

Abstract of PhD thesis of MSc. Maciej Bodlak, titled :

FORECAST OF GAS AND ROCK OUTBURTS FOR DESIGNED EXPLOITATION IN
WAŁAW-LECH DEPOSIT

In 2013, the possibility of resuming mining in the "Waław-Lech" deposit appeared. In the Deposit Development Project, in the aspect of methods of control and forecasting hazard of gas and rock outburst, which will be used during the planned operation, is mentioned, among others "*interpretation parameters of hazard of gas and rock outburst, based on computer technology*". However, the state of knowledge on the forecast of gas and rock outbursts in the "Waław-Lech" deposit, using modern data analysis tools, is low. Until now, there wasn't database describing gas and rock outburst, which could be used as a training set for machine learning algorithms. There is a lack of identified forecasting tools for this phenomenon, for mining, which are still at the design stage. In addition, weren't any attempts with forecasting scale and quantity of gas and rock outbursts for planned mining operations under indicated geological and mining conditions.

The goal of PhD thesis is to **create a model for forecasting potential, in given geological and mining conditions, the scale and quantity of gas and rock outbursts for the planned exploitation in the "Waław-Lech" deposit.**

The new tool was created thanks to research results combining knowledge in the field of geology, rocks mechanics, mining as well as work safety in mining. In order to forecasting the studied phenomenon there was necessary creation a historical and geological database of gas and rock outbursts, which occurred during the past exploitation in the "Waław-Lech" deposit. For this purpose, was made completely full register of indicated phenomenon, based the existing archival materials and information contained in the available literature.

The work is relevant to tasks for the economic development of the Nowa Ruda coal region, due to more than 500 years of documented mining exploitation and due to the possibility of resuming mining in the "Waław-Lech" deposit.

The PhD thesis consists of eight chapters, but the eighth chapter being a list of literature, tables and drawings. The first and second chapters cover background information on the subject of PhD dissertation, thesis, goal and scope of work. The third chapter covers analysis current state of knowledge regarding the phenomenon of gas and rock outbursts. Moreover, in the fourth chapter placed analysis of forecasting methods and prophylactics methods, in particular with regard to experience from mining in the "Waław-Lech" deposit. In addition, the fourth chapter includes a review of selected mining disasters occurring in the "Waław-Lech" deposit, caused by this phenomenon. The fifth chapter describes the geological conditions of the deposit, history of bygone exploitation and an analysis of its condition regarding the studied region. Indicated chapters contribute to get knowledge about the nature of phenomenon and the geological-mining conditions in the deposit. The sixth chapter describes the attempts to predict the size and quantity of gas and rock outbursts in the "Waław-Lech" deposit, using modified analytical and statistical methods as well as machine-learning techniques. The chapter presents a multilevel verification of the "learned" *random forest model* and its use in order to forecast scale of outburst for the averaged historical and physic - mechanical parameters of the indicated deposit. Also, in the sixth chapter, placed the concept of using the results of the developed model to estimate costs / losses generated by the occurrence of the studied phenomenon, during planned exploitation. The work is finished by a summary, included in the seventh chapter.

To doctoral dissertation was attached a register of gas and rock outbursts occurring in history of mining in the "Lech" region, which was created during conducting research on occurrence of this phenomenon.

Maciej Bodlak