Scaling risks during direct use geothermal energy production near Edmonton, Canada

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Numerous reservoirs for direct use geothermal energy production have been identified in the Western Canadian Sedimentary Basin. This presentation provides a preliminary assessment of scaling risks present during the production of geothermal brines from 9 of these reservoirs in the Edmonton, Alberta area. The criteria for selecting these reservoirs were (1) measured bottom-hole tempertures ≥ 60 °C, (2) porosity/permeability suitable for non-EGS fluid production and (3) availability of robust chemical data sets.

We used equilibrium thermodynamics to classify the nature of the *in-situ* fluids, identify the primary scaling forming minerals in these waters and determine the extent of their oversaturation in the selected reservoirs. For comparison, both the B-dot and the Pitzer speciation models were used to construct the models, which describe systems with production temperatures of 65 °C and reinjection temperatures of 10 °C.

The most prominent scale forming minerals in these reservoirs are hematite (Fe_2O_3), which is thermodynamically overstatured in all nine of the studied reservoirs, and barite ($BaSO_4$), which is oversaturated in 8 of the 9 reservoirs. Hematite oversaturation is largely temperature independent. The extent of hematite oversaturation ranges from 10^{-4} g/kg of brine to 10^{-1} g/kg of brine, depending on initial iron concentration. Barite oversaturation is temperature dependant, with the mineral becoming progressively more oversaturated with decreasing temperature. At lower measured concentrations of barium (Ba^{2+}), barite is undersaturated above 50 °C. Similar to hematite, barite oversaturation ranges from 10^{-4} g/kg of brine to 10^{-1} g/kg of brine. Strontianite ($SrCO_3$) is oversaturated (~ 10^{-3} g/kg of brine) in 2 reservoirs. This study is limited by the lack of fluid chemistry data for silicon and aluminum. Even at low concentrations, these two species may oversaturate a variety of zeolites and (ferro-) aluminous clays. Precipitation kinetic data for the identified minerals are required to further quantify the true scaling risks in these systems.