

RESTORATION OF THE AREAS POLLUTED HISTORICALLY WITH PETROLEUM PRODUCTS FROM THE NORTH-EAST OF BIHOR COUNTY

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Abstract

The regulation of the measures for reducing the historically polluted areas aims to protect the human and environmental health from the effects of the soil contamination, by means of measures designed to improve the quality of the environmental factors. To obtain satisfactory results in what concerns the decontamination of some polluted areas, regardless of the chosen remediation technology type, measures must be taken in order to stop the pollution and limit the pollution expansion. Consequently, a depolluted area cannot be used for any purpose, so certain restrictions will have to be implemented and it will be subject to monitoring. The contaminated site of this study is located in the north-eastern part of Bihor county, in the build-up area of the locality of Suplacu de Barcău.

Key words: contaminated site, historical pollution, bioremediation, human health, environmental factors, decontamination, monitoring.

INTRODUCTION

In the process of harmonising the national politics with the politics of the European Union and of transposing and implementing the EU norms and regulations, the problem of the soil and groundwater pollution represents one of the fundamental aspects of the environmental protection.

The remediation of contaminated sites is one of the main components of a sustainable development of the communities on any administrative level. It can form the basis for improving the environmental conditions, the social cohesion and the economic growth. For this purpose, it is taken into account the introduction of functional regulations regarding the prioritisation, the investigation and the remediation of the lands that might present an unacceptable risk for human and environmental health due to the legacy of historical contamination caused by past industrial activities. (Brejea, 2009, 2011)

By means of the European Environment Agency, an analysis was developed at the European Union level, regarding the local contamination of the soil in 2015, the latter being estimated at a number of 2.5 million of

potentially contaminated sites in the 39 countries that participated in this study and out of which 45% were identified. Approximately one quarter of the estimated total of 342,000 contaminated sites of the 39 countries have already been identified and approximately 15% of these 342,000 sites were remediated (European Environment Agency, 2018).

At national level, the National Strategy and the Action Plan for Contaminated Site Management was drawn up for addressing the problems related to the soil and groundwater contamination, as a consequence of past and recent anthropic activities performed on the industrial sites, and for the human and environmental health.

As a consequence of performing both historic and recent economic activities, in the absence of an appropriate legislative framework for the prevention of pollution and the protection of the soil and subsoil, a number of 1,682 contaminated/potentially contaminated sites were identified in Romania and are registered until now.

The first inventory of contaminated or potentially contaminated sites was made in the years 2007-2008. These have been identified by the National Agency for Environmental Protection, through the subordinated units, based on the analysis of the documentation that formed the basis for issuing the regulatory documents. A number of 1,682 contaminated/potentially contaminated sites have been identified, representing areas in which mining, metallurgical, petroleum, chemical and other industrial activities were mainly performed at a large or small scale.



Fig. 1. The map of the contaminated and potentially contaminated sites of Romania. (image taken from the website of the National Agency for Environmental Protection.)

In Bihor county, there are 17 contaminated sites and 67 potentially contaminated sites, registered until now.

The contaminated site refers to a clearly defined area where the presence of soil contamination was confirmed and this fact represents a potential risk for humans, water, ecosystems or other receptors.

The potentially contaminated site refers to a location where unacceptable soil contamination is suspected, but it has not been verified, and where detailed investigations must be performed in order to verify if there is an unacceptable risk of adverse effects on the receptors.

The north-east of Bihor county has been an area dedicated to oil extraction since the 1970s. Before 1989, the Romanian industry was the property of the Government and after 1990 the privatisation process began. In the case of some privatisations, contracts were concluded in order to transfer the environmental obligations to the new owner/operative. The owner of the site contaminated with petroleum products, analysed here, is OMV PETROM, which in 2016 has conducted investigations on the location by collecting samples. The collected samples were analysed in order to determine the total petroleum hydrocarbons (TPH) concentration. The purpose of the investigations was the establishment of the degree of soil contamination on the well location (site) and the proposal of the remediation method for the land in question. The well site is located within the build-up area of the locality of Suplacu de Barcău, at an approximate distance of 500 m from the residential area. The well was drilled in 1977 and its activity was concluded in 1988, due to a lack of inflow and being defective, it was closed.



