

Hydroelectric Unit Outages For 2008

The following describes the outages at PSNH's hydroelectric (hydro) units during 2008. The outage durations listed have been stated as the actual duration of the total outage regardless whether there was water to run the unit. Liberty indicates water availability by a "Y" or "N" next to the outage designation.

Amoskeag Station

Major planned projects at this station included installation of inflatable flashboards to satisfy minimum bypass flow requirements and resurfacing a portion of the dam. Due to high river flows throughout the year and the requirement to keep the pond level below the crest of the dam for the inflatable flashboard project, no annual inspections were made at Amoskeag in 2008. The units were closely monitored for potential problems.

Amoskeag - 1

A

4/11 – 0.02 days – Y

This outage occurred during 2007 and not 2008. It was incorrectly reported. (Also see Outage 2-A and Outage 3-A below)

B

4/15 – 0.25 days – Y

The potential transformer between transformer TB-26 and the TB-26 breaker failed at Eddy substation. The J-114 115 kV breaker was being replaced at the time of the potential transformer failure and the Eddy substation was out of normal configuration with the 358 and 359 34.5 kV lines open at the Rimmon end. Amoskeag is fed directly off of the Eddy 34.5 kV bus and when clearing the potential transformer fault, the Amoskeag generation became momentarily isolated from the system causing the unit to trip.

PSNH reported that the J-114 breaker was being replaced as part of a Northeast Utilities planned breaker replacement project to address its aging circuit breaker population. Replacement dates were based on repair history, availability of spare parts, maintenance costs, and environmental risk.

The master HFA relay coil at Amoskeag also overheated and needed replacement possibly due to sticking contacts on a differential lockout device. All differential lockouts on all units were cleaned, lubed and tested. The units were returned to service. (Also see Outage 2-B and Outage 3-B below)

C

12/5 – 0.03 days – Y

This was a scheduled shutdown of the unit to perform the annual black start and other related emergency tests. The testing could not be done during low flow periods due to inflatable

flashboard work on the dam crest, the requirement to keep pond level below the crest of the dam, and the high water flows experienced during the flashboard work period. After successful completion of the tests, the unit was returned to service. (Also see Outage 2-D and Outage 3-D below)

Amoskeag – 2

A

4/11 – 0.2 days – Y

See dialogue in Outage 1-A above.

B

4/15 – 0.0 days – Y

This outage happened at the same time as Outage 1-B above which explains the outage in detail.

C

6/8 – 0.06 days – N

The unit tripped off line due to a high thrust bearing temperature caused by both high ambient temperatures inside and outside of the building (95 degrees F). Ventilation filters were removed to allow more circulation of air, the bearing was checked, and the unit returned to service. PSNH noted that the fans were replaced with higher volume fans in 2009.

D

12/5 – 0.03 days – Y

This outage happened at the same time as Outage 1-C above which explains the outage in detail.

Amoskeag – 3

A

4/11 – 0.2 – Y

See dialogue in Outage 1-A above.

B

4/15 – 0.04 days – Y

This outage happened at the same time as Outage 1-B above which explains the outage in detail.

C

5/28 – 0.2 days – N

The unit tripped due to activation of the pond control system. The wastegate at Hooksett hydro (7 miles upstream) was closed and caused a sag in the river activating the pond control system. Water flows were such that only this unit was on line at the time, the unit was at minimum load, and would have had to come off line at any time soon anyway.

D

12/5 – 0.03 days – Y

This outage happened at the same time as Outage 1-C above which explains the outage in detail.

Ayer's Island

Major projects at Ayer's Island for 2008 included installation of new trash racks, finalization of the new Osprey camera system which can be accessed by the public (At PSNH.com) and paving of the new parking area.

Ayer's Island – 1

A

3/6 – 0.08 days – N

The unit tripped after phasing on reverse power (initial load not matching minimum excitation settings) when it failed to pick up load. PSNH adjusted the governor control unit and the unit returned to service. (Also see related Outage 1-G below)

B

7/14 – 4.13 days – N

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. In addition, generation maintenance inspected, cleaned and adjusted the governor.

C

7/21 – 0.07 days – Y

The unit tripped on overspeed. The operator found nothing wrong, reset the overspeed relay, and returned the unit to service. The operator also called for the overspeed controls to be checked. (See Outage 1-D below)

D

7/21 – 0.06 days – Y

The unit again tripped on overspeed while the overspeed controls were being checked. Investigation found that the mechanical overspeed switch failed. The failed switch was removed and the electronic overspeed controls were tested prior to returning the unit to service. A spare mechanical overspeed switch was ordered that day for installation during the 2009 annual inspection. The failed switch was sent out for repair and will serve as a spare when returned.

E

9/15 – 0.25 days – Y

This was a scheduled outage for the entire station to ensure diver safety during installation of the new trash racks. (Also see Outage 2-D and Outage 3-B below)

F

9/17 – 0.18 days – N

This was a scheduled outage to ensure diver safety during installation of the new trash racks.

G

10/8 – 0.30 days – Y

The unit tripped when the unit would not pick up load after phasing. Investigation found that the SCADA panel relay had failed. The relay was replaced, an operational check made, and the unit returned to service. A spare relay was also ordered. PSNH believes that this relay was the root cause of Outage A above because if the relay temporarily stuck, it would have driven the governor motor to minimum settings causing the unit to trip.

