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The Assessment of Persistency and Bioaccumulation in the Pesticide Registration Frameworks within the OECD Region

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Series on Pesticides

No. 25

The Assessment of Persistency and Bioaccumulation in the Pesticide Registration Frameworks within the OECD Region

Environment Directorate
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT
Paris, January 2005

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ABOUT THE OECD

The Organisation for Economic Co-operation and Development (OECD) is an intergovernmental organisation composed of 30 industrialised countries in North America, Europe and the Pacific. The OECD works to co-ordinate and harmonise government policies, address issues of mutual concern, and respond to international problems.

The Pesticide Programme was created in 1992 within the OECD's Environmental Health and Safety Division to help OECD countries:

- harmonise their pesticide review procedures,
- share the work of evaluating pesticides, and
- reduce risks associated with pesticide use.

The Pesticide Programme is directed by the Working Group on Pesticides, composed primarily of delegates from OECD Member countries, but also including representatives from the European Commission and other international organisations (*e.g.* United Nations Food and Agriculture Organization, United Nations Environment Programme, World Health Organization, Council of Europe), and observers from the pesticide industry and public interest organisations (NGOs).

In addition to the **Series on Pesticides**, the Environment, Health and Safety (EHS) Division publishes documents in five other series: **Testing and Assessment**; **Good Laboratory Practice and Compliance Monitoring**; **Risk Management**; **Harmonization of Regulatory Oversight in Biotechnology**; and **Chemical Accidents**. More information about the Environment, Health and Safety Programme and EHS publications is available on the OECD's World Wide Web site (see next page).

This publication was produced within the framework of the Inter-Organization Programme for the Sound Management of Chemicals (IOMC). It was approved for derestriction by the Joint Meeting of the Chemicals Committee and the Working Party on Chemicals, the governing body of the Environment, Health and Safety Division.

The Inter-Organization Programme for the Sound Management of Chemicals (IOMC) was established in 1995 by UNEP, ILO, FAO, WHO, UNIDO and the OECD (the Participating Organizations), following recommendations made by the 1992 UN Conference on Environment and Development to strengthen co-operation and increase international co-ordination in the field of chemical safety. UNITAR joined the IOMC in 1997 to become the seventh Participating Organization. The purpose of the IOMC is to promote co-ordination of the policies and activities pursued by the Participating Organizations, jointly or separately, to achieve the sound management of chemicals in relation to human health and the environment.

FOREWORD

Following the publication of the report ***Persistent, Bioaccumulative and Toxic Pesticides in OECD Member Countries – Results of Survey on Data Requirements and Risk Assessment Approaches*** (EHS Publication, Series on Pesticides, No. 15), the Netherlands agreed to take the lead on carrying out an examination of member country case studies to: (i) establish the capacity of different member country risk assessment and decision schemes to identify persistent and bioaccumulating substances; (ii) establish the capacity of the decision making process to take persistence and bioaccumulation into account; and (iii) establish the influence of the assessors' subjectivity to raw data interpretation and selection.

The report ***Case Study on the Assessment of Persistency and Bioaccumulation in the Pesticide Registration Frameworks in OECD Countries*** contains the results of case study on persistent (P) and bioaccumulative (B) pesticides in OECD countries. The objectives of the survey were to: (i) establish the differences in identifying P and B substances; (ii) establish the differences in taking persistency and bioaccumulation into account in the decision-making process; and (iii) establish the role of assessors on data interpretation and data selection. The result of the PB case study led to recommendations for further harmonisation in the following areas: (1) Risk assessment methodologies for bioaccumulation; (2) Uncertainty in higher tier risk assessments; (3) Ways of addressing bound residues in assessments; (4) Use and interpretation of anaerobic degradation data; (5) Criteria for validity of field studies; (6) Use of data: presentation, selection, transformation and handling; (7) Applicability of persistency criteria to water and sediment compartment; (8) classification schemes; and (9) Training of assessors.

The OECD Working Group on Pesticides recommended that this report be forwarded to the Joint Meeting of the Chemical Committee and Working Party on Chemicals, Pesticides and Biotechnology, for consideration as an OECD publication. The Joint Meeting agreed that it should be made available to the public. It is published under the authority of the Secretary-General of the OECD.

Acknowledgement

The first draft of this document was prepared by Mark Montforts, RIVM, Netherlands. The final draft incorporated comments received from Australia and Germany.

The author wishes to thank all who responded to the survey questionnaire, which has made possible the drafting of this report.

EXECUTIVE SUMMARY

This report contains the results of an analysis of member countries' case studies concerning persistent and bioaccumulative pesticides in OECD Member countries that were conducted in 2003, with the following objectives:

- establish the differences in how member countries identify persistent (P) and bioaccumulating (B) substances as such
- establish the differences in how member countries take persistence (P) and bioaccumulation (B) into account in the decision making process
- establish how the assessors' subjectivity influences data interpretation and data selection
- take all information provided into account to formulate recommendations to stimulate harmonisation of data selection, hazard/risk assessment, and decision making.

Case study

The case studies considered two data sets and a list of questions with the following situation in mind. A producer applies for a marketing authorisation for a product that qualifies as a plant protection product. The environmental risk assessment then is performed by a qualified environmental scientist that targets the product and the intended use. The decision on marketing authorisation is taken by a board of (scientists mandated by) regulators. One data set would represent a persistent and bioaccumulating substance, which served as a positive control to the risk assessment and decision making systems in the member countries. The other data set would be more of a borderline case, where data interpretation and data selection strongly influence the risk assessment and decision-making.

The questionnaire, on which the case studies were based, invited the country participants to address essential steps in the assessment of PB criteria, drawing from their expert knowledge and the underlying documentation provided by their own organisation.

The case studies generated a vast amount of information on decision making, risk assessment, risk classification, and data treatment. The following questions were chosen to address and compare the information:

- Is the registration framework capable of deciding on Persistency and Bioaccumulation (PB) as independent qualities?
- Are the criteria behind the regulatory decisions harmonised?
- Is the same information used to address these criteria?
- Are persistency and bioaccumulation equally weighed in different environmental compartments?

PB identification

Clearly there are different approaches to the classification of substances and the subsequent use of PB and Toxicity (T) information in decision making. Registration frameworks in all countries are capable of identifying Persistency and Bioaccumulation as important aspects of the substances, which merit special consideration. The registration frameworks can even decide on Persistency and Bioaccumulation (PB) as independent qualities, as five out of fifteen participating countries apply cut-off values for persistency in soil and/or for bioaccumulation. Three of these countries are EU-member states and have imposed national legislation or policy making for higher-tier assessments, supplementary to the implementation of the 91/414/EEC Directive. One additional EU country indicated that it would apply the criteria of the Stockholm Convention when ratified.

Classification

From the case study results it appears that there are no harmonised agreements on classification: what is actually classified, what information is needed to do so, and under what standard conditions should the data be judged?

Classification is often done per compartment (soil, water, and air), in some cases on the basis of compound-matrix combinations, and different standards are applied. Some countries label the pesticide as persistent on the basis of properties of either active ingredient, its isomers or the metabolites. Other countries refrain from this general label and classify the particular isomer as persistent, some even specifically in conjunction with a compartment or a (presumably representative) compartment property (e.g. soil type, pH). Bound residue formation and mineralisation were not always addressed as parameters for persistency. In one country, these properties are explicitly weighed with degradation rate to find a persistency classification. The trigger values for classifications differ. Some countries apply the Uniform Principles triggers from the EU Directive 91/414/EEC, some use additional international agreements published by international bodies (ECB, UNEP, UN ECE LRTAP), and other do not use fixed triggers.

Hazard based approaches

One major difference noted between countries is the extent to which they are confident with current risk assessment practices. Thus, there seems to be a scale from (on the one hand) the view that reasonably safe decisions can be taken also for PB-substances based on current risk based methodology, to (on the other hand) the view that there is a need for a "safety net" (or upper limit, cut-off criterion) for PB-substances since the uncertainty in risk assessment is too large for these substances to allow safe enough decisions to be taken.

The Netherlands and Japan applied a quantitative cut-off value for soil persistency, but not for other compartments[1]. Norway and Denmark applied quantitative cut-off values both for soil persistency and for bioaccumulation in decision making. Sweden decided on persistency in combination with bioaccumulation, after the 91/414/EEC triggers are surpassed, using the criteria of the Stockholm Convention and UN ECE LRTAP Convention as guidance. In Australia, Germany, Sweden, Switzerland, the Slovak republic and USA, the PB-classification triggers the need for complementary risk information: on residues in succeeding crops, on exposure, on secondary poisoning, on biomagnification, or on (un)certainties in toxicity. When looking at the PB criteria for new and existing substances it is remarkable that persistency in sediment is used, and not in soil, whereas for registration of pesticides in the EU, the situation is the opposite. Germany is an exception: it applies, for classification, the triggers for soil also to sediment. Germany will apply the Stockholm convention for decision-making, after ratification. However, PB criteria have not been used by Germany as cut-off criteria in the authorisation procedure for plant protection products.

Decisions on the reference compound

For the reference compound, the exposure and toxicity profile was unfavourable enough not to neglect the PB classification in those countries without cut-off values. Australia and Slovakia supported authorisations. Australia would support authorisation for the *single* application to wheat, in view of the demonstrated lower persistence in warmer soils[2], with an appropriate buffer zone to minimise

[1] The trigger applies to inorganic compounds as well.

[2] However, no decision was reached in respect of the *multiple* applications to sugar beet or pome fruit, pending further information and consideration.

contamination of the aquatic compartment. Slovakia would only support applications to the soil types that were the least persistent in the laboratory.

Slovenia and Germany would await a soil accumulation study before deciding on authorisation. Japan requested a study on residues in succeeding crops. Switzerland stated that the only reason to consider a substance with these characteristics may be its (important) advantages to control some problems in plant protection, e.g. for resistance management.

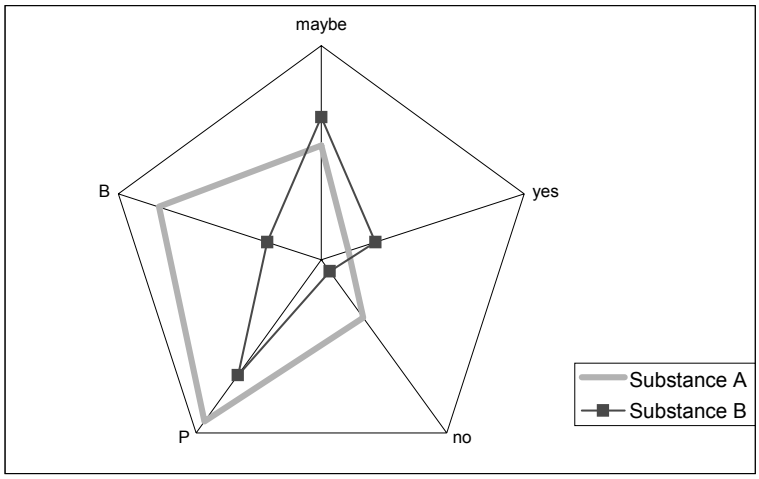


Figure 1 Presentation of the frequencies of classification for P and B, and the final decision on authorisation (yes, no, maybe), for both compounds.

Decisions on the borderline compound

For the borderline substance, the S-isomer was mostly identified as persistent in soil and sediment, and the R-isomer mostly also in sediment. Yet, this was in several instances no reason to deny authorisation, only to perform an advanced risk assessment or ask for specific studies. Slovakia denoted the DT50 values in soil as acceptable, the Netherlands as unacceptable. Australia took rotation of crops into consideration when deciding on the risk of residue accumulation.

Metabolite mA was recognised as a borderline substance with respect to persistency in two countries, but as non-biodegradable in one country, mainly due to the formation of bound residue.

The formation of bound residue triggers further investigations under 91/414/EEC, as the Netherlands and (non-EU) Slovenia noted in response to the questionnaire. In the risk assessment, the UK, Sweden, and Germany addressed this quality, while Denmark did not. The remaining non-EU countries Estonia, Norway, Japan, Switzerland, Australia and USA dealt with this quality, although not all in the same way.

Data selection

Classifications are given based on properties determined in one or more experimental studies. Different studies will yield different results, but no uniform approach to data handling was available. Differences in data selection and data manipulation may have a great influence on the outcomes.

Those countries that did select among the persistency data and re-calculate the values to standard conditions, appeared to use similar methods. For persistency, data would be selected based on test characteristics, and results may be transformed to give standardised values. These were assessed as ranges, means, or values are singled out, for classification and decision making, which resulted in different outcomes. The range of outcomes of the average DT50 for the R-isomer did extend beyond the Uniform Principles trigger value for persistency. Selected field studies are used for information on degradation

rates, but mostly not for information on metabolite formation. The relevance of a soil accumulation study or plateau concentration calculation was decided on differently.

With respect to bioaccumulation, both with respect to data requirements and to study interpretation, there is no harmonisation on the use of data on degradation, clearance rate, and exposure patterns.

Guidance and protocols

The use of harmonised guidance and protocols for summarising studies and for risk assessment will contribute to a consistent and uniform decision making process. Differences in data selection or decision making may be the result of different approaches or of different interpretation of guidance.

The following sources have been mentioned for criteria on decision making

- The EU Uniform Principles (Annex VI to 91/414/EEC)
- UN ECE LRTAP Convention, Executive Body Decision 1998/2
- National legislation and/or policy criteria documents.

The following sources have been mentioned for guidance on study evaluation:

- SETAC Procedures for Assessing the Environmental Fate and Ecotoxicity of Pesticides (Lynch, 1995) (also mentioned in the 91/414/EEC directive)
- The RIVM Manual (Mensink et al., (1995) RIVM report 679101022)
- The respective study guidelines (OECD, EU, EPA, BBA, ISO)

The following sources have been mentioned for guidance on risk assessment:

- The EU Uniform Principles (Annex VI to 91/414/EEC)
- The EU (DG Sanco) guidance documents.
- SETAC Procedures for Assessing the Environmental Fate and Ecotoxicity of Pesticides (Lynch, 1995) (also mentioned in the 91/414/EEC directive).
- The RIVM Manual (Mensink et al., (1995) RIVM report 679101022)
- The EPPO Risk Assessment schemes
- The EC technical guidance document (TGD)
- Code of Federal Regulations, Title 40, part 158, Pesticide Assessment Guidelines Subdivisions E, J, L, N (USA)
- EPFES workshop in Lisbon, April 2002
- Handbook for the Authorisation of Pesticides (Netherlands)
- CTB (NL) Checklist for assessing whether a field study on pesticide persistence in soil can be used to estimate transformation rates in soil – Date 10.07.02 (1 page).
- Data Requirements for Supporting Registration of Pesticides (Notification No.12-Nousan-8147 24 November, 2000), Japan.

Are P and B equally weighed in different environmental compartments?

Persistency and bioaccumulation are not equally weighed between soil, water and air. All countries apply the criteria to soil, but only a few apply the same criteria to water/sediment. Criteria for air are applied by some countries following the Stockholm convention on POPs.

Recommendations

It was stated on some occasions that the quality and relevance of the degradation studies is difficult to evaluate because of the lack of experimental data. This is inherent for lists-of endpoints and questions the degree of harmonisation between member countries if only the lists are available.

To be discussed further as items for further harmonisation:

- risk assessment methodologies for bioaccumulation
- uncertainty in higher tier risk assessments and the merits of trigger values
- ways to address bound residues in the assessments
- ways to interpret and use anaerobic degradation data
- criteria for the validity of field studies
- guidance on data presentation in lists-of-endpoints (e.g. EU and FAO)
- guidance on data selection and data transformation (normalisation)
- guidance on data handling (ranges, averages, single values)
- applicability of persistency criteria to water and sediment
- harmonisation of classification schemes
- training of assessors

CONTENTS

1. INTRODUCTION

This report contains the results of a follow-up case-study on a previous survey on persistent (P), bioaccumulative (B), and toxic (T) pesticides in OECD Member countries.

The primary objective of that first survey3 was to develop a clear understanding of the information generally available to pesticide regulators that is relevant to risks associated with low-dose exposure to persistent, bioaccumulative, and toxic (PBT) pesticides and how this information is used.

The following conclusions were drawn from this first survey. Among member countries, there was a lack of a harmonised definition for the persistence of pest control products. This appeared to stem from a fundamental difference in defining persistence as either dissipation from a particular medium, e.g., soil, or resistance to degradation. As a result, various numerical criteria were used to define persistence. For most countries, flexibility in data requirements as well as the use of expert judgement in the interpretation of results were the key elements for the evaluation of the persistence of a pest control product. The assessment of the risk from major and minor metabolites differs among responding countries, where such an assessment is carried out. The classification schemes used to assess persistence differ among countries. Persistence modelling is rarely used and monitoring for the persistence of pesticides is occasionally conducted on surface water, but less frequently on ground water.

The majority of countries suggested that more reliable methods of determining long-term exposure are needed. This included using more realistic scenarios for risk assessments. Additional areas were suggested for improving the determination and/or assessment of persistence. These suggestions included unifying or harmonising approaches to the classification of persistence; establishing clear criteria for defining persistence and using modelling and measurement. Additional suggestions included determining DT50 values, distinguishing between chemical persistence and biological persistence, and improving test methods. Further ideas included assessing persistence under country-specific climatic conditions, defining the role of bioavailability, developing methodology (exposure/risk assessment or toxicity tests) to assess the risk from prolonged exposure, and defining the contribution of metabolites to exposure.

Almost all OECD countries examined bioaccumulation, however, the data were interpreted differently among countries. Bioconcentration factors, bioaccumulation factors, and octanol-water partition coefficients were used as indicators of bioaccumulation. Where biomagnification of pest control products was examined, various methods were used to assess the risk of biomagnification. From the responses received, there appeared to be a need for harmonising the definition of bioaccumulation and the approaches used in the assessment of bioaccumulation.

Fish were considered to be the best indicator organisms for studies on bioaccumulation, followed by birds and earthworms with only one species of each required for testing. Depuration was indicated by the majority of countries to be relevant to long-term exposure at low concentrations, however, Sweden noted that because the bioconcentration factor is the function of uptake, distribution, and elimination (metabolism and excretion), depuration is not relevant per se given that exposure is continuous.

In the first telephone conference on the follow-up to this first survey (19 December 2001), it was agreed to make a proposal to the Working Group on Pesticides (WGP) for further work on the risk assessment and management of PBT pesticides by OECD Member countries. The proposal was for participating Member

[3] OECD SERIES ON PESTICIDES Number 15 Persistent, Bioaccumulative and Toxic Pesticides in OECD Member Countries ENV/JM/MONO(2002)22

countries to carry out a case study on two fictitious pesticides; one a clear-cut persistent pesticide, and the second a borderline case. This would allow comparison of Member countries approaches to a number of parameters in the risk assessment and evaluation process, for example choice of endpoints, risk assessment approach, use of models, mitigation measures, and the final regulatory decision.

With respect to the outcome of and follow-up to the OECD/UNEP Workshop on the Use of Multimedia Models for Estimating Overall Environmental Persistence and Long-range Transport in the Context of PBTs/POPs Assessment (November 2001), in particular the recommendation to the OECD to review current approaches for assessment of persistence and long-range transport, the case study would focus in particular on persistence, and bioaccumulation.

The case study presented here had the following objectives:

- establish the differences in identifying persistent and bioaccumulating substances in the risk assessments and decision schemes;
- establish the differences in taking persistence and bioaccumulation into account in the decision making process;
- establish the influence of the assessors' subjectivity to data interpretation and selection; and
- take all information provided into account, formulate recommendations to stimulate harmonisation of data selection, hazard/risk assessment, and decision making. Different approaches towards PB criteria in other frameworks (new and existing chemicals, biocides, and medicines) should stimulate discussion.

2. THE CASE STUDY

The case study consisted of three parts: an assignment, the two data sets (for Substance A and B), and a list of questions. The case study has been developed with the following situation in mind. A producer applies for a marketing authorisation for a product that qualifies as a plant protection product. The environmental risk assessment then is performed by a qualified environmental scientist and targets the product and the intended use. The decision on marketing authorisation is taken by a board of (scientists mandated by) regulators. No special preparation for the assignment is required: the assignment targets the average scientific assessor responsible for dossier evaluation and risk assessment. The assessment should be reported in the same format used by the member state to underpin the regulatory decision, including a proposal for decision making and a list of missing data to be addressed by the applicant.

The proposed case study focused on persistence (P) and bioaccumulation (B). Toxicity (T) was only to be used if it is triggered by PB-risks. The European and Mediterranean Plant Protection Organisation (EPPO) had conducted a similar case study in 1993 to test the applicability of its decision making schemes released[4]. The EPPO schemes are designed to address the risk assessment for different criteria such as persistency, groundwater contamination and effects to several environmental species. The schemes consist of questions for data and assessment, and offer possibilities to advance in the scheme or to end the assessment. A result from the EPPO case study was that there were two main reasons for not completing (or starting) the decision-making schemes: (1) unclear questions and (2) no data. The available lists of questions and experiences with guiding assessments were used to draw up the questionnaire for this project.

One data set would represent a persistent and bioaccumulating substance (A), which served as a positive control to the risk assessment and decision making systems in the member countries. The other data set would be more of a borderline case, where data interpretation and data selection strongly influence the risk assessment and decision-making (B). For the latter data set it was the intention to deliver several data endpoints as complete study reports. However, there were several reasons not to do so:

- the influence of the evaluators subjectivity on the selection of endpoints from raw data has already been demonstrated by Brown (1996)[5], Boesten (2000)[6] and Tiktak (2000)[7];
- pitfalls in the selection of public literature have been reported by Pontolillo and Eganhouse (2001)[8];
- In the EU, member states will have to depend on a list-of-endpoints for substances with a listing on Annex I to directive 91/414/EEC at national registration;
- FAO investigates the use of complete assessments and lists of endpoints in developing countries;

[4] OEPP/EPPO. 1993. Decision-making scheme for the environmental risk assessment of plant protection products. Chapters 1-6, 8 & 10. Bulletin OEPP/EPPO Bulletin 23: 1-165

[5] Brown, C.D.,Baer, U.,Guther, P.,Trevisan, M.,Walker, A. 1996 Ring test with the models LEACHP, PRZM-2 and VARLEACH: Variability between model users in prediction of pesticide leaching using a standard data set. Pesticide Science 47: 249-258.

[6] Boesten, J. J. T. I. 2000. Modeller subjectivity in estimating pesticide parameters for leaching model using the same laboratory data set. Agricultural Water Management. 44:389-409.

[7] Tiktak, A., 2000. Application of nine pesticide leaching models to the Vredepeel dataset. Pesticide fate. Agricultural Water Management 44, 119-134.

[8] Pontolillo, J. and Eganhouse, R.P., 2001. The Search for Reliable Aqueous Solubility (S_w) and Octanol-Water Partition Coefficient (K_{ow}) Data for Hydrophobic Organic Compounds: DDT and DDE As a Case Study. Reston, Virginia, USA, US Department of the Interior, US Geological Survey.

- The time needed to complete the assignment should not exceed 8 hours per substance.

It is possible to think of many cases where a straightforward decision cannot be made:

- inorganic active substances,
- volatilising metabolites,
- persistent, bioaccumulating but non-toxic substances,
- conflicting data on persistency,
- high accumulation potential, rapid depuration,
- lack of data.

However, not all exceptions could be fitted in two data sets. The data sets were based on existing substances, but were modified in order to avoid dissemination of confidential information and to complete data gaps. It is possible that fictitious data end-points have been given in order to provide complete data sets.

Much work on questionnaires has been done by Canada in the first survey and by the EPPO. The case study proposed here was not to be restricted by any guidance and should thus give ample room to adress the following items in the assessments:

- assessment criteria and protection levels
- risk assessment guidance and protocols used
- tiers in risk assessment process
- scenario and model assumptions
- rationale or triggers for additional studies
- handling of data gaps
- decision-making

The questions were to invite the participants to address essential steps in the assessment of PB criteria, drawing from their expert knowledge and the underlying documentation provided by their own organisation. The questionnaire was not to guide participants through their assessment, but to challenge them to consider their country's standard assessment procedures.

An overview of the participants is given in Table 1 Overview of participating countries and responses.

Table 1 Overview of participating countries and responses

Country	Institute	Case study	Questionnaire
Australia AS	Department of Agriculture, Fisheries and Forestry (AFFA)	✓	✓
Denmark DA	Danish EPA		✓
Estonia EN	Plant Protection Department	✓	
France FR	Bureau des Substances et Preparations Chimiques (BSPC)	✓	✓
Germany GE	Umweltbundesamt (UBA) Bundesamt für Verbraucherschutz (BVL)	✓ ✓	✓ ✓
Japan JA	Ministry of Agriculture, Forestry and Fisheries	✓	✓
Netherlands NL	Board for the authorisation of pesticides (CTB)	✓	✓
Norway NO	Agricultural Inspection Service of Norway, Pesticides Section	✓	✓
Portugal PO	Núcleo de Protecção do Ambiente Direcção-Geral de Protecção das Culturas		✓
Slovakia LO	National Referential Laboratory for Pesticides, University of Veterinary Medicine.		✓
Slovenia SI	UZK/MZDR		✓
Sweden SW	KEMI	✓	✓
Switzerland SZ	Federal Office for Agriculture, Section Crop Protection Products and Fertilizers	✓	✓
United Kingdom UK	PSD	✓	✓
United States of America US	EPA	✓	✓

3. EVALUATION OF RESULTS

The case studies and questionnaire have generated a vast amount of information on decision making, risk assessment, risk classification, and data treatment.

3.1 The final risk assessment, risk management and regulatory decisions

Substance A was designed to be a fine example of a PB compound, to see how the decision making process deals with PB substances.

Substance B was designed to be an example of a problematic compound and aimed mostly at the scientific assessment process: how is information in lists-of-endpoints used to come to a risk assessment. It was modelled around the trigger values for Tier II testing in the EU 91/414/EEC directive on plant protection products[9]. Data selection and data manipulation (e.g. temperature correction) might affect the outcome drastically, as would the presence of metabolites and a so-called inactive isomer.

In Figure 2 the result of the classification and decision making process is depicted. Classifications and decisions are not equivocal.

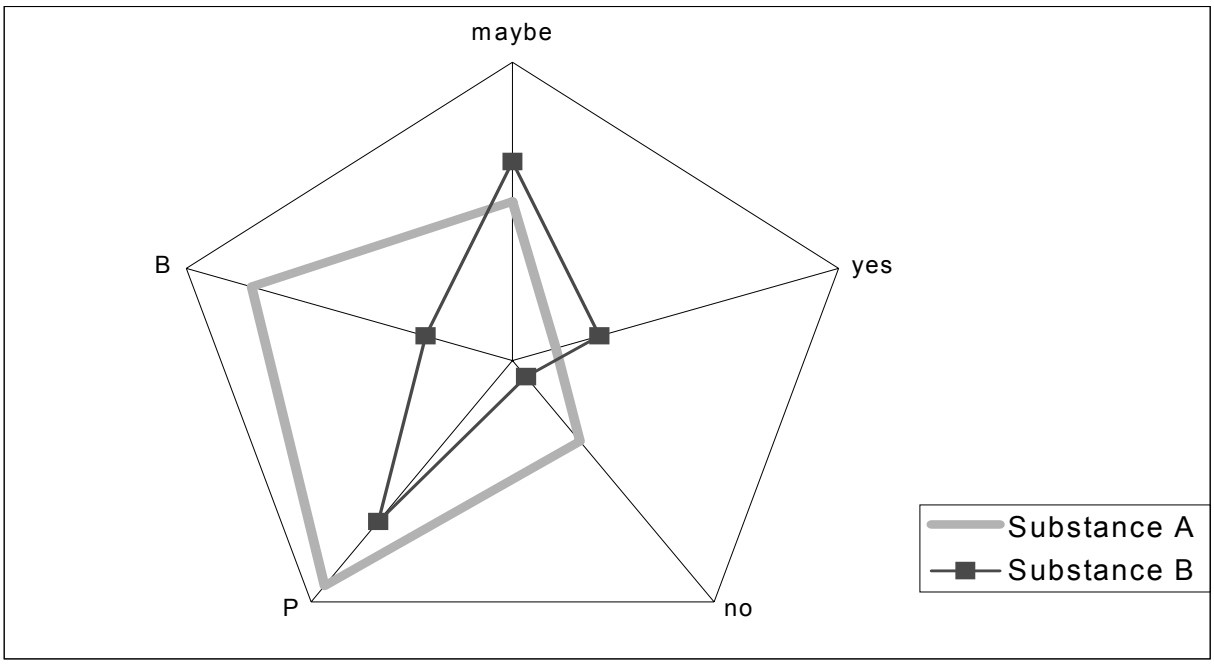


Figure 2 Presentation of the frequencies of classification (P,B), and of the final decision on authorisation (yes, no, maybe) for the two compounds.

The results were taken from the assessments and from the answers to the first question of the questionnaire. The focal point in this paragraph is the use of the PB classification and the underlying information in the decision making when it comes to registration.

[9] It should be noted that these trigger values were not intended for substance classification.

3.1.1 Substance A

Substance A has been determined virtually unanimously as a persistent and bioaccumulative substance (although not all countries used these classifications)[10]. Although the assessments have resulted in the same classification in the participating countries, they also have resulted in different regulatory decisions (Table 2).

While some countries would formulate a negative decision based on the properties of Substance A, and two countries would support authorisation with restrictions imposed[2], several countries (Slovenia, Switzerland, Portugal, Germany, UK and Estonia) concluded that more data were required in order to reach a decision.

Several countries indicated that the available endpoints were accompanied with insufficient information on test conditions to properly value the implications. Nevertheless, the overall information was sufficient to reach a classification.

Table 2 Substance A: classifications and regulatory decisions on authorisation

Country	Persistent	Bioaccumulative	Authorisation ☹ : no 😐 : no, unless … ☺ : yes ☝ : restrictions imposed 🗁: no decision reached
AS			☺☝
DA	✓	✓	☹
EN	✓	✓	😐
FR	✓	✓	🗁
GE	✓	✓	🗁
JA	✓	[10]	😐
LO	✓	✓	☺☝
NL	✓	✓	☹
NO	✓	✓	☹
PO	✓	✓	🗁
SI	✓	✓	😐
SW	✓	✓	☹
SZ	✓	✓	😐
UK	✓	[11]	🗁
US	✓	✓	☹

The USA, Sweden, Denmark, the Netherlands, and Norway oppose registration on PB criteria alone. Norway and Denmark applied cut-off values for degradation rates and for bioaccumulation, the Netherlands only for degradation rates. Sweden uses the criteria of Annex VI to the Directive 91/414/EEC for further assessment and additional requirements, and, depending on the 'degree of exceedance[12]', also as

[10] Japan does not consider bioaccumulation in the assessment

[11] The UK does consider bioaccumulation in the assessment, but does not classify bioaccumulation properties

[12] This was not quantified.

criteria for acceptability. UNEP "Stockholm Convention" Annex D and UN ECE LRTAP Convention[13] triggers are also used.

Other countries have considered the PB properties in conjunction with the information provided by the toxicity data and the use pattern. Switzerland would not grant authorisation, unless a substance with these characteristics may have an (important) advantage to control some problems in plant protection, e.g. for resistance management.

Australia would support authorisation for the single application to wheat, in view of the demonstrated lower persistence in warmer soils, with an appropriate buffer zone to minimise contamination of the aquatic compartment. However, no decision was reached for the multiple applications to sugar beet or pome fruit, pending further information.

The Slovak Republic would not allow the use on clay and sandy soils – only on loamy sand and silty loam at lower pH.

Portugal has not expressed an opinion on registration, but stated that further investigations into bioaccumulation and biomagnification potential were necessary. Slovenia and Estonia would not grant authorisation until further data on soil accumulation were provided. France and UK have not reached a decision, as it depends on the final risk based assessment. France has taken the standards for the European new and existing substances framework and announced Substance A to be PBT substance.

For most countries a (geo)-accumulation study would be required to fully assess the persistency. There are diverging opinions in this issue among the member state experts.

For Japan would require investigations into residues in succeeding crops. If this were demonstrated, no authorisation would have been granted. The data on field studie results does not ensure the safety of use on sugar beet, therefore, sugar beet will not be included in target crop. Japan does not consider degradation in water or bioaccumulation in the assessment.

Germany, Estonia, and Slovenia an accumulation study would be required before further decision making. Australia and Portugal have addressed this potential of soil residues accumulating and found that this did not result in an unacceptable level of residues, particularly from the single application to wheat. Switzerland on the other hand deemed the persistency a major concern and hence repetitive applications as unacceptable.

Germany classified Substance A as very persistent and with high risk on bioaccumulation, but indicates that PB properties per se do not merit the ban of the product, but if the criteria for POP according to Stockholm convention are ratified they will also be used for pesticides.

Sweden, Norway, and USA have raised, but not addressed, the possibility of evaluating alternatives to the substance.

3.1.2. Substance B

Substance B has been determined as a borderline persistent and bioaccumulative substance and has been classified in different ways (Table 3).

[13] http://www.unece.org/env/lrtap/protocol/98pop.htm

In contrast to Substance A, most countries expressed that further data was required to be able to reach a decision for Substance B. Several countries indicated that the available endpoints were accompanied with insufficient information on test conditions to properly value the implications.

On the persistence and bioaccumulating potential of substance B the following comments were given.

The Netherlands classified Substance B as persistent and would not allow authorisation. Germany classified Substance B as not biodegradable in soil and in sediment. A soil field accumulation study was required. For bioaccumulation Germany established a Cause for concern.

Portugal classified Substance B as persistent; metabolite mA as a borderline case. Also the identity of the unextractable radioactivity was a concern. There was no potential for bioaccumulation.

Table 3 Substance B: classifications and regulatory decisions on authorisation

Country	Persistent	Bio-accumulative	Authorisation ☹ : no 😐 : no, unless … ☺ : yes, ☝ : restrictions imposed 🗁: no decision given
AS	✓	-	☺
DA	✓	✓	😐
EN	✓	-	🗁
FR	-	-	🗁
JA	-	[10]	☺
GE	✓	✓	🗁
LO	-	-	☺
NL	✓	✓	☹
NO	-	-	😐
PO	✓	-	🗁
SI	-	-	😐
SW	✓	-	🗁
SZ	✓	✓	🗁
UK	?	[11]	🗁
US	✓	-	☺☝

Australia classified the S-isomer as persistent in some soils (leaving the R-isomer as non-persistent), but both R and S as persistent in sediment. Bioaccumulation was of no concern.

Sweden classified the S-isomer as persistent in soil (leaving the R-isomer as non-persistent), but both R and S as persistent in sediment. The potential for bioaccumulation of the S-isomer was recognised but considered acceptable.

The USA found the S-isomer to be very persistent in soil, and the R-isomer as a borderline case. In sediment both isomers were very persistent.

Norway classified the degradation rate of the R-isomer as moderate to medium and therefore persistency is not regarded as a problem. The S-isomer has a lower rate of degradation and must be regarded as more

persistent. Bioaccumulation in organisms was not expected to be a problem for the R-isomer, but more problematic for the S-isomer.

Slovenia considered Substance B to be a borderline case.

France classified it as not PBT.

Slovakia had no problems with this substance.

As some DT50 are <1 year, Substance B will be registered in Japan. Because some DT50 are >100 days in the field study, studies on residues in succeeding crops are required. Japan does not consider degradation in water/sediment or bioaccumulation.

Switzerland regarded substance B and metabolite mA as relevant soil residues. Furthermore, it was stated that the S-isomer is significantly more persistent than the biologically active R-isomer. The BCF of the S-isomer, together with the less efficient clearance and the rather high use rate, indicated a potential risk for bioaccumulation.

The UK classified the R-isomer as non-persistent, and could not reach a decision on the S-isomer.

Estonia classified the S-isomer as quite persistent in soil, and more persistent in sediment than in water.

France has not performed the assessment to an extent that it could reach a regulatory decision.

Australia is willing to support authorisation, because of the single application per season and crop rotation should limit soil accumulation, and it was not expected to be a problem in cereal growing areas under the proposed use pattern; also bioaccumulation in organisms was not expected to be a concern.

Portugal, Estonia, and the UK did not comment on registration, but indicated , just as Sweden, Slovenia, Denmark and Norway did, that missing data on fate and behaviour, toxicology, and ecotoxicology, made a final decision impossible: hence the classifications on persistency and bioaccumulation are not sufficient to decide against registration.

Given the findings in the assessment and the data gaps, the USA would grant a restricted use for a year in order to fill data gaps that should take toxicological concerns away. In view of the persistency of the S-isomer, which has little activity against the pest(s), the amount of this isomer should be reduced to the extent feasible.

According to Switzerland, there are too many relevant studies missing (data on application of substance B, laboratory studies on degradation in soil, field studies, mobility in soil and behaviour in air) to allow a final decision. It is stated though that a complete dossier may lead to a positive decision with respect to the acceptance of substance B.

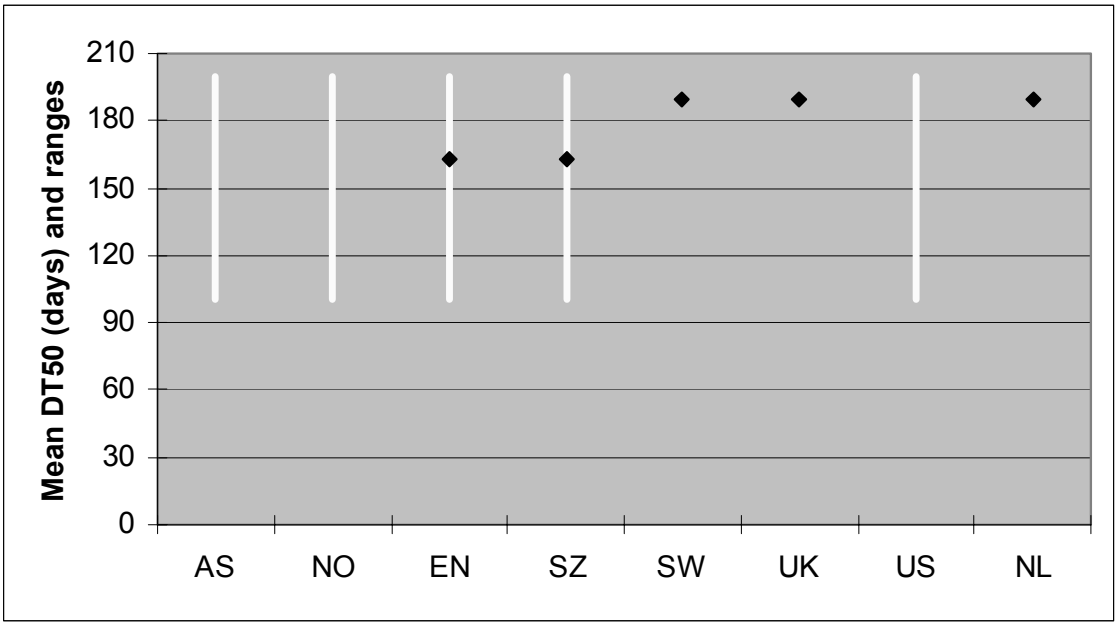


Figure 3 Graphical presentation of mean DT50 and/or ranges used for the decision on authorisation of Substance B. Other types of data selection are not plotted.

UK have not reached a decision yet, as it depends on the final risk based assessment.

In giving classifications, most countries dealt with the isomers as separate entities[14]. Sweden, Norway, Estonia, and the USA referred to the properties of metabolites in major considerations.

The final selection on the persistency parameter DT50 is depicted in Figure 3. In addition to the results shown, Denmark, Slovenia, and Germany, concluded that relevant data were above the UP trigger. Japan noted all DT50 to be less than 1 year.

3.1.3 Conclusions on the status of P and B criteria with respect to decision making

Clearly there are different approaches to classification of substances and the subsequent use of P, B, and T information in decision making.

Classification is done per compartment (soil, water, and air), and in some cases on the basis of compound-matrix combinations, and different standards are applied. Some countries clearly label the pesticide as persistent on the basis of properties of either active ingredient, its isomers, or the metabolites. Other countries refrain from this general label and classify the particular isomer or metabolite as persistent, some even specifically in conjunction with a compartment or a (presumably representative) property of the compartment (e.g. soil type, pH).

The classification is not always binary. For example, Germany has four categories and applies them following a specified protocol. Norway discerns low, moderate, medium, and high rate of degradation, and

[14] Some countries did not report on the case studies and did not address the isomers in the answers to the questionnaire.

substances with DT50 >365 days are classified as persistent substances. Slovenia discerns borderline cases (no, borderline, yes).

The trigger values for classifications differ. Some countries apply the Uniform Principles triggers from the EU Directive 91/414/EEC, some use other international agreements (EC, UNEP, UN ECE LRTAP[15]), and other do not use fixed triggers.

It is remarkable that the EU trigger (Uniform Principles) on soil persistency (DT50 90 days) was applied by some EU member states for classification as well, but that the EU trigger on bioaccumulation (BCF 100 L/kg) was not. Germany applies the BCF 100 L/kg for decision making purposes and not for classification.

Germany applied a tiered classification system with four categories, based on half-life, bound residue formation, and mineralisation for persistency, and on bioaccumulation and clearance, for bioaccumulation. The trigger values are not those found in the Uniform Principles of 91/414/EEC for decision making.

Classifications are not always made on the data point values alone. The USA assigned new 'borderline' classifications, and Denmark incorporated the difference between trigger and datapoints in deciding on classification.

When it comes to decision making on the classifications, again different approaches are taken. The Netherlands and Japan apply a quantitative cut-off value for soil persistency, but not for other compartments. Due to a legislative error, the cut-off value in the Netherlands does not apply for old substances that are not yet placed on Annex I to Directive 91/414/EEC. Norway and Denmark applied quantitative cut-off values for soil persistency and bioaccumulation in decision making. Sweden decided on persistency in combination with bioaccumulation, after the 91/414/EEC triggers are surpassed, using the criteria of the Stockholm Convention and UN ECE LRTAP Convention as guidance. As soon as Germany has ratified the Stockholm convention, it will apply these triggers to pesticides as well[16]. In Australia, Germany, Sweden, Switzerland, the Slovak republic and USA, the PB-classification triggers the need for complementary risk information: on residues in succeeding crops, on exposure, on secondary poisoning, on biomagnification, or on (un)certainties in toxicity. Switzerland and Norway indicated that a conscientious observation of risk/benefit may result in the authorization of a PB compound for only one, the most important crop. A substance may be important regarding e.g. resistance management (risk/benefit). Norway applies the principle of substitution, this means that a substance can be accepted only if it has the same or better pesticide effect, health- or environmental properties. Older substances can be banned if a better alternative is accepted.

For Substance A, the persistent compound, the exposure and toxicity profile was unfavourable enough not to neglect the PB classification in those countries without cut-off values. Australia would support authorisation for the *single* application to wheat, in view of the demonstrated lower persistence in warmer soils[17], with an appropriate buffer zone to minimise contamination of the aquatic compartment. Slovakia would only support applications to the soil types that were the least persistent in the laboratory.

[15] http://www.unece.org/env/lrtap/protocol/98pop.htm

[16] However, PB criteria have not been used as cut-off criteria in the authorisation procedure for plant protection products.

[17] However, no decision was reached in respect of the *multiple* applications to sugar beet or pome fruit, pending further information and consideration.

Slovenia and Germany would await a soil accumulation study before deciding on authorisation. Switzerland stated that the only reason to consider a substance with these characteristics may be its (important) advantages to control some problems in plant protection, e.g. for resistance management.

For Substance B, the borderline substance, the S-isomer was mostly identified as persistent in soil and sediment, and the R-isomer also in sediment. Yet, this was no reason to deny authorisation, only to perform an advanced risk assessment or ask for specific studies. The Slovak Republic denoted the DT50 values of Substance B as acceptable. Australia took rotation of crops into consideration when deciding on the risk of residue accumulation. Metabolite mA was recognised as a borderline substance in two cases, but as non-biodegradable in one country, mainly due to the formation of bound residue. The formation of bound residue triggered further investigations under 91/414/EEC, as Slovenia and the Netherlands noted in response to the questionnaire[18]. In the assessment of substance B, the UK, Sweden, and Germany addressed this quality, while the other EU-member state Denmark did not. The remaining non-EU countries Estonia, Norway, Switzerland, Australia and USA dealt with this quality, although not all in the same way.

When looking at the PB criteria for new and existing substances, provided by France, it is remarkable that persistency in sediment is used, and not in soil, whereas at registration of pesticides in the EU the situation is the opposite. Germany is an exception: it applies the triggers for soil also to sediment.

3.2 Guidance and protocols for PB assessment

The use of harmonised guidance and protocols for summarising studies and for risk assessment will contribute to a consistent and uniform decision making process. Differences in data selection or decision making may be the result of different approaches or of different interpretation of guidance.

The following sources have been mentioned for criteria on decision making

- The EU Uniform Principles (Annex VI to 91/414/EEC)
- UN ECE LRTAP Convention, Executive Body Decision 1998/2
- National legislation and/or policy criteria documents.

The following sources have been mentioned for guidance on study evaluation:

- SETAC Procedures for Assessing the Environmental Fate and Ecotoxicity of Pesticides (Lynch, 1995) (also mentioned in the 91/414/EEC directive)
- The RIVM Manual (Mensink et al., 1995)
- The respective study guidelines (OECD, EU, EPA, BBA, ISO)

The following sources have been mentioned for guidance on risk assessment:

- The EU Uniform Principles (Annex VI to 91/414/EEC)
- The EU (DG Sanco) guidance documents.
- SETAC Procedures for Assessing the Environmental Fate and Ecotoxicity of Pesticides (Lynch, 1995) (also mentioned in the 91/414/EEC directive).
- The RIVM Manual (Mensink et al., 1995)
- The EPPO Risk Assessment schemes

[18] This issue has been addressed by the UK PSD in Environmental Pollution 108 (2000) 15-18, to which the PSD referred in this case study.

- The EC guidance document for new and existing substances and biocides (TGD)
- Code of Federal Regulations, Title 40, part 158, Pesticide Assessment Guidelines Subdivisions E, J, L, N (USA)
- EPFES workshop in Lisbon, April 2002 – guidance will be published in 2003
- Handbook for the Authorisation of Pesticides of the Netherlands (HTB)
- CTB (NL) Checklist for assessing whether a field study on pesticide persistence in soil can be used to estimate transformation rates in soil – Date 10.07.02 (1 page).
- Data Requirements for Supporting Registration of Pesticides (Notification No.12-Nousan-8147 24 November, 2000), Japan. More information is on the web-site (http:// www.acis.go.jp/eng/indexeng.htm).

3.3 To what substances do P and B criteria apply?

In the case studies, data on formulations, active ingredients, isomers, and metabolites were presented. While the pesticide application concerns the product, the environmental properties relate to the substances within a certain matrix (e.g. soil and fish), and the respective metabolites formed in these matrices. It was investigated what chemicals were subjected to the PB assessment, in which environmental compartments, and how this resulted in classification of the pesticidal product or active ingredient.

From the case studies it can be concluded that information on isomers and metabolites is used in different ways when assessing persistency and bioaccumulation properties of pesticides. It appeared that all countries dealt with the isomers in Substance B as separate entities. Sweden, Denmark, Estonia, Germany, Norway, Switzerland, and the USA referred to the properties of metabolites in the considerations on persistency.

The questionnaire addressed the scope of the assessment directly in question 2: what substances are actually assessed on P and B properties?

In response to this question Australia and the USA considered not to have PB criteria in function, while all other countries have PB criteria and triggers. However, from the case studies it is concluded that the (subsequent) risk assessment approach taken by Australia and the USA does not differ from others.

In principle, these criteria apply to all constituents and metabolites of the technical ingredient, unless – within the EU-zone and Japan– the relevancy or activity of metabolites, respectively, isomers, has been negated Impurities are not considered. Consumption, formation rate, or application rates were mostly not considered. In the EU-zone and Japan, however, a 10% formation trigger on dossier requirements is operational. The Netherlands has exempted the environmental risk assessment for metabolites of all applications with dosages below 5 g/ha[19].

Some countries consider accumulation in compartments due to repeated use over the years or in the region as a criterion, others do not. Whether this criterion applies to soil, water and/or air is unclear, and so are the temporal and spatial boundaries for this criterion.

The assessment of inorganic compounds was addressed in a separate question (# 7): “Do the standards on persistency also apply to inorganic compounds and inorganic metabolites?”

[19] Taken from the pilot study that preceded the case study.

In general, member states do not apply the persistency standards to inorganic compounds. The reasons for this are worded well by Sweden and Slovenia from an empirical perspective. The recognition of the increased risk posed by persistency is based on experience from "classical" environmental pollutants like DDT, PCB etc., i.e., organic compounds. Metals have a different structure and different properties (like they are not lipophilic) compared to organic chemicals. For organic substances persistency can be estimated (different estimation methods and models) while for inorganic substances more expert judgement is needed as estimation models are not available.

The UK points out that the standards are not specifically mentioned in relation to inorganic substances in the EU guidance. In the USA and Germany persistence is not considered a meaningful criterion for inorganic compounds (i.e., metals) since they are elements and, therefore, are persistent by definition. France added the observation that standards for persistency should also apply to inorganic compounds but experts do not really know how to handle these data. Contrary to these approaches, in the Netherlands and Japan the (cut-off) criteria for persistency also apply to inorganic substances and –in principle– also for relevant inorganic metabolites.

From the answers it is concluded that

- not all countries have defined PB criteria operational in the registration framework,
- operational criteria are not limited by application rates (except NL) or tonnage,
- formation rate was only mentioned by the USA, although a 10% trigger is included in the EU framework
- some countries specified that the compartment has to be exposed, before the criterion applies, with examples referring to persistency in soil
- it was not explained in most assessments whether or not BCF criteria were applied when water was not exposed. UK does not apply BCF criteria if water is not exposed.
- criteria do not discriminate between different substances (isomers etcetera) or metabolites, unless relevancy and activity have been negated
- accumulation in compartments due to repeated application in time (or in the region) is a persistency criterion in several countries
- in several countries the answers are formulated taking a risk based approach: PB criteria are incorporated in the risk assessment model, rather than used as individual decision making qualities, others apply certain PB criteria in the decision making because of the increased uncertainty of risk assessments for substances with clear PB-properties.
- the questions in the questionnaire on ‘substances’ (e.g. isomers, metabolites >10%), ‘criteria’ (e.g. persistency, bio-accumulation), ‘parameters’ (e.g. DT50, bound residue formation, BCF) and ‘standards’ (e.g. 180 days, 70%, 100 L/kg) were confusing.

3.4 Differences in the use of BCF

In the case study A, BCFs for three different organisms (*Lepomis macrochirus*, *Anguilla anguilla*, *Mytillus edulis*) were given, based on wet weight of the whole organism (ww/wo). Additional information on clearance rate and elimination was given for *L. macrochirus* and the organic carbon content of the used sediment for *A. anguilla*.

BCF studies should be conducted with radiolabelled material, as pointed out by Germany or else some data will not be available. BCF values on radioactivity counts (not on the active ingredient) are acceptable for France, Portugal, Sweden, and Norway. Several countries seem reluctant on this point: care should be taken or raw data (perhaps on the identity of the r.a.?) should be available. Norway considers to the analysis of a.i. and metabolites an advantage; Sweden brings up the idea that after a trigger violation new data may not be based on ^{14}C. Australia, the USA and UK prefer BCF calculated on the basis of the parent

compound concentration. Results based on total radioactivity counts without identification of metabolites are used with qualification if necessary.

Classifications have been made for the substance (Substance A is bioaccumulating), and for combinations of specific taxa and substances (Substance A is highly bioaccumulating in shellfish).

If countries see a distinction between compartments or species, generally only the $BCF_{ww/wo}$ for the aquatic compartment and $BCF_{fat\ tissue}$ for the vertebrates are discerned. Germany however prefers the BCF_{fat} (BCF_{lipid}) as it may allow comparing the bioaccumulation of different species (BCF_{fat} is not a criteria for decision-making). If there is no BCF_{fat}, other BCF are taken into account, e.g. $BCF_{whole\ body}$. The criteria on bioaccumulation (BCF, half-life time for clearance CT_{50}) are the same for all species. Classification will have to depend on test system used as well as species tested. Up to now the German classification system is based on aquatic vertebrate testing (see Table 33 on page 80). Several (EU-) countries did not consider the $BCF_{fat\ tissue}$. The assessment concerning bioaccumulation except livestock is not done at present by Japan.

Conclusions on acceptability are either based
- on BCF endpoints, often in combination with persistency endpoints
- on endpoints together with information on logKow, clearance and use patterns, or
- on combinations of environmental risks (including secondary poisoning) related to use patterns.

While for Australia the relative short-term exposure of a single application compared to repetitive application was an argument to accept the BCF properties, providing the potential for aquatic contamination is minimised, for Sweden the prolonged exposure of a single application of a persistent compounds was an argument not to approve the use, regardless of the absolute amount that reaches the water.

Denmark set a standard for clearance rate for BCF between 100-1000, regardless of repetitive use. Germany uses clearance rates together with BCF for classification. Other countries use a case-by-case approach. No further attention was paid to dependency of the clearance rate on body size, lipid content, and BCF[20].

For some countries, a “bioaccumulative” classification means no approval. For some countries, BCF does not trigger further investigations, mostly because secondary poisoning is routinely assessed. The Uniform Principles criteria trigger examination of risk to secondary poisoning; normally birds consuming fish and earthworm. This is considered sufficient by Sweden at relatively low levels of bioaccumulation but at higher levels (approaching the UNEP criteria) further elements should preferably be added to the risk assessment; for instance, assessing the risk from bioconcentration in invertebrates. So, development of such additional elements should be considered, as supported by Portugal. Contamination of agricultural products (meat) is mentioned once. In addition, the UK notes that the type of study required to address the chronic risk to fish will depend on the BCF. A fish early life cycle study is required by the UP where the BCF is between 100-1000 or the EC50 of the active substance is <0.1 mg a.i./l.

In the case-studies, environmental risk assessments in relation to BCF have been performed considering one or more of the following aspects:
- the aquatic ecosystem
- the terrestrial ecosystem
- secondary poisoning of predators

[20] Sijm and Van der Linde (1995).

- risk for biomagnification in aquatic and terrestrial foodchains (see below)
- fodder residues and livestock product (meat) contamination.

BCF was further assessed given the proposed use patterns and clearance rate. For some countries the endpoint itself was decisive, for others the interval between repeat applications, clearance time, or degradation rate was. Additionally organ specific bioaccumulation and uncompleted elimination may be taken into account on a case by case basis.

An aspect that was not brought to the attention in the case studies was the difference between BCF based on measurements ($C_{organism}/C_{water}$) and BCF based on calculated uptake-elimination kinetics (k_1/k_2).

Biomagnification

On the issue of biomagnification, two lines of reasoning are followed. One follows the approach that secondary poisoning modelling will cover relevant risks. The second points to the uncertainty in these approaches and prefers an early stage cut-off, e.g. BCF >5000 and $BCF_{fat\ tissue}$ >1. Both criteria are available, but are not harmonised, or are not operational. Consensus on the definition of the $BCF_{fat\ tissue}$ is desirable: how is this parameter determined and what role does it play in the risk assessment methodology?

Where potential to biomagnify is identified by the UK, i.e. the whole body residue at steady state is higher than the residue in food (BAF >1) then a step wise approach to the assessment of risk was taken. For the aquatic food chain it was first considered if the BCF>1000 and the elimination during the 14 day depuration phase is <95% and if the substance was stable in water or sediment. Only if these criteria are met one proceeds to the next step. A step wise approach was recommended as given in the SANCO guidance documents.

The quality of biomagnification has been addressed in the case study assessments by Sweden, stating "Substance A has a high potential for bioaccumulation; BCF 5500 (Lepomis), 4000 (European eel), and 10000 in mussels. Biomagnification cannot be excluded."

3.5 Persistency in environmental compartments

Data on three environmental compartments were supplied in the case studies:

- soil,
- water and sediment,
- and air;

for all parent compounds and metabolites. The focal point in this section is the assessment of persistency and bioaccumulation in *different compartments* – for different compounds.

The questionnaire addressed the persistency and bioaccumulation standards applied per compartment in question 4. The answers will be dealt with here, together with the findings in the case studies.

The overall picture is that persistency in soil received the greatest attention, and persistency in water/sediment and in air are often neglected or are without consequences. This is probably a reflection of a lack of criteria for water/sediment and air in the Uniform Principles applied within the EU. However, some countries apply the criteria from the Stockholm Convention and the UN ECE LRTAP Convention for these compartments. Germany however sees no discrepancy in the Uniform Principles towards the different compartments and applies the same (UP) standards to all compartments (soil, water/sediment, and groundwater). Japan requires studies on persistency in anaerobic (waterlogged) soils if the DT50 of aerobic soil studies is 100 days or more and Kom is less than 500 L/kg.

In those countries where persistency is classified, the approaches for different compartments differ. Persistency in soil is mostly classified, but in water and sediment much less attention is devoted to this aspect. Persistency in air has been addressed in some assessments.

Persistency is generally identified by half-life times in the compartment (DT50) although accumulation potential (which also depends on use patterns: repetitions and crop-rotation) is also considered as a criterion. The numerical values of the criteria differ between compartments, and much less between countries within a compartment. The formation of bound residue and mineralisation as criteria for persistency were addressed by most countries, albeit with different results. Germany weighs half-life, bound residue and mineralisation equally in the assessment that leads to a classification. See Table 32 on page 80.

The role of field studies

Field studies are mostly highly appreciated and supersede laboratory results with respect to half-life times, generally not with respect to formation of metabolites[21]. One comment is made here on the dataset and data-interpretation of Substance A. In the field study with substance A, the metabolite mB was formed in 11%. Estonia, Japan, Switzerland, Norway, the USA and the UK noted this, and although field studies were generally not considered to overrule laboratory studies on formation of metabolites, a follow-up was considered. In this case, no data on metabolites in laboratory studies were given.

In general, the field study should be relevant for the conditions of use. Norway and Germany generally do not use field studies to classify a substance for this reason. Norway remarked that most submitted field studies were performed under conditions not relevant for the Norwegian conditions. Germany only uses field-DT50 for PEC-calculation, but not for a different classification of the substance.

Violation of persistency limits, mainly for the soil compartment, usually triggers advanced testing and risk assessment, risk mitigation, and sometimes is a basis for a negative decision on registration. Advanced testing involves usually a study on (geo)-accumulation, although DK requests a field study on effects, and the Uniform Principles also require a litter bag study at a DT90 of >1 year.

3.6 Bound Residue

Bound residues can potentially be a source of active compounds if the organic matter is degraded. The questionnaire asked whether there were additional considerations for products that generate large amounts of bound residue (for example >70% of applied activity)? The phenomenon of bound residue is addressed in the assessments, generally at levels >70%, with two options:

1) assessment of fate and behaviour
   a) including the amount of bound residue in residue of the active substance at the calculation of the DT50 for the active substance
   b) data requirements as those following DT50 trigger violation;

2) assessment of effect
   a) on sensitive soil fauna
   b) data requirements as those for DT50 trigger violation (litter bag studies).

[21] Estonia gave an example where the field formation percentage was used in interpreting the persistency of metabolite A of Substance B. Japan deemed field studies equivalent to laboratory studies both for degradation rate and for metabolite formation.

There is an EU assessment trigger which covers bound residues (BR) and mineralisation to CO_2 jointly: BR >70% at 100 days in aerobic lab soil studies *and* CO_2 <5% at 100 days in aerobic lab soil studies. Estonia did not use the time frame of 100 days in assessing the bound residue formation, and hence did not follow-up on this aspect.

Bound residues are considered in soil laboratory and field testing, so there are no specific considerations to the criterion for Japan.

Germany assessed the formation of bound residue both for soil and sediment and uses classification criteria

Table 32 on page 268). Data requirements follow the UP however.

Sweden and Switzerland referred to definitions of bound residue and suggested that there is a lack of clear identification of extraction methods by which residues are identified as "bound residues" in current guidelines, and thus distinguished from residues which still can be extracted with harsh extraction methods. Sweden and Switzerland also suggested that methods to predict the bioavailability of resistant but still extractable residues would be useful.

3.7 Data selections and implications for decision making

Crucial in the case studies was the availability of a list of endpoints with limited circumstantial information. Treatment and selection of endpoints in the assessment may have generated different outcomes under similar sets of criteria. The focal point in this section is the influence of variation in information on the assessment, due to the ways of standardisation of endpoints in order to measure them against the criteria, and the way missing information is handled. The responses to dataset B are used here.

3.7.1 Soil

In the case study B, laboratory data were provided for different soil types, dosages, temperatures and moisture contents in soil. Field data were designed to match different climatic regions. Data selection and manipulation would influence the endpoint considerably.

Data on anaerobic (under waterlogged conditions) transformation were not provided in the case-study. How these data would have been handled and used in the assessment, cannot be addressed here.

The following selections have been applied:

- use of all data as presented
- selection of data based on
- temperature
- temperature and moisture content
- organic matter content
- dosage
- location of field study.

The following manipulations have been applied:

- correction of endpoints for temperature
- use of range of values
- use of classes
- use of single DT50
- use of averages
- distribution analysis of results (percentiles).

Some approaches to data selections performed by the Netherlands, UK, Sweden, and Switzerland (exclusion of too dry soils, temperature correction, selection of test dosage) can be traced to the RIVM Manual (Mensink et al., 1995) where this selection is guided. Table 4, Table 5, and Table 6, and the accompanying figures, the results of the assessments are summarised.

The major metabolite mA was not given the same weight as the parent compound in three instances (Table 4). The volatile metabolite mB was mostly noted, and left at that. Three countries considered the 'runner-up' metabolite mC relevant. The formation of bound residues above the trigger level for EU registration went unnoticed by Estonia, Japan, and Denmark, but not by other countries. The Slovak Republic did not comment on metabolites and bound residues in the response to the questionnaire.

The data in Table 5 show that different ranges and means for the DT50 of the isomers and mA have been derived using the same dataset on laboratory studies. In most cases, the mean values for the R-isomer are within the ranges defined by all other countries, that all span the UP-trigger. Four mean values are below this threshold, three are above. USA presented two mean values for two dosages of the R- isomer. The mean value for the R-isomer at the lower dosage is under the UP-trigger of 90 days, the other is higher (Figure 4).

With respect to the S-isomer the mean values are within the ranges defined by all other countries, that all span the UP-trigger. The mean DT50 value of 162 days determined by

Table 4 Appraisal of metabolites (mA, mB, mC) and bound residue (BR) in soil

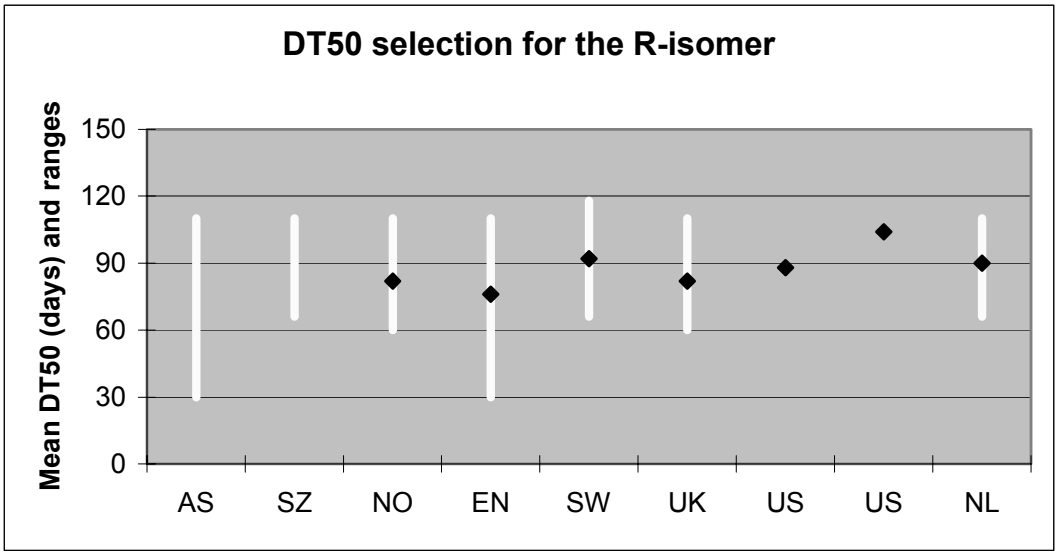
	AS	DA	EN	GE	JA	NL	NO	LO	SW	SZ	UK	US
mA	-	x	+	+	+	x[2]	+[1]	+	+[1]	+	+	-
mB	-	x	-[1]	-	x	x[2]	-	-	-	+	-	-
mC	-	x	-[1]	-	x	x[2]	-	-	+[1]	+	+	-[1]
BR	-	x	-	+	x	+	-	+	-	+	+	-

- acknowledged, but no follow up + follow up on persistency x not considered [1] follow up on groundwater
[2] because of unacceptable degradation rate of parent compound

Table 5 Mean DT50 and ranges [days] for substance B in laboratory soil.

country	R-isomer			S-isomer			mA		
	low	high	mean	low	High	mean	low	high	mean
AS	30	110		50	240		25	120	
EN	30	110	76	50	240	162	25	120	77
NL	66	110	90	177	208	191			
NO	60	110	82	110	240	177	25	120	77
SW	66	118	92	170	240	194	60	120	90
SZ	66	110		170	240		85	120	
UK	60	110	82	110	240	176	60	120	90
US[22]			88			229			
US[22]			104			193			
DA	3/(n=9) >90			8/(n=9) >90					
GE[23]	30-100			>100			>100		
JA	all <1 year								

Estonia is outside the Swiss range of 170-240 days. Two mean values are below the Very Persistent threshold of 180 days for existing substances, four are above. USA presented two mean values for two dosages of the S-isomer. The mean value for the S-isomer at the lower dosage is higher than the DT50 at the higher dosage; as opposed to the R-isomer (Figure 5).



[22] USA separated the two dosages of 0.1 and 2.0 mg/kg, neither of which matches the proposed use rate of 0.67 lb/acre (– 0.67 mg/kg). The 2.0 mg/kg dosage resulted in a lower DT50 for the R-isomer, but a higher DT50 for the S-isomer, compared to the 0.1 mg/kg dosage.

[23] Germany considered both isomers and metabolites, but did not reveal the data selection.From the assigned classes a DT50 of 30-100 days for the R-isomer and a DT50 >100 days for the S-isomer and metabolite A are deduced. It is not clear if ranges or averages were used.

Figure 4 Graphical presentation of mean DT50 and ranges: R-isomer.

