ASSESSMENT OF GROUNDWATER CHEMICAL STATUS IN UNDERGROUND BASIN CRISURI

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Abstract
The article presents the evaluation of groundwater chemical status, with the free level of the groundwater body ROCR01, Cris basin for the period 2009, with emphasis on analysis of drilling (points) of observation, the Municipality of Oradea industrial area, Pollution Control Station belonging. Also to follow the degree of groundwater pollution of groundwater reserves, due to human activities and potential impact of various pollution sources on groundwater.

Key words, groundwaters, pollution, monitorized indicators, thresholde values

INTRODUCTION

Given the need to implement the Water Framework Directive 2000/60/EC and Directive 2006/118/EC about groundwater protection against damage pollution and transposed into national law by HG 53/2009 and OM 137/2009 Department of Water Basin Cris monitors groundwater quality in wells belonging to the National Hydrogeological Network.

Cris River Basin have been identified and delineated a total of nine bodies of groundwater (eg ROCR01), named after the following structure: RO = Romania; CR = catchment area Cris, 01, 02, 03, 04, 05, 06, 07, 08, 09 the number of bodies of water in the catchment area rivers. The paper presents the chemical status of wells with free level (phreatic) Cris river basin, groundwater ROCR01 allocated.

Assessment of groundwater chemical status Cris basin by comparing average annual values obtained from 103 wells National Hydrogeological Network (from 1993-2009), with threshold values (TV-Threshold Values), the MM Order no. 137/2009. Determine which indicators were not included in the order were compared with the MAC of Law No drinking water quality. 458 / 2002, as amended by Law 311 / 2004 and also to take into account the natural background values (NBL), which were calculated for each indicator determined. This analysis was conducted for all groundwater bodies defined and characterized by currently related Basin Rivers.

This analysis was conducted for all groundwater bodies defined and characterized so far, related to Basin rivers.

Observation of the dynamics and evolution of water chemistry of groundwater basin Cris , was made on a number of 103 control wells owned by water body ROCR 01. For the detection of groundwater pollution sources, pollutants and determination of all elements of time tracking their harmful action, within the perimeter of the cone of dejection River station operates a groundwater pollution control, consisting of nine observation wells.

To interpret the results of physico-chemical, taking into account the main sources of pollution in the area, the area was divided into three sectors, trying in this way as a compact group: drilling - sources of pollution.

MATERIAL AND METHOD

This sector includes the observation wells P2 and P4 (monitoring points located on the left bank of Cris Quick, pig farms downstream from - Sântandrei - Palota eg Nutrient Palota SC).

Downstream sector right bank Cris-Repede in Oradea wells in this sector are:

P1=Bors Customs, P3= av. Sântion, P5= Sântion, P6= SC Sinteza SA, P7= Station Peco (sludge fields Sugar Factory), P8= SC Cemtrade SA (old firm Alumina), P9= Sugar Factory, P10= Stadium FC Bihor, P11= Ferma Dosu and biological ponds from Compania de apă Oradea, P13 = SC Orser SA (Greenhouses) and P14 = Episcopia Bihor

The main sources of pollution that are sector: Oradea treatment station, SC Cemtrade SA, SC Sinteza SA, Sugar Factory, C.E.T. I, Station PECO and industrial site located in the West.

Santaul mic sector: This sector includes the drilling P15 = F1 - Santaul Breakfast, the main source of pollution area of slag and ash dump of Society Termoelectrica SA – branch Electrocentrale (CET I) Oradea.

RESULTS AND DISCUSSION

Determination of threshold values was made, the methodology developed in the project MATRA PPA06/RM/7/5. Establishing measures for the rehabilitation of contaminated groundwater due to landfill in order to achieve environmental objectives required by the Water Framework Directive and the Groundwater Directive, based on the natural background values (NBL), by comparison with a reference value. In Romania, having regarded to relevant uses of groundwater were used as reference values, the maximum permissible concentrations (CMA) according to Law No drinking water quality number 458/2002 and Law no. 311/2004 for the amendment of Law 458/2002.

