THE IMPACT OF THE PETROLEUM EXTRACTION ACTIVITY UPON IN THE UNDERGROUND AND SUFACE WATERS

Camelia Căpăţînă, Emil Cătălin Şchiopu
"Constantin Brâncuşi" University of Târgu-Jiu, Faculty of Engineering, 3 Geneva Street, 210152 Târgu-Jiu, Gorj, Romania
E-mail: cam@utgjiu.ro

Abstract
The toxicity of the petroleum and of petroleum products is often underestimated. Researches show that, excepting some highly pure products, all petroleum fractions are toxic for the organism.
Two categories of toxic effects on organisms are known: immediate toxicity and long term toxicity. The immediate toxicity is caused by three fractions. Firstly, the saturated hydrocarbons. They are soluble into water and may produce amnesia in small quantities, but in large quantities they can lead to animals death, especially of younger ones. Another fraction is the aromatic hydrocarbons, also soluble into water, but the most toxic ones: benzene, toluene, xylene, fenantrene etc. The third fraction constitutes of olefin hydrocarbons occurring in refining products with an intermediate toxicity as compared to the other two categories.
The petroleum extraction activity is important for the economic development of the district of Gorj. The pollution of the surface and underground waters may be both direct and indirect, especially due to the pollutant emissions in the atmosphere. In order to demonstrate the impact that the petroleum extraction activity has on the underground and surface waters, one has to analyze their characteristic physical-chemical indicators, using standardized methods in conformity with the national legislation. The experimental results show a negative impact of the petroleum extraction activity on the quality of underground and surface waters.

Keywords: petroleum, underground waters, physical-chemical indicators

1. INTRODUCTION

In the district of Gorj, Romania, the industrial activity includes also petroleum extraction activities.
The pollution of the underground and surface waters may be direct (losses and infiltration of fluids) and indirect (emissions of pollutants carried by the wind in the atmosphere, deposited on the soil, washed then by the precipitations and finally infiltrated in the substratum). In the activity of extraction, the petroleum and the deposit water represent potential sources of water pollution from that area [7].
The derrick, for itself, does not represent a source of pollution of the environmental factors. In case some failures appear when sealing the eruption head and other unsealed places or during the current interventions, the derricks may be considered sources of environmental pollution with deposit fluids (petroleum and deposit water).
In most of the cases, the exploitation derricks are equipped with concreted cellars. The derrick cellar is a concrete cellar, which has to retain the fluid losses and positioned in such a way as not to allow the collection of the pluvial waters from the exterior.
In the case of the derricks the main causes that can produce accidental pollutions are the following:

- The lack of derrick squares properly arranged (retention dams for accidental drains, channels to orient the clean pluvial waters);
- The accumulation of derrick fluids and water resulted from precipitations in quantities that override the storage capacity of the cellar;
- The depreciation state of the cellars;
- Unsealed points at the kits and vans at the cap of the derrick, at the ends of eruption or at the joints of their elements.

The most frequent accidental pollutions due to the extraction activities of hydrocarbons are reported for the case of transportation pipes. These accidents are mainly due to the activity of fluids transported, but also to the age and inadequate quality of the materials and technologies used.

The separators park is established from a group of installations located within strictly delimited premises, where the mixture of fluids is separated in the liquid and gaseous phases.

The most vulnerable points as potential sources of pollution within the park are given by:

- The petroleum pipes or the deposit water;
- The basins that present fissures or advanced corrosion;
- Fissures of the pipes;
- Unsealed points of the ventilators or of the used kits.

The paper presents the impact of the petroleum extraction activity on the surface and underground waters.

2. EXPERIMENTAL

For the evaluation of the underground water there have been taken samples from four fountains located in the exploitation of hydrocarbons deposit area. The samples have been taken during the year 2008, each season a sample, from every point. There have been analyzed the following physical-chemical indicators: the pH, the electric conductivity, the chlorides, the ammonium and the total hardness, using standardized methods according to national regulations (G.D., 2005) [1, 4-6].

The main watercourse that drains the studied area is the river Amaradia, affluent of the River Jiu that crosses the district of Gorj, Romania. To mark out the influence of the activity developed in the area on the quality of the surface water, there were taken samples during the year 2008 from the river Amaradia.

For the surface waters there have been analyzed the following physical-chemical indicators: the pH, the CCO_{Mn}, the chlorides, the sulphates, the nitrates, using standardized methods according to national regulations (G.D. 2005) [1].

3. RESULTS AND DISCUSSIONS

Taking into account the fact that the underground waters frequently constitute sources of potable waters for the inhabitants within the area, the results of lab analysis were interpreted according to the value limits established by the Law No. 458/2002, "The quality of the potable water", modified by the law No. 311/2004.

From the analysis of the values obtained for the established physical-chemical indicators, distinct observations can be drawn for each of them.

The pH presents values that integrate within the limits prescribed by the law of potable water, in every sampling point, for the entire period of the year.

The variation of the electric conductivity during the year 2008 in the 4 sampling points is presented in the Figure 1.