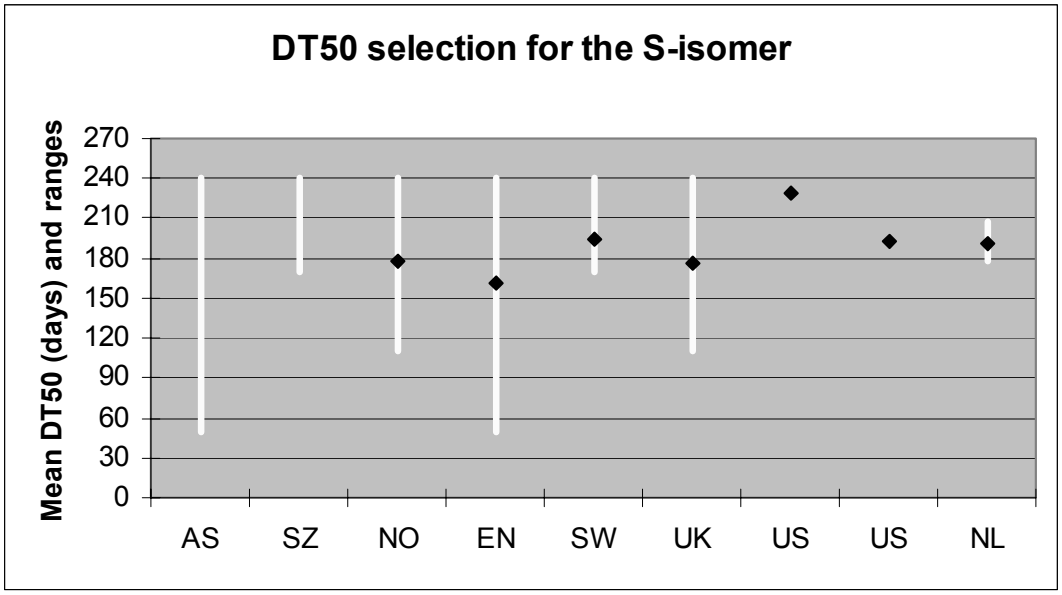


Figure 5 Graphical presentation of mean DT50 and ranges: S-isomer.

With respect to mA, in most cases, the ranges defined by all countries span the UP-trigger. An exception is the mean DT50 value of 77 days determined by Norway and Estonia, that is outside the Swiss range of 85 - 120 days (Figure 5). Australia, USA, the Netherlands and Denmark did not assess the DT50 of mA. Two mean values are below the UP trigger, two are at the trigger value, which means a trigger violation.

Netherlands, Australia, Norway, the UK, and Estonia (12 - 100 days) established the wider range of field DT50 values for the R-isomer, and the USA decided on the narrower range (40 - 70 days). The mean DT50s were close: 59 - 67 days. The mean DT50 in Norway was found

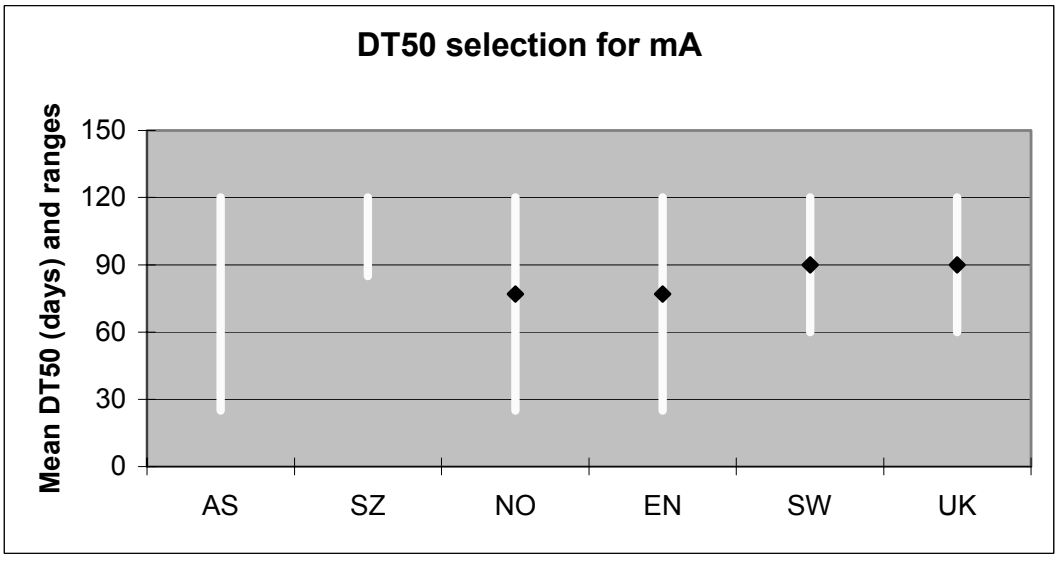


Figure 6 Graphical presentation of mean DT50 and ranges: metabolite A.

Table 6 Field studies in soil: DT50 [days] and DT90 selections for substance B.

Country	R-isomer						S-isomer					
	DT50			DT90			DT50			DT90		
	low	high	mean	low	high	mean	low	high	mean	Low	high	mean
AS	12	100		2m	1y		100	200		1y	2y	
EN	12	100	65	2m	1y		100	200	163	1y	2y	
NL	12	100	67				190					
NO	12	100					100	200				
UK	12	98	59	2m	1y		190			2y		
US	40	70	65				100	200		1y, 2y, 2y		
SW	12	100	67	2m	1y		190			2y		
SZ	25	100	60			9m	100	200	163	20m		
DA	2/(n=9) >90						3 >90, 2 >180					
JA	Some DT50 > 100 days											

at a 43% higher level: 86 days. Denmark notes that in two out of nine data the DT50 is >90 days. DT90 values are less of a favourite (Figure 7 and Figure 8).

For the S-isomer four countries established comparative ranges (100 – 200 days), Estonia and Switzerland defined a mean DT50 of 163 days, Sweden, the Netherlands and UK defined one single DT50 of 190 days, Denmark noted that in all cases the DT50 is >90 days, and in all but one the DT50 >180 days. Four countries noted DT90 values, with a preference for the higher findings (2 year). Germany does not use field studies for classification of persistency (Figure 9 and Figure 10).

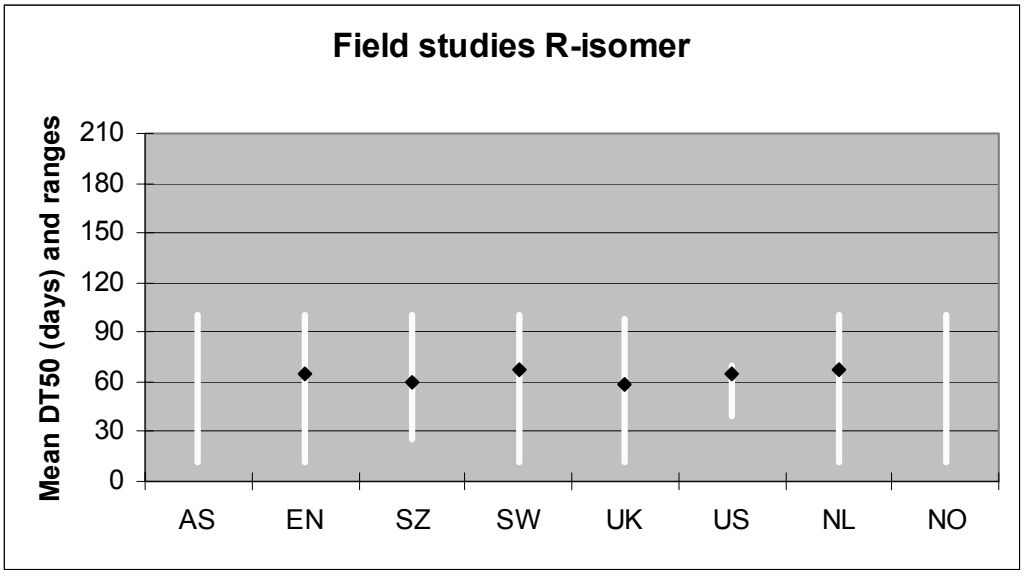


Figure 7 Mean DT50 and ranges (days) for the R-isomer in field studies.

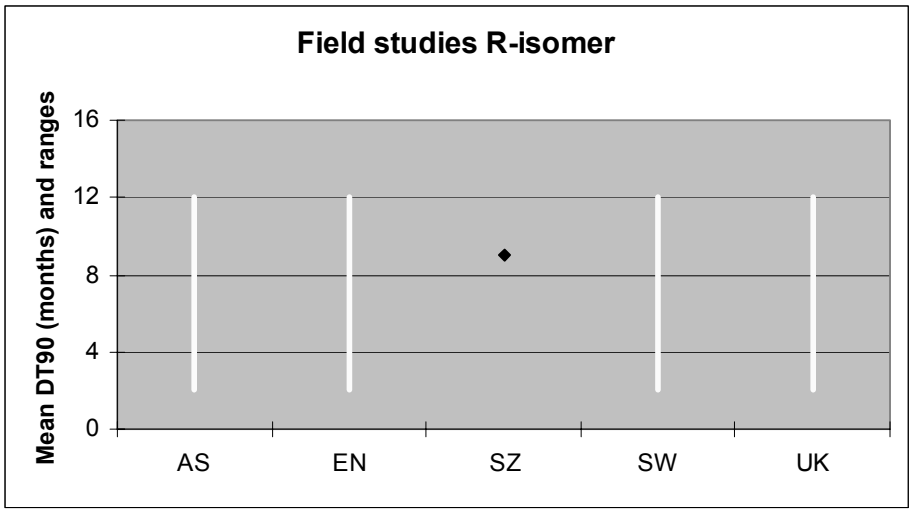


Figure 8 Mean DT90 and ranges (months) for the R-isomer in field studies.

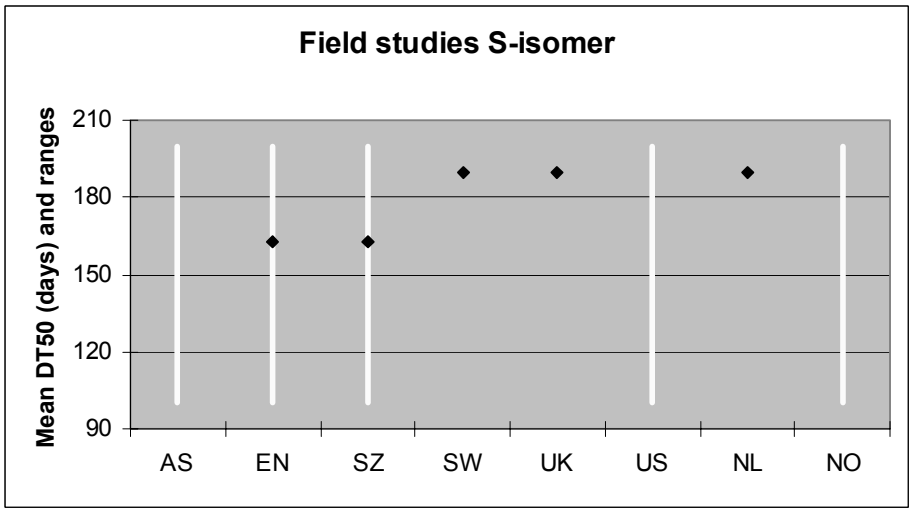


Figure 9 Mean DT50 and ranges (days) for the S-isomer in field studies.

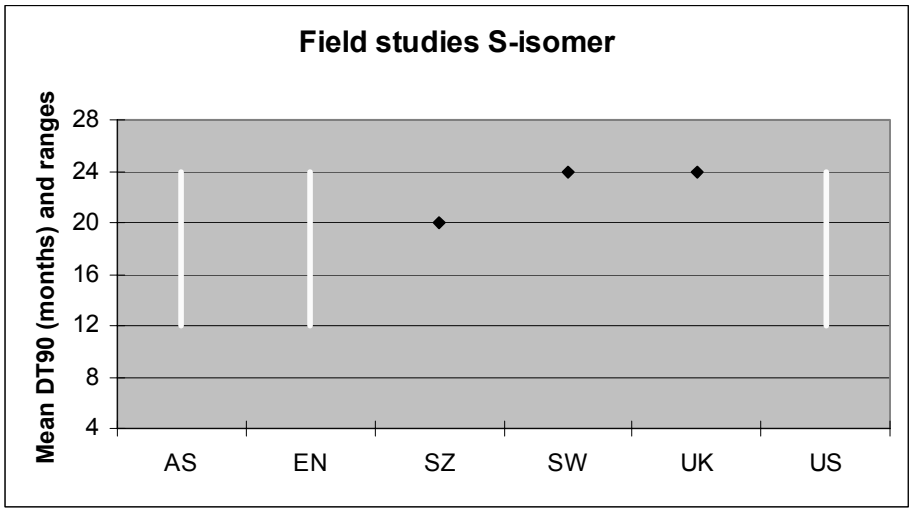


Figure 10 Mean or selected DT90 and ranges (months) for the S-isomer in field studies.

3.7.2 Water and sediment

The variation in data in the case studies was small, therefore it was expected that there would be little difference in selected endpoints between countries. From the responses to the case study it becomes clear that persistency in water/sediment systems is not used as a cut-off value for registration, regardless of any classification of this property.

The one exception was Sweden who decided that, considering the persistency of Substance A and the current exposure modelling approach, additional data requirements would not provide more scientific information on the long term risk, and registration was not acceptable. For Substance B however the persistency in water/sediment systems was used as a trigger for further studies. Four other EU countries however, pointed out that persistency in water/sediment is not considered as such. Japan has no data requirements for this compartment. At the same time, USA considered risk mitigation for this substance effortless. The finding of persistency generally triggers further assessment of sediment risk and analysis of food-chain effects.

All countries take persistency of both parent compounds and metabolites into account. Implicitly the formation percentage of 10% is used for metabolites. The criterion for persistency is generally the half-life time for disappearance; only Germany and Norway have identified bound residue and mineralisation in water/sediment systems as additional criteria. Switzerland and UK discussed the finding of "inherent biodegradability" given the data from the water/sediment systems. Portugal does not consider persistency for water/sediment systems, but recognises the existence of an upper limit for non-persistency for water (which triggers the waiving of long-term studies) of DT50 4 days in the 91/414/EEC data requirements. Those countries that stated the boundaries for classification (persistent or not) referred to the TGD-limits of DT50 >60 and >180 days for water respectively sediment. Slovenia used >40 and >120 days here. No efforts were made to standardise DT50 values for degradation in water or sediment.

3.7.3 Air

The variation in data in the case studies was small, therefore it was expected that there would be little difference in selected endpoints between countries. Volatilisation has often been estimated as negligible using the vapour pressures of both compounds. USA, Sweden and Switzerland suggested (based on the Henry-coefficient) that substance A has a potential for evaporation from plants and soil.

Most countries have “no formal criteria for air”, however an indicative upper limit for non-persistence used by Portugal (for both water and air) is a DT50 of 4 days.

Some countries have referred to the UNEP “Stockholm Convention” and Executive Body Decision 1998/2 under the UN ECE LRTAP Convention for criteria on persistency in air. Only Switzerland addressed persistency in air by stating that the volatile metabolite mB (of substance B) is not sensitive to photodegradation and OH-radicals, and that, considering the relatively high use rate of 750 g/ha, a significant amount will be released to the air. The formation percentage of Substance B metabolite mB (13%) has –au contraire– been considered as non-significant by Sweden.

3.8 Difficulties encountered and suggestions for further development

As it appears from the responses to question 9 in the questionnaire, the assessments seemed to be rather straight-forward for many countries. One EU member state concluded that EU guidance and policy now cover all aspects. Australia, however, noted that its current methodology did not deal well with P and B and identified a need to develop a PBT strategy. Also Portugal expressed concern over the current methodology, especially relating to bioaccumulation and biomagnification. Sweden and Norway also mentioned difficulties to address biomagnification. Sweden also suggested additional elements to current risk assessment approach for substances which have a high bioaccumulation potential (e.g., very few elements are added for a substance with a BCF of 2500 as compared to a substance with no bioaccumulation potential). Criteria for the validity of field studies and guidance on extraction methods for identification of bound residues and methods to predict bioavailability was also mentioned.

4. CONCLUSIONS AND RECOMMENDATIONS

The case study has generated a vast amount of information on the criteria, standards, methodology and reporting formats used at registration of pesticides. Most countries performed an integral assessment, including groundwater and ecotoxicity, although the assignment specifically stated only to focus on PB criteria. Several countries only addressed the case studies through the questionnaire, which sometimes resulted in answers referring to the data set, instead of the assessment procedure and methodology used for national registration. In these cases, no information on data handling was generated.

Only a few focal points are chosen to address and compare the information. These focal points are:

1. is the registration framework capable of deciding on Persistency and Bioaccumulation (PB) as independent qualities?
2. are the criteria behind the regulatory decisions harmonised?
3. is the same information used to address these criteria?
4. is persistency and bioaccumulation equally weighted in different environmental compartments?

Ad 1. Registration frameworks in all countries are capable of identifying Persistency and Bioaccumulation as important aspects of the substances, which merit special consideration[24]. Also, the registration framework can be capable of deciding on Persistency and Bioaccumulation (PB) as independent qualities. Five out of fifteen participating countries apply cut-off values for persistency in soil or for bioaccumulation. Three of these countries are EU-member states and have imposed national legislation or policy making for higher-tier assessments, supplementary to the implementation of the 91/414/EEC Directive. One additional EU country expressed that they would apply the criteria of the Stockholm Convention when ratified.

One major difference noted between countries is the extent to which countries are confident with current risk assessment practices. Thus, there seems to be a scale from (on the one hand) the view that reasonably safe decisions can be taken also for PB-substances based on current risk based methodology, to (on the other hand) that there is a need for a "safety net" (or upper limit, cut-off criterion) for PB-substances since the uncertainty in risk assessment is too large for these substances to allow safe enough decisions to be taken.

Ad 2. From the case study results it is deduced that there are no harmonised agreements on classification: what is actually classified, what information is needed to do so, and under what standard conditions should the data be judged. Classification is often done per compartment (soil, water, and air), and in some cases on the basis of compound-matrix combinations, and different standards are applied. Some countries label the pesticide as persistent on the basis of properties of either active ingredient, its isomers or the metabolites. Other countries refrain from this general label and classify the particular isomer as persistent, some even specifically in conjunction with a compartment or a (presumably representative) compartment property (e.g. soil type, pH). Bound residue formation and mineralisation were not always addressed as parameters for persistency. In one country, these properties are explicitly weighed with degradation rate to find a persistency classification.

[24] Japan does not consider environmental bioaccumulation in the assessment.

Ad 3. Classifications are given based on properties determined in one or more experimental studies. Different studies give different results, but no uniform approach to data handling was available. Differences in data selection and data manipulation may have a great influence on the outcomes.

Those countries that did select among the persistency data and re-calculate the values to standard conditions, appeared to use similar methods. For persistency, data may be selected based on test characteristics, and results may be transformed to give standardised values. These were assessed as ranges, means, or values are singled out, for classification and decision making, which resulted in different outcomes. The range of outcomes of the average DT50 for the R-isomer did extend beyond the Uniform Principles trigger value for persistency.

The question is whether an EU member state is allowed to select and discard laboratory data from the list-of-endpoints that was the basis for Annex I inclusion. Most member states did, which resulted in diverging conclusions.

Field studies are used for information on degradation rates, but mostly not for information on metabolite formation. Different selection among field studies is natural, since it is often desirable that field studies do represent regional conditions. Also the relevance of the accumulation study or plateau calculation was decided on differently.

If test results span one or more classification boundaries, classifications are designated based on extremes or median values, the "distance-to-boundary" is weighed, or classifications are modified ("borderline persistent"), creating new classifications.

With respect to bioaccumulation there is no harmonisation on the use of data on degradation, clearance rate, and exposure patterns in relation to the need for an assessment of the BCF, and the consequences of trigger violation.

Ad 4. Persistency and bioaccumulation are not equally weighed between soil, water and air. All countries apply the criteria to soil, but only a few apply the same criteria to water/sediment. Criteria for air are applied by some countries following the Stockholm convention on POP.

It was stated in some occasions that the quality and relevance of the degradation studies is difficult to evaluate because of the lack of experimental data. This is inherent to lists-of endpoints and puts question marks at the degree of harmonisation between member states if only the lists are available.

To be discussed further as items for further harmonisation:
- risk assessment methodologies for bioaccumulation
- uncertainty in higher tier risk assessments and the merits of trigger values
- ways to address bound residues in the assessments
- ways to interpret and use anaerobic degradation data
- criteria for the validity of field studies
- guidance on data presentation in lists-of-endpoints (e.g. EU and FAO)
- guidance on data selection and data transformation (normalisation)
- guidance on data handling (ranges, averages, single values)
- applicability of persistency criteria to water and sediment
- harmonisation of classification schemes
- training of assessors.

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CASE STUDIES

Primary name

Substance A

Physical and chemical properties

Property	Value	Remark
Vapour pressure	$8x10^{-3}$ Pa	20°C
Log K_{ow}	5.2	pH 7, 20°C
Solubility in water	87 µg/L	pH 7, 20°C
pK_a	-	not available
Molecular weight	400	$g.mol^{-1}$

Formulations

1. 250 EC (emulsifiable concentrate, substance A 250 g/l)
2. 10 WG (water dispersable granulate, substance A 10 %)

Intended use	nr. form.	Dosage	dose a.i.	freq.	interval [days]	time of application
sugar beet (leaf spot)	1	0.4 l/ha	100 g/ha	1-9	4-30	As soon as damage to the crop is observed. Repeat when necessary
summer and winterwheat (leaf spot)	1	0.5 l/ha	125 g/ha	1		As soon as damage to the crop is observed.
apples en pears (scab)	2	0.0375% (37.5 g/100 L water)	38-56 g/ha	1-5	4-30	March-May. As soon as damage to the crop is observed until a maximum of 96 hours after a scab infection occurs (1000 - 1500 L water/ha).

Degradation in soil

Laboratory studies

soil type	incubation	pH	T (°C)	pF	%om	dosage (mg/kg)	DT50 (days)
loamy sand	aerobic	5	20	3.0	4	0.1	240
silty loam	aerobic	7.2	20	3.0	1.5	0.1	229
silty loam	aerobic	7.2	20	3.0	1.5	1.0	368
silty loam	aerobic	7.2	10	3.0	1.5	1.0	554
silty loam	aerobic	7.2	30	3.0	1.5	1.0	297
silty loam	aerobic	7.2	20	4.0	1.5	1.0	430
sandy loam	aerobic	8.5	25	3.0	1.5	9.7	595
loam	aerobic	6.5	25	3.0	3.7	10	620
loam	aerobic	6.8	20	3.0	4.2	10	670

soil type	incubation	pH	T (°C)	pF	%om	dosage (mg/kg)	DT50 (days)
sandy loam	anaerobic	8.5	25	3.0	1.5	9.7	805
loam	anaerobic	6.5	25		3.6	10	950
loam	anaerobic	6.8	20		4.2	10	820

Bound residues were found at a maximum of 28% after 180 days, 25% after 281 days (at the end). CO_2 reached max. 12% after 100 days, max. 23% after 281 days (end) incubation.

Field studies

Substance A

soil type	location	crop	dosage (kg a.s./ha)	DT50 (days)	DT90	Remarks
loam	Canada	no	0.8		>1 year	250 EC
sandy loam	Canada	no	0.125	139	>1 year	250 EC
clay	England	no	0.375	158	>1 year	250 EC
clay	England	no	0.125	182	>1 year	250 EC
sandy clay	England	no	0.375	186	>1 year	250 EC
sandy clay	England	no	0.125		>1 year	250 EC
silty loam	Spain	no	0.5	27	124 days	Dissappears quickly in the first month, afterwards more slowly. DT50 based on first 3 months and DT90 based on first 6 months
loamy sand	Spain	no	0.5	93	124 days	idem
silty loam	Spain	no	0.5	72	<1 year	idem
silty loam	Germany	no	0.15	331	>1 year	250 EC
loamy sand	USA CA	no	0.13	113	<1 year	?

Metabolite mA:

Was formed at a maximum of 8% of the applied radioactivity after 182 days in the 0-10 cm soil layer. After 369 days only 4% remained.

Metabolite mB

Was formed in a field lysimeterstudy at a maximum of 11% of the applied radioactivity 182 days after application. After 369 days 8% remained.

Field studies on wheat and bare field in England showed that residues after application in the third year, after repeated applications of 0.075-0.150 kg/ha, did not exceed residues found after application in the first year.

Adsorption

K_{om}-values for substance A: 633, 1150, 1830, 1850, 2040, 2060, and 3500 dm^3/kg. Values derived from Freundlich isotherms with 1/n between 0.8 and 1.0 and soil o.m. contents between 0.5 and 15% o.m..

Degradation in the aquatic environment

Degradation in water-sediment systems

DT50 of substance A in two water/sediment systems >800 days. Rapid dissipation from water-phase; DT50 10-20 days.

Hydrolysis

Substance A does not hydrolyse in water.

Ready biodegradability

Substance A is not readily biodegradable

Degradation in air

No information available.

Bioaccumulation

For *Lepomis macrochirus* the BCF ww/wo of substance A is 5500 L/kg. The halflife for clearance was 5-8 days. No further elimination after 10 days.
For *Anguilla anguilla* the BCF ww/wo of substance A is 4000 L/kg (in presence of sediment 2% o.c.).
For *Mytilus edulis* the BCF ww/wo of substance A is 10000 L/kg.

Toxicity to earthworms

Species	Duration	Effect	Endpoint	Remarks
Eisenia fetida	14-days	LC50	50 mg/kg	10% o.m.
Eisenia fetida	28-days	NOEC	0.1 mg/kg	10% o.m.

Effects on micro-organisms

Substance A has no influence on soil-respiration and nitrification when used at 1.67 and 16.7 mg/kg.

Effects on other non-target soil organisms

Species	Duration (hours)	Effect	Endpoint	remark
Mucor circinelloides	6 d	NOEC	0.01 mg/kg	10% o.m.
Zea mays	21 d	NOEC	0.4 mg/kg	3.5% o.m.
Sorghum bicolor	21 d	NOEC	1.0 mg/kg	3.5% o.m.
Brassica napus	21 d	NOEC	5.0 mg/kg	3.5% o.m.
Pisum sativum	21 d	NOEC	0.1 mg/kg	3.5% o.m.
Folsomia candida	28 d	NOEC	2.0 mg/kg	10% o.m.
Porcellio scaber	28 d	NOEC	10 mg/kg	10% o.m.

Toxicity data for aquatic species

Species	Duration (hours)	Effect	Endpoint		remark
Oncorhynchus mykiss	96	LC50	0.81	mg/L	actual conc.
Oncorhynchus mykiss	96	LC50	0.81	mg/L	actual conc.
Lepomis macrochirus	96	LC50	1.2	mg/L	actual conc.
Cyprinodon variegatus	96	LC50	0.82	mg/L	actual conc.
Pimephales promelas	34 days	NOEC	6.7	µg/L	actual conc.
Pimephales promelas	68 days	NOEC	8.7	µg/L	actual conc.
Daphnia magna	48	LC50	0.77	mg/L	actual conc.
Daphnia magna	21 days	NOEC	5.6	µg/L	actual conc.
Scenedesmus subspicatus	72	EC50	1.2	mg/L	actual conc.
Scenedesmus subspicatus	72	NOEC	0.3	mg/L	actual conc.
Lemna gibba	14 d	NOErC	2.5	mg/L	actual conc.

Species	Duration (hours)	Effect	Endpoint	sediment spiked	remark
Lumbriculus variegatus	28 d	NOEC	0.5	mg/kg_{dw}	10% o.m.
Caenorhabditis elegans	72 h	NOErC	0.1	mg/kg_{dw}	10% o.m.

Toxicity data for vertebrates

Species	Duration	Effect	Endpoint	Unit
Anas platyrhynchos		LD50	215	mg/kg bw
Rattus norvegicus (m+f)		LD50	150	mg/kg bw
Anas platyrhynchos	11 days	LC50	500	mg/kg feed
Colinus virginianus	9 days	LC50	476	mg/kg feed
Anas platyrhynchos	126 days	NOEC	25	mg/kg feed
Colinus virginianus	154 days	NOEC	15	mg/kg feed
Mus musculis (f)	2 year	NOAEL	0.2	mg/kg bw/day
Rattus norvegicus (f)	Teratogenity	NOAEL	0.5	mg/kg bw/day

Primary name

Substance B

Physical and chemical properties

Property	Value	Remark
Vapour pressure	$3.5x10^{-7}$ Pa	20°C
Log K_{ow}	3.2	20°C
Solubility in water	3.3 mg/L	20°C
pK_a	-	Not available
Molecular weight	300	$g.mol^{-1}$

The substance consists of two stereoisomers (R- and S).

The R-isomers is documented in the efficacy dossier to be the active isomer.

Formulations
1. 500 EC (emulsifiable concentrate, substance B 500 g/l)

Application	dosage	dose a.i.	Frequency	time of application
cereals		750 g/ha	1	Growth phase, from tillering to stem elongation

Degradation in soil

Laboratory studies

Substance B

Soil type	incubation	pH	T (°C)	pF	%om	Dosage (mg/kg)	DT50 S Isomer (days)	DT50 R isomer (days)
*Loamy sand	aerobic	5.5	20	2.2	3.6	0.1	195	98
*Loamy sand	aerobic	5.5	20	2.2	3.6	2.0	240	77
Silty loam	aerobic	7.0	20	3.0	1.4	0.1	177	110
Silty loam	aerobic	5.5	20	3.0	0.4	2.0	208	97
Sandy loam	aerobic	8.0	25	2.5	16	0.1	110	74
Sandy loam	aerobic	8.0	25	2.5	16	2.0	127	60
Loam	aerobic	6.9	20	3.0	2	0.1	170	75
Loam	aerobic	6.9	20	3.0	2	2.0	185	66
Clay	aerobic	6.0	29-31	4.5	1	3.0	50	30

*Route of degradation study.

Metabolites R isomer:
mA
This metabolite has two isomers (50:50%). After 100 days 30% is formed and at the end 60% (at 180 days). DT50 of both isomers was determined in separate studies.

Soil type	incubation	pH	T (°C)	pF	%om	Dosage (mg/kg)	DT50 S Isomer (days)	DT50 R isomer (days)
*Loamy sand	aerobic	5.5	20	2.2	3.6	0.1	95	95
*Loamy sand	aerobic	5.5	20	2.2	3.6	1.0	120	120
Sandy loam	aerobic	6.0	25	2.5	2.5	1.0	60	60
Clay	aerobic	6.0	29-31	4.5	1	1.0	25	25
Loam	aerobic	6.9	20	3.0	2	1.0	85	85

*Route of degradation study.

mB
This metabolites is only found in a volatile trap at max. 13% after 180 days.

mC
After 100 days 6% of this metabolite is found. At the end (after 180 days) 9%. This metabolite is a degradation product of metabolite mA only.

Residues
Bound residues reached a maximum of 78% after 100 days, 55% after 180 days (at the end). CO_2 reached 1% after 100 days, max. 33% after 281 days (at the end) incubation.

Metabolites S isomer:
mA
After 100 days 10% is formed and after 100 days and 30% at the end (after 180 days). This metabolite has two isomers (50:50%). DT50 of both isomers was determined in separate studies (see above).
Fraction of other metabolites (unspecified) total <3%.
Bound residue reached a maximum of 60% after 180 days; CO_2 3% after 180 days.

Field-studies

Substance B

soil type	location	crop	dosage (kg a.s./ha)	DT50 (days)	DT90	Remarks
loam	USA CA	no	0.75	50	½ year	R-isomer
sandy loam	USA KS	no	0.50	60	½ year	R-isomer
clay	Spain	no	0.375	60	½ year	R-isomer
clay	Spain	no	0.125	40	½ year	R-isomer
clay	Spain	no	0.125	100	1 year	S-isomer
sandy clay	Spain	no	0.375	80	1 year	R-isomer
sandy clay	Spain	no	0.125	90	1 year	R-isomer
sandy clay	Spain	no	0.125	200	2 years	S-isomer
silty loam	UK	no	0.5	55	½ year	R-isomer
loamy sand	UK	no	0.5	12	2 months	R-isomer
silty loam	UK	no	0.5	98	1 year	R-isomer
silty loam	France	no	0.5	100	1 year	R-isomer
loamy sand	Germany	no	0.75	70	1 year	R-isomer
loamy sand	Germany	no	0.75	190	2 years	S-isomer

Metabolite mA:
Was formed at a maximum of max. 25% of the applied radioactivity after 40-190 days in the 0-10 cm soil layer. After 369 days (end) only 4% remained.

Adsorption

K_{om}-values for substance B: 2000, 13500, 3600, 2550 dm^3/kg. K_{om}-values for metabolite A: 20, 12, 17, 25 dm^3/kg. Values derived from Freundlich isotherms with 1/n between 0.8 and 1.0 and soil o.m. contents between 0.5 and 15% o.m..

Column leaching

In an aged leaching test metabolite C was formed at 3% of r.a. applied after ageing and was after leaching recovered for 3% of the r.a. in the leachate.

Degradation in the aquatic environment

Degradation in water-sediment systems

In water-sediment systems (10% sediment) no difference in behaviour between both isomers was observed. Metabolite mA was found at 6% after 180 days (end) in the sediment; 11% in the water phase after 180 days.

Substance	Sediment type	T	pH	o.m.	DT_{50} water	DT_{50} sediment	DT_{50} system
		[°C]		[%]	[d]	[d]	[d]
substance B	silt loam	20	5.6	5.8	1	>180	>180
substance B	sand	20	6.7	0.7	3	>180	>180
substance B	loamy sand	20	7.0	1.5	2	>180	>180

Separate studies with mA were conducted.

Substance	Sediment type	T	pH	o.m.	DT_{50} water	DT_{50} sediment	DT_{50} system
		[°C]		[%]	[d]	[d]	[d]
mA	silt loam	20	5.5	5.7	60	170	100
mA	sand	20	6.4	0.7	90	150	90
mA	loamy sand	20	6.9	1.5	70	180	110

Hydrolysis

Substance B does not hydrolyse in water.

Ready biodegradability

Substance B is inherently biodegradable.

Degradation in air

Metabolite B is sensitive neither to photodegradation nor to OH-radicals.

Bioaccumulation

In *Lepomis macrochirus* the BCF ww/wo of the R isomer of substance B is 50 L/kg. DT50 for clearance is 0.5 days. For the S isomer the BCF ww/wo is 400 L/kg. DT50 for clearance is 5 days. For *Lepomis macrochirus* the BCF ww/wo of metabolite A of the R isomer of substance B is 30 L/kg and of the S isomer the BCF ww/wo is 210 L/kg. The DT50 for clearance was 0.5 days for both isomers.

Toxicity to earthworms

Substance B

Species	Duration	Effect	Endpoint	Remarks
Eisenia fetida	14-days	LC50	>1000 mg/kg	10% o.m.
Eisenia fetida	28-days	NOEC	10 mg/kg	10% o.m.

Metabolite mA

Species	Duration	Effect	Endpoint	Remarks
Eisenia fetida	14-days	LC50	>1000 mg/kg	10% o.m.
Eisenia fetida	28-days	NOEC	30 mg/kg	10% o.m.

Effects on micro-organisms

Substance B has no influence on soil-respiration and nitrification when used at 1.0 and 0.1 mg/kg.

Toxicity data for aquatic species

Substance B

Species	Duration (hours)	Effect	Endpoint		remark
Oncorhynchus mykiss	96	LC50	1500	mg/L	actual conc.
Lepomis macrochirus	96	LC50	>2500	mg/L	actual conc.
Cyprinodon variegatus	96	LC50	1200	mg/L	actual conc.
Pimephales promelas	30 days	NOEC	140	mg/L	actual conc.
Pimephales promelas	68 days	NOEC	154	mg/L	actual conc.
Daphnia magna	48	LC50	700	mg/L	actual conc.
Daphnia magna	21 days	NOEC	110	mg/L	actual conc.
Scenedesmus subspicatus	72	EC50	1	mg/L	actual conc.
Scenedesmus subspicatus	72	NOEC	0.1	mg/L	actual conc.
Lemna gibba	14 d	EC50	1000	mg/L	actual conc.
Lemna gibba	14 d	NOEC	120	mg/L	actual conc.

Species	Duration (hours)	Effect	Endpoint	sediment spiked	remark
Lumbriculus variegatus	28 d	NOEC	50	mg/kg_{dw}	10% o.m.
Caenorhabditis elegans	72 h	NOErC	0.01	mg/kg_{dw}	10% o.m.

Metabolite mA

Species	Duration (hours)	Effect	Endpoint		remark
Oncorhynchus mykiss	96	LC50	4500	mg/L	actual conc.
Lepomis macrochirus	96	LC50	>7000	mg/L	actual conc.
Daphnia magna	48	LC50	2000	mg/L	actual conc.
Daphnia magna	21 days	NOEC	300	mg/L	actual conc.
Scenedesmus subspicatus	72	EC50	3000	mg/L	actual conc.
Scenedesmus subspicatus	72	NOEC	300	mg/L	actual conc.

Toxicity data for vertebrates

Substance B

Species	Duration	Effect	Endpoint	
Anas platyrhynchos	5	LD50	>5000	mg/kg bw
Anas platyrhynchos	8	LC50	>5000	mg/kg feed
Colinus virginianus	10	LC50	>5000	mg/kg feed
Anas platyrhynchos	28 days	NOEC	>500	mg/kg feed
Colinus virginianus	28 days	NOEC	>500	mg/kg feed

Metabolite mA

Species	Duration	Effect	Endpoint	
Anas platyrhynchos	2 days	LD50	>15000	mg/kg bw
Anas platyrhynchos	14 days	LC50	4500	mg/kg feed
Colinus virginianus	9 days	LC50	5000	mg/kg feed
Anas platyrhynchos	120 days	NOEC	>4500	mg/kg feed
Colinus virginianus	130 days	NOEC	450	mg/kg feed

ANNEX A – ASSESSMENT OF DATA SET 'A'

A.1. France

Unfortunately, the qualified environmental scientists were not able, due to their workload, to do this case study following the whole national registration process for pesticides. Thus, the exercise has been done considering the approach presented in the draft EU TGD (Technical Guidance Document for new chemicals, existing chemicals and biocides). This guidance is not used actually in France to assess phytosanitary products.

However, the questionnaire has been answered in collaboration with pesticides experts according to the real national standards and procedure.

Persistency assessment:

Water / sediment study	endpoint	standard	conclusion
DT50 Water	10, 20 days	P>40 days vP>60 days	Non P
DT50 Water/sediment	>800 days	P>120 days vP>180	vP

Substance A is not readily biodegradable

Conclusion: Substance A is very persistent => vP

Bioaccumulation assessment:

species	BCF ww/wo	standard	conclusion
lepomis	BCF 5500 DT50 clearance=5.8 days	B > 2000	vB
anguilla	BCF 4000		
mytilus	BCF = 10000	vB > 5000	

Log Kow=5.2, standard is B>4.5 => B

Conclusion : Substance A is very Bioaccumulative =>vB

Toxicity assessment:
Mucor circinelloides (fungi) → NOEC = 0.01 mg/kg→ NOEC < 0.01 mg/kg → T
Anas platyrinchos (bird) → NOEC = 25 mg/kg → NOEC < 30 mg/kg → T
Colinus virginianus (bird) → NOEC = 15 mg/kg → NOEC < 30 mg/kg → T

Conclusion : substance A is toxic T

Conclusion

Substance A is a PBT

A. 2. Australia

Formulation and Use

250 EC Fungicide is a product formulated as an emulsifiable concentrate, containing 250 g/L of the active ingredient, substance A. It is intended for use in sugar beet and summer and winter wheat to control leaf spot. 10 WG Fungicide is a product formulated as a water dispersible granulate, containing 10% of the active ingredient, substance A. It is intended for use in apples and pears to control scab.

No information was provided on the method of application of the fungicides. For field crops, formulations are usually applied by ground spraying with a boom sprayer using medium droplet sizes. Formulations are usually applied to apples and pears by orchard sprayer using medium droplet sizes. While aerial application, particularly to broadacre agricultural crops, cannot be ruled out, in this assessment we will assume the fungicide is applied only by ground spraying.

Rates and Frequency of Application

The fungicide 250 EC is applied to sugar beet at a rate of 0.4 L/ha formulated product, equating to 100 g a.i./ha. It is recommended the fungicide be applied 1 to 9 times per growing season, at 4 to 30 day intervals, as soon as damage to crops is observed. The treatment is repeated when needed.

The fungicide 250 EC is applied to wheat at a rate of 0.5 L/ha formulated product, equating to 125 g a.i./ha. It is recommended that the fungicide be applied once per growing season, as soon as damage to crops is observed.

The fungicide 10 WG is applied to apples and pears in spring at up to 37.5 g formulated product per 100 L of water, equating to 56 g a.i./ha, at 4-30 day intervals, as soon as damage to crops is observed (within 96 hours of damage), using 1000-1500 L water/ha.

Summary of Physico-chemical Properties and Fate

Substance A of MW 400, is slightly volatile (8 X 10^{-3} Pa), very slightly water soluble (87 µg/L at pH 7, 20ºC), and is highly lipophilic (log K_{ow} = 5.2 at pH 7, 20ºC).

Substance A is not readily biodegradable and does not undergo hydrolysis. No photodegradation data were provided. It has a high persistence in aerobic soil in laboratory studies, with DT50 values between 229 and 670 days (average 445 days), and low to high persistence in aerobic soils in field studies (lowest in Spain, highest in Germany, no temperature, pH, OM data provided for field studies), with DT50 values between 27 and 331 days (average 146 days). Under anaerobic conditions in the laboratory, DT50 values in soil are between 805 and 950 days.

The K_{om} values (range 633-3500, OM content, 0.5-15%, pH 5-8.5) predict low mobility in soils due to binding to organic matter. In the laboratory studies, bound residues reached 28% after 180 days, declining to 25% by the end of the test (281 days). CO_2 evolution reached 12% after 100 days, and 23% by the end of the test.

Substance A is highly persistent in water/sediment systems with DT50 values >800 days. It dissipates from the water phase at a medium rate (DT50 10-20 days).

Substance A formed 2 metabolites, mA (field dissipation study) and mB (lysimeter study, no other information was provided from this study). Metabolite mA reached a maximum of 8% after 182 days (0-10 cm layer), and declined to 4% by day 369. Metabolite mB reached a maximum of 11% (182 days), declining to 8% by day 369.

Substance A is highly bioaccumulating (BCF >5000). The BCF (wet weight/whole organism) for the common mussel (*Mytilus edulis)* was 10000 L/kg. The BCF for Bluegill sunfish (*Lepomis machrochirus*) was 5500 L/kg, with a half-life for clearance of 5-8 days, and no further elimination after 10 days. The BCF for the freshwater eel (*Anguilla anguilla*) was 4000 L/kg (in the presence of 2% OC).

Summary of Environmental Toxicity

Normally *Environment Australia* would have separate sections assessing each fate and toxicity test in detail, followed by summaries. However, the latter are well summarized in tables in the documentation and will not be repeated here. It is noted that toxicity data for the individual formulations are not provided. *Environment Australia* agrees that data for the active ingredient is appropriate.

Prediction of Environmental Hazard

Exposure concentrations

The proposed spray rates and equivalent soil concentrations for formulations 250 EC and 10 WG Fungicides for both the single and maximum proposed multiple applications are shown in Table 1. The equivalent concentrations of active substance in soils are calculated for the top 10 cm of soil, assuming a bulk density of 1.5 g/cm^3. Owing to the persistence of substance A, we assume no degradation between treatment intervals and 100% to soil with no capture by vegetation.

Table 1. Expected environmental concentration (EEC) of substance A for each use pattern.

		Single application		Multiple applications	
Formulation	**Crop**	**g a.i./ha**	**mg/kg soil**	**g a.i./ha**	**mg/kg soil**
250 EC	Sugar beet	100	0.067	900	0.60
250 EC	Wheat	125	0.083	Not proposed	
10 WG	Apples, pears	56	0.034	280	0.17

The highest treatment rate for a single application is 125 g a.i./ha rate for formulation 250 EC in the treatment of wheat. However, application to wheat occurs only once per season. The worst-case treatment rate for multiple applications is 900 g a.i./ha for formulation 250 EC in the treatment of sugar beet (i.e. 100 g a.i./ha, up to 9 times per seasons, at a minimum of 4-day intervals), equating to a concentration in soil of 0.6 mg a.i./kg assuming all reaches the soil.

The proposed spray rates for a multiple application of formulation 10 WG Fungicides will result in a worst-case treatment rate of 280 g a.i./ha for apples and pears (i.e. 56 g a.i./ha, 5 times, at 4-day intervals).

Persistence and accumulation in soil

Accumulation of substance A due to its persistence in some soil types could occur, particularly when repeated applications are used. Data from field dissipation and laboratory degradation studies indicate half-life times in soil under aerobic conditions of between 27 and 331 days, and in laboratory studies of between 229 and 670 days.

According to the persistence criteria defined in the Stockholm Convention on Persistent Organic Pollutants (POPs), substance A is persistent in soil (DT50 >180 d) when using the worst-case half-life times of 331 days, derived from field studies, and 670 days, derived from laboratory studies.

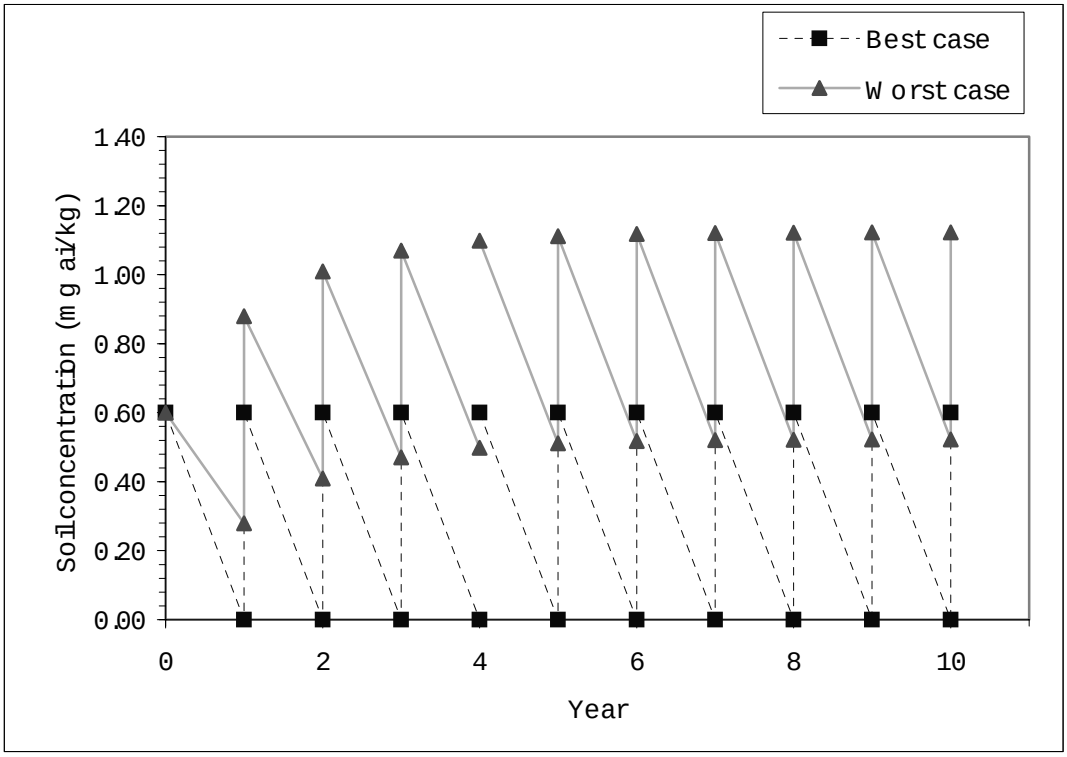
However, field studies carried out on wheat and bare soil in England showed that residues after application in the third year, following repeated applications of 0.075-0.150 kg/ha, did not exceed residues found after application in the first year. The information does not indicate whether repeat applications were made during the growing season, therefore, we assume, the application rates refer to yearly rates.

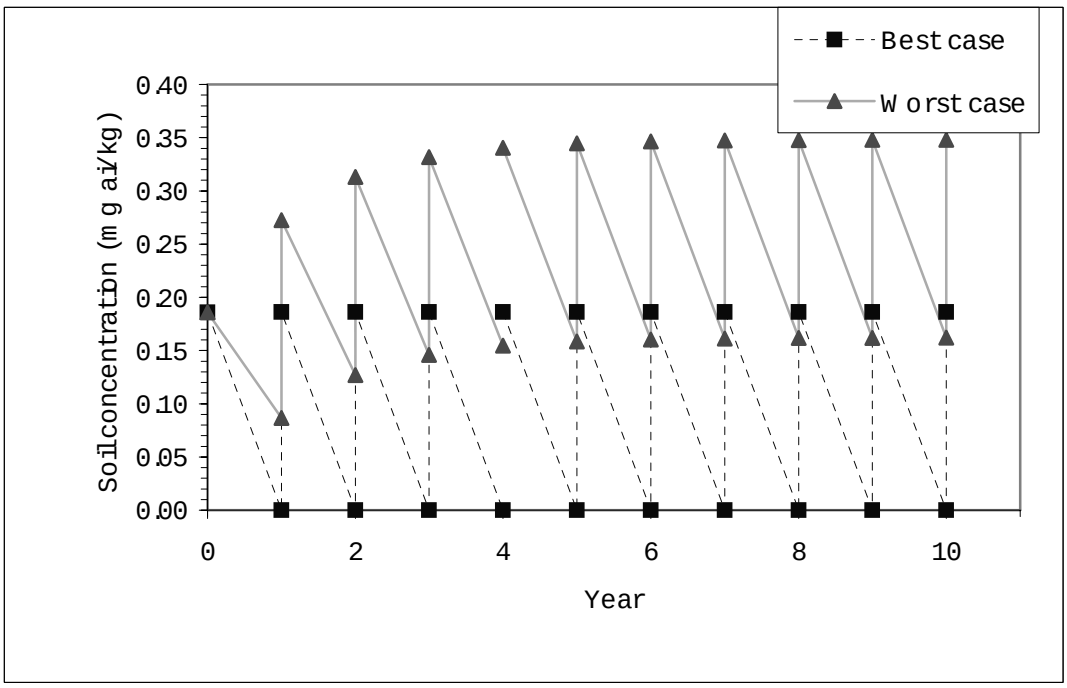
Figures 1a & b indicate the trend in concentrations of substance A in soil over a 10-year period following multiple applications. The concentration estimates pertain to residues remaining in the surface 10 cm of soil with a bulk density of 1.5 g/cm^3 and assumes all of the applied pesticide reaches the soil. We have assumed the best-case (27 days) and worst-case (331 days) half life times for field conditions rather than the slower rates found under laboratory conditions because the field studies are expected to be more representative of on farm degradation. We also assume no movement below 10 cm and no loss in surface run-off.

Figure 1a shows trends in soil concentrations of substance A following application of formulation EC 250 at the maximum rate of 100 g a.i./ha in nine applications at 4 day intervals per year for an initial year and repeated every year for 10 successive years. Figure 1b shows soil concentration trends following application of formulation 10 WG at the maximum rate of 56 g a.i./ha in 5 applications, repeated every year for 10 years.

With the "best case" half-life of 27 days, no accumulation or carryover occurs from year to year with both use patterns. In the case of EC 250, with the "worst case" half-life of 331 days, carryover results in the predicted concentration increasing fairly rapidly in the first 5 years, then remaining relatively stable after that. In year 7, concentrations reach 1.120 mg/kg soil immediately after application, then decline to a minimum of 0.522 mg/kg soil over the year. In year 10, the concentration increased slightly to 0.123 mg/kg, and may continue to increase after 10 years, albeit very gradually. In the case of formulation 10 WG, the annual carryover is about 47%, with concentrations reaching a maximum of 0.348 mg/kg, assuming the worst-case half-life of 331 days.

Figure 1a&b. Effects of 9 repeat applications of 100 g/ha of substance A (top) and 5 repeat applications of 56 g/ha (bottom) on concentrations in the top 10 cm of soil.





These data suggest that accumulation could occur in some soil types if the fungicide is used in multiple applications, which are repeated year after year. However, soil accumulation is not expected to be of

concern in wheat growing areas, where only one application is proposed per year, and wheat crops are grown in rotation. Sugar beet is not widely grown in Australia, but it too is generally grown in rotation with other crops, which should also limit the number of applications of the fungicide from year to year. Accumulation in some soils in fruit growing orchards could potentially occur, when multiple applications are repeated year after year. However, levels in soil may be expected to be much lower than predicted in Figure 1, due to both interception by the foliage of crops and by ground cover in the field.

Hazard Quotients

The environmental hazard from acute exposure is determined from the Environmental Hazard Quotient (Q) calculated by dividing the expected environmental concentration (EEC) by the acute toxicity data for the most sensitive aquatic species (LC50 or EC50). We generally consider the following values as an appropriate guide for the establishment of hazard:

- $Q > 0.5$: hazard is unacceptable,
- $0.1 \leq Q \leq 0.5$: hazard may be able to be mitigated by some form of risk management, such as label restraints for a specific use and an identified hazard arising from that use, and
- $Q < 0.1$: hazard is considered low (and may or may not require some form of risk management, such as general label restraints).

For chronic exposure (eg. repeated sprays and/or relatively persistent substances), the hazard is considered acceptable if the NOEC for the most sensitive species to chronic exposure is less than the EEC estimated for prolonged exposure.

Hazard to terrestrial organisms

Birds and mammals

Birds and mammals are most likely to be exposed to the fungicide through direct contact with the spray or residues on plants and soils, or through the consumption of residues on treated vegetation and insects exposed to the fungicide.

Birds

Substance A is moderately toxic to birds. The 11 d dietary LC50 for mallard duck (*Anas platyrhynchos*) is 500 mg/kg feed, and the 126 day reproduction NOEC is 25 mg/kg feed. The 9 d dietary LC50 for Bobwhite quail (*Colinus virginianus*) is 476 mg/kg feed and the 154 d reproduction NOEC is 15 mg/kg feed.

The PEC values for birds and mammals are based on the Kenaga nomogram (Hoerger & Kenaga 1972) as modified by Fletcher *et al*. (1994). The PEC values describe the dietary exposure concentrations or the amount of residues on food immediately after application. The residue concentrations in food assume a Bobwhite quail has a diet of 30% small insects, and 70% grain, while the mallard duck has a diet of 30% grain and 70% large insects.

Table 2 shows the equivalent concentrations of residues in food (fresh weight) consumed by birds following the highest single application, and for both multiple applications, and the hazard quotients (Q) calculated from the $PEC_{residues}$ and the dietary LC50.

Table 2. The dietary Q values and residue concentrations in food for birds and rats.

		Residues in food mg/kg			Q		
Species	**Toxicity Endpoint**	**1**	**5**	**9**	**1**	**5**	**9**
Colinus virginianus	476 mg/kg feed	13.1	29.3	94.3	0.03	0.06	0.2
Anas platyrhynchos	500 mg/kg feed	4.8	10.9	35	0.01	0.02	0.07
Rattus norvegicus	3000 mg/kg feed*	12	27	88	0.004	0.009	0.03

*Calculated from an LD50 of 150 mg/kg bw, assuming a body weight of 400 g and food consumption of 20 g.

The residue concentrations in food from a single spray at the highest rate (125 g a.i./ha) are below the acute dietary levels for ducks. The resulting Q values are below 0.1, indicating a low concern from a single application.

The residues concentrations in food arising from 5 repeat sprays of 10 WG (56 g a.i./ha/spray, and assuming no breakdown) result in dietary Q values for acute toxicity below 0.1, also indicating a low concern. The residues concentrations in food arising from a worst-case 9-spray treatment program for 250 EC (100 g a.i./ha/spray, and assuming no breakdown) are also below the acute dietary levels for birds. However, the dietary Q value for the quail from acute toxicity are above 0.1, indicating a potential hazard.

Table 3 shows the Q values for birds arising from the residues in food and using the chronic toxicity endpoints. The residue concentrations in food for a single application indicate a low concern to birds (EEC<NOEC). However, for multiple applications of 5 repeat sprays of 10 WG, the Q values are <1 for the domestic duck, but are >1 for the quail, indicating a potential concern from chronic exposure for the quail. For multiple applications of 9 repeat sprays, the residue concentrations in food result in Q values >1 for both species (EEC>NOEC), indicating a potential concern from chronic exposure.

Table 3. The dietary Q values for birds with chronic exposure.

		Q		
Species	**Toxicity Endpoint**	**1**	**5**	**9**
Colinus virginianus	154 d NOEC = 15 mg/kg feed	0.87	1.95	6.3
Anas platyrhynchos	126 d NOEC = 25 mg/kg feed	0.2	0.4	1.4

The assessment indicates a potential chronic hazard, particularly to quail, from repeated application to sugar beet. However, it is unlikely that quail would inhabit beet fields for lengthy periods, and only consume contaminated food, so in practice, the hazard may be more acceptable, particularly in pome fruit orchards. A decline in residue levels over time should also occur.

Rats

Substance A is moderately toxic to rats. The LD50 (duration of test not specified) for *Rattus norvegicus* is 150 mg/kg bw, equivalent to an LC50 of 3000 mg/kg feed (Urban and Cook 1986). The NOAEL for teratogenity is 0.5 mg/kg bw/day. The 2 year NOAEL for the house mouse, *Mus musculis*, is 0.2 mg/kg bw/day.

The equivalent concentration of residues in food (fresh weight) from a single spray consumed by a rat (assuming a diet of 100% grain), are below the acute dietary levels for rats. The resulting Q values for single and multiple applications are well below 0.1, indicating a low concern (Table 2).

Soil dwelling organisms

Table 4 shows the Environmental Hazard Quotients for soil dwelling organisms, using the available toxicity endpoints, and the EEC values derived from the highest single application (125 g/ha), and from both multiple application regimes.

Table 4: Environmental Hazard Quotients for terrestrial species

		Q values		
	Endpoint mg/kg	**125 g a.i./ha**	**280 g a.i./ha**	**900 g a.i./ha**
Earthworms (*Eisenia foetida)*	14 d LC50 = 50 28 d NOEC = 0.1	1.66 X 10^{-3} 0.83	3.4 X 10^{-3} 1.7	0.012 6
Soil fungi (Mucor circinelloides)	6 d NOEC = 0.01	8.3	17	60
Springtail *(Folsomia candida)*	28 d NOEC = 2.0	0.04	0.085	0.3
Nematode *(Caenorhabditis elegans)*	72 h NOEC = 0.1	0.83	1.7	6
Slater *(Porcellio scaber)*	28 d NOEC = 10	8.3 X 10^{-3}	0.017	0.06

Earthworms

Earthworms are likely to be exposed to the fungicide when they move into the upper horizons of the soil to feed.

Substance A is moderately acutely toxic to earthworms *(Eisenia foetida)*, with a 14 day LC50 of 50 mg/kg, but with a 28 d NOEC of 0.1 mg/kg. The Q values for acute toxicity are all less than 0.1 indicating a low hazard from acute exposure. The Q values for chronic exposure are less than 1 for a worst-case single application, but are greater than one (i.e. EEC>NOEC) for both multiple applications, indicating a potential hazard to these organisms from chronic exposure (Table 4) under worst-case conditions. Again, soil levels are expected to be lower than indicated in Figure 1, particularly in orchards where <50% may be expected to reach the soil through interception by vegetation. This would result in an acceptable hazard. It is more difficult to mitigate the hazard from sugar beet use.

Microorganisms

Substance A had no effect on soil respiration and nitrification when applied at rates equivalent to between 1.67 and 16.7 mg/kg. Both of these rates are higher than (~3-38 times) the worst-case EEC for repeated applications, indicating a low hazard to micro-organisms responsible for soil respiration and nitrification processes.

The 6 d NOEC for the soil fungi (*Mucor circinelloides*) is 0.01 mg/kg. The Q values for exposure at the highest single application rate and for both repeat application regimes are all significantly greater than 1, suggesting a potential hazard to these organisms and other beneficial soil fungi from exposure to substance A (Table 4). This is not unexpected due to the product's fungicide activity and cannot easily be mitigated through consideration of interception by vegetation.

Mesofauna

The 28 d NOEC for the springtail (*Folsomia candida*) is 2.0 mg/kg. The Q values are all less than 1 (i.e. NOEC<EEC) indicating a low hazard.

The 72 h NOEC for soil nematodes (*Caenorhabditis elegans*) is 0.1 mg/kg. The worst-case EEC values for repeated applications are higher than the NOEC for the most sensitive organism (nematode), suggesting a potential hazard to mesofauna from chronic exposure to substance A following repeated applications (Table 4). Again, inception by vegetation would probably lower the hazard to an acceptable level in pome fruit orchards, but a hazard from sugar beet use is more difficult to dismiss.

Beneficial Predators and parasites

No data was provided for beetles, spiders or wasps. The 28 d NOEC for the common slater (*Porcellio scaber*) is 10 mg/kg, which is almost 17 times higher than the worst-case EEC (Q = 0.06) for multiple applications of the EC 250 formulation, indicating a low hazard. However, in *Environment Australia's* experience, this is an unusual test species, and the relevance of this result to other species is unclear.

Desirable vegetation

The 21 d NOEC endpoints for several plant species were provided (Table 5). The NOEC endpoints for corn (*Zea mays*) and pea (*Pisum sativum)* are lower than the EEC for multiple applications of the fungicide (Table 1), suggesting a potential hazard to some plant species, particularly legumes, from long-term exposure to substance A.

Table 5: Environmental Hazard Quotients for terrestrial species

		Q values		
	Endpoint mg/kg	**125 g a.i./ha**	**280 g a.i./ha**	**900 g a.i./ha**
Corn (Zea mays)	21 d NOEC = 0.4	0.16	0.43	**1.5**
Sorghum (Sorghum bicolour)	21 d NOEC = 1.0	0.07	0.17	0.6
Rape *(Brasicca napus)*	22 d NOEC = 5.0	0.01	0.03	0.1
Pea *(Pisum sativum)*	21 d NOEC = 0.1	0.67	**1.7**	**6**

Hazard to Aquatic organisms

In an aquatic contamination situation, the EEC (expected environmental concentration) is calculated for spray or runoff reaching lentic water 15 cm deep (as a worst case situation in regard to water depth). *Environment Australia* normally uses a tiered approach to perform the exposure assessment, where as an initial step, we consider the worst-case situation of direct overspray (100% spray drift) at the maximum label rate. If required, we then consider a 10% spray drift situation, and subsequently examine the more likely practical situations, taking into account the factors such as fate, persistence, and the likelihood of exposure.

As an initial worst case for runoff, we generally assume 10% of the substance originally applied to a 1 ha crop, runs off in solution or adsorbed to soil particles into a pond 15 cm deep and 1 ha in area (Urban and Cook 1986). These levels are equivalent to 10% spraydrift, therefore only one number appears in the tables below.

Fish, aquatic invertebrates and aquatic plants

Direct Overspray, Single Application

The EEC values in a body of water 15 cm deep, assuming 100% direct overspray of substance A, following a single application to wheat is 0.083 mg/L, and following an application to sugar beet is 0.067

mg/L. The EECs arising from multiple applications, assuming no degradation or partitioning to sediment, are 0.17 mg/L (5 repeats of 10 WG) and 0.60 mg/L (9 repeats of 250 EC).

Substance A is highly toxic to fish and *Daphnia* in acute toxicity studies. Rainbow trout (*Oncorhynchus mykiss*) had the lowest 96 h LC50 value (0.81 mg/L) of the acute data provided for fish species. *Daphnia magna* was the most sensitive organisms, with a 48 h LC50 of 0.77 mg/L. Substance A is moderately toxic to aquatic plants, with the green algae (*Scendesmus subspicatus*), having a 72 h EC50 of 1.2 mg/L, and *Lemna gibba* having a 14 day NOErC of 2.5 mg/L.

The Q values for acute hazard to aquatic species arising from a single spray to sugar beet and wheat are shown in Table 6.

Table 6: Environmental Hazard Quotients for aquatic organisms resulting from a direct overspray (100% contamination) of substance A from a single application.

		Q	
Species	**Endpoint**	**Sugar beet (100 g/ha)**	**Wheat (125 g/ha)**
Fish	96 h LC50 = 0.81 mg ai/L	0.07	0.1
Daphnia	48 h EC50 = 0.77 mg ai/L	0.08	0.11
Algae	96 h EC50 = 1.2 mg ai/L	0.05	0.07
Duckweed	14 d NOEC = 2.5 mg ai/L	0.027	0.033

For fish and *Daphnia*, the Q values resulting from direct 100% overspray at the recommended rate for a single spray application are near or below 0.1 for acute toxicity endpoints indicating an acceptable hazard to these organisms from acute exposure to substance A.

For algae and Duckweed, the Q values for 100% overspray following a single application are below 0.1 and indicate a low acute hazard these organisms.

Direct Overspray, Multiple Applications

Substance A could be applied up to 9 times a season at 4 day intervals, hence chronic exposure of organisms in the water column could occur. The half-life for dissipation from the water column is greater than the application frequency interval (DT_{50} in water/sediment systems >800 days, with DT_{50} for dissipation from the water phase of 10-20 days), further increasing the potential for chronic exposure.

In chronic studies, the most sensitive species is *Daphnia magna* with a 21 d NOEC of 5.6 μg/L. Fathead minnow (*Pimephales promelas*) had a 34 day NOEC of 6.7 μg/L and the 68 day NOEC is 8.7 μg/L. The green algae (*Scendesmus subspicatus*) had an NOEC of 0.3 mg/L, and *Lemna gibba* had a 14 day NOErC of 2.5 mg/L.

The Q values for chronic hazard to aquatic species assuming 100% direct overspray of substance A during multiple applications, assuming worst case frequency intervals and no degradation are shown in Table 7.

Table 7: Environmental Hazard Quotients for aquatic organisms resulting from a direct overspray of substance A during multiple applications.

		Q	
Species	**Endpoint (mg a.i./L)**	**9 sprays, 4 d intervals**	**5 sprays, 4-d intervals**
Fish	34-d NOEC = 0.0067	EEC>NOEC (89.5)	EEC>NOEC (25.4)
Water flea	21-d NOEC = 0.0056	EEC>NOEC (107)	EEC>NOEC (30.3)
Algae	NOEC = 0.3	EEC>NOEC (2)	NOEC>EEC (0.57)
Duckweed	14-d NOErC = 2.5	NOEC>EEC (0.24)	NOEC>EEC (0.07)

The Q values for fish and *Daphnia* arising from continued exposure during multiple applications are all significantly greater than 1, indicating a high concern from chronic exposure in the worst-case situation of 100% overspray. In the case of green algae and Duckweed, the EEC is greater than the NOEC only for algae, when the worst case multiple application frequency is employed.

The repeated direct overspray scenario is not expected to occur under normal usage of the fungicide. Therefore, it is highly unlikely that aquatic organisms would be exposed to 100% direct overspray of substance A at each application over a continuous period. However, it must be assumed that some off-target spray drift will occur during spray application and hence contamination of soil and water outside the target area. The US EPA estimates that approximately 10% of the amount sprayed will reach the aquatic environment via spray drift for pesticides applied by air or mist blower (Urban and Cook 1986).

Hazard From 10% Spraydrift and Runoff, Single Application

The EEC resulting from 10% spray drift or runoff into a body of water 15 cm deep, are 0.0083 mg/L for a single application at the highest rate (125 g a.i./ha), and 0.06 mg/L (9 X 100 g a.i./ha), and 0.017 (5 X 56 g a.i./ha) for multiple applications at the highest recommended frequency rate. The Q values for acute exposure of aquatic organisms arising from 100% spray drift following a single application at the highest rate indicate a low concern, and as such, an even lower hazard is expected from 10% spray drift.

Table 8 shows the NOEC endpoints and the Q values arising from 10% spraydrift and runoff during multiple applications of substance A. These values indicate a cause for concern for fish and *Daphnia* because the EEC value is greater than the NOEC from chronic exposure. However, there is no concern for algae and duckweed, where the EEC is less than the NOEC.

