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THE ALTERNATIVE APPROACH TO THE ISSUE OF DEMINERALIZATIONS OF MINE WATERS

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In article the hard situation with potable water in Donbass is analyzed. The features of re-structuring of Ukraine economy on the basis of market relations are considered. The positive experience of the rebuilding of economics of the industrially developed countries is systemized. The authors prove the alternative approach of potable and technical water extraction by the use of the mine water.

Mine waters, demineralizations, bowels, a risk estimation, drinking and technical water.

Formulation of the problem. Due to the closing of the mines a problem of mine's water demineralization in recent decades is escalated. In accordance with the requirements of sanitary inspection the salt content in mine waters must not exceed 1 g/litre [1]. The projects of the mine closure must include activities of demineralization of pumped water. Based on the requirements of the Water Code of Ukraine (Article 72) to the enterprise that pumped from the depths of mine water must implement efficient technologies that reduce the level of their natural salinity before being discharged into water bodies. However, due to the high cost of desalination this kind of activity often not considered at all. Ministry of Fuel and Energy of Ukraine with reference to the results of "Ukrainian Mining Invest Experise" concluded that demineralization of mine water must be solved by each mine individually (letter CM / 19-217 of 04.02.02). However, the state sanitary-hygienic department of Donetsk regional sanitary-epidemiological station of the Health Ministry, this approach does not allow (eg, mine "Lesnaya", "Rossypnyanskaya №2", etc.) and requires in the projects of mine liquidation some solutions of demineralization to have. At the same time, this problem is under the supervision of environmental prosecutors. Consequently, there is a contradiction that requires a decision. It is especially evident when considering projects of mine closure which have relations to drinkable water facilities. A striking example is a situation with the state Olhovsky reservoir.

Olkhovsky dam was been commissioned in 1938. 15 companies dropped mine water into it. Because of the small depth of the mines the level of salinity of groundwater was relatively low. For example, in 1947 the total amount of water was about 650m^3/h and the salt concentration did not exceed 0.7 g/litre.

At the moment about 25 mines shed mine water into Olkhovsky reservoir (six of which are closed, "Lesnaya", "Rassypnyanskaya № 2", "Donetskaya", "Kirovskaya", etc.).

The total amount of mine water increased and reached 5840 m^3/h and the salt concentration is increased to 1.8 - 1.9 g/litre, ie exceeds the normal values almost in two times. Despite to such significant variations in water quality Olkhovsky reservoir feeds the city Khartsyzsk, Thorez, Zhdanovka, Snejnoe etc. Water treatment for these cities performed at the filter plant. It includes cleaning of suspended substances, disinfection and reduction of salinity by diluting it to the station channel water from the canal Severskiy Donets - Donbas. The technical condition of the channel at the moment requires a repair.

The dispute around the Olhovsky reservoir situation was temporarily resolved by agreement of construction some equipment of demineralization which is located within the filter plant. This solving was made by Ministry of Health. The purpose of this equipment is to desalination of the amount of water that goes to the city, after mixing with the rest of the volume of filtered water, ie there will be a change of channel water desalination.

The construction of such a facility will allow for the study of both technical and medical-biological characteristics. This will enable to the appropriate supervision Service and Ukrainian Ministry of Health to estimate the possibility of using mine water for the water supply of towns. At the same time men will consider the possibility of utilization of salt rest that we can get from the desalination process. As a temporary scenario considered the option to transfer the salt water to the thermal power Zugres (3 km) to create a last-sodium ionite filters at the preparation process. However, in this case the value of technology of demineralization rapidly increases, which is displayed in the article [2].

Due to the high seriousness of the problem of mine water demineralization (technical complexity and the extremely high-cost) and taking into account the conclusions of the extraordinary predictive difficulties of its decision by the coal industry may be concluded that the public has to realize the depth of the coal industry crisis and seek new approaches to the problem of mine water demineralization.

Presentation of the material and results. An alternative solution to the problem of mine water demineralization is the question of a possible change of discharged water quality standards in terms of "salt content" (dry basis) in the direction of reducing its size to actual environmental conditions in the Donetsk region. This idea was first put forward in the course of Donetsk National Technical University research project: N-6-99 "Study of environmental aspects of the problem and develop recommendations for the protection of the environment in the restructuring of the coal industry in the territories of priority development of the Donetsk-Makeyevka region of Donbass". [3] In general this idea is supported in JSC “Donetsk State Institute of Mine Design” by S.A. Sinyavsky. [2] The concept of improving the ecological condition of the mining regions of Ukraine as one of the main principles of the state system of subsoil estimated realistic environmental requirements and noted that unrealistic and outdated guidelines should be replaced with more advanced [4].

