

MINE SURVEYING SUPPORT OF CONTROLLING LOSSES OF BALANCE INDUSTRIAL RESERVES

Sholokh M. V.

PhD (Engineering), Associate Professor, Kryvyi Rih
National University, Ukraine

Sergieieva M. P.

Senior Lecturer, Kryvyi Rih National University, Ukraine

Summary

The considered methods of the surveyor providing of works are on determination of volumes of crop and setting of norms of quality indexes of balance industrial supplies of bowels of the earth, in that examine the losses of balance-industrial supplies and impoverishments of content of quality indexes of minerals as the determined (non-random) sizes. The conducted review of methods and technical upshots will allow to bring down losses of balance industrial supplies and impoverishments) of content of quality indexes of minerals at a booty, ware housing and necessity of variegation of content of quality indexes of minerals in the stream of iron-ore mass.

The offered methodology of setting of norms of the balance-industrial supplies prepared to the booty is approved on the careers of Kryvyi Rih, and the methodology of setting of norms of preparedness of the balance-industrial supplies prepared to the booty, worked out for operating ore-mining enterprises modernized and adjusted to the use on the stage of planning. By an experience way the set values to the coefficient of reserve of extractive units, time domain between loosening of array of ferrous quartzite's in an extractive coalface accordingly in months and in changes and at presence of in the career of the motor-car and railway transporting of iron-ore mass from coalfaces for different time domains the got dependences for the calculations of norms ready to the booty of balance-industrial supplies.

Executed calculations of supplies taking into account the balanced manner on maintenance quality indexes minerals of supplies, show that the losses of balance-industrial supplies and impoverishments of content of quality indexes of minerals far more than they are certain on the accepted methodologies and that is why careful attitude toward the well balanced on maintenance quality indexes minerals of supplies in iron-ore mass, their timely maintenance and bringing in exploitation are major measures in relation to the guard of bowels of the earth and environment.

Offered methodology of control of the use of found-balance and maintenance of balanced on maintenance quality indexes minerals of supplies, that is attracted in exploitation, calculations conduct that after formulas, that take into account the volume of useful components attract that with breeds and balance on maintenance the quality indexes of minerals of supplies, so losses of balance-industrial supplies of that or other part of found-balance supplies of deposit. If not to conduct the separate account of all sources of entering iron-ore mass of useful components, then throw away opportunity objective comparison of job performances for the improvement of

the use of bowels of the earth of areas of arrays of hard minerals that are in different mining-and-geological terms.

It is well-proven that for the correct choice of normative the level of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals in iron-ore mass in every concrete case of the use of criterion of estimation of economic efficiency, that full enough takes into account the difference of variants of development for operating and capital charges. The criteria of economic evaluation at setting of norms of losses of balance-industrial supplies are differential mountain rent and income.

Introduction. Estimate rationality of process of mastering of mineral resources the indexes of plenitude of exception of them from the bowels of the earth and to the further processing. Planning of development of mountain works in the process of exploitation of balance-industrial supplies of deposit, bed, ore body or areas of array of hard minerals is the important stage in the decision of questions of technology of mountain production that provides plenitude of mastering of balance supplies of bowels of the earth. The complete losses of minerals consist on the average of losses: in the process of booty - 10-30 primary processing (enriching) to 20–40 metallurgical redistribution - 10-15. That is why a task of the complex mastering of bowels of the earth is *actual*.

Researchers are based on materials of work of ore mining enterprises of Krivbass that are in the central part of the Ukrainian shield that is the basic geostructural element of south-west of the east Europe platform.

The aim of the work is the development and introduction of methodology of determination of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals taking.

For the achievement of the aim, such tasks are untied:

- the analysis of present methods of determination of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals;

- the improvement of existent methodologies of determination of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals taking into account the complex mastering of bowels of the earth;

- the establishment of norms of losses of balance-industrial supplies and impoverishment of content of quality indexes useful minerals;

- it is establishment of norms of the balance-industrial supplies prepared to the booty.

The idea of work is analysis and determination of methods of calculation of optimal losses for development of economy of ore-mining enterprises and indexes of plenitude of the use of resources of bowels of the earth at present labor and material resources.

The research object is balance-industrial supplies of bowels of the earth.

The subject of research is losses of balance-industrial supplies and impoverishments of content of quality indexes of useful minerals.

An determination of losses of balance-industrial supplies and impoverishment of content of quality indexes useful minerals.

Basic indexes of the use of supplies of bowels of the earth are losses of balance-industrial supplies and impoverishments of content of quality indexes of minerals in an array and in the stream of iron-ore mass [1]. In quality of indexes to them reciprocals - coefficient of exception of minerals from the bowels of the earth and coefficient of changeability of content of quality indexes of minerals are accepted at the booty of balance-industrial supplies.