Table 8. Toxicity risk quotients for aquatic organisms assuming 10% spraydrift and 10% runoff following multiple applications.

		Q	
Species	**Endpoint**	**5 sprays**	**9 sprays**
Fish	34-d NOEC = 0.0067	2.54	8.95
Daphnia	21-d NOEC = 0.0056	3.0	10.7
Algae	NOEC = 0.3	0.057	0.2
Duckweed	14-d NOErC = 2.5	0.007	0.024

In summary, the above results indicate a low concern from acute exposure to all aquatic organisms assessed following 100% direct overspray and by extension 10% spray drift. However, multiple applications involving five or more repeat sprays, results in an unacceptable hazard to fish and *Daphnia* from chronic exposure due to significant levels of spraydrift.

Refinement of Hazard From Spraydrift

In practice, spraydrift from ground application is likely to be significantly less than 10% and this extent of drift is also unlikely to occur to the same water body every spray. Capture of run-off by grass or plants would also reduce the amount of runoff to waterbodies.

Estimates of spraydrift from ground application using conventional ground rigs have been in the order of <2%. For example, AgDRIFT™ estimates of spraydrift of pesticides (Tier I, low boom sprayer, single application, and a water body 3 m wide) of about 1.6% or 0.6% at 5 m and 30 m downwind, respectively (assuming application is made in good weather conditions with correctly calibrated equipment and applied by boomsprayers, rather than misters).

Field studies carried out in Germany by Rautmann *et al* (2001), using statistical analysis of repeated ground spray applications to various crops, provide spraydrift estimates at various buffer distances from the crop. The data for fruit and vegetables are shown in Table 9 (those crops receiving multiple applications).

Table 9. Basic drift values for three or more applications as a % of the application rate (77th percentiles).

	Percentage Spray Drift		
Buffer (m)	**Early Fruit**	*Late Fruit*	**Vegetables <50 cm**
1			2.01
3	23.96	11.01	
5	15.79	6.04	**0.41**
10	8.96	2.67	0.20
20	2.36	**0.80**	0.10
30	**0.77**	0.36	0.07

These data indicate relatively high levels of spray drift close to the source of the spray, particularly from orchard sprayers, where spraydrift is as high as 24% within a metre of the sprayed area. Consequently, in situation where multiple spray regimes are planned, buffer zones will be required between water bodies and sprayed areas for the protection of aquatic organisms. The data in Table 9 indicate that the buffer distance needed to reduce drift to levels of <1% are 5 m for vegetables (<50 cm tall), 20 m for fruit crops (late in the season), 30 m for fruit crops (early in the season). The spray drift rate would need to be reduced to <1% for a multiple application involving nine sprays and to <4% for multiple applications involving five sprays, to ensure protection of the most sensitive species (i.e. *Daphnia*) from sublethal effects (i.e. EEC<NOEC). These high safety margins are also required for substance A owing to its persistence in water/sediment (DT50>800 d) and bioaccumulative potential.

Further Factors Mitigating Chronic Exposure from Spray Drift and Runoff

Dissipation to sediment would be expected to mitigate the hazard to aquatic organisms during repeated application by reducing the EEC in water. The DT50 for dissipation from the water phase is 10-20 days. Thus, dissipation would be more significant when longer intervals are used between repeat applications. The recommended frequencies for repeat applications are 4-30 days. A reduction in the number of repeat applications would also reduce the aquatic hazard from chronic exposure.

Greater dilution of spraydrift or runoff reaching a water body would also occur in areas where water is flowing and water depth is greater than was used in the above scenarios. Fish or other organisms in streams may also be able to move out of water containing residues. However, in still and confined waterbodies, such as lakes and ponds, poor mixing and stratification may occur as depth increases, limiting dilution and reducing the rate of dissipation to sediment.

Hazard to benthic and sediment-dwelling organisms

Substance A is highly persistent in water/sediment systems with DT50 values >800 days, but relatively rapidly dissipates from the water phase (DT50: 10-20 days), becoming bound to sediment. Thus exposure of benthic organisms could occur through the water, or through the sediment/pore water. Many benthic organisms eat small living and dead material in mud and are likely to ingest some of the mud during feeding, therefore, they could also become exposed through ingestion of contaminated sediment and organic matter in sediment.

An endpoint was provided for the mud worm (*Lumbriculus variegates*). The 28 d NOEC for the mud worm is 0.5 mg/kg dry sediment. Data for concentrations in sediment were not provided. However, if we assume 10% runoff/spraydrift, and nine repeat applications at 4-day intervals, with all of substance A partitioning to sediment, no degradation, and 100% bioavaliability, the exposure concentration in the top 10 cm of sediment during the season could reach 0.06 mg/kg. The resulting Q value is 0.12, (EEC<NOEC), indicating a low hazard.

These values are for worst-case application and accumulation rates for one season. It is possible that continued annual use at high application rates could result in a gradual accumulation in sediment over time to concentrations above the NOEC, but this would be dependent on repeated aquatic contamination occurring. Further, an endpoint for the more common test organisms, chironomids, is not available and *Environment Australia* has no information on the relative sensitivities of these test organisms.

Hazard from bioaccumulation

Substance A is highly toxic to fish and *Daphnia* (EC50<1 mg/L) and (NOEC<0.01 mg/L), is persistent, and is classified as bioaccumulative according to the criteria set out by the US EPA (1999), Environment Canada (2002), and the Stockholm Convention on POPs (a chemical is considered bioaccumulative when log Kow >5 or BCF>5000). Bioaccumulation of substance A from water or contaminated sediment could therefore represent a hazard to aquatic and benthic organisms.

The highest BCF is 10000 L/kg for *Mytilus edulis* (common mussel), classifying substance A as highly bioaccumulative (US EPA criteria). The BCF for *Anguilla anguilla* (freshwater eel) is 4000 L/kg, and the BCF for *Lepomis machrochirus* (Bluegill sunfish) is 5500 L/kg, the latter with a half-life for clearance of 5-8 days, with no further elimination after 10 days.

Environment Australia notes that with up to nine applications of substance A per season in sugar beet and five applications per season in apples and pears, it is possible that aquatic exposure may recur during the

season. The length of time between each exposure could be as short as 4 days, or as long as 30 days. The half-life for clearance of 5-8 days is longer than the worst-case frequency interval of 4-days, such that the concentrations in aquatic organisms could steadily increase under these repeat applications regimes. As no further clearance of substance A was observed after day 10, accumulation could continue even where longer times between repeat applications are employed.

Because substance A is persistent in sediment, it is possible that continued annual use at high application rates could result in a gradual accumulation in sediment over time, from where it may become available to organisms at a later time.

Hazard to groundwater

Substance A has a low solubility in water and binds strongly to soil particles. The K_{om} values predict low to slight mobility in soils, according to the classification system of McCall *et al* (1980). Therefore, based on these data, and in the absence of column leaching or lysimeter data, it is concluded that substance A should not negatively impact on groundwater.

Conclusions

The fungicide formulation 250 EC Fungicide, containing 250 g/L of the active ingredient, substance A, could be applied to sugar beet at a rate of 100 g a.i./ha, 1-9 times per growing season, at 4 to 30 day intervals to control leaf spot. The fungicide 250 EC is applied to wheat at a rate of 125 g a.i./ha, only once per growing season to control leaf spot. The fungicide 10 WG could be applied to apples and pears at a rate of 56 g a.i./ha, 1-5 times per season, at 4-30 day intervals to control scab.

The acute hazard to terrestrial and aquatic organisms from single spray application of the fungicide is generally low. However, the hazard from chronic exposure to terrestrial and aquatic organisms from repeat applications is generally high.

Substance A is highly toxic to fish and *Daphnia* in both acute and chronic studies. Substance A is persistent is some soils, with DT50 values in soil >180 d and is highly persistent in water/sediment systems (DT50>800 d). It relatively rapidly partitions from water to sediment (DT50: 10-20 d). The assessment for birds indicates a potential concern from chronic exposure, particularly from repeated use on sugar beet, where a hazard to terrestrial and soil invertebrates can also not be ruled out.

Substance A is highly bioaccumulating in shellfish and bioaccumulating in fish. Bioaccumulation is a concern with aquatic organisms, should significant or repeated aquatic contamination occur. The likelihood of accumulation of residues in soils and terrestrial organisms such as birds, farm animals, and soil invertebrates should also be considered. Bioaccumulation in farm animals through grazing on plant residues, would be of major concern for the protection our meat export markets, particularly in the light of our past-experience with other pesticides. This aspect has not been examined in this assessment as it is usually carried out in another area of the Australia regulatory regime for pesticides and no specific information was provided.

Recommendations

The following recommendations are made to protect aquatic species, and reduce the likelihood of substance A contaminating water, either accidentally or as a result of normal use.

- To minimize spray drift and run-off to aquatic areas, it is recommended that buffer zones be adopted between the crop being sprayed and a water body. This assessment suggests a buffer distance of at least 5 m is needed for vegetables crops less than 50 cm tall, and buffer distances of

at least 20 m and 30 m are needed for fruit crops, for spraying late in the season, and early in the season, respectively.

- The multiple application regimes should be further examined. To reduce the chronic exposure, the number of repeat application to sugar beet and fruit crops should be reduced, and the intervals between applications should be increased. Repeated yearly applications using multiple applications should also be avoided. Intervals between applications should be sufficient to allow affected organisms to recover, not just to reduce the risk quotient below the levels of concern.
- The degree of persistence and bioaccumulation is of concern. Reducing the number of applications would assist in lowering the potential for bioaccumulation. If registered, monitoring of residues in fish and other environmental media could indicate whether the steps taken have alleviated this concern.

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A.3 Norway

Norway has reviewed the conclusions on the original assessments, but not the assessments themselves, before the final draft.

1. Ecotoxicological evaluation

This evaluation is based on data from OECD.

Recommended dose is 38 – 125 g/ha.

1.1 Substance A

	Physical/chemical data
Water solubility	Low 0,087 mg/l (20 °C)
Vapour pressure	Medium 8 x 10^{-3} Pa (20 °C)
Henrys law constant	Not available
log P_{ow}	Very high 5,2
pK_a	Not available
	Environmental fate
Ads-/desorption	**Medium to very high adsorption,** Kf_{OC} : 367 – 2030, average 1082. No R^2 to say how good the correlation is, and no desorption performed. The content of organic matter varies much and it is not possible to say anything about the influence of organic matter on adsorption. The lack of detailed information on the different soil-types tested makes it difficult to evaluete the adsorption under Norwegian conditions. This kind of information must be provided.
Mobility	Column leaching: no study performed.
Lysimeter:	no study performed.
Evaporation:	No study performed.
Hydrolysis	Substance A does not hydrolyse in water.
Photolysis	No study performed
Degradation in soil	**Aerobic:** Primary degradation is **low, DT50: 229 – 670 days, average 450 days.** The degradation rate is 1.5 times lower at 10 °C, and 1.2 times higher at 30 °C. Information on the amount of bound residues and degree of mineralization is missing. After 100 days the levels of bound residues (28 %) and mineralization (12 %) are quite low. There is no information on metabolites. The water content is should be between pF 2 - 2.5. Above this the soils are so dry that microbial activity, and thus degradation, will be

reduced. A soil pH of 8.5 is not relevant for Norwegian conditions where pH 5 – 7 is more usual).

Anaerobic: Primary degradation is low, DT50: 805 – 950 days, average 858 days.

	Sandy loam	**Loam**	**Loam**	**Loamy sand**	**Silty loam**	**Silty loam**	**Silty loam**	**Silty loam**	**Silty loam**	**Sandy loam**	**Loam**	**Loam**
Aerobic/ anaerobic	Anaerobic			Aerobic								
Duration	-											
pH	8,5	6,5	6,8	5	7,2					8,5	6,5	6,8
Org.mat.	1,5	3,6	4,2	4	1,5						3,7	4,2
Moisture during study	pF 3,0	-	-	pF 3,0					pF 4,0	pF 3,0		
Temp. (°C)	25		20	20			10	30	20	25		20
DT50, days	805	950	820	240	229	368	554	297	430	595	620	670
DT90, days	-											
CO_2 (%) after 100 d	Max 12 % and max 23 % after 281 days											
Bound residue (%)	Max 28 % after 180 days and 25 % after 281 days											
Metab. > 10 %	-											

Field studies: 5 field studies with the formulation 250 EC show a bit more rapid degradation than the laboratory study: DT_{50}: 139 –331 days and DT_{90}: > 1 year. 3 other field studies had much lower DT50 (27-93 days) but they were performed in Spain, not comparable to Norway. A metabolite mA was formed at max 8 % after 182 days at a depht of 0 – 10 cm. After 369 days only 4 % remained. Metabolite mB was formed in a field lysimeterstudy at a maximum of 11% of the applied radioactivity 182 days after application. After 369 days 8 % remained. We do not know in which of these studies metabolites were found. It does not say if it was found in the water or attached to the soil in the lysimeter study. Details on this study should have been provided.

Accumulation in soil

Field studies on wheat and bare field in England showed that residues after repeated applications of 0.075-0.150 kg/ha in three years, did not exceed the residues found after one year. There was no information on the number of applications per year. The maximum dose is 9 times 0.1 kg/ha.

Degradation in water

Ready biodegradability: substance A is not ready biodegradable.

Water/sediment systems:

The primary degradation is low, DT50 > 800 days in two systems. Rapid dissipation from the water phase: DT_{50} 10 – 20 days. No conclusion on bound residues or mineralization is provided.

Residues in surface and ground water — No information.

Bioaccumulation — Substance A has **a very high potential for bioaccumulation**, but seems to have a short half-life. For Lepomis macrochirus the BCF ww/wo of substance A is 5500 L/kg. The half-life for clearance was 5-8 days. No further elimination after 10 days. For Anguilla anguilla the BCF ww/wo of substance A is 4000 L/kg (in presence of sediment 2% o.c.). For Mytilus edulis the BCF ww/wo of substance A is 10000 L/kg.

Effects on terrestrial organisms

Microorganisms — Substance A **has no influence** on soil-respiration and nitrification when used at 1.67 and 16.7 mg/kg. It was also tested on *Mucor circinelloides* and 6 days NOEC was 0.01 mg/kg.

Earthworms — Acute toxic and chronic toxic to earthworms.

Species	Exposure	EC/LC50 (mg/kg)	NOEC (mg/kg)	Study quality
E. foetida	Acute 14 d.	50	-	?
E. foetida	Subchronic 28 d.	-	0,1	?

Pollinators — No study performed.

Other beneficial arthropods — There seems to be **no effect** at the dose recommended (0,01 – 0,17 mg/kg). The substance has a potential for accumulation in soil, but no effect on 10 – 50 times the dosage on the two species tested.

Type of test	Species	Duration	NOEC	Study quality
Lab. test?	*Folsomia candida*	28 d.	2.0 mg/kg	?
Lab. test?	*Porcellio scaber*	28 d.	10 mg/kg	?

Birds — **Acute toxic and very toxic in diet** and substance A could have long term effects on birds.

Species	Acute/diet/ reproduction	LD50/LC50 mg/kg	NOEC/NOEL mg/kg	Study quality
Anas platyrhynchos	**Acute**	**215**	**-**	**?**
Anas platyrhynchos	**Diet, 11 days**	**500**	**-**	**?**
Colinus virginianus	**Diet, 9 days**	**476**	**-**	**?**
Anas platyrhynchos	**Repro: 126 days**	**-**	**25**	**?**
Colinus virginianus	**Repro: 154 days**	**-**	**15**	**?**

Mammals — **Acute toxic and chronic toxic** to rat (LD50: 150 mg/kg and NOAEL: 0,5 mg/kg).

Plants — Recommended doses could be toxic to plants. Doses tested are to low. More details on study design should have been provided.

Species	Duration	NOEC mg/kg
Zea mays	21 d.	0.4
Sorghum bicolor	21 d.	1.0
Brassica napus	21 d.	5.0
Pisum sativum	21 d.	0.1

Field experiments — No data available.

Effects on aquatic organisms

Algae — Toxic to Scenedesmus subspicatus. See table underneath.

Water plants — **Moderately toxic** to Lemna gibba. See table underneath.

Invertebrates — **Very toxic and very toxic to reproduction** in Daphnia magna. See table underneath.

Sediment living organisms — **Not toxic** to tested sediment living organisms. See table underneath.

Fish — **Very toxic to fish**, both long term and short term. See table underneath.

Species	Duration	EC/LC50 (mg/l)	NOEC (mg/l)	Study quality
Oncorhynchus mykiss	96 h	0.81		?
Oncorhynchus mykiss	96 h	0.81		?
Lepomis macrochirus	96 h	1.2		?
Cyprinodon variegatus	96 h	0.82		?
Pimephales promelas	34 days	-	0.0067	?
Pimephales promelas	68 days	-	0.0087	?
Daphnia magna	48 h	0.77		?
Daphnia magna	21 days	-	0.0056*	?
Scenedesmus subspicatus	72 h	1.2		?
Scenedesmus subspicatus	72 h	-	0.3	?
Lemna gibba	14 days	-	2.5	?
Lumbriculus variegatus	28 d	-	0.5 mg/kg	?
Caenorhabditis elegans	72 h	-	0.1 mg/kg	?

*Endpoint used in risk assessment.

Model systems

No information.

1.2 Co-formulants

No information.

1.3 Plant Protection Product

No information.

1.4 Risk assessment

Exposure

Substance A has a low water solubility, the adsorption is medium to high, the mobility is not further studied. Degradation in soil is slow both aerobic and anaerobic (average aerobic DT50 > 1 year). The potential for groundwater pollution should be low because of the adsorption, but low degree of degradation indicates a risk for groundwater pollution. Accumulation in soil could also occur. Field studies showed that repeated applications over 3 years did not give higher residues in soil than after one year. The DT50-value from lab is an absolute cut off value. Metabolites have been found in field experiments.

PIEC in soil supplied with 38 – 125 g a.i./ha at different frequencies and intervals is equivalent to 0.08 mg/kg in wheat, 0.18 mg/kg in fruit and 0.59 mg/kg in sugar beet.

Ganzelmeier (1995) can estimate realistic concentrations in watercourses as a result of spray drift. PEC (predicted environmental concentration) will depend on the safety zone that is used (in this case a dose of 125 g/ha for sugar beet and wheat dosage is used while for fruits 56 g/ha is used):

Safety zone, meter	PEC, µg/l		
	Low cultures	Fruit	
	H > 50 cm	early	late
1 m	1.15	-	-
5 m	0.24	3.71	1.57
10 m	0.12	2.20	0.67
20 m	0.06	0.52	0.20
30 m	0.04	0.19	0.10

The exposure of different water bodies due to surface runoff from treated areas can be estimated in accordance to ECPA (European Crop Protection Association) 1995. For most of the pesticides losses far under 0.5 % have been observed. As a worst case we estimate 0.5 % surface runoff from 1.0 ha area to a 0.2 ha pond with depth 1.0 meter. Because of this potential surface runoff PEC can be estimated to 0.31µg/l from area with low cultures and 0.14 µg/l from areas with fruits.

Degradation in water/sediment is low, DT50 > 800 days. This substance will be a problem for a long time if it reaches the water.

Potential for bioaccumulation is very high (fish: BCF 5500 l/kg), even though the clearance is rapid, this is an absolute cut off value.

The risk of effects on organisms

Terrestrial

Substance A is toxic to earthworms, acute TER= 85 - 625 and chronic TER= 0 -1. The chronic effect can not be accepted (the chronic limit is 5), not even at the lowest dose. Acute toxic and very toxic in diet and could have more long-term effects on birds. Toxic to rats in short term and long term experiments.

Aquatic

Toxic to Scenedesmus subspicatus, moderately toxic to Lemna gibba, very toxic and very toxic to reproduction for Daphnia magna. Not toxic to sediment living organisms. Very toxic to fish.

The TER estimate is related to the lowest chronic NOEC value for *Daphnia* (5.6 µg/l). Acceptabel TER for chronic study is > 10. So in low cultures (sugar beet and wheat) we need a 5 m. safety zone, and in fruit we need a 20 m. safety zone. (An estimation we have used: dosage 125 g/ha for sugar beet and wheat, while for fruits 56 g/ha is used)

Sikkerhetssone, meter	TER, chronic toxicity *daphnia*		
	Low cultures	Fruit	
	H > 50 cm	early	late
1 m	4.9	-	-
5 m	23.6	1.5	3.6
10 m	46.3	2.5	8.3
20 m	89.6	10.8	27.5
30 m	134.4	28.8	55.6

TER for surface runoff is 17.92 in low cultures and 40.0 in fruit.

1.4 Documentation

The quality of the studies is difficult to evaluate because of the lack of information on experimental data and other details of the studies. This information has to be provided before a more detailed and better evaluation can be done. The lack of detailed information on the soil-type(s) tested makes it difficult to evaluate leaching behavior and degradation under Norwegian conditions. This must be provided. We lack studies on: photolysis in soil and water, effects on pollinators and other beneficial arthropods (2 sensitive species).

1.5 Risk of groundwater pollution

By estimating the GUS index we get a value of 2.6 (Koc: 1082, DT50: 450 days). This means we can not conclude that substance A is a non-leacher. If the degradation is lower in Norway because of temperature, or the adsorption is lower then the possibility of contamination of drinking water could be high (>2.8).

1.6 Classification

Present classification

Very toxic to aquatic organisms. Can not be used closer to watercourses than 5 meters when used in wheat and sugar beet, and 20 meters when used in fruits. Toxic to earthworms.

New classification from 30.07.2004

N; Dangerous to the environment.

R50/53 Very toxic to aquatic organisms; may cause long term adverse effects in the aquatic environment.

Can not be used closer to watercourses than 5 meters (wheat and sugar beet) and 20 meters (fruits). Toxic to earthworms.

Conclusion

Substance A should not be accepted. We have a cut off value on the degradation rate and also on BCF. And the TER for earthworms also leads to the same conclusion, unacceptable.

A.4. Sweden

A. Introduction

KemI has received an application for approval of 250 EC and 10 WG Products, containing 250 g/l and 10% of Substance A as active ingredient, respectively. Intended use of EC Product is in sugar beet, summer and winter wheat, while intended use of WG Product is in orchards. Dose rate is 100/125 g a.i./ha in field crops, 38-56 g a.i./ha in orchards.

B. Evaluation

Agricultural conditions/Toxicology/Residues

Environmental fate and behaviour

2.5 Influence on the environment

2.5.1 Fate and distribution in the environment

2.5.1.1. Rate and route of degradation in soil

DT_{50} values derived at 10, 25 and 30°C were roughly recalculated to 20°C, assuming Q_{10} = 2.2. One DT_{50} derived in parent study at pF 4.0 was excluded since soil was considered too dry. Single treatments result in soil concentration 0.05-0.17 mg/kg in the upper 5 cm soil layer, assuming soil density of 1.5 g/cm^3. The worst case PECsoil from repeated use is approximately 1.2 mg/kg soil. Three results were excluded because of unrealistic test concentrations. Field results from Spain and USA (CA) were excluded since they are not assumed to well represent Nordic conditions.

Thus, the results considered were:
- $DT_{50soil,lab}$ values of 229-653 days, mean 348 days, median 252 days (n=5),
- $DT_{50soil,field}$ values of 139-331 days, mean 199 days, median 182 days (n=5),

- $DT_{90soil,field}$ > 1 year (n=7)

No persistent metabolites seem to be formed, but this conclusion is uncertain due to the slow transformation of the parent compound. The results from the soil accumulation study, which showed that residues after repeated use over 3 years did not exceed residues from the first year, do not supersede the concordant results from laboratory and field dissipation studies.

It is concluded that the substance is persistent in soil. It is not considered relevant to require additional studies, since this would not reduce the uncertainty with regard to potential long-term effects to an acceptable level.

2.5.1.2 .Risk for groundwater

Water solubility and log Kow value of parent compound does not indicate significant leaching. This is confirmed by adsorption coefficients, Koc (recalculated from Kom) being 1090-6030, mean Koc 3220 (n=7). It is concluded that the potential for leaching of parent compound to groundwater is negligible.

Potential leaching of metabolites cannot be excluded, since their environmental properties essentially is unknown, and they can be expected to be present at low concentrations over long time periods as the parent molecule slowly degrades.

2.5.1.3. Risk for surface water

In water/sediment studies dissipation from water phase was fairly rapid, DT_{50} 10-20 days, however, degradation in the whole system was very slow; > 800 days. It is concluded that the substance is persistent in sediments. The result is in agreement with the results from soil systems. Again, it is not considered relevant to require additional studies, since this would not reduce the uncertainty with regard to potential long-term effects to an acceptable level.

2.5.1.4. Risk for air compartment

Vapour pressure ($8x10^{-3}$ Pa) is not low enough to exclude volatilization. The Henry's law constant (37 Pa x m^3 x $mole^{-1}$) indicates significant volatilization from moist surfaces. Thus, there is a potential for air-borne transport from the target site. This may in part explain the result of the soil accumulation study. No data is available on potential transformation in air, but deposition at a local and regional scale can be expected.

Ecotoxicology

2.5.2. Impact on non-target species

2.5.2.1. Risk for birds (and other terrestrial vertebrates)

The acute and short-term toxicity to birds is medium to high. The substance is toxic to avian reproduction at low levels (NOEC 15-25 mg/kg feed). Acute toxicity to mammals is high, and also here toxicity to reproduction is shown at low levels of exposure (NOAEL 0.2-0.5 mg/kg bw/d).

In combination with the persistency and the high potential for bioaccumulation, the demonstrated effects on reproduction are serious. It is not considered meaningful to perform a quantitative risk assessment because any estimate of the exposure would in this case be very uncertain, due to expected diffuse distribution into various environmental compartments including biota. It is concluded that there is risk for short- and long-term effects on top consumers in aquatic and terrestrial food chains.

2.5.2.2. Risk for aquatic organisms

The acute toxicity to fish, daphnia and algae is medium to high. NOEC in long-term studies on fish and daphnids is very low (µg/l-range). NOEC for effects on sediment living organisms is also low.

The substance has a high potential for bioaccumulation; BCF 5500 (*Lepomis*), 4000 (European eel), and 10000 in mussels. Biomagnification cannot be excluded. Half life for clearance is of less relevance since the steady-state BCFs already is a function of uptake, metabolism and depuration. Given the persistency of the substance, low environmental concentrations are expected to be present for long time scales and thus allow uptake in biota.

Given the persistency and the high potential for bioaccumulation, and thus an expected widespread distribution in the environment, including biota, it is not considered relevant to perform a risk assessment with comparison of point estimates of exposure and effect levels. From the available data it is concluded that there is a risk for effects on aquatic organisms at various levels of the food chain.

2.5.2.3. Risk for honeybees/ Risk for beneficial arthropods

2.5.2.5. Risk for earthworms and other non-target soil macro-organisms

The acute toxicity to earthworms is high, and the long-term NOEC is very low (in the same range as PECsoil). Several additional studies on non-target soil organisms showed NOEC values in the same range. It is concluded that there is a risk for effects on a range soil organisms.

2.5.2.6. Impact on microbial activity

No negative effects were determined, hence risk acceptable.

C. Decision

Summary of concerns in environmental fate and behaviour and ecotoxicology:
The substance is clearly persistent. It also has a high potential for bioaccumulation, and also risk for biomagnification. Significant volatilization from the target site may occur. A risk for short- and long-term effects on birds, wild mammals, soil macro-organisms and aquatic organisms at different trophic levels were identified.

Alternatives/Risk-benefit analysis

Proposal for decision
The substance is expected to have an unacceptable impact on the environment. It is proposed that it is not authorized for use.

A.5. USA

Information Memorandum

Chemical A

Use Sugar beets, Wheat and Pome fruits

This memorandum supports denying a registration of the new fungicide Chemical A on sugar beets, wheat and pome fruits from an environmental risk standpoint only.

Background

The Office of Pesticide Programs is participating in a case study to investigate approaches used by OECD Member countries to assess and make regulatory decisions concerning persistent and bioaccumulative pesticides. Since the human hazard portion of the equation is missing the regulatory decision deals strictly with the environmental qualities of the chemical. Even with this caveat the outcome could be different if a complete assessment of the chemical were carried out, which would require the human hazard portion, as well as information on alternatives and the pests in question.

A request was made to carry out an environmental risk assessment for Chemical A on sugar beets, wheat and pome fruits.

Chemical A is a fungicide to be applied to sugar beets and wheat (summer and winter) to control leaf spot and on pome fruit (apples and pears) to control scab. There are two formulations an emulsifiable concentrate (EC) and a water dispersable granule (WG). The proposed use rate for sugar beets is 1-9 applications of EC at 100 g/ha (0.09 lb/A) at 4-30 day intervals as soon as damage to crop is observed. The proposed use rate for summer and winter wheat is 1 application of the EC at 125 g/ha (0.11 lb/A) as soon as damage to crop is observed. The proposed use rate for apples and pears is 1-5 applications of 10WG at 38-56 g/ha (0.05 lb/A) at 4-30 day intervals as soon as damage to crop is observed until a maximum of 96 hours after occurrence of a scab infection.

Summary

The Environmental Fate and Effects Division (EFED) has reviewed this action. Since portions of the data presented in the OECD case study are not consistent with values used by the Agency to perform an environmental fate assessment, EFED personnel made assumptions regarding the data. First, all DT_{50} values were used as half-life values, and second, K_{om} values were viewed as K_{oc} values for conclusion on soil adsorption and mobility.

Chemical A is a very persistent compound (half-life > 180 days). Leaching and runoff of Chemical A is not expected. It has a moderate tendency to partition from water to air, on a par with naphthalene, dibromochloropropane, or dichlorobiphenyl. Two metabolites, mA and mB, were observed in lysimeter field studies at maximum concentrations of 8% and 11% AR and were 4% and 8% AR, respectively, at study termination (365 days). Environmental fate data are required for metabolite mB.

Chemical A is a bioaccumulative compound (BCF> 5000 corroborated by a log Kow 5.2). The bioaccumulation study demonstrates that chemical depuration may not be complete. Bioaccumulation data on bluegill sunfish and mussel (BCF >5000) and eel (BCF 4000) indicate that Chemical A bioaccumulates in aquatic organisms which may cause food-chain effects in fish/shellfish-eating organisms.

Risk Assessment

Chemical A is moderately toxic to mammals. Mammalian species are expected to be at chronic risk from all proposed use patterns of Chemical A (RQ = 4-722). The maximum application to sugar beets is expected to pose acute risk to mammals (RQ = 0.52-0.92). Maximum application of the apple/pear use pattern poses acute risk that may be mitigated through restricted use and acute risk to endangered species (RQ = 0.1-0.33). A single application of Chemical A for both the sugar beet and wheat use patterns is expected to present an acute risk to endangered species (RQ = 0.1-0.17).

Chemical A is moderately toxic to birds on an oral basis and highly toxic to birds on a dietary basis. The Agency predicts acute risk to avian species from the maximum application of the sugar beet use pattern (RQ = 0.67). Maximum application of the apple/pear use pattern poses acute risk that may be mitigated through restricted use and acute risk to endangered species (RQ = 0.11-0.24). A single application of Chemical A for both the sugar beet and wheat use patterns is expected to present an acute risk to endangered species (RQ = 0.10-0.12). Chronic risk to birds is expected from all of the proposed uses (RQ = 1.4-9.6) except for a single application to apples/pears.

Using BCF, EEC, and toxicity data, the Agency predicts that fish-eating birds (i.e. osprey, bald eagle) and mammals (i.e. otters, mink) may be adversely affected by movement of Chemical A up the food chain. In addition, predatory fish (i.e. largemouth bass) may be affected by food-chain effects. Risk quotients were calculated for fish- and shellfish-eating birds (i.e. osprey, bald eagle) and mammals (i.e. otters and mink) by dividing the estimated concentration of the pesticide in the food source by the chronic toxicity values. Results show that fish-eating birds may be adversely affected by movement of Chemical A up the food chain (sugar beet use pattern only). Fish-eating mammals may be affected by food-chain effects from all proposed use patterns.

Chemical A is highly toxic to fish and invertebrates however, due to limited exposure the Agency does not expect acute or chronic risk to freshwater fish and invertebrates, acute risk to estuarine/marine fish, or risk to aquatic plants. There is uncertainty in the non-vascular plant data since the test species deviates from the Agency□s test guidelines.

RQ□s from use of fungicide Chemical A on sugar beets, wheat and pome fruit.

Use	Mammals Chronic RQ□s	Mammals acute RQ□s	Avian chronic RQ□s	Avian acute RQ□s	Fish eating mammals RQ□s	Fish eating birds RQ□s
Sugar beets min appl	7 to 108	<0.10 - 0.14	<1-1.4	<0.1 - 0.10		
Sugar beets max appl	45-722	<0.10 - 0.92	<1 - 9.6	<0.1 -0.67	72-180	.96-2.4
Pome fruits min appl	4-60	<0.10	<1	<0.1		
Pome fruits max appl	16-258	<0.1 - 0.33	<1 - 3.4	<0.1 - 0.24	9.5-24	
Wheat	8 to 133	<0.1 - 0.17	<1-1.78	<.01-.12	9.5-24	

Endangered species may be affected (acute risk	≤ 0.1
Acute risk may be mitigated through restricted use, in addition to endangered species risk	≤ 0.2
Acute risk, including endangered species	≤ 0.5
Chronic risk	≤1.0

The following risk cannot be assessed due to lack of data: chronic risk to estuarine/marine fish, and acute and chronic risk to estuarine/marine invertebrates. Two of three proposed uses patterns for Chemical A are associated with estuarine/marine habitats.

The effects of Chemical A on non-target plants can not be assessed at this time. Seedling emergence and vegetative vigor studies are required.

Outstanding Data

The following details the data gaps and/or additional information required from the registrant:

1. Chronic data on estuarine/marine fish.
2. Acute and chronic data to estuarine/marine invertebrates.
3. Environmental fate data are required for metabolite mB..

Recommendation

This assessment suggests that the potential risks to the environment from use of Chemical A are such that its use should not be allowed. Furthermore, it appears that routine mitigating measures such as: 1) reducing use rates, 2) reducing number of applications, 3) dropping use sites, 4) making the product a restricted use pesticide, and/or restricting areas where the product could be used may not be sufficient to allow use of this fungicide. Prior to further consideration the above data should be submitted and reviewed and proposed mitigation measures should be provided.

Case Study 1: chemical A, Environmental Fate and Effects

I. Environmental Risk Conclusions and Characterization

Risk presented in this assessment from use of Chemical A on sugar beets, wheat, and apples/pears are likely to occur in the United States. The major sugar beet producing regions are from the Great Lakes to Pacific Coast states and irrigated lands in the Rocky Mountain states and westward. Substantial amounts of sugar beets are also produced in the North Central and Plains states, and limited quantities are grown in New York and Maine. Wheat is grown in every state of the U.S., with minor production occurring in the New England states. Primary production of apples and pears is in the Pacific Coast states, New York, Pennsylvania, Virginia, West Virginia, and Michigan.

Based on laboratory and field data, Chemical A is a very persistent compound (half-life > 180 days). Chemical A is expected to partition to soil and sediment. Based on a K_{ow} value of 1.6 □ 10^5, leaching and runoff of Chemical A is not expected. Physical properties (Henry□s law constant = 3.63 E-4 atm-m^3-mol^{-1}) indicate a moderate tendency for Chemical A to partition from water to air, on a par with naphthalene, dibromochloropropane, or dichlorobiphenyl. Two metabolites, mA and mB, were observed in lysimeter field studies at maximum concentrations of 8% and 11% AR and were 4% and 8% AR, respectively, at study termination (365 days). Environmental fate data are required for metabolite mB.

Chemical A is also a bioaccumulative compound (BCF > 5000 corroborated by a log K_{ow} 5.2). The bioaccumulation study demonstrates that chemical depuration may not be complete, which raises concerns with food-chain effects in predators of fish-eating organisms. Using BCF, EEC, and toxicity data, the Agency predicts that fish-eating birds (i.e. osprey, bald eagle) and mammals (i.e. otters, mink) may be adversely affected by movement of Chemical A up the food chain. In addition, predatory fish (i.e. largemouth bass) may be affected by food-chain effects.

Chemical A is moderately toxic to mammals (LD_{50} = 150 mg/kg bw). Based on exposure concentrations estimated using methods by Hoerger and Kenaga and toxicity data, mammalian species are expected to be at chronic risk from all proposed use patterns of Chemical A (RQ = 4-722). The maximum application to sugar beets is expected to pose acute risk to mammals feeding on short grass and large insects (RQ = 0.52-0.92). Maximum application of the apple/pear use pattern poses acute risk that may be mitigated through restricted use and acute risk to endangered species (RQ = 0.1-0.33). A single application of Chemical A for both the sugar beet and wheat use patterns is expected to present an acute risk to endangered species which feed on short grasses (RQ = 0.1-0.17).

Chemical A is moderately toxic to birds on an oral basis (LD_{50} = 215 mg/kg bw) and highly toxic to birds on a dietary basis (LC_{50} = 476 mg/kg feed). Based on exposure concentrations estimated using methods by Hoerger and Kenaga and toxicity values, the Agency predicts acute risk to avian species feeding on short grass from the maximum application of the sugar beet use pattern (RQ = 0.67). Maximum application of the apple/pear use pattern poses acute risk that may be mitigated through restricted use and acute risk to endangered species (RQ = 0.11-0.24). A single application of Chemical A for both the sugar beet and wheat use patterns is expected to present an acute risk to endangered species which feed on short grasses (RQ = 0.10-0.12). Chronic risk to birds is expected from all of the proposed uses (RQ = 1.4-9.6) except for a single application to apples/pears.

Chemical A is highly toxic to fish and invertebrates (LC_{50}s = 0.1-1 ppm). Based on Tier II estimated aquatic concentrations (PRZM/EXAMS) and aquatic toxicity data, the Agency does not expect acute or chronic risk to freshwater fish and invertebrates, acute risk to estuarine/marine fish, or risk to aquatic plants. However, the toxicity data for aquatic plants only provides supplemental information for the risk assessment since the test species deviates from the Agency□s test guidelines. The following risk can not be assessed due to lack of data: chronic risk to estuarine/marine fish, and acute and chronic risk to estuarine/marine invertebrates. Two of three proposed uses patterns for Chemical A are associated with estuarine/marine habitats; therefore, the Agency is requesting further testing on these organisms.

II. Introduction

Chemical A is a fungicide proposed for registration on sugar beets and wheat (summer and winter) to control leaf spot and on pome fruit (apples and pears) to control scab. There are two formulations: 250EC, an emulsifiable concentrate (250 g a.i./liter) and 10WG, a water dispersable granule (10% a.i. by weight). The proposed use rate for sugar beets is 1-9 applications of 250EC at 100 g/ha (0.09 lb/A) at 4-30 day intervals as soon as damage to crop is observed. The proposed use rate for summer and winter wheat is 1 application of 250EC at 125 g/ha (0.11 lb/A) as soon as damage to crop is observed. The proposed use rate for apples and pears is 1-5 applications of 10WG at 38-56 g/ha (0.05 lb/A) at 4-30 day intervals as soon as damage to crop is observed until a maximum of 96 hours after occurrence of a scab infection.

III. Environmental Fate Assessment

The data presented in the OECD Case Study are not consistent with values used by the Agency to perform an environmental fate assessment. In order to complete the case study, assumptions were made regarding the data. First, all DT_{50} values were used as half-life values and will be referred to as such throughout this

document. Secondly, K_{OM} values were viewed as K_{OC} values for conclusions on soil adsorption and mobility.

Chemical A is a very persistent (half-life > 180 days) and bioaccumulative (BCF > 5000) compound. These criteria were published by EPA, Office of Pollution Prevention and Toxics, 64 FR 213, pp. 60194-60204, Nov. 4, 1999. It can be expected to persist in agricultural soils, anaerobic soils and sediments, and in the sediment phase of aerobic water/sediment systems. Chemical A will partition to and accumulate in sediments. Chemical A bioaccumulates in aquatic organisms, including bluegill sunfish (BCF=5500), eel (Anguilla anguilla, BCF=4000), and mussel (Mytilus edulis, BCF=10,000). It also has a moderate tendency to partition into air from water.

Physical Properties: Chemical A has a molecular weight of 400 g/mol, a vapor pressure of 6 □ 10^{-5} mmHg, a log Kow of 5.2 (Kow = 158,500) and a solubility of 87 ppb. These properties indicate a strong tendency to partition to soil or sediment rather than water. The calculated Henry□s law constant (3.63 E-4 atm-m^3-mol^{-1}) indicates a moderate tendency to partition to air from water, on a par with naphthalene, dibromochloropropane, or dichlorobiphenyl.

Aerobic Soil Metabolism Laboratory aerobic soil metabolism half-lives in 5 soils ranged from 229 to 670 days, all clearly exceeding the criterion for □very persistent.□ (Table 1.4.1) Maximum bound residues in the laboratory studies were 28% of applied radioactivity at 180 days and 25% AR at study conclusion (281 days). Maximum mineralization (CO_2 produced) was 12% AR at 100 days and 23% at 281 days.

The laboratory soil metabolism data show that the half-life is a function of temperature and dose (application rate), but there is no clear relationship between half-life and soil pH or percent organic matter. Half-life values in the silty loam soil decreased from 554 days at 10□C, to 368 days at 20□C, and 297 days at 30□C. This trend is consistent with the shorter half-lives seen in field studies in warmer climates (Spain).

Field Dissipation Studies Field studies on uncropped fields support the finding of □very persistent.□ (Table 1.4.2) Half-lives in northern countries (England, Germany, Canada, California USA) approached or exceeded the 180-day criterion (half-lives of 113 to 331 days). Field study half-lives were lower in a warmer, southern country (Spain) with values of 27 to 93 days.

Two metabolites were observed in the field studies. Metabolite mA reached a maximum of 8% AR after 182 days in the top 10 cm of soil, and declined to 4% AR at 369 days.

Metabolite mB was formed in a field lysimeter study at a maximum of 11% AR at 182 days after application, and declined to 8% AR at 369 days. Agency guideline data on environmental fate are required for mB.

Repeated applications of 0.075 to 0.150 kg/ha to bare and wheat fields in England did not result in carry-over of residues. Residues after three years of application did not exceed residues after the first year of use. This is consistent with the quicker dissipation at lower application rates seen in laboratory aerobic soil metabolism studies (see below).

Half-lives for the highest application rates in the laboratory studies (9.7 to 10 mg/kg) were the highest observed (595 to 670 days), indicating that Chemical A may be more persistent if used at these higher rates. The one field study in which Chemical A was tested at two different rates (England, clay soil) does not support the laboratory observation, as the half-life was slightly lower at the higher rate (158 days for 0.375 kg/ha vs. 182 days for 0.125 kg/ha). However, the application rates in the field studies were much lower than in the laboratory studies.

Anaerobic Soil Metabolism Three anaerobic soil metabolism studies indicate that Chemical A is "very persistent" (half-lives of 805 to 950 days). These studies were conducted at exaggerated rates (9.7 to 10 mg/kg).

Aerobic Aquatic Metabolism Two aerobic aquatic metabolism studies also support the finding of "very persistent." Half-lives in the total system were greater than 800 days in both studies. Chemical A was present mainly in the sediment. Partitioning from the water phase to the sediment phase was rapid (half-life for disappearance from water phase 10 to 20 days).

Hydrolysis and Biodegradability Chemical A does not hydrolyze (consistent with the aerobic aquatic metabolism study), and is not readily biodegradable (consistent with all metabolism studies).

Soil-Water Partitioning Soil-water partitioning behavior was measured in batch equilibrium studies. Koc values for Chemical A were 633, 1150, 1830, 1850, 2040, 2060, and 3500 L/kg in soils with 0.5 to 15% organic matter. Freundlich isotherms were reasonably linear, with 1/n values of 0.8 to 1.0. These values indicate a pronounced tendency for Chemical A to partition to soil and sediment.

Bioaccumulation Three bioaccumulation factors were measured, in the bluegill sunfish, an eel and a mussel . BCFs for the sunfish and mussel exceed the criterion of 5000 that triggers a finding of "ban pending testing" under TSCA. The BCF for the eel (4000) is only slightly less than the criterion. It also appears that depuration in fish may not be complete, as no further elimination from the bluegill was observed after 10 days, with a clearance half-life of 5 to 8 days. This raises the possibility of food-chain effects in fish-eating organisms such as predatory fish (e.g., largemouth bass) and birds (osprey, bald eagle).

IV. Aquatic Exposure and Risk Assessment

Estimation of Aquatic Exposure Concentrations

Exposures for aquatic organisms were estimated with the combined model PRZM-EXAMS. The versions used were PRZM 3.12, dated May 24, 2001; EXAMS 2.98.04, dated July 18, 2002. PRZM scenario files dated Oct. 15, 2002 and meteorology files dated July 3, 2002 were used. The EXAMS pond scenario dated Aug. 29, 2002, and the EFED shell version 1.2, dated Oct. 15, 2002, were used.

Model input parameters are provided in the table below. Note that the Agency used DT_{50} values as half-life values and K_{OM} values as K_{OC} values in order to complete the case study risk assessment in a manner consistent with Agency policy.

Aquatic Exposure Model (PRZM/EXAMS) Input Values			
Crop	Max. Use Rate, kg/hectare	Number of applications	Application Interval (days)
Minnesota sugar beet	0.1	9	4
North Dakota wheat	0.125	1	n/a
Oregon apples	0.056	5	4

Aquatic Exposure Model (PRZM/EXAMS) Input Values	
Parameter	Value
Koc	1866 (avg of 7 values)
Solubility	0.087 ppm (x10=0.87)
Molecular weight	400 g/mol
Vapor pressure	6 E-5 torr
Henry□s Law constant	3.63 E-4 atm-m^3-mol^{-1}
Soil half-life	397 days (upper 90%ile of mean of 4 values at 20□C and 0.1 or 1.0 mg/kg)
Hydrolysis	stable at all pH
Photolysis (aqueous & soil)	stable
Aerobic Aquatic half-life	800 days
Application efficiency	0.95 (aerial)
Spray drift	0.05 (aerial)
Application date	May 1
Chemical Application Method (PRZM record 16)	2 (linear foliar based on crop canopy)
Disposition of foliar residue after harvest (PRZM record 17)	1 (surface applied)
Foliar extraction (PRZM record 18)	0.5 (default)
PLDKRT (PRZM record 18) decay rate on plant foliage	0 (default)
PLVKRT (PRZM record 18) volatilization rate on foliage	0 (default)
UPTKF (PRZM record 17) plant uptake factor	0 (default)

Estimated environmental concentrations calculated by PRZM-EXAMS are given below. The figures given are the upper 90th percentile of simulations based on modeled conditions from 1961 to 1990.

Estimated environmental concentrations calculated by PRZM-EXAMS (1 in 10 year concentrations)							
Crop	Peak, ppb	4-day, ppb	21-day, ppb	60-day, ppb	90-day, ppb	Yearly, ppb	Average of yearly averages
MN sugarbeet	3.6	3.1	1.6	0.98	0/76	0.35	0.24
ND wheat	0.47	0.43	0.27	0.15	0.14	0.056	0.042
OR apples	0.46	0.40	0.28	0.16	0.12	0.073	0.061

Aquatic Toxicity

Fish (freshwater) acute:	Highly toxic (rainbow trout LC_{50} = 0.81 ppm)
Fish (freshwater) chronic:	NOAEC = 6.7 ppb (fathead minnow)
Fish (estuarine) acute:	Highly toxic (sheepshead minnow LC_{50} = 0.82 ppm)
Fish (estuarine) chronic:	No data available
Invertebrate (freshwater) acute:	Highly toxic (daphnid LC_{50} = 0.77 ppm)
Invertebrate (freshwater) chronic:	NOAEC = 5.6 ppb (daphnid)
Invertebrate (estuarine) acute:	No data available
Invertebrate (estuarine) chronic:	No data available
Aquatic plants	EC_{50} = 1.2 ppm (supplemental algal data)

Risk to Nontarget Aquatic Animals

Exposure to aquatic non-target organisms is possible through surface water runoff, soil erosion, and off-target spray drift. The Agency uses the GENEEC model to predict Tier I EECs in an aquatic environment. When aquatic LOCs are exceeded using the Tier I screening estimate, as was the case with Chemical A, PRZM/EXAMS is used as a Tier II model refinement. The input parameters used in the GENEEC model are similar to those used in PRZM/EXAMS.

Freshwater Fish and Invertebrates

The RQ values do not exceed the LOC for acute or chronic risks to freshwater fish and invertebrates.

Risk quotients for freshwater animals based on a Tier II EEC[1] and LC_{50} values[2]

Use Pattern	Maximum EEC (ppb)	21-Day EEC (ppb)	60-Day EEC (ppb)	Acute RQ (Peak EEC / LC_{50}) Fish/Invertebrate	Chronic RQ (Chronic EEC/ NOAEL) Fish/ Invertebrates
		PRZM/EXAMS			
Sugar beet	3.6	1.6	0.98	<0.05 / <0.05	< 1 / < 1
Apples & Pears	0.46	0.28	0.16	<0.05 / <0.05	< 1 / < 1
Wheat	0.47	0.27	0.15	<0.05 / <0.05	<1 / <1

Risk quotients for freshwater animals based on a Tier II EEC[1] and LC_{50} values[2]

Use Pattern	Maximum EEC (ppb)	21-Day EEC (ppb)	60-Day EEC (ppb)	Acute RQ (Peak EEC / LC_{50}) Fish/Invertebrate	Chronic RQ (Chronic EEC/ NOAEL) Fish/ Invertebrates
Levels of Concern					
Endangered species may be affected (acute risk)				. 0.05	. 1
Acute risk may be mitigated through restricted use, in addition to endangered species risk				. 0.1	. 1
Acute risk, including endangered species				. 0.5	. 1

(1) 21-day EEC = Invertebrate chronic EEC, 60-day EEC = Fish chronic EEC
(2) Acute LC_{50} = 810 ppb (rainbow trout) and 770 ppb (daphnid); chronic NOAEL = 6.7 ppb (fathead minnow) and 5.6 ppb (daphnid)

Estuarine and Marine Fish and Invertebrates

Acute toxicity to fish were the only estuarine/marine toxicity data submitted to support registration of Chemical A. The RQ does not exceed the LOC for estuarine/marine fish. Since estuarine/marine habitats are associated with pesticides use/patterns on apples/pears (WA state) and wheat, the Agency requires the Acute LC_{50} of estuarine/marine invertebrates data submission for Chemical A. The Agency holds on reserve the requirement for chronic toxicity studies.

Acute risk quotient for estuarine/marine fish based on Tier II EEC[1] and LC_{50} values [2]

Use Pattern	Maximum EEC (ppb)	Acute RQ (Peak EEC / LC_{50})	Chronic RQ (Chronic EEC / NOAEC)
Sugar beet	3.6	< 0.05	No data
Levels of Concern			
Endangered species may be affected (acute risk)		$\geq$ 0.05	. 1
Acute risk may be mitigated through restricted use, in addition to endangered species risk		$\geq$ 0.1	. 1
Acute risk, including endangered species		$\geq$ 0.5	. 1

(1) 21-day EEC = Invertebrate chronic EEC, 60-day EEC = Fish chronic EEC
(2) LC50 = 820 ppb (sheepshead minnow)

Toxicity to Aquatic Plants

Toxicity data on the green algae, *Scendesmus suspicatus*, provides supplemental information since it is not the preferred test species. The RQs indicate that the level of concern is not exceeded for vascular and non-vascular aquatic plants.

Acute risk quotient for aquatic plants based on Tier II EEC and NOAEC values

Use Pattern	Test Species	EC_{50} (ppb)	NOAEC (ppb)	Maximum EEC (ppb)	Acute RQ (Peak EEC / EC_{50})	Endangered Species RQ (Peak EEC / NOAEC)
Sugar beet	Green algae *Scendesmus suspicatus*	1200	300	3.6	< 1	< 1
	Duckweed *Lemna gibba*	No data	2500	3.6	NA	< 1
Levels of Concern						
Acute risk to Non-endangered and Endangered plant species may occur					≥ 1	

Risk from Bioaccumulation

Bioaccumulation data on bluegill sunfish and mussel (BCF >5000) and eel (BCF 4000) indicate that Chemical A bioaccumulates in aquatic organisms which may cause food-chain effects in fish/shellfish-eating organisms. To evaluate risk to fish-eating organisms, BCF values were multiplied by the maximum EEC expected in aquatic environments in order to determine the concentration of Chemical A in a food item consumed by predators. Risk quotients were calculated for fish- and shellfish-eating birds (i.e. osprey, bald eagle) and mammals (i.e. otters and mink) by dividing the estimated concentration of the pesticide in the food source by the chronic toxicity values. The risk quotient is compared to the chronic risk level of concern (LOC = 1). Toxicity data for surrogate species for birds and mammals were used to represent species in the United States. In this assessment, the NOAEC value for bobwhite quail (*Colinus virginianus*) is used to represent predatory bird species, and the NOAEL for the house mouse (*Mus musculis*) is used to evaluate risk to predatory mammals. Results show that fish-eating birds may be adversely affected by movement of Chemical A up the food chain (sugar beet use pattern only). Fish-eating mammals may be affected by food-chain effects from all proposed use patterns.

Dietary data are not available for fish species. However, based on chronic toxicity data for fathead minnow (*Pimephales promelas*; NOAEC = 6.7 ppb) and BCFs, the Agency predicts that predatory fish (i.e. largemouth bass) may also be at risk from effects of Chemical A in the food chain.

Risk Quotients[1] for fish-eating birds based on maximum EEC values and a Bobwhite quail NOAEC of 15 mg/kg feed

Species	BCF (L/kg)	Maximum EEC[2] (ppb)	Estimated Concentration in Food Source (mg/kg)	RQ [food]/NOAEC
Mytilus edulis (Mussel)	10000	3.6	36.0	2.4
Lepomis macrochirus (Bluegill sunfish)	5500	3.6	19.8	1.3
Anguilla anguilla (Eel)	4000	3.6	14.4	0.96

[1] RQ = (BCF)(EEC) / NOAEC

[2] Based on maximum application rate of sugar beet use

Risk Quotients[1] for fish-eating mammals based on maximum EEC values and a House mouse NOAEL of 0.2 mg/kg bw

Species	BCF (L/kg)	Use pattern	Maximum EEC (ppb)	Estimated Concentration in Food Source (mg/kg)	RQ [food]/NOAEC
Mytilus edulis (Mussel)	10000	sugarbeet	3.6	36.0	180
		wheat; apples/pears	0.47	4.7	24
Lepomis macrochirus (Bluegill sunfish)	5500	sugarbeet	3.6	19.8	99
		wheat; apples/pears	0.47	2.6	13
Anguilla anguilla (Eel)	4000	sugarbeet	3.6	14.4	72
		wheat; apples/pears	0.47	1.9	9.5

[1] RQ = (BCF)(EEC) / NOAEL

V. Terrestrial Exposure and Risk Assessment

Toxicity

Avian acute oral: Moderately toxic (LD_{50} = 215 mg/kg of body weight)
Avian acute dietary: Highly toxic (LC_{50} = 476 mg/kg of feed)
Avian reproduction: Affected endpoint not reported (NOAEC = 15 mg/kg feed)
Mammalian acute oral: Moderately toxic (LD_{50} = 150 mg/kg of body weight; _ and _ combined)
Mammalian chronic : NOAEL = 0.2 mg/kg bw/day (2-generation)

Avian, Acute and Chronic Risk (Single and multiple applications)

For pesticides applied as a nongranular product (e.g., liquid, dust), the estimated environmental concentrations (EECs) on food items following product application are compared to LC_{50} values to assess risk. The results of the risk quotient calculations indicate that the proposed uses of Chemical A exceed the level of concern for acute and chronic risk to terrestrial organisms (see RQ tables below). For risk to fish-eating predatory birds from bioaccumulation of Chemical A, see section IV on Aquatic Exposure and Risk Assessment.

Avian Acute and Chronic Risk Quotients for Chemical A based on a Mallard Duck LC_{50} of 215 mg/kg bw And a Bobwhite Quail NOAEC of 15 mg/kg feed

Use Pattern	No. Apps. X Rate (lbs ai/A)	Food Items	Max EEC (ppm)	Acute RQ (EEC/LC_{50})	Max EEC (ppm)	Chronic RQ (EEC/NOAEL)
Sugar beet	1 x 0.09	Short grass	21.6	**0.10**	21.6	**1.4**
		Broadleaf plants/Insects	12.2	<0.10	12.2	< 1
		Tall grass	9.9	<0.10	9.9	< 1
		Seeds	1.4	<0.10	1.4	< 1
Sugar beet	9 x 0.09 Interval: 4days	Short grass	145	**0.67**	145	**9.6**
		Broadleaf plants/Insects	81	**0.38**	81	**5.4**
		Tall grass	66	**0.31**	66	**4.4**
		Seeds	9	<0.1	9	< 1
Wheat	1 x 0.111	Short grass	26.6	**0.12**	26.6	**1.78**
		Broadleaf plants/Insects	15	<0.1	15	**1**
		Tall grass	12.2	<0.1	12.2	< 1
		Seeds	1.7	<0.1	1.7	< 1
Apples & Pears	1 x 0.05	Short grass	12	<0.1	12	< 1
		Broadleaf plants/Insects	6.75	<0.1	6.75	< 1
		Tall grass	5.5	<0.1	5.5	< 1
		Seeds	0.75	<0.1	0.75	< 1
Apples & Pears	5 x 0.05 Interval: 4days	Short grass	51.5	**0.24**	51.5	**3.4**
		Broadleaf plants/Insects	29	**0.13**	29	**1.9**
		Tall grass	23.6	**0.11**	23.6	**1.6**
		Seeds	3.2	<0.1	3.2	< 1

Levels of Concern	
Endangered species may be affected (acute risk)	. 0.1
Acute risk may be mitigated through restricted use, in addition to endangered species risk	. 0.2
Acute risk, including endangered species	. 0.5
Chronic risk	. 1.0

[1] EECs are based on Hoerger and Kenega (1972), modified by Fletcher et al (1994).
*LOC exceedences are in bold

Mammalian, Acute and Chronic Risk (Single and multiple applications)

To assess acute risk to mammals from the use of foliar spray products, an estimated dietary endpoint value calculated from the LD_{50} value is used. The EEC is then divided by this calculated dietary value to determine mammalian RQs. Estimating the potential for adverse effects to wild mammals is based upon EFEDs draft 1995 SOP of mammalian risk assessments and methods used by Hoerger and Kenaga (1972) as modified by Fletcher *et al.* (1994). The concentration of Chemical A in the diet that is expected to be acutely lethal to 50% of the test population (LC_{50}) is determined by dividing the LD_{50} value (usually a rat LD_{50}) by the fraction of body weight consumed. A risk quotient is then determined by dividing the EEC by the derived dietary value. Risk quotients are calculated for three separate weight classes of mammals (15, 35, and 1000 g), each presumed to consume four different kinds of food (grass, forage, insects, and seeds).

The residues expected on mammalian food items after a multiple application of non-granular Chemical A (based on a 35 day default half-life) are based on the highest residue concentrations immediately after application (Fletcher, 1994). The results suggest that acute and chronic levels of concern are exceeded. For risk to fish-eating predatory mammals from bioaccumulation of Chemical A, refer to Section IV on Aquatic Exposure and Risk Assessment.

Mammalian (Herbivore/Insectivore and Granivore) Acute risk quotients (RQs) for applications of Chemical to foliage, based on a rat LD_{50} of 150 mg/kg of body weight

Use Pattern		---------- EEC (ppm) [1] ----------				Herbivore/Insectivore Acute RQ[2]			Granivore Acute RQ [2]
No. Apps x Rate (1bs ai/A)	Body Weight (g)	Short Grass	Large Insects	Forage/ Small Insects	Seeds	Short Grass	Large Insects	Forage/ Small Insects	Seeds
Sugar beet 1 x 0.09	15	21.6	12.2	9.9	1.4	**0.14**	<0.1	<0.1	<0.1
	35	21.6	12.2	9.9	1.4	**0.1**	<0.1	<0.1	< 0.1
	1000	21.6	12.2	9.9	1.4	<0.1	< 0.1	< 0.1	< 0.1
Sugar beet 9 x 0.09 Interval: 4d	15	144.6	81.3	66.3	9.0	**0.92**	**0.52**	**0.42**	<0.1
	35	144.6	81.3	66.3	9.0	**0.64**	**0.36**	**0.29**	< 0.1
	1000	144.6	81.3	66.3	9.0	**0.14**	< 0.1	< 0.1	< 0.1
Wheat 1 x 0.111	15	26.6	15.0	12.2	1.7	**0.17**	< 0.1	< 0.1	< 0.1
	35	26.6	15.0	12.2	1.7	**0.12**	< 0.1	< 0.1	< 0.1
	1000	26.6	15.0	12.2	1.7	< 0.1	< 0.1	< 0.1	< 0.1
Apples & Pears 1 x 0.05	15	12.0	6.8	5.5	0.75	< 0.1	< 0.1	< 0.1	< 0.1
	35	12.0	6.8	5.5	0.75	< 0.1	< 0.1	< 0.1	< 0.1
	1000	12.0	6.8	5.5	0.75	< 0.1	< 0.1	< 0.1	< 0.1
Apples & Pears 5 x 0.05 Interval: 4d	15	51.5	29.0	23.6	3.2	**0.33**	**0.18**	**0.15**	< 0.1
	35	51.5	29.0	23.6	3.2	**0.23**	**0.13**	**0.1**	< 0.1
	1000	51.5	29.0	23.6	3.2	< 0.1	< 0.1	< 0.1	< 0.1

Levels of Concern

Endangered species may be affected (acute risk) . 0.1

Mammalian (Herbivore/Insectivore and Granivore) Acute risk quotients (RQs) for applications of Chemical to foliage, based on a rat LD_{50} of 150 mg/kg of body weight

Use Pattern		---------- EEC (ppm) [1] ----------				Herbivore/Insectivore Acute RQ[2]			Granivore Acute RQ [2]
No. Apps x Rate (1bs ai/A)	Body Weight (g)	Short Grass	Large Insects	Forage/ Small Insects	Seeds	Short Grass	Large Insects	Forage/ Small Insects	Seeds
Acute risk may be mitigated through restricted use, in addition to endangered species risk								. 0.2	
Acute risk, including endangered species								. 0.5	
Chronic risk								. 1.0	

1 EECs are based on Hoerger and Kenega (1972), modified by Fletcher et al (1994).
[2] RQ = EEC (mg/kg) / LD50 (mg/kg)/ % Body Weight Consumed
where the % body weight consumed varies with body size and diet:.
Herbivores/insectivores: 95% for 15 g wt; 66% for 35 g wt; 15% for 1000 g wt.
Granivores: 21% for 15 g wt; 15% for 35 g wt; 3% for 1000 g wt.
*LOC exceedences are in bold

Mammalian (Herbivore/Insectivore and Granivore) Chronic Risk quotients (RQs) for applications of Chemical A to foliage, based on a mouse NOAEL 0.20 mg/kg of body weight

Use Pattern	---------- EEC (ppm) [1] ----------				Herbivore/Insectivore Chronic RQ[2]			Granivore Chronic RQ [2]
No. Apps x Rate (bs ai/A)	Short Grass	Large Insects	Forage/ Small Insects	Seeds	Short Grass	Large Insects	Forage/ Small Insects	Seeds
Sugar beet 1 x 0.09	21.6	12.2	9.9	1.4	**108**	**61**	**50**	**7**
Sugar beet 9 x 0.09 Interval: 4days	145	81	66	9	**722**	**407**	**331**	**45**
Wheat 1 x 0.111	26.6	15.0	12.2	1.7	**133**	**75**	**61**	**8**
Apples/Pears 1 x 0.05	12	6.8	5.5	0.75	**60**	**34**	**28**	**4**
Apples/Pears 5 x 0.05 Interval: 4d	51.5	29.0	23.6	3.2	**258**	**145**	**118**	**16**

[1] EECs are based on Hoerger and Kenega (1972), modified by Fletcher et al (1994).
[2] RQ = Maximum EEC (mg/kg) / NOAEC (mg/kg)
*LOC exceedences are in bold

Terrestrial Plants

The data provided on the effects of Chemical A on non-target plants can not be used in this assessment because it is not presented in a form that is familiar to the risk assessor. The Environmental Fate and Effects Division of US EPA□s OPP calculates acute risk to non-target terrestrial plants based on data from seedling emergence and vegetative vigor studies. Currently, OPP does not assess chronic risk to plants.

A.6. Switzerland

General Comments

It is understood, that the data of this case study did not claim to be complete as the goal was to look at persistency and bioaccumulation. But the data are not only far from being complete but are also in some parts wrong and/or could be misunderstood. Especially in the ecotoxicological section there is much confusion (units for endpoints and/or water solubility, etc.). Depending on the number and/or unit one chooses, the results and, consequently, conclusions may be different. This is a pity and makes it more difficult to compare the different evaluations.

Are the units for the endpoints related to the concentration on the product or on the active ingredient (*Substance A*)? It is not clearly defined. In case study 1, where different formulations (products) are used, but only one set of ecotoxicological data given, it is rather clear, that the endpoints are based on the active ingredient, i.e. substance A.

We definitely would not accept an actual dossier presenting such poor data regarding the sections discussed here!

The present assessment summarizes and evaluates the fate and behaviour of *Substance A* (Case Study 1) in various compartments of the environment and its effects on various representatives of terrestrial and aquatic organisms. It is assumed that all endpoints reflect the concentration of the active ingredient and not of the product.

Toxicity values are correlated with predicted environmental concentrations (PEC's) of *Substance A*, which may occur from the recommended use of the respective product, giving the corresponding toxicity exposure ratios (TERs) for each group of organisms.

1. Physical and Chemical Properties

The fungicide *Substance A* has the following physical and chemical properties:

Table 7: Physical and chemical properties of *Substance A*

Property	Value	Remark
Vapour pressure	8 x 10^{-3} Pa	20°C
Log K_{ow}	5.2	pH 7, 20°C
Solubility in water	87 µg/L	pH 7, 20°C
pK_a	-	not available
Molecular weight	400	g·mol^{-1}

2. Uses

The fungicide *Substance A* is presented in form of two formulations:

1. 250 EC (emulsifiable concentrate, *Substance A* 250 g/l)
2. 10 WG (water dispersable granulate, *Substance A* 10 %)

Table 8: Intended use of *Substance A*

Intended use	Nr. form.	Dosage	Dose a.i.	Freq.	Interval [days]	Time of application
sugar beet (leaf spot)	1	0.4 l/ha	100 g/ha	1-9	4-30	As soon as damage to the crop is observed. Repeat when necessary
summer and winter wheat (leaf spot)	1	0.5 l/ha	125 g/ha	1		As soon as damage to the crop is observed.
apples en pears (scab)	2	0.0375% (37.5 g/100 L water)	38-56 g/ha	1-5	4-30	March-May. As soon as damage to the crop is observed until a maximum of 96 hours after a scab infection occurs (1000 - 1500 L water/ha).

3. Fate and Behaviour in the Environment

Fate and Behaviour in Soil

Degradation in Soil

Laboratory Studies

Incubations under aerobic conditions were performed with different soil types, dosages and temperatures (see Table 3 below). Half-lives observed in the different experiments range from 229 to 670 days; DT_{90} values are not listed, but would be expected in the range of 2-5 years. Dosage and temperature significantly influence the half-lives revealing longer DT_{50} values at higher dosages and lower temperatures. The higher dosages used in some of the experiments correspond to an approx. 10-fold overdose compared to the intended use rates.

