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# **SOCIAL, ECOLOGICAL, AND LEGAL ASPECTS OF ENVIRONMENTAL MANAGEMENT**

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## ***RATIONALE FOR THE REGIONAL WATER QUALITY STANDARDS AND LEGAL MECHANISMS OF STANDARD-SETTING AT THE LEVEL OF THE RUSSIAN FEDERATION SUBJECTS\****

*SUMMARY. This paper considers one of the key aspects of environmental regulation — the system of the maximum allowable concentrations for hazardous substances in water. In Russia, approved legal restrictions on anthropogenic impact are actually based on measuring the concentrations of specific pollutants and comparing them with the maximum allowable concentrations (MACs) for fisheries, sanitary and domestic waters. This system seems to be imperfect, and its apparent defect is in the lack of the regional water quality standards and the required legal mechanisms of standard-setting as a practical matter at the level of the Russian Federation subjects. In this paper, the authors form a scientific rationale for the need to carry the regional water quality standards into effect, to select basic water quality variables, which require regional adjustments, and to conceptually justify the legal mechanisms of their implementation at the level of the Russian Federation subjects (case study of West Siberia). The water quality analysis for the water bodies in West Siberia suggests the need to establish the regional MACs along with the federal standards. The need for regional regulation is occasioned by the well-marked differences in climatic, natural, and landscape conditions, the area differentiation by the levels of human environmental impact, the environmental restoration potential of the areas, the relative density of population, and the pollutant level for the previous period as a result of economic activity. In conclusion, the authors propose the recommendations and legal mechanisms to carry the regional MACs into effect.*

*KEY WORDS. Maximum allowable concentration, regional standards, water quality.*

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Environmental regulation is a challenge for the formation of the ecological security system nowadays. One of the conceptual solutions to the problem of anthropogenic load management is the development of the methodology and legal basis for regulation of environmental pollutants. Fresh water is a vital resource for all life on the planet, and it provides the habitat for aquatic organisms. The purpose of water pollution regulation is to maintain high water quality for the life support of people, the stability and functioning of aquatic and land ecosystems, and the development of anthropogenic activities.

At present, in Russia, as in most European countries, legal restrictions on anthropogenic load are approved on the basis of measuring concentrations of specific pollutants and comparing them with the maximum allowable concentrations (MACs) for fisheries, sanitary and domestic waters. It is well-known that the system of pollution supply restrictions based on the MACs for hazardous substances in water is not perfect; it does not provide an appropriate assessment of water quality, and it does not protect aquatic ecosystems from degradation to the full extent. The main reason for such a result appears to be the absence of the regional water quality standards and the required legal mechanisms of standard-setting as a practical matter at the level of the Russian Federation subjects.

**The purpose of this research** *was to form a scientific rationale for the need to carry the regional water quality standards into effect, to select basic water quality variables, which require regional adjustments, and to develop conceptually the legal mechanisms of their implementation into practice at the level of the Russian Federation subjects (case study of West Siberia).*

#### ***Recommendations for the regional MACs implementation***

To assess water quality in water bodies, a number of different methods and classification schemes are used to refer a water body to a certain water quality class, according to the physico-chemical and hydrobiological variables [1]. In Russia, the same MACs values are used for all types of water and geographical-climatic zones within the large territory of the country (from the arctic zone to the arid one) [2]. At the same time, the toxic effect of pollutants in natural waters can significantly vary depending on the environmental conditions of the water body, the contents of calcium and humic substances, and the temperature conditions. Besides, integrated pollution raises the problem of synergistic and antagonistic effects. Therefore, the MAC system, established on the experimental findings, does not provide a scientific basis for environmental regulation of water pollutants.

Practical experience of environmental monitoring requires the search for optimal solutions that are available in terms of methodology and the cost of their implementation. What values of substance and element concentrations can be used as references for establishing regional standards of their concentrations in water taking into account the regional natural features of water quality? The basic parameters of the chemical composition for the lake waters located far from any industry and urbanization impact were established for the natural and climatic zones of the Tyumen Region [3-4]. The approach of the scientists from the Netherlands is considered to be the most appropriate one [5] to determine the MAC values of the hazardous metals in land waters. The method is proposed to determine the MAC values for fresh waters by summing up the background concentrations of the elements in fresh waters and their "disable" concentrations, i.e. threshold ones. The

values of threshold concentrations determined on the basis of the analysis of numerous experimental and field studies vary for different elements ( $\mu\text{g/l}$ ): Sb — 0.4; As — 1.0; Be — 0.02; Cd — 0.08; Cr — 0.3; Co — 0.2; Cu — 0.5; Pb — 0.3; Hg — 0.01; Mo — 4.3; Ni — 3.3; Se — 0.09; Tl — 0.06; Sn — 0.2; V — 0.9; Zn — 2.9. With this approach, we can assess the degree of water pollution and the allowable values using the data on the element concentrations in different natural and climatic zones.

