

DOMINIK LESZCZUK

Ready for new challenges – PeBeKa S.A.

This article presents the history and activities of Przedsiębiorstwo Budowy Kopalń PeBeKa S.A., which celebrated its 60th anniversary in 2020. The range of activities and skills that accompany the functioning of PeBeKa S.A. allowed them to be referred to as the “KGHM Builders”.

Key words: *underground mining, mining works, construction works, deep drilling*

1. PRELUDE

In 2020, Przedsiębiorstwo Budowy Kopalń PeBeKa S.A. proudly celebrated the 60th anniversary of its existence on the market. On April 27th, 1960, PBKRM (later ZBRM, now Przedsiębiorstwo Budowy Kopalń PeBeKa S.A.) was founded with the purpose of the extraction of copper ore in the area between Lubin and Głogów in Lower Silesia. At that time, PBKRM was the general contractor of the largest copper ore mining complex in Europe. The degree of difficulty and the scale of the project was a huge challenge for the engineering staff and employees of the newly established enterprise. Over the last 60 years we have met these challenges and we can proudly define PeBeKa S.A. as the “KGHM Builders”.

2. INTRODUCTION

Thanks to the knowledge and traditions passed down by subsequent generations of employees, PeBeKa S.A. is an enterprise providing services in the field of mining and construction work:

- mining shafts: sinking, maintenance and shut down,
- mining services,
- construction of mines: underground and on the surface,
- deep drilling,
- tunneling,
- construction work,
- conservation of historic mines.

To illustrate the range of activities of PeBeKa S.A. this article will describe the main undertakings of the

company, along with a short presentation highlighting the technologies used. The value and success of PeBeKa S.A.’s work provides great results and rewards the trust that our clients have placed in us. The projects implemented by PeBeKa are in several dozen locations on five continents. From its inception, PeBeKa S.A. constructed 31 shafts for Polish copper mines and nearly 1.5 thousand kilometers of underground headings and drifts. In its history, PeBeKa has constructed several dozen tunnels – metro, rail, road and hydrotechnical. It was PeBeKa that undertook the construction of the metro in Warsaw in the 1980s. Drawing on tradition and great skills, PeBeKa S.A. contributed to the preservation of the history of Polish mining by conducting mining works in the historic Salt Mine in Wieliczka [1].

3. MINING WORKS

3.1. Mining shafts

To access the copper ore deposit in the Fore-Sudetic Monocline, it was necessary to create the requisite infrastructure and assemble the mining facilities and equipment. The first challenge faced by the crew of PBKRM was shaft sinking. The main barrier that made it difficult to reach the level of the ore layers was the geological conditions of the Copper Basin, which consisted of abundant waterlogging, the large depth of unstable sediments and their heterogeneous formation in terms of physical, mechanical and thermal properties. During the planning and design stage, the loose deposits of waterlogged sands, plastic clays and coal managed to achieve

a water inflow reaching up to 30 m³/min, and this posed (and still poses) a major challenge for PeBeKa employees. Striving to ensure safe working conditions that would allow for shaft sinking, PeBeKa employees mobilized to develop and improve their skills and technical ideas, which resulted in the intro-

duction of shaft sinking by means of **artificial ground freezing (AGF)** in the 1960's. Used in KGHM mines, it is a unique solution both in terms of the depth and extent of freezing. The experience with AGF enabled our company to build all the shafts of the KGHM Mines.



Fig. 1. GG-1 Shaft Tower

Now, the 31st mining shaft for KGHM is under construction, with a record depth of 1351.0 m and a record freezing depth of 770 m, the shaft diameter of the lining is 7.5 m [1] (Fig 1). The shafts made by PeBeKa have a complex structure and their final casing, depending on local hydrogeological conditions, can consist of: concrete casing, reinforced concrete casing and cast iron tubing (Fig 2). During the shaft sinking stage, carried out with the use of both blasting agents and mechanical mining, mining bolt linings with nets are formed.

Throughout the entire period of operation of the Company, the evolution of shaft sinking technology continues. It is thanks to the involvement of the engineering staff, employees and cooperation with scientific facilities that shaft sinking, as well as shaft maintenance, is carried out efficiently, safely and includes mining services, assembly and construction works. Thanks to our knowledge and skills, as well as our equipment and facilities, sinking shafts is still the pride of our company.



