STUDY OF THE CONDITION OF WATER PIPELINES AND THE QUALITY OF DRINKING WATER IN THE WATER SUPPLY SYSTEM OF THE CITY OF NUKUS

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ANNOTATION

The article is devoted to the study of the work of monitoring changes in the mineralization of the water of the Amu Darya River within the Karakalpak Republic. The operation of the water supply system is described in stages and analyzed.

Keywords: hydroecological, hydrographic, unsuitable, reservoir, accumulations, corrosion.

ИЗУЧЕНИЕ СОСТОЯНИЕ ВОДОВОДОВ И КАЧЕСТВА ПИТЬЕВОЙ ВОДЫ В СИСТЕМЕ ВОДОСНАБЖЕНИЯ ГОРОДА НУКУСА

АННОТАЦИЯ

Статья посвящена исследованию работы наблюдения за изменением минерализации воды реки Амударьи в пределах Каракалпакской Республики. Поэтапно описан и анализ работы системы водоснабжения.

Ключевые слова: гидрогеологический, гидрографический, непригодный, коллектор, скопления, коррозия.

INTRODUCTION

The territory of the Republic of Uzbekistan is located in one of the low-water regions of the world with very limited water resources. The existing significant shortage of water resources is further aggravated by their qualitative depletion. This process is also complicated by salinization and contamination of surface and groundwater. Against this hydroecological background, a very difficult situation with the water supply of the population has formed in Uzbekistan.

MATERIALS AND METHODS

As I show estimates, 1.8–2.2 m^3/year of water is used for household and drinking purposes in Uzbekistan. The coverage of the population with centralized water supply is on average 70.0%. At the same time, due to the low reliability of water supply systems in cities and settlements of the republic, the available water supply capacities are used only by 53%.

In the conditions of increasing water scarcity throughout Central Asia, the Republic of Karakalpakstan, due to its territorial location in the lower reaches of the Amu Darya, turned out to be the most vulnerable region in terms of water availability.

Due to the decrease in the water content of the Amu Darya River, a radical change in its regime is observed, intensive siltation of the riverbed and significant clarification of the water occur, as well as the mineralization and degree of contamination of the Amu Darya water increases.

The modern natural hydrographic network of the Amu Darya within the delta is represented by the one-arm riverbed, the Kipchak Darya channel and the periodically operating Kazakh Darya arm. Irrigated lands in the Amu Darya Delta are distributed between two large systems of main canals Suenli and Kyzketken.

RESULT AND DISCUSSION

As a result of low water and the discharge of a large amount of collector water into the riverbed, the quality of Amudarya water has sharply deteriorated and it becomes unsuitable for drinking purposes, especially in low-water years .

Observations of changes in the mineralization of the water of the Amu Darya River within the Karakalpak Republic over a long period show that in 1950 – 1963, throughout the year, the mineralization of water in the river changed within acceptable limits and ranged from 330 to 715 mg/l. In subsequent years, the mineralization of Amudarya water gradually increases to 2.2 – 2.8 g/l in the spring, especially in February–March. In low-water years (1982, 1986, 1989), only 1-2 months (July-August) the mineralization of Amudarya water was below the MPC, and in other periods its value reached 2000-2500 mg/l, which increases the maximum concentration by 2.0-2.5 times (Fig.1).

In the Amu Darya River basin, the water quality is deteriorating every year. This problem has become most acute in the lower reaches of the river, where water mineralization has almost doubled over the past 15 years and continues to increase. In 1979, the institute "Sredazgiprovodkhlopok" carried out water management calculations on the forecast of

mineralization of the water of the Amu Darya river. These calculations revealed a further increase in water mineralization as the water intake increases. It is established that it will increase most significantly in the lower reaches of the river.

