

1 Q. Further to PUB-NLH-163, please provide a status report on the actions taken by
2 Hydro in response to any recommendations made in the two previous reviews of
3 the protection system for the transmission lines in the Avalon Peninsula area.
4 Include in the response the completion date for each action implemented.
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7 A. The updated status is contained in PUB-NLH-164 Attachment 1. An internal review
8 of the recommendations not yet completed from the 2010 and 2011 Henville
9 reports showed they had no contributory impact to the electrical supply disruptions
10 of this winter. There are duplications in the two reports as noted in the
11 attachment. The reports by Henville Consulting were initiated by Hydro to review
12 the performance of the Optimho relays and determine the need to replace them. A
13 senior Hydro engineer worked with Mr. Henville and reviewed the first 5 lines. The
14 work continued in 2011, which generated a second report with additional lines
15 included. This report was completed in December 2011. The report
16 recommendations were reviewed in 2012 to ensure a full understanding of the
17 recommendations and the requirements to implement them before proceeding,
18 particularly to ensure any proposed changes to the system would not lead to
19 unforeseen issues. As part of this review a plan of action was generated, including
20 drafting of a capital budget proposal to replace the Optimho relays on TL242. The
21 replacement was planned to begin in 2013, however this was deferred pending
22 completion of an ongoing update of the line protection scheme for TL242 as part of
23 the Soldier's Pond installation to ensure the Henville work and this work were
24 properly integrated together prior to finalizing the overall plan. A capital budget
25 proposal was then submitted for 2014 to replace the Optimho relays on TL203. This
26 has been approved by the Board with execution scheduled in 2014. The focus of
27 efforts in 2013 was implementing the Priority A recommendations from the January
28 11, 2013 report (see Hydro's response to PUB-NLH-160 which outlines these

1 activities). Hydro has increased staffing with an additional P&C Engineer in 2014
2 who will be focused on the remaining recommendations from the 2010/2011
3 Henville reports, the January 11,2013 report and the January 4-6, 2014 reports. A
4 prioritization review meeting has been scheduled for May 8, 2014 to review and
5 confirm the prioritization of the consolidated list of recommendations from all of
6 these reports, the plan in place to address them, and if any changes are required to
7 the schedule or resourcing of that plan to effectively deal with the
8 recommendations.

Rec.	Action	Dept.	Priority/ Target Date	Status	Comments
2010 (a) 2011 (a)	Zero sequence mutual coupling impedances between parallel transmission lines sharing a right of way should be modeled during future line protection settings calculations.	PC&C	B	Complete	2010 (a) and 2011 (a) are duplicates. Communicated to group and agreed to. Completed for 10 230 KV lines on Avalon Peninsula. To be included for future studies as part of normal process.
2010 (b) 2011 (c)	Separate permissive trip communications facilities should be provided for each of the “A” and “B” protection systems so that coordination is obtained between forward and reverse looking measuring elements. This coordination is important when the permissive trip echo function is used (as is proposed for the SEL321 relays for improved speed and sensitivity.	PC&C	B Assessment by Oct. 1/14	Ongoing 2014	2010 (b) and 2011 (c) are duplicates Capital budget proposal will be required. Communications Engineering is being involved as well. The echo function has not been used in the past and needs to be investigated by P&C engineering before implementing and this is scheduled in 2014.
2010 (c) 2011 (e)	For future applications, where suitable auxiliary contacts are available on circuit breakers, the discrete status of each pole of each breaker should be connected into the SEL321 relays instead of a single contact that cannot differentiate between a single pole open and all three poles open.	PC&C	A	Complete	Has been communicated to P&C personnel. Will be included in the design of new breaker installations in 2014 and beyond.
2010 (d)	The transient performance of the Trench CVTs used at Sunnyside for TL202 and TL206 protection should be checked (by comparison with other CVT outputs during faults) to determine whether these CVTs need to be repaired or replaced or whether normal Zone 1 distance protection settings can be applied to these line protections. In particular, records collected during the 21 July 2010 disturbance should be analyzed in more depth to check CVT accuracy.	PC&C	B Discussion with TRO by July 31,2014	Ongoing 2014	Earlier discussions between P&C and TRO identified that further investigation is required to fully define the problem and determine how best to address. This was placed into the 2014 work plan for July based on assigned priority and availability of required resources in both P&C and the TRO Whitbourne office.
2010 (e) 2011 (f)	During disturbance analysis, unfiltered event reports from SEL relays should be captured and retained in addition to the filtered event reports. The unfiltered reports are helpful in analyzing transient phenomena and high-speed events.	PC&C	A	Complete	2010 (e) and 2011 (f) are duplicates. Investigations shows it is possible with manual retrieval, but not with automatic retrieval. Some of the Schweitzer relays can be accessed remotely. P&C engineering and System Operations can retrieve those records remotely, but field operations technicians must retrieve records manually from the others.
2010 (f)	Several adjustments of the protection settings are proposed, some more important than others. The most significant adjustments to be recommended are:				