Fig. 2 The locality of Suplacu de Barcău and the identification of the location.(location established following the STEREO 70 coordinates)

In 2016, depth abandonment works were carried out, based on the agreement issued by the National Agency of Mineral Resources, and works of surface abandonment, remediation and rehabilitation of the location soil are still to be performed. The surface abandonment represents a set of surface works executed for the purpose of restoring and rehabilitating the well locations, executed after the depth abandonment works are completed.

The well site represents the area on which the well was set during the well design/exploitation phase and it consists of:

- drilling installation;
- metallic tanks of 30 m³ capacity for the storage of process water and drilling fluid;
- metallic tank of 30 m³ capacity for the FPE water supply;
- protection zone;
- access road

The area taken into account is of 856 sq m – location area, of which 598 sq m represent the well site and 258 sq m represent the access road. The objective of the well was the exploitation of the hydrocarbons quartered in the collectors from the basal Pannonian of the Suplacu de Barcău structure, at a depth of 154 m (OMV Petrom, 2018).

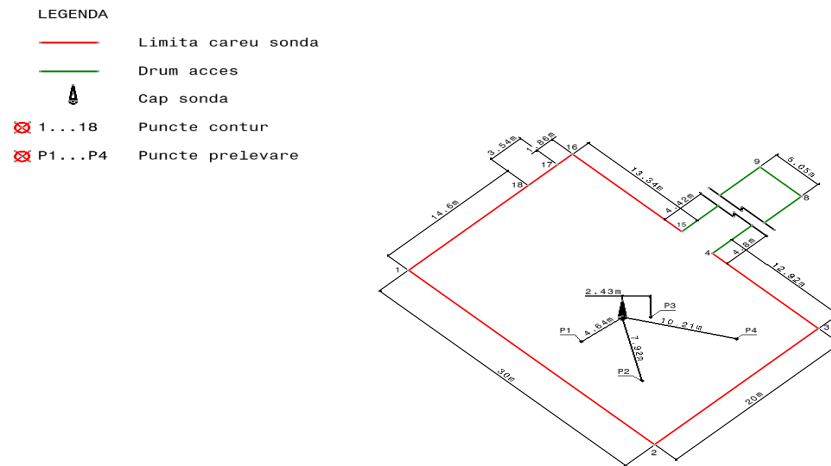


Fig. 3. Represents a well site and the access road

Investigation methods:

Following the identification of the well location with the help of the GARMIN GPS equipment, the sample collection points have been arranged based on the established general sampling plan, taking into account the actual situation on the ground, the history and the type of the well.

The arrangement of the sample collection drilling and the soil sample collection depths have been established taking into account the

pollution sources from the operation period and the location conditions on the collection date. To determine the polluted area, 4 soil sample collection drillings have been performed, set as follows:

- a central drilling: P 3 - in the proximity of the well column at a distance of 2.43 m

- 3 drillings: P1- set at a distance of 4.64 m to the west of the well column

P2- set at a distance of 7.92 m to the south of the well column

P4- set at a distance of 10.21 m to the east of the well column

It is presumably contaminated as in the period of operation (1977 - 1988) there was a pollution potential. The soil samples collected from the 4 points set at different distances from the main well column have been taken from the natural terrain elevation of 0.05 m to 0.90 m deep, as follows:

Fig. 5 Tables 1-4: The results of the laboratory analyses regarding the values of the TPH indicator in the collected samples:

Table 1

Collection of soil samples at a distance of 4.64 m from the well column

No.	Sample coding	Depth of sample collection m	TPH mg/kg DM
1	P1	0.05	21600
2	P1	0.30	348
3	P1	0.60	120
4	P1	0.90	160

Table 2

Collection of soil samples at a distance of 7.92 m from the well column

No.	Sample coding	Depth of sample collection m	TPH mg/kg DM
1	P2	0.05	2520
2	P2	0.30	120
3	P2	0.60	104
4	P2	0.90	192

Table 3

Collection of soil samples at a distance of 2.43 m from the well column

No.	Sample coding	Depth of sample collection m	TPH mg/kg DM
1	P3	0.05	3400
2	P3	0.30	5400
3	P3	0.60	46400
4	P3	0.90	320000

Table 4

Collection of soil samples at a distance of 10.21 m from the well column

No.	Sample coding	Depth of sample collection m	TPH mg/kg DM
1	P4	0.05	14400
2	P4	0.30	2400
3	P4	0.60	480
4	P4	0.90	960

