Q. **Reference: Study, page 9 - Transmission Planning Criteria TP-S-007 NLSO Standard** www.oasis.oati.com/woa/docs/NLSO/NLSOdocs/TP-S-007_Transmission_Planning_Criteria_UPDATED_05112018.pdf

Considering the steady-state voltage criteria sets the post-contingency limits to 0.9 to 1.1 pu for all bus voltages (TP-S-007, section 5.4.1), why is the voltage limited to 1.05 pu at the synchronous condensers terminals in such scenarios? *See Appendix B, page 6.*

A. While the post-contingency limits for bus voltages are set between 0.9 and 1.10 pu[1] of buses, there is an exception for the terminals of the synchronous condenser. The synchronous condenser is a generator, and generators are typically designed to operate within 5% of rated voltage. Deviations in voltage outside these limits may cause thermal stresses as a result of saturation of the magnetic core and excessive fluxes in the laminated core structure of the generator. "IEEE Std C37.102-2006," *IEEE Guide for AC Generator Protection*[2] outlines typical protection settings for overvoltage conditions of a generator in which a unit should be disconnected from the system. These settings recommend tripping a generator within 20 minutes if the overvoltage condition is 10% above rated voltage.

Existing protection of the synchronous condenser, in the form of an excitation limiter, is currently set such that if the voltage at the terminals of the unit reach 7% above rated voltage the excitation system will act to prevent voltages in excess of that value.

As a conservative planning measure, Newfoundland and Labrador Hydro has set the limit of the synchronous condenser to 5% above rated voltage as the 10% overvoltage is not possible for these units.

[1] Per unit ("pu").
[2] Institute of Electrical and Electronics Engineers ("IEEE").

Newfoundland and Labrador Hydro will update its "NLSO Standard Transmission Planning Criteria Doc # TP-S-007"[3] to reflect the terminal voltage limitations.

[3] Newfoundland and Labrador System Operator ("NLSO").