5.2. Ecotoxicology

The ecotoxicological data interpretations given in the PPDB records are highly simplistic and should be used with care. Interpretations are based on a simple comparison with the 'thresholds' given below and take no account of other data which may affect the interpretation such as aquatic solubility, other related toxicological endpoints or the highest concentration tested. In addition, some of the thresholds given below are simple 'rules of thumb' and are not necessarily based on scientific observations.

5.2.1. Terrestrial ecotoxicology

Parameter	Source	Thresholds
Mammals - Acute oral LD50 (mg kg^{-1})	See note 5.	> 2000 = Low 100-2000 = Moderate < 100 = High
Mammals - Short term dietary NOEL (mg kg^{-1})	See note 5.	> 2000 = Low 100-2000 = Moderate < 100 = High
Mammals - Chronic toxicity as mg kg^{-1} d^{-1}	See note 5.	> 200 = Low 10-200 = Moderate < 10 = High
Birds - Acute LD50 (mg kg^{-1})	Consistent with US EPA Guidelines. See note 5.	> 2000 = Low 100 - 2000 = Moderate < 100 = High
Birds - Chronic toxicity as mg kg^{-1} d^{-1}	See note 5.	> 200 = Low 10-200 = Moderate < 10 = High
Earthworms - Acute 14 day LC50 (mg kg^{-1})	See note 10.	> 1000 = Low 10 - 1000 = Moderate < 10 - High
Earthworms - Chronic 14 day NOEC, reproduction (mg kg^{-1})	See note 10.	> 100 = Low 0.1 - 100 = Moderate < 0.1 = High
Soil micro-organisms	Nitrogen / carbon mineralisation.	<= 25% change is considered insignificant.
Collembola acute LC50 mg/kg	See note 11.	No interpretation
Collembola chronic reproduction 28d NOEL mg/kg	See note 11.	No interpretation
Honeybees (*Apis* spp.) - Acute LD50 (µg bee^{-1}) (contact, oral mode and unknown mode), worst case value from 24, 48 & 72hr values)	See note 5.	> 100 = Low 1 - 100 = Moderate < 1 = High
Honeybees (*Apis* spp.) - Chronic LDD50 or LC50 (µg bee^{-1} d^{-1}), 10 day	See note 11.	No interpretation

Bumblebees (*Bombus* spp.) - Acute LD50 (µg bee^{-1}) (contact and oral mode), worst case value from 24, 48 & 72hr values)	See note 5.	> 100 = Low 1 - 100 = Moderate < 1 = High
Mason bees (*Osmia* spp.) - Acute LD50 (µg bee^{-1}) (contact and oral mode), worst case value from 24, 48 & 72hr values)	See note 5.	> 100 = Low 1 - 100 = Moderate < 1 = High
Other pollinators - Acute LD50 (µg insect^{-1}) (contact and oral mode), worst case value from 24, 48 & 72hr values)	See note 5.	> 100 = Low 1 - 100 = Moderate < 1 = High
Beneficial insects (Ladybirds) (variable units and parameters)	See note 11.	No interpretation
Beneficial insects (Lacewings) (variable units and parameters)	See note 11.	No interpretation
Beneficial insects (Springtails) (variable units and parameters)	See note 11.	No interpretation
Beneficial insects (Parasitic wasps) (variable units and parameters)	See note 11.	No interpretation
Beneficial insects (Predatory mites) (variable units and parameters)	See note 11.	No interpretation
Beneficial insects (Ground beetles) (variable units and parameters)	See note 11.	No interpretation
Non-target plants	Data provided for seedling emergence and vegetative vigour. Non-standard species. Worst-case data presented if possible. See note 11.	No interpretation

5.2.2. Aquatic ecotoxicology

Parameter	Source	Thresholds
Fish - Acute 96 hour LC50 (mg l^{-1}) Data is listed (where available) for both temperate and tropical species)	See note 5.	> 100 = Low 0.1 - 100 = Moderate < 0.1 = High
Fish - Chronic 21 day NOEC (mg l^{-1})	See note 5.	> 10 = Low 0.01 - 10 = Moderate < 0.01 = High

Aquatic invertebrates - Acute 48 hour EC50 (mg l^{-1}) Data is listed (where available) for both temperate and tropical species)	See note 5.	> 100 = Low 0.1 - 100 = Moderate < 0.1 = High
Aquatic invertebrates - Chronic 21 day NOEC (mg l^{-1})	See note 5.	> 10 = Low 0.01 - 10 = Moderate < 0.01 = High
Aquatic crustaceans - Acute 96 hour LC50 (mg l^{-1})	See note 5.	> 100 = Low 0.1 - 100 = Moderate < 0.1 = High
Sediment dwelling organisms - Acute 96 hour LC50 (mg l^{-1})	See note 5.	> 100 = Low 0.1 - 100 = Moderate < 0.1 = High
Sediment dwelling organisms - Chronic 28 day NOEC, static, water (mg l^{-1})	See note 5.	> 10 = Low 0.01 - 10 = Moderate < 0.01 = High
Sediment dwelling organisms - Chronic 28 day NOEC, sediment (mg kg^{-1})	See note 5.	> 100 = Low 0.1 - 100 = Moderate < 0.1 = High
Marine Bivalves (oysters)	Variable data.	No interpretation
Aquatic plants (Free-floating)- Acute 7 day EC50, biomass (mg l^{-1})	See note 6.	> 10 = Low 0.01 - 10 = Moderate < 0.01 = High
Aquatic plants (Rooted)- Acute 714 day EC50, biomass (mg l^{-1})	See note 6.	> 10 = Low 0.01 - 10 = Moderate < 0.01 = High
Algae - Acute 72 hour EC50, growth (mg l^{-1})	See note 6.	> 10 = Low 0.01 - 10 = Moderate < 0.01 = High
Algae - Chronic 96 hour NOEC, growth (mg l^{-1})	See note 6.	> 1 = Low 0.001 - 1 = Moderate < 0.001 = High

