

## THE ESTIMATION OF TECHNICAL AND TECHNOLOGICAL SAFETY OF AN ENTERPRISE IN THE CONTEXT OF MODERNIZATION SAFETY OF AN ORE-DRESSING ENTERPRISE FUNCTIONING

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The methodological approaches to determining and estimating the technical and technological safety of ore-dressing enterprises are examined. It has been noted, that the existing procedures of the estimation do not give complete and complex understanding of the state of technical and technological safety of an enterprise. Therefore, it is proposed to determine the technical and technological safety of an enterprise in the context of modernization safety and to consider its guarantees by calculating the increase in the break-even point, which takes into account additional expenditures for the modernization of the basic means, necessary for the achievement of their normative value. As a standard the average coefficient of basic means modernization in the industry is taken. The use the proposed technique will provide the opportunity to determine the state of technical and technological safety considering the development of an enterprise.

*Keywords:* economic safety, technical and technological safety, modernization safety, basic means, the coefficient of basic means modernization, break-even point, investments.

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## ОЦІНКА ТЕХНІКО-ТЕХНОЛОГІЧНОЇ БЕЗПЕКИ ПІДПРИЄМСТВА В КОНТЕКСТІ БЕЗПЕКИ ОНОВЛЕННЯ НА ЕТАПАХ ФУНКЦІОНУВАННЯ ПІДПРИЄМСТВА ГІРНИЧО-ЗБАГАЧУВАЛЬНОЇ ГАЛУЗІ

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Розглянуто методичні підходи до визначення та оцінки техніко-технологічної безпеки підприємств гірничо-збагачувальної галузі. Було зазначено, що наявні методики оцінки не дають повного та комплексного розуміння стану техніко-технологічної безпеки підприємства. Тому запропоновано визначати техніко-технологічну безпеку підприємства в контексті безпеки оновлення та брати до уваги її забезпечення через точку беззбитковості, яка враховує додаткові витрати на оновлення основних засобів, необхідних для досягнення їх нормативного значення. За норматив приймається середньогалузевий рівень коефіцієнта оновлення основних засобів. Використання запропонованої методики дасть можливість визначити стан техніко-технологічної безпеки, враховуючи розвиток підприємства.

*Ключові слова:* економічна безпека, техніко-технологічна безпека, безпека оновлення, основні засоби, коефіцієнт оновлення основних засобів, точка беззбитковості, інвестиції.

## ОЦЕНКА ТЕХНИКО-ТЕХНОЛОГИЧЕСКОЙ БЕЗОПАСНОСТИ ПРЕДПРИЯТИЯ В КОНТЕКСТЕ БЕЗОПАСНОСТИ ОБНОВЛЕНИЯ НА ЭТАПАХ ФУНКЦИОНИРОВАНИЯ ПРЕДПРИЯТИЯ ГОРНО-ОБОГАТИТЕЛЬНОЙ ОТРАСЛИ

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Рассмотрены методические подходы к определению и оценке технико-технологической безопасности предприятий горно-обогатительной отрасли. Было отмечено, что существующие методики оценки не дают полного и комплексного понимания состояния технико-технологической безопасности предприятия. Поэтому предлагается определять технико-технологическую безопасность предприятия в контексте безопасности обновления и принимать во внимание ее обеспечение путем расчета точки безубыточности, которая учитывает дополнительные расходы на обновление основных средств, необходимых для достижения их нормативного значения. В качестве норматива принимается среднеотраслевой уровень коэффициента обновления основных средств. Использование предлагаемой методики позволит определить состояние технико-технологически безопасности, учитывая развитие предприятия.

*Ключевые слова:* экономическая безопасность, технико-технологическая безопасность, безопасность обновления, основные средства, коэффициент обновления основных средств, точка безубыточности, инвестиции.

Today the integration of Ukraine into the world economic space plays an important role for the high-speed and successful development of the country. The entrance to the world markets, the guarantee of the necessary level of the competitive ability of production, the use of the contemporary technologies, which ensure the reduction in the prime cost of production and ecological safety are the primary purposes of the activity of high-technology domestic enterprises. Therefore, providing modernization safety as the part of the technical and technological safety is the basic component of the development of the country's industry.

