Advanced Customisable Leach Columns (ACLC) – A New Kinetic Testing Method to Predict AMD risks by Simulating Site-specific Conditions

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The prediction of how waste materials will evolve geochemically within waste storage facilities has been the subject of many hundreds of thousands of hours researched by geoscientists globally. Despite the quantity of research there are a number of significant areas of uncertainty that remain as partially resolved issues. One of the most significant issues is the applicability of scaling laboratory test results to field conditions, and the use of laboratory data for predictive calculations to determine geochemical evolution of waste materials in the field. This issue has arisen predominantly as a result of the relative paucity of field monitoring data from waste rock storage facilities (WRSFs) and the fact that laboratory test methods are not typically linked to specific field conditions rather are based on generic standardised methods.

To address the limitations of current laboratory kinetic testing methods a new method has been developed that can accommodate and replicate site specific conditions. This method is termed the advanced customisable leach column (ACLC). The highly engineered columns have allowed for field conditions to be simulated in a laboratory setting. OKC has utilised site data from instrumentation placed in waste rock dumps [1] as the basis of design. Key features of the columns include both their capacity, size and technical specification. The inclusion of fully programmable solenoid controlled air supply and in line heating options allow for variable airflow and pressure as well as temperature control. Columns can therefore be adapted for different conditions depending on site specific conditions and variability. Ongoing monitoring of the column conditions by automated temperature control and monitoring, automated oxygen consumption and carbon dioxide production monitoring, and soil moisture/matric suction monitoring enable rapid and reliable data collection for interpretation.

Results from the columns indicate:

- Use of lower L:S ratios produces more realistic estimates of seepage quality (Figure 1)
- Monitoring of oxygen concentrations means a direct measurement of POR can be made rather than using sulfate release rate which is known to be inaccurate
- Monitoring of CO2 concentration allows estimation of neutralising reactions and/or organic carbon oxidation to be made
- Being able to vary the air flux rate means a direct correlation between gas flux rate and POR can be made. It is noted that 1E-5 m3/m2/s is an important limit point for POR above which oxidation rates are unconstrained
- Being able to monitor the matric potential means a direct relationship between saturation state and POR can be made. It is noted that POR increases with decreasing moisture content even at vey low saturation levels of <5% volumetric water content.

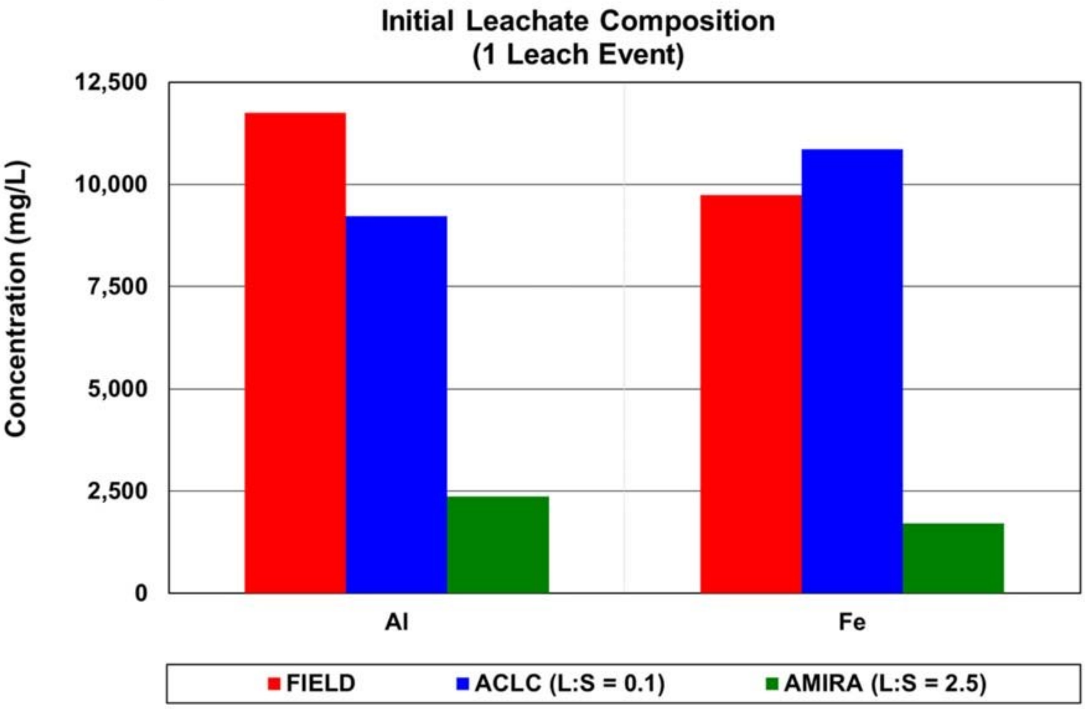

***Figure 1**: Field seepage quality vs laboratory predictions made by standard AMIRA method and ACLC method*

The flexibility of the design allows for more accurate field based assessment of POR rates, through increased controls on temperature, water and oxygen availability. As such, by completing concurrent assessments of the same material type under different conditions the ACLC system allows the assessment of the potential effectiveness of waste management options, such as deposition within a reduced oxygen environment, as simulations of reduced net percolation rates or oxygen ingress rates can be accommodated.

Key words:
Pyrite oxidation rate, kinetic testing, liquid solid ratio

References:

[1] Pearce, S., Barteaux, M., 2014. Instrumentation of waste rock dumps as part of integrated closure monitoring and assessment. In: Proceedings of 9th International Conference on Mine Closure. 1-3 October 2014, Johannesburg, South Africa.