Environmental risks of abandoning a mining project already started: Romaltyn Mining Baia Mare

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Abstract. The history of mining activity, which has been the economy engine in the region and has contributed to the formation of many localities, has been deleted too quickly. During all this time, in the world countries which have invested in mining sector have made considerable progress. The paper brings in question, within the framework of the theme, the implications arising from the abandonment of the Romaltyn project which mainly affects two objectives: Central Tailing Pond and Aurul Tailing Pond. The Central tailing pond constitutes an unfortunate source of pollution for groundwater, surface water, soil and air on a large area around it, because its location upstream of Baia Mare city and in the vicinity of a agricultural production zone. The consequences of the tailing pond maintenance in the current situation are: presence of sclerozing dust with sulphurs content scattered over large agricultural area; soil pollution by acidification; heavy metals release which enter in food chain and will be found in food. The final disposal of the pollution source is the only solution really safe in long term. Abandoning Aurul tailing pond in the current phase of construction involves high environmental risks. Taking in consideration the potential and the huge soil volume which are necessary for rehabilitation, isolation and rehabilitation of this area involve extremely high costs and the realization is, technically, almost impossible in the current context.

1. Introduction

The history of mining activity that has driven the region's economy and contributed to the formation of many settlements was removed too quickly. Meanwhile, the other world's countries that have invested in mining activity have recorded considerable progress.

We discuss, on the topic, the implications arising from the abandonment of the Romaltyn project affecting mainly two objectives: Central Tailing Pond and Aurul Tailing Pond.

The research aims to present in overview the consequences of abandoning or postponing a mining project on medium or long term. It is about the exploitation and capitalization of the material from Central tailing pond and storage it on Aurul tailing pond - which can be secured and rehabilitated due to the existing infrastructure.

The whole process of mining closure in Romania was characterized by a lack of communication with specialists, with the community and academic environment.

The point of view expressed in the paper shall be strictly relates to the technical-economic and environment aspects and implications, the legal and social being of other competence. Specialists from universities, competent in the field of mining activities and the environmental protection may not remain indifferent to the risks of interruption a mining project in progress.

The technical-economic issue supposes the analyses of two separate aspects:
- Abandoning the project in its current phase or postponing it for an indefinite period of time;
- Exploiting on the current location and respect the proposed project of SC Romaltyn Mining Ltd.

2. Abandonment of the project
The implications arising from the abandonment of the project mainly affects two objectives: Central tailing dam and Aurul tailing dam.

2.1. Environmental impact of Central Tailing Pond abandonment

2.1.1. Actual situation. This pond has a similar mineralogical composition to all other ponds belonging to Remin Company (in number of 17) but with the special feature of the subsequent storage of a quantity of concentrated arsenious pyrite (Figure 1).

![Figure 1](image_url) The state of Central Tailing Pond in 2014 – actually, concentrates of arsenious pyrites deposited on the pond surface are transported in China, to be processed

Mining waste in Central Tailing Pond are made up of sterile from the processing of non-ferrous ores containing precious metals from mines Suior, Cavnic, Herja and Turt. UP Central Flotation processed ores during the period 1962 to 1976 and from 1976 the tailing pond is in conservation with a storage capacity of 10 million tonnes. The conservation of the tailing pond has never represented a rehabilitation and environmental safety because it has been the subject of an exploitation and repositioning project.

The Central tailing pond constitutes an unfortunate source of pollution of groundwater, surface water, soil and air on a large area around it, because of its location upstream of Baia Mare city and in the vicinity of a zone with agricultural production (Figure 2 and Figure 3).
Minerals contained in this tailing pond are reactive, because of sulphurs which generates in the presence of water and of oxygen acid drainage (acid waters and heavy metals), which is highly toxic to the environment.

The special feature of this tailing pond is the storage on the surface of 110000 tonnes of arsenious pyrite concentrate for a period of more than ten years, treated by bacterial lixiviation. Even if it is lately, transported (sold in China) lixiviated components are to be found in the body of the tailing pond and are active. This concentrate has been stored in the period of 2004 - 2005.

2.1.2. Consequences of maintaining the tailing pond in actual situation. Dust driven by the wind is sclerosing, because of the silica content under crystalline form that can lead to the silicosis disease.
Furthermore, the drives of the dust with high sulphurs content over large agricultural area pollutes the soil by acidification and worse, by heavy metals entering in the food chain and are to be found in food.

