Soil screening values for assessing ecological risks

Introduction

In 2003 we sought stakeholder views on a framework and methods for assessing harm to ecosystems from contaminants in soil. The role of soil screening values (SSVs) within this framework was described, along with some of the underlying principles behind their derivation and use.

This consultation covers SSV values derived since the original consultation. Your views are sought on the methodology applied and the basis of our decisions on which SSVs will be put forward. Specific questions are highlighted in the boxes below. We will review and respond to the results of this consultation.

Background

An SSV is a value for a total concentration of a substance in soil which, if exceeded, will prompt further assessment as set out in the Environment Agency's Ecological Risk Assessment (ERA) framework. SSVs are used in Tier 1 of the ERA framework (Box 1) when concentrations of substances in the soil at the site of interest are compared against the SSVs. If the SSV is exceeded for any one of the contaminants, then further action is required either within Tier 1 or Tier 2 of the framework.

It is not possible to determine a site as contaminated just on the basis of an SSV being exceeded. The exceedance of an SSV is simply a prompt to progress with the ERA.

Box 1 Simple tiered ERA framework

Desk studies and conceptual site model development

- Site characterisation
- Determining assessment and measurement endpoints

Tier 1

- Screening risk characterisation (Risk Quotient = PEC/PNEC)

Tier 2

- Risk characterisation using ecological and toxicological tests

Tier 3

- Cause–effect attribution

Proposed SSVs

SSVs were designed to help regulators make decisions on the risks to ecoreceptors. It is essential that the SSVs and the overall framework for their use provide a technically appropriate and useable method for assessing the ecological risks associated with potentially contaminated land.

We have derived SSVs for a number of priority substances (Table 1).

Some additional site-specific refinements (considering availability and bioavailability) are possible for copper, nickel and zinc, which provide more ecologically relevant assessments of potential risk. Such refinements account for the changing ecological risks of metals with changing soil conditions.

However, we do not at present propose to account for background metal concentrations. Although methods such as the Added Risk approach can be used, we feel there is little scientific evidence to support their use. Furthermore, such approaches rely on deriving 'background' concentrations for metals in soils. We feel there is too much unquantifiable uncertainty associated with current methods for estimating ambient background metal concentrations in soils.

The ecological relevance of most non-ionic organic micropollutants is strongly determined by the soil's organic carbon content. The SSVs derived for organic substances have been matched, or normalised, to soils with 2 per cent organic carbon (3.5 per cent organic matter). However, not all soils contain 2 per cent organic carbon. A relatively routine calculation is therefore used to normalise the soil at a site to 2 per cent organic carbon to allow comparison between the site-specific concentration of the organic substance and the SSV. This enables a more ecologically relevant assessment to be made at the site of interest.

The derivation of all SSVs is detailed in contaminant-specific reports that are available on a single CD (request SC070009/SR4). These reports make clear the method of derivation and the data used.

Table 1: Proposed SSVs and the basis for their derivation

Substance	Proposed SSV (mg/kg)	Basis for derivation
Benzo(a)pyrene	0.15#	Assessment factor of 10 on earthworm data.
Cadmium	1.15 (0.09)	SSD for soil ecotoxicity data and secondary poisoning data,† plus assessment factor of 1–2 on the HC5.
Chromium	21.1	SSD approach and an assessment factor of 1.
Copper	88.4 (57.8)*	SSD approach and an assessment factor of 1.
Lead	167.9	SSD approach and an assessment factor of 2.
Mercury	0.06	Assessment factor of 10 on springtail data.
Nickel	25.1 (20.3)*	SSD approach and an assessment factor of 2.
Pentachlorobenzene	0.029#	Secondary poisoning value based on mammal data, plus an assessment factor of 30.
Pentachlorophenol	0.6#	SSD approach with terrestrial toxicity data and an assessment factor of 1.
Tetrachloroethene	0.01#	Assessment factor of 10 on microbial nitrification data.
Toluene	0.3#	Assessment factor of 50 on earthworm data.
Zinc	90.1 (72.5)*	SSD approach with terrestrial toxicity data and an assessment factor of 2.

* These SSVs were established for soil with 2 per cent organic carbon (equating to 3.5 per cent organic matter, assuming the latter contains 58 per cent carbon). Therefore the PEC should be normalised according to the percentage of organic matter in the soil under assessment.

† The secondary poisoning SSV is based on renal thresholds of terrestrial mammals. The value in brackets should be used where secondary poisoning is suspected.

*The generic SSV are insufficiently protective for certain soils and should be adjusted to the site-specific conditions. The values in brackets are specific for a sandier soil with a pH of 6.5, an organic matter content of 2 per cent and a clay content of 10 per cent.

Questions

- Do you think the 12 SSV that we propose here have been appropriately derived?
- If not, which values do you disagree with and why?
- What alternative value do you suggest instead, if any?
- On what data do you base your value and how have you derived it?

