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Prof. Dr Snežana Šerbula

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PREFACE

The 31st international conference Ecological Truth & Environmental Research – EcoTER'24 focuses on showing the latest research findings and innovations in the field of ecology, environmental protection and sustainable development. The conference will be held in Sokobanja (Serbia) in hotel Sunce in the period of 18–21 June 2024.

The aim of the conference is to connect the experts in various fields in order to transform attitudes and behaviors in everyday practices, as well as in the industry and economy sector which is essential for achieving the desired changes that our society must undergo.

The 31st international conference Ecological Truth & Environmental Research – EcoTER'24 is organized by the University of Belgrade, Technical Faculty in Bor, and co-organized by the University of Banja Luka, Faculty of Technology; the University of Montenegro, Faculty of Metallurgy and Technology – Podgorica; the University of Zagreb, Faculty of Metallurgy – Sisak; the University of Pristina, Faculty of Technical Sciences – Kosovska Mitrovica and the Society of Young Researchers – Bor.

These Proceedings encompass 119 papers from the authors coming from the universities, research institutes and industries in 15 countries: Brazil, Norway, USA, Spain, Austria, Libya, Italy, Israel, Slovenia, Croatia, Romania, Bulgaria, Montenegro, Bosnia and Herzegovina, North Macedonia, and Serbia. It is a great honor and pleasure to cordially wish a warm welcome to all the participants of the conference.

As a part of this year's conference, the 6th Student Section – EcoTERS'24 will be held. We appreciate the contribution of the students and their mentors who have also participated in the conference and hope that students will continue to explore and to be curious, since education is a never-ending process, and knowledge is continuously growing.

The organization of the EcoTER'24 conference has been financially supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia.

The support of the Donors and their willingness and ability to cooperate has been of great importance for the success of the EcoTER'24 conference. The organizing committee would like to extend their appreciation and gratitude to the Platinum donors of the conference – Serbia ZiJin Copper doo Bor and HBIS SERBIA, to the Gold donor of the conference – Elixir Group, as well as to the Silver donor of the conference – Serbian Chamber of Engineers.

We would like to express our sincere appreciation to all the authors who have contributed to the Proceedings. We would also like to express our gratitude to the members of the scientific, organizing and honorary committees, reviewers, speakers, chairpersons and all the conference participants for their support of the EcoTER'24. Sincere thanks go to all the people who have contributed to the successful organization of the EcoTER'24.

Prof. Snežana Šerbula,

President of the scientific and organizing committee

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MINING AND THE ENVIRONMENT, ENVIRONMENTAL IMPACT MONITORING PROGRAM FOR FLOTATION TAILING RTH-BOR, SERBIA

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Abstract

Because mining, dumping, and tailings can generate waste and radioactive consequences, society must develop methods for successfully treating mining waste from mine dumps, tailings, and abandoned mines. Several characteristics, including background contamination from natural sources related to mineral deposits, contamination from industrial activities in three-dimensional subsurface space, a problem with long-term remediation following mine closure, a problem with secondary contaminated areas near mine sites, land use conflicts, and abandoned mines, distinguish it. The paper study on RTH Bor flotation tailings, which is acquiring waste from near by flotation Bor. Considering great potential of RTH Bor on environmental impact it is necessary to establish adequate monitoring program for monitoring the quality of air, water and surrounding land, in order to monitor the quality of the living environment.

Keywords: monitoring, flotation tailing, environmental.

INTRODUCTION

Mineral resources can serve as critical parts of socioeconomic development and innovative technological materials. Meanwhile, mining has been highlighted as an effective way to eradicate global poverty especially for the remote mountain areas [1]. However, with increasing demand for mineral deposits, the negative impact on the eco-environment is also quickly growing, such as deforestation, habitat and biodiversity loss, forest fragmentation, disruption of food chains, air and water pollution [2]. To quantify mining's impact on the eco-environment, a large number of studies have documented the evaluation of negative impacts during mining, such as the mine environment monitoring, which integrates remote sensing ecological index (RSEI) and ecological index (EI) to investigate mine land use, surface subsidence and vegetation [3–5]. In addition, mine ecological restoration, mainly including environmental pollution and geological disasters control, has also been intensely applied. More recently, the mine eco-environmental survey is also playing a significant role, utilizing multiple methods, including GIS and RS analytical tools, to comprehensively evaluate a series of mine soil, surface water, and underground water problems caused by mining processes [6]. Although these studies have provided important insights for mine eco-environmental evaluation, they commonly only emphasized the current ecological and environmental disturbance caused by mining.