The reactivity of a tailing pond is generated by the reactions of sulphurs oxidation in the presence of water and oxygen. Accordingly, any drop of precipitation water falling on the surface of the pond, will percolate the material and generate these reactions that, in the end, lead to acid drainage. If we analyse that on the Central tailing pond surface, 48 ha, fall in a year 935 l/m² (annual precipitation average for Baia Mare area) we arrive to an impressive amount of acid water, charged with heavy metals which comes out of the tailing pond body. Taking in account of an effective surface reactivity (approximately 38 ha), an evaporation coefficient of 10 % and the average heavy metals content in water out of the pond, it results in a year quantities in the order of hundreds kilograms of Cd, thousands kilograms of Cu and Zn, tens of thousands kilograms of Fe and Mn and for sulphurs (SO4) hundreds of thousands kilograms.

If it is not operating, this tailing pond should be confined and landscape rehabilitated. The confinement implies a total isolation, so that water and oxygen does not come in contact with tailing pond sulphurs. It is necessary to cover with vegetal soil for grassing, but later the objective must be monitored for an unlimited period and that area remains locked for other uses. The costs for these operations are considerable and the experiences of mining closure in Romania are not encouraging, as regards the certainty of the completion of the safety conditions.

The final disposal of the pollution source is the only solution really secure on long term. The exploitation of the Central tailing pond, which ensures the elimination in a good measure of pollutant elements and subsequent greening of the perimeter, represents the rational alternative to resolve definitively the problem.

2.2. Aurul tailing pond abandonment

2.2.1. Actual situation. Aurul tailing pond is built on a flat terrain and is deemed to be a plain pond. Its abandonment in the current construction phase, involve huge environment risks.

Aurul tailing pond is in the property of Romaltyn mining company and it is located in the proximity of some important communities (Figure 4 and Figure 5).
Its building started in 1998. From 1999 until December 2005 it was deposited on the tailing pond a quantity estimated at 5.5 million tonnes of sterile flotation reagent, chemically reactive due to the presence of sulphurs and the construction activity has been stopped for a period which exceeds 8 years, during which time the evolution of chemistry has become significant. The waste stemmed from processing of an old tailing pond containing polymetallic mining waste and gold silver ores and concentrates.

The exploitation activity has been interrupted at the beginning of the year 2006 remaining until present in a particular situation because it is not completed - material deposited represent less than a third of the maximum capacity - and has a large contact surface with the environment. This status generates a remarkable chemical reactivity due to the exposure to environmental factors (Figure 6).

To highlight the tailing pond reactivity it have been analysed the results of the laboratory calculations on samples of untreated water from the pond and the total water quantity allowing the calculation of the sulphates content, suspensions, cyanide Cu, Zn, Cd, Pb, Mn, Fe and Ni, pH. The analyses have been pursued in the period 2013, 2014 and the beginning of 2015. The tests were carried
In the frame of Romaltyn laboratory. Water has been treated up to the level of the permissible limits stated in Romanian standards [2].

In the analysis of the two years period it appears an obvious reactivity, accentuated of the material from the tailing pond. Thus, the sulphates do have had an increase of around 75%; the pH has had a decrease in the average of 3.6 to 2.8; the content of cyanide has dropped by about 80%. It is noticed a greater reactivity toward the period of precipitation October - November 2014 after a period of dry as it was the summer of this year. The explanation is the sulphurs oxidation phenomenon, the formation of sulphates and their solubilisation.

Actually, Romaltyn Company monitors the Aurul tailing pond and keeps under control its safety purposes; the waste water treatment plant built by the owner takes over the waters in excess over the limit of safety in the lake area and exfiltration. This tailing pond does not emit in environment any kind of polluting waters and, consequently, with the condition of station operation there is no environmental impact regarding acid waters loaded with heavy metals. The water treatment, the station maintenance and safety, the pond and the adjacent perimeter safety and stability involves significant costs from the auctioneer, costs which are supported from investment because the company does not produce.

2.2.2. Technical alternative in the case of actual project abandonment. A valley or coast tailing pond could be rehabilitated and put into safety, in different construction stages. The valley tailing pond involves lifting it up to the level at which it can be closed as a dome, so as not to leave a very large surface, delimited by a dam all around and inside there is a very fine material and very difficult to drain.

