

Monitoring of water quality in the process of closure and greening of the Uricani Mine Branch

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Abstract. The closure and greening of a mining branch represents an important stage in the life cycle of a mining operation, being by far the most difficult aspect facing the mining industry. Regarding the quality of environmental factors, that sometimes irreparable pollution and degradation of these as a result of mining activities are solid arguments for applying correct standards and policies for ecological restoration. In the process of closure and greening it is compulsory to monitor the environmental factors throughout the entire period of all activities. An important environmental factor is water. In the process of closure and greening, the quality of the domestic and mine waters must be monitored. In this paper we will present the results obtained from the monitoring of the waters from the closure and greening process of the Uricani Mine Branch. It was found that the maximum permissible values according to the authorization are not exceeded for any of the physico-chemical parameters analyzed. The wastewater from the mine without prior purification cannot be discharged into the environment, for them monitoring is required after the branch is closed.

Key Words: water, quality, monitoring, pollution, environment.

Introduction. Industry throughout the world, in its long existence has had and has negative effects on environmental factors. Today, the problem of rehabilitation of areas affected by industry is raised. In the process of rehabilitation of the areas affected by the industry, a compulsory stage of any project is the monitoring of environmental factors (Parisa et al 2014).

An important environmental factor that requires careful monitoring is water. Water is an indispensable factor in life and it also plays an important role in ecological balances, and its pollution is a current problem with serious consequences for the population (Cîrțînă 2011).

Water pollution represents the alteration of their physical, chemical and biological qualities, being produced directly or indirectly, naturally or anthropically, the polluted water becoming unfit for normal use (Șchiopu 2011; Parisa et al 2014). Water pollution must be viewed not only as a potential risk to humans and terrestrial biomes, but also as a disruption to aquatic ecological systems. In the present study we evaluated the environmental effects of the closure and greening of Uricani Mine.

Theoretical considerations. Uricani Mine branch is one of the mining units in Jiului Valley that is being closed and ecologized. Currently, the phase of closure and greening of the surface area of the Uricani Mine Branch has been reached.

The purpose of the closure and greening of the Uricani mining branch for the surface area is:

- ✓ the development of local infrastructure and the growth of free areas for the economic development of the area;
- ✓ the development of alternative activities and the creation of new jobs for the dismissed personnel in the mining sector and for the population in the area, which will lead to an increase in the employment rate and a decrease in the unemployment rate;
- ✓ green lands are a possible source of attracting investors in mining areas heavily affected by mine closures;
- ✓ increasing the revenues for the personnel involved in the execution of the mine closure works;
- ✓ improving the social and work environment;
- ✓ the impact on the positive environment through:
 - the execution of the closure and ecological works in compliance with the environmental norms and the mine closure manual,

- time tracking of the phenomena of fixing the surfaces on which closing works were performed, monitoring the physical state of the closing works (guard channels, parapets, gabions), tracking the behavior in time from the point of view of stability and physical dynamics -Chemicals, tailings dumps;

The closure and greening works for the Uricani mining branch include:

- ✓ works to rehabilitate the former mining unit;
- ✓ surface recultivation works;
- ✓ monitoring during the execution of the works.

During the execution of the closure and greening of the Uricani mining branch, it is necessary to monitor the environmental, air, water, soil and vegetation factors, the stability of the tailings, noise and vibrations, weather conditions in the main enclosures.

An important environmental factor that requires a special importance is water. During the entire closure and greening of the mining unit, it is necessary to monitor the quality of the water.

Monitoring of water quality. During the execution of the closure and greening works, the waste water is evacuated as follows:

- ✓ the domestic waste water is discharged into the West Jiu river, after treatment in the mechanical-biological treatment plant with the capacity of $Q_{day\ max} = 140\ m^3/day$;
- ✓ mine and technological waste water is discharged into the West Jiu river, after a prior mechanical purification by decanting into settlers with $V = 300\ m^3$ each and in a treatment plant with the capacity designed by $Q_{day} = 2400\ m^3/day$ ($263\ m^3/h$).

The categories of waters in the Uricani mining perimeter whose quality will be monitored are:

- ✓ wastewater from the mine - upon disposal after treatment;
- ✓ sewage wastewater from the mechanical - biological treatment plant.

The water quality monitoring system will include the following sections:

- ✓ sampling of water;
- ✓ determination of the physico-chemical indicators from the sampled waters.

The water quality was monitored by the quarterly sampling. The samples were analyzed in an accredited laboratory. The analyzed parameters are pH / T measurement, CCO-Cr, total suspension materials, dry residue filtered at $105^\circ C$, calcium, magnesium, total dissolved iron, sulphates, phenols, chlorides, lead and nickel for mine waters and pH / T measurement, CCO-Cr, total phosphorus, chlorides, total suspended materials CBO_5 , extractable substances with organic solvents, detergents, ammonium, nitrates and sulphates for domestic water.

The sampling and analysis of the samples was carried out in December 2018, April and August, 2019.

Table 1 presents the averages of the results obtained from the physical and chemical analyzes for the three periods of sampling of wastewater from the mine - upon disposal after treatment.

Table 2 presents the averages of the results obtained from the physical and chemical analyzes for the three periods of domestic wastewater collection from the mechanical - biological treatment plant.

After analyzing the water samples, it was found that the maximum permissible values are not exceeded according to the authorization held by the Uricani Mine Branch.

Table 1

The averages of the results obtained from the physical and chemical analyzes for the three periods of sampling of wastewater from the mine - upon disposal after treatment

No.	Determined parameter	MU	Determined value	Values admitted according to authorization
1	pH/T measurement	u.pH/°C	8.2 / 23	6.5-8.5
2	CCO-Cr	mg/l O	< 30	100
3	Total suspension materials	mg/l	19	60
4	Residue filtered dry to 105°C	mg/l	897	2000
5	Calcium	mg/l	37.3	100
6	Magnesium	mg/l	16.2	30
7	Total dissolved iron	mg/l	0.25	1
8	Sulfites	mg/l	128.18	300
9	Phenols	mg/l	0.25	-
10	Chloride	mg/l	48.9	100
11	Lead	mg/l	< 0.04	0.5
12	Nickel	mg/l	0.2	0.2

Table 2

The averages of the results obtained from the physical and chemical analyzes for the three periods of domestic wastewater collection from the mechanical - biological treatment plant

No.	Determined parameter	MU	Determined value	Values admitted according to authorization
1	pH/T measurement	u.pH/°C	7.3 / 23	6.5-8.5
2	CCO-Cr	mg/l O	< 30	100
3	Fosfor total	mg/l	0.15	1
4	chloride	mg/l	5.8	100
5	Total suspended matter	mg/l	< 10	35
6	CBO ₅	mg/l O	7.7	25
7	Extractable substances with organic solvents	mg/l	12	20
8	detergents	mg/l	< 0.05	0.5
9	Ammonium	mg/l	0.15	2
10	nitrates	mg/l	4,9	15
11	Sulfites	mg/l	17.3	100

Conclusions. Within the projects of closure and greening of the mining units it is necessary to monitor the water sources throughout the projects.

The polluting water sources within the mining units are represented by mine and domestic waters.

Following the monitoring of wastewater from the mine - upon disposal after purification and of wastewater from the mechanical-biological treatment plant; it was found that the maximum permissible values according to the authorization are not exceeded for any of the physico-chemical parameters analyzed.

The wastewater from the mine without prior purification cannot be discharged into the environment, for them monitoring is required after the branch is closed.

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