related to Outage Merrimack CT 2-D

Accion recommends that PSNH establish a process or procedure that expands its process for safety related incidents. PSNH should also save its used tags or other pertinent information when any abnormal switching, valving, or operation event takes place for internal investigative purposes. This recommendation applies to all PSNH generation facilities.

W. F. Wyman-4 Outages For 2009

W. F. Wyman-4 Station

The W. F. Wyman Station was sold in the 1990s to a competitive power supplier and competes in the New England competitive market to sell its power. PSNH is a minority owner (Approximately 3 percent) of Unit #4 at the station. Nextera Energy Resources (Nextera) owns the majority of the unit and is responsible for day-to-day operations. As a minority owner, PSNH is aware of how the plant conducts business. However, PSNH has little influence over day-to-day operations of the plant provided those operations are within wide operating bounds. This unit is a high cost oil unit that has tight environmental operating restrictions placed on it. The unit operates at an annual capacity factor of approximately 5 percent. Accion makes this distinction because it believes that the measurement of prudence is different than the measurement used for PSNH's wholly-owned and controlled units providing energy at cost to PSNH customers because of the extent of outside ownership.

The major project performed at Wyman-4 this year was the replacement of the economizer inlet header during the annual overhaul described in Outage J below.

W. F. Wyman-4

A
1/22 – 0.3 days
The fabric expansion joint at the induced draft fan was leaking and causing exhaust fumes to infiltrate the plant. The unit was taken out of service to repair the leak. The expansion joint was replaced and the unit returned to service.

B
1/24 – 0.1 days
The operator transferred to the automatic load demand control during startup with a throttle pressure that was greater than allowed, causing the swap to fail. The generator load target defaulted to zero and the unit tripped on reverse power relay operation. This outage was classified as an operator error. Nextera's investigation found that the reason that the load demand control did not function properly was that the operator attempted to place the boiler master control into automatic mode before placing the fuel oil controller into automatic mode first as required by procedure. Without both controls in automatic, the load demand control cannot switch to automatic control.

The operator was counseled. In addition and after the incident, Nextera made modifications to the controls and start up procedure and added insulation in areas where the addition of insulation could reduce the unit's long start-up time.

C
1/30 – 0.0 days
The boiler tripped on low air flow while at a low unit loading. The operator placed the 4th burner pair into service and a furnace pressure swing caused the unit to trip when air flow decreased below the trip point. Nextera determined that there was a control logic issue with draft fan air flow when the unit was at low load. As an interim measure, the air flow controller was kept in the manual mode until after the fourth burner pair was placed in service. The unit returned to service without incident. Accion notes that the control logic was changed to address this problem on 2/27/09.

D
2/6 – 0.1 days
The unit tripped on low drum pressure when the boiler feed pump tripped due to low suction pressure. While transferring the condensate polisher to a standby vessel, the outlet valve was left closed by the operator when it should have been opened. As a result, the deaerator level decreased to a point where the boiler feed pump starved initiating the incident. Nextera stated that the control room operator did not see the low deaerator alarm. This outage was classified as an operator error.

Nextera counseled both operators. In addition, a flow meter was installed at the condensate polisher so the control room operator can monitor polisher outflow rate and improved valve position marking was installed at the outlet valve.

E
2/24 – 0.0 days
The boiler tripped on an unsuccessful burner shutdown event. When a burner pair gang valve was closed to remove the burners from service, a limit switch failed to activate to satisfy the burner management controller logic that the oil valve to the burners was closed. Investigation found that the limit switch was in the need of cleaning. The switch was cleaned and tested. As a precaution, 30 other limit switches were tested and found to be operable. The unit returned to service without incident.

F
6/5 – 0.3 days
A planned maintenance outage was taken to perform replacement of the bus duct heaters. Nextera decided to replace the bus duct heaters because of issues that occurred in 2008 and were reviewed as part of the 2008 reconciliation docket.

G
6/30 – 0.4 days
A planned maintenance outage was taken to perform replacement of the bus duct heaters. Nextera decided to replace the bus duct heaters because of issues that occurred in 2008 and were reviewed as part of the 2008 reconciliation docket.

