

APPLICATION OF DIRECTIVE (EU) 2020/2184 ON THE QUALITY OF WATER INTENDED FOR HUMAN CONSUMPTION

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Abstract: Drinking water is a vital resource for public health and sustainable development, yet its quality is increasingly threatened by pollution, climate change, and emerging contaminants. Directive (EU) 2020/2184 on the quality of water intended for human consumption introduces stricter requirements for monitoring, risk management, and public transparency. This paper analyzes the content and significance of the Directive, with a focus on the challenges of its implementation in Bosnia and Herzegovina. Special attention is given to harmful substances such as bisphenol A, PFAS compounds, and cyanotoxins, which pose serious risks to human health. The Directive introduces new water quality parameters, promotes access to water as a human right, and encourages the use of tap water to reduce plastic waste. In conclusion, aligning national legislation with this Directive is essential for improving water quality, protecting public health, and achieving sustainable development goals.

Keywords: drinking water, EU Directive 2020/2184, pollutants.

1. INTRODUCTION

Water is a fundamental natural resource, indispensable for the life and health of all living beings. Its availability and quality are key factors not only for preserving public health, but also for stable economic, social, and environmental development. Although planet Earth has vast amounts of water, only a small percentage of that water is suitable for human use, especially for drinking. This limitation, combined with increasingly severe pollution and climate change, makes sustainable water resource management one of the most important challenges facing modern society.

Precisely for this reason, the water sector is recognized as a key component of integrated development, as its social, economic, and environmental dimensions are interconnected. The necessity of integrated water management implies the simultaneous preservation of quality, rational use, and protection

from water. This approach is a fundamental postulate of the legislative framework in Bosnia and Herzegovina, particularly in Republika Srpska, where it is defined by the Law on Waters. Water is used not only for drinking but also in food and energy production processes, in agriculture, industry, and daily technological procedures, making the protection of its quality a priority of general interest [1].

The quality of drinking water is threatened by numerous natural and anthropogenic factors, ranging from industrial pollution and agricultural activities to wastewater and climate change. In addition to classic pollutants, new substances that were not previously regulated and pose a serious risk to human health are attracting particular attention in modern analyzes. In the theoretical part of this work, the focus is placed on: PFAS compounds (per- and polyfluoroalkyl substances), bisphenol A, and cyanobacteria with their associated cyanotoxins.

Given the increasing challenges in the field of drinking water protection, the European Union has adopted a series of directives setting high water quality standards, with Directive (EU) 2020/2184 being particularly noteworthy. This directive is a response to contemporary health and environmental risks, introducing stricter requirements for monitoring, risk assessment, and transparency in drinking water supply. The role of this regulation is not only technical, but also has broader social significance because it recognizes the right to safe and accessible water as a basic human right [2].

Within the framework of this work, the key aspects of Directive (EU) 2020/2184 were analyzed, with a particular focus on its content, objectives, and the innovations it brings compared to the previous Directive 98/83/EC. In addition, the challenges of transposing this directive into the legislation of Bosnia and Herzegovina were considered, with a focus on institutional obstacles, regulatory shortcomings, and the need to strengthen capacity in the field of water protection. This approach allows for a deeper understanding of the current situation, while also emphasizing the importance of aligning domestic regulations with modern European standards to protect citizens' health and conserve water resources.

2. THEORETICAL PART

The explosive growth of the human population is one of the greatest challenges of the modern era. While the population of planet Earth was 1.6 billion in 1900. years, until 2000. By that year, the number had exceeded 5 billion. According to the latest UN projections, the population will reach 2050. to exceed 9 billion by the year (UN projections). This demographic pressure has significant consequences for our planet, including challenges in creating sustainable food sources, protecting the environment, and preventing global diseases.

One of the key resources for human development is freshwater, whose availability and quality are increasingly threatened. Several factors contribute to this situation [3]:

- less than 1% of global water resources are directly available for use, while rapid population growth demands increasing amounts of freshwater for households, agricultural irrigation, and industry;
- increased pollution by various toxic sub-

stances, including heavy metals, insoluble organic pollutants, pesticides, and fertilizers;

- the discharge of pharmaceutical and cosmetic products into the environment. Many of these pollutants enter terrestrial and aquatic ecosystems through uncontrolled discharges and due to accidental situations.

Water quality is a significant factor both for its usability for various purposes and for the survival of living organisms within it. Awareness of the danger to aquatic ecosystems has led to the introduction of numerous regulations worldwide, aimed at reducing the production and use of harmful chemical substances, as well as preserving the ecological status of water [4].

