

Аннотация диссертации (abstract)

на диссертацию Самбурского Георгия Александровича
«Разработка и совершенствование теоретических и методологических
принципов формирования технологической и нормативной базы обеспечения
качества питьевой воды в Российской Федерации»
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Abstract

"Development and improvement of theoretical and methodological principles of
formation of technological and regulatory framework to ensure the quality of
drinking water in the Russian Federation"

Relevance of the research topic

Providing the population of the country with high-quality and safe drinking water of the required quality is an important state task and is the basis of the National Project "Ecology", implemented in the Russian Federation since 2019. The processes of organizing centralized drinking water supply to the population are, based on the requirements of environmental and sanitary legislation and technical regulation, in a decisive dependence on the quality of available water sources, on the indicators of energy and resource efficiency of applied technological solutions, as well as on the infrastructure of water supply processes. The existing regulatory documents do not fully take into account the modern technological capabilities of drinking water treatment and transportation facilities, including changes in pollutant emissions caused by anthropogenic or natural causes.

This work is devoted to the development of scientific and methodological foundations for ensuring the safety of drinking water for humans, improving approaches to the choice of theoretical and methodological principles for regulating requirements for water supply sources, theoretical substantiation of requirements for standardization of processes and the formation of national standards that allow from an ecological standpoint to ensure the proper quality of drinking water for the population using the services of centralized drinking water supply.

The purpose of the dissertation is the scientific and methodological substantiation of approaches, principles and mechanisms that allow the formation of standards and requirements for environmental assessment, energy- and resource-saving design and operation of processes for providing populations with drinking water, taking into account the improvement of water quality

control methods and the development of integrated methods for evaluating processes based on an environmentally oriented assessment of life cycle costs.

Tasks of the work:

1. To analyze the existing technological and organizational aspects of organizing the provision of drinking water to the population, based on the results of which to determine the sufficiency of requirements for the description of the operation of drinking water supply systems, identify appropriate barriers (risks), propose and standardize the methodology of description for water supply systems.

2. To analyze the current requirements for water supply sources and propose a methodology for the influence of environmental conditions, which allows to improve and standardize the assessment of the quality of water sources from an environmental perspective.

3. To scientifically and methodologically substantiate the relationship between the state of water sources and the requirements for the technological level of processes and facilities for ensuring the quality of drinking water for the purposes of implementing the National Project (NP) "Ecology", the Federal Project (FP) "Clean Water".

4. Methodologically substantiate the possibility of taking risks into account when choosing drinking water treatment technologies, including risk assessment from an environmental perspective, propose risk assessment criteria and a scientifically based methodology for taking into account risks and factors that make up drinking water supply when choosing a water source, water treatment technologies and transportation of drinking water.

5. Based on the scientific analysis of advanced domestic and foreign strategies to propose and standardize an improved methodology for the organization of quality control of drinking water.

6. To propose a uniform methodological approach to the assessment of capital and operational costs for drinking water supply systems.

7. To consider the features of water transportation and to offer recommendations for the selection of materials from the standpoint of energy and resource conservation for the reconstruction of such systems and analysis of the capacity of metal pipelines of water supply systems.

8. Implement the application of the proposed improved scientific and methodological approaches at water supply facilities and at the level of implementation in regulatory and technical documentation defining environmental, hygienic and technological requirements.

Scientific novelty:

1. On the basis of the conducted scientific analysis, the requirements for ensuring the quality of drinking water in the conditions of quality control of a water source from an

environmental standpoint, at water treatment facilities and distribution network from the standpoint of energy and resource conservation, using probability theory, have been formed. Methodological recommendations on the requirements for the organization of industrial quality control of drinking water have been developed jointly with Rospotrebnadzor.

2. The characteristics of water quality of water sources are scientifically substantiated and standardized from the standpoint of the ecological indicator of anthropogenic load. As a result of the work, four national standards have been developed and implemented.

3. The principles of building systems for automatic control of pollutants in water within the framework of monitoring the quality of drinking and waste water based on automatic control methods have been scientifically substantiated, developed and standardized. A national standard has been developed and implemented.

4. The mechanisms of justification of maximum permissible concentrations based on interval analysis have been scientifically substantiated and formed, which makes it possible to justify environmental requirements for the establishment of permissible concentrations to determine the technological indicators of the best available technologies.