The threshold values calculated for all groundwater bodies identified in Romania are included in the Order of the Ministry of Environment no. 137/2009, and for the water body ROCR01 are presented in table 1

Table 1

Threshold values (TV) for body ROCR01

Groundwater body	NH4 mg/l	Cl mg/l	SO4 mg/l	As mg/l	Pb mg/l	NO2 mg/l	PO4 mg/l	NO3 mg/l
ROCR01	1,7	250	250	0,03	0,010	0,50	0,50	50

For assessing the chemical status of groundwater were following steps:

1. Was calculated for each monitoring point (drilling) and multi-annual average values for each chemical element examined in the period 2009;
2. Average annual values for each point were compared with threshold values of the Order 137/2009 MM (those in Table 1), and the value for the limit of NO3 was compared with European standards;
3. The remaining indicators determined in this period, which were not included in the order, were compared with the MAC of Law 311/2004 and the natural background limits (NBL), set by DA-Cris Oradea.
4. If at least one element has exceeded the threshold values, it is considered that the monitoring point is polluted;
5. If the number of monitoring points polluted not exceed 20% of monitoring points on a body of groundwater, it is considered that it is good chemical and points is considered polluted local exceedence of threshold values to the item;

6. If at least 20% of monitoring points on a body of groundwater is polluted, it is considered that this chemical is in poor condition;

7. When analyzed for seven elements were determined not TV, it was noted whether drinking or grandchild of monitored point where the natural background limits (NBL).

In the body of water ROCR01, 103 wells were analyzed, of which 73 wells-order and second order 24. Following the analysis finds that:

• 35 wells show the average values higher than the threshold values of the Order 137/2009, in a percentage of 34.0% and result in poor chemical status. Wells which are overtaking predict: Balc, Cig F1A, Sanmiclaus F1R, Petresti F1, Santau F1, Oradea Airport F1, Oradea F6- P13 , Santaul Mic F1 – P15, Girisu de Cris F1, Custeana F1, Ciumeghiu Sud F1, Pollution Control Station P1, P2, P3, P5, P6, P7, Ginta F2, F5, Talpos F3, F4, Batar F1, Zerind F3, Vanatori S F1, F2, F2A, F3, Bocsig F5, Varsand F1, F3, F5, Masca F1, Santana Sat F1A, Curtici F1 si Siclau F1.

The elements are analyzed in order 137/2009: NH4, Cl, SO_4, As, Pb, NO_2, NO_3 and PO_4.

18 drilling wells undrinkable character, 17.5%.Drilling shows that the average higher than the natural background and Law 458/2009 are: Petreu Chiraleu F2, Salard F2, Tamaseu F2, Ateas F1A, Ciumeghiu F1R, Cermei F3, F4, F5, F6, Adea F1, F3, Vanatori S F1A, F3A, Bocsig F6, and Ineu F2, F2A, F3.

50 wells are for drinking, at the rate of 48.5%. Of the 35 wells that exceeded TV shows, 12 wells shows average values greater than 1.7 mg / l indicator ammonium (NH4). They are: Custeana F1- 2.575 mg/l, St. Contr. Pol. P2 – 3.17 mg/l, P7–6.665 mg/l, Zerind F3 – 2.24 mg/l, Vanatori S F1 – 2.84 mg/l, F2 –3.36 mg/l, F2A – 31.01 mg/l, F3 – 1.72 mg/l, Varsand F1– 2.09 mg/l, F3 –5.275 mg/l, F5 –2.185 mg/l and Siclau F1 – 2.965 Figure 1.

The phosphate (PO 4) - shows values higher than the average TV in 5 wells 137/2009: Custeana F1 – 5.085 mg/l, P6 – 1.64 mg/l, Vanatori S F1 – 0.82 mg/l, Vanatori S F2 – 0.96 mg/l, Vanatori S F2A – 0.54 mg/l, fig. 2.