Fresh water is crucial for the survival of all forms of life. It is used as a source of drinking water, for agriculture, sanitation, industry, recreation, transportation, and many other activities. Within all ecosystems, water is in constant interaction with the solid substrate, the atmosphere, and living organisms, representing a key element that connects the living world [4]. Perceptions of water have changed drastically throughout history, from initially perceiving it as a precious treasure and a gift from divine forces, to the modern, more serious approach to this valuable resource base [5].

According to the Food and Agriculture Organization of the United Nations (FAO) classification, water resources are divided into (FAO, 2003):

- renewable water resources, which are calculated based on the water cycle and represent the long-term average annual flow of rivers (surface water) and groundwater; and
- non-renewable water resources, groundwater reservoirs (deep aquifers) that have a negligible rate of regeneration compared to human lifespan.

Water is an essential resource for human well-being and the functioning of ecosystems. At the same time, the ever-growing water scarcity is one of the biggest challenges facing humanity. By 2030. By the year 2050, the world will experience a 40% water deficit. The global distribution of freshwater is uneven both spatially and temporally, and is further exacerbated by changes in total precipitation, interannual variability, and the frequency of extreme meteorological events [6]. Insufficient treatment of municipal and industrial wastewater has led to anthropogenic elements having a significant impact on

water quality. The water scarcity crisis is the result of inadequate appropriation and utilization of natural resources, with two main consequences: a reduction in availability due to increased demand and a gradual decline in water quality [4].

According to their origin, natural waters are divided into atmospheric, surface, and groundwater. Although their characteristics differ, these types of water are interdependent and are constantly circulating through the hydrological cycle, driven by solar energy and the force of gravity [7]. Although the hydrological cycle connects all water, surface and groundwater are usually studied separately. Surface water is considered to be the water of rivers and lakes, while groundwater is that which is stored in underground reservoirs [4]. The hydrological cycle enables the continuous exchange and renewal of freshwater on Earth, thereby maintaining its relative purity. Although most of the Earth's surface is covered by water, only a very small portion of that water can be used for drinking [7]. Water is an exceptionally good solvent for numerous compounds it encounters on its journey through nature. Various compounds that enter the environment through wastewater from households, industry, agricultural land, and other sources can be found in water [8].

Drinking water is defined as water prepared for human consumption, with minimal harmful consequences in the short or long term [9]. According to the Regulation on the Health Safety of Drinking

Water, water is considered safe for health if it does not contain microorganisms, parasites, and their developmental forms, nor substances in quantities or concentrations that, alone or in combination, pose a risk to human health [10]. The main sources of drinking water are groundwater and surface water [9]. More than 96.5% of the water on Earth is found in the oceans, but ocean water is extremely salty and, without prior treatment, unsuitable for human consumption. Oceanic and saline groundwater make up 97.5% of the Earth's water, while the remaining 2.5% is freshwater [11].

The distribution of freshwater is as follows: freshwater groundwater (30.06%), ice/permafrost (0.86%), lakes (0.26%), soil moisture (0.05%), atmospheric water (0.04%), wetlands (0.03%), rivers (0.01%), and biological water (0.003%) [11]. Protecting and ensuring drinking water is a basic need and human right, as an adequate supply of drinking water is crucial for human life and well-being [9].

The hydrological cycle represents the process of water movement in its three basic aggregate states (solid, liquid, and gaseous) through the Earth's surface and interior. This cycle is the driving force for many other processes in the planet's life cycle [9]. Key components of the hydrological cycle include: evaporation, transpiration, condensation, precipitation, snowfall, surface runoff, infiltration, percolation, and groundwater flow [12].

