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TO THE ISSUE OF RAILROAD WATER SUPPLY

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Abstract. The article discusses key problems related to water supply in railway transportation. The author analyzes the current state of water supply infrastructure, identifying the main shortcomings, such as outdated technologies, high water losses and poor quality of supplied water. Special attention is paid to modern challenges, including safety and environmental requirements, as well as the need for innovative solutions to improve the efficiency of water supply system. The article also discusses the prospects for infrastructure modernization, including the use of automated control systems, energy efficient technologies and water treatment methods. Finally, recommendations for improving water supply on railroads are offered, emphasizing the importance of an integrated approach that includes both technical and organizational measures.

Keywords: water supply, station, water tower, water treatment, railroad, modernization, infrastructure.

Introduction

The railroad system plays a key role in the development of the economy and social sphere in any country. The Republic of Kazakhstan is no exception, and its railway system is of strategic importance for the country's transportation infrastructure.

Currently, Kazakhstan has an extensive network of railroads stretching for thousands of kilometers. This system connects the country's major cities and also provides transportation of goods from Kazakhstan to other CIS countries and to the West. The railroad system also serves to move passengers throughout the country.

Figure 1- Main railroad lines in Kazakhstan

Source: https://pbs.twimg.com/media/Dc6BYH0XkAIr_ZE?format=jpg&name=medium

One of the key elements of the railway system in Kazakhstan is Kazakhstan Temir Zholy (KTZ), the largest railway operator in the country. KTZh provides a wide range of services, from transportation of cargo and passengers to maintenance of cars and locomotives. The company is actively developing its infrastructure, modernizing its fleet of locomotives and wagons, and introducing new technologies to increase the efficiency of transportation.

Another important element of the railway system in Kazakhstan is the Central Asian Transit Corridor, which is part of the New Silk Road international transportation infrastructure. This corridor connects the countries of Europe and Asia, providing faster and more efficient transportation of goods.

The railroad system in the Republic of Kazakhstan includes the mainline railroad network. A system of interconnected mainline and station tracks, as well as power supply, heat supply, water supply, signaling, communication, devices, equipment, buildings, structures, facilities, stations and other facilities.

Railway transport provides half of the total freight turnover and transports the majority of export and transit cargo. Modern technologies, investments in development and cooperation with other countries make railway transportation in Kazakhstan efficient and competitive [1].

Five international railroad routes run through the territory of Kazakhstan. The main transit flows serve China's trade with Europe and Central Asia.

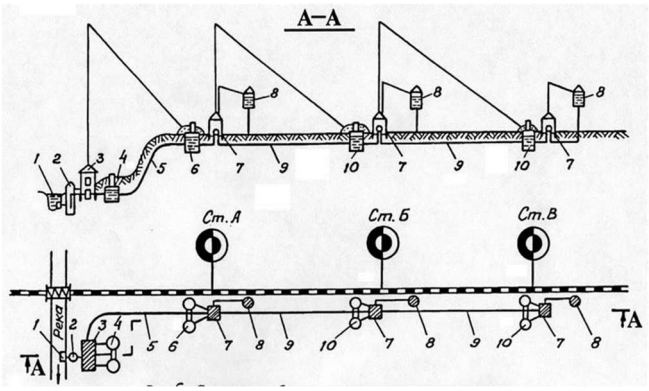
In order to improve the railway system in Kazakhstan, the Government of Kazakhstan is actively working on infrastructure development, equipment modernization and logistics improvement. Large investments in railroad transportation contribute to increasing its capacity, reducing transportation time and improving the quality of service.

The efficiency of railroad transportation directly depends on many factors, among which water supply plays one of the most important roles. Problems with water supply can have a significant impact on the operation of railway transportation, entailing not only delays in train traffic, but also deterioration of working conditions for employees and passengers [2].

Methodology

For the successful operation of a railroad, it is important to ensure its proper water supply.

Water is required for a number of processes related to the operation of rail transportation. First of all, it is required for cleaning and maintenance of trains, wagons and railway infrastructure. Without maintaining a proper level of hygiene and cleanliness, not only does the aesthetics of the vehicle decrease, but also the risk of accidents and malfunctions increases [2].



1 - water intake; 2 - coastal well; 3 - pumping stations of I and II lifts, combined with treatment facilities; 4 - clean water tanks; 5, 9 - pressure pipelines; 6, 10 - storage tanks at railway stations; 7 - linear pumping stations; 8 - water towers.

Figure 2- Technological scheme of the railway station water supply with longitudinal water pipelines

In addition, water plays an important role in the cooling system of engines, mechanisms and other components of railway transportation. If the water supply is insufficient, there is a risk of equipment overheating and further breakdown, which can lead to delays in train schedules and increased repair costs. A train requires a significant amount of water for cooling engines and for other technological processes for normal operation [3]. Lack of water can lead to temporary stoppages or even canceled trips. In regions with water supply problems, train schedules can be disrupted, causing passenger dissatisfaction and increased costs for additional transportation. Train delays result not only in economic losses, but also in reduced confidence in the rail transportation system.