The reactivity of the tailing pond is a particular situation which has not been provided in the design phase. The execution and operation project does not lay down rules for the tailing dam stagnation periods.Normally a tailing pond works during the period of construction, when material are stored (flotation sterile) with certain characteristics (pH 7 to 7.5) treated in the processing plant. The material deposited becomes reagent but reactivity is minimized and limited by the continuous material contribution. Stopping the material submission and tailing pond construction causes accentuated oxidation reactions and generates a strong acid drainage. An important risk is the clogging of the drain system by precipitation of sulphates, carbonates, etc.

The most serious problem of this tailing pond is the major risk given by affection of the structure stability of the penstock, continuously damaged by acid environment. The destruction of the penstock compromises the tailing pond stability and lead to the need for pumping water through the floating systems, etc. The action for penstock remediation is extremely difficult and considerable costly.

The isolation and rehabilitation on this surface are extremely expensive, and the achievement from a technical point of view is almost impossible in current context, taking in consideration the potential and the large amount of soil necessary for rehabilitation.

Without a partner willing to undertake such costs, the isolation and rehabilitation of two ponds in Baia Mare and Recea village becomes, for the community and local and central authorities, a goal impossible to achieve in short and medium term.

The rehabilitation of Aurul tailing pond could also be achieved by the use of considerable quantity of sludge from the waste water treatment plant, by mixing it with local minerals, helping to resolve another stringent problem for Baia Mare city: the storage of the urban waste sludge.

With all these considerations, we affirm that the abandonment of the project in its current phase or postponing it for an indefinite period is not a responsible option.

2.2.3. Exploitation on the current location accordingly to Romaltyn project. The material processing from Central tailing pond on the current location, according to the project involves many discussions regarding the industrial risk. It is known that any industrial activity involves a risk of accident, which takes place when rigors provided in the project are not respected.

In the case of a new activity, the risks could occur even in the design phase.
In the case of an activity with extensive experience and responsible design, risks can occur only as a result of execution errors generated by indiscipline or ignorance. The exceptions are related to the natural disasters or generated by human activities.

The reason for the activity cessation on the current location is the use of cyanide in the process of separating precious metals. On the current location or in the vicinity at the Sasar processing plant, this technology has been used but with minimum safety conditions in comparison with those offered in the new project. In some studies [1], [3] published in the 2014 the risks of this technology were presented and proved that they are much lower than those of any other technologies applied to present. The investor state that the relocation on another area (suggested by the local administration as a solution) is unfeasible and with important delays.

The controversial legal aspects, the hostility of public opinion, mass - media, NGO’s and a part of the political environment have been exposed in various publications of the authors [4-9]. This analysis aims to present, in conclusion, a technical point of view on the risks much higher of postponing or stopping this project compared with the risks posed by its implementation.

Any activity involves a risk that is generally less important than the risk of doing nothing. It is extremely eloquent the saying "who doesn’t risk anything risk everything..."

3. Conclusions
The benefits of continuing Romaltyn project are higher than the risks inherent of the company activity, risks which are smaller than the consequences generated by the maintenance in the current status of the two tailing ponds.

The history of mining activity, which has been the engine of the economy in the region and has contributed to the formation of many localities, has been deleted too quickly. During all this time, in the world, the closing of this activity was realized in phases, after consistent plans for conservation and security of mining perimeters, social protection and, in the majority of cases, the introduction in the tourist circuit of specific mining objectives. The potential of our area for mining tourism has been remarkable, but it has been reduced considerably.

The justification of stopping or postponement for unlimited period of this project is the use of cyanide in mining activities. In the last period, in Europe and, in particular, in Romania it has been developed an very strong opposition against cyanide but not in all domains but only in mining although it uses below 15 % of the entire quantity. This opposition is unjustified and artificially maintained by different structures, either out of ignorance or out of interest. Cyanide is perceived as a powerful poison and associated with her history and for this reason public opinion has a vehement reaction. Any poison used in an irresponsible manner may cause serious risk situations.

In the case of project Romaltyn the risk of stagnation or indefinite delay is clearly much higher than the activity risk on the current location using the BAT (best available technologies).

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