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CHALLENGING ISSUES OF FRESH WATER WITHIN THE TERRITORY OF EAST KAZAKHSTAN AND ADJACENT AREAS OF CENTRAL KAZAKHSTAN

Abstract. Pollution of fresh drinking water resources is one of the most important anthropogenic problems. Along with the growing population in the world and development of industry and agriculture, the growth of environmental pollution, the issue of clean drinking water has become more urgent and will soon become one of the most important problems worldwide. The results of the research show that nowadays groundwater, especially in large and populous cities of the world, face many problems. The penetration of industrial waste into the soil, the presence of absorbing wells for the disposal of human activity, excessive use of detergents and chemical cleaners, ingress of chemical fertilizers and pesticides into the earth pollute groundwater in the most serious, if not irreversible way. The study of drinking groundwater of Kazakhstan is one of the most urgent problems that should ensure the water security of the country in the face of increasing negative processes in most of the country.

Keywords: drinking groundwater, pollution, environmental problems.

Rivers, lakes and even melting and snow contain large amounts of industrial pollution dissolvable in water. Complex precious technology is required to purify this water. The use of such technology on a large scale is not beneficial to any state for the treatment of large amounts of water. Statistical studies show that in developed countries, everyone uses an average of 300 liters of water per day, in particular for bathing, washing dishes and clothes, washing hands and face, irrigation of gardens and farmland. Only two liters of water is used by each person for the needs of the body. That is why, today, the governments only attempt to provide clean water without microbial purification, i.e. by the chlorination process. Meanwhile, the problem of pollution, including toxic, dissolved in water, remains in force.

The climatic changes of the last century and a decrease in precipitation in arid countries lead to frequent droughts causing serious aggravation of the water crisis in the world. Currently, the water scarcity has reached the point being determined by the World Economic Forum as water shortage to be the third global threat of the twenty-first century. Environmental experts also note that more than half of the world's high-rainfall areas have been destroyed so far. Climate fluctuations around the world have changed the patterns of atmospheric water cycle, led to a serious deficit and crisis in water resources.

In Kazakhstan, 20% of the population consume drinking water of poor quality, what is stated in the State Program "Ecology of Kazakhstan" for 2010-2020.

"There is still an acute problem of the population's access to qualitative drinking water, herewith, up to 20% of the population of the Republic of Kazakhstan consume water not meeting the regulatory quality standards", - the State Program notes.

The document explains that the problem relevance of the sustainable water supply of Kazakhstan is determined by the limited availability of water resources, a high degree of pollution, uneven distribution of their reserves in the country. Despite the general shortage of fresh groundwater, groundwater, even in

the explored fields, is not used in full - from 0.2 to 12% of the explored reserves, which affects the degree of water supply to consumers - residential areas and entire regions.

In addition, the environmental experts note, the process of pollution and depletion of surface waters continues, the main cause of which is the growing volumes of fresh water consumption for household and drinking needs from year to year and, accordingly, the volume of discharges to the reservoirs of untreated or insufficiently treated wastewater [1-10]. According to the World Health Organization (WHO), water contains 13 thousand potentially toxic elements, 80% of diseases are transmitted by water. Each year 25 million people on the planet die of them.

It is known that the main water pollutants are phenols, petroleum products, copper, zinc compounds, nitrate nitrogen, mercury, manganese, etc., all these substances are formed as a result of the activities of various enterprises and the settlements functioning. The growth of cities and the rapid development of industry in the XX century led Russia to a rather difficult situation in terms of water quality. Therefore, anthropogenic impact is the main reason for the biosphere functions decline, changes in the groundwater physical and chemical state.

Groundwater pollution occurs during the harmful substances filtration from the surface. Thus, there are several types of pollution sources: industrial sites that use substances able to migrate with groundwater; storage of industrial products and waste; places of household waste accumulation; irrigation fields of agricultural products. Places of pesticides storage, including those ones prohibited for use, as well as enterprises associated with oil production and refining, pose a special danger [11-14].

Pollution of aquatic ecosystems poses a great danger to all living organisms and, in particular, to humans. Mankind has always sought to increase water consumption, exerting a diverse pressure on the hydrosphere. Water, among other things, is the most important social factor, as water bodies, first of all, provide the population with drinking water.

It is established that water pollution can be caused by more than 400 types of substances. In our industrial age, due to the sharp increase in waste, the water bodies are unable to cope with such significant pollution. There is a need to purify wastewater and dispose it. Wastewater treatment is a forced and expensive activity, which is quite a difficult task. The world practice testifies about the need to study the problem of water pollution of drinking quality on Earth, as it becomes one of the most relevant, as evidenced by the numerous publications of foreign authors [16-20].

