

New developments in the gas first-fill process of natural gas storage caverns

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Abstract: The first-fill of natural gas storage caverns involves simultaneous gas injection and brine displacement. With the standard completions used for this purpose in Europe, this process can sometimes take more than a year depending on the size of the cavern. This length of time is largely attributable to the need to subsequently snub the brine displacement string under pressure, and the mandatory stipulation to install a safety shut-off valve. The first-fill time can however be significantly reduced by departing from the use of standard completions, and especially by installing a bigger debrining string. The benefits and risks of this advancement depend on parameters such as cavern size, height and pressure range. Constraints also involve the capacities of the gas supply, brine disposal, gas compressors and brine disposal pumps, as well as limits to the flow velocities of gas and brine. Modifications have to be compatible with the existing gas completion system of the cavern, and must guarantee conditions for safe snubbing operations.

The first part of this paper presents the practical experience with this new development for significant time savings, and therefore earlier commissioning of the cavern. The technical and economic aspects will then be discussed.

The second part of the paper deals with the important safety aspects involving first fill, particularly the pressure surge problem during the first-fill process. The safety shut-off valve

must close immediately if the debrining string breaks off – this rapid closure can give rise to extremely high pressure surges. The associated risk to the surface installations increases overproportionally with the use of larger string diameters, and with faster closing times of the safety shut-off valve. The findings of a parameter study on the basis of a finite element

simulation reveal the effects on the size of the pressure surges.