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ECONOMICALLY EFFICIENT WAYS TO IMPROVE THE RELIABILITY OF WATER SUPPLY SYSTEMS

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Housing services belong to the social sphere connected with everyday life needs of the population . Water supply of cities, settlements and industrial facilities in the required quantities and of the required quality at the required pressure is one of the main tasks of housing services. Improving the reliability of water supply systems is the basis for ensuring safe operation of water utility facilities.

At present considerable attention is paid to ensuring the security of production processes in all spheres of life. The main components in ensuring the safety of production processes are: safety requirements, organization of production, regulation, technical tools, automatization of production as a whole and its processes, control of production, innovative solutions.

In this research the increased reliability to ensure safe production processes, operation, reconstruction and construction of one of the most important aspects of life are analysed. This area covers the water supply systems of cities and towns, settlements, and industrial objects.

Improper operation of water networks for a long time leads to deterioration of their technical condition that has a significant impact on the occurrence of failures and violations in their work. This reflects a reduction in the reliability of water supply systems. To provide the population with high-quality water in the required amount which will meet the existing state standards, it is necessary to take a number of certain measures to improve the reliability of municipal water supplies.

In general the problem of reliability covers a wide range of issues related to providing and maintaining the required level of output of certain types of equipment and structures that are part of the water supply system. Improving the reliability of water networks and their functioning contributes to the growth of labour productivity, saving material resources thus further improving standards of living.

Unfavourable situation with water supply today is under discussion in many countries. Therefore, the problem of improving the stability and reliability of water supply pipelines functioning is now more relevant than ever.

The relevance of this work lies in the consideration of the methods the application of which will make it possible to improve the reliability of water supply systems, namely, methods that are applied to the main element of the system – water supply network. Apart from that the problem of economic efficiency of these methods is considered. Therefore, the method to be chosen should only slightly increase construction costs and subsequent maintenance costs without decreasing quality and working parameters of the system.

Water systems are complex structures designed to supply water in the required quantities and of required quality at the required pressure, at the same time ensuring the reliability of their performance.

The pipelines of the water distribution network are the key elements of urban water supply and, in practice, are its most vulnerable part. Consequently, ensuring reliability of the water supply network functioning correctly is crucial. Water supply network is a system of pipes through which water is transported to consumers.

Systems of water supply and distribution are to meet the following basic requirements:

- to provide consumers with a calculated amount of water;
- to create required pressure in the distribution networks;
- to preserve water quality during its transportation;
- to ensure the reliability and continuity of supply.

Besides the network should be most economical, i.e. to have minimal costs for the construction and operation of the network.

Reliability is a property of an object to maintain through time all the parameters within the established tolerance that are characteristic of the ability to perform the required functions in specified modes and conditions of use, maintenance, storage and transportation. Such an object can be the system as a whole and its separate elements.

It is possible to achieve improvements in the efficiency, reliability and quality of water supply on the condition that information about the technical state of water networks is available. Timely identification of faulty parts of pipelines can help to avoid serious accidents in the sections of the network and thereby avoid large-scale repairs of any damage caused by erosion of large pits, flooding of urban areas, the destruction of buildings, etc. In this connection it is necessary to keep a strict account of damage to the network and analyze the causes of that damage.

The basis for the working out of measures to improve the reliability of urban water supply pipeline network is the estimation and analysis of external factors (characteristics) that can have a significant influence both on the reliability and environmental safety of pipes and on the period of their effective operation.

The technical condition of water supply networks is influenced by various factors such as dynamic load (transport), corrosion, hydraulic shock (sharp change in internal pressure), the deformation of the soil (freezing, thawing, subsidence), groundwater level, aging of metal, the quality of reinforced concrete structures, low quality of construction work, etc.

The high accident rate of pipeline networks jeopardizes water supply to consumers. Repairing damage often leads to long shutdowns of networks and the disruption in water supply. In this connection it is necessary to keep a strict account of any damage to the network and to analyse the causes of the damage.

Comparative analysis of failures and violations in the functioning of water supply systems will allow to define which elements of the network are subject to violations in the course of their work most frequently, and to determine the set of reasons causing these violations. The analysis must take into account the composition of the network and the local conditions, and help to detect weak points in the system of water supply and take the necessary measures.

To consider possible means to improve the reliability it is necessary to study the structure of the network and identify all the weaknesses. A serious role in the reliability of water supply networks is played by the method of installation, namely, in one line (sequentially), or in 2 or more lines (parallel).

With a parallel connection of a number of elements the failure of all elements will cause the failure of the system. If just one element fails then water supply will be guaranteed by the other elements of the system.

