4. Sudakov, A. Khomenko, O., Isakova, M., & Sudakova, D. (2016). Concept of numerical experimentof isolation of absorptive horizons by thermoplastic materials. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, (5), 12-16.

5. Khomenko, O., Sudakov, A., Malanchuk, Z., & Malanchuk, Ye. (2017). Principles of rock pressure energy usage during underground mining of deposits. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, (2), 35-43.

6. Khomenko, O., Tsendjav, L., Kononenko, M., & Janchiv, B. (2017). Nuclear-and-fuel power industry of Ukraine: production, science, education. Mining Of Mineral Deposits, 11(4), 86-95.

7. Khomenko, O., Kononenko, M., & Myronova, I. (2017). Ecological and technological aspects of iron-ore underground mining. Mining Of Mineral Deposits, 11(2), 59-67.

8. Khomenko, O., Kononenko, M., & Bilegsaikhan, J. (2018). Classification of Theories about Rock Pressure. Solid State Phenomena, 277, 157-167.

9. Khomenko, O., Kononenko, M., Myronova, I., Sudakov, A. (2018). Increasing ecological safety during underground mining of iron-ore deposits deposits. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, (2), 29-38.

SUBSTANTIATING A MECHANISM TO INCREASE THERMAL RESOURCE OF WATER-BEARING LEVELS AT THE EXPENSE OF UNDERGROUND COAL COMBUSTION

SADOVENKO Ivan, INKIN Olexander,
DEREVIAHINA Nataliia & HRIPLIVEC Yuliia
Dnipro University of Technology, Dnipro, Ukraine

Purpose. Objective is to study a mechanism increasing thermal resource of water-bearing levels at the expense of underground coal combustion.

Methodology. The studies were carried out by means of substantiation of models of filtration and heat transfer within the water-flooded rocks representing thermodynamical processes of the proposed geocirculating system operation.

Findings. Long-term mining of coal deposits in Ukraine and liquidation of mines have resulted in the formation of natural and technogenic environment within coal-mining regions; the environment contains substantial reserves of energy resources in the form of remaining and off-grade coal as well as warm mine and underground water [1]. Disturbed rock mass has significant capacitive resource capable of accumulating heat carriers which amount is quite sufficient to mitigate seasonal fluctuations of their consumption.

The developed models of filtration and heat-transfer have become the research basic instrument since they reflect thermodynamical processes of a geocirculating system providing both warming and conditioning of industrial and civic buildings

at the expense of summer heat and winter cold preserved within the disturbed water-bearing rocks.

Numerical simulation has been applied for the dynamics of formation and configuration of the thermal resource within water-bearing level occurring over the coal seam to be combusted depending upon its inclination, mining stage, and aquifuge thickness [2-4].

The model has been identified on the basis of epignosis modeling of industrial experiment concerning underground coal combustion within Rocky Mountain deposit (USA) [5]. Relative calculation error is not more than 5%.

The developed technique to activate energy capacity of water-bearing level in the flooded mine in terms of parametric modeling has been tested in the context of Novogrodovskaia 2 mine being under liquidation. Preliminary calculations helped determine that overall amount of the thermal energy, accumulated by water, containing in the flooded workings of the selected mine, is almost 1300 TJ [6]. Its use with the help of a geomodulus may be considered in the context of two technological variations. One of them is connected with the development of natural heat resource of a mine (i.e. “cold well”); the other one is connected with its additional activation at the expense of underground combustion of residual coal (i.e. “warm well”). Thermal resource, generated by variation two, is almost sufficient to meet thermal demands arising during a heating season in the town of Novogrodovka. That makes it possible to consider the operation schedule as the advanced one while using resources of Novogrodovskaia 2 mine being under liquidation. If the modulus operates according to variation one and mine water is applied as low-grade source for thermal pumps, then the supplied energy to heat up buildings will become 150 GJ/day on the average to be four times less to compare with the required thermal flow. It is possible to improve the efficiency of operation schedule one if high-priced thermal pumps are replaced by such heating system as “heat-insulated floor”.

Thus, geotechnical modulus has been substantiated. The modulus provides efficient development of thermal resource of the flooded mine while intaking pumping water from different levels for heat and cold supply of buildings depending upon outdoor temperature as well as its periodical activation by means of underground combustion of residual coal. Novogrodovskaia 2 mine, being under liquidation, has been taken as an example to prove that thermal flow (500-580 GJ/day), formed in the processes of coal combustion and heated water pumping out, is almost enough to supply thermal needs of a settlement which population is 15 thousand people.

Publications are based on the research provided by the grant support of the State Fund For Fundamental Research (project N Ф83/93-2018).

Key words: thermal resource, gasification, modelling, filtration, geomodulus

References

1. Gavrilenko Yu.N. (2004): Technogenic consequences of the closure of the coal mines of Ukraine. Nord-Press, Donetsk, 631 p.

2. Saik, P., Petlovanyi, M., Lozynskyi, V., Sai, K. and Merzlikin, A. (2018). Innovative Approach to the Integrated Use of Energy Resources of Underground Coal Gasification. Solid State Phenomena, 277, 221-231.

3. Falshtynskyi, V.S, Dychkovskyi, R.O, Saik, P.B, Lozynskyi, V.H and Cáceres Cabana, E. (2017). Formation of thermal fields by the energy-chemical complex of coal gasification. Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu, 5, 36-42.

4. Sadovenko I.A., Rudakov D.V. and Inkin A.V. (2012). Numerical study of the features of the thermal field around an underground gas generator. Zbirnik naukovyh prats NGU, 39, 11-20.

5. Berdan G. A. (1993): Restoration plan for the Hanna. Underground coal gasification site in carbon county, Wyoming, 128 p.

6. Sadovenko I.A. and Inkin A.V. (2014). Justification of the parameters of heat energy extraction in conditions of a flooded mine. Gornyy zhurnal, 7, 82 - 90.

MODELS AND INFORMATION SYSTEMS OF ECOLOGICAL AND ECONOMICAL RISKS WITH DECISION MAKING ON THE CLOSURE OF COAL MINES

ALEKSIEIEV Mykhailo & VLASOV Vladyslav
Dnipro University of Technology, Dnipro, Ukraine

Purpose. Development of decision support system based on simulation results of underworking of surface and selection of rational way of remediation.

Methods. The studies were carried out by simulating the processes of lowering the earth's surface by it underworking and closing the coal mines by the finite element method. A model was developed for the decision-making algorithm for minimizing environmental and hydro-economic risks when closing mines.

Finding. Were analyzed software products based on finite element methods for modeling the processes of earth surface lowering by it underworking and identified flooding areas in mines closed by the method of wet preservation. The analysis of the basic techniques for calculating the area of lowering of the surface is performed. Has been developed a database of three-dimensional coordinates of coal seam mining for specific mining geological conditions of the Ternovskaya mine JSC "Pavlogradugol". Has been developed a model of an underworked surface with flooding zones, which makes it possible to determine the necessary remediation works and their cost.

The results contain studies that were conducted under the project GP-489, which is funded by the Ministry of Education and Science of Ukraine.