Modelling of horizontal cavern leaching: main aspects and perspectives

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1. Introduction

In this paper we present some conclusions resulting from the work conducted at CHEMKOP on the topic of horizontal cavern modelling.

Traditional solution-mined caverns are formed by drilling vertical boreholes from the surface. This technology is used extensively, and several computer programs have been developed to optimize solution mining processes for such caverns.

However, for low-thickness salt deposits the vertical borehole method does not allow one to create regular-shaped caverns of large volumes. This is where leaching tunnel-like caverns from horizontal boreholes comes into play. This idea has a long history - the first attempts to leach horizontal caverns were undertaken many years ago. Nevertheless, horizontal boreholes could be drilled from underground mine excavations only, not from the surface. Drilling technologies have been improved over the years, and thus the final dimensions reached by such caverns have grown considerably. Their applications have changed, too, shifting from brine production to storage purposes [1].

In contrast to vertical caverns where both technology description and computer models enjoy a rich bibliography, horizontal caverns are practically absent from literature [1] and the first computer models are in their infancy.

Even in the absence of publications describing the field results of horizontal cavern leaching, general knowledge on this topic is extensive enough so that we are able to form quite clear ideas concerning the development of such caverns.

Below everything we know on the topic of the horizontal cavern leaching process and the resulting cavern shape is discussed. Specific model requirements following from these considerations are presented as well.

For the purposes of this text, leaching medium pumped into the cavern will be described as water though it can also be unsaturated solution. Solution in the cavern will be called brine, regardless of its concentration.