Subsidence Potential of the Hengelo Brinefield (part II)[1]

An analytical model to predict future surface subsidence

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Abstract:

Akzo Nobel Salt has been operating the Hengelo brinefield since 1936, using different leaching techniques. In 1963 the first trough surface subsidence was observed. At the time, it was thought to be the only type of subsidence corresponding to solution mining of bedded deposits. However, in 1991 a sinkhole developed over well 70.
Various studies were carried out to determine the process of surface subsidence, which was identified as cavern migration by roof collapse.

The paper summarizes the boundary conditions for cavern migration, the actual process of cavern migration and the corresponding surface subsidence phases. A classification system of caverns was developed with regard to an inventory of subsidence potential.

1. Introduction

The Hengelo brinefield is situated in between the two cities of Hengelo and Enschede. Currently, both municipalities wish to develop the old mining areas as industrial sites. To support this process and to prevent future subsidence claims, critical caverns had to be determined. A geo-mechanical model was developed, defining the boundary conditions and describing the process of cavern migration. Surface leveling measurements were available since 1941, providing valuable information about past subsidence. This information combined with the knowledge of old cavern shapes, production data and leaching techniques lead to the development of above-mentioned model.

2. Boundary conditions

Surface subsidence is a result of cavern migration to the surface by subsequent roof collapses when the top of the cavern is not situated in the salt layer, after production has ceased. Until recently, roof collapse was considered to be brought about exclusively by physico-chemical deterioration of the roof bed materials [1]. If so, application of an oil blanket would stop the process. However, Bekendam [2] found evidence that failure and collapse of roof layers is mainly a mechanical process.

[1] To be read in conjunction with Part I: "Physic-chemical deterioration and (Hydro)-mechanical failure of salt cavern roof layers" by R.F. Bekendam.