Поскольку за год по разному подсчету в оазисах в среднем наливается примерно около 1 мм отложений, то наличие слоя мощностью примерно в 1 метра указывает на то, что этот массив орошается более 1000 лет.

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Geoecological problems of development of heavy oil and natural bitumen deposits

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Аннотация

Обсуждаются некоторые экологические проблемы, возникающие при добыче тяжелой нефти и природного битума, и способы уменьшения негативного влияния добычи тяжелой нефти и природного битума на биосферу. Рассмотрены экономические и экологические аспекты этой проблемы. Отмечена экологическая опасность широко используемых методов освоения такого вида УВ сырья.

Ключевые слова: запасы, влияние на биосферу, экология, геоэкология, добыча, тяжелый нефть, природный битум, технология.

Abstract

Some environmental problems arising from the extraction of heavy oil and natural bitumen and ways to reduce the negative impact of heavy oil and natural bitumen production on the biosphere are discussed. The economic and ecological aspects of this problem are considered. The environmental hazard of the widely used methods for the development of this type of hydrocarbon raw material is noted.

Keywords: reserves, impact on the biosphere, ecology, geoecology, production, heavy oil, natural bitumen, technology.

The natural state of the environment is affected very negatively by all sectors of the economy, but in today's serious situation, it is worthwhile to separate the most important types of industries, the development of which is considered relatively destructive for the environment.

The development of hydrocarbon resources is accompanied by geological exploration, drilling and construction works, trunk pipelines, roads, urban and residential areas, and the

development of local industries. In general, on the border of the territories of oil and gas extraction there are factors of different technogen influences on the natural environment in significant quantities, depending on the methods and nature of occurrence of its sources and species.

The modern stage of the world economy is characterized by an increase in the scale of the extraction of natural resources, a sharp complication of the process of interaction between nature and society, the rapid development and growth of a specific range of natural-anthropogenic processes due to the influence of technology on nature.

Geocology and the extraction of natural resources are closely interrelated: without understanding the processes (natural and anthropogenic) at the global level, there is no sustainable use of natural resources. The main difference between geocology and the use of natural resources is that geocology is highly focused on understanding very complex natural systems (eco -, geosystems), while the use of natural resources – on the rational use of resources. Ignoring the scientifically based principles of the use of natural resources leads to a number of crisis situations that are characteristic of most regions of the world in nature and economy [1].

Geocology allows to study the laws of the geological and geophysical environment associated with its natural formations (atmosphere, biosphere, hydrosphere), as well as to assess the impact of human activities on the use of natural resources.

Over the past decades, the share of heavy high-viscous oils and natural bitumen has increased significantly, including those that are difficult to obtain in the structure of the reserves of a number of oil-producing countries of the world (unconventional). The extraction of such raw materials is increasing very slowly compared to their share in the total volume of reserves. This disbalance leads to a reduction in the resource base and deterioration of its quality, in particular characteristic for the old mining regions. The issue of development of this type of oil resources is now considered very urgent due to the decrease in the volume of oil reserves in the following years.

Heavy oils and natural bitumen are characterized by aromatic hydrocarbons, a high content of tar-asphalt substances, a high concentration of metals and sulphur compounds, high indicators of density and viscosity, high coking properties. This leads to the high cost of extraction, the practically impossible of transmission through existing oil pipelines, and the nonrentability of processing oil according to classical schemes.

As already mentioned above, the technology of mining, transportation and processing of such reserves is difficult and requires considerable funds. But due to the multi-component nature of their composition, they can be considered not only as an energy source, but also as complex raw material of the XXI century. Their composition has a condensation concentration of rare and non-ferrous metals, in addition to hydrocarbons and other components, in particular heavy hydrocarbons are a high potential source of vanadium raw material from the mineral source. For example, every ton of heavy oil from the Atabaska (Canada) field contains 250 g vanadium, 100 g nickel, while the oil from the Bokan (Venezuela) field contains 1200 g vanadium and 150 grams nickel. Most of Russia's oil fields contain a large amount of vanadium, nickel, silver. In addition to vanadium and nickel in the oil of the Samotlor deposit, it is found that there is gold, chromium, manganese, iron, etc. More than fifty precious metals were identified in total in the various oil deposits of Russia. From these hydrocarbon raw material it is possible to get products that are important for the national economy.

