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LONG-TERM DOWNHOLE FIBRE OPTIC TEMPERATURE MEASUREMENTS AND CFD-MODELING FOR INVESTIGATION OF DIFFERENT GAS OPERATING MODES

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Abstract

The very complex thermodynamic process inside of gas-filled salt cavern influences the operation conditions of a storage site and the available withdrawal rates depending on the various pressure/temperature states.

To get a better understanding of the temperature distribution in caverns and of the time dependent changes a long-term test program was performed in the gas cavern S 107 of the storage site Staßfurt, Germany. By using the fibre optic measurement system of GESO the cavern temperature over a period of 336 hours (14 days) was permanently registered for the different operating modes: withdrawal (3 rates), standstill, injection, standstill.

The applied equipment, the grade of accuracy of measured data and the used methods for data accumulation/processing of the temperature survey will be described. All the acquired data were analysed and interpreted by using the software KAVTEC.

Furthermore the CFD code COMET was applied to simulate the transient gas flow process of selected periods. The requested adaptation of the model parameters and the achieved results in comparison with the measured data will be demonstrated in the paper.

First conclusions regarding the flow processes in caverns and the temperature changes depending on the operating mode will be made. The influence of the cavern shape to the calculated velocity distributions and to the temperature survey will also be discussed.

Finally the possibility to optimize the caverns and to realize best practices will be given for the storage operators.

Key words: Caverns for Gas Storage, Monitoring, Thermodynamics, Computer Modeling