New visualisation and planning tools for cavern leaching operation

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Cavern leaching operation is a process which requires a lot of data input and know-how. One of the reasons is that the shape of a cavern resulting from a leaching process is only measured in intervals of a month up to years. In the meantime it is only possible to assume the development of a cavern from information gathered before and during the operation. Depending on the salt deposit chemical and physical parameters may change considerably with the location of the well and position of the pipes.

The main objectives during the operation are to

- reach the desired shape of the cavern
- minimize work over
- minimize other down times for measurements and other work
- know as accurate as possible about the cavern situation

If the site is operated to provide brine for a plant, then the main objective is to deliver the required amount and quality at any time. Cavern leaching for storage purposes has different goals, it depends on the situation of the site where the emphasis is laid on. Work over is always related to down times and considerable costs. If work over is minimized then it is almost impossible to leach a cylinder with a diameter of a constant size. This makes clear that any attempt to optimize means to weigh the objectives. If one goal is optimized one is pushed into the background.

There are always different phases in a mining block. In the beginning it is of interest how the cavern extensions develop into different directions. As mentioned before several chemical and physical parameters may cause an undesired irregular shape. With sonar measurement equipment the shape of a cavern in a mining progress can be determined with high accuracy. These measurements cause considerable expenses and a down time in production. However, it is of crucial importance to be aware that a cavern design can be limited due to rock mechanics or other reasons.

Over the years a PC-based information storage and retrieval system has been developed which offers various visualisation capabilities. A key feature of the system is the storage of geometric data in real world co-ordinates. It allows to incorporate geological information gained from drilling operation as well as the influence of one cavern location on the other. This includes also stratigraphic and petrographical information (see also figure 1).

Figure 1: caverns in salt formations

Additional information gained during the drilling of the well can be summarised in another visual form as shown in figure 2.

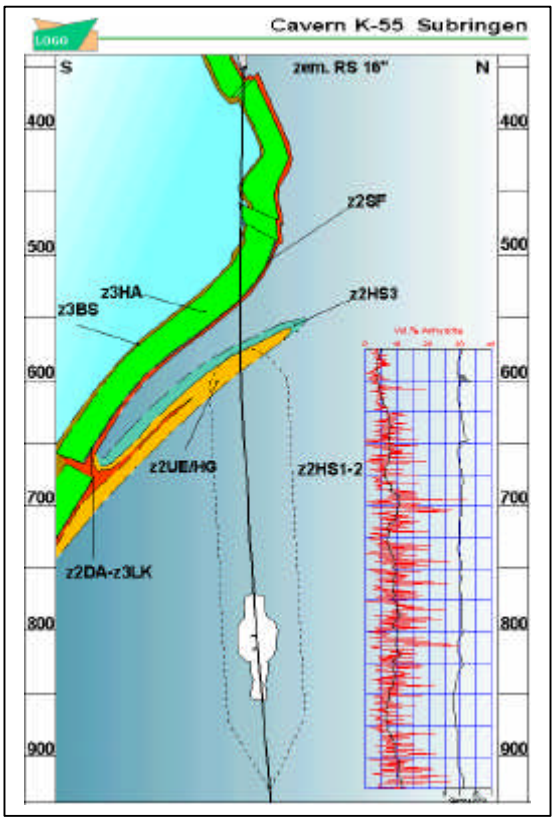

Figure 2: Cavern design and bore hole information

Another feature is the capability to improve the work-over scheduling of the caverns. The result of a variety of assumptions referring to the development of the caverns can be checked quickly and enable an improved operation.

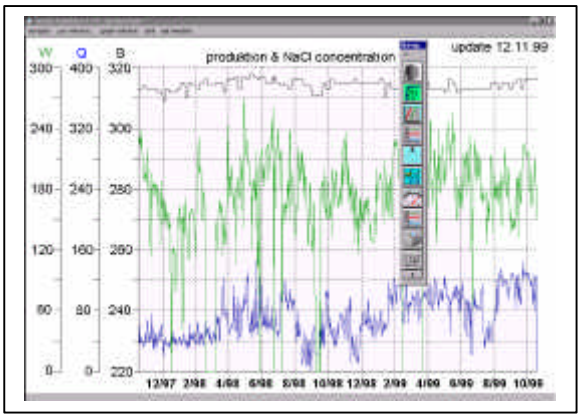

Figure 3: Operational factors of a selected period

One important aspects is the knowledge about key operational factors such as NaCl concentration of input and output streams, level and period of operation (see figure 3). Other chemical data is of interest to predict the development of the caverns shape. These parameters have to be investigated for the individual cavern as well as for the supplying streams. The greatest benefit of such a PC-based system is mainly the capability to combine information of different sources, and to use different tools under a single user-friendly surface. It has been shown in the past that an acceptance of the user is very much dependent on an easy handling combined with a structure of the system adapted to the personal needs of the individual user.

Another important data source are sonar measurements. Very often decisions about moving pipes have to be made quickly after the measurement was carried out. Such a PC-based system must have a tool to process and integrate sonar data without delay. Since companies often have their individual data format converting routines guarantee a standard use of information. For instance, horizontal slices created from sonar data show the development of the cavern over the time. Additionally the remaining reserves are shown (see figure 4).

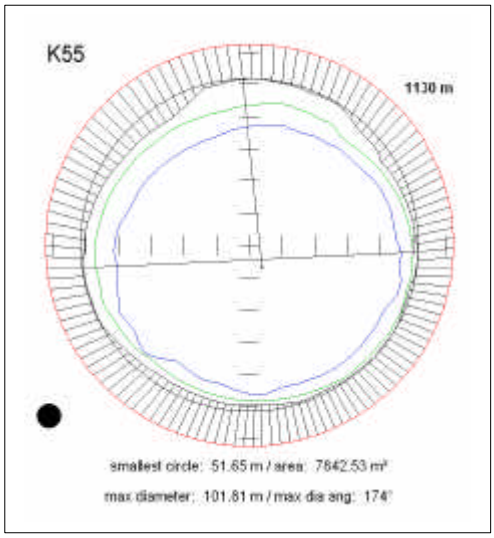

Figure 4: Horizontal slice

Thus the whole system therefore comprises different elements, including the storage of raw data, a database with extracted data, a visualization engine for the database and other tools to predict the future development.