

CONTENT IN HEAVY METALS OF THE COLLECTED SAMPLES FROM MOLDOVA NOUA AREA – May 19, 2022

The first sample collection campaign for the sustainability of the RORS 337 project took place on May 19, 2022 in the Moldova Nouă area. The same samples were collected by the research team and, for the determination of metals, the samples collected from the Moldova Nouă area were sent to the Institute of Mining and Metallurgy in Bor, Serbia.

The results obtained are mentioned in table 1, and the interpretation of the results is made in tables 6 and 7, for surface water samples, respectively, for groundwater samples. The interpretations for sediments and soil are in tables 8 and 9.

The interpretation of the results is in accordance with table 2, in which are the maximum acceptable concentrations (MAC) of heavy metals in surface water samples (according to 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 table 3, which are the maximum acceptable concentrations (MAC) of heavy metals in groundwater samples (according to Law No. 458/2002 regarding the quality of drinking water in Romania republished in 2011).

It can be observed that most results are from class 1 (green color) for surface water (see table 6). The values for iron in sample W23 belong to class 2 (yellow color), and for selenium, all the samples belong to class 2, and for cadmium, all the samples belong to class 2, exceptions are for samples W22, which belong to class 1.

In table 7, all the results are in the normal range for groundwater samples. The green colors expressed this.

Table 8 shows us that most values for sediment samples are in the normal range, exceptions are for copper, zinc, arsenic, and lead ions, from samples S82, which exceed the values in the normal range.

For soil samples, almost all the values are over the normal range, only chromium and mercury have normal values for entire samples.

Table 1 ICP-MS/ ICP-OES analysis of the samples (water, sediments, soil) collected in 19.05.2022– The analysis was performed in Serbia at Institute of Mine and Metallurgy from Bor.

Water Sample ID	Concentration of metals found in collected samples												Other observations
	Cr µg/L	Mn µg/L	Fe µg/L	Ni µg/L	Cu µg/L	Zn µg/L	As µg/L	Se µg/L	Cd µg/L	Pb µg/L	Mo µg/L	S mg/L	Metals from water samples
W18	<1.7	160.4	711.5	<3.6	5.0	26.7	6.7	<4.5	<0.14	3.7	28.1	140,6	
W19	<1.7	24.5	68.5	<3.6	<3.3	12.4	<2.1	<4.5	<0.14	<2.1	9.6	35,5	
W20	<1.7	120.8	1704.9	<3.6	<3.3	12.0	3.2	<4.5	<0.14	2.2	<2.3	8,9	
W21	<1.7	178.7	3237.3	<3.6	4.4	15.0	3.5	<4.5	<0.14	3.6	<2.3	8,7	
W22	3.5	162.0	4523.1	4.5	<3.3	17.4	3.3	<4.5	<0.14	3.4	<2.3	8,8	
W23	2.9	151.3	4242.8	4.5	<3.3	14.9	3.2	<4.5	<0.14	3.1	<2.3	8,1	
WU11	<1.7	4,7	52,3	<3.6	<3.3	<6.2	<2.1	<4.5	1,3	3,4	2,3	21,9	
WU12	5,2	4,4	27,5	<3.6	<3.3	68,7	<2.1	<4.5	1,3	2,5	<2.3	23,8	
WU13	<1.7	4,1	32,5	<3.6	<3.3	<6.2	4,4	<4.5	1,2	2,4	<2.3	22,6	
WU14	<1.7	4,0	88,9	<3.6	<3.3	17,1	<2.1	<4.5	1,1	2,2	<2.3	102,3	



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	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-MS	ICP-AES	Method
	303,1	634,0	2262,4	1211,3	522,1	1453,2	127,5	674,9	431,1	1090,0	578,6		QWPTM-15
	302,0	636,0	2250,0	1210,0	526,0	1460,0	151,0	678,0	430,0	1050,0	578,0		CRM values
	1,00	1,00	1,01	1,00	0,99	1,00	0,84	1,00	1,00	1,04	1,00		Ratio
Soil Sample ID	Cr ppm	Mn ppm	Ni ppm	Cu ppm	Zn ppm	As ppm	Se ppm	Cd ppm	Pb ppm	Mo ppm	Hg ppm	Metals from soil	
S82	7,1	7,1	30,4	421,0	732,6	25,0	2,4	2,4	111,8	7,1	<0.10		
S83	<0.50	<0.50	18,5	29,6	67,0	4,6	<1.9	<0.71	18,9	<0.50	<0.10		
S84	<0.50	<0.50	26,4	23,8	38,8	5,9	<1.9	<0.71	13,1	<0.50	0,18		
S85	32,1	32,1	34,2	1506,4	371,1	59,5	6,5	2,4	347,8	32,1	<0.10		
S86	74,3	74,3	15,7	371,5	56,5	27,1	4,6	<0.71	57,6	74,3	<0.10		
S87	30,6	30,6	19,1	759,5	72,6	46,8	3,1	<0.71	34,1	30,6	<0.10		
S88	15,5	15,5	6,8	227,2	11,2	90,2	6,2	<0.71	191,5	15,5	<0.10		



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Table 2 Maximum acceptable concentrations (MAC) of heavy metals in surface water samples (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)

