

TECHNOLOGICAL SOLUTIONS FOR THE RECONSTRUCTION OF THE SECTION OF THE MAIN OIL AND GAS PIPELINE

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The article proposes a new solution for laying an oil pipeline with the help of a repair pit, which allows to preserve the fertile layer of the earth, which is difficult to restore after conventional work in the traditional way. An analysis of the occurrence of defects was carried out and a conclusion was made about the criteria and operating conditions of the oil pipeline that affect their occurrence. As a novelty, the scheme of the repair pit of the main oil pipeline is proposed. The proposed novelty will significantly optimize and increase productivity during the reconstruction of the main oil pipeline. This method is distinguished by simplicity, as well as the preservation of a fertile soil layer, which is quite important in the conditions of the sharply continental climate of the oil pipeline area. The ongoing reconstruction of the pipeline will allow replacing defective sections of the pipeline, thereby increasing the service life and avoiding accidents on the pipeline, which is quite an important factor in the conditions of uninterrupted supply of petroleum products to the consumer.

Keywords: trunk pipeline, oil pipeline, reconstruction, defective sections, laying of an oil pipeline.

МАГИСТРАЛЬДЫҚ МҰНАЙ-ГАЗ ҚҰБЫРЫ УЧАСКЕСІН РЕКОНСТРУКЦИЯЛАУ КЕЗІНДЕГІ ТЕХНОЛОГИЯЛЫҚ ШЕШІМДЕРІ

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Мақалада дәстүрлі әдіспен әдеттегі жұмыстардан кейін қалпына келтіру қиын болатын жердің құнарлы қабатын сақтауға мүмкіндік беретін жөндеу шұңқырының көмегімен мұнай құбырын төсеу туралы жаңа шешім ұсынылған. Ақаулардың пайда болуына талдау жасалды және олардың пайда болуына әсер ететін мұнай құбырының өлшемдері мен жұмыс жағдайлары туралы қорытынды жасалды. Жаңалық ретінде магистральдық мұнай құбырын жөндеу шұңқырының схемасы ұсынылады. Ұсынылған жаңалық магистральдық мұнай құбырын қайта құру жұмыстарын жүргізу кезінде өнімділікті айтарлықтай оңтайландыруға және арттыруға мүмкіндік береді. Бұл әдіс қарапайымдылығымен, сондай-ақ топырақтың құнарлы қабатының сақталуымен ерекшеленеді, бұл мұнай құбыры орналасқан жердің күрт континентальды климаты жағдайында өте маңызды. Мұнай құбырын қайта жаңарту мұнай құбырының ақаулы учаскелерін ауыстыруға, сол арқылы қызмет ету мерзімін ұзартуға және мұнай құбырындағы аварияларды болдырмауға мүмкіндік береді, бұл тұтынушыға мұнай өнімін үздіксіз беру жағдайында айтарлықтай маңызды фактор болып табылады.

Түйінді сөздер: магистральдық құбыр, мұнай құбыры, қайта құру, ақаулы учаскелер, мұнай құбырын құрастыру.

ТЕХНОЛОГИЧЕСКИЕ РЕШЕНИЯ ПРИ РЕКОНСТРУКЦИИ УЧАСТКА МАГИСТРАЛЬНОГО НЕФТЕГАЗОПРОВОДА

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В статье предложено новое решение по прокладке нефтепровода при помощи ремонтного котлована, позволяющего сохранить плодородный слой земли, который в последствии обычных работ традиционным способом трудно подлежит восстановлению. Проведен анализ возникновения дефектов и сделан вывод о критериях и условиях работы нефтепровода, влияющих на их возникновение. В качестве новизны предлагается схема ремонтного котлована магистрального нефтепровода. Предложенная новизна позволит значительно оптимизировать и увеличить производительность при проведении работ по реконструкции магистрального нефтепровода. Данный способ отличает простота, а также сохранение плодородного слоя почвы, что немало важно в условиях резко-континентального климата местности пролегания нефтепровода. Проводимая реконструкция нефтепровода позволит заменить дефектные участки нефтепровода, тем самым увеличить срок службы и избежать аварий на нефтепроводе, что является немало важным фактором в условиях бесперебойной подачи нефтепродукта потребителю.

Ключевые слова: магистральный трубопровод, нефтепровод, реконструкция, дефектные участки, прокладка нефтепровода.

Introduction. The fuel and energy complex is the basis for the development of all sectors of the economy of Kazakhstan. Its most important element is the system of trunk pipelines for the transport of oil, gas and their refined products. The geographical location of oil and gas fields in Kazakhstan and their consumers puts pipeline transport in the first place among all other types. Only pipeline transport is able to guarantee uninterrupted and uniform supply of significant cargo flows of oil, gas, and petroleum products, while ensuring the lowest economic costs. It is also important that pipeline transport, with proper trouble-free operation, is environmentally friendly.

