

# Ecological and sanitary safety of water supply sources of the Kyrgyz Republic

*Tashmuhamed Khalmukhamedovich Karimov*<sup>1,\*</sup>, *Nazira Baigazy kyzy*<sup>1</sup> and *Malika Tashmukhamedovna Karimova*<sup>1</sup>

<sup>1</sup>Kyrgyz State Technical University named after I.Razzakov, Bishkek, Kyrgyz Republic

**Abstract.** This article addresses the issue of environmental safety as well as the quality of drinking water and wastewater treatment. The problem of supplying clean water and sewage of settlements and cities of the Kyrgyz Republic is raised. Anthropogenic pollution of natural waters. Inadequate wastewater treatment and unsatisfactory condition of sewage treatment plants. This state of affairs in the water supply and sanitation system of the Kyrgyz Republic requires the development and implementation of new advanced technologies for the treatment of natural and waste waters. Also, the results of this article are aimed at the relevance of scientific research in the treatment of natural and wastewater in the Kyrgyz Republic. Creation and development of innovative technologies, optimization of pumps and pumping units in order to save energy, water treatment, wastewater and collector-drainage water treatment, creation of closed water use systems

**Keywords:** environmental Safety, water resources, water sources, sewerage, water protection zone, bacterial contamination

## Introduction

In the modern world, the relevance of environmental safety has long been recognized and actively researched, and the environment as a subject of safety has become prominent due to its widespread degradation. Solving the security problem is the central strategic task of any State.

The specific natural and climatic features of Kyrgyzstan (Fig. 1), as well as ill-conceived economic activities, led to the emergence and increase of environmental problems. In the areas adjacent to former and operating mining and metallurgical enterprises, unfavorable demographic changes are noted, expressed in an increase in the number of cases of diseases and violations of the gene pool of people associated with radiation. Many environmental problems are related to pollution of Kyrgyzstan's water resources.

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\* [tashmukhamied@mail.ru](mailto:tashmukhamied@mail.ru)



**Fig.1** Map of the Kyrgyz Republic

Although most of Kyrgyzstan's water resources are assessed as clean, in the last decade there has been a deterioration in water quality due to a shortage or malfunction of existing drainage and water distribution systems, which ultimately affects the environmental safety of the state. This trend may intensify in low-water periods, and every year the deficit will be felt more and more.

## Materials and Methods

A significant part of the collected water in the republic is lost when taking water from underground sources and transporting it through the water supply network. The reason for the losses lies in the unsatisfactory technical condition of the water distribution systems, wear and tear of the equipment. The existing networks and facilities and equipment of water supply systems are at an extremely low level. And more than 70% of them need urgent reconstruction and re-equipment. The consequence of this is:

1. Significant losses of clean water during its transportation to consumers (20-26% of the total water intake), [1]
2. Deterioration of drinking water quality, the appearance of outbreaks of infectious diseases.

In accordance with the strategic goal, the Kyrgyz Republic has adopted the Drinking Water program, according to which all settlements should be provided with clean drinking water by 2023. The objectives of the development of the water management complex include [4]:

- \* guaranteed provision of drinking water of standard quality to the population and development of water supply systems;

- \* improving the efficiency of groundwater use; - reducing and preventing negative impacts on water bodies;

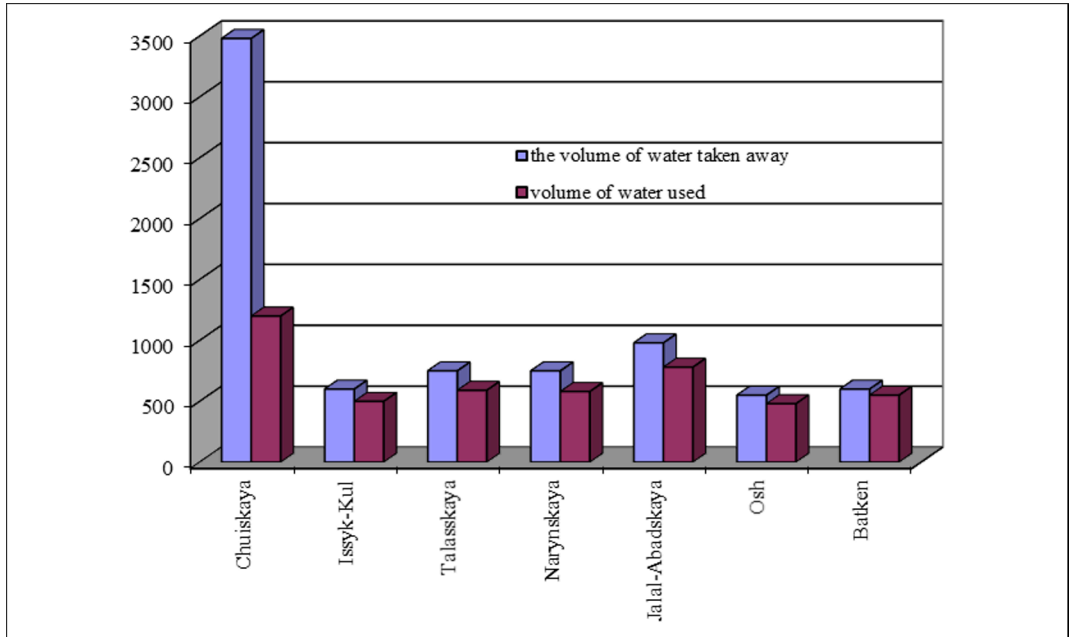
- \* creation and development of innovative technologies, optimization of pumps and pumping units in order to save energy, water treatment, wastewater and collector-drainage water treatment, creation of closed water use systems [13,15];

