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Management of waste of stone processing in the framework of Euro integration of Ukraine

Modern state of the stone industry in Ukraine undergoes drastic changes. In connection with the European integration of Ukraine, except for the requirements to product quality, the problem of proper waste management towards rock excavation and stone dressing enterprises occurs.

The article studies the legislation of Ukraine and EU concerning waste. Major obstacles that arise on the way toward sustainable waste management of rock excavation and stone dressing production in Ukraine are identified. Also the benefits of correct waste management of the stone industry are determined. The strategy of waste management of rock excavation and stone dressing production is offered. It includes 3 stages: 1) waste prevention; 2) plan development of the enterprises toward waste management; 3) determination of the processing waste operations.

On the basis of the legislation of the EU «Circular economy» the structure of the waste management plan of stone production is offered, and includes 4 main points for the rock excavation and stone dressing enterprises.

Keywords: *waste; waste management strategy; waste recycling; the plans of the enterprises towards waste management; waste utilization; waste reuse*.

Problem statement and its connection with important practical tasks. Modern stone dressing industry and construction is distinguished by the waste recycling and utilization. The reason of problem occurrence is not only the increase in building volume, but also the lack of modern standards and the relevant legislation, which provides the rational use of natural resources and environmental protection. Also along with this problem, there is a practice of "self-delivery" of waste at illegal dumps which leads to environmental pollution [1].

In the developed countries (countries of European Community, the USA, Canada), the waste of stone dressing production is regulated by the relevant legislation. The cost of recycling of the waste of stone production is much less than waste disposal. Furthermore, each enterprise has its developed plan of waste management.

Consequently, the development of waste management strategy of stone dressing production constitute relevant scientific and practical task.

Analysis of recent researches and publications that the author rests upon. The study of the problems of waste management was researched by the following scientists: Pier Paolo Manca [5], Lypez-Buendia [6], T.V. Kolomiyets [7], A.M. Soltan [8], I.V. Davydova [9–13], V.V. Korobiichuk [14–21] and others.

Problem statement. The aim of this work is the establishment of a waste management strategy of rock excavation and stone dressing production.

To achieve the goal next tasks were set:

— To analyze the legislation of Ukraine and EU "On waste"

— To develop a strategy of waste management of rock excavation and stone dressing production.

Presentation of the basic material. Major obstacles that arise on the way toward sustainable waste management of rock excavation and stone dressing production in Ukraine are the following:

— The lack of modern legislation, sustainable waste management of rock excavation and stone dressing production.

— The lack of economic incentives. Reserves of natural stone are quite sufficient to meet the demand of consumers in most regions of Ukraine and are relatively cheap compared to recycled materials. Since there are no subsidies and other economic incentives that could encourage the use of recycled materials, we have the choice in favor of primary materials.

— The lack of responsibility. According to concerned parties, the human resources allocated to law enforcement, happening in most cases at the local level, are insufficient. Fines are small and seldom applied.

— The lack of knowledge. Many employees in the public sector do not have the necessary knowledge about the specific rules that relate to the use of recycled waste of rock excavation and stone dressing production.

The benefits of correct waste management. The establishment of a thorough waste management plan generates a multitude of advantages for rock excavation and stone dressing enterprises. They include the following:

— Potential revenue: solid waste and stone slurry can be sold on the market creating an additional source of income of the company.

— Rational use of natural resources: reducing the amount of material lost during the quarrying, fragmenting and cutting increases the efficiency of the company and the number of profitable products.

— Reduction of the cost of storage, transportation and disposal: disposal costs are reduced with less waste to store and transport. The cost of waste disposal to landfill and transportation are reduced.

— Health and safety improving: reducing the number of dust particles in the air. A healthy workforce provides lower health care costs for employers.

— Raising a socially responsible reputation of a company.

Analysis of the legislation of Ukraine and EU "On waste"

In Ukraine all questions regarding waste are governed by the Law of Ukraine "On waste" from 09.05.2016, No. 187/98-VR. It identifies general concepts, in which all wastes are divided into hazardous and recycled materials (table. 1) [2].

