Solution Mining Research Institute Fall 2014 Technical Conference
Groningen, The Netherlands, 29 - 30 September 2014

Managing Subsidence due to Salt Mining

Annemarie G. Muntendam-Bos, Hans Roest and Hans de Waal
State Supervision of Mines, The Hague, The Netherlands

Abstract

Subsidence caused by salt mining operations is a sensitive issue in The Netherlands. An extensive legal framework is in place to ensure a high probability that such subsidence will stay within predefined limits. The key question is: how much subsidence is acceptable and at which rate? And: how can it be reliably assured that (future) subsidence will stay within these limits?

In order to manage and constrain subsidence (rate) within these limits the concept of 'effective subsidence capacity' has been introduced. The 'effective subsidence capacity' is the maximum human-induced subsidence that the affected area can robustly sustain.

On land limits on 'effective subsidence capacity' are dictated by the capabilities of the water boards to manage the water table in the subsiding area in order to prevent flooding of the polders as well as to restrain increasing salinity of shallow subsurface aquifers.

For salt solution mining underneath the wetlands of the Wadden Sea area in the Netherlands, the limiting factor for the 'effective subsidence capacity' is the area-averaged rate of subsidence. This limit for the tidal basin system is determined by the volume of sediment that over a lunar cycle period of 18.6 years can be transported and deposited by nature into the tidal basin system where the subsidence may occur. Taking into account sea level rise and natural shallow compaction (together known as the relative sea level rise), the effective subsidence capacity is the maximum area-averaged subsidence rate available for planning of human activities without damaging the natural environment. It is obtained by subtracting the area-averaged subsidence rate 'consumed' by relative sea level rise from the total long-term acceptable area-averaged subsidence rate limit.

Monitoring and management schemes become of increasing importance to ensure that predicted and actual subsidence (rates) stay within the limit of acceptable subsidence (rates). The schemes contain the validation of models, assessment of position relative to subsidence limits, as well as mitigation actions necessary to reduce subsidence (rate) as soon as it cannot be guaranteed anymore that the imposed limits will not be exceeded. A GPS based early warning system is used for early detection of unexpected behaviour. Regular communication keeps the authorities and the general public informed.

Key words: Environmental Protection and Regulatory Affairs, Sinkholes, Subsidence, The Netherlands