APPENDIX 5

REPORT ON THE ECOLOGICAL RISK ASSESSMENT OF CHEMICALS

1. INTRODUCTION

Several SANCO Scientific Committees (SCs) are involved in the environmental (ecological) risk assessment of chemicals. Other Scientific Committees outside SANCO are also involved.

Basically the task can be divided in two main activities:

1. Revision of comprehensive (in-depth, holistic) risk assessment prepared by Member States (MSs) for registration, authorisation, etc.

- Comprehensive risk assessment of High Production Volume Chemicals. Related to Commission Regulation (EC) 1488/94. This includes a full risk assessment of the whole life cycle of certain priority chemicals. The assessments cover local, regional and continental scenarios and try, whenever possible, to use real emission data and to establish comparisons between predicted and observed level. The CSTEE has produced opinions on several comprehensive risk assessments.

- Risk Assessment for new and existing plant protection products (pesticides and biocides). In principle this is a type of targeted risk assessment to address the risks associated with the specific use of plant protection products by the farmers under Directive 91/414/EEC. The outcome of this risk assessment is the inclusion of the active substance on a positive list (Annex I) of substances that can be used in plant protection products, with or without restrictions, or the total ban of the substance. Monitoring data are essential for proper identifications of the properties of the substance.

- Predictive risk assessment of new notified substances. Related to Commission Directive 93/67/EEC this constitutes a pre-requisite for the production-import-commercialisation of substances that are not currently on the EU market. It represents a predictive approach for a holistic risk assessment of all potential risks associated with the life cycle of the substance.

- Risk Assessment for Veterinary Medicines. Under Directive 2001/82/EEC the environmental risk of new veterinary medicines must be assessed before their commercialisation. It is a type of targeted risk assessment for the inclusion in a positive list. It mostly focuses on local scenarios for national and central marketing authorisations.

- Risk Assessment for Human Medicines. Under Directive 2001/83/EEC the environmental risk of new medicines must be assessed before their commercialisation. It is a type of targeted risk assessment mostly focusing on local scenarios for national and central marketing authorisations. No formal guidance documents have been made available yet.

- Risk Assessment for Biocides. Regulated by Directive 98/8/EC this also represents a targeted risk assessment for inclusion of biologically active chemicals in a positive 1A-1B low risk list. Nevertheless, this regulation presents a much larger variability on intended uses than those related to pesticides or veterinary medicine and therefore, a larger diversity of scenarios both local and regional should be required. The Directive is currently under implementation and the opinion of the CSTEE on the technical guidance document has been requested.

- Risk assessment for feed additives. Regulated by Directive 2001/79/EC the assessment of additives in animal nutrition includes the specific requirement of environmental impact. The guidelines were drafted by the SCAN and submitted to the Commission for adoption. The basic principles are equivalent to those for veterinary medicines.

- Risk assessment of food additives, packaging materials and cosmetics. No environmental assessment is currently required in the case of additives for human nutrition, packaging materials nor cosmetics.

2. Review of risk assessment conducted for specific targets as supporting scientific evidence for particular decisions. These risk assessments are basically produced by consultants, contracted on an ad-hoc basis for each particular assessment.

- Targeted risk assessment of problematic substances/uses. These represent a shortened version of the previous type concentrated on certain specific uses of dangerous chemicals, trying to support decisions on specific bans or restrictions. They do not cover the whole life cycle of the chemical but certain aspects of it, and mostly focus on local or regional scenarios. The use of real emission/exposure data is crucial for a proper decision and in most cases includes a comparative study with those other substances/technologies considered as proper alternatives for the studied chemical. The CSTEE has produced several opinions on targeted risk assessment prepared by consultants contracted by DG Enterprise.

- Risk assessments as part of other regulatory decisions. In addition to specific risk assessment studies such as those presented above, risk assessment also constitutes the basis for several decision-making processes in related areas. To give an example relevant for the CSTEE work, risk assessment decisions are incorporated in the Water Framework Directive to give guidance on prioritisation of pollutants and to set Environmental Quality Standards.

An additional distinction can be made according to the marketed situation of the chemicals already on the market or submitted for authorisation. Obviously, this situation will determine the type of risk assessment to be conducted. If the chemical is already on the market, the evaluation of real exposure levels and environmental problems could be possible. For risks assessments conducted prior to the authorisation of the product, the assessment must depend exclusively on modelled predictions and default estimations.

The above situation will change with the implementation of the recommendations of the White Paper on the Future Chemicals Strategy adopted in February 2001. The

REACH process is expected to cover the risk associated with the general parts of the life cycle for all chemicals, while the risk associated to the specific uses might still be covered by additional legislation. In other words, a chemical with specific uses, such as a plant protection product, could be subjected to a generic risk assessment, covering the industrial phases of this life cycle through REACH, plus a specific assessment for its use as plant protection products by the farmers. The final decisions have not been adopted yet, and therefore, it is not possible to comment on their implications in the harmonisation of the risk assessment process.

2. THE ROLE OF DG SANCO SCIENTIFIC COMMITTEES IN COMPREHENSIVE/IN DEPTH ENVIRONMENTAL RISK ASSESSMENTS

Basically, the SCs are responsible for an independent evaluation of the scientific basis of the final conclusions adopted by the technical experts of the Commission and MS, or of the dossier submitted by the applicant through the Commission. The structure is represented in Figure 1.

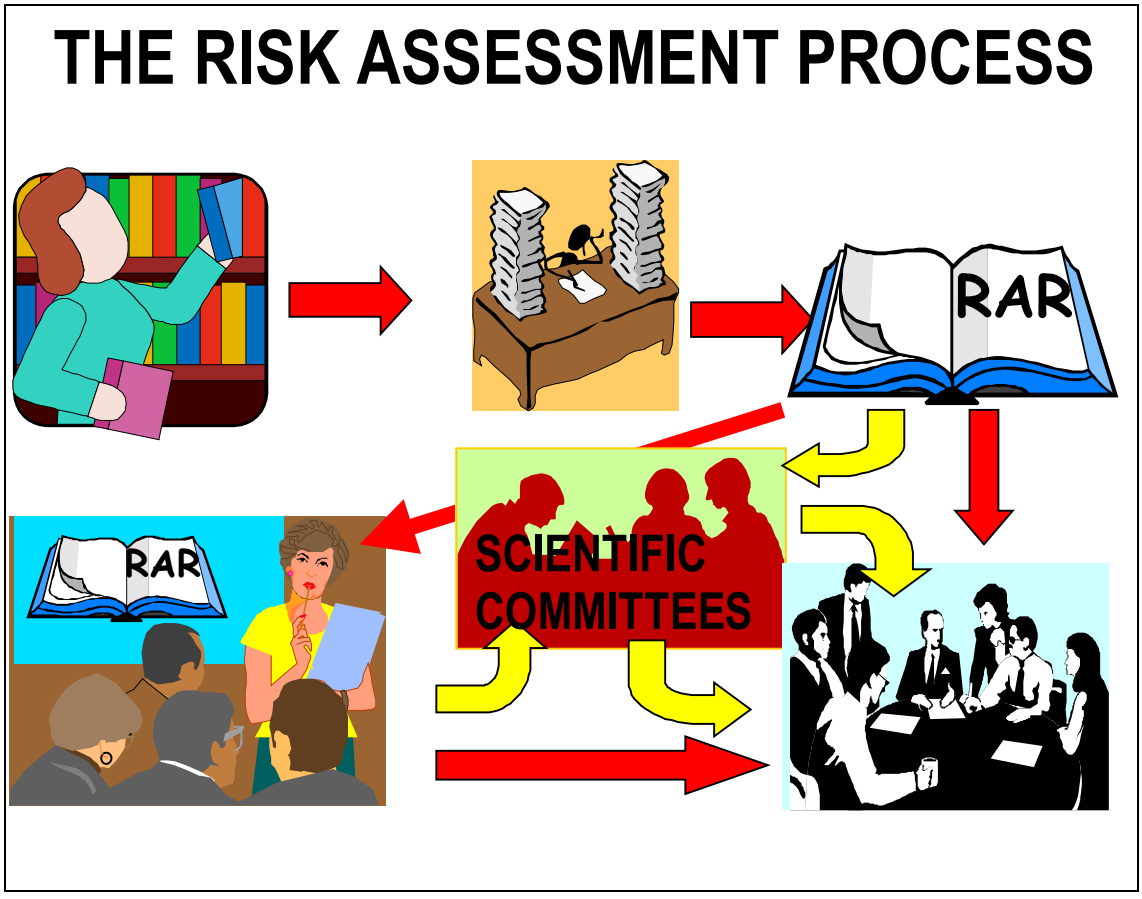

THE RISK ASSESSMENT PROCESS
RAR
SCIENTIFIC COMMITTEES
RAR

Figure 1: Schematic representation of the risk assessment process. The assessment of the available information concludes with the production of a risk assessment report (RAR) or dossier summary produced by the rapporteur MS, the applicant or a contracted consultant. The opinion of the SCs can be requested either at this stage or after and in-depth consideration by experts groups from the Commission services and experts from all MSs. Then, the report and the opinion of the responsible SC are submitted to decision makers. The opinions of the SCs become publicly available through Internet.

The SCP and the CSTEE are Committees with most experience in these assessments. The SCAN is involved in the assessment of feed additives, the guidelines for which are largely similar as those for veterinary medicines; the latter are assessed outside SANCO by the EMEA

A main difference concerns the terms of reference for the consultation:

- For the SCP / SCAN opinion is requested on specific questions from the Commission regarding the evaluation of each pesticide / feed additive in the context of the Council Directives 91/414/EEC and 2001/79/EC, respectively.

- For the CSTEE opinion is requested in general terms related to the quality of the risk assessment reports produced for priority chemicals under Regulation 793/93 and scientific basis of the conclusions, using the following general questions:

  In the context of Regulation 793/93 (Existing Substances Regulation), and on the basis of the examination of the Risk Assessment Report the CSTEE is invited to examine the following issues:

  1. *Does the CSTEE agree with the conclusions of the Risk Assessment Report?*

  2. *If the CSTEE disagrees with such conclusions, the CSTEE is invited to elaborate on the reasons for this divergence of opinion.*

In addition, the SCP opinions are requested for both, new and existing pesticides, while the CSTEE opinion is requested only on existing chemicals but not on new (notified) substances which are treated confidentially.

3. DESCRIPTION OF ENVIRONMENTAL RISK ASSESSMENT PROCEDURES

Although environmental risk is defined as the probability of observing/producing adverse environmental/ecological effects, European legislation of environmental risk assessments includes in all cases a low tier assessment based on a deterministic approach: if the exposure is clearly below the concentrations found toxic in laboratory studies, the environmental risk is expected to be low enough to be accepted.

Each piece of legislation sets specific methods for risk characterisation (PEC/PNEC; TER; etc.) but in the deterministic approach the whole assessment is reduced to the acceptability of certain ratios between the expected exposure and the observed toxicity, defined by a set of adjustment factors. It is assumed that low risk is expected when the exposure level is sufficiently lower than the laboratory toxicity endpoints. The "distance" or ratio between both values to accept low risk should cover the uncertainty in the assessment, and is defined by a adjustment factor, fixed for low Tier assessments through different procedures such as the use of application factors for deriving ecotoxicological thresholds or setting fixed triggers for the Toxicity Exposure Ratios. From a conceptual viewpoint these adjustment factors are equivalent to the "margins of safety" employed in the human health risk assessment; however, it is generally considered that the factors are expressions of risk, not expressions of safety (Forbes and Calow, 2002a).

The CSTEE opinion on risk assessment for terrestrial ecosystems identified clear inconsistencies among the adjustment factors for assuming low risk recommended for general chemicals, pesticides or veterinary medicines, particularly in the terrestrial assessment. The new proposal for the revision of the TGD, if finally accepted, will extrapolate these inconsistencies to aquatic compartments.

The SCs have generally based their advice on the philosophy that the criteria for acceptability are political, and have focused their opinion on the availability of sound information for supporting the risk assessment, and establishing if conditions for assuming low (or high) risk could be scientifically supported. However, the definition of acceptability criteria might be more informed by the science. For example, it should be possible in principle to link trigger values and the ratio thresholds with levels of effects in ecological systems. The management decision would then be about the acceptability of these levels of effects, how they fulfil the desired protection goals, and their socioeconomic consequences. As a general principle, it would seem that SCs, and the scientific community in general, have not been sufficiently challenged by these kinds of questions.

A description of the ERA procedures for different types of chemicals is included below.

3.1 RISK ASSESSMENT OF INDUSTRIAL CHEMICALS

INTRODUCTION

This is concerned with assessing likelihood of adverse effects from industrial chemicals – existing (on the market) and new (before market) - on ecosystems in general. This involves comparing likely exposure concentrations with no-effect concentrations. The process is described in the Technical Guidance Document in support of Commission Directive 93/67/EEC on risk assessment for new notified substances and Commission Regulation (EC) 1488/94 on risk assessment for existing substances (EC, 1996) or TGD.

EXPOSURE

For new substances, usually no relevant measured data are available. Therefore, concentrations of a substance in the environment must be estimated. Unlike for new substances, the exposure assessment of existing substances does not always depend upon modeling. Data on measured levels in various environmental compartments have been gathered for a number of substances.

In many cases a range of concentrations from measured data or modelling is obtained. This range can reflect different conditions during manufacturing and use of the substance, or may be due to assumptions in or limitations of the modeling or measurement procedures. Measured concentrations can also have a considerable uncertainty associated with them, due to temporal and spatial variations.

For existing chemicals, the rapporteur initially makes the generic "reasonable worst case" exposure assessment based on modeling, to derive an environmental concentration.

The subsequent step is to estimate the substance's release rate based upon its use pattern. All potential emission sources are analysed from production and formulation to use and disposal, and the receiving environmental compartment(s) is/are identified. After assessing release, the fate of the substance once released to the environment is considered. This is estimated by considering likely routes of exposure and biotic and abiotic transformation processes. The quantification of distribution and degradation of the substance (as a function of time and space) leads to an estimate of PEC_{local} and $PEC_{regional}$. The PEC calculation is not restricted to the primary compartments, surface water; soil and air, but also includes secondary compartments such as sediments and groundwater.

For the release estimation of substances, a distinction is usually made between substances that are emitted through point sources to which specific locations can be assigned and substances that enter the environment through diffuse releases.
Point source releases have a major impact on the environmental concentration on a local scale (PEC_{local}) and contribute to the environmental concentrations on a larger scale ($PEC_{regional}$).

PEC_{local}
The concentrations of substances released from point sources are assessed for a generic local environment. This is not an actual site, but a hypothetical site with predefined, agreed environmental characteristics, the so-called "standard environment". These environmental conditions can be average values, or reasonable worst-case values, depending on the parameter in question. The scale is usually small and the targets are assumed to be exposed in, or at the border of, the area.

$PEC_{regional}$
The concentrations of substances released from point and diffuse sources over a wider area are assessed for a generic regional environment. The $PEC_{regional}$ takes into account the further distribution and fate of the chemical upon release. It also provides a background concentration to be incorporated in the calculation of the $PEC_{local.}$ As with the local models, a generic standard environment is defined. The $PEC_{regional}$ is assumed to be a steady-state concentration of the substance.

For the chemical industry, two separate industrial categories exist: one for basic chemicals and another for chemicals used in synthesis. Basic chemicals are considered to comprise commonly used chemicals such as solvents and pH-regulating agents such as acids and alkalis. Also the primary chemicals from the oil refining process are considered as basic chemicals. Substances used in synthesis fall into one of two classes, namely intermediates (substances produced from a starting material to be converted in a subsequent reaction into a next substance) and other substances. These other substances consist mainly of 'process-regulators' (e.g. accelerators, inhibitors, indicators). For industrial category 5 (personal/domestic) the use and application of substances (as such or in formulations) is considered at the scale of households. The types of application are e.g. adhesives, cosmetics detergents, and pharmaceuticals. Some private use applications are covered in other industrial categories. These applications comprise fuels and fuel additives (mineral oil and fuel industry), paint products (paints, lacquer and varnishes industry) and photochemicals (photographic industry). For industrial category 6 (public domain), use and application at public buildings, streets, parks, offices, etc. is considered.

A standard table in the TGD provides the estimated total release fractions of the production volume (emission factors) to air, (waste) water and industrial soil during production, formulation, industrial/professional use, private use, and recover, according to their industrial category. The production volume is defined as the total tonnage of a substances brought to the European market in one year, i.e. the total volume produced in the EU plus the total amount imported into the EU, and minus the total volumes exported from the EU excluding the volumes of the substance present in products imported/exported. The total volume released is averaged over the year and used for the $PEC_{regional}$ calculation.

Other standard tables in the TGD are used for the determination of the releases from point sources for the evaluation of $PEC_{local.}$ They provide the fraction of the total volume released that can be assumed to be released through a single point source, and the number of days during which the substance is released, thus allowing the daily release rate at a main point source to be calculated.

If the major share of a substance placed on the market remains in chemical products or articles at their end of service life (releases during production, processing and use are comparatively small), the waste life cycle stage of the substance will need particular attention. For example, this refers to organic substances in landfills and metals in waste incineration processes. The underlying criterion for considering waste emissions in the risk assessment of substances, is that the waste stage will contribute significantly to the overall exposure or environmental concentration in comparison to the emissions from other parts of the life cycle of the substance (e.g. production and use stages).

Transport and transformation ("fate") describe the distribution of a substance in the environment, or in organism, and as it changes with time (in concentration, chemical form, etc.), thus including both biotic and abiotic transformation processes. In general, the assessment of degradation processes is based on data, which reflect the environmental conditions as realistically as possible. Data from studies where degradation rates are measured under conditions that simulate the conditions in various environmental compartments are preferred. However, the applicability of such data, have to be judged in the light of any other degradation data including results from screening tests. Most emphasis is put on the simulation test results but in the absence of simulation test data, degradation rates and half-lives have to be estimated from screening test data.

A listing of various PECs is given in tables of the TGD (EC, 1996)

EFFECTS

The effects assessment comprises the following steps:

- Hazard identification: which aims to identify the effects of concern. For existing substances the aim is also to review the classification of the substance while for new substances a proposal on classification is carried out;
- Dose (concentration) – response (effect) assessment: at this step the predicted no effect concentration (PNEC), shall, where possible, be determined.

The function of risk assessment is the overall protection of the environment. Certain assumptions are made concerning the aquatic environment which allow, however uncertain, an extrapolation to be made from single-species, short-term toxicity data to ecosystem effects. It is assumed that:

- Ecosystem sensitivity depends on the most sensitive species, and;
- Protecting ecosystem structure protects ecosystem processes.

If correct, these two assumptions have important consequences. By attempting to establish which species is the most sensitive to the toxic effects of a chemical in the laboratory, extrapolation can in principle subsequently be based on the data from that species. Furthermore, the functioning of any ecosystem in which that species exists is protected provided the structure is not sufficiently distorted as to cause an imbalance. It is generally accepted that protection of the most sensitive species should protect structure, and hence ecosystem processes. However, most ecotoxicologists are sceptical

about the existence of a most sensitive species for all chemicals, so care needs to be exercissed in application of this presumption.

Currently, for new chemicals, the testing strategy is defined by the production/import tonnage. For existing chemicals, the ERA is based on a revision of the available information conducted by the producer/importer. However, the White Paper on the future for a Chemical Strategy considers the harmonisation of procedures for both existing and new chemicals.

In any case, for all new substance the pool of data from which to predict ecosystem effects is very limited: only short-term data are available at the base-set. For most existing substances the situation is the same; in many cases, only short-term toxicity data are available. In these circumstances, it is recognized that, while not having a firm scientific validity, empirically derived assessment factors must be used. Assessment factors have also been proposed by the EPA and OECD. In applying such factors, the intention is to predict a concentration below which an unacceptable effect will most likely not occur.

In establishing the size of these assessment factors, a number of uncertainties must be addressed to extrapolate from singe-species laboratory data to a multi-species ecosystem. These areas have been adequately discussed in other papers, and may best be summarized under the following headings:

- Intra- and inter-laboratory variation of toxicity data;
- Intra- and inter-species variations (biological variance);
- Short-term to long-term toxicity extrapolation;
- Laboratory data to field impact extrapolation. (Extrapolation is required from mono-species tests to ecosystem. Additive, synergistic and antagonistic effects arising from the presence of other substances may also play a role).

The proposed application factors are presented below.

AVAILABLE INFORMATION	APPLICATION FACTOR
Acute LC50 on three relevant taxa (Aquatic:Fish, invertebrates, algae) (Soil: Plant, eartworms, soil micro-organisms)	1000
Chronic NOEC on one taxonomic group	100
Chronic NOECs on two taxonomic groups	50
Chronic NOECs on three taxonomic groups	10
Higher tier studies	Case-by-case

Reliable QSAR estimates for fish, daphnids and algal toxicity are available for chemicals with a non-specific mode of action. These estimates can be used to assist in data evaluation and/or to contribute to the decision making process whether further testing is necessary to clarify an endpoint of concern and if so, to optimise the testing strategy, where appropriate.

Other alternatives than QSAR for reducing animal testing are also available, including in vitro tests. However, these are not currently used in the risk assessment. Nevertheless, future changes in the testing strategy could be expected, particularly on

mammal testing, where the ECVAM has already prepared a document (Worth and Balls, 2002) but also for other vertebrates.

Substances that strongly absorb on to sediment particles or that bind chemically or via ion exchange to sediment components are candidates for performing an effects assessment for sediment organisms.For most chemicals the number of toxicity data on benthic organisms is limited. At the base-set level for new and existing substances there is no requirement for toxicity tests with sediment organisms. Therefore, as a screening approach the equilibrium partitioning method is proposed to compensate for this lack of toxicity data. This screening method triggers the implementation of whole-sediment tests with benthic organisms.

Chemicals can reach the soil via several routes: application of sewage sludge in agriculture, direct application of chemicals and deposition from the atmosphere. This means that the possibility of adverse effects for soil ecosystems has to be assessed. The proposed strategy focuses on effects of chemicals on soil organisms. At present no strategy is available to assess possible effects on soil processes like filtration, buffering capacity and metabolic capacity.

However, the terrestrial ecosystem comprises the above-ground community, a soil community and a groundwater community. Currently, only effects on soil organisms exposed directly via pore water /or soil are addressed. Reference is made to the strategy for air and for bioaccumulation and secondary poisoning of birds and mammals. So far, it is not possible to carry out effects assessment for the groundwater community because no toxicity data are made available.

There are several motivations for introducing the use of "Species Sensitivity Distributions" (SSDs) into the PNEC derivation, but the main one is that they make use of all the available data when deriving a PNEC. Therefore taking into account the information concerning the interspecies variability will not lead to more stringent outcomes for substances with larger databases.

However, such methods can also be criticised. The most common drawback is that risk assessment based on SSDs (or probabilistic assessment in general) is more complex than the deterministic approach and requires additional decisions on the levels assumed to represent low risk (loss of transparency). Complexity could lead to confusion, or to lack of confidence, or to increase the potential for generating mathematical artefacts. Some of the other drawbacks like the question of the representativeness of selected test species, the comparability of different endpoints and the arbitrary choice of trigger values (fixed value of 10 or a specific percentile and/or a statistical confidence level) are also applicable to the deterministic risk assessment.

The methodology used for effects assessment (and therefore the risk characterisation) of chemicals in water and soil cannot be applied yet in the same manner to the atmosphere. Methods for the determination of effects of chemicals on species arising from atmospheric contamination have not yet been fully developed, except for inhalation studies with mammals.

The TGD does not include guidance on a quantitative characterization of risk by comparison of the PEC_{air} to $PNEC_{air,}$ only a qualitative assessment for air is feasible. However, in certain cases, the raporteur MSs have conducted a quantitative evaluation of the available information, establishing comparisons among the relevance of the available information and the required application factor for a PNEC derivation, or estimating the ratio between the exposure estimation and the measured toxicity on plants or foliar/ground invertebrates.

For the evaluation of an atmospheric risk, the following abiotic effects of a chemical on the atmosphere have to be considered:

- Global warming;
- Ozone depletion in the stratosphere;
- Ozone formation in the troposphere;
- Acidification.

If for a chemical there are indications that one or several of these effects occur, expert knowledge needs be consulted. A proposed quantitative approach is described in De Leeuw (1993):

Global warming
The impact of a substance on global warming depends on its IR absorption characteristics and its atmospheric lifetime. A potential greenhouse gas shows absorption bands in the so-called atmospheric window (800-1200nm).

Stratospheric ozone
A substance may have an effect on stratospheric ozone if e.g.

- the atmospheric lifetime is long enough to allow for transport to the stratosphere, and;
- it contains one or more C1 or Br substituents.

In general, ozone depletion potential values approach zero for molecules with atmospheric lifetimes less than one year.

Tropospheric ozone
The generation of tropospheric ozone depends on a number of factors:

- the reactivity of the substance and the degradation pathway;
- the meteorological conditions (the highest ozone concentrations are expected at high temperatures, high levels of solar radiation and low wind speeds);
- the concentration of other air pollutants (the concentration of nitrogen oxides have to exceed several ppb).

Acidification
During the oxidation of substances containing C1, F, N or S substituents, acidifying components (e.g. HC1, HF, NO_2 and HNO_3, SO_2 and h_2SO_4) may be formed. After deposition, these oxidation products will lead to acidification of the receiving soil or surface water.

RISK ASSESSMENT

This is most often carried out by comparing PECs with appropriate PNECs to give a variety of ratios (ie. PEC/PNEC = RQs cf. TER of PPPs). RQs values lower than one are generally deemed to be acceptable and no further action is taken. Values greater than one either require reconsideration (refinement of PECs and/or PNECs) or suggest the need for action.

Typical PEC refinement options are based on use of real emissions instead of the default values included in the TGD. The refinement of the PNEC value can be conducted by incorporating additional chronic toxicity data or moving to higher tier assays such as mesocosms or field studies. However, this second option, while common for plant protection products, is rarely considered in the case of industrial chemicals.

3.2 PESTICIDES: ACTIVE SUBSTANCES FOR PLANT PROTECTION PRODUCTS

GENERAL

The detailed evaluation and decision making criteria are laid down in **Annex VI** (uniform principles) to the Directive 91/414/EEC. Thus this Annex may be considered as a structured guidance for risk and benefit analyses of plant protection products (PPP). Additional technical guidance is presented in Guidance Documents (e.g. DG SANCO, 2000a; 2000b; 2001ab; 2002; FOCUS 2000; 2001).

General evaluation principles are that all normal conditions under which the PPP may be used (regarding plant health, principles of integrated control, purpose of use, dose, frequency and timing of applications, agricultural practice, environmental conditions including climate) as well as the consequences of its use must be taken into account. The evaluation in the first step is based on the best available data but in a second step also takes account of potential uncertainties in the data and the range of use conditions that are likely to occur (realistic worst case approach), to determine whether the results could differ significantly.

The environmental assessment comprises both the hazard identification and risk assessment. For a hazard identification, for example persistence and bioconcentration in aquatic and soil organisms are considered as inherent properties. The approach to handle these as independent parameters is not dealt with in this chapter, but persistence is used as a property to trigger the performance of selected effect studies for risk assessment.

With respect to the *fate, distribution* and *unwanted impacts* of the active substance, i.e. the potential risk, no authorization of a PPP for the evaluated conditions of use can be granted, if – inter alia - the following are observed:

- Concentrations in **groundwater** are expected to exceed the lowest of the following limit values :

1) Maximum concentration set in Council Directive 80/778/EEC related to the quality of water intended for human consumption, or the maximum concentration laid down by the Commission when including the active substance in Annex I.

   No authorisation shall be granted if the concentration of the active substance or of relevant metabolites, degradation or reaction products in groundwater, may be expected to exceed, as a result of use of the plant protection product under the proposed conditions of use, the lower of the following limit values :

   i. The maximum permissible concentration laid by Council Directive 80/778/EEC [1] of 15 July 1980 relating to the quality of water intended for human consumption, or

   ii. The maximum concentration laid down by the Commission when including the active substance in Annex I, on the basis of appropriate data, in particular toxicological data, or, where that concentration has not been laid down, the concentration corresponding to one tenth of the ADI laid down when the active

[1] OJ L 229,30. 8. 1980, p. 11. Directive as last amended by Directive 91/692/EEC (OJ L 377, 31. 12. 1991, p. 48).

substance was included in Annex I unless it is scientifically demonstrated that under relevant field conditions the lower concentration is not exceeded.

No authorisation shall be granted if the concentration of the active substance or of the relevant metabolites, breakdown or reaction products to be expected after use of the plant protection product under the proposed conditions of use in surface water :

- Exceeds, where the surface of the water in or from the area of envisaged use is intended for the abstraction of drinking water, the values fixed by Council Directive 75/440/EEC of 16 June 1975 concerning the quality required of surface water intended for abstraction of drinking water in the Member States [2], or
- Has an impact deemed unacceptable on non-target species, including animals, according to the relevant requirements provided for in point 2.

The proposed instructions for use of the plant protection product, including procedures for cleaning application equipment, must be such that the likelihood of accidental contamination of surface water is reduced to a minimum.

No authorisation shall be granted if the airborne concentration of the active substance under the proposed conditions of use is such that either the AOEL or the limit values for operators, bystanders or workers are exceeded.

When that concentration has not been laid down, the concentration corresponding to one tenth of the ADI laid down in Annex I, unless it is scientifically demonstrated that under relevant field conditions the lower concentration is not exceeded.

2) As regards **impact on non-target species** :

- Where there is a possibility of birds and other non-target vertebrates being exposed, **no** authorisation shall be granted if :
  - The acute and short-term toxicity/exposure ratio (TER) for birds and other non-target terrestrial vertebrates is less than 10 on the basis of LD50 or the long-term toxicity/exposure ratio is less than 5, unless it is clearly established through an appropriate risk assessment that under field conditions no unacceptable impact occurs after use of the plant protection product according to the proposed conditions of use ;
  - The bioconcentration factor (BCF, related to fat tissue) is greater than 1, unless it is clearly established through an appropriate risk assessment that under field conditions no unacceptable effect occur – directly or indirectly – after use of the plant protection product according to the proposed conditions of use.
- Where there is a possibility of aquatic organisms being exposed, **no** authorisation shall be granted if :
  - The toxicity/exposure ratio (TER) for fish and Daphnia is less than 100 for acute exposure and less than 10 for long-term exposure, or

[2] OJ No L 194, 25. 7. 1975, p. 34. Directive as last amended by Directive 91/692/EEC (OJ No L 377, 31. 12. 1991, p. 48).

- The algal growth inhibition/exposure ratio is less than 10, or
- The maximum bio concentration factor (BCF) is greater than 1000 for plant protection products containing active substances which are readily biodegradable or greater than 100 for those which are not readily biodegradable,

Unless it is clearly established through an appropriate risk assessment that under field conditions no unacceptable impact on the viability of exposed species (predators) occurs – directly or indirectly – after use of the plant protection product according to the proposed conditions of use.

- Where there is a possibility of honeybees being exposed, no authorisation shall be granted if the hazard quotients for oral or contact exposure of honeybees are greater than 50, unless it is clearly established through an appropriate risk assessment that under field conditions there are no unacceptable effects on honeybee laevae, honeybee behaviour, or colony survival and development after use of the plant protection product according to the proposed conditions of use.
- Where there is a possibility of beneficial arthropods other than honeybees being exposed, no authorisation shall be grated if more than 30% of the test organisms are affected in lethal or sublethal laboratory tests conducted at the maximum proposed application rate, unless it is clearly established through an appropriate risk assessment that under field conditions there is no unacceptable impact on those organisms after the use of the plant protection product according to the proposed conditions of use. Any claims for selectivity and proposals for use in integrated pest management systems shall be substantiated by appropriate data.
- Where there is a possibility of earthworms being exposed, no authorisation shall be grated if the acute toxicity/exposure ratio for earthworms is less than 10 or the long-term toxicity/exposure ratio is less than 5, unless it is clearly established through an appropriate risk assessment that under field conditions earthworm populations are not at risk after use of the plant protection product according to the proposed conditions of use.
- Where there is a possibility of non-target soil micro-organisms being exposed, no authorisation shall be granted if the nitrogen or carbon mineralisation processes in laboratory studies are affected by more than 25% after 100 days, unless it is clearly established through an appropriate risk assessment that under field conditions there is no unacceptable impact on microbial activity after use of the plant protection product according to the proposed conditions of use, taking account of the abillity of micro-organisms to multiply.

Species	**short-term TER Based on acute toxicity data**	**Long-term TER Based on chronic data**
Terrestrial organisms (BCF >1)		
Birds	<10	<5
Vertebrates	<10	<5
Earthworms (representative for soil organisms)	<10	<5
Bees	Alternative method (a hazard quotient value must be below 50 to be acceptable)	
Non-target arthropods (tests to be carried out with two standard species as surrogates and two crop specific species)	Alternative method (Decision initially based on effect level instead of TER, recently revised in a new document, (DGSANCO, 2002) to a hazard quotient approach where the value must be below 2 to be acceptable)	
Soil micro-organisms	Alternative method (Decision based on effect level instead of TER) (>25% lethal)	
Further non-target organisms - Soil macro-fauna (e.g. Collembola or gamasid mite; reproduction or or the functional litter bag test) (for persistent substances only=DT90>100 days) - Other flora and fauna believed to be at risk (assessment scheme to be developed) - - Secondary poisining (bioconcentration for aquatic organisms)	test procedures and assessment be discussed on a case-by-case basis BCF <100 or <1000 depending on biodegradation potential	
Aquatic organisms		
Fish	<100	<10
Daphnia	<100	<10
Algae	<10*	

* Algal growth inhibition test for 72 h. Since algae go through several cell division cycles during the exposure time, the test can be considered as algae lifecycle test (long term exposure), however, the acute endpoint (EC50) is used.

DETAILS ON ENVIRONMENTAL EXPOSURE AND RISK ASSESSMENT

GROUNDWATER

Residues which enter **groundwater** may cause exposure to the consumer of drinking water. Risk Assessment on Groundwater is performed by a tiered approach comprising modelling, laboratory studies, lysimeter studies and – if needed – field testing. Proceeding from one Tier to another is triggered by fixed concentrations.

Vulnerability of ground water to contamination resulting from the use of an active substance is addressed by nine realistic worst-case scenarios. Collectively, these represent agriculture across Europe, for the purposes of an initial screening (**Tier 1)** EU-level assessment of leaching potential. The scenarios do not mimic specific fields, and nor are they necessarily representative of the agriculture at the location after which they are named or in the Member States where they are located.

The purpose of the standard scenarios is to assist in establishing if "safe" scenarios exist which are relevant for use of a substance. Since they form Tier 1 of the assessment, they have been defined to represent a realistic worst case.

From this first Tier assessment there are three possible outcomes

1. The critical model output for a substance may exceed 0.1 µg/l for all relevant scenarios
2. It may be less than 0.1 µg/l for all relevant scenarios
3. It may exceed 0.1ug/l for some relevant scenarios and be less than 0.1ug/l for others

- If a substance exceeds 0.1µg/l for all relevant scenarios, then Annex 1 inclusion would not be possible unless convincing higher Tier data (e.g. studies, monitoring or more refined modelling) were available to over-ride the modelling results.
- If a substance occurs at less than 0.1µg/l for all relevant scenarios, then the choice of a realistic worst-case definition for the scenarios means that there can be confidence that the substance is unlikely to cause harm in the great majority of situations in the EU. This does not exclude the possibility of leaching in highly vulnerable local situations within specific Member States, but such situations should not be widespread and can be assessed at the Member State level.
- If a substance occurs at less than 0.1ug/l for at least one but not for all relevant scenarios, then in principle the substance can be included on Annex 1 with respect to leaching to groundwater. The scenarios represent major agricultural areas of the EU, so this would indicate that uses unlikely to cause harm have been identified, which are significant in terms of agriculture in the EU. The scenarios which gave results less than 0.1ug/l, along with the results of any higher Tier studies which already exist, help to indicate the extent of the acceptable uses which exist for the substance. These higher Tier studies could include lysimeter or field leaching studies, monitoring and more refined modelling. The results of the entire leaching assessment at the EU level could then be used to guide local assessments of leaching at the Member State level." (FOCUS, 2000).

SURFACE WATER

Risk Assessment on Surface water also is performed using a tiered approach. Depending on the results of the initial risk assessment, more detailed data relating to environmental exposure or hazard may be required to clarify the environmental risk. Such data are generated from an increasingly comprehensive series of studies (higher tiered studies). At each Tier a relevant comparison has to take place between the estimated exposure and the estimated hazard and there are thus separate Tiers for both exposure and hazard estimation. This includes fate modelling and laboratory fate studies (for the exposure assessment) as well as laboratory acute and chronic single species testing on the lower Tier and – as higher Tier testing – full life cycle tests and aquatic microcosms (for the hazard assessment). Ecological monitoring is a further promising tool for risk assessment of existing plant protection products.

PEC-calculations are performed using mathematical simulation models that need environmental and chemical input data (FOCUS, 2001). "The first step in the Tiered approach is to estimate surface water exposure based on a putative extreme worst case loading scenario. However, it has been pointed out that the proposed conditions do not necessarily represents worst-case conditions in all cases, and are particularly problematic for the Mediterranean area (Ramos et al., 2000). The estimated exposure may be compared to the relevant toxicity concentrations, the lethal or effect concentration, L(E)C50, or the No-effect concentration, NOEC, of the water organisms investigated. If, at this early stage, the use is considered safe no further surface water risk assessment is required. If however, the result indicates that use is not safe, it is necessary to proceed to a Tier 2 exposure assessment."

The use is not considered safe when the TERs are below the triggers already given in the first paragraph of this chapter.

TERRESTRIAL COMPARTMENT

For the terrestrial compartment only a preliminary tiered assessment scheme has been developed (SCP, 2000), a Guidance document is available DG SANCO 2002.

"In the terrestrial compartment, several sub-compartments and various exposure routes must be distinguished:

- within the soil
- on the soil surface
- on plants

When a PPP is applied, terrestrial organisms can be exposed depending on where they live:

- within the soil, via soil particles with absorbed PPP (contact, oral uptake)
- on the soil surface, via soil particles or plants (contact, oral uptake) and by direct contact/uptake (spray liquid, granules)
- on plants, via contact and oral uptake of plant material or other animals, or by direct contact/uptake (spray liquid, granules).

This multitude of cases has to be addressed in different ways.

For soil micro-organisms (and non-target arthropods other than bees in the previous versions of the guidance documents),, the exposure is not assessed separately from the

effects but is included in the effects testing in a quantity and way that mimics more or less closely the worst cases of the intended use conditions (e.g., the PPP is mixed into soil, or onto a surface, which is then used directly in a toxicity test). Thus, the effect of the combined, overall exposure is often measured directly, without quantifying the respective contributions of the different exposure routes. In addition, effects of direct application of spraying liquid to the arthropods are often measured. For non-target arthropods, this situation has, however, changed recently after the outcome of a second topic workshop for discussing the risk assessment protocol for these non-target arthropods (Candolfi et al, 2001). The new proposal includes an initial tier assessment based on dose-response toxicity tests on two selected species. The results are presented as the standard LD50, where the dose is expressed as the application rate. These values are then compared with the expected exposure level, represented by overspray for in-crop populations and spray drift in the case of off-crop populations. Results of field trials and laboratory assays are compared for selecting the extrapolation factors that should be applied to the laboratory LD50s, and, considering that a similar approach was used for bees, the workshop conclusions recommended the use of Hazard Quotients for expressing the risk characterisation. These conclusions are currently under debate for their incorporation in the regulatory protocol. The use of the term Hazard Quotient was selected following the proposal for bees, on the basis that in both cases the acceptability triggers where directly derived from field studies, instead of from conceptual considerations as in the case of the TER. The use of different terms for risk characterisation methods based on different methodological approaches can increase the transparency of the assessment and it is welcomed. However, the term HQ is used in same cases as equivalent to RQ. Efforts to harmonise risk characterization terminologies within and among the different guidelines should be encouraged.

For birds and mammals, earthworms and bees, however, the assessment includes an exposure estimation and the effect prediction based on dose-response tests. Exposure is estimated as the residue levels in/on food items (treated plants, granules, drops of spraying liquid) and estimations of daily food uptake (from general biological/ecological data); PECsoil, or the direct application rate, for vertebrates, earthworms and bees respectively (of DG SANCO, 2002). A new guidance document on the Risk assessment for Birds and Mammals, adopted by DG SANCO in 2002 presents an updated proposal for assessing the risk of pesticides on terrestrial vertebrates. The opinion of the SCP on the draft document was requested and is available. The new document includes significant changes for assessing this risk, and covers new aspects such as refined exposures and biomagnification potential.

The new guidance document on terrestrial ecotoxicology includes a tiered risk assessment for non-target terrestrial plants, which are defined as non-crop plants located outside the treatment area. The proposal includes a screening Tier 1 based on existing data, a quantitative Tier 2 that can be conducted either through deterministic or probabilistic methods, and a higher Tier 3 based on field studies.

HIGHER TIER RISK ASSESSMENT

Plant Protection Products: Environmental risk assessment procedures and scenarios

GROUNDWATER

Tier 1 assessment results in three possible outcomes: i.e. the model output may exceed 0.1 µg/l for all relevant scenarios, it may be less than 0.1 µg/l for all relevant scenarios, or it may exceed 0.1µg/l for some relevant scenarios and be less than 0.1µg/l for others. Substances falling withinthe first and the last mentioned possibilities can, nevertheless, still be considered for inclusion in Annex 1 if convincing higher Tier assessments results demonstrate acceptable use. The higher Tier assessment comprises both the use of specific scenarios / site specific data and data from lysimeter studies or field testing as model input. As for Tier 1, no comparison with effect data is needed since groundwater as such is to be protected. The Tier 2 and 3 can be summarized as given in the annexed scheme (DG AGRICULTURE, 1995).

SURFACE WATER

The general concept of higher Tier exposure assessment for surface water is given for Tier 2 – 4 in the scheme (modified from reference 2). The scheme has been proposed by the FOCUS group on surface water and is - so far – not adopted by the Scientific Committee on Plants.

"Tier 2 assumes surface water loading based on sequential application patterns taking into account the degradation of the substance between successive applications. Again the PECs are calculated and may be compared to the same and/or different toxicity levels for aquatic organisms. As with Tier 1, if the use is considered acceptable at this stage, no further risk assessment is required whereas an unacceptable assessment necessitates further work using a Tier 3 calculation. In Tier 3, more sophisticated modelling estimations of exposure are undertaken using a set of 10 scenarios .... representing 'realistic worst-case' situations for surface water within Europe. At this stage, the calculated PECs for each scenario are compared with relevant toxicity data and a decision made as to whether it is necessary to proceed to Tier 4 exposure estimation. Risk assessments using Tier 3 exposure estimation may incorporate higher-Tier toxicity data generated from micro- or mesocosm studies.

The final Tier 4 can be regarded as a higher-Tier exposure assessment step. This may include a variety of refinement options of different degrees of complexity covering, for example, refinement of fate input parameters, or regional and landscape-level approaches. By its nature, Tier 4 will be a 'case-by-case' process, depending on the properties of the compound, its use pattern, and the areas of potential concern identified in the lower Tier assessments. As such, it is not appropriate to make specific recommendations for the Tier 4 process. Rather, some guidance on the sorts of approaches that may be applied has been developed. It is conceivable that Tier 4 approaches would be used both for Annex 1 listing and for national registration purposes. For certain specific uses, Tier 4 approaches could also be useful for identifying safe uses at Member State level, for example if certain local or regional considerations mean that the lower-Tier, EU level assessments were overly conservative." [2]

TERRESTRIAL COMPARTMENT

As for the aquatic compartment, TER-values (see first para for figures) are used as triggers to proceed to further options that are refined exposure estimates, higher-tier-studies or re-evaluation of the risk considering magnitude, probability and ecological significance of the effects. (Recently, probabilistic approaches are being put forward especially focused on birds and mammals. These include the use of field observations on the time spent for foraging in treated crops/orchards, in order to specify the likelihood, type and duration of exposure (SSC, 2000)). The higher-tier-studies aim at (DGSANCO, 2002):

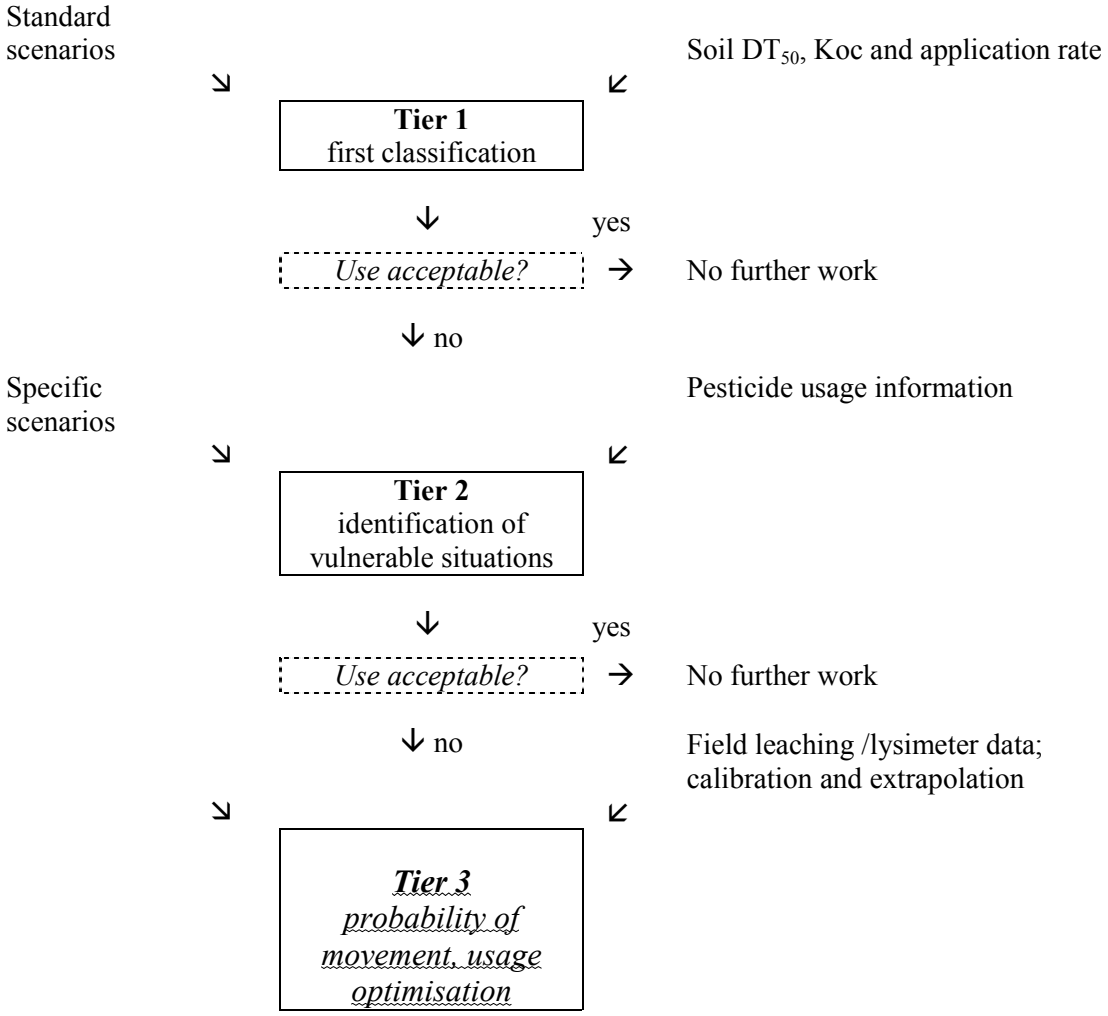
- generation of information on certain parameters of the risk assessment (e.g.: an avian acceptance test gives information on the palatability of potential food items which is used to refine the food consumption rate and thus the exposure estimate)
- investigating effects under more realistic conditions
- producing effects data for a wider range of species and cover inter-species interactions (example: model ecosystems or soil community tests in the field).

In general, the higher-tier-studies provide information on the exposure effects under more realistic conditions as compared to the laboratory studies, i.e. semi-field or field-tests. Some tests on the terrestrial compartment are standardized – such as the bee field tests. Most tests have to be planned on a case-by-case basis. Usually the results of the basic tests, together with the background information, are used to define the design and objective of the higher-tier-study.

As compared to the surface water, exposure pathways are more complex and multiple, and thus the procedure to proceed from one tier to another has to be more flexible in considering different aspects. As a consequence, “linear” tiered assessment schemes comparable to those elaborated are not sufficient.

Tiered assessment schemes: groundwater and surface water

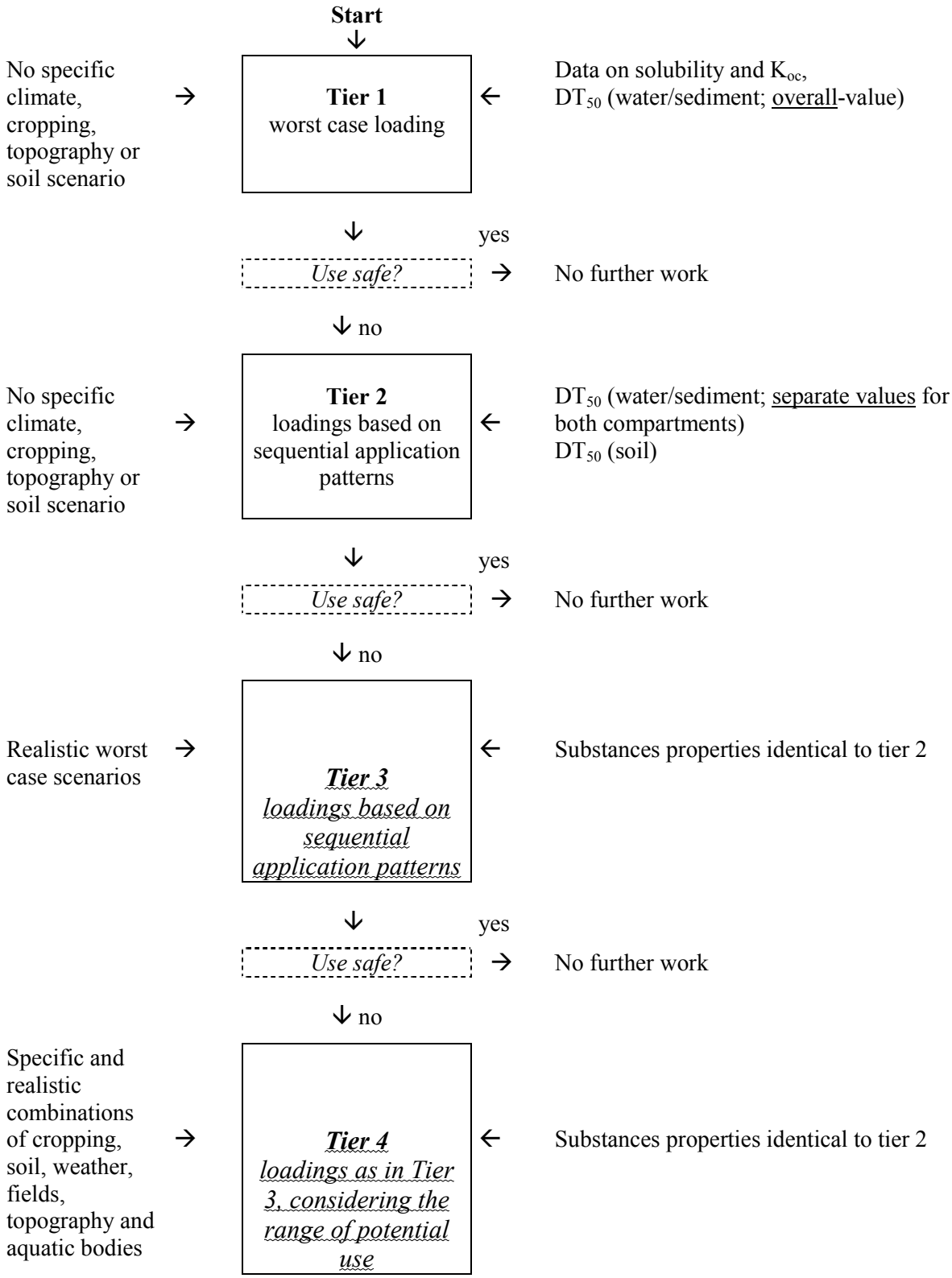
1. Groundwater



References:

1. FOCUS (2000) "FOCUS groundwater scenarios in the EU plant protection product review process" Report of the FOCUS Groundwater Scenarios Workgroup, EC Document Reference Sanco/321/2000, 197pp
2. Modelling environmental fate of plant protection products in the context of their Authorization within the European Union, Document 1694/VI/95, DG Agriculture

2. Surface Waters



References:

1. FOCUS (2001): FOCUS Surface Water Scenarios in the EU Evaluation Process under 91/414/EEC". Report of the FOCUS Working Group on Surface Water Scenarios, EC Document Reference SANCO/4802/2001-rev.0.xxxpp

3.3. PHARMACOLOGICAL VETERINARY MEDICINES.

The 'European Medicines Evaluation Agency' (EMEA), through its scientific committee, i.c. the Commitee on Veterinary Medicinal Products (CVMP), agrees Opinions on the applications submitted for the authorisation of new medicines through the centralised procedure. The opinions on quality, efficacy and safety of the products, once adopted by the committees are the basis of Decisions taken by the Commission. Disagreement between the Member States in the decentralised procedure (mutual recognition) leads to a referral to the CVMP for arbitration on any particular point in the assessment. The committee is also mandated to draft guidelines on behalf of the EU to elaborate testing requirements for the authorisation of medicines.
Member states appoint two independent experts to the CVMP, that can also rely on registered experts for additional expertise, such as the Working Group on Environmental Risk Assessment (AGHERA).
The environmental risk assessment of veterinary medicines is required by the Directive 2001/82/EC. The requirement covers eterinary products notified since January 1998. For the authorisation of a generic veterinary medicinal product no new environmental risk assessment is required, if the product is essentially similar to a medicinal product that has been already authorised The EMEA published guidance on the environmental risk assessment of veterinary pharmaceuticals (EMEA, 1997). Within this assessment two phases are discerned, Phase I and II. In 2000 a revised Phase I guideline was adopted following the international harmonisation process through the Veterinary International Conference on Harmonisation (VICH).
The assessment procedure for veterinary medicines takes the use of the product and the properties of the products into account in determining the scope of the assessment (phase I or II), the emission routes (slurry-soil; water; pasture) and data requirements. The VICH Phase I is depicted in the following flow diagram (denoted Figure 1); the EMEA Phase II for soil is depicted in the flow diagram in 'Figure 3" and in Annex I, and for aquaculture in the scheme denoted 'Figure 4'.

Phase I

The Phase I assessment targets the parent drug by following a total residue approach. Limited assessment is foreseen for substances with a generally accepted low hazard (e.g. vitamins, electrolytes) and with a presumed negligible emission and exposure levels. The exposure level that is considered irrelevant is quantified both for water and soil: 1 µg/L in effluent of fish rearing facilities and 100 µg/kg in soil amended with slurry, respectively. These triggers do not apply for veterinary medicinal products used to treat aquatic species in a non-confined facility and all ecto-and endoparasiticides used on pasture animals, which must undergo a Phase II assessment

In the Phase I guidance, emission is observed for three routes: emission to water through discharge from fish-rearing facilities in the case of fish medicines, emission to soil through manure or slurry in case of medicines applied to housed animals, and direct emission (urine and dung) into the environment in case of pasture animals. In the latter

situation (mainly concerning antiparasitics) a Phase II assessment is always warranted; in the former two situations, the triggers for water and soil, respectively, also determine all further risk assessment for other compartments, such as sediment and (ground)water. The provision of further guidance is intended and the EMEA has informed that work on this has already started.

Phase II

Further assessment in Phase II, as published by EMEA (1997), is risk based, as both exposure and effect are assessed. Phase II defines the substances and the environmental criteria that need to be assessed: substance persistence and bioaccumulation, and risks to soil, groundwater and surface water. Data requirements are specified in the guidance. Intrinsic substance properties (insecticidal activity) and a risk quotient for earthworms defines the extent of data requirements for grazing animals. Toxicity to grassland invertebrates and predators is also to be assessed (not shown in flow diagram). Whenever the soil is reached, persistence and sorption may trigger further standards and data requirements.

Phase II makes use of several acceptability triggers:

- risk ratios for species (plants, earthworms, micro-organisms)
- effect levels for single dose tests (arthropods and dung fauna)
- persistence levels for soil
- PEC/PNEC ratio for aquatic systems.
- Expert judgement for bioaccumulation.

Breaching these acceptability triggers leads to a further refinement of the risk assessment on the trigger of concern.

Degradation of the medicinal product in the target animal and/or during storage of manure, and/or in soil are aspects of the environmental risk assessment (PEC) that were mentioned in the Phase II guidance as information that may be considered in refining the PEC. The guidance does not provide the details on for example, standardisation of laboratory test results, repetitions in exposure, and time intervals, thus leaving these refinements to expert judgement. In Phase II all active ingredients and all metabolites formed >20% at metabolism or in environmental compartments are to be assessed. The guidance is unclear whether information on transformation (animal-slurry-soil-water) is compulsory or not.

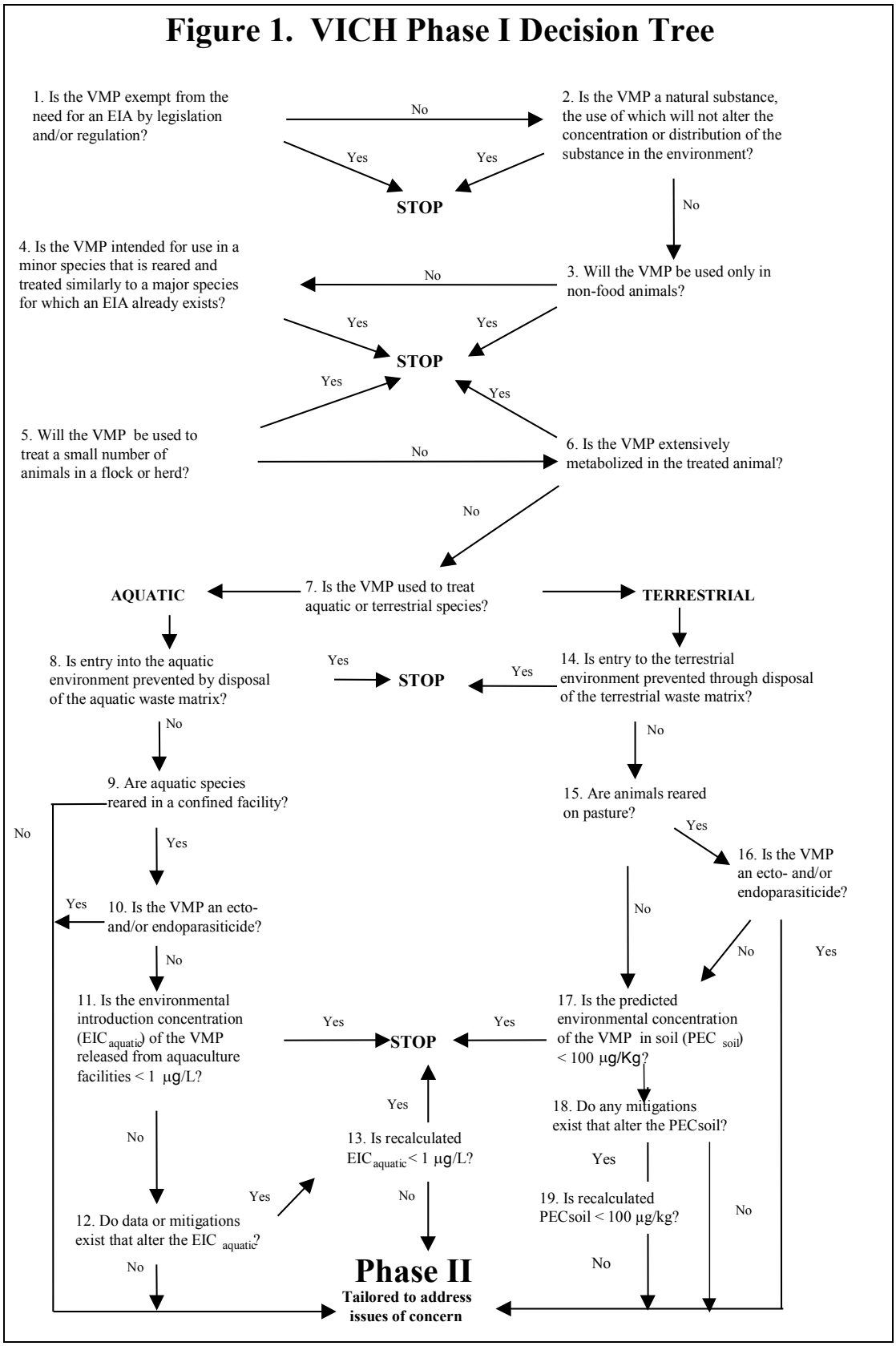
The VICH Phase I assessment does not seamlessly connect to the EMEA Phase II assessment. A VICH Phase II guidance document is expected to be completed in the near future and the CVMP AHGERA Group feels compelled to make sure that the VICH phase II guidance will be in compliance with existing EU guidance documents on the environmental risk assessment of other chemicals as much as possible.

Guidance on risk mitigation measures (to be included in the Summary of Product Characteristics) and on emission in the waste-stage of the product is not included in the guidance documents.

Guidance Documents:

- EMEA. Note for guidance: environmental risk assessment for veterinary medicinal products other than GMO-containing and immunological products. European Agency for Evaluation of Medicinal Products, Committee for veterinary medicinal products, EMEA/CVMP/055/96, 1997.
- VICH, 2000. Environmental Impact Assessment (EIAs) for Veterinary Medicinal Products (VMPs) - Phase I. CVMP/VICH/592/98-final.

Figure 1. VICH Phase I Decision Tree



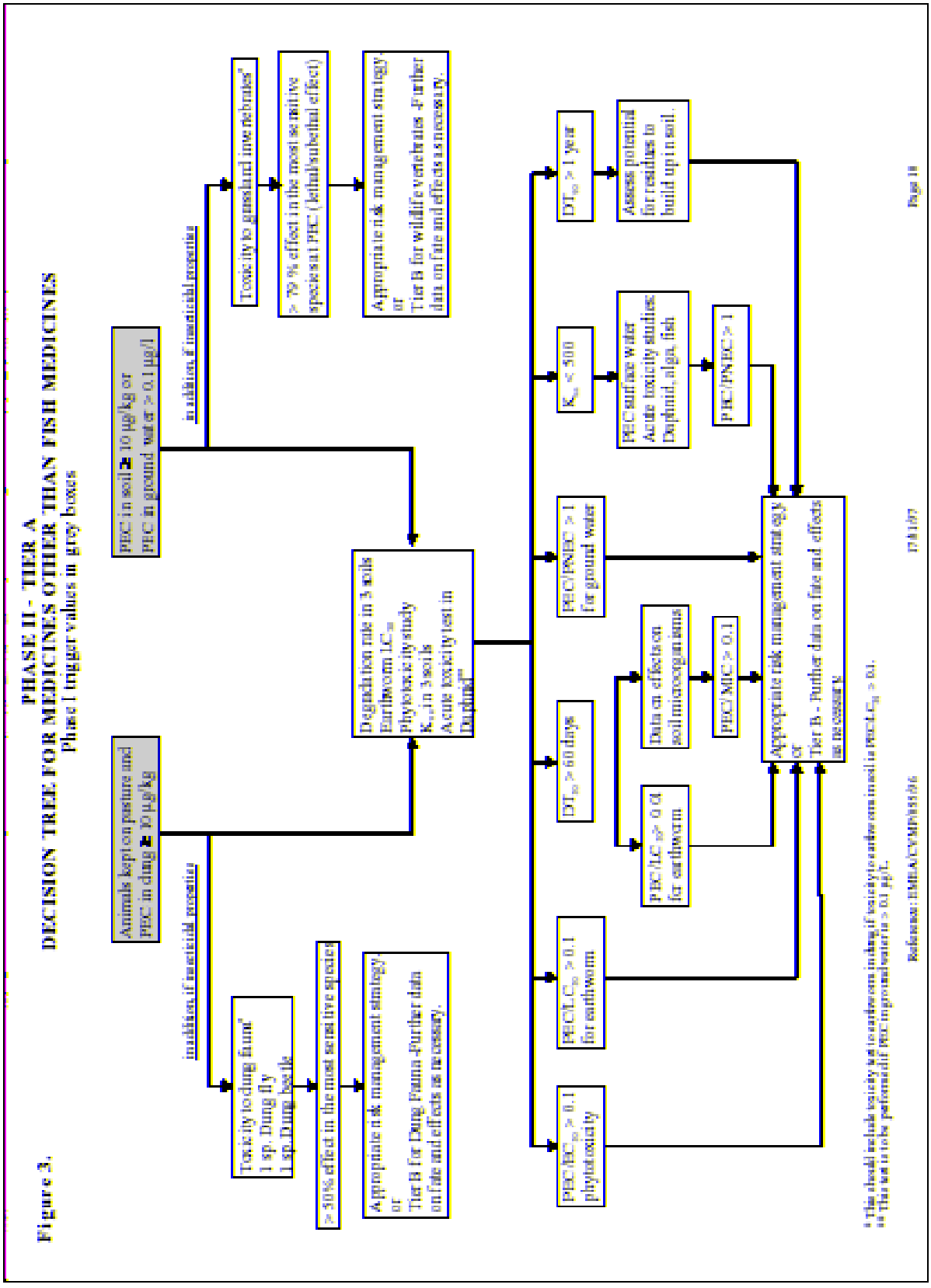
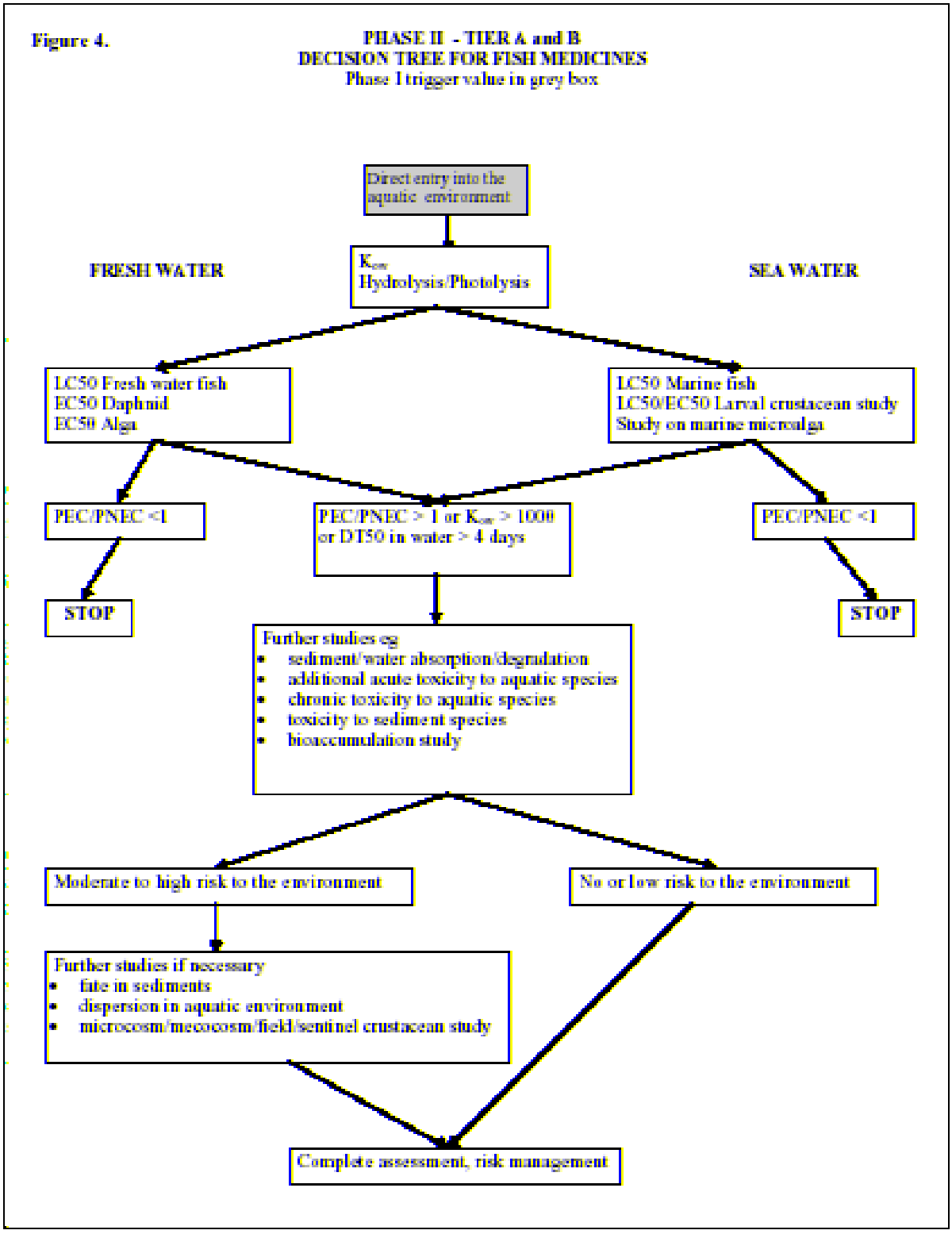

PHASE II - TIER A
DECISION TREE FOR MEDICINES OTHER THAN FISH MEDICINES
Phase I trigger values in grey boxes
Figure 3.
Animals kept on pasture and PEC in dung ≥ 10 µg/kg
PEC in soil ≥ 10 µg/kg or PEC in ground water ≥ 0.1 µg/l
in addition, if insecticidal properties
Toxicity to dung fauna* 1 sp. Dung fly 1 sp. Dung beetle
> 50% effect in the most sensitive species
Appropriate risk management strategy or Tier B for Dung Fauna -Further data on fate and effects as necessary.
Degradation rate in 3 soils
Earthworm LC50
Phytotoxicity study
Koc in 3 soils
Acute toxicity test in Daphnid*
Toxicity to grassland invertebrates*
> 79 % effect in the most sensitive species at PEC (lethal/sublethal effect)
Appropriate risk management strategy or Tier B for wildlife vertebrates -Further data on fate and effects as necessary.
PEC/LC50 ≥ 0.1 for earthworm
PEC/EC50 ≥ 0.1 phytotoxicity
DT50 > 60 days
PEC/PNEC > 1 for ground water
Koc < 500
DT50 > 1 year
PEC/LC ≥ 0.1 for earthworm
Data on effects on soil microorganisms
PEC/MIC > 0.1
PEC surface water Acute toxicity studies Daphnid, algae, fish
PEC/PNEC > 1
Assess potential for residues to build up in soil.
Appropriate risk management strategy or Tier B - Further data on fate and effects as necessary
* The should include toxicity to earthworms in dung if toxicity to earthworms in soil is PEC/LC50 > 0.1.
** The test is to be performed if PEC in ground water is > 0.1 µg/L
References: EMEA/CVMP/033/96
17/11/97
Page 18

Figure 4.



Therefore, a limited assessment is foreseen for substances with a generally accepted low hazard (vitamins, electrolytes), and with a presumed negligible emission and exposure levels (non-food animals or treatments for a reduced number of individuals). In addition, the procedure includes a set of triggers of exposure, where the decision of low risk is assumed without information on the ecotoxicological properties of the substance. The exposure level that is considered irrelevant is quantified both for water and soil for

antibiotics: 1 µg/L and 100 µg/kg, respectively. The CSTEE has questioned both, the use of exposure triggers without ecotoxicological information as part of the risk assessment of human and veterinary pharmaceuticals and the trigger values proposed in the guidance document (CSTEE, 2001) and indicated several alternatives for tiering the protocols other than exposure triggers. The assessment of both exposure and effects, for the active substance and relevant metabolites, is considered a key for a risk assessment process. An additional consequence of the use of these exposure triggers, is that the majority of the veterinary drugs are commercialised without a single ecotoxicological data. According to the information provided by EMEA, currently, phase II (the real environmental risk assessment comparing exposure and effect data) has been conducted only for 6 veterinary products, representing about 15% of the total number of products registered at the European level and about 25% when immunological products are excluded. No information has been provided on products registered through the Member States Mutual Recognition System, but checking the SPC (Summary of Products Characteristics) database, no ecotoxicological information has been found. Therefore, the evaluation of the levels of pharmaceuticals found in the environment cannot rely on the information provided by manufactures but only on the data produced by the scientific community.

Several authors have discussed risk assessment methodologies for veterinary pharmaceuticals, offering alternatives for the exposure assessment (Pablos et al., 1998; Montforts, Kalf et al.,1999; Halling-Sorensen, Jensen et al., 2001), the effect assessment (Römbke et al., 2001a; Lumaret and Errouissi, 2002), and discussing the general scientific and regulatory issues (Montforts, 2001; Römbke et al., 2001b; Montforts and De Knecht, 2002; Daughton and Jones-Lepp).

The concern on the environmental risk of pharmaceuticals (both for human and veterinary use) is currently receiving considerable attention, and relevant information is currently obtained from several on-going research projects. Drugs are, by definition, biologically active chemicals, and a large amount of information for setting the expected mechanisms of action on several ecological receptors can be obtained from the toxicokinetic and toxicodinamic properties, efficacy experiments, chemical structure and active sites, mammalian toxicology, etc. The incorporation of this information in the environmental risk assessment process represents a challenge that must be considered by the scientific community.