Table 9: Half-lives of Substance A in laboratory soil incubation studies under aerobic conditions

Soil type	Incubation	pH	Temp [°C]	pF	OM [%]	Dosage [mg/kg]	DT_{50} [days]
Loamy sand	aerobic	5	20	3.0	4	0.1	240
Silty loam	aerobic	7.2	20	3.0	1.5	0.1	229
Silty loam	aerobic	7.2	20	3.0	1.5	1.0	368
Silty loam	aerobic	7.2	10	3.0	1.5	1.0	554
Silty loam	aerobic	7.2	30	3.0	1.5	1.0	297
Silty loam	aerobic	7.2	20	4.0	1.5	1.0	430
Sandy loam	aerobic	8.5	25	3.0	1.5	9.7	595
Loam	aerobic	6.5	25	3.0	3.7	10	620
Loam	aerobic	6.8	20	3.0	4.2	10	670

Significant amounts of bound residues were found with a maximum of 28% after 180 days and 25% after 281 days (at the end of incubation). There was also a significant mineralization reaching maximal CO_2 levels of 12% and 23% after 100 and 281 days of incubation, respectively. No information is given on the formation of metabolites in these studies and consequently metabolic pathways are missing. Metabolites are mentioned under "field studies" (see below).

The degradation under anaerobic conditions was slower than under aerobic conditions with half-lives in the range of 805 to 950 days (see Table 4).

Table 10: Half-lives of Substance A in laboratory soil incubations studies under anaerobic conditions

Soil type	Incubation	pH	Temp [°C]	pF	OM [%]	Dosage [mg/kg]	DT_{50} [days]
Sandy loam	anaerobic	8.5	25	3.0	1.5	9.7	805
Loam	anaerobic	6.5	25		3.6	10	950
Loam	anaerobic	6.8	20		4.2	10	820

Field Studies

Field dissipation studies were performed at different locations in Europe (D, E, and GB), Canada, and the U.S. (Ca). The results are summarized in Table 5. Applications were made to bare soil. The use rates were in the range of 0.125 to 0.8 kg a.i./ha, consistent with the intended rates. Apparently, single applications were done; the date of application is not stated. Half-lives range from 27 to 331 days, DT_{90}-values from 124 days to > 1 year. In some experiments (E) fast initial dissipation was followed by a significantly slower reaction. In general, dissipation in the field was faster than in laboratory studies, indicating the importance of microbial activity and/or photolysis regarding the rate of degradation.

Table 11: Half-lives and DT_{90}-values of *Substance A* in the field

Soil type	Location	Crop	Dosage [kg a.i./ha]	DT_{50} [days¡	DT_{90}	Remarks
Loam	Canada	no	0.8		>1 year	250 EC
Sandy loam	Canada	no	0.125	139	>1 year	250 EC
Clay	England	no	0.375	158	>1 year	250 EC
Clay	England	no	0.125	182	>1 year	250 EC
Sandy clay	England	no	0.375	186	>1 year	250 EC
Sandy clay	England	no	0.125		>1 year	250 EC
Silty loam	Spain	no	0.5	27	124 days	Disappears quickly in the first month, afterwards more slowly. DT_{50} based on first 3 months and DT_{90} based on first 6 months
Loamy sand	Spain	no	0.5	93	124 days	idem
Silty loam	Spain	no	0.5	72	<1 year	idem
Silty loam	Germany	no	0.15	331	>1 year	250 EC
Loamy sand	USA CA	no	0.13	113	<1 year	?

The appearance of two metabolites is reported in field studies:

- **Metabolite mA** was formed at a maximum of 8% of the applied radioactivity after 182 days in the 0-10 cm soil layer. After 369 days only 4% remained.
- **Metabolite mB** was formed in a field lysimeter study at a maximum of 11% of the applied radioactivity 182 days after application. After 369 days 8% remained.

There are no data available on photolytic processes; therefore it is assumed that the rate and route of metabolism mainly depends on the microbial activity of the soil. Besides the mineralization to CO_2 (12% within 100 days) significant amounts of bound residues are formed as a consequence of the metabolism of *Substance A* by micro-organisms.

Based on reduced mobility in soil, and the lack of data regarding the biological activity and mobility of the metabolites, *Substance A* is regarded as the only **relevant soil residue**.

But due to the occurrence of metabolites at levels close to (met. mA) or above (met. mB) 10% of the applied radioactivity data regarding adsorption (mobility), accumulation and the behaviour of the metabolites in other compartments are required.

Under practical conditions, i.e. in the field, the dissipation is faster as observed in the laboratory studies. The DT_{50f} ranged from 27 to 331 days. All DT_{50f} values, except one, are significantly greater than 2 months. The 50-percentile or median value of all field studies is 139 days. The 10-percentile value is 72 days and the 90-percentile value is 186 days[25]. In most cases the DT_{90f} was not reached during the experiment, revealing values of > 1 year. Median values are considered as typical values, while 10-percentile and 90-percentile are taken as realistic best and worst cases.

Realistic DT_{50f} varies between 72 and 186 days, with a most typical value of 139 days.
Realistic DT_{90f} is > 1 year.

For the calculation of the *"Predicted Environmental Concentrations"* in soil (PEC_S) at different intervals after application, the median value of the DT_{50f} will be used, i.e. **DT_{50f} = 139 days**.

Accumulation in Soil

The results from laboratory and field studies indicate significant potential for *Substance A* to accumulate in soil. Therefore, soil accumulation studies are required and must be submitted before the dossier can be considered complete. The only information on soil accumulation available in this case study dossier is that in field studies on wheat and bare field in England, it was shown that residues after application in the third year, after repeated applications of 75-150 g/ha, did not exceed residues found after application in the first year.

Adsorption

Substance A exhibits low mobility with K_{om}-values of 633, 1150, 1830, 1850, 2040, 2060, and 3500 dm^3/kg. Values derived from Freundlich isotherms with 1/n between 0.8 and 1.0 and soil o.m. contents between 0.5 and 15% o.m.
No data about the mobility of metabolites is available.

Predicted Environmental Concentrations in Soil (PEC_S)

The dossier on the environmental fate of *Substance A* is incomplete and would thus not be acceptable for registration in Switzerland in its present form. Nevertheless, for a preliminary assessment predicted environmental concentrations in soil, surface or groundwater were calculated based on different scenarios.

The estimation of PEC_S values for the different indications is based on the use recommendations for *Substance A* given in Table 2 (page 5).

The calculated soil concentrations are based on the assumption that 50% of the applied amount reaches the soil during application, leading **after the first** application soil residues of 0.067, 0.083, and 0.037 mg/kg, for sugar beet, wheat, and apples, respectively, assuming equal distribution in the top 5 cm and a bulk density of 1.5 g/cm^3. Subsequent degradation is assumed to follow first order kinetics with a half-life (**DT_{50f}**) of **139 days**, representing the most typical value.

[25]Evaluation of the data as percentiles is preferred over the evaluation as mean values and standard deviation presuming normal distribution, because percentile are less susceptible to outliners (which may be false) and assumption of normal distribution is not justified

Spray drift may lead to certain residues in adjacent fields. These residues are significantly lower than those in the treated field itself. Hence, they are not considered with respect to the risk of soil organisms.

The PEC_S were calculated using PELMO 3.21 and the standard FOCUS scenario for Hamburg without modification.

Assumptions:	**Crop**	**Use rate [g a.i./ha]**	**Number of appl.**	**Date of 1st appl.**	**Interval [days]**
	Sugar beet	100	9	1. May	4
	Wheat	125	1		
	Apples and pears	56	5	1. May	4

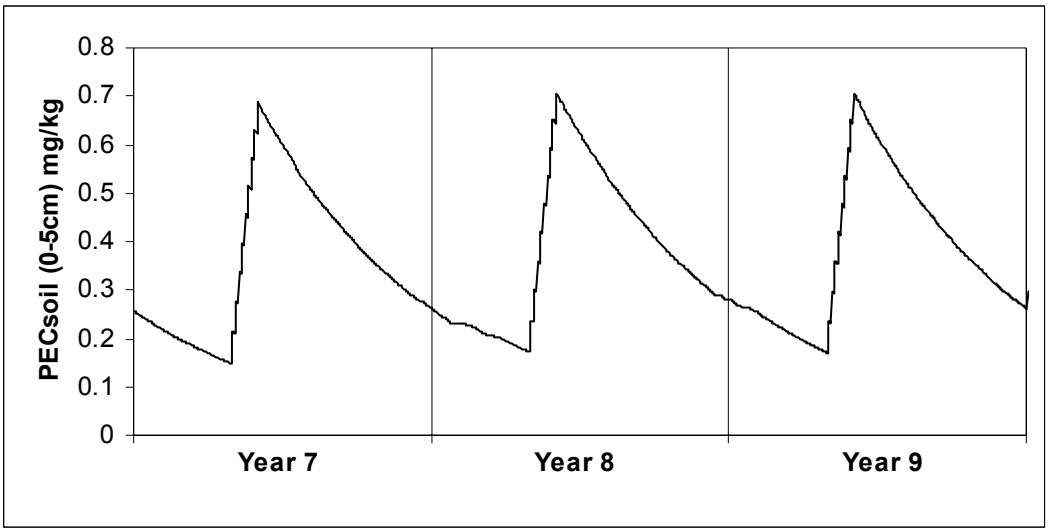
Further assumptions are:

- A crop intercept of 50%
- The degradation half-life in soil was set to 139 d (median value of the half-lives obtained in the field dissipation studies) and was used without soil temperature and moisture correction.
- A K_{OC} of 3238, derived from a median K_{OM} of 1850 L/kg, was used to simulate the leaching behaviour.
- As no DT_{50} and K_{OC} data were supplied for metabolites, these were not included in the calculation.

Initial calculations using the data on vapour pressure and solubility of *Substance A* indicated a substantial contribution of volatilization to the overall dissipation of the compound in the field. As the field dissipation rate constant for *Substance A* already includes volatilization, this process was not included in subsequent calculations.

A plateau of residues in soil will be reached in the 4th year of application for winter wheat and after 7 years in sugar beet and apples (see Figure 1 and Table 6)

Figure 11: PEC_S calculated for the scenario "sugar beet**" (9 applications of 100g a.i./ha each, first application on 1st May, subsequent applications at 10-day intervals)**



The following table summarizes the predicted environmental concentrations in soil for the different scenarios, whereby:

- PEC_S initial = concentration in soil after the **first application**
- PEC_S ini (n) = concentration in soil after the **last** application in the **first year**
- PEC_S max. = plateau residue level in soil after n years
- PEC_S average = time weighted average (twa) concentration in soil over the year at the plateau level

Table 12: PEC_S (0-5 cm) for the scenarios "sugar beet", "wheat", and "apples"

Scenario	Sugar beets	Apples	Winter wheat
Application rate [g/ha]	100	56	125
PEC_S initial [mg/kg]	0.067	0.037	0.083
No. of applications	9	5	1
Interval [days]	4	4	
PEC_S ini (n) [mg/kg]	0.56	0.18	0.083
PEC_S max. [mg/kg]	0.67[26]	0.21[26]	0.10[27]
PEC_S average [mg/kg]	0.31	0.10	0.046

Degradation in the Aquatic Environment

Degradation in Water-Sediment Systems

The behaviour of *Substance A* was investigated in two water/sediment systems. Rapid dissipation from the water-phase with a DT_{50} of 10-20 days and transfer into the sediment was observed. This is consistent with the hydrophobic nature of the compound. Degradation in the sediment is slow, leading to an overall DT_{50} in the systems of >800 days. This indicates a potential risk for sediment dwelling organisms.

Hydrolysis

Substance A does not hydrolyse in water.

Ready Biodegradability

Substance A is not readily biodegradable.

Predicted Environmental Concentrations in Ground water (PEC_{GW})

As mentioned in section 3.1.3 "Adsorption" *Substance A* showed a low mobility and would therefore not be expected to reach groundwater tables.

This estimation is consistent with model calculations performed with the same model and parameters used for the calculation of PEC_S. For the "sugar beet" and "winter wheat" scenario PEG_{GW} was < 0.001 µg/l. Metabolites were not considered due to the lack of data.

[26] Maximum reached in the 7th year

[27] Maximum reached in the 4th year

Estimation of Concentrations in Surface Water

Potential Routes of Contamination

To estimate the *Predicted Environmental Concentration* in surface water (PEC_{SW}) several routes have to be considered: Direct overspray, spray drift, run-off, and discharge via drains. These instantaneous events lead to peak values which subsequently decrease by dilution, mainly in flowing water bodies and by degradation.

The predicted environmental concentration in surface water is calculated for a water depth of 30 cm. Table 7 below presents the initial PEC_{SW} values after the first application.

Direct overspray: This way of exposure could only occur in case of inadequate practice. With an application rate of 56 to 125 g per hectare it would result in PEC_{SW} presented in Table 7 for the different application scenarios.

Spray drift: Assuming 0.6% drift (field crops) and 19.9% (fruit crops) to a water body at a distance of 5 m leads to the PEC_{SW} presented in Table 7 below.

Run-off: On fields exceeding a certain slope, run-off can occur. Assuming 0.5% loss from a one hectare field into a 0.2 ha pond and a crop intercept of 50% results in the PEC_{SW} presented in Table 7, if distributed in a water body of 30 cm depth.

Table 13: PEC_{SW} initial (depth: 30 cm; distance: 5 m) for the scenarios "sugar beet", "wheat", and "apples" after the first application **(conditions/assumptions mentioned above)**

Use	**Use rate [g a.i./ha]**	**Direct overspray [µg/l]**	**Spray drift**		**Run-off [µg/l]**
			[% of d.]	**[µg/l]**	
Sugar beet	100	33	0.6	0.2	**0.4**
Wheat	125	42	0.6	0.2	**0.5**
Apples	56	19	19.9	**3.7**	0.2

In the "sugar beet" the estimated concentration in water may significantly be higher. Due to the slow degradation of *Substance A* in soil a "run-off" after the last of the 9 applications could lead to a concentration of about **3.3 µg/l** in surface water.

All these scenarios represent worst-cases. They are not realistically expected to coincide. For further estimation run-off is considered as leading to the highest PEC_{SW}, regarding the field crops and spray drift with respect to fruit crops, disregarding direct overspray as resulting from inappropriate use. Degradation is assumed to be the only pathway of dissipation. In reality, some dilution by water turn-over would decrease the concentration with time. This is not taken into account in this worst-case estimation, however.

The initial concentrations in water bodies would decrease by degradation, by adsorption to sediment, and by dilution.

Predicted Environmental Concentrations in Surface Water (PEC_{SW})

The calculation of the initial PEC_{SW} is based on the use rate, the number of application and the defined conditions for the drift and run-of scenarios, respectively. Subsequent dissipation is assumed to follow first order kinetics with a half-life (**DT_{50}**) of **20 days**. But it has to be kept in mind, that the multiple applications do influence the PEC_{SW} only in a stagnant water body and may be neglected for moving water bodies.

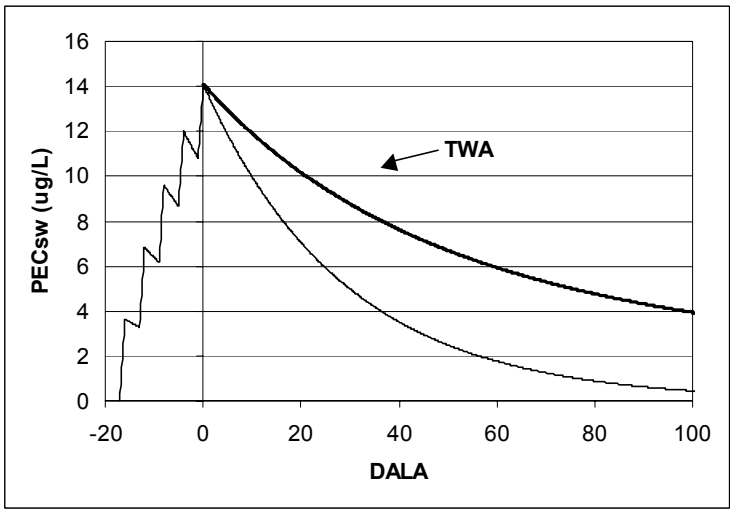
In addition, the *"time weighted average concentrations"* are calculated using the following formula:

$$PEC_l = PEC_i \cdot \frac{DT_{50}}{t_1 \cdot \ln(2)} \left(1 - e^{(-t_1 \cdot \ln(2)/DT_{50})}\right)$$

where PEC_l = time weighted average concentration, PEC_i = initial concentration, and t_l = time period. This PEC_l reflects the average concentration a species would be exposed within a given time period t_l.

As an example Figure 2 shows the "*actual*" (punctual) predicted environmental concentrations at different time points (thin line) compared to the *"time weighted average concentrations"* (TWA).

Figure 12: PEC_{SW} of *Substance A* after multiple applications in apples



Degradation in Air

No information available.

As *Substance A* is somewhat volatile, information on volatilisation and on degradation in air is required for the dossier to be considered complete.

Summary and Conclusions

Degradation in soil:

In laboratory studies, under aerobic conditions, *Substance A* is degraded slowly with half-lives in the range of 229-670 days. Degradation under anaerobic conditions is even slower with half-lives > 800 days. No data on metabolites was supplied.

In the field, *Substance A* dissipates faster than in laboratory experiments with dissipation half-lives in the range of 27-331 days. The more rapid dissipation may, in part, be explained by some volatilization of the compound, which is supported by the faster initial dissipation observed in some of the field experiments and by the importance of microbial activity and/or photolysis. The finding of DT_{90}-values >1year would clearly indicate the necessity of soil accumulation studies.

Residues in wheat are found to be at the same level after the third year of application to this field. This may indicate that the root uptake does not play an important role, assuming higher residues in soil.

Two metabolites were observed in the field experiments at concentrations of up to 8 and 11% relative to the parent compound, respectively. It is not known how these metabolites fit into a metabolic pathway. At least one of the metabolites is relatively persistent.

Mobility in soil:

The parent compound exhibits low mobility in soil as derived from its high K_{OM}-values. No data was supplied on the mobility of metabolites and no data is available on movement of parent and metabolites to deeper soil layers in the field dissipation studies.

Behaviour in water:

Substance A is hydrolytically stable and not readily biodegradable. In sediment-water-systems, the compound dissipates from the water phase with a half-life of 10-20 days by adsorption to the sediment. Degradation in these systems is slow (DT_{50} >800d), indicating a potential risk for sediment dwelling organisms.

Behaviour in air:

The Henry-coefficient of ≈40 J/mole suggests a potential for evaporation of the compound from plants and soil. However, no data on volatilization and/or degradation in air was supplied.

Data Gaps

- *Laboratory studies on degradation in soil*:
  Studies should provide information on metabolites, so that a complete mass balance can be established and a metabolic pathway can be derived. If metabolites in quantities >10% of the applied radioactivity are observed, their half-lives in soil should also be provided.
- *Field studies*:
  Information on translocation of parent and metabolites to deeper soil layers should be provided. A soil accumulation and a rotational crop study must also be submitted.
- *Mobility in soil*:
  Information on the mobility of metabolites in soil must be submitted.
- *Behaviour in air*:
  Studies on the volatilization of substance A and on its half-life in the atmosphere must be submitted.

4. Ecotoxicology and Risk Assessment

As already mentioned under "General Comments" (page 97) there is much confusion (unclear or even contradictory data concerning units for endpoints and/or water solubility, etc.) especially in the field of ecotoxicological studies. Depending on the number and or unit you are choosing, the result and consequently conclusions may be different.

But a rough observation of the data demonstrated that ecotoxicology is not the critical point requiring a closer examination, except for soil macro-organisms and/or sediment dwelling organisms. Therefore, this part will not be presented and discussed in the usual detailed manner!

Birds

The table below summarizes the endpoints for acute (LD_{50}), short term (LC_{50}), and long term (NOEC) studies for two bird species. There are no data available for metabolites.

Table 14: Acute, short and long term toxicity data for birds

Species	Duration	Effect	Endpoint	Remark
Anas platyrhynchos		LD_{50}	215 mg/kg bw	acute
Anas platyrhynchos	11 days	LC_{50}	500 mg/kg feed	short term
Colinus virginianus	9 days	LC_{50}	476 mg/kg feed	short term
Anas platyrhynchos	126 days	NOEC	25 mg/kg feed	long term
Colinus virginianus	154 days	NOEC	15 mg/kg feed	long term

A comparison of the "*Estimated Theoretical Exposure*" (ETE) with the LD_{50} and LC_{50} values of the tested birds clearly demonstrate a high safety factor with respect to acute and short term exposure.

The NOEC of the long term study with bobwhite quails (*Colinus virginianus*) revealed a TER_{lt} close or even below the trigger value of 5. But this value is based on a really worst-case assumption, i.e. that birds fed exclusively contaminated food. In reality, exposure of birds will be much lower, due to their varied food sources.

A bioconcentration factor BCF > 1 is expected leading, according to Annex VI (Uniform Principles), to an unfavourable judgement. Information about the BCF in birds is missing.

Due to the high bioaccumulation potential of the a.i., the use of the product could result in risks to terrestrial vertebrates through secondary poisoning. This could occur for example along the food chain through fish or earthworms to fish-eating and earthworm-eating birds, respectively rough estimation of this risks revealed adequate safety margins. And again, it is very unlikely, that birds fed exclusively contaminated fishes or earthworms.

The realistic probability of exposure of birds to contaminated fish may be low. However, to quantify the realistic exposure, additional studies are necessary, giving detailed information on the bioaccumulation and depuration process in fishes.

Conclusion

The "Toxicity Exposure Ratio" (TER values), based on worst-case scenario, indicate that there is a sufficient safety margin for birds regarding acute and short-term exposure. Regarding the rather theoretical assumption that birds fed exclusively on contaminated food, even the long-term TER value is acceptable.

Aquatic Organisms

The assumptions which led to the initial value of the predicted environmental concentration in surface water are discussed in chapter 3.2.5 *"Estimation of Concentrations in Surface Water"*. Run-off is considered as leading to the highest PEC_{SW}, regarding the field crops and spray drift with respect to fruit crops, disregarding direct overspray as resulting from inappropriate use.

Table 15: Acute, short and long term toxicity data for aquatic species

Species	Duration	Effect	Endpoint	Remark
Oncorhynchus mykiss	96 h	LC_{50}	0.81[28] mg/L	actual conc.
Lepomis macrochirus	96 h	LC_{50}	1.2 mg/L	actual conc.
Cyprinodon variegatus	96 h	LC_{50}	0.82 mg/L	actual conc.
Pimephales promelas	34 d	NOEC	6.7 µg/L	actual conc.
Pimephales promelas	68 d	NOEC	8.7 µg/L	actual conc.
Daphnia magna	48 h	LC_{50}	0.77 mg/L	actual conc.
Daphnia magna	21 d	NOEC	5.6 µg/L	actual conc.
Scenedesmus subspicatus	72 h	EC_{50}	1.2 mg/L	actual conc.
Scenedesmus subspicatus	72 h	NOEC	0.3 mg/L	actual conc.
Lemna gibba	14 d	NOErC	2.5 mg/L	actual conc.

Acute Toxicity to Fish

The toxicity exposure ratios (TER) for fish were calculated for the most sensitive fish species tested.

The **acute** TER is based on the LC_{50} determined for *Substance A* (810 µg/L) and the initial PEC in surface water of 30 cm depth.

For all three intended uses, the calculated TER_a was clearly above the trigger value of 100.

Chronic Toxicity to Fish

The long-term TER is calculated on the basis of the NOEC (7 µg/L) obtained in respective toxicity study with *Pimephales promelas* considering the *time weighted average* PEC_{SW} for 34 days, corresponding to the exposure time.

For the use in wheat, the TER_{lt} is clearly above the trigger value of 10. In the case of sugar beet (run-off after the 9th application) and apples (spray drift) the estimated TER_{lt} are below the trigger value.

Bioconcentration in Fish

The very high BCF of 5500 L/kg which is far above the trigger value of 100 (according to the Uniform Principles), leads to an unfavourable judgement. The half-life for clearance was 5-8 days, but there was no further elimination after ten days. These facts together with the multiple application of *Substance A* may result in rather high residues in fish and other aquatic organisms.

Acute Toxicity to Aquatic Invertebrates

The TER ratio for aquatic invertebrates was calculated using *Daphnia magna* as a representative. The acute TER_a are based on the EC_{50} (770 µg/L) and the initial PEC_{SW} values.

For all three intended uses, the calculated TER_a was clearly above the trigger value of 100.

[28] The solubility in water was given with 0.087 mg/L !!??

Chronic Toxicity to Aquatic Invertebrates

The **long-term** toxicity exposure ratio for *Daphnia magna* in (**stagnant**) water was calculated with the NOEC (6 µg/L) and, according to the test duration, the 21 day PEC_{SW} value (time-weighted average).

The situation is the same as for fish, i.e. for the use in wheat; the TER_{lt} is above the trigger value of 10. In the case of sugar beet (run-off after the 9th application) and apples (spray drift) the estimated TER_{lt} are below the trigger value.

Algae

The TER_a for algae is based on the EC_{50} value (1.2 mg/L) for the green algae *Scenedesmus subspicatus* and the initial PEC_{SW} values.

All application scenarios reveal a high (to very high) safety factor for *Substance A*, even a prolonged exposure would not cause unacceptable damage to algae.

Aquatic Plants

The TER_{lt} for aquatic macrophytes, based on the NOEC value of *Lemna gibba* and the time weighted average PEC_{SW} value calculated for 30 cm deep stagnant water, is far above the trigger value of 10.

Sediment Dwelling Organisms

Table 10 presents the NOEC values for two sediment dwelling organisms, based on experiments using spiked sediment; (the figures are given for dry weight).

Table 16: Toxicity data for sediment dwelling organisms

Species	Duration	Effect	Endpoint	Remark
Lumbriculus variegatus	28 d	NOEC	0.5 mg/kg_{dw}	10% O:M:
Caenorhabditis elegans	72 h	NOErC	0.1 mg/kg_{dw}	10% O:M:

The NOEC refers to sediment; hence it should be compared to the $PEC_{Sediment}$, which was estimated based on the following assumptions:

- the whole amount of *Substance A* is transferred from water to the sediment
- water depth: 30 cm
- sediment depth: 5 cm
- sediment density: 1.5 kg/dm^3
- neglecting degradation in the sediment (DT_{50} > 800 days).
-

Crop	Dose [g/ha]	No. of appl.	Scenario	PEC_{SW} [µg/l]	$PEC_{Sediment}$ [µg/kg]	TER_{lt}
Wheat	125	1	run-off	0.52	2.1	48
Sugar beet	100	9	run-off	3.3	13.2	8
Apples	56	5	drift	3.7	14.8	7

Based on these assumptions it is concluded, that for the "wheat application scenario" there is a sufficient safety margin, but in the case of the other scenarios these organisms are endangered.

Conclusions

The safety factors for the aquatic species indicate that *Substance A* can be used with virtually no **acute** risk to these organisms, considering all the three intended uses. For the "**wheat** scenario" also the **long-term** TER quotients indicate that even for a prolonged exposure to *Substance A*, there is a high or at least sufficient safety margin. For the "sugar beet" and "apple scenario" the **long-term** TER values indicate a potential risk for fish, daphnia, and sediment dwelling organisms. But it has to be kept in mind, that the calculated TER values are based on worst case scenario, especially on the assumption of stagnant water. In reality, there would be some dilution leading to more favourable conditions. On the other side the very high BCF is of importance.

Earthworms

Predicted Environmental Concentrations in soil (PEC_S)

The predicted environmental concentrations in soil and the respective assumptions are presented in section 3.1.4 "Predicted Environmental Concentrations in Soil (PEC_S)".

The follwing table shows the toxicity data for earthworms.

Table 17: Toxicity data for earthworms

Species	Duration	Effect	Endpoint	Remark
Eisenia fetida	14 days	LC_{50}	50 mg/kg	10 % O:M:
Eisenia fetida	28 days	NOEC	0.1 mg/kg	10 % O:M:

The amount to which a soil organism would be exposed as a worst-case is an initial concentration accumulated after multiple applications over years regarding the "sugar beet scenario", amounting to about 0.71 mg/kg. But even in this worst-case the acute TER (TER_a) is calculated to be 70, i.e. clearly above the trigger value of 10, indicating that acute toxicity is not relevant.

But the long-term TER (TER_{lt}), based on the NOEC value and a PEC of 28 days (time weighted average) was below the trigger value, even after a single application in the "apple scenario". This indicates that long-term exposure to *Substance A* is of high risk for earthworms and other soil macro-organisms. In contrast to the other species discussed above, like birds and aquatic organisms, a prolonged exposure is realistic in the case of soil organisms.

Micro-Organisms

Substance A has no influence on soil-respiration and nitrification when used at 1.67 and 16.7 mg/kg. This demonstrates that the incorporation of *Substance A* in soil at concentrations of up to 20 times the maximum estimated concentration after the yearly use of the substance had no prolonged effect upon either short-term respiration or nitrification.

Terrestrial Vertebrates other than Birds

An acute toxicity test with rats revealed an LD_{50} value of 150 mg a.i./kg bw, indicating that substance A is harmful to small mammals.

The NOAEL values were determined to be 0.5 and 0.2 mg a.i./kg bw/day for rats (teratogenity study) and mouse (2 year study), respectively.

Table 18: Acute and long term toxicity data for terrestrial vertebrates

Species	Duration	Effect	Endpoint	Unit	Remark
Rattus norvegicus (m+f)		LD_{50}	150	mg/kg bw	acute
Rattus norvegicus (f)	Teratogenity	NOAEL	0.5	mg/kg bw/day	long term
Mus musculis (f)	2 year	NOAEL	0.2	mg/kg bw/day	long term

Exposure of **small terrestrial mammals** may occur by either feeding on cereal grains, emerging plants, leaves and small insects which were over sprayed with the product. The estimated exposure is calculated according to Herger and Kanga and considering a maximum application rate of 125 g a.i./ha, resulting in 3.9 mg/kg leaves and small insects and 0.38 mg/kg grains and large insects as residues on potential food directly after spraying.

The maximum daily oral intake for rats with a mean body weight of 200 g is 20 g feed/day (food intake corresponding to 10% of the body weight). The maximum daily intake of residues by feeding exclusively on potentially contaminated food is 0.39 mg per kg body weight for leaves and small insects and 0.038 mg/kg bw for cereals and large insects. The corresponding TER_a value, based on the LD_{50} obtained and the highest estimated exposure level is presented below:

$$\mathbf{TER_{a\ \textit{wild mammals}}} = \frac{LD_{50}[\text{mgai/kgbw}]}{ETE[\text{mgai/kgbw}]} = \frac{150}{0.39} = \mathbf{385} \quad \textbf{(leaves, rat)}$$

$$TER_{lt\ \textit{wild mammals}} = \frac{NOAEL[\text{mgai/kgbw/day}]}{ETE[\text{mgai/kgbw}]} = \frac{0.2}{0.39} = 0.5 \quad \text{(leaves, mouse)}$$

Based on the acute TER value, **no risk for small mammals**, such as rats, has to be expected.

The TER_{lt} indicates a high risk, but the assumption is rather unrealistic, i.e. the exclusively feeding on potentially contaminated food at the initial residue levels.

Summary

Effects on birds: The LD_{50} and LC_{50} values demonstrate *Substance A* to be slightly toxic to birds. The "Toxicity Exposure Ratio" (TER values), based on worst-case scenario, indicate that there is a sufficient safety margin for birds regarding acute and short-term exposure. Regarding the rather theoretical assumption that birds fed exclusively on contaminated food, even the long-term TER value is acceptable.

Effects on aquatic organisms: *Substance A* is toxic to **algae** and very toxic to **fish and daphnia**. But for all three intended uses, the calculated TER_a was clearly above the trigger value for all aquatic species tested, indicating that there is no acute risk for these organisms.

Regarding the **long-term exposure**, there is no risk for aquatic species in case of the wheat application. But for the other uses (sugar beet and apples) the TER_{lt} are below the trigger value regarding **fish** and **daphnia**, indicating a potential risk for these species.

For algae and lemna all application scenarios reveal a high (to very high) safety factor for *Substance A*, hence, even a prolonged exposure would not cause unacceptable damage to algae and higher aquatic plants.

The hydrophobic nature of *Substance A* and its slow degradation in sediments (DT_{50} >800 days) indicate a potential risk for **sediment dwelling organisms**. For the "wheat application scenario" there is a sufficient safety margin, but in the case of the other scenarios these organisms are endangered.

Effects on bees and beneficial arthropods: No data are available on the ecotoxicity of *Substance A* for bees and beneficial arthropods.

Effects on other non-target organisms: The acute TER quotients, calculated for the intake of potentially contaminated leaves and small insects by rats and mice, was found to be clearly above the trigger value. Due to this safety factor, no acute risk for small mammals has to be expected.

The TER_{lt} indicates a high risk, but the assumption is rather unrealistic, i.e. the exclusively feeding on potentially contaminated food at the initial residue levels.

Laboratory studies on **earthworms** performed with *Substance A* revealed a sufficient safety margin for acute exposure. But a long-term exposure to *Substance A* is of high risk for earthworms and other soil macro-organisms. In contrast to the other species discussed above, like birds and aquatic organisms, a prolonged exposure is realistic in the case of soil organisms.

Substance A has no **adverse effect on soil microbial activity** and therefore on soil fertility at concentrations of up to 20 times the maximum estimated concentration in soil.

No information is presented on potential effects of soil metabolites. At least for mB which is rather persistent this is requirement.

Additional requirements (Data Gaps)

- Additional studies should be provided on the ecotoxicity of *Substance A* and the soil metabolites mA and mB regarding soil macro-organisms, bees and beneficial arthropods.
- Laboratory studies on earthworms with metabolites mA and mB should be performed.
- Due to the potential chronic risks for earthworms, semi-field or field studies with of *Substance A* should be provided.
- Acute and long-term studies with *Chironomus* in water-sediment system (sediment spiked) should be provided, including more precise information on the degradation and bioavailability of the a.i. in the sediment.
- Since there is no information available on the toxicity of the formulated products, an acute study with those should be provided at least for *Daphnia* (the most sensitive water organism to *Substance A* tested).

5. Conclusion

There are too many relevant studies missing. And besides, the high persistency of Substance A and its metabolites in soil represents a serious problem to achieve a registration. Above all multiple applications will definitely not be acceptable and therefore not all intended uses possible.

The only reason to consider a substance with these characteristics may be its (important) advantage to control some problems in plant protection, e.g. for resistance management.

In summary, it can be concluded that based on the available data Substance A does represent an undue risk for the environment, if used as recommended, especially with multiple applications in sugar beet and fruit crops.

A.7. UK

We consider it would be helpful to have the fate and behaviour comments and the ecotox comments together. The fate comments all relate to exposure and the ecotox comments to have these exposure values are used in the risk assessment. Comments are in red and blue respectively.

Primary name

Substance A

Physical and chemical properties

Property	Value	Remark
Vapour pressure	$8x10^{-3}$ Pa	20°C
Log K_{ow}	5.2	pH 7, 20°C
Solubility in water	87 µg/L	pH 7, 20°C
pK_a	-	not available
Molecular weight	400	$g.mol^{-1}$

Relatively high vapour pressure for a modern pesticide – but this parameter is not currently formally classified under EU or UK pesticide legislation.

At the present time in the EU assessment process and under UK national requirements there is no formal regulatory scheme for evaluation of pesticide concentrations in air – therefore we do not regulate on vapour pressure.

The log Kow value is high and therefore the compound may be bound to soil and sediment. Water solubility is very low.

If a pKa is not supplied we assume it is not dissociated in water at environmental pH.
Molecular weight is 'normal' for a pesticide.

High log Kow (>3) means that bioaccumulation in fish would need to be addressed.

Also means earthworm and collembola toxicity end points would need dividing by a factor of 2 (as recommended by EPPO 2002) to take account of the fact that the laboratory test soils contain more organic matter than field soils.

EPPO (2002) Environmental risk assessment scheme for plant protection products. Chapter 8. Soil organisms and functions. EPPO Bull, in prep.

Formulations

1. 250 EC (emulsifiable concentrate, substance A 250 g/l)
2. 10 WG (water dispersable granulate, substance A 10 %)

Intended use	nr. form.	dosage	dose a.i.	freq.	interval [days]	time of application
sugar beet (leaf spot)	1	0.4 l/ha	100 g/ha	1-9	4-30	As soon as damage to the crop is observed. Repeat when necessary
summer and winterwheat (leaf spot)	1	0.5 l/ha	125 g/ha	1		As soon as damage to the crop is observed.
apples en pears (scab)	2	0.0375% (37.5 g/100 L water)	38-56 g/ha	1-5	4-30	March-May. As soon as damage to the crop is observed until a maximum of 96 hours after a scab infection occurs (1000 - 1500 L water/ha).

Presumably this is a fungicide for spring/summer use.

The worst case environmental loading is the use on sugar beet at 100 g/ha upto 9x per season – that is 900 g/ha per season.

Degradation in soil

Laboratory studies

soil type	incubation	pH	T (°C)	pF	%om	dosage (mg/kg)	DT50 (days)
loamy sand	aerobic	5	20	3.0	4	0.1	240
silty loam	aerobic	7.2	20	3.0	1.5	0.1	229
silty loam	aerobic	7.2	20	3.0	1.5	1.0	368
silty loam	aerobic	7.2	10	3.0	1.5	1.0	554
silty loam	aerobic	7.2	30	3.0	1.5	1.0	297
silty loam	aerobic	7.2	20	4.0	1.5	1.0	430
sandy loam	aerobic	8.5	25	3.0	1.5	9.7	595
loam	aerobic	6.5	25	3.0	3.7	10	620
loam	aerobic	6.8	20	3.0	4.2	10	670

The soils used look typical arable soils – mineral class, pH and %OM are all 'normal'. Incubation conditions are aerobic in the laboratory. Temperature is 20/25°C except for 2 incubations at 10 and 30°C. These results could all be transformed to a standard temperature of 20°C via use of the agreed Q10 value of 2.2 – however the DT50 values are so high above any EU trigger values that this will not provide any further real information on degradation of this compound. Therefore we could exclude the 2 values at 10 and 30°C. Therefore we can quote DT50lab values at 20/25°C (n=7) as follows –

- range : 229 to 670 days;
- mean : 450 days.

soil type	incubation	pH	T (°C)	pF	%om	dosage (mg/kg)	DT50 (days)
sandy loam	anaerobic	8.5	25	3.0	1.5	9.7	805
loam	anaerobic	6.5	25		3.6	10	950
loam	anaerobic	6.8	20		4.2	10	820

The anaerobic incubations show the DT50 values to be even higher and therefore the compound is slower degrading under these conditions in the lab.

For spring/summer use in arable/orchard crops, these anaerobic data would not normally be used in the assessment process.

Bound residues were found at a maximum of 28% after 180 days, 25% after 281 days (at the end).

CO_2 reached max. 12% after 100 days, max. 23% after 281 days (end) incubation.

Presume these data are from aerobic incubations (not stated).

No further use made of these data on bound residues and CO2 unless they BOTH breach the EU trigger of BR >70% and CO2 <5% at 100 days in lab aerobic incubations. (See EU Guidance Document on Persistence in Soil – DGVI B II.1 – 9188/VI/97 rev8, dated 12.07.2000).

Field studies

Substance A

soil type	location	crop	dosage (kg a.s./ha)	DT50 (days)	DT90	Remarks
loam	Canada	no	0.8		>1 year	250 EC
sandy loam	Canada	no	0.125	139	>1 year	250 EC
clay	England	no	0.375	158	>1 year	250 EC
clay	England	no	0.125	182	>1 year	250 EC
sandy clay	England	no	0.375	186	>1 year	250 EC
sandy clay	England	no	0.125		>1 year	250 EC
silty loam	Spain	no	0.5	27	124 days	Dissappears quickly in the first month, afterwards more slowly. DT50 based on first 3 months and DT90 based on first 6 months
loamy sand	Spain	no	0.5	93	124 days	idem
silty loam	Spain	no	0.5	72	<1 year	idem
silty loam	Germany	no	0.15	331	>1 year	250 EC
loamy sand	USA CA	no	0.13	113	<1 year	?

These field studies have been performed in several countries. In the UK we only take account of field data from countries in the central EU zone – but we MAY look at data from eg. Canada and Northern USA, depending on weather data etc. In above list we would NOT take account of data from Spain and USA CA.

Normally we require full climate/site/treatment history etc for all field studies, which are lacking here, and we generally follow the Netherlands CTB checklist approach for field studies – See Checklist for assessing whether a field study on pesticide persistence in soil can be used to estimate transformation rates in soil – Date 10.07.02 (1 page).

For results from Canada, England and Germany –

- DT50field : range 139 to 331 days, mean 199 days (n=5).
- DT90field : > 1 year (all results).

Metabolite mA:

Was formed at a maximum of 8% of the applied radioactivity after 182 days in the 0-10 cm soil layer. After 369 days only 4% remained.

Not very clear if lab or field data here. However metabolite mA may need assessment under EU rules as formed at >5%.

Metabolite mB

Was formed in a field lysimeterstudy at a maximum of 11% of the applied radioactivity 182 days after application. After 369 days 8% remained.

Would need assessment under EU rules as formed at >10%.

Field studies on wheat and bare field in England showed that residues after application in the third year, after repeated applications of 0.075-0.150 kg/ha, did not exceed residues found after application in the first year.

Presume this is data on active substance – not very clear.

Tends to show no soil accumulation is occurring after use on wheat at upto 0.150 kg/ha for 3 years – but this is not worst case use for soil accumulation – should assess use on sugar beet where can be upto 900 g/ha per year on same plot – but may be in rotation. Need agronomy input here.

The soil predicted environmental concentrations (PECs) would be used in the ecotox risk assessment. If it was concluded that there was accumulation in soil then the maximum soil PEC that included any accumulation would be used in the risk assessment for soil organisms e.g. earthworms. In addition, the fact that the $DT90_{field}$ is > 365 days would trigger the need for certain studies. For example a sub lethal study for earthworms is therefore required as well as a litter bag test. No such study is indicated in the data set provided and this would be identified as a data gap and be required prior to authorisation.

Similarly an assessment of metabolite B would be undertaken since it occurs at >10%. For metabolite A a more qualitative approach would be possible e.g. consideration of structure etc.

Adsorption

K_{om}-values for substance A: 633, 1150, 1830, 1850, 2040, 2060, and 3500 dm^3/kg. Values derived from Freundlich isotherms with 1/n between 0.8 and 1.0 and soil o.m. contents between 0.5 and 15% o.m..

Under EU rules normally use Koc, not Kom.
All results will be used in assessment as conditions all satisfactory.
Kom –

- range : 633 to 3500 dm3/kg,
- mean : 1866 dm3/kg (n=7).

High soil sorption in agreement with high log Kow etc.

Degradation in the aquatic environment

Degradation in water-sediment systems

DT50 of substance A in two water/sediment systems >800 days. Rapid dissipation from water-phase; DT50 10-20 days.

Very persistent in water/sediment study – rapid transfer from water to sediment via partitioning according to high Kow etc. We presume that little or no degradation takes place in water phase – all dissipation is via partition to sediment – would need confirmation from study data.

Assessment of the chronic risk in e.g. surface water is linked to the DT50 of the active substance (and metabolites) in the water and sediment phases. The DT50 in water is ≥2 days therefore both an acute and chronic risk assessment for the active substance is required. Testing on sediment dwelling organisms is required if >10% of applied radioactivity (represented as parent compound) is present in sediment at or after day 14. Further details on this would be needed from the study. Additionally, to avoid unnecessary testing, the chronic NOEC for Daphnia is considered and testing is needed if NOEC <0.1 mg/l as is the case in this study.

An acute risk assessment for fish, aquatic invertebrates and a chronic assessment for fish, aquatic invertebrates and algae would be undertaken. Lemna would also need to be assessed if the active substance was a herbicide. If the TER is >100 for the acute assessment or >10 for the chronic assessment then the risk is considered acceptable. If the TERs are below this then extra data e.g. mesocosm study, extra species or management of exposure e.g. via no spray zones would be considered.

Hydrolysis

Substance A does not hydrolyse in water. This is expected from other results.

Ready biodegradability

Substance A is not readily biodegradable. This is expected from other results.

Degradation in air

No information available.

Bioaccumulation

For *Lepomis macrochirus* the BCF ww/wo of substance A is 5500 L/kg. The halflife for clearance was 5-8 days. No further elimination after 10 days.

For *Anguilla anguilla* the BCF ww/wo of substance A is 4000 L/kg (in presence of sediment 2% o.c.).

For *Mytilus edulis* the BCF ww/wo of substance A is 10000 L/kg.

NB. We are unfamiliar with the units used here and have assumed that the values given equate directly to a standard BCF i.e. 5500 L/kg = BCF of 5500. This also applies to Case2.

Generally we only receive information from a fish test and the result for the 'whole' fish is used. Other information would be considered if the tests methods in the studies were of an appropriate quality. A fish bioconcentration test is required as the log Kow >3and the active substance is stable in water.

1. The risk to birds and mammals that eat fish would be considered using the following approach:
    - Highest water PEC
    - Whole body BCF (usually from fish but if the *M. edulis* study was considered valid we would use this)
    - Estimate fish residues : PEC fish = PEC water * BCF
    - Use the resulting residue to undertake a long term risk assessment for fish eating bird and mammal and compare with the standard TERs for birds or mammals. For full details see the Bird and Mammal guidance document (see earlier). If the trigger values were

breached then consideration would need to be given to the depuration of the active substance i.e. consider whether a refinement of exposure and consequently the residues in fish was possible. The current guidance document focuses on the need to address the long term risk to birds and mammals, however in the past we have also considered acute and short term risk too.

2. The risk to birds that eat earthworms would also be considered using a similar type of approach.

- Use PEC soil
- Estimate BCF for earthworms from

$BCF = (0.84 + 0.01\ Kow)/f_{oc}K_{oc}$

Where K_{oc}= Organic carbon adsorption coefficient
f_{oc} = Organic carbon content of soil (0.02 used as a default value)

- Estimate residues in earthworms: PEC worm = PECsoil * BCF
- Use the resulting residue to undertake a long term risk assessment for earthworm eating birds and mammals and compare with the standard TERs for birds or mammals.

3. Since the BCF>1000 and the substance is stable in water a fish full life cycle may be required even though the fish EC50 is >0.1 mg a.s./l. It is unclear from the data provided exactly what type of test the 68 day *Pimephales promelas* is. However, if this was not a full life cycle study may be required. The need for such studies is also considered on a case by case basis depending on the properties on the active substance.

4. The risk of biomagnification would be considered if a potential to biomagnify was identified. See criteria as per case 1. More details would be needed from the bioconcentration study to determine exactly what is happening and deciding if the risk of biomagnification needed to be addressed.

Toxicity to earthworms

Species	Duration	Effect	Endpoint	Remarks
Eisenia fetida	14-days	LC50	50 mg/kg	10% o.m.
Eisenia fetida	28-days	NOEC	0.1 mg/kg	10% o.m.

Since the log Kow is >2 the toxicity end points would be divided by 2 before using then in the earthworm risk assessment. The assessment would be undertaking using the maximum soil PEC (including any accumulation if applicable see earlier) as follows:

Acute TER = $\frac{25\ mg\ a.s./kg}{Max\ soil\ PEC} = X$ if X >10 is OK, if below 10 then further data required

Chronic TER = $\frac{0.05\ mg\ a.s./kg}{Max\ soil\ PEC} = X$ if X >5 is OK, if below 5 then further data required

Further data could for instance consist of earthworm field studies that appropriately reflected the use rates of the product etc.

Effects on micro-organisms

Substance A has no influence on soil-respiration and nitrification when used at 1.67 and 16.7 mg/kg.

We would consider whether these data appropriately covered the soil PEC. Also as indicated earlier a litter bag test would also be required since the DT90f is >365 days. The risk to soil macro-organisms e.g. F. candida would be considered by comparing the NOEC with the maximum soil PEC. The NOEC would again be divided by 2 as for earthworms above, to take account of the higher organic matter of the laboratory study. If the TER is >5 then the risk is considered acceptable.

Effects on other non-target soil organisms

Species	**Duration (hours)**	**Effect**	**Endpoint**	**remark**
Mucor circinelloides	6 d	NOEC	0.01 mg/kg	10% o.m.
Zea mays	21 d	NOEC	0.4 mg/kg	3.5% o.m.
Sorghum bicolor	21 d	NOEC	1.0 mg/kg	3.5% o.m.
Brassica napus	21 d	NOEC	5.0 mg/kg	3.5% o.m.
Pisum sativum	21 d	NOEC	0.1 mg/kg	3.5% o.m.
Folsomia candida	28 d	NOEC	2.0 mg/kg	10% o.m.
Porcellio scaber	28 d	NOEC	10 mg/kg	10% o.m.

Toxicity data for aquatic species

Species	Duration (hours)	Effect	Endpoint		remark
Oncorhynchus mykiss	96	LC50	0.81	mg/L	actual conc.
Oncorhynchus mykiss	96	LC50	0.81	mg/L	actual conc.
Lepomis macrochirus	96	LC50	1.2	mg/L	actual conc.
Cyprinodon variegatus	96	LC50	0.82	mg/L	actual conc.
Pimephales promelas	34 days	NOEC	6.7	µg/L	actual conc.
Pimephales promelas	68 days	NOEC	8.7	µg/L	actual conc.
Daphnia magna	48	LC50	0.77	mg/L	actual conc.
Daphnia magna	21 days	NOEC	5.6	µg/L	actual conc.
Scenedesmus subspicatus	72	EC50	1.2	mg/L	actual conc.
Scenedesmus subspicatus	72	NOEC	0.3	mg/L	actual conc.
Lemna gibba	14 d	NOErC	2.5	mg/L	actual conc.

Species	Duration (hours)	Effect	Endpoint	sediment spiked	remark
Lumbriculus variegatus	28 d	NOEC	0.5	mg/kg_{dw}	10% o.m.
Caenorhabditis elegans	72 h	NOErC	0.1	mg/kg_{dw}	10% o.m.

Toxicity data for vertebrates

Species	Duration	Effect	Endpoint	Unit
Anas platyrhynchos		LD50	215	mg/kg bw
Rattus norvegicus (m+f)		LD50	150	mg/kg bw
Anas platyrhynchos	11 days	LC50	500	mg/kg feed
Colinus virginianus	9 days	LC50	476	mg/kg feed
Anas platyrhynchos	126 days	NOEC	25	mg/kg feed
Colinus virginianus	154 days	NOEC	15	mg/kg feed
Mus musculis (f)	2 year	NOAEL	0.2	mg/kg bw/day
Rattus norvegicus (f)	Teratogenity	NOAEL	0.5	mg/kg bw/day

A.8 Estonia

Active: Substance A

Molecular weight: 400 g.mol^{-1}
Solubility in water: 87 µg/L at pH 7, 20°C
Log K_{ow}: 5.2 at pH 7, 20°C
Vapour pressure: 8x10^{-3} Pa at 20°C

Formulation

250 EC, emulsifiable concentrate, substance A 250 g/l
10 WG (water dispersable granulate, substance A 10 %)

Intended uses (applications

Application rates: 100 g a.i./ha – sugar beet, up to 9 applications; 125 g a.i./ha – summer and winter wheat, once per season; 38-56 g a.i./ha – apples and pears, up to 5 applications.

1. Environmental risk assessment

Fate And Behaviour

Fate and behaviour in soil:

Route of degradation (lab):

Results: Bound residues: 28% after 180 days, 25% after 281 days. Mineralisation: CO2 12% after 100 days, max 23% after 281 days. No data about metabolites.

Concl.: No formation of bound residues in unacceptable amounts. Max mineralisation rate after 281 days 23% is quite low.

Rate of degradation (lab):

Aerobic:

Test conditions: 4 soil types – loamy sand, silty loam, sandy loam, loam; pH 5 – 8.5; pF 3.0-4.0; 1.5 – 4.2 % OM; temp. mainly 20-25°C, once 30 and 10°C.
Results: DT50 – range: 229 – 670 days, mean 445 days. There was dependence on soil pH and on temp. Degradation was faster in acidic soils and lower temperature (10°C) slowed the degradation.

Anaerobic:
Test conditions: 2 soils, pH 6.5 – 8.5, 1.5 – 4.2 % OM, temp 20-25 °C.
Results: DT50 – range 805 – 950 days, mean 858 days.

Concl.: Subs A degraded very slowly both in aerobic and anaerobic conditions according to lab studies. DT50 mean value 445 from lab studies is far above the trigger value and indicates the high persistency of the substance. Worst case DT50 – 670 days.

Rate of degradation (field):

Test conditions: 7 soil types; locations Canada, England, Spain, Germany, USA; bare soil, no data about OM content and soil pH. Applications 125 – 800 g a.i./ha.

Results: DT50 – range: 113 – 331 days, mean 185 days; except Spain conditions, where DT50 was 27 – 93 days. DT90 > 1 year; only in Spain 124 days and <1 year.

Metabolite mA was formed max 8% of AR after 182 days, after 369 days only 4% remained.

Concl.: Subs A was persistent, with DT50 more than 100 days and DT90 more than 1 year, in most soil conditions. Only under warmer climatic conditions, in Spain, the substance degraded faster, DT50 being less than 100 days. DT50 worst case from field dissipation studies 331 days. Metabolite mA can be considered as not relevant, 4% of AR remained after 1 year.

Soil accumulation:

Test conditions: bare soil and with crop (wheat), location England, repeated applications 75 – 150 g a.i./ha, three years.

Results: residues in soil after the third year did not exceed residues found after application in the first year.

Concl.: There seems to be no accumulation of residues in soil under field conditions. No data about plateau concentration of substance in soil after repeated applications.

Field lysimeter study:

Results: Metabolite mB formed max 11% of AR after 182 days, 8% of AR remained after 369 days.

Concl.: met mB might be relevant for soil organisms, also for leaching. No accumulation potential in soil, as degrades in the long run.

Adsorption:

Test conditions: 1/n : 0.8 – 1.0; content of OM in soil 0.5 – 15%.

Results: K_{OM} : range 633 – 3500, mean 1866. K_{OC} (calculated, mean): 3217.

Concl.: Subs A adsorbed to soils very strongly. Low solubility in water and high K_{OC} indicate low potential for leaching.
No data about adsorption of metabolite mB, which is relevant for leaching.

PEC soil:

Calculated on worst case basis, input data:

- max applic. rate cereals 125 g ai/ha, orchard 56 g ai/ha, also no interception by crop
- DT50 field, worst case 331 days
- assumption: soil depth 5 cm, bulk tensity 1.5 kg/l

Results:

Crop	Crop interception	Dose kg a.i./ha	PEC initial (mg/kg)
1. Cereals	0.5	0.125	0.0833
2. Orchad	0.25	0.056	0.0560
3. No interception	0	0.125	0.1667

Table of PEC values (mg(kg) in cereal

Time t; d:	TWA	Actual
1	0.083246	0.083159
2	0.083159	0.082985
4	0.082985	0.082638
7	0.082726	0.082121
28	0.080937	0.078588
42	0.079774	0.076317
100	0.075186	0.067589

Table of PEC values (mg(kg) in orchad

Time t; d:	TWA	Actual
1	0.055941	0.055883
2	0.055883	0.055766
4	0.055766	0.055533
7	0.055592	0.055185
28	0.05439	0.052811
42	0.053608	0.051285
100	0.050525	0.04542

Table of PEC values (mg(kg) in no interception

Time t; d:	TWA	Actual
1	0.166492	0.166318
2	0.166318	0.16597
4	0.165971	0.165276
7	0.165451	0.164241
28	0.161875	0.157175
42	0.159548	0.152634
100	0.150373	0.135177

Concl.: Pec initial in soil in the case of summer and winter wheat is 0.08 mg/kg, in the case of use in orchard 0.06 mg/kg (after the 1st application) and max PEC is 0.17 mg/kg, when spraying on bare soil. PEC TWA after 28 days in soil 0.0809 mg/kg (cereals) and 0.05 mg/kg (orchard).

Fate and behaviour in water:

Hydrolytic degradation:

Results: subs A does not hydrolyse in water.

Photolytic degradation: no data

Ready biodegradability: not readily biodegradable

Degradation in water/sediment:

Results: DT50 water – 10-20 days; DT50 whole system > 800 days.

Concl.: Subs A is not persistent in water, very persistent in sediment. No data about metabolites.

PEC SW:

1. Calculated on worst case basis for all scenarios.

    1. Calculated for wheat scenario with one application, input data:

        spray drift - according to new aquatic guideline; 90th percentiles drift values
        application rate – 125 g ai/ha
        water body – 30 cm depth
        DT50 – 20 days

Results: PEC initial 41.7 µg (overspray), all values in the table.

Table of PEC values (mg/l)
Cereals

Time (days)	Overspray		1 m - drift (2.77%)		5 m - drift (0,57%)		10 m - drift (0,29%)		20 m - drift (0,15%)	
	Actual	TWA	Actual	TWA	Actual	TWA	Actual	TWA	Actual	TWA
Initial	0.0417	0.0417	0.0011542	0.001154	0.000238	0.000238	0.000120833	0.000120833	0.000063	0.000063
1	0.040247	0.040953	0.0011149	0.001134	0.000229	0.000233	0.000116717	0.000118763	0.000060	0.000061
2	0.038876	0.040255	0.0010769	0.001115	0.000222	0.000229	0.000112741	0.000116741	0.000194	0.000060
4	0.036273	0.038908	0.0010048	0.001078	0.000207	0.000222	0.000105192	0.000112832	0.000054	0.000058
7	0.032691	0.036998	0.0009055	0.001025	0.000186	0.000211	9.48039E-05	0.000107293	0.000049	0.000055
14	0.025649	0.033013	0.0007105	0.000914	0.000146	0.000188	7.43816E-05	9.57366E-05	0.000038	0.000050
21	0.020124	0.0296	0.0005574	0.00082	0.000115	0.000169	5.83587E-05	8.58399E-05	0.000030	0.000044
28	0.015789	0.026667	0.0004373	0.000739	9E-05	0.000152	4.57873E-05	7.73347E-05	0.000024	0.000040
42	0.009719	0.021948	0.0002692	0.000608	5.54E-05	0.000125	2.81854E-05	6.36489E-05	0.000015	0.000033

2. Calculated for sugar beet scenario with repeated applications:
input data: application rate 100 g ai/ha, 9 applications, interval 4 days, DT50 – 20 days, 77th percentiles drift values according to new Aquatic.

Results:
a) PEC initial values (mg/l) after the 1st application:

Distance (m)	basic drift value	PEC
1	2.01	0.0006700
5	0.41	0.0001367
10	0.2	0.0000667
15	0.14	0.0000467
20	0.1	0.0000333
30	0.07	0.0000233
40	0.05	0.0000167
50	0.04	0.0000133

b) PEC initial values (mg/l) after the 9th application:

Distance (m)	basic drift value	PEC
1	2.01	0.0046566
5	0.41	0.0009499
10	0.2	0.0004633
15	0.14	0.0003243
20	0.1	0.0002317
30	0.07	0.0001622
40	0.05	0.0001158
50	0.04	0.0000927

2. Calculated for orchard scenario with repeated applications:
Input data: application rate 56 g ai/ha, 5 applications, interval 4 days, 77th percentiles drift values according to new aquatic guideline, DT50 – 20 days.

a) PEC initial values (mg/l) after the 1st application:

Distance (m)	basic drift value	PEC
1	23.96	0.0044725
5	15.79	0.0029475
10	8.96	0.0016725
15	5.23	0.0009763
20	2.36	0.0004405
30	0.77	0.0001437
40	0.35	0.0000653
50	0.19	0.0000355

b) PEC initial values (mg/l) after the 2nd application:

Distance (m)	basic drift value	PEC
1	23.96	0.0086489
5	15.79	0.0056998
10	8.96	0.0032343
15	5.23	0.0018879
20	2.36	0.0008519
30	0.77	0.0002779
40	0.35	0.0001263
50	0.19	0.0000686

c) PEC initial values (mg/l) after the 3rd application:

Distance (m)	basic drift value	PEC
1	23.96	0.0125487
5	15.79	0.0082698
10	8.96	0.0046927
15	5.23	0.0027391
20	2.36	0.0012360
30	0.77	0.0004033
40	0.35	0.0001833
50	0.19	0.0000995

d) PEC initial values (mg/l) after the 4th application:

Distance (m)	basic drift value	PEC
1	23.96	0.0161903
5	15.79	0.0106696
10	8.96	0.0060545
15	5.23	0.0035340
20	2.36	0.0015947
30	0.77	0.0005203
40	0.35	0.0002365
50	0.19	0.0001284

e) PEC initial values (mg/l) after the 5th application:

Distance (m)	basic drift value	PEC
1	23.96	0.0195907
5	15.79	0.0129106
10	8.96	0.0073261
15	5.23	0.0042763
20	2.36	0.0019296
30	0.77	0.0006296
40	0.35	0.0002862
50	0.19	0.0001554

Bioaccumulation:

Results: BCF ww/wo: *Lepomis macrochirus* 5500 L/kg; *Anguilla anguilla* 4000 L/kg; *Mytilus edulis* 10000 L/kg.

Concl.: All bioaccumulation factors for aquatic organisms are very high. As the substance is persistent in aquatic environment, proceed from chronic risk assessment, trigger value 10 is not met in the case of fish and Daphnia (if comparing the relevant chronic NOEC and PEC TWA) on the worst case basis (overspray, wheat scenario etc.). Microcosm or mesocosm study is needed for refinement of the RA.

6. Summary for e-fate

Metabolisation and degradation

1. Substance A is stable to hydrolysis, does not hydrolyse in water. No data about photolytic degradation.

2. The degradation of subs A in soil studies is characterised by a quite low mineralisation rate, up to 23% after 281 days. There is no formation of bound residues in high amounts, about 28% after 180 days.
3. Metabolite mA formed max 8% of AR after 182 days in soil and can be considered as not relevant. Metabolite mB formed max 11% of AR after 182 days in field lysimeter study and can be considered as relevant for soil organisms and for leaching.
4. Subs A degrades very slowly in water/sed systems, DT50 > 800 days. In the case subs A reaches the water, it dissipates from the water phase with DT50 between 10-20 days. No data about metabolites and mineralisation in water/sed system.

Persistence

1. Subs A is persistent under aerobic and anaerobic conditions in soil according to lab studies, DT50 mean value 445 days.
2. Subs A is persistent, with DT50 more than 100 days and DT90 more than 1 year, under most soil conditions, except Southern European conditions, with DT50 331 days, which is worst case from field dissipation studies.
3. Metabolites mA and mB are not persistent in soil since degrade in the long run.
4. Subs A is very persistent in aquatic environment, it dissapears from water phase and accumulates in sediment.

PECs

1. PEC in soil - PEC initial in soil in the case of use in summer and winter wheat is 0.08 mg/kg after the 1st application and in the case of use in orchard 0.06 mg/kg. Max PEC in soil is 0.17 mg/kg, when spraying on bare soil.
2. PEC SW – max PEC initial is 41.7 μg in the case of overspray and use in summer and winter wheat after the 1st application.

Adsorption/mobility and leaching

1. Subs A adsorbs to soils strongly with K_{OM} mean value of 1866 and have low potential for leaching.
2. No data about adsorption of metabolite mB, which is relevant for leaching.

Accumulation in soil/bioaccumulation

1. There is no accumulation of residues in soil under field conditions. Residues in soil after the third year did not exceed residues found after application in the first year.
2. Substance is very bioaccumulative in aquatic organisms.

Ecotoxicology

Effects on aquatic organisms (fish, aquatic invertebrates, algae):

Toxicity data for aquatic species

Species	Duration (hours)	Effect	Endpoint		remark
Oncorhynchus mykiss	96	LC50	0.81	mg/L	actual conc.
Oncorhynchus mykiss	96	LC50	0.81	mg/L	actual conc.
Lepomis macrochirus	96	LC50	1.2	mg/L	actual conc.
Cyprinodon variegatus	96	LC50	0.82	mg/L	actual conc.
Pimephales promelas	34 days	NOEC	6.7	µg/L	actual conc.
Pimephales promelas	68 days	NOEC	8.7	µg/L	actual conc.
Daphnia magna	48	LC50	0.77	mg/L	actual conc.
Daphnia magna	21 days	NOEC	5.6	µg/L	actual conc.
Scenedesmus subspicatus	72	EC50	1.2	mg/L	actual conc.
Scenedesmus subspicatus	72	NOEC	0.3	mg/L	actual conc.
Lemna gibba	14 d	NOErC	2.5	mg/L	actual conc.

1. Crop: summer and winterwheat
Application rate: 125 g a.i./ha
Frequency: 1

7. PEC initial values from fate and behaviour part

Tier I. Results:
Toxicity/exposure ratios for substance A
1. Short term toxicity/exposure ratios:

Species	Toxicity data	0 m	1 m	5 m	10 m	Trigger
Oncorhynchus mykiss	96h LC50 0.81 mg/l	19.4	702	3411	6703	100
Lepomis macrochirus	96h LC50 1.2 mg/l	28.8	1040	5053	9931	100
Cyprinodon variegatus	96h LC50 0.82 mg/l	19.7	710	3453	6786	100
Daphnia magna	48h LC50 0.77 mg/l	18.5	667	3242	6372	100
Scenedesmus subspicatus	72h EC50 1.2 mg/l	28.8	1040	5053	9931	10

Concl.: Although subs A has very high acute toxicity to all aquatic organisms, toxicity/exposure ratios in this case for wheat scenario are acceptable.