Methodology recommends also [2] the coefficient of obstruction of content of quality indexes of minerals. The first four indexes of the use of balance supplies are accepted officially by all ore-mining enterprises in accordance with [2] on determination, setting of norms and account, to the economic evaluation of losses of balance-industrial supplies of hard minerals.

For correct determination of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals in iron-ore mass, the same as indexes of exception from the bowels of the earth and changeability of content of quality indexes of minerals of iron-ore mass, value has a choice of method of the surveyor providing of works, that most full answers that is why or to other type of minerals. The indexes of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals are needed for the decision of economic tasks in iron-ore mass must take into account not only content of quality indexes of minerals, lose that impoverishing

breeds, but also where and on what stage of the survey or providing of project mountain works lose these minerals and impoverish.

Only classification of losses of balance-industrial supplies of hard minerals [3-6], built because of division on the technological processes of booty and places, where losses of balance-industrial supplies are. This classification is given for all methods of development and all hard minerals. Taking her for basis, will consider the types of the surveyor providing of works on determination of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals in relation to the terms of development of iron-ore deposits.

Subdivide the losses of balance-industrial supplies into the losses of balance-industrial supplies in guard that does not withdraw even after liquidation of ore-mining enterprise and if barrier temporal in some period of time envisage their partial or complete exception, then minerals in that does not attribute to the losses of balance-industrial supplies, but set off to the balance supplies the operating losses of balance-industrial supplies (quantitative and quality), that is related directly to the booty of balance-industrial supplies, as they largely differ in technological reasons and places of their formation.

In relation to that or another way of development or to the certain mining and geological conditions, a number of varieties of losses of balance-industrial supplies will be it is or diminished, or megascopic. Depending on the type of losses of balance-industrial supplies and impoverishment to content of quality indexes of minerals in an array and in the stream of iron-ore mass choose the corresponding methods of the surveyor providing of works on their determination, and the detailed selection of types of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals in an array and in the stream of iron-ore mass allows in every separate case to choose more exact methods of the surveyor providing of their determination.

Determination of volume of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals in iron-ore mass.

Characterize the losses of balance-industrial supplies an amount and quality of part of minerals that abandon in the bowels of the earth, in comparing to liquidate balance-industrial supplies. Foremost

at a choice and comparison of methods and systems of development, determination of production capacity of mine (career), height of floor (to the ledge), estimation of balance-industrial supplies and establishment of standard on minerals, comparison of opening methods, determination of rational parameters of the systems of development and surveyor providing of technology of mountain works.

The coefficient of exception of balance-industrial supplies from the bowels of the earth characterizes an amount and quality of the obtained part of balance supplies. If balance-industrial supplies are lost on content of quality indexes of minerals does not differ from the balance-industrial supplies of block determine their volume directly in the process of the surveyor providing of realization of mountain works in a coalface, for example at the semilongwall of development of loss of balance-industrial supplies determine in parts units by a direct method.

At the surveyor providing of mountain works at the systems of development with bringing down of array of hard minerals of loss of balance-industrial supplies determine an indirect method.

Impoverishment of content of quality indexes useful minerals in iron-ore mass (changeability of content of quality indexes of minerals) characterize a decline in the process of booty of balance-industrial supplies of content in them quality indexes of useful components and increase of part of the finished mixing breeds in comparing to the same indexes in the balance supplies of array of hard minerals. In separate case at the surveyor providing of mountain works of development of iron-ore deposits of hard minerals, impoverishment of content of quality indexes of minerals in iron-ore mass determine attitude of mass of the finished mixing breeds toward the obtained iron-ore mass. Characterize the coefficient of changeability of content of quality indexes of the obtained balance-industrial supplies content of quality indexes in him useful components or harmful admixtures, parts of the finished mixing breeds, by humidity, grade and other factors on that the degree of fitness of minerals depends for the further processing or use in a national economy. Impoverishments of content of quality indexes of minerals in iron-ore mass determine in parts of units a direct method. Both types the brought formulas [6] over allow to estimate the use of balance-industrial supplies in two cases, when lose balance-industrial supplies with balance

content of quality indexes of useful components, and at impoverishing on maintenance the quality indexes of obtained minerals breeds there are not useful components or there are useful components.

In two another cases, when lose balance-industrial supplies that on content of quality indexes differ from middle balance on maintenance the quality indexes of minerals and at impoverishing on maintenance the quality indexes of obtained minerals breeds there are not useful components or there are useful components. For more clear surveyor providing of works on control of the use of found-balance and maintenance of balanced on maintenance quality indexes minerals of supplies, that will be in the near time attract in exploitation, calculations conduct after formulas, that take into account both mass of useful components attract that with breeds and balanced on maintenance the quality indexes of minerals of supplies and losses of balance-industrial supplies of that or other part of the found out supplies.