Other key aspect is the evaluation of the representativeness of the standard test and endpoints for these chemicals. For example, assessing the effects of antimicrobials on the soil microbial community using functional endpoints such as total respiration does not cover changes on biodiveristy, while other methods, such as the Pollution-induced community tolerance (PICT) (Salminen, et al., 2001; Berard and Benninghoff, 2001) could offer additional information. Similarly, some sulfanilamides are much more toxic for vascular aquatic plants than for the green algae employed in the standard tests (Pro et al., 2003) effect that could be associated to their structural similarity to some herbicides. Both aspects, currently investigated in the ERAVMIS (V EU R&D Framework Programme) research project, suggest the possibilities for including mechanistic and structural information in the risk assessment procedures.

3.4 FEED ADDITIVES

The environmental risk assessment of feed additives includes a tiered approach, based on two phases, that are closely related to the assessment of veterinary medicines.

Phase I is described in Commission Directive 2001/79/EC as a screening assessment of existing information with the purpose of determining whether or not a significant environmental effect is likely. However, this whole step focuses on exposure assessment, without consideration of data on the toxicity. Use patterns, and expected concentrations in manure, soil and groundwater determine the need for conducting Phase II assessment.

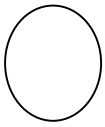
Phase II is sub-divided in two steps. Phase II-A is a lower tier assessment based on short-term data. Both aquatic and terrestrial compartments are considered, using three taxonomic groups for each compartment, fish, *daphnia* and algae for the aquatic; terrestrial plants, earthworms and soil miro-organisms for the terrestrial. It is assumed that the risk for terrestrial vertebrates is covered by the assessment of efficacy and risk for the target farm species. The toxicological information for the key species within each compartment is analysed and a PNEC value is derived by applying an adjustment factor to the most sensitive species. The recommended factor is 100 for both, aquatic and terrestrial organisms. Risk characterisation follows the PEC/PNEC comparison. The suggested acceptable levels for this comparisons range between 1 and 0.1. depending on the nature of the test result.
This phase also include some hazard identification steps, particularly for bioaccumulation and persistence in soil. If a hazard is identified, Phase II-B evaluation must be conducted independently of the PEC/PNEC estimations.

Phase II-B requires sublethal long-term studies. No specific triggers or guidance for risk characterisation is currently applied.

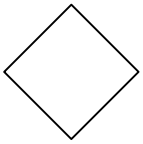
4. SCHEMATIC REPRESENTATION OF THE RISK ASSESSMENT PROCEDURES AND DECISION TREES

The conceptual model, analysis plan, and decision strategy for each group of chemicals is summarised in the following figures.

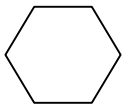
The following conventions have been used: Basic geometric figures represent the data inputs, establishing distinctions between exposure, effect and hazard identification data:



Exposure assessment



Effect assessment

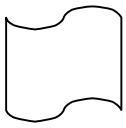


Hazard identification

In the case of hazard identification, the information can be specifically related to exposure or to effect conditions, and therefore, two symbols can be used to present a single data input step.

In addition, exposure assessment can be conducted at different levels within a single step, i.e., the general release on the environment (covering all compartments) is followed by specific assessment for soils, surface water, groundwater, etc. These cases are represented by a large circle/ellipse with several small circles inside is presented

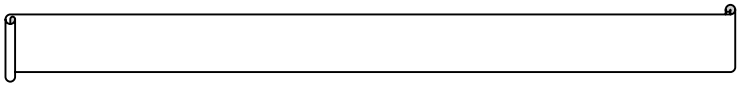
True risk characterisations, as comparisons of exposure levels and expected effects, are presented by the following symbol:



The terminology employed for the characterisation, as well as the covered risk, is presented. Standard terms include:

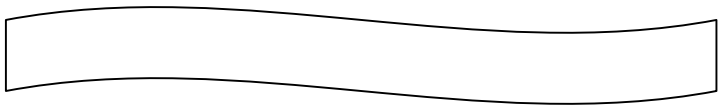
PEC: Predicted Environmental Concentration
PNEC: Predicted No Effect Concentration
TER: Toxicity Exposure Ratio
HQ: Hazard Quotient
EL: Effect Level

Decision steps are represented by the following symbol:



These decision steps appear at different point within the process. If conditions for acceptability are fulfilled, the process stops at this point. Therefore, the steps included under each decision step will only be conducted when the outcome of the decision is than an unacceptable risk cannot be excluded.

Higher tier assessment, based mostly on case-by-case evaluation without specific guidance or recommendations are represented by the following symbol:



It can cover exposure and/or effect refinement, higher tier studies including mesocosms or field studies as well as risk reduction measures.

Figures are presented in annex 1.

5. HIGHER TIER RISK ASSESSMENT

The current regulatory arena does not present clear guidance on acceptability in the case of environmental risk assessment conducted on the basis of higher tier information.

Both, the SCP and the CSTEE have acknowledged the use of higher tier assessments, either based on probabilistic exposure and/or effect estimations, or on the use of microcosms/mesocosms/field studies.

The use of species-distribution curves for the derivation of PNEC values and the use of probabilistic risk assessment have been considered valid and scientifically sound (i.e. **CSTEE Opinion on Cadmium. The Final Report by WS Atkins International Ltd. Based on: The Final Report (September 1998) & Additional Assessment September 1998): "Assessment of the risks to health and to the environment of Cadmium contained in certain products and of the effects of further restrictions on their marketing and use").** The advantages and disadvantages of these methods have been previously presented in this document.

The use of an uncertainty factor of 1 for field studies has been considered acceptable when the available information was considered to cover the most sensitive species/systems. (CSTEE **Opinion on "Risk assessment underpinning new standards and thresholds in the proposal for a daughter directive for tropospheric ozone"**). Specific factors for covering the remaining uncertainty should be applied if the available information does not cover all potential possibilities. Several factors, including among others the study design, relevance of assessed endpoints, realisms and representativeness of the studied conditions, are critical when reviewing field studies. Therefore, although field studies are higher tier tools, this categorisation does not necessarily imply that low uncertainty factors can be applied in all cases. Both, general guidelines (e.g. the TGD) and opinions of SCs (to include opinions of SCP when adopted) recognise the need for applying factors under a case-by-case basis when considering field studies.

The need for a higher tier risk assessment has been identified in certain cases (**CSTEE Opinion on the results of the Risk Assessment of HYDROGEN FLUORIDE**). The SCs have welcomed the application of case-specific assessments for analysing risks not covered by the guidance documents when the assessments were scientifically sound and presented in a transparent way, and have concluded that the lack of guidance in the technical documents cannot be used to justify that an assessment which is considered relevant is not conducted.

In the absence of clear regulatory guidance on acceptability, the SCs have adopted opinions based on the realistic risk: likelihood for relevant adverse environmental effects, considering the specific requirements established in the legal frameworks (e.g. the specific statements covered in the "unless" clauses for plant protection products) applying the best available scientific knowledge under the current "state of the art" for assessing ecological effects, expressing the risk and the associated uncertainty whenever possible, and avoiding opinions on acceptability and other management decisions.

6. UNCERTAINTY ASSESSMENT

Most environmental risk assessment procedures are based on quantitative comparisons between toxicity data and expected exposure levels. For lower tier assessment, regulations include the acceptability trigger, and therefore the uncertainty assessment is limited to a consideration of the data reliability, model uncertainty when relevant and the appropriateness of the proposed adjustment factor between laboratory toxicity results and expected exposure for assuming low risk.. In fact the use of larger or smaller adustement factors than those proposed, although allowed by most procedures, is rarely applied.

The exposure assessment is based on scenarios and models. For generic assessments, standard scenarios based on a set of assumptions are usually proposed. Screening scenarios usually represent worst-case conditions, while higher tier assessments present trends to more realistic evaluations. A similar situation is observed for models. The regulatory goals of model predictions are diverse and three groups of models can be identified based on their applicability: screening, primary and secondary models; or on their scale: local, regional or continental. Models are also classified according to their algorithmic design. Mathematical modelling approaches for estimating mass transfer and concentration in environmental compartments can be either deterministic or stochastic, and are either mechanistic (rate models) or functional/empirical (capacity models). Some characteristics are presented below:

- Screening models should be used to provide rapid prediction of the potential environmental fate of a compound. Primary models should provide a standardized approach to characterise substance behaviour and should permit rapid review of modelling submissions by regulators and help to ensure consistent regulatory decision making. Secondary models are appropriate for chemical and site-specific predictions. Secondary models might be applicable for higher tier assessments and will require calibration.
- A deterministic model uses a single set of assumed conditions taken from the range of conditions that can be present in reality. The practical use of the predictions depends on the nature and extent of the variability within the actual system. Several parameter values in current exposure models are selected from the stochastic distributions, e.g. pesticide residues on feed and drift values for repeated applications of pesticides.
- Stochastic models take the complete distribution of parameter values into account. With this probabilistic approach the full range of the resulting outcomes and the main sources of uncertainty are available for decision-makers. It is claimed that this approach may be useful for management purposes as it shows the information needed to refine the (deterministic) risk assessment.. These models are however not yet fully integrated in the regulatory risk approach for products: the acceptability of risk for pesticides, biocides, chemicals, medicines and feed additives is expressed in risk thresholds where safety factors account for uncertainty. The acceptability of risk is not (yet) expressed in terms of the probability of exceeding a certain threshold, in which case the uncertainty would be placed in the distribution,
- All models operate within certain dimensions (time units, distances and areas) on which the parameter values depend, and the type of model is not necessarily related to the spatial scale of the simulation. Local, regional and continental scales are

complementary to each other, as different processes can be modelled. However, within several frameworks only one scale of modelling is applied and comparative situations are handled differently (e.g. exposure of agricultural soil by fertilisers, veterinary medicines, feed additives, biocides, pesticides and sewage sludge).

- For diffuse non-point source emissions continental and regional modelling is warranted (e.g. chemicals and biocides), for foreseeable point-source emissions local modelling is preferred (e.g. pesticides, feed additives, medicines), together with regional models for long-range transport processes.

Addressing the uncertainty and variability associated with the scenarios and models is not easy. The European environmental conditions cover several ecoregions, from the Northern latitudes to the temperate Mediterranean area; therefore, a large variability for most parameters should be expected.
The parameter values in a model are considered representative for the range of rates for the modelled process within the selected area and interval in space and time. In general the variability of input parameters increases with the size of the area or duration for which the prediction is made.

In lower tier estimations variability is usually reduced to a fixed standard scenario. The rationale for the selection of parameters representing "European" conditions should be transparent.

Uncertainty represents a lack of knowledge about specific factors or parameters that characterise the physical system that is being modelled. In fact, these parameter values are fixed, but the actual value (or expected distribution for the value) cannot be determined accurately. Uncertainty can lead to inaccurate or biased estimates and can be reduced through further measurements with for instance a larger sample size, or an unbiased sample design. The use of more sophisticated modelling and analysis tools can also reduce uncertainty. The use of field measurements is an option in all frameworks. The design of a representative monitoring strategy and the final selection of representative data is imperative in order to validate or falsify the model predictions. Only in the case of the assessment of an ongoing activity, can real-time measurements replace model results.

- In exposure assessment uncertainty includes:
  - parameter uncertainty (e.g. measurement errors),
  - model uncertainty (e.g. uncertainty due to necessary simplifications or variability), and
  - scenario uncertainty (modelling scale, selection of emission and distribution routes, descriptive errors).

The comparison between the recommended application factors in the effect assessment for establishing a low risk assessment is not an easy task because the terminology and procedures vary for the different groups of chemicals.

Tables 1 and 2 present a summary of these comparisons, expressed as the ratios between the laboratory toxicity results and the expected exposure levels for assuming low risk

calculated for each assessment, provided in the CSTEE opinion on the terrestrial environment (CSTEE, 2000) with the additional inclusion of feed additives.

Table 1. Comparison of the adjustment factors between laboratory toxicity results and expected exposure levels for assuming low risk (called margins of safety in the CSTEE opinion) (ratio between toxicity and the expected exposure level) for the protection of terrestrial organisms employed in the environmental risk assessment of feed additives, veterinary medicines, industrial chemicals and pesticides.

Group	Exposure route	Timing	Adjustment Factor (Margin of safety*)			
			Feed Additives	Veterinary Medicines	Industrial chemicals	Pesticides
Vertebrates (birds and mammals)	Direct	Acute Chronic	Not considered	10 -	Not considered Not considered	10 5
	Secondary poisoning	Acute Chronic	Not considered	10 -	1000 100-**10**	10 5
Plants	Soil	Acute Chronic	100- >1000 -	10 -	1000 100-**10**	Not considered
Earthworms	Soil	Acute Chronic	100- >1000 -	10 or 100 depending on persistence in soil	1000 100-**10**	10 5
Bees	Oral Contact	Acute Acute	Not considered	Not considered	Not considered Not considered	5-17 5-1500
Other arthropods	Contact	Acute	Not considered	<1-1	Not considered	1-5
Soil micro-organisms	Soil	Acute Chronic	100- >1000 -	10 -	1000 100-**10**	1-5

Table 2. Comparison of the adjustment factors between laboratory toxicity results and expected exposure levels for assuming low risk (called margins of safety in the CSTEE opinion) (ratio between toxicity and the expected exposure level) for the protection of aquatic organisms employed in the environmental risk assessment of feed additives, veterinary medicines, industrial chemicals and pesticides.

Group	Exposure route	Timing	Adjustment factor (Margin of safety*)			
			Feed Additives	Veterinary Medicines	Industrial chemicals	Pesticides
Fish	Water column	Acute Chronic	100- >1000 -	100	1000 100-**10**	100 10
Invertebrates (Daphnia)	Water column	Acute Chronic	100- >1000 -	100 -	1000 100-**10**	100 10
Algae	Water column	Acute Chronic	100- >1000 -	100 -	1000 100-**10**	10 10
Aquatic plants	Water column	Acute	Not considered	Not considered	1000 100-**10**	10 10

*The term Margin of safety in Tables 1 and 2 is used by analogy with human risk assessment, representing the ratio between the toxicity endpoint (acute L(E)C50 or chronic NOEC) and the expected exposure level (short or long-term PEC). Numbers represents the values recommended for concluding low risk in the lower tier assessment.

It is clear that large differences between the adjustment factors for assuming low risk can be found among the different chemicals, particularly in the terrestrial compartment.

In order to address the uncertainty of the process, in addition to the adjustment factor, the amount and quality of the data must be considered. It is clear that the lowest adjustment factors are requested for pesticides, but it is also clear that the standard testing requirements for pesticides are much higher than for any other group of chemicals. Acute and chronic data on several taxonomic groups, requiring in some cases several species within the group, are basic requirements for pesticides. The opposite situation can be observed for veterinary medicines, where the ecotoxicitity tests are required only if the exposure triggers are exceeded, and even in these cases test requirements for the initial assessment are low.

In these lower tier assessments, the protocols also present different approaches for covering the uncertainty assessment related to data quality.

