An integrated approach for the prediction of hazardous dynamic events. The case study of retrospective data in the area of a tectonic rockburst in the Rasvumchorr mine on January 9, 2018

Kozyrev A.A., Semenova I.E., Zhuravleva O.G.

Mining Institute – Subdivision of the Federal Research Centre «Kola Science Centre of the Russian Academy of Sciences», Apatity, Russia

e-mail: ZhuravlevaOG@goi.kolasc.net.ru

The study discusses the results of a multifactor analysis of a strong 3.3 magnitude seismic event which occurred on January 9, 2018 (6:00 AM MSK) in the Rasvumchorr mine (the Apatitovy Tsirk deposit). The event's hypocenter was in the footwall of the ore body outside the mining zone. The event was accompanied with a strong noise, underground and surface shaking and severe damage to mine excavations, and was felt both by the mine personnel and residents of Kirovsk and Apatity towns. Disturbances in mine excavations were detected within the elevation range of 100 m. Such rank events occur at the Khibiny rockburst hazardous deposits at a period of 5–10 and more years.

This strong dynamic event could be triggered by a technologic blast on January 8, 2018, when the rock mass went into an extremely unstable state. Events of a similar mechanism cause the most significant seismic response of the rock mass and can lead to large damage to underground and surface objects.

In spotlight of this study is application of an integrated approach for the prediction of hazardous dynamic events on the example of retrospective data. The geological, geomechanical and mining-engineering factors were considered which impact the geodynamic behavior of the rock mass part given.

The proposed approach is based on combining probabilistic assessment data of potentially seismic dangerous zones (occurrence of strong events of 6-8 energy class) with 3D numerical modeling data of the rock mass stress-strain state, taking into account the main geological, geomechanical and mining-engineering factors at several large-scale levels. It is shown that the combined use of various indicators of seismic hazard and parameters of the stress-strain state of a particular site during the development of mining operations makes it possible to increase the reliability of prediction of seismic hazardous zones.