The primary purpose of the monitoring plan is to define the criteria and details for the environmental monitoring plan and implementation in order to quantify the environmental impact of the facility and provide a basis for the decision-making process.

The monitoring plan and the results obtained from its implementation should lead to the achievement of the following specific goals:

- evaluations of compliance of the operator's emissions with the emission limit values defined by the respective laws and by-laws;
- assessments of the implementation of the best available techniques;
- provision of data confirming the implementation of the measures required by the permit;
- provision of data necessary for assessing the impact of the operator's activities on the environment;
- provision of preventive measures to prevent possible environmental pollution that may occur as a result of the operator's activities.

MINING AND THE ENVIRONMENT

Concerns were raised among the general public regarding the impact that the mining industry may have impact on the environment due to its operations (Figure 1) [7]. This is because people are becoming increasingly aware of the potential adverse effects that these operations may have [8]. The government and the mining sector have collaborated on a number of pieces of legislation aimed at reducing the negative impacts of mining on the surrounding environment before, during, and after mining operations to study environmental impact assessment (EIA) [9]. The effects of mining and its environmental impact is illustrated in Figure 2 where we explored the impact of excessive mining and their effects.

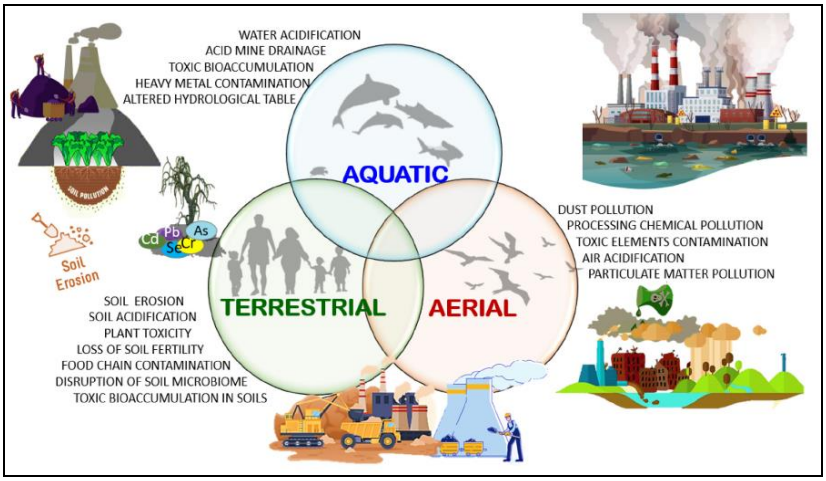


Figure 1 *Potential effects of mining and imbalance in different environments [10]*

Depending on a number of elements unique to each mine, the extent and character of the repercussions could range from negligible to severe [11]. Some of these include the nature of the ore body, the mining equipment and extraction methods employed, whether or not minerals are processed onsite, and how fragile the local ecosystem is [12]. The negative consequences of mining on the environment are widespread, yet they are often only felt in

small places [13]. In addition to the readily apparent physiological effects that extractive activities have, there is also the potential for air, land, and water contamination. Mining may not be the primary land use that disrupts biological systems [14]. This is because the effects on the environment are cumulative by their varying nature, and other activities or events that occurred in the past may have contributed to these consequences [15].