For oil, pipeline transport is the main mode of transport in our country. Pipeline transportation of oil is the most economical, environmentally friendly, and easily automated. These advantages over other modes of transport explain its intensive development [1-3].

Modern trunk pipelines are independent transport enterprises equipped with a complex of head, intermediate pumping pumping stations of high capacity with the necessary production and auxiliary facilities.

Failures on trunk pipelines cause not only great economic damage due to product losses and disruption of the continuous production process in related industries, but can be accompanied by environmental pollution, fires and even human casualties.

Modern conditions of oil pipeline transportation are characterized by the natural aging of fixed assets, increased requirements for their environmental safety and the need to maintain the linear part of the main oil pipelines in working condition for the uninterrupted

provision of transport services to oil companies [4-6].

When transporting large volumes of oil at high pressures, it is necessary to ensure the reliability of the main oil pipelines and the prevention of failures and accidents. The natural aging of oil trunk pipelines and, in connection with this, a significant increase in the requirements for their environmental safety are characteristic features of the working conditions of oil pipeline transport. These moments determine the main directions of improving the system of prevention and liquidation of emergency situations in the industry.

Materials and methods. The quality of repair work is largely determined by the perfection of the machines and mechanisms used, the high-quality organization of operational control at all stages of repair and, finally, the competent fulfillment of the requirements of repair technology. The rational solution consists in carrying out effective preventive actions, consisting in timely detection of pipe defects, in carrying out repairs in order to eliminate the adverse effects of defects, to prevent their dangerous development [7-9]. The reconstruction of the existing Kalamkas-Karazhanbas-Aktau oil pipeline (Kazakhstan oil pipeline) connecting the Buzachin oil and gas fields of Kalamkas, Karazhanbas, Severnoye Buzachi, Arman, Zhalgistube with the city of Aktau is being considered, which will then connect with the Aktau-Zhetybai-Uzen oil pipeline. By means of a planned diagnostic study on the Kalamkas-Karazhanbas-Aktau oil pipeline, on a section of 30 km from the «Kalamkas» GNPS in the direction of the «Karazhanbas» GNPS, a section of deterioration of the pipeline along a length of 50 km was detected.



Scheme of main pipelines

On this section of the pipeline, according to the results of in-line and electrometric diagnostics, the following defects were identified:

- insulation defects (unsatisfactory adhesion, gusts, lack of insulation, etc.);
- corrosion defects (wall thinning, the effect of stress corrosion, brook corrosion, etc.);
- defects in welded joints (due to wear and defects during construction and installation work);
- defects in the geometry of the pipeline (dents, corrugations, ovality of more than 3%, etc.);

Along the pipeline route of the investigated section, 80% of the length is occupied by defects of priority repair.

The reconstructed section of the oil pipeline is laid in a separate trench at a distance of 4 meters from the existing route of the Kalamkas-Karazhanbas-Aktau oil pipeline with subsequent opening and dismantling of the replaced one. The target of the reconstructed section is moved to the right along the course of the oil [10].

Before laying, the new oil pipeline thread must be fully ready for connection to the existing oil pipeline: welded into a thread, cleaned and insulated with anticorrosive insulation. The pipeline, welded into a thread, as well as individual sections of pipes on the route should be laid on inventory beds with soft gaskets that exclude insulation damage. Laying the pipe on earthen prisms is not allowed.

The proposed novelty relates to the repair of pipelines. The repair pit contains slopes with specified slopes on both sides of the main pipeline, while the pipeline is located in the ground with a minimum wall thickness of at least 200-300 mm, and a flat bottom is formed on both sides of the pipeline located in the ground to the width of the excavator bucket. The soil extracted from the pit is located at least 500 mm from the edge of the slopes of the pit on both sides. The method of developing a repair pit along the main pipeline consists in the fact that the repair pit is formed in the form of a trench, and the fertile soil layer is removed beforehand, the drainage strip is cleared of shrubs and vegetation, the trench axis is broken down and fixed on the terrain, the latter is made by the end face method when a single-bucket excavator moves along the axis of the newly laid oil pipeline instead of the repaired one. The soil removed from the trench is placed in the dump no closer than 0.5 - 0.7 m from the edge of the trench. When developing a trench with a single-bucket excavator, hangers are placed along the axis of the trench in front of it along the course of its movement and behind along the already dug trench, and in rectilinear sections, along the course of its movement, landmarks with a height of 1 - 3 m are set every 30 - 50 m. To increase the accuracy of the excavator movement on curved sections relative to the trench within the curve along the width of the tracks or along the width of the trench on both sides, landmarks are set every 1-2 m. As a result, simplification of work

