Q. **E-104; Volume I, Tab E: Replace Optimho Relays on TL203 – Western Avalon to Sunnyside; Various Sites, pages E-114 and E-115.**

Please provide a brief description of the protection schemes for the bulk 230 kV transmission lines based on changes to the P1 and P2 protection systems.

A. For this project, only the P1 relay will be replaced. There will be no changes in the protection schemes. Both the line protective relays, 21P1 and 21P2, are distance relays which measure the impedance of the protected line to determine if there is a fault on the line. When a fault occurs on the line, the line impedance will decrease. By using the current and voltage values, the line relays will be able to calculate the impedance changes and initiate a trip to the line breakers to isolate the faulted line. There are two zone settings used in each line relay by Hydro. Zone 1 is set around 85% of the line impedance and Zone 2 is set around 120% of the line impedance. The relays use "Permissive Overreach Transfer Trip Scheme" to speed up the clearing time for the faults at the remote end of the transmission line. In this scheme, transfer trip signal channels are required. The distance relay Zone 2 element set to reach beyond the remote end of the protected line is used to send a transfer trip signal to the remote end when it detects a fault within its Zone 2. The receiving relay contact is monitored by a directional relay contact to ensure that tripping does not take place unless the fault is within the protected section. The instantaneous contacts of the Zone 2 unit are arranged to send the signal, and the received signal, supervised by Zone 2 operation, is used to energise the trip circuit. The overcurrent element of the line distance relays are also set up to provide backup protection for line-to-ground faults.