SOME SPECIFIC ASPECTS ON THE STRATEGY OF WASTE PRODUCT MANAGEMENT IN THE MINING INDUSTRY IN ROMANIA – BOZÂNŢA SETTING POND, MARAMUREŞ DISTRICT

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Abstract

The conclusions concerning the stability conditions of Bozânţa setting pond, exposed in the present circumscribed paper (which could be included in the specific aspects of the strategy of waste product management generated by the mining industry in Romania, 2003-2013) are the following: the stability analysis took place in three stages, and the conclusion regarding the application of the proposed method has as main advantages the field economy, the assurance of an additional disposal quality with a minimum investment effort, the raising of the safety degree, the sign of the existent facilities and the implementation of an environment management system.

Keywords: strategy, management, waste, mining industry, specific aspects

Knowledge stage in the field

a. National Strategy of Waste Product Management

The National Strategy of Waste Product Management was elaborated by the Board of Environment and Water Economy, according to the specific responsibilities related to the European legislation regarding the field of the waste product management and the

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providings of the 78/2000 Urgent Government Ordinance, concerning the waste product regime, modified and approved by 62/2001 Law. This was elaborated for 2003-2013, with a periodic audit, according to the technical progress and the environment protection demands, in order to satisfy the present strategy. All types of waste product generated on the territory of our country are formally classified as:

- city and assimilable waste products: the totality of the generated waste products within urban and rural environments, individual farms, institutions, commercial and service (domestic waste products) centers, street waste products collected from public spaces, streets, parks, green spaces, construction and demolition waste products, sediments from used city water;

- production waste products: the totality of the waste products generated by industrial activities, including those generated from the mining industry; could be inoffensive or dangerous waste products;

- waste products generated by the medical activities: are the waste products from hospitals, clinics, individual surgeries, and they divide in two categories: dangerous medical waste products, which are infectious, stinging-biting, anatomic-pathological organs, waste products coming from the infectious diseases sides, etc., and other exclusive above-mentioned waste products, which represent the assimilable waste products category.

b. Mineralization belt

The belt of the polimetallic mineralizations associated to the epimetamorphical schists from East Carpathians. Within this belt there are known numerous occurrences and ores massive sulphures and/or dissemination of pyrite + Cu and Zn + Pb + Cu. They extend, with some discontinuities, from North, from Poienile downward the mountains towards South, to Bălan, over about 200 km; towards South, similar mineralizations were recently marked in Comana-Veneția region, Perşani Mountains. The specified belt, with a NW-SE orientation, suffered Alpine fragmentations, and it is situated within the Bucovinic Nape – the upper unit of the Central-East Carpathian napes. The sulphure mineralizations are situated within the volcanites and the sediments from Tulgheş Lithogroup (Tg3 Formation = Leşu Ursului Lithozone) from Putna Unit. The mineralizations occur at several stratigraphical stages, being exposed on tens of kilometers, represented by massive accumulations and sulphures disseminations which, normally, include prevailing pyrite, eventually associated with chalcopyrite (Bălan, Leşu Ursului, Fundu Moldovei) or blende, chalcopyrite, galena (Burloaia, Leşu Ursului). The occurrences of sulphure mineralizations from Tg3 Formation represent layers, lens, impregnations, breccias process areas, and rarely small veins. They group in local agglomerations separated by large spaces, where host acid metasulphures and chloritous-sericitous and sericitous schists are sterile. The ore bodies, conformable with the schistuosity, are synchronous and conformable folded with the crystalline schists. The mineralogical composition has a hydrothermal character. The texture of the ores is rubanated, overlaid by a cataclastic texture due to the metamorphism.

Some pseudohydrothermal aspects are the result of some sinmetamorphical remobilisations, especially for chalcopyrite and sometimes for galena. The geochemical data show an antagonistic variation of Pb and Zn against Cu, characteristic for hydrothermal ores. Generally, the Zn content is higher than the Pb and Cu one.

