REMEDIATION OF THE OLD WISMUT-SHAFT 302 IN MARIENBERG AND INSTALLATION OF A TECHNICAL PLANT FOR GEOTHERMIC MINE WATER USE (ORE MOUNTAINS, GERMANY)

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Abstract
After World War II in the soviet occupied zone in Germany the extraction of uranium started under supervision of the soviet army in 1946. In 1947 the SAG (Soviet Stock Corporation) was founded, which was transferred into the SDAG (Soviet German Stock Corporation) in 1954. In this time the history of the company was characterized by an intensive mining in the Free States of Saxony and Thuringia with sometimes more than 100,000 employees. Interestingly, the former GDR (German Democratic Republic) became one of the biggest producers of uranium in the world. After reunification of Germany the mining of uranium was finished by the end of 1990 based on an intergovernmental agreement between Federal Republic of Germany and Soviet Union. Simultaneously, the SDAG was renamed in WISMUT GmbH, an enterprise of the Federal Ministry of Economics.
As one major result of the so-called WISMUT-Law from December 12th 1991, the WISMUT GmbH obtained the task for remediation of all areas of the SDAG, which were in the ownership of the company by June 1990. However, the remediation of large uranium mining areas from the Fifties and Sixties, the so-called WISMUT-Abandoned Industrial Sites, which were not part of the WISMUT-Law, was not funded by the government. According to the prevailing case law there is no responsibility for anyone with regard to these abandoned industrial sites. At Saxony's urging the Federal Government entered into negotiations. As a result in 2003 an administrative agreement for financing of remediation of the WISMUT-Abandoned Industrial Sites was signed, the so called VA WISMUT-Altstandorte. This agreement involves an available amount of 78 million € split as shown in Figure 1.

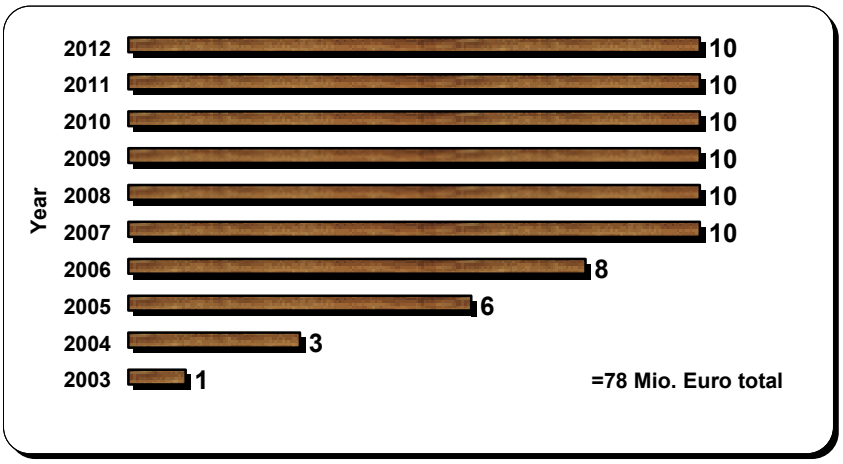

Figure 1. Overview about the fund of WISMUT-Abandoned Industrial Sites in Saxony.

The fund is provided by the Free State of Saxony and the Federal Government by equal shares. The leadership of the project was assumed by the WISMUT GmbH, whereas the PGAC (task force for liquidation and controlling) is responsible for project controlling.

The town Marienberg and the shaft 302
One remediation site of the VA WISMUT-Altstandorte represents the town Marienberg/Ore Mountains. This town has a 500-years old mining history, primarily in copper, silver and tin. In the period between 1947 and 1954 the SDAG was also extracting uranium (totally 141 tons). After ending mining there was no remediation of the installed shafts at all and performed remediation procedures were done insufficiently (no long-term safety). One of these shafts is shaft 302. It has a depth of 144 metres and was secured by two platforms at different levels and by a fence on the surface. Because of the very high risk for the public safety this shaft was classified in the

current program of remediation of Saxonian uranium mines. In 2005 the remediation of the shaft started. In contrast to other secured shafts, this shaft should be used again in future. Therefore, it was necessary to establish a permanent and safe access, especially, in order to control the most important dewatering gallery of this underground mining area, the so-called 'Weißtaubener Stolln' by the mining authority.

