

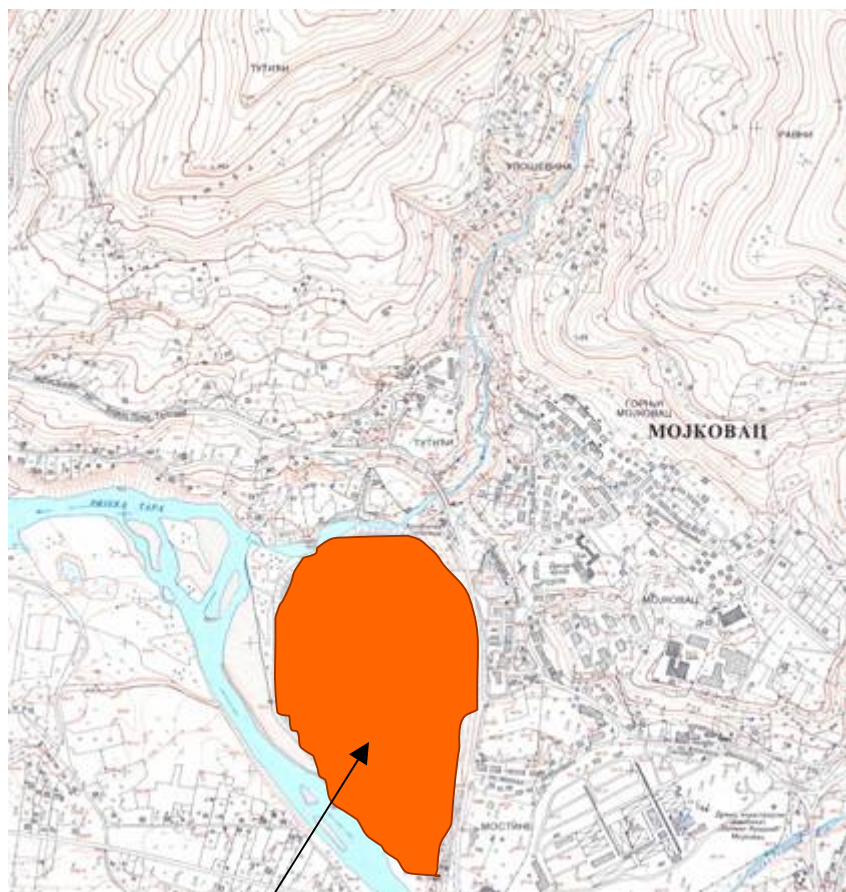
Strengthening capacities in the Western Balkans countries to address environmental problems through remediation of high priority hot spots: Montenegro country component- Mojkovac Lead and Zinc Tailing Mine Impound

PROJECT DESCRIPTION

I. General information

City/Municipality: Mojkovac/Mojkovac

Intervention Location (Hot Spot): Lead and Zinc Tailing Mine Impoundment (TMI) in Mojkovac



Position of the Tailing Mine Impoundments in Mojkovac

Ownership: Land occupied by TMI and TMI facility are state owned.

Proposing National Authority: Government of Montenegro, Ministry of Tourism and Environment

II. Problem description

Previous activities at the location

Lead and Zinc Mine "Brskovo" was operating in the period 1976 – 1991. Its Tailing Mine Impoundment (hereinafter TMI) has been formed in the area between right river bank of Tara and western side of urban zones of Mojkovac. TMI occupies an area of 19 ha and approximately 2 million m³ of disposed tailing impounded materials.

Technical characteristics of the hot spot

TMI has been designed and constructed through three stages: the first one up to the peak elevation of 801 ASL¹, the second up to 805 ASL, and the third and final stage, up to 807, 5 ASL. TMI construction followed a principle of a complete isolation from the water current, i.e. Tara River.

Along with the TMI brim towards River Tara and Juskovica Stream, an embankment dam was built by the gravel from the riverbed. The dam is 1130 m long, with an average height of 12, 5 m. A concrete covering was placed on the outer slope of the dam towards River Tara, to retain high waters of the river. The dam slope and bottom of the TMI, except for the slope part towards the main road, is covered with the PVC 0,8 mm thick liners, in order to prevent migration of impounded masses into the underground and Tara River. The slope towards the main road is covered with plastic liners up to level of 801 asl.