H
8/10 – 0.1 days
The unit tripped due to low drum pressure caused by a trip of the boiler feed pump. As the unit was loaded, the condensate pump discharge pump failed in the open position causing the deaerator level to drop and subsequently tripping the boiler feed pump. Investigation found that the valve motor actuator bushing key failed thus decoupling the valve from its actuator. The actuator bushing key failed because it fell out of position because the original design never had a key retaining device. The valve was repaired with the addition of a key retaining device and the unit returned to service. Nextera also added key retaining devices to all like valves.

I
8/11 – 0.1 days
The control room operator attempted repeat starts on a burner pair which induced a furnace pressure swing that tripped the boiler on low furnace pressure. This outage was classified as an operator error. Investigation found that the operator did not follow procedure by attempting repeat starts of the burner pair. Apparently, each start attempt pulses other items such as air flow dampers etc. which caused the boiler pressure excursion. The unit was restarted without incident. Subsequent to this outage, Nextera introduced a 30 second delay into the burner start up logic which prevents repeated start attempts and corresponding compound pulses to other equipment.

J
11/6 – 30.1 days
This planned outage was taken to perform the annual overhaul of the unit. In addition to regularly scheduled maintenance, the economizer inlet header was replaced. The economizer work controlled the outage and the outage was completed within the ISO-NE scheduled outage window.

K
12/21 – 0.0 days
The boiler tripped on low combustion air flow tripping the unit. Investigation found that the thermal couple which supplied the temperature value to the combustion air flow

calculation had an internal lead failure in its sensing element. The internal lead failure resulted in a 1300^{o} F temperature (much higher than actual) feeding into the calculation resulting in a reduction in air flow and incomplete combustion. The thermocouple and sensor were replaced and the unit returned to service. Subsequent to the outage, high/low limits were added to the digital control system for this point and other similar points.

Evaluation Except for Outages Wyman 4-B, 4-D, and 4-I

Accion reviewed the outages above and found them either to be reasonable and not unexpected for this unit and its vintage, or necessary for proper operation of the unit. Accion concluded that PSNH conducted proper management oversight.

Evaluation of Outages Wyman 4-B, 4-D, and 4-I

Nextera classified each of these outages as operator error. Although operator error was the direct cause, Accion finds that operator attention, operator awareness, operator understanding of procedures, and operator lack of understanding that procedures must be followed are the causes of these outages. All of these issues relate to training inadequacy of the operators involved. Accion recommends that the replacement power costs associated with these outages not be passed on to customers.

Stipulation Items from the 2008 Energy Service/Stranded Cost Recovery Review (Docket DE 09-091)

During the 2008 Energy Service/Stranded Cost Recovery Review conducted in 2009 in Docket DE 09-091, Public Service of New Hampshire (PSNH) and the parties stipulated to a number of items to resolve outstanding issues in the case (Stipulation). The formal Stipulation was signed on November 20, 2009. The actions taken by PSNH on each stipulated items and Accion comments follow.

1 - Mitigation of Customer Costs

From Section II-A of the Stipulation, PSNH was to provide its efforts to mitigate customer costs related to certain 2008 generating unit outages: Outage MK-2 E, Outage NEW 1-C, and Outage NEW 1-D.

Outage MK-2E

When the new HP/IP turbine experienced problems due to foreign material intrusion, it essentially became "used equipment". Siemens would normally reduce any warrantees for used equipment and could then claim that the performance guarantees given for the "new" HP/IP turbine were no longer valid.

Rather than pursue a host of smaller settlements with Siemens on multiple contracts, PSNH decided that it would have more leverage in negotiations if it were to pursue a global settlement. To that end, a global settlement was reached with Siemens that produced the following credits to customers. PSNH:

- Reduced the MK-2 exciter rental payments from October 2008 through April 2009 by $784,000;
- Maintained the 10-year warranty for the HP/IP turbine as if it were new equipment. While savings cannot be quantified, the value of this extended warranty is high, especially when considering the large risks of a turbine failure;
- Negotiated the reinstatement of the performance guarantees for the HP/IP turbine as if it were new equipment. The value of this settlement will only be known after the termination of the guarantees, but PSNH believes that it could be worth millions of dollars over the life of the turbine;
- PSNH deferred making $7 million in performance payments to Siemens from May 2008 until December 2009, saving approximately one million dollars.