According to experts estimates, the geological reserves of vanadium five oxides amounted to 1,312 million tons only in vanadium deposits, which are large in their reserves, while the associated with oil will be taken 0,213 million tons. Vanadium is one of the important legalizing elements used for the production of steel and castings. The main part of vanadium is used in the production of corrosion protection pipes, large-diameter main gas and oil pipes, long bridges, large-volume reservoirs, construction steel used for the construction of

transport machinery and automobiles. Approximately 70% of vanadium in the world is extracted from the sludge obtained when processing natural bitumen of heavy oil and bituminous sandstone. In developed countries (Canada, Japan), vanadium is completely extracted from heavy high-viscous oil.

The anomaly of the physical and chemical properties of heavy hydrocarbons, and most importantly their high viscosity and density, leads to the fact that traditional methods of extraction are often ineffective for the extraction of heavy oil and natural bitumen, and in a number of cases remain completely unsuitable. Therefore, in order to develop the deposits of high-viscous heavy oil and natural bitumen in industrial significance, special technologies of extraction, transportation, primary preparation and processing are needed, taking into account their properties. Naturally, such technologies require large energy and material costs. These costs increase significantly, especially in the cold autumn-winter period. Therefore, it is necessary to analyze the accumulated experience of the world in solving the geoecological problems of developing the reserves and natural bitumen deposits, in which oil is difficult to obtain [2].

The method of extraction has a certain effect on the properties of hydrocarbons and the preservation of associated components to this to some extent. When choosing a method of using heavy oil and natural bitumen deposits, these negative effects should be taken into account. In the implementation of methods of extraction through the well, heavy oil and natural bitumen are first diluted by heating the layer or injecting the solid solutions, and then obtained through the well. Heating hydrocarbons can be carried out in different ways. Heat method change the physical and chemical properties of the extracted product. As a result of the application of the method of fire generation inside the layer, irreversible loss of metals in the extracted oil occurs. When the method of fire generation is carried out inside the layer, the average amount of vanadium and nickel in the oil (from the beginning in %) is 38,6-39,5% in the zone of intense exposure, 64,24-77,2% in the zone of average exposure, 81,5-91,7% in the zone of weak exposure and 100% in the zone of not effected. When using the method of exposure to hot steam, the loss of associated components does not exceed 10-15%. In mining, the rock saturated with oil or bitumen is transported to the earth surface, while hydrocarbons are separated from it by solvents, hot water and steam, and other agents. Here achieves a relatively high oil extraction coefficient and makes it possible to use raw materials complexly [3, 4].

Such deposits are potentially poisonous in terms of their composition, for example, heavy sulphur-containing oils and natural bitumen, the content of which is abundant in metals, sulphur or mercury gases, etc. Therefore, the first task of assessing environmental risks in the assimilation of this type of HC raw material is the study of the quality of raw material from the stage of search work. This creates an opportunity to predict the conditions of environmentally safe development, processing and extraction.

It is known that in oil more than 60 different elements are identified. Among the biologically active toxic elements vanadium, nickel, cobalt, sulphur, sometimes uranium, mercury, arsenic reach relatively high concentrations. In natural raw material, they can be in active or safe form. Vanadium and nickel are concentrated in the resin-asphalt fractions of heavy oil even during geological periods of time, practically without moving to dissolving compounds. During the search work, they do not bring toxic elements into the environment. But in the conditions of the influence of high temperature in the extraction and processing of the same oil itself, it concentrates these elements in heavy residual fractions and forms a dangerous commodity product for use – vanadium-nickel mazutes, tar, sometimes with the conditional concentration of these elements.