The facilities² for holding and returning clear waters from the tailings impoundment to the plant for treatment of used waters and repeated engaging in the technological process of flotation, with no discharge into water currents, are constructed. Among other facilities, in the area³ of the TMI are constructed sewer facilities for both, communal⁴ and storm waters. The main sewer discharge tube⁵ was placed in the area of the TMI, upon pooling, on the dam's slope, below the petrol station. While constructing TMI, works were not undertaken on collection and drainage of surface storm waters from the main road lane and neighbouring watershed.

From the beginning to the end of the technological processes in the mine, all of flotation tailings have been impounded into this area. According to data on total production in "Brskovo" mine,

¹ Above sea level

² Main manhole, main sewer along the bottom of the TMI to the pump station and the pump station

³ At the slope next the main road

⁴ For the "upper" and "down" part of the town of Mojkovac

⁵ Discharge to the Juskovica brook

approximately 2.600.000 t of tailings is produced. Available capacity of stage 3 (around 450.000m³) is estimated to be 75% occupied by the flotation tailings. Pursuant data on chemical elements contents in the flotation products, the impounded flotation tailings includes following components: Lead = 0, 20%; Zinc = 0, 30-0, 40 %; Copper = 0, 10%; Iron = 4-5% and Sulphur = 10-12%. Along with the aforesaid, the elements that are also present are Cadmium, Antimony, Mercury, Arsenic, Gold, Silver, Germanium, Molybdenum etc. In addition, when regarding flotation reagents, there is Cyanide, Copper sulphate, Xanthalates, and Zinc sulphate.

Environmental aspect

Main environmental impacts of the hot spot are as follows:

- Leaching of muddy and liquid component of the impounded material through the bottom and lateral sides of TMI and their migration to Tara River that is under national⁶ and international⁷ protection.
- Non-treated sewage waters from Mojkovac are discharging and remain into the TMI. Also, there is direct or indirect runoff into Tara River.
- Precipitations, i.e. storm waters from the road (Kolasin-Mojkovac-Bijelo Polje) and neighbouring urban zones of Mojkovac are draining into the TMI, and consequently participate in the runoffs into Tara River.
- Airborne pollution by flying ash from the dry upper parts of TMI. This is a threat to human health of local population living in the vicinity of TMI.
- Disposing of the communal solid waste at the TMI
- Eventual breakdown of dam stability could cause overflow off the toxic material from TMI to Tara River
- Biodiversity (macrophyte vegetation, fish, birds) living in the water part of the TMI are posed to the permanent process bioaccumulation of toxic substances from the water / mud at the TMI

Technical aspect

As mentioned before, in the area of TMI are constructed certain facilities of municipal sewerage system, so technical resolving of the problems caused by these facilities has to be considered as priority activity for this hot spot.

In general, this include construction of a Waste Water Treatment Plant (hereinafter WWTP) and (re) construction of the sewer systems for communal and storm waters.

Activities that are recently carried out by the Government are in relation to this priority.

Implemented activities:

a) In the past

Upon cessation of the flotation tailings impounding, the following activities have been performed:

- Reclamation of dam towards Tara River, for 150 m of its length. The dam was damaged during great floods in 1992. The filling was done with crushed rocks and gravel, and the works were performed at the end of 1992 and at the beginning of 1993. Protection of the reclaimed dam is provided, in a segment, by placing gabions along the dam base.
- Regulation of Tara River bed, direction opposite the TMI. The works were performed in 1993.

⁶ National Park Durmitor with Tara River Canyon, since 1952

⁷ Durmitor with Tara River Canyon is an UNESCO World Heritage site, since 1980, as well as UNESCO M&B World Biosphere Reserve since 1977

