Solution Mining Research Institute Spring 2023 Technical Conference

Detroit, Michigan, USA 24-25 April 2023

TRENDS IN SALT CAVERN STORAGE IN ONTARIO, CANADA

Abstract

There are 71 operational salt solution mined storage caverns in Ontario with a combined storage capacity of approximately 3.4 million m^3 (22 million barrels). All caverns are in bedded salt formations. Nearly all the caverns store petrochemicals and liquified petroleum gases at high pressures.

A large amount of bedded salt deposits are suitable for storage cavern development. Salt deposits in Ontario occur principally along the western edge of the southwestern region, and are utilized in the Windsor, Sarnia, and Goderich areas. This coincides with the eastern edge of the Michigan Basin and is an extension of the Michigan salt deposits. Solution mining of salt is presently occurring at Windsor and Goderich. Salt occurs within four of the Salina units in Ontario; the A-2, B, D, and F units, at depths ranging from 300 to 720 meters (984 to 2,362 ft.) below the surface. The total combined salt thickness in these four units exceeds 215 meters (705 ft.) in the Sarnia area.

The Ontario salt storage caverns are constructed within salt strata of the Salina A-2 Unit and the B Unit. While there have been no new caverns specifically developed for hydrocarbon storage in Ontario recently, some of the former solution mining operations have been converted into mid-stream storage. In addition, one new compressed air energy storage project in a salt cavern was brought online in 2019.

The caverns are operated and maintained in accordance with Canadian Standards Association Standard *Z341 Storage of Hydrocarbons in Underground Formations.* This standard incorporates life cycle considerations and requires inherent safety features to be built into the well design, construction, operations and maintenance to ensure long term mechanical integrity of the salt cavern storage system. Operators are responsible for updated operational / maintenance procedures, emergency plans and risk assessments.

Many operators would like to increase the storage capacity and increase redundancies. There is increased demand for mid-stream hydrocarbon storage. There is a potential to develop salt caverns for storage of natural gas especially given that up to 60% of natural gas consumed in Ontario in winter comes from reservoir storage.

New regulations and standards for Compressed Air Energy Storage (CAES) in solution-mined salt caverns have been recently adopted. And given the inconsistencies of green energy sources such as wind and solar, there is potential to further develop storage caverns to take advantage of the compressed air energy storage and hydrogen storage initiatives.

The limiting factor that is hindering further salt cavern development for storage appears to be the ability to manage brine that is generated from dissolution. To address this, there may be an opportunity to further enhance the relationship and collaboration between the salt solution mining and the salt cavern storage industries in Ontario.

Key words: Ontario hydrocarbon storage caverns, Geology of cavern storage Ontario, Trends in Hydrocarbon storage Caverns