RESEARCH REGARDING SURFACE AND DEPTH GROUND WATERQUALITY FROM BEGA-TIMIŞ RIVER BASIN, IN 2008-2009 PERIOD

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Abstract: *The contaminations problem of surface and depth groundwater sources with various chemical substances in the Banat Basin Area represents a topical issue of large actuality.The importance that is given to the monitoring of groundwater quality is derived from large share that usefull water from the Hydrographic Basin Bega-Timis are feeds from these sources. In the centralized water supply systems, the total water requirement for the population needs provided from medium and deep drillings, is required to ensure a good chemical status so for the benefit of human health and also for the environmental quality in general. This paper has in view the quality of groundwater in the year 2008, 2009 from I, II hydrogeological drillings also from the freatic layer pollution. and through deep drilling situated in the Bega-Timis River Basin. The samples frequency from drillings have done according to the monitoring program collection made in periods of high rainfall in spring and drought period(summer-autumn). The analysised colected samples 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). 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.*

Key words: *surface water, depth water, hydrogeological drillings, physical-chemical indicators, the maximum admited limits*

INTRODUCTION

Among his many vital uses**,** water**,** was used to retrieve the waste products generated by human activity. Along the atmosphere and the soil, waters, remained one of the major receptors for these products, both in the form of wastewater of various sorts (fecaloid-domestic, industrial, agricultural) and also chemical and radioactive pollutants.

In general, natural waters, have the ability to dilute and disperse the impurities in the whole water amount, and also they have the quality to be naturally self purification (phenomena of whose intensity varies according to the nature of water: flowing water, slack or underground water). Currently, there are a number of legal regulations (national and international) which impose restrictions on the using water as residues receptors.

The International Organization Health stipulates a limit interval for a series of substances and from this one they can adopt different countries standards expressed by maximum concentration admitted (mg/dm^3). In our country, the appreciation of the degree of

drinkability of water is based on value of quality indicators underlined in Law nr. 458 / 2002 completed by law 311 / 2004. Among the anorganic origin products which contaminates the surface and depth waters there are the nitrogen compounds. The causes of the contamination of water with these compound are: the intensive agriculture, animal raising, rain-falls and levigation of the nitrogen compounds.

In many countries, intensive agriculture coresponds to the administration of fertilizers in doses of 250-300 kg/ha, but nowadays, the tendency is to increase these quantities twice or three times. Overfertilization contributes both to the eutrophization of surface waters and accumulation of the nitrates in the underground waters and acidifying of the soil, at the same time with emanation of gases.

These rules shall specify, in specific terms, the extent limits until is allowed water quality emissary degradation, so it does not enter in conflict with environmental and land use functions of the water resource. The **pollution** was defined in Law No.310\2004 – Law amending and supplementing waters Law no.107/1996 as: direct or indirect introduction, as a result of human activity, of substances or heat into the air, water or soil, which may harm human health or to the quality of aquatic or terrestrial ecosystems. Compared to surface water, groundwater pollution differ both in the propagation of the pollutant and by the process of self-purification.

Surface water pollution takes only days, possibly weeks. Instead groundwater pollution takes time, persistence of pollutants can be tens or even hundreds of years. If the pollutant does not decompose immediately or isn't immobilized, he can persist in groundwater indefinitely time. This paper has in view the quality of groundwater in the year 2008, 2009 from I, II hydrogeological drillings also from the freatic layer pollution. and through deep drilling situated in the Bega-Timis River Basin.

MATERIAL AND METHOD

Banat Hydrographical Area extends from South of Mures up to the Cerna river confluence with the Danube in an area of 18393, 5 km^2. The rivers that water gathers in that territory, have specific features to the southwest of the country, but at the same time are distinguished as river systems with specific characteristics hydrographic basin. In Banat Hydrographical Area in to the Bega-Timis River Basin, were identified, delimited and described a number of 6 source of groundwater, 5 sources for phreatic and one for deep strata. Hydrological drillings network state which investigates the aquifers, dealing specifically the lowland of the Banat plain, came only on the upper river valleys on their courses. The quality of groundwater was monitored through the hydro geological drillings I, II and the freatic layer pollution and through deep drilling. The samples frequency from drillings have done according to the monitoring program collection made in periods of high rainfall in spring and drought period (summer-autumn). In the classification of the two categories: groundwater and depth, conventionally considered that the drillings depth below 50 m fall into exploitation of the aquifer strata while those with greater depth of 50 m in exploitation of the deepaquifer strata. 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).

RESULTS AND DISCUSSIONS

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).

Situation pollutant concentrations exceeding is presented in the table below:

Table 1.

