Statistical modeling of mine pool formation in underground coal mines of Ohio[1]

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Mining has occurred in Ohio for over two hundred years and has resulted in hundreds of flooded or partially flooded mines releasing acid mine drainage. Present mining regulations in Ohio prevent the approval of a mining permit if it is predicted that the future mine will potentially create a pollutional discharge. However, there is not a consistent methodology that mining companies and regulators use to determine, with some degree of uncertainty, if a mine will develop a pool or not. This work is part of a larger project that aims to create a tool that can predict with some certainty if a mine pool will form in a future coalmine, and if it does, where it could discharge. Mines that have been recently exploited in Ohio are being investigated. Data such as stratigraphy, pre- and post-mining potentiometric heads of wells within the mining area and precipitation was collected from public sources and are being investigated. Using the statistical program, Unscramble, multivariate statistical analysis such as step-wise multivariable regression, principle component analysis regression, and partial least square regression discriminant analysis is performed on these variables for multiple mines. This analysis will result in a regression equation that allows for the prediction of mine pool formation using potentiometric heads, hydrological parameters, and stratigraphy and topography of the mined area. Preliminary statistical analysis has shown that the amount of shale in the overburden is positively correlated with post-mining potentiometric head. This indicates that as the amount of shale in the overburden increases, the hydraulic conductivity decreases which decreases the vertical flow of water allowing it to accumulate in the overburden. The equations relating elevation of the water within the mined area and the variables cited above will be used to predict the formation or not of mine pool in future mines within some uncertainty.

Additional Key Words: