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RELATIONSHIP BETWEEN SUBSIDENCE AND CAVERN CONVERGENCE AT TERSANNE (FRANCE)

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Surface volume losses derived from subsidence measurements are correlated to underground volume losses due to creep in the case of TERSANNE (GAZ DE FRANCE natural gas storage in salt caverns). Procedures applied for volumes determination and merits of such a comparison are discussed.

1. INTRODUCTION

Surface subsidence is evidence of underground undergoing phenomena. As far as storage caverns in salt are concerned, this underground activity is convergence, that is, loss of cavern volume due to creep of rocksalt because of its viscous behaviour.

In most cases, storage operators are interested by both convergence and subsidence, but tend to treat them as separate problems. Cavern creep represents loss of storage space and therefore loss of money which has been invested for solution mining ; trying to minimize creep leads generally to rocksalt laboratory characterization, computer code modelling and site-specific operating procedures. Subsidence corresponds to disturbances caused to environment and may be considered in extreme cases as a potentially hazardous event that can damage structures and property ; attempting to investigate subsidence leads to the design and construction of a subsidence monitoring network for regular monitoring of positinal changes of the ground surface. Instead of considering these two phenomena separately, analysing relationship between them should be encouraged, especially for a better comprehension of site-specific subsidence mecanisms.

This relationship has been studied by GAZ DE FRANCE by comparing volume variations underground and at the surface.
Underground volume variations due to crep can be regularly evaluated by taking into account cavity pressure history and rocksalt characteristics in mechanical computer codes. Surface volume variations can be derived from regular elevation measurements interpretation.
On the TERSANNE fourteen-cavern field (GAZ DE FRANCE natural gas storage), these volumes have been regularly estimated over past ten years. Careful comparison of the two types of volumes may prove helpful in understanding how underground volume losses are transmitted by sinking (compaction) of upper layers.