Development of Mining Processes with Regard of Limits Correction

Vaclav Pilny1, Eliska Fiedlerova1, Andrea Mokrosova2

1Severočeské doly a.s., Bílina Mine, Důlní 375/89 418 29 Bílina, Czech Republic
2Technical University of Ostrava, Czech Republic

Pilny.Vaclav@sdas.cz

Abstract. The Bílina surface quarry belongs to the largest brown coal mining company in the Czech Republic, Severočeské doly a.s. Mining activities within the POPD quarry Bílina take place in the territory of this quarry for the period of years 2010 to 2030. For a smooth, safe and economical process of the whole quarry in new territorial ecological limits, the process of overburden cuts needs to be extended as soon as possible to the south to the limit of new mining limits. However, this extension is limited by the current line of valid POPD. For the continuation of mining in the territorial ecological limits pursuant to the Resolution of the Government of the Czech Republic No. 827/2015, which is entirely in accordance with §30, par. a) of the Mining Act No. 44/1988 Coll., ie when using reserved deposits it is necessary, in particular, to extract the reserves of the reserved deposit as completely as possible, with the least possible losses and pollution. It is necessary to have a new POPD based on mining – technological procedures of OPV DB (Mining to new territorial environmental limits by 2035) approved by 2021 at the latest. However, these procedures will require a more complex methodology, because it will be necessary to mine in places, which could not be extracted within a valid POPD. Another intention is also to prolong the life of the quarry, and securing supplies to heating plants, power plants ČEZ a.s. (joint-stock company), as well as supplying quality low-sulfur brown coal to small customers throughout the Czech Republic.

1. Introduction
The Bílina surface quarry annually extracts approximately 9.5 million tons of coal during overburden extraction and removal of about 56 million cubic meters of the overlying soil.

It is located in the western part of the North Bohemian Brown Coal Basin between the towns of Bílina, Duchcov, Osek, Ledvice and the villages of Braňany, Mariánské Radčice and Lom. The current mining is in the western direction on seven working horizons, coal mining is carried out on three cuts with an average length of 3.5 to 4 km.

Overlying soils are deposited on the inner dump. For the smooth, safe and economical process of the whole quarry in new territorial ecological limits, the process of overburden cuts needs to be extended as soon as possible to the south to the limit of new mining limits. In addition to the determination of territorial ecological limits, the Government Resolution No. 827/2015 requires that the mining limits be set 500 meters from the built-up area of the municipality (Figure 1).
2. Development of overburden mining processes

For a smooth, safe and economical procedure of the whole quarry in the new territorial ecological limits, it is necessary to obtain a plan of opening, preparation and extraction (POPD) until 2021 at the most, so that the continuity of mining is fully maintained, that is, the front will be mined in a parallel west direction with a slight dialling in the north (Figure 2).

During this period, mining will take place near the village of Braňany with the first overburden cut to the limit set by the Czech Government Resolution No. 827/2015 including the 500 m protection zone. Under the village of Braňany and beneath the Červený vrch site, giant machines with the help of auxiliary mechanization will create a closing slope. The northern slopes to the 3rd overburden level are sloped to a stable slope and immediately grassed to increase stability and avoid dust. In advance of
the 1st overburden cut, gravel sand will be excavated in the northern part of the front face to prevent water inflows. [1]

All cuts will gradually cleanse the northern and western slopes of Albert, respectively the northwest head of a coal seam. The 7th overburden cut will purge the coal bed before the coal cuts progress. Due to the fitting of the coal seam in the northern and central portions of the front, the individual cuts continually deepen throughout the entire period. The processed mining procedures presuppose the deployment of a new TC2 series excavator in 2021 as a replacement for the obsolete K10000 / K74.

This new giant machine will be gradually transported to the permanent deployment on the 6th overburden section during overburden extraction at individual working horizons (where it will replace giant machines during overhauls).

3. Development of mining procedures of internal dump

Loading of all masses from overburden cuts is concentrated only in the inner dump. At the end of 2018, a new stacker of the TC2 series (ZPDH 6300.2-CZ / Z103) was put into operation, which will be used as a replacement for reconstructed and overhauled stacker machines. Subsequently, it will allow the ZP 10000 / Z81 to be shut down (year 2021). The last floor of the inner dump will be established in the northern part through the assembly site of Jana to the reclaimed dump Pokrok.

After the relocation of belt coal conveyors on the southern side of the quarry (end of 2023) the loose space will be used by the inner dump. From 2031 onwards, the lower 4 levels begin to fan out in a western direction with a turning point at the new PVZ (belt stacker) node at location Albert. At the last level in the eastern part of the inner dump, there is a left room for the storage of energy-by-products from the Ledvice Power Station throughout its expected lifetime. [2]

After 2030, in a situation where the quarry edge reaches the boundary of the binding mining limits, the volumes of the mined mass are gradually decreasing. The logical consequence of this will be the decreasing pressure on the necessary volumes of the dump space and thus the gradual improvement of the stability ratios of the entire dump body. [1]
4. Development of coal mine mining practices
The coal seam has an average thickness of 30 m, in the southern part, the coal seam rises to the terrain. The coal quarry is divided into 3 sections, due to the different quality parameters of the coal seam and its course. Material that cannot be mined by large-scale excavators (e.g. seam outcrops, deep mining drifts, large working slopes) is excavated by shovel excavators and transported cyclically to large-scale machinery. The extracted coal is conveyed by belt coal conveyors to the coal treatment plant. In the so-called PVZ node, it is possible to change the direction of transport of the extracted coal. Here are deployed 4 tracked wagons. Near each large machine is also a PVZ, which is used irregularly if necessary. During the years 2021 to 2023, a part of the coal conveyor belt conveyors will be relocated in the area of the southern slopes, but the existing system of coal extraction and transport will be preserved. After 2025, the first old mine of the former Venus mine will be found at the bottom of the quarry in the central part of the front. After 2030, virtually all coal mining will take place in the area that was re-grounded in the first half of the 20th century.

5. Conclusion
The mining technical analysis, which is being carried out in parallel with the preparation of the opening, preparation and extraction plan of the Bílina quarry in the new conditions of the territorial ecological limits, shows that this plan is realistically feasible for the whole evaluated period until 2035 (Figure 3). A detailed evaluation of mining procedures for individual time periods is a subject to separate partial assessments, the previous text only summarizes the essential facts. It is clear that under given marginal conditions, especially the influence of geological quarry construction and limiting ecological conditions of mining, it will be necessary to take into account the necessity of carrying out the demanding leading but also additional works during the quarry procedure. These activities will need to be concentrated mainly in the southern and south-western edge of the mining processes under consideration. From the point of view of time, it will be necessary to concentrate these works, especially in the period 2019 - 2025. Two facts decide on the side of the inner dump from the perspective of ensuring its stability. On the one hand, after 2021, it is possible to spread the deposition of masses in the northeast and subsequently in the northern part of the area and to release the dump
space in the south by the timely relocation of coal levies on the southern slopes of the quarry in 2021-2023.

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