2. Long term toxicity/exposure ratios

Species	Toxicity data	0 m	1 m	5 m	10 m	Trigger
Pimephales promelas	34d NOEC 6.7 µg/l	0.16	6	28	55	10
Pimephales promelas	68d NOEC 8.7 µg/l	0.21	8	37	72	10
Daphnia magna	21d NOEC 5.6 µg/l	0.13	5	24	46	10
Scenedesmus subspicatus	72h NOEC 0.3 mg/l	7.2	260	1263	2483	10
Lemna gibba	14d NOErC 2.5 mg/l	60	2166	10526	20690	10

Tier II. Results:
Toxicity/exposure ratios for substance A:

	Species	mg/l	mg/l	TER 0 m	TER 1 m zone	TER 10 m zone	TER 20 m zone
(Sub)Chronic		NOEC	PECtwa				
1	Fish	0.0067	0.0245	0.27	10	94	182
2	Daphnia	0.0056	0.0296	0.19	7	65	126
3	Algae	0.3	0.0403	7.45	269	2 570	4 968.28
4	Lemna	2.5	0.0330	75.73	2 734	26 113	50 485.74

2. Crop: apples and pears
Application rate: 56 g a.i./ha; frequency: 5; interval: 4 days.
PEC initial values from fate and behaviour part

Tier I. Results:
After the 1st application:
Short term toxicity/exposure ratios:

Species	Toxicity data	0 m	3 m	5 m	10 m	Trigger
Oncorhynchus mykiss	96h LC50 0.81 mg/l	43.4	181	275	484	100
Lepomis macrochirus	96h LC50 1.2 mg/l	64.3	268	407	717	100
Cyprinodon variegatus	96h LC50 0.82 mg/l	43.9	183	278	490	100
Daphnia magna	48h LC50 0.77 mg/l	41.3	172	261	460	100
Scenedesmus subspicatus	72h EC50 1.2 mg/l	64.3	268	407	717	10

Long term toxicity/exposure ratios:

Species	Toxicity data	10 m	15 m	20 m	30 m	Trigger
Pimephales promelas	34d NOEC 6.7 µg/l	4	7	15	47	10
Pimephales promelas	68d NOEC 8.7 µg/l	5	9	20	61	10
Daphnia magna	21d NOEC 5.6 µg/l	3	6	13	39	10
Scenedesmus subspicatus	72h NOEC 0.3 mg/l	179	307	681	2087	10
Lemna gibba	14d NOErC 2.5 mg/l	1495	2561	5675	17393	10

Tier II. Results:

After the 1st application:

Toxicity/exposure ratios for substance A:

Species	mg/l	mg/l	TER 0 m	TER 1 m zone	TER 10 m zone	TER 20 m zone
(Sub)Chronic	NOEC	PECtwa				
1 Fish	0.0067	0.0110	0.61	3	7	79
2 Daphnia	0.0056	0.0133	0.42	2	5	55

After the 2nd application:

Short term toxicity/exposure ratios

Species	Toxicity data	0 m	3 m	5 m	10 m	Trigger
Oncorhynchus mykiss	96h LC50 0.81 mg/l	22.4	94	142	250	100
Lepomis macrochirus	96h LC50 1.2 mg/l	33.2	139	211	371	100
Cyprinodon variegatus	96h LC50 0.82 mg/l	22.7	95	144	254	100
Daphnia magna	48h LC50 0.77 mg/l	21.3	89	135	238	100
Scenedesmus subspicatus	72h EC50 1.2 mg/l	33.2	139	211	371	10

Long term toxicity/exposure ratios

Species	Toxicity data	10 m	15 m	20 m	30 m	Trigger
Pimephales promelas	34d NOEC 6.7 µg/l	2	4	8	24	10
Pimephales promelas	68d NOEC 8.7 µg/l	3	5	10	31	10
Daphnia magna	21d NOEC 5.6 µg/l	2	3	7	20	10
Scenedesmus subspicatus	72h NOEC 0.3 mg/l	93	159	352	1079	10
Lemna gibba	14d NOErC 2.5 mg/l	773	1324	2935	8994	10

Tier II. Results:

After the 2nd application:
Toxicity/exposure ratios for substance A:

	Species (Sub)Chronic	mg/l NOEC	mg/l PECtwa	TER 0 m	TER 1 m zone	TER 10 m zone	TER 20 m zone
1	Fish	0.0067	0.0212	0.32	1	4	41
2	Daphnia	0.0056	0.0256	0.22	1	2	28

After the 3rd application:

Short term toxicity/exposure ratios

Species	Toxicity data	0 m	3 m	5 m	10 m	Trigger
Oncorhynchus mykiss	96h LC50 0.81 mg/l	15.5	65	98	173	100
Lepomis macrochirus	96h LC50 1.2 mg/l	22.9	96	145	256	100
Cyprinodon variegatus	96h LC50 0.82 mg/l	15.7	65	99	175	100
Daphnia magna	48h LC50 0.77 mg/l	14.7	61	93	164	100
Scenedesmus subspicatus	72h EC50 1.2 mg/l	22.9	96	145	256	10

Long term toxicity/exposure ratios

Species	Toxicity data	10 m	15 m	20 m	30 m	Trigger
Pimephales promelas	34d NOEC 6.7 µg/l	1	2	5	17	10
Pimephales promelas	68d NOEC 8.7 µg/l	2	3	7	22	10
Daphnia magna	21d NOEC 5.6 µg/l	1	2	5	14	10
Scenedesmus subspicatus	72h NOEC 0.3 mg/l	64	110	243	744	10
Lemna gibba	14d NOErC 2.5 mg/l	533	913	2023	6199	10

After the 4th application:

Short term toxicity/exposure ratios

Species	Toxicity data	0 m	3 m	5 m	10 m	Trigger
Oncorhynchus mykiss	96h LC50 0.81 mg/l	12	50	76	134	100
Lepomis macrochirus	96h LC50 1.2 mg/l	18	74	112	198	100
Cyprinodon variegatus	96h LC50 0.82 mg/l	12	51	77	135	100
Daphnia magna	48h LC50 0.77 mg/l	11	48	72	127	100
Scenedesmus subspicatus	72h EC50 1.2 mg/l	18	74	112	198	10

Long term toxicity/exposure ratios

Species	Toxicity data	10 m	15 m	20 m	30 m	Trigger
Pimephales promelas	34d NOEC 6.7 µg/l	1	2	4	13	10
Pimephales promelas	68d NOEC 8.7 µg/l	1	2	5	17	10
Daphnia magna	21d NOEC 5.6 µg/l	1	2	4	11	10
Scenedesmus subspicatus	72h NOEC 0.3 mg/l	50	85	188	577	10
Lemna gibba	14d NOErC 2.5 mg/l	413	707	1568	4805	10

After 5th application:

Short term toxicity/exposure ratios

Species	Toxicity data	0 m	3 m	5 m	10 m	Trigger
Oncorhynchus mykiss	96h LC50 0.81 mg/l	10	41	63	111	100
Lepomis macrochirus	96h LC50 1.2 mg/l	15	61	93	164	100
Cyprinodon variegatus	96h LC50 0.82 mg/l	10	42	64	112	100
Daphnia magna	48h LC50 0.77 mg/l	9	39	60	105	100
Scenedesmus subspicatus	72h EC50 1.2 mg/l	15	61	93	164	10

Long term toxicity/exposure ratios

Species	Toxicity data	10 m	15 m	20 m	30 m	Trigger
Pimephales promelas	34d NOEC 6.7 µg/l	1	2	3	11	10
Pimephales promelas	68d NOEC 8.7 µg/l	1	2	5	14	10
Daphnia magna	21d NOEC 5.6 µg/l	0.76	1.31	2.9	8.89	10
Scenedesmus subspicatus	72h NOEC 0.3 mg/l	41	70	155	477	10
Lemna gibba	14d NOErC 2.5 mg/l	341	585	1296	3971	10

Tier II. Results:

After the 5th application:
Toxicity/exposure ratios for substance A:

	Species	mg/l	mg/l	TER 0 m	TER 1 m zone	TER 10 m zone	TER 20 m zone
(Sub)Chronic		NOEC	PECtwa				
1	Fish	0.0067	0.0480	0.14	1	2	18
2	Daphnia	0.0056	0.0581	0.10	0	1	13

3. Crop: sugar beet
Application rate 100 g a.i./ha, frequency: up to 9, interval: 4 days, PEC initial values from fate and behaviour part

Tier I. Results:
After the 9th application:
Short term toxicity/exposure ratios

Species	Toxicity data	0 m	1 m	5 m	10 m	Trigger
Oncorhynchus mykiss	96h LC50 0.81 mg/l	3.5	174	853	1748	100
Lepomis macrochirus	96h LC50 1.2 mg/l	5.2	258	1263	2590	100
Cyprinodon variegatus	96h LC50 0.82 mg/l	3.5	176	863	1770	100
Daphnia magna	48h LC50 0.77 mg/l	3.3	165	811	1662	100
Scenedesmus subspicatus	72h EC50 1.2 mg/l	5.2	258	1263	2590	10

Long term toxicity/exposure ratios

Species	Toxicity data	10 m	15 m	20 m	30 m	Trigger
Pimephales promelas	34d NOEC 6.7 µg/l	0.03	1	7	14	10
Pimephales promelas	68d NOEC 8.7 µg/l	0.04	2	9	19	10
Daphnia magna	21d NOEC 5.6 µg/l	0.02	1	6	12	10
Scenedesmus subspicatus	72h NOEC 0.3 mg/l	1.29	64	316	647	10
Lemna gibba	14d NOErC 2.5 mg/l	11	537	2632	5396	10

Tier II. Results:

After the 9th application:

Toxicity/exposure ratios:

	Species	mg/l	mg/l	TER 0 m	TER 1 m zone	TER 10 m zone	TER 20 m zone
(Sub)Chronic		NOEC	PECtwa				
1	Fish	0.0067	0.1361	0.05	2	25	70
2	Daphnia	0.0056	0.1646	0.03	2	17	49

Conclusion for aquatic:

1. Tier I and II toxicity-exposure-ratios for chronic toxicity, in the case of sugar beet scenario, are below the Annex-VI-triggers, i.e. the risk in this case is not acceptable.
2. Tier I and II toxicity-exposure-ratios for acute and chronic toxicity, in the case of orchard scenario, are below the Annex-VI-triggers, i.e. the risk in this case is not acceptable.
3. As the substance is very persistent in aquatic environment and bioaccumulation factors are very high, for the refinement of the RA, microcosm or mesocosm study is needed.
4. Risk mitigation measures are need to be implemented.

7. Effects on birds

Mallard duck Anas platyrhynchos: LD50 215 mg/kg bw
Mallard duck Anas platyrhynchos: 11d LC50 500 mg/kg feed
Bobwhite quail Colinus virginianus: 9d LC50 476 mg/kg feed
Mallard duck Anas platyrhynchos: 126d NOEC 25 mg/kg feed
Bobwhite quail Colinus virginianus: 154d NOEC 15 mg/kg feed

Risk assessment:
Application rate 125 g a.i./ha in wheat
The initial concentration of substance A was estimated according to Hoerger and Kenaga (1972)
Scenarios for for small bird (30% food consumption) and large bird (10% food consumption)

Bird type	**Food consumed**	**Estimated initial residues, mg a.i./kg food**	**TER**	**Trigger**
Small bird (<100 g), LD50 215 mg/kg bw	Short grass	112*0.125=14	215/14*0.3= 51	10
	Small seeds and small insects	29*0.125=3.6	215/3.6*0.3=199	10
Small bird (<100 g), LC50 476 mg/kg feed	Short grass	112*0.125=14	476/14= 34	10
	Small seeds and small insects	29*0.125=3.6	476/3.6=132	10
Small bird (<100 g), 154d NOEC 15 mg/kg feed	Short grass	112*0.125=14	15/14= 1.07	5
	Small seeds and small insects	29*0.125=3.6	15/3.6=4.2	5
	Leaves and leafy crops	31*0.125=3.875	15/3.875=3.87	5
	Cereals and large insects	2.7*0.125=0.3375	15/0.3375=44	5
Large bird (>100g), LD50 215 mg/kg bw	Short grass	112*0.125=14	215/14*0.1= 153	10
	Small seeds and small insects	29*0.125=3.6	215/3.6*0.1=597	10
Large bird (>100g), LC50 500 mg/kg bw	Short grass	112*0.125=14	500/14= 36	10
	Small seeds and small insects	29*0.125=3.6	500/3.6=139	10
Large bird (>100g), 126d NOEC 25 mg/kg feed	Short grass	112*0.125=14	25/14= 1.8	5
	Small seeds and small insects	29*0.125=3.6	25/3.6=6.9	5
	Leaves and leafy crops	31*0.125=3.875	25/3.875=6.5	5
	Cereals and large insects	2.7*0.125=0.3375	25/0.3375=74	5

Conclusion for birds:

1. The acute, dietary and chronic toxicity of subs A to birds is high. Taking into account the intended use 125 g ai/ha in the case of wheat and worst case assumptions, toxicity-exposure-ratios for acute and dietary toxicity are above the Annex-VI-triggers, i.e. the risk in this case is acceptable.
2. Toxicity-exposure-ratios for chronic toxicity, in the case when small birds are eating short grass, small insects and leafy crops and in the case when large birds are eating short grass, are below the Annex-VI-triggers, i.e. the risk in these cases is not acceptable.
3. There is no safe use of subs A with application rate of 125 g ai/ha in spraying wheat, especially considering the risk for small birds. The potential risk of subs to small birds indicates that more appropriate refined risk assessment is needed. More data about residues of subs in plantation should be provided.

8. Effects on small mammals

Rat Rattus norvegicus LD50 150 mg/kg bw
Rat Rattus norvegicus NOAEL 0.5 mg/kg bw/day
Mouse Mus musculis 2 year NOAEL 0.2 mg/kg bw/day

Risk assessment:
Application rate 125 g a.i./ha in wheat
The initial concentration of substance A was estimated according to Hoerger and Kenaga (1972)
Scenario for small mammals (10% food consumption)

Mammal	**Food consumed**	**Estimated initial residues, mg a.i./kg food**	**TER**	**Trigger**
Rat Rattus norvegicus LD50 150 mg/kg bw	Short grass	112*0.125=14	150/14*0.1= 107	10
	Small seeds and small insects	29*0.125=3.6	215/3.6*0.1=597	10
Rat Rattus norvegicus NOAEL 0.5 mg/kg bw/day	Short grass	112*0.125=14	0.5/14*0.1=0.36	5
	Small seeds and small insects	29*0.125=3.6	0.5/3.6*0.1=1.4	5
	Leaves and leafy crops	31*0.125=3.875	0.5/3.875*0.1=1.3	5
	Cereals and large insects	2.7*0.125=0.3375	0.5/0.3375*0.1=14.8	5
Mouse Mus musculis 2 year NOAEL 0.2 mg/kg bw/day	Short grass	112*0.125=14	0.2/14*0.1= 0.14	5
	Small seeds and small insects	29*0.125=3.6	0.2/3.6*0.1=0.56	5
	Leaves and leafy crops	31*0.125=3.875	0.2/3.875*0.1=0.52	5
	Cereals and large insects	2.7*0.125=0.3375	0.2/0.3375*0.1=5.9	5

Conclusions for small mammals:

1. The acute toxicity of subs A to small mammals is high.

2. Taking into account the intended use 125 g ai/ha in the case of wheat, under worst case assumptions, toxicity-exposure-ratios for acute toxicity are above the Annex-VI-triggers, i.e. the risk in this case is acceptable.

3. Toxicity-exposure-ratios for chronic toxicity, in the case when small mammals are eating short grass, small seeds, small insects and leafy crops, are below the Annex-VI-triggers, i.e. the risk in these cases is not acceptable.

4. There is no safe use of subs A with application rate of 125 g ai/ha in spraying wheat, especially considering the risk for small mammals. The potential risk of subs to small birds indicates that more appropriate refined risk assessment is needed. More data about residues of subs in plantation should be provided.

9. Effects on earthworms

10. Toxicity to earthworms

Species	Duration	Effect	Endpoint	Remarks
Eisenia fetida	14-days	LC50	50 mg/kg	10% o.m.
Eisenia fetida	28-days	NOEC	0.1 mg/kg	10% o.m.

Acute TERs

Crop	Crop interception	Dose kg a.i./ha	PEC initial (mg/kg)	TER initial
1. Cereals	0.5	0.125	0.0833	600.00
2. Orchad	0.25	0.056	0.0560	892.86
3. No interception	0	0.125	0.1667	300.00

Chronic TERs

Crop	Crop interception	Dose kg a.i./ha	PEC initial (mg/kg)	TER initial	PEC twa	TER twa
1. Cereals	0.5	0.125	0.0833	1.20	0.0809	1.24
2. Orchad	0.25	0.056	0.0560	1.79	0.0544	1.84
3. No interception	0	0.125	0.1667	0.60	0.1619	0.62

Conclusions for earthworms:

1. The studies on subs A indicate that the acute toxicity to earthworms is quite high, but the acute TER is above the relevant Annex VI trigger.
2. Toxicity-exposure-ratios for chronic toxicity, in the case of using product for wheat and in orchards, are below the Annex-VI-trigger, i.e. the risk in this case is not acceptable.
3. There is no safe use of subs A in spraying wheat and orchards considering the risk for earthworms. The potential risk of subs to earthworms shows that for performing more appropriate refined risk assessment, an earthworm reproduction study should be provided.

Effects on micro-organisms

Results: Substance A has no influence on soil-respiration and nitrification when used at 1.67 and 16.7 mg/kg.

Remark: RA for sediment and for non-target soil organisms was not performed.

Overall Conclusion:

1. There is no safe uses for subs A under the intended use scenarious according to the provided data, because the risk for environment is unacceptable.

2. Subs A is very persistent in soil and in aquatic systems and has high potential to bioaccumulate. Substance shows unacceptable chronic toxicity to aquatic and soil organisms and wildlife, especially to earthworms and small birds.

3. The potential risk of subs indicates that more appropriate refined risk assessment is needed.

4. Proposal for decision making: no authorisation of products with subs A without more refined risk assessment, for which the supplementary studies have to be provided.

Data requirement:

1. Effects of metabolite mB on soil organisms (earthworms). Adsorption study of metabolite mB.

2. Soil accumulation study with data about subs A plateau concentration in soil.

3. Study on residues of subs A in plantation.

4. The earthworm reproduction study.

A.9 Japan

1.1. Primary name : Substance A

1.2 Physical chemical properties

1.3 Formulation

1.4 Degradation in soil

1.4.1. Laboratory studies

Some DT50 of the laboratory tests in soil container of Substance A are longer than one year. Therefore, studies of residue in succeeding crops are necessary to confirm the persistency. If Substance A residues in succeeding crops, the formulated products containing Substance A won't be granted the registration by The minister of Agriculture, Forestry and Fisheries according to item 5 paragraph 1 article 3 the agricultural chemicals regulation laws.

1.4.2. Field studies

The data in the table 1.4.2 doesn't ensure the safety use for sugar beet (see table 1.3), therefore, sugar beet won't be included in target crop. Studies of residue of succeeding crops will be necessary, since some DT50 are longer than 100 days in field study.

The amount of mB is 11% of Substance A. So DT50 of mB as well as Substance A should be clearly identified, in accordance with Japanese test guideline (8147).
(http://www.acis.go.jp/eng/indexeng.htm)
However, if any available data indicate non-toxic concern of mB, DT50 of mB may not be identified.

1.5 Adsorption

Adsorption is available as one of the triggers of additional studies on studies of fate in aerobic soil. (If DT50 of studies of fate in aerobic soil is 100 or over and Kom is less than 500, DT50 of studies of fate in anaerobic soil may be identified.)

1.6 Degradation in the aquatic environment

1.6.1 Degradation in water-sediment systems

No data requirement at present.

1.6.2. Hydrolysis

Hydrolysis as part of physical and chemical properties is used to identify the compound.

1.6.3. Ready biodegradability

No data requirement at present.

1.7 Degradation in air

No data requirement at present.

1.8. Bioaccumulation

No data requirement at present.

1.9 Toxicity to earthworms

No data requirement at present.

1.10. Effects on micro-organisms

No data requirement at present.

1.11. Effects on other non-target soil organisms

No data requirement at present.

1.12. Toxicity data for aquatic species

We use only LC50 (Carp) of formulated products for fish risk management. But we can't find the LC50 of formulated products in table 1.12, we tried to extrapolate LC50 of *Oncorhynchus mykiss* of active ingredient to those of formulated products (250EC and 10 WG). So we considered a worst-case scenario and evaluated the effect to fish.

250EC(25%)

1.LC50 0.81mg/l, as LC50 of 250EC

2. Maximum amount of use: 50ml/10a (summer and winter wheat)

3. Z (risk) = Y (PEC) / X (toxicity)
Y = 1 ppm
X = 0.81
Z= 1/0.81= 1.23
Precaution phrase;
No specific concern

10WG(10%)
1.LC50 0.81mg/l, as LC50 of 10WG
2.Maximum amount of use: 56.25ml/10a (apples and pears)
3. Z (risk) = Y (PEC) / X (toxicity)
Y= 1.125 ppm
X= 0.81
Z= 1.125/0.81 = 1.35
Precaution phrase;
No specific concern

1.13. Toxicity data for vertebrate

Those data are used to estimate ADI and to provide precaution phrase for operator.

A.10 The Netherlands

Persistence in soil

Substance A: For the Netherlands the DT50 values determined at 10 ºC and 30 ºC would be excluded. The values determined a 25 ºC will be recalculated to 20 ºC using the Arrhenius equation. $DT_{50,lab}$ values range from 229 to 925 days, the average is 535 days.

The substance does not pass the persistence criteria based on laboratory data. There are several field studies performed. No detailed information is available for these field studies (climate/site/history). This information is necessary to decide if the field studies are relevant for the Dutch situation. Therefore we would decide to use only the studies for UK and Germany. Based on the results for these locations 4 relevant DT_{50} values are derived with an average of 214 days (range 158-331 days).

The substance does not pass the Dutch criterium of a maximum DT_{50} of 180 days for new substances and substances that are not listed on the Annex I.

Considering substance A a new substance no further assessment is necessary.
No registration possible.

A.11. Germany

Persistency

Soil

endpoint	value	assessment	class
dt_{50}	> 100 days	negligible primary degradation	IV
CO_2	10-25 %	limited mineralisation	III
bound residues	25-50 %	high plateau	III

persistence category III, high persistence in soil

Water/Sediment System

endpoint	value	assessment	class
dt_{50}	> 800 days	negligible primary degradation	IV
CO_2	no data	not assignable	n.a.
bound residues	n.d.	n.a.	n.a.

persistence category IV, not biodegradable in water/sediment system

Bioaccumulation

endpoint	value	assessment	category
BCF	> 1000	very high BCF	IV
ct_{50}	3-10 days	delayed elimination	II
organ specific bioaccumulation?	no data	not assignable	n.a.
uncompleted elimination?	n.d.	n.a.	n.a.

overall assessment category III, cause for concern

ANNEX B – ASSESSMENT OF DATA SET 'B'

B.1. France

Unfortunately, the qualified environmental scientists were not able, due to their workload, to do this case study following the whole national registration process for pesticides. Thus, the exercise has been done considering the approach presented in the draft EU TGD (Technical Guidance Document for new chemicals, existing chemicals and biocides). This guidance is not used actually in France to assess phytosanitary products.

However, the questionnaire has been answered in collaboration with pesticides experts according to the real national standards and procedure.

Persistency assessment:

	Water / sediment study	endpoint	standard	conclusion
Substance B	DT50 Water	1 to 3 days	P>40 days vP>60 days	Non P
	DT50 Water/sediment	>180 days	P>120 days vP>180	vP
Metabolite	DT50 Water	60 to 90 days	P>40 days vP>60 days	P
	DT50 Water/sediment	150 to 180 days	P>120 days vP>180	vP

Substance B is inherently biodegradable

Conclusion: Substance B is potentially non P, to be confirmed

Bioaccumulation assessment:

Lepomis	BCF ww/wo	standard	conclusion
Substance B R isomer	BCF 50 DT50 clearance=0.5 days	B > 2000 vB > 5000	Non B
Substance B S isomer	BCF 400 DT50 clearance=5 days		
Metabolite A; R isomer	BCF 30 DT50 clearance=0.5 days		Non B
Metabolite A; S isomer	BCF = 210 DT50 clearance=0.5 days		Non B

Conclusion : Substance B and isomers are not Bioaccumulative

Toxicity assessment:

→ NOEC = 15 mg/kg → NOEC < 30 mg/kg → T

Conclusion : substance B is toxic T

Conclusion: Substance A is not PBT nor vPvB.

In order to finalise the PB assessment, both case studies need to be assessed following the 91/414/EEC procedure.

B.2. Australia

Formulation and Use

The pesticide 50 EC is a product formulated as an emulsifiable concentrate, containing 50 g/L of the active ingredient, substance B. Substance B consists of two stereoisomers (R and S). The R isomer is documented in the efficacy dossier to be the active isomer. No information was provided on the proportions of each isomer. The formulated product is intended use in cereals. No other information was provided.

Rates and Frequency of Application

The pesticide 50 EC is applied once to cereal at a rate of 0.4 L/ha formulated product, equating to 750 g a.i./ha during the growth phase, from tillering to stem elongation. There is clearly an error in this information as 0.4 L/ha of 50 g/L formulation equates to 20 g/ha. The higher rate has been adopted in this assessment.

Summary of Physico-chemical Properties and Fate

Substance B has a MW of 300. It is very slightly volatile (3.5 X 10^{-7} Pa), slightly water soluble (3.3 mg/L, 20ºC), and has a log K_{ow} of 3.2 at 20ºC.

In laboratory studies, the S isomer of substance B had DT50 values between 50 and 240 days in aerobic soil, and the R isomer had DT50 values between 30 and 110 days. Substance B formed one major and two minor metabolites (mA, mB, mC). The R isomer formed all three metabolites, while the S isomer formed only mA. The main metabolite mA itself comprises of two isomers (at a ratio of 50:50).

Metabolite mA formed by the R isomer of substance B reached 30% after 100 days, and 60% after 180 days. Metabolite mA formed by the S isomer of substance B reached 10% after 100 days, and 30% after 180 days (end of test). The DT50 values for both isomers were between 25 and 120 days. Bound residues (R isomer) reached 78% after 100 days, declining to 55% after 180 days, CO_2 reached 33% by the end of the test (281 days). Bound residues (S-isomer) reached 60% after 180 days. CO_2 reached 3% after 180 days.

In field studies, the S isomer of substance B had DT50 values between 100 and 200 days, and DT90 values between 1 and 2 years. The R isomer had DT50 values between 12 and 100 days, with DT90s ranging between 2 months and 1 year. In field studies, only metabolite mA formed. It reached 25% of applied radioactivity in the 0-10 cm layer after 40-190 days, declining to 4% by day 369.

In water/sediment systems, there was no difference in the behaviour of the two isomers. Metabolite mA reached 6% in the sediment and 11% in the water after 180 days. Substance B had a DT50 of >180 days in sediment and in the whole system, and from 1-3 days in water. Metabolite A had a DT50 of between 60-90 days in water, 150-180 days in sediment, and 90 and 110 days in the whole system.
In adsorption studies, the K_{om} values (OM content, 0.5-15%) for substance B ranged between 2000-13,500 indicating slight mobility to immobility in soils. The K_{om} values for the metabolite mA ranged between 12 and 25, indicating a high mobility in soils.

Substance B is inherently biodegradable, but does not undergo hydrolysis or photodegradation.

For the R-isomer of substance B, the BCF (wet weight/whole organism) of Bluegill sunfish (*Lepomis machrochirus*) was 50 L/kg, with a half-life for clearance of 0.5 days. For the S-isomer, the BCF ww/wo is 400 L/kg, with DT50 for clearance of 5 days. For metabolite A of the R-isomer of substance B, the BCF ww/wo is 30 L/kg, and for metabolite A of the S-isomer, the BCF is 210 L/kg, with DT50 for clearance of 0.5 days for both isomers.

Summary of Environmental Toxicity

Normally *Environment Australia* would have separate sections assessing each fate and toxicity test in detail, followed by summaries. However, the latter are well summarized in tables in the documentation and will not be repeated here. It is noted that toxicity data for the individual R and S isomers are not provided. *Environment Australia* agrees that data for the mixture is appropriate.

Prediction Of Environmental Hazard

Accumulation in soil/sediment

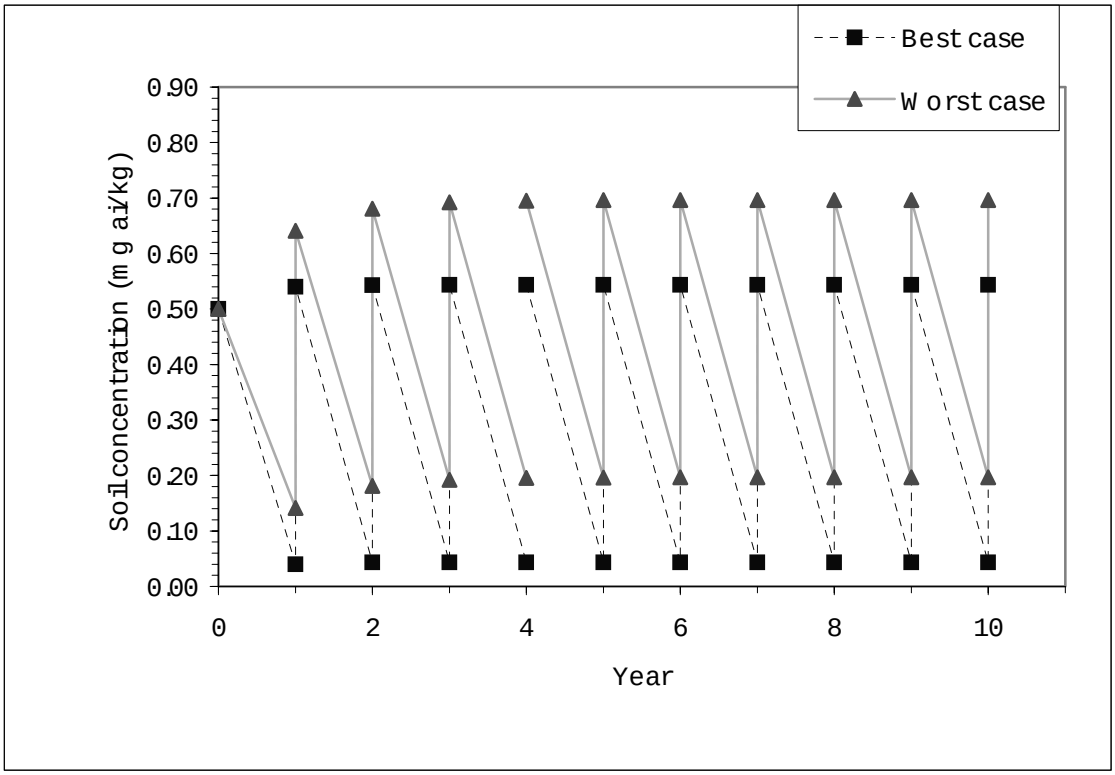
A single application of 50 EC insecticide, at an application rate of 750 g a.i./ha, would result in an initial concentration in the top 10 cm of soil of 0. 5 mg a.i./kg soil, assuming a bulk density of 1.5 g/cm^3. With repeated application, accumulation of substance B or its metabolite could potentially occur in some soil types due to persistence (i.e. DT50 >180 d).

Figure 1 indicates the trend in concentrations of substance B in soil over a 10-year period following a single annual application (Smith 1982). The concentration estimates pertain to residues remaining in the surface 10 cm of soil with a bulk density of 1.5 g/cm^3. We have assumed the best-case (100 days) and worst-case (200 days) half life times for field conditions for the S isomer, rather than the faster rates found for the R isomer (i.e. DT50: 12-100 d). We have also used the data from field studies rather than laboratory studies as they are expected to be more representative of on farm degradation. We also assume no movement below 10 cm and no loss in surface run-off, and 100% to soil with no capture by vegetation.

With the "best case" half-life time of 100 days, about 8% carryover occurs from year to year. Using the "worst case" half-life of 200 days, about 22% carryover occurs. These carryover rates result in the soil concentrations reaching maximums of between 0.543 mg/kg (in year 2) and 0.697 mg/kg (in year 6), and then stabilizing. Using the shorter DT50 values for the R isomer the carryover rates are 0 and 8% respectively.

These data suggest that slight accumulation of the S isomer of substance B could occur in some soil types, in which application is repeated year after year. According to the efficacy data, the S isomer is the inactive substance. However, in cereal growing areas, where crops are normally grown in rotation, accumulation is not expected to be of concern. Further, levels in soil may be expected to be much lower than predicted in Figure 1, due to both interception by the foliage in the field.

Figure 1. Effects of applications of 750 g/ha of substance B on concentrations in the top 10 cm of soil, using the best and worst-case half life times of the S isomer.



Hazard Quotients

The environmental hazard from acute exposure is determined from the Environmental Hazard Quotient (Q) calculated by dividing the expected environmental concentration (EEC) by the acute toxicity data for the most sensitive aquatic species (LC50 or EC50). We generally consider the following values as an appropriate guide for the establishment of hazard:

- $Q > 0.5$: hazard is unacceptable,
- $0.1 \leq Q \leq 0.5$: hazard may be able to be mitigated by some form of risk management, such as label restraints for a specific use and an identified hazard arising from that use, and
- $Q < 0.1$: hazard is considered low (and may or may not require some form of risk management, such as general label restraints).

For chronic exposure (eg. repeated sprays and/or relatively persistent substances), the hazard is considered acceptable if the NOEC for the most sensitive species to chronic exposure is less than the EEC estimated for prolonged exposure.

Hazard to terrestrial organisms

Birds

Substance B is slightly toxic to birds (Mensink *et al* 1995). The 8 d dietary LC50 for mallard duck (*Anas platyrhynchos*) is >5000 mg/kg feed. The 10 d dietary LC50 for Bobwhite quail (*Colinus virginianus*) is >5000 mg/kg feed. Metabolite A of substance B is also slightly acutely toxic to birds (Mensink *et al* 1995). The 14 d dietary LC50 for mallard duck (*Anas platyrhynchos*) is >4500 mg/kg feed, and the 9 d dietary LC50 for Bobwhite quail (*Colinus virginianus*) is >5000 mg/kg feed.

Birds are most likely to be exposed to substance B through the consumption of residues on treated vegetation, or residues on insects killed by the pesticide. Therefore, dietary Q values are calculated from residue concentrations (fresh weight) in food according to the method of Kenaga (Fletcher *et al.* 1994; Urban and Cook 1986). The residue concentrations in food assume a Bobwhite quail has a diet of 30% small insects, and 70% grain, while the domestic duck has a diet of 30% grain and 70% large insects.

Table 1 shows the equivalent concentrations of residues in food (fresh weight) consumed by birds following a single application of substance B at the highest rate, and the hazard quotients (Q) calculated from the $PEC_{residues}$ and the dietary LC50 values. The values for the metabolite assume that 100% of substance B is transformed to the metabolite, mA.

Table 1: The dietary Q values and residue concentrations in food for birds.

	Endpoint (mg/kg feed)	Residues in food mg/kg	Q
Organism	**Substance B**		**Substance B**
Mallard duck	8 d LC50 >5000	29.1	0.0058
Bobwhite quail	10 d LC50 >5000	78.6	0.016
	Metabolite		**Metabolite**
Mallard duck	14 d LC50 >4500	As above*	0.0065
Bobwhite quail	9 d LC50 >5000		0.016

* assumes 100% transformation to metabolite A

The dietary Q values for acute exposure to substance B following a single application at the highest spray rate (750 g a.i./ha) are 0.016 for the Bobwhite quail and 0.0058 for the mallard duck. These values are less than 0.1, indicating a low concern to birds (Table 1).

The dietary Q values for acute exposure to the metabolite following a single application at the highest spray rate (750 g a.i./ha) are 0.016 for the Bobwhite quail and 0.0065 for the mallard duck. These values are also less than 0.1, indicating a low concern to birds.

No chronic exposure to substance B or its metabolite is anticipated from a single application per season. In chronic studies with substance B, the 29 day subacute NOEC for mallard duck (*Anas platyrhynchos*) is >500 mg/kg feed. The 28 d NOEC for Bobwhite quail (*Colinus virginianus*) is >500 mg/kg feed. For metabolite A, the 120 day reproduction NOEC for mallard duck (*Anas platyrhynchos*) is >4500 mg/kg feed, and the 130 d reproduction NOEC for the Bobwhite quail (*Colinus virginianus*) is >450 mg/kg feed. These NOEC values are significantly greater than the EEC values, indicating a low concern from chronic exposure.

Earthworms

Earthworms are likely to be exposed to the pesticide when they move into the upper horizons of the soil to feed.

Substance B is very slightly toxic to earthworms *(Eisenia foetida)*, with a 14 day LC50 of >1000 mg/kg and a 28 d NOEC 10 mg/kg. The Q value for acute exposure following a single application of the pesticide is 0.0005 indicating a low hazard from acute exposure. The NOEC is 20 times higher than the EEC, also indicating a lower hazard from chronic exposure.

Metabolite A is very slightly toxic to earthworms *(Eisenia foetida)*, with a 14 day LC50 of >1000 mg/kg and a 28 d NOEC 30 mg/kg. The Q value for acute exposure to the metabolite is 0.0005 indicating a low hazard. The NOEC is 60 times higher than the EEC, also indicating a low hazard for chronic exposure.

Mesofauna

A 72 h NOErC for the soil nematode, *Caenorhabditis elegans*, of 0.01 mg/kg dw soil was provided, indicating a high toxicity to these organims. No toxicity data for the metabolite, mA was provided. A soil nematode exposed to 0.5 mg/kg of substance B, would result in a Q value of 50, suggesting a significant hazard from exposure.

Organisms could become exposed through contact with soil residues following application, or through exposure to bound residues, which subsequently become available through mineralisation of organic matter. Bound residues (R isomer) reached 78% after 100 days, declining to 55% after 180 days, thus these stored residues could potentially provided a route of exposure.

Microorganisms

Substance B had no effect on soil respiration and nitrification when applied at rates up to 1.0 mg/kg, which is twice as high as the recommended rate, indicating a low hazard to these micro-organisms.

Hazard to Aquatic organisms

In an aquatic contamination situation, the EEC (expected environmental concentration) is calculated for spray or runoff reaching lentic water 15 cm deep (as a worst case situation in regard to water depth). *Environment Australia* normally uses a tiered approach to perform the exposure assessment, where as an initial step, we consider the worst-case situation of direct overspray (100% spray drift) at the maximum label rate. If required, we then consider a 10% spray drift situation, and subsequently examine the more likely practical situations, taking into account the factors such as fate, persistence, and the likelihood of exposure.

As an initial worst case for runoff, we generally assume 10% of the substance originally applied to a 1 ha crop, runs off in solution or adsorbed to soil particles into a pond 15 cm deep and 1 ha in area (Urban and Cook 1986).

Hazard from Direct Overspray

Fish and aquatic invertebrates

Substance B is very slightly toxic to fish and *Daphnia* in acute toxicity studies (Mensink *et al* 1995). The 96 h LC50 values for 3 fish species range from 1200 to >2500 mg/L, with *Cyprinodon variegatus* having the lowest 96 h LC50 value. The 48 h LC50 for *Daphnia magna* is 700 mg/L. In chronic studies, the

Fathead minnow (*Pimephales promelas*), has a 30 day NOEC of 140 mg/L and the 68 day NOEC is 154 mg/L. The 21 d NOEC for *Daphnia magna* is 110 mg/L.

The metabolite, mA, is very slightly toxic to fish and *Daphnia* in acute toxicity studies (Mensink *et al* 1995). The 96 h LC50 for Rainbow trout is 4500 mg/L, and for *Lepomis macrochirus* is >7000 mg/L. The 48 h LC50 for *Daphnia magna* is 2000 mg/L. The 21 d NOEC for *Daphnia magna* is 300 mg/L.

Table 2 shows the Q values for the acute exposure of fish and *Daphnia* assuming 100% overspray of substance B (and its metabolite) in a body of water 15 cm deep. The values for the metabolite assume that 100% of substance B is transformed to the metabolite, mA.

Table 2: Environmental Hazard Quotients for the most sensitive fish species and Daphnia resulting from a direct overspray (100% contamination) of substance B and metabolite A.

	Endpoint (mg/L)	**Q**
Organism	**Substance B**	**Substance B**
Fish	96 h LC50 = 1200	4.2×10^{-4}
Daphnia	48 h EC50 = 700	7.1×10^{-4}
	Metabolite	**Metabolite**
Fish	96 h LC50 = 4500	1.1×10^{-4}
Daphnia	48 h EC50 = 2000	2.5×10^{-4}

The Q values resulting from single spray application are all several orders of magnitude below 0.1, indicating a low hazard to fish and Daphnia from acute exposure to substance B and its metabolite.

Table 3 shows the Q values for chronic exposure of fish and *Daphnia* assuming 100% overspray of substance B into a body of water 15 cm deep.

Table 3: Environmental Hazard Quotients for fish and *Daphnia* resulting from a direct overspray (100% contamination) of substance B.

	Endpoint (mg/L)	**Q**
Organism	**Substance B**	**Substance B**
Fathead Minnow	30 d NOEC = 140	3.6×10^{-3}
Fathead Minnow	68 d NOEC = 154	3.2×10^{-3}
Daphnia	21 d NOEC = 110	4.5×10^{-3}

The Q values for chronic exposure for fish and *Daphnia* are all significantly less than 1 (NOEC>EEC) indicating a low concern.

Algae and aquatic plants

Substance B is moderately toxic to the green algae (*Scendesmus subspicatus*), with a 72 h EC50 of 1.0 mg/L and an NOEC of 0.1 mg/L, and is very slightly toxic to Duckweed (*Lemna gibba*) with a 14 day EC50 of 1000 mg/L and an NOEC 120 mg/L. The metabolite mA is very slightly toxic to *Scendesmus subspicatus,* with a 72 h EC50 of 3000 mg/L, and an NOEC of 300 mg/L.

Table 4 shows the Q values resulting from acute exposure of green algae and Duckweed to 100% overspray of substance B and its metabolite, mA. The values for the metabolite assume that 100% of substance B is transformed to the metabolite.

Table 4: Environmental Hazard Quotients for the most sensitive fish species and Daphnia resulting from a direct overspray (100% contamination) of substance B and metabolite A.

	Endpoint (mg/L)	**Q**
Organism	**Substance B**	**Substance B**
Scenedesmus subspicatus	72 h EC50 = 1.0	0.5
Lemna gibba	14 d EC50 = 1000	5×10^{-4}
	Metabolite	**Metabolite**
Scenedesmus subspicatus	72 h EC50 = 3000	1.6×10^{-4}

The Q values for algae and aquatic plants, assuming 100% spray drift following a single application, are orders of magnitude below 0.1, with the exception of the *Scendesmus subspicatus* exposure to substance B, which has a Q value of 0.5, indicating a hazard that may be mitigated through management. The 100% direct overspray scenario is not expected to occur under normal usage of the pesticide.

A 10% spraydrift or 10% runoff scenario would result in a Q value of 0.05 for the most sensitive species, algae, indicating a low hazard. Therefore, the hazard to aquatic organisms posed by substance B and its metabolite are considered low.

Hazard to benthic organisms

Exposure of benthic organisms to substance B or its metabolite could potentially occur through contact with contaminated water, sediment/pore water, sediment, or through ingestion of contaminated sediment. A 28 d NOEC of substance B was provided for the mud worm (Lumbriculus variegatus) of 50 mg/kg dry sediment.

In water/sediment systems the DT50 values of substance B were >180 d in sediment, and from 1-3 days in water, indicating rapid partitioning into the sediment. If we assume 100% overspray reaches a water body and then all of it adsorbs to sediment, a mud worm could be exposed to maximum concentrations of 0.5 mg/kg sediment (assuming mixing in the top 10 cm, and no degradation). The resulting Q value for chronic exposure is 0.01 (NOEC>EEC), indicating a low hazard to mud worms from exposure in sediment, even assuming 100% overspray and allowing for differences between wet and dry weight. Note that an endpoint for the more common test organism, chironomids used in draft OECD test Guidelines 218 and 219, is not available, and *Environment Australia* has no information on the relative sensitivities of these test organisms.

Hazard from bioaccumulation

The highest BCF is 400 L/kg for *Lepomis machrochirus* (Bluegill sunfish), for the inactive S isomer of substance B, with a half-life for clearance of 5 days. The BCF for the active substance is 59 L/kg. It is unclear why the BCF is higher for the inactive substance than the active substance. The log Kow of substance B is 3.2, presumably the value should be identical for both enantiomers. It appears that the active substance is metabolized more rapidly than the inactive substance. The half-life to clearance of the R-isomer was 0.5 days, which is significantly more rapid for the S isomer.

These data indicate that substance B, its isomers, and major metabolite are not significantly bioaccumulative according to the criteria set out by the US EPA (1999), Environment Canada (2002), and the Stockholm Convention on POPs (i.e. log Kow >5 or BCF>5000). Therefore, bioaccumulation in organisms is not expected to be a concern.

Hazard to groundwater

Substance B is slightly water soluble. In adsorption studies, the K_{om} values (OM content, 0.5-15%) for substance B ranged between 2000-13,500 indicating slight mobility to immobility in soils. Based on these data, substance B should not negatively impact on groundwater.

The K_{om} values for the metabolite mA ranged between 12 and 25, indicating a high mobility in soils, and a potential to leach from soil into water (McCall *et al* 1980). However, mA is not toxic to aquatic organisms, and is not bioaccumulative, thereby reducing the environmental hazard. Further, data from column leaching studies reported only 3% AR of metabolite C was recovered in the leachate, and the depth of leaching for metabolite A was not beyond 10 cm in field studies.

Conclusion

The pesticide 50 EC is applied to cereals at a rate of 750 g a.i./ha, once per season. Substance B and its main metabolite, mA, are practically non-toxic to terrestrial and aquatic species, with the exception of the soil nematode, *Caenorhabditus elegans*, to which the substance is very toxic.

The active R isomer of substance B is not persistent in soils. The inactive S isomer is classified as persistent in some soils. In water/sediment studies, substance B was found to be persistent in sediment. Modeling studies in soil indicated a maximum carryover of 22% in soil using the worst-case half-life for the S isomer. However, the low application rates and crop rotation practices used in Australia, should limit soil accumulation, and it is not expected to be a problem in cereal growing areas under the proposed use pattern,

Bioaccumulation in organisms is not expected to be a concern.

The hazard to terrestrial and aquatic organisms from the recommended single spray application is low, even assuming 100% overspray into the aquatic environment. The exception is soil nematodes, which may be the target organisms, as no specific information on the target organisms was supplied and *Environment Australia* has not previously seen test results for these organisms.

Hazard to benthic organisms also cannot be ruled out. Substance B is persistent (DT50 >180 days) in sediment and toxicity data are only available for mud worms rather than chrinonomids, a more standard test organism which may be more sensitive.

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B.3 Norway

Norway has reviewed the conclusions on the original assessments, but not the assessments themselves, before the final draft.

2. Ecotoxicological evaluation

This evaluation is based on documentation from OECD. Dose in cereals: 750 g a.i./ha.

2.1 Active substance

2.1.1. Substance B

Physical/chemical data

Water solubility	Moderate, 3.3 mg/l (20 °C)
Vapour pressure	Low, 3.5×10^{-7} Pa (20 °C)
Henrys law constant	? Pa m^3/mol
Log P_{ow}	High, 3.2 (20 °C)
pK_a	-

Substance B consists of two stereoisomers (R- and S-). The R-isomer is documented in the efficacy dossier to be the active isomer.

Environmental fate

Ads-/desorption	The adsorption of substance B can be classified as very high, with Koc > 1160 (corresponds to a Kom-value of 2000). The adsorption of metabolite A can be classified as low, with Koc < 15 (corresponds to a Kom-value of 25). 1/n is between 0,8 and 1,0 and soil o.m. contents between 0,5 and 15 %. A soil o.m. content of 5 % or above is not regarded as relevant for Norwegian conditions. The lack of detailed information on the different soil-types tested makes it difficult to evaluete the adsorption under Norwegian conditions. This kind of information must be provided (2.4).
Mobility	In an aged leaching test metabolite C was formed at 3% of r.a. applied after ageing and was after leaching recovered for 3 % of the r.a. in the leachate. The mobility of metabolite C in soil can thus be classified as high. The lack of detailed information on the soil-type(s) tested makes it difficult to evaluete the leaching behavior under Norwegian conditions. A study on the leaching behavior of substance B and other relevant metabolites (metabolites formed at levels of 10 % or above, metabolite A in this case. Metabolite B is only found in a volatile trap) should have been provided (2.5).
Evaporation	No information. Based on the vapoure pressure one could suspect that evaporation could occur.
Hydrolysis	Substance B dose not hydrolyse in water (2.6.2).
Photolysis	Metabolite B is sensitive neither to photodegradation nor to OH-radicals. Information on substance B and other relevant metabolites should have been provided (2.7).
Degradation in soil	**Aerobic**: The primary degradation of substance B can be regarded as moderate to medium, DT50: 30-110 days, with an average of 76 days. The degradation of the relevant metabolite mA is also moderate to medium, DT50: 25-120 days, with an average of 77 days. The degradation rates seem to a certain extent to be effected by the content of organic matter, temperature, water content and pH. The rate of degradation can also be caracterized as moderate to medium in field experiments, DT50: 12-200 days, with an average of 86 days.

	Loamy sand	Loamy sand	Silty loam	Silty loam	Sandy loam	Sandy loam	Loam	Loam	Clay
Aerobic/anaerobic/sterile	Aerobic	Aerobic	Aerobic	Aerobic	Aerobic	Aerobic	Aerobic	Aerobic	Aerobic
Duration	-	-	-	-	-	-	-	-	-
Sand (%)	-	-	-	-	-	-	-	-	-
Silt (%)	-	-	-	-	-	-	-	-	-
Clay (%)	-	-	-	-	-	-	-	-	-
pH	5,5	5,5	7,0	5,5	8,0	8,0	6,9	6,9	6,0
% OM.	3,6	3,6	1,4	0,4	16	16	2	2	1
pF	2,2	2,2	3,0	3,0	2,5	2,5	3,0	3,0	4,5
Temp. (°C)	20	20	20	20	25	25	20	20	29-31
S Isomer DT50, days	195	240	177	208	110	127	170	185	50
R Isomer DT50, days	98	77	110	97	74	60	75	66	30
CO_2 (%) after 100 days	-	-	-	-	-	-	-	-	-
Bound residues (%) after 100 days	-	-	-	-	-	-	-	-	-
Metabolites > 10 %	-	-	-	-	-	-	-	-	-
Study quality	-	-	-	-	-	-	-	-	-
Referance	2.3.1								

Metabolites R isomer

Several metabolites are produced, but the mA metabolite is the most important one. After 100 days 30 % is formed and after 180 days 60 % is formed. mA also consists of R- and S- isomers.

	Loamy sand	Loamy sand	Sandy loam	Clay	Loam
Aerobic/anaerobic/sterile	Aerobic				
pH	5,5	5,5	6,0	6,0	6,9
% OM.	3,6	3,6	2,5	1	2
pF	2,2	2,2	2,5	4,5	3,0
Temp. (°C)	20	20	25	29-31	20
S Isomer DT50, days	95	120	60	25	85
R Isomer DT50, days	95	120	60	25	85
Referance	2.3.1				

Metabolite mB is only found in a volatile trap at max. 13 % after 180 days. Metabolite mC is found at 6 % after 100 days and at 9 % after 180 days. This metabolite is a degradation product of metabolite mA only.

Residues:
Bound residues reached a maximum of 78 % after 100 days, 55 % after 180 days (at the end). CO_2 reached 1% after 100 days, max. 33 % after 281 days (at the end) incubation.

Metabolites S isomer:
After 100 days 10 % of metabolite mA is formed and 30% at the end (after 180 days). This metabolite has two isomers (50:50 %). DT50 of both isomers was determined in separate studies (see above).

Residues:
Fraction of other metabolites (unspecified) total <3 %.Bound residue reached a maximum of 60 % after 180 days; CO_2 3 % after 180 days.

The quality and relevance of the degradation studies is difficult to evaluate because of the lack of experimental data.

Anaerobic: No information.

Sterile: No information.

Field studies: Moderate to medium degree of degradation with DT50: 12-200 days, and an average of 86 days. In reaction the the draft report, Norway indicated that the results of the R- and S-isomer should not have been combined.

	Loam	Sandy loam	Clay	Clay	Clay	Sandy clay	Sandy clay	Sandy clay	Silty loam	Loamy sand	Silty loam	Silty loam	Loamy sand	Loamy sand
DT50, days	50	60	60	40	100	80	90	200	55	12	98	100	70	190
DT90, days	183	183	183	183	365	365	365	730	183	60	365	365	365	730
Ref.	2.3.2													

Metabolite mA:
was formed at a maximum of max. 25 % of the applied radioactivity after 40-190 days in the 0-10 cm soil layer. After 369 days (end) only 4 % remained.

Accumulation in soil — No information.

Degradation in water — Ready biodegradability: Substance B is inherently biodegradable (2.6.3).

Water/sediment systems:

The primary degradation of substance B in the systems can be regarded as moderate with DT50: 180 days. In the waterphase degradation can be regarded as high with an average DT50 of 2 days. The degradation of metabolite mA in the systems can be regarded as moderate with an average DT50 of 73 and 100 days in the waterphase and whole system respectively.

In water-sediment systems (10 % sediment) no difference in behaviour between both isomers was observed.

	Substance B	**mA**
Aerobic/anaerobic/ sterile	-	-
Temperature (°C)	20	20
DT50 (water), days	1, 3, 2 (average 2)	60, 90, 70 (average 73)
DT 90 (water), days	-	-
DT50 (sediment), days	> 180 (in all tested sediments, silt loam, sand , loamy sand)	170, 150, 180 (in silt loam, sand and loamy sand respectively. Average 167)
DT50 (system), days	> 180	100, 90, 110 (average 100)
DT90 (system), days	-	-
CO_2 (%) after 100 days	-	-
Bound residues after 100 days	-	-
Metabolites > 10 % after 180 days	mA (sediment: 6 %, water: 11 %)	-
Study quality	?	?
Referance	2.6.1	2.6.1

pH in sediments: 5,5-7,0.% organic matter in sediments: 0,7-5,8.

	The quality and relevance of the degradation studies is difficult to evaluate because of the lack of experimental data.
Residues in surface And ground water	No information.
Bioaccumulation	The potential for bioaccumulation can be regarded as moderate for the R isomer and medium to high for the S isomer of both substance B and the metabolite mA. In Lepomis macrochirus the BCF ww/wo of the R isomer of substance B is 50 L/kg. DT50 for clearance is 0,5 days. For the S isomer the BCF ww/wo is 400 L/kg. DT50 for clearance is 5 days. For Lepomis macrochirus the BCF ww/wo of metabolite A of the R isomer of substance B is 30 L/kg and of the S isomer the BCF ww/wo is 210 L/kg. The DT50 for clearance was 0,5 days for both isomers (2.8).

Effects on terrestrial organisms

Micro-organisms:	Substance B has no influence on soil-respiration and nitrification when used at 1,0 and 0,1 mg/kg (2.10).

Earthworms **Both substances B and metaboliote mA can be classified as not toxic to earthworms**.

Testsubstance	Species	Duration	EC/LC50 (mg/kg)	NOEC (mg/kg)	Study quality	Reference
Substance B	E. foetida	Acute 14 d.	> 1000	-	?	2.9
Substance B	E. foetida	Subchronic 28 days	-	10		
Metabolite mA	E. foetida	Acute 14 d.	> 1000	-		
Metabolite mA	E. foetida	Subchronic 28 days	-	30		

1.1.1. Pollinators No information.

Species	Duration	Contact LD50	Oral LD50	Study quality	Reference
-	-	-	-	-	-

Other beneficial arthropods No information.

Test type	Species	Stadium	Test-substance	Dose (g/daa)	Endpoint	E-value (IOBC)	Study quality	Reference
-	-	-	-	-	-	-	-	-

Birds **Substance B and metabolite mA can both be classified as not toxic to birds**.

Test substance	Species	Study type /duration (days)	LD/LC50	NOEL/ NOEC	Study quality	Ref.
Substance B	*Anas platyrhynchos*	5	> 5000 mg/kg bw	-	?	2.12
Substance B	*Anas platyrhynchos*	8	> 5000 mg/kg feed	-		
Substance B	*Colinus virginianus*	10	> 5000 mg/kg feed	-		
Substance B	*Anas platyrhynchos*	28	-	> 500 mg/kg feed		
Substance B	*Colinus virginianus*	28	-	> 500 mg/kg feed		
Metabolite mA	*Anas platyrhynchos*	2	>15000 mg/kg bw	-		
Metabolite mA	*Anas platyrhynchos*	14	4500 mg/kg feed	-		
Metabolite mA	*Colinus virginianus*	9	5000 mg/kg feed	-		
Metabolite mA	*Anas platyrhynchos*	120	-	> 4500 mg/kg feed		
Metabolite mA	*Colinus virginianus*	130	-	450 mg/kg feed		

Mammals	No information.
Plants	No information.
Field experiments	No information.
	Effects on aquatic organisms
Micro-organisms	No information.
Algae	Substance B can be classified as very toxic to Scenedesmus subspicatus. Metabolite mA can not be regarded as toxic to algae (see table underneath).
Water plants	Substance B is not toxic to Lemna gibba (see table underneath).
Invertebrates	Substance B and metabolite mA can both be regarded as non-toxic to *Daphnia magna* (see table underneath).
Sediment living organisms	Substance B can be classified as moderately to extremely toxic to sediment living organisms (see table underneath).
Fish	Substance B and metabolite mA can both be regarded as non-toxic to fish (see table underneath).

Toxicity to aquatic species:

Test substance	Species	Duration (hours)	EC/LC50 (mg/l)	NOEC (mg/l)	Study quality	Reference
Substance B	*Oncorhynchus mykiss*	96	1500	-	?	2.11
Substance B	*Lepomis macrochirus*	96	>2500	-	?	2.11
Substance B	*Cyprinodon variegatus*	96	1200	-	?	2.11
Substance B	*Pimephales promelas*	30 days	-	140	?	2.11
Substance B	*Pimephales promelas*	68 days	-	154	?	2.11
Substance B	*Daphnia magna*	48	700	-	?	2.11
Substance B	*Daphnia magna*	21 days	-	110	?	2.11
Substance B	*Scenedesmus subspicatus*	72	1	-	?	2.11
Substance B	*Scenedesmus subspicatus*	72	-	0,1*	?	2.11
Substance B	*Lemna gibba*	14 days	1000	-	?	2.11
Substance B	*Lemna gibba*	14 days	-	120	?	2.11
Substance B	*Lumbriculus variegatus*	28 days	-	50	?	2.11
Substance B	*Caenorhabditis elegans*	72	-	0,01	?	2.11
Metabolite mA	*Oncorhynchus mykiss*	96	4500	-	?	2.11
Metabolite mA	*Lepomis macrochirus*	96	>7000	-	?	2.11
Metabolite mA	*Daphnia magna*	48	2000	-	?	2.11
Metabolite mA	*Daphnia magna*	21 days	-	300	?	2.11
Metabolite mA	*Scenedesmus subspicatus*	72	3000		?	2.11
Metabolite mA	*Scenedesmus subspicatus*	72	-	300	?	2.11

*Endpoint used in risk assessment.

Model systems No information.

Reference			
Duration	-	-	-
Design	-	-	-
Eksposure	-	-	-
Biological design	-	-	-
Effects	-	-	-

2.2. Co-formulants

No information.

2.3 Plant Protection Product

No information.

2.4 Risk assessment

Exposure

The water solubility of substance B is moderate, the adsorption in soil is very high and the aerobic degradation is moderate to medium in soil and moderat in water/sediment systems. The strong adsorption of substance B indicates a high risk of surface run off. The mobility of metabolite mC is high and has thus a potential to reach the groundwater. The aerobic degradation of metabolite mA is moderate to medium in soil and moderate in water/sediment systems. The lack of detailed information on the soil-type(s) tested makes it difficult to evaluete leaching behavior and degradation under Norwegian conditions. A study on the leaching behavior of substance B and other relevant metabolites should have been provided.

PIEC in soil supplied with 750 g a.i./ha is equivalent to 1 mg/kg in soil without plant cover, and 0,50 mg a.i./kg in soil with 50 % plant cover.

Ganzelmeier (1995) can estimate realistic concentrations in watercourses as a result of spray drift. PEC (predicted environmental concentration) will depend on the safety zone that is used (in this case a dose of 750 g/ha is used):

Safety zone, meters	PEC, µg/l
	Cereals
1 m	10.00
5 m	1.50
10 m	1.00
20 m	0.25
30 m	0.25

The exposure of different water bodies due to surface runoff from treated areas can be estimated in accordance to ECPA (European Crop Protection Association) 1995. For most of the pesticides losses far under 0.5 % have been observed. As a worst case we estimate 0.5 % surface runoff from 1.0 ha area to a 0.2 ha pond with depth 1.0 meter. Because of this potential surface runoff, PEC can be estemated to 1.9µg/l in cereals.

Degradation of substance B in water/sediment systems can be regarded as moderate with DT50 = 180 days. The degradation of metabolite mA is moderate with an average DT50 of 100 days.

The potential of bioaccumulation is moderate for the R isomer and high for the S isomer of substance B. The potential of bioaccumulation is also moderate for the R isomer and high for the S isomer of metabolite mA.

The risk of effects on organisms

Terrestrial Based on the provided data set risk of effects on terrestial organisms can be regarded as low, but data on pollinators and other beneficial arthropods are missing and should be provided.

Aquatic Substance B can be classified as very toxic to *Scenedesums subspicatus* and extremely toxic to the nematode *Caenorhabditis elegans*. Substance B is not toxic to water plants, *Daphnia magna* or fish.

The calculations of TER (toxicity/exposure ratio) are based on the lowest acute LC50 value for substance B to *Scenedesmus subspicatus* (0,1 mg a.i./l). The risk of negative effects in the aquatic environment is only acceptable if a 5 meter safety zone to water is used.

Sikkerhetssone, meter	**TER, a*cute toxicity Scenedesmus subspicatus*** Cereals
1 m	10.0
5 m	66.7
10 m	100.0
20 m	400.0
30 m	400.0

TER for surface runoff is 53.3.

2.5 Documentation

The quality of the studies is difficult to evaluate because of the lack of information on experimental data and other details of the studies. This information has to be provided before a more detailed and better evaluation can be done. The lack of detailed information on the soil-type(s) tested makes it difficult to evaluete leaching behavior and degradation under Norwegian conditions. This must be provided. An aerobic soil degradation study at 10 °C must be performed and documented. A study on the leaching behavior of substance B and other relevant metabolites must be provided. In addition studies on acute oral and contact toxixcity of substance B and metabolite mA to bees and toxicity tests on two other arthropods (parasite and predator mite) must be provided. Before a plant production product can be accepted toxicity tests (acute toxicity tests on algae, invertebrates and fish) must be performed and provided. Information on co-formulants must also be provided.

2.6. Alternative Plant production Products and their properties.

No information.

2.7. Risk of spread to drinking water/ground water

By estimating the GUS index for substance B we get a value of 1.76 (Koc: 1160, DT50: 76 days). This means that we can not conclude that substance B is a leacher. If the adsorption is lower or if the degradation rate is lower in Norway because of lower soil temperature then the possibility of contamination of ground water or drinking water could be high. Metabolite mA is produced in high amounts under aerobic conditions, is mobile and has a moderate degradation rate. This indicates high risk of leaching to ground water.

Classification

Present classification:
Very toxic to aquatic organisms. Can not be used closer to watercourses than 5 meters.

New classification from 30.07.2004:N;
Dangerous to the environment.
R50/53 Very toxic to aquatic organisms; may cause long term adverse effects in the aquatic environment. Can not be used closer to watercourses than 5 meters.

Conclusion
This substance would not have been accepted in Norway due to the lack of detailed study reports on the studies whose results have been summarized above. In addition important data requirements have not been fulfilled. If one should assume that all other criteria were of no concern, this substance probably would have been approved.

B.4 Sweden

A. Introduction

KemI has received an application for approval of 50EC Product, containing 50 g/l of Substance B as active ingredient. B consists of two stereoisomers (R and S), of which only R is active. Intended use is in cereals at a dose of 750 g a.i./ha, as a single application from tillering to stem elongation, i.e. in May-June for spring cereals, September-October for winter cereals.

B. Evaluation

Agricultural conditions/Toxicology/Residues

Environmental fate and behaviour

2.5. Influence on the environment

2.5.1 Fate and distribution in the environment

2.5.1.1. Rate and route of degradation in soil

DT_{50} values derived at 25 and 29-30°C were roughly recalculated to 20°C, assuming Q_{10} = 2.2. One DT_{50} derived in parent study at pF 4.5 was excluded since soil was considered too dry. Normal use results in soil concentration 1 mg/kg in the upper 5 cm soil layer, assuming soil density of 1.5 g/cm^3 and no results were excluded because of unrealistic test concentrations. One soil had very high organic matter content and high pH value, but since the results were within the range seen for other studies, the results were taken into consideration. Only results from field studies performed in UK, France and Germany were considered relevant for Swedish conditions.

Thus, the DT_{50} values considered were:
S-isomer, lab studies: 170-240 days, mean 194 days, median 190 days (n=8)
S-isomer, field studies: 190 days, DT_{90} 2 years (n=1)
R-isomer, lab studies: 66-118 days, mean 92 days, median 96 days (n=8)
R-isomer, field studies: 12-100 days, mean 67 days, median 70 days, DT_{90} 2 mo-1 yr (n=5)

It is concluded that the S-isomer is persistent in soil. It is not active, but this does not exclude toxicity to non-target organisms. However, the potential ecotoxicity of the S-isomer is to a large extent covered by tests on the isomeric mixture. The R-isomer is not persistent in soil. Due to the persistency of the S-isomer and the high level of bound residues and the slow mineralization rate, further data is required (see below).

DT_{50} values for the metabolite mA were recalculated as above. One value was excluded because the soil was too dry. Thus, DT_{50} values for mA considered were: mA, S/R-isomer, lab studies: 60-120 days, 90 days, median 90 days (n=4+4).

The metabolite mA is found in high amounts and is not rapidly degraded. Therefore, it is included in the environmental assessment below. Metabolite mB is not considered further. Metabolite mC may eventually reach levels >10% of applied amount since it is formed from mA which increased in amount during the whole degradation test. Therefore, more information on mC is required. So far it can be concluded that mC is not persistent, otherwise it would have been detected at higher amounts in the soil.

From the available information on route and rate of degradation in soil the following additional data is required:
- Soil accumulation study.
- Effects on soil non-target macro-organisms, e.g. impact on organic matter breakdown.
- A clear description of extraction method used, and a justification for choice of method.
- Further attempts to identify the nature of the bound residues.
- Identification of metabolite mC.
- Assessment of potential environmental effects of mC.

2.5.1.2. Risk for Groundwater

Water solubility and log Kow value of parent compound does not indicate significant leaching. This is confirmed by adsorption coefficients, Koc (recalculated from Kom) being 3500-23000, mean Koc 9300 (n=4). It is concluded that the potential for leaching of parent compound to groundwater is negligible.

However, the Koc values for the metabolite mA indicate a very high mobility in soil; 21-43, mean Koc 32 (n=4). Thus, running the simulation model MACRO with three Swedish scenarios will be performed, to estimate potential leaching to groundwater from spring/autumn application (though not included in this OECD exercise). The absence of demonstrated leaching in the column study is not sufficient to exclude potential leaching to groundwater. Potential leaching of mC should also be assessed.

2.5.1.3. Risk for Surface Water

In water/sediment studies dissipation from water phase was rapid, DT_{50} 1-3 days, however, degradation in the whole system was very slow; > 180 days. It is concluded that both isomers are persistent in sediment.

As a consequence of the slow degradation, less (though still significant) amounts of mA were formed than in soil systems. mA remained much longer in the water phase than the parent compound (DT_{50} 60-90 days), and degradation rate in the whole system was slow (DT_{50} 90-110 days). Degradation rate in the sediment phase alone was even slower (DT_{50} 150-180 days). It is concluded that also metabolite mA is persistent in aquatic systems. A risk assessment for sediment living organisms is needed for both parent and metabolite.

The persistency in aquatic systems triggers the following data requirements:
- Fish life cycle test on parent compound.
- Toxicity to sediment living organisms, especially *C. elegans*, of metabolite mA.

2.5.1.4. Risk for Air Compartment

Vapour pressure as well as Henry's law constant (3.2×10^{-5} Pa x m^3 x $mole^{-1}$) indicates that volatilization of parent compound is negligible. Amount of mB found in trap for volatiles in soil degradation study is not considered significant.

