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 59, lines 1665-1668.**

What are the implications for the reliability of the LIL that it does not meet industry best practice that the structural support system should fail first compared to the cable system?

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

CSA 60826 requires a prescribed sequence of failure be maintained should the line fail. For an extreme event, it is important that key components of an overhead line fail in a certain sequence; in this context, conductor/shield wire system including hardware part ("wire support system" in Haldar Report) should be the last component to fail because a loss of "wire support system" component will release significant energy and introduce a "shock load" (dynamic impact load) into the remaining components in the system. Depending on the components' residual (reserved) strengths to withstand these large dynamic impact loads, the failure zone could propagate well beyond the location of the initial failure. It has been reported during the 1998 Quebec storm that a 735 kV line lost as many as 80 self-supported steel lattice towers in one longitudinal cascade situation in three different sections of the line. Therefore, any triggering event that could initiate a failure in the "wire support system" component should be avoided completely. However, recent advances in numerical modelling can provide realistic answers in determining the expected cascade zone should the line is exposed to probable cascade failure due to loss of an optical ground wire or a phase conductor.[1,2]

[1] Haldar, Asim, Veitch, Maria, Andrews, Trevor and Tucker, Kyle 2010 Numerical Modeling of a Transmission Line Cascade with Load Reduction Device, Proc., CIGRE SCB2, Paper # B2-304, August 27-30, Paris, France.

[2] Haldar, Asim 2018 Optimum Placement of Anti-Cascade Structures – A Probabilistic Framework, Report CEATI TR143700-3395.

Newfoundland and Labrador Hydro provides the following additional information.

As outlined by Haldar and Associates above, this could potentially result in a multi tower failure versus a single tower failure, resulting in increased restoration time. However, this would be dependent upon a number of factors including reserve capacity in the towers, landscape, loading, etc. As seen during the winter 2021, a cable break was experienced but did not result in any complete tower failures. To mitigate and limit risk associated with multi-structure failure propagation, the Labrador-Island Link has been designed with anti-cascade structures in accordance with CSA guidelines. In addition, the cable system will withstand loading in excess of design limits before a mechanical failure occurs under ultimate limit states and therefore the loading would have to surpass local design criteria before a mechanical failure of the cable is experienced.