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Exploring Countermeasures to Enhance the Safety of Water Quality in Urban Water Supply

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Abstract: The safety of water quality in China's urban water supply has always been the focus of attention from all walks of life, and the study and analysis of strengthening the safety of water quality in the urban water supply are to ensure that the quality of life in China's cities and towns is improved as well as the safety of people's lives and health. At present, many cities and towns in China have water quality problems, bringing a great impact on people's lives. Therefore, this paper studies the safety of water quality in towns and cities firstly analyses the main factors affecting the safety of drinking water quality, and then proposes some corresponding measures to solve the current situation. It is hoped that the study of this paper can bring some degree of help to China's urban water supply management.

Keywords:urban water supply; water quality safety; water supply safety

1. Preface

The water quality safety of urban water supply is an important factor affecting the quality of life of residents, which is directly related to the development of towns and cities, social stability and people's health level. First of all, water quality safety is closely related to the health of residents. If the water quality of the urban water supply is not up to standard, residents will drink water containing toxic and harmful substances, which will cause health hazards. For example, harmful substances may lead to a number of diseases, such as gastrointestinal disease, liver disease and so on. Secondly, the safety of water quality in towns and cities has a direct impact on the development of towns and cities. Excellent water quality in towns and cities can provide quality services, attract more investors and promote the economic development of the town area.

Finally, the safety of water quality in towns and cities is also related to social stability. The existence of safety risks in the water quality of urban water supply may lead to instability of facilities in the region, or even a situation of water purification robbery because of water supply problems. Therefore, it is very important to strengthen the safety of water quality in towns and cities. Town management agencies should take effective measures to strengthen water source protection, improve water quality, ensure the safety of residents, promote town development and maintain social stability.

2. Analysis of urban water supply systems

At present, urban water supply systems are mainly composed of water supply pipeline networks. Usually, urban water supply systems are divided according to geographical areas, with each geographical area establishing a water supply system, and they are supplied by a central water supply plant, which then sends water to the pumping stations in each water supply area, and the pumping stations transport the water supply to the residents in the area,

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who can use the water directly (Chen & Zhou, 2018). The water sources for urban water supply systems are both surface water (rivers, lakes and other water sources) and groundwater (wells or underground river water), but because environmental and climatic conditions vary from region to region, there are significant differences in the actual distribution of water resources, which leads to different ways of operating urban water supply systems in different regions and usually requires a locally adapted water supply system management strategy.

Water supply systems are set up primarily to treat, purify and prepare water for use by the population. Water treatment plants generally have two components, water source treatment and purification treatment. Water source treatment is the most basic process in the system and it usually includes filtration, sedimentation and conditioning (Zhang, 2019). Filtration is the removal of suspended matter from the water, sedimentation is the coagulation of the suspended mixture, and conditioning is the adjustment of the pH of the water to keep it within a suitable range for the subsequent purification treatment steps. Purification treatment refers to the process of removing organic matter, heavy metals and other harmful substances from the water. In addition, the staff of the water supply agency regularly maintain and service the system as a means of checking and updating the filtration equipment as a means of ensuring a safe and clean water source for the town's water supply.

3. Problems with the safety of water quality in towns and cities

3.1 Water pollution

Under the impetus of urbanisation development, some towns and cities actively carry out industrialisation development, but because the sewage treatment infrastructure in the area is not sound, resulting in the sewage level of small factories failing to meet the requirements of urban regulations, which leads to the shallow groundwater in the area being affected, and even the phenomenon of regional pollution. In the face of water pollution, localities do not set up scientific emergency mechanisms, increasing the difficulty of drinking water treatment in the region, while the traditional sewage treatment methods can not be solved or are difficult to apply to regional micro-polluted water treatment, resulting in the current regional drinking water quality safety problems can not be guaranteed (Guo, 2020).

3.2 Agricultural aspects of the pollution problem

In the process of urban development, local agriculture still maintains a stable development trend, which leads to increased difficulty in controlling effective surface source pollution in agriculture, specifically: (1) pesticide residues. Excessive or inappropriate use of pesticides can cause residues in the soil, pesticide residues contaminate water sources, seriously endanger the living environment of aquatic organisms, and reverse discharge into rivers and lakes, easily polluting natural water bodies (Yin, 2020). (2) Chemical fertilizer pollution. When fertilizers are applied in excess or mixed, they are easily dissolved in water, forming water pollution. In addition, excessive application of chemical fertilizers can cause loss of soil organic matter, leading to ecological degradation and a decline in the quality of water bodies. (3) Surface water discharge pollution. Agricultural production produces large amounts of surface silt, residue and water pollutants which, if discharged directly into surface water, can cause pollution of water bodies.

