



ENSURING ENVIRONMENTAL PROTECTION EFFICIENCY IN CONSTRUCTION MATERIALS MANUFACTURING ENTERPRISES TASHKENT UNIVERSITY OF ARCHITECTURE AND CONSTRUCTION

*Tashkent University of Architecture and
Civil Engineering Department of Management*

Associate Professor, PhD

Xaydarova E'zoza Shukurullayevna

Abstract: The article discusses the ecological situation and the problem of environmental protection, as well as the proper organization of production processes at construction materials enterprises. Both the negative and positive impacts of construction material production on the environment are evaluated. Strategies for improving environmental protection are proposed, including increasing energy efficiency, utilizing renewable energy sources, waste reduction and recycling strategies, reducing harmful gases and substances in the environment, effective use of raw materials and natural resources, as well as environmental monitoring and control. The article also covers environmental safety systems and certification for construction enterprises.

Keywords: construction materials, environmental protection, raw materials and resources, energy sources, harmful gases, emission reduction.

I. Introduction

In recent years, environmental issues and the need for environmental protection have become widely discussed topics around the world. One of the main contributors to environmental pollution is the construction industry. To thoroughly examine this issue, it is important to analyze the primary factors through which construction processes negatively affect the environment.

No construction site can operate without the use of various tools, machinery, and equipment. However, the operation of this machinery releases toxic exhaust gases, significantly deteriorating air quality. In addition to this harmful impact on the atmosphere, other construction activities such as the dispersion of particulate pollutants (e.g., cement, lime), the burning of waste materials and construction debris, and the disposal of construction waste without proper containment all contribute to environmental degradation. Moreover, the production and handling of insulation materials without using enclosed systems further exacerbate the problem.

Another major source of air pollution is the production of asphalt concrete. During its manufacturing, not only dust but also resinous substances, carbon oxides, sulfur compounds, radionuclides, and heavy metals are released into the atmosphere, having a severely negative impact on the environment¹

During the production of construction materials, components, and structures, dust, soot, and harmful gases are emitted, polluting the air and adversely affecting human health.

According to the Presidential Decree of the Republic of Uzbekistan, the Development Strategy of New Uzbekistan for 2022–2026 includes the implementation of an automatic sampling

¹ Environmental and Social Impact Assessment and Management (2023).

"Participating city municipalities support vulnerable households through investment in MIT infrastructure and measures to improve energy efficiency."

system to monitor pollutants emitted by high-risk environmental facilities. It also sets objectives for improving environmental pollution assessment mechanisms, enhancing environmental monitoring and pollution forecasting systems, and ensuring continuous data provision for state environmental control. The strategy also mandates regular monitoring of emission sources and their environmental impacts, and conducting state environmental expertise to evaluate the compliance of economic and other activities with ecological requirements across the country²

II. Materials and Methods

The United Nations also provides recommendations on environmental protection and outlines approaches aimed at reducing the ecological footprint of construction materials production. The National Report was prepared with the financial support of the United Nations Economic Commission for Europe (UNECE), the United Nations Environment Programme (UNEP), and the Food and Agriculture Organization of the United Nations (FAO), within the framework of the cooperation agreement under the “Global Public Goods and Challenges” (GPGC) programme between the European Commission and UNEP.

The purpose of the report is to assess the state and trends of the environment in Uzbekistan, to expand public access to environmental information and awareness, and to encourage public participation in environmental decision-making processes.

The efforts and contributions of the team from the International Institute for Sustainable Development (IISD) are gratefully acknowledged. The authors of the National Report express their gratitude to the Ministry of Ecology, Environmental Protection, and Climate Change of the Republic of Uzbekistan, as well as to all participants and advising organizations.

The interpretations, views, and conclusions expressed in the National Report are those of the authors and do not necessarily reflect the views of the United Nations or its member state³

General requirements for construction materials are as follows: they must be safe, hygienic, and should not cause harm to the environment. Specifically, construction materials must:

not emit toxic gases;

not release radioactive radiation;

not pollute water or soil;

not become an additional source of environmental pollution through construction waste;

not contribute to the accumulation of moisture in structural elements or inside constructed buildings.

Until recently, the main objective of construction was to create an artificial environment suitable for human habitation. The natural environment was viewed primarily from the standpoint of protecting the new artificial environment from its negative effects. Only recently has the reverse impact—how construction activity affects the natural environment and vice versa—become a topic of comprehensive consideration.

Previously, only specific aspects of this issue were addressed at a practical level (e.g., waste disposal and air quality in populated areas). However, construction is one of the most significant anthropogenic factors affecting the environment. This anthropogenic impact is diverse in nature and occurs throughout all stages of construction—from raw material extraction to the operation of completed structures.

