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## **Development of the Hollenbeck HB-1 Cavern; Operating Experiences.**

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### **Abstract**

The Akzo Nobel Hollenbeck HB-1 cavern exploits the salt of the Zechstein 2 - or Staßfurt - Formation (Upper Permian) of the Harsefeld salt dome, situated in the vicinity of Hamburg, Germany. Gas is produced since start-up of the leaching process in 1999. Simultaneously the annular space between the 10 ¾” casing and the 12¼ “ borehole wall (blanket annulus) was decreased due to creep of salt at a particular depth interval. This was detected during a routine borehole survey. As there was a high potential of plugging of the annulus a number of mitigating measures have been undertaken.

Geological and geophysical information, obtained during the original drilling, have been re-interpreted to enable a common understanding of the described phenomena. Detailed Gamma-Gamma- and Puls-Neutron-Gamma-surveys identified the most intense narrowing of the blanket annulus. The most intense creep of the borehole occurred at the centre of the syncline inside the Knäuelsalz (z2HS1), the oldest member of the whole section. This base member of the Upper Permian Salt tends to much stronger convergence in salt mines, compared to the younger Staßfurt sections, and has therefore to be milled more frequently. At the same time gas samples have been taken to determine the origin and the age of the nitrogen-dominated gas and to assess the further development of the degassing process.

After removing the blanket oil, as a first measure, the narrowing zone was enlarged by fresh water injection into the 10¾” x 7” annulus and brine production through the 10¾” x 12¼ “ blanket annulus until crystallisation plugged the latter. Subsequently, the upper part of the borehole was widened with reversed flow, however not sufficient to reach the zone of the most intense creeping features. After reapplying the procedure the resulting volume was estimated by simultaneous blanket addition and Puls-Neutron-Gamma-survey.

Continuous mining without blanket and dedicated control of the yielded volume has been performed until sufficient annular space was created. As the borehole was widened from bottom to top a compromise regarding the or mining concept and the operational safety was developed.