In third case, when lose the balance-industrial supplies of minerals, content of quality indexes of that differs from balance supplies on maintenance the quality indexes of minerals, but at impoverishing on maintenance quality indexes minerals breeds there are not useful components, determine the indexes of the use of balanced on maintenance quality indexes minerals of supplies [6].

In most general, fourth case, when content of quality indexes of minerals in balance-industrial supplies, lose that, differs from middle content of quality indexes of minerals in the balance-industrial supplies of array of hard minerals and impoverishing on maintenance the quality indexes of minerals of breed contain useful components, formulas for determination of indexes of the use of balance-industrial supplies of bowels of the earth [6].

Formulas are however above-mentioned suitable only for one component minerals without the account of possibilities of the complex use of passing components of minerals. Today all less than one component minerals become and less than. In ferrous quartzite's except a basic component there is much copper, vanadium, zinc, lead and other useful components, part from them in composition wastes use as building material. On some deposits, beds, ore bodies or areas of array of ferrous quartzite's content of quality indexes of titan, vanadium, cobalt, copper, zinc, sulphur, nickel, phosphorus, germanium and non-metallic minerals sometimes higher, what in the

basic deposits of minerals of the coloured metals. The applied formulas are for determination of indexes «visible» losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals in iron-ore mass concordantly [5; 7; 8] both adulterations in iron-ore mass of useful components of containing breeds and their additions or reductions take into account in her due to abandonment in the losses of balance-industrial supplies of impoverished or enriched on maintenance the quality indexes of minerals of part. However the end-point allows exactly to take into account and divide the sources of bringing in iron-ore mass on maintenance the quality indexes of useful components and source of losses of balance-industrial supplies and on maintenance quality indexes minerals of supplies, as a result visibility of prosperity is created sometimes even in case of impermissible severe losses of balance-industrial supplies. At content of valuable component in breeds that apply, (often it arrives at 0,3–0,5 middle content of quality indexes of minerals) such visibility of prosperity is possible even at 30 % losses of balance-industrial supplies.

If not to conduct the separate account of all sources of entering iron-ore mass from the balance-industrial supplies of useful components, then lose another possibility of objective comparison of work for the improvement of the use of bowels of the earth of areas of arrays of hard minerals that are in the different mining (at presence of in the breeds of useful components and without them, at possibility of abandonment in the losses of balance-industrial supplies of poor on maintenance quality indexes minerals and without them) and geological conditions. In an order to take into account this important circumstance, some other factors (even partly), for example multicomponent of minerals and possibility of determination of losses of balance-industrial supplies at the surveyor providing of booty and complexity of the use of mineral raw material, it is expedient to replace an index – content of quality indexes of useful components (metals) by next indexes:

- minerals, that withdraw the value of content of quality indexes in the balance supplies of u_6 ;
- in supplies, that lose u_n ;
- at impoverishing on maintenance quality indexes minerals breeds of u_p ;

- by a value on maintenance quality indexes in digging, that withdraw u_d .

Then for four losses of balance-industrial supplies and impoverishment considered earlier cases on maintenance the quality indexes of minerals of breed determine after next formulas

a - when $u_{\delta}=u_n$ i $u_p=0$

$$\Pi = 1 - (D_u / B u_{\delta}); \quad (1)$$

$$P = 1 - (u_d / u_{\delta}). \quad (2)$$

δ - when $u_{\delta}=u_n$ i $u_p \neq 0$

$$\Pi = 1 - \frac{D(u_d - u_p)}{B(u_B - u_p)}; \quad (3)$$

$$P = 1 - \frac{u_B - u_d}{u_B - u_p}. \quad (4)$$

ε - when $u_{\delta} \neq u_n$ i $u_p=0$

$$\Pi = 1 - \frac{D u_d}{B u_d}; \quad (5)$$

$$P = \frac{B(u_B - u_n) - D(u_d - u_n)}{B(u_{\Pi} - u_p)} \quad (6)$$

ζ - when $u_{\delta} \neq u_n$ i $u_p \neq 0$

$$\Pi = \frac{B(u_B - u_n) - D(u_d - u_p)}{D(u_{\Pi} - u_p)}; \quad (7)$$

$$P = \frac{B(u_B - u_n) - D(u_d - u_p)}{D(u_n - u_p)} \quad (8)$$

With these formulas study not only entering sources balance-industrial supplies of useful components but also entering sources iron-ore mass of harmful components.