The least flexibility can be found in the assessment of pesticides. Both data requirements (a set of standard tests, which must be conducted under established protocols and GLPs) and acceptability triggers are fixed, and therefore the decision on acceptability is straightforward.

The greatest requirements for a transparent uncertainty assessment are observed for feed additives, where the acceptability trigger is expressed as a range instead as a single value. This situation forces the risk assessor to conduct a proper uncertainty assessment when the risk estimate falls within the rage.

Industrial chemicals can be considered in-between these approaches. Data availability and quality are not so well established, and use of the PNEC approach obliges risk assessors to consider an overall picture of the toxicological profile of the molecule. However, once a PNEC has been established, clear acceptability triggers are imposed.

The SCs have considered that the uncertainty assessment is a key element in the process even if the guidance includes specific triggers, and the level of uncertainty in the assessment should be presented in a transparent way.

The uncertainty analysis becomes the key issue in higher tier risk assessment. Although several workshops have been organised, the final conclusions still indicates the need for a case-by-case assessment. Two aspects require special attention within the uncertainty analysis: uncertainty on the ecological relevance of the observed effects, and uncertainty on the capability of the study(ies) to cover all relevant European conditions. Some proposals for addressing these issue are available. For example, Tarazona (1998) proposed to establish three main sources or types of uncertainty in ecological risk assessment. The epistemological uncertainty associated with the lack of knowledge on ecological functions and roles; the methodological uncertainty associated with the limitations in the available sources for producing relevant information; and the technical uncertainty associated with the reliability of the data.

Sources of uncertainty in the threshold assessment and potential solutions. From Tarazona (1998)

SOURCES	CLASSICAL SOLUTIONS	OTHER SOLUTIONS
CONCEPTS: lack of definition on ecotoxicological criteria and/or on the relevance of	Safety factors Field studies and validations	Probabilistic approaches. "Mode of Action" biomarkers Prediction+Monitoring Assessment

ecological endpoints		
METHODS: limitations in: Test species Endpoints	selection of "target" taxa multispecies tests	Δ number of test species Δ number of exposure route Cost/effective tests Multivariate analysis Biomarker-based endpoints
TECHNIQUES: Problems of: Reproducibility Data analysis	Standardisation GLP, intercalibration EC50, NOEC, LOEC	Biotechnological Applications Statistical improvement Time-concentration-effect assessments Modelling

Several proposals for evaluating the uncertainty in risk assessment are available (e.g. Helton and Davis, 2002; Pate-Cornell, 2002) which obviously may also be suitable for risk associated to environmental issues (von Stackelberg, 2002; Johnston, 2002).

The adoption of procedures for expressing the uncertainty in the risk assessment is strongly recommended, and the efforts for harmonizing the evaluation and expression of the uncertainty, developed by other fora such as NIST (Taylor and Kuyatt, 1994), although not directly intended for environmental risks, might be highly valuable

7. OPINIONS ON GENERAL GUIDANCE DOCUMENTS

Several Scientific Committees, including SCP, SCAN and CSTEE have adopted several opinions on guidance documents related to environmental risk assessment of pesticides, general chemicals, feed additives, biocides and pharmaceuticals.

The request from the Commission services has not been consistent, and therefore, it is not easy to synthesize the set of general conclusions from these requests.

The SCP and the CSTEE have been requested to produce opinions on the scientific basis of the proposals presented to them. However, the SCAN was requested to produce a guidance document on the risk assessment of feed additives, which was subsequently submitted to the Commission for adoption.

Co-operation among the different Scientific Committees, through the participation of members of one Committee as external experts in Working Groups created under the umbrella of a different Committee, is being used in various cases, particularly to cover environmental issues. The CSTEE activities have covered a broad spectrum of chemicals, either directly, through consultations on guidance documents on environmental risk assessment of industrial (general) chemicals, biocides and human pharmaceuticals, or in co-operation with SCP and SCAN working groups covering pesticides and feed additives. In addition, an internal initiative from the CSTEE produced an opinion on the effect and risk assessment for terrestrial environments, which started with a comparison among procedures for different groups of chemicals.

Three main conclusions can be made from an epistemological assessment of the opinions produced by the different committees.

1. There is a general agreement that the environmental exposure assessment must be related to the use pattern and possibilities for environmental releases during the life cycle of the substance. Distinctions among intended and non-intended releases are obvious, but not sufficient for a proper assessment of the environmental exposure. The need for specific scenarios for different groups of chemicals and even for different uses within the same category should be supported. However, it has also been recognised that the scenarios should be harmonised for related uses among different chemical categories: good examples are environmental releases of veterinary medicines, feed additives and some biocides associated to the use of contaminated sludge as soil fertilizer.
2. The use of environmental exposure triggers, currently accepted for veterinary medicines and feed additives and proposed for human pharmaceuticals, as well as for the groundwater risk assessment in the case of pesticides, has been strongly criticized by some committees. The problem arises from the assumption of the equivalence between low exposure level and low risk, when there is no information on the ecotoxicity of the substance. There is evidence that certain substances can be highly toxic to different species at concentrations clearly below the proposed exposure triggers, and therefore this approach is not justified.
3. The lack of harmonization among protocols is particularly significant for the terrestrial environment. The WG realises that, this fact has been already addressed in a specific CSTEE opinion, and therefore will not be subjected to an in-depth discussion in this general paper.

8. PROPOSALS FOR HARMONISATION.

The protocols for environmental risk assessment do not have the advantage of the large experience associated to Human Health risk assessment. Nevertheless, they suffer from the same problem of a lack of harmonisation at the regulatory and scientific levels.
The WG considers that the need for specific guidance and scenarios required for certain assessments should not be used to justify the lack of harmonization. Efforts for harmonizing the protocols and the opinions of the scientific committees should be encouraged.

Two different groups of proposals are presented. The first group focuses on the scientific basis for the assessment. The second, on the format and terminology.

1. Harmonisation of the scientific basis of the environmental risk assessment

Assessment of the current guidelines indicates the existence of large differences at all levels of the assessment, but particularly at the lower tiers.

- Exposure scenarios and models for the same compartment (e.g. agricultural soil exposed through the use of fertilizers) show large differences in both the definitions, and the default values. For example, different default values for the

bulk density of European agricultural soils, or for the depth of the arable soil layer, are used in different guidelines.

- The effect assessment is probably the best harmonized, particularly regarding aquatic organisms. However, significant differences are observed in the use of QSARs, extrapolation of data, use of mammalian toxicity data (initially designed to support the Human Health assessment), or the terrestrial compartment in general. Certain assessments use toxicity tests designed on the basis of the expected level of exposure (e.g. the application rate). The WG strongly recommends moving to dose/response toxicity tests for all species.
- The risk characterization, at the lower tier level, is basically a risk quotient assessment based on the direct comparison between the toxicity observed in single-species laboratory tests and the expected environmental concentration. However, the margins of safety applied to these quotients can differ by orders of magnitude. The methodologies for the assessment also involve large differences, i.e., grouping or not the different taxonomic groups selected as key species for a particular compartment.
- The use of fixed exposure triggers is deployed for certain chemicals, but it cannot be supported from a scientific basis, as a risk assessment is in all cases a comparison of exposure and effects.

The WG suggests two different measures for reducing this lack of harmonization:

1. On the short term, an in-depth revision of the different protocols for environmental risk assessment. The information presented in the guidelines is also variable, and specific details are not always mentioned. Therefore, it is strongly recommended to conduct this revision considering also the risk assessment reports for a selected number of chemicals representing the different groups.
2. On a medium term, more research on the scientific basis of environmental risk assessment is required. Significant efforts are curretly on going, covering ecological concepts (Forbes and Calow 2002b ; Forbes et al., 2001); models for understanding the chemical-organism-environment interaction (Paquin et al., 2002) ; or conceptual models for specific compartments (Tarazona et al., 2002 ; Tarazona and Vega, 2002). These efforst should be reinforced, e.g. through the EU research programmes.

The use of different ecological receptors and adjustment factors by different regulatory protocols is perfectly acceptable as the final decision on risk acceptability does not only consider the scientifically based assessment but also the protection goals, cost/benefit assessment, and a large long of issues related to risk management. However, the scientific basis for the extrapolation of laboratory data to the magnitude and likelihood for ecological effects, should be as much harmonised as possible, allowing a better understanding of the realistic risk and the uncertainty associated to each methodological approach.

2. Harmonisation of opinions: definitions, format, and structure of the conclusions.

The WG has identified a number of differences that are not related to the scientific basis but to the procedure and regulatory definitions.

The WG considers that all these differences present a large obstacle for understanding the basic processes of environmental risk assessment. The transparency of the assessments, including the opinions of the scientific committees suffers from this lack of normalization. For example, the risk assessment based on PEC/PNEC ratios or on TERs has exactly the same meaning: acceptability is based on the use of an adjustement factor for comparing toxicity versus expected exposure. However, the use of different terminology, trigger definitions, structure and format creates confusion among users of specific field when trying to understand the process described for other fields.

The WG considers that these aspects can be easily harmonized, both for the protocols and for their use by the scientific committees. This harmonization will increase the transparency and the feasibility for risk communication.

Some initiatives for harmonisation have been implemented already. A good example appears in the procedure for environmental risk assessment of feed additives. Although the basis for the protocol is the guidance document on veterinary medicines, a single methodology for risk characterisation is proposed. In fact, SCAN recommends use of the EMEA document on environmental risk assessment of veterinary medicines as the starting point for the proposal, but harmonising the procedures for risk characterization following the TGD for industrial chemicals. As a result, all risk characterizations for feed additives are based on the same approaches PEC/PNEC ratios, providing a higher consistency that the assessment of pesticides or veterinary medicines which use at least three terms for risk characterisation.

Finally, the outcome of the risk assessment must be presented in a clear and transparent way. It is essential to give public access not only to the final conclusions of the risk assessment but to the data used for estimating exposure, effects and the final risk characterisation. Summaries listing the data validated and used for the assessment, such the list of endpoints prepared for Plant Protection Products, are very useful.

