Solution Mining Research Institute, Fall 2001 Technical Meeting
Albuquerque, New Mexico, USA, October 8-9-10

Carbon Dioxide Sequestration Potential in Salt Solution Caverns in Alberta, Canada

Maurice B. Dusseault, PRISM Production Technologies Inc. and Department of Earth Sciences, University of Waterloo, Waterloo, ON, N2L 3G1, CANADA

Stefan Bachu, Alberta Geological Survey, Division of the Energy Conservation Board
4th Floor - Twin Atria, 4999 -98 Ave, Edmonton, AB, T6B 2X3, CANADA

Brett C. Davidson, PRISM Production Technologies Inc.
#207 – 11434 - 168 St, Edmonton, AB, T5M 3T9, CANADA

Abstract

Anthropogenic effects on climate can be mitigated through various measures, among them being CO_2 sequestration in geological media. Geological sinks for CO_2 do not need any major new technological development; the technology exists and has been applied for other uses. The challenge is rather to identify the most appropriate methods and sites for long-term sequestration. There are several potential methods for CO_2 sequestration using geological media: utilization in enhanced oil and gas recovery, injection in depleted oil and gas reservoirs, displacement of methane in coal beds, injection in deep saline aquifers, and storage in salt caverns.

Although perhaps of low priority among carbon sequestration schemes, salt caverns may be suitable permanent (>1000 yr) or temporary (decades) repositories for CO_2 separated from flue gases or from other major point sources. Despite the cost and other potential environmental issues associated with cavern mining, the advantages of salt caverns are high capacity, high filling rate, the potential economic value of leached brine, and the local potential for CO_2 sequestration sites in areas where other sequestration options are problematic. Intact halite is impermeable to supercritical CO_2 and, as slow closure takes place because of the time-dependent behavior of halite, the pressure in the cavern will likely asymptotically approach the isotropic stress state in the salt. If a cavern leaks, possibly around the injection well, there are mitigating factors that will most likely preempt massive CO_2 release into the atmosphere. Overlying salts and horizontal shale aquitards should stop upward migration of CO_2, while overlying saline aquifers should trap the CO_2. A layer-cake type of stratigraphy and the absence of tectonic activity in bedded salt deposits greatly enhance the retardation ability of these strata against any potential leak.

Alberta, the province with the largest CO_2 emissions in Canada, has massive bedded salt resources in an area where there are significant current emissions from heavy oil operations, where additional development is proceeding rapidly, and where other geological means for geological CO_2 sequestration are absent or of low quality. These salt beds are currently used for LPG and refined product storage in central Alberta, as well as brine recovery and non-hazardous oilfield waste placement elsewhere in eastern Alberta, and they have the potential to be used for other storage purposes (natural gas, heavy oil, excess process coke or biosolids waste). The characteristics of the Lotsberg Salt and Prairie Evaporite in Alberta are presented in the context of possible use for CO_2 sequestration.