PHYSICOCHEMICAL ANALYSIS OF THE COLLECTED WATER SAMPLES FROM MOLDOVA NOUĂ AREA – SUMMER SAMPLING (07.02.2021)

This is the last report were interpreted the results of physicochemical parameters from the waters of western Romania, more precisely areas of Caraș Severin County, the area of sterile halts near Moldova Nouă, and localities around an old industrial area which is currently off. This area was the objective of this project, to constate the toxicological effect of heavy metals that remained in soil and water after the mine was closed, and to propose some remediation methods.

The drinking water quality was investigated 3 times before - in October, February and May (autumn, winter and spring seasons) and now are the last times in the summer season, to ensure that the quality of water is between optimal parameters and if is safe to drink water from public wells. In this regard, a detailed physical and chemical analysis of drinking water samples and rivers samples was carried out in different residential areas and upstream of the rivers from the area. Several parameters such as pH, turbidity, conductivity, dissolved oxygen (DO). The obtained values of each parameter were compared with the standard values set by the World Health Organization (WHO).

PHISICOCHEMICAL PARAMETERS ANALYSIS

All samples (Table 1) were collected, and parameters were examined according to the *Sample collection procedure*, established in the project. *In situ*, the parameters were measured using a portable multimeter (pH, conductivity, dissolved oxygen), a turbidimeter (turbidity), and a thermometer (air, water, and soil temperature). The location parameters as latitude, longitude and altitude were identified using the Altimeter application.

The sampling points were like in all the other 3 seasons when we sampled, and we keep the same coordinates in the next table.

Table 1. Sampling points in the Moldova Nouă area, Romania.

Sample ID	Location name of the sample	Latitude	Longitude	Altitude(m)
W18	Boșneag River (Moldova Veche)	44°43'55"N	21°29'40"E	114
W19	Boșneag River (upstream Moldova Veche)	44°43'39"N	21°41'25"E	158
W20	Radimna River (Pojejena)	44°47'34"N	21°33'45"E	96
W21	Radimna River (upstream Pojejena)	44°48'06"N	21°33'58"E	105
W22	Nera River (Socol)	44°51'48"N	21°22'22"E	82
W23	Nera River (upstream Socol)	44°51'48"N	21°22'22"E	82
WU11	Well from village of Coronini, near the pond Boșneag	44°41'10"N	21°40'26"E	78
WU12	Well from village of Moldova Veche, near the pond Boșneag	44°46'57"N	21°29'06"E	77
WU13	Well from village of Macesti	44°45'21"N	21°36'14"E	91
WU14	Well from city of Moldova Noua	44°43'25"N	21°37'14"E	86
S82	Sediments from W18 location (Bosneag River)	44°43'55"N	21°29'40"E	114
S83	Sediments from W19 location (Radimna River)	44°47'34"N	21°33'45"E	96
S84	Sediments from W20 location (Nera River)	44°51'48"N	21°22'22"E	82
S85	Soil near Bosneag tailings pond	44°43'01"N	21°38'39"E	85
S86	Soil at 200 m in Bosneag tailings pond (N-W direction)	44°43'01"N	21°25'33"E	95
S87	Soil at 400 m in Bosneag tailings pond (N-W direction)	44°43'01"N	21°38'44"E	87
S88	Soil at 600 m in Bosneag tailings pond (N-W direction)	44°43'01"N	21°38'46"E	84

As I said before (in the last report), a sample is acidic if the pH is below 7.0, while if the pH is higher than 7.0 the sample is alkaline. Acidic water can lead to corrosion of metal pipes and plumbing systems. The alkaline water shows the presence of disinfectants in water. The normal drinking water pH range mentioned in the WHO and NDWQS guidelines is between 6.5 and 8.5/9.0.

