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Scientific and pedagogical internship

# INNOVATIONS IN TRAINING ENGINEERING SPECIALISTS IN THE EU HIGHER EDUCATION INSTITUTIONS

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## ANALYSIS OF THE EFFICIENCY OF USING THE TECHNOLOGY OF STORAGE OF OIL AND GAS COMPLEX WASTE IN THE PROCESS OF TRAINING STUDENTS MAJORING IN "OIL AND GAS ENGINEERING AND TECHNOLOGY"

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Well construction technology and environmental protection measures foreseen by construction projects must first be focused on preventing possible causes and pathways of pollutants entering the environment. The main potential sources of environmental pollution during well construction are drilling waste, drilling mud and formation fluids [2]. Only in 2017–2018, the facts of environmental pollution by drilling waste in the region were recorded in the territory of Poltava region (Velyka Bagachka, Lokhvitsa, Myrhorod district).

As anti-filtration screens can be used soil anti-filtration screens of poorly permeable compacted clay soils, resistant to the salts contained in the liquid phase of drilling waste; clogging anti-filtration screens of surfactants and polymers; colloidal-chemical screens based on an aqueous suspension of hydrolyzed polyacrylamide (HPAA) and bentonite clay; anti-filtration screens made of polyethylene.

Therefore, the purpose of the work is to investigate the creation of arrangement method of sludge storage during the construction of wells. This method will provide guaranteed protection of surface, ground and groundwater from contamination. The purpose of the article is achieved by developing a constructive solution for an efficient, economical and safe life-long closed-type sludge with a soil cement screen.

This task is solved by applying the technology of mixing drilling waste with soil of the construction site. Mix the mixture to a certain consistency and then apply a coating over the sludge from the soil cement.

The essence of the technology is that the walls of the pit of life-long sludge are waterproofed by a vertical anti-filtration veil of soil cement.

It is proposed to arrange the soil-cement elements according to the blending technology without removing the soil according to the "wall in the soil" type. The elements are immersed in a waterproof soil layer. The sludge deposit is closed.

The construction of life-long sludge storage begins with the fact that a monolithic vertical anti-filtration curtain is being constructed around the perimeter of the planned sludge storage facility. Such an anti-filtration veil is constructed according to the "wall in soil" type of soil cement elements (Fig. 1). The distance between the centers of adjacent elements should be 0.8d (d – diameter of soil cement elements).



Fig. 1. Durable toxic waste sludge:

1 - bulk soil; 2 - soil cement overlap; 3 - drilling waste;
4 - anti-filtration veil by the type "wall in soil", made of soil-cement elements by blending technology without soil extraction;
5 - waterproof soil layer

Soil cement is a material that consists of multicomponent systems – cement and soil. The main leading factor in the conversion of soil properties is cement, which is a polydisperse and polymeric system that can form a solid after the addition of water [1; 5].

Waterproofing of soil-cement has been proved by the results of laboratory and industrial researches. For example, samples of soil cement in laboratory and field conditions were made of loess soil with the addition of 20%. Portland cement M400 by weight of dry soil. The samples were made at a water-cement ratio of 1, without additional compaction and hydrophobic additives, by the method of "wet spot" and the express method, which is to determine the breathability. On the basis of these results, the soil cement grade corresponding to the W12-W16 classification of concrete for water resistance was determined [3; 4].

The soil-cement elements are made by a blending method, which consists in the fact that with the help of special equipment when the loosening of the soil is performed without its removal. At the same time a slurry is pumped into the loose soil, mixing and compaction of the soil-cement mixture is performed. Thus, we obtain cylindrical soil-ement elements with a diameter of 0.3 - 0.8 m and a length of up to 30 m [1]. A wall-to-soil anti-filtration curtain of sub-soil soil-cement elements is immersed in a waterproofing to a depth not less than 1 m in order to ensure no filtration. Waterproof layer is a layer of waterproof rocks that limits the aquifer from above or below. Waterproof roof is formed by waterproof rocks, such as clays, solid limestones and solid crystalline rocks, clay shales, crystalline shales.

After solidification of the soil-cement elements, the soil mass is extracted by the volume of the sludge [2]. The period of wetting in the moistened state lasts 28 days. Over time, the strength and water resistance of soil-cement increase. Preparation and packing work is carried out within the storage area. After filling the project volume of the storage with a compacted mixture, a soil-cement horizontal screen 50 cm thick is arranged behind its surface. The soil-cement covering of the sludge deposit with hardens, it is covered with a layer of fertile soil with a thickness of not less than 1.5 m. The size of the life sludge and its volume, profile and depth are determined at the stage of design work in relation to a particular site, taking into account the soil category, depth of groundwater, depth of water resistance and other characteristics. An important factor in the design of the repository is the choice of the location of the repository, provided there is a waterproof layer at the optimum depth from the surface (8-20 m).

Advantages of the sludge storage construction with the device of a covering from a soil-cement which is put on the drilling waste condensed to a rigid-plastic consistency with addition of soil of a construction site is low cost of production due to use of a soil water-resistant layer as the bottom of a structure. It is also possible to solve the problem of utilization of the soil sludge extracted during construction.

The positive thing is that the sludge tank walls have a high water resistance W8 - W12; significant compressive strength - 2 MPa; environmental safety and durability.

The technology proposed by the author is recommended to be considered in the discipline "Fundamentals of oil and gas extraction". The concept of waste storage technology in the process of well operation is important for future engineers and students majoring in 185 "Oil and Gas Engineering and Technology."

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## SCIENTIFIC AND METHODOLOGICAL ASPECTS OF IMPLEMENTATING ENERGY-SAVING, ENVIRONMENTALLY SAFE TECHNOLOGIES, AND TECHNICAL MEANS FOR CABLE SKIDDING DURING TRAINING FOREST ENGINEERING SPECIALISTS

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Forests are important strategic natural resource of Ukraine. Sustainable forestry development is based on a harmonious combination of ecological, economic and social functions of forests. At the regional level, implementation of forestry development strategy requires implementation of specific measures for effective operation and development of forestry enterprises [1].

One of the most effective means of mechanization of skidding and transport logging operations in terms of energy consumption and material consumption, which are significantly ahead of other similar machines [2], are skyline logging methods [3]. Therefore, the transportation of timber in suspended or semi-suspended positions with the use of skylines is widely used in many industrialized countries [4].

In past, Ukraine created normative documents for introduction of advanced technologies for the development of logging and the priority use of air-skidding mobile and stationary skylines. In particular, it was planned to gradually replace skidding in structure of technological processes of logging industry with an increase in the share of wood transported by cable systems from 3% to 35%. At the same time, structure of expenditures for purchase of new machinery and equipment