THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI.
FASCICLE IX, METALLURGY AND MATERIALS SCIENCE
N°. 2 - 2018, ISSN 1453-083X

IMPACT OF HYDROCARBON EXPLOITATION ACTIVITY ON SURFACE AND UNDERGROUND WATERS IN THE AREA

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ABSTRACT

This paper presents the natural components of water, and those of pollution. For this, water samples were taken from the brook that runs through the analysed area, and from a fountain, located on the edge of the village, near which many wells are located. The result of these analyses was compared with the regulation, which refers to the quality of drinking water, aiming at protecting people against the effects of contamination.

KEYWORDS: hydrocarbon exploitation, water quality, contamination

1. Introduction

Exploitation Independenţa is located on the territory of Galati, on the outskirts of the localities, Schela, Slobozia Conachi and Independenţa, about 22 km away northwest from Galati. The discovery of the oil structure Independenţa caused the emergence of a field of wells, reservoir parks, oil deposit, and other annexes, as a result, the agricultural preponderance was diminished by the industrial one.

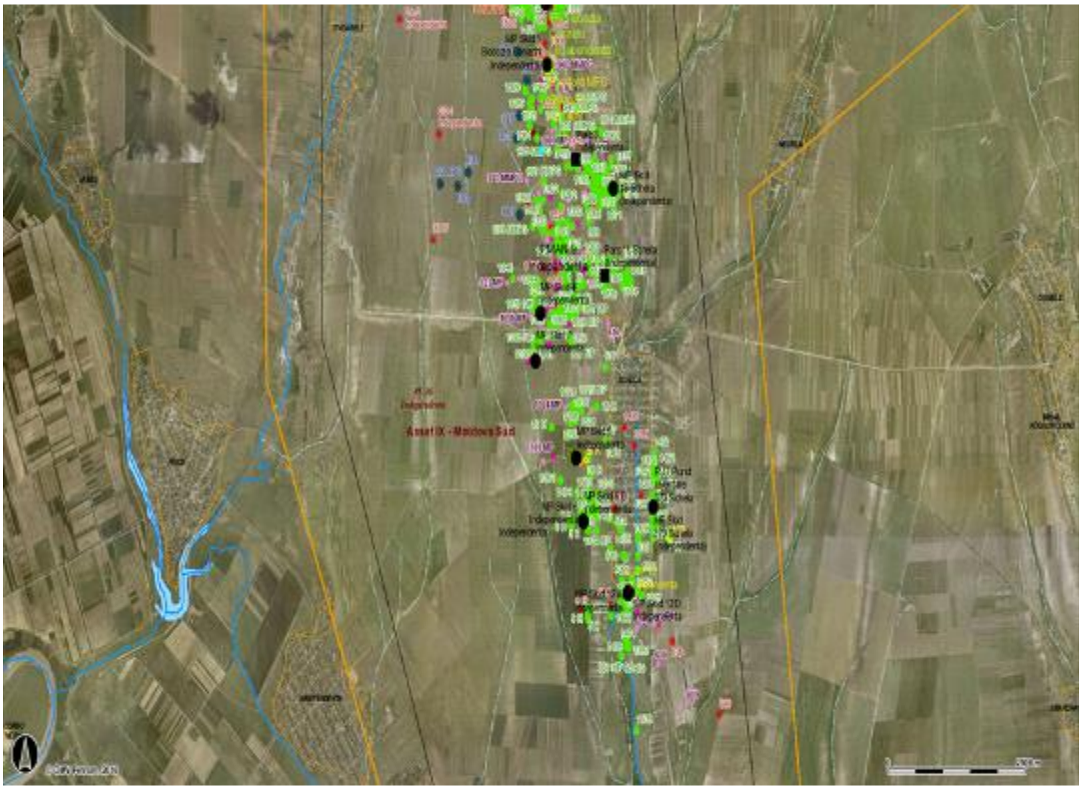

Fig. 1. *GIS Map* ***-*** *Independenţa Oil Zone* [3]

The site is in the river basin of the Siret River, one of the largest rivers in the country, in length, and drained surface. In the area, the hydrographic network is poor, the most important permanent course being the Lozova brook, which collects water from the Căpăţâna Valley, a watercourse, strongly influenced by the precipitation regime. The low volume of precipitation, and the significant level differences, caused the formation of streams, with significant soil erosion, during torrential rains. In this way, many lands are degraded, transformed into pastures [1].

So far, over the Independence structure, more than 800 wells have been dug. Out of these, 420 wells are in operation, and the crude oil flow is about 700 t/day. Wastewater discharge is made by 8 wells [4].

Fig. 2. *Pump unit*

Soil and groundwater pollution can be direct (loss and infiltration of fluids), and indirect (pollutant emissions into the atmosphere, which are worn by wind, are deposited on the soil, where they are washed by precipitation, and infiltrate into the substrate).

By infiltration, of the fertilizers, fungicides for the insect, wastewater and zootechnics, can occur the deep-water pollution. Soil pollution with phenols, cresols, massive residues of petroleum products, leads to the long-term pollution, of the underground water layer with the impossibility of using it [5].

