

DRINKING WATER SUPPLY

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Summary

The problem of providing potable water for people still remains unsolved in many countries and acquires a critical character in some regions. The process of preparing potable high quality water and its delivery to the population depends on a number of factors. The most important are the status of water sources, conditions of centralized systems of potable water supply, sanitary and technical status of the water distribution networks, and level of laboratory control of water quality at all stages of its preparation and supply.

This problem acquires an international character, and scientists of many different countries must be involved in its solution.

Groundwater, surface water, and atmospheric precipitation are the sources of potable water supply.

Establishment of standard requirements is conducted at international, regional, or national levels. The “Manual on Quality Control of Potable Water” developed by the World health Organization in 1994 and the Directive on Potable Water of the European

Community 98/83EC are the principal documents containing recommendations or requirements that are adopted as basic, when national standards or other documents are developed in most countries. Also, several countries are using as basic requirements the norms of the US Environmental Protection Agency (EPA).

The characteristics of the potable water quality can be classified as follows: physical characteristics; chemical characteristics; bacterial characteristics; biological characteristics.

Treatment of water to make it potable includes a complex of physical, chemical, and biological methods. The term, water treatment, includes not just purification from a number of undesirable and harmful admixtures, but also improvement of its natural properties by enriching it with components in short supply.

There are two main constituents for monitoring of potable water quality:

- continuous quality control to ensure that purification and distribution are in correspondence with the permanent aims and existing rules;
- periodic microbiological inspections of the agency responsible for water supply, and sanitary supervision for the whole system of water supply from source to customer.

1. Introduction

Deficiency of potable water, unfavorable changes in its quality, disparity between quality and sanitary and hygienic requirements, and serious consequences for human health from consuming poor quality water cause some of the gravest concern at the beginning of the twenty-first century.

The problem of providing potable water for people still remains unsolved in many countries and acquires a critical character in some regions. The process of preparing potable high quality water and its delivery to the population depends on a number of factors. The most important are the status of water sources, conditions of centralized systems of potable water supply, sanitary and technical status of the water distribution networks, and level of laboratory control of water quality at all stages of its preparation and supply.

The main sources of potable water in many countries are surface water basins. Various causes can lead to deterioration of their condition: intensive pollution (first of all, by unpurified wastewater), unsatisfactory conditions of sanitary protecting zones, etc. Although the sanitary and hygienic conditions of undergroundwater sources is better, pollution by iron, fluorine, bromine, boron, manganese, strontium, and other microelements have all been recently observed in some regions. Intense development of industry, energy production, rural and municipal utilities, increased water consumption, and enhanced requirements for water quality require construction of new systems for water supply and enlargement and modernization of existing ones. Humanity now faces serious problem in supplying water that is harmless for health. This problem acquires an international character, and scientists of many different countries must be involved in its solution.

Specialists under the umbrella of the World Health Organization have elaborated common norms of permissible concentrations of various pollutants in water. The Technical Committee “Water Quality” was organized within the International Standardization Organization (ISO TC 147). This Committee develops methods and procedures of analysis that make possible objective evaluation of water quality in any country. Other international organizations, countries themselves, and regions are also involved in activity targeted at improving water quality.

2. Selection of water sources and their protection

Groundwater, surface water, and atmospheric precipitation are the sources of potable water supply. Groundwater includes water beneath the riverbed, in the ground, in interlayers, artesian, karst, and mine waters. Surface waters include those of rivers, lakes, reservoirs, ponds, channels, and seas. The water composition is determined by soil and geological conditions, as well as by climatic, geomorphologic, and human factors. As a rule, water from the surface sources contains considerable bacterial contamination. Atmospheric water includes precipitation in the form of rain or snow that accumulates in natural or artificial reservoirs. The composition of these waters is determined by the purity of atmosphere, amount of water, hydrogeological properties of the water accumulation basins, and method of water collection and storage. In addition, the conditions at the time of precipitation falling must be taken into consideration.

Groundwaters are usually characterized by constant temperature and composition. Their mineralization is rather high, but suspended matter is absent. The concentrations of organic substances and silicic acid are low. The mineralization of groundwater changes after it reaches the surface, and dissolved oxygen increases.

The composition of natural water alters continuously due to processes of oxidation and reduction, and sedimentation of dispersed and colloidal admixtures and salts. In addition, changes in pressure and temperature, ion exchange between water and bottom sediments, enrichment of water with microelements resulting from biochemical processes, and mixing waters of different origin all cause changes in water composition.

Self-purification of water due to physical, chemical, and biological processes is observed in surface water streams. Aeration, mixing, decanting of suspensions, and dilution of pollutants in large masses of water are all favorable for self-purification. Bacteria and viruses perish due to action of aquatic Protozoa, antagonistic bacteria, bacteriophages, and antibiotics of biological origin. Also, the influence of biochemical and oxidizing processes is important for elimination of bacterial and viral contamination.

The proper selection and protection of water sources are of primary importance for providing safe and harmless potable water supply. It is always better to protect water from pollutants than to purify it after polluting.

Before selecting new sources for potable water supply, it is important to be convinced that water quality is satisfactory and that the water can be purified to the required standards. In addition, the available quantity of potable water must be sufficient to

satisfy the demands. Day-to-day and seasonal variation in water consumption and planned growth of the serviced population should also be taken into account.

The water accumulating area should be protected from unfavorable effects of human activity. Protective measures include isolation of the water accumulating area and control of human activity which could lead to water pollution. Recreational activity in the water accumulating area should be limited.

Sources of groundwater including springs and wells should be selected in such a way as to protect them from surface flow and floodwater. The zones of water take-off should be fenced to prevent human access. These zones should be kept clean and clear of wastes. They should be located so as to prevent formation of stagnant water basins in periods of wet weather. Strict control of livestock is necessary in such zones.

Protection of open surface water is a serious problem. It is possible to protect water reservoirs from most kinds of human activity, but protection for rivers is possible only in a limited way, if at all. It is often necessary to accept existing and historical uses of rivers or lakes and to organize an appropriate water purification process.

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Biographical Sketch

Ludmila A.Prilipko is Chief of Department All-Russia Scientific and Research Institute on standardization, Gosstandart of Russia. Professor Prilipko's research and teaching interests are focused in a number of areas. One is standartization, certification, metrology, management and control quality driking water. A second area is standartization and certification food products and food technology. A third focus is designing (projection) technology processes and production in the food industry. Her research laid the foundation for system certification on drinking water and equipment for water in Russia.