Statement of pollutant concentrations in 2008

Indicator	**The number of the exceedings admited limits**	**Name basin - drilling**
1	2	3
- nitrites	max. 1,4-18,2	**Timiş** – Cruceni, Voiteg
	max. 1,5	**Bârzava –** Birda
- nitrates	max. 2,7	**Bega** – Giarmata
	max. 2,1	**Timiş –** Cruceni
	max. 1,3-14	**Bega Veche** – Fibiş, Sânandrei, Satchinez, Biled, Checea, Lenauheim
	max. 1,4-4,5	**Bârzava –** Măureni, Şemlacu Mare
	max. 1,2-6,9	**Moraviţa –** Butin, Moraviţa, Şemlac
- chloride	max. 1,4-3,8	**Bega Veche**- Sânandrei, Lenauheim, Lunga, Jimbolia (poluare)
-iron	max. 1,5-2,9	**Bega Veche** – Checea, Gottlob
	max. 1,5-6,7	**Timiş** – Sîlha, Hitiaş, Cruceni, dragşina, Voiteg, dolaţ, Toager, Grăniceri
	max. 4,1	**Bârzava –** Birda (polution)
-oxidability	max. 2,1-2,3	**Bega** – Şuştra, Margina, Uivar
	max. 1,2-8,4	**Bega Veche –** Remetea Mică, Fibiş, Vinga, Cernăteaz, Orţişoara, Satchinez, Iecea Mare, Checea, Comloşu Mic, Lunga
	max. 1,8-3,8	**Timiş** – Hitiaş, Cruceni, Buziaş, Dragşina, Voiteg, Toager
	max. 2,6-5,1	**Bârzava** – Birda (polution)
	max. 2,1-3,8	**Moraviţa –** Butin, Moraviţa
- manganese	max. 1,8-15,8	**Bega** – Răuţi, Margina
	max. 1,6-15,8	**Bega Veche** - Jimbolia (poluare), Remetea Mică, Sânandrei, Iecea Mare, Iecea Mică, Checea, Lenauheim, Comloşu Mic,
	max. 1,6-35,8	**Timiş** – Sîlha, Hitiaş, Cruceni, Glimboca, Duleu, Vermeş, Otveşti, Ionel, Diniaş, Foeni, Dragşina, Voiteg, Dolaţ, Toager, Grăniceri
	max. 4,2-4,5	**Bârzava –** Partoş, Şemlacu Mare
	max. 2,4-9,0	**Moraviţa –** Gaiu, Butin, Moraviţa
- ammonium	max. 1,2-7,1	**Bega –** Otelec, Margina Răuţi, Şuştra
	max. 2,6-4,1	**Bega Veche** - Comloşu Mic, Checea, Jimbolia (polution)
	max. 1,5-6,0	**Timiş** – Sîlha, Hitiaş, Cruceni, Glimboca, Ionel, Foeni, Cerna, Toager, Grăniceri, Diniaş
	max. 1,4-3,4	**Bârzava** – Birda (polution)
	max. 4,6-14,7	**Moraviţa** – Butin, Moraviţa, Gaiu, Jamu Mare

The most serious cases of pollution - Critical areas -at the aquifer with several times exceeding the maximum permissible limit in most indicators, according to Law 311/2004 (for the amendment and completion of Law No.458/2002 on drinking water quality) in 2008 are recorded : organic matter, ammonia, nitrites, nitrates, iron, manganese and chloride.

Critical areas of pollution are located in the following catchment areas:

- **Bega River Basin**:- on the Balinţ - due to insufficient sewage network and improper use of chemical fertilizers on agricultural land and also on the downstream sector Timisoara - border- particularly diffuse pollution.

- Timis River Basin: -on Lugoj area (as required the upgrading of wastewater treatment plant) and the downstream Coştei - border with the origin of the pollution from household utilities,as well as diffuse pollution.
- Barzava River Basin : - downstream sector Bocşa - border, with origin of residual pollution from livestock (Birda) and poultry complexes (Bocşa) communal households (Bocşa and Deta) and diffuse pollution.
- Bega Veche River Basin : - in the superior course of the Bega Veche River with the origin of the pollution from agrozootehnical activities and manure storage basins at the former pig farms and from diffuse pollution. Maintain high level of pollution in the groundwater aquifer layer and in areas where certain production units have greatly reduced activity or even closed.

Regarding the water quality in the deep aquifer layer in the BEGA-TIMIŞ Basin, in **2008,** were monitored 29 drillings in layer depth.

Quality measurements were performed for the Ionic balance indicators: temperature, pH, conductivity, fixed residue , CCO-Mn, Na, K, Ca, Mg, Fe, Mn, Cl, SO_4, PO_4, CO_3, HCO_3, NO_2, NO_3, NH_4, and other indicators according to HG 351/2005 (Pb, Zn, Cu, Ni).