Ayer's Island – 2

A

2/11 – 2.45 – N

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

B

7/19 – 0.02 days – N

The unit tripped on overspeed due to a line fault on the 3114 34.5 kV line and the opening and closing of that circuit at the Pemigewasset substation. The Ayers Island generation is fed out of the Pemigewasset substation by the radial 3149 34.5 kV line. This is an overtrip condition. The PSNH standard practice is to not specify reclosing times less than 5 seconds on a circuit such as the 3114 34.4 kV line and the 3149 34.5 kV line to Ayer's Island.

This is an area of apparent mis-coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

C

7/28 – 0.01 – Y

The unit tripped due to a high lower guide bearing temperature. The temperature in the building was at 90 degrees F with all fans in operation. An operator happened to be present and checked the guide bearing temperature. It was found to be 58 degrees C compared to the trip setting of 60 degrees C. The bearing and the temperature device were checked and the unit was returned to service. PSNH will install a new wall fan later in 2008 and will have a fan operational when generating. The wheel pit fan will be thermostatically controlled to operate when air temperature is 70 degrees F.

D

9/15 – 0.25 days – Y

This outage happened at the same time as Outage 1-E above which explains the outage in detail.

E

9/18 – 0.40 days – N

This was a scheduled unit shutdown to ensure diver safety during the installation of the new trash rack.

F

9/19 – 0.04 days – N

This was a scheduled unit shutdown to ensure diver safety during the installation of the new trash rack.

G

9/20 – 0.26 days – N

This was a scheduled unit shutdown to ensure diver safety during the installation of the new trash rack.

H

9/22 – 0.37 days – N

This was a scheduled unit shutdown to ensure diver safety during the installation of the new trash rack.

I

9/23 – 0.32 days – N

This was a scheduled unit shutdown to ensure diver safety during the installation of the new trash rack.

J

9/24 – 0.31 days – N

This was a scheduled unit shutdown to ensure diver safety during the installation of the new trash rack.

K

9/25 – 0.29 days – N

This was a scheduled unit shutdown to ensure diver safety during the installation of the new trash rack.

L

10/3 – 0.01 days – Y

The unit was taken off line when an operator saw a shiny spot on the exciter commutator. Inspection revealed that one of the brush holders had moved. The brush holder was adjusted, the other brush holders were checked, and the unit was returned to service.

Ayer's Island – 3

A

9/13 – 0.34 days – N

This was a scheduled unit shutdown to ensure diver safety during the installation of the new trash rack.

B

9/15 – 0.05 days – Y

This outage happened at the same time as Outage 1-E above which explains the outage in detail.

C

10/20 – 4.33 days – N

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

Canaan

Major activities at this station in 2008 included relicensing studies, since Canaan's FERC license is currently undergoing FERC review. Major construction projects may be required to satisfy future license requirements dictated by the Vermont Water Quality Certificate. PSNH is currently appealing the conditions imposed. In 2008, extensive retaining wall repairs were made. The penstock is scheduled to be replaced in 2009.

Canaan – 1

A

3/6 – 0.07 days – Y

A fault occurred on the VELCO system which is tapped off of the PSNH 355X10 34.5 kV line. The phase conductor came down and Canaan tripped at the same time. No breaker operations occurred on the PSNH system. VELCO opened the J-510 switch to isolate the area to facilitate VELCO repairs and the unit returned to service.

This is an area of apparent mis-coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

B

3/6 – 0.01 days – Y

PSNH closed the J-510 switch to restore service to the VELCO load tapped off of the PSNH 355X10 34.5 kV line at VELCO's request. When closed, the unit tripped. There were no breaker operations on the PSNH system. The switch was opened and the unit returned to service.

This is an area of apparent mis-coordination. PSNH states that future review is required. Please see recommendation at end of this report.

C

4/23 – 0.09 days – Y

Lightning was being experienced in the area. The 0355 34.5 kV breaker at Lost Nation tripped and reclosed. The unit was temporarily isolated from the system and tripped on overspeed.

PSNH also reported one operation of the 357 breaker. The 357 breaker trips on undervoltage. The unit returned to service without incident when released by the dispatcher.

This is an area of apparent mis-coordination coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

D

5/15 – 0.06 days – Y

The former Groveton Village substation was in the process of being decommissioned when a piece of falling steel caused contact in the substation. The piece of steel fell on to a neutral wire below causing the poles to move and caused the phase conductors of the mobile transformer (Feeding the 13H1 circuit) to slap together. The 0355 34.5 kV breaker at Lost Nation properly tripped and reclosed because the point of contact was beyond the high side fuse protection of the mobile transformer. The unit was temporarily isolated from the system and tripped on overspeed. PSNH also reported one operation of the 357 breaker. While cutting steel, the torch man did not cut a piece of steel all the way through as he should have causing the steel to pivot on the remaining steel hinge as it fell. When the hinge broke, the steel fell in an unexpected direction towards the neutral conductor. The torch man had a ground spotter for safety and was counseled after the incident. Liberty views this incident as accidental. The unit returned to service when released by the dispatcher.

E

5/23 – 0.09 days – Y

A tree fell on the 355X line causing the 0355 34.5 kV breaker at Lost Nation to trip and reclose. The unit was temporarily isolated from the system and tripped on overspeed. The 355 right of way underwent trimming in 2007, however the subject tree was located outside of the right of way. PSNH states that danger trees were removed and side trimming was done on the right of way in 2007 when those vegetation programs commenced. PSNH further states that many of their old easements including those at issue here do not contain language that specifically provides rights to take down trees outside of the easement. The unit returned to service when released by the dispatcher.