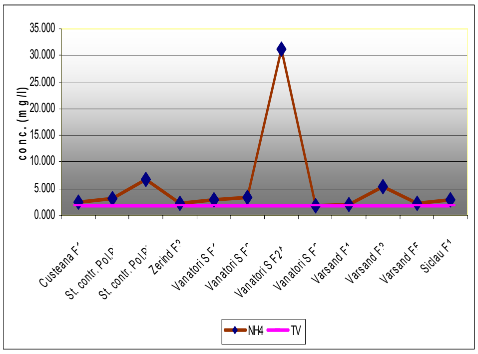


Fig. 1. Values higher than the average TV on ind.NH4

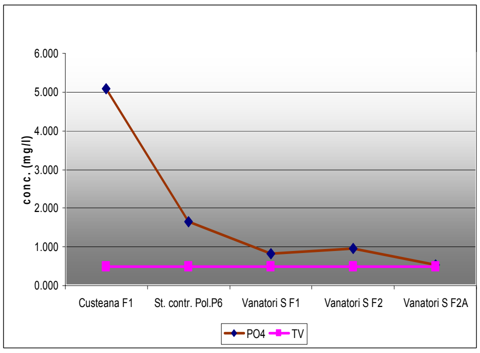
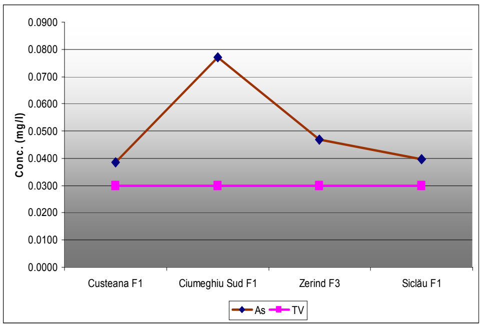


Fig. 2. Values higher than the average TV on ind.PO4

The Arsenic (As) - shows the average TV larger than 0030 mg / l in 4 wells: Custeana F1 – 0.0386 mg/l, Ciumeghiu S F1 – 0.071 mg/l, Zerind F3 – 0.0468 mg/l and Siclau F1 – 0.0398mg/l. fig. 2

The lead (Pb) - shows the average values higher than the TV, in three wells: Talpos F3 – 0.023 mg/l, Talpos F4 – 0.031 mg/l and Batar F1 – 0.0269 mg/l.



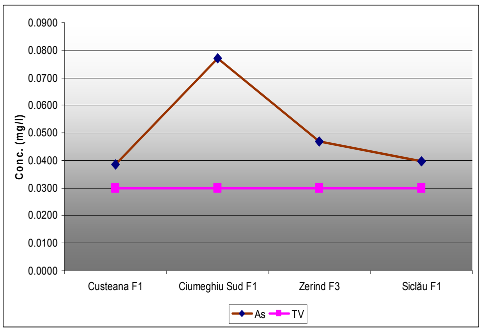
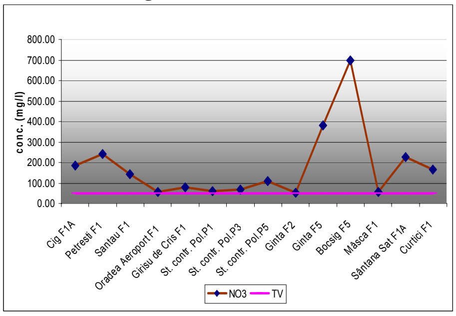


Fig. 3Values higher than the average TV on ind. Pb

Fig. 4 Values higher than the average TV on ind. As

The nitrate (NO_3) - shows the average values greater than 50 mg / l in 14 wells: Cig F1A – 185.11 mg/l, Petresti F1 – 242.4 mg/l, Santau F1 – 144.12 mg/l, Oradea Airport F1 – 55.6 mg/l, Girisu de Cris F1 – 78.64 mg/l, P1 – 61.11 mg/l, P3 – 68.34 mg/l, P5 – 108.2 mg/l, Ginta F2 – 52.8 mg/l, Ginta F5 – 379.94 mg/l, Bocsig F5 – 699.13 mg/l, Masca F1 – 58.11 mg/l, Santana Sat F1A – 225.26 mg/l and Curtici F1 – 165.22 mg/l. Fig. 5