Sequential connection of a number of elements in a system is characterized by the fact that the failure of any one element leads to the failure of the entire system.

Another disadvantage of connecting elements sequentially is that the pipelines carry much more stress than the pipelines connected in parallel. Therefore, accidents on such networks are bound to arise more often. Consequently, sequential connection of waterpipes in one line without additional measures to improve reliability does not provide a continuous supply of water.

At present the most frequently used methods for improving the reliability of water supply systems are:

- temporal redundancy;
- duplication;
- structural redundancy;
- designing of ring networks.

According to the data obtained from calculation, we can say that the least economically favourable but at the same time the most reliable way is duplication while the most cost-effective and, at the same time, meeting the requirements of reliability is the transformation of a stub network into a ring one.

The poor state of water networks, the imperfection of their management in most cities, lead to numerous accidents and as a result to material and environmental losses from changes in the hydrogeological regime of the territories, the flooding of urban areas, erosion, excavation, undermining and the collapse of buildings, etc.

The basis for the working out of measures to improve the reliability of water networks and their rehabilitation is the assessment and analysis of external factors (characteristics) that can have a significant influence on reliability and environmental safety and lifetime of pipes.

On the basis of statistical studies of the operation of pipelines it is possible to identify the main factors destabilizing their reliability and environmental safety. The structuring of these factors allows us to identify "weak" links in the system - areas with a high risk of failure and to identify priority objects for restoring (reconstruction, transformation) of pipelines.

At present, there exist relatively inexpensive methods to improve the reliability of water supply systems, allowing to abandon construction of stub networks, which cannot provide the reliability of uninterrupted water supply to consumers.

According to the results of the research the most effective and economical way to achieve reliability is the conversion of a stub network into a ring one through implementing of the required number of jumpers. Therefore, this work proves the effectiveness of using ring networks for city's water supply not only from the engineering-technological point of view, but also economically.

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OPTIMAL PLACEMENT OF ISSUES SUPPLY THE DIFFUSERS AND EXHAUST AIR DUCTS GENERAL VENTILATION

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At an article consider issues of improving industrial ventilation by optimal location of supply and exhaust devices General systems. Article include scheme of air movement by using different diffusers and exhaust devices and formulas to determine their optimal placement.

Ventilation should provide the required climatic and sanitary conditions, especially in the working area. In practice, however, most often take the supply of clean air to the upper zone where it is superheated and saturated with gas and dust hazards, and from there transports them then in the working area. The upper distribution of supply air generally excludes the possibility of reliable maintaining the necessary purity of the atmosphere in the working area.

The inflow to the upper zone is justified only by convenience of laying of air ducts. To opt out of this scheme of distribution of air, the need for new approaches in the design of the physical facilities, allowing not to blow, flooding the work area with supply air.

Widespread distribution obtained of jet supply air does not provide uniform ventilation of the working area. In this case, are formed as active and overly ventilated, and stagnant zones that are not consistent with the increase of air environment quality and completeness of using the beneficial properties of fresh air [1].

The location and design of supply air ducts and diffusers in are in accordance with the production technological and the layout of its equipment. But with any change of technology is necessary to reconstruct system of transportation and distribution of air. The actual ski are not yet available ventilation solutions for the efficient ventilation of the working area in terms of enterprises with frequently changing technology. But flexible technology will be basis of domestic industrial enterprises.

The supply air must come directly into the working area and evenly to ventilate to the entire volume, regardless of production technology. Only in this case possible any re-arrangement of production equipment without reconstructing ventilation systems.

These tasks conforms to the design premises with two floors: the lower primary and upper perforated [2]. Inlet diffuser should be placed evenly between the sexes and to release clean air directly into the underfloor-space. From there he will go straight into the working area through the perforations of the upper floor and continuously displacing harmful emissions up, will provide the necessary purity of the atmosphere.

To reduce the amount of air issuing from the holes should be at slow speed, which may be of the order of 0.1-0.15 m/s, i.e. less than the permissible speed in the working area. In addition, to approach the people to the equipment in the necessary places on the floor are superimposed perforated metal sheets in tracks. Generally, such overhead sheets, you can adjust the flow of air on the floor, directing more volume to work areas and process equipment. The division of the underground section with independent air supply ducts allows you to create the appropriate microclimate and purity of air in the required places under any arrangement of process equipment [3].

Schematic of flow through perforated floors are particularly suitable for hot shops and light industry, as well as wherever you need to maintain the purity of the atmosphere in the whole volume or local areas of the working area.

Section space under perforated floors, and can be equipped with exhaust ventilation, if necessary extraction from the lower zone (for shops with the release of dust, heavy gases, vapours).