

Present State of Hard Coal Underground Mining in the Czech Republic

J.DVORACEK

Faculty of Mining and Geology, VSB-Technical University of Ostrava, Ostrava, Czech Republic

ABSTRACT: This paper describes the development of mining in the Czech Republic. Special attention is paid to development in recent years characterized by mining activity damping; i.e., reduction in mining activities. The organization of underground coal mine damping and the experience with damping in the most significant hard coal deposit in the Czech Republic - the Ostrava-Karviná Region - is described.

1 INTRODUCTION

The development of human society is integrally bound with the use of raw materials. In the historical Czech countries in Central Europe, the beginnings of mining are connected with the mining of precious metals and ores. In the Middle Ages. The rapid development of industry at the end of the 19th century and in the 20th century affected coal mining and the development of mining technologies in underground as well as opencut mining. After World War II, intensive mining of uranium began. Significant disruption in Czech mining occurred after the year 1989, when, in association with the transformation to a market economy, the restructuring of the whole national economy took place. The decrease in demand for products of the mining industry as well as difficulties with the sale of these products on the home market led to the liquidation of ore mining, limitation of uranium mining with the prospect of uranium mine activity finishing in the short term, and also a decrease in underground as well as opencut coal mining.

These changes also affected the largest domestic hard coal deposit - the Ostrava-Karviná Region. The Ostrava-Karvina Region was the greatest producer of hard coal mined underground. In the past and remains the most important deposit although production has significantly dropped. The greatest output in the history of this region was 24.8 million tons, which was achieved in the year 1979. Then production started to drop, the only exception being in the year 1987, when output compared to the preceding year increased, to the level of 22.8 million tons. Since that time, production has been constantly decreasing, to the current level of approximately 13 million tons.

2 DAMPING OF UNDERGROUND COAL MINING

In the years 1945-1989, in the former Czechoslovakia 4 723 million tons of coal was mined, of which 1 278 million tons was hard coal and 3 495 million tons was brown coal and lignite. Since the year 1987, the process of significant decline in annual coal output volumes has continued. In the year 1989, 112.1 million tons of hard and brown coal was mined, while in the year 1999, production dropped to 59.3 million tons of hard and brown coal. The decrease in hard coal production was smaller than the decrease in the brown coal output.

The restructuring of the mining industry took place with mining damping and the rise of new mining companies oriented towards profit and working in a competitive environment. Mining damping was, in essence, the process of adaptation of previously oversized mining capacities to new economic conditions. This process was caused by a whole series of factors: the decreasing importance of heavy industry; a decrease in economic efficiency; the opportunity to obtain all raw materials by means of importing; an emphasis on efficiency; the end of subsidiary and redistribution processes in the national economy; and the increasing importance of the ecology.

The reason for mining limitation and mines closing in the Ostrava-Karvina Region since the beginning of the 90s has been the economic conditions, especially the long-term negative economic effects and problems with coal sales. Mines characterized by long-term mining activity, mining at great depths, the necessity of air

conditioning or shortening of the working time underground were closed. The damping of underground mines in the Ostrava-Karvina Region began at the end of the year 1991, when mining finished and the liquidation of the first mine was commenced. To date, mining has finished in 7 mines.

3 ORGANIZATION OF UNDERGROUND COAL MINE DAMPING

Mining damping, with respect to significant economic, social, safety, ecological, technical aspects, etc., has to be uniformly organized and controlled.

The organization of underground mine damping is as follows: the existing state and outlook of a mine in question is considered from the viewpoint of economic results, ensuring sales of its production, ecological loads resulting from its activity, the safety of mining activity, and from the viewpoint of social, technical and other factors. On the basis of analysis, it is decided whether the coal deposit is suitable for further mining and processing of the production. In this way, the pressure is developed to leave such coal deposit parts which do not comply with the criteria for the regions considered. After this comes the completion of mining activity and the liquidation or securing of a mine or its non-effective part.