MAC for SW					
Metals	Classes				
	I	II	III	IV	V
As, µg/l	10,00	20,00	50,00	100,00	>100
Cd, µg/l	0,50	1,00	2,00	5,00	>5
Cr, µg/l	25,00	50,00	100,00	250,00	>250
Cu, µg/l	20,00	30,00	50,00	100,00	>100
Fe, tot., µg/l	300,00	500,00	1000,00	2000,00	>2000
Hg, µg/l	0,10	0,30	0,50	1,00	>1
Mn, µg/l	50,00	100,00	300,00	1000,00	>1000
Ni, µg/l	10,00	25,00	50,00	100,00	>100
Pb, µg/l	5,00	10,00	25,00	50,00	>50
Se, µg/l	1,00	2,00	5,00	10,00	>10
Zn, µg/l	100,00	200,00	500,00	1000,00	>1000

Table 3 Maximum acceptable concentrations (MAC) of heavy metals in groundwater samples (according to Law No. 458/2002 regarding the quality of drinking water in Romania republished in 2011)

MAC for GW	
Metals	MAC µg/L
As, µg/l	10
Cd, µg/l	5
Cr, µg/l	50
Cu, µg/l	100
Fe, tot., µg/l	200
Hg, µg/l	1
Mn, µg/l	50
Ni, µg/l	20
Pb, µg/l	10
Se, µg/l	10
Zn, µg/l	5000

Table 4 Maximum acceptable concentrations (MAC) of heavy metals in sediment samples (according to Law No. 458/2002 regarding the quality of drinking water in Romania republished in 2011)

Metals	Normal values mg/kg
As, mg/kg	17
Cd, mg/kg	3,5
Cr, mg/kg	90
Cu, mg/kg	200
Hg, mg/kg	0,5
Pb, mg/kg	90
Zn, mg/kg	300

Table 5 Maximum acceptable concentrations (MAC) of heavy metals in soil samples (according to Law No. 458/2002 regarding the quality of drinking water in Romania republished in 2011)

Metals	Normal values mg/kg
As, mg/kg	5
Cd, mg/kg	1
Cr tot., mg/kg	30
Cu, mg/kg	20
Hg, mg/kg	0,1
Mo, mg/kg	2
Ni, mg/kg	20
Pb, mg/kg	20
Se, mg/kg	1
Zn, mg/kg	100

Table 6 Interpretation of chemical results for every metal/nonmetal identified in surface water samples (Moldova Noua)

Samples	Cr	Mn	Fe	Ni	Cu	Zn	As	Se	Cd	Pb	Hg
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
W18-c	<1.7	24,0	79,1	<3.6	<3.3	41,5	3,3	<4.5	1,4	2,8	<0.0005
W19-c	<1.7	14,4	34,4	<3.6	<3.3	7,5	<2.1	<4.5	1,5	2,5	<0.0005
W20-c	<1.7	18,6	52,6	<3.6	<3.3	<6.2	<2.1	<4.5	1,2	2,4	<0.0005
W21-c	<1.7	19,4	77,2	<3.6	<3.3	7,0	<2.1	<4.5	1,3	2,7	<0.0005
W22-c	8,7	23,6	267,5	<3.6	<3.3	7,5	<2.1	<4.5	0,94	2,1	<0.0005
W23-c	<1.7	34,4	411,6	<3.6	<3.3	<6.2	<2.1	<4.5	1,4	2,8	<0.0005

Table 7 Interpretation of chemical results for every metal/nonmetal identified in groundwater samples (Moldova Noua)

Samples	Cr	Mn	Fe	Ni	Cu	Zn	As	Se	Cd	Pb
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
WU-11c	<1.7	4,7	52,3	<3.6	<3.3	<6.2	<2.1	<4.5	1,3	3,4
WU-12c	5,2	4,4	27,5	<3.6	<3.3	68,7	<2.1	<4.5	1,3	2,5
WU-13c	<1.7	4,1	32,5	<3.6	<3.3	<6.2	4,4	<4.5	1,2	2,4
WU-14c	<1.7	4,0	88,9	<3.6	<3.3	17,1	<2.1	<4.5	1,1	2,2



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Table 8 Interpretation of chemical results for every metal/nonmetal identified in sediment samples (Moldova Noua)

Samples	Cr	Cu	Zn	As	Cd	Pb	Hg
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
S82-c	20,5	421,0	732,6	25,0	2,4	111,8	<0.10
S83-c	11,1	29,6	67,0	4,6	<0.71	18,9	<0.10
S84-c	24,4	23,8	38,8	5,9	<0.71	13,1	0,18

Table 9 Interpretation of chemical results for every metal/nonmetal identified in soil samples (Moldova Noua)

Samples	Cr	Ni	Cu	Zn	As	Se	Cd	Pb	Mo	Hg
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
S85-c	12,1	34,2	1506,4	371,1	59,5	6,5	2,4	347,8	32,1	<0.10
S86-c	12,1	15,7	371,5	56,5	27,1	4,6	<0.71	57,6	74,3	<0.10
S87-c	16,0	19,1	759,5	72,6	46,8	3,1	<0.71	34,1	30,6	<0.10
S88-c	4,1	6,8	227,2	11,2	90,2	6,2	<0.71	191,5	15,5	<0.10



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