

Mobile drilling rigs are used so that operations can move easily to a new location once drilling is complete. However, these rigs are limited to open water conditions because at other times the movement of ice makes drilling impossible. Regardless, normal drilling procedures and the use of equipment must be adjusted to Arctic conditions to withstand and work safely in ice. These include the use of barriers and procedures to prevent spills (see box on barriers, next page). Additionally, we continuously seek ways to reduce any impacts of our operations such as the effect that the sound of drilling can have on marine life.

Drilling rigs Shell engineers have helped develop a new drillship that is easier to maneuver and more energy-efficient than traditional drillships. This “bully rig” is 25% smaller and 60% lighter than normal drillships, and has a reinforced ice-class hull that increases protection between its cargo and the sea. The bully rig can drill to a depth of four kilometres and can also navigate in shallow water. Shell owns and operates the Kulluk, one of the few Arctic rigs capable of year-round operation in severe ice environments. We also redesigned and refurbished the Frontier Discoverer drilling rig for Arctic service.

When thinking about future Arctic drilling, it should be clearly emphasised that for precise planning of any future Arctic Ocean drilling campaigns, including site selection, evaluation of proposed drill sites for safety and environmental protection aspects, etc., comprehensive site-survey data are needed first [3].

### References

1. Opportunities and Challenges for Arctic Oil and Gas Development. Eurasia Group report for the Wilson Center, Washington, D.C. Wilson Center. 28 p. [Электронный ресурс]. – Режим доступа: [https://www.wilsoncenter.org/sites/Artic%20Report\\_F2.pdf](https://www.wilsoncenter.org/sites/Artic%20Report_F2.pdf).
2. Russian – Norwegian Oil and Gas industry cooperation in the High North. Drilling, Well Operations and Equipment. INTSOK Norwegian Oil and Gas Partners, 2014. 58 p.
3. Stein R. Challenges in Arctic Ocean Drilling // ECORD Newsletter. October, 2011. P. 17-19.

## **OIL AND NATURAL GAS ARCTIC FIELDS EXPLORATION ON THE KARA SEA SHELF**

**L.V. Metlyakov, S.D. Zlobin**

Scientific advisor associate professor G.P. Pozdeeva

*National Research Tomsk Polytechnic University, Tomsk, Russia*

The Kara Sea is as an extension of the West Siberian oil and gas basin and accounts for 60% of oil production in Russia. Directly influenced by natural features: the depth of the sea - 40-350 meters, the ice held 10 months a year, and its thickness reaches a half meters, and winter temperatures go down to 46°C below zero. In 2010 JSC ‘NK Rosneft’ received a permission to investigate the shelf of the Arctic seas and started projects in three East Prinovozemelsky areas of the Kara Sea. In September 2014 the drilling results of the University-1 well in the first prospective oil land were obtained. During drilling operations, oil was discovered at a depth of 2000 meters. In short terms of drilling (one and half a month) all environmental and technological requirements were followed. ‘Pobeda’ is a new field name [2].

## СЕКЦИЯ 12. АРКТИКА И ЕЕ ОСВОЕНИЕ (доклады на английском и немецком языках)

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The Universitetskaya-1 platform is about 200 square kilometers. The study found that only the first trap layer (rock with accumulated oil) contains not less than 100 million tons of oil. Altogether the three studied sites comprise about 30 traps. According to the study, the resource base includes 87 bln barrels. Later scholars of 'Tyumen Petroleum Research Center' Ltd examined the core sample and confirmed that the reserve volume of the first open trap is 391.9 bln. cubic meters of gas and 128.7 mln. tons of C1 + C2 category oil.

In October of 2014 OJSC 'TomskNIPIneft' specialists completely studied the Universitetskaya-1 oil properties and OJSC 'NK Rosneft' leadership was presented these results. The results of comprehensive drill cuttings analysis, samples of reservoir fluids and core samples confirmed that the first portion, i.e. 'Pobeda' contains ultralight oil, which due to the main indicators (sulfur and density) is much better than SiberianLight, WTI oil and Brent sample oil. These oil peculiarities can be compared with the Vietnam 'White Tiger' oil field offshore. The main indicators of the oil: density - 808-814 kg/cubic meter (Brent oil/crude - 834 kg/cubic meter); a sulfur weight content is 0.02% (Brent - 0,2-1%; Urals - 1,2-1,3%); a high fractional top yield is 60-70%; low tar content is 1.5%. The oil with these/similar indicators is highly valued in the world market owing to methane hydrocarbons predomination and low-tar content. Being very simple in processing, it is used as raw material for petrochemical industries, as well as for heavy oil dilution. Besides, there is the world current tendency of an abrupt light oil reserves decline which increases its attractiveness for consumers [1].