The process of modernization at domestic enterprises in the ore-dressing field is of great importance due to the high share of the worn basic means. The coefficient of the depreciation is expressed both in the physical and in the moral values. A great number of scientists are occupied by the problem of modernization and providing the technical and technological safety of an enterprise, namely Shkarlet S. M., Molodetska E. N., Ilschenko S. N., Evdokimov Ph. I., Belozubenko V. S., etc.

According to the basic indices of the state of technical and technological safety the scientists differentiate the effectiveness ratios of the basic means' use, but do not examine the state of modernization and the level of the use of energy resources with respect to the general tendency in the country. Besides the formation of technical and technological safety at the development stage of an enterprise has been examined.

In accordance with the theory of an enterprise development, the entity as a living organism passes the appropriate stages of the development, each of them is characterized by specific features of functioning. Therefore, the formation of economic safety, namely the technical and technological safety features should include functioning of an enterprise at the appropriate stage of development.

According to the researches, the development of enterprises in the ore-dressing field passes the following stages: "Establishing", "Infancy", "Infantile stage", "Bulge", "Constancy" and "Declining stage". Conditionally, these stages can be divided

into "Layout" and "Establishing" periods. To the "Layout" period it is necessary to refer the "Establishing" stage, which provides for the creation and the realization of the business plan. Other stages should be taken to the "Functioning" period, i.e., the stages of the continuous economic activity. Based on this, it is expedient to examine the level of technical and technological safety in the "Functioning" period of an enterprise as in the period of the direct production.

The safety modernization reflects the state of the replacement of worn-out equipment to the new, more contemporary one. The need for modernization is caused by the obsolescence of basic means at ore-dressing enterprises. At the same time, the safety evaluation of modernization must be conducted taking into account the branch-wide tendencies.

For the more detailed characteristics of the state of basic means, it is proposed to examine a change in the index of modernization of basic means during 2007 – 2011 in comparison with the industry average value. The dynamics of a change in this index is shown in the Figure.

According to the Figure, a significant drop in the coefficient of modernization is observed in 2009. It means the decrease of the rates of the enterprise's development that is an objective phenomenon in the situation of the world economic crisis.

According to the results of 2011, in the structure of the noncurrent assets of PJSC "Ingulets mining-and-processing integrated works" of 31.12.2011 basic means and low-valued objects in the tax calculation compose 4,361,040.000 UAH (the first cost of the basic means in the accounting period composes 5,334,401.000 UAH, the accumulated depreciation is 973,361.000 UAH), that is by 15,54 % higher compared to the previous period. The coefficient of the depreciation of basic means composes 48.94 % (it is calculated on the basis of the planned and deadline of the beneficial use). The general index of modernization of basic means, in comparison with 2010, was increased by 87 %. In comparison with the industry average value, the state of basic means modernization is less than a general index by 4.31 %.

OJSC "Southern mining-and-processing integrated works" according to the results of 2011 shows an increase of the

modernization coefficient compared to 2010 by 37.28 %. In 2011 the introduction of the fixed funds composed 7,719,498.000 UAH including the input of fixed funds for a capital construction in the amount of 20,958.000 UAH. By the results of 2011, the rate of fixed assets modernization is less than the industry average value by 0.09.

In OJSC "Southern mining-and-processing integrated works" the total residual cost of the basic means of production designation compose 99.94 %; non-production designation is 0.06 %. In 2011 basic means for the total sum were 35,180.000 UAH, including the following: the liquidated total first cost in the amount of 27,150.000 UAH; the residual cost of 2,984.000 UAH; transferred into the category of goods for sale in the amount of 6,519.000 UAH; copied after the deficiency according to the results of conducting the annual inventory on the total first cost in the amount of 49.000 UAH. Totally in 2011 717,927.000 UAH were entered, 35,180.000 UAH were retired, including: 474,873.000 UAH put into the use of new basic means, 243,054.000 UAH of modernized (reconstructed) basic means. The coefficient of basic means modernization in 2011 in comparison with 2010 increased by 58.7 %, and in comparison with average branch value increased by 0.09.