Examining statistics and infographics, we see that we lose almost 20-30% of water during transportation - these are local losses and leaks due to the fact that the entire water supply

network in Bishkek is in poor condition and huge investments are required for the reconstruction of these networks.

In order to solve these problems, it is necessary to clearly understand and follow a specific, verified action plan.

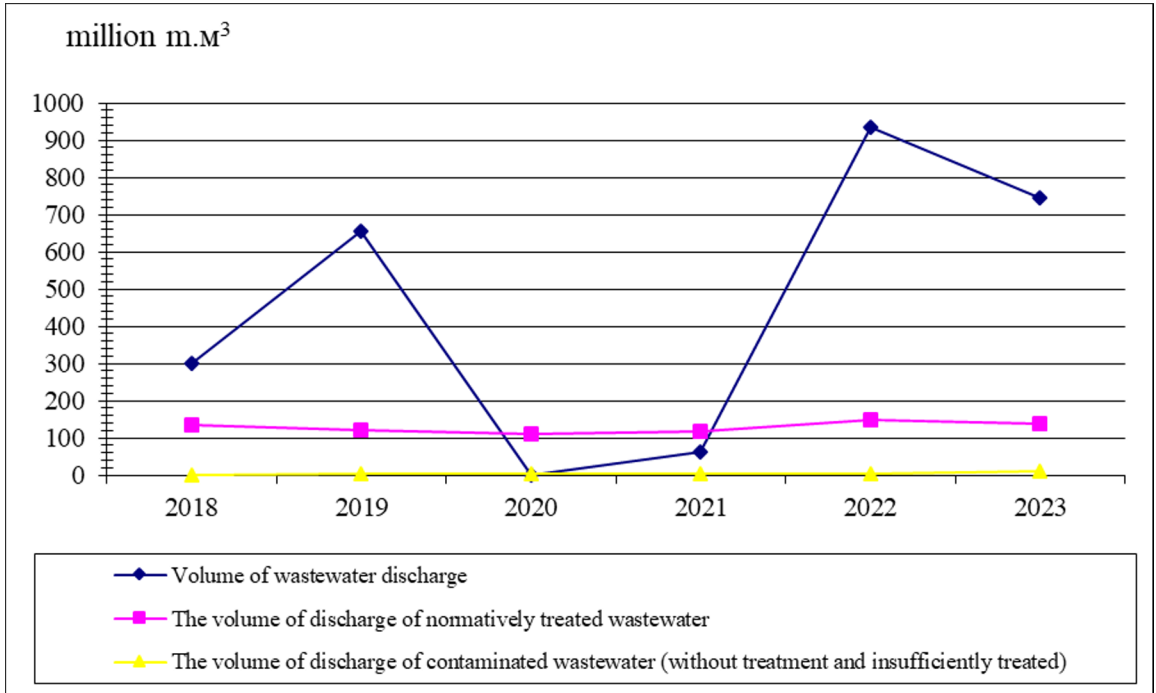
It is necessary to change the established standards and norms. Implement energy-efficient and resource-saving equipment at the legislative level, which will reduce operating costs, as well as have a long life cycle. (Figure 2)



**Fig. 2** Water intake and use by regions of the Kyrgyz Republic, thousand m<sup>3</sup>

In most of the country, the vast majority of small rivers in the valley part are practically unsuitable for drinking purposes. Most of the small towns of the republic do not have centralized sewage systems and sewage treatment plants. Filtration from fields during irrigation due to the dissolution of fertilizers and pesticides, unorganized discharges from agricultural facilities, waste water from fields are the main sources of pollution of groundwater and open water bodies. [1,2]

An increase in the volume of pollutants discharged into the environment, unsatisfactory storage, processing, disposal of industrial and household waste, low agricultural production culture led to local pollution of open reservoirs and groundwater of the republic, shown in Figure 3.