The analysis of the regime observations of the state and rational use of underground drinking water in the eastern and central regions of Kazakhstan for the period 2014-2018 years indicates the unfavorable conditions of their condition and the presence of pollution processes of both natural and artificial, man-made toxic chemical compounds such as pesticides, herbicides and other substances. In this work, the main attention was paid to the pollution of drinking groundwater mainly by heavy metals in connection with the specifics of these regions, where the enterprises of mining, chemical, metallurgical specialization prevail. The regions under consideration are the place of high concentration of various industries associated with the production of new chemical compounds widely used in various sectors of these regions' economy.

During the research, we have collected and analyzed numerous materials on chemical analysis of groundwater "Vostokkaznedra" and "Tsenrkaznedra", as well as the data of chemical analysis of drinking water performed in the Hydrochemical Laboratory of the Institute of Hydrogeology and Geoecology named after U. M. Akhmedsafin in recent years (2011-2017). The laboratory tests were performed to determine the complete chemical analysis (mineralization, pH, basic chemical components of water composition, and micro components: cadmium, copper, zinc, lead, manganese, lithium, fluorine, arsenic, mercury, beryllium, etc. This set of components is fully consistent with the components of pollutants regulated by GOST 27384 – 2002 "Drinking Water".

As it turned out, the pollutants of underground water on the territory of Ust-Kamenogorsk are 12 major sources of pollution (field test site ofsolid chlorine-containing waste of Ust-Kamenogorsk Titanium-Magnesium Plant (UK TMP), industrial site and red mud disposal field of UK TMP, ash dump of Sogrinskiy Thermal Power Plant and other sites. The first data on chemical pollution were obtained from the well of industrial water intake of the Ust-Kamenogorsk Lead-Zinc Plant UK LZP) in 1957-58. These were elevated levels of lead, arsenic, zinc, manganese, sulfates. The thermal pollution of water was also noted from 1979 to 1998. East Kazakhstan Regime Party conducted groundwater monitoring in the

observation network Kazzinc UK, where there had been chemical contamination in seven components (salinity, total hardness, sulphate, manganese, selenium, lead, cadmium) by several times.

Since 1982, the EK Regime Party has been monitoring the quality of groundwater in the observation wells of the regime network located in the centers of pollution and water intakes of the city. As a result, the sources and centers of underground waters pollution by different components were revealed. In the 90's and 91's water intakes of TWD (technical working design), CG (concrete products), the construction sites of 19 and 20 quarters were closed due to heavy pollution of groundwater, the water intake was closed in Zaschitink in 1992, and in 2009 the water intake of the 3rd residential district of Ust-Kamenogorsk was eliminated.

In 1990-93's Belousovskaya Hydrogeological Party conducted the integrated ecological-hydro-geological and engineering-geological survey Ust-Kamenogorsk industrial area of 1 : 50 000 scale (V.F. Bocharov, V.M.Buleyko). As a result of the work carried out in the snow cover, a stable association of a number of toxic elements is identified (Pb, Hg, As, Ws, and others related to the complex of Ore-Altai polymetallic ores by chemical property. Ust-Kamenogorsk focal area of pollution is classified as a very high dangerous level of pollution and according to the high concentrations of pollutants in the soils of this area.

Thus, on the entire area of distribution of the first from the alluvial aquifer surface, they do not meet the requirements of GOST "Drinking Water". State expertise of geological information was performed in 2002 by Geoincentr – East LLP as for subsoil area for construction and operation of the current slurry reservoirs of UK TMP JSC for obtaining subsoil use rights. As a result, reliable information was obtained allowing to trace the negative impact of the slurry reservoirs to the subsurface, the pollution foci were assessed, design solutions were developed and recommended to minimize the negative impact of the slurry reservoirs to the subsurface, including the underground waters.

The pollution of groundwater by polychlorinated biphenyls (PCBs), chemical compounds is of particular concern, which have been developed by chemists to control crop pests. These are not natural substances, they are created by human. PCBs are one of the most dangerous anthropogenic pollutants of the environment belonging to the group of persistent organic pollutants (POP), which, due to their toxicity and stability, ability to migrate over long distances in air, water and accumulate in living organisms, have an adverse impact on the environment and public health.

112 samples of soil, water, sediments, fish and vegetation were analyzed to assess the extent of PCB pollution to identify patterns of their distribution in the environment and the current level of pollution under the influence of their long-term use. As follows from the analysis of soil samples from different functional zones of Ust-Kamenogorsk (city dump of domestic garbage adjacent to the "hot" spots of agricultural land, areas of mining and metallurgical complexes and electric power sectors), it is found that the PCB content is in the range of 0.022-171.192 mg/kg. The highest levels of soil pollution were found in the territory of the storage pond of UKKZ JSC. The maximum values of PCB in the points of agricultural use is 0.022 mg/kg [4].

