CURRENT STAGE OF THE RESEARCH ON THE SOIL POLLUTION WITH PETROLEUM PRODUCTS AS A CONSEQUENCE OF OIL EXTRACTION AT NATIONAL AND LOCAL LEVEL

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Abstract

According to the Constitution, the Romanian State recognizes the right to a healthy and ecologically balanced environment of every person, thus guaranteeing the right of association in environmental protection organisations, the access to information regarding the environment, the right to indemnification in case of damage, the right to bring before the court environmental issues, the right to be consulted in the decision-making process. In the process of harmonising the national policies with those of the European Union and of transposing and implementing the provisions of the EU regulations, the soil pollution problem represents one of the fundamental aspects of the environmental protection and the guarantee of a sustainable ecosystem development. The remediation of contaminated sites is one of the main components of a sustainable development of the communities at every administrative level. It is the basis for improving the environmental conditions, the social cohesion and the economic growth.

Key words (contaminated site, bioremediation, soil pollution, EU regulations, ecosystem, sustainable development, environmental damage, environmental protection, legislation).

INTRODUCTION

The National Agency for Environmental Protection is trying to implement a National Strategy and a National Action Plan for the Management of the Contaminated Sites of Romania, which aim at reducing the impact on the environment, generated by soil contamination. As a result of the industrial revolution, Romania inherited numerous historically contaminated sites. The history of the contamination and the aspects related to property differ from one site to another. During the development of the anthropic activities, each owner of the potentially contaminated or contaminated site had a contribution in what concerns the pollution. The strategy and action plan consists of promoting legal norms that can establish the responsibility percentage of each land owner, proportionally with the

rate of contribution to the soil contamination (National Agency for Environmental Protection 2019) .

The agriculture has an essential impact on the carbon dioxide (CO2) and nitric oxide (N2O) emissions from soil. The EU soils contain more than 70 billion tons of organic carbon, which means almost 50 times more than our annual greenhouse gas emissions. The loss of organic matter from soils and, consequently, the increased CO2 emissions represent an extremely serious issue as they contribute to the climate changes.

The importance of the soil as a non-renewable resource, essential for a sustainable environment, should be recognised through broad policies and measures for its protection.

The Romanian oil and gas industry has a history of over 150 years and it has an important role for the Romanian economy. The Romanian natural gas production covers 80% of the internal consumption and the crude oil production covers approximately 40% of the necessary oil.

The first record of oil production began in 1857. The first Romanian refinery was established in the area of Ploiesti, about 60 km north of Bucharest. The production increased constantly from approximately 1.9 million tons per year in 1914 to approximately 8.7 million tons per year in 1936.

Fig. 1. Petroleum field in Moreni, 1920
Image source: APM Bucharest site

This paper refers to the current problems of the impact that the petroleum and oil exploitation activities have on all the environmental factors, but especially on the soil and subsoil from the north-west area of

Bihor county, in Suplacu de Barcău. The purpose of this paper is to identify the sites historically polluted with petroleum products and the methods for remediating and integrating the lands in the agricultural circuit based on the land classification (Brejea,2009,2011).

The following were used for composing this paper: specialised bibliography, personal observations, documentary research, the creation of an overview of the qualitative and quantitative state of the lands.

The commune of Suplacu de Barcău is composed of six localities: Borumlaca, Dolea, Foglaş, Suplacu de Barcău, Valea Cerului and Vâlcelele. The commune centre is Suplacu de Barcău. The commune is on the eastern part of Bihor, approximately 75 km north of Oradea. It has an area of 4448 ha, out of which 775.53 within the built-up area, and a population of 4522 inhabitants.

The limits of the locality are established by the borders with the other territorial and administrative divisions that compose it:

N- Balc locality, Bihor county commune

S- Popesti locality, Bihor county commune

E- Marca, Sumal, Port localities from Salaj county

V- Abram locality, Bihor county commune

On a distance of 57 km towards west, it skirts the locality of Leta Mare on the Romanian border with Hungary.

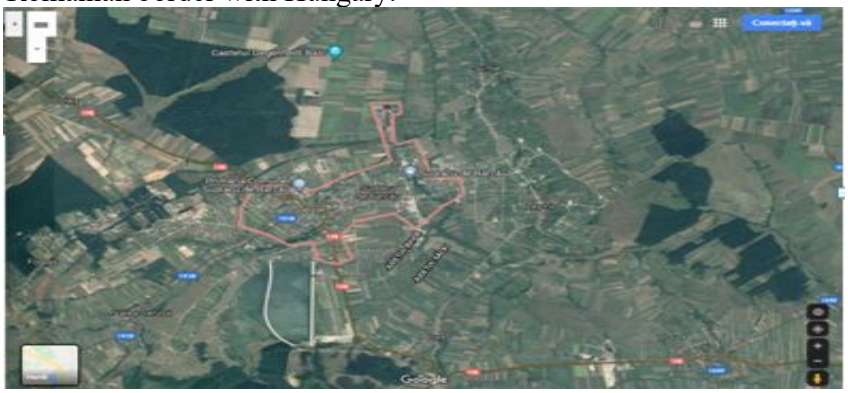

Fig. 2 Map - geographic location of Suplacu de Barcu (Google Maps source)

The studied areas are located in the built-up area and outside the built-up area of Suplacu de Barcau, being bordered by unproductive or productive lands, and nearby there are extraction activities, pipeline transport, oil processing and oil containment/storage.

