Ecological and Epidemiological Status of Drinking Water in Chechen Republic

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Abstract. The article deals with the issues of ecological and epidemiological status of drinking water for the territory of the Chechen Republic. Studies of a number of samples of drinking water at various sites of resource-supplying organizations on the territory of the Republic were carried out. Certain deviations from the norms corresponding to sanitary requirements for water pipes and their unsatisfactory condition were revealed. There is an unsatisfactory provision of the population of the Republic with quality drinking water.

1. Introduction
As you know, water is associated with all forms of life on Earth, the quality criteria are adequate, reliable, clean, affordable, acceptable and safe drinking water supply, which should be available to various users. Over the past decade, the environmental situation in the Chechen Republic has not changed much, despite the fact that the emission of harmful substances into the atmosphere and the discharge of polluted waste water into surface water bodies has decreased several times. In most of the administrative territories of the Chechen Republic, issues of surface water pollution, groundwater pollution and depletion, and soil and land fertility conservation are relevant. Anthropogenic loads exceed the established standards, and there is a tense situation in which there are significant changes in the landscape, there is a depletion and loss of natural resources, and the living conditions of the population deteriorate significantly.

2. Theoretical part
Issues of water quality, access to it, condition, and treatment will always be relevant, as they reflect the environmental well-being of the human environment and its anthropogenic activities. They are considered in the works of many domestic and foreign authors. For example, in the work of Tara R. Zolnikov [1], important attention is paid to the possibilities of access to clean drinking water, as well as water-borne diseases caused by poor quality water, and water supply interventions. Issues of drinking water quality are noted in the authors’ work on diseases (diarrhoeal diseases and enteropathy) [2], which are caused by the use of water contaminated with microbes. The victims of such diseases are primarily children under the age of five. The authors provide a comprehensive analysis of water quality in the conditions of limited resources of provincial territories. Surveys were conducted in 405 households in rural communities in Limpopo province to determine.
3. Scientific significance
Long-term consumption of drinking water with a high level of contamination with substances of natural and anthropogenic origin is one of the reasons for the development of diseases in humans. According to the world health organization, every year about 5 million people die as a result of consumption of polluted water and poor hygiene conditions [3]. Many researchers have widely studied the influence of chemical composition, physical properties, microbiological and parasitological parameters of drinking water on human health [4-9], etc. Issues of rational use of drinking water in the Chechen Republic, as well as for all regions of Russia, are important and relevant in the development of the activities of Supervisory organizations that are designed to monitor the quality of water consumption and their condition. As a rule, the supply of drinking water to the distribution network at the points of water intake of the external and internal water supply network should correspond to hygienic standard.

On the territory of the Chechen Republic, there are 5 resource-supplying organizations that provide the population with cold drinking water: sue "Chechvodokanal" (provides drinking water to 11 districts of the Republic and Argun), sue "Vodokanal Grozny" (provides water to Grozny), sue "ZHEU-2 Nadterechny district" (provides drinking water to the population of Nadterechny district, except for the village of Znamenskoye, the village of Podgornoye), sue "puzkhk Vedensky district" (provides Vedensky district), LLC "Rodnik" (provides the Shatoysky district). Currently, there are 573 sources of centralized water supply in the Chechen Republic, including 560 underground sources, 13 surface sources, and 35 water intakes.

The practical significance of the discussion of experimental studies. Epidemiological safety of drinking water is determined by sanitary-chemical, microbiological and parasitological indicators. In 2019, 5105 samples of drinking water were selected and studied as part of the sanitary and hygienic monitoring. The problem remains with water supply facilities and the distribution network. The share of water pipes that do not meet sanitary requirements remains at the same level and is 77%.

583 samples of drinking water were examined for sanitary and chemical indicators from centralized sources, the proportion of unsatisfactory samples was 8.9%, in 2018 – 6.6%, in 2017-10.9%. From centralized sources, 834 samples were examined for microbiological indicators, of which 129 samples (15.4%) did not meet hygiene standards, which is significantly higher than in 2018 (8.6%). From the breeding network, 844 samples of drinking water were examined for sanitary and chemical indicators, 88 of them did not meet the standards, the percentage of non-compliance with hygiene standards was 10.4%, which is 3.8% higher than in 2018 (6.6%) [10].