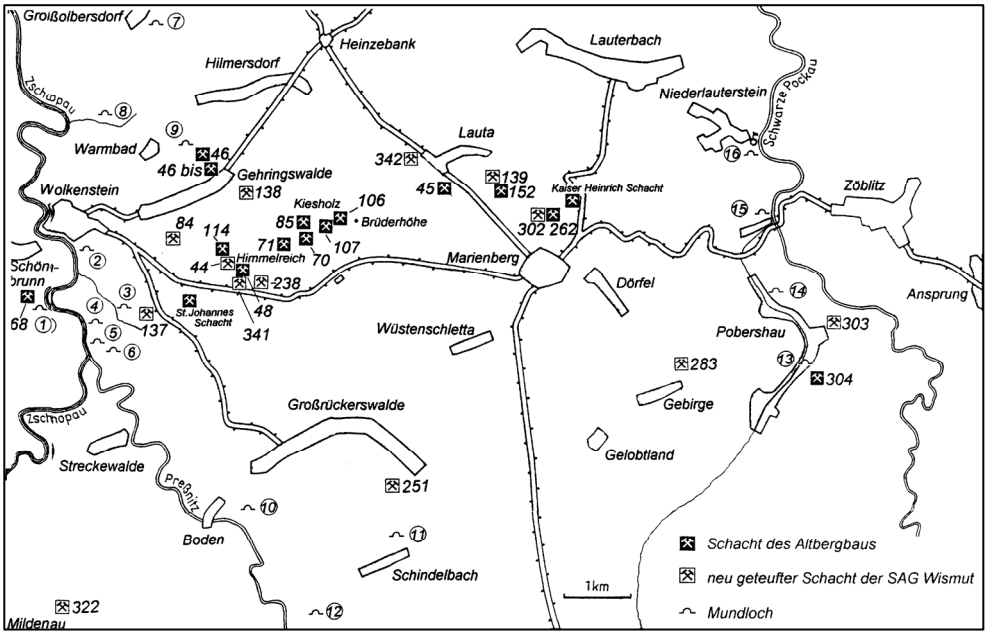

Figure 2. Overview about Old Mining around Marienberg (chronicle of Wismut).

Just before beginning remediation the idea to use the mine water in case of its geotechnical, chemical and hydraulic suitability for a geothermic application was expressed by the municipal utility of Marienberg. For this reason, after opening the shaft first investigations took place showing the following results:

- the bottom landing is suited to install the geothermic plant;
- there is enough water for using (> 120 m³/h) (6th Old Mining Colloquium, 2006);
- there is a constant and sufficiently high water temperature of 12°C;
- the chemistry of the water has no negative effects on the systems engineering.

With these results detailed planning for the installation of a geothermic plant could start, which resulted in its installation in October 2006. Today, the most important systems engineering are installed and the shaft 302 is secured for a long-term safety.

The shaft remediation

After opening the old shaft a video inspection of the old shaft-pipe was performed, which demonstrated very good conditions. The surrounding mountain consists of solid gneiss. In the old filling station lots of waste material interspersed with old wood was found. This waste material was laying on an old shaft covering in a depth of 107 meters (see Fig. 3).

Because of the plan to use the filling station to install the systems engineering for the geothermic plant, and to guarantee a riskless drainage of mine water, it was necessary to clear the filling station completely. During clearing the measurements revealed an artesian outflow of the shaft water. Additional explorations showed that the upstream flow of the old dewatering gallery “Weißtaubener Stolln” was broken somewhere and the dewatering of the underground mining area basically took place via shaft 302.

Due to this positive result regarding the shaft suitability, money could be used for establishing shaft safety and clearing the filling station instead of expensive shaft sealing. Simultaneously, it became possible to construct a manual shaft lining. Beside accessibility to the geothermic plant a continuous control of the dewatering gallery „Weißtaubener Stolln“ by the mining authority became possible. Furthermore, the gallery could also be used as an escape route for a possible further exploration and for safety actions.

For a long-term use shaft linings are made of zinc coated iron instead of wood. The standpipe and the downpipe of the geothermic plant are shown in Figure 5.

Figure 3. Filling station shaft 302 after opening (view top down).

