

POST MINING HYDRODYNAMICS OF THE KARST AQUIFERS IN KIZEL COAL BASIN (THE WEST URALS, RUSSIA)

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Perm region is an old mining region. Mining has been underway for more than 300 years. Potash salts and coal were the main types of exploitable mineral deposits in the twentieth century. Coal deposits are located in the Pre-Urals, geologically confined to the West-Urals folding zone. The high prevalence of karst rocks is typical for this area.

Deposits of the Kizel coal basin are the subject of study. These deposits were developed from the end of the 19th to the beginning of the 2000s. High water inflows were common - total drainage reached 10-12 thousand m³/hour. The mines have been flooded since the beginning of the 90s of the last century, by now all the mines have been flooded, 16 springs of mine waters have been formed. High discharge rates - up to 1000 m³/hour during snow melting arc typical for these springs, the total average annual flow rate of springs of mine waters is more than m³/hour. The waters of the mine water springs are sulphate high-metal with low pH. These springs for tens of kilometers pollute the rivers of the Kama basin, the Volga tributary. Attempts are being made to reduce the environmental damage caused by the spouting of mine waters since the early 2000-s.

Geofiltration models have been developed for all watersheds of mine fields. I lie location in the unique for each field geological structures - synclines and anticlines is taken into account. The geofiltration pattern and stratification of model layers is the main problem. The model took into account aquifer complexes confined to rocks from the Permian to the Devonian age. The angles of incidence of rocks reach 70°, the total depth varies from full pinching to 1200 m. The width of catchments is from 5 to 14 km with a length of 2-3 times more.

The balance structure of the groundwater formation at different stages of the territory development was first evaluated. The following stages are considered natural conditions, the situation at the end of mining, the current situation with mine springs, forecast for the implementation of various water protection measures. Resources of the coal-bearing strata provided no more than 50% of the mine drainage flow. In the simulation, it was necessary to add to the model the interaction of the coal aquifer with the overlying (Visean-Artinsky) and underlying (Franco-Tournaisian) aquifers.

Clear seasonality of mine springs flow rates has been established. Due to the consumption of surface runoff, up to 50% of the flow rate of springs is formed. Solved model tasks for years of different water content confirmed this. Drainage of surface runoff by ditches is proposed here as a basic water protection measure. Embedding of the spout points is effective where the springs are small in terms of discharge rate. The implementation of this event will lead to the cessation of outflow and increased discharge in the bottom of the rivers. To ensure the centralized discharge and concentrated purification of groundwater, options for organizing pumping from coal-bearing strata or Visean aquifer are also considered.

Key words: *geofiltration model, karst, mine floor, river pollution, Kizel coal basin*