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## CONTINUING COSTS OF A MINE LIQUIDATED

**Summary.** This article gives the analysis of the continuing costs development connected with a mine operation in the time period of decreasing output, after the mining ending and in the time period of a mine and surface objects liquidation.

## KOSZTY DŁUGOTRWAŁE LIKWIDACJI KOPALŃ

**Streszczenie.** Artykuł przedstawia analizę długotrwałych kosztów ekonomicznych związanych z działalnością kopalń w okresie zmniejszenia wydobywania, po likwidacji działalności górniczej oraz w okresie likwidacji infrastruktury podziemnej i powierzchniowej kopalń.

### Introduction

The development in mining industry after the year 1989 in the connection with the restructuring of national economy of today's Czech Republic has led to the limitation of mineral raw materials mining, closing of the whole series of mines and their liquidation. However, it was showed soon that even the last phase of the service life of a mine, the way of its closing and liquidation require the analytical evaluation and acceptance of certain principles and recommendations, and namely not only in the technical and safety spheres but in the economic one as well. In the last years, it has been proved too, that the left underground spaces represent the safety and ecological risk for their environs (subsidence and falls of the surface, methane leakage etc.) which can be solved by hydraulic stowing of these spaces. This stowing material was manufactured in the past from the flotation waste rock and power plant res. heating plant flue ash, however, it was found out that it can be produced also from other

kinds of industrial wastes. In the Jan Šverma Mine in Žacléř, this process has been running for already several years with the positive impact on living environment. It means the further reason for the analysis of an economic development of a mine in the last phase of its service life because the economic effectiveness of the underground spaces stowing is one of the basic presuppositions for realization of this way of safety and ecological risks solution.

### **Last phase of a mine service life**

The process of mining ending, mine closing and liquidation as well as the obliteration of the mining activity consequences is very complicated as to the realization, time and economics, that's why, it must be controlled in an unified organizational way, because the most costs for a mine closing and liquidation are settled by the state as the owner of the mine enterprises in the past.

From the formal viewpoint this process as a whole begins after the preceding preparatory stage by the damping announcement for the concrete mine in the form of governmental resolution. Hereby, the so called 1<sup>st</sup> stage of the damping starts which lasts up to the mining completion. After that, the so called 2<sup>nd</sup> stage follows lasting since the mining completion up to the time period of the ending of the main mine workings liquidation mouting on the surface. Then the last stage follows which is connected with the obliteration of mining activity consequences. Since the damping announcement, it is necessary to solve the decreasing of total number of employees of a mine and to settle the obligations to them in socially health sphere.

Further, we will be dealing with the problems of the underground coal mine in the Ostrava-Karviná District where the damping was announced in January 1998, the mining ended in June 1999, so the 1<sup>st</sup> stage lasted 18 months. The analysis of the 2<sup>nd</sup> stage of damping will be carried out for the time period of the same duration, i.e. since July 1999 until December 2000, although the 2<sup>nd</sup> stage is going on even after this date. In the given time period, however, the substantial part of liquidation works has run.

After announcement of damping until May 1998 the driving of preparatory workings for mining of the rest coal reserves run. The mining was ended on June 30, 1999, until this time period the machines and equipment containing the matters which could jeopardize the living environment (e.g. oil products) were removed from the mine. The clearance run since January 1998 until September 2000.

In the framework of the mine liquidation the works were carried out connected with the gradual closing of mine workings, with regulation of ventilation and with the gas outlet control. In the second half of the year 1999 the liquidation of peripheral shafts started by their backfilling with compacted stowing material, by the end of the year 2000 this liquidation was completed roughly from three fourth. The liquidation of central shafts was started in the beginning of the year 2000 also with the help of compacted stowing material, their liquidation was planned until the year 2002. The liquidation of shafts was carried out in the supplier's way under the cooperation of the own employees of the mine. The surface objects were partially liquidated, one part of buildings and equipment will be used further.

### **Economic development of the last phase of the mine activity**

The economic theory pays a substantial attention to the importance of the so called **fixed costs**, i.e. the costs which are not dependent on the production volume. Their total relative stability causes the growth of their share per the production unit at the decreasing of the production volume. In this way, as a rule, the total costs ratio increases and the economic result per production unit is being worsened.

The decreasing of the output, however, is unavoidable in the course of a mine closing. In case of the mine analyzed, the output in the time period of the 1<sup>st</sup> stage of damping dropped between single months in average by 11,9 %, while the total costs for production dropped, in average between single months by 3.3 %. So, the high share of costs independent on the output, i.e. fixed costs can be presupposed. So, the growth of unit costs for mining between the single months in average by 9,7 % was the result of this development.