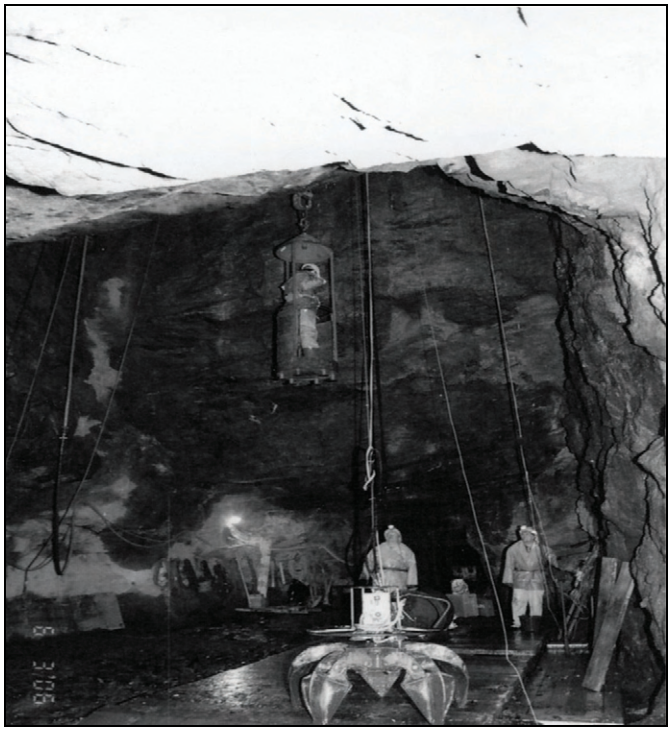

Figure 4. Mining activities in the cleared bottom landing.

The geothermic plant

The principle of the plant could be described as follows. In a closed secondary loop water, cooled by means of heat pumps, is pumped into plate heat exchangers (see Fig. 6), which are located in the old filling station at a depth of 105 meters. In the geothermic plant this water is heated up by 5°K using mining water. The mining water flows in a primary loop and has no direct contact to the water of the secondary closed loop. The primary loop is operated by three underwater pumps with a capacity of 120 m³/hour. The same performance is provided by the secondary loop. This results in an available heat capacity of 690 kW, which is high enough to ensure the base load of all affiliated consumers. However, to ensure the peak load, a junction to public heat generation plants is furthermore necessary. The general scheme of the plant is presented in Figure 7.

Figure 5. New shaft fixtures.

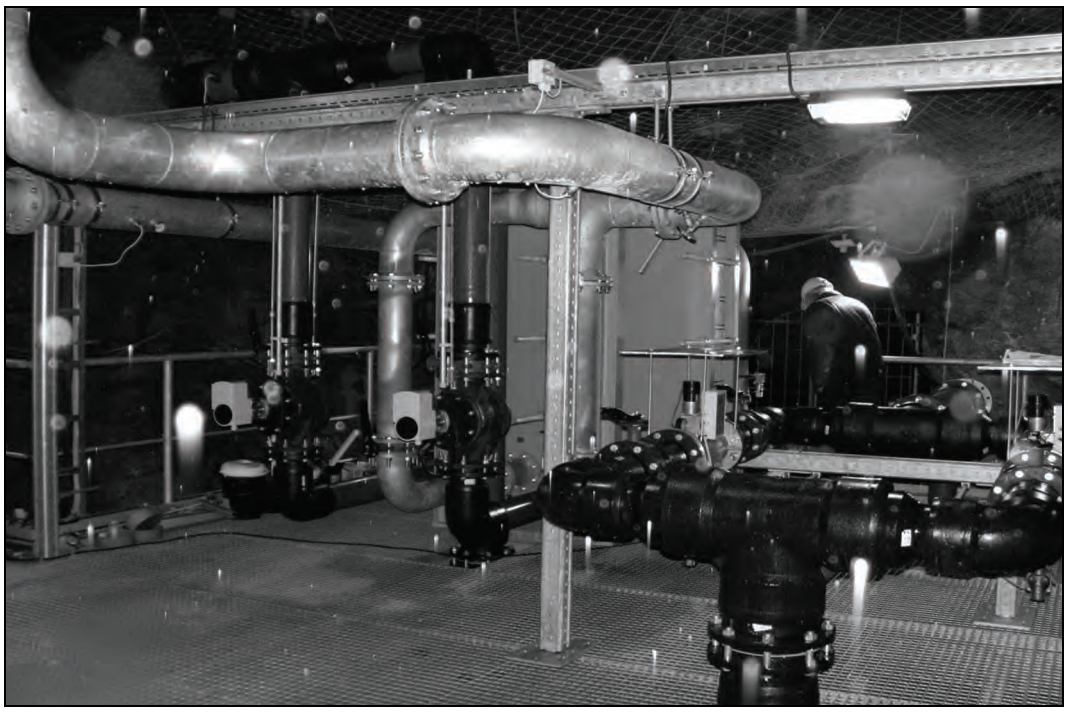

Figure 6. Plate heat exchanger with pumps at the depth of 107 m (old bottom landing).

The most important advantage for the construction of the plant was its direct proximity to the consumers. Close to the shaft there were a large swimming hall, a tennis court and some super markets. All these facilities should be powered by the geothermic plant by the end of 2007.