F

5/31 – 0.14 days – Y

The center phase wire came off its insulator during a storm due to a broken tie wire causing the 0355 34.5 kV breaker at Lost Nation to trip and reclose twice. The unit was temporarily isolated from the system and tripped on overspeed. Voltage sensing switch 355-J9 also operated and isolated the Canaan unit at the same time. PSNH states that all 34.5 kV lines in rights of way were thermographically inspected aerially in 2007 – 2008. The 355 line was inspected on May 17, 2008 and a broken tie wire was not identified at that time. PSNH also states that declining REP funding has caused constraints and other types of patrols were not performed. Repairs were made and the unit returned to service.

G

6/10 – 0.10 days – Y

The northern part of the PSNH system was experiencing a severe lighting storm. 115 kV breakers D-1420 and S-1360 tripped and locked out at Whitefield isolating the Lost Nation and Berlin substations except by the 376 34.5 kV line between Whitefield and Lost Nation. A tree that had fallen from the edge of the right of way was found on the D-142 115 kV line between Whitefield and Lost Nation. The TB-33 transformer opened at Lost Nation causing loss of power to the 355 34.5 kV line and the trip of the Canaan unit. The fault condition needed to be isolated prior to re-energizing the 115 kV system. During this series of events, the Canaan unit, Smith hydro, and Gorham G-2 tripped. The dispatcher removed the remaining 3 units at Gorham from service. The D-142 right of way was mowed in 2003 and was scheduled for mowing in 2009. PSNH states that they have a 10-year side trim maintenance program and that the edge of the rights of way is patrolled every two years to identify and correct hazardous conditions. The unit returned to service when released by the dispatcher.

H

6/10 – 0.09 days – Y

Lightning was being experienced in the area. The 0355 34.5 kV breaker at Lost Nation tripped and reclosed. The unit was temporarily isolated from the system and tripped on overspeed. PSNH also reported one operation of the 357 breaker on undervoltage. The unit returned to service without incident.

I

8/13 – 0.01 days – Y

A loon flew into the 355X10 34.5 kV distribution line in Stewartstown. A 40T fuse on one phase operated and cleared the fault. There were no breaker operations on the PSNH distribution system and the Canaan unit tripped at the same time. Repairs were made, the other fuses were visually inspected, and the unit returned to service. PSNH checked fuse coordination and it was found to be proper.

This is an area of apparent mis-coordination coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

J

8/17 – 4.42 days – Y

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

K

8/26 – 0.05 days – Y

The Hydro Quebec feed to the VELCO system was lost. VELCO requested that the J-510 switch be closed to restore service to VELCO customers off of the PSNH 355X10 34.5 kV distribution line. The Canaan unit tripped on overspeed when the switch was closed and no breaker operations occurred on the PSNH system. The unit returned to service when released by the system dispatcher.

This is an area of apparent mis-coordination coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

L

9/13 – 0.17 days – Y

A tree fell on the 355X line causing the 0355 34.5 kV breaker at Lost Nation to trip and reclosed twice. The unit was temporarily isolated from the system and tripped on overspeed. The 355 right of way underwent trimming in 2007, however the subject tree was located outside of the right of way. The unit returned to service when released by the dispatcher.

This is an area of apparent mis-coordination coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

M

10/9 – 0.08 days – Y

A black bear climbed the 355 34.5 kV line and came into contact with the neutral and primary wires causing the 0355 34.5 kV breaker at Lost Nation to trip and reclose. The unit was temporarily isolated from the system and tripped on overspeed. The unit returned to service when released by the dispatcher.

N

11/24 – 1.05 days – Y

This was a scheduled outage for the unit to have consultants inspect and have access to the inside and outside of the penstock in preparation of the upcoming penstock replacement project in 2009.

O

12/25 – 0.13 days – Y

Windy conditions caused multiple contacts on the 355X10 34.5 kV distribution line. There were no breaker operations on the PSNH distribution system, but it is believed that the contacts recorded caused the unit to trip on overspeed. The unit returned to service when released by the system dispatcher.

This is an area of apparent mis-coordination coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

Eastman Falls

The major projects at this station for 2008 included resurfacing of the dam, a rewind of the G-1 generator, and improvements to the G-2 ventilation system.

Eastman Falls-1

A

2/7 – 0.07 days – Y

The unit tripped off line immediately after start up. It appeared to the operator that the unit did not pick up load fast enough causing the unit to trip. The relay was reset and the unit was returned to service. The unit was monitored and no anomalies were noted.

B

3/26 – 0.10 days – Y

The 337 34.5 kV line sustained a fault due to a failed polymer suspension insulator causing the 337 34.5 kV breaker to trip and reclose. The insulator failure subsequently flashed over to the J-125 115 kV line that is on the same pole and on the same side of the pole. This fault caused the J-1250 breaker at Webster and the TB-125 low side transformer breaker also to trip and reclose. Eastman Falls is tapped off of the 337 34.5 kV line and when this line tripped, the unit was temporarily isolated from the system and tripped on overspeed. The unit returned to service when released by the dispatcher. PSNH estimates that the distance between the two conductors is 66 inches which meets NESC requirements. (Also see Outage 2-B below)

C

6/26 – 0.08 days – N

The unit tripped on overspeed due to a fault in the speed module relay. The speed module relay was replaced and the unit was returned to service. The relay output was monitored to see if the event happened again. During the annual inspection (Outage D below), the electronic overspeed was recalibrated.

