STUDY REGARDING GROUNWATER QUALITY IN THE ARANCA RIVER BASIN DURING 2008-2009 PERIOD

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Abstract: *The study presents the quality of groundwater in the Aranca Basin during the 2008-2009 ,achieved through the hydro geological drillings I, II for the freatic layer pollution and through deep drilling. The water samples were collected according to the monitoring program. The Aranca river Basin is located in the north-western part of the Banat hydrographic area.This area is occupied by fields that represent the maximum development of the western part of the Romanian territory also the South-eastern sector of Pannonian basin. From the point of view of the freatic aquifer, it presents itself as a horizon in the lowlands low down to depths of about 30-40 m. In the North of the low plain on the Mureş–Bega Veche, Mureş–Aranca, underground stream has the direction NE – SV, with a slight tendency for drainage Aranca – Bega Veche. The drainage basin includes two bodies of groundwater aquifer GWBA 01 LOVRIN-VINGA and GWMU 20, split with ABA Mures.In the groundwater aquifer quality characterization and establishment of critical areas, has been taken into account the comparing of the indicators values with the admitted limits of Law 311/2004 (amending and completing Law No. 458/2002 on the quality of drinking water).Starting in 2009, with the transposition of the European Directive 2006\/118\/EC into national law by Decision No. 53\/2009 for the approval of the national plan for the protection of groundwater against pollution and deterioration, groundwater is assessed from the point of view of quality, being two ways of framing: good or poor chemical status. The main criterion in assessing quality is considering the number of drillings in which recorded overrun of the parameters. If it is more than 20% of the total of drillings, then the source of groundwater is considered in poor chemical status. An essential criterion in the assessment of the chemical status of groundwater is the establishment of the limit values. For their determination for each groundwater source in part we had in view the origin of pollutants, that they may be naturally present in groundwater, the tendency of dispersion and degree of toxicity. The values can be found in the order 137\/2009 on approval of the limit values for groundwater sources in Romania.*

Key words: *groundwater, river basin, water quality, drilling, monitoring program*

INTRODUCTION

The scientific-technical progress directly affected the balance man-nature causing quality alteration of air, soil, water with impact on human health and the environment. Due to large amounts of waste and their diversity, this raises special problems in the protection and prevention of environmental pollution. They can pollute the soil, concomitant water sources (surface or groundwater) and air through their decomposition products and also may contaminate foods with that come in contact.

In the Western part of Romania, especially in the Timiş county, the source of the ground water is refound even from 5−10 m depth, what assures the possibility of its frequent pollution not only water anorganic substances, but also water organic wastes resulted from the activity of raising animals, industrial and agricultural activities. The same aspect can be found in the population′s households, in which the minimum distance between the water source and the animals′ shelters or the garbage platform is not respected. Very frequently the water samples from the local sources, in this region of the country, contain increased quantities of ammonium, nitrites, nitrates but also a great load of microorganisms. Also, the practice of an

intense agriculture and the incorrect use of the fertilizers and pesticides caused the contamination of the ground water with pesticides and nitrogen contaminants.

Because of using the fertilizers and the pesticides, it has been found that the natural underground water resources are seriously polluted with chemical substances. The discharge of the residues appears abundantly in urban places, with high population, having direct negative results over the majority consumers of drinking water.

The environmental pollution, knowing the disturbing factors of the ecological equilibrium and the working out of the strategies concerning the reduce of biotic contamination factors representing prior topics of the interdisciplinary research (agriculture-ecology-chemistry) promoted at a national and international level in the domain of the environment protection. In this way, the monitorising of the quality of the ground waters and the establishment of the causes which lead to their pollution represents a special scientific and practical interest. The International Organization of Health stilulates a limit interval for a series of substances and from this one they can adopt different countries standards expressed by maximum concentration admitted. In our country, actualdiferential quality standards depending on nature of water, surface, irrigation or underground watters. The underground waters have in general a composition close to the drinking water needs, except their loading with mineral elements, presenting at the same time smalll variations in their composition. Unlike the underground waters, the surface waters lack of any natural protection, are intensely polluated, and the concentrations variation of the different chemical substances are very big.

The study presents the quality of groundwater in the Aranca Basin during the 2008-2009, achieved through the hydro geological drillings I, II for the freatic layer pollution and through deep drilling. The water samples were collected according to the monitoring program.

MATERIAL AND METHOD

The Aranca river Basin is located in the north-western part of the Banat hydrographic area.

This area is occupied by fields that represent the maximum development of the western part of the Romanian territory also the South-eastern sector of Pannonian basin.

From the point of view of the freatic aquifer, it presents itself as a horizon in the lowlands low down to depths of about 30-40 m. In the North of the low plain on the Mureş–Bega Veche, Mureş–Aranca, underground stream has the direction NE – SV, with a slight tendency for drainage Aranca – Bega Veche. The drainage basin includes two bodies of groundwater aquifer GWBA 01 LOVRIN-VINGA and GWMU 20, split with ABA Mures.