After the mining ending it is necessary, for the whole series of months, to maintain a mine in operation for carrying out of clearance, preparation for liquidation and the liquidation works themselves. The costs connected with the ensuring of the necessary operation of the equipment in a mine and on the surface of the locality being closed and costs for activities connected with the control of a mine being liquidated are identified as the so called **continuing costs for a mine operation**. The existence of these costs follows from the fact that until the completion of the main mine workings liquidation all securing systems of an underground mine must be in operation, especially: ventilation, pumping of mine waters, supplying of a mine with electrical power and compressed air, mine horizontal and inclined transport, vertical transport on the surface, activity of mine rescue station, service and

maintenance of securing systems, control of mine workings, equipment of liquidation works, other necessary activities according to the local conditions. These continuing costs should decrease in dependence on the rational control of damping and liquidation of a mine.

It can be presupposed that it is necessary to differentiate between the term “fixed costs” and the “continuing costs” because the first ones are related to the output volume while the other ones are expended in the time period when the production has been already completed.

The accounting records keep separately the costs for mining and the continuing costs connected with a mine operation. In can be found out, with the using of accounting and statistical documents, that the fixed component of costs represents 63,7 % from the costs for coal mining, however, the costs for energy which are kept in continuing costs of a mine are not included in these costs. The similar calculations in the same mine in the year 1998 showed that in case of including of the costs for energy the fixed component of costs represents 75 % (Dvořáček, 1997).

As to the continuing costs connected with a mine operation are concerned, than the survey of single costs items and their share in the total costs structure of both time periods is given in the following table No. 1.

Structure of costs items

Table 1

Costs item	1/1998 – 6/1999 Structure of costs [%]	7/1999 – 12/2000 Structure of costs [%]
Material consumption	8.68	0.91
Power consumption	21.37	22.72
Repairs	1.17	0.25
Travel costs	0.07	0.01
Other services	2.15	6.21
Wage and personal costs	58.57	14.18
Other taxes and fees	0.17	0.08
Other operating costs	0.07	0.02
Depreciation incl. net book value	7.74	55.62
Other extraordinary costs	0.01	0.00
<b>TOTAL COSTS</b>	<b>100.00</b>	<b>100.00</b>

### Continuing costs for a mine operation

In the costs structure there exist several costs items with their so small share that they can be omitted. Accordingly, the following ones belong among these items in both time periods:

repairs, travel costs, other taxes and fees, other operating costs, other extraordinary costs. The development in other costs items is different.

**Material consumption:** the development of this costs item shows moderate decrease in the time period of the 1<sup>st</sup> damping stage, i.e. in the time period of the decreasing output. After ending of the coal production there comes to the jump decrease of the material consumption, in the time period of the 2<sup>nd</sup> damping stage approximately on 12 % of average values from the time period of the damping 1<sup>st</sup> stage. Until the end of the year 2000 the material consumption is dropping comparatively very sharply with two exclusions, and namely at the end of the year 1999 and before the half of the year 2000. This is the question of the time period when the liquidation of peripheral and subsequently the central shafts was commenced in the form of their filling with the compacted stowing material and the growth of this costs item corresponds to purchase of material for creation of mixtures for the shafts filling.

**Power consumption:** in the time period of the 1<sup>st</sup> damping stage there came to the moderate decreasing of power consumption. In the course of the 2<sup>nd</sup> stage of damping the power consumption of a mine is dropping more substantially, however, the single monthly values show greater dispersion variance. The significant one is the growth of the power consumption after the beginning of peripheral shafts liquidation due to the non-optimum run of the main ventilator. The interference into the ventilation system in this time period led to higher resistance of the ventilation network and passive regulation. After the commencement of the central shafts liquidation there comes to the jump drop of the power consumption which shows then the stable values for several following months.

**Other services:** the development of this costs item shows the increasing trend in the 1<sup>st</sup> stage of damping, the jump increase occurs after the mining ending, especially in the time period of peripheral shafts liquidation commencement. Since this time the costs decrease with the fluctuating increase after the commencement of the central shafts liquidation. The development of this costs value corresponds to its content which is created by liquidation works in the underground and on the mine surface carried out in the supplier's way.

**Wage and personal costs:** the development of this costs item corresponds to the presuppositions concerning the decreasing of the employees total number in the connection with the limitation of a mine activity. In the time period of the 1<sup>st</sup> damping stage these costs have a dominant share which decreases in the course of the 2<sup>nd</sup> damping stage roughly by 75 %. The trend in the time period of the mining ending is moderately dropping one what is the reflection of the high share of fixed costs. After mining completion this costs item has significantly decreasing trend, however, the jump decrease corresponding to the jump

limitation of employees total number can be observed. In the course of the year 2000 three relatively stable levels of wage and personal costs can be recognized. In the structure of these costs the growth of social costs (e.g. severance pay) in the connection with the decreasing of the total employees number can be recorded.