D

9/2 – 146.29 days – Y

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. During this inspection, a new Kingsbury thrust bearing was installed (emergent work), the generator was rewound, and the generator rotor and exciter were inspected and cleaned resulting in the requirement to rewind the exciter. Upon startup, the thrust bearing was found not to be in the correct position. Modifications were made to the thrust bearing at the contractor's expense. The unit was returned to service without incident.

Eastman Falls – 2

A

3/13 – 0.17 days – Y

This scheduled outage was taken to change the oil filter on the hydraulic system as scheduled. In many cases, if the unit is down for another reason the filter can be changed without the need for a specific outage. The filter was changed and the unit returned to service.

B

3/26 – 0.05 days – Y

This outage happened at the same time as Outage 1-B above which explains the outage in detail.

C

5/28 – 0.08 days – N

The unit failed to start due to an incomplete starting sequence and not achieving minimum power output requirements. The programmable logic controller was adjusted to have the unit pick up 0.9 MW on startup (From 0.6 MW) and the unit was returned to service.

D

6/11 – 0.35 days – N

While the unit was off line, a high sump level alarm was triggered. A water/oil mix was drained from the hydraulic tank, new oil was added, and the unit was returned to service. The problem for the water intrusion, leaking seals on the stub shaft, was corrected during the annual inspection in Outage H below.

E

6/23 – 0.06 days – N

The unit tripped when a high sump level alarm was triggered. A water/oil mix was drained from the hydraulic tank, new oil was added, and the unit was returned to service. The problem for the water intrusion, leaking seals on the stub shaft, was corrected during the annual inspection in Outage H below.

F

6/23 – 0.03 days – N

While the unit was off line, a creep alarm was initiated. Two sensors ensure that the lube pumps are operating whenever the generator/turbine shaft is turning (Potential leak in intake gates). A mismatch in this requirement is called creep and will alarm and shut the unit down. Inspection found no anomalies and the unit was returned to service. (Also see related Outage G below)

G

6/27 – 0.01 days – N

While the unit was off line, another creep alarm was initiated. Again inspection and review of the programmable logic controller found nothing wrong. The alarm was concluded to be extraneous and a 30 second time delay was inserted into the creep alarm logic when the unit is off line. When the unit is on line, there is zero time delay to initiate a trip for creep conditions. The unit returned to service without incident.

H

8/4 – 24.25 days – Y

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. The nose cone area was inspected, stub shaft seals were replaced, and weld repairs were made to the runner blades.

Garvins Falls

Major work at the station in 2008 included the replacement of the station step up transformer, work on the Shoreline Management plan, and the Recreation Management Plan.

Liberty notes that the annual inspections at Garvins could not be done concurrently with the replacement of the step transformer as no station services were available while the new step up transformer was being installed.

Garvins Falls-1

A

6/9 – 15.11 days – N

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. Cracked blades were also repaired.

B

8/25 – 26.38 days – N

This scheduled outage was taken to replace TB-36, the station step up transformer with a new more efficient unit. In addition the start up transformer for G-1 and G-2 had to be removed from service to facilitate demolition. The 115 kV bus had to be de-energized requiring that all four units to be taken out of service. This outage is reflected in Outages 2-A, 3-B, and 4-C below, however, outages for G-3 and G-4 were for only 5 days.

C

9/27 – 0.05 days – Y

The unit would not automatically phase onto the system when requested by the dispatcher. A local operator phased the unit on with local control and returned the unit to supervisory control. The dispatcher was able to control the unit. Investigation found nothing wrong, and the auto/local/supervisory switch was cleaned. The problem has not reoccurred.

Garvins Falls – 2

A

8/25 – 26.38 days – N

This outage is identical to Outage 1-B above which contains the outage details.

B

11/3 – 37.38 days – Y

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. In addition, major work was performed on the head gates.

Garvins Falls – 3

A

6/23 – 2.32 days – N

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

B

8/25 – 5.35 days – Y

This outage is identical to Outage 1-B above which contains the outage details. This outage is for a shorter duration.

Garvins Falls – 4

A

6/16 – 4.19 days – N

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

B

6/22 – 0.06 days – N

The pond control system took the unit off line. Investigation found that the pond control system was working within its parameters, but the generation level at that time could not be supported by the river flow. This incident occurred during the time period when the pond control system was being fine tuned. Adjustments were made to the pond control system and the unit returned to service.

C

8/25 – 5.36 days – Y

This outage is identical to Outage 1-B above which contains the outage details. This outage is for a shorter duration.

D

12/28 – 2.18 days - N

A low oil alarm for the lower guide bearing was received by the dispatcher. When a station operator arrived, he found that the oil pump was not returning oil from the bearing sump to the bearing reservoir fast enough. The unit was immediately taken off line. Investigation found that the oil return line was being restricted by a kink in the line. The line was replaced and the unit returned to service.

Gorham

The minimum flow gate and fifty hinged flashboards were replaced in 2008. An underground auxiliary power cable from the upper gatehouse to the station was also installed.