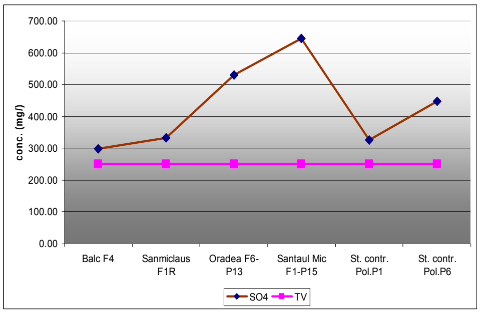


Fig. 5 Values higher than the average TV on ind. NO3

Fig. 6 Values higher than the average TV on ind.SO4

The Sulfate (SO4) - shows the value exceeded in 6 wells: Balc F4 - 298,45 mg/l, Sanmiclaus F1R – 332.05 mg/l, Oradea F6 – P13 – 530.0mg/l, Santaul Mic F1 – P15 – 644.95 mg/l, St. Control. Pollution P1- 324.95 mg/l si P6 – 447.05 mg/l. Fig. 6

Wells were analyzed to assess the chemical status of groundwater from BH Cris were executed during 1966 to 1976. In fig.7 are nitrate concentration has been determined at the implementation of boreholes and the average concentration of nitrates in the period 1993-2009.

One can see the upward trend in the time of this parameter in areas of pressure and impact of agricultural sources.

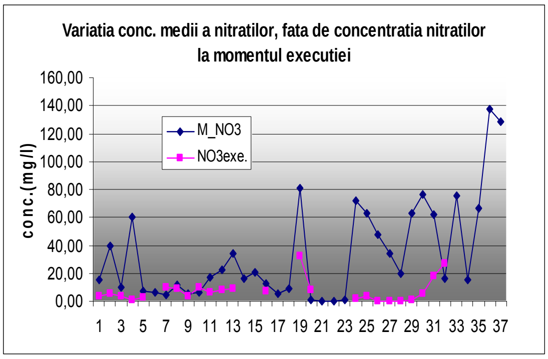


Fig. 7 Variation the concentration of nitrate versus conc. NO3 at the time of execution drilling

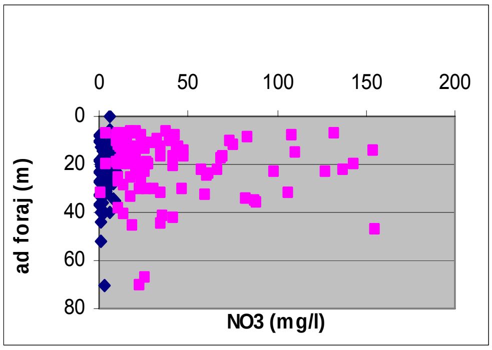


Fig.8 NO3 content variation with depth drilling

The remaining elements were analyzed compared with MAC values in accordance with Law 458/2002 and the natural background values and character set drinking and grandson of monitored point. Determine which indicators were compared with Law 458/2002 and NBL are: Iron, Manganese, Sodium , Calcium, Magnesium, fixed residue and pH.

In assessing the chemical status of groundwater, the results of individual monitoring points have been reported in the water body considered that ROCR01. Comparison of mean values determined in the period 1993-2009, with threshold values (TV) and the Order 137/2009 limit of Law 311/2004, it is found that in all points monitored wells have exceeded one or more indicators analyzed. Of the 103 points (wells) analyzed ROCR01 water body, the following quality classes:

• 48,5 % of the wells shows good chemical status;
• 34 % of the wells show poor chemical status;
• 17,5 % of wells undrinkable nature.

In 50 wells, were not exceeded the threshold of Order 137/2009 indicators studied and good chemical status.

In 35 wells analyzed were recorded higher than average annual values of TV (threshold value) of the Order, especially the wells belonging Pollution Control Station and has poor chemical status, as indicators: NH4, NO3, PO4, SO4, as a result of pollution by domestic and livestock products from the activity. Oradea area and the large livestock (and Cefa Palota).