Indexes of the use of bowels of the earth are with taking into account of sibilance on maintenance quality indexes minerals of supplies. Experience of development of iron-ore deposits testifies that in many cases she is carried out in a few stages. On the measure of working off the richest deposits, beds, ore bodies or areas of array of hard minerals in exploitation attract more poor on maintenance quality indexes minerals. In a number of cases with high efficiency

already work off deposits, beds, ore bodies or areas of arrays of balance-industrial supplies that yet recently distinguished as sibilance. Maintenance and account presently of sibilance on maintenance quality indexes minerals of supplies matter Therefore, especially for creation of raw mineral-material base of country on the nearest years.

On many deposits of hard minerals exploitation of poor and sibilance on maintenance quality indexes minerals of supplies is already conducted. In the Kryvyi Rih pool develop ferrous quartzite's in that on maintenance quality indexes iron presents 32-37 % id est 0,76-0,82 % and 0,61-0,73 % medium on maintenance the quality indexes of minerals in the balance-industrial supplies of rich on maintenance quality indexes minerals. Mark at the same time, that a guard and rational use of balanced on maintenance quality indexes minerals of supplies on enterprises carries out levels not on a due. Yes, from data [8-13], at development of rich on maintenance quality indexes minerals of supplies of Kryvyi Rih counterfeited and, thus, up to a point 2,6 milliards of τ of ferrous quartzite's are lost for future development. On some ore mining enterprises the surveyor providing of mountain works is at development of balance-industrial supplies on mine enterprises carry out levels not on a due. To such attitude toward the balanced on maintenance quality indexes minerals of supplies the methods of their determination and account applied at this time promote in a great deal. In accordance with them the volumes of losses of balance-industrial supplies, impoverishment on maintenance the quality indexes of minerals and indexes of exception of balance-industrial supplies provide for to determine without an account on maintenance the quality indexes of minerals, lose that and volumes presently balanced on maintenance quality indexes minerals of supplies, that bring over to the booty. On the deposits of hard minerals where clear differentiations are between ore bodies and containing breeds that apply and does not contain the quality indexes of useful components, and also on deposits work off that the systems with a book-mark et al, fully sufficiently methods of the surveyor providing of works on an account, that provide for [5;14], however in most cases they do not allow to provide the complex and rational use balance-industrial and balanced on maintenance quality indexes minerals of supplies.

Zabalance on maintenance the quality indexes of minerals supplies enormous money is expended in secret service of that, unfortunately, while economically not estimated and, thus does not have a value. In the total in mining districts a giant loss the consequences of that it is while difficult to estimate is inflicted a future raw mineral-material base. Quite obviously, that the problem of the complex mastering of bowels of the earth cannot be decided on the basis of estimation and account of the use only of balance-industrial on maintenance quality indexes minerals of supplies, id est supplies of today, without a corresponding estimation and account presently of zabalance on maintenance quality indexes minerals of supplies, or supplies of future periods the especially nearest. Not to take into account them - so to conduct disorderly predatory exploitation of bowels of the earth, but especially their part – balanced on maintenance quality indexes minerals of supplies, that can as it is visible on the example of Kryvyi Rih considerably exceed balance supplies.

Accordingly [3] from the surveyor providing of works on the account of losses of balance-industrial supplies and impoverishment on maintenance the quality indexes of hard minerals, the «actual» losses of balance-industrial supplies and impoverishments determined only on maintenance the quality indexes of minerals, losses of balance-industrial supplies and impoverishments are on maintenance the quality indexes of minerals of balance supplies. The lack of these methods consists in that they do not take into account useful components in finished mixing to iron-ore mass of breeds, losses of balance-industrial supplies balanced after impoverishment on maintenance the quality indexes of minerals and corresponding to them indexes of exception from the bowels of the earth of balance-industrial supplies and changeability of content of quality indexes of minerals in the obtained balance-industrial supplies concordantly [3]. Use of indexes and formulas in [2;6] and branch instructions [2;4] take into account a multicomponent on maintenance the quality indexes of minerals of balance-industrial supplies on the basis of determination of their value, and also total content of useful components in the obtained balance-industrial supplies regardless of or there were they in balance-industrial supplies or introduced with impoverishing on maintenance the quality indexes of minerals breeds or

balanced on maintenance the quality indexes of minerals supplies. At the same time, unlike the actual losses of balance-industrial supplies and impoverishment on maintenance the quality indexes of minerals, such indexes, as a coefficient of exception of balance-industrial supplies from the bowels of the earth, the coefficient of changeability on maintenance the quality indexes of minerals and «visible» losses of balance-industrial supplies and impoverishments on maintenance the quality indexes of minerals (concordantly [5]) quite not take into account neither a possible rejection on maintenance the quality indexes of minerals, lose that from middle on maintenance the quality indexes of minerals of balance-industrial supplies, nor part and impoverishing on maintenance quality indexes minerals of breeds (of content in them useful or harmful components).

