Assessment of a Carbonate Aquifer for CO_2 Geological Storage in the Wabamun Lake Area

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Abstract/Excerpt

A significant number of large CO_2 emitters are located in central Alberta, Canada, including four coal-fired power plants in the Wabamun Lake area (Figure 1), with cumulative annual emissions in the order of 30 Mt CO_2. To help industry and regulatory agencies in selecting and permitting sites for CO_2 storage, proper characterization is essential, covering the principal aspects of CO_2 storage: capacity, injectivity, and confinement. The sedimentary succession in the Wabamun Lake area southwest of Edmonton was identified as a potential CO_2 storage site because it would minimize transportation needs and costs from the large CO_2 sources in the vicinity. A wealth of data on stratigraphy and lithology, fluid compositions, rock properties, geothermal, geomechanical and pressure regimes was used to create and characterize a comprehensive three-dimensional model of the deep saline aquifers in the area that could be CO_2 storage targets. These have sufficient capacity to accept and store large volumes of supercritical CO_2 at the appropriate depth and are overlain by thick confining shale units. One of these targets, the Nisku Formation in the Devonian Winterburn Group, was chosen for a more detailed investigation and modelling of the injection and spread of CO_2 in the subsurface.

The detailed assessment of the Nisku aquifer includes the geological and hydrogeological characterization of the Devonian Nisku Formation, as well as two-phase flow modelling to evaluate the fate of injected CO_2. A potential injection site was chosen in the center of the study area, in the vicinity of the Keephills and Genesee power plants. Combined annual emissions of these two power plants are in the order of 12.5 Mt based on published 2004 data by Alberta Environment). For the purpose of modelling the CO_2 spread in the subsurface, 30 years of CO_2 injection were assumed.