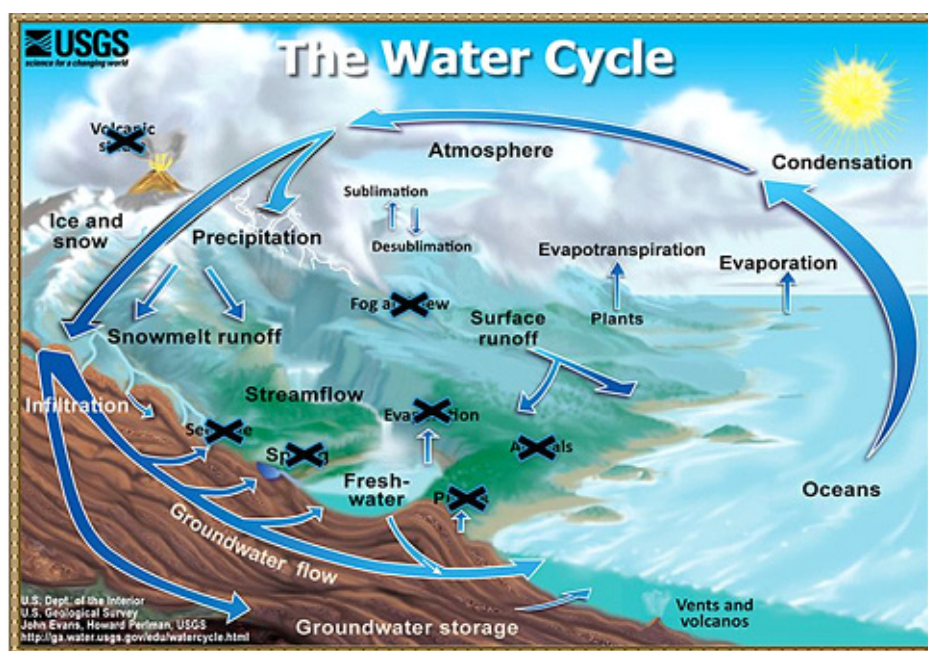


Figure 1. The natural water cycle in nature [12]

The sun's heat allows water to evaporate from oceans, lakes, and rivers, as well as releasing water vapor from plants thru transpiration. When moist air rises into the atmosphere, it cools and condenses, forming clouds that bring precipitation [9]. Although the hydrological cycle naturally provides a continuous flow of water, it is not immune to human activities. Pollutants such as heavy metals, pesticides, microorganisms, and chemicals can enter the water at any stage of the cycle, posing a serious challenge to maintaining water quality [9].

2.1. Emerging water pollutants

Directive (EU) 2020/2184 on the quality of water intended for human consumption defines new parameters that must be monitored to improve water quality control and protection. Among them, the following stand out in particular:

- Bisphenol A (BPA)
- Per- and polyfluoroalkyl substances (PFAS)
- Cyanobacteria
- Cyanotoxins

These substances are designated as indicators of potential risks to human health and the environment.

BPA is a carbon-based chemical compound belonging to the group of diphenylmethane and bisphenol derivatives [13]. BPA is an industrial chemical of commercial significance, with a global production capacity of approximately 5.2 million tons in 2008. year [14]. It is primarily used in the production of polycarbonate plastics and polyepoxides, which explains its widespread use.

Research has proven that BPA easily migrates from products it is found in and that very low concentrations cause various negative biological effects. BPA can mimic the female hormone estrogen, which classifies it as an endocrine disruptor. It has been proven that endocrine disruptors slow fetal development, and there are concerns that they may be partially responsible for the development of breast, prostate, and testicular cancer, as well as for a decrease in sperm count [15].

Due to its toxicity, according to the CLP regulation, BPA is classified as a substance of very high concern (SVHC) and is subject to authorization and restriction lists [16].

The European Food Safety Authority (EFSA) in 2006. In 2002, it set an acceptable daily intake

(TDI) of 50 µg BPA/kg body weight/day, but based on new research in 2015, it... In 2021, it set a new TDI value of 4 µg BPA/kg body weight/day, which is 12.5 times lower than the previous value [15].

According to ECHA, BPA is classified as a substance that: causes toxic effects on reproduction, causes serious eye damage, may cause respiratory irritation and skin allergies, and is very toxic to aquatic life with long-lasting effects [16].

PFAS are a large group of chemicals that are increasingly recognized as significant pollutants. Their production and application are present in numerous industrial sectors, including aerospace and defense, the automotive industry, food contact materials manufacturing, the textile and leather industry, and the food and pharmaceutical industries [17].

PFAS chemicals are characterized by unique physicochemical properties, such as exceptional chemical stability, resistance to water, oil, and high temperatures, and the ability to persist in the environment for a long time. Due to the strong bond between carbon and fluorine atoms, these substances decompose very slowly, which is why they are known as “forever chemicals” [17].

PFAS break down very slowly, which means they continue to pollute the environment even after use has stopped. The main emission sources include industrial facilities, professional and consumer product use, and food contact materials. By polluting groundwater and drinking water, PFAS pose long-term environmental and health risks, as they accumulate in organisms and are linked to serious health problems [16].

