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The ecological situation in contaminated areas of oil and gas exploration in Atyrau region

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Abstract

Oil and gas, as the main levers of economic prosperity of the republic, are the main sources of pollution of the environment (air, water, soil, etc.). For the extraction, transportation, processing and use of energy resources as its presence is observed on the surface of the earth. Major oil and gas reserves according to geological data are concentrated in the west of Kazakhstan, more precisely in the Caspian lowlands, including at the bottom of the Caspian Sea.

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1. Introduction

In Atyrau region developed 43 oil and gas fields, including the unique Tengiz field. Under development is the largest field in the north-eastern part of the Caspian Sea Kashagan East and West with a margin of more than 7 billion tons of oil.

The greatest negative environmental impact on the territory of the North Caspian associated with the development of the Karachaganak oil and gas field, which has a high content of sulfur admixtures, which are often carried out with gross violations of environmental requirements. In this case, removed from agricultural use large areas of land are released into the atmosphere thousands of tons of pollutants, including sulfur dioxide and hydrogen sulfide. Sulphur after cleaning oil stockpiled in the open air, under certain climatic conditions, can go to many

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harmful chemicals and have a negative impact on the environment. The aim of this study to determine the ecological situation in contaminated areas of oil and gas exploration Atyrau region, in Kazakhstan.

2. Location

Atyrau Province is located at the mouth of the Ural River, 2700 kilometers west of Almaty. Atyrau is famous for its oil and fish industries. It has 154,100 inhabitants and it is Kazakhstan's main harbour city on the Caspian Sea at the delta of the Ural River. Atyrau city is approximately 20 meters below sea level. The city is divided by the Ural River. The city is a hub for the oil-rich Caspian Depression; because of this, many oil wells have been drilled in the Tengiz and Kashagan areas. An oil pipeline runs from Atyrau to Samara, where it joins the Russian pipeline system. A separate oil pipeline runs from the Tengiz field to the Russian Black Sea port of Novorossisk. The third biggest refinery in Kazakhstan is located in Atyrau.

3. Findings and Discussion

In Atyrau region in the shelf zone of the Caspian Sea for more than 30 years are operated persalt fields Gran, Martyshy, Zhanatalap, Buzuchi, Karajansbas since 1993 - Tengiz. The composition of emissions include hydrocarbons, hydrogen sulfide, oxides of sulfur, nitrogen, carbon. These substances are released into the atmosphere, absorbed by the underlying surface and alter the natural conditions of existence of the biota. Analysis of the Caspian Sea water along the coast Tengiz shows that in addition to the oil contamination in the water is accumulated synthetic surfactants, phenols, heavy metals and oil, which occupy a special place among the pollutants since there are chemical and biological degradation, and increased in concentrations have a deleterious effect on the aquatic ecosystem.

Because of the high degree of contamination occurs exclusion of land from agricultural use, which become almost unusable for agriculture, disrupts the ecological balance of natural landscapes, slow development, and at high concentrations observed in the death of living organisms of the soil.

Every year in the oceans dropped about 10 million tons of oil. Photography from satellites, direct observations in the seas and oceans suggest that about a third of the surface of the water is covered with a thin film.

Very thin film of oil on the surface of the water reduces evaporation from this area by 60%. As a result of increasing the heating of the water surface, the temperature difference contributes to the emergence of more frequent cyclones.

Oil causes a lot of trouble to the sea. A ton of oil can contaminate about 12 km2 of ocean surface to destroy all life in it. Because plankton most of its life it is in near-surface layers of the water, where the meeting with the oil is especially likely.

The influence of oil also leads to the fact that hatch from the eggs fry freaks, plankton dies and populations suffer the ocean difficulties due to lack of supply. Getting to the gills, the molecules of petroleum products is seriously disrupting the operation of this important organ.

Extracts from oil pollution of the sea, even those residents who reside in the depths, and those who used to live and feed in the reefs.

Oil plagues and ocean mammals: whales, dolphins, seals and birds. If the seal comes up in the oil patch, his soiled fur is no longer to be a reliable thermal insulator. The same thing happens with the bird's plumage.

