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Effect of natural convection on the blanket dissolution rate in a salt cavern

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ABSTRACT

In a paper presented during the SMRI 2006 Fall Meeting in Rapid City, the authors suggested that, before abandonment, a small quantity of gas be injected in the cavern to increase cavern compressibility and to prevent pressure build-up from being too severe. This solution proved to be robust in that a gas leak can be beneficial, making pressure build-up even slower than when gas remains trapped in the cavern.

In this paper the effect of brine convection on gas dissolution rate is discussed. It is proved that brine convection is driven by density changes induced by non-uniformity in brine temperature and by gas dissolution. Numerical computations considering both phenomena are performed, and different cavern shapes are considered. Two thermal loadings are discussed: (1) cavern brine temperature is lower than rock mass temperature by 3 °C ; and (2) globally, cavern brine is in thermal equilibrium with the rock mass (no temperature difference). The influence of the area of the gas/brine interface is discussed. The characteristic times of gas dissolution in these two cases are compared.

Keywords: Abandonment, Natural convection, Gas dissolution