Q. Please provide a project description and schedule for the systems improvements outlined in Section 2.4.3 of document DC1210_filed.pdf "HVDC Sensitivity Studies", July 2010 required to mitigate the 3 phase fault at Bay d'Espoir. The system improvements noted are a cross tripping/over frequency protection system, a new 230 kV circuit between Bay d'Espoir and Western Avalon, plus two new 230 kV circuits between Bay d'Espoir and Sunnyside.

A. Stability studies of the existing Island system under peak load conditions demonstrate that a 230 kV three phase fault at Bay d'Espoir with tripping of a 230 kV transmission line between Bay d'Espoir and Sunnyside will result in angular instability. In other words, the system does not recover from the fault and an outage will occur. To the extent that the existing AC system cannot survive a three phase fault at Bay d'Espoir during peak load conditions, the DC1210 – "HVDC Sensitivity Studies" contemplated an Island system with an HVdc interconnection having performance similar to the existing Isolated Island Scenario. This was outlined in section 2 of the study, last paragraph of page 2-1 which states:

> …It is also based on the assumption that the three-phase Bay d'Espoir fault will not be considered when determining the synchronous condenser requirements and system upgrades. This fault is not considered in this sensitivity analysis as the intent is to determine the system additions for the HVdc integration with system performance comparable to that of the existing system.

For clarification, Section 2.4.3 of DC1210 – "HVDC Sensitivity Studies" does not state that two new 230 kV circuits between Bay d'Espoir and Sunnyside are required to mitigate a 3 phase fault at Bay d'Espoir.

Section 2.4.3 states at page 2-5:

> However, if the new 230 kV circuit between Bay d'Espoir and Western Avalon is built and if this new circuit plus the two circuits between Bay d'Espoir and Sunnyside are 50% series compensated, AND if 2x300 MVAR high inertia Toshiba synchronous condensers are in service at Soldiers Pond (which means 3x300 MVAR installed to account for maintenance outages), the system is able to recover from a three-phase fault at Bay d'Espoir within criteria.

The "two circuits between Bay d'Espoir and Sunnyside" refer to the two existing circuits between these locations (i.e. TL202 and TL206).

The upgrades necessary to recover from a three phase fault at Bay d'Espoir are:

1) <u>A new 230 kV circuit between Bay d'Espoir and Western Avalon</u>

This circuit is common to both the Interconnected and Isolated scenarios, and is included in NL Hydro's 2012 capital budget submission. Construction of the 230 kV transmission line between Bay d'Espoir and Western Avalon has a five year completion schedule and includes:

- Addition of three 230 kV circuit breaker bays at Bay d'Espoir Terminal Station #2 to complete the breaker and one half arrangement on legs 1 and 2 with the new line termination on leg 3;

- Construction of 188 km of overhead 230 kV transmission line consisting of 795 kcmil ACSR "DRAKE" conductor on steel towers with overhead shield wire along the entire length; and
- Addition of a four 230 kV GIS circuit breaker ring bus arrangement at Western Avalon.

2) Three 300 MVAR high inertia synchronous condensers at Soldier's Pond. Three 300 MVAR units are currently in the Basis of Design for the Labrador-Island Transmission Link, but quantities and final rating will be determined during detailed engineering. The applicable design criteria will be to ensure that the Island system remains stable for faults under which the Island system remains stable today.

3) 50% series compensation of the two existing and one new transmission line (from (1)) between Bay d'Espoir and Sunnyside. This work is neither budgeted nor scheduled. Nalcor has not opted to install the series compensation on each of the three 230 kV transmission lines between Bay d'Espoir and the eastern portion of the system. Given the extremely low probability of the event, the increase in cost for series compensation in the HVdc scenario was deemed to unnecessarily penalize the Interconnected Scenario over the Continued Isolated Scenario from a performance perspective.

Similar to the existing Island System, there are load scenarios in the interconnected case where the system will survive the 230 kV bus fault at Bay d'Espoir. Preliminary analysis of the Interconnected System with a simplified model of the Labrador – Island HVdc Link reveals that the Island System will

remain stable following a three phase fault at Bay d'Espoir with the 230 kV transmission line between Bay d'Espoir and Western Avalon added and all synchronous condensers in service during the spring/fall intermediate load levels.