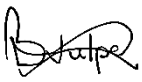
Project title:	**ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area**		
eMS:	RoRS 337		
Partners:	WUT		
Author(s):	**VULPE Constantina Bianca**	**Junior Researcher (Chemistry)**	
Title of the document:	DETERMINATION OF HEAVY METAL CONCENTRATIONS IN SAMPLES POTENTIALLY CONTAMINATING FROM THE MOLDOVA NOUA AREA – 15 June 2023		
Document description:	The present document contains heavy metal concentrations determined at the Institute of Metallurgy, Bor, Serbia. Samples of surface water, groundwater, sediment, and soil were taken from Moldova Noua area, Caras-Severin, Romania, and were sent for determination of heavy metal concentrations in them by an analytical method using an ICP-OES (Inductively coupled plasma - optical emission spectrometry). The interpretation was made according to Order of Ministry of Environment and Water Management 161/2006, for surface waters samples and Law No. 458/2002 regarding the quality of drinking water in Romania republished in 2011 for groundwater, soil, and sediments samples.		
Scope / Objective of document:	The objective of this report is to continue to monitor the environmental quality in the Moldova Noua mining area as a sustainability of the project we implemented during 2019–2021.		
Name of the documents to which it is related (if any):	-		
Name of the electronic file:			
Work-package:	WPT		
Activity:			
Type:	Deliverable		
Location of the printed document:			
Version:			

HEAVY METAL CONCENTRATIONS IN SAMPLES POTENTIALLY CONTAMINATING FROM THE MOLDOVA NOUA AREA
15 JUNE 2023

The WUT team continued to collect samples during the campaign which took place on June 15, 2023. The same samples were collected from the Moldova Nouă area, and for the determination of metals, the samples (surface water, groundwater, sediment, and soil) that were collected were sent to the Institute of Mining and Metallurgy in Bor, Serbia.

Table 1 and Table 2 show the results obtained and their interpretation for surface water samples and groundwater samples, respectively. The interpretations for sediments and soil are made in Table 3 and Table 4. The interpretation of the results is in accordance with Order of the Ministry of Environment and Water Management 161/2006, for the approval of the normative on the Classification of Surface Water Quality to establish the ecological status of the water bodies and with according to Law No. 458/2002 regarding the quality of drinking water in Romania republished in 2011.

The results for the surface water samples show that in this campaign, due to the heavy rains, the concentration of heavy metals was slightly influenced. So, the W22 sample can be classified as class I for most of the analyzed heavy metals, except for chromium and cadmium which belong to class III. The most affected sample is sample W19, which has increased values for the iron ion, belonging to class IV, but also for arsenic, copper, manganese, and selenium ions, which belong to class III. Also, samples W18, W20 and W23 were affected during the summer period when the samples were collected.

Table 1 Interpretation of chemical results for every metal/nonmetal identified in surface water samples (Moldova Noua) according to Order of Ministry of Environment and Water Management 161/2006, for the approval of the Normative on the Classification of Surface Water Quality to establish the ecological status of the water bodies.

Metals	Classes*					Samples µg/l					
	I	II	III	IV	V	W18	W19	W20	W21	W22	W23
As, µg/l	10	20	50	100	>100	3.8	6.7	2.7	2.2	<2.1	2.4
Cd, µg/l	0,5	1	2	5	>5	1.4	1.9	1.5	1.6	1.4	1.4
Cr, µg/l	25	50	100	250	>250	2.7	4.9	4.3	1.7	<1.7	3.8
Cu, µg/l	20	30	50	100	>100	21.1	45.0	5.3	<3.3	4.0	4.2
Fe, tot., µg/l	300	500	1000	2000	>2000	831.1	1729.8	1196.6	306.9	285.5	1047.8
Mn, µg/l	50	100	300	1000	>1000	104.1	202.2	124.6	59.6	33.5	142.8
Ni, µg/l	10	25	50	100	>100	<3.6	4.2	<3.6	<3.6	<3.6	<3.6
Pb, µg/l	5	10	25	50	>50	5.4	9.9	4.2	3.3	2.7	3.7
Zn, µg/l	100	200	500	1000	>1000	23.7	50.5	12.3	7.3	14.1	46.4
Se, µg/l	1	2	5	10	>10	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5

