Design of the Opencast Coal Mine Drmno Dewatering System

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Abstract. Development of mining in the opencast mine Drmno from Kostolac basin in Serbia is carried out in the increasingly complex geological and hydro-geological conditions with the decline of the coal seams to the alluvial part of Europe's largest river Danube. Greater depth and inflow of groundwater significantly increase costs for dewatering facilities construction with the requirement for optimizing of this more and more important surface mining process. Making decision on screen construction in the opencast mine with redesign of line wells parameters for the defence against groundwater, in addition to geology and hydrogeology exploration activities, analyzing the elements of the opencast mining systems and a number of working environment parameters with the development of the hydrodynamic model requires necessary review of economic and environmental effects. A detailed techno-economic analysis has been done in order to demonstrate technological justification and economy of screen construction as the system for protection against groundwater in the opencast mine. The defence of the opencast mine against the groundwater without the construction of screen causes construction of several dewatering wells and lines with increased pumping capacities by the end of deposit mining. On the other hand, screen construction means big initial investments but with a smaller number of dewatering wells with reduced capacities, lower cost of electricity and larger reliability of the system operation in the long period until the closure of the opencast mine. Estimates of environmental impact and efficiency comparison between these systems options for protection against of groundwater have been done. DCF analysis has shown that the long-term averaged costs for opencast mine Drmno dewatering against groundwater per ton of coal are approximate for the both system options. Final decision on the approval of the combined dewatering system with a reduced number of dewatering wells and screen construction has been caused by the system reliability and environmental effects related to the impact on the groundwater level outside of the opencast mine boundaries and safer operation of the hydro power plant Djerdap system on the Danube River.

Keywords: dewatering system, groundwater, hydrodynamic model, dewatering wells, screen, reliability, environmental effects.

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1 Introduction

Opencast mining, especially today when mining is performed at greater depths in complex hydrogeological conditions, requires special attention of the scientific and experts community in terms of dewatering in all phases of the opencast mine development. Therefore, in recent decades, significant progress has been made primarily by developing methods, models and software that significantly facilitates the design of optimized groundwater dewatering system.

From the standpoint of dewatering, opencast mines are typically very dynamic systems influenced by a large number of natural, technical-technological, economic, environmental and safety factors and constraints in all periods of the life cycle. The entire life cycle is defined by periods of surface mining, realized through a set of business processes in each of the periods that allow the efficient, effective and reliable mineral resources mining in the opencast mine. One of the key process is the process of opencast mine dewatering, which belongs to the group of the *technical support processes* for the implementation of the opening process, production and closing of the opencast mine, as well the reclamation process.

Established dewatering process flow is at the general content level and is applicable regardless of the opencast mine size, the type of mineral resources being mined and complexity of deposit conditions. In addition, it is applicable during a new opencast mine opening, but also when it is required to design or redesign dewatering process in the opencast mine where is performed mining.

Groundwater dewatering system is a complex of more than one dewatering facilities and it represents the most complex sub-process of dewatering process, to which is necessary to pay the greatest attention [6]. In practice, as a base, are the most commonly used systems of dewatering wells, dewatering channels system and the water collector and waterproof screens.

2 Dewatering Planning Process of Opencast Mines

Successful implementation of the opencast mine protection against ground and surface water depends on the knowledge reliability degree of hydrological, hydrogeological and geotechnical characteristics of the near and distant deposit areas and their correct interpretation. The initial parameters for the dewatering requirements, in addition to these mentioned, are hydraulic and hydrodynamic parameters and dynamic parameters of groundwater.

Through a detailed analysis determine data on the possible methods, systems, facilities and equipment for dewatering in the opencast mine. Based on these data and data from the deposit model, too, (hydrological, hydrogeological, hydraulic, geological, geophysical and geotechnical), as well as data on applied mining technology and the conditions of the opencast mine stability (opencast mine model data), is carried out dewatering system selection for the opencast mine (fig. 1). For sure, it has to be emphasized that for the dewatering system selection is required