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PREVENTION OF STORED GAS HUMIDIFICATION: LESSONS LEARNT AND REVIEW OF POSSIBILITIES

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Abstract

During natural gas storage in salt caverns, water evaporates into the dry stored natural gas at the interface with residual brine. Upon withdrawal, this water vapor content may exceed the gas grid requirements and may cause hydrate formation, risking plugging and damaging surface facilities. This issue is treated at the surface by having the withdrawn gas flow through pre-heating and dehydration units. This equipment typically represents 5-15% of a site overall CAPEX and may limit the site total withdrawal rate.

The alternative would be to prevent the gas humidification from happening in the cavern. Three main options are identified: removing the residual brine from the cavern, lowering the water evaporation at the brine / gas interface, and lowering the water vapor content thermodynamic equilibrium.

Removing and replacing the residual brine water by an alcohol has been proposed, but its efficiency and feasibility at affordable cost is yet to be proven.

Limiting the mass transfer at the interface using a sump sealing has been heavily discussed in the 70s and 80s, and was applied on three German sites and on one Danish site from 1974 to 1990. The underwhelming results from these three attempts and the operational problems triggered in the latest one, combined with an increasingly stringent regulation, probably explains that the subject disappeared from the public technical discussions since then. The present paper analyzes what can be learnt from these past precious attempts, and reviews the options for sump sealing medium.

Last, the driving force of the gas humidification is the thermodynamic equilibrium between gaseous and aqueous phases that happens when their activity coefficients are equal. The options for lowering the activity coefficient in the aqueous phase -the residual brine- are reviewed and quantified in terms of cost and efficiency.

Key words: Salt caverns for gas storage, hydrates prevention, sump sealing, water partial pressure