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LOCAL AND CENTRALIZED WATER SUPPLY: DRINKING WATER SAFETY AS AN IMPORTANT FACTOR OF PUBLIC HEALTH

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ABSTRACT: This article describes the content, operating principles, advantages and limitations of centralized and local (decentralized) systems for supplying the population with drinking water. Special attention is paid to the choice of the water source, treatment and disinfection, maintenance of the distribution network, sanitary control and safety measures at the household level. The analysis is based on international guidance on drinking-water quality and small-community water safety, national water legislation and hygienic literature. It is shown that centralized systems allow water to be prepared in a single technological process and to be controlled regularly in the laboratory, but depend on pipes, pumps and a continuous energy supply, whereas local sources such as wells and springs are valuable where the central network does not reach, but their safety depends directly on location, construction, technical condition and the hygienic habits of users. Neither system can be considered superior in all situations: the choice depends on local conditions, water quality, the number of consumers and the possibility of safe management. Safe water is not merely water that looks clean; it is water controlled at all stages from the source to the consumer, protected from contamination and meeting the established quality requirements. The responsibility for this is shared by state bodies, water supply organizations, local communities and each household.

Keywords: drinking water; centralized water supply; local water supply; well; water treatment; disinfection; sanitary control; public health.

INTRODUCTION

Water is a natural resource necessary for human life, health and well-being. People use it for drinking, cooking, washing, keeping the home clean and other daily needs. However, the availability of water does not mean that it is safe: water that is clear in appearance and usual in taste may still contain disease-causing microorganisms or chemical substances harmful to health. For this reason, water supply is not only an engineering or economic task but also an important matter of sanitation, hygiene and public health.

According to the World Health Organization, unsafe drinking water can cause the spread of diarrhea, cholera, dysentery, typhoid and hepatitis A. The main criteria of a safe drinking-water service are that water is accessible on the premises, available when needed and free from fecal and priority chemical contamination. Consequently, the assessment of water supply cannot be limited to the source alone: the entire path of water until it reaches the consumer must be controlled. Chemical pollution of water resources by domestic, agricultural and industrial waste is an additional and growing concern [1, 3].

Depending on the characteristics of the settlement, the population may receive water through a centralized network or from a local source. The task of both systems is the same: to deliver water in sufficient quantity and of a quality that meets the established requirements. However, their technical structure, methods of control, costs and risks differ. The aim of this article is to describe and compare centralized and local water supply from the hygienic point of view, to review the

indicators and procedures of sanitary control of drinking water, and to discuss the problems of water supply systems and the shared responsibility for drinking-water safety.

METHODS

Scope and source base

This is a scientific analytical article of a narrative type. It is based on the analysis of the World Health Organization guidance on drinking-water quality and on water safety planning in small communities, the reports of the WHO/UNICEF Joint Monitoring Programme, UNICEF materials on water, sanitation and hygiene, the Law of the Republic of Uzbekistan "On Water and Water Use", and the hygienic literature on communal hygiene. No new measurements or laboratory analyses were carried out for this article.

Comparison of the two systems

Centralized and local water supply were compared by the following criteria: the type of water source, treatment and disinfection, distribution of water, responsibility for management and control, and the main hygienic risks. In line with the general principle of sanitary-hygienic analysis, the observed or measured indicators of water are evaluated against normative requirements [3, 6].

Assessment of drinking-water quality and sanitary control

Three groups of indicators are taken into account in the assessment of drinking-water quality: organoleptic, chemical and microbiological. Sanitary control of a water source includes the following steps, which are in accordance with the general principles of testing and evaluating the parameters of the environment [7]:

1. inspection of the territory of the water source;
2. checking the technical condition of the facilities;
3. correct sampling of water into a clean, special container and its delivery to the laboratory in the prescribed order;
4. laboratory analysis of the sample;
5. comparison of the results with the established norms.

If a hazard is found, the cause must be identified, the population informed and corrective measures taken.

RESULTS

Centralized water supply

Centralized water supply is a system in which water is taken from one or several sources through special intake structures, passed through treatment and disinfection, and delivered through a network of pipes to many consumers. It is widely used in cities, district centers, large villages, enterprises and institutions. Its main components are the water source, intake structure, treatment plant, disinfection equipment, pumps, storage reservoirs, main and distribution pipelines and means of control.

A river, reservoir, spring or groundwater may serve as the water source. When the source is selected, its quantity, seasonal changes, likelihood of pollution, chemical composition and ability to meet the long-term needs of the population are assessed. Sanitary protection zones around the source help to restrict polluting activities and to preserve water quality.