- Partial covering of the TMI area by gravel taken from riverbed of Tara and Rudnica rivers, in order to prevent the tailings to be blown by wind in a dry spell. The works were performed in 1993.
- Dislocation of main sewer and a part of the precipitation collector in Mojkovac, partly leading through the area of TMI. The works were performed pursuant to the Dislocation Project in 1995, and have been seriously damaged in the meantime.
- A possibility of biological re-cultivation was tested in the TMI, when the examinations of the tailings and vegetation experiments were conducted in half-controlled conditions in a green house. This examination gave positive results. In 1995, a field vegetation experiment was conducted at the very TMI in the vegetation period, as to realize possibility of a biological re-cultivation and change of the latter into a green area. The aforesaid experiment involved various treatments and a mixed grass sowing. These results are outlined in the Institute for Technology of Nuclear and Other Mineral Raw Materials, Belgrade.
- Study on the Mojkovac Environment Quality and Study on the Protection of the Environment, as a part of a General Urban Plan of Mojkovac.
- Disassembling and removing of pulp pipeline for the tailings transport from the flotation to the TMI and off the dam top and pipelines for supply and distribution of Tara River water, for the TMI drenching, (the works were performed in 1994).
- Disassembling and removal of a pump from the main manhole for protruding waters is done.
- Project *Remediation and recultivation of the Mojkovac lead and zinc tailings mine impoundment* has been prepared and verified in 2004.

b) Recent activities:

Since mid of 2005, following activities were implemented:

- For collecting storm waters, 350 meters of the sewer with its inflow and outflow has been constructed
- Cleaning up of the vertical collecting manhole (shaft) and existing sewer discharging tube placed in the TMI
- Opening of a slot for the placing discharging tube in order to drain surface waters at the TMI to Tara river
- Technical design project for WWTP for Mojkovac that should be placed at northern side of TMI dam, next to the mouth of Juskovica brook
- Additional research / investigations and
- (re)construction of main sewer for wasted waters from Mojkovac that is an on-going activity

Activities given above were funded by the Government of Montenegro with 930.000,00 \$, as well as by donations of the Government of Czech Republic worth 500.000, 00\$

Importance of the TMI Mojkovac hot spot has been emphasised by UNEP report *South Eastern European mining-related risks: Identification and verification of "environmental hot spots"* (see pages 44 and 46 in draft Report)

III. Proposed interventions and expected results

In order to provide significant progress in cleaning-up activities at the hot spot location, as well as in achieving sustainable development in the region, this project is aimed to provide support in the implementation of the *Phase I of the project Remediation and recultivation of the Mojkovac lead and zinc tailings mine impoundment*. In relation to this, priority should be given to the activities that still wait on the implementation.

Proposed activities of Phase I of the Project are presented in following table

No	Activity	Remark
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1.	Additional research works in order to provide more precise data on mud volume and its suitability for stabilization.	Implemented
2.	Commissioning of the existing control manhole and drainpipe, construction of a new section of a drain canal to Tara River	Implemented
3.	Facilities for tailings impoundment protection from external storm waters (storm waters collector and other facilities)	On - going
4.	Removal of surface water from Tailings Impoundment	Not implemented
5.	Reconstruction and completing of the sewerage system for wastewater in the area of Tailings Impoundment	Not implemented
6.	Construction of waste waters treatment plant of Mojkovac	Not implemented
TOTAL Phase I		

Construction of the waste waters treatment plant (WWTP) should be considered as top priority.

Preparedness of technical documentation

In order to secure implementation of the cleaning-up activities, this project will use already prepared and verified Technical Design Project named *Remediation and recultivation of the Mojkovac lead and zinc tailings mine impoundment*. This project was prepared by faculty of Civil Engineering Podgorica and associated institutions⁸ in 2004. Its implementation is planned through 3 phases, with total budget of 10.000.000, 00\$.

Also, for the implementation of proposed priority activity (construction of WWTP for Mojkovac), Technical Design Project is already prepared⁹. According to the project, WWTP of 5.200 ES has to be placed at northern side of TMI dam, next to the mouth of Juskovica brook. In the construction works are included construction of an access road and regulation of Juskovica brook, so total budget for all these activities is 2mil \$.

Plan for the implementation of proposed interventions

Project activities, particularly construction works will be in the course of already prepared project documentation given above (technical design projects).

Expected results

Implementation of proposed activities will be in compliance with the Intervention Strategy of UNDP Capacity Development Programme *Strengthening capacities in the Western Balkans countries to address environmental hot spots through an integrated approach*. In particular, by reducing / eliminating pollution of Tara river, this project will significantly reduce local and cross border pollution in downstream countries (BIH, Serbia...).

