

## **Hengelo Brine Field revisited: “Determination of Allowable Loading of Pillars”**

Ralf Eickemeier<sup>a</sup>, Wim A. Paar<sup>b</sup> and Stefan Heusermann<sup>a</sup>

<sup>a</sup> Federal Institute for Geosciences and Natural Resources (BGR)  
Section B2.6 (Numerical modelling)  
P.O. Box 510153, 30631 Hannover, Germany

<sup>b</sup> Akzo Nobel Salt b.v., Minerals Department  
P.O. Box 25, 7550 Hengelo (OV), The Netherlands

### **Abstract**

The Hengelo Brine Field of Akzo Nobel Chemicals bv consists of about 200 caverns. Up to now, the total production amounts about 2.0 Mio. t of salt. In the past, BGR defined recommendations for the planned expansion of the brine field (e. g. minimum pillar width and maximum cavern diameter). After having finished a 3D model of the entire brine field in terms of geology and cavern geometry it was evident that some pillars and caverns did not fulfill the recommendations. Therefore, an additional stability proof had to be performed.

Most of the caverns are approximately arranged in parallel rows. However, a part of the caverns is arranged in a more complex manner. Since specific calculations for each cavern configuration would be very voluminous, an easier way to show the stability of the pillars had to be found. So it was decided to calculate allowable pillar widths as a function of cavern diameter. For reasons of simplification two-dimensional FE models had to be developed considering only the main pillars between cavern rows and neglecting the inline pillars. This approach would be conservative and could be applied to any cavern row in the brine field. As a suitable criterion the stress intensity index  $\eta$  was chosen to mark allowable and not allowable loading of the pillar. Thus, a sensitivity study was made using FE calculations of cavern line configurations. In the calculations the leaching process of the caverns was simulated by simultaneously decreasing of the lithostatic rock pressure and increasing of the hydrostatic brine pressure in the cavern. The creep parameters of the rock salt were obtained from laboratory tests on core samples of the brine field.

Now an easy assessment criterion is provided for the Hengelo brine field to decide whether a pillar is stable or not. Only in case of stability problems of a pillar according to the elaborated assessment criterion additional investigations need to be done.