

Touloustouc pressure tunnel leakage estimation, filling, instrumentation and control

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Abstract:

The Hydro-Quebec Touloustouc hydroelectric project is located approximately 150 km north of the city of Baie-Comeau, Quebec, and was commissioned in July 2005. The water conveyance system to the 520 MW surface powerhouse is assured by a 10 km long, 13 m x 11 m unlined headrace tunnel and a 175 m high vertical surge shaft, operating under a maximum static head of 180 m.

In-situ stress measurement tests results indicated the presence of local minimum principal stresses lower than the water pressure in the tunnel. Those minimum measured values were also lower than the stress predicted by topographic rock cover criteria. Based on stress measurements results, the penstock steel liner behind the powerhouse was lengthened and, at a second location, a pressure relief curtain was constructed in the low stress zone to control the propagation of potential local hydraulic jacking and also to control pore pressures in the near surface zone that might destabilize the overburden located above the tunnel. The paper presents the leakage estimation, the filling procedure and the monitoring program that was carried out in order to closely follow and control progressive rock mass saturation and total tunnel leakage. The tunnel was filled in March 2005 and has performed satisfactorily since then, with acceptable water losses within the predicted range.

Keywords: Precambrian Age; mix of grey and pink gneisses, folded and cut by granitic and mafic dykes; in-situ permeability measurements; expected leakage; rate of filling; leakage control; leakage at the powerhouse; leakage in the low stress zone; total tunnel leakage.