Fig. 2. Sinking the Shaft GG-1 for O/ZG "Polkowice-Sieroszowice" Mine

PeBeKa specialists also participate in the liquidation of mining shafts. A very complicated process of the disassembly of all shaft equipment and installations has to be carried out, and water dams have to be built to cut off the mine workings from the shaft pipe, thus protecting the functioning part of the mining plant from potential water ingress. Thanks to the preparation of detailed documentation, the lining of the terminated shaft is made malleable, which is then filled with a specially selected material [2].

3.2. Mining excavations

Another area in which PeBeKa S.A. specializes is the construction of mining drifts to create the basic underground structure of the mining plant, enabling the commencement of the exploitation of the deposit (Fig. 3).

Nearly sixty years ago, the pioneers of Polish copper mining used hand-operated pneumatic tools to drill drifts and moved between areas of the mine on foot.

As technology progressed and new mechanical devices appeared, including self-propelled mining machines, the PeBeKa equipment fleet and the range of mining technologies was constantly expanding. At the moment, the company has a very well-equipped fleet enabling the construction of underground drifts by blasting the rock mass with explosives, as well as with mechanical mining of the rock mass.

In the vast majority of drifts, the walls and ceilings are secured with mining bolts, which are the basic form of support in KGHM's mining plants. Our mining technologies are not solely limited to mining bolt support, we also execute horizontal drifts secured with flexible support casings (Fig. 4) as well as implementing other technical solutions.



Fig. 3. Drift in the Salt Layer



Fig. 4. Drift with Mine roadway supports and EKOFLEX – Mine Foam

The PeBeKa crew made about 20 km of drifts with Roadheaders, which were also secured with mining bolt lining. Depending on the prevailing conditions, we use preemptive merging injections. As already mentioned, the PeBeKa team has carried out mining works on five continents, and it is this experience that makes us constantly raise the bar of the difficulty of the tasks we perform.

It is precisely this type of challenge that is currently being carried out on a project involving the con-

struction of a new underground ore bunker, and the modernization of an existing, functioning underground ore bunker. The task is being carried out in the immediate vicinity of an active mining shaft, and the constantly operating equipment and facilities of the mining plant. Only thanks to the involvement of the employees and the equipment fleet was the task carried out without any unnecessary downtime and the level of work safety and work quality at a very high degree [2].



Fig. 5. Construction works in Ore Bunker

4. ASSEMBLY WORKS

The functioning of a mining plant is characterized by continuous change. The mine develops, expands its area of operation, and finally closes down after the end of its operation. In each of the main stages of the mining plant operation period, it is necessary to perform tasks whose unique traits are well known to PeBeKa.

Along with reaching for lower and lower parts of the copper ore deposits, new challenges arise that PeBeKa has to face. As part of our skills, we make various types of underground facilities, devices and installations that enable the operation of underground mining plants. In order to ensure the proper working conditions in the underground workings located at depths exceeding 1,200 m, it was necessary to build an air-conditioning system. At the beginning of the 21st century, this was the challenge that PeBeKa engineers faced. The result of their hard work and cooperation with contractors is the central air conditioning system in the Rudna Mine [2]. The cooling system for underground workings operates by utilizing ‘ice water’ at a temperature of 1.5°C, which is

produced by the two air-conditioning stations on the surface. Chilled water is brought in from the mining station with the use of shaft pipelines and pipelines built into large-diameter holes in the rock mass. The underground part of the system includes a three-chamber feeder, pumping station, main pipelines, controlling and measuring equipment and air coolers.

In the past, PeBeKa has built a lot of facilities, such as: underground machinery operation chambers, belt conveyors with a total length of more than 100 km, ore bunkers and transformer chambers. Each of these objects is a very important element of the mining plant and their execution requires a large amount of knowledge and skill.

