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Comprehensive Approach to Caprock Characterization

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Caprock integrity plays a crucial role in the success of any In Situ operation, and is especially important for operators who inject steam under high pressure, or work in areas with thinner overburden. The Mackay River SAGD development, operated by Suncor (formally Petro-Canada), has been producing bitumen since 2002. The field is currently producing in excess of 30,000 bbls per day from depths between 80 and 140 meters TVD. Due to the comparatively shallower depth of SAGD operations at Mackay, Suncor has conducted caprock-related data collection programs prior to production, and that work has ramped up substantially since 2006. While our data collection programs are not limited to geoscience data, that work is highlighted here. Geoscience data collection programs are divided into those aimed at defining stratigraphy of caprock layers, accurately describing lithology, and the characterization of natural fractures.

The stratigraphic refinement of the caprock layers has been conducted using open hole logs, seismic data, extensive coring programs, and drill cuttings collected from the shallow section of vertical wells. In the Suncor Mackay region, the stratigraphic column overlying the McMurray Formation reservoir starts with several discrete units of the Wabiskaw Member of the Clearwater Formation, which in turn are overlain by the Lower Clearwater Shale. Upper Clearwater deposits overly the Lower Clearwater Shale, and they are overlain by Quaternary sediments. Quaternary sediments include sandy and clay-rich tills, as well as subglacial channel deposits represented by the Birch Channel.

Work to define the lithology of the units has focused on the sedimentology and differentiation of caprock layers, the analysis of grain size data, and analysis of XRD data. In addition to work of the stratigraphy and lithology of the caprock succession, Suncor has initiated a multi-year program to characterize natural fractures that occur within the caprock layers. As part of this program, whole core observations of fractures are paired with open hole image logs, in order to quantify and categorize any natural fractures that occur within the caprock layers.