SSV Spreadsheet Decision Tool

We are also offering a spreadsheet tool to help with calculating availability adjustments/normalisation and for generating Risk Quotients. This is now available for peer review as a part of this consultation.

SSVs not proposed at present
We derived values for more than 20 other substances for consideration as additional proposed SSVs, but our current view is that these values are unsuitable for the purposes of ecological risk assessment. This is because we think that there is an unacceptable level of uncertainty associated with the derived values. This uncertainty arises where there is a very limited amount of soil ecotoxicological data, which results in SSVs with very high assessment factors (>50) or, in some cases, where there are no reliable soil data at all, in SSVs derived from aquatic ecotoxicity datasets by equilibrium partitioning.

We consider SSVs derived from aquatic ecotoxicity data or limited amounts of soil-specific ecotoxicity data should not be used in ecological risk assessment. The SSVs not considered fit for purpose are listed in Table 2 with the basis for their derivation.

Table 2: SSVs not considered fit for purpose and the basis for their derivation

Substance	Proposed SSV (mg/kg)	Basis for derivation
1,1,1-trichloroethane	0.015	EqP based on algal data, plus AF of 50.
1,2,4-trichlorobenzene	0.05	AF of 1,000 on terrestrial plant data.
1,2-dichloroethane	1.37	EqP based on water flea data, plus AF of 10.
Arsenic	0.04	Only an Added Risk value derived.
Anthracene	0.02	AF of 1,000 on terrestrial plant data.
Benzene	0.2	EqP based on fish data, plus an AF of 10.
Chloroform	0.496	EqP based on fish data, plus an AF of 10.
2-chlorotoluene	0.024	EqP based on water flea data, plus an AF of 50.
4-chlorotoluene	0.281	EqP based on water flea data, plus an AF of 10.
alpha-chlorotoluene	0.01	EqP based on water flea data, plus an AF of 50.
Cyanides	0.0057	AF of 1,000 on terrestrial plant data.
Ethylbenzene	0.879	EqP based on water flea data, plus an AF of 50.
Hexachlorobutadiene	0.032	EqP based on fish data, plus an AF of 100.
Naphthalene	0.0533	EqP based on fish data, plus an AF of 50.
Organolead compounds	0.068 (tetramethyl lead) 0.196 (tetraethyl lead)	EqP based on fish data, plus an AF of 1,000.
Organotin compounds	0.034	AF of 100 on earthworm data.
Phenol	0.136	AF of 1,000 on earthworm data.
Tetrachlorobenzene	0.024	AF of 100 on terrestrial plant data.
Thiocyanates	7.18	AF of 1,000 on wireworm data.
Total petroleum hydrocarbons (TPH)	Depends on different hydrocarbon blocks present at site	EqP and hydrocarbon blocking approach used.
Trichloroethylene	1.71	EqP based on fish data, plus an AF of 10.
Xylenes	0.34	EqP based on water flea data, plus an AF of 10.

AF = assessment factor, EqP = equilibrium partitioning

Questions

- Do you agree that these values should not be proposed as SSVs?

- If not, on what basis do you warrant the proposal of a particular value?
- Or do you consider that there is a more appropriate value for any of these compounds?
- On what data do you base your value and how have you derived it?

Use of guideline values from other countries

Where there is no proposed SSV for a compound, the technical guidance document supporting the ERA framework proposes the use of guideline values from other countries (Table 3) considered on a case-by-case basis with the agreement of all stakeholders. The basis of the derivation of these values and their potential limitations in a UK context are explained in the guidance document.

Table 3: Sources of additional SSV values

United States Environmental Protection Agency Soil Screening Levels (Eco-SSLs) www.epa.gov/ecotox/ecossl/	Oak Ridge National Laboratory Screening Benchmarks www.esd.ornl.gov/programs/ecorisk/benchmark_reports.html
Canadian Soil Quality Guidelines (SQGs) www.ec.gc.ca/CEQG-RCQE/English/Cegg/soil/default.cfm	RIVM Serious Risk Concentrations (SRCs) www.rivm.nl/bibliotheek/rapporten/711701023.pdf

Questions

- Do you agree with the proposed sources of alternative values?
- If not, which would you exclude and why?
- Or do you propose other sources of alternative values?
- On what justification do you propose the inclusion of other sources?

Next steps

We have derived values for a priority group of substances. However, some of these are not considered suitable for proposal as SSVs. We would like your views on how these values can, or should, be taken forward.

Questions

- Which, if any, of the compounds listed in Table 2 should be given priority and why?
- How can we obtain additional information to allow the appropriate derivation of an SSV?
- Are there any other compounds that you feel should be considered?
- Is there suitable data available to allow the appropriate derivation of an SSV?