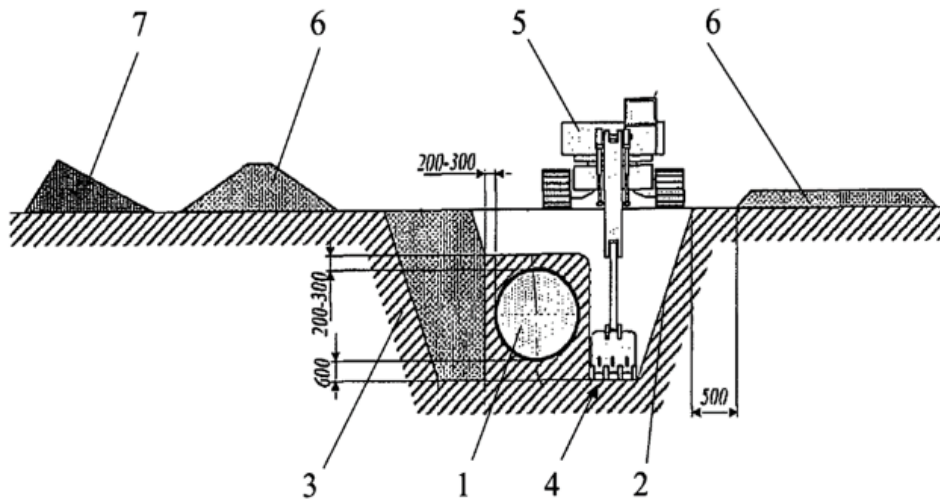
is achieved by minimizing manual labor with minimal environmental impact [11].

Results and discussion. The repair pit contains slopes with specified slopes on both sides of the main pipeline, while the pipeline is located in the ground with a minimum wall thickness of at least 200-300 mm, and a flat bottom is formed on both sides of the pipeline located in the ground to the width of the excavator bucket. The technical result is that it is possible to simplify the work by reducing manual labor as much as possible with minimal environmental impact. The repair pit along the main pipeline 1 contains on both sides of the main pipeline 1 slopes 2 with specified slopes (steepness). The main pipeline 1 is located in the ground 3 with a minimum thickness of the soil wall of at least 200 - 300 mm, and on both sides of the main pipeline 1 located in the ground 3, a flat bottom 4 is formed for the width of the excavator bucket 5. The soil extracted from the pit 6 is located at least 500 - 700 mm from the edge of the slopes 2 of the pit on both sides.

The method of developing a repair pit along the main pipeline 1, in particular the oil pipeline, is that the repair pit is formed in the form of a trench, and the fertile soil layer is previously removed, which is formed in the form of a separate dump 7, the drainage strip is cleared

of shrubs and vegetation, the axis of the trench is broken down and fixed on the terrain, which is made by end face when moving a single-bucket excavator 5 along the axis of the newly laid oil pipeline instead of the repaired one, while the soil 6 removed from the trench, they are placed in the dump no closer than 0.5 - 0.7 m from the edge of the trench. When developing a trench with a single-bucket excavator 5, hangers are placed along the axis of the trench (not shown in the drawing) in front of it along the course of its movement and behind along the already dug trench, and in rectilinear sections, along the course of its movement, landmarks (hangers) with a height of 1 - 3 m are set every 30 - 50 m, to increase the accuracy of movement excavators on curved sections relative to the trench within the curve along the width of the tracks or along the width of the trench on both sides set landmarks every 1-2 m. [12-13].

During the work carried out, it was found that the described method ensures the precise movement of the excavator 5 along the underground main pipeline 1 laid in the ground, and no strengthening of the slopes is required, the ingress of soil from the dumps into the trench is completely prevented and the fertile soil layer is preserved, which fully allows restoring the environment after repair work on the main pipeline and at the same time, minimize the use of manual labor to clean the main pipeline under repair from the ground.



Scheme of the repair pit of the main oil pipeline

The trench, preferably, is deepened no more than 3.0 m, but not less than 1.6 m, along the lower base the trench is expanded no more than 4 m, while the slopes of the trench, arranged without fasteners in soils located

above the groundwater level, are performed with the greatest steepness equal to $45^\circ - 60^\circ$ with respect to the horizontal.

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Conclusions. The proposed novelty will significantly optimize and increase productivity during the reconstruction of the main oil pipeline. This method is distinguished by simplicity and economic

expediency, as well as the preservation of a fertile soil layer, which is quite important in the conditions of the sharply continental climate of the oil pipeline area.

The proposed novelty will significantly optimize and increase productivity during the reconstruction of the main oil pipeline. This method is distinguished by simplicity and economic expediency, as well as the preservation of a fertile soil layer, which is quite important in the conditions of the sharply continental climate of the oil pipeline area. The restoration of the fertile soil layer is significantly reduced and practically not affected, in the conditions of reconstruction and repair of the main oil pipeline.

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