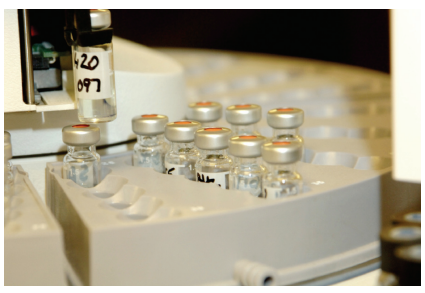
Characterising Landfill Waste - The Role of Lab Methodologies

The Landfill Regulations (2002), when fully implemented, have had a major impact on the way that contaminated land remediation is carried out.

The requirement for a waste producer to treat and characterise its waste in terms of chemical composition and leaching behaviour has had far reaching effects on the analysis of site materials at the UK's Environmental Labs. This characterisation requires comparison of analytical results with waste acceptance criteria (WAC) to determine the class of landfill able to take the waste. This waste characterisation also applies to the removal of any contaminated land waste destined for disposal at a landfill.

The regulations prescribe the leaching methodologies that the laboratories must follow, with the previous, simple, contaminated land leaching methods deemed inappropriate.



The newly prescribed leaching methods have impacted on the service offered by laboratories. Whereas the turnaround time for chemical analysis for remediation work has reduced considerably over the past few years, with five days becoming the norm, some of the new leaching and percolation tests can take up to 10 weeks to complete.

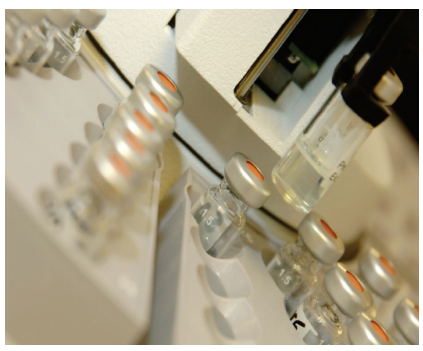
The most common leaching methods now in use are the BS EN 12457-3, two-stage leaching and the up-flow percolation test. Analysis of the resulting eluate samples (we no longer call them leachate as that term is reserved for landfill sites) can then be compared with waste acceptance criteria, to decide the class of landfill site able to accept the waste.

Further leaching methods such as 'Maximum Availability' and 'pH Dependence tests' can also be employed for particular waste types, in addition to the 'Diffusion Tank' and 'Compliance Leaching test' for monolithic wastes.

In all, there are now a plethora of new laboratory testing procedures with analysis testing times far greater than those previously offered.

Characterisation of Waste

The laboratory methods employed in the characterising waste to the new criteria (WAC) are dependent on the chemical nature of the parameters being assessed.



In the main, organic parameters such as, total organic carbon (TOC), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), benzene, toluene, ethyl benzene and xylene compounds (BTEX) and mineral oil are determined as 'total' concentrations. That is, the samples are analysis 'as received' rather than first undergoing one of the prescribed leaching tests. The term 'total' is slightly misleading here, since the chemical methods used for some of the groups of compounds such as PAH only identify a particular list of compounds (for instance the USEPA group of 16 priority PAHs), and should not be considered as a total of every PAH that might be there.

However, inorganic parameters such as metals and anions are not analysed 'as received' but as the concentration that is leached under certain prescribed conditions, leading to an understanding of both the long term and short term leaching behaviour.

These leaching tests enable predictions of contaminant release to be made for different conditions, such as different pH conditions or very low liquid to solid ratios.

Batch leaching test - BSEN 12457

This is the recently introduced British Standard, Characterisation of waste-Leaching-Compliance test for leaching of granular waste materials and sludges.

Three variants of the leaching test are available to UK offering different liquid to solid (L:S) ratios and solids content

These leaching methods generate eluates (not leachates, as this term is reserved for liquids generated on landfill sites) for analysis, enabling the assessment of leachability under mild extraction conditions for waste disposal or material reuse options.

The default version in the UK is the version BSEN 12457-3, the two stage leaching method.

The method is only applicable to waste material and sludge having a dry matter content ratio of at least 33%. Where sludges have a very low dried solids content and L:S ratio of 2:1 cannot be achieved, then the single stage BSEN 12457-2 (L:S 10:1) may be undertaken.

These new leaching methods are not only, more time consuming and therefore more costly than the long standing Interim NRA leaching method, but also generate two water samples for analysis and hence twice the cost for chemical analysis.

The cumulative result from the two stage leaching is the one that is used for comparison with the WAC in order to identify the most appropriate class of landfill to accept the waste.

It should be remembered that this eluate analysis covers mainly the inorganic parameters and that the more volatile and organic parameters are analysed on the waste itself.

Up-flow percolation test - prEN 14405

This method falls into the category of the 'Basic characterisation' and is used to provide information on short and long term leaching behaviour of inorganic constituents from granular waste. The