**Fig.3** The main indicators characterizing wastewater discharge (million m<sup>3</sup>)

In the republic as a whole, out of 350 wastewater treatment plants, only 105 (30%) meet sanitary requirements, 140 (40%) do not perform their functions at all. Cholpon-Ata sewage treatment plants biological wastewater treatment on aerotanks does not work.



**Fig.4** Biological water purification of the Cholpon-Ata wastewater treatment plant

Biological treatment on biofilters does not work at the municipal wastewater treatment plants in Jalal-Abad.



**Fig. 5** Distribution bowl of biological filter treatment facilities in Jalal-Abad city

More than half of small towns and regional centers do not have centralized wastewater disposal systems and water treatment plants, for example, 35% of the population of Kara-Balta, about 30% of the population of Jalal-Abad, and only 13% of the population in Naryn. In remote mountain villages, the population uses water for drinking directly from rivers, not knowing about the degree of pollution.

## Results

Data on the discharge of contaminated wastewater into surface water bodies are shown in table 1

By territory, million cubic meters	2019	2020	2021	2022	2023
<b>Kyrgyz Republic</b>					
Batken region	-	-	-	0,2	0,1
Jalal-Abad region	0,7	0,7	0,7	0,4	0,4
Issyk-Kul region	0,0	-	-	-	0,1
Talas region	0,3	0,3	0,3	0,3	0,3
Chui region	3,0	3,0	3,0	1,5	1,5
Bishkek	0,0	0,0	1,0	-	-

Annually, 900-1150 million m<sup>3</sup> of various effluents are diverted to the surface water bodies of the republic, of which 301-635 million m<sup>3</sup> of wastewater undergoes biological, physico-chemical or mechanical treatment. Without purification, 0.42-0.75 million tons are discharged into open reservoirs and watercourses per year. m<sup>3</sup> of dangerously polluted wastewater. The content of harmful substances in them is ten times higher than the established standards. Observations of the Republican Sanitary and Epidemiological Station (SES) showed

that 14% of water samples do not meet bacteriological standards, and 34% do not meet physico-chemical standards. [5]

The entry of organic pollutants, oil and petroleum products, phenols and other harmful substances into water bodies is associated with inefficient cleaning of urban municipal wastewater, wastewater from meat and dairy enterprises, food industry, leather and agricultural production, and motor transport enterprises.

Another danger factor of the environmental situation is that there are 92 facilities on the territory of Kyrgyzstan, which house over 250 million m<sup>3</sup> tons of toxic and radioactive waste. Since most of them are located in outflow cones and in floodplains, there is a possibility of their destruction, which poses a threat to the environment. With the recent intensification of man-made catastrophic phenomena, landslides, mudslides, erosion processes, the threat of contamination of surface and groundwater by them is increasing many times [4,6,8].

A significant factor that has a negative impact on the quality of water resources is disordered economic activity in water protection zones and strips of surface water bodies, as well as the unsatisfactory condition of the zones of sanitary protection of groundwater deposits.

The incidence of children under 14 years of age in the last ten years has amounted to 52 cases out of 1,000 people. The main causes of death were respiratory diseases in winter, as well as acute intestinal diseases in summer, the cause of which lies in poor sanitation and contaminated open water sources. The sanitary condition has deteriorated: schools that previously used toilets with flushing into the sewer system (60 students per 1 toilet) have switched to "toilets" with cesspools (500 students per 1 toilet) due to the lack of personal hygiene (especially for female students).

Table 2 shows the deteriorating health situation of the population, using the example of infant mortality: it is the levels of infant morbidity and mortality that serve as indicators of the health of residents of the region.

**Table 2.** Key health indicators

	2019	2020	2021	2022	2023
Number of doctors total thousand	13,3	13,4	13,6	13,5	13,6
Per 10,000 population	24	24	24	23	23
Number of nursing staff 1 - total, thousand.	31,4	32,3	33,3	33,8	34,5
Per 10,000 population	57	57	58	57	57
The number of hospital facilities in total, thousand.	177	177	179	182	181
Number of hospital beds total, thousand	27,6	27,7	27,6	27,6	26,9
Per 10,000 population	50	49	48	47	45
The number of institutions providing primary health care, units	156	153	163	172	155

The number of paramedic and obstetric stations, units	998	1003	1010	1020	1026
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In recent years, the main indicators of regression related to climate change have also begun to appear. As a result, there is an increase in the lack of drinking water, the destruction of the ecosystem and an increased threat to public health.

Already, about 70% of the population has problems with access to clean drinking water. The highest level of bacteriological contamination of tap water in the republic is observed in Jalal-Abad (28.3%), Chui (18.4%), Issyk-Kul (19.3%) regions, as well as in the cities of Osh (28.2%) and Karakol (33.8%). In the Chui region, the highest level of bacterial contamination of tap water is observed in the settlements of Alamudunsky (33%), Keminsky (20.2%) districts and the city of Tokmok (13.2%), with an average of 9.8% in the republic [2,7].