Directive (EU) 2020/2184 defines a list of 20 PFAS compounds that must be monitored, with a limit value of 0.10 µg/l for the parameter “Total PFAS”. More PFAS substances are on the REACH candidate list for substances of very high concern (SVHC), among which perfluorooctanoic acid (PFOA), perfluorinated carboxylic acids with nine to fourteen carbon atoms (C9-C14 PFCAs), and perfluorohexanesulfonate (PFHxS) stand out [16].

Cyanobacteria (blue-green algae) represent the oldest and most diverse group of photoautotrophic organisms on Earth. They played a crucial role in the evolutionary history of the planet, being the first organisms to perform oxygenic photosynthesis, contributing to the creation of today's atmosphere [18].

Today, cyanobacteria are most often associated with the eutrophication of water resources, which is considered the primary cause of deteriorating water quality globally. Eutrophication is the process of nutrient accumulation in water, primarily nitrogen (N) and phosphorus (P), leading to reduced depth and species succession due to increased primary production [19]. Anthropogenic impacts further accelerate this process, known as cultural eutrophication, which poses a significant problem for water supply sources [20].

Cyanobacteria have an extremely wide geographical distribution, inhabiting areas from polar to tropical regions. They have developed efficient adaptations that allow them to survive in diverse, even extreme habitats [19]. According to more recent classifications, three basic groups of cyanobacteria are distinguished in aquatic ecosystems: benthic species, planktonic species, and picocyanobacteria [21].

The growth of cyanobacteria is influenced by numerous factors, including light availability, water temperature, nutrient concentration, thermal stratification, and water turbulence [4]. Climate change further exacerbates the situation, as global warming increases water temperature and prolongs seasonal stratification, which favors the development of thermophilic cyanobacteria [19].

The mass appearance of cyanobacteria is known as a “water bloom” [18]. This phenomenon manifests as a change in water color, turbidity, reduced transparency, the appearance of surface foam, and visible clumps on the water surface [22]. In Europe, Asia, and America, over 40% of lakes and reservoirs are eutrophic and provide a favorable environment for the mass development of cyanobacteria [23].

The bloom has serious ecological consequences: it reduces water transparency and blocks the penetration of sunlight, preventing photosynthesis and leading to a decrease in the amount of oxygen in the water. When cyanobacteria begin to die, intense decomposition processes occur that require additional oxygen consumption, which can lead to hypoxia or anoxia, and consequently, to the mass mortality of aerobic organisms [23].

When blooms are associated with negative environmental consequences, they are defined as harmful algal blooms (HABs). The biggest problem related to the occurrence of water blooms is the production of toxic secondary metabolites - cyanotoxins [18].

Cyanotoxins represent a wide range of toxic, low molecular weight compounds that are colorless, tasteless, and odorless, making them particularly dangerous because they often go unnoticed by users of water bodies [24]. There are over a hundred compounds classified as cyanotoxins, which can vary greatly in chemical structure and toxic effects [25]. Cyanotoxins are typically classified according to the organs they affect [20, 25]:

- Hepatotoxins (microcystins, nodularins) - damage the liver,
- Neurotoxins (anatoxins, saxitoxins) - alter neuromuscular transmission,
- Dermatotoxins - cause dermatitis and gastrointestinal inflammation,
- Cytotoxins (cylindrospermopsin) - cause allergic reactions.

The most frequently detected toxins at elevated concentrations are microcystins and cylindrospermopsin, while neurotoxins rarely occur in significant quantities [29]. It is estimated that up to 70% of freshwater blooms worldwide are toxic [17].

- Cyanotoxins can enter the human body thru [4]:
- Consumption of contaminated drinking water,
 - Consumption of food (shellfish, dietary supplements),
 - Inhalation of aerosols during recreation,
 - Dermal contact with contaminated water

Directive (EU) 2020/2184 sets a maximum permissible concentration of 1.0 µg/L for microcystin-LR, one of the most toxic and widespread cyanotoxins. Microcystin-LR is classified as potentially carcinogenic to humans (Group 2B) by the International Agency for Research on Cancer [30].

3. PRACTICAL PART

Access to safe drinking water, sanitation, and hygiene is a fundamental prerequisite for a healthy and dignified life and a key component of Sustainable Development Goal 6 [27]. Over the decades, the European Union has developed a comprehensive legal framework to ensure the quality of drinking water, with the aim of harmonizing national standards, improving public health, and ensuring the free movement of goods and services [28].

