

Opinion of the Scientific Committee on Plants on the Draft Guidance Document on Terrestrial Ecotoxicology (DG VI - 2021/VI/97 -Rev. 4 of 21.12.1998) - (Opinion expressed by SCP on 24 September 1999)

1. Terms of reference

The draft Guidance Document on Terrestrial Ecotoxicology has been referred to the Scientific Committee on Plants for consultation with the following questions:

7. Which are considered adequate criteria to trigger studies of sublethal effects in earthworms (points 23, 24, 25 of Guidance Document) ?
8. Which are considered adequate triggers for a reproduction study in birds (point 12 of the Guidance Document vs. Annex II point 8.1.3 of Directive 91/414/EEC)?
9. Is the method proposed for long term exposure assessment of birds considered to be adequate (point 16 of Guidance Document) ?

2. Background

The draft Guidance Document on Terrestrial Ecotoxicology has been developed as a working document of the Commission. The purpose of the document is to provide guidance to Member States and to notifiers on the use and interpretation of the relevant terrestrial ecotoxicology sections of Annexes II, III and VI of Directive 91/414/EEC. Its ultimate aim is to promote consistency and transparency in decision making for the benefit of the public, industry and policy makers.

The document was referred to the Scientific Committee on Plants for opinion. The Committee had also been supplied with comments from Member States, FOCUS groups and the ECPA.

This response begins with a list of the main points that have been raised in the opinion on the draft Guidance Document (section 3). These issues are further explored in the detailed notes (section 4), before addressing the three specific questions listed above (section 5). References and abbreviations are given in sections 6 and 7 respectively. The opinion ends with a summary of key points (section 8).

3. General observations

The Guidance Document provides a good overview of issues that need to be considered when evaluating terrestrial ecotoxicological effects in the context of Directive 91/414/EEC ¹. The SCP supports the majority of views that are expressed.

3.1 Overall presentation

As one of the ultimate goals is to promote transparency in the decision making process, the SCP believes that the presentation of the document could be improved. In particular, flow diagrams and/or the tabular listing of data requirements would provide a very useful

indication of the overall structure of the assessment process, and how the disparate information links together. Furthermore, the clarity of the manuscript could be improved if some of the more technical details (e.g. TWA calculations; calculation of statistical power) were placed in annexes.

The Terrestrial Guidance Document should - to the extent possible - cross-reference, and be compatible with, the Guidance Documents on Aquatic Ecotoxicology (8075/VI/97), Persistence in Soil (9188/VI/97) and the document on Relevant Metabolites (in development). Indeed, the Terrestrial and the Aquatic Ecotoxicology Guidance Documents mention some general issues which may apply to both, and therefore could be merged in a common section for both documents. Similarly, some of the issues raised in this opinion may be relevant to other guidance documents.

3.2 Underlying principles

While reviewing the document, several general issues were discussed in relation to terrestrial ecotoxicological risk assessment, which are commented on below:

- - Use of NOEC's (no observed effect concentration) (section 4.1)
- - Trigger for long-term sublethal tests (section 4.2)

3.3 Areas that may require further consideration

Our review identified several areas that may need more detailed consideration, principally:

- - general guidelines for estimating exposure under standard scenarios (section 4.3)
- - probabilistic risk assessment (section 4.4)
- - higher tier tests (section 4.5)
- - the testing and assessment of non-target terrestrial plants (section 4.6)
- - the testing and assessment of soil arthropods (section 4.7)
- - standard scenarios for estimating exposure in birds (section 4.8)

3.4 Areas that may require revision in the future

Clearly the document should be reviewed and (when necessary) revised on a regular basis, in order to reflect changes of the scientific knowledge and results of international activities / harmonisation in this area (e.g., test guidelines, FOCUS results). In particular, the following areas are currently likely to require more detailed guidance in the near future:

