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# ANALYSIS AND ASSESSMENT OF DRINKING WATER SUPPLY SYSTEMS

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**Annotation**

In general, the problem of reliability of water supply covers a wide range of issues related to ensuring and maintaining the required level of uninterrupted operation, both of individual types of equipment and structures included in the water supply system.Its solution includes two aspects: quantitative determination of the degree of reliability and provision of its specified technical level.

**Keywords**: water supply, waterworks, pipelines, manganese oxides, drinking water, settlements, gland.

## Introduction

The main purpose of the water supply system is to meet the industrial and social needs of enterprises and the population for water.

The reliability of water supply is characterized by the ability of systems to perform the functions of water supply , while maintaining the established technological indicators over time within the limits corresponding to the specified modes and conditions of operation and maintenance. In general, the problem of water supply reliability covers a wide range of issues related to ensuring and maintaining the required level of uninterrupted operation, both of individual types of equipment and structures included in the water supply system. Its solution includes two aspects: quantitative determination of the degree of reliability and provision of its given technical level. The quantitative determination of these properties of the reliability of the water supply system has become possible only recently. A study of the experience of operating water pipelines has shown that plumbing equipment, such as pumps, pipes, valves, manufactured at the same factory, exhibit a different ability to maintain a healthy state. During their operation, damage occurs that causes failure of water supply systems at the most unexpected moments.

Thus, the physical meaning of reliability lies in the ability of water supply systems to maintain their original technological characteristics during operation. At the same time, it is obvious that the reliability of water supply depends on not only the duration of the period and operating conditions, but also on what functions the system performs.

The organizational, technological and economic aspects of the impact on the operation of water supply facilities and networks, which play a decisive role in the effective functioning of water supply systems in settlements, have been studied [6, 7,10,13,14]. At the same time, studies were carried out to study the sanitary and technical efficiency of the systems of centralized domestic and drinking water supply in some cities of the CIS countries. In particular, a number of works are devoted to the study of the reliability of pipelines in Moscow, Tashkent, Dushanbe, where the main reasons for the violation of the reliability of the drinking water supply of the population, due to the poor quality of pipe manufacturing,

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violation of the technology of construction and operation of water pipelines, have been established [10,16].

A study of the state of pressure pipelines in Moscow, by means of excavations, showed that the main damage was caused by the physical deterioration of the pipe material. A similar situation was revealed in other cities of the CIS countries. At the same time, damage and destruction of pipes of the drinking water supply system also occurs from seismic effects [15]. The results of a survey of individual pipelines of centralized water supply systems in the CIS countries showed that after 10-12 years their further operation becomes unsuitable. The period of satisfactory operation of steel pipelines in water supply systems is 4-6 years [8]. Under such conditions, it is often impossible to provide water supply to consumers by increasing the pressure at pumping stations. Therefore, it becomes necessary to lay additional lines, which requires large financial costs.

In urban water supply networks, the most characteristic contaminants deposited on pipe walls are manganese and iron oxides, compacted sediment, and foreign substances. The sediment can be represented by both mineral (slag, sand) and organic substances.

The most common reason for the deterioration of water quality is the removal of corrosion products, primarily iron, into drinking water. The deterioration of the safety of drinking water supply is also influenced by the aging of underground pipelines for various purposes, leading to losses in water pressure, a decrease in throughput, and a deterioration in the physical and chemical parameters of transported drinking water. Water leaks from pipelines, caused by their structure, are also the reason for raising the groundwater level.

Uzbekistan does not have water resources to provide the population with good quality drinking water. There is a need to create regional water conduits for the transfer of water from the regions.

Centralized water supply systems are not reliable due to wear and tear of equipment and water supply networks and cannot provide the population with high-quality drinking water, which poses a threat to health.

Continuous, largely chaotic and uncontrolled changes in the mode of operation of water pipelines create exceptional difficulties in ensuring the reliable operation of water supply systems. These questions were raised and analyzed by a number of authors [1,2,3]. But they didn't come up with a satisfactory solution.

Water supply systems are a complex of elements, including water intake facilities, pumping stations, reservoirs, treatment facilities, water conduits and a water supply network. The reliability of the functioning of these facilities is one of the main conditions for the uninterrupted supply of water to industrial enterprises and settlements.

In general, the problem of water supply reliability covers a wide range of issues related to ensuring and maintaining the required level of uninterrupted operation of both individual types of equipment and structures that are part of water supply systems. Its solution includes two aspects: quantitative determination of the degree of reliability and provision of its specified technical level. The problem of providing cities and industrial enterprises with stable operation of water supply systems of cities and industrial enterprises found its qualitative solution at the level of technical capabilities and knowledge that characterized the various stages of their development. A feature of the current stage in the

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development of water supply is, along with a qualitative determination of the reliability of the operation of water supply systems, the need for a quantitative approach to solving this problem [3]. The quantitative determination of these properties of the reliability of water supply systems has become possible only recently. A study of the experience of operating water pipelines in different countries has shown that plumbing equipment, such as pumps, pipes, valves, manufactured at the same factory, do not show the same ability to maintain working condition. Because of this, during their operation, damage occurs that causes the failure of water supply systems at the most unexpected moments.

The most intense corrosion is observed on 60% of operated pipelines, which is accompanied by a sharp loss in the throughput of pipeline systems and a deterioration in the quality of the water transported through them.