The directive introduces seven key innovations that form its practical framework:

- Risk assessment and management throughout the supply chain
- Protection of vulnerable and marginalized groups
- Increased transparency and public information
- Reducing plastic waste and encouraging the use of tap water
- Quality and substance parameters to be monitored
- Watch list and new pollutants
- European Positive List for Materials

The key innovation of Directive 2020/2184 is the introduction of the concept of risk-based management. This concept encompasses all stages of the water supply system, from the source to the end consumer (Table 1) [28].

Table 1. Risk Assessment and Management in the Supply Chain [28]

Chain Phase	Description of Assessment and Measures
Source (Article 8)	Analysis of potential surface and groundwater pollution, including identification of contamination sources from industrial, agricultural, and natural activities.
Water supply (Article 9)	Analysis of water transmission and storage through pipelines, reservoirs, and the distribution network, with the application of treatment and quality assurance measures.
Domestic installations (Article 10)	Assessment of materials used in household installations (pipes, faucets), with a special emphasis on potential risks such as lead and asbestos.

The directive affirms the right to water as a fundamental human right, emphasizing the special obligation to ensure access for vulnerable and marginalized population groups (such as the socially disadvantaged, migrants, the homeless, and rural populations).

Member States are required to:

- Conducting comprehensive assessments of drinking water availability for different social groups.
- Implementation of measures that guaranty physical and economic access to water.
- Providing citizens with information about their rights to connect to the water supply network and available solutions.

- Promoting the use of tap water in public institutions and facilities (e.g., universities, healthcare facilities, shopping malls).

The directive further strengthens the obligation to transparently inform the public, with the aim of increasing citizens' trust in the public water supply system and strengthening the accountability of service providers.

The anticipated obligations include:

- Regular publication of water quality data by local and national institutions;
- Preparation of reports on water supply network losses, including mandatory analysis, determination of limit values, and preparation of action plans by 2028. years;
- Providing easy access to information through digital platforms (websites, mobile applications).

Among the important, albeit indirect, objectives of the Directive is the reduction of the population's reliance on bottled water, which is sought through [2]:

- strengthening consumer confidence in the safety and quality of publicly supplied water,
- mandatory availability of taps in public spaces,
- conducting information and education campaigns about the benefits of local water,
- achieving potential financial savings at the EU level, estimated at hundreds of millions of euros annually.

By encouraging the use of tap water and installing public fountains, the Directive indirectly contributes to reducing the consumption of bottled water and plastic waste.

The Directive (sets stricter standards for monitoring substances in drinking water, with key parameters shown in Table 2 [2].

Table 2. Selected parameters with limit values in accordance with Directive (EU) 2020/2184 [2]

Substance	Limit Value ($\mu\text{g/L}$)	Potential Health Effect
Lead (Pb)	5 (until 2036), currently 10	Neurotoxicity, developmental disorders
Arsenic (As)	10	Carcinogenic, skin and liver damage
Nitrates (NO_3^-)	50	Methemoglobinemia (blue baby syndrome)
Pesticides (total)	0.5	Hormonal disorders, toxicity
PFAS (“forever chemicals”)	0.1–0.5 (in transition phase)	Immunotoxicity, liver damage

The novelty brought by the Directive is the introduction of a “watch list” of substances that are not yet fully regulated but may pose a potential threat to human health. This allows for their earlier detection and improved management of treatment processes.

Table 3. *Examples of substances on the watch list (2022) (European Union, 2020)*

Substance	Type of pollutant	Effect on the organism
Beta-estradiol	Endocrine disruptor	Hormonal disorders, impact on reproductive health
Nonylphenol	Surfactant	Hormonal disorders, bioaccumulation

Member states are obliged to monitor the presence of these substances at “critical points” within the water supply chain.

One of the important innovations is also the establishment of a European positive list of materials that may come into contact with drinking water (Article 11 of the Directive). This list:

- includes all materials approved for use (e.g., plastics, metals, coatings);
- prescribes the obligation of manufacturers to comply with EN and ISO standards;
- enables harmonization and greater transparency in the EU market;
- significantly contributes to consumer health safety and facilitates trade in construction products

Bosnia and Herzegovina, as a signatory to the Stabilization and Association Agreement, is obliged to harmonize its legislation with the EU acquis. However, the process of transposing Directive 2020/2184 faces significant challenges [29].

The decentralized system of government in BiH, where competencies are transferred to the entity level, makes it difficult to coordinate and implement uniform regulations. Although the Food Safety Agency of BiH has a coordinating role, the entities (FBiH and RS) have their own laws and regulations [26].