The vast majority of the implemented facilities have been commissioned by the user, which means that the works were performed in the “turn-key” formula. In 2015, using the formula “design-build” PeBeKa S.A., got to modernize a nearly thirty-year-old shaft. The modernization of the shaft also involved a change in its function. Without stopping the functioning of the mining plant, PeBeKa employees carried out a very complicated process of chang-

ing the function of the mining shaft. The functioning air-intake shaft was transformed into a material, people and equipment hoisting and air-intake shaft. Such a function change is a very complex process, involving:

- assembly works:
 - reconstruction of the Shaft Tower,
 - assembly and installation of hoisting devices,
 - shaft reinforcement,
 - assembly and installation of electrical and telecommunication devices, etc.
- mining works:
 - reconstruction of the shaft bottom,
 - construction works:
 - erecting buildings related to the new functions of the shaft.

5. DEEP DRILLING AND CONSTRUCTIONS WORKS

The analysis of the demand for specialized mining services prompted the authorities of PeBeKa to create another branch whose task is to provide drilling services. The technical staff, crew and their drilling equipment perform a number of drilling works in our country, related to the identification of mineral deposits, as well as the search for geothermal water deposits.

To ensure the comprehensive execution of complex tasks, within the PeBeKa structure is also a branch whose task is conducting construction work. The range of services provided by this branch is very wide, and includes industrial, housing and communication construction.



Fig. 6. Geothermal borehole – Tomaszów Mazowiecki

6. SUMMARY

A willingness to face new challenges, and the constant development of technology has accompanied

our employees, thanks to which PeBeKa S.A. has achieved so much in its great history and continues to grow. It is worth emphasizing that PeBeKa boasts over 1600 km of underground drifts.

It is also worth noting the safe working conditions for the PeBeKa S.A. staff which are of superior value. The commitment of the management and staff was appreciat-

ed by the “Bezpieczne Górnictwo” Foundation of Professor Waclaw Cybulski in December 2019, by awarding PeBeKa a prize in the “Safe Branch” competition (Fig. 7).

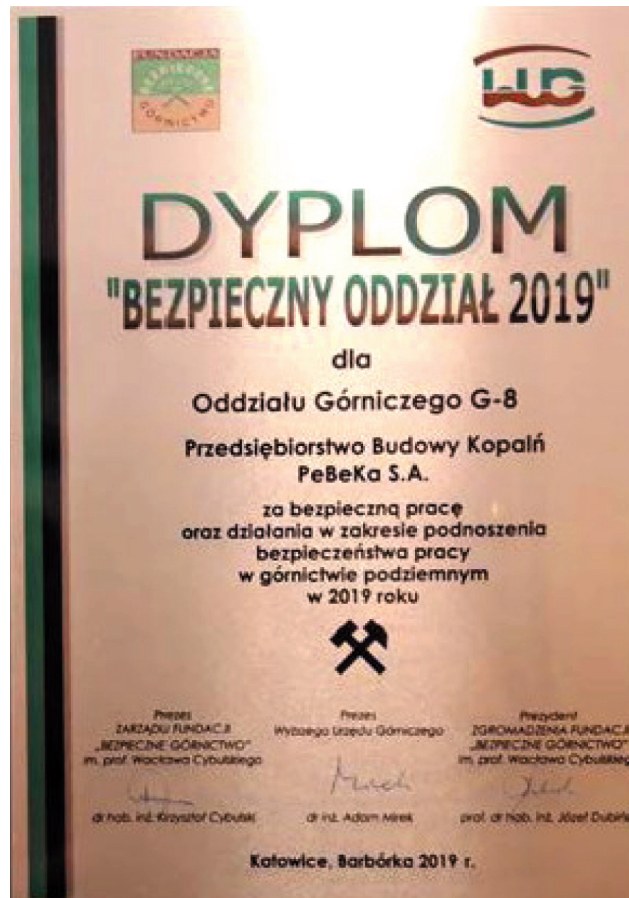


Fig. 7. “Safe Branch” diploma for PeBeKa S.A.

References

- [1] PeBeKa S.A.: *Czerpiemy z tradycji, stawiamy na przyszłość Kronika 50-lecia PeBeKa S.A.*, Lubin 2010.
- [2] PeBeKa S.A.: *Kronika PeBeKa 1960–2020. Cel – Ludzie – Technologia*, Lubin 2020.

DOMINIK LESZCZUK

PeBeKa S.A.

ul. Marii Skłodowskiej-Curie 76, 59-300 Lubin, Poland

dominik.leszczuk@pebeka.com.pl