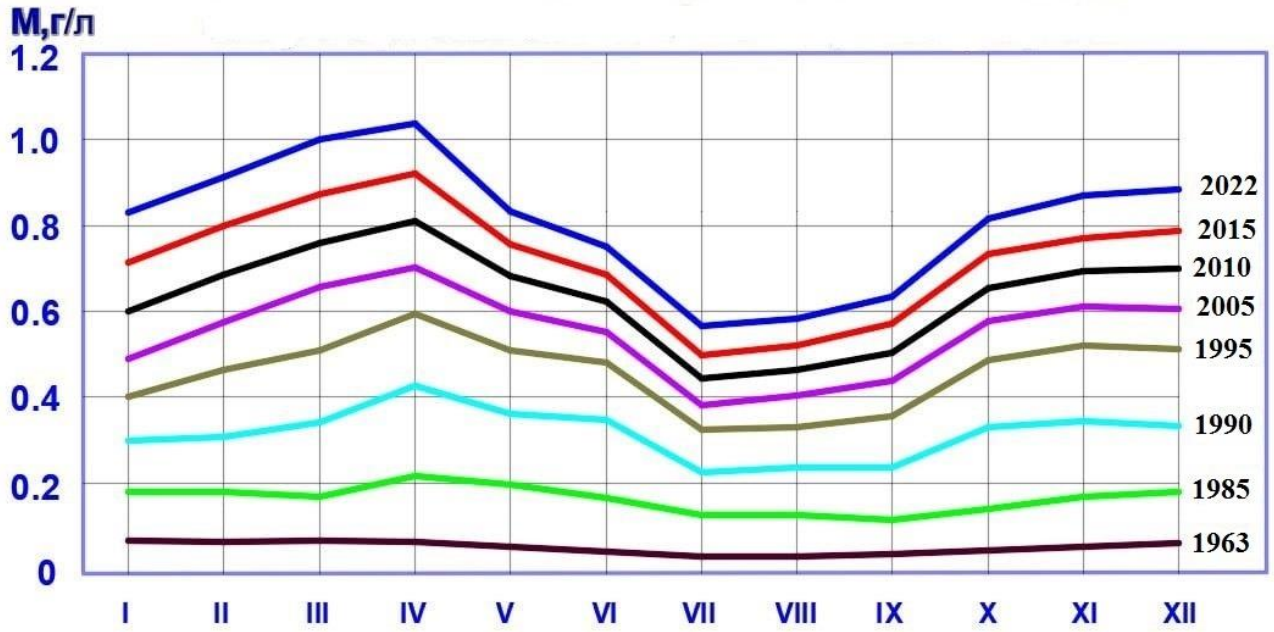

Fig.1. Dynamics of mineralization of Amudarya water near the city of Nukus

Calculations have established that, with regard to low-water years due to the accumulation of summer expenses, the mineralization of water in the Kaparas reservoir will change during the year: at the level of 1985 - 0.5-0.9 g/l, at the level of 2000 - 1.0-1.05 g/l. In the middle-water and high-water years, it will be even smaller.

Thus, the Tuyamuyun–Nukus water pipeline is designed to provide high-quality drinking water to the population of the capital of Karakalpakstan, and will also be extended to the northern regions of the republic. It originates from the channel capacity of the Tuyamuyun reservoir (Kaparas reservoir), therefore, the water quality of the water supply systems of the city of Nukus will largely depend on the quality of river water, and the Kaparas reservoir serves as a source of water intake of the conduit.

At present, despite the availability of sufficient capacity of the central drinking water supply system of settlements and cities, there are still significant problems. In particular, the population is deprived of the opportunity to receive uninterrupted drinking water in sufficient quantity that meets the "drinking water" standard. The analysis of the work of the water supply system of the city of Nukus showed that the possible potential of the centralized water supply system allows providing each resident with drinking water per day in the amount of 145 liters. Water leakage during its transportation is more than 30%. To determine the condition of water pipelines in a centralized water supply system, an inspection of the interior of steel water pipes in the city of Nukus is required. The operated steel pipe with a diameter of d-0.8 m has been in operation since 1970. The walls of the pipe, especially its bottom part, are subject to corrosion, nevertheless, this section of the pipe is used as the main part of the centralized drinking water supply system of the city of Nukus. In order to establish the influence of bottom sediments on

the hydraulic regime of water movement, field studies are required. As a result of the long-term operation of the pipelines of the water supply system, severe clogging of pipes was observed, that is, the accumulation of bottom sediments in them and an increase in the actual value of the hydraulic resistance to friction compared to the design value by more than 10 times, which had an adverse effect on the water supply of the population. Therefore, in 2002-2004, the old steel and cast-iron main pipelines were replaced with plastic pipes.

Due to the ever-decreasing flow of the Amu Darya River in its lower reaches , the degree of mineralization is constantly increasing. At the same time, hygienic standards are also exceeded in terms of the content of chlorides and sulfates, reaching values of 466 mg/l to 734 mg/l, respectively, in some years, and the total hardness is 21.0 mg-eq/l. The indicators of bacterial contamination of water are also significant, especially in the spring and summer period. Tens and hundreds of times exceed the standards for sources of household and drinking water supply. The overregulation of the flow of the Amu Darya rivers and the discharge of collector-drainage waters also made it unsuitable for use as a water supply for the population of the Republic of Karakalpakstan. About 44% of the population of the Republic of Karakalpakstan is provided with centralized water supply, including 66% in cities, and 18% in rural areas. In many rural areas, part of the population is forced to use water from wells and surface reservoirs for household needs.

On water supply lines, there may be emergency damage to both the pipes themselves and the fittings installed on them. Timely detection and rapid elimination of an accident on the network or water pipelines is an extremely responsible task, since when the damaged section is disconnected in the network, water flows are redistributed, pressure is applied and the normal supply of water to consumers is disrupted. In addition, in case of accidents, large water losses and flooding of basements, tunnels, etc. are possible.

The causes of accidents can be various phenomena and events: hydraulic shocks, temperature deformations and accidental mechanical damage, Violation of the tightness of the pipeline can occur due to a violation of the strength and tightness of butt joints, corrosion of pipe material, rupture of pipes and fittings.

Hydraulic shocks on pressure pipelines, which occur as a result of a sudden stop of pumps when the electric current stops, are the most common cause of damage to water pipelines. In urban conditions, it is very important to quickly detect an accident, since water flowing out at the site of damage can spread under the asphalt surface for a long distance.

CONCLUSIONS

1. As a result of human economic activity, an unfavorable water management situation has developed in the lower reaches of the Amu Darya.

2. The results of the research have shown that the water quality of the Tuyamuyun reservoir largely depends on the quality of the Amudarya water, therefore, in order to guarantee the supply of good drinking water to the water supply lines, it is necessary to solve the problem of completely stopping the discharge of collector-drainage waters into the Amudarya riverbed.

3. The location of the Tuyamuyun-Nukus water pipeline in the arid zone, a large length, metal pipes of large diameter – all this requires special approaches to its operation. Prolonged presence of aggressive Amudarya water in iron pipes can cause negative biochemical and

microbiological processes. This conduit is still in operation, therefore, research work is required to determine the current mechanical and technical condition of the conduit..

4. As a result of the uninterrupted supply of drinking water through the centralized water supply system of the city, the water pressure in the pipes and the accumulation of bottom sediments in them decrease, which has an adverse effect on the water supply of the population.

5. Static data on the operation of water supply networks and water pipelines show that the greatest percentage of damage occurs at the junction. In steel pipes, a significant amount of damage is caused by metal corrosion.

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