Q. **Reference: Assessment of Labrador Island Transmission Link (LIL) Reliability in Consideration of Climatological Loads, March 10, 2021 (Haldar Report) by Dr. Asim Haldar, Ph.D., P. Eng. page 46, lines 1399-1404.**

Explain why Dr. Haldar disagrees with the main premise in the Thomas 2011 Technical Note that a higher return period than 50 years could not be justified because the 230kV line feeding the Soldier's Pond converter station operates under a 50-year return period.

A. *The following response has been provided by Haldar and Associates.*

It is our understanding that Mr. Thomas's analysis is purely based on a deterministic planning principle. Although this planning philosophy was developed to account for randomly occurring failures in power systems, it does not incorporate the probabilistic or stochastic nature of system behavior and component failures. A deterministic approach can provide the consequence of an outage but it overlooks the probability of an outage. For example, an outage event that is not severe but has high risk and the probability of occurrence could be missed.

The argument that Mr. Thomas makes—that a return period higher than 50 years is unjustified because the 230 kV line feeding the Soldiers Pond converter station operates under a 50-year return period—fails to acknowledge that the 230 kV system feeding the station could be upgraded to make it more reliable. This is purely based on a single assumption that a repair window of 14 days is sufficient during peak load and no sensitivity analysis is presented to this repair window. It also fails to account for the associated cost versus the expected cost of failure of the HVdc line and consequences (tangible and intangible) based on a 50-year design criterion. Our 2009 study[1] took the entire 230 kV system (isolated), integrated it with the HVdc line, and used a full probabilistic planning model (value based planning) to show that the optimum design

[1] Haldar, Asim 2009 Assessment of Optimum Design Return Period of a ± 450kv HVDC Line, Nalcor Report ##, WTO# 1081, Prepared for LCP project.

return period should be based on minimizing unavailability for the entire BEPS system. We also noted that the determination of return period must consider the impact of failure rate and repair rate of all major components (generation and transmission) and multiple contingencies including several low probability outages with high consequences. A deterministic model cannot include these factors and therefore not suited for a realistic economic analysis for a cost-risk analysis in terms of reliability level. Input data for the component failures and repair data and line allowable load capacity was used in consultation with Mr. Thomas. Our conclusion at the time was that this HVdc line as part of an isolated system should be designed for a 150-year return period for climatic loads, with option to additional generation support near the load center.