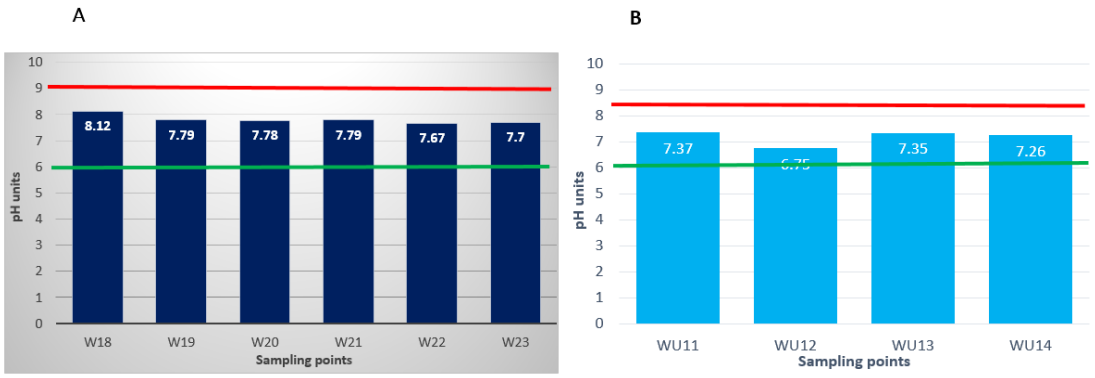

*Figure 1. **pH** values of water samples collected in 07.02.2021. (A) Samples collected from rivers, (B) Samples collected from wells. WU11 = Well from village of Coronini, near the pond Bosneag, WU12 = Well from village of Moldova Veche, near the pond Bosneag, WU13 = Well from village of Macesti, WU14 = Well from city of Moldova Noua, W18 = Bosneag River (Moldova Veche), W19 = Bosneag River (upstream Moldova Veche), W20 = Radimna River (Pojejena), W21 = Radimna River (upstream Pojejena), W22 = Nera River (Socol), W23= Nera River (upstream Socol). Green line is the minimum values and the red line are the maximum values according WHO.*

The pH values of all the water samples are found to be in the range between 6.75 and 8.12 (Figure 1, A, B) where the lowest values are from WU12 (Well from village of Moldova Veche, near the pond Bosneag)) and the highest values are from W18 (Bosneag River (Moldova Veche)). As last time, the highest pH value was for the W18 sample, and the lowest value was for the WU12 sample..

According to WHO and NDWQS the pH from all samples of water is within the recommended limits. (Patil 2012)

Conductivity is a measure of water's capability to pass electrical flow. Compounds that dissolve into ions are also known as electrolytes. The more ions that are present, the higher the conductivity of water. Likewise, the fewer ions that are in the water, the less conductive it is.

The normal drinking water conductivity range mentioned in the WHO and NDWQS guidelines is between 200 – 800 µS/cm for wells and 100 – 2000 µS/cm for rivers.(Gray et al. 2000)

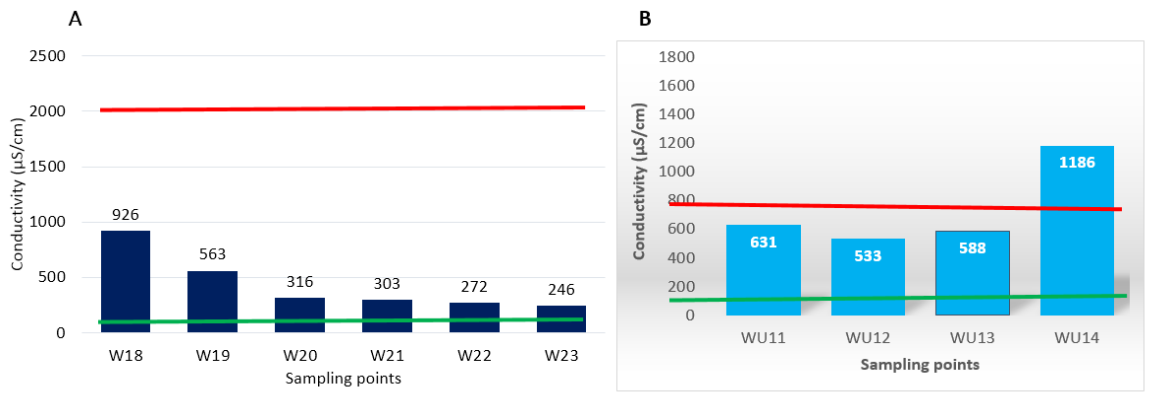

*Figure 2. **Conductivity** values of water samples collected in 07.02.2021. (A) Samples collected from rivers, (B) Samples collected from wells. WU11 = Well from village of Coronini, near the pond Bosneag, WU12 = Well from village of Moldova Veche, near the pond Bosneag, WU13 = Well from village of Macesti, WU14 = Well from city of Moldova Noua, W18 = Bosneag River (Moldova Veche), W19 = Bosneag River (upstream Moldova Veche), W20 = Radimna River (Pojejena), W21 = Radimna River (upstream Pojejena), W22 = Nera River (Socol), W23= Nera River (upstream Socol). Green line is the minimum values and the red line are the maximum values according WHO.*