In some cases, water supply is necessary for the functioning of systems responsible for traffic safety, such as brakes and control systems. When water is scarce, locomotives can operate in a mode that leads to increased wear and tear on equipment. This in turn increases the risk of accidents and incidents [4]. If proper water supply is not ensured, a situation may arise where equipment fails during operation, resulting in serious consequences for both passengers and the working service of the railroad.

The lack of water creates unbearable conditions for railroad employees and their passengers. In the hot season, the lack of drinking water in the carriages leads to deterioration of passengers' well-being. It is important to note that occupational health and safety regulations require adequate drinking water on the route. Since train maintenance workers also depend on a normal water supply, degradation in the quality of their work affects their productivity and morale. Prolonged exposure to water shortages leads to physiological and psychological problems, which ultimately affects the level of safety and quality of service.

It is important to consider the importance of water supply in meeting the needs of passengers and railroad station personnel. Providing access to clean drinking water and sanitation is essential for the comfort and safety of passengers and staff.

Under the conditions of harsh climate and unstable environmental situation in a number of regions of the Republic of Kazakhstan, problems with water supply can have a serious impact on the operation of railway transportation. Therefore, it is important to develop effective strategies to ensure sustainable water supply for railway transportation, including the development of infrastructure for water protection and treatment, rational use of water resources and training of employees on water economy and environmental issues.

By ensuring adequate water supply, authorities can contribute to the efficient operation of the railway system, increasing passenger safety and comfort, reducing accident risks, and ensuring sustainable development of the transportation industry [4, 5].

There are serious problems of insufficient water supply to railroad stations. One of such problems is the lack of water for technical needs at railway stations. Insufficient water can lead to station shutdown, which in turn will cause problems with freight and passenger transportation. It is necessary to pay special attention to this issue and develop effective measures to increase water supply at railway stations.

Another problem is poor quality water supplied to railroad stations. Insufficiently clean water can damage the equipment and infrastructure of the station, which can also lead to downtime and disruption of work schedules. It is necessary to control the quality of water that is used at railway stations and regularly check its compliance with standards [5].

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In addition, the remoteness of some stations and facilities from large bodies of water makes them dependent on wells and underground sources, which often leads to problems with water quality and quantity [5, 6].

Inefficient water supply system on the railroads of Kazakhstan has a number of negative consequences that affect the entire transportation industry:

- Decrease in the quality of services. Lack of quality water directly affects travel conditions for passengers and reduces the operational capacity for freight transportation;
- increased costs. Inefficiency of the water supply system leads to an increase in operating costs, which in turn can lead to an increase in transportation tariffs;
- environmental concerns. Water losses in systems, as well as inefficient use of resources, can negatively impact the environment, exacerbating water scarcity problems in the region.

Results and Discussion

The problems of water supply in railway transportation remain topical, especially in the context of growing requirements to the quality of service and safety. One of the most effective solutions to this problem is the modernization of water supply infrastructure. Investing budget funds in the renovation of old water supply facilities can lead to many positive changes that will contribute to improving water quality and reducing losses [6].

1. Renovation of old water supply facilities. The existing water supply infrastructure at many railroad stations and depots is often outdated and does not meet modern requirements. Modernization of these facilities includes replacement of old pipelines, pumping stations and filtration systems. This will not only reduce physical water losses, but will also significantly improve water quality, as new treatment and filtration technologies can effectively remove contaminants.

2. Introduction of modern technologies. Modern technologies, such as automated water supply management systems, allow for more efficient control of water supply and distribution processes. The use of sensors and real-time monitoring systems can help quickly identify leaks and anomalies in system performance, reducing repair and operating costs. The introduction of

purification technologies such as membrane systems or ultraviolet sterilization will also significantly improve the quality of the water supplied.

3. energy efficiency and sustainable development. Modernization of water infrastructure should also take energy efficiency into account. Installing energy-efficient pumps and control systems can significantly reduce electricity consumption, which in turn reduces operating costs. In addition, the use of alternative energy sources such as solar panels to power water supply facilities will contribute to sustainable development and reduce the carbon footprint.

4. Staff training and development. For successful implementation of modernization projects, attention must also be given to training and staff development of personnel working on water supply systems. Specialists should be familiar with modern technologies and working methods, which will allow them to effectively manage the upgraded infrastructure and quickly respond to emerging problems.

5. Financing and state support. Adequate funding must be provided to implement water infrastructure modernization proposals. State agencies should develop support programs to leverage investment in upgrading water supply facilities on railroads. This may include both direct budgetary investments and the creation of favorable conditions for private investors.

