Risky business

Complex risk assessment modelling is a critical component of any robust Part 2A Determination, explains STEVE PEARMAIN, head of land quality at Atkins Global

THE CONTAMINATED land régime presented in Part 2A of the Environmental Protection Act 1990 introduced into the UK a statutory definition of contaminated land. Under Part 2A it is defined as 'any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that: (a) significant harm is being caused or there is a significant possibility of such harm being caused; or (b) pollution of controlled waters is being, or is likely to be, caused.'

The Water Act 2003 will also at some point amend (b) above to include 'significant' in front of '...pollution of controlled waters.'

In order to prove that land is contaminated under Part 2A, assessors need to demonstrate that it represents a 'significant possibility of significant harm,' often referred to as the SPOSH test.

Grasp the concept

To understand how we can assess the significance of land contamination on a site-specific basis we need to understand the concept of **risk assessment** and **pollutant linkages**.

Risk is defined as the combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences. For a risk to be present there must be a pollutant linkage between a contaminant (eg, benzene), a pathway (eg, permeable strata) and a receptor (eg, on-site residents). This is commonly referred to as the Source-Pathway-Target approach, and quantitative risk assessment (QRA) software tools of varying degrees of complexity enable the professional assessor to determine the significance of land contamination to human and environmental receptors in a site setting and end-use specific context.

Fundamental to this is an understanding of the physico/chemical/toxicological properties of the contaminants themselves, the characteristics of the pathway and the quality standards at the receptor/s. These quality standards may be in the form of a published tolerable daily intake (TDI) value for human ingestion or a regulatory water quality standard. It is not uncommon for sites to have multiple potential pollutant linkages that require individual assessment to determine if they constitute significant pollutant linkages that require addressing.

Risk assessment is a tiered process that increases in complexity as you progress up the ladder. A Tier 1 generic quantitative risk assessment (GQRA) generally comprises comparative assessment against generic look-up numbers. The statistically determined mean concentration for each contaminant is compared against published standards, which in the UK include Soil Guideline Values (SGVs) and Drinking Water Standards (DWS). Only 10 SGVs have been published to date, and in the absence of such, consultants are required to generate their own generic assessment criteria (GAC) using UK guidance documentation.

This is a complex and time-consuming process however, and consequently Atkins has produced a set of ATRISK™ Soil Screening Values (SSVs) for the environmental assessment sector.

The importance of robust site-sampling plans and detailed statistical analysis in the assessment process cannot be over-emphasised. It is not possible to characterise every grain of soil on a site, and it is consequentially critical that the sampling density and pattern are sufficient to characterise the ground conditions with the required degree of confidence. Deficiencies in this regard will most likely result in flawed assessments that will not withstand technical scrutiny.

Detailed modelling

Contaminants failing Tier 1 are taken forward to detailed quantitative risk assessment (DQRA) modelling. Risk assessment practitioners have a variety of models at their disposal, the selection of which will largely be governed by a particular project's complexity and requirements.

Risk assessment models can be run in deterministic or stochastic modes, the difference being that the latter considers variability by allowing ranges to be entered for a number of key parameters. The output is then subject to Monte Carlo simulation and the results reported in terms of probability of occurrence.

DQRA modelling aims to simulate actual site conditions within a modelled environment in order to facilitate a better understanding of the risk associated with each potential pollutant linkage. This process requires detailed site and receptor information, and inevitably involves enhanced site assessment.

The results of any modelling exercise are only as good as the data entered into the tool, and sensitivity analyses are undertaken to assess the effects of altering certain key variables. Many sites that advance to DQRA require the use of two or three modelling tools to assess the significance of the various pollutant linkages.

Once a model is built it can be run in forward mode to predict the point of exposure (POE) concentration for a given substance at the receptor, and this value is compared with the pertinent quality standard. Should the POE exceed the quality standard then a significant pollutant linkage has been established that requires addressing under Part 2A. The same models can then be used to back-calculate the soil and groundwater remediation standards that will underpin the design of any remediation scheme.

It can be seen that risk assessment modelling is a complex discipline in its own right, and one that should be undertaken only by suitably trained and experienced practitioners. In unqualified hands the process can produce false positives, with the consequential potential of blight and the implementation of unnecessary over-specified remediation. The flip side of this would be false negatives, whereby significant risks go unrecognised and the necessary risk management measures are not put in place. □