In 18 wells analyzed, resulting character of the water undrinkable, according to parameters Mn, Fe and Ca, as a result of comparing the average annual values of NBL (natural background values).

Local indicator Pb and I have exceeded the annual average values and believes the area is polluted Local. In Fig. 9 are presented as three classes.

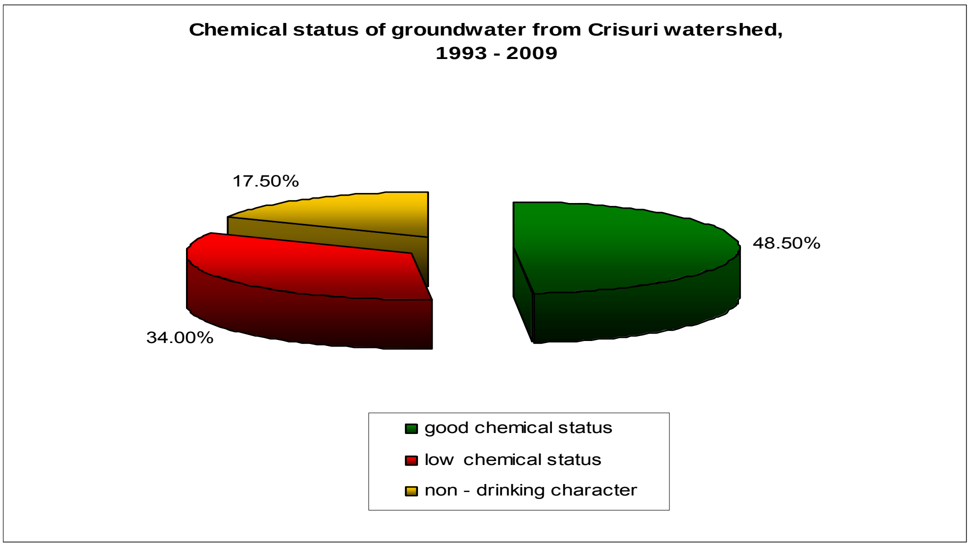
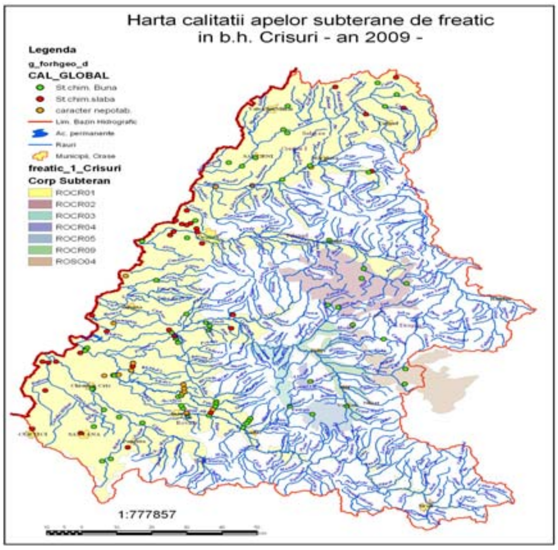


Fig. 9 global chemical status of groundwater



SURSA : ABA Crisuri

Fig. 10 Map of phreatic groundwater quality in three rivers in 2009 bh

These data show that the groundwater aquifer resources, in particular, pose a high risk of pollution, both long term and short term. For this reason they can not be used as sources of water supply for the population.

Because groundwater is moving slowly through the basement, the impact of human activities can affect a long time. This means that pollution that occurred decades ago - whether in agriculture, industry or other human activities - can still threaten the water quality today and in some cases will continue to do so also for several future generations.

Therefore, an important emphasis should be placed primarily on pollution prevention.

In conclusion, the groundwater are "hidden resources" that are quantitatively more important than surface water and that pollution prevention, monitoring and rehabilitation are much more difficult than surface waters due to their inaccessibility.

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