Table 1

Waste classification (in the framework of the Law of Ukraine "On wastes")

Waste classification	
Hazardous waste	Waste as secondary raw materials
Waste having such physical, chemical, biological or other hazardous properties, which create or can create considerable danger for the environment and human health and which require special methods and means of dealing with them	Waste for recycling and utilization of which in Ukraine there are appropriate technological and production-technological and/or economic background

Also, the State Committee of Ukraine for standardization, metrology and certification the waste classifier DK 005-96 of February 29, 1996 was developed. N 89. This classifier contains information on all types of waste in different branches of production, creating a regulatory framework for conducting comparative analysis of the structure and the volume of waste within the European statistics of all economic activities, including production statistics, agricultural statistics, service statistics, and comparative analysis services relating to the waste, at the cross-sectoral, national, international levels [3].

In EU countries waste management is regulated by 2008/98/EU Directive which defines the main concepts and definitions related to waste management, such as definition of waste, recycling, recovery. It explains when waste ceases to be waste and become secondary raw materials (so-called "criteria-waste") and how to distinguish between waste and secondary products.

Secondary product is a product that is the result of a specific process of obtaining the target product. It can be considered as waste and secondary product used to manufacture other products, and must satisfy the following conditions:

— undoubted further use of the product;

— the product can be used directly without any further processing, in addition to standard production practice;

— the product is used as a part of the production process;

— further use is legal, i.e. the product ensures the production of all relevant products in compliance with the requirements of environmental protection and health care for a specific use and will not lead to overall adverse impacts on the environment or human health.

The EU Directive outlines certain basic principles of waste management: it provides that waste management is carried out without risk to human health and the environment and in particular without risk to water, air, soil, plants or animals, without generating harmful noise or odors, and without affecting the countryside or places of special interest [4].

In contrast to the Law of Ukraine "On waste" in the EU Directive there is a hierarchy of required steps for waste prevention and production waste management set out in section 4 (Fig. 1). So, as a result of analysis of legislation of Ukraine and the EU "On waste" is important difference that is the absence of criteria of waste as secondary raw materials (secondary products) that allows to distinguish secondary products from waste.

Waste management strategy of rock excavation and stone dressing production consists of the following main stages:

1. **Waste prevention** of rock excavation and stone dressing enterprises lies in:

— The application of economical technologies for the extraction and processing of stone during production – the use of rope cutting and other methods as a replacement of a drill and blast tunneling method of mining; processing – using equipment that could produce less fines and dust; the use of screens with the appropriate cell size for sifting; while treatment – using saws with fine dust cutting segments to reduce the width of cut.