The analysis of the data [3] demonstrates that the contents of the most hazardous elements, such as cadmium and lead, in the land waters of West Siberia are low. The increased Cd concentrations (up to  $0.37 \mu\text{g/l}$ ) are registered in the lake waters of the northern territories. If we focus on the values of MACs for fisheries and domestic use ( $\text{MAC}_{\text{fsdu}}$ ) enacted in Russia, the Cd concentrations do not exceed them. However, the Ca concentrations in the tundra and taiga zones are low, so, if we focus on the standards of the European countries and Canada [3], [6-8], the critical value of its concentration for the waters in the northern regions is  $0.2 \mu\text{g/l}$ , and in the southern regions it is from 0.8 to  $1.3 \mu\text{g/l}$ . The increased Pb concentrations are observed in some lakes of West Siberia located near the developed system of main transport routes. Similar to the Cd concentrations, the Pb concentrations do not exceed the  $\text{MAC}_{\text{fsdu}}$  values enacted in Russia, but in some lakes, the Pb concentrations exceed the standards of the European countries.

The increased concentrations of manganese are typical of middle and southern taiga and steppe, and the maximum value is  $30 \mu\text{g/l}$ , which is 3 times as high as the MAC. The Mn and Fe concentrations are quite high in many lakes due to natural humification processes in water producing areas which stimulate the element migration in water.

The distribution of the Cu concentrations in the land waters should be analyzed in a more detailed way. The copper concentrations in some lakes are 17 times as high as the MAC values (if we focus on the standards enacted in Russia for fisheries —  $1 \mu\text{g/l}$ ). High affinity of copper to form complexes with organic ligands, as mentioned above, leads to its inactivation [9-10]. Therefore, it is methodologically incorrect to substantiate the environmental risk of water pollution with Cu by comparing its total concentrations to the standards enacted in Russia: if we focus on the standards of the European countries and Canada, there is no water pollution with Cu in West Siberia. Therefore, no enterprise concerned with water utilization in the WS territory can reach the standard Cu value.

There are acidic lakes with very high Al concentration. For low-mineralized water with low pH, this indicator requires tightening, as in acidic waters Al attains toxic properties with the value of  $30 \mu\text{g/l}$ . The increase of this metal content is greatly affected by natural and anthropogenic water acidification. In the latter case, it is highly toxic to aquatic organisms [11-12].

Petroleum hydrocarbons (PH) values in the baseline (natural) lake systems are much lower than the Russian standards, which are quite adequate [4]. The toxic effects of oil pollution are almost independent on the calcium concentration in waters or their pH [13].

On the basis of the international practice, the distribution of the baseline values of the elements in the WS waters and the assessment of natural water quality (their main indicators) in different natural and climatic zones of West Siberia, and the

thresholds of the substances and their compounds, as recommended for the development of the pilot project for conceptual and subject regulatory and legal establishment of regional indicators for surface water quality, the following elements and their values are proposed.

**The tundra and forest-tundra zone (the Yamal-Nenets Autonomous Okrug)**

CaCO<sub>3</sub> (mg/l) <60, the elements (µg/l): Cd — 0.2, Pb — 1, Cu — 2, Mn — 10. pH <6.5, the element (µg/l): Al — 30 µg/l, pH > 6.5: Al — 100.

**The northern and middle taiga zone (the Khanty-Mansiysk Autonomous Okrug)**

CaCO<sub>3</sub> (mg/l) <60, the elements (µg/l): Cd — 0.2, Cu — 2, Pb — 1, Mn — 10. pH <6.5, the element (µg/l): Al — 30 µg/l, pH > 6.5: Al — 100.

CaCO<sub>3</sub> (mg/l) 60-120, the elements (µg/l): Cd — 0.8, Cu — 3, Pb — 2, Mn — 20. pH <6.5, the element (µg/l): Al — 30 µg/l, pH > 6.5: Al — 100.

**The southern taiga and steppe zone (the south of the Tyumen Region)**

CaCO<sub>3</sub> (mg/l) 60-120: Cd — 0.8, Cu — 3, Pb — 2, Mn — 10, pH <6.5, Al — 30.