The main mineralizations, from NW towards SE, concentrate in the following metalliferous districts:

1. Borşa – Vişeu, Maramureş Mountains, where Bozânța setting pond is located;
2. Fundul Moldovei – Leşu Ursului, Bistrița Mountains;
3. Harlagia – Şumuleu;
4. Bălan – Fagul Cetății, Giurgeu Mountains.

Bozânța setting pond

a. General data

Bozânța setting pond is situated in the Someşu Mare hydrographical basin, at the junction between Săsar and Lăpuş rivers, between the 0 and 1 CSA landmarks, from Săsar river, and 6 and 7 CSA, from Lăpuş river, in the southern side of the old setting pond (now in preservation) of U.P. Săsar.

From administrative point of view, it is situated on territory of Bozânța Mare, Tăuții Măgheruş village, Maramureş district. Besides Bozânța Mare, the nearest villages for the setting pond are:

- Săsar village, situated eastward and upstream the setting pond, at about 1 km;
- Bozânța Mică village, situated SW and downstream the setting pond, at about 4 km.

The work holder: The Central Flotation Unit within Baia Mare Mining Branch.

The setting pond is designated for safe deposition of the mining preparation sterile, fine-grounded and hydraulically transported.

The industrial water purification function is the second important one, mainly for the industrial waters from the mining industry of this area. The place is located in the major and minor river beds of Sîsar river and, part of it, in the major river bed of Lăpuş river. As the setting pond is situated at the junction between Săsar and Lăpuş rivers, there were performed safe works against the negative effects resulted from the extraordinary outputs which appear on these two rivers. Therefore, Săsar river was flood controlled since the implementation of the setting pond in the area between the old setting pond of U.P. Săsar and the junction with Lăpuş river.

Pluviometrically, in this area, the weak precipitation cycles or lacking precipitation ones alternate with abundant precipitation cycles.

b. The abduction solution for Bozânța setting pond

The Bozânța setting pond represents a „flat" setting pond, closed all along its margins by a striking dam, limited at W and SW by Lăpu river, and in E and SE by Săsar river. For the analysis of the stability conditions of Bozânța setting pond, the following methods were used:

- the circle yielding surface method – Fellenius;
- Spencer method;
- the preexistent yielding surface method – Jambu.

Fellenius Method considers that the yielding surface is circular and examines the force equilibrium for each strip of the bank slope. The safety coefficient is determined by the ratio between the stability and the overturn moments.

The calculation is automatical, using a program which allows the examination of the complex inhomogeneous sections up to 30 types of material.

In this paper, there are shown only the minimal values of the safety coefficient established this way.

Spencer Method admits that in the yielding moment, on the cornice, takes place the fracture on a vertical fissure whose depth results from several probes, the fissure continuing towards the base of the bank slope with a circle-cylindrical yielding surface.

Jambu Method considers the field limited at the lower part by the preexistent yielding surface. The yielding domain is divided in stripes, for each stripe being determined the equilibrium of forces, implicitly the normal and tangential efforts on the slip surface.

In order to perform the calculations, there is necessary some knowledge of the layer position fro the studied structure and the resistance characteristics of the grounds from each layer.

The analysis of the stability conditions for Bozânța setting pond was performed for three over-raising stages. In each depositional stage, the stability conditions of the bank slopes were verified for static burdens and seism. The results shown in this paper are mainly from the final stage. In the last over-raising stage, in the calculation section shown in Figure 1, the following characteristics are presented:

- the setting pond is over-raised at 218 height and is 58 m in height;
- the position of the depression curve is maintained by the former drainage system;
- the beach is 75 m width.

In these conditions, the following safety coefficients resulted:

F1 = 1.35 considering the static solicitation hypothesis;

F2 = 1.04 for the seism calculations.

Conclusions considering the stability conditions of Bozânța setting pond

The stability analysis of Bozânța setting pond was performed for three deposition stages, namely:

- first stage, the setting pond is 31.50 m in height, the cornice of the last dam being situated at 191 m;

- the second over-raising stage at 205 m height, with a 45 m height setting pond;

- the calculations were performed for static stress and seism, considering the stabilized infiltration regime, the depression curve position maintained due to the scheduled drainage system;

- the stability conditions of the setting pond are synthetically characterized by the size of the safety coefficients shown in the next table, considering the over-raising stage and the stress hypothesis.

