CONTROLS ON COAL MINE DRAINAGE CHEMISTRY, WEST COAST, SOUTH ISLAND.

J. Pope[1], N. Newman[1] and D. Craw[2]
[1] CRL Energy Ltd, 123 Blenheim Rd, Christchurch, j.pope@crl.co.nz
[2] Geology Department, University of Otago, Dunedin.

Acid mine drainage (AMD) is the largest environmental problem facing the mining industry because it can effect the environment many kilometres downstream of mine sites and if untreated, can persist decades to centuries after mining has ceased. AMD forms when sulphide minerals disturbed by mining oxidise, react with surrounding rocks and release acid, Fe, Al and trace elements. AMD chemistry is highly variable and therefore the nature and severity of environmental impacts and optimal mitigation or treatment methods are difficult to predict.

A suite of samples from coal mine drainages on the West Coast of the South Island has been collected to determine chemical variability. All samples have been collected as close to source as possible to avoid changes in chemistry due to downstream processes. Mine drainage chemistry on the West Coast can be related to several factors including regional geology, mine type, hydrogeology, and local rock types.

The impact of regional geology on mine drainage chemistry is best demonstrated by comparison between mine drainage from Paparoa Coal Measures and Brunner Coal Measures. Mines within Paparoa Coal Measures produce neutral mine drainage with low concentrations of Fe, Al and trace elements. Mines within Brunner Coal Measures produce acid mine drainage (AMD) with elevated Fe, Al and trace elements. Differences in mine drainage chemistry between mines hosted in Paparoa Coal Measures and Brunner Coal Measures can be correlated with differing mineralogy in coal and surrounding sediments related to depositional and diagenetic processes.

In Brunner Coal Measures AMD, mine type (open cut or underground) influences the ratio of Al to Fe. Open cut mines produce AMD with a higher Al:Fe ratio than underground mines because reaction between acid and aluminosilicate minerals can proceed more readily in subareal waste rock dumps compared to underground workings. At underground mines in Brunner Coal Measures, hydrogeology influences the total acidity of AMD. The pH and concentrations of acidic cations (Al + Fe) is lower in flooded underground mines (portal above the workings) compared to underground mines that are continually flushed by groundwater (portal lower than the workings). At active open cut mines in Brunner Coal Measures local rock type influences the total acidity of AMD. Mudstone rich waste rock produces AMD that has higher total acidity than sandstone rich waste because sulphides are typically more abundant and possibly more reactive in mudstones.

The influence of regional and local factors on mine drainage chemistry is supported by rock geochemistry data from active mine and exploration areas. These data and relationships can be used to construct a hazard model for mine drainage water quality. Prediction of mine drainage chemistry improves management of environmental risks from mining and optimises planning for mitigation or remediation strategies.