Cooperation beyond borders.
Interreg-IPA Cross-border Cooperation Romania-Serbia Programme is financed by the European Union under the Instrument for Pre-accession Assistance (IPA II) and co-financed by the partner states in the Programme.
Project RoRS 337- ROmania Serbia NETwork for assessing and disseminating the impact of copper mining activities on water quality in the cross-border area (RoS-NET2)

*Values according to maximum acceptable concentrations

The results for groundwater samples (WU11-WU14) are in the normal range for all metal concentrations. The presence of green in the rectangles expressed the good quality of the groundwater collected from wells in the Moldova Noua area (Table 2).

Table 2 Interpretation of chemical results for every metal/nonmetal identified in groundwater samples (Moldova Noua) according to Law No. 458/2002 regarding the quality of drinking water in Romania republished in 2011. The rectangles with a red colour are the samples that exceed the MAC, and the rectangles with a green colour are the samples that are under the MAC.

Metals	MAC µg/L	WU11 µg/l	WU12 µg/l	WU13 µg/l	WU14 µg/l
As, µg/l	10	<2.1	6.7	<2.1	<2.1
Cd, µg/l	5	1.3	1.5	1.4	1.4
Cr, µg/l	50	<1.7	<1.7	2.0	<1.7
Cu, µg/l	100	<3.3	<3.3	<3.3	<3.3
Fe, tot., µg/l	200	49.1	136.4	116.6	19.1
Mn, µg/l	50	6.1	7.6	6.5	6.2
Ni, µg/l	20	<3.6	<3.6	<3.6	<3.6
Pb, µg/l	10	3.3	2.8	2.9	2.4
Se, µg/l	10	<4.5	<4.5	<4.5	<4.5
Zn, µg/l	5000	<6.2	<6.2	<6.2	<6.2

*Maximum acceptable concentrations

The values for the sediment samples (S83–S85) are in the normal range for samples S83 and S84. Sample S82 had MAC values exceeded for As, Cu, Pb, and Zn according to Law No. 458/2002 regarding the quality of drinking water in Romania, republished in 2011 (Table 3).

Table 3 Interpretation of chemical results for every metal/nonmetal identified in sediment samples (Moldova Noua) according to Law No. 458/2002 regarding the quality of drinking water in Romania republished in 2011. The rectangles with a red colour are the samples that exceed the MAC, and the rectangles with a green colour are the samples that are under the MAC.

Metals	MAC* mg/kg	S82 mg/kg	S83 mg/kg	S84 mg/kg
As, mg/kg	17	47.5	5.1	16.3
Cd, mg/kg	3.5	2.5	<0.71	<0.71
Cr, mg/kg	90	12.3	7.6	36.5
Cu, mg/kg	200	1113.5	16.1	46.2
Hg, mg/kg	0.5	<0.10	<0.10	<0.10
Pb, mg/kg	90	115.7	6.3	21.5
Zn, mg/kg	300	323.6	14.6	74.4

*Maximum acceptable concentrations

For soil samples (Table 4), almost all the values are above the normal range; only chromium and mercury have normal values for the entire samples (S85-S88). Copper ions had the highest values for all the soil samples analyzed. During this campaign, arsenic ions recorded higher values for all soil samples than in another campaign.

Table 4 Interpretation of chemical results for every metal/nonmetal identified in soil samples (Moldova Noua) according to Law No. 458/2002 regarding the quality of drinking water in Romania republished in 2011. The rectangles with a red colour are the samples that exceed the MAC, and the rectangles with a green colour are the samples that are under the MAC.

Metals	MAC* mg/kg	S85 mg/kg	S86 mg/kg	S87 mg/kg	S88 mg/kg
As, mg/kg	5	51.2	47.1	24.1	23.7
Cd, mg/kg	1	5.8	3.6	1.0	2.2
Cr tot., mg/kg	30	9.4	22.5	11.7	8.7
Cu, mg/kg	20	994.5	1099.6	202.7	405.5
Hg, mg/kg	0.1	<0.10	<0.10	<0.10	<0.10
Mo, mg/kg	2	23.6	6.9	1.3	4.1

*Maximum acceptable concentrations