Geothermal Technical Division

Linking CCS and Geothermal: Exploring CO_2 Plume Geothermal Potential at Aquistore

Speaker: Rick Chalaturnyk, PhD, PEng, FEIC
Location: Virtual

Thursday, May 12, 2022 | 12:00pm – 1:00pm (MST)

ABSTRACT

Aquistore is the geological storage component of the Boundary Dam Integrated Carbon Capture and Storage (CCS) demonstration project, owned by SaskPower. The required CO_2 is captured from the flue gas of a coal-fired power generation station. If CO_2 is not required for Enhanced Oil Recovery (EOR) projects, it is transported through an underground pipeline to the Aquistore injection well (~3.4 km deep). As one of the most comprehensive full-scale geological field laboratories in the world, Aquistore continues to show that geological storage of CO_2 in deep saline aquifers can be a safe, practical way to meet the commitments of climate change and net-zero carbon emission policies. Treating CO_2 as a valuable commodity, emerging technologies such as CO_2 Plume Geothermal (CPG) may offer new possibilities to utilize CO_2 as a geothermal working fluid to generate geothermal power, while permanently sequestering CO_2 in underground formations.

Prior to performing any field experiment, the Reservoir Geomechanics Research Group (RG^2) of the University of Alberta conducted a "Feasibility Study for a Proposed CO_2 Circulation Test at the Aquistore Injection Site, Saskatchewan". The talk will discuss the outcomes from the simulation work aimed primarily at providing an assessment of key reservoir variables that potentially affect the performance of a CO_2 circulation test at Aquistore injection site.

The presentation will discuss issues when geologically sequestered CO_2 is recirculated to the surface using a well doublet system. Based on both static and dynamic modelling studies, issues related to the impacts of the extent and shape of CO_2 plume, initial water and CO_2 saturations within the CO_2 plume, heterogeneity in petrophysical properties, and operational variables of both injection and production wells, among others, were studies. Simulations suggest that CO_2 circulation seems feasible at Aquistore; it does not result in huge volumes of brine production from the aquifer, but the operating conditions of both the injector and the producer need to be optimized for a successful CO_2 circulation test; including, but not limited to, well stimulation, injection/production rates, pressure constraints, and completion designs at both injector and producer. The study also estimated potential complex flow regimes and their impacts on the producer (co-production of CO_2 and brine) using simplified two-phase vertical flow models, and commented on the formation of CO_2 clathrate during CO_2 circulation operation that could result in tubing/pipes blockage, reduced flow rates, or salt precipitation.

Beyond a discussion of the outcomes from the feasibility study, future work and knowledge gaps are also discussed including the impact of potential thermally induced fractures and their propagation (short circuiting the wells), geochemistry of supercritical CO_2 (brine/CO_2/rock), possible long-term changes in reservoir porosity and permeability, heat extraction behavior during CO_2 circulation, CO_2 loss, and the need for make-up fluid.

BIOGRAPHY

Rick Chalaturnyk is a Professor of Geotechnical Engineering in the Department of Civil and Environmental Engineering at the University of Alberta and holds an NSERC/Energi Simulation Industrial Research Chair in Reservoir Geomechanics. Prior to joining the University in 1997, Rick co-founded a reservoir surveillance company called PROMORE Engineering and after joining the University, was engaged as Executive VP of Opsens Solutions, a company providing fiber-optic and non-fiber monitoring solutions to the SAGD and CO_2 Storage world. At the University of Alberta, he has established the Reservoir Geomechanics Research Group, working primarily in subsurface processes related to current and future energy processes and to support the research group, has established four unique GeoInnovation Environments, which includes 3D printing of rocks, high temperature/pressure reservoir geomechanical testing capability and a geotechnical beam centrifuge. Rick has over 20 years' experience in CCUS projects, is currently working with PTRC and SaskPower in the Aquistore Project, is pursuing the integration of CO2 storage and geothermal opportunities and is involved with several other international CCS initiatives. In addition to research at the University of Alberta, Dr. Chalaturnyk has also founded GeoVer Inc., a reservoir geomechanics consulting company focussing on the development and deployment of advanced reservoir geomechanics surveillance technologies.