2573 samples of drinking water for microbiological indicators supplied to the centralized water supply network were studied. The proportion of unsatisfactory samples was 13.9% (in 2018 and 9.4%, for 2017 – 9.8 per cent). 1136 samples were examined from sources, the proportion of unsatisfactory samples was 8.7% (in 2017-19.2%, in 2016-17.5%). These problems are associated with an increase in unsatisfactory samples due to the fact that the country is undergoing reconstruction and replacement of old water pipe networks [10].

| Chechen Republic | Percentage of water samples that do not meet hygiene standards in the distribution network on sanitary and chemical issues indicators | Percentage of water samples that do not meet hygiene standards on microbiological indicators |
|------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 2017             | 10,9%                                                             | 2017                                                                                      |
| 2018             | 6,6%                                                              | 2018                                                                                      |
| 2019             | 10,4%                                                             | 2019                                                                                      |
|                  | 9,8%                                                              | 9,4%6                                                                                     |
|                  | 13,9%                                                             |                                                                                           |

According to the Regional information Fund data social-hygienic monitoring (SGM RIF) for the 2017-2019 biennium., the priority substances polluting drinking water include: increased content of water in underground aquifers calcium, magnesium and iron, high content of humic substances in water from surface sources, anthropogenic and technogenic pollution of surface and groundwaters, the absence or inadequate maintenance of sanitary protection zones (SPZ) of water sources, lack many of the intakes.
of water treatment plants, low sanitary and technical condition of existing water supply networks and structures. The reasons for unsatisfactory water quality according to microbiological indicators are: non-compliance with the sanitary protection zones of water sources; high wear of the distribution networks; unstable water supply to the distribution network, leading to its secondary contamination; lack of disinfection of drinking water.

**Table 2.** Percentage of centralized water supply sources that do not meet the requirements sanitary and epidemiological requirements (%).

| Name                                      | 2017 г. | 2018 г. | 2019 г. | Dynamics by 2018 |
|-------------------------------------------|---------|---------|---------|------------------|
| Centralized water supply sources          | 64,0    | 62%     | 99%     | Growth by 30%    |
| of them due to the lack of sanitary       | 82,8    | 97%     | 99,2%   | Growth by 2%     |
| protection zones, the number of           |         |         |         |                  |
| non-conforming                            |         |         |         |                  |
| including surface                         | 80,0    | 100%    | 100%    | Stably          |
| underground                               | 63,8    | 97%     | 99,2%   | Increase        |

![Figure 1. Share of centralized water supply sources that do not meet sanitary and epidemiological requirements (%).](image)

The share of centralized water supply sources that do not meet sanitary and epidemiological requirements remains stable at the same level.
Table 3. Percentage of water samples in centralized water supply sources that do not meet sanitary and epidemiological requirements (%).

| Name                           | 2017 | 2018 | 2019     | Dynamics by 2018 |
|--------------------------------|------|------|----------|------------------|
| Sanitary and chemical indicators |      |      |          |                  |
| Microbiological indicators     | 19.2 | 8.7% | 15.4%    | Promotion by 7.0%|
| Parasitological indicators     | 0    | 0    | 0        | stably           |

Figure 2. Percentage of water samples in centralized water supply sources that do not meet sanitary and epidemiological requirements (%).

The comparative analysis of sanitary-chemical, microbiological and parasitological indicators in the studied samples of drinking water in the Republic for 2017-2019 shows no positive dynamics. The specific weight of samples that do not meet the microbiological indicators increased by 4.0% [10].

Table 4. Condition of underground sources of centralized drinking water supply in the Chechen Republic.

| Name                                           | 2017 | 2018 | 2019 | Dynamics by 2017 |
|------------------------------------------------|------|------|------|------------------|
| Number of sources                               | 432  | 503  | 560  | Increase         |
| Of them does not meet sanitary rules and regulations (%) | 64,8 | 64,5%| 99,2%| Increase         |
| Incl. due to the lack of sanitary protection zones among non-compliant (%) | 82,8 | 97%  | 99,2%| Increase         |
| The number of samples examined for sanitary and chemical indicators | 288  | 383  | 581  |                  |
| Number of samples examined by sanitary and chemical indicators | 0    | 10,2%| 8,9% | decrease by 1,3% |
Of these, they do not meet hygiene standards (%) 
Number of samples tested for microbiological indicators 
Of these, they do not meet hygiene standards (%) 
Number of tested samples for parasitological indicators Some of them do not meet hygiene standards (%) 

Source: State report «On the state of sanitary and epidemiological welfare of the population in the Chechen Republic in 2019» [10].

In 2019, 1471828 people lived on the territory of the Chechen Republic, including 922886 people in rural areas (63% of the population of the Republic) [11]. In 2019, 1.071.120 people – 73% of the population of the Republic (in 2018 – 91%, 2017 – 90.3%) were provided with drinking water that meets the safety requirements (benign + conditionally benign). There is a decrease in the provision of quality drinking water to the population of the Republic. This is due to the fact that repair works are in full swing in the Republic with the subsequent replacement of the distribution network of drinking water supply.