Oil production in the Kara Sea. The deposit was discovered by the companies of 'Rosneft' and Exxon Mobil altogether. The project involved the company Nord Atlantic Drilling, as well as experts of Schlumberger, Weatherford, Halliburton, Trendsetter, and others. The well was being drilled at a depth of 81 meters in open water conditions back 250 km from the continent. Drilling was carried out through the West Alpha platform. The platform was provided by the Norwegian company 'Nord Atlantic Drilling'. This platform is a ship with a displacement of 30 thousand tons and 70 meters long, which is attached to the bottom. The setting is held on site by an eight-anchor position control system. The construction can withstand a storm with up to 15 meters waves. In the center of it is the rig construction. Maximum drilling depth is 7 km. All equipment provides duplicate options to change if it is necessary [3].

Transportation problems. Despite all promising forecasts of oil regional production, there still remains a very serious problem of very difficult and reckless oil transportation. The fact that the Kara Sea coast actually is not provided with transport. Old ports cannot withstand large traffic. A fully functional railway line establishment could significantly reduce the marine transportation share of produced oil in the Kara Sea. However, it is unlikely to happen in the near future, because it involves large financial difficulties. Since none of the Kara Sea coast ports is nonfreezing; navigation is only possible for a short summer period in the ports. Winter transportation is only possible through the nearest nonfreezing port Murmansk, which also entails high additional costs.

Near-term prospects. In winter the exploration drilling project at the Universitetskaya-1 platform will be suspended as planned and renovated in spring, when favorable weather conditions occur in the Kara Sea. Initially a joint project of two companies intended to drill 40 exploration wells on the Russian shelf until the end of 2018. However, due to the introduction of Exxon Mobil sanctions it was impossible to reach an agreement with the US authorities to continue projects in Russia. As a result, 'Rosneft' cooperation for offshore development was frozen. 'Rosneft'

company is considering a possibility of the field production in the Kara Sea in 5-7 years. This development strategy will be focused both on their own development and finding new partners.

Environmental aspect. Environmental issue is one the key aspect of oil production in the Kara Sea. The basin is in immediate proximity of protected natural objects, such as ‘Russian Arctic’ national park in the Kara Sea; ‘Wrangel Island’ which is under UNESCO patronage as a ‘maternity home’ of polar bears. All this requires greater attention of development companies-developers at all stages of its activities. Tough framework of Russian Environmental Legislation requires full compliance with international regulations and agreements at all phases of offshore projects. Consequently, one of the main work aspects of the Arctic Research and Design Center of offshore development was the environmental impact assessment. On the basis of the center the thorough environmental impact monitoring of all works was conducted, as well as their assessment to prevent emergency situations. One of the main objectives is oil leakage prevention. At the initial stage the West Alpha drilling platform was subjected to thorough modernization in order to ensure complete environmental safety work. The platform was equipped with two groups of blowout preventer equipment and special individual underwater shut-off device. If there is the slightest risk, these mechanisms are able to seal the well to prevent leakage [4].

According to expert estimates, Kara field should exceed by natural resources volume such ‘giants’ as the Gulf of Mexico and the Arctic shelf of North America and Canada and be compared with the Saudi Arabia resources. However, as the basic facts show, the large-scale development of the Kara oil basin is possible not earlier than in 3-5 years. With the gradual development of all the above-mentioned trends, the Russian Arctic exploration will be considerably less costly and should significantly impact the Russia’s growth and its role in the world arena in the long term prospect.

### References

1. Joint Projects of “RosNeft” and ExxonMobil [Electronic resource] <http://www.vestifinance.ru/articles/47597?page=5> free, reference date 20.05.16 (In Russian).
2. Oil production prospects in the Kara Sea [Electronic resource] <http://greenologia.ru/eko-problemy/proizvodstvo-neft/dobychi-v-karskom-more.html>, free, reference date 20.05.16 (In Russian).
3. The largest field of light gravity oil and gas is explored in the Kara Sea [Electronic resource] <http://novorossiya.name/razvedano-krupneysheye-mestorozhdeniye-nefti-i-gaza/> free, reference date 20.05.16 (In Russian).
4. “Universitetskaya-1” drilling platform begins its operation in the Kara Sea [Electronic resource] [.https://www.1tv.ru/news/2014/08/09/39132v\\_karskom\\_more\\_nachala\\_rabotu\\_novaya\\_supersovremennaya\\_burovaya\\_platforma\\_universitetskaya\\_1](https://www.1tv.ru/news/2014/08/09/39132v_karskom_more_nachala_rabotu_novaya_supersovremennaya_burovaya_platforma_universitetskaya_1) free, reference date 20.05.16 (In Russian).