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Practical considerations when selecting recompletion method (dry/wet) in underground cavern storage UK

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Abstract

The necessity to undertake a well recompletion is typically driven by a need to either; remediate a well failure, extend the asset's operational lifetime or change the asset utilisation (e.g. from natural gas storage to storage of hydrogen).

In general, there are two options for well recompletion to be considered; 'dry' or 'wet' recompletion methods. 'Dry' recompletion involves the isolation of the stored product in the cavern with mechanical barriers prior to recompletion, while 'wet' recompletion involves the removal of the cavern inventory by re-watering the cavern prior to recompletion. The selection of the recompletion method for any project is complex. A 'dry' recompletion can offer Operators significant cost savings however there are other parameters such as asset economics, operational duration, operational complexity and trade-offs in methodology which may mean a 'wet' recompletion option is the preferred solution.

This publication discusses the decision-making process for designing and planning a well recompletion for a mid-sized cavern leached in bedded salt. Both 'wet' and 'dry' options are considered, with the risks and trade-offs of both options presented. This study utilises an idealised well and cavern, considering several scenarios based on design issues encountered on past recompletion projects. The main areas of consideration are:

a) available infrastructure of the storage site, e.g. surface plant and disposal route of brine,
b) wellhead configuration,
c) well status,
d) duration of workover,
e) local geology,
f) geomechanical behaviour of cavern.

To support the decision-making process a geomechanical assessment of the idealised cavern is presented. 'Wet' and 'dry' variations are numerically modelled for a range of recompletion durations. The analysis presents a comparison between the variations concerning the respective Serviceability Limit State (SLS) and Ultimate Limit State (ULS) conditions. The expected change in cavern geometry due to leaching under 'wet' conditions will be examined and the effect of non-halite salt and insolubles will be discussed.

The risks associated with each option are reviewed where the risk profile for each method can vary, over the course of the design, planning and enactment phases of a project. Furthermore, the impact of completion and well design on the recompletion method is reviewed, as is the relevant UK legislation with focus on well barriers and risk assessment.

Key words: Gas Storage Caverns, United Kingdom, Dry, Wet, Recompletion, Rock Mechanics, Well Design, Rewatering and Workover