Gorham – 1

A

1/24 – 0.00 days – Y

Infrared inspection revealed that disconnect DX5308 in the generation area of the substation was hot. The entire station was taken off line and DX5308 was exercised. PSNH thermographically inspects all generation disconnects annually. The units returned to service. Also see Outage 2-A, Outage 3-A, and Outage 4-A below.

B

3/11 – 0.02 days – Y

The entire station tripped off line when a raccoon made contact with the low side bushing (22 kV) on TB-47 at Eastside substation. The protection operated correctly, however the 0351 34.5 kV breaker at Gorham also tripped at the same time causing the Gorham units to trip for this event. Animal guards were installed at this substation by PSNH, but TB-47 is a customer owned transformer and was not protected. The units were returned to service when released by the dispatcher. Also please see Outage 2-B, Outage 3-C, and 4-B below and Outrage Smith 1-A below.

This is an area of apparent mis-coordination coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

C

6/10 – 0.04 days – Y

Thunderstorms were being experienced in the northern portion of the PSNH system causing 115 kV outages and other units to trip and voltage instability. The dispatcher removed Gorham station from the system as an instability precaution. The units were returned to service when the storms passed and voltage swings stabilized. Please also see Outage 2-C, Outage 3-I, and Outage 4-H below and Outage Smith 1-E below.

D

7/28 – 0.04 days – Y

The unit tripped off line due to a failed MW transducer. The transducer was replaced and the unit returned to service.

E

10/6 – 3.25 days – N

This scheduled outage was taken to perform the annual inspection. Both units 1 and 2 are done at the same time as they have a common intake structure. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. In addition, a problem was discovered with the draft tubes; however divers were not available at this time. Inspection of the draft tubes therefore required a special outage. Please see Outage 1-H and Outage 2-F below.

F

10/15 – 0.12 days – Y

This was a scheduled outage for the entire station so that the neutral protection scheme on the station grounding bank could be reconfigured to address distribution wire routing concerns. The work was performed and the units returned to service. Also see Outage 2-E, Outage 3-L, and Outage 4-I below.

G

10/25 – 0.03 days – Y

A fault occurred on the 351 34.5 kV line between Whitefield and Berlin. The 351 breaker at Whitefield and the 352 breaker at Gorham (On the 352 line between Gorham and Berlin) tripped. PSNH has the choice of two mis-coordination scenarios here. The current scheme prevent prevents the 351 breaker from operating for faults on the 352 line is chosen over its opposite scenario which trips Gorham station.

This is an area of apparent mis-coordination coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

H

10/29 – 0.16 days – Y

This scheduled outage was taken to inspect the draft tubes as a result of the annual inspection. Both G-1 and G-2 have a common intake. Divers found that the G-1 draft tubes needed to be replaced. PSNH has scheduled this work for 2009. Also see Outage 2-F below.

Gorham – 2

A

1/24 – 0.00 - Y

This outage is identical to Outage 1-A above which contains the outage details.

B

3/11 – 0.02 days – Y

This outage is identical to Outage 1-B above which contains the outage details.

C

6/10 – 0.05 days – Y

This outage is identical to Outage 1-C above which contains the outage details.

D

10/6 – 3.25 days – N

This outage is identical to Outage 1-E above which contains the outage details.

E

10/15 – 0.12 days – N

This outage is identical to Outage 1-F above which contains the outage details.

F

10/29 – 0.16 days – Y

This outage is identical to Outage 1-H above which contains the outage details.

Gorham – 3

A

1/24 – 0.0 days – Y

This outage is identical to Outage 1-A above which contains the outage details.

B

2/7 - 0.05 days – Y

The unit tripped when the power supply for the electronic tachometer/overspeed device tripped. The power supply was reset and the tachometer/overspeed and the unit was returned to service. A new power supply was ordered and installed on 4/28. Also see Outage E below.

C

3/11 – 0.02 days – Y

This outage is identical to Outage 1-B above which contains the outage details.

D

3/17 – 0.01 days – Y

During a routine check of the exciter brushes, it was observed that one was worn more than the others, so the unit was taken off line. All six brushes were replaced as a precautionary measure and the unit was returned to service.

E

4/28 – 0.08 days – Y

The unit tripped when the power supply for the electronic tachometer/overspeed device tripped. The power supply was replaced with the one ordered in February and the unit was returned to service.

F

6/3 – 0.01 days – Y

The unit was taken out of service to replace the exciter brush holder springs. After the brush replacement in Outage D above, PSNH monitored the brushes and determined that the brushes were wearing down too fast. The brush holder springs were replaced and the unit returned to service.

G

6/7 – 0.04 days – Y

The unit tripped off line due to high thrust bearing temperature. The trip point for thrust bearing temperature is 70 degrees C. The temperature in the station was above 90 degrees F. In addition, the water level was at dam crest level to facilitate flash board replacement leaving the oil cooler in the wheel pit partially exposed and thus receiving less cooling from the water flow. Fans were added on the top of the unit to draw air through the unit and windows were

closed so that cooler air would be drawn from the floor of the station. The unit was returned to service.

H

6/8 – 0.53 days – Y

The units again tripped off line due to high thrust bearing temperature after the remedies in Outage G above were applied. Discussion with maintenance determined that the set point for the thrust bearing trip temperature could be raised to 75 degrees C. The change was made and the unit returned to service.

I

6/10 – 0.04 days – Y

This outage is identical to Outage 1-C above which contains the outage details.

J

7/17 – 2.34 days – N

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected.

