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## **INNOVATIVE APPROACHES TO RESTORATION AND HYDRO- ECOLOGICAL PROTECTION OF MINING REGIONS**

Further development of the energy, agricultural and economic sectors of Ukraine is largely connected to a possibility of systematic liquidation of a number of unprofitable and old mining enterprises. At the same time, the priority problems that occur during this process include the emerging loss of jobs, the cost of maintaining hydrodynamic safety of closed enterprises, landscape disturbance in a large number of territories, degradation of fertile soil and a threat of environmental pollution [1-3]. With the current agricultural priorities of the country development, a large amount of lands disturbed by mining needs to be restored both in terms of relief and fertility, followed by monitoring using fundamentally new methods of recultivation. At the same time, the previously established approaches to transformation of mining enterprises are mostly general and do not focus on the specifics of domestic industry, which significantly limits their use and requires the development of new, more targeted methods of restoration and management of production facilities and territories, which are located at sites of closed mines and quarries. The factors required in the field of environmental security of Ukraine are: a high level of scientific justification of measures for green production, strengthening the control functions of government, using market economy model in the context of environmental security and European integration interests of Ukraine. Land recultivation after the deposits have been developed is responsibility of the mining enterprise, so recultivation funds should be considered as the final part of the production process, and the cost of creating reserve funds for recultivation should reduce the amount taxed, i.e. should be included in the cost. This approach is implemented in developed countries [4-6].

Further development of economy and energy sector of Ukraine is largely connected to a possibility of systematic liquidation of a number of unprofitable and old mines and quarries. At the same time, the priority problems that occur during this process include the emerging loss of jobs, the cost of maintaining hydrodynamic safety of closed enterprises and a threat of environmental pollution. In this regard, the authors' research is aimed at developing a parametric basis for technical and biological restoration of territories disturbed by mining, which allows their integrated usage for industrial and agricultural sectors, increases the economic efficiency of such lands and reduces the negative impact of mining on environmental state of the Dnipro region, while helping strengthen the energy security of Ukraine.

To solve this set of studies, a number of tasks is set and solved.

1. The research of technological, biological-ecological and mining-hydrogeological factors of operating and closed mining enterprises is carried out. This helps establish the mechanism of transformation of their production profile into a complex system of innovative agro-industrial technologies. It is necessary to use the model of technological profile analysis, which is developed on a basis of geotechnological and industrial criteria using a set of optimization methods, during determining the final configuration of the agro-industrial location and the sequence of changes of a mining enterprise at the liquidation stage. Integration tools and methods are developed that provide joint usage of common infrastructure, different types of energy, residual resources, relief, land resources and internal logistics in compliance with modern environmental standards, in order to realize the separate technological chains within the selected agro-industrial location.

2. Creating a design and management system of a separate agro-industrial location is ensured by establishing criteria for adaptation and modernization of production, which are determined in the process of cross-analysis of description of a closed mine or quarry and biological-technological features of a set of created innovative enterprises. Comprehensive studies of mining, hydrogeological and biological conditions of mining enterprises, based on comparison of results of field measurements, physical and mathematical modelling, will allow adequate agro-geotechnological parameterization of replacing their production profile with a set of modern technologies that will restore relief, soil fertility and greening the production in the studied region. At the same time the usage of residual resources of deposits, which ensures maximum usage of both underground and surface space (spoil tips, etc.) will be addressed.

3. It is necessary to develop a methodology for determining and implementing the most efficient energy crops, based on mining-hydrogeological and soil-climatic conditions of mining regions during restoration of soil fertility. Development of universal schemes for restoration and relief planning of disturbed territories with organization of phytoagrocinoses for different types of development of mineral deposits, with quantitative and qualitative justification of a possibility of returning reclaimed territories to agricultural and hunting purposes. Particular attention should be paid to structured and adapted methods of ensuring the stability of ground complex of structures and relief in general, based on a type of mineral deposit. With the help of simulation economic-mathematical analysis conducted research aimed at studying the agro-industrial demand for usage of individual objects of closed mines and quarries and development of recommendations for its increase.

When recultivating disturbed lands, it is important to consider the area of further usage of these lands: for example, the yield of lucerne and sainfoin on tertiary rocks without soil cover is 30-50 centner/ha (costs will return within 3-9 years). Growing winter wheat costs increase due to the necessity of work on adding a layer of chernozem [2].

The primary scientific significance of the results is in a new approach to development of comprehensive and stage-by-stage restoration of territory of a liquidated mining enterprise, which allows their full usage for industrial and agricultural sectors, increases economic efficiency of such lands and reduces the

negative impact of mining on ecological condition of Dnipro region. Development of agro-technological recommendations and schemes for integrated development of such lands with restoration of relief, soil fertility, usage of residual resources of the mineral deposit, etc. is also a distinctive feature of this research related to the adaptation and development of recultivation measures in disturbed territories.

**Keywords:** recultivation, residual resources, natural-technogenic resource, soil fertility restoration.

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