Accion believes PSNH made the correct judgment in its global approach for two reasons. PSNH protected its customers against future damage claims that may result from future HP/IP problems and assured the preservation of the economics of the project as originally

envisioned for customers. Accion believes that this approach in turn kept Siemens very sharp in their rework efforts at their facility in North Carolina.

In addition to the these credits, customers were insulated from replacement power costs due to PSNH procuring insurance. Because this outage was more than 60 days after the initial event, all replacement power costs were covered by insurance other than those that would have taken place despite the outage. In that regard, PSNH did have to credit the normal 4-week maintenance outage that would have taken place during the spring of 2009, so 14 weeks of replacement power costs (out of 18 weeks) were covered by insurance.

Accion believes that if replacement power costs are contractually included in PSNH vendor contracts, customers will pay for those costs through higher charges from the manufacturer.

PSNH customers received an additional benefit that is not so evident. The fact that MK-2 ran for 18-months instead of the normal one year between maintenance outages, customers in essence received one-half of a maintenance outage for free (i.e., two weeks of replacement power costs). Accion estimates customer savings for these two weeks of replacement power cost savings to be noteworthy. For each day PSNH received insurance payment for replacement power costs for MK-2, customers received $77,000 for each $10/MWH differential between MK-2 and the market energy price (320MW x $10 x 24 hours). That represents $1.1 million in savings for the two-week reduction in the maintenance cycle mentioned above for each $10/MWH of energy differential to market price.

To date, PSNH submitted claims totaling $13,871,020 for replacement power costs from July 2008 through December 2009, $3,000,000 has been received, and $10,871,020 is outstanding. Also to date, PSNH submitted $19,800,211 in boiler and machinery claims, with another $1,215,874 of claims yet to be submitted, $13,000,000 has been received from the insurance company, and $8,016,085 is outstanding subject to a $1,000,000 deductible.
Accion considers its review of this outage complete, recommends that PSNH file a report with the Commission with the final figures regarding insurance payments when known.

Outage New 1C and Outage NEW 1-D

The repair/cost of the Newington exciter was approximately $1.8 million. The insurance policy had a $1 million deductible clause, which PSNH paid. Insurance paid the remaining $800,000, which has been credited to customers. All payments have been received and this issue is financially closed.

Accion believes that PSNH customers actually received $800,000 in benefit from this outage. PSNH customers essentially traded a 35-year old exciter for a brand new exciter discounted to a price of $1 million. The exciter was becoming obsolete and was on the planning horizon for replacement and customers would have then had to pay the entire $1.8 million as a normal cost of doing business. The value of the Newington exciter was included in the global Siemens settlement surrounding the Merrimack 2 HP/IP turbine.

Accion considers its review of this outage complete and recommends closure.

2 – Schiller Warranty Items

From Section II-A of the Stipulation, PSNH agreed to submit a report by February 1, 2010, regarding the issues of Alstom's warranty (and performance) issues relating to the outages at Schiller-5 and to continue to file such reports until all issues are resolved.

On February 1, 2010, PSNH filed its first report in this regard. Accion presents its discussion on an issue by issue basis below:

Air Damper Shaft Linkage Workmanship

The issues stemmed from an outage where the air damper shaft was not attached. PSNH believed the issue was due to workmanship issues.

The entire linkage was replaced by Alstom at their cost. After a year of operation, PSNH made additional non-warranty improvements at their cost to ensure long-term reliability operation of the unit.

PSNH considers this issue closed.

Inlet Header Economizer Tube Stress Cracks

A leak had occurred at the economizer inlet tube after the warranty period had expired. Investigation revealed that the stress crack did not show up in non-destructive examination conducted in the previous spring. PSNH conducted non-destructive examination of the remaining similar welds and found no issues.

Both PSNH and Alstom concluded that this was an isolated incident, that it occurred after warranty, and that it is not covered under warranty.

PSNH considers this issue closed.

Forced Draft and Induced Draft Fan Capabilities Under Soft Start Conditions

During a start-up in February of 2008, the forced draft fan faulted. The repair used a higher class of insulation (type H versus installed type F) to endure soft start conditions. PSNH discovered that the induced draft fan has the same issue. PSNH has ordered new

FD and ID fan motors capable of soft start capability. PSNH will rewind the existing motors to specifications and retain them as spares.

Soft start capability was requested by PSNH by design. This item is still in negotiations.