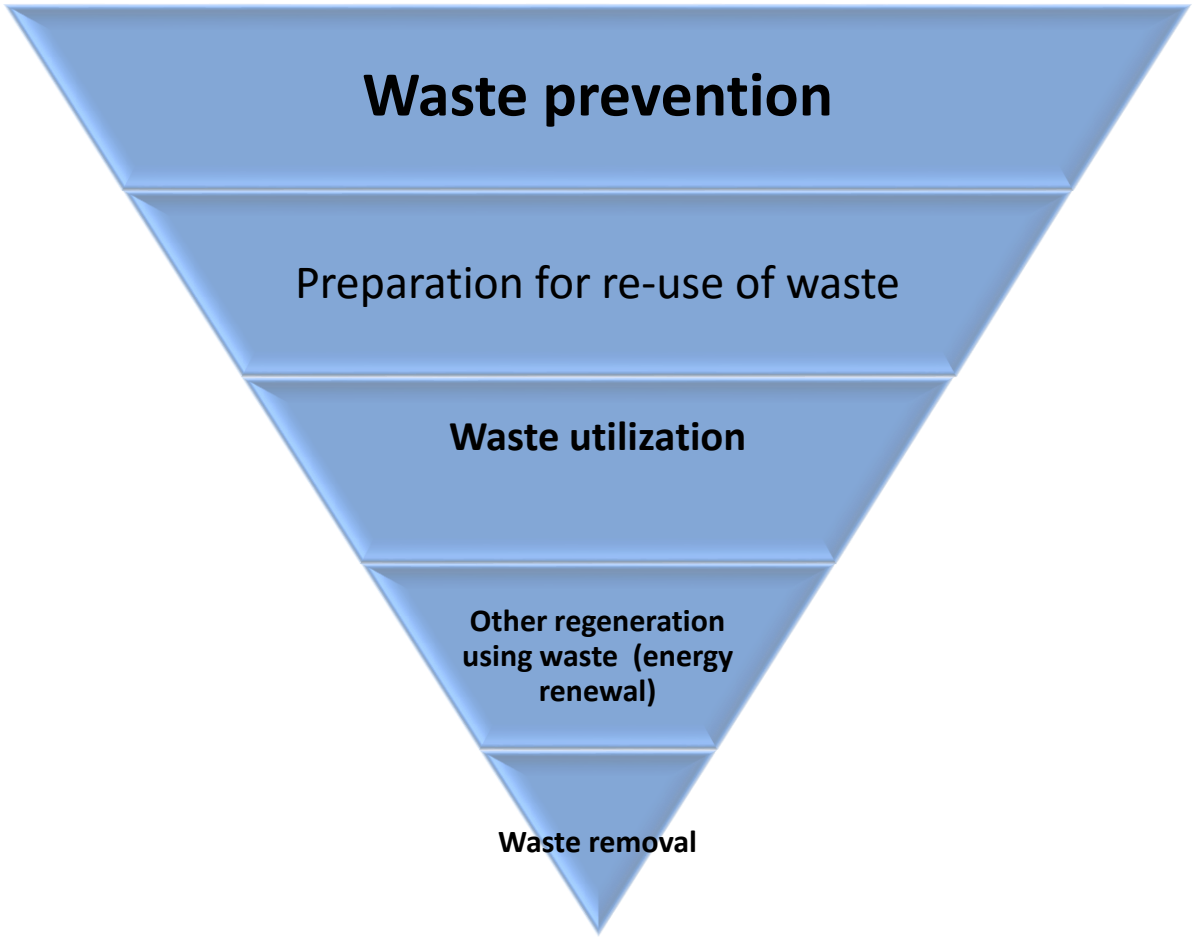

Fig. 1. The hierarchy of the stages of waste management

— The proper organization of the rock excavation and stone dressing enterprises: extraction – carrying out an accurate assessment of the calculation of reserves of stone for maximum efficiency of excavation of minerals; determination of rational direction of front movements of mining operations; processing, using the appropriate operating parameters to reduce consumption of tools and dust; calibration and monitoring of wear of the working tool and supply required amount of water, since a worn tool may create excessive amounts of dust and fine particles; using CNC precision machine parameters and minimizes costs.

2. The development plans of the enterprises on waste management of rock excavation and stone dressing enterprise**.**

According to European Law on circular economy, regional government should provide enterprises with the waste management plans. In terms of European integration of Ukraine in the framework of proper treatment of waste, development of waste management plans need to shift to the enterprises, since they have the most experienced professionals in their field. But the waste management plan must include the following items:

— the purpose of the recycling, preparation for re-use and recycling of waste, and disposal of waste;

— the existing situation in waste management (the amount of waste that is contained on the balance sheet; the amount of waste produced by the plant for the species, according to the waste classifier of Ukraine DK 005-96);

— necessary measures to improve recycling of wastes and their disposal, including assessments of their ability to achieve the goals;

— necessary measures, which include reduction of harmful substances from the storage, processing and disposal of waste.

3. The definition of the operations for processing waste of rock excavation and stone dressing enterprise is to determine the physical and chemical properties of the waste of rock excavation and stone dressing production to determine directions of their use or elimination.

Depending on the type of waste of rock excavation and stone dressing production they are used in the following production processes (table. 2).

Table 2

Directions for use of different types of waste of rock excavation and stone dressing production

Type of stone waste	Directions for use
1. Small stone waste (including sludge)	Production of asphalt and concrete Manufacture of bricks Construction fill Agents for bioretention systems or soil remediation Mineral content for the soil The production of synthetic aggregate
2. Waste in the form of riddlings	Construction fill Ingredient for concrete mixture For reclamation in landscaping and decorative use Agents for bioretention systems For road filling
3. Large stone pieces and cobblestones	Filler for foundations For reclamation in landscaping and decorative use
4. Damaged blocks and slabs	Use as a foundation filler For cutting tiles of small size, production of paving stones or tiles

Conclusions and prospects for further research. In the result of the study we revealed the following:

1. So, as a result of analysis of legislation of Ukraine and the EU "On waste" the main drawback is defined that is the absence of criteria of waste as secondary raw materials (secondary products) that allows to distinguish secondary products from waste.

2. The strategy of waste management of rock excavation and stone dressing production is offered. It includes 3 stages: 1) waste prevention; 2) plan development of the enterprises toward waste management; 3) determination of the processing waste operations.

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