The ecological state of drinking water of Zaisan city, East Kazakhstan region, was also investigated. In the city of Zaisan, with a population of 16 thousand people, there is a centralized water supply system, where the underground water of the Dairovskoye field is used. The study objects were 26 samples of drinking water in Zaisan, of them 20 samples of water "from the tap" and 6 – "from the water fountains". Determination of chemical and biological indicators of drinking water quality was performed in accordance with international standards and generally accepted standard methods. The studies have shown that drinking water in Zaisan is safe for use and indicate the well-being of ecosystems throughout the surrounding area.

In general, the situation of technogenic pollution of underground waters in the megalopolis of East of Kazakhstan are very similar because of the development of mining and mineral processing The general environmental situation in the region of East Kazakhstan requires close attention in the field of water management, especially of water resources.

The regions of Central Kazakhstan are also in difficult ecological and hydrogeological conditions due to the intensification of mining and processing industries of the mineral industry. The presence of numerous deposits of polymetallic, rare-metal, iron-manganese ores of their extraction and processing caused the strengthening of ecological destabilization in natural ecosystems. Ecological disturbance

creates "favorable conditions" for the negative hydrogeochemical processes development in the areas of active human intervention to the natural environment of man-made processes.

The major object under the research of the considered industrial region of the country is drinking water of the main water artery feeding the city of Karaganda - the channel named after K.I. Satpayev. This is a surface source being open throughout the channel, up to the pumping station of the second lift, where the primary disinfection of the source water with chlorine is performed as well as preparation for further treatment at water treatment facilities. The studies have shown that generally, the water quality meets the requirements of SanPiN (Sanitary Rules and Regulations) No.554 28.07.2010 RK "Sanitary and epidemiological requirements for water sources, drinking water supply, places of cultural and domestic water use and safety of water bodies." However, it is found that the provision of Karaganda population with pathogen-free drinking water from year to year has been reduced by an average of 3-5%, respectively, water consumption from decentralized water sources and open water bodies increased. It is also established that microbiological contamination of water remains unstable and requires special attention. During microbial and bacteriological studies to detect coli-phages, it is found that water treatment facilities, Fedorov and Chkalov water reservoirs, large and small ponds of the Central Park, three lakes on Blue ponds do not currently meet the sanitary requirements.

As a result of the research, the following conclusions can be drawn: 1. Basically, the water quality according to physical and chemical parameters meets the requirements of SanPiN No.554 RK. 2. The general condition of the water bodies for the presence of microbiological objects is currently close to the norms. However, it is necessary to constantly monitor the number of coli-phages, when taking the necessary measures for water disinfection and compliance with the required safe values of these indicators.

Despite the relatively high degree of groundwater availability in the country as a whole, Central Kazakhstan experiences an acute shortage of quality water for domestic drinking water supply. Nevertheless, the development of fresh groundwater explored reserves is very slow, and in recent years in some areas almost completely suspended. Many underground water deposits have not been used for 10-15 years or more. A significant anthropogenic impact on the environment of Karaganda-Temirtau territorial-industrial complex associated with the presence of a large number of mining and processing enterprises has led to a high degree of contamination of surface water and soil and vegetation layer. It is obvious that uncontrolled and unsystematic use of groundwater can lead to mixing of contaminated surface water with groundwater and dramatically worsen its quality. At present, the groundwater of explored and exploited deposits, the area of which is marked by pollution, when it comes to consumers, still contributes to sanitary standards (SanPiN). And in the course of pollution ongoing process, their quality deterioration is not excluded as for individual ingredients to the values exceeding their maximum permissible concentrations, and the withdrawal of water intake for this reason from the water supply systems. The facts of underground waters pollution with oil products have already been identified in the areas of oil depots, gas stations.

A number of drinking underground water deposits have been explored in the territory under consideration. Below we provide the main parameters and quality indicators of groundwater of some of them. Akmola (336). It is located in the north-eastern part of the Teniz cavity and is confined to the southern and eastern wing of Akmola geological basin. Distance from Astana city is 5-10 to 30-60 km. The southern part of the field is located within the city (M-42-XII). It has been explored for domestic drinking water supply in Astana as one of the sources of deficiency coverage in drinking water. Demand - 22.5 thousand m3/day. Water-bearing rocks - limestone of Tournai stage containing fractured karst water. The stratification depth of groundwater table varies from 0 to 33 m, averaging 7-12 m. Water is mainly non-pressure and only in areas covered with clays surface, acquire pressure, reaching 5-28 m. The effective fracture can be traced to a depth of 120-150 m. Well flow rates vary from 1.2 to 16.4 l/s with a level decrease of 27.5 and 6.6 m, respectively. The water quality is fresh and slightly saline with mineralization from 0.2 to 1.9 g/l. The chemical composition of water is chloride-bicarbonate sodium-calcium. Calculated hydrogeological parameters: the filtration coefficient is 2.1-3.4 m/day, level conductivity - 1.23x104 m2/day, water return - 0.02, aquifer thickness - 100 m. The operational reserves of Akmola field are approved for 4 sites, three of which are located on the eastern wing of the geological basin and one - the north-western on the south. Reserves approved by the SRC (State Reserves Committee) USSR in stages.