Alarm Point Mis-set

PSNH fount that the inboard bearing on the forced draft was hot when bearing oil filter plugged. The bearing should have alarmed at 90^{o} C but did not as Alstom set the bearing alarm at 100^{o} C. The bearing reached 95^{o} C and was not damaged. PSNH set the alarm point to the proper value, checked other alarm point settings, and found no major problems.

With no damage, there is no warranty issue and PSNH considers the issue closed.

Inlet Duct Design

The inlet duct experienced vibration and required additional stiffening. Alstom redesigned the inlet duct and the complete physical modification was made at Alstom's cost.

PSNH considerers this issue closed.

Induced Draft Fan Circuit Board Failure

The induced draft fan tripped when an associated circuit board failed which then tripped the unit.

Both PSNH and Alstom concluded that this was an isolated incident, that it occurred after warranty, and that it is not covered under warranty.

PSNH considers this issue closed.

Vortex Finder Design

Alstom completed Vortex Finder repairs and attachment upgrades in 2007 under warranty. The Vortex Finder failure occurred when the lower half of one Vortex Finder failed at a factory weld in 2008. PSNH installed a new and redesigned Vortex Finder in 2008 and replaced the remaining 5 Vortex Finders in 2009 at its cost.

With no warranty, PSNH considers this matter closed.

Air Heater Design

The air heater has experienced excessive leakage due to air heater corrosion and tube failures. The air heater leaks result in the unit operating at reduced loads and difficulty in

controlling the bed materials. The costs of this re-tubing and other air heater design issues are being discussed with Alstom under contract claims provisions.

PSNH retubed a portion of the air heater in 2009 and installed new sleeves in 2010.

This item and other air heater design issues remain open and in negotiations. PSNH is going to mediation in accordance with the contract.

Accion agrees with the PSNH resolution of the items to date and considers the resolutions reasonable. Accion recommends that Item 2 remain open and that PSNH file an update prior to the review of the 2010 Stranded Cost recovery Charge.

3 - Review of Isophase Bus Duct at Merrimack and Schiller Stations

From Section II-A of the Stipulation, PSNH agreed to perform an evaluation of the need for isophase bus duct heaters at Merrimack and Schiller stations.

In response to STAFF 01-033, PSNH filed its evaluation of the need for bus duct heaters at Merrimack and Schiller stations. PSNH engaged Eaton Electric to perform the evaluation.[1] Eaton noted that the failure at W. F. Wyman #4 was on a long run (200 feet) of non-segregated bus, not on the isophase bus as reported. Eaton investigated each section of non-segregated bus and isophase bus at both Schiller and Merrimack. Their conclusion was that both Merrimack and Schiller stations are at low risk of bus duct failures because:

- Merrimack and Schiller stations do not have long runs on non-segregated bus duct
- Non-segregated bus duct is limited at the station and is routinely cleaned and tested during annual overhauls.

Eaton Electric does not recommend installation of bus duct heaters at either Merrimack or Schiller stations. Eaton Electric also notes that much of the non-segregated bus duct is within the plant and thus in a heated environment that is much less likely to be subjected to moisture conditions.

Accion accepts PSNH‘s report and recommends that bus duct heaters are not required at Merrimack and Schiller stations for reliable operations.

Accion recommends closure of this Stipulation item.

4 - Review of Low Oil Alarm Procedures

From Section II-A of the Stipulation, PSNH agreed to review its procedures when a low oil alarm for hydro unit bearings is received at the Electric-System Control Center (E-SCC).

[1] Eaton Electric made the bus duct heater repairs at W. F. Wyman #4. That Wyman #4 outage was the outage that generated this recommendation.

In response to STAFF 01-034, PSNH filed its report regarding its review of its procedure when a low oil alarm is received by the E-SCC dispatcher. The concern was that "low oil" could be "no oil" resulting in damage to the unit's bearings. The PSNH determination was that no changes should be made to dispatcher action upon the receipt of a "low oil" alarm because a unit shutdown is initiated if a "low oil" alarm is received. When an alarm is received, a field investigation is performed prior to restarting the unit. In addition, the PSNH evaluated the trip point settings and determined that they were adequate to prevent damage.

PSNH also states that it began upgrading the "low oil" protection system on hydro bearings late in 2008. The upgrade provides for two sensing devices. The first device will provide an alarm for "low oil" (or "no oil") much like the current system, but also includes a controlled shutdown of the unit at a preset high bearing temperature which protects the integrity of the bearing. PSNH plans to have the upgraded protection systems installed on all hydro units by the end of 2010.

