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# DESIGNING OF THE STORAGE CAVERN FOR LIQUID PRODUCTS, ANTICIPATING ITS SIZE AND SHAPE CHANGES DURING WITHDRAWAL OPERATIONS WITH USE OF UNSATURATED BRINE

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**Abstract**

Storage caverns for liquid fuels built in the salt deposits, need during emptying them of the stored product, simultaneous injection of so called maneuvering brine. Brine is replacing the stored product and afterwards is staying in the cavern until the next filling, when it is being removed outside, under the pressure of the injected product. Maneuvering brine can be stored on the surface in open buffer ponds, but of the limited capacity. If the operator of the magazine is co-operating with the leaching plant, he can use also the brine produced in leaching caverns as maneuvering brine. But in this case also, there are quantitative and qualitative limitations connected with the leaching plant production capacity.

Thus, very often the operator of the magazine has the problem with the necessary amount of the maneuvering saturated brine to withdraw the product from the storage caverns. In such cases, he is forced to use the unsaturated brine or even the fresh water. It causes the further dissolution of the cavern walls and, as the cavern size is limited by the geomechanical stability criteria, the number of such withdrawal operations is limited.

Simulation of this effect is difficult and labor-consuming using normal leaching simulation software, because of continuously variable level of stored product-brine interface. Authors created the new version of leaching simulation software, basing on their own **WinUbro** model, allowing to predict changes of the cavern shape during such storage operations.

With this new software, it is possible to determine how many filling and withdrawal cycles will be possible for the cavern of given starting shape and fixed maximum diameter, depending on the concentration of maneuvering brine and on filling-withdrawal schedule.

Using such a modeling during the designing phase of the storage project, it is possible to choose the optimum starting cavern shape in a way to allow the maximum number of withdrawal operations with the use of unsaturated brine. It is also possible to adapt the proper schedule of the storage cavern operation in order to avoid the development of wider flat roof areas, which are unfavorable from geomechanical point of view.

**Key words:** Caverns for Liquid Storage, Computer Modeling, Cavern Operation, Cavern Design, Cavern Development, Cavern Dissolution Modeling.