<p>(i) 2011 (g) (i)</p>	<p>The permissive trip echo function should be enabled on SEL321 relays on all lines after implementation of recommendation (b) above. The echo function is especially important at Come by Chance for the TL207 and TL237 protection systems to provide fast clearing of faults near Come by Chance under the single contingency of one 230 KV line to Come by Chance being out of service. The echo function is also important to obtain complete sensitivity for single line to ground faults with resistance of up to 100 ohms on the complete circuit.</p>	<p>PC&C</p>	<p>B Assessment by Oct. 1/14</p>	<p>Ongoing 2014</p>	<p>2011 (f) (i) and 2011 (g) (i) are similar. 2011 (f)(i) refers to Come by Chance and 2011(g)(i) refers to Oxen Pond. Required action here is dependent on assessment in Recommendation 2010(b) . Since the function has not been used in the past, it needs to be investigated by P&C engineering before implementing to confirm operation and identify any possible risks.</p>
<p>2010 (f) (ii)</p>	<p>The resistive reach of the zone 1 ground distance elements of the SEL 321 relays on circuit TL207 should be reduced significantly to increase the security of these functions.</p>	<p>PC&C</p>	<p>A Sept.30/14</p>	<p>Ongoing 2014</p>	<p>To be addressed in 201 by Sept 30</p>
<p>(iii) 2011 (g) (iv)</p>	<p>The overreaching Zone 2 ground distance functions of all line protections except TL207 should be increased to provide dependable coverage of single line to ground faults near the remote terminals in the presence of zero sequence mutual coupling from parallel lines.</p>		<p>A Sept.30/14</p>	<p>Ongoing 2014</p>	<p>2010 (f)(iii) and 2011 (g)(iv) are duplicates. TL217, TL218 and TL242 were recommended in the 2011 report and are completed. TL 201 and TL236 are to be completed in 2014. P&C engineering is procuring additional resources to complete this work in 2014.</p>
<p>2010 (f) (iv) 2011 (g) (v)</p>	<p>The current supervision elements of all distance protection functions (except perhaps the zone 1 function) should be set at minimum to increase the dependability and to reduce the need to continuously check the relationship between maximum load and minimum fault conditions to determine a setting for these elements.</p>	<p>PC&C</p>	<p>B Nov.30/15</p>	<p>Under review</p>	<p>2010 (f) (iv) and 2011 (g) (v) are duplicates. This recommendation is on the consolidated list being reviewed at a meeting on May 8, 2014 to evaluate priority and identify any required changes to schedule and resources.</p>

<p>2010 (f) (v)</p>	<p>Setting adjustments should be made to the ground time overcurrent protection systems on TL203, TL207 and TL237 so they may coordinate with each other. These setting adjustments also require reduction in the tripping delays (from 1.0 s to 0.6 or 0.3 s) of the zone 2 distance elements on the P1 relays and the zone 2 ground distance elements on the P2 relays on both terminals of TL203, and TL207 and the CBC terminal of TL237.</p>	<p>PC&C</p>	<p>A Sept. 30/14</p>	<p>Ongoing 2014</p>	<p>Settings need to be confirmed; some timers are done.</p>
<p>2010 (g) (i) 2011 (h) (i)</p>	<p>Replacing some or all of the existing Optimho distance protection systems to improve flexibility of settings and monitoring facilities for disturbance analysis. Maintenance issues due to lack of availability of spare parts for these systems are now becoming a concern.</p>	<p>PC&C</p>	<p>A To start in 2014</p>	<p>Ongoing 2014</p>	<p>2010(g) (i) and 2011 (h) (i) are similar. Project in 2014/2015 to replace on TL203. Optimho relays on TL217, TL201 and TL242 to be replaced as part of LCP upgrade. This will provide used spares for the remaining lines. Other lines to be started in 2018 with one line per year. This schedule considers the availability of outages required to perform the work with small customer impact as well as the full portfolio of work and resources required to support. It may be possible to accelerate the schedule starting in 2018 by doing 2 lines a year if additional outage windows can be scheduled. This recommendation is on the consolidated list being reviewed at a meeting on May 8, 2014 to evaluate priority and identify any required changes to schedule and resources.</p>
<p>2010 (g) (ii) 2011 (h) (ii)</p>	<p>Removal of the electromechanical ground time overcurrent relays in the P2 protection systems since they add little value to the ground time overcurrent function built into the SEL321 relays. A more independent ground time overcurrent function would be available in the new P1 protection systems if they were replaced.</p>	<p>PC&C</p>	<p>A</p>	<p>Ongoing 2014</p>	<p>2010 (g) (ii) and 2011 (h) (ii) are duplicates. To be done with Optimho relay replacement.</p>
<p>(iii)</p>	<p>Modification of the dead line check function of the existing automatic reclosing system to increase the security of the 230 KV supply.</p>	<p>PC&C</p>	<p>B Nov.30/16</p>		<p>Evaluated as low risk to reliability and currently scheduled for 2016. To be reviewed at meeting scheduled for May 8, 2014.</p>