Accion accepts PSNH's review of the dispatcher action when a "low oil" alarm is received as a reasonable approach to the issue carried out over a reasonable timetable. Accion also notes that the PSNH procedure was not clear at the time its recommendation was made in that an operator would be dispatched to the unit generating the alarm prior to restarting the unit.

Accion recommends closure of this Stipulation item.

5 - Interconnection of PSNH Generating Units to the PSNH Distribution System

From Section IIA of the Stipulation, PSNH agreed to perform an interconnection analysis of all its units connected to its lower voltage distribution system. The reason for the analysis is that over the years, many incorrect unit trips occurred for unrelated system outages. This analysis is an effort to determine if protection coordination is part of the problem. PSNH additionally committed to file a report on its progress on this matter to date along with an estimated completion schedule with the Commission for review in the 2009 Stranded Cost Recovery Review.

PSNH filed a progress report with the Commission in this regard on May 7, 2010. As of April 30, 2010, PSNH had completed its under voltage study of the units, issued letters for relay setting changes, and completed field changes. PSNH found that most of the under voltage relays were set approximately 33 percent higher than they should have been. The protection margin at the Canaan hydro station is less than desirable because of the long lines and light loadings in the area, but is deemed adequate by PSNH.[2] These settings would account for some of the over trip outages.

[2] Accion notes that many of the over trips occurred at Canaan and suspects that other coordination issues exist in this area of the system due to the topology of the system.

PSNH is in the process of completing protection coordination studies[3] and has completed the studies at two hydro stations. These stations were analyzed to coordinate with major construction activity occurring at these stations. PSNH has plans to conduct other station coordination studies with other construction activity (requiring coordination studies themselves) that will take place in the near future.

In 2011, Gorham coordination analysis will be completed as part of the planned transformer replacement and Hooksett coordination analysis will be completed as part of the planned breaker replacement. In addition, Cannan coordination will be analyzed in an attempt to improve coordination and reduce unit trips with no projects planned.

PSNH did not include the Schiller combustion turbine in its low voltage analysis because the combustion turbine's normal connection is to the 115kV system and not the lower voltage distribution system. As part of the current review process, PSNH has agreed to include this unit in its analysis.

PSNH is just beginning its evaluation of the settings of over speed relays for these units.

Accion believes that good progress is being made in both understanding the issues caused by poor distribution coordination and in addressing them. Accion recommends that this Stipulation item remain open and that PSNH file an additional report with the Commission prior to review of the 2010 Stranded Cost Recovery Charge.

6 - Establish a Relay Test Program

From Section II-A of the Stipulation, PSNH agreed to establish a formal relay test program for all its units connected to the lower voltage distribution system as review found that one was not in place. PSNH additionally committed to file a report on its progress on this matter to date along with an estimated completion schedule with the Commission for review in the 2009 Stranded Cost Recovery Review.

PSNH filed a progress report with the Commission in this regard on May 7, 2010. As of April 30, 2010, PSNH had completed placing the NPCC relay testing program in place for under frequency load shedding relays for those stations where NPCC compliance is applicable and has completed the required NPCC relay testing.

For station relays subject to NPCC relay testing requirements, PSNH created the Generation Protection System Maintenance and Testing Procedure (GEN 8114). All applicable relays have been tested. For station relays not subject to NPCC testing requirements, PSNH created the PSNH Hydro, Protective Relay Test Procedure. All applicable relays have been tested.

[3] Protection coordination studies are performed to ensure that system protection equipment such as relays, circuit breakers, fuses, etc. operate in the proper sequence. For example, a fuse on a remote line tap should operate prior to a recloser halfway back to the substation, which should operate before operation of the substation circuit breaker.

Again, PSNH did not include the Schiller combustion turbine in its low voltage analysis because the combustion turbine's normal connection is to the 115kV system and not the lower voltage distribution system. As part of the current review process, PSNH has agreed to include this unit in its analysis.[4]

Accion recommends closure of this Stipulation item.

7 - Evaluate Procurement of Critical Spare Generator and Turbine Components, Physically or Contractually

From Section II-A of the Stipulation, PSNH agreed to perform an evaluation of procuring spare critical generator and turbine components or entering into arrangements with others (i.e. vendors, manufacturers, etc.) to reduce the risk of catastrophic failures.