Such an approach fits well in the concept of other countries, including Russia, where in recent years the priorities of environmental policy based on the account MPC, MPD, MPE and other rules and regulations impacts on nature are reviewed. The reason: the low efficiency of the normative approach because of the possibility of the subjective approach to "normal" and the manipulation of the concept. Therefore, to the base on the state of environmental policy in the progressive contamination of the environment is gradually laid the concept of environmental risk. Under the environmental risk (R) is the probability (p) of the appearance of negative changes in the environment induced or otherwise influence. Under the environmental risk is also a probability measure risk of harm to the environment, the population in the form of potential losses (y) for some time.

$$R = \sum p \times y \tag{1.1}$$

The risk estimation can not be exact because of environmental hazards due to a number of reasons inherent stochasticity (uncertainty). In discussing the problem of environmental risk, as a rule, a man has keep in mind the consequences of anthropogenic impacts on the environment and on people. It is important to consider the following:

The cumulative effect of any long-term effects to the natural objects (organisms, ecosystems, etc.), ie a significant increase in the accumulation of actions over time, often leading to sharp qualitative changes by adding weak quantitative shifts.

Nonlinearity of the dose effects of impacts to living organisms, which is expressed in the form of a disproportionately strong biological effects of low-dose exposure, which is associated with increased sensitivity to weak (information) influences.

Synergistic (joint) effect of various environmental factors on living, which often leads to unexpected effects, which is not the sum of the answers to have an effect, the effect of one factor can both strengthen and weaken, or qualitatively change the effects of other influences.

Substantial individual differences of living beings (including humans) in sensitivity to environmental factors, and adverse changes in resistance (in fact, there are mechanisms of natural selection, the force is many times higher in the age of technological changes in the environment).

The delayed nature of the changes in population characteristics of the person. For example, the analysis of the consequences of the Chernobyl disaster showed no border between the effects of radiation and chemical injury, as well as on the definition of the threshold and tolerance doses, because the environment is impossible to isolate the effect of any one factor.

Consequently, regulation of environmental risks and hazards whould be based of both factors: an assessment of the sourses of danger and the study of sustainability and environmental capacity of natural ecosystems as well as on the definition of "safety margin of the human body" - the capacity for homeostatic regulation.

Changing the rules of the salt content in the water surface water suggests, in our opinion, mitigation and non-uniform rule salt content of not more than 1 g/litre. When mine water desalination is advisable to leave this rule only in the case of use of mine water for drinking purposes. Thus, it is proposed to develop regional standards. This proposal is supported by the following considerations.

Among the objective reasons for the critical situation of drinking water in Donbass, is the lowest natural water quality (especially groundwater) in Donbass compared with other regions of Ukraine. It is caused by the presence of various types of rocks and minerals in the interior of the region, which are the source of groundwater contamination with mineral salts, heavy metals from liquid infiltration of fluids in the rock mass. These are often fed by groundwater, surface water flows, which are used for watering plants in the fields, as well as a population of domestic and drinking purposes.

Thus, in the area of the mine "Zaperevalnaya №2" groundwater salinity ranges from 0.5 to 5 g/litre, while in mine waters, it is 2-4 g/litre.

In the area of the mine "Yuzhnodonbasskaya" -3 salt content in mine waters are, respectively, 2,6 g/litre and 4 g/litre, while in the drinking water wells of the village Andreyevka it is 6-8 g/litre.

Another example is the high content of salt in r.Solenaya (district Selidovo) is 5-6 g/litre, which was celebrated in this watercourse back in 1890 (hence the name Salt River).

Does it make sense to improve the natural (background) the salt content in the hydrosphere Donbass? After all, the desire to dump mine water, which in its genesis are underground, with a salt concentration at the surface of the natural background, really means improving the natural hydrochemical situation compared to its historical natural existence.