Ecotoxicology

2.5.2 Impact on non-target species

2.5.2.1. Risk for birds and other terrestrial vertebrates

The acute and short-term toxicity to birds seems to be low to medium, since most endpoints are "higher than" values. The lack of data on toxicity to bird reproduction is a concern. None of the soil metabolites are considered to pose a risk to birds.

The acute and short-term risk assessment resulted in Toxicity to Exposure Ratios (TERs) of >106 and >60, respectively, which both implies an acceptable risk (compare Uniform Principles criteria TER 10). Standard scenarios from the Guidance Document on Risk Assessment for Birds and Mammals (SANCO/4145/2000, 25 Sept. 2002) were used for the risk assessment. The short-term LC_{50} given as mg/kg feed is recalculated to mg/kg bw/d, assuming that that LC_{50} > 5000 ppm equals > 1500 mg/kg bw/d. The assessment represents worst case since diet is assumed to solely consist of contaminated plant material.

Since the substance has a log Kow > 3 the risk for secondary poisoning needs to be addressed. The scenarios would include 1) a bird feeding on fish which accumulated the substance at steady-state level from worst case concentrations in surface water, and 2) a bird feeding on earthworms which accumulated the substance from the worst case soil concentrations. This assessment should be carried out in accordance with the above guidance document when results from the bird reproduction study is available.

Conclusion: The risk assessment based on acute and short-term dietary data demonstrated an acceptable risk for birds. The following data requirements apply:

Bird reproduction study - Risk assessment including risk for secondary poisoning - based on the results from the bird reproduction study.

(In a "real" case, toxicologial data on mammals would be needed for a final decision, in addition to the avian data presented for this case study.)

2.5.2.2. Risk for aquatic organisms

The toxicity to fish, daphnids and higher plants (Lemna) is low, while toxicity to algae is medium to high. Risk assessment is carried out assuming spray drift as the only route of contamination. On the other hand, contamination of a narrow and stagnant, 0.3 m deep water body is assumed as a worst case scenario (i.e. any dilution is minimized).

The acute as well as chronic TERs for fish, daphnids and higher plants are > 10000 even very close to the treated field (water body assumed to be 1 m from field edge), thus risk is acceptable (compare Uniform Principles criteria TER 100 and 10 for acute and long-term exposure, respectively).

TERs for algae in table below also indicate an acceptable risk (compare Uniform Principles criteria TER 10).

Species	***Ecotox endpoint***	***Distance from field edge***	***% drift rate***	***Initial PECsw***	***TER***
algae	EC_{50} 1 mg/l	1 m	2.77	7.0 µg/l	143
algae	NOEC 0.1 mg/l	1 m	2.77	7.0 µg/l	14

The metabolite mA is less toxic than the parent compound, to the investigated species of fish, daphnids and algae.

The bioconcentration potential of the R-isomer of parent and mA formed from R-isomer is low. However, the S-isomer has BCF 400 and 210 for parent and mA, respectively. Thus, the S-isomer has a potential for bioaccumulation.

For sediment, it is assumed that all parent compound is distributed to the underlying sediment because the $DT_{50\ water\text{-}phase}$ is short and no specific information was available on partitioning to sediments. Mixing in 0-2.5 cm sediment with a density of 1.3 g/cm^3 is assumed. The $PEC_{sediment}$ is thus:

7.0 µg/l x 3 l = 21 µg; 21 µg/0.325 kg sediment = 65 µg/kg sediment (ww).

TERs are:

50 mg/kg / 0.065 mg/kg = 770 (oligochaet) and
0.01 mg/kg / 0.065 mg/kg = 0.15 (nematode).

The risk for the nematode species is unacceptable (Uniform Principles criteria TER 10 used here since the nematode test includes reproductive endpoints). Even at a distance of 50 m from the field edge TER would be less than 10 (7.7) so risk management in form of untreated zones around the field does not seem practicable. Due to the persistence in the sediment, the risk assessment cannot be refined by assuming that degradation takes place.

Conclusion: Risk to aquatic organisms living in the water column is considered acceptable. However, as stated under 2.5.1.3, a fish life cycle test must be performed due to the persistency in aquatic systems.

An unacceptable risk to effects on the reproduction of certain sediment living organisms has been identified. The risk should be addressed by the applicant, possibly in the form of higher-tier studies, such as microcosms studies with the same vulnerable species. In addition, the toxicity of the metabolite mA to sediment living organisms must be investigated due to its persistency in the sediment phase.

2.5.2.3. Risk for honeybees/ Risk for beneficial arthropods

2.5.2.5. Risk for earthworms and other non-target soil macro-organisms

Acute toxicity to earthworms was low for parent compound as well as metabolite mA. PEC_{soil} immediately after application is 1 mg/kg soil. Thus;
$TER_{parent,\ acute}$ = >1000 mg/kg / 1 mg/kg soil = >1000. The risk is acceptable (compare Uniform Principle criteria TER 10). TER for mA would be even higher.

Chronic toxicity studies on earthworms revealed higher toxicity.
$TER_{parent,\ chronic}$ = 10 mg/kg / 1 mg/kg soil = 10, which still is above the Uniform Principles criteria (TER 5) so risk is considered to be acceptable.

Given a higher $NOEC_{earthworm}$ and a lower PEC_{soil} for the metabolite mA also risk from this metabolite is acceptable.

Since nematodes are important in soil ecology the available results on *C.elegans* was used for risk assessment also for the soil compartment. The TER for effects on reproduction is
0.01 mg/kg / 1 mg/kg soil = 0.01 which indicates an unacceptable risk for effects on the soil microfauna (the same Uniform Principles criteria as for earthworms, i.e. 5, is used).

Conclusion: The risk for earthworms is acceptable. An unacceptable risk for effects on nematodes was identified. This risk needs to be addressed further. Due to persistency of S-isomer, high amount of bound residues and low mineralization rate as well as the identified risk to nematodes, further data on soil non-target macro- and microfauna is needed.

2.5.2.6. Impact on microbial activity

No negative effects were determined, hence risk acceptable.

C. Decision

Summary of concerns in environmental fate and behaviour and ecotoxicology:

The S-isomer of the parent compound is persistent in soil. There is a high level of bound residues and a slow mineralization rate. In water/sediment systems, both isomers are persistent. The metabolite mA is also persistent in water/sediment systems. These are areas of concern which trigger some further data requirements. Further information on the metabolite mC is also required.

Leaching to groundwater of metabolite mA is a potential problem to be addressed.

A bird reproduction study must be performed before a decision can be taken. Risk for secondary poisoning of birds must be assessed when the repro study is available.

The S-isomer of the compound has a potential for bioaccumulation, but within acceptable limits. An unacceptable risk to reproduction of certain sediment dwellers was identified, and no practicable risk mitigation measure was identified. The risk must be addressed before a decision can be taken. Also, the toxicity of mA to sediment living organisms must be investigated. Finally, the data on the sediment living nematode was used also to assess the risk for effects on soil microfauna, and an unacceptable risk was identified. Also this risk must be addressed before a decision can be taken.

Alternatives/Risk-benefit analysis

Proposal for decision

A decision cannot be taken on present information. There are several areas of concern, identified risks, and data gaps which must be addressed before a decision can be taken.

B.5. USA

INFORMATION MEMORANDUM

SUBJECT **OECD PBT Case Study**
CHEMICAL Chemical B
USE Cereal grains

This memorandum supports a conditional registration of the new fungicide Chemical B on cereal grains from an environmental risk standpoint only.

Background

The Office of Pesticide Programs is participating in a case study to investigate approaches used by OECD Member countries to assess and make regulatory decisions concerning persistent and bioaccumulative pesticides. Since the human hazard portion of the equation is missing the regulatory decision deals strictly with the environmental qualities of the chemical. Even with this caveat the outcome could be different if a complete assessment of the chemical were carried out, which would require the human hazard portion, as well as information on alternatives and the pests in question.

A request was made to carry out an environmental risk assessment for chemical B on cereal grains. Chemical B is made of two stereoisomers, R and S. The R isomer is the active isomer.

Chemical B will be applied at a rate of 0.67 lbs per acre between tillering and stem elongation.

Summary

An environmental risk assessment was conducted in relation to the use of Chemical B on cereal grains. There are no other uses for this chemical.

The Environmental Fate and Effects Division (EFED) has reviewed this action. Since portions of the data presented in the OECD case study are not consistent with values used by the Agency to perform an environmental fate assessment, EFED personnel made assumptions regarding the data. First, all DT_{50} values were used as half-life values, and second, K_{om} values were viewed as K_{oc} values for conclusions on soil adsorption and mobility.

Available data indicate that the S-isomer is persistent to very persistent and the R-isomer is borderline persistent. The S-isomer has a larger bioaccumulation potential then the R-isomer although neither meets the criterion for a bioaccumulative chemical. Overall, Chemical B is considered to be persistent in sediment but not a bioaccumlative compound. Leaching and runoff of chemical B is not expected to occur.

There are three major metabolites of Chemical B, mA, mB, and mC. Metabolite B was found (13% AR) only in the volatile trap in the aerobic soil metabolism studies of the R-isomer. Metabolite C was found at 6% AR at 100 days, and 9% AR at 180 days, in the aerobic soil metabolism studies of the R-isomer. Metabolite C, a daughter product of the breakdown of metabolite A, was detected in the leachate of an aged leaching study. Therefore, Metabolite C is, a potential ground water contaminant, but more physical/chemical and fate data are needed to make this determination.

Metabolite A was identified in aerobic soil metabolism studies of both the R- and S-isomers of chemical B. Due to the faster degradation kinetics of the R-isomer, mA is formed at higher percentages in R-isomer

studies than those in S-isomer studies laboratory data indicate that mA is persistent to very persistent in sediment. Metabolite A is not classified as a bioaccumulative compound.

Chemical B (taking into account the R and S isomers and mA) is practically non-toxic to avian species, fish and invertebrates. Chemical B is not expected to cause acute or chronic effects to avian species or freshwater fish and invertebrates; or acute effects to estuarine/marine fish and aquatic plants.

Data is lacking on mammals and non-vascular plants. Chronic data on is lacking on estuarine/marine fish, and acute and chronic risk to estuarine/marine invertebrates.

There are currently no concerns for Chemical B for terrestrial or aquatic endangered animals.

Outstanding Data

The following details the data gaps and/or additional information required from the registrant:

- Acute and chronic mammalian studies.
- Chronic studies on estuarine/marine fish and invertebrates.
- Acute studies on estuarine/marine invertebrates.
- Effects on terrestrial plants.
- Physical/chemical and fate data concerning metabolite C.

Recommendation

This assessment suggests that Chemical B=s use, under the conditions outlined below would be protective of the environment. Condition of use would include:

1. That the use be conditioned for 1 year while the registrant conducts additional studies to assess the potential impact of chemical B on: 1) mammals, 2) the chronic toxicity on estuarine fish and invertebrates, 3) acute studies on estuarine/marine fish and 4) terrestrial plants. Limiting the use to one year should not result in any chronic adverse effects, allow the registrant sufficient time to fill data gaps and allow use in non sensitive cereal grain growing areas.

2. The use be restricted to those states which do not boarder estuarine or salt water. Limiting use to areas that are not adjacent to or allow run off to estuarine or salt water protect the estuarine animals and invertebrates while allowing use in most cereal grain areas in the U.S.

3. The use not be allowed in counties which have endangered mammals. Because of the lack of data on mammals use in counties where endangered mammals are known to exist should be prohibited until the mammalian data are submitted and reviewed.

4. Drift mitigation language to limit damage to non target terrestrial plants.

5. Because the S-isomer is very persistent yet has little activity against the pest(s), the registrant should eliminate or reduce to the extent feasible, through improved production techniques, the amount of S-isomer in the formulation.

6. The registrant be required to submit the data listed under the Outstanding Data paragraph above.

Case Study 2: Chemical B, Environmental Fate and Effects

I. Environmental Risk Conclusions & Characterization

Cereal grain production occurs in every state of the U.S., therefore risks associated with use of Chemical B are likely to occur.

Chemical B is a mixture of two stereoisomers, R and S. The results of laboratory studies indicate that the R-isomer is persistent ($t_{1/2}$. 60 days). Field data indicate that the R-isomer is borderline persistent ($t_{1/2}$ = 65 . 26 days). Based on laboratory and field data, the S-isomer is persistent ($t_{1/2}$. 60 days) to very persistent ($t_{1/2}$. 180 days). Metabolism in sediment is slow for both isomers and Chemical B is considered to be very persistent in sediment. Chemical B is not classified as a bioaccumulative compound (BCF <1000). Based on results of a leaching study and a K_{ow} value of 1.6 □ 10^3, leaching and runoff of Chemical B is not expected to occur.

Three metabolites (mA, mB, and mC) of Chemical B have been identified in various studies. Due to the faster degradation kinetics of the R-isomer, mA is formed at higher percentages in R-isomer studies than those in S-isomer studies. Half-lives of mA were 60-120 days at 20-25□C, with the exception of 25 days in a clay soil at 29-31□C. Laboratory data indicate that mA is persistent to very persistent in sediment. Metabolite A is not classified as a bioaccumulative compound. Metabolite B was found (13% AR at 180 days) only in the volatile trap in the aerobic soil metabolism studies of the R-isomer. Metabolite C was found at 9% AR at 180 days in the aerobic soil metabolism studies of the R-isomer. Metabolite C, a daughter product of the breakdown of metabolite A, was detected in the leachate (3% AR) in an aged column leaching study of the parent, indicating its potential to contaminate ground water, but more physical/chemical and fate data are needed to make this determination. Variation in the formation of metabolites between the R- and S-isomers may be due to the slower degradation rate of the S-isomer or differences in metabolic pathways.

Chemical B is practically non-toxic to birds (LD_{50} >5000 mg/kg bw). Mammalian toxicity data were not submitted and are required for registration of this pesticide. Based on terrestrial exposure concentrations (Hoerger and Kenaga) and toxicity data, Chemical B is not predicted to cause acute or chronic effects in birds. Avian toxicity data indicate that Metabolite A is slightly toxic on an acute dietary basis (LC_{50} = 4500 mg/kg feed) and practically non-toxic on an acute oral basis (LD_{50} > 15000 mg/kg bw). Based on exposure concentrations and toxicity data, mA does not pose acute or chronic risks to birds.

Chemical B is practically non-toxic to fish and invertebrates (LD_{50}s = 700-1500 ppm). Based on estimated aquatic exposure concentrations (GENEEC) and ecological toxicity data for Chemical B, the Agency does not expect acute or chronic risk to freshwater fish and invertebrates; or acute risk to estuarine/marine fish and aquatic plants. However, the toxicity data for aquatic plants only provides supplemental information to the risk assessment since the test species deviates from the Agency□s test guidelines. The following risk can not be assessed due to lack of data: chronic risk to estuarine/marine fish and acute and chronic risk to estuarine/marine invertebrates. Limited data suggest that Metabolite A is practically non-toxic to freshwater fish and invertebrates (LC_{50}s = 2000-4500 ppm). Based on EECs and toxicity data, mA is not expected to pose an acute or chronic risk to freshwater fish and invertebrates or vascular plants. Toxicity data on other aquatic species was not provided for mA.

II. Introduction

Chemical B is a fungicide proposed for use on cereal grains. The formulation is an emulsifiable concentrate with 50g/L of Chemical B. The proposed use rate is one application at 750 g/ha (0.67 lb/acre).

The timing of application is during the growth phase, from tillering to stem elongation. The commercial product is a mixture of two stereoisomers, R and S, of which the R isomer is the active ingredient.

III. Environmental Fate Assessment

The data presented in the OECD Case Study are not consistent with values used by the Agency to perform an environmental fate assessment. In order to complete the case study, assumptions were made regarding the data. First, all DT_{50} values were used as half-life values and will be referred to as such throughout this document. Secondly, K_{OM} values were viewed as K_{OC} values for conclusions on soil adsorption and mobility.

III.A. Parent Chemical

Physical Properties. Chemical B has a molecular weight of 300 g/mol. Its log Kow is 3.2, and its solubility in water is 3.3 mg/L, both at 20□C. The log Kow and solubility indicate a moderate tendency to partition to soil or sediment from water.

Chemical B□s vapor pressure is quite low, 3.45×10^{-12} atm at 20□C. The Henry□s Law constant calculated from this is also quite low, 3.14×10^{-10} atm□m^3□mol^{-1}. Thus, Chemical B has very little tendency to partition from water to air.

Soil Metabolism Studies. The degradation of Chemical B was studied in six different soils in the laboratory (Table 2.3.1). The soil textures ranged from a sandy loam to a clay. All studies were conducted at 20□C or 25□C (sandy loam), except for the clay soil, which was conducted at 29-31□C. The temperature for the clay soil study is unacceptably high, so it will not be considered further, except to say that the half-lives obtained were the shortest obtained from any of the studies (50 days for S-isomer and 30 days for R-isomer), as would be expected at an elevated temperature. The dose rates in the remaining five studies were either 0.1 or 2.0 mg/kg, neither of which matches the proposed use rate of 0.67 lb/acre (□ 0.67 mg/kg).

Half-lives for the active ingredient (R-isomer) were shorter than those for the S-isomer in all studies. We conclude from this that the R-isomer is more easily metabolized by soil microorganisms.

The effect of initial concentration was different for the two isomers. Half-lives for the S-isomer were uniformly higher when tested at 2.0 mg/kg (average 229 days vs. 193). The R-isomer behaved in the opposite fashion: half-lives were uniformly shorter at the 2.0 mg/kg dose rate (average 88 days versus 104). These results are also consistent with the conclusion that the R-isomer is preferentially metabolized by soil microbes.

The R-isomer of Chemical B is considered to be □persistent□ (half-life ≥ 60 days) by both TSCA section 5(e) and TRI criteria. The S-isomer is considered to be □very persistent□ (half-life ≥ 180 days).

Aqueous Metabolism Studies. Three studies of the metabolism of chemical B were conducted in aerobic sediment-water systems with 10% sediment (Table 2.6.1). The sediments tested were a silt loam, a sand, and a loamy sand. In each study, chemical B was rapidly removed from the water column (half-life 1 to 3 days), and partitioned to the sediment. The half-lives in the sediments and in the total systems (water plus sediment) were greater than 180 days in all cases. From these results, we conclude that chemical B is □very persistent□ in sediment. There was no difference in the half-lives of the R- and S-isomers, as was seen in the soil metabolism studies. This supports the conclusion that metabolism in sediment was very slow.

Hydrolysis. Chemical B does not hydrolyze in water.

Photolysis. Chemical B does not photolyze, nor is it subject to attack by hydroxyl radicals (OH□) in the atmosphere. The Agency concludes that gaseous or suspended chemical B is stable in the atmosphere.

Mobility. Soil-water partition coefficients (Koc) for chemical B range from 2000 to 13500 L/kg, with an average of 5413 (n=4). However, three values were lower than the maximum, and relatively similar (2000, 2550, 3600 L/kg). The Freundlich isotherms were acceptably linear (1/n ranged from 0.8 to 1.0) in soils of 0.5 to 1.5% organic matter content. These data indicate that chemical B is of moderate to low mobility.

In an aged column leaching experiment, metabolite C was formed at 3% of the applied radiation, and was completely recovered in the leachate. The Agency concludes that metabolite C is mobile in soil, and may be a concern for ground water contamination.

Bioaccumulation. The bioaccumulation potential of both isomers of chemical B was tested in the bluegill sunfish. The S-isomer had a larger BCF than the R-isomer (400 L/kg vs. 50), and its clearance half-life was longer (5 days vs. 0.5). Neither isomer meets the TSCA 5(e) or TRI criterion for a bioaccumulative chemical (BCF ≥ 1000).

Terrestrial Field Dissipation Studies. Fourteen non-cropped field studies were conducted in California, Kansas, Spain, the United Kingdom, France, and Germany (Table 2.3.2). Nine different soils, ranging from a sandy loam to a clay and sandy clay, were tested. Dosage rates were at or below the proposed use rate of 0.75 kg/ha.

Three studies compared the half-life and DT90 of the R- and S-isomers (Spanish clay and sandy clay soils and German loamy sand). In all three cases, the S-isomer persisted in soil at least twice as long as the R-isomer (based on $t_{1/2}$ and DT90 values). This result is consistent with the results from the laboratory soil metabolism studies.

Half-lives for the R-isomer ranged from 12 days (UK loamy sand) to 100 days (French silty loam). Most values were in the range of 40 to 70 days, with an average of 65 days (std. dev. 26 days). The Agency concludes that the R-isomer is borderline persistent, when compared to the TSCA 5(e) or TRI criterion of half-life ≥ 60 days.

The three half-life values for the S-isomer were 100, 190, and 200 days. DT90 values were 1 year, 2 years, and 2 years, respectively. The half-life values are consistent with what was observed in the laboratory soil metabolism studies. The Agency concludes that the S-isomer clearly meets the half-life criterion for □persistent□ (half-life ≥ 60 days), and that it is borderline □very persistent□ (half-life ≥ 180 days).

III.B. Metabolites

Three metabolites (mA, mB, and mC) of chemical B have been identified in various studies. Other metabolites totaled less than 3% of applied radiation in laboratory studies. Bound residues in soil metabolism studies of the R-isomer reached 78% of applied radiation at 100 days, and 55% at the end of the study (180 days). Carbon dioxide totaled 1% at 100 days and 33% at 180 days. In studies of the S-isomer, bound residue reached a maximum (60%) at 180 days. Carbon dioxide was 3% at 180 days. The bound residue and carbon dioxide data reflect the slower degradation of the S-isomer of chemical B.

Metabolite B was found only in the volatile trap in the aerobic soil metabolism studies of the R-isomer. It was formed at 13% AR at 180 days.

Metabolite C was found at 6% AR at 100 days, and 9% AR at 180 days, in the aerobic soil metabolism studies of the R-isomer. Metabolite C is a daughter product of the breakdown of metabolite A. As noted above, it was formed at 3% AR in an aged column leaching study, and was all recovered in the leachate. Metabolite C is therefore a potential ground water contaminant, but more physical/chemical and fate data are needed to make this determination.

Metabolite A. Soil Metabolism Studies. Metabolite A was identified in aerobic soil metabolism studies of both the R- and S-isomers of chemical B. It is formed as a racemic (50%:50%) mixture of isomers from both the R- and S-isomers. Metabolite A is formed to a greater extent in studies with the R-isomer (30% vs. 10% at 100 days and 60% vs. 30% at 180 days) than with the S-isomer. This is undoubtedly due to the faster degradation kinetics of the R-isomer. The half-life values for both isomers of metabolite A are the same (Table 2.3.1), and range from 60 to 120 days at 20 to 25□C, with a value of 25 days in a clay soil incubated at 29-31□C.

Aerobic Aquatic Metabolism Studies. Metabolite A was also found in the aerobic aquatic metabolism studies of the R- and S-isomers of chemical B. It was formed at 6% of applied radiation in the sediment, and 11 % AR in the water phase at study conclusion (180 days). Separate aerobic aquatic metabolism studies of metabolite A were conducted (Table 2.6.1). Half-lives ranged from 60 to 90 days in the water phase, and 150 to 180 days in the sediment. Total system half-lives were more consistent, ranging from 90 to 110 days.

Mobility Studies. Batch equilibrium studies on metabolite A indicate that it is much more mobile (approximately a factor of 1000) than the parent compound. Kom values obtained were 12, 17, 20, and 25 L/kg (average 18.5).

Bioaccumulation Studies. The bioaccumulation potential of metabolite A was studied in the Bluegill Sunfish. Metabolite A of the S-isomer (□A of S□) had a higher BCF (210 L/kg) than that (30 L/kg) derived from the R-isomer (□A of R□). Depuration half-lives were the same (0.5 days). Neither □A of S□ nor □A of R□ qualifies as bioaccumulative, as the BCF values are below 1000.

Field Dissipation Studies. In a □hot□ field study, metabolite A was formed in the top soil layer (0 to 10 cm). It reached a maximum of 25% of applied radiation in the 40 to 190 day time period, and fell to 4% at the end of the study (369 days).

IV. Aquatic Exposure and Risk Assessment

Estimation of Aquatic Exposure Concentrations

Expected environmental concentrations (EECs) in water were estimated with the Tier 1 screening model GENEEC v 2.(dated Aug. 1, 2001). EECs are given for both the R- and S-isomers of chemical B, and for metabolite A. There is insufficient data to calculate EECs for metabolites B and C.

The table below gives the input parameters used for the GENEEC runs. Explanatory notes are given below the table. Also note that the Agency used DT_{50} values as half-life values and K_{OM} values as K_{OC} values in order to complete the case study risk assessment in a manner consistent with Agency policy.

Aquatic Exposure Model (GENEEC2) Input Values			
Input Parameter	R-isomer	S-isomer	Metabolite A
Max. Use Rate and No. Applications (notes 1, 2)	1 @ 0.67 lb/acre	1 @ 0.67 lb/acre	1 @ 0.40 lb/acre
Soil metabolism half-life (notes 3, 4)	88 days	229 days	121 days
Aerobic aquatic half-life (note 5)	180 days	458 days	111 days
Soil/Water Partition Coefficient (Kom) (note 6)	2000 (minimum)	2000	12 (minimum)
Solubility (note 7)	3.3 ppm	3.3 ppm	7000 ppm
Application Method	Aerial, medium size spray droplet, zero-foot no-spray zone	same	same
Spray Drift	13%	13%	13%
Wet-in?	No	no	no
Hydrolysis (note 8)	stable	stable	stable
Photolysis (note 8)	stable	stable	stable

Notes on input parameters. (1) The maximum use rate of 0.67 lb/acre was used for both R- and S-isomers, since the isomer ratio of the commercial product was not specified. (2) The application rate for metabolite A is the parent□s rate times the maximum formation of A in a laboratory soil metabolism study (60%). (3) Half-lives for R- and S-isomers are 90% upper confidence bound on mean half-life from 4 studies at 20 or 25□C, and 2.0 mg/kg dose rate. (4) Half-life for metabolite A is 90% upper confidence bound on mean half-life from 3 studies at 20 or 25□C, and 1.0 mg/kg dose rate. (5) Aquatic half-life for R-isomer was a □greater than□ value of 180 days from aerobic aquatic study. For S-isomer, it is 2 times the soil half-life input parameter. For metabolite A, it is 90% upper confidence bound on mean total system half-life from 3 aerobic aquatic studies. (6) Minimum Koc values were used as per guidance. (7) No solubility data were given for metabolite A, so it was set to highest LC50 (bluegill sunfish). (8) Metabolite A was assumed to be stable to hydrolysis and photolysis, since there was no data.

The following aquatic EECs were calculated by GENEEC based on the given input parameters.

Estimated environmental concentrations calculated using GENEEC					
Chemical	Peak EEC (ppb)	Max 4-day avg EEC (ppb)	Max 21-day avg EEC (ppb)	Max 60-day avg EEC (ppb)	Max 90-day avg EEC (ppb)
R-isomer	11	11	10	9.0	8.3
S-isomer	11	11	11	9.5	8.8
Metabolite A	24	23	23	21	20

Aquatic Toxicity of Chemical B

Fish (freshwater) acute: Practically non-toxic (rainbow trout LC_{50} = 1500 ppm)
Fish (freshwater) chronic: NOAEC = 140 ppb (fathead minnow)
Fish (estuarine) acute: Practically non-toxic
(sheepshead minnow LC_{50} = 1200 ppm)
Fish (estuarine) chronic: No data available
Invertebrate (freshwater) acute: Practically non-toxic (daphnid LC_{50} = 700 ppm)
Invertebrate (freshwater) chronic: NOAEC = 110 ppm (daphnid)
Invertebrate (estuarine) acute: No data available
Invertebrate (estuarine) chronic: No data available
Aquatic plants EC_{50} = 1000 ppm (*Lemna gibba*)
EC_{50} = 1 ppm (supplemental algal data)

Aquatic Toxicity of Metabolite mA

Fish (freshwater) acute: Practically non-toxic (rainbow trout LC_{50} = 4500 ppm)
Invertebrate (freshwater) acute: Practically non-toxic (daphnid LC_{50} = 2000 ppm)
Invertebrate (freshwater) chronic: NOAEC = 300 ppm (daphnid)
Aquatic plants: EC_{50} = 3000 ppm (supplemental algal data)

Risk to Nontarget Aquatic Animals

Exposure to aquatic non-target organisms is possible through surface water runoff, soil erosion, and off-target spray drift. The Agency uses the GENEEC model to predict Tier I EECs in an aquatic environment.

Freshwater Fish and Invertebrates

The RQ values do not exceed the LOC for acute or chronic risks to freshwater fish and invertebrates.

Risk quotients for freshwater animals based on a Tier I EEC[1] and LC_{50} values[2]

Relationship to Chemical B	Maximum EEC (ppb)	21-Day EEC (ppb)	60-Day EEC (ppb)	Acute RQ (Peak EEC / LC_{50}) Fish/Invertebrate	Chronic RQ (Chronic EEC/ NOAEL) Fish/ Invertebrates
R-isomer	11.1	10.3	9.0	<0.05 / <0.05	< 1 / < 1
S-isomer	11.1	10.5	9.5	<0.05 / <0.05	< 1 / < 1
Metabolite mA	23.6	22.8	21.3	<0.05 / <0.05	<1 / <1
Levels of Concern					
Endangered species may be affected (acute risk)				. 0.05	. 1
Acute risk may be mitigated through restricted use, in addition to endangered species risk				. 0.1	. 1
Acute risk, including endangered species				. 0.5	. 1

(1) 21-day EEC = Invertebrate chronic EEC, 60-day EEC = Fish chronic EEC
(2) Chemical B: Acute LC_{50} = 1500 ppm (rainbow trout) and 700 ppm (daphnid); chronic NOAEL = 140 ppm (fathead minnow) and 110 ppm (daphnid); Metabolite mA: Acute LC_{50} = 4500 ppm (rainbow trout) and 2000 ppm (daphnid); chronic NOAEL = 300 ppm (daphnid)

Estuarine and Marine Fish and Invertebrates

Acute toxicity to fish were the only estuarine/marine toxicity data submitted to support registration of Chemical B. The RQ does not exceed the LOC for acute risk to estuarine/marine fish.

Acute risk quotient for estuarine/marine fish based on Tier I EEC and LC_{50} values [1]

Isomer of Chemical B	Maximum EEC (ppb)	Acute RQ (Peak EEC / LC_{50})	Chronic RQ (Chronic EEC / NOAEC)
R-Isomer	11.1	< 0.05	No data
S-Isomer	11.1	< 0.05	
Levels of Concern			
Endangered species may be affected (acute risk)		> 0.05	. 1
Acute risk may be mitigated through restricted use, in addition to endangered species risk		> 0.1	. 1
Acute risk, including endangered species		> 0.5	. 1

(1) LC50 = 1200 ppm (sheepshead minnow)

Toxicity to Aquatic Plants

Toxicity data on the green algae, *Scendesmus suspicatus*, provides supplemental information since it is not the preferred test species. The RQs indicate that the level of concern is not exceeded for risk to vascular

and non-vascular aquatic plants from use of Chemical B. RQ calculations suggest that the LOC is not exceeded for risk to non-vascular plants from Metabolite mA; vascular plant data were not submitted for the Metabolite.

Acute risk quotient for aquatic plants based on Tier I EEC and EC_{50} and NOAEC values

Relationship to Chemical B	Test Species	EC_{50} (ppm)	NOAEC (ppm)	Maximum EEC (ppb)	Acute RQ (Peak EEC / EC_{50})	Endangered Species RQ (Peak EEC / NOAEC)
R-Isomer	Green algae *Scendesmus suspicatus*	1	0.1	11.1	< 1	< 1
	Duckweed *Lemna gibba*	1000	120	11.1	< 1	< 1
S-Isomer	Green algae *Scendesmus suspicatus*	1	0.1	11.1	< 1	< 1
	Duckweed *Lemna gibba*	1000	120	11.1	< 1	< 1
Metabolite mA	Green algae *Scendesmus suspicatus*	3000	300	23.6	< 1	< 1
	Duckweed *Lemna gibba*	No data			NA	NA
Levels of Concern						
Acute risk to Non-endangered and Endangered plant species may occur					> 1	

V. Terrestrial Exposure and Risk Assessment

Toxicity of Chemical B

Avian acute oral: Practically non-toxic (LD_{50} >5000 mg/kg of body weight)
Avian acute dietary: Practically non-toxic (LC_{50} >5000 mg/kg of feed)
Avian reproduction: NOAEC >500 mg/kg feed
Mammalian acute oral: No data available
Mammalian chronic : No data available

Toxicity of Metabolite mA

Avian acute oral: Practically non-toxic (LD_{50} >15000 mg/kg of body weight)
Avian acute dietary: Slightly toxic (LC_{50} =4500 mg/kg of feed)
Avian reproduction: Affected endpoint not reported (NOAEC = 450 mg/kg feed)

Avian, Acute and Chronic Risk

For pesticides applied as a nongranular product (e.g., liquid, dust), the estimated environmental concentrations (EECs) on food items following product application are compared to LC_{50} values to assess

risk. The results of the risk quotient calculations indicate that the proposed use of Chemical B does not exceed the level of concern for acute and chronic risk to birds (see RQ tables below).

Avian Acute and Chronic Risk Quotients for Chemical B based on an LC_{50} of >5000 mg/kg bw And a NOAEC of >500 mg/kg feed; AND for Metabolite mA based on a Mallard Duck LC_{50} of 4500 mg/kg feed And a Bobwhite Quail NOAEC of 450 mg/kg feed

Relationship to Chemical B	No. Apps. X Rate (lbs ai/A)	Food Items	Max EEC[1] (ppm)	Acute RQ (EEC/LC_{50})	Chronic RQ (EEC/NOAEL)
R-Isomer	1 x 0.67	Short grass	161	<0.10	< 1
		Broadleaf plants/Insects	90	<0.10	< 1
		Tall grass	74	<0.10	< 1
		Seeds	10	<0.10	< 1
S-Isomer	1 x 0.67	Short grass	161	<0.10	< 1
		Broadleaf plants/Insects	90	<0.10	< 1
		Tall grass	74	<0.10	< 1
		Seeds	10	<0.10	< 1
Metabolite mA	1 x 0.40	Short grass	96	<0.1	< 1
		Broadleaf plants/Insects	54	<0.1	< 1
		Tall grass	44	<0.1	< 1
		Seeds	6	<0.1	< 1

Levels of Concern	
Endangered species may be affected (acute risk)	. 0.1
Acute risk may be mitigated through restricted use, in addition to endangered species risk	. 0.2
Acute risk, including endangered species	. 0.5
Chronic risk	. 1.0

[1] EECs are based on Hoerger and Kenega (1972), modified by Fletcher et al (1994).
*LOC exceedences are in bold

Mammalian, Acute and Chronic Risk

Data indicating the toxicity of Chemical B to mammals was not provided. Therefore, the Agency can not assess acute or chronic risk to these animals. Data submission of acute and chronic toxicity of Chemical B to mammals is required for this new use registration.

Terrestrial Plants

Data indicating the effect of Chemical B on terrestrial plants was not provided. Therefore, the Agency can not assess risk to these organisms.

B.6. Switzerland

General Comments

It is understood, that the data of this case study did not claim to be complete as the goal was to look at persistency and bioaccumulation. But the data are not only far from being complete but are also in some parts wrong and/or could be misunderstood. Especially in the ecotoxicology section there is much confusion (units for endpoints and/or water solubility, etc.). Depending on the number and/or unit you are choosing, the results and consequently conclusions may be different. The data and information concerning the metabolite isomers are somewhat confusing. This is a pity and makes it more difficult to compare the different evaluations.

Are the units for the endpoints related to the concentration on the product or on the active ingredient (*Substance B*)? It is not clearly defined.

> ***We definitely would not accept an actual dossier presenting such poor data regarding the sections discussed here!***

The present assessment summarizes and evaluates the fate and behaviour of *Substance B* (Case Study 2) in various compartments of the environment and its effects on various representatives of terrestrial and aquatic organisms. It is assumed that all endpoints reflect the concentration of the active ingredient and not of the product.

Toxicity values are correlated with predicted environmental concentrations (PEC's) of *Substance B*, which may occur from the recommended use of the respective product, giving the corresponding toxicity exposure ratios (TERs) for each group of organisms.

1. Physical and Chemical Properties

Substance B (apparently a herbicide) has the following physical and chemical properties:

Table 19: Physical and chemical properties of *Substance B*

Property	Value	Remark
Vapour pressure	3.5×10^{-7} Pa	20°C
Log K_{ow}	3.2	20°C
Solubility in water	3.3 mg/L	pH 7, 20°C
pK_a	-	not available
Molecular weight	300	$g \cdot mol^{-1}$

The substance consists of two stereoisomers (R and S). The R-isomers is documented in the efficacy dossier to be the active isomer. However, it is not stated if only the R-enantiomer or a racemate is used as active ingredient in the product. We assume that a racemate is used.

2. Uses

Substance B is formulated as a 50 EC (emulsifiable concentrate; *Substance B* 50 g/l):

Table 20: Intended use of *Substance B*

Intended use	Dosage	Dose a.i.	Freq.	Time of application
cereals	0.4 l/ha	750 g/ha	1	Growth phase, from tillering to stem elongation

There is a discrepancy concerning the dosage between dose a.i. and dosage (litre product/ha). We used the dose of **750 g a.i./ha** for our considerations.

3. Fate and Behaviour in the Environment

Fate and Behaviour in Soil

Degradation in Soil

Laboratory Studies

Incubations under aerobic conditions were performed with different soil types, dosages and temperatures (see Table 3 below). Apparently, not the racemate but individual enantiomers were incubated (would need to be clarified by company) and the half-lives were determined separately for both enantiomers. Half-lives observed in the different experiments at 20°C range from 170 to 240 days (*S*-enantiomer) and from 66 to 110 days (*R*-enantiomer), respectively. The active *R*-enantiomer is thus degraded faster. DT_{90}-values are not listed, but would be expected in the range of ½-2 years. The influence of dosage appears to be minimal. (Strange in this context is the directly opposed behaviour of the two isomers regarding the half-lives, i.e. slower degradation of the S-isomer at higher dose but a faster degradation for the R-isomer (?!)). The experimental design does not provide for information about the influence of temperature on the half-lives. The intended field application rate would lead to a concentration in soil of 1 mg/kg (top 5cm) and is thus in the middle of the range of dosages used in these experiments.

Table 21: Half-lives of Substance B in laboratory soil incubation studies under aerobic conditions

Soil type	Incubation	pH	Temp [°C]	pF	OM [%]	Dosage [mg/kg]	DT_{50} S-Isomer [days]	DT_{50} R-Isomer [days]
*Loamy sand	aerobic	5.5	20	2.2	3.6	0.1	195	98
*Loamy sand	aerobic	5.5	20	2.2	3.6	2.0	240	77
Silty loam	aerobic	7.0	20	3.0	1.4	0.1	177	110
Silty loam	aerobic	5.5	20	3.0	0.4	2.0	208	97
Sandy loam	aerobic	8.0	25	2.5	16	0.1	110	74
Sandy loam	aerobic	8.0	25	2.5	16	2.0	127	60
Loam	aerobic	6.9	20	3.0	2	0.1	170	75
Loam	aerobic	6.9	20	3.0	2	2.0	185	66
Clay	aerobic	6.0	29-31	4.5	1	3.0	50	30

* Route of degradation study.

- **Metabolites R-isomer:**

mA: This metabolite has two isomers (50:50%). After 100 days 30% is formed and 60% at the end of the experiment (180 days). It is not stated, whether both isomers are formed upon degradation of the *R*-enantiomer of *Substance B*. We assume that only *R*-mA is formed from *R*- *Substance B*.

The half-lives of both isomers were determined in separate studies. The data presented in Table 4 below show that the degradation of mA seems to be not stereoselective and the half-lives of both isomers at 20°C are in the range of 85 to 120 days. However, DT_{50}-values for *R*- and *S*-isomers are surprisingly equal, indicating a possible error during copying this table from the original study to the dossier.

Table 22: Half-lives of metabolite mA in laboratory soil incubation studies under aerobic conditions

Soil type	Incubation	pH	Temp [°C]	pF	OM [%]	Dosage [mg/kg]	DT_{50} S-Isomer [days]	DT_{50} R-Isomer [days]
*Loamy sand	aerobic	5.5	20	2.2	3.6	0.1	95	95
*Loamy sand	aerobic	5.5	20	2.2	3.6	1.0	120	120
Sandy loam	aerobic	6.0	25	2.5	2.5	1.0	60	60
Clay	aerobic	6.0	29-31	4.5	1.0	1.0	25	25
Loam	aerobic	6.9	20	3.0	2.0	1.0	85	85

* Route of degradation study.

mB: This metabolites is only found in a volatile trap at max. 13% after an incubation of 180 days.

mC: After 100 days 6% of this metabolite are found increasing to 9% at the end of incubation (180 days). This metabolite is a degradation product of metabolite mA only and appears to be relatively persistent.

Bound residues reached a maximum of 78% after 100 days of incubation, decreasing to 55% at the end of the study (180 days. **CO_2** reached 1% after 100 days and a maximum of 33% at the end of incubation. Due to the formation of such large amounts of bound residues and the low mineralization, special attention should be given to possible harmful effects for succeeding crops and soil biota.

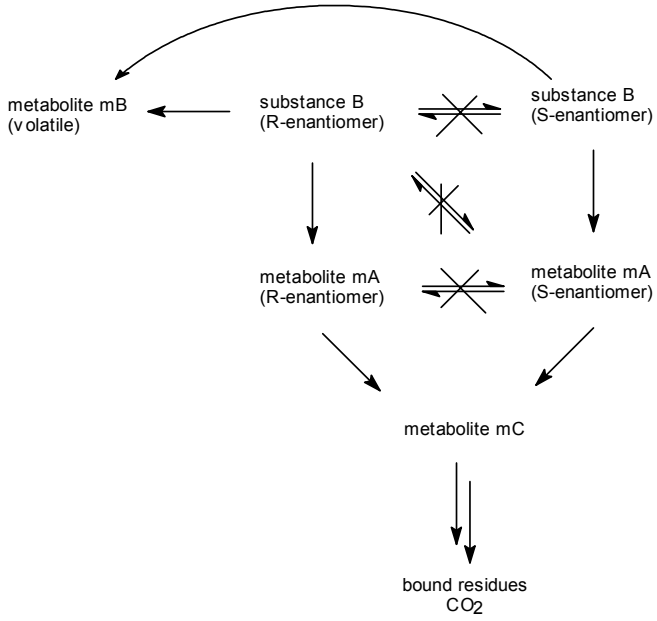
- **Metabolites S-isomer:**

mA: After an incubation of 100 days and after 180 days (at the end) 10% and 30% of mA are formed. This metabolite has two isomers (50:50%). DT_{50} of both isomers was determined in separate studies (see above).

Fractions of other metabolites (unspecified) amounted totally for <3%.

Bound residues and CO_2 reached a maximum of 60% and 3%, respectively, after 180 days of incubation.
A metabolic pathway is not provided with the case study documentation. For our own purpose, we constructed a metabolic pathway (which could be different from the one that the authors had in mind):

Figure 13: Proposed metabolic pathways for *Substance B* in soil



Field Studies

Under field conditions, the dissipation of *Substance B* was (as expected) somewhat faster than observed in the laboratory studies. The half-lives were in the range of 12 to 100 days and 100 to 200 days for the *R*- and *S*-enantiomer, respectively (see Table 5 below). The 50-percentile or median value of all field studies performed with the ***R-isomer*** is 60 days. The 10-percentile value is about 25 days and the 90-percentile value is about 100 days[29]. Median values are considered as typical values, while 10-percentile and 90-percentile are taken as realistic best and worst cases. There were only 3 studies performed with the **S-isomer**, therefore the mean value is determined as the typical half-life. The DT_{90f} values are about 9 and 20 months for the R- and S-isomer, respectively.

- **R-isomer:**

Realistic DT_{50f} varies between 25 and 100 days, with a most typical value of 60 days.
The DT_{90f} is about 9 months.

- **S-isomer:**

The DT_{50f} varies between 100 and 200 days, with a mean value of 163 days.
The DT_{90f} is about 20 months.

For the calculation of the *"Predicted Environmental Concentrations"* in soil (PEC_S) at different intervals after application, the median value of the DT_{50f} and the mean value will be used for the R- and S-isomer, respectively, i.e. **DT_{50f} = 60 days (R-isomer) and DT_{50f} = 163 days (S-isomer)**.

[29] Evaluation of the data as percentiles is preferred over the evaluation as mean values and standard deviation presuming normal distribution, because percentile are less susceptible to outliners (which may be false) and assumption of normal distribution is not justified.

It is not clear from data in Table 5, if the R- and S-isomers were incubated in the same soils and at the same time. Differences could be due to enantioselective degradation or due to differences in conditions.

Table 23: Half-lives and DT_{90}-values of R- and S-isomer of *Substance B* in the field

Soil type	Location	Crop	Dosage [kg a.i./ha]	DT_{50} [days¡	DT_{90}	Remarks
Loam	USA CA	no	0.75	50	½ year	R-isomer
Sandy loam	USA KS	no	0.50	60	½ year	R-isomer
Clay	Spain	no	0.375	60	½ year	R-isomer
Clay	Spain	no	0.125	40	½ year	R-isomer
Clay	Spain	no	0.125	100	1 year	*S-isomer*
Sandy clay	Spain	no	0.375	80	1 year	R-isomer
Sandy clay	Spain	no	0.125	90	1 year	R-isomer
Sandy clay	Spain	no	0.125	200	2 years	*S-isomer*
Silty loam	UK	no	0.5	55	½ year	R-isomer
Loamy sand	UK	no	0.5	12	2 months	R-isomer
Silty loam	UK	no	0.5	98	1 year	R-isomer
Silty loam	France	no	0.5	100	1 year	R-isomer
Loamy sand	Germany	no	0.75	70	1 year	R-isomer
Loamy sand	Germany	no	0.75	190	2 years	*S-isomer*

Metabolite mA was formed at a maximum of 25% of the applied radioactivity after 40-190 days in the 0-10 cm soil layer. After 369 days (end) only 4% remained. It is not stated, if mA is formed from *R*-, *S*- or both enantiomers of *Substance B*.

No information is given for translocation of substance B or its metabolites to deeper soil layers.

Accumulation in Soil

The results from laboratory and field studies indicate at least for the S-isomer of *Substance B* a potential to accumulate in soil. For the biologically active R-isomer accumulation is not expected to become an issue. However, soil accumulation studies would help to better understand the long-term behaviour of *Substance B*.

Adsorption

K_{om}-values for *Substance B* of 2000, 13500, 3600, 2550 dm^3/kg indicates low mobility in soil. However, K_{om}-values for metabolite mA of 20, 12, 17, 25 dm^3/kg reveal high to very high mobility of this metabolite.

Column Leaching

In an aged leaching test metabolite mC was formed at 3% of radioactivity applied after ageing and was after leaching recovered for 3% of the radioactivity in the leachate, indicating very high mobility of metabolite mC as well (see also section 3.2.4 “Predicted Environmental Concentrations in Ground water (PECGW).

No data is given on metabolite mA, which is expected to show high mobility in this experiment as well (see also section 3.2.4 “Predicted Environmental Concentrations in Ground water (PECGW).

Predicted Environmental Concentrations in Soil (PEC_S)

The dossier on the environmental fate of *Substance B* is incomplete and would thus not be acceptable for registration in Switzerland in its present form. Nevertheless, for a preliminary assessment predicted environmental concentrations in soil, surface and groundwater were calculated.

The estimation of PEC_S is based on the following use recommendations for *Substance B*:

- Maximum recommended use rate of 750 g active ingredient per hectare to cereals
- One single treatment at growth phase (from tillering to stem elongation).

Spray drift may lead to certain residues in adjacent fields. These residues are significantly lower than those in the treated field itself. Hence, they are not considered with respect to the risk of soil organisms.
The following PEC_S were calculated using PELMO 3.22 and the standard FOCUS scenario for Hamburg without modification. For the winter wheat scenario, one application per year (1. May) of 0.75 kg *Substance B* (racemate) per hectare was used and a crop intercept of 0% was assumed. The degradation half-lives of *Substance B* were taken from the field dissipation studies; **DT_{50f} = 60** and **163 days**, for the *R*- and *S*-enantiomers, respectively, and used without soil temperature and moisture correction. For metabolite mA, a half-life of 85 days (median value from laboratory studies) was used with recommended temperature correction. Results from the field dissipation studies indicated a somewhat faster degradation of metabolite mA. However, no kinetic evaluation of those data was provided in the dossier. It was assumed that 87% of the parent compound degraded via metabolite mA and 13% via metabolite mB. Pelmo does not allow the modelling of volatile metabolites. Therefore, PEC_S were not further evaluated for metabolite mB. As no data on degradation rates of metabolite mC were available, this metabolite was not included in the simulation. K_{OC} values of 5381 and 32 L/kg, derived from median K_{OM} values of 3075 and 18.5 L/kg for parent and metabolite mA, respectively, were used to simulate the leaching behaviour.

The results demonstrate that regarding the R-isomer there is practically no accumulation as the maximum residues are already reached in the second year. Due to the slower degradation the residue plateau for the S-isomer will be reached later, i.e. in the 5th year (see Table 6 below).

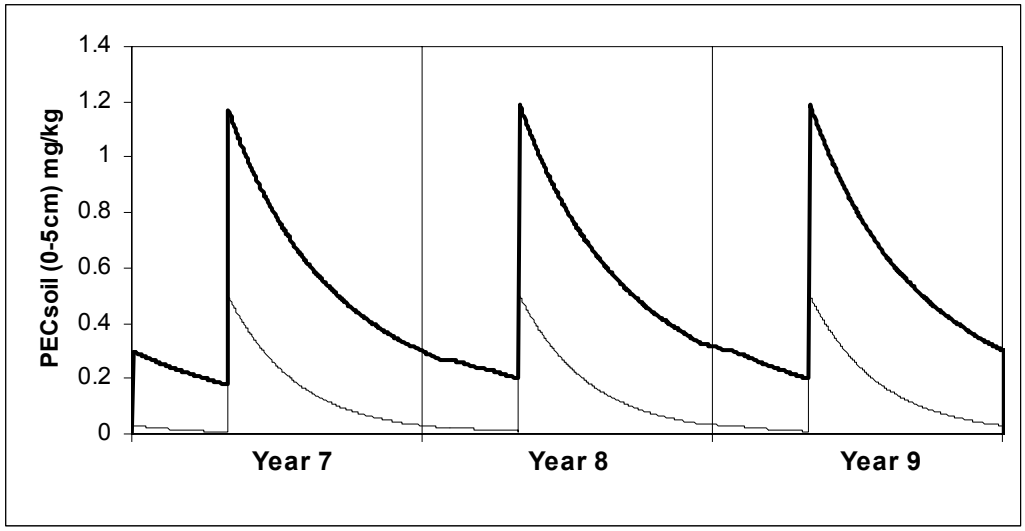
Table 6 summarizes the predicted environmental concentrations in soil for the racemate and the two isomers, whereby:

- PEC_S initial = concentration in soil after application in the **first year**
- PEC_S max. = plateau residue level in soil after 2 and 5 years for R- and S-isomer, respectively
- PEC_S average = time weighted average (twa) concentration in soil over the year at the plateau level

Table 24: PEC_S (0-5 cm) for *Substance B* calculated for the scenarios "winter wheat"

Substance	**R-isomer**	**S-isomer**	**Racemate**
Application rate [g/ha]	375	375	750
No. of applications	1	1	1
DT_{50} [days]	60	163	-
PEC_S initial [mg/kg]	0.50	0.50	1.0
PEC_S max. [mg/kg]	0.51	0.63	1.2
PEC_S average [mg/kg]	0.26	0.32	0.49

Figure 14: PEC_S calculated for the scenario "winter wheat" (one application of 750 g racemic a.i./ha on 1. May of each year). The bold line corresponds to total, the thin line to *R*-isomer concentration, respectively.



PELMO 3.22 does not provide a straightforward way of exporting PEC_S data for metabolites. For the purpose of this case study and due to lack of time, PEC_S of metabolite mA were thus not evaluated. However, PEC_{GW} of mA calculated for this scenario are provided below (section 3.2.4).

Degradation in the Aquatic Environment

Degradation in Water-Sediment Systems

In water-sediment systems (10% sediment) no difference in behaviour between both isomers was observed. Rapid dissipation from the aqueous phase by transfer to the sediment was observed. Further degradation in the sediment (and in the system as a whole) was slow with half-lives of >180 days. After 180 days (end of experiment) 6% and 11% of metabolite mA were found in the sediment and water phase, respectively.

Table 25: Half-lives of *Substance B* in water-sediment systems

Sediment type	Temp [°C]	pH	OM [%]	DT_{50} water [days]	DT_{50} sediment [days]	DT_{50} system [days]
Silt loam	20	5.6	5.8	1	> 180	> 180
Sand	20	6.7	0.7	3	> 180	> 180
Loamy sand	20	7.0	1.5	2	> 180	> 180

In separate studies metabolite mA showed half-lives in the water-sediment systems of 60 to 90 days (water phase) and 90 to 110 days (whole system).

Table 26: Half-lives of *Metabolite mA* in water-sediment systems

Sediment type	Temp [°C]	pH	OM [%]	DT_{50} water [days]	DT_{50} sediment [days]	DT_{50} system [days]
Silt loam	20	5.5	5.7	60	170	100
Sand	20	6.4	0.7	90	150	90
Loamy sand	20	6.9	1.5	70	180	110

Hydrolysis

Substance B does not hydrolyse in water.

Ready Biodegradability

According to the case study dossier, substance B is inherently biodegradable. However, substance B was slowly degraded in soil and practically not degraded in sediment/water-systems indicating that this compound is rather persistent. Therefore, the interpretation that substance B is "inherently biodegradable" is at least questionable.

Predicted Environmental Concentrations in Ground water (PEC_{GW})

No data on predicted environmental concentrations in groundwater are provided in the dossier of the case study. The model used for our calculation of PEC_S was also used to predict concentrations of *Substance B* and metabolite mA in groundwater based on the same parameters.

As for the PEC_S calculations, due to lack of necessary K_{OC} and DT_{50} data metabolite mC was not included in the model calculation. In the scenario „winter wheat/Hamburg", which was selected as an illustrative example, PEC_{GW} were < 0.001 µg/L for parent *Substance B* (sum of both enantiomers). However, metabolite mA showed predicted concentrations in the percolate in the range of 24-36 µg/L (average, 32 µg/L), indicating a significant potential of this metabolite for groundwater contamination.
Based on the information on metabolite **mC** given in section 3.1.4 “Column Leaching” a rough estimation of PEC_{GW} will be done:

Metabolite mC was formed at 3% of the applied dose and the total amount was recovered in the leachate during the “aged column leaching study. Considering an application rate of 750 g/ha (corresponding to 75 mg/m^2) of which 3% are transformed to metabolite mC and translocated to the water table, and an annual groundwater recharge of 300 l per m², this would result in an average concentration of 7.5 µg mC per litre soil water. Assuming 10% of the groundwater catchment area treated with *Substance B*, PEC_{GW} is estimated to be 0.75 µg/l.

The worst case estimation thus results in **PEC_{GW}: 0.75 µg/l** for metabolite mC.

Estimation of Concentrations in Surface Water

Potential Routes of Contamination

To estimate the *Predicted Environmental Concentration* in surface water (PEC_{SW}) several routes have to be considered: Direct overspray, spray drift, run-off, and discharge via drains. These instantaneous events lead to peak values which subsequently decrease by dilution, mainly in flowing water bodies and by degradation.

The predicted environmental concentration in surface water is calculated for a water depth of 30 cm.
Direct overspray: This way of exposure could only occur in case of inadequate practice. With an application rate of 750 g per hectare it would result in PEC_{SW} of 250 µg/l.

Spray drift: Assuming 0.6% drift to a water body at a distance of 5 m leads to an initial PEC_{SW} of 1.43 µg/l.

Run-off: On fields exceeding a certain slope, run-off can occur. Assuming 0.5% loss from a one hectare field into a 0.2 ha pond and a crop intercept of 0% results in a PEC_{SW} of 6.25 µg/l.

All these scenarios represent worst-cases. They are not realistically expected to coincide. For further estimation run-off is considered as leading to the highest PEC_{SW}, disregarding direct overspray as resulting from inappropriate use. Degradation and transfer to sediment are assumed to be the only pathways of dissipation. In reality, some dilution by water turn-over would decrease the concentration with time. This is, however, not taken into account in this worst-case estimation.

The initial concentrations in water bodies would decrease by degradation, by adsorption to sediment, and by dilution.

Predicted Environmental Concentrations in Surface Water (PEC_{SW})

The calculation of the initial PEC_{SW} is based on the assumptions given above. Dissipation from the water phase was calculated using the simulation software AQUASIM 2.1a (http://www.aquasim.eawag.ch/), assuming first order kinetics with a half-life (**DT_{50}**) of **3 days**.

For metabolite mA, PEC_{SW} from surface run-off were calculated assuming a formation of 25% relative to parent (maximum observed amount in a field dissipation study; worst case) and a half-life in water of 70 days, corresponding to the median value from sediment/water studies.

Table 27: PEC_{SW} (time weighted averages) for *Substance B* and metabolite mA after application in winter wheat

		PEC_{SW} (twa) in [µg/l]				
		Parent Substance B				**Met. mA**
		dir. overspray	**spray drift**	**run-off**	**sum**	**run-off**
Use rate [g/ha]		750	750	750	750	(188[30])
Buffer [m]		-	5	-	(5)	-
Drift / run-off [%]		-	0.57	0.5	-	0.5
DT_{50} in water [d]		3	3	3	3	70
DALA	0	250	1.43	6.25	7.68	1.56
	1	223	1.27	5.58	6.86	1.55
	2	200	1.14	5.02	6.16	1.54
	4	163	0.93	4.09	5.02	1.53
	7	124	0.71	3.10	3.81	1.51
	14	74.2	0.43	1.87	2.30	1.46
	21	51.1	0.29	1.28	1.58	1.41
	30	36.0	0.21	0.90	1.11	1.35

For the calculations of TER values the initial PEC_{SW} of **6.25** and **1.56 µg/l** were use for *Substance B* and metabolite mA, respectively.

Degradation in Air

The volatile metabolite mB is sensitive neither to photodegradation nor to OH-radicals. In laboratory studies it was found in amounts for up to 13% of the applied radioactivity. Considering the relatively high use rate of 750 g/ha, a significant amount will be released to the air.

[30] Corresponding to 25% of the use rate, i.e. the produced amount of metabolite mA

Definition of the Residues

Substance B and metabolite mA are regarded as **relevant soil residue**.

The metabolites mA and mC both are very mobile and based on the calculations and rough estimations they have a real potential to reach groundwater.

Summary and Conclusions

Degradation in soil:

In laboratory studies, at 20°C and under aerobic conditions, *Substance B* is degraded slowly with half-lives in the range of 66 to 110 days (*R*-enantiomer) and from 170 to 240 d (*S*-enantiomer), respectively. Three metabolites were observed, of which 2 (mA and mC) are highly mobile in soil (see below) and one (mB) is volatile.

In the field, *Substance B* dissipates somewhat faster than in the laboratory experiments with dissipation half-lives in the range of 12 to 100 days (*R*-enantiomer) and 100 to 200 days (*S*-enantiomer), respectively. Metabolite mA is also observed in field experiments at concentrations up to 25% relative to the parent compound. The finding of DT_{90}-values >1year would clearly indicate the necessity of soil accumulation studies.

Mobility in soil:

The parent compound exhibits low mobility in soils as derived from its high K_{OM}-values. On the other hand, K_{OM}-values of 12 - 25 L/kg for metabolite mA indicate high mobility. Modelling dissipation and vertical transport of mA indicates a significant potential for groundwater contamination with PEC_{GW} of about 30 µg/L. Results from a leaching study with aged residues indicates also high mobility for metabolite mC with expected concentrations of about 1 µg/L. No data are available on the movement of parent and metabolites to deeper soil layers under field conditions.

Behaviour in water:

Substance B is hydrolytically stable and its stated "inherent biodegradability" is at least questionable. Degradation in sediment/water-systems is slow (DT_{50} >180 days, whole system) and the compound primarily dissipates from the water phase by adsorption to the sediment with a half-life of 1-3 days.

Behaviour in air:

No data on degradation of *Substance B* in air is provided. However, the parent compound is not volatile. The volatile metabolite mB is apparently not degraded in air to any significant extent, so that long-range transport may be expected. No data on chemical-physical properties are provided in the dossier, so that it is impossible to assess the impact of this metabolite.

Data Gaps

The dossier on the environmental behaviour of *Substance B*, to our opinion, is incomplete in many ways. On the basis of the data supplied for this case study, the following additional information would be required for a further assessment of the environmental behaviour of *Substance B*. Further data requirements can be defined only after the following data are evaluated:

- *Data on application of Substance B:*

  It should be clarified whether pure R-isomer or the racemate is used in the product. Also, information on the dose rate should be corrected.

- *Laboratory studies on degradation in soil:*

  A metabolic pathway must be provided. It is not clear which isomer of Substance B is transformed into which isomer of metabolite mA. This needs to be clarified. Data on half-lives of isomers of metabolite mA should be checked and, if necessary, corrected. Data on the degradation kinetics of metabolite mC need to be provided, as this metabolite is very mobile in soil and shows a potential for groundwater contamination.

- *Field studies*

  Information on translocation of parent and metabolites to deeper soil layers should be provided. A soil accumulation study must also be submitted.

- *Mobility in soil*

  Metabolites mA and mC are very mobile in soil. Information on the degradation and mobility of metabolite mC is inadequate to assess its potential for groundwater pollution. A lysimeter or field leaching study must be submitted to allow for a more detailed assessment of groundwater pollution potential.

- *Behaviour in air*

  Metabolite mB, which is formed in soil in significant amounts, is persistent in air. Data on chemical-physical properties of this metabolite need to be provided in the dossier, so that its impact in the environment (bioaccumulation, ozone depletion, groundwater contamination) can be adequately assessed.

4. Ecotoxicology and Risk Assessment

As already mentioned under "General Comments" there is much confusion (unclear or even contradictory data concerning units for endpoints and/or water solubility, etc.) especially in the field of ecotoxicological studies. Depending on the number and or unit you are choosing, the result and consequently conclusions may be different.

But a rough observation of the data demonstrated that ecotoxicology is not the critical point requiring a closer examination, except for algae and/or sediment dwelling organisms. Therefore, this part will not be presented and discussed in the usual detailed manner!

Birds

The table below summarizes the endpoints of *Substance B* and metabolite mA for acute (LD_{50}), short term (LC_{50}), and long term (NOEC) studies for two bird species. There are no data available for metabolite mC.

Table 28: Acute, short and long term toxicity data for birds regarding *Substance B* and metabolite mA

Test substance	Species	Duration	Effect	Endpoint	Unit	Remark
Substance B	*Anas platyrhynchos*	5 days	LD_{50}	> 5000	mg/kg bw	acute
	Anas platyrhynchos	8 days	LC_{50}	> 5000	mg/kg feed	short term
	Colinus virginianus	10 days	LC_{50}	> 5000	mg/kg feed	short term
	Anas platyrhynchos	28 days	NOEC	> 500	mg/kg feed	long term
	Colinus virginianus	28 days	NOEC	> 500	mg/kg feed	long term
Metabolite mA	*Anas platyrhynchos*	2 days	LD50	> 15000	mg/kg bw	acute
	Anas platyrhynchos	14 days	LC50	4500	mg/kg feed	short term
	Colinus virginianus	9 days	LC50	5000	mg/kg feed	short term
	Anas platyrhynchos	120 days	NOEC	> 4500	mg/kg feed	long term
	Colinus virginianus	130 days	NOEC	450	mg/kg feed	long term

A comparison of the "*Estimated Theoretical Exposure*" (ETE) with the LD_{50} and LC_{50} values of the tested birds clearly demonstrate a high safety factor for *Substance B* and metabolite mA with respect to acute and short term exposure.

For *Substance B* and metabolite mA the NOEC of the long term studies reveal TER_{lt} values clearly above the trigger value even under the really worst-case assumption, that birds fed exclusively contaminated food.

Conclusion: The "Toxicity Exposure Ratio" (TER values), based on worst-case scenario, indicate that there is a sufficient safety margin for birds even after prolonged exposure to *Substance B* or metabolite mA.

Aquatic Organisms

The assumptions which led to the initial value of the predicted environmental concentration in surface water are discussed in *"Estimation of Concentrations in Surface Water"*. Run-off is considered as leading to the highest PEC_{SW}, disregarding direct overspray as resulting from inappropriate use. The initial PEC_{SW} were calculated to be **6.25 µg/l** and **1.56 µg/l** for *Substance B* and metabolite mA, respectively (see Table 9 on page 196).

Table 29: Acute, short and long term toxicity data of *Substance B* and metabolite mA to aquatic species

Test substance	Species	Duration	Effect	Endpoint [µg/l[31]]	Remark
Substance B	*Oncorhynchus mykiss*	96 h	LC_{50}	1500	actual conc.
	Lepomis macrochirus	96 h	LC_{50}	> 2500	actual conc.
	Cyprinodon variegatus	96 h	LC_{50}	1200	actual conc.
	Pimephales promelas	30 d	NOEC	140	actual conc.
	Pimephales promelas	68 d	NOEC	154	actual conc.
	Daphnia magna	48 h	LC_{50}	700	actual conc.
	Daphnia magna	21 d	NOEC	110	actual conc.
	Scenedesmus subspicatus	72 h	EC_{50}	1	actual conc.
	Scenedesmus subspicatus	72 h	NOEC	0.1	actual conc.
	Lemna gibba	14 d	EC_{50}	1000	actual conc.

[31] The unit in the dossier is given as **mg/l**. But it is assumed, that **µg/l** would be the right unit, comparing the data to the given solubility in water of 3.3 mg/l. Hence the calculations presented in this assessment are based on **µg**/l.

	Lemna gibba	14 d	NOEC	120	actual conc.
Metabolite mA	*Oncorhynchus mykiss*	96 h	LC50	4500	actual conc.
	Lepomis macrochirus	96 h	LC50	> 7000	actual conc.
	Daphnia magna	48 h	LC50	2000	actual conc.
	Daphnia magna	21 d	NOEC	300	actual conc.
	Scenedesmus subspicatus	72 h	EC50	3000	actual conc.
	Scenedesmus subspicatus	72 h	NOEC	300	actual conc.

Take notice of the footnote referring to the unit of endpoints in Table 11

Acute Toxicity to Fish

The toxicity exposure ratios (TER) for fish were calculated for the most sensitive fish species tested.
The **acute** TER is based on the LC_{50} determined for *Substance B* (1200 µg/l) or metabolite mA (4500 µg/l) and the respective initial PEC in surface water (PEC_{SW}).

For both compounds, the calculated TER_a was clearly above the trigger value of 100.

Chronic Toxicity to Fish

The **long-term** TER is calculated on the basis of the NOEC (140 µg/l) obtained in respective toxicity study with *Pimephales promelas* for *Substance B* considering the *time weighted average* PEC_{SW} for 30 days, corresponding to the exposure time.

The TER_{lt} is clearly above the trigger value of 10.

