Review of publications 1960 - 2000 on subsidence and sinkhole formation over solution-mined caverns

Results of a literature search, identification of fields for new research

by

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Summary

Surface subsidence is an irrevocable consequence of underground mining. This is true for solution mining as well. Being a sub-discipline of geo mechanics and mine surveying, the cause and mechanism of through subsidence and sinkhole formation is well understood and documented in many scientific papers, case studies and reports. However, as a general rule, main emphasis is on narrative description of the occurrence itself. Quantitative descriptions or predictive tools are found to be rare or not existing, especially when dealing with sink development above bedded deposits. The same applies for legal or financial implications and, to a larger extent, for mitigating operational measures.
Increased environmental conscience, constraints with respect to urban planning and development, the negative impact of 'unexpected' surface subsidence as well as the need for public esteem and support for mining in general ('license to operate') make it necessary to address these issues in more detail.
This literature search, which has a limited scope, is meant to give insight in the work done so far, to assess the state-of-the-art and to make a synthesis. In doing so lacks in understanding and knowledge are disclosed and fields for research or spearhead actions can be identified.

Introduction

As a general rule, solution mining results in subsidence, i.e. the development of a through-like depression or the occurrence of a sinkhole at the surface.
The SMRI autumn 2000 semi-annual meeting[1] is dedicated to a special symposium on sinkholes and unusual subsidence over solution mined cavities and salt and potash mines.
This paper describes the results of a literature search and focuses on publications on sinkholes and subsidence over solution mined caverns solely. Shaft mining on salt or potash isn't taken into account. The idea is merely to assess the existing basis of experience and knowledge - the case studies and engineering and research efforts undertaken so far - and not so much to count the number of publications.
Papers published 1960 – 2000 by operators, professional organizations, engineering companies, research institutes, regulators and the like are identified and analyzed regarding their content. Essentially the search was executed as a database search using the SMRI bibliography and key word index on solution mining and salt.
Proprietary databases of KBB[2] and Akzo Nobel Salt, which contained public domain references, were used as secondary sources of information. Moreover, the proceedings of the subsequent World Salt Symposia were analyzed regarding papers on subsidence and sinkhole formation.

[1] 15 – 17 October, The Menger Hotel, San Antonio, Texas
[2] Kavernen Bau- und Betriebsgesellschaft, Hannover