The measurements reveal that all indicators have concentration values lower than permissible limits, authorized by Law 311\/2004 (amending and supplementing law No. 458\/2002 on the quality of drinking water), with the exception of the following indicators: ammonium, phosphates, oxidability, iron, manganese, nitrates and chlorides.

Situation where concentrations of pollutants are admitted:
- **ammonium**: max. 1,2 – 19,6 ori : Orţişoara (1,4), Jimbolia (1,6), Bethausen (17,6), Pustiniş (1,5), Coştei (1,6), Diniaş (1,4), Giulvăz (1,2), Petroasa Mare (2,8), Chevereşul Mare (19,6), Liebling (1,3), Răcăjdia (18,8), Beregsăul Mare (1,9), Giera (2,2), Gătaia (3,5), Voiteg (1,2), Denta (5);
- **oxidability:** max. 1,2 – 8,4 ori: Jimbolia (3,49), Pustiniş (1,8), Petroasa Mare (1,2), Chevereşul Mare (8,4), Liebling (1,6), Beregsăul Mare (7,6), Gătaia (1,2), Denta (2,3);
- **nitrates:** Maşloc (2,9 ori);
- **manganese**: max. 1,2 – 12,1 ori : Orţişoara (1,4), Carani (3,0), Bărăteaz (12,1), Lenauheim (2,5), Timişoara Nord (3,7), Coştei (1,6), Diniaş (4,8), Giulvăz (2,8), Petroasa Mare (2,0), Chevereşul Mare (1,2), Sacoşu Turcesc (1,3), Liebling (4,2), Voiteg (4,2), Variaş (3,4), Beregsăul Mare (2,1), Voiteg (1,3);
- **iron:** max. 1,5 – 7,9 ori : Orţişoara (6,4), Carani (3,7), Jimbolia (1,5), Bethausen (1,8), Pustiniş (1,3), Diniaş (1,2), Giulvăz (3,3), Chevereşul Mare (7,9), Liebling (3,8);
- **chlorides:** max.Chevereşul Mare (1,9ori).

Table 2

Critical areas of deep aquifer

Nr. crt.	Area	NO_3	Oxidability	NH_4
B.H. Bega				
1	Diniaş F1 AD	-	-	*
B.H. Bega Veche				
2	Pustiniş	-	*	*
3	Jimbolia F1 AD	-	*	*
4	Orţişoara	-		*
5	Maşloc	*	-	-
	Beregsău Mare primarie	-	*	*

B.H. Bârzava				
6	Gătaia	-	*	*
7	Denta	-	*	*
B.H. Timiş				
8	Chevereşu Mare F1 AD	-	*	*
9	Bethausen	-	-	*
10	Giera	-	-	*
11	Liebling	-	*	*

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

Groundwater quality in 2008 in most of boreholes performed in deep aquifer layer shows exceeding the maximum permissible limit (according to Law 311/2004) in the main indicators: organic substances and ammonia.

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. In BEGA-TIMIŞ River Basin was established a network of observation wells aim to establish rules on variation of piezometric levels, temperatures and chemistry of groundwater aquifer. The boreholes are qualitative order supervised I, II and drilling pollution.

Analysis of collected samples in 2009, was done in the Water Quality Timişoara Laboratory from the Banat Basine Waters Administration.

Situation pollutant concentrations exceeding admitted according to 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:

For the water source, GWBA 02 FIBIŞ situation is as follows:

Table 3

GWBA 02 FIBIŞ

Indicator	Name drilling-area	Water source
- iron	Recaş F1,	GWBA 02 FIBIŞ
- nitrates	Bencecu de Sus F1, Fibiş F1, Fiscut F1, Giarmata F1, Maşloc F1, Pişchia F5	GWBA 02 FIBIŞ
- manganese	Recaş F1	GWBA 02 FIBIŞ
- phosphates	Cernăteaz F1	GWBA 02 FIBIŞ

GWBA 02 FIBIŞ water body, is in poor chemical status due to the exceedings recorded in more than 20% of the boreholes, due the Order 137/2009.

In terms of Law 311/2004, the monitoring point Recaş F1 is not drinkable due to iron and manganese exceedances parameters.

Table 4

GWBA 03 TIMIŞOARA

Indicator	Name drilling-area	Water source
-oxidability	Cenei F1, Foeni F1, Ghilad F1, Jimbolia P1, Jimbolia P3, St. exp. Diniaş F7	GWBA 03 TIMIŞOARA
-Iron	Cruceni F2	GWBA 03 TIMIŞOARA
- nitrates	Biled EF1, Birda P2, Cebza-Ceacova F5, Voiteg NF1	GWBA 03 TIMIŞOARA
- nitrites	Cenei F1, Sânandrei F4	GWBA 03 TIMIŞOARA
- ammonium	Birda P3, Dolaţ F1, Jimbolia P1	GWBA 03 TIMIŞOARA
- manganese	Cenei F1, Cruceni F1, Cruceni F3, Cruceni F2, Liveziile F1A, Petroman F1A,	GWBA 03 TIMIŞOARA
- phosphates	Birda P3, Jimbolia P1, Petroman F1	GWBA 03 TIMIŞOARA
- chlorides	Cruceni F6	GWBA 03 TIMIŞOARA

GWBA 03 FIBIŞ water body, is in poor chemical status because the exceeding values recorded in more than 20% of the monitoring points, due the Order 137/2009.