The current legal framework in the Republic of Srpska, based on the 2017 Regulation on the Health Safety of Water. years, it is still aligned with the outdated Directive 98/83/EC. Although the RS ESAP document recognizes the need to transpose the new Directive, the process is blocked by political disagreements [1, 25].

Key implementation challenges include:

- Lack of harmonization at the state level
- Outdated monitoring infrastructure
- Insufficient capacity of relevant institutions
- Financial constraints for system modernization

Priority measures defined in the ESAP document include full transposition of directives, development of Action Plans, strengthening institutional capacities, and improving water quality monitoring [1].

4. RESULTS AND DISCUSSION

The Directive (EU) 2020/2184 on the quality of water intended for human consumption represents a qualitative leap compared to the previous Directive 98/83/EC, as it introduces an expanded list of parameters and modernized monitoring methods, with the primary goal of improving public health protection and strengthening water supply safety. These changes have a dual character, both technical and regulatory, which makes them a particular challenge for countries in transition, including Bosnia and Herzegovina. While previous regulations primarily focused on basic water quality indicators, the new directive significantly expands the scope and sets a higher standard of responsibility toward end users.

Among the key innovations introduced by Directive (EU) 2020/2184, the following stand out [28]:

- introduction of limit values for certain disinfection by-products (HAA5, chlorate, and chlorite);
- revision of limits for metals such as antimony, boron, lead, chromium, and selenium;
- inclusion of new parameters in regular monitoring, including PFAS, bisphenol A, microcystin-LR, and uranium;
- creating a monitoring list that includes β -estradiol, nonylphenol, and microplastics.

With these amendments, the European Union is not only raising the level of consumer health protection but also improving access to monitoring and risk assessment in the field of water supply.

One of the most significant innovations of the new directive concerns stricter regulation of disinfection byproducts (DBPs). Although disinfection is a crucial protective measure, the chemical reactions of chlorine with organic matter create secondary compounds that can have harmful health consequences.

Unlike the previous directive, the new regulation introduces stricter criteria: the maximum per-

missible concentration for trihalomethanes (THMs) remains 100 µg/l, but with a recommendation to lower the value. For the first time, mandatory limit values were also prescribed for haloacetic acids (HAA5), chlorate, and chlorite, compounds that were not previously monitored (Table 4) [28].

Table 4. Maximum permissible concentration (MPC) for specific compounds [28]

Parameter	MPC (Directive 98/83/EC)	MPC (Directive 2020/2184)
Trihalomethanes (THMs)	100 µg/l	100 µg/l (But a lower level is preferred)
Haloacetic acids (HAA5)	-	60 µg/l
Chlorate	-	0,25 mg/l
Chlorite	-	0,25 mg/l

The new directive also introduces changes regarding the limit values for certain metals that are naturally found in water or originate from the corrosion of water pipes. While some standards remained unchanged, others were tightened, further emphasizing the need to reduce chronic exposure to these elements (Table 5).

The new values for lead and chromium are particularly demanding, as their reduction by 2036 year implies significant investment in the renovation of outdated water supply systems.

One of the key differences between the old and new regulations is the introduction of additional chemical parameters that were not previously required to be monitored, even tho their harmful effects have been scientifically confirmed. The most important among them are [28]:

- PFAS compounds – synthetic substances widely used in industry and everyday products, extremely resistant and long-lasting in the environment;
- Bisphenol A – a known endocrine disruptor;
- Microcystin-LR – a cyanobacteria toxin with hepatotoxic effects;
- Uranium – a natural element in groundwater, harmful to kidney function.

Monitoring these substances relies on mandatory risk assessment, which allows for tailoring measures to each local community based on specific

water supply conditions. This ensures a more flexible and efficient water quality control system.

Table 5. New and revised chemical limits in drinking water according to Directive (EU) 2020/2184 [28]

Substance	Status	Value / Monitoring
β-estradiol	Monitoring list	1 µg/l (WHO recommendation)
Nonylphenol	Watch List	0.3 µg/l (WHO recommendation)
Microplastics	Watch List	Methodology under development until 2024

5. CONCLUSION

Based on the previously discussed research, theoretical insights, and presented results, it can be concluded that the growth of the world's population and the increasing demand for water make sustainable water resource management one of the key issues of the modern era. The combination of intensive consumption in households, agriculture, and industry, along with climate change and pollution, seriously threatens the quality and availability of drinking water, requiring coordinated and decisive measures. In this context, preserving water quality and protecting aquatic ecosystems become priorities, and Directive (EU) 2020/2184 plays a crucial role by setting stricter standards and introducing monitoring of substances such as PFAS compounds, bisphenol A, and cyanotoxins.