CaCO<sub>3</sub> (mg/l) 120-180: Cd — 1.3, Cu — 3, Pb — 4, Mn — 10; Al — 100, Mn — 20.

CaCO<sub>3</sub> (mg/l) > 180: Cd — 1.8, Cu — 4, Pb — 7, Al — 100.

Thus, on the basis of the conducted research, it is possible to form an environmental rationale to carry the regional water quality standards into effect at the level of the Russian Federation subjects.

*Status of the regulatory and legal framework*

At present, the Russian legal control of land water quality is regulated by a set of laws and regulations. General standards appear in the Federal Law *On Environmental Protection* (2002) [14], the *Water Code of the Russian Federation* (2006) [15], and other federal laws. They are specified in the subordinate legislation as in the Government Resolutions *On the Procedure for Approval of Standards of Permissible Environmental Impact for Water Bodies* (2006) [16], *On the Procedure for Approval of Standards for Maximum Permissible Discharges of Substances and Microorganisms into Water Bodies for Water Consumers*, (2007) [17]; in the orders of the Ministry of Natural Resources *On Approval of the Guidelines for the Development of Standards of Permissible Impact on Water Bodies*, (2007) [18], *On Approval of the Methodology of Development of Standards of Permissible Discharges of Substances and Microorganisms into Water Bodies for Water Consumers* [19]; in the order of the Federal Fishery Agency *On Approval of the Water Quality Standards for Fishery Water Bodies, Including Standards of Maximum Allowable Concentrations of Harmful Substances in Fishery Water Bodies*, (2010) [20]; and in hygienic standards and sanitary rules.

Legal restrictions of economic activity are based, as already mentioned, on comparing the measured concentrations of water pollutants with the MACs in effect. Therefore, the MAC values are fundamental standards in the system of requirements for water quality. Meanwhile, at the legislative level, the concept of the MAC standards is only regulated by the Federal Law *On Environmental Protection* [14]. Consequently, being generally outlined, this concept leaves out not only the particular geographical and climatic location of various natural objects, but the natural differentiation of their types (water bodies, land, air, minerals, etc.).

In its turn, the MAC concept for water in water bodies is only regulated by the subordinate legislation. For example, in accordance with the GN 2.1.5.1315-03 hygiene regulations [21], MAC is the maximum concentration of a substance in water that, when it enters the body throughout life, must not impact directly or indirectly on population health of the present and future generations, including long periods of life, as well as must not deteriorate the hygienic conditions of water use. This definition highlights **the problem of inconsistency between the federal laws and subordinate legislation not only in the context of the terms and concepts used for the legal regulation, but also in setting goals and objectives for the introduction and application of MACs.** In the legislation of the Russian Federation subjects, no concepts of general or specific MACs for different types of natural objects and ecosystems appear.

The analysis of the existing regulatory and legal framework (both at the federal level and at the level of subjects of the Russian Federation), which determines the establishment and application of water quality standards for water bodies, suggests that in the laws and subordinate legislation, the introduction of water quality standards is hardly linked to the legal consequences of non-compliance with these standards. The responsibility for non-compliance with the MAC standards is of general effect, without distinctions depending on the nature of the violation, the potential or actual impacts, the form and the degree of culpability of the offender, as well as the specific features of the natural objects and ecosystems, which suffer the direct damage as a result of non-compliance with the standards. In other words, **the regulation of environmental quality and certain types of natural objects implies the need to clearly define the legal consequences of non-compliance with the established standards.**

Moreover, there is no clear legal regulation of water quality targets for water bodies of the Russian Federation at the moment. On this matter, the Russian Government issued the Resolution No. 883, dd. 30.12.2006, *On the Procedure for the Development, Approval and Implementation of the Schemes for Multipurpose Water Use and Protection of Water Bodies, the Introduction of Amendments to these Schemes.* [22] The schemes for multipurpose water use and protection of water bodies must set water quality targets for water bodies that characterize the composition and concentration of chemicals, microorganisms, and other indicators of water quality in water bodies that are planned to be achieved upon completing the water-protective and water-economic measures provided by the schemes. The water quality targets for water bodies are developed taking into account the individual natural and climatic characteristics of every river basin, its part, the conditions of the target use of water bodies or their parts located within the river basin.

However, the schemes for multipurpose water use and protection of water bodies have not been developed in Russia yet. In accordance with the Decree of the Russian Government, No. 1235-r, dd. 27.08.2009, *On the Approval of the Water Strategy of the Russian Federation for the Period up to 2020* [23], the above-mentioned schemes must be the main tool to achieve the multipurpose water use for water bodies; but their development will be completed only by 2015.