PSNH made the determination that procurement of spare parts for critical components should be done on a case-by-case basis. No formal evaluations were made or formal contracts were put into place. PSNH reasoning was that

- PSNH held extensive discussions with Siemens on this topic. Siemens informed PSNH that few utilities have spare steam turbine or generator components and some that do, are upgrading those components to gain efficiency (renders spares useless)
- Up-front cost can run into millions of dollars
- There are storage issues such as space, cost, and controlled atmosphere
- Some major components that fit many units are now in "seed" programs[5]
- Major suppliers are improving steam turbine blade fabrication time
- PSNH has an inventory of spare critical components and continues to add to it as warranted. Those items include a spare Schiller LP rotor (had 3 units), MK-2 extension shaft (rebuilt old), in process of procuring Newington ID and FD fans (rebuild old), and MK-2 generator stator coils
- Utility cooperation has decreased markedly with competition requiring each utility to bear all costs

Accion accepts PSNH reasoning that unless a business case can be made under deregulated market conditions that major spare components should be procured on a case-by-case basis. Accion recommends that this Stipulation item be closed.

[4] Accion notes that due to the 115kV normal connection for this unit, it is subject to much stricter relay testing requirements.

[5] For example, Newington received a seed exciter when its exciter failed. The Newington exciter became the seed exciter and ironically that exciter replaced the Merrimack 2 exciter upon its failure.

8 - Hold Manufacturers Responsible for Unreasonable Delays of Shipments of Major Components and Have Shipment Plans in Place

From Section II-A of the Stipulation, PSNH agreed to ensure that contractual arrangements with the manufacturer will hold the manufacturer responsible for unreasonable (shipping) delay of and that the manufacturer have plans in place for shipping major components.

PSNH engaged Siemens to review transportation policies with consideration of the following points:

- Unit outage schedules are approved by ISO-NE and once approved, they are finalized
- Detailed shop inspection can markedly change return schedule based on the condition of the component as determined by the inspection
- Pre-confirm weights and widths so they can be factored into transportation plan (permit or non permit load by state), work plan, and schedule
- Perform as much field work as possible
- Use of professional transportation experts who know where shipping restrictions may occur

Based on these discussions, PSNH has implemented changes to its outage scheduling. For items that are on or close to critical path, the outage start day will begin to optimize transportation logistics so outage time is minimized because of transportation delays (permit loads, construction restrictions etc.) PSNH will also hold formal discussions with the vendor's transportation department as warranted to seek shortest schedule considering potential contingencies.

PSNH implemented this procedure during the repair of the Merrinmack-2 HP/IP turbine in 2009. During that outage, Siemens committed to a firm return date in its contract. Discussions were held with Siemens at least twice a week during the outage to determine schedule changes based on Siemens shop schedules and revised transportation plans were made. PSNH in turn factored these changes into its work force scheduling to take advantage of any schedule gains. At one point during the outage, Siemens was at least one week ahead of schedule, committed to try and meet the revised schedule, but also reminded PSNH that its contractual return date remained as stated in the signed contract.

PSNH contractually burdens the vendor and trucking company with the obligation to "carry safely" and "arrive timely".

Accion believes that the process worked well and that both PSNH and Siemens were well in tune with what the other party was doing. Accion recommends that due to the critical nature and financial consequences to customers from transportation mishaps, that PSNH evaluate if additional tools such as GPS, speed and shock recorders, or other devices or methods should be employed to further augment its "carry safely" and "arrive timely" goals. Upon agreement by PSNH with the preceding recommendation, Accion recommends closure of this Stipulation item.

9 - Perform Own Review of Maintenance Outage Cycle Extensions

From Section II-A of the Stipulation, PSNH agreed to perform its own analysis of outage maintenance cycle extension rather than rely solely on the manufacturer's recommendation associated with major components.

This item was made an issue due to Accion's experience reviewing other utilities' generating unit outages. Accion noted that manufacturers were recommending the extension of maintenance time for some major generator and turbine components. These recommendations were accepted by the utility (most likely to gain efficiency in a competitive market) and major failures sometimes occurred prior to reaching the extended maintenance cycle.