**Depreciation including the net book value of the property liquidated** : depreciation, in the time period of the 1<sup>st</sup> stage, showed relatively unchanged trend, the moderate increase occurred after the end of the year 1998, the further jump decrease occurred after the mining completion and lasted until the beginning of the last quarter of the year 2000, even in the event that in several cases the accounting operations processed, with the negative values, the monthly depreciation values. The last quarter is connected with the order growths of this item, the cause for it is, however, the accounting catching of the net book value of liquidated but not depreciated property.

The other costs items reach, in the costs structure of the 1<sup>st</sup> damping stage, fewer than 1.5 %, in the time period of the 2<sup>nd</sup> stage fewer than 0.4 %, so they can be omitted.

## Conclusion

The analysis of economic development of the underground coal mine in the last phase of its activity has shown that the continuing costs connected with a mine operation are comparatively significantly connected with the mining, even in the event that its intensity is falling down. The different development of basic costs items in the time period of the 1<sup>st</sup> damping stage, i.e. since the damping announcement up to the mining completion, and, in the following time period of the same duration after the mining completion it is caused by the necessity to save, in the full range, the activity of all auxiliary and securing activities for mining (e.g. spheres of ventilation, mine rescue service etc.). Only after its completion these activities can be limited, however, with the respect of the mining legislation.

The attention must be paid also to the problems of power consumption and depreciation. After completion of coal mining the greatest part of power consumption will be connected with the mine ventilation and with pumping of mine waters. The rational management of the mine damping concerns especially the ventilation where the mine workings can be closed which will not be liquidated, to reduce the number of independent ventilation sections, to decrease the air quantity sucked into a mine with the respect of keeping the regulations concerning the composition of mine atmosphere. The power consumption control requires the

technical solution. The problems of depreciation is an accounting matter with the acceptance of the fact that until the end of a mine service life it is necessary to transfer all purchase value of the property which will be liquidated into the costs. The solution of this problem in the last months of its service life leads to the distortion of the values shown.

The decrease of the continuing costs for the whole time period of mining damping, i.e. in the time period of the 1<sup>st</sup> as well as the 2<sup>nd</sup> damping stage can be ensured basically in two ways:

- by the gradual jump decrease of continuing costs by limiting the activity scope of single technological and technical systems, by closing of corresponding parts of a mine, reduction of the total employees number etc.
- by shortening of the total time period of mining damping and mine liquidation duration, i.e. limitation of the months number in the framework of the 1<sup>st</sup> as well as the 2<sup>nd</sup> damping stage. The presupposition for it is the sufficient amount of financial sources for carrying out of a mine and surface objects liquidation.

## LITERATURE

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**Realized under the financial support from state means of the Grant Agency of the Czech Republic in the framework of the grant project reg. No.: GA/105/02/1381 what is greatly appreciated.**

Recenzent: Dr hab. inż. Krystian Probiez, prof. Pol. Śl.

## Streszczenie

Proces likwidacji kopalni polega na zmniejszeniu działalności górniczej, jej zakończeniu oraz likwidacji zarówno części podziemnej, jak i powierzchniowej kopalni, a także

obowiązkowym uregulowaniu skutków działalności górniczej i rozwiązaniu problemów socjalno-zdrowotnych. Prace likwidacyjne, jak również konieczne prace przygotowawcze wymagają ciągłych kosztów, które można nazwać kosztami długotrwałymi. Celem uporządkowania terminologii konieczne jest wyodrębnienie tych kosztów z kosztów łącznych, które powiązane są z wielkością produkcji. Przedstawiona analiza wykazała, że koszty łączne wiążą się z działalnością górniczą, ponieważ nawet w przypadku obniżenia eksploatacji górniczej, konieczne jest utrzymanie wszystkich oddziałów i służb w pełnym zakresie. Dopiero po zakończeniu działalności górniczej możliwa jest redukcja kosztów długotrwałych poprzez racjonalną kontrolę prac likwidacyjnych. Stałą uwagę powinno się zwracać na zużycie energii, a szczególnie na obniżenie zużycia, które istotnie odzwierciedla rzeczywisty poziom kosztów. Koszty zamykania kopalni, w tym działalności związanej z likwidacją obiektów podziemnych i powierzchniowych, są bardzo uzależnione od racjonalnej kontroli tego procesu.