Modernization of water supply infrastructure in railway transport is a necessary step to solve existing problems. Investing budgetary funds in the renovation of old water supply facilities will lead to reduced losses, improved water quality and increased overall efficiency of railway transportation [7]. Modern technologies, energy-efficient solutions and trained personnel are the key factors contributing to the successful implementation of this initiative. Only an integrated approach to modernization will make it possible to create a reliable and safe water supply system that meets modern requirements and challenges.

Conclusion

Modernization of water supply infrastructure in railway transport is a necessary step to solve existing problems. Investing budgetary funds in the renovation of old water supply facilities will lead to reduced losses, improved water quality and increased overall efficiency of railway transportation [7]. Modern technologies, energy-efficient solutions and trained personnel are the key factors contributing to the successful implementation of this initiative. Only an integrated approach to modernization will make it possible to create a reliable and safe water supply system that meets modern requirements and challenges.

List of references

1. Dikarevsky V.S. et al. Water supply and water disposal on the railway transportation. Textbook for universities of railway transport. - Moscow: Transport, 2015. - 440 c.

2. Law of the Republic of Kazakhstan dated December 8, 2001 N 266-II On railway transport.

2. Bagazhov V.V. Self-propelled rolling stock: a textbook for professional training of railway transport workers / V.V. Bagazhov, A.P. Bolshakov, N.L. Lorer. - Moscow: ucheb.-metodicheskiy center for education on the railway transport, Transportnaya kn., 2019. - 614 c.

3. Kunz K.L. About the problem of water quality in the railway water supply systems // Problems of hydraulics, water supply, water removal: Collection of scientific articles Novosibirsk, 2020. C. 33-36.

4. Azerier, S.H. Water supply on the railway transportation. Volume 2 / S.H. Azerier. - Moscow: Book on Demand, 2012. - 509 c.

5. Ovechkina, Zh.V.; Yudaeva, O.S.; Grechushnikova, D.V. Ensuring the sanitary and hygienic safety of passenger travel on the railway transport // Proceedings of the XI All-Russian Congress of hygienists and sanitary doctors. - T. 1. - M., 2012. - C. 609-612.

6. Yudaeva O.S., Grechushnikova D.V. Sanitary and hygienic tests of the prototype of the water disinfection unit for passenger cars of locomotive traction // Collection of works of scientists and specialists of the transport industry, II issue - M., 2016. - C. 32-39.

7. Kaskov Yu.N. Scientific substantiation and implementation of the system of priority measures to ensure sanitary and epidemiological well-being on the railway transport in the conditions of administrative reform // Dissertation for the degree of Doctor of Medical Sciences. - SpbU, 2014. - 380 c.

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ТЕМІРЖОЛ СУМЕН ЖАБДЫҚТАУ МӘСЕЛЕСІ

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Аннотация. Мақалада теміржол көлігіндегі сумен жабдықтауға байланысты негізгі мәселелер қарастырылады. Автор ескірген технологиялар, судың жоғары шығыны және жеткізілетін судың сапасыздығы сияқты негізгі кемшіліктерді анықтау арқылы су инфрақұрылымының ағымдағы жағдайын талдайды. Қауіпсіздік пен экологияға қойылатын талаптарды, сондай-ақ сумен жабдықтау жүйелерінің тиімділігін арттыру үшін инновациялық шешімдерді енгізу қажеттілігін қоса алғанда, қазіргі заманғы сын-тегеуріндерге ерекше назар аударылады.

Сондай-ақ, мақалада инфрақұрылымды модернизациялау перспективалары, соның ішінде автоматтандырылған басқару жүйелерін, энергияны үнемдейтін технологияларды және суды тазарту әдістерін қолдану талқыланады. Қорытындылай келе, техникалық және ұйымдастырушылық шараларды қамтитын кешенді тәсілдің маңыздылығына назар аудара отырып, теміржолдарда сумен жабдықтауды жақсарту бойынша ұсыныстар ұсынылды.

Түйін сөздер: сумен жабдықтау, станция, су мұнарасы, суды дайындау, теміржол, жаңарту, инфрақұрылым.

К ВОПРОСУ ЖЕЛЕЗНОДОРОЖНОГО ВОДОСНАБЖЕНИЯ

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Аннотация. В статье рассматриваются ключевые проблемы, связанные с водоснабжением на железнодорожном транспорте. Автор анализирует текущее состояние инфраструктуры водоснабжения, выявляя основные недостатки, такие как устаревшие технологии, высокие потери воды и низкое качество подаваемой воды. Особое внимание уделяется современным вызовам, включая требования к безопасности и экологии, а также необходимость внедрения инновационных решений для повышения эффективности систем водоснабжения.

Статья также обсуждает перспективы модернизации инфраструктуры, включая использование автоматизированных систем управления, энергоэффективных технологий и методов очистки воды. В заключение предложены рекомендации по улучшению водоснабжения на железных дорогах, акцентируя внимание на важности комплексного подхода, включающего как технические, так и организационные меры.

Ключевые слова: водоснабжение, станция, водонапорная башня, подготовка воды, железная дорога, модернизация, инфраструктура.