PSNH states that manufacturer recommendations are an important technical input to the maintenance decision making process, but do not dictate the timing or the scope of the work to be performed. PSNH also factors in last repairs, current condition, historical knowledge, non-destructive examination information, PSNH equipment specialist's experience, the number of starts/stops, and hours of operation into its decision.

Accion accepts PSNH's approach for maintenance cycle outage planning. Accion recommends closure of this Stipulation item.

10 - Transmission and Distribution Personnel Protocol in Substations Containing PSNH Generating Units

From Section III-D of the Stipulation, PSNH agreed to establish a protocol for transmission and distribution workers performing activities in substations containing PSNH generating units.

PSNH established and implemented a protocol for transmission and distribution workers performing activities in substations containing PSNH generating units and has integrated the protocol into its key card access system and dispatcher notification requirements. PSNH hydro access policy requires that each access request be decided on an individual basis. Work activities are prioritized according to the level of work to be performed in relation to the potential to cause a unit outage. For example, delivering a part to the job site is a lower priority than snow removal within the station which in turn is a lower priority than performing electrical testing on station equipment.

All Northeast Utilities (NU) employees must be trained to the level of work being performed in order to oversee that work. Non-employees cannot have unescorted access and NU escorts may only escort persons of their skill level or lower.

Accion accepts PSNH's protocol for work activity in PSNH generating stations. Accion recommends that this Stipulation item be closed.

11 – Other Agreements

From Section II-A of the Stipulation, PSNH accepted the recommendation that National Electrical Safety Code patrols be performed on all distribution facilities on a four-year schedule.

From Section II-A of the Stipulation, PSNH accepted the recommendation that PSNH address danger trees outside of the 34.5kV right-of-way and determine where PSNH does and does not have rights to remove such danger trees.

Both of these recommendations were transferred to the PSNH 2009 Reliability Enhancement Improvement Program review contained in the then current PSNH distribution rate case review, Docket DE 09-035 where they would be addressed.

Accion has no analysis or recommendations regarding these two stipulated items.

Accion Recommendation Summary

1 - Mitigation of Customer Costs Related to Certain 2008 Generating Unit Outages

- Leave Outage MK-2E open - Capture final monetary resolution and file report with Commission prior to the next SCRC.
- Close Outage NEW 1-C – Commitment satisfied.
- Close Outage NEW 1-D – Commitment satisfied.

2 – Schiller Warranty Items

- Close Air Damper Shaft Linkage Workmanship – Issue resolved.
- Close Inlet Header Economizer Tube Stress Cracks – Issue resolved.
- Leave open Forced Draft and Induced Draft Fan Capabilities Under Soft Start Conditions – Negotiations still in progress.
- Close Alarm Point Mis-set – Issue resolved.
- Close Inlet Duct Design – Issue resolved.
- Close Induced Draft Fan Circuit Board Failure – Issue resolved.
- Close Vortex Finder – Issue resolved.
- Leave open Air Heater Design – Negotiations still in progress.

- File report with Commission on remaining open items prior to the 2010 Stranded Cost Recovery Charge review.

3 - Review of Isophase Bus Duct at Merrimack and Schiller Stations

- Close – Commitment satisfied.

4 - Review of Low Oil Alarm Procedures

- Close – Commitment satisfied.

5 - Interconnection of PSNH Generating Units to the PSNH Distribution System

- Leave open – Analysis and implementation incomplete. PSNH to include Schiller CT in its analysis and a review of over unit speed relays. File additional report with the Commission prior to the 2010 Stranded Cost Recovery Charge review.

6 - Establish a Relay Test Program

- Close – Commitment satisfied.

7 - Evaluate Procurement of Critical Spare Generator and Turbine Components, Physically or Contractually

- Close – Commitment satisfied.

8 - Hold Manufacturers Responsible for Unreasonable Delays of Shipments of Major Components and Have Shipment Plans in Place

- Close on contingent basis – Commitment completed upon PSNH acceptance of additional recommendation of further review.

9 - Perform Own Review of Maintenance Outage Cycle Extensions

- Close – Commitment satisfied.

10 - Transmission and Distribution Personnel Protocol in Substations Containing PSNH Generating Units

- Close – Commitment satisfied.

11 – Other Agreements

- Not applicable to this review – NESC inspection frequency and danger trees are now part of Docket DE 09-035.