

Numerical modelling of highly saline wastewater disposal in Northeast British Columbia

M.S. Simons, D.M. Allen, D. Kirste

Department of Earth Sciences, Simon Fraser University, Burnaby, BC, Canada

L.A. Welch

British Columbia Oil and Gas Commission, Kelowna, BC, Canada



ABSTRACT

In Northeast British Columbia, wastewater from hydraulic fracturing and oil and gas production is injected into deep groundwater or depleted hydrocarbon reservoirs for disposal. The wastewater typically has a salinity in excess of 100,000 mg/L, while the formation water may be significantly less saline. The injection of relatively dense wastewater into disposal formations has the potential to influence the pressure/head distribution in the aquifer within the disposal zone, potentially extending to the regional scale. At the same time, wastewater plume migration is influenced by subsurface pressure conditions and hydrogeological properties, which dictate regional groundwater flow characteristics of the deep formation. This study investigates the integration of wastewater disposal plumes into the Paddy-Cadotte formation in Northeast BC, where formation water, defined as “deep groundwater” under the Water Sustainability Act, has a relatively low natural salinity of approximately 10,000 mg/L, and in which seven disposal wells are currently operating. Geological, reservoir, and disposal well data on file at the BC Oil and Gas Commission are used to support development of a density-dependent flow and solute transport model using the code FEFLOW. Boundary conditions representing the conceptual regional deep groundwater flow system are employed. Model results are used to inform the understanding of potential implications of dense wastewater disposal on the regional deep groundwater flow regime and vice versa. Insights are also gained regarding the potential for regional intermingling of wastewater plumes from different disposal wells within the regional hydrogeological context.

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