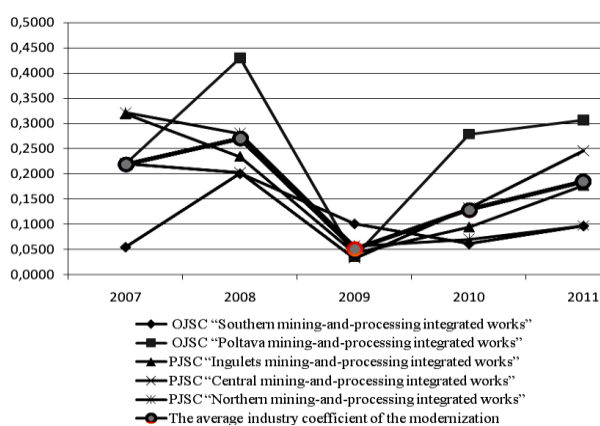


Figure. The dynamics of index of basic means modernization in ore-dressing enterprises in 2007 – 2011

Basic means in OJSC "Poltava mining-and-processing integrated works" according to their use in the technological process are divided into: production designation (97.93 %) and non-production designation (2.07 %). The means on exploitation and maintenance of objects of social and cultural life, tourist center, and medical service belong to the basic means of non-production designation at an enterprise. The sum of total first cost of basic means (including the low-valued irreversible material assets, investment real estate) of 31.12.2011 was 5,046,011.000 UAH, the depreciation was 1,828,196 UAH. According to the balance data in 2011 the residual cost of basic means in OJSC "Poltava mining-and-processing integrated works" in comparison with the previous year increased by 680,6 m UAH (27 %). The coefficient of basic means modernization in 2011 in comparison with 2010 increased by 10 %, and in comparison with the industry average value increased by 22.43 %. This tendency testifies the stable development of an enterprise.

PJSC "Central mining-and-processing integrated works" according to the results of 2011 showed the coefficient of the depreciation of basic structures and construction, transmitting devices equal to 16.7 %, machines and equipment equal to 24.7 %, transportation means equal to 26.8 %, tools, instruments, inventory (furniture) equal to 26.0 %, other basic means and low-valued objects in the tax calculation equal to 55.4 %.

During the accounting period the amount of basic means was 792.280 UAH. At an enterprise during the accounting period the object of basic means was withdrawn from the active assets as a result of sale and the liquidation, in connection with the nonconformity to the criteria and as a consequence in 2011 the first cost of basic means decreased by 9,509.000 UAH; the sum of the overcharged depreciation decreased by 7,279.000 UAH. At the same time, the rate of increase in the coefficient of modernization composed 45.9 % compared to 2010. In comparison with industry average value, the coefficient of a modernization is 0.06 higher.

It should be noted that there are enterprises, the modernization coefficient of which is less than industry average value; it is indicated as the insufficient level of modernization. According to this, the enterprises must draw additional resources for financing the basic means. It is also necessary to note that the source of financial resources must not be external in order not to lose the financial independence of an enterprise.

Therefore, as the source of funds it is proposed to accept the profit of the enterprise, the calculated value of which will be produced by means of the determination of the additional total break-even condition [1], according to the formula:

$$\Delta V_0 = \frac{\Delta I_H}{cm}, \quad (1)$$

where  $\Delta V_0$  is the increase in the point of break-even condition, which will ensure the necessary level of the process of modernization, UAH;

cm is the relative contribution margin.

The numerator of formula (1) should be considered as a profit, which is not sufficient for the enterprise to guarantee the normal level of modernization. The calculation of an additional profit must be conducted taking into account the depreciation allowances and measure of the effectiveness of capital investments [2].

Calculation is done according to the formula:

$$\Delta ko = (\Delta ko_H \cdot oZ_{NP}) - oZ_D,$$

$$\Delta I_H = \frac{\Delta ko}{A_M + E_H}; \quad (2)$$

$$\Delta ko_H = \begin{cases} ko_H - ko_f, ko_H > ko_f \\ 0, ko_H - ko_f \leq 0 \end{cases},$$

where  $\Delta I_H$  is a deficiency in the investment resources, UAH;

$ko$  is the normative expenditures in the process of modernization, UAH;

$ko_f$  is the actual investment outlay in the process of modernization, UAH;

$A_M$  is the average annual depreciation allowances, UAH;

$E_H$  is the normative effectiveness ratio of the capital investments, UAH.

