Q. Further to PUB-NLH-513, please explain whether there are any conditions, not discussed in the responses to PUB-NLH-482 and PUB-NLH-487, that would be considered to give an N-1 starting position, and for which Hydro would consider it to be permissible for under-frequency load shedding to occur in the event of a single pole tripping. Please include in the reply a discussion of the impact of operation with an outage of an AC harmonic filter and operation with a single electrode line conductor.

A. The normal (N-0) starting position for the Labrador-Island HVdc Link (LIL) considers the following equipment in-service:

- Balanced bipolar mode of operation;
- Two in-service conductors per electrode line (Muskrat Falls to L'Anse au Diable and Soldiers Pond to Dowden's Point);
- 5 x 72 MVAR ac harmonic filters at Muskrat Falls including one spare;
- 6 x 75 MVAR ac harmonic filters at Soldiers Pond including one spare; and
- Three submarine cables (two on Pole 1, one on Pole 2) in the Strait of Belle Isle crossing.

The design and operation of the Island Interconnected System includes an under frequency load shedding (UFLS) scheme to prevent system collapse following the single (N-1) contingency loss of generation capacity nominally greater than 50 MW. The limited system inertia on the Island Interconnected System due to its isolation from the larger North American grid, the governor response times, and the fact that technically viable solutions to prevent load shedding under those circumstances would be costly has resulted in that circumstance since the Island Interconnected System was established.

The construction of two HVdc links (one to Labrador and one to Nova Scotia) will improve the performance of the Island Interconnected System for the loss of generation as the lost capacity can be restored through automatically rapidly adjusting the power flows over the HVdc link from Labrador. In addition, the configuration of the LIL ensures that under frequency load shedding will not occur on the Island Interconnected System for loss of a single element in the HVdc scheme (i.e., N-1 contingency).

Single element contingencies associated with the LIL include:

- Trip of one pole of the bipolar scheme including:
  - Failure of converter transformer;
  - Failure of thyristor valve;
  - Loss of pole conductor; and
  - Failure of one set of controls for converter.
- Loss of an electrode line conductor;
- Trip of one ac harmonic filter at either converter station; and
- Loss of a submarine cable.

Following the first N-1 contingency, the design will not ensure load shedding will not occur for every second order contingency that may occur. The operation objective will be to adjust the system dispatch to best position to prevent a customer load interruption for the next N-1 contingency (N-1-1). Also, for the planned removal of system elements the System Operator will schedule the removal for periods when an N-1 contingency would limit potential under frequency load shedding to only cases where the LIL bipole is out of service or forced out of service. Prevention of under frequency load shedding or customer load interruption for an N-1-1 contingency involving the LIL during peak load

conditions is beyond Hydro's design objectives for the LIL and existing transmission planning criteria.

The impact of operation with an outage of an AC harmonic filter and operation with a single electrode line conductor are discussed in Hydro's responses to PUB-NLH-504 and PUB-NH-506.