introducing corrosion-resistant pipes. The main focus is on pipelines of the first (highest) hazard class.

Options are considered to use alternative materials, including non-metallic pipes, in conditions of highly corrosive environments. These materials can be used to construct pipelines of the fourth hazard class (which include discharge lines), taking into account the bearing capacity of the soil. If optimal solutions are found, they can be also be applied in permafrost conditions.

Major efforts are made to prepare pipelines for the autumn-winter season and for floods, which includes maintaining hydraulic locks (oil separators) in working order so as to reduce the likelihood of spills. In order to reduce the number of spills, the frequency of bypasses is increased, especially with regard to potentially hazardous areas that may be exposed to melt water and rain.

Assessing the effectiveness of measures

In order to improve the operational reliability of pipeline transport, the effectiveness of implemented measures is assessed annually, as part of the following processes.

1. Selective, comprehensive inspections of the production activities of oil and gas companies: every three years, all territorial-industrial companies undergo assessment.
During inspections, the indicators and methods for recording accidents of losses of pipelines integrity are analyzed, and measures to rectify the situation are determined. In parallel, corporate oversight over compliance with federal and industry requirements is performed. Based on the results of a comprehensive inspection, instructions are issued to eliminate violations, as well as any identified deviations.

2. Technical meetings of Network Group experts.
Technical meetings are held on a quarterly basis and at the year end to analyze the results of activities to improve the reliability of pipeline transport. Decisions taken at the meetings are documented in a protocol in which recommendations and instructions for LUKOIL Group entities are recorded, including the testing of pipes made of new materials and the introduction of new technologies. The meeting minutes are approved by management (including the Vice President of PJSC LUKOIL).

Results of the Network Group's work in 2018

Due to the active work performed by the Network Group in 2018, results were achieved that lay the foundation for improving the future reliability of pipelines.
- Based on the test results, the list of suppliers of various pipe products was expanded, including pipes made of alternative materials.
- New pipe diagnostic methods were proposed for implementation.
- More effective inhibitors of corrosion and deposits of asphalts, resins, and paraffin were identified.
- Liability for products supplied in the supply chain was increased.

In order to reduce the risk of pipeline failures, the discipline and responsibility of not only specialized corporate services, but also contractors and pipe suppliers, have been significantly strengthened. The warranty period for pipes with protective coatings is set at not less than 10 years: if an independent party establishes a factory defect during this period, all costs incurred by the Company are charged to the supplier.

All contracts for construction and installation works have a warranty period of at least 60 months (five years), which increases the liability of the parties performing this work, and reduces the likelihood of the most frequent failures occurring due to the fault of contractors.

Updating industry standards

With the active participation of specialists from PJSC LUKOIL and the Russian entities of LUKOIL Group, in 2018 a national standard was for the first time elaborated and approved by the Federal Agency for Regulation and Metrology. The standard introduces requirements related to applying protective paintwork on the inner surface of steel pipes, fittings for oilfield pipelines, and tubing for oilfield equipment[4].

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[4] GOST R 58346-2019 Steel pipes and fittings for the oil industry. Protective paintwork for the inner surface. General technical requirements.