Taldinsk-Karagailinsk (410). Located 10 km from the north-east of the Karagaily mine in the middle reaches of the Taldy river (M-43-XXII). Explored for economic, drinking and technical water supply of Karagaily mine. Demand - 25.9 thousand m3/day. The deposit is confined to the medium-quaternary-modern alluvial deposits of the Taldy river valley. Water-bearing rocks are represented by gravelly sands with pebbles. The aquifer capacity is 2.5 to 17.7 m. Groundwater with a depth of 0.7-2.5 m. Well flow rates range from 8.3 to 25.0 m inrecession of water level, respectively, at 0.8-2.0 m. The water quality is fresh with mineralization from 0.4 to 0.6 g/l. By chemical composition it is sodium bicarbonate. Water fully complies with the requirements of the GOST standard for drinking water.

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ШЫҒЫС ҚАЗАҚСТАН МЕН ОРТАЛЫҚ ҚАЗАҚСТАННЫҢ ІРГЕЛЕС АУДАНДАРЫНДАҒЫ ТҰЩЫ СУЛАРДЫҢ КҮРДЕЛІ МӘСЕЛЕЛЕРІ

Аннотация. Тұщы ауыз су ресурстарының ластануы бүгүнде ең басты антропогендік проблемалар болып табылады. Әлемдегі өсіп келе жатқан халықпен қатар, индустрия мен ауыл шаруашылығын дамытумен қатар, қоршаған ортаның ластануының өсуі таза ауыз су мәселесі өзекті болып қалады және жақын арада әлемнің ең маңызды мәселелерінің бірі болады. Зерттеулердің нәтижесі бойынша, жер асты суларының, әсіресе әлемнің ірі және адамдар көп қоныстанған қалаларында көптеген проблемалар кездеседі. Өнеркәсіптік қалдықтарды топыраққа ену, адам қалдықтарын жоюға арналған сіңіргіш ұңғымалардың болуы, жуғыш заттар мен химиялық тазартқыштардың шамадан тыс пайдаланылуы, жер асты суларын қайтаруға болмайтын жағдайда жер бетіне химиялық тыңайтқыштар мен пестицидтердің түсуі айтарлықтай.

Қазақстандағы жер асты суларының ауыз суын зерттеу республиканың көпшілігінде теріс үдерістердің өсуіне қарамастан елдің су қауіпсіздігін қамтамасыз етуі тиіс ең өзекті мәселелердің бірі болып табылады.

Түйін сөздер: жерасты ауыз суы, ластану, экологиялық проблемалар.

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ПРОБЛЕМНЫЕ ВОПРОСЫ ПРЕСНОЙ ВОДЫ НА ТЕРРИТОРИИ ВОСТОЧНОГО КАЗАХСТАНА И ПРИЛЕГАЮЩИХ РАЙОНОВ ЦЕНТРАЛЬНОГО КАЗАХСТАНА

Аннотация. Одной из самых главных антропогенных проблем является загрязнение ресурсов пресной питьевой воды. Наряду с ростом численности населения в мире и развитием промышленности и сельского хозяйства, ростом загрязнения окружающей среды, вопрос о чистой питьевой воде приобрел большую актуальность и в ближайшее время превратится в одну из наиважнейших проблем мира. Итоги исследований показывают, что сегодня подземные воды, особенно в крупных и многонаселенных городах мира, сталкиваются с множеством проблем. Проникновение промышленных отходов в почву, наличие поглощающих скважин для утилизации отходов человеческой жизнедеятельности, чрезмерное использование моющих средств и химических очистителей, попадание химических удобрений и пестицидов в землю самым серьезным, если не необратимым образом, загрязняют подземные воды. Изучение питьевых подземных вод Казахстана представляет собой одну из самых актуальных проблем, которая должна обеспечить водную безопасность страны в условиях нарастания негативных процессов на большей части республики.

Ключевые слова: питьевые подземные воды, загрязнение, экологические проблемы.

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