The source of natural pollution, which can cause pollution of surface and underground waters in the Independence oil zone, is the meteoric waters in the form of torrential rains with very high intensities. In this situation, the wells and the parks can be flooded, and subject to partial washing. Surface water, which intercepts the flood, and which transits the land, downstream from parks, to the natural receiver, can suffer both chemical and organoleptic depreciation [2].

2. Determination of water quality

The physicochemical analysis of water aims at determining the natural components of the water, as well as of the pollutants. Water quality control can be done through current, complete or special analyses, depending on the intended purpose [4-6].

Regarding surface water, water samples were taken, outside from the locality, from an area of interest because, in addition to the wells, there is also a park in the area. The two surface water samples were taken as follows: the first sample (A 2) was taken upstream of the park, 50 m away, and the second sample (A 3) was taken downstream, 50 m away from the park.

Regarding groundwater, even if the tanks parks, the oil depot and the annexes related to the Independenta oilfield are on the outskirts of Schela and Slobozia Conachi localities, part of the wells, they reach the neighbourhood of the individual households in Schela. Under these circumstances, a sample of water (A 1) was taken from a village fountain. The water taken from the local fountain is possibly influenced by the activity carried out in the area, considering the probes spreading on the surface of the analysed perimeter, and the underground communication of the permeable porous.

The determinations were made at the Stationary Laboratory for Soil and Water Analysis at Galati Engineering Faculty where the following parameters were determined: pH, turbidity, residual chlorine, hardness, salinity, sulphate, calcium, magnesium.

For the determination of water quality, the stationary laboratory equipment was used to analyse soil and water samples at the Faculty. The analyses were performed with the DR 5000 spectrophotometer, and the portable multiparameter HQ 40d, to determine the pH (Fig. 4, Fig. 5).

After analysis, the samples taken from the Lozova brook will be recorded and compared with the regulations in force concerning the quality of the drinking water (Table 1).

Fig. 3. *Fountain water sampling area (A1)* [3]

Fig. 4. *Spectrophotometer DR 5000* [6]

Fig. 5. *Portable multiparameter HQ 40d* [7]

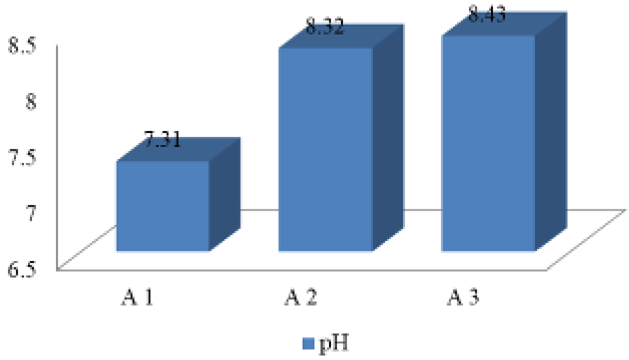

Fig. 6. *pH content of the 3 water samples*

Table 1. *Determinations of the analysed indicators, and their comparison with the laws in force*

Indicator analysed	Unit of measurement	A_1	A_2	A_3	Law 458/2002 Law 311/2004
pH	pH units	7.31	8.32	8.43	6.5 < pH < 9.5
Turbidity	mg/L	1.00	6.00	8.00	<5
Chlorine	mg/L	0.10	0.10	0.10	0.1 < pH < 0.5
Hardness	ppm	41.30	20.30	19.60	5.0
Salinity	‰	12.60	4.49	4.46	-
Sulphate (SO_4^{2-})	mg/L	>3.50	82.00	86.00	250.0
Calcium	mg/L	73.50	78.20	74.90	-
Magnesium	mg/L	134.00	40.40	39.20	-

By analysing each indicator in part, from all three samples taken, we find the following:

• pH - water from the village fountain, has a slightly alkaline character, close to the neutral zone. The two samples taken from the Lozova brook indicate a higher value of alkalinity, exceeding 8 units. However, the value indicated by the regulations in force ranges from 6.5 to 9.5 units, so the pH of the water is ideal and does not seem to be affected by any pollutant;

• turbidity - comparing the three samples taken, we can see that only the water in the well has a degree of transparency, in the normal range of less than 5 units, the other two, exceeding by 1 and 3 units the value required by the regulation. Considering that turbidity is produced, and river deposits, it is possible that this is the main cause of water opacity;

• hardness – it is given by the concentration of calcium and magnesium salts. By comparing the indicated measurement values, we can see that the water in the well exceeds the 8-fold concentration level imposed by the regulations in force. The other two samples, taken from the Lozova brook, exceed the value indicated by the regulation, 5 units, reaching about 20 units. In this case, it is necessary to know the source of the calcium and magnesium salts in the water.

• sulfates - salts of sulfuric acid. The sulphate content of the three samples falls below the limits set by the regulations in force, of 250 units, being quite low in the samples from the Lozova brook, and at a very low level, just 3.5 units at the well water.

