

## Systematic Approach for Storage Integrity Assessment of Existing Cavern Storages

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### Abstract

Salt caverns are suitable for storing gas and oil products and provide a relatively high storage volume which can be operated customizably. It is possible to use the cavern as strategic reserve, for seasonal compensation or even for high-frequency storage operation. The creation and preparation of a salt cavern for storage operation need major, long-term investments. For worthwhile and safe investment the serviceability of the storage capacity has to be ensured. Maintenance on a regular basis is essential to reach a longest possible service life. During the entire cavern life time the integrity of the storage facility is the basic requirement for the use as reservoir.

To secure the assets – storage capacity on the one hand and storage medium on the other hand – the durability of a salt cavern and therewith its integrity has to be maintained. With an increasing number of aging storage caverns, the knowledge about the current status of the storage system becomes an indispensable requirement. On the basis of this status the present storage integrity and its expected development can be evaluated to guarantee third party protection and long-lasting containment of the storage medium within further operation.

Apart from securing the investment, the serviceability and the safety of the cavern, a great number of legal, regulatory and normative standards must be fulfilled for the operation of storage facilities resulting in a wide scope of maintenance and monitoring activities. Therefore the boundary conditions, technical influences, regulatory and technical standards need to be assessed and can should be merged in a management system.

In this paper a systematic approach to assess the storage integrity of existing salt cavern storages will be discussed and the benefits of an accompanying management system will be presented. The main preliminary investigations are:

- Re-Assessment of documentation: Data collection of cavern construction and operation to determine a status quo of the facility.
- Investigations on well integrity: Evaluation of the current status of the barrier system consisting of casings, cementations and completion elements by using appropriate standards and software.
- Rock mechanical, geological and thermodynamic modeling of location: (Re-)evaluation of the cavern performance and long term behavior of the salt location based on the operation mode (history and planned)
- Investigation on subsidence: creation of a subsidence model for the location for evaluating surface and subsurface effects

Based on these main aspects and according to effective standards the aspired output is a systematic risk-based maintenance and inspection plan (or an extension thereof) that includes:

- Periodic determination of cavern volume, sump depth, contour condition and subsidence
- Periodic inspection of corrosion (anchor casing, completion) and cathodic protection system
- Review of changed operating envelope; adjustment with respect to rock mechanics, thermodynamics where appropriate

The method and proceeding will be demonstrated.

**Key words:** storage integrity, well integrity, inspection, maintenance, subsidence induced stress, rock mechanical model, thermodynamic simulations