When discussing the environmental impact of construction, it is important to distinguish construction as a key sector of the economy, especially in relation to agricultural development, and also as a product of this sector, including urbanized areas, road networks, and more. As an

² Decree of the President of the Republic of Uzbekistan No. PF-60 dated January 28, 2022

³ National Report on the State of the Environment (2024).

"Major facilities such as the processing industry, thermal power plants, the chemical industry, and the production of construction materials are concentrated in specific areas."

industry, construction consumes vast amounts of raw materials, building components, energy, water, and other resources—whose production exerts substantial pressure on the environment. Direct construction activities on-site often result in severe landscape disruption and environmental pollution.

These violations typically begin with site clearance, removal of the topsoil layer, and excavation works. During the clearing of construction sites previously used for industrial activities, large amounts of waste are generated. When burned, this waste pollutes the environment or damages landfill areas, altering their morphology, worsening hydrological conditions, and contributing to erosion.

The degree of environmental impact depends on several factors: the types of materials used in construction, the technologies applied in the construction of buildings and structures, the technical equipment of construction production, and the types and quality of machinery, mechanisms, and transport vehicles involved.

Construction sites often become sources of pollution for adjacent areas, due to emissions and noise from vehicle engines, as well as the burning of waste materials. Water is widely used in construction processes—as a component in various mixtures, and as cooling water in thermal systems. After use, this water is often discharged in a way that pollutes groundwater and soil.

Nevertheless, construction itself is a relatively short-term process⁴

III. RESULTS

In our country, consistent efforts are being made to protect the environment, ensure the rational use of natural resources, and improve sanitary and ecological conditions. However, the results of recent analyses indicate the absence of a comprehensive approach and strategic planning in the implementation of state functions related to environmental protection. Furthermore, they reveal that the existing environmental protection authorities lack sufficient powers to effectively fulfill their assigned tasks.

To address these issues, several measures have been developed. These include defining the priority directions of state policy in the field of environmental protection, introducing effective mechanisms for the prevention, identification, and mitigation of violations of environmental legislation, strengthening the personal responsibility of public authorities, heads of business entities, and citizens for the sanitary and ecological condition of the country's settlements, and ensuring the achievement of national goals and objectives for sustainable development by 2030⁵

Construction materials are essential components required for every construction project. They form the backbone of the construction industry, playing a crucial role in the construction, repair, and reinforcement of buildings and structures. The production of construction materials is a complex process that encompasses the operations of both large and small enterprises and significantly contributes to national economic growth, job creation, and the preservation of ecological balance.

Enterprises engaged in the production of construction materials represent one of the key branches of the industry and can have a negative impact on the environment. Improving the efficiency of environmental protection in such enterprises can be both ecologically and economically beneficial. These companies often rely on energy-intensive processes and generate significant amounts of waste. Moreover, the consumption of natural resources and raw materials during production can lead to environmental degradation. Therefore, it is crucial to

⁴ Environmental and Natural Resource Economics (2024).

The textbook covers topics such as environmental issues, valuation of the environment, resource allocation, the use of renewable energy sources, and other related subjects.

⁵ Decree of the President of the Republic of Uzbekistan (2021).

“On the Approval of the Environmental Protection Concept of the Republic of Uzbekistan for the Period Until 2030.”

implement effective environmental protection measures to mitigate ecological risks and ensure sustainable development.

Today, the construction industry is one of the most vital sectors driving economic development worldwide. However, it also poses significant threats to the environment. The production of construction materials—such as bricks, concrete, cement, reinforced concrete, and others—involves high energy consumption and the generation of pollutants. As a result, this sector is responsible for emissions of carbon dioxide (CO²), harmful chemicals, and various other pollutants that degrade the environment. Hence, establishing an effective environmental protection system within construction material production enterprises is of utmost importance.

IV. DISCUSSION

This article examines the key strategies that need to be implemented to improve the efficiency of environmental protection in construction material manufacturing enterprises. These strategies not only ensure environmental safety but also contribute to increased economic benefits.

Improving energy efficiency and using renewable energy sources

One of the main issues in the production of construction materials is the high level of energy consumption. Cement production, for instance, is among the most energy-intensive processes. By improving energy efficiency and integrating renewable energy sources, it is possible to reduce the negative impact on the environment.

Implementation of high-efficiency energy systems: Introducing advanced technologies aimed at energy conservation—such as heat recovery systems—can significantly reduce energy consumption during production. These systems allow for the reuse of excess heat in other parts of the production process.

Automation: Automating production processes with control systems and sensors helps optimize operations and minimize excessive energy use.

Use of solar and wind energy: Utilizing renewable sources like solar panels or wind turbines in construction material production reduces environmental harm and lowers energy costs.

Biomass and geothermal energy: Employing biomass or geothermal energy in the manufacturing process can reduce the use of natural gas and other fossil fuels.

Waste reduction and recycling strategies

Reducing and recycling waste is critical from an environmental standpoint. It is necessary to minimize waste generation during the production of construction materials, recycle it efficiently, and manage it properly. This not only protects the environment but also conserves resources and provides economic advantages.