- - replacement of NOEC by more appropriate triggers (section 4.1)
- - the principles of refined risk assessment following a probabilistic approach (where results from the US - ECOFRAM initiative will need to be reviewed and possibly adapted) (section 4.4)
- - assessment of effects on soil organisms using model ecosystems (section 4.7)
- - the testing and assessment of endocrine effects (where the currently ongoing work of the OECD EDTA group should be reviewed and possibly implemented) (section 4.9)
- - indirect effects (section 4.10)
- - assessment and prediction of sub-lethal (e.g. reproductive) effects on birds as further techniques and recommendations arise from specialised working groups (section 4.11)

4. Detailed notes

4.1 NOEC's

Several tests in both the aquatic and the terrestrial compartment aim at determining a no-observed-effect-level / concentration (NOEL or NOEC), a concept that has been challenged on scientific grounds (e.g. Laskowski, 1995). OECD member countries have agreed to phase out the NOEC and replace it by a regression-based parameter (based on an EC_x - design). Currently, the OECD is working on those alternatives for evaluating such tests. The SCP supports the decision to phase out the NOEC. In view of current OECD activities, a common section could be added to both guidance documents on the issue of replacing the NOEC by an EC_x, to be developed and decided upon under OECD. Such section could be based on section 3 ("NOEL-values as summary parameters") of the Terrestrial Guidance document.

4.2 Trigger for long-term sublethal tests

Although this issue is not presently considered in general terms, it is clearly a subject of relevance to a number of test programs. Correspondence between acute and long-term effects depends on the substance-specific mode of action, the organism and the endpoints concerned, and therefore cannot be established in a generally valid way. Statistical correspondence (correlation) has been used for pragmatic reasons to minimise testing (and costs), but the precision of such predictions may actually be very low (e.g., within 3 orders of magnitude). Therefore, the requirement for long-term testing should be based on likelihood of exposure together with other information (e.g. sublethal effects of substances with similar modes of action, structure-activity considerations, persistence), rather than on acute toxicity only.

4.3 Exposure assessment

The Guidance Document does not currently have a general section on the estimation of exposure, but deals with this issue separately for different test species. It would be helpful to summarize the general methods of estimation of predicted environmental concentrations (PEC) for standard scenarios. This summary could include a discussion of issues that relate to routes of exposure (e.g. direct contact, trophic), incidental exposure away from the target crop (e.g. spray-drift), repeated exposure (cf. Guidance Document on Persistence in Soil), and the use of indices such as time-weighted-averages.

When estimates which relate to exposure vary between studies, then the reliable worst case should be considered. Furthermore, the Committee recommends that upper percentiles be quoted and used as triggers, since these represent conservative measures. However, the computation of the appropriate upper confidence limits should be done carefully, and, where necessary, the assumptions behind this calculation identified.

Some calculations of exposure will be based on models which involve parameters that have themselves been estimated. In many of these cases it would not be appropriate to ignore the statistical error (underlying variability or genuine uncertainty) that is associated with these parameters. The most appropriate modelling technique will therefore incorporate appropriate stochasticities in all of the estimated parameters. Ideally, such an approach would be capable of generating not only appropriate confidence intervals, but highlighting the most sensitive parameters involved.

4.4 Probabilistic risk assessment

Current assessment procedures are based on a series of qualitative (often dichotomous) classifications (e.g. pass/fail). Although practical and easy to interpret, this procedure is rather wasteful of information. Over the next few years it is very likely that techniques (e.g. Monte Carlo simulations) which provide quantitative estimates of overall risk will become increasingly accepted (probabilistic risk assessment, PRA). While PRA's have their own limitations (e.g. data requirements), they have already been used occasionally in the risk assessment process, particularly in exposure assessment, and therefore the approach merits some reference in the Guidance Document.

4.5 Higher tier tests

Higher tier tests have received relatively little attention in the draft Guidance Document (point 29). Given the crucial importance of these tests, it is important to outline as far as possible their underlying general characteristics. For instance, it may be useful to outline exactly what constitutes a higher tier trial, and examine the relative merits of the different forms of test. For instance, under what conditions would a more realistic laboratory trial be sufficient, and when is a field/semi-field trial deemed necessary?

4.6 Non-target terrestrial plants

Although the current guidance document includes a very short section (point 28) on testing of other non-target organisms believed to be at risk, the SCP believes that this section could be considerably expanded. The section should include a more explicit indication of the general circumstances under which additional data will be needed. In particular, the SCP feels that the triggers and data requirements for the testing of non-target terrestrial plants should be more clearly outlined.

4.7 Tests for soil invertebrates other than earthworms

Earthworms are not necessarily representative of other soil invertebrates (e.g. see Spurgeon & Hopkin, 1999) and therefore the SCP welcomes the section that considers additional tests on soil organisms (point 26), especially soil arthropods. Given the extreme differences in ecology and physiology of invertebrate groups associated with soil (within it and on its surface), the SCP agrees that additional tests, for instance using collembola, are entirely reasonable and desirable. Indeed, the SCP is of the opinion that tests on soil organisms other than earthworms should eventually be considered for both persistent and non-persistent substances which are regularly applied.

Field studies and the development of appropriate model ecosystems play an important role in the evaluation process. However, such studies should not be too complex, ambitious or poorly understood, that they compromise the ultimate goal of understanding the effects of these substances.

4.8 Standard scenarios for evaluating exposure of birds

The Committee recommends that the Guidance Document be revised to acknowledge and account for the variability in likely exposure of particular bird species across Europe to given

plant protection products (Evans, 1990), and preferably consider standard scenarios (e.g. non-/ground-nesting, insectivorous / granivorous / frugivorous birds).

4.9 Endocrine effects

Endocrine disrupting chemicals (EDC) cause adverse health effects in organisms and/or their progeny as a result of deleterious changes in endocrine function. Endocrine effects have been reported in a variety of terrestrial organisms, including birds, and their implications for wildlife are generally considered as potentially serious. Unfortunately, the full extent of the problem is currently not known, and the ability to predict **a priori** the type of chemical that will affect the endocrine system is relatively poor. Even less is known about the consequences of exposure of organisms to multiple putative EDC's.

On-going discussions (e.g. OECD EDTA) may help identify appropriate methods to test for endocrine effects. EDC's are not considered explicitly in the current Guidance Document, but the SCP recommends that, at very least, once appropriate methodology is identified and agreed on, then these recommendations be translated into advice to notifiers.

4.10 Indirect effects

Changes in long-term population size can arise not only as a direct consequence of chemical application, but also as an indirect consequence, for instance through changes in food supply or habitat. Indeed, it is possible that recent declines in a number of farmland bird species in the UK have arisen, at least in part, due to these indirect effects (Campbell **et al.** 1997). Several studies are currently being conducted to investigate this phenomenon further (e.g. see Ashby, 1999), with the aim of identifying the key resources affected by pesticides and assessing whether the current regulatory procedures are sufficient. Therefore, it may be important to revise the Guidance document, once this type of data is evaluated and practical ways of dealing with this important concern have been debated.

4.11 Sub-lethal tests for birds

Initiatives are underway at the SETAC/OECD level to develop revised LC50 / LD50 / reproductive and avoidance tests for birds. One aim of this work is to reduce the overall number of birds tested (Ashby, 1999). For instance, since reproductive effects often arise through deleterious influences on particular biochemical pathways (e.g. calcium metabolism), then it is hoped that, as our ability to predict these effects improves, then the number of birds that need to be tested will be reduced.

5. Answers to specific questions

5.1 Trigger for sublethal effects in earthworms

Which are considered adequate criteria to trigger studies of sublethal effects in earthworms?

Context

The draft Guidance Document on Terrestrial Ecotoxicology suggests that a test for sublethal effects in earthworms should be triggered when combinations of particular persistence (DT₉₀)

and use (applications per annum) criteria are exceeded. There is a "grey area" where case-by-case decisions need to be made.

It has been suggested that these criteria are possibly too complex and a simple persistence and use trigger which is based on either / or conditions could be employed. Furthermore it has been proposed that sublethal testing should also be based on acute toxicity data: if the product is harmless to earthworms, then there should be no requirement for further testing.

Opinion

The SCP commend the attempt to define "continued or repeated exposure", but agree that the current criteria appear somewhat arbitrary. Furthermore, the Committee observes that this procedure differs considerably from the approach taken in the aquatic Guidance Document. The SCP agree that the "grey area" is likely to result in time-delays and protracted correspondence. The SCP therefore recommends that the Guidance Document be revised. In any revision it should be noted that numbers of applications per annum is likely to vary considerably from location to location, hence triggers should be based on realistic maximum and minimum rates of application rather than simply the mean rates (**see section 4.3**).

The SCP accepts that a knowledge of the concentrations at which mortality occurs, coupled with the maximum estimated concentrations of the compound, can be indicative of the likelihood of sublethal effects (**see section 4.2**). However, the relationship is at best crude and the range over which sublethal effects are expressed is often difficult to predict. Even if a substance was harmless to earthworms as judged by mortality tests, then it could still have an effect on characteristics such as birth rate or generation time. Clearly, major reductions in long-term population size are possible through a deleterious effect on these characteristics alone. The SCP accepts that these issues have been the subject of several international workshops, but the way forward remains controversial. While toxicity information should inform experimenters (for instance, of the conditions under which sub-lethal effects should be investigated), the SCP does not believe that there is currently sufficient scientific argument or general acceptance to move the trigger from being based on persistence and use, to being based on persistence and toxicity.

The above question raises the issue of whether tests on other soil organisms are desirable, and if so, what form of tests are most suited. This issue is discussed in detail in **section 4.7**.

5.2 Trigger for a reproduction study in birds

Which are considered adequate triggers for a reproduction study in birds ?

Context

The current draft Guidance Document on Terrestrial Ecotoxicology suggests that a test for a reproduction study in birds should always be conducted unless it can be demonstrated that exposure of birds does not occur during the breeding season. However, it has been proposed that the requirement of a reproduction test should be based more broadly on the duration of exposure of relevance to reproduction. Furthermore, regular insistence on reproduction studies may conflict with welfare legislation.

Opinion

The welfare of bird species is an important concern (see draft Guidance Document, section 2: Animal experimentation). In a sense, the avian tests already take welfare into account by assaying effects on reproduction only when it is shown that exposure will occur during the breeding season, and by using only a few indicator species. However, it is appropriate to consider whether even these forms of test are necessary. When an avian reproduction test is deemed appropriate, then the respective test guideline should be designed in such a way that it involves only sufficient replication to stand a good chance of detecting a difference in statistical population means, if there was one.

In view of the above concern, the SCP is of the opinion that the guidance document and/or data requirements should be both clear and flexible enough to allow notifiers **not** to conduct a reproduction study, if it is likely to provide relatively little useful information. For the time being, the SCP recommends that the criteria should be based on exposure alone and not toxicity (**see section 4.2**). However it is hoped that, as our ability to predict these effects improves, the criteria can eventually be expanded (**see section 4.11**).

One question is whether a reproduction study should be triggered by **any** exposure during the breeding season whatsoever, or by a particular relevant level. The SCP believes that any exposure whatsoever during the breeding season provides cause for concern, and that it represents an appropriate working baseline. However as it is in practice difficult to define even those conditions that give rise to no exposure, then the guidance document should be expanded to include further general rules and examples. Furthermore, the Committee recommends that the revised guidance acknowledges and accounts for the variability in likely exposure of particular bird species across Europe and consider standard scenarios (**see section 4.8**).

5.3 Long-term exposure assessment for birds and wild mammals

Is the method proposed for long term exposure assessment of birds considered adequate?

Context

There has been some debate concerning: (a) whether to base estimated residue levels on sample mean values, or upper maximum values for true means (for instance 95%), (b) over what time period should the Time Weighted Average (TWA) be calculated and (c) the extent to which ecology should be taken into account when estimating the exposure of birds.

Opinion

The SCP also believes that exposure estimates should be based on upper maximum estimates and they should be labelled as such (**see sections 4.3, 4.4**). This is consistent with a conservative approach to risk assessment.

The SCP agrees that the exposure period adopted in calculating statistics such as TWA should be ecologically supportable, whether it acts to reduce the estimate of exposure or increase it. When doubt exists as to the most relevant ecological time-period, both short- and long- term averages should be supplied. Because of the conservative nature of risk assessment, when ecology is cited as an argument in reducing a preliminary worst case estimate of exposure, it

is appropriate that the notifier provides clear evidence of the underlying ecological information when supporting its case.

6. Acknowledgements

The Committee wishes to acknowledge the contribution of the following working group that prepared the initial draft opinion:

Environmental: Professor A. Hardy (Chairperson), and Committee Members Dr. H. G. Nolting and Prof. A. Silva Fernandes and invited experts Professor V. Forbes and Drs. J. Boesten, A. Carter and T. Sherratt and Mr H. Koeppe.

7. References

- **Ashby, P. (1999)** The risks to wildlife from pesticides. *Aspects of Applied Biology* **53**, Challenges in applied population biology, 1-7.
- **Campbell, L.H., M.I. Avery, P. Donald, A.D. Evans, R.E. Green & J.D. Wilson (1997)**. A review of the indirect effects of pesticides on birds. JNCC Report No. 227. Joint Nature Conservation Committee, Peterborough, UK.
- **Evans, P.R. (1990)** Population dynamics in relation to pesticide use, with particular reference to birds and mammals. In: *Pesticide Effects on Terrestrial Wildlife* (L. Somerville & C.H. Walker Eds). Taylor & Francis.
- **Laskowski, R. (1995)** Some good reasons to ban the use of NOEC, LOEC and related concepts in ecotoxicology. *Oikos* **73**, 140-144.
- **Spurgeon, D.J. & S.P. Hopkin (1999)** Seasonal variation in the abundance, biomass and biodiversity of earthworms in soils contaminated with metal emissions from a primary smelting works. *Journal of Applied Ecology* **36**, 173-183.

8. Abbreviations

- **ECOFRAM - Ecological Committee on FIFRA Risk Assessment Methods**
- **EDC - Endocrine disrupting chemical**
- **EDTA - Working group on Endocrine Disruptor Testing and Assessment**
- **FIFRA - Federal Insecticide, Fungicide and Rodenticide Act**
- **NOEL(C) - No Observed Effect Level (concentration)**
- **OECD - Organisation for Economic Co-operation and Development**
- **PEC - Predicted Environmental Concentration**
- **PRA - Probabilistic Risk Assessment**
- **TWa- Time-Weighted Average**

9. Summary of key points

The SCP supports the majority of the principles outlined in the Draft Guidance Document on Terrestrial Ecotoxicology.

Overall, the SCP feels that more attention needs should be given to the layout and presentation of the document and that several issues deserve more detailed consideration. These areas include:

the estimation of exposure under standard scenarios; probabilistic risk assessment; the form of higher tier tests; the testing of non-target terrestrial plants; the testing of soil arthropods; scenarios for exposure assessment in birds;

Furthermore, the following sections may need to be introduced and/or revised in the light of on-going work on each of these subjects:

the use of NOECs; probabilistic risk assessment; the testing of endocrine effects; indirect effects; experimental model ecosystems for soil organisms; the prediction of reproductive effects in birds.

A number of more general issues arose while reviewing the document, which relate to the conservative nature of risk assessment:

the SCP does not believe that there is currently sufficient scientific argument or general acceptance to consider acute toxicity data as part of a trigger for longer-term sub-lethal tests; estimates should be based on worst case upper maxima; while ecological information can be used to reduce a preliminary estimation of exposure, clear evidence of such ecological attributes should be given.

Specifically, in relation to the questions set, the SCP recommends that:

the current triggers for an evaluation of sublethal effects in earthworms should be revised; exposure of birds during the breeding season continue to be the baseline trigger for sub-lethal tests in birds. However the SCP recommends that any revised guidance document acknowledges the variability in likely exposure of particular bird species across Europe and preferably considers standard scenarios (e.g. insectivorous / granivorous / frugivorous birds); time-weighted averages should be based on ecologically relevant time-periods: where this is debateable, both short- and long-term averages should be supplied.

¹ OJ No 230, 19. 8. 1991. p.1