In these cases then, the application of the organization for inclusion in the program of coal and ore mining damping is worked out. The application must be documented by a variant solution of the liquidation or securing of a mine. The basic variants include the following:

- liquidation of a mine with mining completion at the commencement of damping;
- liquidation of a mine with additional mining of reserves after the commencement of damping;
- securing of a mine;
- a combination of the methods above.

After the selection of the optimal variant and its approval by the Ministry for Industry and Trade, the mine is included in the relevant decree of the Czech Republic government. In this way, a substantial part of the costs for damping can be covered by state budget subsidy.

The condition for commencement of damping with the participation of the state budget in the form of subsidy is the working out of the Technical and Social Project of a Mine Liquidation or Securing, which is the document worked out according to the unified methodology. The mine damping then includes the following:

- technical liquidation or securing of a mine or surface;

- elimination of the mining activity consequences;
- socially-health costs connected with damping.

Liquidation is the activity which includes the completion of mining works and cancellation of the property of the enterprise underground as well as on the surface. The securing of a mine, on the other hand, is the procedure of the finishing or limitation of mining works and temporary securing of the enterprise property for the possibility of later renewal of mining.

The costs for damping should preferably be settled from:

- the reserve created according to mining law,
- the means of the mining enterprise,
- the yields of mining damping.

The greatest share of costs, however, is contributed by the state budget - in the Ostrava-Karvina Region it accounts for approximately 90 %. However, there is no legal claim on this subsidy and its size remains uncertain. For this reason, the damping organization has to take into account the economics of the process.

4 EXPERIENCE WITH DAMPING OF UNDERGROUND COAL MINES

The beginning of the 90s, with mining damping, took the industry of underground coal mining and the mining of other raw materials by surprise. After the first hurried mining closures, the problems started to be solved methodically, and the empirical experience of the substantial variability of forms and ways of underground coal mine damping began to be compiled and evaluated. From existing knowledge, two marginal damping variants can be considered.

- The go-ahead variant. This is characterized by the short time from the announcement of damping to the finish of mining. The reserves prepared for mining are not exploited, the liquidation works in a mine are carried out very quickly, the clearance of only some machines is carried out, and, for ecological reasons, the quick sale or elimination of surface objects takes place. The shortest time from the announcement of mining damping to the finish of mining was only 3 months. This variant shortens the operation time of costly power-consuming devices (compressors, ventilator fans, pumps). On the other hand, it can be the source of social problems related to job losses for a great number of employees, and the solution of these social problems is very costly.
- The step-by-step variant. This is characterized by a longer time from the announcement of damping to the finish of mining. The coal

reserves prepared for exploitation are used, the large depletion of mine workings and clearance of machines are carried out, single areas of a mine are gradually liquidated or secured, the mine workings are used for alternative purposes (e.g., for depositing wastes), and the surface objects are gradually eliminated. The longest interval between the announcement of damping and finishing was 18 months in one mine and 39 months in the another. The advantage of this variant is that the solution of social problems is simpler and less costly, and substantially higher damping yields are obtained.

Should the time period between the announcement of damping and the finish of mining be evaluated from the viewpoint of technical-organizational parameters, the following can be stated:

- damping leads to the selection of relatively good conditions of mining (greater thickness of seams, longer average length of working faces);
- from the viewpoint of organization and management, in the time period of damping the trends are the same as in the preceding evaluated time period of 10 years - a decrease in certain parameters (e.g., average daily outputs of 1 working face, average daily areas worked out) in the previous time period is followed by a decrease in the damping period, while growth in given parameters in the previous decade is followed by growth in the damping period. In the case of a shorter damping time period, however, the negative changes are more conspicuous - decreases in the indicator values by tens of percentage points compared with the previous decade. This leads to the assumption that the cause of this is the quick method of damping, i.e., the go-ahead variant.

For evaluation of the time period between the announcement of damping and finish of mining, from the viewpoint of economic parameter development, the development of three liquidated mines was analyzed where this period was three, six and fourteen months. The analysis showed that the shorter the time period is between the announcement of damping and the finish of mining, the worse the economic results compared with the previous time period. The results of analyses proved the positive effect of extending the time period between the announcement of damping and the finish of mining. In the case of unavoidable decrease in yields due to the decrease in mining, this longer time period gives greater opportunity not only to decrease costs dependent on the output volume (variable costs), but also to decrease costs of fixed character.

