ENVIRONMENTAL PROBLEMS AND MITIGATION METHODS IN THE CEMENT MANUFACTURING INDUSTRY

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Abstract. *It is shown that cement production takes a significant place in the pollution of the natural environment. General information about the negative impact of emissions from industrial production is given. The main pollutants of the environment and environmental protection measures are considered.*

Key words: *cement, mining, ecology, waste, natural resources, raw materials, technologies.*

ЦЕМЕНТ ИШЛАБ ЧИҚАРИШ САНОАТИДАГИ ЭКОЛОГИК МУАММОЛАР ВА САЛБИЙ ТАЪСИРНИ КАМАЙТИРИШ УСУЛЛАРИ

Аннотация. *Цемент ишлаб чиқариш атроф-муҳит ифлосланишида муҳим ўрин тутиши кўрсатилган. Саноат ишлаб чиқаришидан чиқадиган чиқиндиларнинг салбий таъсири ҳақида умумий маълумот берилган. Асосий экологик ифлослантирувчи моддалар ва атроф-муҳитни муҳофаза қилиш чоралари кўриб чиқилган.*

Калит сўзлар: *цемент, тоғ-кончилик саноати, экология, чиқиндилар, табиий ресурслар, хом ашё, технология.*

Cement production has been shown to play an important role in environmental pollution. General information about the negative effects of waste from industrial

production is given. Major environmental pollutants and environmental protection measures are reviewed.

Cement production and consumption is one of the types of industrial products that characterize the country's economic potential. It occupies a leading position among building materials. It is in the greatest demand in the construction industry, and more than 2 billion tons of products are produced in the world every year, and this figure is constantly growing. In the context of the implementation of large construction projects, there is a steady increase in cement production and an increase in the exploitation of raw material deposits for the cement industry.

The construction materials industry of the Republic of Uzbekistan is rapidly developing today due to the dynamic growth of active construction. It is considered one of the main components of the republic's economy and is important for its sustainable development in the most important long-term perspective. In order to further improve the construction industry, to form mechanisms for the consistent development of architecture and construction bodies and institutions, to ensure the efficiency of the state management system, and to gradually introduce digital technologies, the strategy of modernization, rapid and innovative development of the construction industry of the Republic of Uzbekistan in 2021-2025 was approved by the Presidential Decree. [1].

The Cabinet of Ministers of the Republic of Uzbekistan annually approves the balance of cement production and consumption in order to optimize the volume of supply, to meet the cement needs of the sectors of the republic's economy in a stable and rhythmic manner, including the implementation of the most important national development and modernization programs, large investment projects.

In order to create favorable conditions for the rapid development and diversification of the industry, to attract investments in the processing of local mineral raw materials, and to increase the export of construction materials, the parameters for expanding the base of raw materials of the construction industry have been approved by the government. These target parameters have been developed by the government

keeping in mind the increasing demand for construction products. According to the decree, it is planned to systematically increase the volume of cement production in the country by 2 times [2].

According to information, the total volume of cement production in the republic in 2022 will be 15.2 mln. tons and increased by 7% compared to 2021 (14.2 million tons). Currently, the design capacity of cement production in the republic is 27.1 mln. reached tons. As part of the target list of investment projects for cement production for 2022-2023, the government: It is planned to build two cement plants in Andijan, Namangan, Samarkand and Fergana regions, and one cement plant each in Jizzakh, Kashkadarya, Navoi, and Tashkent regions [3].

In the cement industry, carbonate rocks such as limestone, chalk, shale limestone, marble, limestone tuff, etc. are used. These rocks consist mainly of calcium carbonate $CaCO_2$. Limestone and chalk are used more often, their sediment origin determines the diversity of their chemical composition and physical properties. The quality of carbonate rocks depends on the structure, the amount of impurities and the uniformity of their distribution in the raw material mass. Rocks with a constant chemical composition and the same fine crystal structure are relatively more favorable. Depending on the quality of the raw materials, the combustion temperature, furnace performance and product characteristics change. High-density marble-like limestones are more difficult to burn than ordinary limestones. A special type of carbonate raw material is marl - a transitional rock from limestones to clays formed by sedimentation. The most valuable raw material is calcareous marl (it contains 75-80% limestone and 20-25% clay). According to its chemical composition, it is close to the ready-made portland cement raw material mixture, its use simplifies the technology of portland cement production. Such marls, whose composition corresponds to the composition of Portland cement raw mix, are called natural. Clay rocks composed of fine particles (smaller than 0.001 mm) are the second main component of Portland cement raw material mixtures. Clay rocks vary considerably in structure and physical properties. Along with clay, soil, silt soil and clay shale are used in the cement industry [4].