Вопрос можно рассматривать и в другой плоскости. Донбасс омывается Азовским морем. Если бы шахтные воды чрезмерно засоляли реки региона, то это, вероятно, сказалось бы на изменении солености Азовского моря в течение почти 200-летней разработки угольных пластов. Последнее почти не наблюдается (даже в условиях разбора пресных вод из рек Северский Донец, Дон, и др. на хозяйственно-питьевые и сельскохозяйственные нужды). Можно предположить, что в Донбассе имеет место естественный круговорот вод: Азовское море подпитывает Донецкий горный массив, а откачиваемые шахтами соленые воды вновь поступают в море. Таким образом, поддерживается стабильно-подвижное равновесие в гидросфере региона (гомеостаз).

The question can be looked from another aspect. Donbass is washed by the Azov Sea. If mine water excessively salted the rivers of the region, this is likely to be affected by changes in the salinity of the Azov Sea for almost 200 years of the development of coal seams. The last one is hardly observed

(even in the parsing of fresh water from the rivers Seversky Donets, Don, and others for drinking and agricultural purposes). We can assume that in the Donbass is a natural cycle of water: The Sea of Azov is fueling Donetsk mountain range, and the mines pumped salt water into the sea again. Thus, the steady-supported mobile balance of the region in the hydrosphere (homeostasis).

So the idea of demineralization of mine water must undergo changes, namely in the direction of:

- change (decrease) of the limits of salinity of mine water;
- mine water accumulation in the special reservoirs, diluting their precipitation and subsequent discharge during the spring floods in the river.

According to the second concept of a foreign and domestic experience:

- Polish coal mines discharging water accumulated in a career where they infiltrate and then (during the flood) in the Vistula River;
- mine "Krsnoarmeyskaya-Zapadnaya", where instead demineralization installation built storage pond;
- ordinary clarifiers ponds in which the water is diluted by precipitation.

Deep mine water desalination has an ecological sense only if from mine water must receive water of drinking quality. Moreover it is advisable to carry out the latter especially in remote towns where the water lines are not stretched regional fresh water.

New approaches to solve the problem of mine water demineralization, improve water Donbass advisable to continue with the position of the positive experience of the world ecological and economic development of industrialized countries with market economies. Experience of developed countries shows that since the late 70's - mid 80's, these countries with a high level of technological and social progress, had to start the restructuring of their economies. Restructuring due to the fact that the development of production in these countries has come up against the limitations of natural resources. In a society have come to realize the existing catastrophe such as "front" of the economy, which views nature as "exhaust" pipe, capable of infinite assimilate any waste, we realized the finiteness of natural resources and interdependence of ecological and economic processes in noobiosfere. It was the reason for developing a new concept of global economic development, taking into account environmental constraints, ie the concept of sustainable ecological and economic development in the economic well-being of society. Its overriding principle is to ensure a balance between economic, social and environmental components of development that is achieved reasonable satisfaction of basic needs of people living today as well as future generations. It is in the framework of sustainable development in industrialized countries have made some positive changes and restructuring of their economies. In the face of the deteriorating environmental issues one of the motivators for companies, firms to sustainable management and reconciliation of the interests of business to address environmental problems are market-operating in these economies.

Business need has given rise to the concept of "green image", which is pushing the countries, enterprises perform their economic policies based on environmentally balanced objectives, "to look far ahead," to protect his business, which for example, is particularly important in light of the possible privatization of the coal enterprises of Ukraine.

Many Western companies have realized that the modern approach of environmentally based policy in business is a kind of investment, aimed, among other things, to conquer the vast market.

Thus, in the world of economic development a new modern ideology of nature is appeared. It implies a certain sequence of actions priorities green economy and environmental issues:

- alternative solutions to environmental problems (economic restructuring, changes in export policy, conversion);
- development of low-and resource-saving technologies, technological change;

- used as the final link of direct environmental measures (construction of various treatment facilities, land reclamation, etc.).

This scheme of priorities indicates that immediate direct environmental measures that dominate at present, should be implemented only if you can not solve environmental problems through alternative or low-waste and non-waste technologies.

Analyzing given priorities, we can conclude that a separate but closely related to the free production process is the use (or processing) of associated wastes. They are incidentally - extracted mine water, the use of which is therefore a priority for a green economy.

Global experience also shows that the problems of sustainable economic and environmental development is especially important for those regions where acute deep pressing problems of protection of natural resources and ecosystems. The Donbas region of Ukraine which has strong features of the territorial-industrial complex (TIC) with infrastructure management is the one. It is the presence of well-developed infrastructure TIC are the best opportunities for the development of low-waste and non-waste production, including the use of produced mine water. In the TIC at enterprises is always a demand for incidental waste from other industries, which corresponds to the Mendeleev formula: "In industry, there is no waste, there is a raw material for other industries."

