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ASSESSMENT OF TECHNOGENIC IMPACT ON MARINE ECOSYSTEMS
DURING OIL PRODUCTION PROCESS**

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The aim of the work was to determine the basic eco-destructive factors in the development and operation of offshore deposits, which form a danger zone for marine biota. On the basis of the integral-differential approach, a significant and moderate degree of influence has been substantiated for the stages of drilling the well and extracting oil, insignificant for seismic exploration and decommissioning. Drilling and oil extraction are accompanied by contamination of the habitat of marine hydrobionts with oil, drill mud, drill wastewater, heavy metals, radioactive elements.

The polluting effect of offshore oil production for both biota and air basin, subsoil, water and land resources is compounded by the risk of emergency spills during drilling and industrial operations, oil storage and transshipment operations, pipeline transfers and tanker transport. The probability of accidents on pipelines is estimated to be from $6.3 \cdot 10^{-4}$ to 10^{-3} leakages / km / year, and accidents in case of tanker oil transportation – from $9 \cdot 10^{-4}$ to $1.5 \cdot 10^{-2}$ spills per year. Significant environmental hazards are caused by fires that result from an open fountain of oil.

The technological load on the marine ecosystem is present at all stages of the production cycle of oil production such as exploration, drilling, oil and gas production, preparation and storage, transportation and processing. An adequate assessment of the impact of the investigated process involves the allocation of four main stages of the development of oil and gas fields. Such an approach is associated with the presence of various environmental degradation factors that cause parametric and ingredient contamination.

Action on the subsoil associated with geomechanics; hydrodynamic; geochemical; geothermal changes, present at all stages of oil production.

To predict the strength and significance of the negative impact of the above stages of the oil extraction process on marine hydrobionts, it is necessary to take into account both external factors and the structure of internal relationships that arise between different ecological groups of organisms. In ecological systems trophic connections are core, as they determine the place of each trophic level in the food chain and most fully and adequately testify the interdependence of producers, consumers and decomposers.

In order to assess the load on marine ecosystems from oil production, it is advisable to use an integral-differential approach, the essence of which is in the following aspects:

1) development of a single extended system of categories indicator (signal) indicators of quality, taking into account climatic, geological, geographic, geophysical, geochemical, hydrobiological and other parameters of the environment of oil production and as a consequence of its impact on local biota;

2) allocation within each category of aggregated indicators, which would most fully characterize the state of the ecosystem of the open ocean and the continental sea, for instance, the Arctic shelf and the Gulf of Mexico;

3) the application of the system of refined indicators within the corresponding aggregated units for each individual object under study.

An adequate assessment of the impact of marine deposits and oil production development on the environment quality can be made based on the developed system of integral categories of indicators. We have selected and substantiated seven categories of indicators: water parameters; phytoplankton; zooplankton; sea fish; sea birds; marine mammals; benthos. Any ecosystem, including marine, is a collection of organisms of different taxonomic groups and levels of organization, interconnected by trophic, topical, foric and factory relations, that is, it consists of an abiotic and biotic component.

A systematic approach to the solution of this problem involves the study of oil production as a systemic whole, therefore decomposition of the process into interrelated components was performed in order to identify the key factors of influence at all stages. It is determined that at the stage of seismic research the main eco-destabilizing factor is noise, in relation to which cetaceans and pinnipeds act as the most sensitive recipients. Drilling and oil extraction are accompanied by contamination of the habitat of marine hydrobionts with oil, drill mud, drill wastewater, heavy metals, radioactive elements.