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Mechanical Integrity Testing Using the Fibre Optic Temperature Sensing Technique

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Abstract

The evaluation of Mechanical Integrity Tests (MIT) to verify the tightness of cavern wells is primarily based on determining the depth of the gas/liquid interface below the casing shoe of the last cemented casing. Repeated measurements using gamma-gamma tools represent, however, a significant source of errors. The fibre optic temperature sensing technique is a viable alternative.

The fibre optic temperature sensing technique was first implemented in a pilot test at the Huntorf K 5 gas cavern, EWE Aktiengesellschaft, Oldenburg, in order to confirm that temperature measurements are able to determine the position of the interface level with sufficient accuracy. The measurements took place immediately after a standard gamma-gamma interface log.

The fibre optic temperature sensing cable was installed in the future 4 ½“ brine displacement string to a depth approx. 30 m below the anticipated interface level. This was achieved by determining the interface level in the open well below the last cemented casing based on measurements taken from within the 4 ½“ string. Temperature effects were stimulated by withdrawing approx. 400 l brine from the string at the cavern head and measuring the reestablishment of temperature equilibrium. The gas/liquid interface was proven unequivocally. The depth corresponded with that determined by the gamma-gamma log.

While the temperature sensing technique offers measurement accuracy comparable with the gamma-gamma method, it also offers the advantage of a quasi-continuous measurement. This would allow early identification of trends e.g. in the development of rates of leakage, which would in turn allow the period of testing to be curtailed.

Keywords: fibre optic temperature measurements, gas/liquid level determination, mechanical well integrity testing, MIT