In terms of Law 311/2004 most monitoring points are not drinking mainly due to exceedances parameters:oxidability (Cenei F1, Foeni F1, Ghilad F1, Jimbolia P1, Jimbolia P3, St. exp Diniaş F7), nitrates (Biled EF1, Birda P2, Cebza-Ceacova F5, Voiteg NF1) and manganese (Cenei F1, Cruceni F1, Cruceni F2, Cruceni F3, Liveziile F1A, Petroman F1A).

Table 5

GWBA 04 LUGOJ

Indicator	Name drilling-area	Water source
- oxidability	Hitiaş F4, Mănăştiur F1	GWBA 04 LUGOJ
- nitrates	Petroasa Mare F1	GWBA 04 LUGOJ
- nitrites	Otveşti F4	GWBA 04 LUGOJ

GWBA 04 LUGOJ water body, is in good chemical status, parameters values are considered as local exceedances.

In terms of Law 311/2004 monitoring points Hitiaş F4, Mănăştiur F1 are not drinking due oxidability parameter exceedances**.**

Table 6.

GWBA 05 GĂTAIA

Indicator	Name drilling-area	Water source
- ammonium	Gătaia F4,	GWBA 05 GĂTAIA
- nitrates	Şipet F1,	GWBA 05 GĂTAIA
- nitrites	Tormac F1	GWBA 05 GĂTAIA
- phosphates	Şipet F1	GWBA 05 GĂTAIA

GWBA 05 GĂTAIA water body, is in poor chemical status because the exceeding values recorded in more than 20% of the monitoring points, due the Order 137/2009.

GWBA 06 – FARASESTI (M. Poiana Ruscăi) water body, is in good chemical status. There is no drilling on this. Monitoring is done by fountain Cripta.

GWBA 07 LUNCANI (M. Poiana Ruscăi) water body, is in good chemical status. Monitoring is done by fountain Luncani.

Water body **GW-ROBA18-Banat** includes the entire space of Banat from Mures to v.Vicinic (Caras Plain) and from the Timis culoar (inclusive) to the western border.

It continues to the West and the Republic of Serbia; surface-11408 $km^{2.}$

Quantitative and qualitative pressures: all catchments for water supply (drinking, industrial, livestock, irrigation, heat exchangers, etc.) are in this body, and this situation will increase by expanding centralized power in the rural villages and livestock farms (especially those belonging S.C Smithfield Ferme S.R L). The degree of exploitation is very different from a household level to that of large catchments for water supply, especially drinking (Deta, Recas, Faget, Jimbolia, Sinnicolau Mare, Oravita, dar in special Lugoj si Timisoara).
In 2009, 28 wells were monitored in layer depth. Quality measurements were performed for the following indicators: temperature, pH, conductivity / fixed residue, CCO-Mn, Na, K, Ca, Mg, Fe, Mn, Cl, SO_4, PO_4, CO_3, HCO_3, NO_2, NO_3, NH_4, as well as other indicators according to HG 351/2005 (Pb, Zn, Cu, Ni).

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 7

GWBA 18 BANAT

Indicator	Name drilling-area	Water source
- oxidability	Chevereşu Mare F1AD, Giulvăz F1AD	GWBA 18 BANAT
- ammonium	Biled F1AD, Chevereşu Mare F1AD, Răcăjdia F1AD	GWBA 18 BANAT
- phosphates	Diniaş F1AD, Beregsău Mare F1AD	GWBA 18 BANAT
-nitrites	Masloc primarie	GWBA 18 BANAT

GWBA 18 BANAT water body, is in good chemical status, parameters values are considered as local exceedances.
In terms of Law 311/2004 monitoring points Chevereşu Mare F1AD, Giulvăz F1AD are not drinking due oxidability parameter exceedances and Biled F1AD, Cheveresu Mare F1AD si Racajdia F1AD due ammonium parameter exceeding.

Groundwater quality in 2009 in most of drillings executed in aquifer and in deep aquifer layer shows an improvement over the previous year, still recorded exceeded the maximum allowed (according to Order 137/2009 on approval of threshold values for groundwater bodies in Romania and the Law 311/2004) to at least one indicator of water quality characterization.

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.
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.

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.

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