The results of a study by the Agency for Community Development and Investment in the Kyrgyz Republic (ARIS) conducted in 2013 showed that only 59.9% of the rural population has access to drinking water, since out of 1,890 rural settlements, 725 villages do not have sufficient access to centralized drinking water supply (in 267 villages, water pipelines were built before 1960, in 458 villages - before 1980, in 396 villages there are no water pipelines).

Full coverage of the population by the water supply system is noted only in Bishkek (81%), high, more than 90% — in Chui, Issyk-Kul, Talas regions, low — in Jalal-Abad, Osh, the lowest – in Batken, insufficient number of water pipes was noted in Osh and Naryn region.

The thing is that the aquifer infrastructure, laid down in the middle of the last century, is significantly worn out, and in most villages it has fallen into disrepair. Access to clean drinking water is significantly limited, which is why the number of diseases among the population is increasing.

One of the most acute threats to the environment is household waste. It should be noted that the cleaning of solid household waste in large cities (Bishkek and Osh) does not meet sanitary and environmental requirements, there is no technology for their industrial disposal. Thus, 24 million m<sup>3</sup> of waste is currently stored at the Bishkek landfill (with a design capacity of 3.3 million m<sup>3</sup>), which creates a risk of contamination of groundwater feeding the city of Bishkek [5].

In recent years, most cases of diseases related to drinking water quality have been reported in rural areas of the Kyrgyz Republic, especially in the Southern regions of the country (Batken, Osh, Jalal-Abad regions) and the southern part of Issyk-Kul region (Ton, Jeti-Oguz, Ak-Suu).

The average republican incidence of infections of the general intestinal group remains at a consistently high level, reaching in some years from 332.4 per 100 thousand population to 490.2. The highest incidence was registered in Batken region (980 people per 100 thousand population) and Jalal-Abad (552.8), exceeding the indicator of the country as a whole by 1.8 times.

The more vulnerable segments of society are children, the elderly and the elderly, and sick people. Every year, up to 40 thousand cases of intestinal infection are officially registered in the republic, of which more than 80% of the cases are children under 14 years of age. The mortality rate ranges from 150 to 300 children under 14 years of age. The highest mortality rate is observed in the regions of the southern region (Osh, Jalal-Abad, Batken), which account for 80-90% of all deaths in the republic [3].

Among the diseases related to the quality of drinking water is typhoid fever, outbreaks of which have been occurring for a number of years in the city of Mailuu-Suu and the Nookan district of Jalal-Abad region. This is mainly due to insufficient access to safe drinking water [5].

The incidence of infectious diseases in the population

**Table 2.** Intestinal infections, cases

Kinds	2019	2020	2021	2022	2023
Typhoid fever paratyphs	114	50	69	71	45
Salmonella infections	260	273	199	93	81
Acute intestinal infections caused by unidentified pathogens	18550	21665	18466	18606	17894
Gastroenteritis, colitis caused by established pathogens	8602	10444	9039	9819	9680
Bacterial dysentery	1354	1673	1540	1809	2131
Viral hepatitis					
Viral hepatitis (including serum)	13 252	22 226	20 486	12 024	11 252
hepatitis B	549	565	456	438	349
hepatitis C	111	127	112	104	78
<b>Airborne infections</b>					
Diphtheria	-	1	-	-	-
Whooping cough	77	63	94	113	280
Measles	226	-	1	308	17 783
Mumps is an epidemic	300	377	690	892	569
Meningococcal infection	20	8	12	28	90
Flu	583	2071	431	694	585
Acute respiratory infections	162 106	191 725	142 012	159 934	171 640

## Discussion

All the above-mentioned factors were discussed at the Department of Water Supply and Sanitation, i.e. reducing the environmental intensity of all types of activities is a threat to the environmental safety of the Kyrgyz Republic. At the same time, currently the costs of environmental protection do not exceed 0.03% of GDP.

Of course, at the present stage, when the Kyrgyz Republic is experiencing crises in the economy and politics, environmental safety may be less of a concern, but we must remember that lack of attention to them leads to a decrease in the quality of human habitat and poses threats to the health and safe development of the Kyrgyz population, ultimately it is the environmental safety of the state in the future.

## Conclusions

These problems, outlined in the article in the field of water, energy and resource conservation, are now acute all over the world. This problem is no less relevant in the countries of the South

Caucasus, such as Georgia, Azerbaijan and Armenia, due to the similarity of natural and climatic conditions and terrain. A large number of mountain rivers and underground water reserves. As in Kyrgyzstan, the countries of the South Caucasus are solving the problems of providing clean drinking water and environmental safety of water resources at the legislative level.

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