Bioconcentration in Fish

The K_{OW} value is above 3. But the BCF of 50 L/kg for the active R-isomer of *Substance B* do not require further investigations; in addition its DT_{50} of 0.5 days for clearance is rather favourable. The BCF for the S-isomer is significantly higher (400 L/kg) and together with the less efficient clearance of 5 days and the rather high use rate, it indicates a potential risk for bioaccumulation.

Acute Toxicity to Aquatic Invertebrates

The TER ratio for aquatic invertebrates was calculated using *Daphnia magna* as a representative. The acute TER_a are based on the EC_{50} for *Substance B* (700 µg/l) or metabolite mA (2000 µg/l) and the respective initial PEC_{SW} values.
For both compounds, the calculated TER_a was clearly above the trigger value of 100.

Chronic Toxicity to Aquatic Invertebrates

The **long-term** toxicity exposure ratio for *Daphnia magna* in (**stagnant**) water was calculated with the NOEC for *Substance B* (110 µg/l) or metabolite mA (300 µg/l) and, according to the test duration, the respective 21 day PEC_{SW} value (time-weighted average).
For both compounds, the calculated TER_{lt} is clearly above the trigger value of 10.

Algae

The TER_a for algae is based on the determined EC_{50} for *Substance B* (1 µg/l) or metabolite mA (3000 µg/l) for the green algae *Scenedesmus subspicatus* and the respective initial PEC_{SW} values.

*In the submitted "dossier" the EC_{50} values were given in **mg/l**, but here they are considered to correspond to **µg/l** (see also footnote 31). Assuming the original given unit in **mg/l** to be the right one, the calculated TER_a would far above the trigger value of 10!*

Based on the EC_{50} values presented in this evaluation, the TER_a of 0.2 for *Substance B* is below the trigger value, indicating a potential risk for algae. This is also valid regarding a prolonged exposure to *Substance B*.

The TER value for metabolite mA reveal a high safety factor demonstrating that metabolite mA does not cause any negative effects to algae at the recommended use of *Substance B*.

Aquatic Plants

Rather surprising is the fact, that *Lemna gibba* is less susceptible to *Substance B* (supposed to be a herbicide) than algaes are.

The calculated TER values for *Lemna gibba*, based on the EC_{50} and NOEC values and the respective PEC_{SW} value for 30 cm deep stagnant water are clearly above the trigger value of 10.

Sediment Dwelling Organisms

Table 12 presents the NOEC values for two sediment dwelling organisms, based on experiments using spiked sediment; (the figures are given for dry weight of sediment).

Table 30: Toxicity data for sediment dwelling organisms using *Substance B*

Species	Duration	Effect	Endpoint	Remark
Lumbriculus variegatus	28 d	NOEC	50 mg/kg_{dw}	10% O:M:
Caenorhabditis elegans	72 h	NOErC	0.01 mg/kg_{dw}	10% O:M:

The NOEC refers to sediment; hence it should be compared to the $PEC_{Sediment}$, which was estimated based on the following assumptions:

- initial PECSW = 6.25 µg/l based to the "run-off scenario"
- the whole amount of Substance B is transferred from water to the sediment
- water depth: 30 cm
- sediment depth: 5 cm
- sediment density: 1.5 kg/dm3
- neglecting degradation in the sediment (DT50 > 180 days).

Based on these assumptions and the recommended use rate a $PEC_{Sediment}$ of 25 µg/kg is calculated, resulting in a **TER_{lt} of < 1** for *Caenorhabditis elegans*. This value indicates high risk for sediment dwelling organisms.

Conclusions

The safety factors for the aquatic species indicate that *Substance B* can be used with virtually no risk to these organisms even at prolonged exposure, expect for algae and sediment dwelling organisms which are very susceptible[32].

Earthworms

Predicted Environmental Concentration in soil (PEC_S)

The predicted environmental concentrations in soil and the respective assumptions are presented in section "Predicted Environmental Concentrations in Soil (PECS)" on page 101. The initial **PEC_S** was calculated to be **1 mg/kg** regarding the sum of applied R- and S-isomers of *Substance B*.

Metabolite mA was found to amount up to 25% of the applied material, hence, revealing an initial PEC_S of 0.25 mg/kg.

The following table shows the toxicity data for earthworms exposed to *Substance B* or metabolite mA.

Table 31: Toxicity data for earthworms to *Substance B* or metabolite mA

Test substance	Species	Duration	Effect	Endpoint	Remark
Substance B	*Eisenia fetida*	14 days	LC_{50}	> 1000 mg/kg	10 % O:M:
	Eisenia fetida	28 days	NOEC	10 mg/kg	10 % O:M:
Metabolite mA	*Eisenia fetida*	14 days	LC_{50}	> 1000 mg/kg	10 % O:M:
	Eisenia fetida	28 days	NOEC	30 mg/kg	10 % O:M:

The amount to which a soil organism would be exposed as a worst-case is an initial concentration of 1 mg/kg which then declines according to the respective half-lives of the two isomers (see section 3.1.5). The acute TER (TER_a) is calculated from the LC_{50} value and the initial PEC_S of 1 mg/kg and 0.25 mg/kg for *Substance B* and metabolite mA, respectively. The long-term TER (TER_{lt}) is based on the NOEC value and a PEC of 28 days (time weighted average).

The TER_a are far above the trigger value of 10. Even prolonged exposure reveal TER_{lt} values of 12 and 134 for *Substance B* and metabolite mA, respectively, being clearly above the trigger value of 5.

Micro-Organisms

Substance B has no influence on soil-respiration and nitrification when used at 1.0 and 0.1 mg/kg. This demonstrates that the incorporation of *Substance B* in soil at concentrations of up to the maximum estimated concentration of the substance had no prolonged effect upon either short-term respiration or nitrification.

Terrestrial Vertebrates other than Birds

No data available.

Summary

Effects on birds

[32] Assuming an EC_{50} for algae of 1 **µg/l** and not 1 mg/l !!

The LD_{50} and LC_{50} values demonstrate *Substance B* and metabolite mA to be not toxic to birds. The "Toxicity Exposure Ratio" (TER values), based on worst-case scenario, indicate that the safety margins are sufficient regarding acute, short-term exposure and even long-term exposure.

Effects on aquatic organisms
The calculated TER_a as well as the TER_{lt} for *Substance B* were clearly above the trigger values for all aquatic species tested, except for algae. Regarding algae the TER value indicates a rather high risk for these organisms to be endangered at chronic as well as at acute exposure.

The safety margins for metabolite mA are sufficient for all aquatic species tested.

The hydrophobic nature of *Substance B* and its slow degradation in sediments (DT_{50} >180 days) indicate a potential risk for **sediment dwelling organisms**. This will be endorsed by the estimated $\mathbf{TER_{lt} < 1}$ for *Caenorhabditis elegans*.

Effects on bees and beneficial arthropods
No data are available on the ecotoxicity of *Substance B* and its metabolites for bees and beneficial arthropods.

Effects on other non-target organisms
No data are available on the ecotoxicity of *Substance B* and its metabolites for terrestrial vertebrates other than birds.

Laboratory studies on **earthworms** performed with *Substance B* and metabolite mA revealed sufficient safety margins for acute and chronic exposure.

Substance B has **no adverse effect on soil microbial activity** and therefore on soil fertility at concentrations of up to 20 times the maximum estimated concentration in soil. There is no information available on metabolite mA, but based on the ecotoxicological data reported on other organisms, it can be assumed that metabolite mA would not endanger soil microbial activity.

Additional requirements (Data Gaps)

- Acute and long-term studies with *Chironomus* in water-sediment system (sediment spiked) should be provided, including more precise information on the degradation and bioavailability of the a.i. in the sediment.
- Since there is no information available on the toxicity of the formulated product, an acute study should be provided at least for *Daphnia* and algae.
- The pronounced susceptibility of algae to *Substance B* (assuming the chosen EC_{50} of 1 **µg/l** is correct) strongly recommends the evaluation in other algae species.
- Additional studies should be provided on the ecotoxicity of *Substance B* on bees, beneficial arthropods and terrestrial vertebrates other than birds.

5. Conclusion

There are too many relevant studies missing to allow a final decision. The information about the isomers is not clear and/or confusing. The S-isomer is significantly more persistent than the biologically active R-isomer, which shows a much more favourable environmental behaviour. Applying only the R-isomer would significantly improve the environmental profile of the product.

In summary, it can be concluded that a complete dossier including the additional studies requested may lead to a positive decision with respect to the acceptance of Substance B.

B.7. UK

Physical and chemical properties

Property	Value	Remark
Vapour pressure	$3.5x10^{-7}$ Pa	20°C
Log K_{ow}	3.2	20°C
Solubility in water	3.3 mg/L	20°C
pK_a	-	Not available
Molecular weight	300	$g.mol^{-1}$

Relatively low vapour pressure for a modern pesticide – but this parameter is not currently formally classified under EU or UK pesticide legislation.

At the present time in the EU assessment process and under UK national requirements there is no formal regulatory scheme for evaluation of pesticide concentrations in air – therefore we do not regulate on vapour pressure.

The log Kow value is moderately high and therefore the compound may be bound to soil and sediment.

Water solubility is moderate.

If a pKa is not supplied we assume it is not dissociated in water at environmental pH.
Molecular weight is 'normal' for a pesticide.

Same Ecotox comments as for case study 1.

The substance consists of two stereoisomers (R- and S).
The R-isomers is documented in the efficacy dossier to be the active isomer.

Isomer questions are dealt with on a case by case basis – depending on the type of isomerisation. EU policy on isomers is not very clear.

We would want to know that we had covered the appropriate toxicity of the formulation and the isomers it contained in any toxicity studies. Therefore we would expect the testing to be undertaken with active substance containing the same ratio of isomers as in the product for which authorisation is sought. Only if the isomers had already been shown to be of equivalent toxicity across a suitable range of species would we depart from this requirement.

Formulations
1. 50 EC (emulsifiable concentrate, substance B 50 g/l)

Application	dosage	dose a.i.	frequency	time of application
cereals	0.4 l/ha	750 g/ha	1	Growth phase, from tillering to stem elongation

Use on cereals at 750 g/ha once per year.

Degradation in soil

Laboratory studies

Substance B

Soil type	incubation	pH	T (°C)	pF	%om	Dosage (mg/kg)	DT50 S Isomer (days)	DT50 R isomer (days)
*Loamy sand	aerobic	5.5	20	2.2	3.6	0.1	195	98
*Loamy sand	aerobic	5.5	20	2.2	3.6	2.0	240	77
Silty loam	aerobic	7.0	20	3.0	1.4	0.1	177	110
Silty loam	aerobic	5.5	20	3.0	0.4	2.0	208	97
Sandy loam	aerobic	8.0	25	2.5	16	0.1	110	74
Sandy loam	aerobic	8.0	25	2.5	16	2.0	127	60
Loam	aerobic	6.9	20	3.0	2	0.1	170	75
Loam	aerobic	6.9	20	3.0	2	2.0	185	66
Clay	aerobic	6.0	29-31	4.5	1	3.0	50	30

*Route of degradation study.

The soils used look typical arable soils – mineral class, pH and %OM are all 'normal'. Incubation conditions are aerobic in the laboratory. Temperature is 20/25°C except for the clay soil incubations at 29-31°C. These results could all be transformed to a standard temperature of 20°C via use of the agreed Q10 value of 2.2 – however the DT50 values are relatively high and above any EU trigger values and therefore this will not provide any further real information on degradation of this compound. Therefore we could exclude the values at 29-31°C. Therefore we can quote DT50lab values at 20/25°C (n=8) as follows –
S Isomer -
range : 110 to 240 days;
mean : 176 days.
R Isomer -
range : 60 to 110 days;
mean : 82 days.
There is a clear difference in stability under aerobic conditions for the 2 isomers.

Metabolites R isomer:
mA
This metabolite has two isomers (50:50%). After 100 days 30% is formed and at the end 60% (at 180 days). DT50 of both isomers was determined in separate studies.

Soil type	incubation	pH	T (°C)	pF	%om	Dosage (mg/kg)	DT50 S Isomer (days)	DT50 R isomer (days)
*Loamy sand	aerobic	5.5	20	2.2	3.6	0.1	95	95
*Loamy sand	aerobic	5.5	20	2.2	3.6	1.0	120	120
Sandy loam	aerobic	6.0	25	2.5	2.5	1.0	60	60
Clay	aerobic	6.0	29-31	4.5	1	1.0	25	25
Loam	aerobic	6.9	20	3.0	2	1.0	85	85

*Route of degradation study.

The soils used look typical arable soils – mineral class, pH and %OM are all 'normal'. Incubation conditions are aerobic in the laboratory. Temperature is 20/25°C except for the clay soil incubations at 29-31°C. These results could all be transformed to a standard temperature of 20°C via use of the agreed Q10 value of 2.2 – however the DT50 values are relatively high and above any EU trigger values and therefore this will not provide any further real information on degradation of this compound. Therefore we could exclude the values at 29-31°C. Therefore we can quote DT50lab values at 20/25°C (n=4) as follows –
S Isomer -
range : 60 to 120 days;
mean : 90 days.
R Isomer -
range : 60 to 120 days;
mean : 90 days.
There is no difference in stability under aerobic conditions for the 2 isomers of this metabolite.

mB
This metabolites is only found in a volatile trap at max. 13% after 180 days.

This metabolite is therefore somewhat volatile and may have to be assessed for concentration in air – but at present in EU and UK we do not have any agreed guidance on this aspect of pesticide assessment. At 13% this is a significant amount.

mC
After 100 days 6% of this metabolite is found. At the end (after 180 days) 9%. This metabolite is a degradation product of metabolite mA only.

This metabolite at 9% max at study end is therefore persistent and would have to be assessed in some way – using EU guidance on metabolite assessment.

Residues
Bound residues reached a maximum of 78% after 100 days, 55% after 180 days (at the end). CO_2 reached 1% after 100 days, max. 33% after 281 days (at the end) incubation.

Presume these data are from aerobic incubations (not stated).
The bound residues and CO2 BOTH breach the EU trigger for further assessment - EU trigger of BR >70% and CO2 <5% at 100 days in lab aerobic incubations. (See EU Guidance Document on Persistence in Soil – DGVI B II.1 – 9188/VI/97 rev8, dated 12.07.2000).

However method for further assessment has not yet been defined – guidance awaited. Therefore the next step here is not very clear under EU policy. No UK policy exists on this aspect.

Metabolites S isomer:
mA
After 100 days 10% is formed and after 100 days and 30% at the end (after 180 days). This metabolite has two isomers (50:50%). DT50 of both isomers was determined in separate studies (see above).
Fraction of other metabolites (unspecified) total <3%.

Bound residue reached a maximum of 60% after 180 days; CO_2 3% after 180 days.

This area of information is not very clear.

Is this the same metabolite mA as above ?
The BR and CO2 do NOT breach the EU trigger for further assessment.

Field-studies

Substance B

soil type	location	crop	dosage (kg a.s./ha)	DT50 (days)	DT90	Remarks
loam	USA CA	no	0.75	50	½ year	R-isomer
sandy loam	USA KS	no	0.50	60	½ year	R-isomer
clay	Spain	no	0.375	60	½ year	R-isomer
clay	Spain	no	0.125	40	½ year	R-isomer
clay	Spain	no	0.125	100	1 year	S-isomer
sandy clay	Spain	no	0.375	80	1 year	R-isomer
sandy clay	Spain	no	0.125	90	1 year	R-isomer
sandy clay	Spain	no	0.125	200	2 years	S-isomer
silty loam	UK	no	0.5	55	½ year	R-isomer
loamy sand	UK	no	0.5	12	2 months	R-isomer
silty loam	UK	no	0.5	98	1 year	R-isomer
silty loam	France	no	0.5	100	1 year	R-isomer
loamy sand	Germany	no	0.75	70	1 year	R-isomer
loamy sand	Germany	no	0.75	190	2 years	S-isomer

These field studies have been performed in several countries. In the UK we only take account of field data from countries in the central EU zone – but we MAY look at data from eg. Canada and Northern USA, depending on weather data etc. In above list we would NOT take account of data from Spain and USA CA. We only take account of data from Northern France (not clear in above list of studies which area of France).

Normally we require full climate/site/treatment history etc for all field studies, which are lacking here, and we generally follow the Netherlands CTB checklist approach for field studies – See Checklist for assessing whether a field study on pesticide persistence in soil can be used to estimate transformation rates in soil – Date 10.07.02 (1 page).

For results from USA KS, UK and Germany –
R isomer -
DT50field : range 12 to 98 days, mean 59 days (n=5),
DT90field : 2 months to 1 year
S isomer – (1 result only)
DT50field : 190 days,
DT90field : 2 years.
Clearly the persistence of the 2 isomers differs in the field.

Metabolite mA:
Was formed at a maximum of max. 25% of the applied radioactivity after 40-190 days in the 0-10 cm soil layer. After 369 days (end) only 4% remained.

Not very clear if lab or field data here. However metabolite mA would need assessment under EU rules as formed at max 25%.

We would discuss with our fate colleagues whether field exposure to both isomers is likely and also to metabolite mA. However, since DT50 values etc have been derived for these we would expect to need to cover the risk from all of these. We would expect that data holder to have considered the best way of approaching this, not only in generating the toxicity data package but in then relating this to the actual exposure. We would want to be assured that the risk from both isomers had been appropriately addressed (see above). The rest of the approach would be as for case study 1.

Adsorption

K_{om}-values for substance B: 2000, 13500, 3600, 2550 dm^3/kg. K_{om}-values for metabolite A: 20, 12, 17, 25 dm^3/kg. Values derived from Freundlich isotherms with 1/n between 0.8 and 1.0 and soil o.m. contents between 0.5 and 15% o.m..

Under EU rules normally use Koc, not Kom.
All results will be used in assessment as conditions all satisfactory.
Kom for substance B –
- range : 2000 to 13500 dm3/kg,
- mean : 5412 dm3/kg (n=4).

High soil sorption in agreement with high log Kow etc.
Kom for metabolite A -
- range : 12 to 25 dm3/kg,
- mean : 18 dm3/kg (n=4).

Metabolite A has very low sorption to soil.

Column leaching

In an aged leaching test metabolite C was formed at 3% of r.a. applied after ageing and was after leaching recovered for 3% of the r.a. in the leachate.
Significance of this result is difficult to assess.

The ecotox risk assessment undertaken would depend on the conclusions regarding exposure from the fate and behaviour assessment. Consideration of the relevance of groundwater metabolites would be undertaken if necessary. This would include biological relevance and mammalian and ecotoxicological relevance (as per the ground water guidance document).

Degradation in the aquatic environment

Degradation in water-sediment systems

In water-sediment systems (10% sediment) no difference in behaviour between both isomers was observed. Metabolite mA was found at 6% after 180 days (end) in the sediment; 11% in the water phase after 180 days.

Substance	Sediment type	T [°C]	pH	o.m. [%]	DT_{50} water [d]	DT_{50} sediment [d]	DT_{50} system [d]
substance B	silt loam	20	5.6	5.8	1	>180	>180
substance B	sand	20	6.7	0.7	3	>180	>180
substance B	loamy sand	20	7.0	1.5	2	>180	>180

Results here are all satisfactory for risk assessment.
DT50 water – 1-3 days,
DT50 sediment - >180 days
DT50 system - >180 days.
Clearly dissipation is very rapid from the water phase via partition to sediment. But then the substance is very persistent in sediment.

See comments for Case 1, the approach used would be similar. In this case both the acute and chronic risk to aquatic organisms would need to be addressed for the active substance. Although the active substance occurs in sediment at >10% after 14 days potentially triggering the need for a risk assessment for sediment dwellers, the chronic NOEC for Daphnia is >0.1 mg/l and so above the value given in the aquatic guidance document. This value was set to avoid unnecessary testing and therefore the risk to sediment dwellers does not need to be addressed.

Separate studies with mA were conducted.

Substance	Sediment type	T [°C]	pH	o.m [%]	DT_{50}water [d]	DT_{50} sediment [d]	DT_{50} system [d]
mA	silt loam	20	5.5	5.7	60	170	100
mA	sand	20	6.4	0.7	90	150	90
mA	loamy sand	20	6.9	1.5	70	180	110

If the fate and behaviour analysis of these data confirms the DT50 of the metabolite in water is >2days then the aquatic risk would need to be addressed in the same way as for the active substance.

Hydrolysis

Substance B does not hydrolyse in water.
Agrees with other results.

Ready biodegradability

Substance B is inherently biodegradable.

Does NOT agree with other results. We would question this result in view of other data.

We would take advice from the fate and behaviour assessment with regard to the acceptance or rejection of whether the active substance is readily biodegradable.

Degradation in air

Metabolite B is sensitive neither to photodegradation nor to OH-radicals.
Therefore metabolite B may be persistent in air and will need assessment when the guidance is available – may need to be compared with criteria for POPs.

Bioaccumulation

In *Lepomis macrochirus* the BCF ww/wo of the R isomer of substance B is 50 L/kg. DT50 for clearance is 0.5 days. For the S isomer the BCF ww/wo is 400 L/kg. DT50 for clearance is 5 days.

For *Lepomis macrochirus* the BCF ww/wo of metabolite A of the R isomer of substance B is 30 L/kg and of the S isomer the BCF ww/wo is 210 L/kg. The DT50 for clearance was 0.5 days for both isomers.

Again, we would wish to ensure that we had appropriately covered both isomers as per their occurrence in the formulation and the environment.

1. The risk to birds and mammals that eat fish would be considered using the same approach as for Case 1. Similarly the risk from the consumption of contaminated earthworms would also be considered as per Case 1.

2. A fish early life cycle study would be required since the BCF is between 100 – 1000. It is unclear from the data provided whether or not the 68 day test on *Pimephales promela* is actually a fish early life cycle study. Clarification would be required.

3. More information would be needed on the elimination of radioactivity during the 14 day depuration period. Again the approach would be as for case 1.

Toxicity to earthworms

Substance B

Species	Duration	Effect	Endpoint	Remarks
Eisenia fetida	14-days	LC50	>1000 mg/kg	10% o.m.
Eisenia fetida	28-days	NOEC	10 mg/kg	10% o.m.

Metabolite mA

Species	Duration	Effect	Endpoint	Remarks
Eisenia fetida	14-days	LC50	>1000 mg/kg	10% o.m.
Eisenia fetida	28-days	NOEC	30 mg/kg	10% o.m.

Comments are as for Case 1.

Effects on micro-organisms

Substance B has no influence on soil-respiration and nitrification when used at 1.0 and 0.1 mg/kg.

Comments are as for Case 1 .

Toxicity data for aquatic species

Substance B

Species	Duration (hours)	Effect	Endpoint		remark
Oncorhynchus mykiss	96	LC50	1500	mg/L	actual conc.
Lepomis macrochirus	96	LC50	>2500	mg/L	actual conc.
Cyprinodon variegatus	96	LC50	1200	mg/L	actual conc.
Pimephales promelas	30 days	NOEC	140	mg/L	actual conc.
Pimephales promelas	68 days	NOEC	154	mg/L	actual conc.
Daphnia magna	48	LC50	700	mg/L	actual conc.
Daphnia magna	21 days	NOEC	110	mg/L	actual conc.
Scenedesmus subspicatus	72	EC50	1	mg/L	actual conc.
Scenedesmus subspicatus	72	NOEC	0.1	mg/L	actual conc.
Lemna gibba	14 d	EC50	1000	mg/L	actual conc.
Lemna gibba	14 d	NOEC	120	mg/L	actual conc.

Species	Duration (hours)	Effect	Endpoint	sediment spiked	remark
Lumbriculus variegatus	28 d	NOEC	50	mg/kg_{dw}	10% o.m.
Caenorhabditis elegans	72 h	NOErC	0.01	mg/kg_{dw}	10% o.m.

Metabolite mA

Species	Duration (hours)	Effect	Endpoint		remark
Oncorhynchus mykiss	96	LC50	4500	mg/L	actual conc.
Lepomis macrochirus	96	LC50	>7000	mg/L	actual conc.
Daphnia magna	48	LC50	2000	mg/L	actual conc.
Daphnia magna	21 days	NOEC	300	mg/L	actual conc.
Scenedesmus subspicatus	72	EC50	3000	mg/L	actual conc.
Scenedesmus subspicatus	72	NOEC	300	mg/L	actual conc.

Toxicity data for vertebrates

Substance B

Species	Duration	Effect	Endpoint	
Anas platyrhynchos	5	LD50	>5000	mg/kg bw
Anas platyrhynchos	8	LC50	>5000	mg/kg feed
Colinus virginianus	10	LC50	>5000	mg/kg feed
Anas platyrhynchos	28 days	NOEC	>500	mg/kg feed
Colinus virginianus	28 days	NOEC	>500	mg/kg feed

Metabolite mA

Species	Duration	Effect	Endpoint	
Anas platyrhynchos	2 days	LD50	>15000	mg/kg bw
Anas platyrhynchos	14 days	LC50	4500	mg/kg feed
Colinus virginianus	9 days	LC50	5000	mg/kg feed
Anas platyrhynchos	120 days	NOEC	>4500	mg/kg feed
Colinus virginianus	130 days	NOEC	450	mg/kg feed

B.8. Estonia

Active: Substance B
Molecular weight: 300 $g.mol^{-1}$
Solubility in water: 3.3 mg/L at 20°C
Log K_{ow}: 3.2 20°C
Vapour pressure: 3.5 x 10^{-3} Pa at 20°C

Subs. – two stereoisomers: R-isomer, S-isomer. R-isomer acts as active regarding efficacy.

Formulation:
500 EC, emulsifiable concentrate, substance B 500 g/l

Intended uses:
Application rate: 750 g a.i./ha – cereals, once per season; from tillering to stem elongation.

1. Environmental risk assessment

Fate And Behaviour

Fate and behaviour in soil

Route of degradation (lab)

Results:

R-isomer

1. mineralisation – 1% after 100 days, 33% after 281 days;
2. bound residues – 78% after 100 days, 55% after 180 days;
3. metabolites:
    1) mA – 30% after 100 days, 60% after 180 days;
    2) mB – only in volatile trap, max 13% after 180 days;
    3) mC – 6% after 100 days

S-isomer

1. mineralisation – 3% after 180 days;
2. bound residues – 60% after 180 days;
3. metabolites:
    1) mA – 10% after 100 days, 30% after 180 days;
    2) fraction of unspecified metabolites – <3%

Concl.: Very low mineralisation rate of both isomers. Amount of bound residues 78% after 100 days in the case of R-isomer is high, although it degrades further to 55% after 180 days. R-isomer seems to degrade more favourably.

Formation of metabolite mA in amounts above 10% of AR indicate that it is relevant for soil organisms. This metabolite is also a main metabolite. The relevance and toxicity to soil organisms according to ecotox data need to be checked.

Rate of degradation (lab):

Aerobic:

Test conditions: 5 soil types – loamy sand, silty loam, sandy loam, loam, clay – for both isomers; 4 soiltypes – loamy sand, sandy loam, clay, loam – for metabolite mA; pH 5.5 – 8.0; pF 2.2-4.5; 0.4 – 16 % OM; temp. 20-29^{o}C.

Results:
R-isomer
DT50 – range: 30 – 110 days, mean 76.3 days.
The fastest degradation is occurres in clay soil, with DT50 30 days.

S-isomer
DT50 – range: 50 – 240 days, mean 162.4 days.
There was a dependence on soil pH and on soil type. Acidic conditions in soil did not favour the degradation. Degradation was faster in clay soil.

Metabolite mA
This metabolite has two isomers (50:50%), which degraded in separate studies with identical DT50 values.
DT50 – range: 25 – 120 days, mean 77 days.
There was a dependence on soil pH and on soil type. Acidic conditions in soil did not favour the degradation. Degradation was faster in clay soil.

Concl.: Subs B degraded in aerobic conditions according to lab studies, while R-isomer degraded faster. DT50 mean value for R-isomer is 76.3 days and for S-isomer 162.4 days. Main metabolite mA degraded with mean DT50 value of 77 days.
The degradation was faster in clay soils and in more alkaline conditions.
Worst case DT50 was in the case of S-isomer 240 days.

Rate of degradation (field):

Test conditions: 6 soil types; locations USA, Spain, UK, Germany, France; bare soil, no data about OM content and pH of soils. Dosage 125 – 750 g a.i./ha.

Results:
R-isomer
DT50 – range: 12 – 100 days, mean 65 days; DT90 – range: 2 months - 1 year.

S-isomer
DT50 – range: 100 – 200 days, mean 163 days; DT90 – range: 1 - 2 years.

Metabolite mA was formed max 25% of AR after 40-190 days, after 369 days only 4% remained.

Concl.: S-isomer was more persistent in all soil conditions, with mean DT50 value of 163 days and DT90 up to 2 years. R-isomer degraded better and DT50 and DT90 values remained below trigger values.
Main metabolite mA did not accumulate in soil, 4% of AR remained after 1 year.

Adsorption:

Test conditions: 1/n : 0.8 – 1.0; content of OM in soil 0.5 – 15%.

Results:
Subs B: K_{OM} : range 2000 – 13500, mean 5412.5. K_{OC} (calculated, mean): 9331.2.
Metabolite mA: K_{OM} : range 12 – 25, mean 18.5. K_{OC} (calculated, mean): 31.9.

Concl.: Subs B adsorbs to soils very strongly. The high K_{OC} value indicates a low potential for leaching.
Main metabolite mA has a potential to leaching.

Column leaching:

Results: In an aged leaching test metabolite C was formed at 3% of r.a. applied after ageing and was after leaching recovered for 3% of the r.a. in the leachate.

Concl.: Metabolite mC is the degradation product of the main metabolite mA and therefore might be relevant for leaching.

PEC soil:

Calculated on worst case basis for S-isomer, which is more persistent in soil, and for main metabolite mA.

Input data:

S-isomer:

- applic. rate cereals 750 g ai/ha
- DT50 field, worst case for Northern Europe 190 days
- assumption: soil depth 5 cm, bulk tensity 1.5 kg/l

Metabolite mA:

- applic. rate cereals 187.5 g ai/ha (assumed that mA is formed at 25% of AR after 190 days)
- DT50 worst case 80.4 days for loamy sand (calculated value from lab studies, which is corrected according to water content is soil and adjusted to field capacity)
- assumption: soil depth 5 cm, bulk tensity 1.5 kg/l

Results:

S-isomer

Crop	Crop interception	Dose kg a.i./ha	PEC initial (mg/kg)
1. Cereals	0.5	0.750	0.5

Table of PEC values (mg(kg) in cereal

Time t; d:	TWA	Actual
1	0.499089	0.498179
2	0.49818	0.496365
4	0.49637	0.492757
7	0.49367	0.487393
28	0.475311	0.451448
42	0.463578	0.42897
100	0.418945	0.347163

Metabolite mA

Crop	Crop interception	Dose kg a.i./ha	PEC initial (mg/kg)
1. Cereals	0.5	0.188	0.1253

Table of PEC values (mg(kg) in cereal

Time t; d:	TWA	Actual
1	0.124792	0.124252
2	0.124254	0.12318
4	0.123186	0.121064
7	0.121608	0.117958
28	0.111289	0.098335
42	0.105061	0.087102
100	0.083835	0.052696

Concl.: PEC initial in soil for S-isomer of subs B is 0.5 mg/kg and for main metabolite mA 0.1253 mg/kg. PEC TWA after 28 days in soil for S-isomer is 0.4753 mg/kg and for mA 0.1113 mg/kg.

Fate and behaviour in water:

Hydrolytic degradation: Results: subs B does not hydrolyse in water.

Ready biodegradability: subs B is inherently biodegradable (shows potential degradability)

Degradation in water/sediment:

Results: no differencies in behaviour between both isomers.

Substance B

DT50 water – range 1-3 days, mean 2 days; DT50 whole system > 180 days; DT50 sediment > 180 days.

Metabolite mA
DT50 water – range 60-90 days, mean 73 days; DT50 whole system 90 - 110 days; DT50 sediment 150 - 180 days.

Distribution of metabolite mA: 11% in the water phase after 180 days and 6% after 180 days in the sediment.

Concl.: Subs B rapidly disappears from water phase, but it is relatively persistent in sediment with DT50 more than 180 days. The toxicity to sediment dwelling organisms according to ecotox data need to be checked.
Main metabolite mA is relevant for water, 11% of this metabolite was found in water phase, where it disappears with DT50 mean value of 73 days.
The higher OM content and acidic conditions favoured the degradation of parent and metabolite in the system.

PEC SW:

Calculated on worst case basis for parent and for main metabolite.

Subs B
Input data:

cereals with one application

spray drift - according to new aquatic guideline; 90th percentiles drift values
application rate – 750 g ai/ha
water body – 30 cm depth
DT50 – 2 days (calculated mean value for water phase from water/sed study)

Metabolite mA
Input data:

cereals with one application

spray drift - according to new aquatic guideline; 90th percentiles drift values
application rate – 82.5 g ai/ha (assumed that mA is formed at 11% after 180 days)
water body – 30 cm depth
DT50 – 73 days (calculated mean value for water phase from water/sed study)

Results:
Subs B:
PEC initial 0.25 mg/l (overspray), all values in the table.

Table of PEC values (mg/l)
Cereals

Time (days)	Overspray		1 m - drift (2.77%)		5 m - drift (0,57%)		10 m - drift (0,29%)		20 m - drift (0,15%)	
	Actual	TWA	Actual	TWA	Actual	TWA	Actual	TWA	Actual	TWA
Initial	0.2500	0.2500	0.006925	0.006925	0.001425	0.001425	0.000725	0.000725	0.000375	0.000375
1	0.176777	0.211278	0.0048967	0.005852	0.001008	0.001204	0.000512652	0.000612706	0.000265	0.000317
2	0.125	0.180337	0.0034625	0.004995	0.000713	0.001028	0.0003625	0.000522977	0.000625	0.000271
4	0.0625	0.135253	0.0017313	0.003746	0.000356	0.000771	0.00018125	0.000392233	0.000094	0.000203
7	0.022097	0.093941	0.0006121	0.002602	0.000126	0.000535	6.40816E-05	0.00027243	0.000033	0.000141
14	0.001953	0.051122	5.41E-05	0.001416	1.11E-05	0.000291	5.66406E-06	0.000148255	0.000003	0.000077
21	0.000173	0.034326	4.782E-06	0.000951	9.84E-07	0.000196	5.00637E-07	9.95459E-05	0.000000	0.000051
28	1.53E-05	0.025761	4.227E-07	0.000714	8.7E-08	0.000147	4.42505E-08	7.47064E-05	0.000000	0.000039
42	1.19E-07	0.017175	3.302E-09	0.000476	6.79E-10	9.79E-05	3.45707E-10	4.98073E-05	0.000000	0.000026

Metabolite mA:
PEC initial 0.028 mg/l (overspray), all values in the table.

Time (days)	Overspray		1 m - drift (2.77%)		5 m - drift (0,57%)		10 m - drift (0,29%)		20 m - drift (0,15%)	
	Actual	TWA	Actual	TWA	Actual	TWA	Actual	TWA	Actual	TWA
Initial	0.0277	0.0277	0.000766	0.000766	0.000158	0.000158	8.02E-05	8.02E-05	0.000042	0.000042
1	0.027405	0.027536	0.000759	0.000763	0.000156	0.000157	7.95E-05	7.99E-05	0.000041	0.000041
2	0.027146	0.027406	0.000752	0.000759	0.000155	0.000156	7.87E-05	7.95E-05	0.000136	0.000041
4	0.026636	0.027148	0.000738	0.000752	0.000152	0.000155	7.72E-05	7.87E-05	0.000040	0.000041
7	0.025888	0.026767	0.000717	0.000741	0.000148	0.000153	7.51E-05	7.76E-05	0.000039	0.000040
14	0.024223	0.025907	0.000671	0.000718	0.000138	0.000148	7.02E-05	7.51E-05	0.000036	0.000039
21	0.022665	0.025083	0.000628	0.000695	0.000129	0.000143	6.57E-05	7.27E-05	0.000034	0.000038
28	0.021208	0.024294	0.000587	0.000673	0.000121	0.000138	6.15E-05	7.05E-05	0.000032	0.000036
42	0.018568	0.022816	0.000514	0.000632	0.000106	0.00013	5.38E-05	6.62E-05	0.000028	0.000034

PEC GW:

1. **<u>Modelling using PELMO version 2.2.2.</u>**

26 year run. Simulation for parent (S-isomer, as it more persistent), for main metabolite mA and for it's metabolite mC.

Scenario: Jokioinen (more similar for Estonian conditions), spring cereals.

As several data for metabolites mA and mC (mol weight, vapour pressure etc) is missing, assumptions have been made about these characteristics for these metabolites.

Proposed pathway for degradation:

Substance B (S-isomer) → CO2 + bound residues
3 + 60 = 63%
↓
30% to met mA
↓ ↓
9% to met Mc 91% to CO2
↓
100% to CO2

<u>Input data (for both models):</u>

<u>Subs B</u>

Mol. mass	300
Solubility in water	3.3 mg/l
Vapour pressure	3.5×10^{-7} Pa, 20°C
Dose	750 g ai/ha ⇒ 0.750 kg/ha x 0.5 = 0.375 kg/ha
Application	May 25 on crop canopy
Interception	BBCH 20-39 – 50% = 0.5
Plant cover	50%
Plant uptake factor	0.5
Crop	spring cereals
DT50	144.3
K_{OC}	9331 (average)

l/n 0.9 (estimated average)
Transformation rate 0.3 to met mA, 0.63 to CO2 + bound residues

DT50 lab data recalculated, in recalculations pF changed to max field capacity (pF2) according to table 5.2 from FOCUS.
Used lab values for recalculations:

Texture	pF	Lab DT50	Recalculated DT50
Loamy sand	2.2	195	130.7
Loamy sand	2.2	240	160.8
Silty loam	3.0	177	173.5
Silty loam	3.0	208	203.8
Sandy loam	2.5	110	93.5
Sandy loam	2.5	127	108
Loam	3.0	170	171.7
Loam	3.0	185	186.9
Clay	4.5	50	70

Average DT50 = 144.3

Metabolite mA
Mol. mass 150 (considering 0.5 weight units of as)
Solubility in water no data (assuming 3.3 mg/l as for parent)
Vapour pressure no data (assuming 3.5 x 10^{-7} Pa, 20°C as for parent)
Plant uptake factor 0.5
DT50 63.2
K_{OC} 31.9 (average)
l/n 0.9 (estimated average)
Transformation rate 0.09 to met mC, 0.91 to CO2

DT50 lab data recalculated, in recalculations pF changed to max field capacity (pF2) according to table 5.2 from FOCUS.
Used lab values for recalculations:

Texture	pF	Lab DT50	Recalculated DT50
Loamy sand	2.2	95	63.7
Loamy sand	2.2	120	80.4
Sandy loam	2.5	60	51
Loam	3.0	85	85.9
Clay	4.5	25	35

Average DT50 = 63.2

Metabolite mC

Mol. mass	75 (considering 0.5 weight units of mA)
Solubility in water	no data (assuming 3.3 mg/l as for parent)
Vapour pressure	no data (assuming 3.5 x 10^{-7} Pa, 20^{o}C as for parent)
DT50	63.2 (assuming the same as for mA)
K_{OC}	31.9 (assuming the same as for mA)
l/n	0.9 (estimated average)
Transformation rate	1 to CO2

Results:
Calculated 80th percentile concentration for substance B – 0.000 μg/l, for main metabolite mA – 0.124 μg/l and for metabolite mC – 0.638 μg/l.

2. Modelling using PEARL version 1.3.13

Simulation for parent (S-isomer), for main metabolite mA and for it's metabolite mC. 26 year run.
Scenario: Jokioinen, spring cereals.
Input data and proposed pathway the same as for PELMO.

Results:
Calculated 80th percentile concentration for substance B – 0.000 μg/l, for main metabolite mA – 0.965 μg/l and for metabolite mC – 0.062 μg/l.

Concl.:
Predicted 80th percentile concentration of substance B in GW is far below 0.000 μg/l and do not ecxeed the trigger value 0.1 μg/l. Predicted 80th percentile concentration of main metabolite mA in GW is about 0.965 μg/l and this is above the trigger value 0.1 μg/l. Predicted 80th percentile concentration of metabolite mC in GW is about 0.638 μg/l and is this above the trigger value 0.1 μg/l too.
Parent substance B is not expected to leach to GW according to model calculations, but the main metabolite mA and it's metabolite mC have the potential risk to leach to GW. Therefore, more data is needed about tox properties of these metabolites (genotoxic, toxic to reproduction, carcinogenic, toxic or very toxic) to decide about their relevance in the decision making.

Degradation in air:

Photolytic degradation: no photodegradation.

6. Summary for e-fate

Metabolisation and degradation

1. Substance B undergoes degradation in soil and water. Substance is stable to hydrolysis, does not hydrolyse in water. No photodegradation.
2. The degradation of subs B in soil studies is characterised by very low mineralisation rate, for S-isomer only 3% after 180 days. There is no formation of bound residues above trigger value, about 55-60% after 180 days for both metabolites.
3. Metabolite mA formed max 60% after 180 days from R-isomer and max 30% from S-isomer in soil lab studies and max 25% of AR in field studies. This metabolite is main and considered as relevant for leaching. Metabolite mB formed max 13% only in volatile trap. Metabolite mC

formed 6% from R-isomer in lab and 3% in aged leaching test and it's relevance for leaching have been checked.
4. Subs B degrades rapidly in water in water/sed systems, but is more stable in sediment. 11% of metabolite mA was found in water and this metabolite is also relevant for aquatic systems.

Persistence

1. S-isomer of substance B is quite persistent under aerobic conditions in soil according to lab studies with DT50 mean value of 162.4 days, while the same value for R-isomer is 76.3 days.
2. S-isomer of substance B is also persistent in soil according to field studies with DT50 mean value of 163 days and DT90 up to 2 years.
3. Metabolite mA degarded in lab conditions with DT50 mean value of 77 days. It did not accumulate in soil according to field studies.
4. Substance B is not persistent in water, but it is more persistent in sediment with DT50 value of more than 180 days.
5. Metabolite mA degrades in water with DT50 mean value of 73 days and in sediment with DT50 value of 150-180 days.

PECs

1. PEC initial in soil for subs B (S-isomer) is 0.5 mg/kg and for main metabolite mA 0.125 mg/kg. PEC TWA after 28 days in soil is 0.475 and 0.111 mg/kg accordingly, which are far below from the chronic toxicity endpoints for earthworms in soil.
2. PEC SW - max PEC initial for substance B is 0.25 mg/l and for metabolite mA is 0.028 mg/l in the case of overspray.
3. PEC GW - 80th percentile concentration for subs B is far below 0.000 μg/l and do not ecxeed the trigger value 0.1 μg/l, for metabolite mA this value is 0.965 μg/l and for metabolite mC 0.638 μg/l.

Adsorption/mobility and leaching

1. Subs B adsorbs to soils strongly with K_{OC} mean value of 9331 and have a low potential for leaching.
2. Main metabolite mA has a high potential for leaching with mean K_{OC} value of 32.

Accumulation in soil/bioaccumulation

1. Substance B is not accumulative in soil, it degrades to metabolites, mainly to mA, which is not accumulative according to field studies, only 4% of AR remained after 1 year.
2. This is supported also by the results of studies with soil micro-organisms, where the subs does not have the negative effect on soil respiration and nitrification.
3. S-isomer of subs B and it's metabolite mA have the potential to bioaccumulate in aquatic organisms.

Overall Conclusions:

1. Substance B undergoes some degradation in soil and in water, but the substance and main metabolite mA are quite persistent in soil and in aquatic systems. Therefore the toxicity of parent and relevant metabolites to soil and aquatic organisms need to be clarified.

2. There is a concern regarding the contamination of ground water by metabolites mA and mC. Therefore, more data is needed about tox properties of these metabolites (genotoxic, toxic to reproduction, carcinogenic, toxic or very toxic) to decide about their relevance in the decision making.

3. Definition of residues relevant to the environment:
   Soil – parent (S-isomer), mA
   Surface water - parent, mA
   Sediment - parent
   Ground water - parent, mA, mC

Additional data needed:

Depending on the results of available toxicological studies, genotoxicity, carcinogenicity, teratogenicity and toxicity studies with metabolites mA and mC.

B.9. Japan

2.1. Primary name : Substance B

2.2. Physical chemical properties

2.3. Degradation in soil

2.3.1.1. Laboratory studies

Some DT50 of the laboratory tests of Substance B aren't longer than one year, which meets in the standards for withholding of agricultural chemicals Registration. As a result, the formulated product containing Substance B will be registered. If paddy will be included in target crop of the formulated product, studies of water polluting properties should be conducted.

The amount of mA is 60% of Substance B. So DT50 of mA as well as Substance B should be clearly identified, in accordance with Japanese test guideline (8147).
However, if any available data indicate non-toxic concern of mA, DT50 of mA may not be identified.

2.3.2. Field studies

Some DT50 of the field tests of Substance B aren't longer than one year, which meets in the standards for withholding of agricultural chemicals Registration. As a result, the formulated product containing Substance B will be registered. If paddy will be included in target crop of the formulated product, studies of water polluting properties should be conducted.

Studies of residue of succeeding crops will be necessary, since some DT50 are longer than 100 days in field study.

The amount of mA is 25% of Substance B. So DT50 of mA as well as Substance B should be clearly identified, in accordance with Japanese test guideline (8147).
(http://www.acis.go.jp/eng/indexeng.htm)
However, if any available data indicate non-toxic concern of mA, DT50 of mA may not be identified.

2.4. Adsorption

Adsorption is available as one of the triggers of additional studies on studies of fate in aerobic soil. (If DT50 of studies of fate in aerobic soil is 100 or over and Kom is less than 500, DT50 of studies of fate in anaerobic soil may be identified.)

2.5. Column leaching

No data requirement at present.

2.6. Degradation in the aquatic environment

2.6.1. Degradation in water-sediment systems

No data requirement at present.

2.6.2. Hydrolysis

Hydrolysis as part of physical and chemical properties is used to identify the compound.

2.6.3. Ready biodegradability

No data requirement at present.

2.7. Degradation in air

No data requirement at present.

2.8. Bioaccumulation

No data requirement at present.

2.9. Toxicity to earthworms

No data requirement at present.

2.10. Effects on micro-organisms

No data requirement at present.

2.11. Toxicity data for aquatic species

We use only LC50 (Carp) of formulated products for fish risk management. But there isn't LC50 of formulated products in table 2.11, we tried to extrapolate LC50 of *Cyprinodon variegates* of active ingredient to those of formulated products (50EC).

So we considered a worst-case scenario and evaluated the effect to fish.

50EC(5%)
1. LC50 1200mg/l, as LC50 of 50EC
2. Maximum amount of use: 40ml/10a (cereals)
3. Z (risk) = Y (PEC) / X (toxicity)

Y = 0.8 ppm
X = 1200、
Z= 0.8/1200 = 0.0006
Precaution phrase;
No specific concern

2.12. Toxicity data for vertebrate

Those data are used to estimate ADI and to provide precaution phrase for operator.

B.10 The Netherlands

Persistence in soil

Substance B has two isomers, the S-isomer and the R-isomer. There is a clear difference in stability under aerobic conditions for the 2 isomers.

The DT50 values determined at a temperature of 29-31 ºC are excluded for the Dutch assessment. The values determined a 25 ºC will be recalculated to 20 ºC using the Arrhenius equation. $DT_{50,lab}$ values for the S-isomer range from 177 to 208 days, the average is 191 days. $DT_{50,lab}$ values for the R-isomer range from 66 to 110 days, the average is 90 days. These results mean that field studies are triggered.

For the reported field studies no detailed information on the sites (climate/history/site information) is available which is necessary in principle to decide if the field studies are relevant for the Dutch situation. Therefore in this case we would use only the data from the UK and Germany. Because the value from France is in the same order of magnitude this can be considered as well. The average $DT_{50,\ field}$ for the R-isomer is 67 days (range 12-100 days), for the S-isomer there is only 1 field value available, 190 days. This means that for the R-isomer substance B meets the persistence criteria. However, the S-isomer does not pass the criterium of a maximum DT_{50} of 180 days for new substances and substances that are not listed on the Annex I.

Considering substance B a new substance no further assessment is necessary. No registration possible.

B.11. Germany

Persistency

Soil

R-isomer

endpoint	**value**	**assessment**	**class**
dt_{50}	30-100 days	slow primary degradation	III
CO_2	no data	not assignable	n.a.
bound residues	n.d.	n.a.	n.a.

persistence category III, high persistence in soil

S-isomer

endpoint	**value**	**assessment**	**class**
dt_{50}	> 100 days	negligible primary degradation	IV
CO_2	no data	not assignable	n.a.
bound residues	n.d.	n.a.	n.a.

persistence category IV, not biodegradable in soil

Metabolite mA

endpoint	**value**	**assessment**	**class**
dt_{50}	30-100 days	slow primary degradation	III
CO_2	< 10 %	negligible mineralisation	IV
bound residues	> 50 %	very high plateau	IV

persistence category III, high persistence in soil

Result: substance is not biodegradable in soil (persistence category IV)

Water/Sediment System

water

endpoint	value	assessment	class
dt_{50}	< 10 days	rapid primary degradation	I
CO_2	no data	not assignable	n.a.
bound residues	n.d.	n.a.	n.a.

persistence category I, rapid primary degradation in water

sediment

endpoint	value	assessment	class
dt_{50}	> 100 days	negligible primary degradation	IV
CO_2	no data	not assignable	n.a.
bound residues	n.d.	n.a.	n.a.

persistence category IV, not biodegradable in sediment

whole system

endpoint	value	assessment	class
dt_{50}	> 100 days	negligible primary degradation	IV
CO_2	no data	not assignable	n.a.
bound residues	n.d.	n.a.	n.a.

persistence category IV, not biodegradable in water/sediment system

Result: substance is not biodegradable in water/sediment system (persistence category IV)

Bioaccumulation

R isomer

endpoint	value	assessment	category
BCF	30-100	moderate BCF	II
ct_{50}	< 3 days	rapid elimination	I
organ specific bioaccumulation?	no data	n.a.	n.a.
uncompleted elimination?	n.d.	n.a.	n.a.

overall assessment category II, indication of risk potential

Calculation of the overall assessment category considers also the lack of information on organ specific bioaccumulation and uncompleted elimination.

S isomer

endpoint	value	assessment	category
BCF	100-1000	high BCF	III
ct_{50}	3-10 days	delayed elimination	II
organ specific bioaccumulation?	no data	n.a.	n.a.
uncompleted elimination?	n.d.	n.a.	n.a.

overall assessment category III, cause for concern

Calculation of the overall assessment category considers also the lack of information on organ specific bioaccumulation and uncompleted elimination.

metabolite mA of R isomer

endpoint	value	assessment	category
BCF	30-100	moderate BCF	II
ct_{50}	< 3 days	rapid elimination	I
organ specific bioaccumulation?	no data	n.a.	n.a.
uncompleted elimination?	n.d.	n.a.	n.a.

overall assessment category II, indication of risk potential

Calculation of the overall assessment category considers also the lack of information on organ specific bioaccumulation and uncompleted elimination.

metabolite mA of S isomer

endpoint	**value**	**assessment**	**category**
BCF	100-1000	high BCF	III
ct_{50}	< 3 days	rapid elimination	I
organ specific bioaccumulation?	no data	n.a.	n.a.
uncompleted elimination?	n.d.	n.a.	n.a.

overall assessment category III, cause for concern

The lack of information on organ specific bioaccumulation and uncompleted elimination leads to an overall assessment category which is higher than the one based on calculation alone.

Result for substance B: cause for concern (overall assessment category III)

ANNEX C – ANSWERS TO QUESTIONNAIRE

C.1. Questionnaire

Thank you for performing the assessments. The following questions refer to the conclusions on case study substances 1 and 2, and address more generally the assessment procedure and methodology used for your national registration process for pesticides.

The question(s) your answer is referring to should be clearly indicated. Participants are invited to respond in English and may choose their own format for the reactions to the questionnaire.

1) Conclusions drawn on the substances in Case study 1 and 2, respectively.
   a) What's your final conclusion on the Persistency of the substance?
   b) What's your final conclusion on the Bioaccumulation potential of the substance?
   c) Do the PB properties of the substance give reason to add further element(s) to your normal standard for assessment? If so, in what way?
   d) Do the PB properties per se merit risk mitigation or other regulatory decision like limiting areas of use, ban of product etc.?

2) Assessment criteria
   a) When does a substance or its metabolite(s) qualify for a risk assessment on persistency or bioaccumulation (PB)? For example: minimum total annual consumption, demonstrated absence of hazard, minimum formation rate per compartment, minimum application rate of product.
   b) Do the PB assessment criteria apply to all enantiomers, fermentation products, and by-products of the active substance?
   c) Are there different standards per PB criterion for different substances (e.g. active or not)?
   d) Is accumulation in compartments due to repeated use over the years or in the region, considered as a criterion?

3) On the use of guidance or protocols.
   a) What are the guidelines, protocols or SOPs used in the evaluation of submitted literature on PB?
   b) What are the guidelines, protocols or SOPs used in the product safety assessment on PB (environmental risk assessment)

4) Standards: Is persistency part of the risk assessment?
   a) What are the criteria (e.g. DT50) and standards relating (e.g. 180 days) to persistency?
   b) Are the criteria on persistency for the different compartments (soil, water, sediment, groundwater, feed, air) the same?
   c) Are lab-results equivalent to (or super-seded by) results obtained from field-studies regarding
      i) formation of metabolites (identity, percentage)
      ii) persistency?
   d) If field results can outweigh lab-results, are there specific criteria that have to be fulfilled (sufficient study replications, sampling strategy, detection limits etcetera)?
   e) If a substance is considered to be persistent, what will be the next step in the risk assessment?

5) Standards: Are data on bioaccumulation used in the risk assessment?
   a) What are the criteria used for bioaccumulation? BCF_{fat}, $BCF_{ww/wo}$ and/or other[33]?

[33] BCFfat: accumulation factor in fat tissue; BCFww/wo: accumulation factor in wet weight for the whole organism.

b) Are the criteria on bioaccumulation for the different compartments or functional groups (water, vertebrates) the same?
c) Is elimination/depuration taken into account, if so: how?
d) Are results based on radio-activity acceptable?
e) What property value or level of risk is acceptable? What value triggers further assessment or additional requirements?
f) If a substance is considered to be bioaccumulating, what will be the next step in the risk assessment?

6) Standards: Are data on bio-magnification through the food-chain used in the risk assessment?
   a) What are the criteria used for bio-magnification? BCF_{fat}, $BCF_{ww/wo}$ and/or other?
   b) Are the criteria on bio-magnification for the different compartments or functional groups (water, vertebrates) the same?
   c) What property value or level of risk is acceptable? What value triggers further assessment or additional requirements?
   d) If a substance is considered to be biomagnifying, what will be the next step in the risk assessment?

7) Do the standards on persistency also apply to inorganic compounds and inorganic metabolites?

8) Bound residues can potentially be a source of active compounds if the organic matter is degraded. Are there additional considerations to the criteria listed above for products that generate large amounts of bound residue (e.g. >70% of applied activity)?

9) Has completing the questionnaire make you revise the assessment of the PB criteria or even change conclusions on the substances? What aspects were the most challenging?

Thank you for your efforts. Please report your findings in English to mark.montforts@rivm.nl

C.2. Slovak Republic

1a) Substance A preparation may be applicated on loamy sand and silty loam and also at more acidic pH. In other types of soils unacceptably high amounts of substance persist.

1a) Substance B degradation half-life is acceptable for all types of soils and single way of application R-isomer has more suitable features.

1b) Substance A for water organisms the bio accumulative coefficients are high, during application it is suitable to restrict the enter of preparation in water environment.

1b) Substance B bio accumulative coefficients are suitable better values are for R-isomer.

1c) It is a need to evaluate the bio accumulative tests on birds and rodents, especially wildlife predators. For the problem of persistency there is a need to determine pH of soil in the field studies.

1d) Substance A – yes. Use on loamy sand and silty loam at more acidic pH. Do not use on clay and sandy soils.

1d) Substance B Because of high bio accumulative coefficients on water organisms minimizes the contact of preparation with water environment during application.

2a) At the time of crops harvest.

2b) Incompletely lack information about degradation products of single active substances.

2c) Yes, according to toxicity of substance and accumulation in the environment and its further transport in food chain.

2d) Yes, for substance A. For substance B these data are missing.

3a) These data are uncompleted, especially for some non-target species.

3b) Data about safety precautions are missing for both substances.

4a) Besides DT there is a need to inform about solubility in water and lipids, information about photolysis, hydrolysis etc.

4b) No. In all these environmental compartments biodegradation factors are different.

4c) In laboratory and field conditions the different doses were used and therefore the comparison is difficult. In the laboratory study for Substance A and B the worse features were determined than in field conditions.

4ci/ii) Data about persistency and formation of metabolites are missing for substance A in this study.

4e) To determine the ways for this substance in food chain, ecosystem and measures for more rapid degradation (melioration, the change of crops...)

5a) Solubility in water and lipids. Ways for entry into food chain.

5a) Substance A- laboratory and field studies differ and they are imprecise, large-scale range.

5a) Substance B- differences according to soil type.

5b) No, water organisms are in more narrow contact with environment. Position in food chain includes bioaccumulation-the most sensitive are predators. Bio accumulative coefficient. Sensitivity of „end“ species to preparations, especially predators.

Substance A – the studies must be aim on quails, pheasants, rodents living in the area of use. As well as bees.

5b) Substance B – few target species, data for applicated doses LC,NOEC are missing. Important data for domestic birds are missing.

5c) As the evaluation of degradation time percentage of active substance in the environment for target species –persistency and bioaccumulation in water. Degradation in air-fruit trees, leaves of sugar beet, wheat-data about photolysis of preparation are missing.

5c) Substance B – to use on sandy and clay soils.

5d) partially yes, but measurement whether labelled element is a part of parent molecule or was transported into other compounds of which toxicities are unknown.

5e) Which have got a minimal effect on the most sensitive organisms in the ecosystem, especially „end“ species in food chain, predators, influence on man.

5f) To determine the way in food chain, to the most effective dosing to restrict the excessive application into ecosystem.

6a) Also the amount preparation accumulating in the sediments, water soil.

6b) They are different because of different position in food chain and intensity of metabolism caused by different stage of phylogenetic development.

6c) The dose that does not influence the most sensitive species in area of application of active doses.

6d) Evaluation of measurements and areas of use in which these undesirable effect are minimized (melioration and suitable agro technical procedures)

7) It is different because many organic substances are more complicated and undergo difficult changes.

8) Determination of certain metabolites their toxicity may be useful, e.g. radioactive labelling method.

9) To fill in the questionnaire help me in revision of possible risks according to available data even if the list was not complete and certain important data, e.g. toxicity in bees for preparation used in agriculture, were missing.

C.3. Australia

Question 1: Conclusions drawn on the substances in Case study 1 and 2, respectively.

1a) Substance A: It was concluded that substance A may be persistent in some soil types, in cropping areas, where multiple applications are used at short intervals, and if repeat applications are carried out year after year. Soil accumulation is not expected to be of concern in crops grown in rotation, with only one application per season.

It was concluded that substance A would persist in sediment if allowed to enter the aquatic environment through run-off or spraydrift. The potential for this to occur is increased where multiple applications are used, and repeated year after year.

Substance B: The R isomer of substance B is not persistent in the field soils according to the persistence criteria used. The S isomer could persist in some soil types (DT50 >180 days). Soil acccumulation due to persistence is not expected from a single application each year, nor when cereal crops are grown in rotation. However, substance B is persistent in sediment (DT50>180 days) which is of concern if significant aquatic contamination occurs.

1b) Substance A: It was concluded that substance A has considerable potential to bioaccumulate in organisms if organisms were repeatedly exposed to the substance through contamination of water by spraydrift or runoff.

Substance B: It was concluded that substance B should not bioaccumulate.

1c) Standard assessment methodology based on the risk quotient of ecotoxicity results and the potential environmental concentration (PEC) calculations do not deal well with persistence and bioaccumulation. While these properties can be identified, some additional elements are needed to deal with them, such as PB criteria that would restrict registration if they were not met. Australia currently does not have such a policy.

1d) Substance A: We make recommendations to the regulatory agency that measures are required to avoid contamination of aquatic areas by direct overspray, spray drift and run-off to protect aquatic and benthic organisms from chronic exposure. For example, buffer zones, limitations on the number and frequency of repeat applications.

Substance B: No measures were recommended for substance B.

For a new active ingredient being registered for use in Australia, a suite of additional information would be required than was provided in the case studies prior to beginning the assessment process. For example:

- draft labels for each use pattern, which include more detail on the method of application eg. ground or aerial spray, and the type of equipment, and suitable advice to minimize aquatic contamination by the product.
- full test reports for all required physico-chemical, fate and toxicity studies.
- long-term soils accumulation studies.

2a) Persistence and bioaccumulation are considered in the risk assessment if there is evidence that the substance is persistent or may bioaccumulate. Evidence may include physical and chemical or fate properties such as log Kow, DT50, BCF. Other factors considered in the decision-making are how toxic the substance is, whether use patterns indicate a potential for aquatic contamination (ie aerial spraying), the field application rates (high rates, repeat applications etc.), potential to accumulate in soil and sediment. However, Australia does not currently have formal criteria for unacceptable levels of persistent and bioaccumulation.

2b) While Australia has no formal PB assessment criteria, environmental tests should be conducted on the active ingredient as used, i.e. include all enantiomers, fermentation products and by-products.

2c) No, there are no formal PB criteria at present.

2d) Yes, but during the assessment in the absence of criteria.

3a) Australia has not developed its own test guidelines and we refer to the guidelines and protocols under which the particular fate or toxicity test was conducted. These may include current OECD, SETAC, EC and US test guidelines, depending on the study submitted. Some of these include, the OECD Test Guidelines, the US EPA Pesticide Assessment Guidelines, Subdivision N, Chemistry, Environmental Fate § 161-2, Oct. 18, 1982; the EC Commission Directive 95/36/EC amending Council Directive 91/414/EEC Annexes I + II, Fate and Behavior in the Environment, 14th July 1995, and SETAC Procedures for Assessing the Environmental Fate and Ecotoxicity of Pesticides, March 1995.

3b) See Qa above.

4a) The criteria used to determine persistence of a substance is the DT50 or half-life. We do not generally determine an "overall persistence", but rather determine the maximum degradation half-life time for a specific media (i.e. water, soil). We may also determine the DT50 for a specific mechanism (photodegradation, hydrolysis, biodegradation). We then compare these data to international classifications such as those of the OECD and the US EPA, and in the past, have widely used those published by Mensink *et al*. (1995).

The cut-off values informally used to determine the persistence of substance A and B are those defined in the Stockholm Convention on Persistent Organic Pollutants (POPs).

4b) The criteria for persistence differ for each compartment or degradation mechanism. The criteria used for substance A and B to determine persistence in the different compartments were as follows: sediment and soils, DT50 >180 d; water, DT50 >60 d, air DT50 >2 d.

4c) We generally prefer data from field studies rather than from laboratory studies to represent on-farm conditions when evaluating persistence and metabolite formation.

4d) All studies (laboratory and field) need to meet the criteria set out under the test guidelines for that particular study. We normally require the full test reports for all environmental fate studies. From the raw data, we are able to assess the quality of the data in terms of meeting the guidelines and protocols, the test conditions and methodologies used, etc. From the details of the field studies, we are better able to assess the potential behaviour of the chemical under Australian conditions (eg. soil, climate, rainfall, use patterns). We use a weight of evidence approach for persistence by considering all of the relevant data.

4e) If the weight of evidence indicates a substance is persistent, a risk assessment for persistence is incorporated within an overall hazard and risk assessment.

The overall hazard and risk assessment involves developing exposure scenarios for on farm and off-site transport for each use pattern and application rate, and then determining expected environmental concentration (EEC) for each compartment (eg soil, water, sediment). *Environment Australia* normally uses a tiered approach when developing exposure scenarios, beginning with the worst-case situation. We then compare the EEC's for each scenario and compartment against the relevant ecotoxicity data. We select pivotal values for toxicity (EC50, NOEC) for the most sensitive species.

To determine the potential for soil accumulation of substance A and B due to persistence, we model the range of soil concentration likely to be carried over from year to year, using the worst-case half-life (from field studies) and maximum application rates. In the case of substance A, to get our worst-case application rate, we used the highest number of repeat applications, shortest frequency between applications, and assumed no degradation between applications or interception by vegetation.

To determine sediment accumulation, we initially used worst-case aquatic contamination situations in terms of off-site transport (100% overspray), water depth (shallow), partitioning to sediment (100%), half-life (worst-case). We then refine these scenarios to more realistic situations.

5a) The criteria used to determine bioaccumulation include log Kow, BCFfat, or BCFww/wo. In the case of substance A and B, the BCF ww/wo was used. We tend to use the criteria and definitions in the Stockholm Convention on Persistent Organic Pollutants (POPs) to classify a substance as bioaccumulative. These criteria are similar for the US EPA, Environment Canada (i.e. BCF>5000; BAF>5000, or log Kow >5) but have not been adopted formally.

Other factors considered are how toxic the substance is to fish and Daphnia (highly toxic if EC50 <1 mg/L; NOEC <0.01 mg/L), and the persistence.

5b) Log Kow is used as an indicator of potential to bioaccumulate in all organisms. While the BCF generally is provided for fish and other aquatic organisms, in the absence of other data, the BCF (fish) may be assumed to indicate, in a general way, a potential to bioaccumulate in all organisms. For substances released directly to water, eg. antifoulants, we have requested bioaccumulation data for other organisms such as shellfish.

5c) Elimination and depuration are taken into account when considering the overall potential to cause harm to aquatic organisms due to bioaccumulation. For example, in considering the bioaccumulation of substance A, the DT50 for depuration was compared to the frequency between repeat applications of the fungicide. The half-life for clearance was longer than the worst-case application frequency of 4-days, which increased the concern for bioaccumulation, as it meant that, if overspray/runoff was not managed and contamination occurred, relatively constant levels of the substance could be maintained by repeat applications, such that concentrations of the substance in aquatic organisms could steadily increase.

5d) Bioaccumulation testing using ^{14}C-radioactivity is normally an acceptable measure, provided we have the raw data to check details.

5e) This is done on a case-by-case basis as we have limited experience in this area.

5f) See Qe above.

6a) The BCF would be used in the absence of other data as a general indicator. However, we do not generally consider biomagnification in organisms, that is, bioaccumulation in organisms at higher levels than are found in its food. In our experience, this is relatively rare for modern pesticides. Data for whole body concentrations of a substance in the tissue of terrestrial organisms are generally not available. There are also no methods available to relate soil concentrations to whole body concentrations in soil or sediment dwelling organisms. Therefore, bioaccumulation in mammals, birds, and other terrestrial organisms is not generally considered in the risk assessment.

6b) See question 6a.

6c) See question 6a.

6d) See question 6a.

7) No.

8) For substance A, there are no additional considerations with regard to the degradation of organic matter, and potential release of active compounds from bound residue, i.e. from product that generate large amounts of bound residue (>70%). However, these factors may be discussed in the assessment. For substance B, where bound residues (R isomer) reached 78% after 100 days, their subsequent availability through mineralisation was considered in the assessment of sensitive soil fauna.

9) It has reminded us, as has occurred in several recent assessments, that the current assessment methodology does not deal easily with persistence and bioaccumulation, and it has also reinforced the need to develop a PBT policy, including adopting formal criteria, to better take these factors into account.