None of formulas [6] and branch instructions [2;4] for determination of volumes of losses of balance-industrial supplies, impoverishment on maintenance the quality indexes of minerals, coefficients of exception of balance-industrial supplies from the bowels of the earth and changeability of content of quality indexes of minerals does not take into account the possible bringing in exploitation with the impoverishing breeds of balanced on maintenance quality indexes minerals of supplies or them possible earning additionally, that eliminates normal exploitation of these balanced on maintenance quality indexes minerals of supplies in the future.

On ore-mining enterprises planning content of quality indexes of useful components in iron-ore mass is provided due to earning additionally presently substandard balanced on maintenance quality indexes minerals of supplies, that eliminates their normal exploitation in the future. Earning additionally of supplies of poor on maintenance quality indexes minerals is inflict a loss not only to the bowels of the earth, but potentially and to the environment, because instead of present it will be to master the new deposits of hard minerals and accordingly to distort the ecological balance in new districts. Therefore for more complete and complex use of bowels of the earth and improvement of conservancy it is necessary to take into account all subtleties of the use of balance-industrial and balanced on maintenance quality indexes minerals of supplies in close connection with conservancy.

That more exactly and clearly to control the use self of balance-industrial supplies, but not balance-industrial supplies together with balanced on maintenance the quality indexes of minerals of supplies and by the enriched useful components by breeds and simultaneously to provide an account and maintenance of balanced on maintenance quality indexes minerals of supplies, that can be in the near time also attracted in exploitation, it is necessary to use formulas [15–20], what is taken into account by receivables in iron-ore mass of useful components separately from balance-industrial supplies, containing breeds and balanced on maintenance quality indexes minerals of supplies, and also what quality indexes and how many useful components abandon in the lost iron-ore mass, but not in general in the bowels of the earth.

Taking into account of amount and quality of attracted in the booty of balanced on maintenance quality indexes minerals of supplies, and also amount and content of quality indexes of attached here and broken, restored to a state, useless for further development in the future, balanced on maintenance quality indexes minerals of supplies. Balance of content of quality indexes of metals at the surveyor providing of works at development of balance-industrial supplies with the partial bringing in exploitation of him balanced on maintenance quality indexes minerals of supplies and adulteration it is hard to iron-ore mass of certain part of impoverishing on maintenance quality indexes minerals of breeds looks like

$$D\alpha = Bc + q_1 Bc_3 - \Pi Bc + Bb \quad (9)$$

where D, B, B is mass accordingly the liquidated balance-industrial supplies obtained, and finished mixing to loosen to iron-ore mass of impoverishing on maintenance quality indexes minerals of breeds, τ ; and, c, c_3 and b is content of quality indexes of metal or other useful component accordingly in the obtained iron-ore mass from the array of balance-industrial supplies, content of quality indexes of minerals in balance-industrial supplies, at balanced on maintenance quality indexes minerals supplies and impoverishing on maintenance quality indexes minerals breeds, q_1 is a fate of attracted in exploitation of balanced on maintenance quality indexes minerals of supplies (in relation to balance-industrial), part of units.

If mass of the lost balance-industrial supplies equals $\Pi \times B$, then mass of finished mixing to loosen to iron-ore mass of impoverishing

on maintenance quality indexes minerals of breeds can be certain after expression

$$B = \Delta + \Pi B - q_1 B \quad (10)$$

Putting of this expression in a formula (9), determine the losses of balance-industrial supplies (in parts of units) after a formula

$$\Pi = 1 + \frac{q_1(c_3 - b)}{c - b} - \frac{\Delta(a - b)}{\Delta(c - b)} \quad (11)$$

and impoverishment of content of quality indexes of minerals in iron-ore mass after a formula

$$P = \frac{\Delta(c - a)}{\Delta(c - b)} - \frac{Bq_1(c - c_3)}{\Delta(c - b)} \quad (12)$$

If balanced on maintenance the quality indexes of minerals supplies does not attract in exploitation, and only earn additionally and violate, id est when $q_1=0$, then formulas (11) and (12) look like

$$\Pi = 1 - \frac{\Delta(a - b)}{B(c - b)}; \quad (13)$$

$$P = \frac{c - a}{c - b}. \quad (14)$$

Calculations in obedience to these the formulas show, if to examine the supplies o minerals taking into account the balanced on maintenance quality indexes minerals of supplies, then volumes of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals in iron-ore mass in reality far more than they are certain on the accepted methodologies.

