

SOLUTION MINING RESEARCH INSTITUTE

679 Plank Road
Clifton Park, NY 12065, USA

Telephone: +1 518-579-6587
www.solutionmining.org

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Conference
Paper**



**Recompletion of oil caverns to create a monitoring
annulus at the Etzel cavern storage facility**

Steven Patzer, ESK GmbH, Freiberg, Germany

Carsten Reekers, STORAG ETZEL GmbH, Friedeburg, Germany

**SMRI Fall 2023 Technical Conference
2-3 October 2023
San Antonio, Texas, USA**

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Steven Patzer, ESK GmbH, Freiberg, Germany

Carsten Reekers, STORAG ETZEL GmbH, Friedeburg, Germany

Abstract

STORAG ETZEL GmbH is the largest independent supplier of cavern storage facilities in Germany, making a valuable contribution to energy security and gas grid stability in Germany and northwestern Europe.

Since 1971, Storag Etzel GmbH has been building, maintaining, and leasing underground storage capacity for oil and gas at Etzel cavern storage site, Germany. Currently, around 3.9 billion cubic meters of gas is stored in 51 gas caverns. A further 24 caverns can store over 10 million cubic meters of crude oil.

With the H2CAST Etzel research project STORAG ETZEL advances the research and development of large-scale underground hydrogen storage.

As part of regular workover operations on the cavern boreholes, an additional annulus is planned to be installed for monitoring purposes and for an additional well barrier. This additional barrier prevents direct contact between the storage medium (crude oil) and the last cemented casing, thus increases the operational safety of the cavern.

In planning the new completion, the main goal was the hydraulic optimization of the system to minimize performance losses (at given injection and withdrawal rates). Additionally, pipes were designed based on the expected pipe stress occurring during storage operation.

At the Etzel storage site, the existing caverns were first categorized by type based on depth position, well path and last cemented casing dimensions to identify potential sizes for the additional tubing. Following this, the appropriate pipe material was selected followed by detailed considerations of suitable connectors, and evaluations of the entire completion for hydraulic and mechanical compliance. A suitable packer system was selected. Installation options were then thoroughly analyzed and evaluated.

The paper gives an insight into the development of the recompletion concept. It also describes the steps of implementation and presents the optimization of individual work steps (in particular the further development of the packer design) after meanwhile 14 recompleted wells.

Key words: Caverns for Liquid Storage, Cavern Hydraulics, Well Design, Drilling and Completion, Well Integrity