Practical intent to move towards sustainable development demonstrated Donetsk. This city was the first in the Donetsk region and seventh in the Ukraine, joined October 20, 2000 to the Aalborg Charter of European cities for sustainable development. Signing the charter means that the economic development of the city, social protection and preservation of OPS is now viewed as a single concept - sustainable development. Providing it - the problem of the city authorities and the committee for sustainable urban development.

Conclusions. Contained (in a critical situation with drinking water in the Donbass, especially the economic restructuring of Ukraine on the basis of market relations, the positive experience of the restructuring of the economy of the industrialized countries, held by them in the framework of sustainable environmental development) leads to the conclusion that the objectives should be addressed primarily based on the "market" approach, ie, commercial necessity in relation to water management Donetsk TIC. Formulated an approach is cost-effective in today's economic environment Donbass.

First, the justification of the approach to observe the basic market conditions: in the region (as shown above) is great demand for drinking water. A specific feature of Donbass is that there was a paradoxical situation: the region suffers from a lack of drinking water and of produced in a large quantity of water is not used mine to overcome it and cause significant adverse environmental effects in the hydrographic network. Moreover, the value of pumped mine water is not only to use them as a resource to overcome the shortage of drinking water, but also in the fact that in the process of demineralization produced brines can be regarded as a comprehensive source of raw materials not only common, ie common salt (such as NaCI, Na_2SO_4, etc.), but also valuable rare and dispersed chemical elements.

The greatest ability to accumulate in the water have trace elements with strong anionic and cationic properties, which include, for example, lithium, rubidium, cesium, strontium and iodine, bromine, boron. Their concentrations can reach industrial values. By now it is known that mine water has a higher content of strontium, titanium and nickel. Evaluation of mine water in their content of other (rare) items is yet preliminary, since made on the basis of individual data and analyzes of samples of water. In this connection it is necessary to continue to monitor the composition of the mine water, representing at the same time that in the event of positive results in the future may have a considerable profit.

Secondly, with a total lack of drinking water in the region, much of it after buying the company spent last ineffective, ie for technical purposes, recharge water supplies, etc. Due to the high cost and inefficient use of water, paying for it has become a financial burden for most businesses. Therefore,

they are not only interested in the stabilization of prices for receiving water, but above all in their decline. This is possible only when a regional alternative and cheaper sources of water.

Thus, it can be said that, compared with other regions of Ukraine (who have large resources of natural water of acceptable quality, and are characterized by relatively low prices for drinking water and fresh technical) in the Donbas are favorable economic conditions (lack of water and its high cost) to solve the problem of drinking and process water through the use of mine water. At the same time, to some extent will be decided and environmental challenge of improving the state of water resources in the region.

Accurate analysis of the current situation in the region suggests that the search strategy of getting out of it is to be rational and to appear in the solution of two simultaneous tasks:

- protection of local water resources from pollution by cleaning up mine water based on adjusted discharged water quality standards;
- rational use of treated mine water as a resource, industrial water supply in the region.

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АЛЬТЕРНАТИВНИЙ ПІДХІД ДО РІШЕННЯ ПРОБЛЕМИ ДЕМИНЕРАЛИЗАЦИИ ШАХТНИХ ВОД

У статті проаналізовано критичну ситуацію з питною водою в Донбасі, особливості реструктуризації економіки України на основі ринкових відносин, позитивний досвід перебудови економіки промислово розвинених країн, проведеної ними в рамках концепції стійкого екологічного розвитку. Авторами обґрунтовано альтернативний підхід одержання питної й технічної води за рахунок використання шахтних вод.

Шахтні води, демінералізація, надра, оцінка ризику, питна й технічна вода.

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АЛЬТЕРНАТИВНЫЙ ПОДХОД К РЕШЕНИЮ ПРОБЛЕМЫ ДЕМИНЕРАЛИЗАЦИИ ШАХТНЫХ ВОД

В статье проанализированы критическая ситуация с питьевой водой в Донбассе, особенности реструктуризации экономики Украины на основе рыночных отношений, позитивный опыт перестройки экономики промышленно развитых стран, проводимой ими в рамках концепции устойчивого экологического развития. Авторами обоснован альтернативный подход получения питьевой и технической воды за счет использования шахтных вод.

Шахтные воды, деминерализация, недра, оценка риска, питьевая и техническая вода.