In the groundwater aquifer quality characterization and establishment of critical areas, has been taken into account the comparing of the indicators values with the admitted limits of Law 311/2004 (amending and completing Law No. 458/2002 on the quality of drinking water).

Starting in 2009, with the transposition of the European Directive 2006\/118\/EC into national law by Decision No. 53\/2009 for the approval of the national plan for the protection of groundwater against pollution and deterioration, groundwater is assessed from the point of view of quality, being two ways of framing: good or poor chemical status. The main criterion in assessing quality is considering the number of drillings in which recorded overrun of the parameters. If it is more than 20% of the total of drillings, then the source of groundwater is considered in poor chemical status.

An essential criterion in the assessment of the chemical status of groundwater is the establishment of the limit values. For their determination for each groundwater source in part we had in view the origin of pollutants, that they may be naturally present in groundwater, the

tendency of dispersion and degree of toxicity. The values can be found in the order 137\2009 on approval of the limit values for groundwater sources in Romania.

RESULTS AND DISCUSSIONS

The Aranca River Basin is located in the north-western part of Banat hydrographic area. This area is occupied by fields that represent the maximum development of the western part of the Romanian territory also the South-eastern sector of Pannonian basin.

From the point of view of the freatic aquifer, it presents itself as a horizon in the lowlands low down to depths of about 30-40 m. In the North of the low plain on the Mureş–Bega Veche, Mureş–Aranca, underground stream has the direction NE – SV, with a slight tendency for drainage Aranca – Bega Veche. Groundwater quality was monitored by I, II hydrogeological drillings from the freatic layer pollution. and through deep drilling.

In ARANCA Hydrographic Basin were analyzed 10 drillings from which were collected samples according to the program of monitoring.

In 2008 was monitored I, II hydrogeological drillings of which 13 water samples were taken. The analysised colected samples in was done in to the Water Quality Timişoara Laboratory from the Banat Basine Waters Administration being determined the physical-chemical indicators of the Ionic balance and the specific pollution indicators of that area: temperature, pH, conductivity, fixed residue, CCO-Mn, Na^{+}, K^{+}, Ca^{2+}, Mg^{2+}, Fe^{2+}, Mn^{2+}, Cl^{-}, SO_4^{2-}, PO_4^{3-}, HCO_3^{-}, NO_2^{-}, NO_3^{-}, NH_4^{+}, phenols and other indicators as HG 351/2005 (Pb, Zn, Cu, Ni). The quality of groundwater aquifer characterization and establishment of critical areas, has in view the comparison of determined indicators values with the maximum admitted limits of Law 311/2004 (amending and completing Law No. 458/2002 on the quality of drinking water).

Table 1.

Critical areas of the deep aquifer in B.H. ARANCA

Nr. crt	Critical areas	Groundwater body	Exceeded the admited limit by Law 311/2004		
			NH_4	NO_3	Oxidability
1.	Sânpetru Mare F3	GWBA01	*	-	*
2.	Sânpetru Mare F5	GWBA01	-	-	*
3.	Sânnicolau Mare F2	GWMU20	*	-	*
4.	Sânnicolau Mare F5	GWMU20			*
5.	Tomnatec F1	GWBA01	-	*	*
6.	Teremia Mare F1	GWBA01	*	*	-
7	Sânnicolau Mare F1	GWMU20	*	-	*
8	Beba Veche F1	GWMU20	*	-	*

Note: * - exceeding the admitted limit under Law No.311/2004

The pollution levels in executed drilling in the aquifer is present, being recorded exceedances of the admitted limit (according to Law 311/2004) for the following indicators: ammonium, nitrates, oxidability.

In 2008, in to the Aranca Hidrographic Basin, pollution levels is observed in all the basin. In to the drillings of Sanpetru Mare and Sânnicolau Mare is observed organic load. In 2008, there were no exceedances of the permitted limits under Law 311/2004 on List II monitored metals, according to HG 351/2005 (Zn, Cu, Pb, Ni).

Groundwater quality changes stationed at 40 m depth are produced by :

- lack of sewage and wastewater treatment plants in some areas of the river basin;
- discharges of the untreated or insufficiently treated wastewater from agro-industrial area Sânnicolau (of secondary sewerage and drainage channels.)
- depositing of domestic waste in undeveloped rural areas;
- spreading on agricultural land-of chemical fertilizers and pesticides regardless of the best times of their administration.

Water quality in the deep aquifer layer in ARANCA Hidrographic Basin

In the two deep drillings followed, Teremia Mare F1AD and Lovrin F1AD, quality measurements were performed for the physical-chemical indicators of the Ionic balance: temperature, pH, conductivity, fixed residue, CCO-Mn, Na^+, K^+, Ca^{2+}, Mg^{2+}, Fe^{2+}, Mn^{2+}, Cl^-, SO_4^{2-}, PO_4^{3-}, HCO_3^-, NO_2^-, NO_3^-, NH_4^+, phenols and other indicators as HG 351/2005 (Pb, Zn, Cu, Ni).

In 2008 two deep monitored drillings were followed according to the monitoring program.