Considering the current status of the regulatory and legal framework, which defines the procedure for the establishment and application of water quality standards for water bodies in the Russian Federation, we should also note **the problem of**

**the lack of clear sharing of powers between the Federation and its subjects on the MAC introduction and water quality targets for different types of water use.**

According to Article 19 of the Federal Law *On Environmental Protection* [14], environmental regulation is held in accordance with the procedure established by the Government of the Russian Federation. The powers of the public authorities of the Russian Federation in the field of relations concerning environmental protection include the establishment of the requirements for environmental protection, development, and enacting of standards and other normative acts [14, Art. 5]. The powers of public authorities of the Russian Federation subjects include the establishment of environmental quality standards, containing the relevant requirements and standards, which are not lower the requirements and standards established at the federal level [14, Art. 6].

Thus, the environmental legislation concedes the development of standards at the level of the Russian Federation subjects. However, the sectoral water legislation does not contain similar powers of the subjects of the Russian Federation applied to the field of the use and protection of water bodies [15, Art. 25, 26]. Dissembling the powers of the Russian Federation subjects to establish the standards of water quality, the federal legislation, actually, narrows down the potentialities of the Russian Federation subjects for their contribution to the solution of such questions being in joint competence as natural resources, environmental protection, and environmental security (Paragraph D, Part 1, Art. 72 of the Constitution of the Russian Federation).

*The need for regional water quality regulation*

At present, some subjects of the Russian Federation enact their own standards to ensure the water quality in their territories, e.g. the Resolution of the Government of the Khanty-Mansi Autonomous Okrug-Ugra, No. 441-p, dd. 10.11.2004, *On Approval of the Regional Standard "Maximum Allowable Concentrations for Oil and Oil Products in the Benthal Deposits of the Surface Water Bodies in the Khanty-Mansi Autonomous Okrug-Ugra"* [24]. However, as demonstrated above and confirmed by the results of the field research of water samples, the particular geographical and climatic features of different water bodies are often ignored in the water quality standards established at the federal level; and the standards are unreasonably high. In this regard, the demand of the Federal Law *On Environmental Protection* "to establish standards ... not lower than the requirements and standards established at the federal level" practically makes it devoid of sense to form a rationale for the regional water quality standards which are based on the natural background, and to carry them into effect.

The analysis of the water quality in the West Siberia water bodies demonstrates the need to establish the regional MACs along with the federal ones. The need for regional regulation is occasioned by the well-marked differences in climatic and natural conditions and landscape conditions, the differentiation of the areas by the levels of anthropogenic environmental impact, the environmental restoration potential of the areas, the relative density of population, and the pollutant level for the previous period as a result of economic activity.

It is evident that in this situation, the practice of the development and approval of the regional water quality standards at the level of the Russian Federation subjects

by means of enacting the required laws and regulations must be supported by a clear position of the federal legislator. Different forms of federal collaboration and cooperation of consolidated efforts in the field of integrated environmental monitoring of water bodies and related natural systems must be available for the Russian Federation subjects, which have common borders, or which are located in similar geographical and climatic conditions. The appropriate measures to prevent environmental damage and to restore damaged ecosystems must be applied.

The analysis of the socio-economic factors and conditions that determine the need for water quality standards establishment at the level of the Russian Federation subjects gives the reason to suppose that these standards, along with other environmental requirements and standards, can effectively conserve and reproduce the corresponding natural objects and ecosystems. However, it is important to take into account the fact that **the implementation of the requirements for the regional water quality standards (and for other environmental regulations) must be based on the results of the accelerated development of the regulatory and legal framework to ensure the creation of the socio-economic conditions as required and background for the effective use and full compliance with these regulations in the Russian Federation subjects.**

*Regulatory support for water quality regulation  
at the level of the Russian Federation subjects*

In accordance with the *Water Strategy of the Russian Federation up to 2020* [23], one of the priority areas to improve the public administration in the water sector is the development of standards for allowable impact on water bodies, taking into account the regional differences and individual characteristics of water bodies. As shown in this paper above, the results of studying the water samples taken from different water bodies in West Siberia, as well as the current status of the regulatory and legal framework for the environmental regulation in the water sector, prove that in order to implement the above-mentioned principle of the *Water Strategy of the Russian Federation*, as well as the corresponding water quality assessment, there are good reasons to create a legal mechanism of introduction and application of the regional water quality standards at the level of the Russian Federation subjects. These standards are developed to maintain and modernize ecological, economic, and social components in life activity of the population in the geographic and climatic zones of the country.