Mainly because of the natural exhaustion of oil and gas resources, and the decrease in volume of the exploitation and investment works, the annual natural gas and oil production decreased in 2013 to 4.19 million tons

of oil and 11.03 billion m³ of natural gas. However, in 2018, Romania remains the largest gas and oil producer of Central and East Europe.

Oil and natural gas value chain

The value chain of the oil and gas industry is divided into three main sectors: - Upstream,
- Midstream,
- Downstream

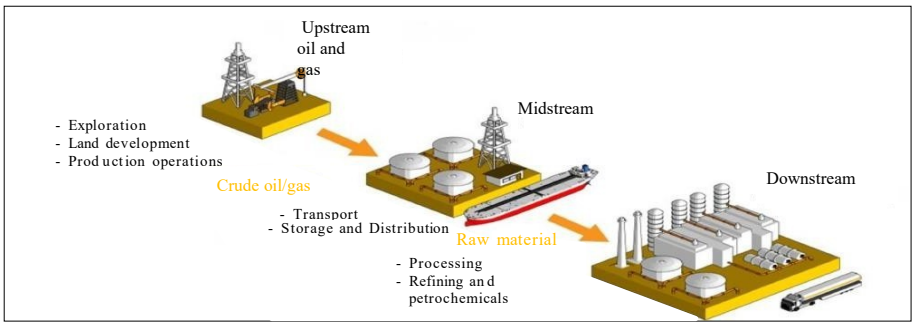

Fig. 3: The value chain of oil and natural gases - upstream, midstream and downstream sectors (source: Arcadis Design and Consultancy for natural and built assets)

The upstream sector includes the exploration (search and detection) of onshore and offshore natural gas and oil deposits, the drilling of exploration wells and, afterwards, the drilling and exploitation of the production wells for obtaining oil or natural gases (The HC BREF is not a part of the information exchange under the IED/IPPC Directive, 2014).

Upstream sector

According to the information provided by the Romanian Petroleum Exploration and Production Companies Association (ROPEPCA), in 2018 in Romania there were 450 oil and gas deposits and over 13.000 active wells.

The ongoing exploitation activities in Romania include:
- 255 commercial oil and natural gas deposits with approximately 9.450 oil wells and 830 natural gas wells, where petroleum agreements are owned by a single company, an oil and natural gas producer;
- 153 commercial deposits with approximately 3.200 natural gas wells, for which the petroleum agreements are owned by a single company that carries out activities in the natural gas sector;
- other 39 deposits for which petroleum development-exploitation and petroleum exploitation agreements have been concluded, with various

companies as holders. Most deposits are mature, with an exploitation duration of over 25-30 years.

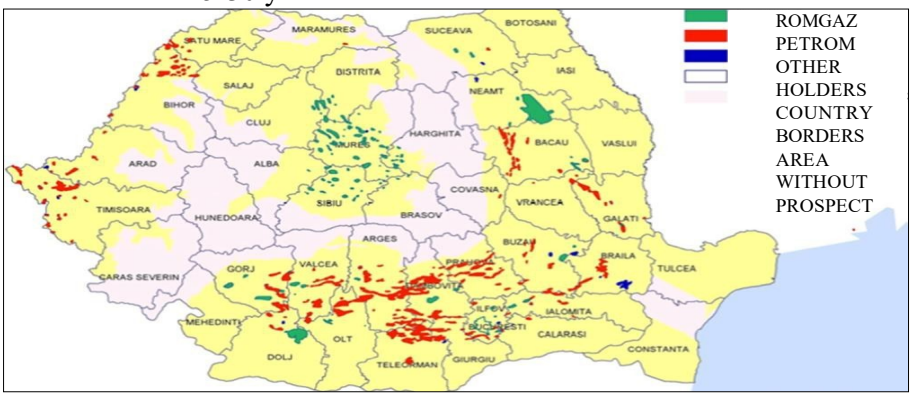

Fig 4. Onshore gas and oil concessions in Romania
Source: Romanian National Agency for Mineral Resources

A recent update of the 2017 register establishes that the number of contaminated sites from the oil and gas industry of Romania reaches 516. Other 60 sites have been classified as decontaminated .

The numbers displayed in the table include the total number of contaminated sites from the oil and gas industry of Romania for each county. The exploration and production wells have not been considered individually due to their large number. However, groups of wells have been classified as a contaminated site if contamination of the subsoil was registered in that location.