Tab. 1. Stability conditions of Bozânța setting pond, synthetically characterized by the size of the safety coefficients.

Over-rainsing stage	Static stress	Seism determined stress
1st stage – 31.50 m setting pond	1.37	1.05
2nd stage– 45 m setting pond	1.32	1.03
3rd stage – 58 m setting pond	1.35	1.04

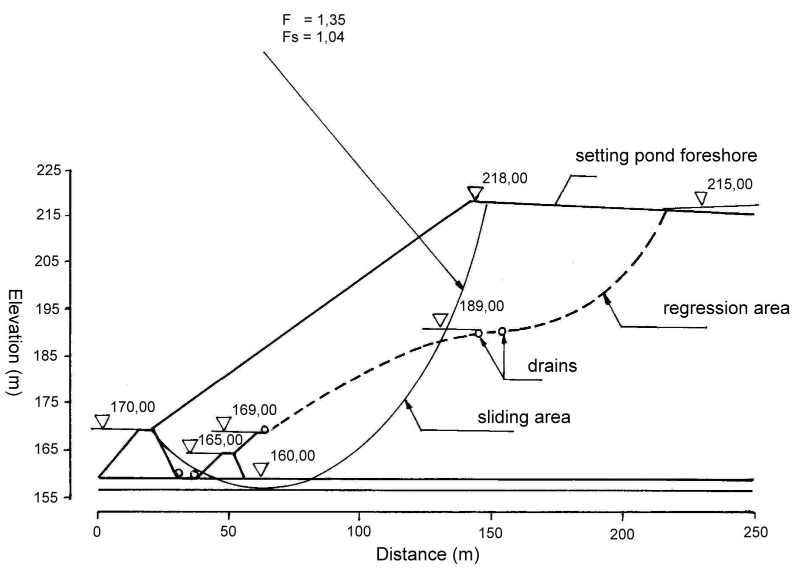

Fig. 1. The Bozânța setting pond. The stability analysis of gradients for the final stage – The height of setting pond - H = 58 m.

We notice the setting pond over-raising from 34.50 to 58 m height does not affect the stability of the slope banks, but there is a control of the infiltration regime by the conservation of the depression curve at a sufficient low level, as a result of the movement study of underground waters.

The setting pond over-raising is possible in the following conditions:

- the conservation of the bank slope at 1:2.55;

- the coservation of the depression curve postion for each over-raising stage at the mentioned heights, based on the study of the infiltration regime;

- in seism conditions, the safety coefficients determined over-units for each depositional stage, without any stability reserves to allow the pass of a steeper slope for the setting pond;

- the depositional anisotropy, reflected by a reduce permeability on vertical and a higher one on horizontal, results in a raising of the depression curve with about 1 m;

- the stability conditions of Bozânţa setting pond were analyzed by three calculation methods, onsidered better theoretically grounded and for which the ordinary safety coefficients have the following values: Fellenius Method (F=1.37); Spencer Method (F=1.47); Jambu Method (F=1.61).

We notice that the Fellenius Method has the safety coefficients with the most reduced values and, therefore, this method was used for the analysis of the slope banks stability duuring the over-raising stages.

Conclusions on the application of the suggested method

As a result of the existent world information, as well as according to the results obtained by the mathematical shaping performed on a real case, considering the infiltration regime and the stability, the suggested method could be applied to all setting pond types, which presently use the raising method towards upstream. Against the presented and proved facts, we consider that the suggested method brings the following main advantages:

1. the field economy realized by the neutralization of new surfaces;
2. the utilization of the existent facilities;
3. the diminuishing of the invvestment effort for a manager;
4. the assurance of a suplementary storage capacity of the sterile coming from the preparation center;
5. the increasing of the mining safety degree;
6. easier satisfying the request concerning the water and environmental management, considering that all the development takes place on an existent setting;
7. the implementation of the risk management system.

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