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THE WERRA PRODUCTION CENTER OF THE NEWLY FORMED KALI UND SALZ GMBH - COMPLEX RAW ORE AND DIVERSIFIED PRODUCT LINES

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1. INTRODUCTION

Kali und Salz GmbH was founded in December 1993 by merger of Mitteldeutsche Kaliwerke (in the former German Democratic Republic) and K+S AG's potash and rock salt mines. Its production sites are situated in the federal states (Laender) of Hessa, Thuringia, Saxony-Anhalt and Lower Saxony with its head office in Kassel/Hessa. After concluding the merger programme in 1997, the planned production will be accomplished by only six potash and two rock salt mines. Potash production will then be concentrated, besides Zielitz, Sigmundshall and Neuhof, in the Werra-district. But where exactly is the Werra-salt mining district situated?

"The Werra Production Center" lies in the German "cultural quadrangle" Bad Hersfeld - Eisenach - Meinigen - Fulda with their characteristic, famous cultural sights such as the ruins of the Romanic convent - the Wartburg with Luther's room - the Royal theatre - and the famous "Bonifatius-Cathedral at Fuda. This cultural quadrangle is not only passed through by the Werra river, but was crossed once by the former border between East/West Germany; today, it only separates the two German federal states of Thuringia and Hestia. The Werra-region has a very charming landscape with castles and many old half-timbered houses and villages.

In 1993, the mining industry in the Werra-district celebrated its one-hundredth anniversary. Even today, it is still the largest potash deposit in Germany. Of the former nine mines with a total of 28 shafts, only three productive mines are still in existence: the Wintershall and Hattorf mines in Hestia and the Unterbreizbach mine in Thuringia.

2. DESCRIPTION OF THE WERRA-DEPOSIT

After this short introduction, now the description of the Werra-salt mining deposit.

As far as known, the potash mining district extends over an area of more than 700 square kilometres. It is as large as the German coal-mining district at the Saar river and even larger than the lignite-mining district in the Cologne-Aachen basin. As already mentioned, it is by far the largest Germany potash deposit.

At depths of 300 to 1,000 metres there is a 200 to 400 metres-thick rock salt deposit, embedding two horizontal potash seams each with an average thickness of 3 metres. The deposit is sealed at the bottom and the top by clay layers; faults are rare.

Due to the horizontality of the potash seams, the efficient room-and-pillar mining method is used. For reasons of safety, about 50% of the reservoir is "lost" in the pillars. Despite these losses resulting from "security"-mining, the mineable reserves of the three Werra-mines will last for more than 50 years. However, the deposit has one important disadvantage: the average KCl content of the raw salt is only 17% versus 36%, e.g. of the Canadian raw ore.

This disadvantage is compensated by the following advantages:

- large deposit at low depths
- the flat deposit allows for high underground mining performance reaching up to 100 t/man and shift already to-date. Thus, the hoisting capacity of the mines Wintershall, Hattorf and Unterbreizbach amounts to more than 20 million tons per annum.
- Creation of particularly secure cavities to be used for underground waste disposal. One example is the UTD Herfa-Neurode, underground waste disposal facility, which is part of the Wintershall potash plant.
- And not least of all - turning to the actual subject of this lecture - the mineral composition of the Werra raw ore:

In addition to KCl, another valuable substance is $MgSO_4$ in the form of Kieserite:-

- Thus, the percentage of valuable substances in the raw salt is increased to 30%, that means, to a similar level as our competitors.
- $MgSO_4$ in addition to KCl together provide the preconditions for a diverse range of products.

Before the topic of processing and our product range is discussed in more detail, some special mining features of the Werra-mining district should be mentioned:

The two Werra potash plants in the German federal state of Hesse (Hattorf and Wintershall) have interconnected underground operations. The same holds for the three former East German plants, Merkers, Springen/Dorndorf and Unterbreizbach.

A proposal of interconnecting the mines in Hesse and in the former East German part has been rejected so far for reasons of safety. However, new drifts will be established between the Hessian and Thuringian deposits in order to obtain a secure and new compound operation of the active salt mining district.

The adjacent geologically younger, volcanic rock formations of the Rhön-mountains have basaltic intrusions into the rock salt deposit resulting in CO₂ accumulation. This dangerous environment requires special mining experience and care.

For the before mentioned reason, the production method with continuous mining machines ("mining by cutting") has not been generally accepted in the Werra - "hard salt" - deposit until today. The largest part of the production is carried out by blasting. K+S has developed a high standard in drilling-and-blasting-technology. Only trackless vehicles are used in all areas which are more and more equipped with electric drive.

Further mining details would go beyond the scope of this paper.

3. PROCESSING AND PRODUCT RANGE

A simple processing cycle typical for a pure sylvinitic salt, such as:

grinding - - - flotation - - - finished 60% K₂O

is certainly only a dream for the "Werra producers"!

Compared to this simple process, the flow chart of the Wintershall-plant, e.g., looks completely different. It is similar to that of a chemical plant divided up into several processing and transformation steps.

Here in the Electrostatic Separation process (ESTA) has gained an outstanding importance for the Werra mines. By means of ESTA, it is possible today to split all crude ore components into the different fractions.

In a pretreatment stage, more than 50% of the starting material can be eliminated (mostly NaCl and CaSO₄) and is transferred to waste piles.

The remaining salt-fraction which is then passed to further treatment has a KCl-content comparable to that of our competitors. Together with the MgSO₄-content, the share of valuable substances amounts to more than 50%.

Further advantages of the ESTA process are:

- Clearly lower maintenance costs in comparison to wet separation (Thermal dissolution processes or flotation)
- Clearly reduced specific energy demand.

When the ESTA method was introduced, the plant power stations were converted as well. The power station of the Wintershall plant, for example, has accomplished a highly efficient combined heat and power generation with a primary energy yield of higher than 90%.

The most important advantage of the Werra plants is, however, the diversity of the product range: using all four constituents of the raw salt - KCl, $MgSO_4$, NaCl and $MgCl_2$ - products for de-icing, agriculture and industry including building materials and pharmaceutical sectors are obtained.

The share of sulphate and Mg-products in total production is already about 50%.

4. PROSPECTS

Finally, some remarks concerning the prospects for the Werra Production Center should be made and summarized as follows:

The disadvantages of the deposit - the low KCl-content and relatively long distance to the next seaport - are set off by the following advantages:

- High actual performance
- $MgSO_4$ -raw material for ESTA-Kieserit, $MgSO_4$ -anhydrous and Epsom salt as well as for several potassium sulphate-grades and granulated sulphate of potash magnesia (Patentkali).
- Pharmaceutical products, electric current supplies, the UTD Herfa-Neurode, the central Potash Research Institute located at the Werra plants and other services complete the production programme of the "Werra-Production-Center" and will be even increased.
- The utilization of the production residues NaCl and $MgCl_2$ still remain a matter of central importance.
- A special strength of the Werra Center is the combined operation structure above-ground and underground, already existing and being currently further expanded.

We hope that we will be able to remedy the weakness in the KCl market with these strengths and potentials.