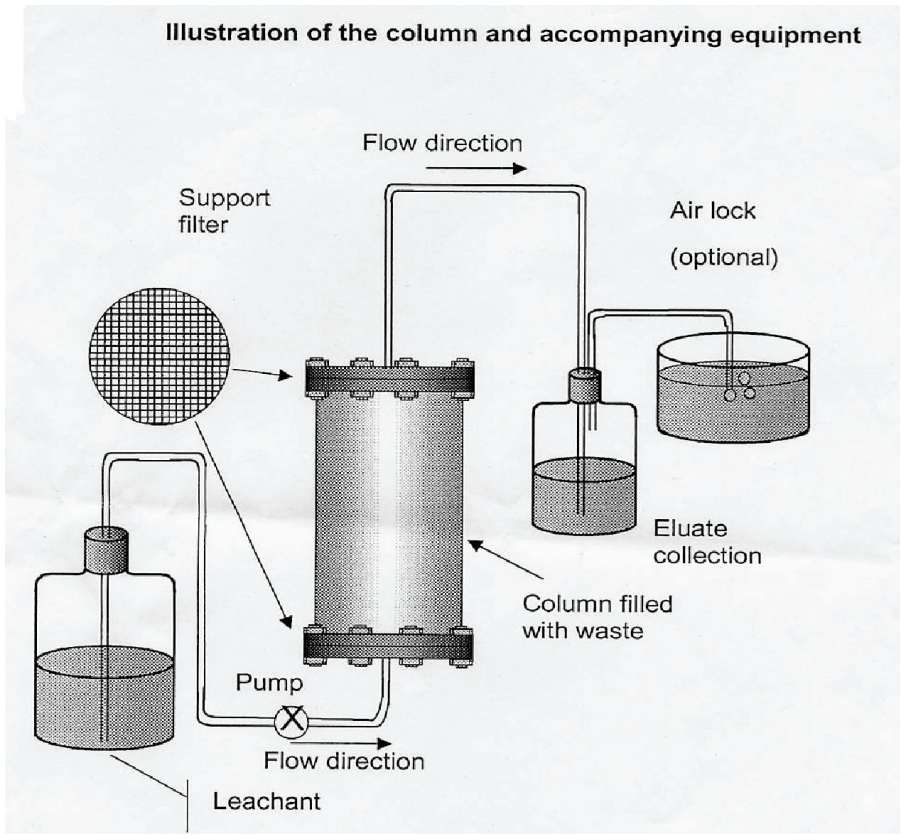


Fig. 1 Upflow Percolation Rig

waste is subjected to percolation with water on a once through column system, with the subsequent test results establishing the distinction between different release patterns of the constituents.

A continuous vertical up-flow is used so that the column of waste is always saturated, the flow being between 15ml and 60ml per hour. The flow rate of de-ionised water, weight of waste used and individual test results enable conclusions to be drawn on which components are rapidly being washed out and which are released under the influence of interaction with the matrix.

The results of the analysis are expressed as a function of L:S ratio, in terms of both mg of the constituents released per litre of eluate, and mg of the constituents released cumulatively per kg of waste material. It is this cumulative mg/kg result that is then assessed against the WAC.

This is not a quick test to perform and it is not uncommon for the leaching process to take 30 days.

This can create something of a dilemma for testing facilities. The actual number of samples that the new WAC might generate (particularly for tests such as up-flow percolation) is something of an unknown quantity. Will there very few samples per year, will there be hundreds, will there be thousands?

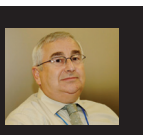
Each sample rig, of considerable cost if automated, will only be able to carry out about 10 percolation tests per year (See Fig. 1)

In order to comply with WAC these tests will be required as standard since July 2005. The initial estimates in the lab industry suggested that rapid uptake in 2005 and 2006 would be followed by a decline in demand in 2007 onwards. So far this has not been the case, so much so that certain Waste Management Operators have deemed it viable enough to set up their own lab testing facilities.

One thing is certain, and that it is that the setting up of WAC testing rigs is costly, but if laboratories do not take the gamble of providing ample capacity then clients might find themselves being advised that there is a long waiting list for accepting samples. The 30 to 40 day test period might not seem so long after all.

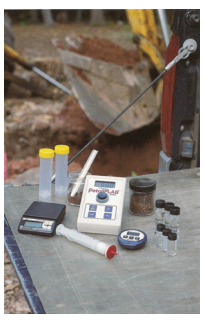
***WSP Environmental Laboratories** has over 60 highly trained chemists, engineers and research scientists delivering high quality, state-of-the-art analytical services to consultancy, site investigation and remediation clients globally. WSP's Lab facility has one of the most extensive ranges of UKAS and MCERTS accredited tests in the industry, and participates in several external benchmarking proficiency schemes including Aquacheck, CONTEST and RICE.*

AUTHOR DETAILS



Mike Cohen BA (Hons),
CCHEM, M.R.S.C., M.C.I.W.E.M
(Operations Manager,
WSP Environmental Laboratories)
Tel: 01159 739 220
Email: wsplabinfo@wspgroup.com

The Answer Lies in the Soil!



There has always been a need for an accurate, quick and convenient field testing system for soil in land sites. Hydrocarbons in abundance as waste are mostly found in ground where industry has operated – sometimes elsewhere for not such noble reasons. Now for some years PetroFLAG, available from

QUADREX Scientific (UK), has become more widely used and accepted, operating successfully producing the desired results to meet the latest environmental regulations for suspect contaminated land.

The PetroFLAG system makes quantitative determinations in soils contaminated by a wide range of Hydrocarbons including Fuels, Lubricating Oils,Hydraulic Fluids, and greases etc., by providing the user with instant results whilst on-site, thus permitting immediate decisions for remedial action.

No special training is required to operate the PetroFLAG system. Using field calibration standards to achieve a very high degree of accuracy, the results are displayed on an LCD – all in around ten minutes from collecting the sample. All the reagents are environmentaly friendly and can be disposed of as harmless laboratory waste.

The PetroFLAG system comes complete with reagents and all necessary ancilliary items, contained in a lightweight case which can be easily carried, or transported to the site and operated from the car boot.

Reports from the field have proven to be very positive for its operation,accuracy and satisfaction.