

The main task nowadays is to minimize undesired consequences by the rational use of natural conditions. Oil and gas industry will be more ecologically-friendly if we follow the next points:

1. develop new oil and gas fields in faraway areas.
2. improve the level of professional training of petroleum engineers and apply new technologies in order to carry out the exploration effectively as we and develop new oil and gas fields.
3. make better environmental conditions and compensate ecological consequences made by oil companies.
4. dispose oil associated gas.

Careless handling of oil can cause big troubles. We should use natural resources carefully and considerable. Oil requires an attentive attitude. All who deals with oil and gas industry should know it.

#### References

1. Экологические проблемы нефтяной промышленности [Electronic resource] <http://neftegaz.ru/analysis/view/6078>
2. Экологические проблемы и нефтегазовая промышленность [Electronic resource] <http://ecoclub.nsu.ru/isar/mu7/4.html>
3. Deepwater Horizon oil spill [Electronic resource] [http://en.wikipedia.org/wiki / Deepwater Horizon Oil Spill](http://en.wikipedia.org/wiki/Deepwater_Horizon_Oil_Spill)

#### **ENVIRONMENTAL PROBLEMS OF OIL PRODUCTION IN THE ARCTIC**

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In the spring of 2015 on the shelf of the Pechora Sea in the area of Nenets Autonomous Okrug the commercial oil was produced for the first time, which thereafter was sent to consumers. This event is the starting point for development of the Arctic as a region of hydrocarbon production, which is comparable to the resource base of Saudi Arabia.

At present it is little-known about the Arctic territories, but the information that has been obtained as a result of the expeditions is enough to state with confidence that oil and gas deposits on the Arctic shelf are significant [1].

The world's leading oil and gas producing companies are currently carrying out global researches on the territory of the Arctic shelf in order to develop a new resource base of Russia.

However, considering all the evidence of perspective development of the Arctic as a petroleum province of the future, one should remember that the Arctic is one of the regions, which is connected with other parts of the Earth, so, despite the remote access, the harmful pollutants can enter the Arctic territory by air, sea and river flows. Scientists have estimated that in Russia there are about hundreds of areas where indicators of pollution exceed significantly permissible levels. Some of them are associated with the activities of the oil and gas complex [2].

There are a number of environmental issues that arise in the Arctic as a result of the oil industry activities within the territory:

1. **Contamination of soil.** According to experts, about 500 hectares of land are polluted during the construction of the trunk pipeline which is 100 km long. Due to climate conditions, the restoration of plant communities on the territory of the Arctic is very slow, and technologies of cleaning up contaminated lands are ineffective. The oil polluted areas are most often exposed to sanding; thus, a simulation of soil reclamation activities is provided.

2. **Large-scale oil spills.** Oil production and its further transportation are quite often accompanied by large-scale spills, the consequences of which affect the world's population. The oil that is released in the Arctic has the ability to spread over large areas. Harmful substances which are components of oil get into Eurasia and North America, with water and air streams, having a devastating impact on the flora and fauna (Figure).

Drilling in the Arctic shelf environments is a very dangerous and risky process, as currently there is no successful experience of oil spill response actions under ice conditions. At low temperatures, it becomes difficult to pump oil, as it becomes very thick. Consequently, the usual tools for spilled oil collection become ineffective under these conditions. There is another method of oil spill disposal, which is based on burning, but it must be used within the first 50 hours since the accident took place as after that period oil becomes unsuitable for burning.

3. **Climate change.** Oil separation causes emission of associated petroleum gas which is either released into the atmosphere or burnt. Associated petroleum gas contains methane - a greenhouse gas that contributes to climate change. The result of increased methane content in the atmosphere is intense warming in the Arctic region, which exceeds almost twice the permissible limits around the globe. Such a sharp increase in temperature entails a number of consequences: changes in the amount of average annual rainfall, increase of the depth of permafrost thawing, decrease in sea ice coverage. This brings about new island occurrences, which were hidden under the ice cover until recently.

It also should be noted that the high content of methane in the surface air can lead to explosions during oil and gas exploration and production on the Arctic shelf [3].



Figure 1– Collection of spilled oil on the coast of Norway  
(photo from the site: <http://www.greenpeace.org/russia/ru/campaigns/protect-the-arctic/threat-to-the-Arctic/#link>)

4. **Contamination of groundwater.** One of the main problems in the regions where oil industry is increasingly developing is the poor quality of groundwater. For

example, in Yamalo-Nenets and Nenets Autonomous Okrug, the content of hydrocarbons in drinking water exceeds the permissible limits.

At the moment, the pollution of the Arctic affects local areas. However, due to the fact that modern society is very dependent on oil, major oil companies are moving into Arctic areas in order to find oil without paying attention to damage that is caused to its unspoilt nature. Over the past decade pace of oil and gas industry development has harshly increased in the Arctic shelf region which has already caused environmental degradation.

#### References

1. Zolotova M. (2014) Arktike net alternativni *Odnako*. [Internet resource] – Retrieved from URL: <http://www.odnako.org/almanac/material/arktike-net-alternativi/> (access date 27.10.2015).
2. Ponomarev V. (2014) Shelfoviy proryiv *Expert*. №34. [Internet resource] – Retrieved from URL: <http://expert.ru/expert/2014/34/shelfoviy-proryiv/> (access date 27.10.2015).
3. Shakhova N.E. Semiletov I.P. Methane Hydrate Feedbacks // Arctic Climate Feedbacks: Global Implications / Ed. M. Sommerkorn, S. J. Hassol // WWF International Arctic Programme, August, 2009. pp. 81–92.