Table 5. The dynamics of the provision of the population of the Chechen Republic with drinking water, meeting safety requirements.

| Year | 2017 | 2018 | 2019 | Dynamics by 2017 |
|------|------|------|------|------------------|
| Percentage of the population provided with quality drinking water | 90.3% | 91.0% | 73.0% | decrease by 18% |
| Percentage of the population provided with poor-quality drinking water | 9.6% | 9.0% | 14.6% | Increase by 5% |

Source: State report «On the state of sanitary and epidemiological welfare of the population in the Chechen Republic in 2019» [10].

Figure 3. Share of centralized water supply sources that do not meet sanitary and epidemiological requirements (%).
The quality of water from the distribution network of centralized water supply differs significantly in certain regions of the Chechen Republic. The percentage of non-conforming drinking water samples by municipal and urban districts of the Republic is shown in table 6. As can be seen from table 6, the percentage of non-conforming samples in terms of sanitary and chemical indicators exceeds the national average (10.4%) in many regions of the Republic, but a very high level of excess was observed in the Urus-Martanovsky, Nadterechny and Gudermessky districts. The most favorable situation for these indicators is observed in the Shali, kurchaloyev, Shatoy, Sharoy, Itum-Kalinsky, Vedensky districts and Argun, Shali, Urus-Martan, Kurchaloy. The districts that have a high level of microbiological contamination include Urus-Martanovsky, Grozny, Nozhay-Yurtovsky, Gudermessky, Achkhoy-Martanovsky, Sunzhensky, Sharoysky districts and Grozny. The areas in which there is a high level, Kurchaloy, Vedeno and Kurchaloy districts of the city.

Table 6. Percentage of nonconforming drinking water samples by municipal districts and urban districts of the Chechen Republic 2018.

| Name of district     | According to sanitary | Chemical indicators | chemical indicators | For microbiological | Non compliance the | Percentage of non compliance |
|----------------------|-----------------------|---------------------|---------------------|---------------------|---------------------|-----------------------------|
| Grozny               | 402                   | 36                  | 8,9                 | 786                 | 127                 | 16,2                        |
| Argun                | 28                    | 0                   | 0                   | 59                  | 5                   | 8,5                         |
| Gudermes             | 10                    | 2                   | 20,0                | 26                  | 2                   | 7,7                         |
| Shali                | 15                    | 0                   | 0                   | 25                  | 1                   | 4                           |
| Urus-Martan          | 26                    | 0                   | 0                   | 118                 | 13                  | 11                          |
| Kurcaloy             | 3                     | 0                   | 0                   | 10                  | 0                   | 0                           |
| Groznensky           | 105                   | 20                  | 19,1                | 184                 | 24                  | 13,1                        |
| Shatoi               | 18                    | 0                   | 0                   | 407                 | 29                  | 7,1                         |
| Sharoysky            | 0                     | 0                   | 0                   | 7                   | 2                   | 28,6                        |
| Itum-Kalinsky        | 4                     | 0                   | 0                   | 25                  | 1                   | 4                           |
| Achkhoy-Martanovsky  | 52                    | 2                   | 3,8                 | 257                 | 71                  | 27,6                        |
| Sunzha               | 14                    | 2                   | 14,3                | 27                  | 4                   | 14,8                        |
| Urus-Martanovsky     | 4                     | 2                   | 50,0                | 126                 | 27                  | 21,2                        |
| Naursky              | 55                    | 3                   | 5,4                 | 117                 | 5                   | 4,3                         |
| Nadterechny          | 12                    | 6                   | 50,0                | 51                  | 0                   | 0                           |
| Shkelovskaya         | 14                    | 1                   | 7,2                 | 50                  | 4                   | 8                           |
| Kurchalovskaya       | 7                     | 0                   | 0                   | 36                  | 0                   | 0                           |
| Shalinsky            | 15                    | 0                   | 0                   | 21                  | 1                   | 4,7                         |
| Venedo               | 3                     | 0                   | 0                   | 30                  | 0                   | 0                           |
| Nozhay-Yurtovsky     | 12                    | 2                   | 16,6                | 80                  | 18                  | 22,5                        |
| Gudermessky          | 45                    | 12                  | 26,6                | 131                 | 26                  | 19,8                        |
| Ubtotal:             | 844                   | 88                  | 10,4                | 2573                | 360                 | 13,9                        |
4. Conclusion
Drinking water is a vital resource for human health and must meet sanitary-chemical, bacteriological and parasitological indicators. In everyday life, part of the population uses drinking water for cooking. Packed in plastic containers of various spills, which is not subjected to treatment and cleaning, preserving its natural properties, but with long-term storage may lose its natural properties, and in some cases is practically unusable. Therefore, natural underground water is most useful for the body, since it is extracted and bottled directly at the extraction site using modern technologies and adhere to sanitary and hygienic standards.

5. References
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