The shortage of investment resources at ore-dressing enterprises is designed as the difference between the normative investments into the process of modernization and their actual value. As a standard one must set the industry average value.

If the normative expenditures are less than the actual ones, an enterprise doesn't need additional investments for the modernization, and increase in the point of a break-even condition is not calculated.

The new level of the point of break-even condition, taking into account providing safety modernization, is calculated as the sum of the actual point of break-even condition and the additional one. The estimation of safety level is proposed to

conduct modernization with the help of the absolute and relative indices according to the formula:

$$\Delta V = \frac{V_{bb} - V_{bf}}{V_{bb}}, \quad \Delta V = \frac{V_{bb} - V_f}{V_{bb}}, \quad (3)$$

where  $V_f$  is an actual volume of realization, UAH;

$V_{bb}$  is the new level of break-even condition taking into account safety of modernization, UAH;

$V_{bf}$  is the actual level of the point of the break-even condition, UAH.

The scale of safety level of modernization is represented in Table 1.

Table 1

**The scale of safety level of modernization**

Increase of the break-even point	Safety level of modernization
$\Delta V > 0$	high
$0 \leq \Delta V \leq 0.05$	average
$\Delta V > 0.05$	low

According to these data, let us determine, what level of technical and technological safety, precisely, of safety modernization, has the enterprises mentioned above (Table 2).

Table 2

**The safety level of modernization at the ore-dressing enterprises in 2007 – 2011**

The enterprise	2007	2008	2009	2010	2011
PJSC "Central mining-and-processing integrated works"	high	average	low	average	average
OJSC "Poltava mining-and-processing integrated works"	high	high	average	high	high
OJSC "Southern mining-and-processing integrated works"	low	low	high	low	average
PJSC "Northern mining-and-processing integrated works"	high	average	average	average	average
PJSC "Ingulets mining-and-processing integrated works"	high	average	low	low	average

The further research of the formation of technical and technological safety of ore-dressing enterprises must assume the estimation of energy safety at the stages of the enterprises functioning.

**References:** 1. Дубицький Д. П. Оцінка економічної безпеки підприємства при зовнішньоекономічній діяльності (на прикладі

гірничо-добувних підприємств) : автореф. дис. ... канд. екон. наук : спец. 08.00.04. – Економіка та управління підприємствами / Д. П. Дубицький. – Кривий Ріг, 2010. – 22 с. 2. Лукашенко О. В. Удосконалення методів оцінки ефективності функціонування підприємств : автореф. дис. ... канд. екон. наук : спец. 08.06.01 – Економіка, організація і управління підприємствами / О. В. Лукашенко. – Кривий Ріг, 2004. – 19 с. 3. Фінансові звітності за 2007 – 2011 рр. підприємств гірничо-збагачувальної галузі Дніпропетровщини [Електронний ресурс] : за даними "SMIDA review – новий інформаційний сервіс Агентства з розвитку інфраструктури фондового ринку". – Режим доступу : [www.smida.gov.ua](http://www.smida.gov.ua).

**References:** 1. Dubytskyi D. P. Otsinka ekonomichnoi bezpeky pidpriemstva pry zovnishnioekonomichnii diialnosti (na prykladi hirnycho-dobuvnykh pidpriemstv : avtoref. dys. ... kand. ekon. nauk : spets. 08.00.04 – Ekonomika ta upravlinnia pidpriemstvamy / D. P. Dubytskyi. – Kryvyi Rih, 2010. – 22 p. 2. Lukashenko O. V. Udoskonalennia metodiv otsinky efektyvnosti funktsionuvannia pidpriemstv : avtoref. dys. ... kand. ekon. nauk : spets. 08.00.04 – Ekonomika, orhanizatsiia i upravlinnia pidpriemstvamy / O. V. Lukashenko. – Kryvyi Rih, 2004. – 19 p. 3. Finansovi zvitnosti za 2007 – 2011 rr. pidpriemstv hirnycho-zbahachuvanoi haluzi Dnipropetrovshchyny [Electronic resource] : za danymy "SMIDA reiew – novyi informatsiinyi servis Ahentstva z rozvytku infrastruktury fondovoho rynku". – Access mode : [www.smida.gov.ua](http://www.smida.gov.ua).

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