2010 (g) (iv) 2011 (h) (iii)	Replacing all pneumatic timers used for automatic reclosing or transfer trip auxiliaries with modern digital timers and configurable logic systems.	PC&C	A Oct. 31/14	Ongoing 2014	2010 (g)(iv) and 2011 (h)(iii) are duplicates. Scheduled in consideration of full workload and other priority work and risk to the system. As settings could drift over time, the risk is that pneumatic timers are not as accurate. If this is observed then the schedule will be revisited. Assessment to be done by Oct. 31/14 of timers still on the system. Capital proposal needed for any to replace.
2010 (g) (v) 2011 (h) (iv)	Use of the monitoring functions available in the new relays for steady state current and voltage balance checks. These functions could provide an alarm of steady state unbalances that could indicate a problem in the current or voltage sensing to the relays.	PC&C	B Nov.30/16	Under review	2010 (g)(v) and 2011 (h)(iv) are duplicates. Evaluated as low risk to reliability and currently scheduled for 2016. To be reviewed at meeting scheduled for May 8, 2014.
2010 (g) (vi) 2011 (h) (v)	Retrieving event records from relays and teleprotection systems in the highest possible resolution to supplement the sequence of events records, particularly in the case of questionable operations.	PC&C	A	Complete	2010 (g)(vi) and 2011 (h)(v) are duplicates. This has been communicated and is being done.
2011 (b)	The 66 KV Newfoundland Power connections to the Oxen Pond 66 KV bus should be added to the Aspen OneLiner model of the power system.	PC&C	B Nov.30/15	Under review	Evaluated as low risk to reliability and currently scheduled for 2015. To be reviewed at meeting scheduled for May 8, 2014.
2011 (d)	The performance of the breaker auxiliary switch on breaker of L01L37 at Western Avalon Terminal station should be monitored or tested.	PC&C	A	Ongoing	Working with TRO to determine specific schedule date in 2014 based on outage and resource availability.
2011 (g) (ii)	Several adjustments of the protection settings are proposed, some more important than others. The most significant adjustments to be recommended are: The resistive reach of the zone 1 ground distance elements of the Optimho and SEL 321 relays on circuits TL218 and TL242 should be reduced significantly to increase the security of these functions.	PC&C	A Sept.30/14	Ongoing 2014	Completion planned for Sept. 30, 2014.

(iii)	The reactive reaches of the P1 zone 1 ground distance elements on TL218 and TL242 should also be reduced to increase its security with the existing long resistive reaches.	PC&C	A	Complete	Also a recommendation in January 11,2013 report.
(vi)	Setting adjustments should be made to the ground time overcurrent protection systems on circuits TL218 and TL236.	PC&C	A Sept. 30/14	Ongoing 2014	Completion planned for Sept. 30, 2014.
(vii)	The CT ratios on the Oxen Pond terminals of TL218 and TL236 and the Hardwoods terminal of TL236 should be increased when the 230 to 66 KV transformer capacity at Oxen Pond is increased. The existing CT ratio of 600/5 will limit the load carrying capabilities of the 230 KV lines.	PC&C	A May 15/14	Ongoing 2014	CT to be checked to see if higher ratios are available.
2011 (h) (i)	Consideration should be given to the following items: Replacing some or all of the existing Optimho distance protection systems to improve flexibility of settings and monitoring facilities for disturbance analysis. Maintenance issues due to lack of availability of spare parts for these systems are now becoming a concern. A line current differential protection system is the most appropriate replacement system for circuits TL236 and TL242 since these lines are relatively short, and one terminal (OPD for TL236 and HWD for TL242) is very weak under some single contingency conditions.	PC&C	A	Planned	Similar to Recommendation 2010 (g) (i). Optimho relays on TL217, TL201 and TL242 to be replaced as part of LCP upgrade. The protection schemes on TL201, TL 217, TL 242 will be current differential with distance as protection B. The B protection relay selected for the LCP work will be used as the Optimho replacement relay on the other lines. The decision to time this work with the LCP upgrades considered cost savings, outage coordination and risk to reliable service.