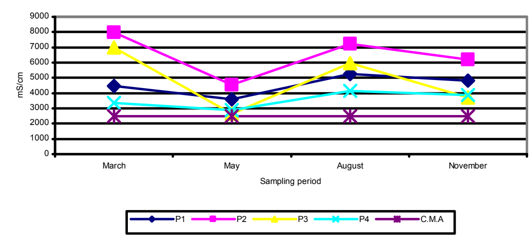

Figure 1 The variation of the electric conductivity in the ground water

For this indicator, the Law 458/2002 prescribes a value limit allowable of 2500 μS/cm. Analyzing the values obtained, one can notice that in all the cases the allowable limit imposed by the law was overridden.

The lowest value was registered in the point 3 in May, being 1.04 times over than the allowable limit. The maximum value has been registered in the point 2, in May, this being 3, 14 times over the allowable limit.

For the chlorides chemical indicator, the Law 458/2002 prescribes an allowable value of 250 mg/L, the variation of chlorides concentration in the 4 sampling points during the year 2008 is presented in the Figure 2.

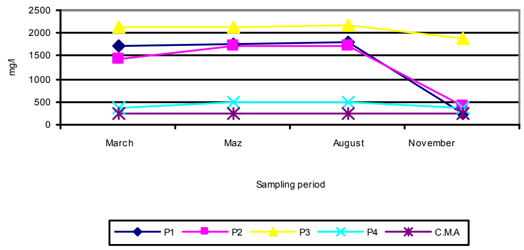

Figure 2 The variation of chlorides concentration in the ground water

Analyzing the values obtained one can notice that in all the cases the allowable limit was overridden by 250 mg/L. the highest values were registered in the sampling point number 3, these oscillating from 7.71 times higher in March to 8.66 higher in August in regard to the allowable limit. The lowest concentrations measured during the whole year were registered in the point 4. These were 1.42 times higher in March and 2 times higher in August in regard to the allowable value.

The allowable limit for the ammonium indicator according to the La 458/2002 is of 0, 5 mg/L. The values obtained in the year 2007 have not passed the allowable limit.

Comparing the results obtained with the limits prescribed by the law, one can notice that the water from the ground water does not integrate within the limits of potability, being registered overflows with regard to mineralization (the conductivity, the chlorides).

For the present case, the values obtained for total hardness of 32^0d in the 4 points of sampling show very hard water.

The interpretation of the results obtained following the accomplishment of the analysis was done according to the requirements of the Order of the environment and water management ministry No. 161/2006 for the sanction of the Normative regarding the classification of the quality of the surface waters with a view to establish the ecological state of the water bodies.

Dependent of the values obtained for the measured chemical indicators this Normative establishes 5 quality classes of the surface waters.

Following the analysis of the results obtained, one may mention the following aspects with regard to the analyzed indicators:

The pH integrates within the limits prescribed by the Normative in force.

Analyzing the values obtained, the chlorides integrate the section analyzed in the quality class III. The chlorides concentration variation in the Amaradia river water, at Hurezani, is presented in Figure 3.

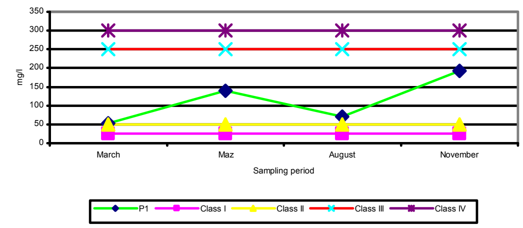

Figure 3 The variation of the Cl^- concentration in the Amaradia river

For the indicator quality conductivity, the Order No. 161/2006 does not stipulate limits [2].

According to the Order No. 161/2006 the results obtained for sulphates integrate the water from the section analyzed in the quality class II.

In the case of the nitrates, the values measured correspond to the quality class II for the water analyzed and are presented in Figure 4.

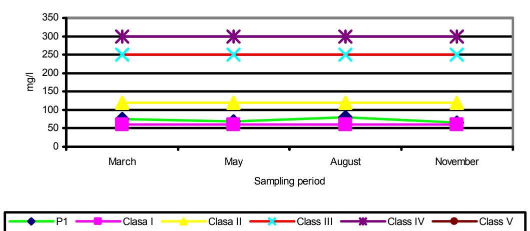

Figure 4 The variation of NO_3^- concentration in the Amaradia river

According to the values obtained for CCOMn the water analyzed corresponds to the quality class I.

Comparing the results obtained with the limits stipulated by the Order 161/2006 one may notice that the river Amaradia, in the section analyzed, corresponds to the class III from the point of view of the representative indicators for salinity (chlorides and sulphates), to the class II for nutrients (nitrates and ammonia) and to the class I of the oxygen regime (the chemical consumption for oxygen).

4. CONCLUSIONS

The physical-chemical indicators experimentally established show a negative impact of the petroleum extraction activity on the surface and underground waters.

The measures to be imposed to diminish the impact that the petroleum extraction activity has on the surface and underground waters are:

• The exploitation derricks have to be equipped with cellars embedded in concrete;

• The fissures in the transportation pipes can be retrieved in due time, without having a significant impact on the waters;

• In order to avoid the accidents and to decrease the negative impact on the surface and underground waters, the technological flux and the work parameters specific to the tank park impose the existence of some equipments and settlements that magnify the safety degree.

5. REFERENCES

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