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Acid mine drainage nuisance: case studies in abundant collieries in Witbank Coalfields

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Coal mining played a significant role in the industrial growth and development of South Africa and coal contributed large on the World War II. Coal mining, together with industrial development was often accompanied by severe environmental implications i.e. water contamination, land subsidence and spontaneous coal combustion.

This study evaluates hydrochemical characteristics of the acid mine drainage as well as flow path, to present environmental implications induced by coal mining in relation to acid mine drainage (AMD) from abandon coal collieries in eMalahleni in the Witbank Coal Field. It is also aimed at contributing towards the best management of acid mine drainage in the Republic of South Africa and abroad.

Field surveys were carried out in the study sites which entail site examination through visiting and collection of water samples for hydrochemistry analysis from areas of subsidence, AMD decanting points including seepage and focused flows, boreholes, old shafts, ponds and receiving environments. Flow rates were measured along the acid mine drainage flow path with aid of a rectangular weir notch method which allowed recording of flow rate even in small flowing water. Environmental water quality guidelines and standards were used to facilitate the hydrochemical characterisation of the AMD.

Discharging mine water is mainly through inclined shaft, bedding plane and/or contact between underlying impermeable shale and permeable overlying unconsolidated material comprising of arenaceous sandstone, coal, siltstone and shale. The unconsolidasion of the overlying material resulted from land subsidence perpetuated by pillar instability. During wet season, high infiltration takes place in the undermined area characterised by high density of tension joints resulting from land subsidence. This water fails to percolate through the underlying consolidated material i.e. shale and siltstone and becomes lateral flow which discharges at the lower laying grounds.

All water samples from the discharging mine water are characterised by severely deteriorated water with by high acidity, electrical conductivity and concentration of Al-Fe-Mn-Co-Ni-Zn-SO_4. The magnitude of contamination is so massive, such that the most immediate receiving environments present similar deterioration, it was however noted that the recipients presented a high concentration of V-Cr which may derived vanadium and chromium plants operating on site.