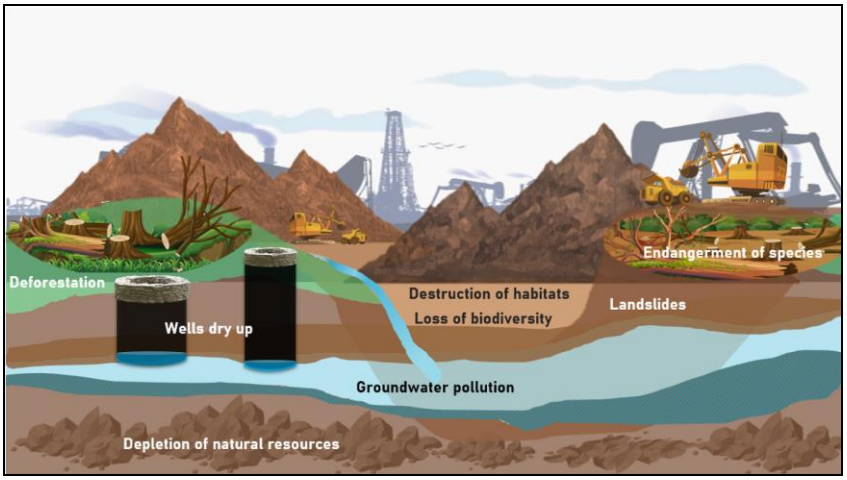


Figure 2 *Impact of excessive mining and their consequences in the environment [10]*

STUDY CASE – FLOTATION TAILING RTH BOR

The RTH (Mine body H (**R**udno **T**elo **H**)) flotation tailings pond (Figure 3) was formed southeast of the Bor flotation in the excavation area of the RTH open pit. After the excavation, space of the open pit RTH was filled, and due to the need to increase the volume of the storage area, the flotation disposal site was expanded to the northwest and southeast in the former valley of the Bor river. The river valley in the northwest towards the smelter slag disposal site and the abandoned open pit Bor was blocked by Dam 1 (Figure 3). Downstream, the valley of the Bor river is blocked by dam 2 (Figure 3). On the eastern side, the flotation tailings pit abuts the Eastern landfill of open pit Bor, and on the western side of the flotation tailings, a peripheral embankment has been erected.

Figure 3 *Spacial representation of the location of the flotation tailing RTH*

PARAMETERS ON THE BASIS OF WHICH HARMFUL EFFECTS ON THE ENVIRONMENT CAN BE DETERMINED

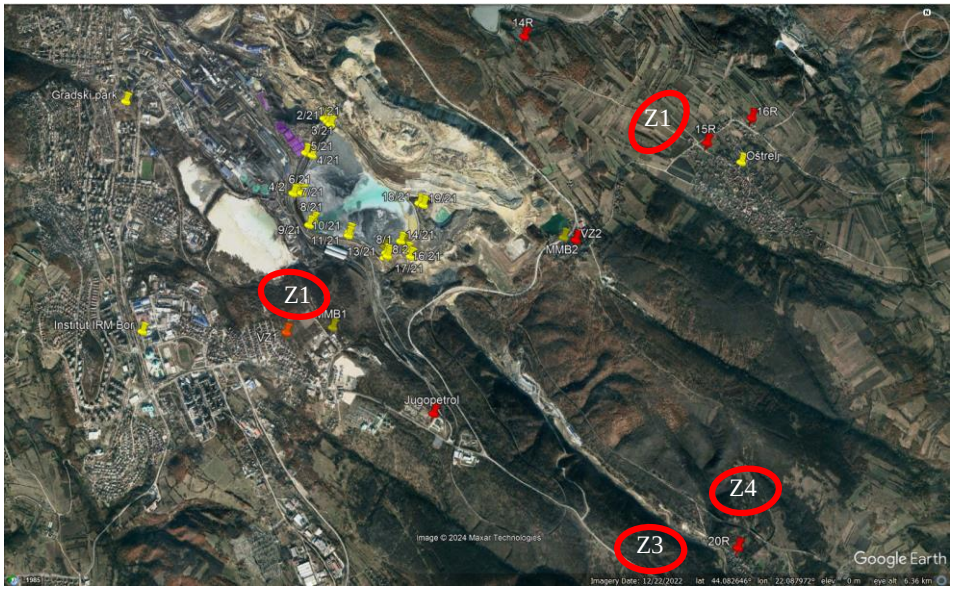
Study of this paper includes all activities at the RTH flotation tailings pond. Considering the characteristics of the facilities themselves, it can be stated that the active surfaces of the flotation tailings (beach, dams) are the largest emitters of polluting substances at the location in question.