5. On the basis of scientific and methodological analysis, a methodology has been developed that allows, from the standpoint of energy and resource conservation, to form requirements for the choice of water quality assurance technologies based on the assessment of the life cycle cost of materials, reagents, equipment and water supply and sanitation infrastructure facilities. The work was carried out jointly with the Research Institute of Construction Physics on the instructions of the Ministry of Construction of Russia. A national standard has been developed and implemented.

6. The requirements for the reagent for water purification – aluminum polyoxochloride - have been scientifically and methodically substantiated, developed and standardized at the national and interstate level for the first time. National and interstate standards have been developed and put into effect.

7. A national standard in the field of water sampling requirements has been scientifically substantiated, developed and implemented.

8. Based on the scientific analysis, an assessment was carried out and recommendations were proposed to ensure the safe transportation of drinking water from the standpoint of energy and resource conservation in conditions of degradation of pipeline infrastructure. For the first time, an algorithm for choosing solutions for pipeline infrastructure has been developed and implemented from the standpoint of creating a safe and comfortable living environment.

9. The requirements for the description of water supply systems for the needs of local self-government bodies have been formed and standardized on the instructions of the Ministry of

Construction of Russia and the Housing and Communal Services Fund GC. A national standard has been developed and implemented in the field of graphical representation of water treatment systems for the needs of local governments.

The practical results of the work were the creation and approval (including at the interstate level) of a number of standards in the field of quality of reagents for water supply, measurement methods, requirements for water quality of a water source, risk-oriented control.

The improvement of water supply systems through their integration into a common set of measures for sustainable socio-economic development of territories reduces the consumption of primary natural resources and, accordingly, contributes to the sustainable development of water industry enterprises, both during the operation of relevant facilities and during the implementation of design and construction activities. An algorithm has been developed and implemented for selecting technological solutions for water treatment depending on the water quality of the water source, which allows predicting the quality of water at water supply and sewerage enterprises. The relevant document has been implemented by the Ministry of Construction of Russia.

Based on the use of the proposed principles and scientific and methodological approaches, technological approaches to optimizing water treatment processes have been developed and implemented. The developed standards and technological regulations have been implemented at enterprises of the Russian Federation and are protected by patents of the Russian Federation.

Based on the research conducted with the participation of the author of this work, six professional standards have been developed and implemented and for the first time a professional standard has been developed for the new specialty "Specialist in water supply and sanitation technologies (aquatronic)".

Provisions submitted for protection:

1. The analysis of drinking water supply systems and methodological principles of standardization in the description of water supply systems in order to improve the quality of drinking water. National standards in the field of water quality assessment developed under the guidance and with the participation of the author.

2. A scientifically based and standardized approach to determining the quality of water sources from an ecological perspective, taking into account anthropogenic load. Developed national standards for environmental assessment of the quality of water sources. Scientific and methodological principles and mechanisms for assessing the probabilistic nature of the MPC for a water body.

3. Methodological justification and unification of risk assessment for drinking water supply purposes. Principles of requirements for improving water treatment technologies in the

context of risk-based supervision. Approaches to risk assessment in the selection of water treatment technologies developed and implemented based on the results of the study.

4. Substantiation of the frequency of monitoring and the list of controlled indicators, metrological features of determining water quality indicators.

5. Standardization of scientific and methodological principles for the construction of automatic control systems for pollutants in water, including the possibility of correlation assessment for a number of pollutants in their determination. The developed and implemented national standard on requirements for automatic control systems.

6. Standardized methodology and national standard for life cycle cost assessment for Infrastructure facilities, Reagents, Materials and Technical solutions for water supply and sanitation.

7. Methodology of technology selection for the modernization of pipeline water supply systems, implemented for the evaluation of projects within the framework of the "Clean Water". Recommendations for assessing the possibilities of operating metal pipelines from the standpoint of energy and resource conservation.

8. Methodological approaches to standardization of water treatment reagents for the purpose of improving the quality of drinking water. Standardization of aluminum polyoxochloride and aluminum sulfate, developed national standards

9. Formation of the qualification's framework for the purposes of water supply and sanitation from the standpoint of the study of the influence of environmental conditions and the creation of a safe and comfortable living environment. Developed and implemented by the order of the Ministry of Labor dated 05/25/2021 No. 340n professional standard "Specialist in water technologies of water supply and sanitation (aquatronic)"

Keywords: environmental protection, energy and resource conservation, drinking water, water sources, environmental assessment, pollutants