This mechanism, as far as we can see, must conceptually satisfy the following key parameters:

— the principle of the environmental protection, as set in Paragraph 15 of Art. 3 of the Federal Law *On Environmental Protection*, should be formulated on the basis of the governmental priority tasks to provide favorable environment for the benefit of the present and future generations: to ensure reducing the negative impact of economic and other activities on the environment to a level required by the environmental protection standards. This level can be achieved using the best available techniques taking into account the economic and social factors, **as well as the regional natural conditions and characteristics**;

— the concepts of “water MACs for water bodies”, “regional background”, “regional standards”, and other related concepts are to be formulated in the acts of the sectoral legislation, especially in the *Water Code of the Russian Federation*;

— in the subordinate legislation, the requirements on the compulsory recording of natural and socio-economic conditions of the Russian Federation subjects while justifying MACs as well as the adjustment of regional standards allowed by the federal laws are to be established;

— to ensure compliance with the regional water quality standards, the rights and responsibilities of the governmental authorities and local government bodies for the monitoring and assessment of the actual ecological status of water bodies in relation to the regional baseline values and MACs for chemical and other substances, depending on the current purpose of water use are to be established. At the same time, at the federal level, the rights of the Russian Federation subjects are to be expanded in the specification of the elements of administrative offences in the water sector, and in the establishment of administrative penalties if the set of elements of an offense is not provided for by the *Code of Administrative Offences of the Russian Federation*.

In addition, identifying and fixing legislative gaps in the rationale system of the MACs for water bodies at the federal level, it would be expedient for the following to be introduced into the federal legislation:

— the description of key regional natural conditions in relation to which the MACs are specified;

— the existing and potential interactions between the chemical elements and their compounds in complex water pollution, the combinations of these elements, the actual and potential effects of these interactions and combinations;

— the danger level of exceeding MACs for living organisms, human life and activity; the threshold concentrations of substances and chemical elements in waters of water bodies.

We should point out that the sub-federal framework of laws and regulations is also formed to establish and ensure the application of the regional water quality standards for water bodies. As there is lack of legal regulation in the water sector at the level of the Russian Federation subjects, the development and enactment of the regional Conceptions for regulatory support to maintain and develop the quality of aquatic ecosystems have to be considered as a starting point at the level of the Russian Federation. The contents of such regional Conceptions will be and should be specific for a certain region of the country, as geographical, climatic, environmental, and socio-economic conditions essentially differ. Within this research, as an alternative, we propose the following **pattern structure of the regional Conception for regulatory support to maintain and develop the quality of aquatic ecosystems**:

1. The passport of the Conception.

2. The analysis of the aquatic ecosystems, climatic changes, and their impacts in the territory of a subject of the Russian Federation:

— key problems to maintain and develop the quality of aquatic ecosystems in a subject of the Russian Federation;

— a system of principles, goals, and objectives to maintain and develop the quality of aquatic ecosystems in the territory of a subject of the Russian Federation.

3. The organizational, legal, and economic basis for the utilization and protection of aquatic ecosystems in a subject of the Russian Federation:

— the actual condition and problems in organizing the regulatory and legal framework for the utilization and protection of aquatic ecosystems;

— the organizational mechanism of governmental and local management in the utilization and protection of aquatic ecosystems in the territory of a subject of the Russian Federation;

— the forms and practical experience of public-private partnership in the maintenance and development of water quality and water resources;

— the target program algorithms of implementing governmental policy in the field of water ecosystem management.

4. The main directions of maintaining and developing the quality of aquatic ecosystems in the territory of a subject of the Russian Federation:

— the improvement of the mechanism for regulating relations in the maintenance and development of the quality of aquatic ecosystems;

— the development of organizational and economic methods to effectively control the quality of aquatic ecosystems in the territory of a subject of the Russian Federation;

— the improvement of environmental education;

— the list of Conception actions aimed at supporting and developing the quality of aquatic ecosystems in the territory of a subject of the Russian Federation.

5. Concluding provisions.

As seen from the above suggested pattern structure of the regional Conception for regulatory support to maintain and develop the quality of aquatic ecosystems, such regulations, if enacted at the level of the Russian Federation subjects, will be, in fact, a program-legal foundation to fill the gaps and resolve conflicting regulations found at present in the analysis of the laws and regulations at the federal level, regulating government and environmental management in the water sector.

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