Therefore careful attitude toward the balanced on maintenance quality indexes minerals of supplies, their timely maintenance and bringing in exploitation are major measures in relation to the guard of bowels of the earth and accordingly all environments. Like a previous conclusion balances of mass and values to the case of the surveyor providing of works on the account of the partial bringing in exploitation and earning additionally of balanced on maintenance quality indexes minerals of supplies in relation to the terms of multicomponent minerals can be presented by the next system

$$\begin{cases} \mathcal{D}u_{\delta} = \mathcal{B}u_{\delta} + q_1 \mathcal{B}u_3 - \mathcal{P}\mathcal{B}u_{\delta} + \mathcal{B}u_p \\ \mathcal{B} = \mathcal{D} + \mathcal{P}\mathcal{B} - \mathcal{B}(1 + q_1) \end{cases} \quad (15)$$

where $u_{\mathcal{D}}$ and u_{δ} is a value of digging from the array of balance-industrial supplies and minerals in the array of balance-industrial supplies; u_3 and u_p is a value of mineral sat the balanced on maintenance quality indexes minerals of supplies and impoverishing on maintenance quality indexes minerals of breeds.

Uniting the system of equalizations relatively \mathcal{P} , obsessed

$$\mathcal{P} = 1 + \frac{q_1(u_3 - u_p)}{u_{\mathcal{D}} - u_p} - \frac{\mathcal{D}(u_{\mathcal{D}} - u_p)}{\mathcal{B}(u_{\delta} - u_p)} ; \quad (16)$$

$$P = \frac{\mathcal{B}}{\mathcal{D}} = \frac{u_{\delta} - u_{\mathcal{D}}}{u_{\delta} - u_p} - \frac{\mathcal{B}q_1(u_{\delta} - u_p)}{\mathcal{D}(u_{\delta} - u_p)} \quad (17)$$

Expressions of indexes of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals in iron-ore mass (11) and (12) characterize only the state of the use of sibilance on maintenance quality indexes minerals of supplies basic to the component. They are the useless for description uses that sometimes attract in exploitation or the counterfeited balanced on maintenance quality indexes minerals of supplies that also beds together with other minerals, breeds of opening and driving of making, feigns etc. For the decision of task of the complex use and mastering of deposit, bed, ore body or areas of array of hard minerals, creation had rejected and unrejected technologies of booty of balance-industrial supplies and processing of content of quality indexes of minerals in iron-ore mass it is necessary to create the corresponding methods of the surveyor providing of works on determination of losses of balance-industrial supplies and processing of content of quality indexes of minerals in iron-ore mass.

Determination of volumes of losses of balance-industrial supplies and impoverishment is on maintenance the quality indexes of minerals taking. At development of complex deposit, bed, ore body or areas of array of hard minerals withdraw one useful fossil, and other often loses for further development. The value of passing minerals sometimes considerably exceeds the value of basic useful fossils and,

naturally, loss from the losses of balance-industrial supplies large enough. However, at determination of volume of losses of balance-industrial supplies and loss from them this variety of losses of balance-industrial supplies, similarly as volumes of losses of balance-industrial supplies balanced on maintenance the quality indexes of minerals supplies that operate in present tense methods quite not take into account. In quality of losses of balance-industrial supplies will consider privation of possibility of the useful use of mine-out space. So, for example, at the systems with bringing down and with a complete book-mark this possibility is practically eliminated, at the systems with cleansing open-space and with his partial book-mark there is large possibility of the use of greater volumes of mine-out space.

At the surveyor providing of works on the account of potential value of passing minerals that bed together with a basic useful component, mine-out space of breeds and wastes of mountain and ore mining and processing production balance of values on a deposit, bed, ore body or areas of array of hard minerals is presented like previous. At terms, when lose all passing minerals and does not use other possibilities (mine-out space, opening breeds, wastes of booty of balance-industrial supplies and enriching of content of quality indexes of minerals, is in iron-ore mass), losses of balance-industrial supplies in two simplest cases, when $u_n=u_{\delta}$ and $u_p=0$, and also $u_n=u_{\delta}$ and $u_p \neq 0$, determine by formulas

$$\Pi = 1 - \frac{D_1 u_{D1}}{B u_{\delta 1} + \sum_{i=1}^n r_i B_i u_{\delta i}} \quad (18)$$

$$\Pi = 1 - \frac{D_1 (u_{D1} - u_{Dp1})}{B \left(u_{\delta i} + \sum_{i=1}^n r_i B_i u_{\delta i} + u_{\delta p1} \right)} \quad (19)$$

where D_1, B is mass of digging from the array of balance-industrial supplies and balance-industrial supplies in the bowels of the earth of basic useful fossil, τ ; u_{D1} and $u_{\delta 1}$ is a value of content of quality indexes of minerals in iron-ore mass of obtained useful fossils from the array of balance-industrial supplies and balance supplies of basic useful fossil, hrn./of τ ; r_i is a coefficient that shows, in the how many

times greater or less balance-industrial supplies of i-a of useful fossil from the array of balance supplies of basic useful fossil; B_i is balance-industrial supplies of i-a of useful fossil, τ ; u_{6i} is a value of content of quality indexes of minerals in iron-ore mass of i-a of useful fossil obtain that from the array of balance-industrial supplies to the hrn./of τ ; u_{6p1} is a value of impoverishing on maintenance quality indexes minerals of breeds, obtain that, on basic useful fossil, hrn./of τ .

