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.**

Further to PUB-NLH-197, is there an accepted methodology to evaluate the impact of line length on the reliability of a transmission line?

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

I am unaware of any accepted methodology to evaluate the impact of line length on the reliability of a transmission line. Following the submission of the Labrador-Island Link ("LIL") Report in April 2021, Dr. Haldar worked with Prof. Hong at Western University to test the analysis hypothesis that the regions are independent with respect to extreme storm events. EFLA Consulting Engineers was asked to provide the extreme event wind and ice analysis data for two specific regions; a correlation study indicated a strong correlation exists within a specific region, but the correlation was weak between two remote regions. Therefore, assessing LIL reliability based on the assumption of complete independency of the four regions is valid, and the reliability level in Case 4D in Table 6.2 for DLS is the appropriate lower-bound reliability level value. This is a "unique" way to incorporate the impact of long line length in a structural reliability analysis of a spatially distributed system exposed to multiple hazards. This observation has also been noted in a separate study: a transmission line under tornado wind showed that line length significantly impacted the probability of failure ("POF") (or reliability) of the line compared to the probability of failure of site-specific structure that has been "hit" by downbursts. It is shown that a one order of magnitude increase in transmission line length leads to about a one order of magnitude increase in the annual POF.[1]

[1] Banik, S.S., Hong, H.P and Kopp, G.A. 2008 Assessment of Tornado Hazard for Spatially Distributed Systems in Sothern Ontario, Journal of Wind Engineering and Industrial Aerodynamics, Vol.96, pp.1376-98.

It is to be noted that the CSA 60826 provides the bare minimum reliability level and that many other considerations are necessary to address specific line reliability level issues, such as weather exposures, hazard levels and types, regional geography (inland versus coastal), and terrain types. CSA 60826 recommends three specific levels of reliability, and it recognizes that return period above 50 years should be considered for an important line (like LIL), unless a shorter return period can be validated by an optimization study.

Newfoundland and Labrador Hydro provides the following additional information.

The work referenced above by Haldar and Associates in conjunction with Professor Hong at Western University relates to the Extreme Event Analysis area of additional consideration. As noted in response to PUB-NLH-202, this analysis has been completed and interpretation of the results are ongoing and will be included in Newfoundland and Labrador Hydro's Q4 2021 report.