If the presence of sulphur is felt immediately by the smell, then most other biotoxins remain unnoticed. But arsenic or radioactive elements can be detected only with the help of special Studies. This suggests that it is necessary not only to simply study the

qualitative composition of oils, but also to study the toxic components that are more common in them.

If viewed from the point of view of the duration of storage in the environment, for example, hydrogen sulfide pollution can be calculated relatively short-term, while the metals of heavy oil accumulate unnoticed, spread slowly, the cumulative effect of which can not be practically eliminated, almost pre-assessing the general effect of their biological effect.

An increase in techno seismicity can lead to a violation of bioresources [5]. It is also necessary to take into account the processes of anomalous reactions of living substances, in particular their enrichment with toxicants in the biosenosis zones [6]. Vanadium and nickel are actively assimilated with the plant (merged, mixed), enter the natural biocycle, go into the ground waters, the dust breathes with its impurities. That is, in the direct contact of all living things with metals separated from oil, many opportunities are created [7].

Although there is not enough accurate data on the amount of toxic hazardous elements in the oil of individual deposits, the overall level of study of the metal content of the oil is relatively high in order to properly guide future research on this problem.

This control of the quantity for oil, first of all, sulphur, vanadium, nickel, cobalt, uranium and arsenic, for gases –hydrogen sulfide, mercury and arsenic vapors. Including vanadium, nickel and uranium can be collected in asphalt-tar fractions of heavy oil [6].

General forecasts of this type can be used to predict the ecological situation on the border of individual oil and gas bearing regions, but without accurate chemical-analytical studies, it is impossible to conclude whether there are toxic elements in the composition of the deposits and the safety of the deposit.

Heavy oil and natural bitumen enter the inexhaustible natural resources and are relatively irreversible. Bitumen does not repeat the composition and properties of traditional oil, due to this it is considered as complex raw material for a number of sectors of the economy: petrochemicals, chemical metallurgy, construction, etc.

Until now, bitumen was not considered as a valuable hydrocarbon material by its energy and chemical properties, since there were no profitable technologies for their extraction and processing. Currently available technologies in most countries do not allow the extraction of natural bitumen to be economically feasible and environmentally safe [8].

The most promising areas for solving environmental protection problems in the extraction and processing of natural bitumen are the transition to the effective use of natural resources on the basis of low-waste (in the future, production without waste) technologies. The overall efficiency of investments in nature protection measures to protect the atmosphere from pollution by impurities (sulphur, vanadium and nickel) is significantly higher than the normative index, which is evidenced by the high efficiency of these measures [9, 10].

In summary, it can be said that the oil and gas production network is one of the most environmentally hazardous sectors of land use. It is characterized by a large volume of energy, significant pollution of large areas and high fragility of industrial facilities fire. Protection of the landfill provides for the implementation of a complex of measures to prevent the loss of oil and gas, ensure the safety of the population, rational use of surface and groundwater, prevent their pollution.

In the extraction of oil and natural bitumen, it is not possible to reduce the technological impact on the environment without assessing the state of geological environmental components.

The main task of geoecological analysis is the research of the system «geological-geophysical – natural-technological processes».

When developing heavy oil and natural bitumen deposits, it is necessary to carry out:

- evaluation of the geodynamic stability of the territory;
- to identify the principles of geoecological analysis of the area;
- separation of types of geoecological hazards;
- evaluation of the geoecological risk of the area.

In order to implement ways of developing bitumen resources in the long run, it is necessary:

- the first turn development of new technologies and methods of extraction of searched reserves of heavy oil and natural bitumen;
- obtaining raw material without losing its valuable components;
- to maintain the ecological situation and natural ecological state and economic profitability of the work at the objects of extraction.

In the near future, there will be no serious alternatives to fossil fuels. However, its traditional species remained close to the completion of its resources (oil and natural gas). Therefore, before humanity, there is a question of solving a number of tasks related to the creation of new technologies for the extraction of fossil fuels that were not used before, as well as ways of minimizing their impact on the environment.

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