Q. Further to the response to PUB-NLH-224 please explain what priority will be allocated to measures necessary to prevent and/or minimize power supply interruptions such as load shedding, for events associated with the Labrador Island Link, e.g. temporary bipole and/or pole blocks, prolonged ac network faults near the rectifier or inverter stations, dc overhead line faults with such events extending beyond the durations which have been used in the transient stability studies.

A. The Island Interconnected System is required to maintain system stability with no loss of load for a permanent pole fault on the Labrador Island HVdc Link (LIL). As a result, the duration of the pole fault has no impact upon the performance of the Island Interconnected System.

With respect to the duration of the temporary bipole fault, Hydro's response to PUB-NLH-002 in the Board Proceeding *Application for Approval for Upgrade of the Corridor – Bay d'Espoir to Western Avalon*, attached as PUB-NLH-283 Attachment 1 presents the impacts of a change in 200 msec restart time for the overhead temporary bipole fault. As noted in that particular response, the exact restart time is dependent upon a number of factors and will not be known until system testing. The 200 msec is deemed to be reasonable based upon similar HVdc systems. A sensitivity study has been completed which indicates that there would be no loss of load for a restart time of 250 msec with two 175 MVAR high inertia synchronous condensers in service and 467 msec with three high inertia synchronous condensers in service.

For events involving the LIL, the Nova Scotia Block will be curtailed to ensure maximum load supply to the Island during the event and as noted in Hydro's response to PUB-NLH-217, load shedding on the Island Interconnected System would only occur for a permanent bipole fault.

For ac system faults close to the converter, Hydro is utilizing dual high-speed protection systems for clearing of faulted equipment. Consequently, delayed clearing of ac faults near the converter will be the result of events such as a circuit breaker failing to operate. The impacts on Island Interconnected System stability to breaker fail will be addressed in the response to PUB-NLH-241.

Q. Please refer to page 7, footnote 4 of the Upgrade Transmission Line Corridor Report. Explain in detail why the 200ms shutdown time for a short circuit near Soldiers Pond was assumed. Include in the response the fault detection and fault clearance time assumed and whether the contingencies of second stage protection are considered.

A. For a temporary bipole fault, it is assumed that a duration of 200 ms is required for detection and the de-ionisation of the HVdc system. It is assumed that faults can be detected in 25 ms and that of 175 ms is required for de-ionisation. These values have been provided by TransGrid Solutions.

The recommendations are based on their experience and on a review of HVdc systems that include a submarine cable section of similar or greater length, combined with overhead line sections. The following systems were found to have de-ionisation times of approximately 150 ms:

HVdc System	Overhead Line Length (km)	Cable Length (km)
Fennoskann	33	200
Gritta	110	163 (Sea) + 43 (Land)
Konti Skan	17	87
New Zealand	572	40

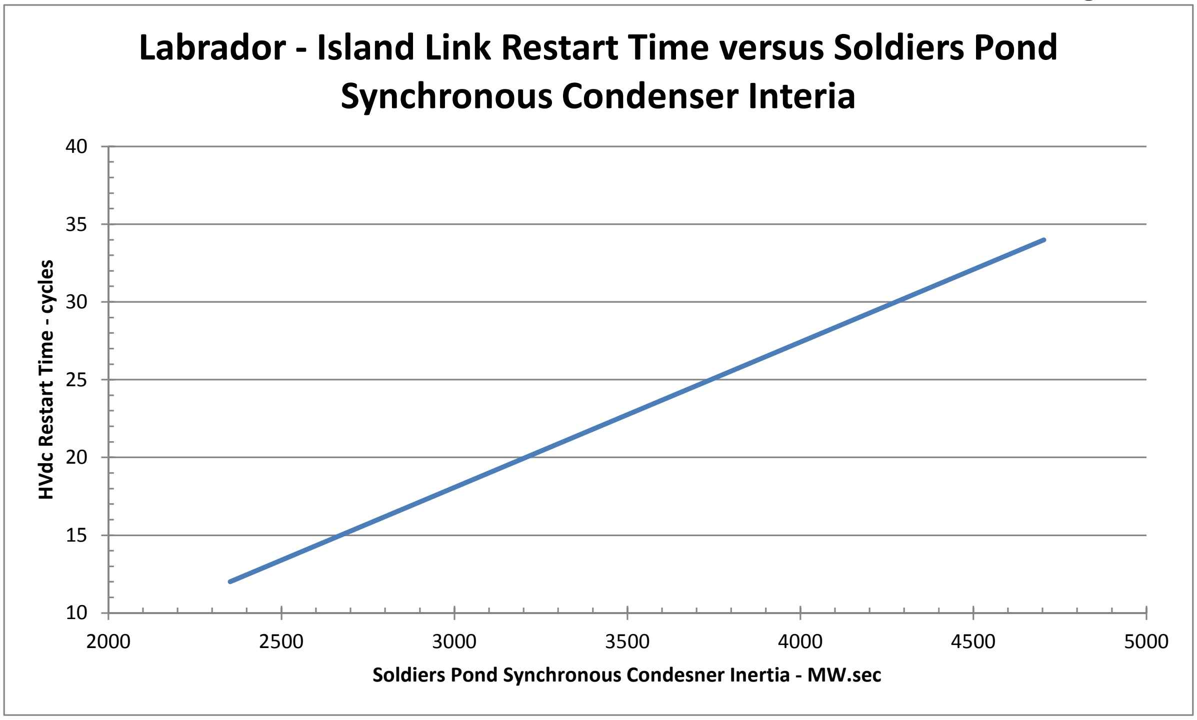
The actual de-ionisation time will not be known until system testing. This value is also dependent on other factors including temperature, humidity, and pollution. Based on the above, a 200 ms re-start time for a bipole overhead line fault was deemed to be a reasonable approximation.

Contingencies of second stage protection have not been considered for this investigation. Hydro’s approach to the failure of primary protection and other disturbances classified by NERC as being “Category D” or “Extreme Events” are discussed in Hydro's response to PUB-NLH-061.

Appendix C10 SNC-Lavalin Stability studies March 2012 provided in Section 3.6, page 121 provides a sensitivity analysis to the temporary bipole fault restart time. The results of the analysis are provided in the table below.

Maximum Restart Time for Temporary Bipole Fault SNC-Lavalin Stability Study March 2012				
No of High Inertia Synchronous Condensers	**Synchronous Condenser Size MVAR**	**Inertia Constant H MW.sec/MVA**	**Total Soldiers Pond Inertia MW.sec**	**Maximum Restart Time cycles**
2	150	7.84	2352	12
3	150	7.84	3528	23
4	150	7.84	4704	34

A graph of restart time versus total Soldiers Pond inertia (provided on the following page) demonstrates the linear relationship between inertia and restart time for the temporary bipole fault.



Given that the project now includes three 175 MVAR high inertia synchronous condensers, the SNC-Lavalin results indicate that with two 175 MVAR synchronous condensers in service with a total inertia contribution of 2744 MW.sec, one expects the maximum restart time for the temporary bipole failure to be approximately 15 cycles or 250 msec. With three 175 MVAR synchronous condensers in service at Soldiers Pond (4116 MW.sec) the maximum restart time is estimated to be 28 cycles or 467 msec.