Q. Further to the responses to PUB-NLH-482 and PUB-NLH-487, Hydro's definition of a bipole failure is quite different from the definition used by Cigre, which counts only simultaneous (caused by the same event) failure of both poles as a bipole outage. However, Hydro classifies the failure of a pole whilst in bipolar operation as a bipole failure.

Using Hydro's definition of a bipole failure is likely to result in a significant increase in the number of bipole failures, since one of the poles may be out of service for extended durations (days or weeks) because of maintenance, repair or simply fault finding. It is also likely to result in longer bipole outage times in the event of a failure of the remaining pole in service, e.g. because it is necessary to fault find and repair a much more complex system, and some repairs may take several days, if special equipment (e.g. cranes) has to be brought to site for equipment replacement.

Please explain why Hydro's definition of a bipole outage is different from the normal Cigre definition and explain why a higher number of bipole outages, than presently estimated by Hydro, would not occur.

A. As provided in Hydro's response to PUB-NLH-124, Hydro's definition of a bipole outage is consistent with the Cigre definition of simultaneous loss of both poles of the bipole system. Hydro's calculation of one bipole outage in three years is based upon the Cigre data for similar bipole HVdc schemes with one converter per pole.

Both Hydro's responses to PUB-NLH-482 and PUB-NLH-487 are written in the assumption that one pole of the Labrador - Island HVdc Link (LIL) is out of service

and considers the impact and frequency of load shed for failure of the second, or in service, pole. As noted in response to PUB-NLH-482:

> In determining the potential frequency of under frequency load shedding on the Island Interconnected System for loss of the LIL while in monopolar mode, one must first consider the frequency with which the LIL has gone from its normal bipole operating state to a monopolar mode of operation. Next, one considers the frequency of moving from the monopolar operating state to the LIL outage state.

Hydro's position is that it does not intend to operate for extended periods of time at high power flows on the LIL in monopolar mode. To reduce impacts to the Island Interconnected System, LIL pole maintenance is to be scheduled during periods when there is sufficient generation on the Island to supply all load in the event of the loss of the LIL in monopolar mode for maintenance. Hydro recognized in response to PUB-NLH-482 that:

> The greatest risk to under frequency load shedding on the Island Interconnected System due to loss of the LIL while operating in monopolar mode will occur during peak load periods when one pole of the LIL has been forced out of service. During late fall, winter, and early spring when there will be insufficient generation on the island to supply all island load, deliveries to the island via the LIL will be at their greatest.

In order for there to be an impact on load shedding during the peak load period, the LIL must transition from normal bipole mode of operation to monopolar mode of operation to loss of the healthy pole in a relatively short period of time.

Statistically, the sudden loss of one pole of a bipole system followed by the sudden loss of the second pole of the bipole system in a short period of time approaches the probability of the bipole outage. As a consequence, Hydro's response to PUB-

NLH-482 placed the frequency of a pole outage, followed by a second pole outage during the winter months at once in three years, as per the calculated bipole outage rate.