The choice of the most optimal method of development of cement production in a certain area involves taking into account many factors that affect the economic characteristics of the enterprise, the social and environmental situation in the area. When studying the problem of choosing a method of development of cement production, analyzing the factors affecting the increase in efficiency, it should be noted that the amount of factors and the degree of their influence will depend on the conditions of the location of the enterprise:

- economic and ecological, which determines economic and environmental security;
- natural-climatic and infrastructural conditions, which determine the living conditions of workers;
- mine-geological and mine-technical conditions that determine the level of safety and comfort of work.

Thus, the problem of determining the factors that determine the economic, ecological and social situation in the area and have the greatest impact on decision-making after the commissioning of new facilities becomes of fundamental importance.

Cement production involves significant environmental issues from the extraction of natural resources to the production of the finished product.

These include:

1. Seizure of significant land areas from economic turnover;
2. Changing the natural landscape;
3. Pollution of underground and surface water;
4. Formation of rock wastes as a result of mining and low level of their use (about 20%);
5. Atmospheric pollution with gas emissions. Currently, the negative impact is very large. According to experts, up to 25% of all CO_2 emissions in the world come from the construction industry, including more than 80% of cement, brick, mortar and steel production [5];

6. Release of cement dust into the atmosphere during loading of products, as well as emissions from smoke pipes and emissions of volatile components;

7. Other emissions that negatively affect people living nearby, such as noise, vibration, odor, polluted industrial water.

The number one problem in the fight against environmental pollution in cement production is gaseous emissions from the kiln system. The most harmful and main gases released into the atmosphere are nitrogen oxides and sulfur dioxide. Other less harmful compounds are volatile organic compounds, carbon monoxide or carbon dioxide, ammonia, hydrogen chloride, and heavy metals. An important environmental problem of cement production is the great ecotoxicological risk of cement dust. A high level of ecotoxicological risk for cement dust is determined by its qualities such as high dispersion and high adsorption potential, that is, the ability to absorb liquid and gaseous substances, including toxic substances.

Cement production, along with other types of production such as metallurgy or chemical industry, has the effect of accumulating harmful effects for all living beings and primarily for humans living in the vicinity of cement production plants [6, 7]. At the same time, it should be noted that cement production is one of the most energy-intensive industries (from 42 to 52% of all costs), so supplying energy to enterprises is one of the technical obstacles in the introduction of electric filters and a number of other environmental protection equipment. and turning off this equipment is one of the ways to reduce the cost of cement. Taking into account the scale of raw material extraction and cement production, it becomes clear that the level of technological discipline of production needs to be significantly increased. The essence of the matter is that, on the basis of the new management elements available today, it is possible to significantly improve the organization of management of raw material extraction and production of final products in quarries. For this, it is necessary to conduct an environmental audit and certify enterprises according to standards.

The most important environmental measures are the replacement of natural mineral raw materials with production waste. A number of secondary products of other

sectors used as raw materials in cement production are very close to the cement raw material mixture in terms of chemical composition. They can replace clay and partial components in its composition. As a rule, such secondary products undergo heat treatment in the main production, do not contain $CaCO_2$ and may even contain a number of clinker minerals. Therefore, their inclusion in the composition of raw materials allows to reduce the combustion temperature and increase the efficiency of furnaces.

The cement industry has great potential for the efficient disposal of stone crushing wastes from the mining complex, which today are excluded from economic circulation and inefficiently stored in landfills.

The use of secondary products and wastes from other sectors in the cement industry is an important step in the development of technologies that help in the rational use of natural resources and environmental protection.

Suitability of industrial waste as a component of the raw material mixture is determined in a specific case on the basis of special studies.

One of the ways to reduce the negative impact of cement production on the environment is the introduction of modern technologies. To make a decision on the introduction of modern technological and ecological equipment, it is necessary to conduct a preliminary environmental and economic assessment based on the determination of the impact of options on the final cost of production. Since there is currently no single methodology for calculating the cost of many non-metallic building materials, it is necessary to develop a suitable methodology that takes into account environmental costs for each enterprise.

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