

Solids Fill in Salt Caverns – A Struggle with Laws of Physics and Authorities

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Abstract

Backfilling coal, metal and salt mines is a method to improve the structural integrity of mines and expand its lifetimes. Fill materials are usually waste rock / salt and by-products originating from the mines. Throughout recent decades abandoned mining rooms attracted the interest of administrations in Europe, particularly Germany, seeking space for storage of waste including those possibly hazardous to the environment. Regulatory approval is granted if proposals prevent, in accordance with regulations, damage to the biosphere.

Solids fill in salt caverns, in analogy to backfilling mines, is practiced by salt producers world-wide where waste / by-products are deposited as sludge in caverns. While the mine rids of useless material the solid contributes to cavern and ground stability. Backfilling at large scale involves fill materials originating from sources outside the mine, preferably waste. Past proposals submitted in UK, Canada, Germany a.m. have not been approved and realised. A first permit for liquid non-hazardous waste injection has been granted in the year 2000 for a salt cavern at the Moss Bluff salt dome in Texas.

A survey of SMRI literature on the subject reveals that the saturated brine contained in salt caverns is the main physical obstacle against solids injection. Different to mines, solid volume placed must displace an equal volume of brine. The brine has to be processed to salt, but a threat is imposed on product quality from brine contamination caused by fill stream turbulence. In addition, future contamination of groundwater by contact with brine must be excluded. A complex procedure for making up a fill mixture and adequately placing solids in caverns must be designed that meets flow, settling and non-contamination requirements.

Regulatory authorities are caught in the middle between waste removal from and long term protection of the environment. Waste deposited belowground must be reclaimable, was a regulatory demand raised in the years past 1980. This was a knock out criterion. Alternative waste fill in dry caverns has, in response, been investigated, by example, in Germany at that time. After years of negotiations the proposal was shelved. Instead, backfilling abandoned mines with waste materials was approved for the higher ranking aim of ground stabilisation.

A single project involving saturated brine is underway. Solids fill, made of flyash, salt and cementing agents, in urgent support of the ground above flooded salt mines has been approved in the UK.

Key words: caverns for solids storage, brine disposal, regulation