To address these problems, firstly, the regional government needs to implement standardised management and promote green farming or planting techniques to farmers in the area to reduce the amount of pollution at the source; secondly, water-saving irrigation is used. Water-saving irrigation can reduce the infiltration of fertilisers and pesticides into groundwater, reducing the level of pollution of groundwater and achieving protection of groundwater sources(Zhai, 2021). It can also reduce the discharge of sewage caused by excessive use of surface water and reduce the discharge of pollutants into rivers and lakes, thus protecting the water quality of surface water sources. In addition, water-saving irrigation can reduce the amount of water transferred, reduce water loss in the process of

water transfer, and reduce the potential impact of pollutant migration on water resources.

4. Measures to strengthen the safety of urban water quality

4.1 Build a water quality monitoring and supervision system

At present, the monitoring and supervision of water quality in urban areas is mainly constituted by local water departments and water supply enterprises, so the whole process of water quality monitoring needs to be carried out from water source extraction - water output - pipe network nodes - end of pipe network - water for residents, in order to protect residents' living Water safety. Specific measures are as follows: (1) Develop water quality monitoring standards for water supply systems. In order to build a water quality supervision and monitoring system for urban water supply systems, water purification standards applicable to local conditions should be developed to ensure that the water quality of the water supply system meets the requirements.

(2) Establish a water quality monitoring system for water supply systems. Regular sampling and testing of the water supply system's water sources, pipe networks and reservoirs, and analysis and judgement of the monitoring results to check whether the water quality of the water supply system meets the standards, which requires a variety of ways to obtain water quality data in different parts of the whole process, such as through water quality online testing devices, regular testing and mobile sampling, etc. The relevant personnel need to strictly follow the national regulations and requirements, of scientific operation, so as to ensure the accuracy of the testing Accuracy of the results (Wang, 2021).

(3) Strengthen the water quality of the water supply system through publicity and social education. To the public, schools and local social groups regularly organise promotional activities, training social workers to increase the public's awareness of environmental protection and self-protection, while the public needs to monitor the work of the water authorities in the supervisory area, for the existence of problems with water quality or water sources to do a good job of reporting.

4.2 Do a good job of protecting drinking water sources

From the perspective of water safety in urban areas, the need to do a good job in the protection of drinking water sources of traceability. As the development of urbanization accelerates, each region will have different degrees of environmental pollution problems, which has a greater impact on surface water, and at the same time, in order to reduce the use of the ground area, some areas will use underground space, tunnel, track construction, the construction process will affect the safety of underground drinking water sources in the region, in view of this, the town water department should actively play a leading role, in coordination with the regional land, urban planning and many other departments, tighten the implementation of the protection of local drinking water sources, while establishing a sound water source protection system and protection system to strengthen the management of water sources (Zhang et al., 2022). Specific measures are as follows.

(1) Strengthen the investigation and assessment of water resources, determine the amount of water that can be exploited, scientifically formulate national economic and social development plans, basically eliminate the water shortage dilemma, effectively improve the efficiency of water resources use, and improve the water source situation in urban areas.

(2) Implement water resources protection planning, control water resources development and utilisation, as well as establish a reasonable water pricing policy and a sound water resources management system.

(3) Raising awareness of water source protection, strengthening water source protection management in urban areas, establishing a water source pollution control system, continuously improving pollution control facilities, strengthening wastewater discharge standards and treating sources of water pollution. At present, water quality in urban areas is affected by many factors, including water pollution problems are

more serious, with the development of urbanisation, the regional ecological environment can be affected by more factors, which requires good prevention and control of pollution at the water source, in order to improve the safety of urban water quality, which requires the water department in conjunction with other departments, the urban area of household water problems to be investigated, through the delineation of drainage units, water supply This requires water authorities to work together with other departments to investigate the water problems of households in urban areas and to carry out regional and grid-based management through the designation of drainage and water supply units (Shu et al., 2022). At the same time, a comprehensive study of water use by users in polluted areas should be carried out, and corresponding sewage treatment measures should be formulated according to the results of the study, so as to gradually improve the regional sewage ecology.

