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INFLUENCE OF TUBING DIAMETERS ON LIFTING METHODS DURING GAS FIRST FILL OF GAS STORAGE CAVERNS – A PRACTICAL EXAMPLE IN THE NÜTTERMOOR CAVERN FIELD

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1 Abstract

The development of the Nüttermoor natural gas cavern field of EWE GASSPEICHER GmbH (EWE) involved the construction of several caverns including caverns Nüttermoor K19 and Nüttermoor K21. Because of the exceptionally good salt quality in this part of the cavern field, these two caverns have been dimensioned with larger cavern heights than usual, to the effect that unconventional measures became necessary during the gas first fill process of the two gas storage caverns. The planning and technical supervision of this unconventional gas first fill was planned and supervised by KBB Underground Technologies GmbH.

Due to the large heights of these two caverns, and the limited maximum pressures, a conventional gas first fill i.e. the displacement of the brine by injecting natural gas was not sufficient for complete brine displacement. The limitation meant that the lower part of the cavern could not be debrined - which would have meant the loss of utilisable cavern volume.

The challenge of complete debrining was solved by injecting a medium with a lower density (freshwater and/or nitrogen) into the produced brine which leads to a lower total density and allows complete debrining with lower gas pressures without exceeding the limiting maximum pressures.

Because of the good experience with the gas lift method in another project, as described in the previous paper [MP2009S Bernhardt], the decision was taken to also use the method to improve the gas first fill of the two EWE caverns.

Due to changes in the European standard completion specifications, and in contrast to the previous project, it was now possible to install debrining strings with larger diameters. This led to significant time savings. Additionally, the gas lift method proved to be more efficient than could be explained by the larger diameter of the debrining string alone.

The paper gives an insight into the practical experience with the gas lift method, and particularly on the impact of the tubing diameter, which can now be implemented because of the changes in completion specifications. One of the main influences on the lifting method can therefore now be analysed and will allow a better applied design for further projects. Due to these findings, it is possible to reduce the associated risks and costs of future applications of the gas lift method. Additionally, the effect on the efficiency of lifting methods during gas first fill when using larger tubing diameters will be discussed, as well as the effect of different lifting media.

Key words: Cavern design, caverns for gas storage, gas storage, gas first fill, gas lift method, lifting methods