

LEAF Test Methodology

LEAF laboratory methods are based on US EPA SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, include Test Methods 1313, 1314, 1315 and 1316. ChemCentre is NATA accredited to perform all four tests on soil-type materials. Each method is described below.

- Test Method 1313 determines how liquid-solid partitioning varies with the pH of the leaching solution using a parallel batch extraction method. This test method applies a full range of pH conditions that Waste Derived Materials (WDMs) may be exposed to in the environment, thereby providing a high level of confidence in predicting the likely concentrations of contaminants in leachates from these materials in various settings.
- Test Method 1314 determines how liquid-solid partitioning (LSP) varies with varying liquid to solid ratios using an up-flow percolation column procedure. This test method considers how the concentration of leachate will vary as the liquid to solid ratio changes.
- Test Method 1315 determines mass transfer rates of chemical constituents in leachate from monolithic and compacted granular materials (e.g. construction materials) using a semi-dynamic tank leaching procedure.
- Test Method 1316 determines how liquid-solid partitioning varies with the liquid-to-solid ratio using a parallel batch extraction procedure.

Test Method 1313

The procedure is comprised of nine parallel batch extractions of particle-size reduced material over a pH range between 2 and 13 by the addition of pre-determined amounts of acid or base to achieve specified final pH values.

A known mass of solid material is placed in each of nine extraction vessels and mixed with deionised water at a liquid-solid ratio (L/S) of 10 mL/g. Nitric acid or potassium hydroxide is added to each vessel to obtain a specified final pH value based on a pre-test pH-dose rate titration curve. The nine vessels are tumbled in an end-over-end fashion for a time commensurate with the maximum particle-size. Eluate pH and electrical conductivity (EC) are recorded. Analytical samples are filtered and preserved for chemical analysis.

Constituent concentrations (mg/L) or mass release (mg/kg) are usually plotted as a function of eluate pH. Constituent concentrations over the pH range typically show characteristic liquid-solid partitioning behaviour for cationic, amphoteric, oxyanionic and high soluble species such as dissolved organic carbon (DOC).

The results of this test are used to:

- Provide maximum (available) solute release values; and



- Provide equilibrium concentrations when environmental conditions control solution pH. Results may then be used for geochemical speciation modelling to identify likely release-controlling mineral phases.

Test Method 1314

Method 1314 is based on a percolation column test designed to obtain liquid-solid partitioning (LSP) information as a function of liquid to solid ratio (L/S). L/S is represented as the cumulative volume of leaching solution (in litres) passing through a column containing a known mass of material (in kilograms). For some materials, particle size reduction may be required to meet column dimension considerations and facilitate the approach to equilibrium.

Solid sample is loosely packed into a glass column and leached with a percolating eluent solution at low flowrate. Eluent is pumped in an up-flow direction to minimise preferred flow pathways and air entrapment. Eluates are collected at specific cumulative L/S values between 0.2 and 10 mL/g. Eluate concentrations and solute cumulative release masses are plotted as a function of L/S.

Method 1314 results provide an estimate of porewater concentrations at low L/S and demonstrate how LSP changes as solutes are released during successive pore volumes.

Test Method 1315

Method 1315 is used to determine mass-transfer based release rate information from either monolithic or compacted granular materials in a sequential tank test. Mass transport is the dominant solute release mechanism when water flows around a material with low hydraulic conductivity relative to surrounding materials.

As the test materials in this study do not possess these physical characteristics, the test method was not used for this assessment.

Test Method 1316

Method 1316 is designed to provide the liquid-solid partitioning (LSP) of inorganic constituents (such as heavy metals, metalloids and nutrients relevant to IMG/NUA) and non-volatile organic constituents (e.g. polycyclic aromatic hydrocarbons, PAHs, analysed as dissolved organic carbon at the natural pH of the solid material as a function of L/S under conditions that approach liquid/solid chemical equilibrium.

The eluate concentrations at a low L/S provide insight into pore solution composition either in a granular bed (e.g., soil column) or in the pore space of low-permeability material (e.g., solidified monolithic or compacted granular fill). In addition, analysis of eluates for dissolved organic carbon and of the solid phase for total organic carbon allow for evaluation of the impact of organic carbon release and the influence of dissolved organic carbon on the LSP of inorganic constituents.