Also of great importance for the development of oil and gas contamination of the environment is by far the oil and soil contamination. This process changes the properties of soils, cleaning of oil which has a lot of difficulties. Oil falls to the ground in the exploration and production of oil in the pipeline accident, accidents at sea and river oil tankers, oil leaks at tank farms, gas stations. Oil coats the soil particles, the soil is not wetted by water, the particles clump together her, killed microorganisms, plants do not receive proper nutrition. Oil goes into more oxidized state, hardens, and high levels of contamination of the soil resembles mass like bitumen. Control measures for low levels of pollution: fertilizer, stimulating the development of microorganisms and plants, which contributes to the partial mineralization of oil. When a major accident with the oil of the soil cover is removed by mechanical means.
Restoring soil fertility after exposure to crude oil extends over decades. To restore contaminated land applied agro and agro-chemical methods. This plowing (earthing), burning (thermal degradation), chemical oxidation - wash solvent detergent treatment, backfilling with soil contaminated sites and removal of contaminated soil in the dumps.

For oil spills on water surfaces used oil collection methods, with subsequent separation, towing oil slicks treated hardener, the use of absorbent materials (straw, peat, polypropylene tape, etc.). One method - is the collection of oil using acoustic transmitters. Processing is applied oil adsorbents and absorbents (sand, sediment laced with silica or chalk, talc dust and lignin).

However, the applied physical-chemical methods of restoring soil and water, often by themselves cause more environmental damage to the environment than oil pollution. With these methods, soil cleaning can be irreversible destruction of topsoil farmland, additional surface soil contamination at export and storage of oil-contaminated layer. Dispersants used to eliminate oil spills, toxic to marine organisms, extracting oxygen from the water, creating dead zones in calm.

The most promising method for decontamination of soils and waters from pollution by oil and oil products is recognized as a biological method. The main advantage of this method is the use of natural uglevodorodo utiliruyuschih microorganisms.

In the presence of large areas of contaminated soil, effectively carry out the treatment Biodestructors, thus there is no need to transport the contaminated soil. Adding to the contaminated soil pure cultures, able to carry out the oxidation of aliphatic, aromatic and other hydrocarbons usually leads to accelerated soil cleaning and ensures stability of the process of biological decomposition at relatively low cost purification.

However, the most efficient to use any method, and their complex, particularly where the worst dirt. Using appropriate microorganisms at low concentrations, or contamination in the final purification steps after applying other methods, mainly mechanical.

Atyrau has a special place on pollution components of the environment in the integrated pollution Kazakhstan. The underlying cause of this fact is the pronounced human impact on the natural gas industry natural state of the environment. Also have a special role and climatic factors of the environment, in particular the rise of the Caspian Sea.

Increased oil and gas extraction of a large number of raw materials affects the pollution of air, surface and groundwater, the degradation of soil and vegetation cover, due to the accumulation of heavy metals, radionuclides, and petroleum products.

Oil and oil dispersed in the environment all over the place, as they are widely used in human activities. The main sources of pollution of air, water and soil are - oil spill, waste water and gaseous emissions of refineries and petrochemical plants, oil-containing waste accumulating in landfills. In the space free of human activities (reserves, inaccessible areas) hydrocarbons are transported by air and water currents.

The main sources of pollution of the environment are oil fields, pipelines, storage tanks (tank farms); refineries, land and sea transport, transporting petroleum products; railcar wash station, railway transport enterprise (locomotive and wagon depots, repair factories, etc.)

The causes of air pollution oil and gas industry:
- Accidents and fires in storage tanks and refineries;
- Emissions from oil refineries and petrochemical industries;
- Emissions from gasoline and diesel vehicles;
- Incineration, burning dumps, etc.

In Atyrau main pollutants from the oil fields are: solids, sulfur dioxide, nitrogen oxides, carbon oxides, hydrocarbons. Another source of air pollution is motor vehicles, the impact of which is particularly evident in the city of Atyrau.

In the city of Atyrau air contains many contaminants that are not found in rural areas. At night radiative cooling of streets and buildings, especially in the city center, the upper layer of the urban air is warmer, thereby forming a temperature inversion, which contributes to the accumulation of heat in the center of the city. When inversion is formed domed cloudy veil over the city, the densest - over the center. This fog adversely affects the human body.
The main factors of the spatial dispersion of man-made emissions are the weather conditions: wind speed and direction, air temperature, precipitation, relative humidity and other gas-dust emissions are deposited on the soil surface, firmly fixed in the upper horizon.

The main share (80-85%) of air pollution in the region accounts for companies involved in oil and gas production and oil refining business operations.

The level of air pollution measured by the integrated pollution index (IPI5), which is calculated for the five substances with the highest normalized values of maximum permissible concentrations (MPC) based on their hazard class, as well as the over maximum permissible concentrations.

If IPI5 value less than or equal to 5, the level of air pollution is considered "low", with a range of more than 5 to 7, and - "elevated", with more than 7 and less than 14 - "high", more than 14 - "very high."