The conductivity values of all the water samples are found to be in the range between 246 and 1186 µS/cm (Figure 2, A, B) where the lowest values are from W23 (Nera River (upstream Socol)) and the highest values are from WU14 (Well from city of Moldova Noua). Now the lowest values were kept, in Nera River upstream Socol, but for the wells, the highest values change with values of WU14 sample.

According to WHO and NDWQS the conductivity from all samples of water is within the recommended limits, without sample WU14.

Dissolved Oxygen (DO) is one of the most important parameters. Its correlation with water body gives direct and indirect information e.g., bacterial activity, photosynthesis, availability of nutrients, stratification etc. The solubility of oxygen in river waters depends mainly on the water temperature and salinity. Water in equilibrium with air is normally saturated with oxygen (i.e., at 100% Saturation) and DO can be expressed either as % Saturation or in concentration terms as mg/l O2. The maximum solubility of oxygen (fully saturated) ranges from approximately 15 mg/l at 0°C to 8 mg/l at 25°C (at sea level).(Patil 2012)

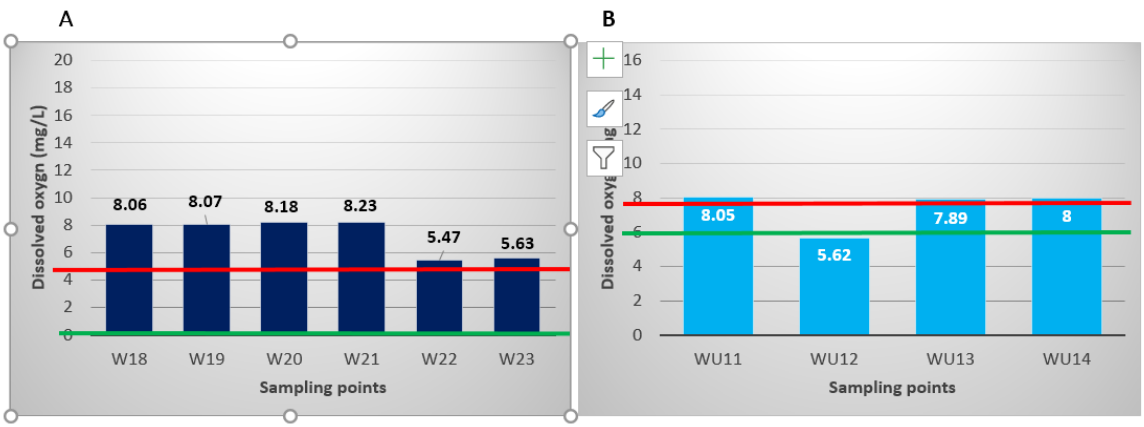

*Figure 3. **Dissolved oxygen** values of water samples collected in 07.02.2021. (A) Samples collected from rivers, (B) Samples collected from wells. WU11 = Well from village of Coronini, near the pond Bosneag, WU12 = Well from village of Moldova Veche, near the pond Bosneag, WU13 = Well from village of Macesti, WU14 = Well from city of Moldova Noua, W18 = Bosneag River (Moldova Veche), W19 = Bosneag River (upstream Moldova Veche), W20 = Radimna River (Pojejena), W21 = Radimna River (upstream Pojejena), W22 = Nera River (Socol), W23= Nera River (upstream Socol). Green line is the minimum values and the red line are the maximum values according WHO.*

The dissolved oxygen values of all the water samples are found to be in the range between 5,47 and 8,23 mg/L (Figure 3, A, B) where the lowest values are from WU12 (Well from village of Moldova Veche, near the pond Bosneag) and the highest values are from W21 (Radimna River (upstream Pojejena)).