(4) Increase the efforts of water source protection measures such as vegetation protection, actively explore and carry out river protection, river chief systems, water conservation and renovation trials and other protective measures, as well as establish and improve institutional mechanisms for water source protection to promote green development.

In addition to the above measures, water authorities should follow regulations to severely combat and punish acts of polluting water sources, and impose administrative penalties on those responsible or those in charge of enterprises.

4.3 Design a reasonable water supply network planning scheme

The construction of water supply systems in urban areas is a very important project for people's livelihoods, which requires not only increased input from local governments, but also the current situation of water supply in urban areas, which is supported by special water supply funds in rural areas, but some towns fail to set up or use this special fund, resulting in water supply problems in a small number of areas. In view of this, it is necessary to follow the idea of "urbanisation of rural water supply and integration of urban and rural water supply" and design a reasonable water supply pipeline network scheme, with the following specific measures.

(1) Establish a sound management system for urban and rural water supply. We need to strengthen the coordination of urban and rural water supply management, improve the urban and rural water supply management system, establish an urban and rural water supply coordination mechanism and an urban and rural water supply linkage mechanism, and effectively organise and co-ordinate urban and rural water supply co-ordination work.

(2) Improve the investment mechanism for urban and rural water supply. The contribution of financial and social funds in the construction of urban and rural water supply should be given full play, and investment mechanisms for urban and rural water supply, such as financial support, phased payments, construction funds and software services, should be effectively implemented, thereby promoting the in-depth promotion of urban and rural water supply construction.

(3) Focus on the governance of urban and rural water supply safety. To further strengthen the governance of urban and rural water supply safety, accelerate the construction of an "integrated water management system" and unify the governance of various water sources to make the management of urban and rural water supply safety more systematic and standardised, and improve the sustainability of urban and rural water supply.

(4) Encourage the introduction of supporting technologies for urban and rural water supply. We should give full play to the role of science and technology, actively introduce supporting technologies for urban and rural water supply, strengthen the renovation and upgrading of technologies related to the construction of urban and rural water supply networks, improve the quality of urban and rural water supply, and further promote the integration of urban and rural water supply.

Water quality safety in urban areas is related to the physical and mental health of urban residents and is a very important livelihood project, which requires the implementation of a reasonable water supply scheme

to achieve water quality protection. This requires designers to scientifically grasp the current urban development plan and to optimise and adjust the water supply network in old and new urban areas, rather than working behind closed doors. Specific measures are as follows:

(1) divide the town into different areas and set up storage tanks or reservoirs in each area to ensure the water supply in the network;

(2) reasonably arrange pumps to ensure that the volume and pressure of the network remain unchanged;

(3) connect the networks in different areas according to the design flow rate to ensure that the water supply in each area of the city is timely, intensive and safe;

(4) to ensure the safety of the water supply network, regular inspections of the testing of the pipe network to detect and remove faults in a timely manner to ensure the normal operation of the network;

(5) actively carry out the renewal of the water supply network to improve the city's water supply network with modern technology and equipment to ensure higher water quality and water supply.

In addition to the above measures, water supply network renovation work should also be done in the old city areas, in accordance with the principle of "co-ordination and balance", led by the local water department, in conjunction with other departments to do a good job of mapping the old city, and on the basis of the existing, scientifically set up renovation plans, as far as possible for the subsequent renovation work to lay a solid Preliminary preparatory work.

5. Conclusion

The safety of water quality in towns and cities is of paramount importance, which will affect the safety and stability of residents' lives in the region. Firstly, the safety of water quality in towns and cities can provide people with safe and reliable drinking water and ensure the health of residents. Secondly, the safety of water quality in towns and cities will provide good environmental conditions for local economic development and help maintain the local ecological environment. Finally, the safety of urban water quality can bring more investors and contribute to social and economic development. In view of this, water supply enterprises should build a wisdom water platform and do a good job of checking water quality in the whole process of water supply, while the water department should improve the planning and transformation of the current water supply network lines in new and old urban areas and the protection of drinking water sources to improve the quality of water for water users in the region.

Conflict of Interest

The authors declare that they have no conflicts of interest to this work.

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