According to this statistic dates, the level of contamination of the atmosphere at the boundary with the low elevated. Also, there is variability in the values due to climatic conditions, as well as the degree of instability of the effects on the atmosphere.

Experts believe that the increase in oil pollution of the natural environment of the North Caspian additional 10 MPC can lead to disaster ecosystem of the region. Kazakhstan part of the Caspian Sea is an ecological system, the most fragile and sensitive to external influences. The influence of pollutants on the ecosystem here is 100 times stronger than in the rest of the sea.

Tengiz Gas Processing Complex allows the burning of associated gas flaring, causing air pollution in the region. Outdoors stores more than 3.7 million tons of lump sulfur.

The main factors of the spatial dispersion of man-made emissions are the weather conditions: wind speed and direction, air temperature, precipitation, relative humidity, etc. The gas and dust emissions are deposited on the soil surface, firmly fixed in the upper horizon.

Significant areas are filled with discharges of oil and drilling fluids. In soils of all forms of gross deposits of heavy metals (cadmium, mercury, copper, cobalt, selenium, antimony, lead) do not exceed the maximum permissible concentration, except for certain areas in the Tengiz field, where the lead content of 60 mg / kg and higher than the MPC by 2 times and on the profile 1 exceeds the MCL in 8-12 times, and the total content of zinc in the 18-29 times. Arsenic places in 15-30 times higher than the MPC. Accumulation of heavy metals in the soil occurs mainly through manmade emissions of dust, smoke, aerosol. In plants, there is an accumulation of heavy metals (copper, zinc, cobalt, lead, cadmium). However, their content is much lower than the maximum permissible level (MRL) for animal feed, except nickel. High absorption capacity have succulent halophytes.

On the Tengiz oil and gas field in the spring, lead concentrations in the range 0 - 4.5 (in plants) and 3 - 15 mg / kg (soil), zinc - 19.5-63 and 16.5 - 28; copper - 4.5 -19.5 and 7.5 - 25.5; iron - 675.0- 967.0 and 10.5 - 3622.5 mg / kg respectively.

Human-made disturbances are the dominant form of human degradation, resulting in the soil cover is destroyed completely or partially. They are associated with disordered movement of vehicles, exploration and development of oil and gas, construction, communication lines and power transmission, a variety of building and construction works, the alienation of land for storage of industrial and domestic waste pits.

4. Conclusion

In solving the problems of nature must proceed from the recognition of the impossibility of complete prevention at present and in the foreseeable future human impact on the natural environment, even if the improvement of production and other spheres of human activity. Therefore, in the first place should be made on the implementation of measures aimed at maintaining sustainable interaction between human activities and the natural environment, conservation and restoration of natural resources that prevent the direct or indirect effect on the results of the company and the nature of human health.

The most important priority of the oil refineries is to ensure the environmental safety of the region, and the application of advanced technologies and techniques in order to avoid their destabilizing effects on the environment.

The environmental monitoring is carried out by enterprises based on a program industrial environmental monitoring, and analytical control schedules of air and waste water. According to the this program, the following types of monitoring: monitoring of atmospheric air quality, monitoring of waste water; monitoring of ground water,
monitoring of soil and vegetation monitoring radiation safety-monitoring of physical factors, physical factors of production control.

Soil contamination with heavy metals is due to the unsustainable use of natural resources, including the oil and gas. The main sources of pollution of the biosphere in oil production are the construction of oil and gas wells (drilling waste water and sludge, emissions from wells, lubricants, etc.), collection and transportation of oil through pipelines, preparing to refining; infield oil refining and storage, cream and liquid bulk operations.

Since there was a problem particularly acute prevention of pollution by oil and oil of the Caspian Sea due to the proximity of oil fields, which are located in the flooded condition. Pollution is also due to runoff of the rivers Volga and Ural. From the Volga falls 77 thousand tons of petroleum hydrocarbons into the sea every year.

The problem of oil pollution is very sharp in the North Caspian Sea, as its waters due to imperfect systems and equipment oil production complex, as well as increasing the volume of crude oil and oil tankers there is a systematic accumulation of vast masses of oil spills. A significant amount of oil gets into an accident at sea of ships, particularly oil. On the ecological state of the region, in addition to internal sources, adversely affect oil-field and gas processing plants nearby areas.

According to many researchers, the state of the ecosystem in the Atyrau region is characterized as pre-crisis. In case of failure of protective measures threatens ecological disaster region with serious consequences not only for the area, but on a global scale.

References