Table 5

The reference value for (TPH) according to the Order 756/1997 of MAPP (Romanian Ministry of Environment, Water and Forests) expressed in mg/kg DM

Traces of pollutant	Normal values	Alert thresholds/ Types of use		Intervention thresholds/ Types of use	
		Sensitive	Less sensitive	Sensitive	Less sensitive
1	2	3	4	5	6
Total Petroleum Hydrocarbons (TPH)	<100	200	1000	500	2000

RESULTS AND DISCUSSION

Due to the contaminated site positioning, in the build-up area of the locality of Suplacu de Barcău, it is included in the category of sensitive land use. According to Order 756/1997, article 8, paragraph a) the sensitive land use represents the use of the land for residential and recreational areas, for agricultural purposes, as well as the land areas provided for such future use.

The results of soil samples taken for the P1 drilling indicates that:

- at a depth of 0.05 m, that is at a natural terrain elevation, there is a high TPH concentration, of 21600 mg/kg of dry matter (DM), the intervention threshold of 500 mg/kg DM for sensitive land being exceeded.
- at a depth of 0.30 m, there is a high TPH concentration, of 348 mg/kg of dry matter (DM), which is under the intervention threshold of 500 mg/kg DM for sensitive land, but above the alert threshold of 200 mg/kg DM

The results of soil samples taken for the P2 drilling indicates that:

- at a depth of 0.05 m, that is at a natural terrain elevation, there is a high TPH concentration of 2520 mg/kg of dry matter (DM), the intervention threshold of 500 mg/kg DM for sensitive land being exceeded.

The results of soil samples taken for the P3 drilling indicates that:

- at a depth of 0.05 m, that is at a natural terrain elevation, there is a high TPH concentration of 3400 mg/kg of dry matter (DM), the intervention threshold of 500 mg/kg DM for sensitive land being exceeded.
- at a depth of 0.30 m, that is at a natural terrain elevation, there is a high TPH concentration of 5400 mg/kg of dry matter (DM), the intervention threshold of 500 mg/kg DM for sensitive land being exceeded.
- at a depth of 0.60 m, that is at a natural terrain elevation, there is a high TPH concentration of 46400 mg/kg of dry matter (DM) was found, the intervention threshold of 500 mg/kg DM for sensitive land being exceeded.

- at a depth of 0.90 m, that is at a natural terrain elevation, there is a high TPH concentration of 320000 mg/kg of dry matter (DM), the intervention threshold of 500 mg/kg DM for sensitive land being exceeded.

The results of soil samples taken for the P4 drilling indicates that:

- at a depth of 0.05 m, that is at a natural terrain elevation, there is a high TPH concentration of 14400 mg/kg of dry matter (DM), the intervention threshold of 500 mg/kg DM for sensitive land being exceeded.
- at a depth of 0.30 m, that is at a natural terrain elevation, there is a high TPH concentration of 2400 mg/kg of dry matter (DM), the intervention threshold of 500 mg/kg DM for sensitive land being exceeded.
- at a depth of 0.60 m, that is at the natural terrain elevation, there is a high TPH concentration, of 480 mg/kg of dry matter (DM), which is under the intervention threshold of 500 mg/kg DM for sensitive land, but above the alert threshold of 200 mg/kg DM
- at a depth of 0.90 m, that is at a natural terrain elevation, there is a high TPH concentration of 960 mg/kg of dry matter (DM), the intervention threshold of 500 mg/kg DM for sensitive land being exceeded.

After comparing the laboratory results regarding the TPH value with the reference values of the Order 756/1997 of MAPPM expressed in mg/kg DM, there is a historical pollution of the land with petroleum products. The exceedance of the concentrations of one or more soil pollutants of the alert and intervention thresholds for the existing land use is considered to have an impact on the environment (Ord. MAPPM 756/1997).

Using the affected area for sensitive use is allowed only after carrying out the remediation measures. The remediation measures are established based on the results of the risk assessment and on the estimation of the costs and remediation benefits. For the remediation activities, the holder is responsible for the involved works and will submit to the local authorities the proof that through the remediation works, the concentrations established as remediation objectives by the competent authority, were turned off.

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