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PROCEEDINGS

Editors:
Ljubiša Balanović
Dejan Tanikić

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PREFACE

On behalf of the Organizing Committee, it is a great honor and pleasure to welcome all esteemed participants of the 54th International October Conference on Mining and Metallurgy (IOC 2023), scheduled to take place at the picturesque Bor Lake, Serbia, from October18th to 21st 2023.

The collaborative efforts of the University of Belgrade, the Technical Faculty in Bor, and the Mining and Metallurgy Institute Bor have meticulously organized this year's IOC. Our focus remains unwavering on showcasing the latest research findings and advancements in geology, mining, metallurgy, materials science, technology, environmental protection, and other engineering disciplines. Our primary objective is to foster a dynamic environment where academics, researchers, and industry professionals can come together to share their knowledge, experiences, and innovative ideas while exploring opportunities for collaborative research endeavors.

Our conference agenda is rich and diverse, encompassing plenary sessions, engaging invited lectures, technical presentations, enlightening oral and poster sessions, informative technical tours, a diverse exhibition, and memorable social gatherings. At the heart of this event lies our strong commitment to sustainable development within the mining and metallurgy sector. We are dedicated to exploring ecologically conscious methodologies, responsible resource extraction practices, and cutting-edge technologies that reduce the industry's environmental impact and enhance the well-being of local communities.

The conference proceedings comprise 129 papers authored by individuals from universities, research institutes, and industries in 22 countries. We are proud to welcome participants from Bosnia and Herzegovina, Bulgaria, Canada, China, Croatia, Germany, Greece, India, Iran, Kazakhstan, Libya, North Macedonia, Montenegro, Morocco, Romania, Russia, Slovakia, South Africa, Spain, Turkey, United States, and, of course, Serbia.

We are excited to host the 8th International Student Conference on Technical Sciences (ISC 2023) as part of IOC 2023. This event offers students from Serbia and the wider region a unique chance to showcase their research and discuss the future of their fields with experts.

We sincerely thank the Ministry of Science, Technological Development, and Innovation of the Republic of Serbia for their generous financial support. In addition, we express our profound gratitude to all our sponsors, exhibitors, and friends of the Conference for their contributions and unwavering support for playing a pivotal role in ensuring the success of IOC 2023.

We would like to express our heartfelt thanks to all authors, committees, reviewers, speakers, and chairpersons for their invaluable contributions in shaping IOC 2023.

We look forward to welcoming you to the 55th International October Conference on Mining and Metallurgy (IOC 2024), which will be held in October 2024.

On behalf of the 54th IOC Organizing Committee,

Prof. dr Ljubiša Balanović

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MANAGEMENT OF RISK ASSESSMENT IN ENVIRONMENTAL PROTECTION IN SURFACE COPPER MINE

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Abstract

Successful environmental protection is largely based on a quality assessment of possible and present risks. Environmental risk management is a complex process that includes: risk identification, risk assessment and risk control, which taking measures to reduce that risk to an acceptable level. The focus of this work is on the application of the methodology of environmental risk assessment and analysis, as the most important aspect of successful management of environmental protection. The paper presented the analysis of the risk analysis that was carried out for one copper surface mine in Serbia.

Keywords: risk assessment, environmental protection, surface copper mine

1. INTRODUCTION

Due to the destructive impact of human economic activities on the environment for the purpose of a sustainable global economy, the intensity and duration of exploitation in all areas of industry also means major disturbances in the integrity of the terrain, air and eco-system.

Therefore, investing in the protection and restoration of the natural environment is one of the priorities of all of us. Reasonable environmental management should include adequate measures to minimize environmental damage.

Management of environmental protection in mines for the exploitation of metal mineral raw materials enables to identify and control the impact of exploitation activities, products and services on the environment, to improve the attitude towards the environment, to implement a systematic approach that will achieve the goals related to environmental protection and provide evidence that the set goals have been achieved. [1]

The introduction and functioning of the environmental protection management system is influenced by several factors, the most important of which are: constant environmental pollution, fear of complete exhaustion of natural resources, lack of organized and systematic monitoring of the consequences of pollution, increased interest of public opinion in environmental protection, legal solutions and special working conditions in endangered areas. [2]

Management of environmental protection requires a multidisciplinary perspective and the involvement of all members of society. This is due to the fact that health, the environment and social conditions are in constant interaction, so the disturbance of the environment leads to ecological disturbances and disturbances of social relations, which are interconnected and conditioned. By evolving the very understanding of environmental problems, the main focus of current environmental management is centered on the integration of social and ecological systems. In this context, environmental decision-making must deal with the complexity of both ecological systems and interdependent human organizational and institutional systems. [3]

Proper management of environmental protection can reduce negative impacts on the environment, reduce the risks of environmental disasters, increase the ability to quickly and effectively

intervene, improve reputation and build trust with the community, increase legal certainty due to compliance with environmental protection laws, easier to obtain authorizations and permits from local and state authorities, increase energy efficiency and water protection, carefully select raw materials and control waste recycling, contribute to cost reduction and raise competitiveness, improve the quality of workplaces and employee morale, and open new employment opportunities in mining industry markets where ecological production is important. [4]

2. EXPERIMENTAL

Risk assessment is an integral part of risk management and contributes to minimizing the possibility that the environment and employees in that environment are exposed to danger during the performance of work activities, some scientific and research activities were carried out, which had as their subject the analysis of the process of preventing the potential risk that the activities in copper surface mining production could lead to in technical and technological systems, in order to prevent them.