According to modern concepts, the main cause of corrosion is the corrosiveness of water, which, as a rule, increases when foreign elements enter the inner part of the pipe. The corrosion process is influenced by a large number of interrelated factors, such as the chemical composition and temperature of water, the components contained in it in various concentrations and ratios that inhibit and stimulate corrosion, the grade of pipe metal, the mode of operation of water supply systems, etc.

Metal pipelines mainly operate in settlements with open sources of water supply. As a rule, these are large cities with a significant length of water conduits and water supply networks.

The safety of water supply in the conditions of Uzbekistan is the provision of the population with drinking water that meets the requirements of the state standard of the Republic of Uzbekistan O ' zDSt 950:2011 “Drinking water. Hygienic requirements and quality control”.

The above literature data show that one of the reasons that leads to disruption of the population's water supply systems is also the corrosion of the distribution network. In addition to material damage, internal corrosion, worsening the quality of drinking water, poses a threat to public health. The so-called secondary deterioration of water quality in the systems of its supply and distribution is the main reason for the decrease in the safety of drinking water supply systems in settlements. The quality of water is reduced, as a rule, in terms of color, turbidity, iron concentration, coli-index values, organoleptic indicators (the appearance of odors and tastes). Such changes are especially noted in long-distance systems with many dead-end sections, counter-reservoirs of pumping stations. In the networks of urban and rural water supply systems, the most characteristic contaminants deposited on the walls of pipes are compacted sediment, oxides of manganese and iron (in the form of bumpy growths), complex compounds based on oxides of iron and lime, foreign inclusions (pieces of wood, small gravel, etc.). ). The availability of recent data indicates a low quality of water treatment, as well as the ingress of foreign objects into pipelines during their laying or repair of shut-off and control valves. In drainage networks, sediment can be represented by both mineral (slag, sand) and organic substances.

The study of the safety of drinking water supply of the population has been sufficiently studied in a number of foreign works [2,4,8,9]. At the same time, the state of functioning and safety of drinking water supply systems in Uzbekistan has its own regional characteristics. First of all, these are the features of the hydraulic mode of functioning of water supply systems and the intermittent supply of water to the population.

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The state of safety of drinking water supply is also affected by the aging of underground pipeline communications for various purposes, which leads to losses in water pressure and a decrease in the throughput of pipes due to their overgrowth. There is a deterioration in the physical and chemical indicators (color) of the transported drinking water due to corrosion of water pipes. Due to cracks in pipes, fistulas, violations of butt joints in the event of network aging, water is re-polluted. Water leaks from pipelines caused by their wear also cause groundwater to rise, which can lead to intensive destruction of buildings in operation and existing engineering infrastructure structures.

A characteristic feature of large and medium-sized cities in any region of our country is the presence of branched and very long underground pipelines, in particular, water supply and drainage (sewer) networks of various diameters and materials, which are inevitably subject to aging and the risk of accidents over time.

Improving the reliability of underground pipelines, preventing their aging and promptly eliminating the consequences of accidents in networks are one of the main tasks of the utility services. The solution of these issues is currently of particular relevance, since the aging of underground pipelines and other equipment for various purposes has reached a critical level.

The most expensive element of the water supply complex of any large city is the system for transporting drinking and industrial water. It includes water conduits, a distribution network, facilities installed on it and fittings for shutting down, regulating, maintaining, repairing and ensuring reliable and trouble-free operation of pipelines. Similar problems with their specific manifestations in terms of premature aging, numerous pathologies and related emergencies are also characteristic of the drainage network.

In recent years, the municipal services of metropolitan cities in various countries have been paying more and more attention to solving the issues of using promising trenchless technologies for restoration (rehabilitation) and laying water supply, drainage and other engineering networks, which is an alternative to the traditional open method of reconstruction and construction of pipelines, using excavation and trench methods.

The main causes of damage to water pipelines are pipe wear, poor material quality, excessive pressure, external and internal corrosion, sudden seasonal temperature changes, the formation of air pockets and other factors.

Extending the service life of underground metal pipelines is possible if asbestos cement is sprayed onto their inner surface [10]. In recent years, plastic chips have been used as sprayed repair coatings. These measures met the established technical requirements for pipelines, as they made it possible to increase the duration of operation of networks and postpone the time for their repair. However, these methods proved to be insufficiently effective and are currently practically not used.

When spraying polyurethane-based coatings on the inner surface of steel and cast iron pipelines, pipelines can be used in water supply systems, since the compositions recommended by the technology have the appropriate certificates. Solid coatings in the form of flexible polymer sleeves or pipes made of various materials are used for both water and sewer pipes.

An analysis of the state of water supply in the republic shows that the available technological capacities of water pipelines are used only by 49.6%. With such unsatisfactory use of water supply capacities,

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significant water losses are allowed, on average in the republic - 26.4%, in the Bukhara region - 34.6%, in the Khorezm region - 33.9%, in the Republic of Karakalpakstan - 32.8% [11.12 ,17].

The lack of adequate accounting of water consumption in the housing stock also significantly affects the irrational use of water, especially in the summer, when drinking water is used for irrigating green spaces, cooling food and vegetables, and other needs. In rural areas, there is practically no accounting for water consumption by consumers; it is partially available only in the area of group water supply.

Considering the importance of the drinking water supply sector for the socio-economic development of the country, the Government of the Republic of Uzbekistan in recent years has paid close attention to the reconstruction, development and operation of water supply facilities and networks. Work in this direction should be based on evidence-based approaches and measures, as a result of which, at minimal financial, labor and material costs, it is possible to ensure high reliability and safety of drinking water supply for the population.

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