The new regulations bring significant progress because they introduce a risk-based approach, set stricter chemical and microbiological parameters, and establish mechanisms for early detection of pollution thru a monitoring list, further emphasizing the importance of transparent information and protection of vulnerable social groups.

The expansion of mandatory parameters, including microcystin-LR and uranium, as well as the tightening of lead and chromium limits, indicates the need for significant infrastructure investments and strategic planning.

The environmental and social dimension of the directive is particularly reflected in the promotion of public water over bottled water, thru the mandatory installation of free sources in public spaces, which simultaneously strengthens trust in the water supply

system and contributes to reducing plastic waste.

However, Bosnia and Herzegovina, although obliged to harmonize its regulations with the EU, has not yet implemented this directive, the entities have initiated activities, but the legal framework still relies on the old Directive 98/83/EC, which does not meet contemporary challenges.

Finally, the Directive (EU) 2020/2184 establishes an integrated risk management model that covers the entire supply chain, from source to end consumer, enabling timely problem identification and targeted interventions, but also requiring a significant strengthening of institutional and technical capacities in water quality control systems.

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6. LITERATURE

- [1] ESAP-Strategija zaštite životne sredine Republike Srpske za period 2022–2032. godine, Vlada Republike Srpske, Banja Luka, 2022.
- [2] European Union, *Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption*, Official Journal of the European Union, L 435/1, pp. 1–62, 2020. [Online]. Available: <https://eur-lex.europa.eu/legal-content/HR/TXT/PDF/?uri=CELEX:32020L2184>
- [3] D.-P. Häder, “Ecotoxicological monitoring of wastewater,” in *Bioassays*, D.-P. Häder, Ed. Erlangen: Friedrich-Alexander University, 2018, pp. 369–383.
- [4] J. Ž. Jovanović, *Rasprostranjenje cijanobakterija u površinskim vodama namenjenim za vodosnabdevanje i rekreaciju u Srbiji*. Beograd: Univerzitet u Beogradu, Biološki fakultet, 2020.
- [5] S. Frioux, “Environmental history of water resources,” in *The Basic Environmental History*, M. N. Agnoletti, Ed. Cham: Springer, 2014, pp. 121–141.
- [6] O. Shumilova, K. Tockner, M. Thieme, A. Koska, and C. Zarfl, “Global water transfer megaprojects: a potential solution for the water–food–energy nexus?,” *Frontiers in Environmental Science*, Lausanne, 2018.
- [7] K. Vojvodić, *Analiza ekološki povoljne metode uklanjanja teških metala iz kontaminiranih voda*. Beograd: Univerzitet „Union-Nikola Tesla“ u Beogradu, 2019.
- [8] D. Damijanjević, *Otpadne vode i utjecaj na čovjeka i okoliš*. Karlovac: Veleučilište u Karlovcu, Odjel sigurnosti i zaštite, 2019.
- [9] R. Rajagopal, M. D. Wichman, and E. Brands, “Drinking water,” in *International Encyclopedia of Geography*, 2016.
- [10] Ministarstvo zdravlja i socijalne zaštite Republike Srpske, *Pravilniku o zdravstvenoj ispravnosti vode za piće*, Banja Luka, 2015.
- [11] I. Shiklomanov, “World Fresh Water Resources,” in *Water in Crisis: A Guide to the World's Fresh Water Resources*, P. H. Gleick, Ed. New York: Oxford University Press, 1993, pp. 13–24.
- [12] U.S. Geological Survey, *The USGS Water Science School: Saline Water*. 2014. [Online]. Available: <http://water.usgs.gov/edu/saline.html>
- [13] M. Kazazić and M. Đapo, “Štetnost ftalata i bisfenola A i njihov utjecaj na zdravlje,” in *Proc. 9th Int. Sci. Conf. on Production Engineering: Development and Modernization of Production*, Mostar: Univerzitet “Džemal Bijedić”, Nastavnički fakultet, 2013, pp. 651–656..
- [14] S. M. Arnold, K. E. Clark, C. A. Staples, G. M. Klecka, S. S. Dimond, N. Caspers, and S. G. Hentges, “Relevance of drinking water as a source of human exposure to bisphenol A,” *Journal of Exposure Science & Environmental Epidemiology*, pp. 137–144, 2012.
- [15] R. Hofer, *Bisfenol A i njegov utjecaj na okoliš*. Završni rad, Sveučilište u Zagrebu, Fakultet kemijskog inženjerstva i tehnologije, Zagreb, 2021.
- [16] European Chemicals Agency (ECHA), *Per- and polyfluoroalkyl substances (PFAS)*, 2025. [Online]. Available: <https://www.echa.europa.eu/hot-topics/perfluoroalkyl-chemicals-pfas>
- [17] Singh, N. Kumar, A. K. Yadav, R. Singh, and K. Kumar, “Per- and polyfluoroalkyl substances (PFAS) as a health hazard: Current state of knowledge and strategies in environmental settings across Asia and future perspectives,” *Chemical Engineering Journal*, 2023..