• residual Chlorine - The level of chlorine in the water falls within the limits of the law, with an identical value for all three samples taken, of 0.1 mg/L. Since the value indicated by the "Drinking Water Quality" regulations ranges from 0.1 to 0.5 mg/L, we believe that the water in the area under consideration is an ideal one, does not endanger human health, nor does it the environment.

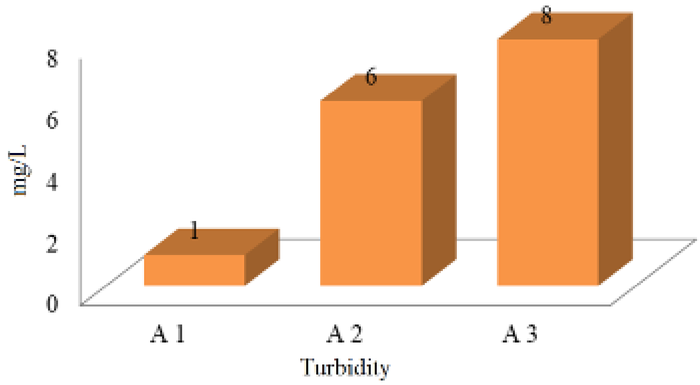

Fig. 7. *Water turbidity in the analysed area*

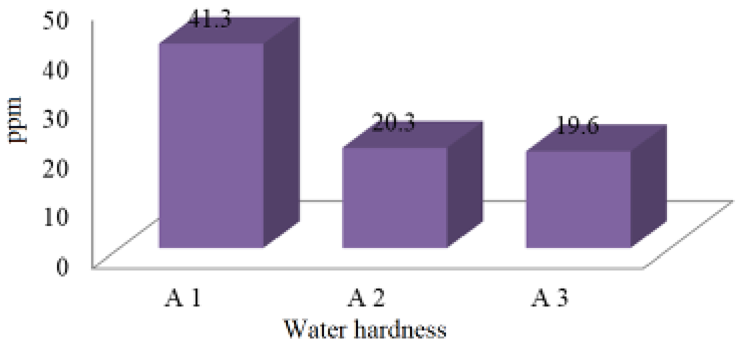

Fig. 8. *Water hardness of samples taken*

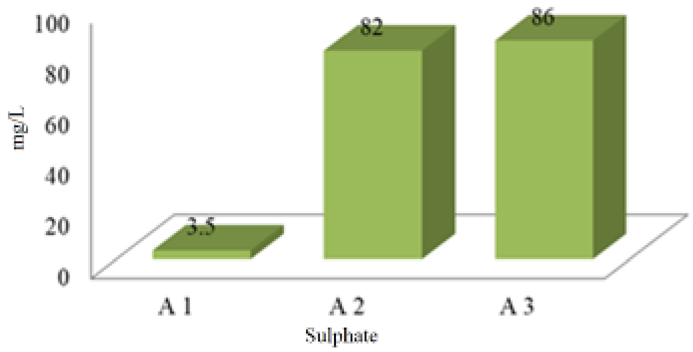

Fig. 9. *Sulphate (SO_4^{2-}) content in water*

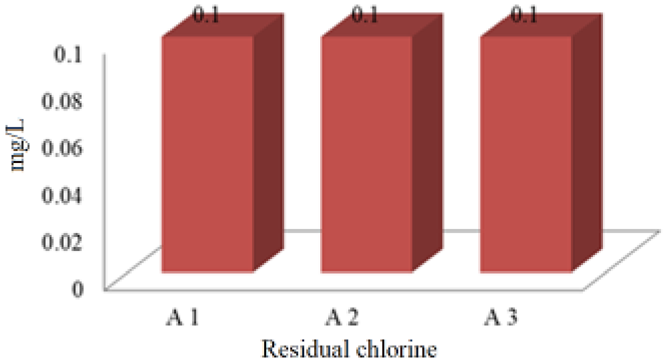

Fig. 10. *Concentration of residual chlorine from the collected water*

3. Conclusions

To analyse the water concentrations, we compared the values recorded by the measuring apparatus with the values indicated by the regulations in force, namely, Law no. 458 of July 8, 2002, regarding the quality of drinking water, and Law no. 311 of 28 June 2004, amending and supplementing Law no. 458/2002 on the quality of drinking water [9].

The present law regulates the quality of drinking water with the objective of protecting human health against the effects of any type of drinking water contamination by ensuring its quality.

As can be seen, the main problem is the high content of calcium and magnesium salts from all three samples, with more emphasis being placed on water in the well, which exceeds 8 times the value required by law. This requires prohibiting the use of that water for drinking purposes, but not its use in irrigating crops.

The analyses on surface and underground water have been designed to determine the natural components of water as well as those of pollution. Samples taken from the brook that runs through the area, and from the fountain, located on the edge of the location where probes are located, indicated quite high values in terms of their hardness. In all three cases, the degree of transparency is exceeded only by the water in the creek. The other indicators correspond to the values indicated by the regulations on water quality.

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