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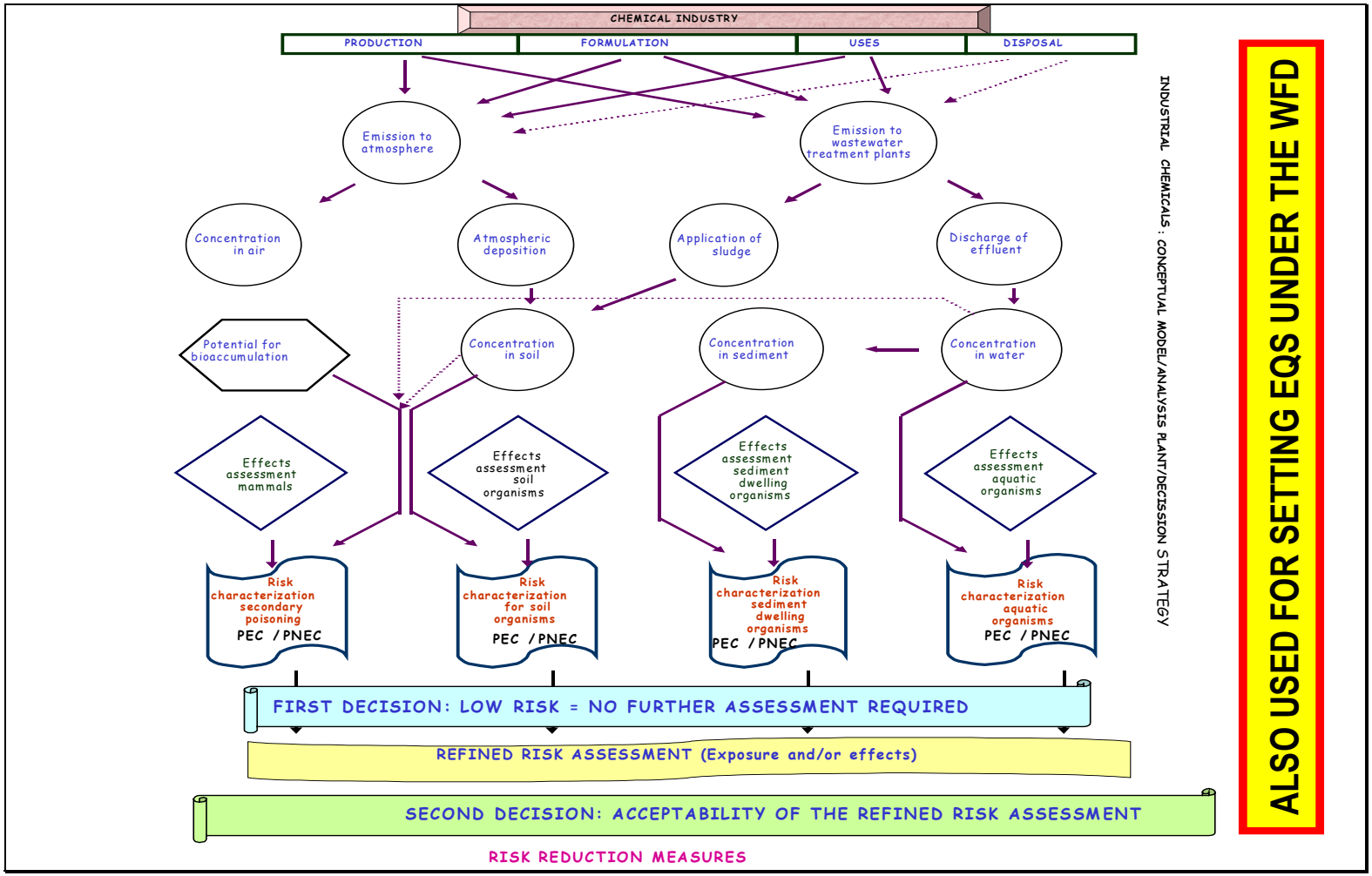
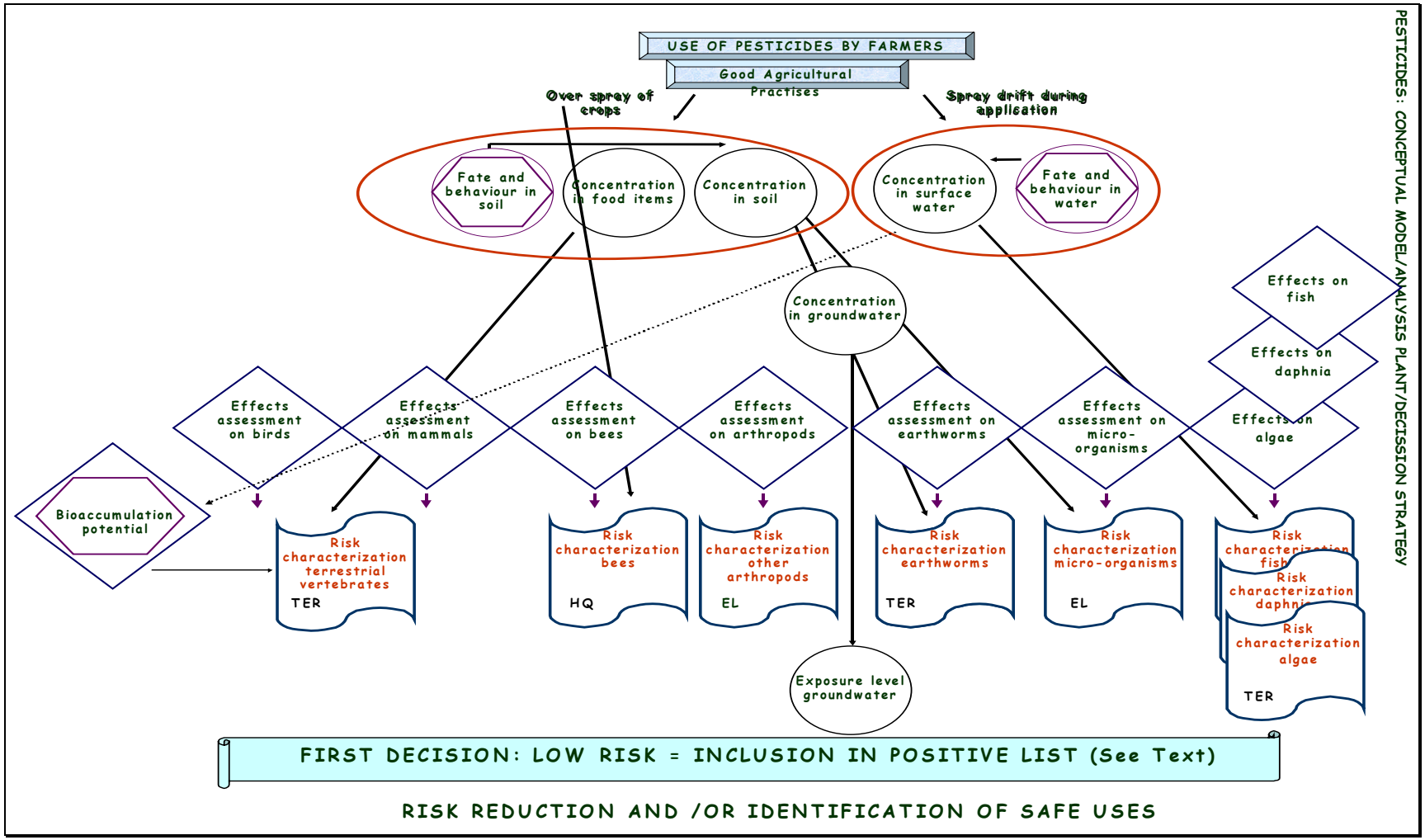
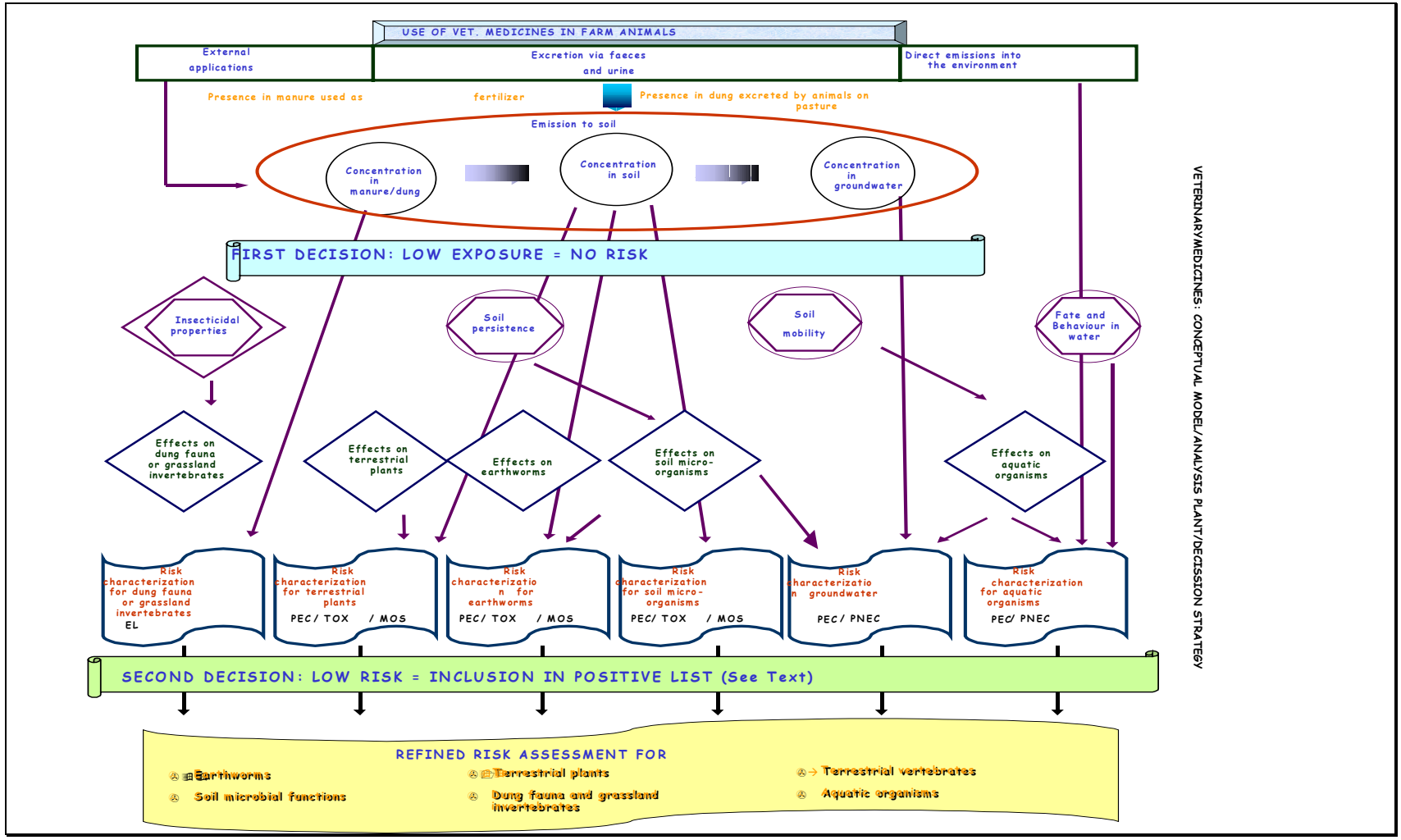
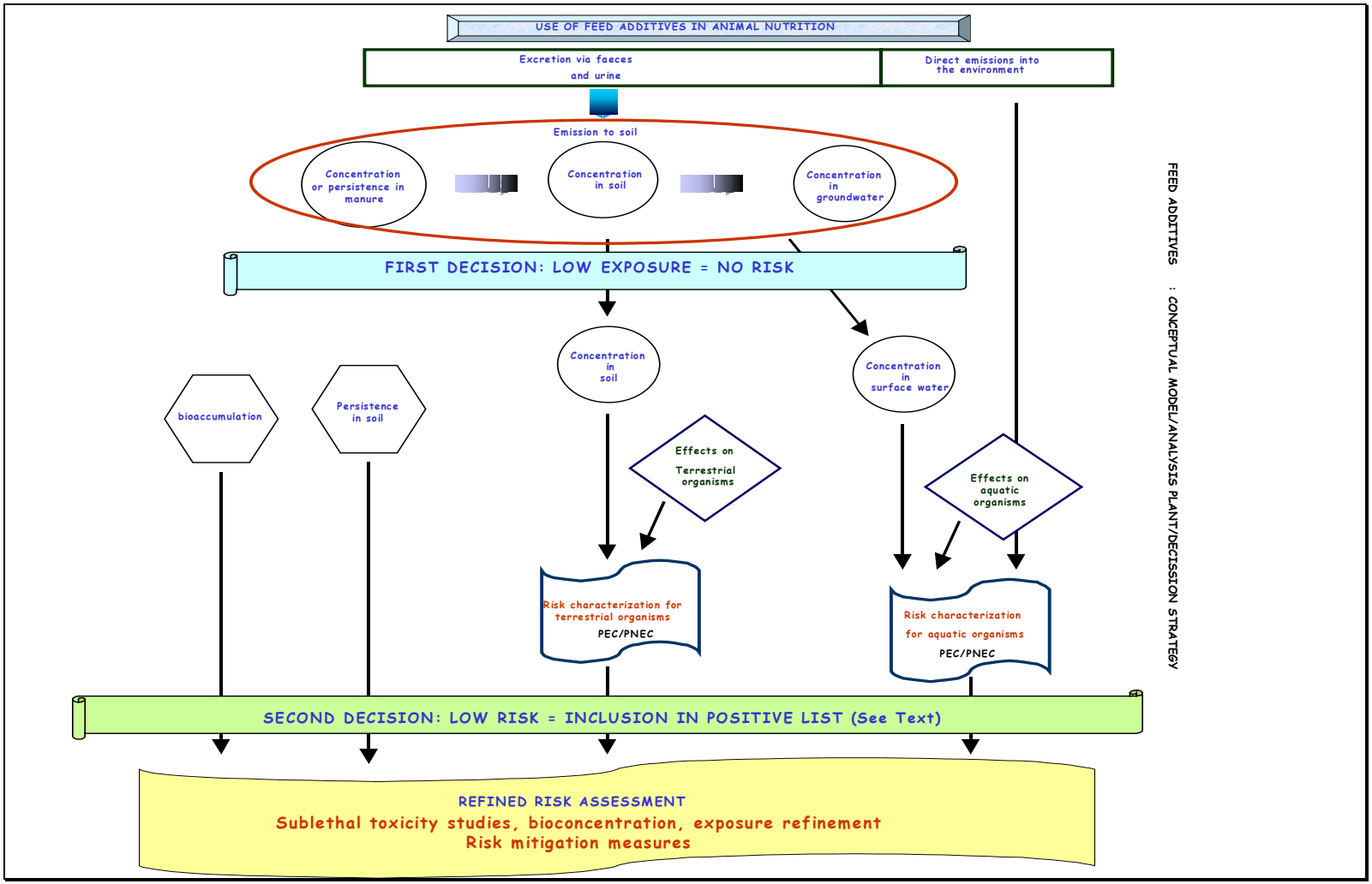
The SSC also thanks the contribution of those experts and institutions that contributed with comments to the preliminary report during the public consultation procedure.

ANNEX 1


CHEMICAL INDUSTRY
PRODUCTION
FORMULATION
USES
DISPOSAL
Emission to atmosphere
Emission to wastewater treatment plants
Concentration in air
Atmospheric deposition
Application of sludge
Discharge of effluent
Potential for bioaccumulation
Concentration in soil
Concentration in sediment
Concentration in water
Effects assessment mammals
Effects assessment soil organisms
Effects assessment sediment dwelling organisms
Effects assessment aquatic organisms
Risk characterization secondary poisoning PEC / PNEC
Risk characterization for soil organisms PEC / PNEC
Risk characterization sediment dwelling organisms PEC / PNEC
Risk characterization aquatic organisms PEC / PNEC
FIRST DECISION: LOW RISK = NO FURTHER ASSESSMENT REQUIRED
REFINED RISK ASSESSMENT (Exposure and/or effects)
SECOND DECISION: ACCEPTABILITY OF THE REFINED RISK ASSESSMENT
RISK REDUCTION MEASURES
INDUSTRIAL CHEMICALS : CONCEPTUAL MODEL/ANALYSIS PLANT/DECISSION STRATEGY
ALSO USED FOR SETTING EQS UNDER THE WFD


PESTICIDES: CONCEPTUAL MODEL/ANALYSIS PLANT/DECISSION STRATEGY
USE OF PESTICIDES BY FARMERS
Good Agricultural Practises
Over spray of crops
Spray drift during application
Fate and behaviour in soil
Concentration in food items
Concentration in soil
Concentration in surface water
Fate and behaviour in water
Concentration in groundwater
Effects assessment on birds
Effects assessment on mammals
Effects assessment on bees
Effects assessment on arthropods
Effects assessment on earthworms
Effects assessment on micro-organisms
Effects on fish
Effects on daphnia
Effects on algae
Bioaccumulation potential
Risk characterization terrestrial vertebrates
TER
Risk characterization bees
HQ
Risk characterization other arthropods
EL
Risk characterization earthworms
TER
Risk characterization micro-organisms
EL
Risk characterization fish
Risk characterization daphnia
Risk characterization algae
TER
Exposure level groundwater
FIRST DECISION: LOW RISK = INCLUSION IN POSITIVE LIST (See Text)
RISK REDUCTION AND /OR IDENTIFICATION OF SAFE USES


USE OF VET. MEDICINES IN FARM ANIMALS
External applications
Excretion via faeces and urine
Direct emissions into the environment
Presence in manure used as fertilizer
Presence in dung excreted by animals on pasture
Emission to soil
Concentration in manure/dung
Concentration in soil
Concentration in groundwater
FIRST DECISION: LOW EXPOSURE = NO RISK
Insecticidal properties
Soil persistence
Soil mobility
Fate and Behaviour in water
Effects on dung fauna or grassland invertebrates
Effects on terrestrial plants
Effects on earthworms
Effects on soil micro-organisms
Effects on aquatic organisms
Risk characterization for dung fauna or grassland invertebrates EL
Risk characterization for terrestrial plants PEC/ TOX / MOS
Risk characterizatio n for earthworms PEC/ TOX / MOS
Risk characterization for soil micro-organisms PEC/ TOX / MOS
Risk characterizatio n groundwater PEC/ PNEC
Risk characterization for aquatic organisms PEC/ PNEC
SECOND DECISION: LOW RISK = INCLUSION IN POSITIVE LIST (See Text)
REFINED RISK ASSESSMENT FOR
Earthworms
Soil microbial functions
Terrestrial plants
Dung fauna and grassland invertebrates
Terrestrial vertebrates
Aquatic organisms
VETERINARY MEDICINES: CONCEPTUAL MODEL/ANALYSIS PLANT/DECISSION STRATEGY


USE OF FEED ADDITIVES IN ANIMAL NUTRITION
Excretion via faeces and urine
Direct emissions into the environment
Emission to soil
Concentration or persistence in manure
Concentration in soil
Concentration in groundwater
FIRST DECISION: LOW EXPOSURE = NO RISK
Concentration in soil
Concentration in surface water
bioaccumulation
Persistence in soil
Effects on Terrestrial organisms
Effects on aquatic organisms
Risk characterization for terrestrial organisms PEC/PNEC
Risk characterization for aquatic organisms PEC/PNEC
SECOND DECISION: LOW RISK = INCLUSION IN POSITIVE LIST (See Text)
REFINED RISK ASSESSMENT
Sublethal toxicity studies, bioconcentration, exposure refinement
Risk mitigation measures
FEED ADDITIVES : CONCEPTUAL MODEL/ANALYSIS PLANT/DECISSION STRATEGY