ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

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New Acid Mine Drainage Services

Acid Mine Drainage (AMD) or Acid Rock Drainage (ARD) is widely recognised as the single largest environmental issue facing Australian and international mining industries. Failure to properly manage Acid Mine Drainage can place a significant threat on ecosystems, the environment surrounding a mine site as well as the long term sustainability of the mine site.

Background on AMD

Waste rock containing the sulfur mineral pyrite, when exposed to air and water, can generate large amounts of sulfuric acid which in turn can dissolve other metals present in the rock and produce a highly acidic and metalliferous leachate. Assessment of the acid generation potential of the waste, the evaluation of neutralising capacity of carbonate and aluminosilicate minerals and the estimation of the rate of acid generation can all aid in the formulation of an effective AMD Management strategy. The early development and implementation of an AMD Management strategy can significantly reduce the long term costs and ecological impacts on the mine and the surrounding environment.

New AMD Services offered at ALS

In addition to the more common 'static' AMD analyses already available (Net Acid Production Potential (NAPP), Net Acid Generation (NAG) and Acid Neutralising Capacity (ANC)), ALS is now able to offer a new suite of AMD services to assist in the evaluation and management of Acid Mine Drainage. These new services are – the **Free Draining Kinetic Column Leach Procedure, Acid Buffering Characterisation Curves (ABCC's), Kinetic NAG and Sequential NAG.**

Free Draining Kinetic Column Leach

Free draining kinetic leach columns are used to compliment environmental geochemical investigations on mine rock and waste materials and are used to determine drainage chemistry. Free draining leach columns simulate field weathering conditions to provide information on a range of issues including sulphide reactivity, oxidation kinetics, metal solubility and the leaching behaviour of the test materials.

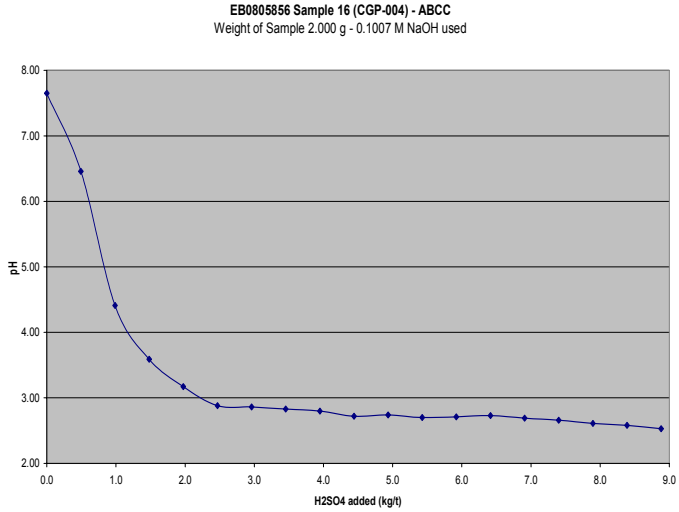
The procedure is designed to simulate a weekly wet-dry cycle and a monthly leaching cycle. The sample is wetted by applying the test solution (usually deionised water), to the surface of the test material and the leachate is then collected and analysed for predetermined parameters.

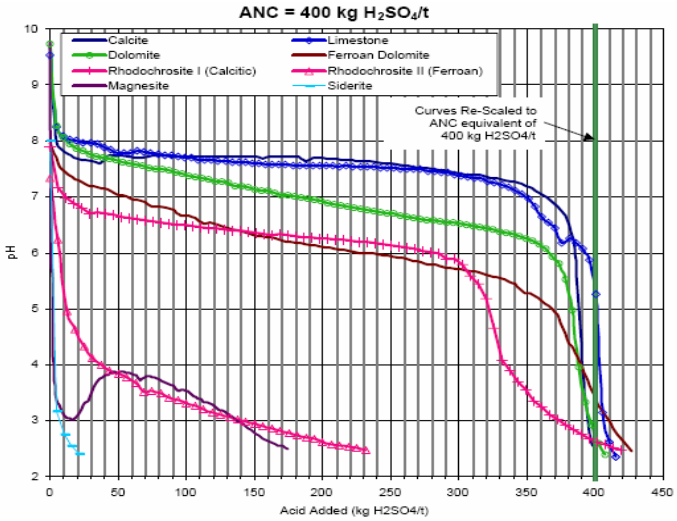
Right solutions….
….Right partner

Acid Buffering Characterisation Curves (ABCC's)

ABCC's are an ARD prediction method developed by Miller and Jeffery (1995). The process involves slow titration of a sample with the addition of acid over set time intervals while continuously monitoring the pH. The data provides an indication of what portion of the ANC measured in a sample is available for acid neutralisation. This is of benefit to the Client as useful information is provided of the acid neutralisation characteristics of the soil under investigation. The ABCC profile is compared to a standard carbonate curve to interpret the ANC reactivity.

The figure below shows a typical example of ABCC and carbonate standard profiles. The ABCC test is effective in discriminating between carbonates of different reactivity, with limestone and calcite effectively neutralising acid and siderite and magnesite neutralising little acid.





Kinetic and Sequential NAG

The Sequential NAG (s-NAG) test provides a "snapshot" of the balance between the acid generation and the acid neutralising reactions occurring in solid material without the need for Sulfur analysis. The s-NAG test provides the net acidity after each of five additions of hydrogen peroxide and a NAG total value, which is useful in determining if a material is potential acid forming (PAF) or non-acid forming (NAF). This test is applicable to solid material from mines and is used for the assessment of Acid Rock Drainage (ARD) potential but is not applicable to non-mine soils from coastal regions, where a SPOCAS test should be used. s-NAG overcomes the limitations of the single addition NAG test caused by the decomposition of hydrogen peroxide prior to the complete oxidation of all reactive sulphides in the sample.

The Kinetic Nag (k-NAG) test is a variation of the static NAG method involving monitoring and recording of the temperature and pH of a material at set intervals during the reaction period. Variations of these parameters over time, gives an indication of how a material will behave under field conditions (i.e. the kinetics of the NAG test can provide an indication of lag times and oxidation rates in a similar way to leach columns (Miller, 1997).

For further information please contact ALS Brisbane Client Services or your local ALS team.

References:

(1) Ferrando-Miguel G, Pape S, Stimpfl M (2008), Water in Mining: Acid and Metalliferous Drainage, Chemistry in Australia, 75(4), pp 25 – 28.
(2) Stewart W, Miller S, Smart R (2006), Advances in Acid Rock Drainage Characteristics of Mine Wastes, Paper presented at 7th International Conference on ARD.
(3) Miller S, Jeffery J (1995), Advances in the Prediction of Acid Generating Mine Waste Materials, pp 33-43, Proceedings of the 2nd Australian Acid Mine Drainage Workshop, Australian Centre for Minesite Rehabilitation Rresearch.
(4) Tran AB, Miller S, Williams DJ, Fines P, Wilson GW (2003), Geochemical & Mineralogical Characterisation of two Contrasting Waste Rock Dumps – The INAP Waste Rock Dump Characterisation Project, pp 939-947, Proceedings of the 6th International Conference on ARD.