The analysis and evaluation of the existing state of the environment, as well as the assessment of possible risks to the environment and human health that are a consequence of the operation of the coper surface mine, show that the quantification of possible consequences can be achieved through the analysis of the impact of surface exploitation and preparation of copper ore on the environment.

The identification of environmental aspects and their possible impacts represents an analysis of the relationship between surface mining, flotation, tailings - the environment, where, on the basis of knowledge of the basic ecological potential of the analyzed space and the basic relationships in the system of emissions - transmission - immission - impact, all relevant facts are defined for the selection of adequate technologies of surface exploitation and preparation of copper ore.

3. RESULTS AND DISCUSSION

The analysis of possible causes of environmental pollution and degradation within the risk and impact assessment of surface exploitation and preparation of copper ore includes the following processes:

- surface mine with ore dump,
- transport of ore to flotation,
- flotation: crushing, grinding and flotation of ore,
- transport of concentrate and tailings, and
- flotation tailings pond.

The following possible sources of environmental pollution can be registered in the mine.

a) Air pollution

By analyzing air pollution with suspended particles (mineral dust), the following potential sources of pollution were identified:

- dry surfaces on active floors and surfaces (surface mine and ore dump),
- road routes for truck transport on the surface mine,
- crushing plant for ore and tailings at the surface mine,
- conveyor route with tailings belt,
- operational activities of mining machines and technological equipment at the surface mine (drilling rigs, excavators, bulldozers, graders),
- machines and technological equipment for the preparation of copper ore (crushing, grinding, flotation),
- conveyor route with ore belt,
- road routes for truck transport of concentrate,

- dry areas on the flotation tailings.

Air pollution with exhaust gases (CO, NO_x, SO_2) from the engines of mining loading, transport and auxiliary machines was caused by the following possible sources: trucks and bulldozers.

The blasting process in surface mine can represent a potential source of air quality threats because, under the influence of the wind, dust and gaseous blasting products (CO, NO, NO_2, etc.) are distributed in the area of mining operations.

b) Noise

By analyzing the process of working noise sources in the mine, the following potential sources of noise emissions and threats were identified:

- mining mechanization, machines and technological equipment at the surface mine (drilling rigs and compressors, excavators, bulldozers, graders),
- machines and technological equipment for the preparation of copper ore (crushers, mills, flotation machines),
- transport machines (trucks, conveyors),
- auxiliary machines (bulldozers, loaders).

c) Water pollution

The registered threat sources were:

- water drainage systems from the mine area,
- impact on the hydrological regime of the exploitation area, lowering of the groundwater level,
- atmospheric waters that reach the contour of the mine and landfill,
- potential contamination of local rivers with process water from flotation and tailings,
- potential contamination of local groundwater in the tailings area,
- potential change in the hydraulic regime of local groundwater,
- influence on the hydrological regime of the area,
- atmospheric waters that wash away material from the slopes of the dams, creating torrents that pollute the surrounding area.

d) Land degradation

The identified sources of land endangerment are:

- surface mine - mining waste,
- ore deposit at the surface mine,
- flotation facilities - ore waste, concentrate waste, and
- flotation tailings pond - waste flotation sludge.

The purpose of the analysis of the situation and management of environmental protection based on risk analysis in the copper surface mine is to act productively and proactively in order to timely establish risk control mechanisms and take measures to realize opportunities and thus achieve the necessary balance between creating opportunities for profit and minimizing production loss.

From the context of global and local problems due to the increasing and faster technical-technological progress of society as a whole, the constant advancement of technology means that it is very difficult to determine the level of technological risk. That is why it is necessary to constantly develop and improve methods and principles as well as criteria for risk assessment and management.

Finally, the obtained results of this work were reflected in the identification of risks and the prevention of negative impacts of mining works and processes not only on the environment but

also on the context of the economic and financial effects that the mine can cause with its irresponsible operations, both on its the environment as well as the social community as a whole.

4. CONCLUSION

Technical-technological systems, which include surface copper mines, can threaten the safety of people, the economic stability of the organization and the environment in a wider sense. Therefore, the analysis of the risks to the environment in mines are becoming not only a subject of increasing interest, but also an increasingly subject of legislative regulation.

Environmental risks in mines must be assessed, quantified, in order to predict and prevent potential damages, both for the business entity itself and for the wider social community. The purpose of the activities carried out was to analyze the process of prevention of potential risks caused by mining activities and processes in mines, in order to prevent them.

It can be concluded that the process of prevention of potentially dangerous events that lead to technical-technological accidents with as many possible aspects as possible, from definition, strategy, goals, legal regulation, risk assessment methods, to their impact on financial effects and sustainable development, is important.

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