Q. Further to PUB-Nalcor-61, how has compliance with the referenced standards been considered in the Project design for the Muskrat Falls-Labrador-Island Link Project?

A. Since Newfoundland and Labrador has not implemented legislation regarding compliance with NERC standards, the NERC standards referenced in PUB-Nalcor-61 are not directly applicable to the Island Interconnected system. The design of the Muskrat Falls facility and the Labrador Island Transmission Link ensures the level of performance historically expected of the Island Interconnected system. Further the design is in compliance with Newfoundland and Labrador Hydro operating and design criteria.

For comparative purposes, compliance with the NERC standards can be considered in the project design for the Muskrat Falls–Labrador-Island Link Project as follows:

NERC TPL (Transmission Planning) Standards

Table I Transmission System Standards – Normal and Emergency Conditions of the NERC TPL standards outlines the required system performance under various contingencies. Transmission Planning for the project is compliant under the following conditions:

Category A – No Contingencies – It has been standard practice within NLH to ensure that the power system is capable of supplying the forecast load with all equipment in service such that the system is stable and both thermal and voltage limits are within applicable rating. Each planning cycle peak and light load base cases are developed for the coming five years. Voltage and/or load violations are identified and appropriate system additions placed in the five year plan to return

the system to within limits with all equipment in service. System integration studies for the Labrador-Island Transmission Link have identified the required system additions under Category A. These additions have been incorporated in the Basis of Design.

Category B – Event resulting in loss of a single element (with no loss of load) – NLH is not fully compliant in Category B today and is not planning to be compliant with the addition of the Labrador Island Transmission Link.

Areas of compliance in Category B include:

- Single line to ground faults with successful reclose of transmission line
- Switching of transmission circuits and transformers without a fault
- Single pole block with normal clearing has been a criterion used in integration studies for the HVdc link. The system is planned to survive the sudden loss of a pole with no load loss on the Island Interconnected system.

Non-compliance issues include:

- Loss of a generator today results in under frequency load shed. With the Labrador Island Transmission Link completed it is expected that under frequency load shed for loss of on Island generation will be reduced
- 3-phase faults with loss of transmission today will result in loss of Holyrood for faults between Bay d'Espoir and St. John's. With the Labrador Island Transmission Link a 3-phase fault at Bay d'Espoir will result in loss of load
- Many 230 kV transformers are connected to the 230 kV bus via a motor operated disconnect switch and not a 230 kV circuit breaker. A fault on a 230 kV power transformer will result in tripping of a section of 230 kV bus with short term loss of load until the faulted transformer can be isolated and the 230 kV bus restored. Historically this has been deemed acceptable given

the low probability of transformer fault. Breaker and one half arrangements are being used for terminal stations associated with the project to eliminate this issue.

Category C – Events resulting in the loss of two or more elements (planned/controlled load loss) – NLH is generally compliant with the contingencies in this category, however, the magnitudes of load loss have not been identified for each possible contingency. For the bi-pole failure an SPS is envisioned to isolate central and west coast generation with sufficient load to maintain a stable isolated system. NLH does not use multiple circuit towers as a rule. For the Muskrat Falls ac interconnection multiple circuit towers have been deemed acceptable for station entrances and river crossing only.

Category D – Extreme event resulting in two or more elements removed or cascading out of service – this category has not historically been evaluated by NLH as it requires joint evaluation with other neighbouring systems and to date the Island Interconnected system has been isolated. System integration studies involving Island Interconnected system disturbances with impacts in Nova Scotia and vice versa are being evaluated with respect to the Maritime Link. Due to the HVdc interconnection between the Island Interconnected system and Nova Scotia, ac disturbances (i.e. over/under voltage or frequency) on the Island system are unable to propagate over the Maritime Link to Nova Scotia. In essence, the Nova Scotia electrical system is “firewalled” from disturbances in the Island Interconnected system.

NERC Protection and Control System (PRC) Standards

FERC Order 693 states:

P 1436. … we note that while the PRC Reliability Standards do not specifically require protection systems consisting of redundant and independent protection groups for each critical element in the Bulk-Power System, such requirements are included as one potential solution in the TPL Reliability Standards.

In keeping with the spirit of NERC PRC standards and FERC Order 693, redundant systems, denoted protection group A and protection group B, are being used for the Muskrat Falls Labrador Island Transmission Link Project. In addition each separate protection group will be supplied by a separate dc battery bank system to ensure reliable operation of the protection and control scheme. Beyond the NERC PRC standards and FERC Order 693, critical clearing time requirements on the ac transmission systems in both Labrador and on the Island require high speed protection such that redundant high speed protection systems are required to maintain power system stability.