Notes

1. Consistent with EU Guidance. (9188/VI/97 rev. 8.) and
   - I. Kerle EA, Jenkins JJ & Vogue PA (1996), Understanding pesticide persistence and mobility for groundwater and surface water protection. Oregon State University. EM 8561.
   - II. Rao PSC & Hornsby AG (2004) Behaviour of pesticides in Soils and water. University of Florida. See http://edis.ifas.ufl.edu/SS111.
   - III. See also Note 3 below.
2. Several relevant references which include:

I. Van der Werf , HMG (1996) Assessing the impact of pesticides on the environment. Agriculture, Ecosystems & Environment, 60, 81-96.

II. Jury WA, Spencer WF, & Farmer WJ (1984) Behaviour assessment model for trace organics in soil. III Application of screening model. J. Environ Qual. 13, 573-579.

III. Kerle EA, Jenkins JJ & Vogue PA (1996) Understanding pesticide persistence and mobility for groundwater and surface water protection. Oregon State University. EM 8561.

3. Table below has been extracted from:

I. Goss, D & Wauchope RD (1990) The SCR/ARS/CES Pesticide Properties Database. II using it with Soils data in a screening Procedure. In D.L. Weigmann Ed., Pesticides in the next decade: the challenge ahead, Virginia Resources Research Centre, Blacksburg, VA, USA pp471-493.

Potential for Particle-bound transport	Criteria
High	DT50 >= 40 days & Koc >= 1000 DT50 >= 40 days, Koc >= 500 & solubility <= 0.5 mg/l
Low	DT50 <= 1 day DT50 <= 2 days & koc <= 500 DT50 <= 4 days, Koc <= 900 & solubility >= 0.5 mg/l DT50 <= 40 days, Koc <= 500 & solubility >= 0.5 mg/l DT50 <= 40 days, Koc <= 900 & solubility >= 2 mg/l
Medium	All other

4. Classification given below has been extracted from the WHO Guidelines document: The WHO recommended classification of pesticides by hazard & guidelines to classification. (2004). See http://www.who.int/publications/en/

- Class Ia: extremely hazardous
- Class Ib: highly hazardous
- Class II: moderately hazardous
- Class III: slightly hazardous
- O: Obsolete
- NL: Not listed

5. Thresholds used have been selected to be consistent with industry guidelines, were developed, and are consistent with regulatory thresholds used in both the UK and EU. Alternative classification systems are in use. In particular, that published by the FAO (https://www.fao.org/3/X2570E/X2570E06.htm) may be useful.

6. The EU (Uniform Principles) (Annex VI of Directive 91/414/EEC) guidelines have been adopted have set toxicity:exposure (TER) ratios for algae and aquatic plants at 1/10th of those for fish and daphnids. The same ratio has been applied here.

7. In EU pesticide regulatory risk assessments 'hazard quotients' are used to determine the need for additional studies to assess risk to beneficial arthropods. Hazard quotients (HQ) are determined by dividing the Predicted Environmental Concentration (PEC) of the active substance by the median lethal rate (LR50). HQ values less than 2.0 are considered to be low risk to beneficial arthropods and additional

(higher tier) data are not required. Values greater than 2.0 trigger additional data requirements. As the PEC is not known we are unable to provide an interpretation.

8. SCI-GROW is a screening model used by the US EPA to estimate pesticide concentrations in vulnerable groundwater. The model provides an exposure value that can be used to determine the potential risk to the environment and to human health from drinking water contaminated with the pesticide. The SCI-GROW estimate is based on environmental fate properties of the pesticide (aerobic soil degradation half-life and linear adsorption coefficient normalised for soil organic carbon content), the maximum application rate, and existing data from small-scale prospective ground-water monitoring studies at sites with sandy soils and shallow ground water.

   SCI-GROW estimates represent worse case estimates. For this reason, it is not appropriate to use SCI-GROW concentrations for national or regional exposure estimates. Nor is this indicator an alternative to a scientific risk assessment. Values given are based on a standard 1 kg ha^{-1} or 1 L ha^{-1} application rate and should be adjusted to the actual application rate used

   For more information see: http://www.epa.gov/oppefed1/models/water/scigrow_description.htm.

9. The distribution of a pesticide between the solution and absorbed phases can often be described by the "Freundlich equation", an equation that is used to describe a wide variety of adsorption data from every area of science. The equilibrium concentration and adsorbed pesticide amounts are determined experimentally. The Log10 of the quantity of adsorbed pesticide is plotted against the equilibrium concentrations. Often the relationship obtained is approximately linear and can be described by the Freundlich equation: Q=KC1/n, where Q is the adsorbed amount of pesticide (µg kg-1), C is the equilibrium concentration (µg l-1), and kf and n are the experimental parameters unique to the isotherm. The parameter n is greater than 1, the larger it is the more non-linear the equation becomes.

10. The availability of the pesticide in the soil can depend on the amount of soil organic carbon (SOC). The toxicity endpoint value may therefore be corrected for the difference in SOC of the test soil and the reference soil. This means that the toxicity endpoint value is divided by the percentage organic matter in the standard test soil and multiplied by the percentage organic matter in the reference soil. Uncorrected values are quoted herein unless otherwise stated e.g. '(corr)'.

11. Data is very limited and is presented in the literature in a variety of formats. Therefore, neither a standard format nor interpretation can be provided.