Jun 25th, 3:40 PM - 5:00 PM

Challenges with integrated flow and geochemical modelling considering uncertainties in backfilling

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Challenges with integrated flow and geochemical modelling considering uncertainties in of coal mine backfilling

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Abstract: There is a limited market in South Africa for the reuse of coal combustion products (CCPs), resulting in massive disposal sites. Various reuse options are considered, but are limited to small-scale volume use. Coal mine backfilling has the potential to use large volumes of ash as part of the site water management strategy. Therefore, it is important to determine feasible CCP backfilling conditions. Environmental and Water legislation would prevent this proposed activity if it induces a negative environmental impact as compared to the pre-existing mine. A combination of field, laboratory hydraulic and geochemical experiments have been set up to predict the influence of the ash backfilling into an acid mine drainage environment. Modflow USG based numerical flow models were set up to predict changes in water levels and fluxes for various CCP backfilling scenarios. Consideration was given to geochemical processes reducing hydraulic properties of the CCP backfill over time. Geochemical models, using Geochemist Workbench, were set up to predict pit water quality. Water quality is dependent on the following feedback factors: mine water levels, oxygen availability in the mine backfill, recharge rates and mine leachate quality. The integration of both flow and geochemical models, used to simulate the processes driving the water quality concentrations and availability of oxygen, has not been achieved yet. Manual feedback between the different models are used in this project, enhancing our understanding of the cause and effect of different management/backfilling options. Factors contributing most to the environmental uncertainty are highlighted shall be included in site specific studies.

Keywords: uncertainty; predict; coal combustion products