K

9/1 – 0.03 days – Y

The unit tripped due to loss of field. The operator found that the 34.5 kV voltage was swinging between positive and negative. The operator waited until the bus voltages and reactive output were normal and phased the unit on line. The unit was monitored for an hour and all seemed normal.

L

10/15 – 0.12 days – Y

This outage is identical to Outage 1-F above which contains the outage details.

M

10/25 – 0.02 days – Y

This outage is identical to Outage 1-G above which contains the outage details.

N

11/26 – 0.00 days - Y

The unit tripped due to a malfunction of the overspeed relay card. (Note – This was the new power supply installed on 4/28) The card was removed and reinserted and the unit returned to service. PSNH is finding that the electronic overspeed devices on older units are having problems due to stray EMF in common cable trays. The electronic overspeed devices at Gorham will be changed to mechanically driven devices in 2009.

Gorham – 4

A

1/24 – 0.00 days – Y

This outage is identical to Outage 1-A above which contains the outage details.

B

3/11 – 0.03 – Y

This outage is identical to Outage 1-B above which contains the outage details.

C

4/15 – 0.03 days – Y

The unit tripped due to low oil pressure. Investigation found that the actuator (Builds oil pressure) was working properly, oil pressure was normal, and no indications of other problems were found. The unit was returned to service. Also see Outage D, Outage E, Outage F, and Outage G below.

D

4/16 – 0.06 days Y

The unit again tripped on low oil pressure. The oil pressure in the tank was again found to be normal. The wiring on all switches, the actuator motor, and the actuator motor were checked. The oil filter was also changed even though it appeared normal. In addition, all switches and the motor were checked. Nothing abnormal was found and the unit was returned to service pending further troubleshooting later in the day. This outage is related to Outage C above and Outage E, Outage F, and Outage G below.

E

4/16 – 0.05 days – Y

The unit was taken off line to perform more troubleshooting. Testing of the actuator pump motor contacts indicated that one contact may be bad. All three contacts were replaced. After testing, readings were normal. The unit was returned to service and new overload contacts were ordered as the operator also suspected that the problem may be related to the overload devices. This outage is related to Outage C and Outage D above and Outage F and Outage G below.

F

4/17 – 0.05 days – Y

During operational testing, the operator felt that the actuator pump took too long to pick up its suction. The actuator pump was replaced and the unit returned to service. Plans were made to rebuild the actuator hydraulic piston during the annual inspection outage. (Outage K below) Also see Outage C, Outage D, Outage E above and Outage G below.

G

4/18 – 0.05 days – Y

The unit again tripped off line due to low oil pressure. In rush current readings were also taken on the actuator pump motor. Since the actuator contacts were replaced in Outage E above, a bad overload device on the actuator pump motor was suspected. After the motor starter overloads had cooled, the unit was returned to service. The new overload devices ordered on 4/16 were installed later that day with the unit on line. Also see Outage C, Outage D, Outage E, and Outage F above.

H

6/10 – 0.04 days – Y

This outage is identical to Outage 1-C above which contains the outage details.

I

10/15 – 0.12 days – Y

This outage is identical to Outage 1-F above which contains the outage details.

J

10/25 – 0.02 days – Y

This outage is identical to Outage 1-G above which contains the outage details.

K

11/10 – 16.20 days – Y

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. In addition, the lower guide bearing was replaced and the actuator piston was rebuilt.

Hooksett

The major projects completed at Hooksett in 2008 included the replacement of the trash racks and updating the building ventilation system.

Hooksett – 1

A

3/4 - 0.02 days – Y

When cleaning the trash racks, the trash rack rake boom got stuck in the down position due to an internal hydraulic failure. The unit was taken out of service so the boom could be safely removed. Repairs were made and the unit returned to service.

B

4/7 – 0.05 days – Y

The unit was taken off line because the governor was not responding to raise and lower pulses. Investigation revealed that the synchronizing motor clutch needed adjustment due to wear. The adjustment was made and the unit returned to service.

C

7/21 – 28.11 days – Y

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. The intake racks were also replaced during this outage. The replacement racks were built to very old station prints; however alignment problems were encountered during installation requiring dimension modifications.

D

10/15 – 0.17 days – Y

This outage was scheduled to have divers install shims between the new intake racks and their support structures. Shims were required because of contour differences between the racks and the support structures. This work was not able to be completed during the annual inspection

(Outage C above) because the material could not be procured during the window of that outage. Repairs were made and the unit returned to service.

Jackman

The major project for this station in 2008 was an upgrade of the station ventilation system.

Jackman-1

A

2/1 – 0.08 days – N

The unit tripped on overspeed due to the tripping and reclosing of oil circuit recloser OCR-73 on the 3173 line (Two times). The operation of the oil circuit recloser was initiated by a limb falling on the line during a snowstorm. The circuit was last trimmed in 2007 and the origin of the limb was determined to be from outside of the trim zone. Investigation indicated that the Jackman undervoltage relay should have ridden through the event and it did. The unit was returned to service when released by the dispatcher.

This is an area of apparent mis-coordination coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

B

2/13 – 0.06 days – N

A tree limb fell onto the 3140 34.5 kV circuit out of Jackman during a snow storm. The 3140 34.5 kV breaker at Jackman tripped and reclosed twice. The unit tripped on overspeed at the same time. The unit returned to service when released by the dispatcher.

This is an area of apparent mis-coordination coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

C

3/28 – 0.11 days – Y

This outage was scheduled so that trip circuits could be installed in preparation for the installation of the 115 kV mobile substation. The mobile substation is required to provide continuity of service while a major transmission project (Installation of 2-13.3 MVAR 115 kV capacitor banks) was performed in the high yard of the station. The accommodations were made and the unit returned to service.

D

4/18 – 0.05 days – Y

The unit tripped due to a high thrust bearing temperature. The unit was placed in local control and returned to service with PSNH monitoring the thrust bearing temperature. The temperature of the bearing was 89 degrees F and the operator attempted to further cool the bearing by opening windows and doors without obtaining relief. Fans were added to the wheel pit areas

and the exciter area and the unit operated throughout the weekend. Note – the new ventilation system had not yet been installed. Also note that a new and higher temperature Kingsbury bearing was installed in Outage E below.

E

5/5 – 30.24 days – N

During the upgrade of the transmission side of the substation, a contractor's excavator boom contacted the generator output cables that connect to the generator step up transformer. The contact resulted in the failure of the generator step up transformer. No injuries were reported. Inspection revealed that no other equipment was damaged during the incident. The outage was required to allow time to bring in a mobile transformer replacement. The mobile transformer would allow operation of the unit up to 2.2 MWs.

The annual inspection was conducted during this outage and the thrust bearing was replaced with a new Kingsbury type of bearing.

The contractor had swapped out the smaller machine being used in the grading of the substation. PSNH specifically instructed the contractor not to use the larger machine inside the substation, but when the PSNH inspector left, the larger machine was brought into the substation to perform the remaining work tasks. The incident occurred even though the contractor had a spotter who was determined to be "inattentive" at the time of the incident.

The contractor has accepted total responsibility for the incident and PSNH is pursuing financial compensation including replacement power costs.

F

8/8 – 0.34 days – Y

The mobile substation acting in place of the generator step transformer tripped due to a vehicle accident and subsequent fault that that occurred on 3173 34.5 kV circuit out of Jackman. PSNH electricians inspected the mobile sub, reset all drops, and restored service to the mobile sub. The unit was restarted without incident.

This is an area of apparent mis-coordination coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

G

9/9 – 0.03 days – Y

The unit tripped off line on overspeed. There were no known power outages in the area at the time. Station controls checks revealed no problems. The unit was returned to service. A power quality meter was installed for 30 days, but no anomalies were found.

This is an area of apparent mis-coordination coordination between PSNH lower voltage generating units and the distribution system. PSNH states that future review is required. Please see recommendation at end of this report.

H

11/6 – 0.25 days – N

The unit tripped off line while a transmission contractor was performing relay and control work in the substation. Investigation found that circulating current of approximately 1 amp was flowing in the CT residual circuit (CT circuit shorted and bus de-energized condition) and was sufficient enough to initiate the trip. A potential of 0.19 volts existed between the point of grounding of the relay ground and the relay cabinet. The unit was returned to service. Further work included the installation of new 4/0 ground conductors being installed between the old control house and the new 115 kV control house to reduce the potential difference.

I

12/2 – 0.01 days – N

The unit tripped when transmission contractors working in the substation caused the auxiliary breaker on the mobile 34.5 kV substation to operate and in turn causing the trip of the unit. During the removal of the front access panel in the distribution control room, a breaker for the mobile substation popped out of place. This panel is similar to the breaker panel a residential homeowner has in his basement. A white caution tag had been installed on the panel indicating that operation of this breaker would trip the unit. When the face panel was removed, the breaker was activated and the unit tripped. The breaker was reset and the unit returned to service.

Smith

Major projects at this station in 2008 included the installation of 11 cooling fans on the generator step up transformer and the rebuilding of the control and communications line between the hydro station and the East side substation.

Smith-1

A

3/11 – 0.01 days – Y

This outage is identical to Outage Gorham 1-B above which contains the outage details.

B

3/31 – 0.05 days – Y

The unit tripped off line due to loss of oil pressure to the turbine bearing. Investigation found that the spider coupling on the AC motor/pump had failed. The backup DC pump was found operating but its operation was not sufficient to allow continued operation of the unit. The spider coupling was replaced and the unit was returned to service and PSNH informed the ISO that it would request an outage later in the day for trouble shooting. Also see Outage 1-C below.

C

3/31 – 0.06 days – Y

This outage was taken to determine why the backup DC lube pump did not allow continued operation of the unit in Outage 1-B above. The AC and backup DC oil pumps feed a common header and the pressure is monitored by a common pressure sensing switch. If pressure is not

detected, a slow shutdown of the unit is initiated. PSNH staged a shutdown of the unit by a loss of AC pump oil supply. The DC backup pump started immediately and oil pressures were measured as normal, but after 15 seconds the unit tripped on low oil pressure. Investigation found that adequate oil was flowing when the DC backup pump was running, but the flow was not enough to keep the pressure switch in the open position. An adjustment was made to the oil pressure switch, testing was performed to ensure proper operation, and the unit returned to service. Also see Outage 1-B above. Note – PSNH installed a new DC lube pump in Outage 1-D below which further increased oil pressure when on the DC backup lube pump.