- [18] D. Drobac, *Putevi izloženosti čoveka cijanotoksinima i njihov uticaj na zdravlje*. Novi Sad: Univerzitet u Novom Sadu, Prirodno-matematički fakultet, 2015.
- [19] S. N. Scholz, M. Esterhuizen-Londt, and S. Pflugmacher, “Rise of toxic cyanobacterial blooms in temperate freshwater lakes: Causes, correlations and possible countermeasures,” *Toxicological & Environmental Chemistry*, pp. 543–577, 2017.
- [20] S. Merel, D. Walker, R. Chicana, S. Snyder, E. Baurès, and O. Thomas, “State of knowledge and concerns on cyanobacterial blooms and cyanotoxins,” *Environment International*, vol. 59, pp. 303–327, 2013.
- [21] W. Vincent, “Cyanobacteria,” in *Encyclopedia of Inland Waters*, G. E. Likens, Ed. Oxford: Elsevier, 2009, pp. 226–232.
- [22] Z. B. Svirčev, *Srpski vodič za cvetanje cijanobakterija*. Novi Sad: Institut za onkologiju Vojvodine i PMF, 2011.
- [23] J. S. Metcalf and G. A. Codd, *Cyanobacterial toxins in the water environment: A review of current knowledge*. Marlow: Allen House, Foundation for Water Research, 2014.
- [24] I. Chorus and J. Bartram, *Toxic cyanobacteria in water: A guide to their public health consequences, monitoring and management*. London: E&FN Spon, WHO, 1999.
- [25] World Health Organization, *Guidelines for Drinking-water Quality: Incorporating 1st and 2nd Addenda, Vol. 1, Recommendations*. Geneva: World Health Organization, 2008.
- [26] International Agency for Research on Cancer (IARC), *Ingested Nitrate and Nitrite, and Cyanobacterial Peptide Toxins*. Lyon: IARC, 2010..
- [27] S. Papuga, *Malozagađujuće tehnologije i čistija proizvodnja*. Banja Luka: Univerzitet u Banjoj Luci, Tehnološki fakultet, 2022.
- [28] J. Agbaba, *Direktiva o vodi za piće – protokol o vodi i zdravlje*. Beograd: Prirodno-matematički fakultet, 2022.
- [29] A. Dučić, “Blokirano usvajanje propisa EU o ispravnosti vode za piće”, *Crna hronika*, Nov. 24, 2023.
- [30] Food and Agriculture Organization of the United Nations (FAO), *Review of World Water Resources by Country*. Rome: FAO, 2003

PRIMJENA DIREKTIVE (EU) 2020/2184 O KVALITETU VOĐE NAMIJEĐENE ZA LJDSKU POTROŠĐU

Sažetak: Voda za piće predstavlja ključni resurs za javno zdravlje i održivi razvoj, ali je njen kvalitet sve ugroženiji usljed zagađeđa, klimatskih promjena i prisustva novih zagađivača. Direktiva (EU) 2020/2184 o kvalitetu vode namijene za ljudsku potrošđu donosi strožije zahtjeve za monitoring, upravljađe rizikom i informisađe javnosti. Ovađ rad analizira sadržaj i značaj Direktive, s fokusom na izazove nene primjene u Bosni i Hercegovini. Posebna pažnja posveđena je štetnim supstancama poput bifenola A, PFAS jeđiđeđa i cijanotoksina koje predstavljađu prijetđu po zdravlje ljudi. Direktiva uvodi nove parametre kvaliteta vode, promovira pristup vodi kao ljudskom pravu i podstiče korišđeње vode iz slavine radi smađeđa plastičnoг отпада. Zaključno, usklađivađe domađih propisa sa ovom Direktivom je ključno za unapređeње kvaliteta vode, zaštitu stanovništva i postizađe ciljeva održivog razvoja.

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