After monitoring the depth drilling there is found exceeded concentrations allowed by Law 311/2004 for the following indicators:

ammonium: -Teremia Mare exceeding of 3.0 times.
- Lovrin exceeding of 1,5 times .

manganese: -Teremia Mare exceeding of 4,0 times.
- Lovrin exceeding of 3,0 times.

iron: - Lovrin exceeding of 2,7 times.

phosphates: - Teremia Mare exceeding of 6,4 times.

In Lovrin and Teremia Mare area is observed ammonium and phosphates pollution due to the lack of sewerage networks and wastewater treatment also because non-respective optimum periods for fertilizing of agricultural land.

In the deep aquifer water quality is unfit for human consumption (but compared to previous years deep water quality is better), in the two investigated drillings, registering exceeded at the allowed limit for ammonium indicator to 3.0 times, and manganese up to 4.0 times.

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Groundwater quality in B.H. Aranca in 2009

Groundwater quality was monitored by I and II drillings- phreatic layer and in deep drillings.

In B.H.ARANCA were analyzed 12 drillings from which the samples were collected according to the monitoring program.

In 2009 was monitored 12 hydrogeological drillings I, II of which 15 water samples were taken. The analysised colected samples in was done in to the Water Quality Timişoara Laboratory from the Banat Basine Waters Administration being determined the physical-chemical indicators of the Ionic balance and the specific pollution indicators of that area: temperature, pH, conductivity, fixed residue, CCO-Mn, Na^{+}, K^{+}, Ca^{2+}, Mg^{2+}, Fe^{2+}, Mn^{2+}, Cl^{-}, SO_4^{2-}, PO_4^{3-}, HCO_3^{-}, NO_2^{-}, NO_3^{-}, NH_4^{+}, phenols and other indicators as HG 351/2005 (Pb, Zn, Cu, Ni).

The drainage basin includes two bodies of groundwater aquifer GWBA 01 LOVRIN-VINGA and GWMU 20, split with ABA Mures.

From the obtained values it appears that in 2009, on the water bodies is a slight improvement for the analyzed parameters, compared to previous years the level of pollution is throughout the basin. On Sânpetru Mare F1 and Lovrin F1 drillings is observed organic load.

Situation pollutant concentrations exceeding permissible under order 137/2009 approving the threshold values for groundwater bodies in Romania and Law 311/2004 (amending and supplementing the Law No.458/2002 on drinking water quality) is presented in the tables below:

Table 2.

GWBA 01

Indicator	Name drilling-area	Water source
-oxidability	Sânpetru Mare F5, Lovrin F1	GWBA 01 LOVRIN-VINGA
- iron	Valcani F5	GWBA 01 LOVRIN-VINGA
- manganese	Valcani F5	GWBA 01 LOVRIN-VINGA
-phosphates	Sânpetru Mare F5, Lunga F1	GWBA 01 LOVRIN-VINGA

In 2009, there were no exceedances of the permitted limits under Law 311/2004 on metals monitored List II, according to GD 351/2005 (Zn, Cu, Pb, Ni).

Following the interpretation of the analyzes we can consider the water body **GWBA 01 LOVRIN-VINGA** as having good chemical status, exceedances pollution in the local monitoring points being local

In terms of Law 311/2004 monitoring points Sânpetru Mare F5, Lovrin F1, Valcani F5 are not drinking because the exceedances for the iron parameters, oxidability and manganese.

Water quality in the deep aquifer in BH ARANCA

In 2009 was monitored Teremia Mare F1AD drilling, finding exceeded concentrations to the phosphates under Order 137/2009 and for ammonia, organic substances according to Law 311/2004.

Over the previous year is slightly decreasing trend of groundwater contamination due to start achieving sewage networks, reducing pollution from agriculture and rehabilitation facilities (pipeline, crossings) of Petrom in the extreme western part of the basin.

CONCLUSIONS

In Banat hydrographical area by centralized water supply systems, 22,46 % of the total water requirement ensures the needs of the population of medium and deep drillings

where results importance of monitoring groundwater quality and ensure good chemical status for the benefit of human health and environmental quality in general.

The evolution of groundwater quality from Bega-Timis River Basin is positive for the analised period, the most executed drillings in to aquifer freatic layer shows an improvement of the physical-chemical indicators, even are registered local speed at least one indicator of water quality characterization. The water quality into the deep aquifer layer, we can conclude that this source of water maintains good chemical status.

The depth analysed drillings, done by the local councils which supply the neccessary drinking water, centralised at the rural locations level are framed between normal limits of the analysed parametres.

Changes for groundwater quality are produced by:

- discharges of untreated or insufficiently treated wastewater from settlements subordinated basin
- the absence or insufficiency of sewerage network of settlements in catchment area;
- leakage from drainage channels, canals accidentally or temporarily used for wastewater discharge from the old pits of livestock units
- storage and spreading on agricultural land of fertilizers and pesticides regardless of the best times of their administration;
- residual contamination due to former sewage discharges from swine breeding complexes and those of poultry;
- garbage storage unprepared surfaces.

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