Optimization of production processes: Enhancing the efficiency of production processes helps reduce waste. For example, precise material calculations, avoiding excessive use of raw materials, and maximizing material utilization are essential.

Improving material quality: Higher quality materials reduce the duration of production processes and the volume of waste. Durable materials that last longer also help minimize waste over time.

Recycling and reuse: Implementing recycling processes—such as reprocessing old concrete in cement production or recycling bricks—can save raw materials.

Waste separation: Proper separation of waste during production and establishing recycling systems are vital. For example, separating organic waste enables the production of new materials from it⁶

Reducing Harmful Gases and Substances in the Environment

⁶ Environmental Impact Assessment and Environmental and Social Governance (2023).

“Participating city municipalities are involved in investments in MIT infrastructure and measures to improve energy efficiency related to vulnerable households.”

The emission of harmful gases and chemical substances into the atmosphere during the production of construction materials has a significant negative impact on the environment. Reducing these emissions can substantially decrease environmental harm.

Air purification systems

Modern filtration systems should be installed to capture and treat harmful gases and substances emitted during production. These systems can significantly reduce pollutants such as CO₂ and nitrogen oxides released into the air.

Emission reduction technologies

The implementation of new technologies can minimize waste and reduce the volume of harmful gases released into the atmosphere. For example, next-generation production methods can lower energy consumption and reduce emissions.

Efficient use of raw materials and natural resources

Construction material production consumes large amounts of natural resources and raw materials. To conserve natural resources and promote efficient use in production, innovative approaches must be adopted. This includes the use of recycled materials and strategies aimed at resource efficiency.

Recycled materials

Using recycled materials in the production of construction materials (e.g., recycled concrete, bricks, aluminum, etc.) helps reduce environmental impact, minimizes the use of natural resources, and decreases waste.

Resource monitoring

To ensure efficient use of raw materials, specific monitoring systems should be implemented in production processes. These systems help control consumption and prevent excessive use of resources.

Environmental monitoring and control

To reduce environmental risks, enterprises must regularly monitor and control environmental indicators. This can be achieved through the use of modern technologies and sensors that continuously track production processes.

Sensors and monitoring systems

Sensors and monitoring systems should be installed to measure harmful gases, waste, and other pollutants during the production process. These systems enable continuous environmental oversight.

Compliance with environmental standards

To prevent environmental damage during the production of construction materials, it is essential to adhere to environmental regulations. These processes must be continuously monitored to ensure ecological safety throughout production.

Environmental protection systems and certification

Obtaining international environmental certifications is crucial for ensuring environmental protection and achieving sustainable development. This contributes to reducing a company's ecological footprint and increasing competitiveness in global markets.

ISO 14001 Certification

Implementing an environmental management system in accordance with ISO 14001 is essential for reducing environmental impact and ensuring sustainable development⁷

V. CONCLUSION

⁷ Environmental Impact Assessment and Environmental and Social Governance (2023).

"Participating city municipalities are engaged in initiatives related to infrastructure investments in MIT and measures to improve energy efficiency for low-income households."

To ensure environmental protection and enhance ecological efficiency in construction material manufacturing enterprises, it is essential to implement several key strategies. These strategies are aimed at reducing environmental risks, improving energy efficiency, minimizing waste, and conserving natural resources. Furthermore, by optimizing production processes, utilizing recycled materials, and continuously monitoring the environmental impact, it is possible to achieve sustainable development in the field of construction material production. This approach is not only beneficial from an environmental perspective but also offers economic advantages.

References:

1. Environmental Impact Assessment and Environmental and Social Governance (2023). “Participating city municipalities are involved in investment in MIT infrastructure and energy efficiency measures for vulnerable households.”
2. Presidential Decree of the Republic of Uzbekistan No. PF-60, dated January 28, 2022.
3. National Report on the State of the Environment (2024). “Covers major facilities such as recycling industries, thermal power stations, chemical industry, and construction materials production.”
4. Azizov, S., Siddiqova, M., & Muradov, S. (2024). Construction materials and their impact on the environment. *Modern Science and Research*, 3(12), 210–225.
5. Environmental and Natural Resource Economics (2024). “This textbook discusses environmental problems, environmental valuation, resource allocation, renewable energy use, and other related topics.”
6. Nizamov, K. (2025). Increasing the efficiency of management in construction material production enterprises. *Universal International Scientific Journal*, 2(1), 30–39.
7. Presidential Decree of the Republic of Uzbekistan (2021). “On the approval of the Environmental Protection Concept of the Republic of Uzbekistan for the period up to 2030.”
8. Waste Management at Construction Sites. “Architecture – Construction Science and the XXI Century.
9. Kalimbetov, A. (2023). Head of the Department for the Protection of Atmospheric Air.