D

4/12 - 0.46 days – Y

This outage was scheduled to allow the control and communication cable between the station and Eastside substation to be moved to new poles. PSNH could not wait until the annual inspection as the wetland permit required the work to be done while ice was still present. The unit was required to be out of service to maintain system integrity and the safety of the unit. Work was performed on a Saturday to minimize replacement power costs. The DC lube pump (see Outage 1-C above) was also replaced during this outage. The cable work was performed and the unit returned to service.

E

6/10 – 0.01 days – Y

This outage is identical to Outage Gorham 1-C above which contains the outage details. The unit tripped while it was being taken off line.

F

9/6 – 5.25 days – Y

This scheduled outage was taken to perform the annual inspection. A visual inspection, general cleaning, and equipment tests were performed. Both the turbine and generator were inspected. In addition, the oil header piping and check valves for the AC and DC turbine bearing system were replaced.

G

10/14 – 0.06 days – Y

The unit was taken off line due to a leak in the turbine bearing oil line emanating from the new header system installed on 9/6. The turbine bearing oil line consisted of many couplings and one union. Over time, vibration caused the fittings to leak. The brass oil line and fittings were replaced with a high pressure hydraulic flex hose and stainless fittings, the repairs were made, and the unit returned to service. PSNH states that this line was in an area that was not visible when the header was replaced in Outage 1-F above.

Evaluation for Hydro Units Except Outage Garvin's Falls 4-D, Jackman 1-E, Jackman 1-H, and Jackman 1-I

Liberty 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. Liberty concluded that PSNH conducted proper management oversight.

Evaluation for Garvins Falls Outage 4-D

A kink in the oil return line has to occur from human handling during normal cleaning operations or other work related to the return lube oil system. When dismantling and reassembling the oil return line, it must be moved to allow line up of the connections. Liberty believes that an operator did not exercise due care during one of these operations. Further, the operator should have known the oil line was kinked; known that oil flow could be restricted to the reservoir, and should have either replaced the line immediately or as soon as possible. Liberty recommends disallowance of replacement power costs for this outage.

Evaluation for Jackman Outage 1-E

For the contractor to directly ignore PSNH instructions indicates a significant weakness in the understanding between PSNH and contractors working in PSNH substations and the authority of the contractor to change PSNH instructions. Liberty also notes that PSNH supervision was heavily concentrated at the Mammoth Road TB-73 transformer upgrade project at the time of this incident. Liberty recommends disallowance of replacement power costs for this outage.

Evaluation for Jackman Outage 1-H

When doing incremental projects in old substations, grounding configuration, adequacy, and location may not be fully known. A ground potential check is done to ensure proper grounding between the existing and new work. A ground potential check was not part of this project and Liberty recommends disallowance of replacement power costs for this outage.

Evaluation of Outage Jackman 1-I

There has been a rash of contactor related outages at hydro stations and many of them appear due to speed of work and therefore lack of due care. In this case, the breaker could not have tripped unless it was bumped during a hasty removal of the panel cover or the white tag became entangled in the panel cover upon removal. In either case, due care was not exercised. There appears to be a weakness in the PSNH/contractor relationship on the expectation of due care to be exercised when in PSNH substations. Liberty recommends disallowance of replacement power costs for this outage.

Recommendation Regarding Outages Due to Trees Outside of 34.5 kV Rights of Way

Outages Canaan 1-E and Canaan 1-L were caused by trees which PSNH stated were outside of the right of way. PSNH further states that many of its older 34.5 kV lines in rights of way (1,600 miles plus) do not have language in the easements that allow PSNH to address “danger trees” outside of the right of way. PSNH therefore does not address the outside of right of way danger tree issue. Liberty recommends that PSNH address danger trees that are outside of the 34.5 kV rights of ways, include identification of such trees in NESC required patrols, and identify where PSNH has and does not have the rights to do so. Liberty further recommends that this issue be specifically addressed in the 2009 Reliability Enhancement Program contained in PSNH’s current rate case.

Recommendation Regarding Lack of NESC Patrols.

In its explanation regarding Outage Canaan 1-F, PSNH stated that that patrols were limited to aerially thermographic inspection of 34.5 kV lines in rights of way due to constraints of declining Reliability Enhancement Program funding. Liberty understands that PSNH had agreed to perform inspections of all distribution facilities on a 4 year schedule as part of its 2006 REP plan. Liberty recommends that this issue be specifically addressed in the 2009 Reliability Enhancement Program contained in PSNH’s current rate case.

Recommendation Regarding Apparent Mis-coordination Between PSNH Lower Voltage Generation and the Distribution System

Many outages above involve apparent mis-coordination between PSNH lower voltage generating units and the distribution system. PSNH has begun an analysis regarding settings etc. and suspects that some trip settings may be set too tight. PSNH also states that many of its small generating stations do not have regimented relay testing requirements by NPCC or NERC as they are not considered bulk power facilities. PSNH does perform relay testing on all units. PSNH further states that relay settings have not changed at its small generating stations since the early 1980s. While new generation coming onto the PSNH system has undergone an interconnection analysis that reviews coordination, no such analysis has been done for PSNH's own units. Liberty recommends that PSNH perform interconnection analyses for all combustion turbines and hydro units connected to the lower voltage PSNH system. Merrimack combustion turbines and Smith hydro are connected to the 115 kV system and such mis-coordination does not exist. Liberty further recommends that PSNH establish an appropriate relay testing program for all combustion turbines and hydro units. Liberty suggests that PSNH complete this work prior to the next SCRC filing and file a report of its actions concurrent with that filing.