According to WHO and NDWQS the DO from approximatively all samples of water is out of the recommended limits with one exception, sample WU12, and in wells, all the samples have higher concentrations of dissolved oxygen. But the higher concentrations of DO is in the river's samples, in this season.

Turbidity is the measure of relative clarity of a liquid. It is an optical characteristic of water and is a measurement of the amount of light that is scattered by material in the water when a light is shined through the water sample.

During periods of low flow (base flow), many rivers are a clear green color, and turbidities are low, usually less than 10 NTU. During a rainstorm, particles from the surrounding land are washed into the river making the water a muddy brown color, indicating water that has higher turbidity values. Also, during high flows, water velocities are faster and

water volumes are higher, which can more easily stir up and suspend material from the stream bed, causing higher turbidities.(Soros et al. 2019)

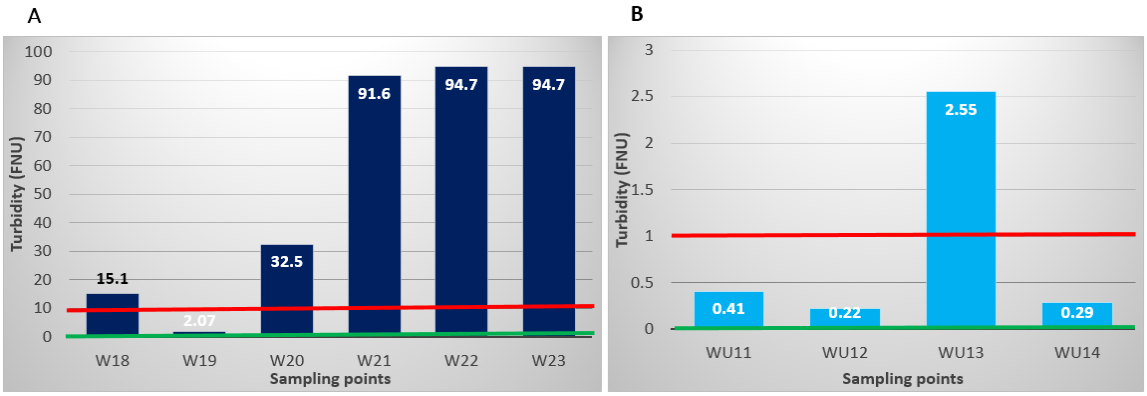

*Figure 4. **Turbidity** values of water samples collected in 07.02.2021. (A) Samples collected from rivers, (B) Samples collected from wells. WU11 = Well from village of Coronini, near the pond Boșneag, WU12 = Well from village of Moldova Veche, near the pond Boșneag, WU13 = Well from village of Macesti, WU14 = Well from city of Moldova Noua, W18 = Boșneag River (Moldova Veche), W19 = Boșneag River (upstream Moldova Veche), W20 = Radimna River (Pojejena), W21 = Radimna River (upstream Pojejena), W22 = Nera River (Socol), W23= Nera River (upstream Socol). Green line is the minimum values and the red line are the maximum values according WHO.*

The Turbidity values of all the water samples are found to be in the range between 0.22 and 94,7 FNU (Figure 1 4, A, B) where the lowest values are from WU12 (Well from village of Moldova Veche, near the pond Boșneag) and the highest values are from W22 (Nera River (Socol)) and W23 (Nera River (upstream Socol)).

According to WHO and NDWQS the Turbidity from majorities samples of water is out of the recommended limits because the rivers were agitated and turbulent, and the turbidity was increased for all the samples.

These were the values determined by the WUT team in the summer season. The values have not changed much from the spring determinations. Now the reports are completed, and we have all the sampling collected and interpreted.

In the Moldova Noua area, we don't have such a big problem with waters, and both rivers and wells are in optimum parameters, and the local's people can consume this water in their houses.

References

Patil, P. 2012. "Physico-Chemical Parameters for Testing of Water -A Review." *International Journal of Environmental Sciences* 3: 1194–1207.

Soros, Ampai et al. 2019. "Turbidity Reduction in Drinking Water by Coagulation-Flocculation with Chitosan Polymers." *Journal of Water and Health* 17(2): 204–18. https://doi.org/10.2166/wh.2019.114.