Summary and conclusions

Plentiful mining water with a suitable chemical quality and the temperature to build geothermic plants can be found in the Ore Mountains. Nevertheless, only a few plants using this source of energy have been built up. This is due to the very high initial investment and the general cost risk of mining operations. Therefore, in every single case a detailed geotechnical preliminary investigation has to be done. Shaft 302 could be exemplarily used as an example to demonstrate the possibility to combine an ordinary remediation with a further use. In order to guarantee a constant consumption it is also essential to erect this particular type of power plant close to customers. In those cases it becomes possible to use that money primarily intended for remediation for an

additional purpose. Finally, this procedure could be used to secure the safe mining drainage and a permanent access to the main drainage gallery "Weißtaubener Stolln" in the old mines of Marienberg.

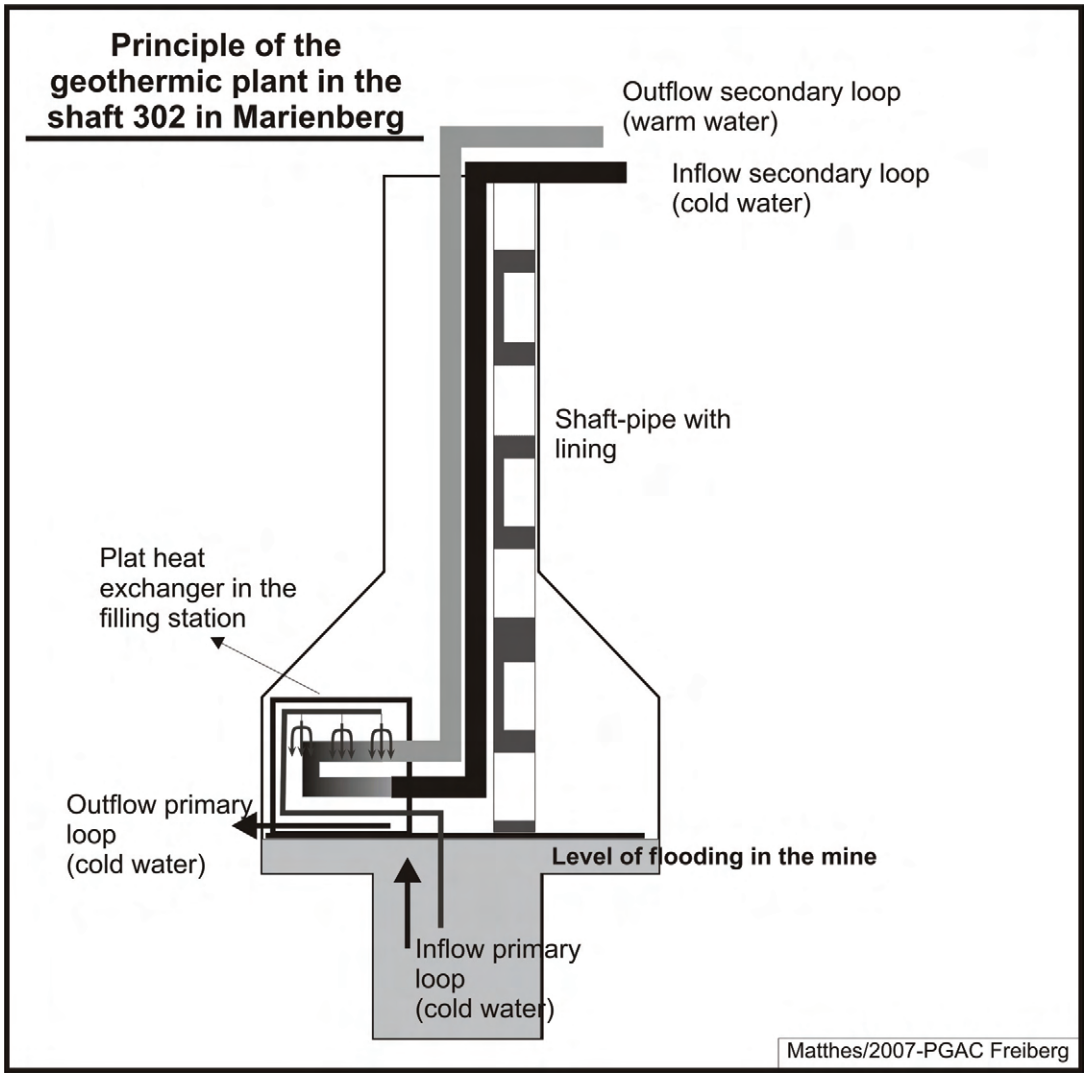

Figure 7. Scheme of the geothermic plant.

References

6th Old Mining Colloquium (2006). RWTH Aachen, Germany.