Surface water, as the largest transport medium, should be monitored diligently, in terms of monitoring the water quality of nearby watercourses. Taking into account the location of the flotation tailings and its structural characteristics, it can be concluded that there is a possibility of influence on underground water. Monitoring soil quality will mean monitoring the distribution of heavy metals in the soil in accordance with the wind rose. The flotation tailings pond is a facility where there are no machines and devices that would have a significant impact on increasing the noise level. Apart from the mining machinery that periodically works at this location, there are no other sources of noise.

The measurement of noise emissions into the environment will be monitored, with an emphasis on the area where the concentration of the surrounding population is closest to the mining facilities. The parameters to be monitored on the mentioned entities are shown in Table 1. Disposition of measuring points are shown on Figure 4.

Table 1 *Monitoring parameters*

Location	Frequency of monitoring	Parameters
Waters: **Underground piezometer** • (3 referent)	2 times per year	• Water temperature, colour, smell, pH, electrical conductivity, sedimentary matter, suspended matter, HPK, BPK5, soluble oxygen, oxygen saturation; • Metals, metalloids and their compounds: Cr, As, Cd, Pb, Zn, Hg, Ni, Fe, Cu, Mn • Sulfates; Cyanides; Nitrates, nitrites; Mineral oils and hydrocarbons; Total fats and oils.
Air • Measuring points are placed near private houses in the south, east, southwest of the proposed location	• Sedimentation matter - monthly • Suspended particles - daily samples, twice a year (summer and winter period, 30 days each);	• Total sediments: amount of sediments, • Suspended particles: PM10, PM2.5 • content of heavy metals (Cr, As, Cd, Pb, Zn, Hg, Ni, Fe, Cu, Mn)
Noise: Measuring points in the vicinity of the nearest private buildings (northeast and east)	1 per year	• Equivalent intensity level, daily measurements • Equivalent level-intensity, night measurements
Soil: • The measuring points are located on the surrounding areas to the southeast, northeast and eastt of the subject location	1 per year	• Humus content • Soil pH • calcium carbonate, nitrogen, electrical conductivity; phosphorus; • Metals: As, Cd, Pb, Zn, Hg, Ni, Fe, Cu • Sulfates; Fluorides; Chlorides; Nitrites, nitrates, Cyanides. Aromatic organic compounds.



Legend:

**/* – for underground waters,*

MB - for noise level,

**R – for PM (Particulate matter),*

VZ- for sedimentation matter,*

Z – for soil.*

Figure 4 *Disposition of measuring points*

CONCLUSION

Mining activity has increased significantly due to significant population growth and worldwide demand for mineral resources [16]. This increase coincides with a new awareness in which environmental issues have become an increasing challenge for all actors in the sector [17,18]. There is an increased social demand for sustainable development of all activities related to mining, especially adequate management of waste products during each phase of the mining process, including prospecting and research, development, extraction, transportation and treatment of the obtained products, *etc*. [19]. Energy requirements, environmental and human health risks, water resource requirements and required technology must be taken into account [20].

Taking these arguments into account, the monitoring system gains great importance. The monitoring system collects and interprets the information necessary to determine whether the environmental protection management plan and related systems have been effectively implemented, and whether the environmental goals set by the company, the authorities and the community have been properly met.

The monitoring system should consist of: identification of pollution sources and parameters, selection of environmental parameters for which measurements are made, determination of critical areas and data collection, analysis and assessment. The goal of the environmental monitoring system is to analyze the sources of pollution while considering the effectiveness of the applied environmental protection measures.

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