Water from open sources is usually prepared in several stages. First, large impurities are retained by screens and mechanical methods. Then coagulation and flocculation may be applied to bring fine particles together, followed by settling and filtration. Finally, depending on the conditions of the system, chlorination, ultraviolet irradiation or other approved methods are used to

inactivate microorganisms. The exact technology depends on the initial quality of the water and on current requirements.

Safety must also be ensured after water leaves the treatment plant. Cracks in pipes, a drop in pressure, repair work or proximity to sewage networks may increase the risk of contamination. It is therefore important to check water quality at the source, at the treatment facility, in the distribution network and at the points where water reaches the consumer.

The advantages of the centralized system are the possibility of preparing large volumes of water in a single technological process and of organizing regular laboratory control. It is convenient for continuous supply to apartment buildings, hospitals, schools and other public facilities. In a properly designed and well-managed network, it is easier to apply uniform water quality requirements and to detect and eliminate emergencies. At the same time, such a system requires construction, electricity, pumps, repair of pipes and the permanent work of specialists.

Local (decentralized) water supply

Local or decentralized water supply means that water is taken from a source close to a particular household, yard or small group of people without connection to a common main network. It may include wells, some springs, protected water intake structures and small local systems. This method is important in rural areas that the central network does not reach and for separately located households.

The convenience of a local source is the reduced need to bring water over a long distance through pipes and, in some cases, lower costs of use. However, the safety of the source depends directly on its location, construction, technical condition and the hygienic habits of users. If a well is close to a latrine, a waste storage place, an area where livestock are kept or a place where wastewater flows, microbes and chemical pollutants may pass into groundwater.

When a well or spring is used, its opening must be tightly closed, its surroundings must be clean and equipped in a waterproof way, and rain and melted snow water must not flow inside. The bucket, rope and other equipment used to take water must be kept clean. Washing clothes, watering animals or collecting waste near the well may pollute the water. In pump systems, the integrity of pipes and joints should also be checked regularly.

The transparent appearance of water from a local source, or the absence of an unpleasant odor, does not prove that it is suitable for drinking. Laboratory examination is therefore appropriate before a new well is used and after a flood, repair of the well or any likelihood of contamination. The scope of the examination depends on the characteristics of the area; usually microbiological indicators, turbidity, odor, taste and important chemical indicators are evaluated.

DISCUSSION

Safety along the whole path from source to consumer

The analysis confirms that the safety of drinking water cannot be judged by its appearance. Safe water is controlled at all stages from the source to the consumer, protected from contamination and meets the established quality requirements. This applies equally to both systems, but the points of greatest risk differ. In the centralized system, the critical points are the integrity of the network after treatment and the continuity of treatment and energy supply. In the local system, they are the placement and sanitary protection of the source and the daily behavior of its users. The choice between the systems therefore depends on local conditions, including regional characteristics [2], and on whether the system can be managed safely.

Problems of water supply systems

The problems of water supply differ by region. In some places, the decrease of water sources, drought and climate change increase the pressure on resources. In other areas, old pipes, water

losses, interruptions in the power supply, aging of treatment facilities, or pollution of water sources with household and industrial waste may be the main hazard [3, 5]. In local wells, non-compliance with sanitary protection and the lack of regular water testing are among the most frequent problems.

Ways of addressing the problems

To reduce these problems, first of all, water sources should be protected and their pollution prevented. Proper management of sewage and wastewater, not discharging waste into water bodies and the careful use of agricultural chemicals in the proper amounts serve to preserve water quality. Timely repair of water facilities and pipelines, reduction of water losses and strengthening of laboratory control are also important.

In the development of the centralized system, attention must be paid not only to the construction of new pipelines but also to the treatment capacity, uninterrupted power supply, qualified personnel and emergency preparedness. In local systems, the priority tasks are the construction of wells in accordance with sanitary requirements, maintenance of the protection zone, periodic testing of water and simple hygienic information for the population. Water facilities managed collectively by the community can also be an effective solution in small settlements, but those responsible for them, the source of financing and the order of control must be clearly defined. The hygiene education of the population and of the persons responsible for water facilities supports the consistent application of these measures [4].

Shared responsibility and rational water use

State bodies, water supply organizations, local communities and each household have their own tasks. If each of them performs these tasks responsibly, it is possible to prevent waterborne diseases, to improve the quality of life and to preserve water resources for future generations. Rational use of water is also a common task: not leaving the tap open unnecessarily, repairing leaking pipes, using water-saving equipment and safely collecting rainwater for suitable needs other than drinking reduce the pressure on water resources. However, saving water must not be achieved by reducing the requirements for its sanitary quality.

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