INVESTIGATION METHODS

The risk assessment is a systematic assessment process of the potential risks related to the contamination of soil, ground water or soil vapor. Risk assessments can be used for various purposes, such as:

- tool for assessing the need for remediation,
- tool for assessing the urgency of remediation,
- to assess if precaution measures are necessary or not,
- to establish remediation objectives based on risks.

The risk represents a combination between danger and exposure of a receptor. If one of these three components (source/danger, pathway, receptor) is missing, then there is no risk.

Fig. 5. Source-Pathway-Receptor model source: Arcadis Design and Consultancy for natural and built assets)

A **source** is a substance or an area that has the potential to cause damage or to affect in a negative way the human health or the ecological integrity. Among others, potential danger sources on an industrial location are: leakage from storage tanks and pipelines, vapor emissions, inappropriate waste management. Such sources can lead to the contamination of soil, soil vapor, groundwater and/or air. In this sense, the source is slightly differently defined compared to the classic definition used in the brownfield management, where "source" means the area where the contamination is produced and which presents high concentrations of soil-associated contaminants.

The **pathway** is the link between the "source" and the "receptor". There are three main exposure pathways:

- Skin contact (for instance, touching the contaminated soil or washing with contaminated water that comes from a contaminated river of aquifer).
- Inhalation exposure (inhalation of contaminated dust, usually caused by aeolian erosion of contaminated soil or vapour inhalation.
- The contaminants from the soil vapours could evaporate and gather inside buildings, where they can be inhaled. Generally, their evaporation into the atmosphere will not lead to critical concentrations in the atmospheric air due to immediate dilution).
- Ingestion (for instance, the consumption of contaminated soil, the food cultivated in contaminated soil).

Also, the migration of the contaminants dissolved in the groundwater can represent an exposure pathway towards the receptors outside the location. In this case, the risk assessment will consider the delay, dilution and

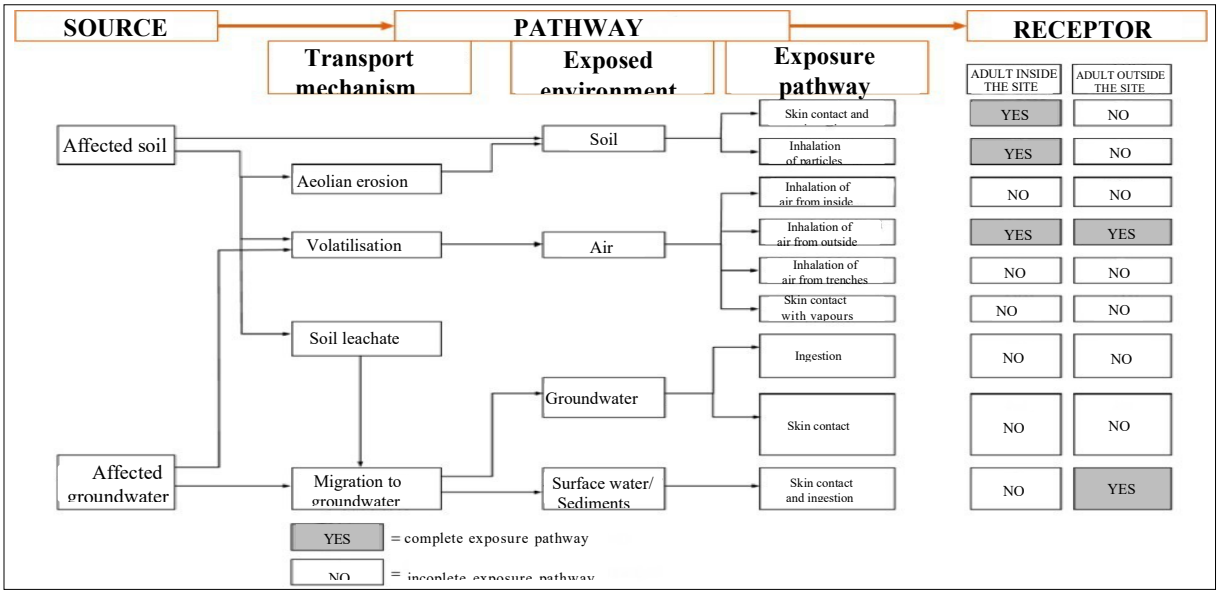

Fig. 6: The MCS example of human health (highlighting site-specific relevant pathways) source: Arcadis Design and Consultancy for natural and built assets)

CONCLUSIONS

The rehabilitation of new lands in agricultural and forestry production, the increase of the land fund and its preservation are necessary for the agri-food production increase. The land is extremely important for agriculture, constituting the main means of production, because, through its soil layer, it is the source of nourishment for plants, which, with the help of solar energy, transform the mineral substances from soil into organic matter. The millenary existence of humanity is closely linked to this process, as it represents the basis for acquiring food and raw materials for the manufacturing industry.

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