Title

Qualitative risk assessment of methane ignition and explosion for longwall mining

Abstract

The purpose of the research was to develop a method of qualitative methane risk assessment, for underground coal mining, in order to evaluate both measurable and immeasurable risk factors.

Methane hazard and associated risks of the effects of ignition and explosion of methane is one of the most severe natural hazards. That is why a method named RMQE-IM (Risk Methane Quality Evaluation In Mining) was proposed. Heuristic methodology based on the Delphi approach and a group survey by a panel of experts was used to assess the magnitude of methane risk for nineteen longwalls. The first step of the proposed methodology was to identify the risk factors, both for causes and consequences of the methane risk in the exploitation areas. The evaluation of factors, divided into 4 groups (factors shaping the methane hazard; the activity of the methane ignition initiators; detection and prevention of methane risk; and possible human and material losses), was conducted in accordance with the procedure of the adopted method, based on the proposed algorithm. Assessments by experts were used to calculate the indicators of the magnitude of methane hazard for each group of factors separately. Finally all the results were used to calculate aggregated indicators of methane risk, that is final risk values for each longwall separately. The last step contained determining the criteria of the methane risk acceptance level and assigning facilities to the appropriate risk category.

The adopted tools for assessing the current state of methane risk factors and their possible accident consequences were targeted surveys, with the participation of experts representing, mainly, engineering-technical personnel of mine ventilation service.

The proposed method of methane risk assessment can be an important element in the design and construction of a modern methane safety system in coal mines. It provides the possibility of controlling this risk and enables the minimization of its consequences in accordance with the criteria of their acceptance, adopted in this thesis. The method does not replace the currently used methods of methane risk assessment, but complements them in a significant and modern way.