Like there can be the decided tasks on determination of losses of balance-industrial supplies and impoverishment to content of quality indexes of minerals in iron-ore mass for another cases, id est when $u_n \neq u_6$ and $u_p = 0$, and also when $u_n \neq u_6$ and $u_p \neq 0$ [6].

In connection with the tendency of increase of the productivity of obtaining units on the booty of balance-industrial supplies and opening breeds the size of the productive productivity of quarry on rocky mountain mass in a prospect must increase. In addition, in connection with the improvement of technique and technology of explosive works increase the number of blocks, that simultaneously use during a mass explosion that conduces to the increase the sizes of the productive productivity of quarry on rocky mountain mass, and thus, to the increase of range of changeability of the productive productivity of quarry in that the size of time domain does not depend on the productive productivity.

Thus, basic indexes of the use of supplies of bowels of the earth are losses of balance-industrial supplies and impoverishments of content of quality indexes of minerals in iron-ore mass and in relation to that or another way of development or to the certain mining and geological conditions, a number of varieties of losses of balance-industrial supplies can be it is or diminished, or megascopic.

1. Depending on the type of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals in iron-ore mass choose corresponding to them methods of the surveyor providing of works on their determination. The detailed selection of types of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals in iron-ore mass allows in every separate case to choose the exact methods of their determination.

2. On the basis of the conducted analysis of present methods of determination of volumes of losses of balance-industrial supplies it is analyzed to content of quality indexes of minerals in relation to the terms of development of iron-ore deposits and it is set that the complex mastering of bowels of the earth, requires application of corresponding methods of determination and estimation of losses of balance-industrial supplies of minerals that take into account to the feature of complexity and plenitude of the use of all supplies balance and all minerals.

3. In connection with the tendency of increase of the productivity of obtaining units on the booty of balance-industrial supplies and opening breeds the size of the productive productivity of quarry on rocky mountain mass in a prospect must increase. In addition, in connection with the improvement of technique and technology of explosive works increase the number of blocks, that simultaneously use during a mass explosion that conduces to the increase the sizes of the productive productivity of quarry on rocky mountain mass, and thus, to the increase of range of changeability of the productive productivity of quarry in that the size of time domain does not depend on the productive productivity.

4. Methodology of control of the use of found-balance and maintenance of balanced on maintenance quality indexes minerals of supplies, that is attracted in exploitation, calculations it is necessary to conduct after formulas, that take into account both mass of useful components attract that with breeds and balanced on maintenance the quality indexes of minerals of supplies and losses of balance-industrial supplies of that or other part of found-balance supplies and if not to conduct the separate account of all sources of entering iron-ore mass from the balance-industrial supplies of useful components, then throw away opportunity objective comparison of work for the improvement of the use of bowels of the earth of areas of array of hard mineral, that be in different mining-and-geological conditions.

5. On the ore-mining enterprises, working off balance-industrial supplies execute with the groundless bringing in exploitation of part of balanced on maintenance quality indexes minerals of supplies, as a result violate their arrays and throw away opportunity the effective use in the future of basic part, or application of the system of

development and the methods of redemption of mine-out space do not allow to return on old areas for the exception of balanced on maintenance quality indexes minerals of supplies.

6. Implementation calculations show, if to examine the supplies of minerals taking into account the balanced on maintenance quality indexes minerals of supplies, then the losses of balance-industrial supplies and impoverishments of content of quality indexes of minerals far more than they are certain on the accepted methodologies in reality.

7. Certainly, that for the correct choice of optimal level of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals in every concrete case uses the criterion of estimation of economical efficiency that takes into account the difference of variants of development on running and capital expenses.

References

1. Collection of guidance on the protection of mineral resources. (1973). Collection of guidance on the protection of mineral resources. Moscow, Moscow: Nedra.
2. Uniform rules for the protection of mineral resources in the development of solid mineral deposits. (1987). Uniform rules for the protection of mineral resources in the development of solid mineral deposits. Moscow, Moscow: Nedra.
3. **Sidorenko V.D., Fedorenko P.I., Sholokh N.V., Peremetchik A.V.** (2010). New directions in mine surveying. Krivoy Rog, Krivoy Rog: KTU Publishing Center.
4. Sectoral instructions for the determination, accounting and rationing of ore losses in the development of iron ore, manganese and chromite deposits at the enterprises of Minchermet USSR. (1975).
5. Sectoral instructions for the determination, accounting and rationing of ore losses in the development of iron ore, manganese and chromite deposits at the enterprises of Minchermet USSR. Belgorod, Belgorod: VIOGEM.
6. **Sholokh M. V.** (2017). Methodology for the standardization losses of ready-to-extract solid minerals. // For participation in the 2nd International Scientific and

Technical Internet Conference «Innovative Development of Mining Industry». Kryvyi Rih, Kryvyi Rih.