⁸ Institute of Mining, Geology and Ecology, Podgorica, Center for Eco-toxicological Analysis, Republic Institute for Hydrometeorology, Republic Institute for Geological Researches and Geos d.o.o.

⁹ Prepared by Czech company » Vodni Zdroje«, Praha

IV. Intervention time frame

Time frame:

Proposed interventions in the Phase I

Activity	Time (months)						
	1	2	3	4	5	6	7
Surface water removal from the TMI	90 days						
Rebuilding of waste water sewerage	120 days						
Waste Water Treatment Plant	210 days						
Additional works							

Phase I and II of whole project (from TDP)

Activity	TIME																																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37			
Reconstruction of the storm water sewerage	150days																																							
Collection manhole reconstruction		90 days																																						
Surface water removal from the TMI										90 days																														
Rebuilding of waste water sewerage											120 days																													
Waste Water Treatment Plant												210 days																												
Stabilization of the mood																																								
TMI back-filling																																								45
Building of the final solidification layer																																								30

Strengthening capacities in the Western Balkan countries to address environmental problems through remediation of high priority hot spots

Risks Log

Waste Water Treatment Plant (WWTP) located at the Tailing Mine Impoundment (TMI) in Mojkovac

(Component 3 in the Phase I of the Project REHABILITATION AND RECULTIVATION OF THE TAILING MINE IMPOUDMENT (TMI) IN MOJKOVAC

#	Description	Category	Impact & Probability	Countermeasures / Mngt response	Owner	Author	Date Identified	Last Update	Status
1	Lack of financial means to complete all project activities that are mutually linked (Insufficient Donor or Government funds)	Financial	Implementation of project activities could be stopped or reduced P = 4	Provide additional funds / Fund rising	UNDP / Ministry responsible for Environmental Protection	UNDP	Identification phase – November 2006	October 1st 2007	No change
2	Project abused or neglected because of new Government priorities for investment in environmental infrastructure	Political Strategic Environmental	Project could be stopped. Consequently, threats of the tailing mine impoundment (TMI) to the environment will remain. Tara river (UNESCO WH and BR) will be under great threats. P = 2	Promote the project and keep its status as Government priority. Both, Government and Municipality Mojkovac, have to take care on the importance of the project in their plans, programmes, policies and strategies	Ministry responsible for Environmental Protection / Municipality Mojkovac / UNDP	UNDP	Identification phase – November 2006	October 1st 2007	Dead / No change
3	Poor technical quality of the construction works	Operational Environmental	Project activities linked to this activity could be stopped or reduced because of necessary revisions	Technical supervision of the construction works should be performed. Additional	Contractor / Directorate for Public Works / Ministry responsible for	UNDP	Identification phase – November 2006	October 1st 2007	Dead

Capacity Development Programme

Strengthening capacities in the Western Balkan countries to address environmental problems through remediation of high priority hot spots

			P = 3	construction works for improvements should be designed and revised by new contractor	Environmenta l Protection				
4	Leakage of sewage waters during construction phase (works on connecting WWTP on the sewage system)	Environmenta l Operational	Most critical could be impact to the environment, i.e. pollution from the leakages will easy come to Tara river that is UNESCO World Heritage and Biosphere Reserve P = 3	Technical supervision of the construction works should be performed. Contractor should provide necessary technical measures for preventing possible leakages	Contractor / Directorate for Public Works / Ministry responsible for Environmenta l Protection – Environmenta l Inspectorate	UNDP	Identificatio n phase – November 2006	October1 st 2007	Dead
5	Technical malfunction of other components of the system for collection and disposal sewage waters	Operational Environmenta l	Similar to previous, critical impacts will be to the environment. However, sanitary situation in the town will be aggravated by such an situation P = 2	Technical supervision of the construction works should be performed for all components of the project. Contractors should provide all works timely and of appropriate quality. Public Utility Company should provide existing system ready for connection to the WWTP	Contractors / Public Utility Company Mojkovac / Directorate for Public Works / Environmenta l Inspectorate	UNDP	Identificatio n phase – November 2006	October1 st 2007	Dead / No change

1 – Low/Unlikely Risk

5 – High/Likely Seriously Risk