The experience from the mines closing also showed that the subsidy from the state budget was lower than expected by the mines. In this case, it was necessary to use the resources of mining

enterprises which - as mentioned above - are created by:

- reserves created according to mining law: it is a question of strictly purposeful reserves for the removal of mine damage, maintenance and reclamation. With respect to their amount and possibility of use, they can cover only a very small part of the costs for mining activity damping.
- the financial means of the mining enterprises themselves: if a mine is closed for economic reasons, it means that the effect on its *economy* is a negative one. The expending of its own financial means on mining activity damping will deepen this loss and the enterprise will be in a worse economic situation than it would be if it continued its mining activity.
- the yields of the mining damping: theoretically, it is possible to obtain a number of yields. In the course of the damping of a mine - revenues from sales of coal mined after the announcement of damping, revenues from sales of metal waste arising in the course of technical liquidation of a mine, revenues from sales of machines, equipment and materials, revenues from rental of property determined for liquidation, revenues from sales of building material arising in the course of technical liquidation of surface objects, etc. However, experience of damping program realization shows:
 - the sale of mining machines and equipment outside the Ostrava-Karvina Region is rare because there are only a small number of potential customers;
 - the transfer of mining machines and equipment in the framework of the district represents a problem due to different mining and geological conditions;
 - certain benefits follow from the removal and renewal of steel arch support, but the use of this support at greater depths is not optimal from the viewpoint of its load-bearing capacity;
 - the costs of retrieving metal waste from underground are higher than the market price, which is why the clearance of machines for scrap is done only for ecological reasons;
 - further benefits can follow from depositing waste in underground spaces; however, ecological problems can occur there again, and these activities cannot prolong the period of mine liquidation;
 - the costs of liquidation of above-ground objects are higher than the value of the usable material obtained.

It is evident then that the only important benefit in the mining activity damping time period, which can decrease the necessity for state subsidy or improve the economics of the mine being damped, is

the revenues from sales of coal which is mined in the time period after the announcement of damping.

For this reason, the go-ahead damping variant was rejected, and the time period between the announcement of damping and the finish of mining was extended. As a result of this, the following was made possible:

- exploitation of all coal reserves prepared for mining;
- increase in the degree of tangible investment property depreciation used for a mine activity;
- the carrying out of liquidation and clearance works in a mine in the time period of the decrease in mining because these works would have to be done for safety or ecological reasons anyway;
- less costly solution of social problems (retirement of miners, requalification, new employment, lower severance pay)
- decrease in variable and fixed costs of the mining enterprise.

The extending of the mining time period, although with a decreasing trend, means the prolongation of the mine service life, the gradual solution of social and property questions, a decrease in the requirement for state budget subsidy, limited drawing of social allowances, and the maintaining of social conciliation.

5 CONCLUSIONS

The entrepreneurial process in the mining industry starts with a deposit survey and a build-up in mining and preparation capacities, and goes on with exploitation of the deposit itself, ending with mining damping, mine liquidation and the elimination of mining activity consequences. Underground and

opencut coal mining in the Czech Republic was concentrated on the first three stages of this process until the end of the 80s, from the viewpoint of both theoretical investigation and practical activity.

The experience of the past 10 years with regard to the finishing of mining and liquidation of mines has shown that the last stage of the mining activity also requires the generalization of knowledge and theoretical investigation.

In the conditions of underground mining in the Czech Republic, especially in the Ostrava-Karviná Region, the following can now be observed:

- the aim of additional mining of coal reserves prepared,
- decrease in fixed costs already in the time period of mining decrease, i.e., immediately after the commencement of damping,
- creation of hypotheses for quick completion of liquidation works underground after the finish of mining,
- understanding of coal reserves as a non-renewable source of natural wealth,
- research into ways of obtaining the greatest use of this wealth.

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