7. **Sholokh M. V., Sholokh S. M., Sergieieva M. P.** (2018). An analysis of surveyor control of losses of balance-industrial supplies is at mastering of bowels of the Earth. // Innovative development of resource-saving technologies for mining. Multi-authored monograph. Sofia, Sofia: Publishing House «St. Ivan Rilski».

8. **Sholokh M. V.** (2018). Determination and research of norms of the ferrous quartzites prepared to booty. // Development of scientific foundations of resource-saving technologies of mineral mining and processing. Multi-authored monograph. – Sofia, Sofia: Publishing House «St. Ivan Rilski».

9. **Sholokh M. V.** (2018). An analysis of surveyor control of losses of balance-industrial supplies is at mastering. // International Scientific and Technical Internet Conference «Innovative Development of Resource-Saving Technologies of Mineral Mining and Processing». Book of Abstracts. Petroșani, Romania, Petroșani, Romania: UNIVERSITAS Publishing.

10. **Sholokh M. V.** (2018). Optimization of correlation of losses of balance-industrial supplies and obstruction of content of quality indexes of minerals is in the stream of iron-ore mass. // International Scientific and Technical Internet Conference «Innovative Development of Resource-Saving Technologies of Mineral Mining and Processing». Book of Abstracts. Petroșani, Romania, Petroșani, Romania: UNIVERSITAS Publishing.

11. **Sholokh M. V.** (2018). Planning of development of mountain works in the process of exploitation of balance-industrial supplies. // International Scientific and Technical Internet Conference «Innovative Development of Resource-Saving Technologies of Mineral Mining and Processing». Book of Abstracts. Petroșani, Romania, Petroșani, Romania: UNIVERSITAS Publishing.

12. **Sholokh M. V., Sergieieva M. P.** (2018). Taking into account of amount and quality of attracted in the booty of balanced on maintenance quality indexes minerals of supplies. // International Scientific and Technical Internet Conference «Innovative Development of Resource-Saving Technologies of Mineral Mining and Processing». Book of Abstracts. Petroșani, Romania, Petroșani, Romania: UNIVERSITAS Publishing.

13. **Sholokh M. V.** (2017). Economic estimation of losses of balance-industrial stocks and dissipation of content of qualitative indexes of minerals in iron-ore mass. Kryvyi Rih, Kryvyi Rih: Sat scientific works "Herald of the KNU".

14. **Sholokh M. V.** (2016). Methodology for determining and standardizing the content of qualitative indices of minerals in industrial balance stocks. Kryvyi Rih, Kryvyi Rih: Publishing Center of KNE KNVN.

15. **Sholokh M. V.** (2017). Modeling processes of forming the quality of ore and minerals in the ore raw material of the ore stream. Kryvyi Rih, Kryvyi Rih: Scientific and Technical University. Collection "Mining Bulletin" of the State University "KNU".

16. **Sholokh M. V.** (2017). Normalization of balance-industrial stocks of ferruginous quartzite by degree of readiness for extraction in an open way. Kryvyi Rih, Kryvyi Rih: Scientific and Technical University. Collection "Mining Bulletin" of the State University "KNU".

17. **Sholokh M. V.** (2017). Standardization of ready-to-use balance-industrial stocks of ferruginous quartzites with open method. Kryvyi Rih, Kryvyi Rih: Sat scientific works "Quality of Mineral Raw Materials", FAP Chernyakhovsky D. A.

18. **Sholokh M. V.** (2018). The effect of losses of balance-industrial stocks and impoverishment of the content of quality indicators of minerals on the process of averaging. Kryvyi Rih, Kryvyi Rih: Scientific and Technical Collection "Mining Bulletin".

19. **Sholokh M. V.** (2018). Surveying providing prediction and management of qualitative indicators in the development of iron ore deposits. Dnipro, Dnipro: Forum of miners-2018.

20. **Sholokh M. V., Sergieieva M. P.** (2018). Modeling of characteristics of volumetric-qualitative parameters of flows of iron-ore masses of quarries and mines. Kryvyi Rih, Kryvyi Rih: Scientific and Technical University. Collection "Mining Bulletin" of the State University "KNU".

21. **Sholokh M. V.** (2018). Normalization of balance-industrial stocks of ferruginous quartzite by degree of readiness for extraction. Premier Publishing r o Vienna, Premier Publishing. r o Vienna: The Second International Scientific Congress of European Scientists. - Proceedings of the II International Scientific Forum of Scientists «East-West» (May 10-11, 2018).