C.4. France

(Work done in collaboration with P.GAILLARDON and E. THYBAUD)

This questionnaire has been answered in collaboration with pesticides experts according to the real national standards and procedures.

2a) PB assessment is done for every substance and for relevant metabolites.

2b) Yes

2c) No but the degradation product should be considered as relevant to be assessed in the same way as the active substance

2d) Yes

3a) SETAC: procedure for assessing the environmental fate and ecotoxicity of pesticides. Ed. Dr M. Lynch

3b) Council Directive 97/57/EC of 22 September 1997 establishing Annex VI (uniform principles) to directive 91/414/EEC concerning the placing of plant protection products on the market.

4a) DT90 soil (field study) >1 year
DT50 soil > 3 months

4b) DT50 is used for soil, water and sediment. DT90 is used for soil. No criteria for feed and air.

4c) Data regarding formation of metabolites are obtained from lab results which are more precise, but data from field studies can be used if they show a higher risk. Data regarding persistency obtained from field studies always supersede lab data.

4d) Yes:
- studies should be carried out in four different location
- plot size is 100 m2
- soil sampling:
-1 control
-5 sampling periods
-20 cores per plot at 0-10 and 10-20 cm depth.
-soil should be transferred to a deep freeze maintained at –18°C
-samples should be passed through a sieve
- analyse should be performed with a validated residue method.

4e) Stabilization concentration level is calculated using DT50 and application dose rate. Next step will be :
- ecotoxicological assessment of the risk for non target species
- assessment of phytotoxicity
- risk assessment on residues in food.

5a) In general BCF ww/wo, sometime BCF fat.

5b) Aquatic: BCF ww/wo mainly obtained on fish studies
Mammals: BCF fat

5c) Yes, mainly when BCF is estimated from uptake and depuration kinetics.

5d) Yes; care should be taken for results based on total 14C

5e) Mammal organisms: BCF fat >1 -> further risk assessment
Aquatic organisms: BCF ww/wo >1000 for non persistent substances -> further risk assessment.
BCF ww/wo >100 for persistent substances -> further risk assessment.

5f) A risk assessment must be performed for species which are directly or indirectly .

6) Not directly, bio magnification is taken into account through the risk assessment for non target species performed when bioaccumulation data are superior to standards.

7) Standards for persistency should also apply to inorganic compounds but experts don't realy know how to handle these data.

8) Yes: bound residues >70% applied molecules and mineralisation level < 5% in 100 days.

C.5. Norway

Substance A

1a) Substance A is in theory too persistent to be accepted because it overrides the cut off value of one year If the accumulation study had been done in Norway or in a comparable climate, soil etc., and no accumulation had been shown after 9 applications over several years, we could conclude that no accumulation would occure. In Norway field studies are taken into account as well, but they rarely overrule well-performed lab.-studies. The accumulation study performed showed little degree of accumulation, but detailed information was missing. The study indicates that the substance does not adsorb as much as expected (instead percolates to groundwater). A lysimeter study would help to describe the mobility and should be provided.

1b) The potential for bioaccumulation of substance A can be regarded as high. Cut off for BCF is set at 5000 (not depending on clearance/depuration).

1c) Since the adsorption varies a lot and the degree of mobility is uncertain a lysimeter study should be provided.

1d) On background of the ecotoxicological properties of the substance, we can not reccomend approval of this substance in Norway. Cut off is reached for both aerobic degradation in soil and for BCF. The TER-calculations (toxicity/exposure) for earthworms also supports this conclusion.

Substance B

1a) The degradation of substance B can be regarded as moderate to medium under both laboratory and field conditions. The degradation of the metabolite can be regarded as moderate to medium as well. The conclusion is that the persistence of this substance does not seem be a problem. More detailed information on the experimental part of all studies and aerobic degradation in soil at 10 °C for both substance B and metabolite mA should have been provided.

1b) The potential for bioaccumulation of substance B can be regarded as moderate for the active R isomer and is thus not considered to be a problem. The potential for bioaccumulation of the S-isomer can be regarded as medium to high, and must be considered to be somewhat problematic.

1c) The PB properties of the substances do not give reason to add further elements to our standard assessment. In Norway we operate on one level. We evaluate and assess a substance from the data we have and this again forms the basis of our decission of banning or approval. Higher tier studies might in some cases be required, for example a lysimeter-study or studies on sublethal effects.

1d) On background of the ecotoxicological properties of substance B documented in the data set, substance B can be accepted and approved in Norway. Yet, in a “real” assessment several data reaquirements would have had to be fulfilled and all original study reports must have been provided before an approval could have been given. This applies to the data on substance A as well. In addition to the ecotoxicological properties of a substance we evaluate toxicological and agronomic sides of the substances. All this information together formes the basis on which we makes our decissions. Even though a substance has unfortunate ecotoxicological or toxicological properties it might be granted authorisation if it has properties thar are very advantagous in plant

protection, e.g. for resistance managment or if there is a lack of other alternatives. It is important to add that we in Norway follow a substitution principle, which mean that we take out/ban pesticides if alternatives with better properties exist.

2a) In Norway risk assessments of the active substances and relevant metabolites (metabolites > 10 % in aerobic degradation in soil) are always performed unless the use of a plant production product is limited to e.g. seed dressings or greenhouses only.

2b) The assessment criteria apply to both active ingredients (active and non-active enantiomers) and relevant metabolites. We do not usually apply the criteria to metabolites from other degradation studies (e.g. metabolites from photolysis or hydrolysis) unless these routes of degradation are very relevant/more important.

2c) We have no standard criteria for the co-formulants other than that data sheets must be provided.

2d) Accumulation in soil as a result of repeated use is always considered.

3a) BBA, USEPA and OECD-guidelines, among others, should be followed.

3b) In the environmental risk assessments we use internal guidelines wich are based on EU and EPPO guidelines.

4a) For persistency following criteria are used: primary aerobic degradation DT50, DT90 and mineralization in soil and water/sediment (cut off values, see flow chart on page 238).

4b) We evaluate the DT50/90 values in soil, water and sediment, but only the persistency in soil (DT50, 20 °C, aerobic) is further used in the risk assessment.

4c) i) + ii) Lab-results are most important, but field studies can give us good indications. Field studies performed are often not relevant for our climate. It is easier to compare substances on the basis of lab-results. If field studies are performed in a Nordic climate they will be relevant and used in the assessment.

4d) No specific criteria have to be fulfilled because field studies just give us certain indications.

4e) The next step will be to try to simulate the possible accumulation with a model. This could indicate the concentration level in soil after several applications over several years. If the substance is too persistent and the DT50 > 1 year cut off is reached. Sublethal effects on earthworms must be investigated if DT90>100 days. If a substance is persistent, the risk of leaching to groundwater must be evaluated.

5a) In Norway BCFww/wo is used. If BCF is missing, logPow is used.

5b) The standard data requirement in Norway is bioaccumulation in fish.

5c) It is taken into account. We evaluate whether the elimination is quick or not. Even if a substance has a high BCF we might evaluate it to be acceptable if the elimination process is quick.

5d) Yes, in general we accept results based on total radioactivity, even though analysis on metabolites etc. would have been an advantage.

5e) A BCF > 2000 could cause cut off depending on degradation, mineralization and the amounts of bound residues (see flow chart page 238).

5f) None, but it contributes in the total picture of the substance.

6) No

7) No

8) No but it is taken into account.

9) Completing the questionnaire has not made us revise the assessments or the conclusions. The data set that has been provided here is far from detailed and good enough for an assessment in Norway. We would like to add that the bioaccumulation/bio-magnification-question is one of the most challenging ones and that this is subject to discussions among ecotoxicologists at The Norwegian Agricultural Inspection Service

Below the classifications and cut off values for persistency and bioaccumulation applied in Norway are presented.

Below are some of the evaluation tables which we use in Norway for the classification of degradation, bioaccumulation and mobility. In addition we have tables for the classification toxicity to different organisms, hydrolysis, photolysis and other physical/chemical parameters.

Degradation in soil, water and sediment are classified by this table:

Rate of degradation, DT_{50}	**Grading**
> 200 days	Low
60 - 200 days	Moderate
10 - 60 days	Medium
1 - 10 days	High
< 1 days	Very high

BCF can be evauated by this table:

BCF	**Grading - Potential for bioaccumulation**
> 1000	Very high
200 - 1000	High
100 - 200	Medium
10 - 100	Moderate
< 10	Low

n-octanol/water coefficiant (P_{OW}) (K_{ow})	
log P_{OW}	**Grading**
> 5	Very high
3 – 5	High
1 – 3	Medium
0 – 1	Moderate
< 0	Low

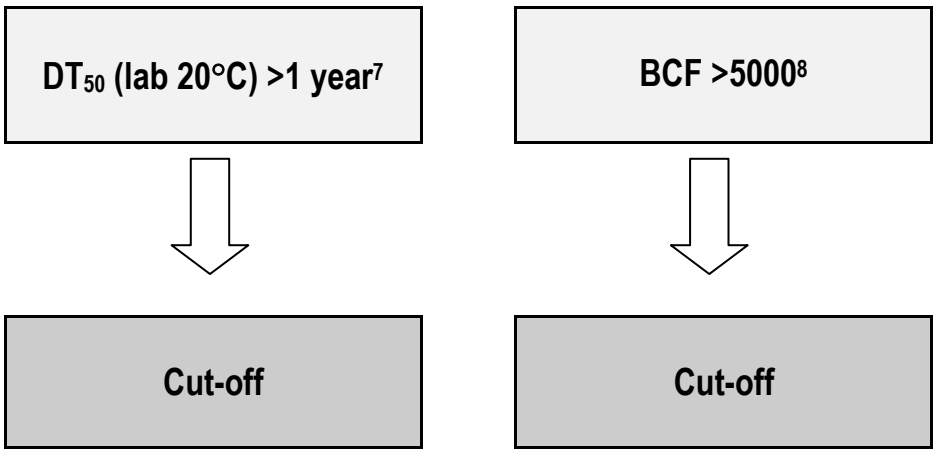
Adsorption and mobility:

K- or K_d- value	**K_{oc}**	**Adsorption**	**Potential for mobility**
< 0,75	< 50	Low	Very high
0,75 - 2,25	50 - 150	Moderate	High
2,25 - 7,5	150 - 500	Medium	Medium
7,5-30	500 - 2000	High	Moderate
> 30	> 2000	Very high	low

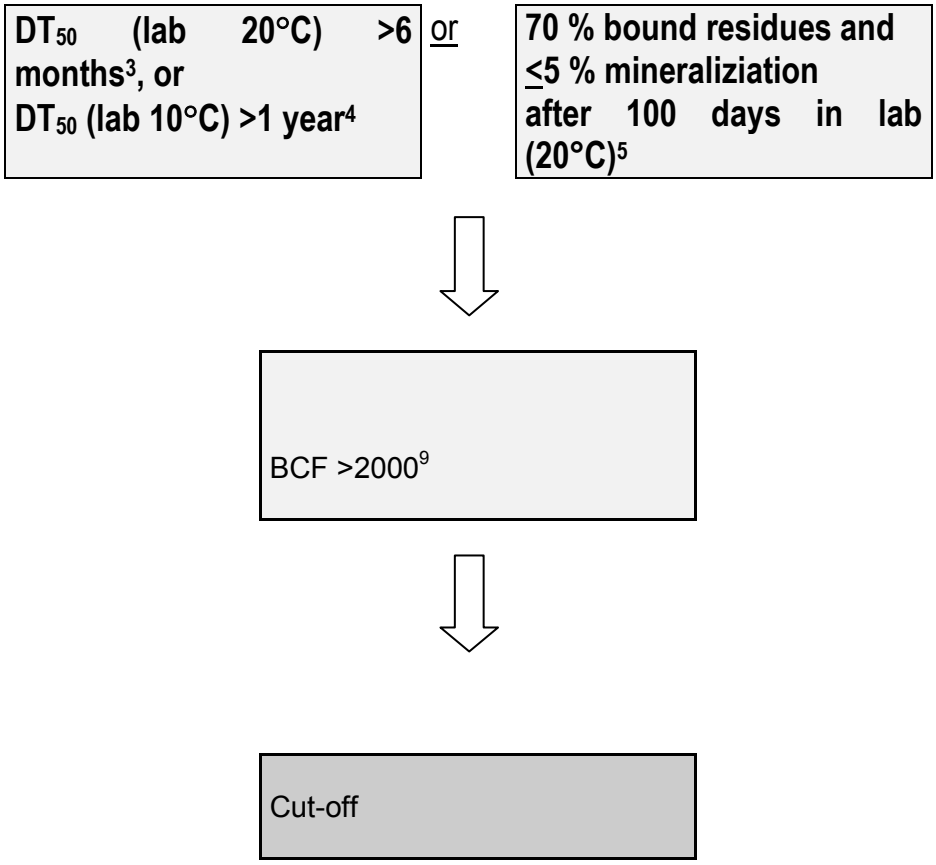
Persistence + bioaccumulation

Only average values from studies/experiments with acceptable quality are to be used.

Absolute cut-off:



Combination of persistence og bioaccumulation:



References:

1. European Commision, 9188/VI/rev. 6, 29.03.2000. Draft working document. ”Guidance document on persistence in soil”.
2. Norwegian (NAIS) criteria for the definition of persistence, built on Swedish KEMI’s system of classification.
3. Proposal from Denmark, 1997. ”Discussion paper regarding issues of pesticide persistence”. First revised edition. Christian Kjær and Pia Lassen.4. DT50 (lab 10°C) >1 year: Our starting point was the 6-months limit. When temperature decreases by half, degradation rate increases with an factor of about 2.
5. European Commission, 9188/VI/rev. 6, 29.03.2000. Draft working document. ”Guidance document on persistence in soil”.
6. ISPRA-Criteria for terrestrial classification
7. Proposals of criteria for Annex I listing, European Commision, Document SANCO/746/2000 rev. 2, 25.09.2000, Draft guidance document, ”Criteria for inclusion of active substances in Annex I of council directive 91/414/EEC”
8. Proposal from Sweden, 2000. ”Summary reports from round-table discussions on criteria for phasing out persistent and bioaccumulating organic chemicals”. SOU 2000:53, and Proposal of criteria for Annex I listing, European Commision, Document SANCO/746/2000 rev. 2, 25.09.2000, Draft guidance document, ”Criteria for inclusion of active substances in Annex I of council directive 91/414/EEC”
9. Proposal from Sweden, 2000. ”Summary reports from round-table discussions on criteria for phasing out persistent and bioaccumulating organic chemicals”. SOU 2000:53.

C.6. Portugal

Case Study 1

1a) Persistent, but doesn´t have potential for accumulation

1b) The compound has a potencial for bioaccumulation since the log Kow > 5, BCF >> 1000 for all tested organisms, DT50 for clearance significant and appearently no extensive depuration from the fish occurs

1c) The a.s. can be considered as persistent in soil but there is no reason to expect that it will be accumulable. On the other hand, there are strong indications of a bioaccumulation potential that should be investigated further. The possibility of biomagnification through the food chain should be adressed with appropriate modelling/data

1d) The PB properties of the a.s. merit further investigation specially with regard to the bioaccumulation and Biomagnification potential.

2a) whenever it meets the criteria currently adopted under Annex VI to the 91/414/eEEC Directive and complementary Guidance documents. DT50 lab. > 60 days (20ºC) or DT50field > 3 m; DT90 > 1 y, BCF > 1000 for non biodegradable substances or > 100 for biodegradable substances

2b) In principle, as long as the compounds exhibit FQ properties indicating indicating relevance under the criteria applied to the a.s.. However there can be the case where an enantiomer (by-product, etc.) is not biologically active (in a broad sense fyciso-chemical properties can also be different) or has a significant decrease in activity relative to the other enantiomer(s). In this case we rather draw our attention to the molecule that is most active and therefore most environmentally relevant.

Case Study 2

1a) Persistent, mA is a borderline case of persistency

1b) No potential for bioaccumulation despite Log Pow is borderline.

1c) Further information on unextractable rad. should be given. The a.s. is inherently biodegradable. Would it be expectable that unextractables may become bioavailable?

1d) The PB properties of the substance merit further investigation with regard to non extractable radioactivity

2a) Whenever it meets the criteria currently adopted under Annex VI to the 91/414/eEEC Directive and complementary Guidance documents. DT50 lab. > 60 days (20ºC) or DT50field > 3 m; DT90 > 1 y, BCF > 1000 for non biodegradable substances or > 100 for biodegradable substances

2b) In principle, as long as the compounds exhibit FQ properties indicating indicating relevance under the criteria applied to the a.s.. However there can be the case where an enantiomer (by-product, etc.) is not biologically active (in a broad sense fyciso-chemical properties can also be different) or has a significant decrease in activity relative to the other enantiomer(s). In this case

we rather draw our attention to the molecule that is most active and therefore most environmentally relevant.

2c) In principle, yes (see b)

2d) Yes

3a &b)

EU guideline on persistence in soil 9188/VI/97 rev.8. and ECB draft document on PBT's, Annex VI of 91/414/EEC

4a) Guidance document on persistence in soil ; DT50 lab. > 60 days (20ºC) or
- DT50 field > 3 months and DT90 field > 1 year or
- During lab. Tests, form non-extractable residues in amounts > 70% of the initial dose after 100 days with mineralization rate less than 5% in 100 days. There are no formal criteria for other compartments however an indicative upper limit for non-persistence is used for both water and air that is DT50 of 4 days. The persistence of a compound in different compartments is evaluated on a case by case basis taking in account the criteria as set out in Annex VI to 91/414/EEC and respective Guidance documents. In our opinion "persistency" cannot be considered in isolation from other features (FQ properties, Toxicity to non-target org., mode of action, GAP, etc.). Therefore the use of cut-off triggers or limits is not usual in decision making.

4b) See 4.a)

4c) It depends on the quality validity of the data, resp. from lab or field studies. Lab studies rather give a standardised picture of how the molecule degrades and the influence of different factors (Tº, pH, soil moisture, %o.m., etc). However, field studies incorporate natural influences on the degradation of an a.s. (dissipation) and are thus preferred. However for exposure assessment purposes it may be necessary to use the standardised lab results.

4d.) There are no specific criteria to be fulfilled, however a representative number of field studies (at least 4) carried out under GLP conditions are preferred.

4e) Investigation of accumulation potential and long term effects on non-target organisms; Implementation of risk mitigation measures, Ex: reduction on the number of applications, reduction on doses, restrictions concerning soil texture, etc

5) We have had very limited experience on evaluating bioaccumulation beyond the current approach followed in the available Guidance documents.

5a) In principle the BCFww/wo is used.

5b) We have no formal criteria for different compartments.

5c) Yes. Trigger of > 95% depuration after 14 days for additional investigation/risk assessment

5d) It is preferred that RA is expressed in terms of ppm.

5e) It depends on the risk assessment/profile of the compound. As referred before, bioaccumulation should be viewed in a much broader sense, taking also in account FQ properties, BCF, DT50 clearance, dissipation in aquatic systems, etc

5f) In principle the next step would be to assess secondary poisoning in vertebrates and further investigate for biomagnification but limited guidance is available.

6) Yes, when available.

6a, b & c)
See above.

6d) thorough investigation of toxicocinetics of the substance. Prohibiting the product might be an option depending on the whole profile of the substance and its use

7) No

8) The > 70% is used as a cut-off criteria in the Annex VI to 91/414/EEC. Unextractables should be characterised as fas as technically feasible

9) We find there is still much to do on assessing PB compounds. The most challenging aspects relate to the assessment of bioaccumulation and biomagnification.

C.7. Sweden

Case Study 1

1a) The substance is persistent (recalcitrant to degradation). The degree of persistency is considered unacceptable, especially in combination with the high potential for bioaccumulation.

Case Study 2

1a) In soil, the S-isomer is considered to be persistent, while the R-isomer is not. The high level of bound residues and the low mineralization rate is an area of concern. In sediments, both isomers as well as the metabolite mA are considered to be persistent.

The overall conclusion is that the persistency of this substance is within acceptable limits. However, the persistency of S-isomer in soil, the high amount of bound residues, the low mineralization rate, and the persistency in water/sediment systems trigger additional data requirements.

Case Study 1

1b) The substance has a high potential for bioaccumulation and there is also a risk for biomagnification. In combination with the persistency this makes the substance unacceptable.

Case Study 2

1b) The S-isomer has a potential for bioaccumulation, but not the R-isomer. The overall conclusion is that the potential for secondary poisoning of compound B needs to be addressed.

Case Study 1

1c) The PB properties alone make the substance unacceptable.

The general line of reasoning with regard to PB properties is:

- Long persistence and high bioaccumulation potential increases the risk for widespread distribution to different environmental compartments, including biota. This implies a higher than normal uncertainty in the estimates of exposure.
- Despite the large data package usually available, unpredictable effects following long-term exposure of biota cannot be excluded when substances are persistent in the environment. This implies a higher than normal uncertainty in the estimates of effects. A high potential for bioaccumulation implies a risk for bioconcentration in various organisms at lower levels of aquatic and terrestrial food chains, and for biomagnification at higher trophic levels. To address the risk for effects from such bioconcentration/biomagnification would presumably necessitate an impracticable high number of studies.
- The expected widespread distribution and the risk for unpredictable effects makes the applicability of point estimates of exposure and effects more uncertain in the risk assessment than for other compounds.

- If unforeseen effects eventually would appear, and *ad hoc* risk reduction measures then applied, it could still take a long time to bring down the environmental concentrations to levels at which affected biota can recover.

In this particular case (Case Study 1), the available data package showed effects on a range of species at low levels of exposure, including effects on reproduction, so the problem was not only related to "unpredictable" effects and increased uncertainty. Already the available ecotoxicological data warranted a negative decision with regard to product authorisation and the decision was taken with confidence; this substance would cause problems. It was not considered necessary to perform a standard risk assessment. Nor was it considered relevant to require further studies.

Case Study 2

1c) Yes, further studies are required. We also took the lack of bird reproduction study, the potential risk for secondary poisoning and the risk to sediment dwellers more seriously into account because of the persistence (of S-isomer in soil, and both isomers and mA in sediment) and the bioaccumulation potential (of S-isomer).

Case Study 1

1d) Yes, the product would not be approved for use in Sweden.

Case Study 2

1d) No, unless the study requirements triggered by the persistency and the bioaccumulation potential (secondary poisoning) give reason for concern in the risk assessment.

2a) All substances are subject to assessment according to the same criteria, with regard to PB as well as other properties. The criteria have been formulated with a view of pesticides used in agriculture, horticulture and forestry, thus normally resulting in environmental exposure. Fate and distribution in the environment must be assessed whenever a product can reach environmental compartments such as soil or surface water under the proposed conditions of use (Uniform Principles Part B. Evaluation). Exceptions do theoretically exist, such as if exposure is exclusively indoors, or when using injection treatment in forestry. Such exceptions would be treated case-by-case.

2b) Generally, the criteria applies to the technical material, i.e. the "active ingredient", whether or not it consists of different enatiomers, fermentation products etc. However, if there are clear differences, e.g., between different isomers, then the criteria would be applied to each one of them.

2c) The same criteria apply, however, we rarely have information on PB-properties of other product ingredients than the actives.

The criteria applies to active ingredients and their relevant metabolites, degradation and reaction products. For determination of "relevant" mainly three guidance documents are helpful: Guidance Doc. on Aquatic Ecotoxicology, Sanco/3268/2001 rev. 4 (final), 17 October 2002; Guidance Doc. on Terrestrial Ecotoxicology SANCO/10329/2002 rev. 2 (final) 17 October 2002

and; Guidance Doc. on the Assessment of the Relevance of Metabolites in Groundwater Sanco/221/2000 rev. 9 (draft) 2 February 2003.

2d) No.

3a) What to consider as well as criteria are found in Part B and C, respectively, of the Uniform Principles (Annex VI to Directive 91/414/EEC).

Guidance is provided in: Guidance Doc. on Persistence in Soil 9188/VI/97 rev. 8 12.07.2000; Guidance Doc. on Aquatic Ecotoxicology Sanco/3268/2001 rev. 4 17 October 2002; Guidance Doc. on Terrestrial Ecotoxicology SANCO/10329/2002 rev. 2 (final) 17 October 2002 and; Guidance Doc. on Risk Assessment for Birds and Mammals SANCO/4145/2000 25 September 2002.

Criteria also used are found in the UNEP "Stockholm Convention", Annex D, and in the UN ECE LRTAP Convention, Executive Body Decision 1998/2.

3.b) The same as under 3a).

4. Yes.

4a) Uniform Principles, Part C. Decision-Making p. 2.5.1.1:
$DT_{50soil,\ field}$ > 3 months and $DT_{90\ soil,\ field}$ > 1 year.
These criteria are used for further assessment and additional requirements, and, depending on the degree of exceedance, also as criteria for acceptability.

UNEP "Stockholm Convention", Annex D:
DT_{50} in water > 2 months, DT_{50} in soil > 6 months, DT_{50} in sediment > 6 months, or other evidence of persistence.

UN ECE LRTAP Convention, Executive Body Decision 1998/2:
With regard to P, the same set of criteria as in UNEP "Stockholm Convention".

4b) The Uniform Principles contain only criteria for soil, however, in the overall judgement of P, data from water/sediment studies are also considered.

UNEP "Stockholm Convention" and Executive Body Decision 1998/2 under the UN ECE LRTAP Convention also includes criteria for persistency in air, e.g. half-life > 2 days.

4ci) Normally not, since conclusive data on formation of metabolites is usually available from lab studies only.

4cii) To some extent, yes, since the criteria (see 4a)) relates to field studies. Results from field studies are not necessarily given more weight than lab-results, mainly due to the lack of mass balance in field studies. With regard to metabolites, conclusive field data on persistency of metabolites is not always present.

4d) No. Such criteria would be useful.

4e) It depends on the degree of P. (As example: In Case Study 1, no further steps. In Case Study 2, further data requirements.)

5) Yes, bioconcentration study in fish required when log Pow > 3, and the data used e.g., to assess the risk for secondary poisoning.

5a) BCF, related to fat tissue, for terrestrial vertebrates, BCFww/wo for aquatic organisms (Uniform Principles, Part C. p. 2.5.2.1 and 2.5.2.2).

5b) No different, see 5e).

5c) Only taken into account if exposure is exclusively intermittent ("pulse exposure"). However, generally half life for clearance is of less relevance since the steady-state BCFs already is a function of uptake, metabolism and depuration. For persistent substances, low environmental concentrations are expected to be present for long time scales and thus allow uptake in biota.

5d) Yes. (In case the assessment would result in a negative decision, results not based on ^{14}C would likely be submitted and taken into consideration.)

5e) Uniform Principles, Part C. Decision-Making p. 2.5.1.1 and 2.5.2.2:
BCF terrestrial vertebrates >1, related to fat tissue.
BCF aquatic organisms > 1000 for active substances which are readily biodegradable and BCF aquatic organisms > 100 for active substances which are not readily biodegradable.
These criteria are used for further assessment and additional requirements.

UNEP "Stockholm Convention", Annex D:
BCF or BAF aquatic species >5000 (or, in the absence of such data log Pow > 3), or other evidence or bioaccumulation. These criteria are used as criteria for acceptability.

UN ECE LRTAP Convention, Executive Body Decision 1998/2:
With regard to B, the same set of criteria as in UNEP "Stockholm Convention".

5f) The Uniform Principles criteria trigger examination of risk to secondary poisoning; normally birds consuming fish and earthworm. There is also some risk assessment tools for biomagnification provided in the guidance documents.

This is considered sufficient at relatively low levels of bioaccumulation but at higher levels (approaching the UNEP criteria) further elements should preferably be added to the risk assessment; for instance, assessing the risk from bioconcentration in invertebrates. So, development of such additional elements should be considered.

With respect to biomagnification, partly different standards to address risk for biomagnification have been developed within the EU (for plant protection products, biocides, and industrial chemicals). Harmonization of these tools and of the usage of such tools should be considered.

6) No. We can hardly expect generation of such data for predictive purposes for pesticides since there is only a limited database on biomagnification available even for the "dirty dozen" substances.

6a) No such criteria exist, other than use of monitoring data as mentioned in UNEP "Stockholm Convention", Annex D and UN ECE LRTAP Convention, Executive Body Decision 1998/2.

The criteria for bioaccumulation adopted under these conventions (BCF >5000) has been established with the goal to avoid biomagnification.

We doubt whether criteria for bio-magnification would be meaningful and robust enough for predictive purposes. Such criteria would be difficult to interpret, partly because the concentration in the top consumer is less important. What is important, is the potential effect on the top consumer. Such effects may be the result of accumulation in specific organs, and whole body concentrations may therefore represent useless estimates of the risk. On the other hand, to use concentrations in specific organs as estimates of the risk implies that there is a lot of knowledge on mechanism of toxicity in various species. In the best case, we may have such knowledge for very few species, but the uncertainty would in most cases be very high.

6b) See 6a).

6c) Any demonstrated biomagnification would be regarded as unacceptable.

6d) Next step would be risk management with the goal of ceasing any environmental exposure.

7) No. The recognition of the increased risk posed by persistency is based on experience from "classical" environmental pollutants like DDT, PCB etc., i.e., organic compounds.

8) In addition to criteria related to DT_{50}/DT_{90} (see 4a) above), the Uniform Principles, Part C. Decision-Making p. 2.5.1.1 also gives the following criteria:
>70% bound residues and <5% CO_2 after 100 days in soil laboratory study.
This criteria triggers the same data requirements as the criteria related to DT_{50}/DT_{90}.

Non-extractable residues gives reason for consideration about their potential bioavailability.
Bound residues are "chemical species originating from pesticides, used according to good agricultural practice, that are un-extracted by methods which do not significantly change the chemical nature of these residues" (definition adopted by IUPAC), but modifications have been suggested; "compounds in soils, plants or animals which persist in the matrix in the form of the parent substance or its metabolite(s) after extraction. The extraction method must not substantially change the compounds themselves *or the structure of the matrix*." According to the definition (at least with the modification suggested), bound residues can be expected to be released at a rate equal to the turnover rate of organic material, which is very slow. Exposure from such released compounds may be expected to be very low.

What is perhaps lacking in today's guidelines is a clear identification of the extraction methods by which residues are identified as "bound residues". Bound residues according to the definition are expected not to be bioavailable as long as they are still in that form - and should be distinguished from residues which still can be extracted in intact form by harsh methods. Such "recalcitrant" residues may still be available for uptake in biota, but prediction of the degree of uptake is uncertain. Method development aiming at predicting bioavailability would be useful.

9) First question: No.
Second question: To address questions related to bio-magnification.
Also, we identified areas for possible future development:

- More precise criteria for validity of field data (see 4b)).
- Risk assessment strategies for bioaccumulating substances having BCF values < 5000 (i.e. lower than the UNEP criteria), such as development of further elements to add to the risk assessment, and harmonization of the tools used to address potential biomagnification. This is

because at present very few elements are added for substances having, say BCF of 2500, as compared to totally non-bioaccumulating substances. (see 5f)).

- Clear identification of extraction methods by which "bound residues" are identified. Also, methods to predict bioavailability of "recalcitrant" fraction. (See 8).

C.8. Slovenia

Case study 1

1a) Substance A is very persistent in soil (field studies : DT50 > 3 months and DT90 > 1 year) and in sediment..

Substance A is very slightly soluble in water and not volatile. It is very slightly degradable and does not hydrolise in water. Due to its rapid dissipation from water phase it is expected to accumulate in sediment. Due to its very high Kom and range of DT50 values it is not expected to leach into groundwater.

1b) Substance A has logKow 5.2. For *Lepomis macrochirus* the BCF of the substance is 5500 l/kg, the half -life for clearance is 5-8 days and there is no further elimination after 10 days. From this data we can conclude that the substance A is bioaccumulative.

1c) No.

1d) Yes. There is no authorisation for this plant protection product unless if the applicant can scientifically demonstrate that under field conditions there is no accumulation in soil in such levels that unacceptable residues in succeeding crops occur and/or that there is no unacceptable impact on the environment, according to the relevant requirements.

For the intended uses the accumulation of residues in soil and the level at which the plateau concentration is achieved must be investigated with the following options:

1. FOCUS soil model for the calculation of the plateau concentration (this should be used first if it can be assumed dissipation to be first order),
2. soil accumulation studies or
3. integrated studies.

Case study 2

1a) Substance B is a borderline "case" in terms of persistency. The substance consists of two stereoisomers (R and S) of which R isomer is documented to be an active isomer. Laboratory studies for degradation in soil show that S isomer is more persistent than R- isomer. Results for DT50 and DT90 values from the field studies which were performed in different countries (example: Germany and UK) differ for the same type of soil. However, also in the field studies the S-isomer show to be more persistent. In certain studies DT90 and DT50 values exceeded the trigger value of 1 year and 3 months respectively.

Trigger value (70% after 100 days) for bound residues was exceeded for isomer R. The result was 78% after 100 days with the mineralisation rate less than 5%.

Metabolite A is the only relevant metabolite. From the field study we can see that was formed at maximum 25% and that is not persistent.

Metabolite (mA) is according to the DT50 values and Kom value predicted to leach in the groundwater.

Substance B is not persistent in water phase but it is according to the DT50 values persistent in sediment (trigger value 120 days).

mA is persistent in both water (trigger value 40 days) and sediment (trigger value 120days).

1b) According to the BCF value and DT50 for clearance, the R isomer of substance B will not bioaccumulate but S isomer of substance B (BCF $_{WW/WO}$ of 400 L/kg) might bioaccumulate. However, the DT 50 value for clearance is only 5 days and that is why we don't really expect bioaccumulation.

According to the data mA is also not expected to bioaccumulate.

1c) No.

1d) The results from the field studies in soil show that the substance may be very persistent in certain field conditions. For the risk assessment purposes we would like to have the results form filed studies performed under realistic conditions in which the product is intended to be used in order to be able to establish that no unacceptable residues in succeeding crops will occur and that there is no unacceptable impact on environment.

The use of substance B may according to the toxicity data for aquatic species and its persistency cause risk for organisms in sediment.

Risk mitigation: For example, an appropriate buffer zone should be determined to limit the exposure of aquatic compartment.

2a) In general we do not have any special national models or criteria for assessing PB criteria. For this purpose we mostly use the available EU guidelines, guidance documents and models.

2b) In principle we would assess for the PB also the enantiomeres, fermentation products and by products of the active substances.

2c) No.

2d) We consider that this also needs to be considered as criterion in case of frequent use of certain product in the same region.

3a) In general guidelines from European Commission (e.g. Guidance document on Persistence in soil, FOCUS Guidance etc.)

In general guidelines from European Commission (e.g. Guidance document on Persistence in soil, FOCUS Guidance etc.)

3b) What are the guidelines, protocols or SOPs used in the product safety assessment on PB (environmental risk assessment)

Annex VI of the 91/414/EEC Directive, Guidance Document on Aquatic Ecotoxicology, Guidance document on Terestrial Ecotoxicology, Guidance Document on Risk Assessment for Birds and Mammals.

Soil persistence models and EU registration document, FOCUS ground water scenarios.

4a) For soil from the field studies:
DT50 > 3 months and
DT90> 1 year or
formed non -extractable (bound) residues in amounts exceeding 70% of the initial dose after 100 days with a mineralisation rate of less than 5% in 100 days

For water:
DT50 > 60 days (in marine water) or > 40 days (in fresh water)

For sediment:
DT50> 180 days (in marine sediment) or >120 days (in fresh water sediment)

4b) No.

4c)

i) formation of metabolites (identity, percentage) No.
ii) persistency? No.

4d) Yes, there are specific criteria written in the Directive and also in the Guidelines (e.g. SETAC guidelines).

4.e) The next step is to assess chronic risk for organisms living in compartments where the substance is persistent and where the exposure is possible. Furthermore bioaccumulative potential of the substance should be assessed.

5a) BCF_{fat} and $BCF_{WW/WO}$, log Kow (greater than or equal to 3 indicate that the substance may bioaccumulate), dissipation (even if BCF is high and the substance is dissipating it is not a problem), high adsorptive capacity, molecular weight (greater than 700 may not be readily taken by fish), structural features etc.

5b) Yes.

5c) Yes, elimination/depuration is taken into account. If DT50 in water phase is low which means that exposure time will be relatively short (the substance dissipate) and it rapidly (like 0,5 day is a short depuration time) depurates from fish. Than we can make the conclusion that risk to aquatic life is considered to be acceptable with appropriate risk mitigation measures.

5d) Yes.

5e) If BCF is less than 1000 (when the substance is readily biodegradable) or BCF is less than 100 (when the substance is not readily biodegradable) is considered that the substance is not bioaccumulative.

5f) Higher tier RA should be performed where chronic data will be taken into account. If after this chronic RA , $TER_{chronic}$ values are below the trigger value, then RA needs to be refined (taking

into account more realistic exposure data) or appropriate risk mitigation measures should be taken.

6a) BCF_{fat}, $BCF_{ww/wo}$ and/or other? BCF_{fat} , log Kow (>3)

6b) Yes.

6c) BAF >1 (trigger value)

6d) Higher tier exposure assessment and food chain modelling.

7) No. Different chemical class (i.e. organic chemical, metals) have different structure and different properties (like they are not lipophilic). For organic substances persistency can be estimated (different estimation methods and models) while for inorganic substances more expert judgement is needed as estimation models are not available.

8) --

9) --

C9 USA

(1a & 1b) Chemical A is both persistent and bioaccumulative, based on the criteria used in the exercise (BCF > 5000 and half-life > 180 days). The S-isomer of chemical B is considered persistent, but not bioaccumulative by the same criteria. The R-isomer of chemical B is borderline-persistent and not bioaccumulative.

(1c) The PB properties of chemicals A and B triggered analysis of food-chain effects (toxicity to consumer organism due to concentration in prey, based on water concentration and BCF).

(1d) The PB properties of Chemical A indicate that routine mitigating measures may not be sufficient to allow use of this chemical without review of additional data: (1) reducing use rates, (2) reducing number of applications, (3) dropping use sites, (4) making the product a restricted use pesticide, and/or (5) restricting areas where the product could be used. Potential risks to the environment from use of Chemical A are such that its use should not be allowed.

The PB properties of Chemical B merit risk mitigation measures and regulatory conditions for registration, including time limitation on duration of use, use area restrictions, drift mitigation language, elimination/reduction of the S-isomer in the formulation, and submission of outstanding data requirements.

(2a) There are no special qualifications for a risk assessment of a chemical based on its PB properties. The persistence and bioaccumulation potential of pesticides are assessed on a routine basis. Chemicals with log Kow > 3 are considered bioaccumulative. Compounds with half-lives allowing year to year accumulation are considered persistent.

(2b) Yes, the PB assessment criteria apply to all "enantiomers, fermentation products, and by-products" of the pesticide. Generally, risk assessments are done for any metabolites or degradates that form at >10% of the parent application rate, or for those that are of toxicological concern.

(2c) No, the same PB criteria would also apply to non-active ingredients.

(2d) Yes, accumulation in environmental compartments due to repeated use is routinely considered in EPA's risk assessments.

(3a) If "submitted literature" means studies published in the "open literature," EPA uses scientific judgment to evaluate the usefulness of such information in its risk assessments.

(3b) The protocols and guidance used by EPA in the risk assessment of pesticides is published in the Code of Federal Regulations, Title 40, part 158, Pesticide Assessment Guidelines Subdivisions E, J, L, N.

(4a) As responded to the OECD survey (ENV/JM/PEST(2001)7; Q #9), the US EPA OPP evaluates the persistence of pesticides on a case-by-case basis since OPP does not have an established classification system for determining persistence. An effort is underway to establish persistence triggers. For this exercise, the EPA OPP used persistence and bioaccumulation criteria published by the EPA OPPTS and TRI. Use of these criteria for assessing P and B has not been formally established as EPA OPP policy.

(4b) No, the persistence criteria in soil, water, sediment, ground water, feed, and air are not the same. The half-life of the chemical in the various media is used to identify persistence. Currently, EPA OPP does not have established triggers for defining persistence. So the criteria are judged on a case-by-case basis. Refer to US response to the OECD survey (ENV/JM/PEST(2001)7; Q #9).

(4c) Field study results are interpreted in light of the expectations drawn from laboratory studies. Field study results are used to supplement laboratory results when the field study results can be explained in terms of the expected behavior.

(4d) The US is currently revising its guidance for terrestrial field dissipation studies in cooperation with Canada under the auspices of NAFTA.

(4e) There is no unique change to the risk assessment procedure of a chemical because it is persistent. This property is one of many that will be used to characterize the risk. Persistence is used, as applicable, when assessing toxicity to non-target organisms and managing risks under proposed use conditions for the pesticide and alternative approaches.

(5a) As responded to the OECD survey (ENV/JM/PEST(2001)7; Q #27), the US uses a BCF > 1000 and log Kow > 3 as indicators of high bioaccumulation potential. See response to question (4a) of the questionnaire.

(5b) The US EPA OPP generally does not receive data on the bioaccumulation of pesticides in the different compartments or functional groups and, therefore, does not have evaluation criteria for them.

(5c) Yes, elimination and depuration are taken into account. Chemicals that are quickly eliminated are judged to be less of a problem. However, rapid depuration alone may not avoid bioaccumulation in environments where environmental concentrations are not likely to change, such as sediments.

(5d) A BCF calculated on the basis of parent compound concentration is preferable. Results based on total radioactivity counts without identification of metabolites are used with qualification if necessary.

(5e &5f) Further assessment and additional requirements are triggered on a case-by-case basis.

(6a-c) For biomagnification effects, EPA OPP relies on information in open literature studies since our data requirements only allow for analysis of one consumer trophic level (i.e., consumers of fish). Therefore, biomagnification is evaluated on a case-by-case basis since EPA uses scientific judgment to evaluate the usefulness of published literature in its risk assessments

(6d) There is no unique change to the risk assessment procedure of a chemical because of biomagnification. This property is one of many that will be used to characterize the risk. Biomagnification is used, as applicable, when assessing toxicity to non-target organisms and managing risks under proposed use conditions for the pesticide and alternative approaches.

(7) No, persistence is not considered a meaningful criterion for inorganic compounds (i.e., metals) since they are elements and, therefore, are persistent by definition.

(8) Bound residues are considered on a case-by-case basis. If the bound residues are believed to be parent chemical, the total system half-life is calculated including the bound mass.

(9) No, completion of the questionnaire does not change EPA's assessment and conclusions for Chemicals A or B. The criteria for assessing persistence and bioaccumulation were not changed by this exercise. The most challenging aspects of the case study were working with incomplete information especially human health data, using data reported in a manner inconsistent with EPA guidelines, and making registration decisions in the absence of a risk management pressures (i.e. the registrant advocating acceptance of the chemical registration). The normal risk management exercise of balancing ecological and human health issues was not possible.

C.10. Denmark

Case-study 1 –Substance A

1a) Laboratory DT50 is considerably above 90 days, which means that relevant field studies are required. If DT50 in field studies is under 90 days, are substances not regarded as persistent. If DT50 is between 90 days and 180 days, are substances only regarded as not persistent if field effect studies do not show any unacceptable effects. If DT50 in field studies is above 180 days, will a substance always be regarded a persistent, and it can not be approved in Denmark. Since 3 out of the 9 field studies exceeds a DT50 of 180 days (the German soil which is comparable to Danish conditions, are the soil with the highest DT50 – 331 days), is the regarded as persistent and is can not be approved in Denmark.

1b) LogPow is greater than three, so bioaccumulation properties shall be examined. If a fish BCF (ww/wo) exceeds 1000 and DT50 > 3 days, the substance is regarded as bioacummulating and can not be approved in Denmark.

1c) DT50 between 3 and 6 month lead to requirement of field effect data study to address the risk.

1d) Yes ban for outdoor use if certain criteria are exceeded (DT50 > 180 days or BCF > 1000 with depuration rate DT50 > 3 days)

Case-study 2 – Substance B

1a) Our national assessment of substance b would include both the R- and S sterioisomer, regardless of that the R-isomer is documented in the efficacy dossier to be the active isomer. The latter do not prove that the S-isomer can not have any ecotoxicological effects. However, information on the proportion between the sterioisomers could have an implication on the relevance on an assessment.

Three of the laboratory studies of DT50 of R isomers exceed 90 days, meaning that field studies are required. In the field studies are DT50 just above 90 days in two out of nine cases. Field effect studies could be required, however, this will probably not be the case for the R isomer, given the few and slight exeedances.

Eight out of the nine laboratory studies on degradation of the S-isomer shows DT50 values higher than 90 days. Field-studies are therefore required. Here all three studies show DT50 values above 90 days, and two studies shows DT50 higher just above the 180 days. This means, that substance b can not be approved due to persistency, unless acceptable field effect studies are presented.

1b) LogPow is greater than three, so bioaccumulation properties shall be examined. BCF of the R isomer of substance b or its metabolite do not exceed 100, so it will not be regarded as bioaccumulating. However, BCF of the S isomer is 400 and the DT50 is 5 days, so it is regarded bioaccumulation, since a BCF above 100 and below 1000 can only be accepted for substances with a DT50 less than 3 days (72 hours). The BCF of the metabolite of the S isomer do exceed 100, but have a DT50 less than 3 days.

1c) Lack information on the proportion of the R- and S isomer, in relation to the assessment + see answer to c) above.

1d) See answer to d) above.

2a) The PB assessment is always a part of the risk assessment.

2b) In general yes but it depends to some extend on the quantities (expert judgement).

2c) PB criterion are the same for different substances, regardless of if they are the active form or not, since ecotoxicological effects may relate to other forms than the active.

2d) Not directly, but taken into account in the overall assessment.

3) The Danish assessment of PPP persistency and bioaccumulation follows our national assessment framework, independently of whether the substance is included in annex 1 of the Pesticide directive 91/414.

4a) If DT50 in laboratory studies exceeds 90 days, (DT90 > 1 year) and/or residue concentrations higher than 50% of initial dose after 30 days or 70% after 100 days, combined with a mineralisation on less than 5% after 100 days, field degradation studies are required. If DT50 is less than 90 days in field studies, the substance is considered 'not persistent'. If field study DT50 are higher than 90 days and less than 180 days are relevant field effect studies required. If the latter mentioned studies are missing or not complete or effects are unacceptable, the substance can not be approved. If DT50 exceeds 180 days in a field study, for a given active substance – it can not be approved due to persistency.

4b) The criteria are for soil. No specific criteria for other compartments.

4c) Field studies supersede lab studies, if the field studies are acceptable an representative for Danish conditions (expert judgement).

4d) Expert judgement.

4e) The substance is not approved.

5a) If $\log P_{ow} > 3$, bioaccumulation potential is assessed from lab. studies of the active substance and relevant metabolites. A substance or its metabolites is/are regarded as bioaccumulating if BCF_{fat} (used for assessment of birds and mammals) > 1 or if $BCF_{ww/wo}$ (fish) is bigger than 1000 and ready biodegradable (DT50 < 3 days) or if $BCF_{ww/wo}$ (fish) is bigger than 100 and not ready biodegradable (DT50 > 3 days).

5b) No, see answer to question above.

5c) Yes – see above

5d) See above.

5e) Non approval

6) Denmark has strict criteria for bioaccumulation – therefore no need to consider biomagnification. (See answer to section 5)

7) Not for elementary substances

8) No.

9) No. The most challenging part was the assessment of the supplied ecotoc. data.

C.11 Germany

Case Study 1

1a) Substance is of high persistence in soil (Persistence Category III).
In detail (cf. Table 1): Substance shows
- negligible primary degradation (class IV) in soil
- limited mineralisation (class III) in soil
- and builds up a high plateau of bound residues in soil (class III)

Some criteria for assessing the persistency of the substance in water-sediment systems are missing. There is no information on mineralisation or bound residues. Based on the information available, i.e. negligible primary degradation (class IV), the substance is regarded as not biodegradable in water-sediment system (Persistence Category IV).

Case Study 2

1a) Substance is not biodegradable in soil (Persistence Category IV)
In detail (cf. Table 1):
S-Isomer shows negligible primary degradation in soil (class IV)
R-Isomer shows slow primary degradation in soil (class III)
Metabolite mA which is the main metabolite for both isomers is not biodegradable in soil (Persistence Category IV).
It shows: - slow primary degradation (class III)
- negligible mineralisation (class IV)
- a very high plateau of bound residues (class IV)
Metabolites mB and mC are not relevant for assessment.
Annotation: We prefer to draw conclusions from studies that yield all criteria needed for assessment of persistency together. The degradation pathways may be not fully known. The same holds true for possible interactions between metabolites. Thus studies for studying the degradation of each metabolite alone may have the drawback that the results gained here possibly will differ from results gained in a study in which the metabolites are not separately tested but followed simultaneously to all other criteria.

Some criteria for assessing both the persistency of the substance and the metabolite mA in water-sediment systems are missing. There is no information on mineralisation or bound residues. Based on the negligible primary degradation (class IV) the substance is regarded as not biodegradable in water-sediment system (Persistence Category IV).

Metabolite mA: negligible primary degradation in water-sediment system (class IV) resulting in: not biodegradable in water-sediment system (persistence category IV). This assessment is based on the data for whole system.

Case Study 1

1b) High risk (Overall Assessment Category IV)
In detail (cf. Table 2): Substance shows
- a very high BCF (category IV)
- and delayed elimination (category IV)

Case Study 2

1b) Cause for concern (Overall Assessment Category III). This is a worst case assessment which is based on following considerations (cf. Table 2):
R-isomer: moderate BCF (class II) and rapid elimination (class I) resulting in indication of risk potential (Overall Assessment Category II)

Metabolite mA of R-isomer: moderate BCF (class II) and rapid elimination (class I) resulting in indication of risk potential (Overall Assessment Category II) Metabolite mA of S-isomer: high BCF (class III) and rapid elimination (class I) resulting in cause for concern (Overall Assessment Category III)

1c) Tiered approach according to Annex II of EU-guideline 91/414/EWG. If persistence is very high (dt_{90} > 1 a) a study on geo-accumulation is required (expert judgement).

1d) Not at present state, but if the criteria for POP according to Stockholm convention are ratified they will also be used for pesticides.

2a) Tiered approach according to Annex II and VI of EU-guideline 91/414/EWG and Guidance Documents on Aquatic and Terrestrial Ecotoxicology.

2b) Yes for enantiomers, no for by-products. According to our experiences it is often difficult to estimate PB-criteria for fermentation products due to their properties. However, if it is possible to estimate the PB-criteria then the PB assessment is applied to them, too.

2c) No.

2d) This aspect is considered by the exposure assessment and also in the tests on persistency by selecting the test concentration adequately.

3a) According to Annex II of EU-guideline 91/414/EWG
Guidelines: OECD 305 Bioconcentration: Flow Through Fish Test
OECD 307 Aerobic and Anaerobic Transformation in Soil
OECD 308 Aerobic and Anaerobic Transformation in Aquatic Sediment Systems
BBA-guideline, part IV, 4-1 Verbleib von Pflanzenschutzmitteln im Boden - Abbau, Umwandlung und Metabolismus
BBA-guideline, part IV, 5-1 Abbaubarkeit und Verbleib von Pflanzenschutzmitteln im Wasser/Sediment-System
SETAC – Procedures for Assessing the Environmental Fate and Ecotoxicity of Pesticides
Annotation: The assessment of PB is based solely on test protocols. Literature is used as additional information, only.

3b) Cf. 1)d)

4a) Criteria: dt_{50}
development of CO_2
bound residues
The values after 100 d are accounted for these criteria

4b) They are the same for soil, sediment, water and groundwater.

4c) No, the assessment of persistency is based on the 3 criteria mentioned above. Only laboratory studies provide the information needed. Consequently the assessment is based on laboratory studies. However, calculation of PEC is done on the dt_{50} of field studies.

4d) Not appropriate.

4e) Persistency is taken into account qualitatively and contributes to measures for risk reduction on the basis of TER-values (Toxicity-Exposure-Ratio)

5a) Criteria: BCF
ct_{50}
Additionally organ specific bioaccumulation and uncompleted elimination may be taken into account on a case by case basis. (expert judgement).
We prefer the BCF_{fat} (BCF_{lipid}) as this BCF may make it possible to compare the bioaccumulation of different species. If there is no BCF_{fat} other BCF are taken into account, e.g. $BCF_{whole\ body}$.

5b) The criteria on bioaccumulation (BCF, ct_{50}) are the same for all species. Classification will have to depend on test system used as well as species tested. Up to now our classification system is based on aquatic vertebrate testing.

5c) The clearing time is taken into account, too. For both criteria, i.e. BCF and ct_{50}, classes are derived, summed up and the average calculated. This average forms the overall assessment category (cf. Table 2).

5d) Yes they are. In fact it is a prerequisite for an assessment of bioaccumulation of a substance that the results are based on radio-activity. Otherwise some criteria won't be available.

5e) According to Annex VI 2.5.2.2 of EU-guideline 91/414/EWG: If the BCF of a readily biodegradable substance is > 1000 or of substance which is not readily biodegradable is > 100, accumulation in and transfer through the food chain has to be considered (expert judgement).

5f) See above

6a) Up to now there are no criteria on biomagnification.

6b) Not appropriate.

6c) Not appropriate.

6d) Not appropriate.

7) No. Inorganic compounds can't be biodegraded. We think it doesn't make sense to assess persistency to inorganic compounds because persistency is not a criterion which would enable a differentiation of inorganic compounds.

8) According to Annex VI 2.5.1.1 of EU-guideline 91/414/EWG: If bound residues are > 70 % and mineralisation is < 5 % at day 100 a field study has to be conducted. In case of a dt_{90} < 1 year a study on geo-accumulation with a time scale of 3 years is required.

9) We didn't revise the assessment or change conclusions.

Table 32 Analytical Parameters of Biodegradation Tests

1st Criterion: Primary Degradation

dt_{50}	class	assessment
< 10 days	I	rapid primary degradation
10 - 30 days	II	delayed primary degradation
30 - 100 days	III	slow primary degradation
≥ 100 days	IV	negligible primary degradation

2nd Criterion: Mineralisation (after 100 d)

CO_2	class	assessment
> 50 %	I	extensive mineralisation
25 - 50 %	II	moderate mineralisation
10 - 25 %	III	limited mineralisation
< 10 %	IV	negligible mineralisation

3rd Criterion: Bound Residues (after 100 d)

amount	class	assessment
< 10 %	I	low plateau
10 - 25 %	II	moderate plateau
25 - 50 %	III	high plateau
> 50 %	IV	very high plateau

Calculation of Persistence Category

The three criteria mentioned above, resp. the resulting classes are equally taken for calculation of the overall persistence category (average by rounding):

sum of single classes : number of parameters = persistence category

I	low persistence
II	moderate persistence
III	high persistence
IV	not biodegradable

On a case-by-case basis the degradation curve as well as the metabolism scheme is considered for obtaining the overall persistence category.

Example

A substance shows the following properties:

dt_{50}	3 days	**I**	rapid primary degradation
CO_2	12 %	**III**	limited mineralisation
bound residues	60 %	**IV**	very high plateau
		------	
		8 : 3 = 2.7	**(rounded: 3)**

Consequently the substance has to be considered as highly persistent (persistence category III). This example clearly demonstrates that a classification on the basis of primary degradation alone (class I) would have resulted in a wrong assessment of the real persistence.

Table 33: Analytical Parameters for Bioconcentration Tests

Bioconcentration Factor (BCF)

BCF range	**Assessment Category**	**Comment**
< 30	I	low BCF
30 - 100	II	moderate BCF
100 - 1,000	III	high BCF
> 1,000	IV	very high BCF

Elimination

ct_{50} range	**Assessment Category**	**Comment**
< 3 days	I	rapid elimination
3 -10 days	II	delayed elimination: short term bioaccumulation
10-30 days	III	slow elimination: medium term bioaccumulation
> 30 days	IV	insignificant elimination: long term bioaccumulation

Overall Assessment of Bioaccumulation

The categories of the bioaccumulation criteria BCF and ct_{50} are **equally** taken into account in the overall assessment of bioaccumulation as follows:

$$\frac{\text{BCF category} + ct_{50}\text{ category}}{2}$$

The result of this calculation will lead to one of four bioaccumulation assessment categories. If the resulting quotient lies between two categories, the higher is taken. If elimination data are not available, then only the BCF category can be used.

Overall Assessment Category	**Comment**
I	no concern
II	indication of risk potential
III	cause for concern
IV	high risk (recommendation for risk reduction)

In the overall assessment a more negative classification may be made if there is an indication of organ specific bioaccumulation or of uncompleted elimination leading to bound residues forming a plateau which would raise the risk of biomagnification significantly.

C.12. United Kingdom

Case Study 1

1.a) Case study 1 – DT90F >1year (all results) – therefore definitely persistent in soil;

Case Study 2

1a) DT90F R isomer – 2 months to 1 year – not persistent in soil;
S isomer – 2 years (1 result only) – may be persistent in soil but more data needed.

1b) We consider bioaccumulation in different compartments of the environment e.g. birds and mammals that eat fish. We use this approach to obtain some estimate of the possible implications of bioaccumulation and assess whether or not the risk is acceptable.

1c) Soil persistence is fully covered in the EU assessment process – particularly for pesticides where DT90Field is >1year.

Where the DT90 field is over one year certain additional ecotoxicological studies are required as laid out under Directive 91/414/EEC e.g. litter bag test. The requirements are indicated in the case studies.

1d) Soil persistence – No. The approach taken is risk based. If an unacceptable risk is identified we will first consider if this risk can be refined in some way e.g. additional more realistic data. We will also consider if management of the risk is appropriate e.g. no spray zones to manage the risk to surface water. However, if neither of these approaches allows a 'safe use' to be identified then no authorisation is given to the product/active substance.

2a) There are no items like this in the EU or UK systems, for soil persistence. As indicated above our whole approach is risk based.

2b) All metabolites of the a.s. are covered but for isomers the policy is less clear – still in discussion at EU level.

2c) All a.s. are treated equally.

2d) Soil accumulation due to repeated use on the same land either in the same year or over several years is fully assessed (by field study and/or calculation or modelling) to provide a predicted plateau concentration in soil which is used in ecotox risk assessment. Plateau concentration in soil not used directly as decision making criterion.

3a) Please note that complete EU and UK policy on pesticide persistence and bound residues in soil is given in the published paper –
Bound residues of organic compounds in the soil : the significance of pesticide persistence in soil and water : a European regulatory view.
A Craven. Environmental Pollution, 108, 15-18, (2000).

Please see also the EU Guidance Document on Persistence in Soil – DGVI B II.1 – 9188/VI/97 rev8, dated 12.07.2000. This EU document gives the complete EU policy in this area, which the UK follows in all pesticide assessment.

In the UK the ecotoxicological risk from a pesticide is considered under Directive 91/414/EEC. The specific directives that are relevant to this consideration are Directive 97/57/EC and 96/12/EC. In addition, guidance documents are available and these are as follows: 'Guidance document on risk assessment for birds and mammals under council directive 91/414/EEC, SANCO/4145/2000', Guidance document on terretrial ecotoxicology under council directive 91/414/EEC, SANCO/10329/2002' and 'Guidance document on aquatic ecotoxicology, SANCO/3268/2001.' There is also the 'Guidance document on the assessment of relevance of metabolites in groundwater of substances regulated under Council Directive 91/414/EEC, Sanco/221/2000. The initial consideration of persistence and bioaccumulation is undertaken in accordance with these Directives and guidance. If issues are identified, then at a later stage during the process the implications of other legislation and regulations are also considered.

In addition reference is given to the Ecotox guidance documents and Directives under 91/414/EEC that will be used in undertaking a risk assessment (see above).

3b) See above 2 refs to EU and UK guidance and policy in this area. Covered by 91/414. See also reference to Ecotox Directives and guidance documents.

4a) 100
Main one in EU risk assessment for soil persistence is DT90Field >1year. But this is only a criterion for further studies or assessment, not a decision point in itself.

4b) Compartments other than soil do not have clear criteria. The method of use of information on persistence in water or sediment from the water – sediment study in the assessment of the aquatic risk is indicated in the case studies.

4c) (i) formation of metabolites (identity, percentage)- lab results are used for decision making.
(ii) persistency? - field results are used for decision making.

4d) Most of this sort of thing is covered in EU and other internationally accepted study guidelines such as OECD. UK does not have specific written guidance but we like to see at least 20 field soil cores for each sample and LOQ at least 5% of added amount with cold field studies.

4a) If DT90F >1year, then further studies will be needed or some further assessment. But this is not a decision point itself – soil persistence is only assessed on the possible environmental effects that may be shown, following long term exposure. Some guidance now recently available from the EPFES workshop in Lisbon in April 2002 – guidance will be published this summer (draft already available). Again, as indicated above the fact that the DT90field is >1 year may mean that further studies are needed that are then used in the risk assessment. In addition, where the DT90 field is >100 days further consideration is given to other soil macro organsisms e.g collembola.

5a) A fish bioconcentration study is generally provided where the log Kow is >3. If it can be justified that exposure is unlikely to occur e.g. since the active substance is unstable in water, then a study may not be required. The key bioconcentration factor (BCF) from this study is considered to be the end point for the whole fish rather than an individual fish part e.g. viscera.

5b) The principles of the approach are similar for terrestrial and aquatic organisms. The information from the fish bioconcentration study is used to assess the risk to the terrestrial environment e.g. via the consumption of fish (see case studies).

5c) Yes, in considering the overall risk posed the depuration of the active substance will also be considered. For instance, if an active has a high BCF value but a rapid clearance rate it may be possible for additional studies to be provided that examine the bioconcentration of the active substance under more realistic conditions. These may show that the bioconcentration of the active substance under flow through conditions is too worse case and that under more realistic conditions it is lower. If we are content that the extra studies better reflect the actual conditions of exposure we would use them in the risk assessment.

5d) We would take account of point 5 in OECD 305 i.e. that BCFs based on total radioactivity may not be directly comparable to a BCF derived from specific chemical analysis of the parent compound only. BCFs derived from total radioactivity can be used as one of the criteria in determining if degradates identification and quantification is necessary.

5e) The bioconcentration factor acts as a trigger for the need to consider certain routes of exposure e.g. fish eating birds. In addition, the type of study required to address the chronic risk to fish will depend on the BCF. A fish early life cycle study is required where the BCF is between 100-1000 or the EC50 of the active substance is <0.1 mg a.s./l.

5f) It depends on exactly what is meant by bioaccumulating and whether this is what is realistically expected to happen under field conditions. As previously emphasised we take a risk based approach to our assessment. If there was accumulation in soil, then the maximum soil PEC would be used in the appropriate compartments of the environment e.g. earthworms. If there is bioconcentration in fish then an assessment would be made of the risk to birds and mammals that eat fish. Similarly the risk to birds from the consumption of contaminated earthworm is also assessed. Details are given in the case studies. Depending on the risk assessment results a decision is then made on whether authorisation can be given.

6a) Where potential to biomagnify is identified i.e. the whole body residue at steady state is higher than the residue in food (Bioaccumulation factor, BAF >1) then a step wise approach to the assessment of risk is taken. For the aquatic food chain it is first considered if the BCF>1000 and the elimination during the 14 day depuration phase is <95% and if the substance is stable in water or sediment. Only if these criteria are met do you go on to the next step. It is important to note that although this is the approach outlined for biomagnification in principle, we are not aware of situations where it has in fact been necessary to undertake this approach.

6b) A similar approach is taken for both aquatic organisms and the terrestrial environment.

6c) The trigger for assessment is as outlined at (a).

6d) A step wise approach is recommended as follows:

Terrestrial environment

- Obtain information from mammalian toxicity section on ADME studies (adsorption, distribution, metabolism, excretion) and residue metabolism studies. If the bioaccumulation potential is stated as low then stop here.
- Estimate the food to organism bioaccumulation factor (BAF) according to the equation

$BAF_{organism/food} = \alpha F / k_2$

Where

α is fraction of ingested dose that is adsorbed, available from toxicokinetic studies.
F is food ingestion rate relative to body weight (Food intake ratio to body weight ratio) for carnivorous/ictivorous species a value of 0.3 can be used as a default value.

k_2 =ln(2)/T1/2 – the rate constant for depuration (available from toxicokinetic studies)

If the BAF from this calculation is below 1 then stop. If not then food chain modelling should be undertaken. Further details are given in Appendix III of 'Guidance document on risk assessment for birds and mammals under Council Directive 91/414/EEC'. As the details are lengthy they are not repeated here, instead please refer directly to the guidance.

2. Aquatic environment

For persistent and bioaccumulating substances a risk assessment is required ('Guidance document on aquatic ecotoxicology'). The need for higher tier assessment is based on considering whether the BCF in the whole fish >1000 and the elimation of radioactivity during the 14 day depuration phase in the bioconcentration study is <95% and the substance is stable in water or sediment (DT90>100days).

If these criteria are met then detailed food modelling is required or micro/mesososm studie which take into account biomagnification should be submitted. Careful consideration should be given to ensuring that any modeling is appropriate to the exposure that is likely to occur to the pesticide. Modelling should cover a food chain consisting of at least 3 steps (algae, algae-feeding-invertebrates and invertebrates-feeding fish). Accumulation in algae is estimated as a BCF for unicellular algae. For accumulation within food in invertebrates and fish toxicokinetic equations for oral uptake and depuration such as the following should be used:

BCF = Fα/kd

F= daily food intake, α=assimilation factor and kd= depuration constant.

Further details on the exact proposals beyond this are given in the Aquatic guidance document (see above) and this should be consulted for them.

Again, as indicated at (a) it is important to note that the need to consider biomagnification for pesticides is a rare occurrence. If this was necessary our approach would be to follow the guidance outlined and try to use it to make a decision on whether or not the risk was acceptable. It should be noted that we would do this very carefully it is not generally necessary to consider biomagnifcation for modern pesticides. Therefore if there was one where this approach was necessary it would prompt careful and critical scrutiny.

7) These are not specifically mentioned – except that inorganic metabolites in groundwater are deemed of no concern under EU guidance.

8) There is an EU assessment trigger which covers bound residues and mineralisation to CO2 JOINTLY – as mentioned above, this is BR >70% at 100 days in aerobic lab soil studies AND CO2 <5% at 100 days in aerobic lab soil studies. BUT – no further assessment process available at present at EU or UK levels.

Additional ecotox testing e.g. litter bag tests for soil organisms, are required where the DT90 field is >1year or where mineralisation is <5% in conjunction with bound residue formation of >70%. So the presence of bound residues is considered to some extent if necessary.

9) All aspects now covered by EU guidance and policy.
No it has not, however it has provided an opportunity to reflect on what we actually do. We look forward to the outcome of the study with interest.

C.13. Switzerland

Case Study 1

Conclusions drawn.
Substance of case study 1

1a) The high persistency of Substance A and its metabolites in soil represents a serious problem to achieve a registration. There are serious doubts that the additional requested studies may result in a positive decision. Above all multiple applications will definitely not be acceptable and therefore not all intended uses possible.

1b) There is a high bioaccumulation potential of the substance, due to the high BCF of 5500 L/kg and the incomplete depletion, i.e. no further elimination after 10 days resulting in remaining residues in fish of about 40%. The high BCF itself results in a negative judgment according to 91/414/EEC Annex VI.

Requirement for the nature of residues in fish and possible further studies.

Requirement for the BCF in birds.

1c) One has to consider potential effects regarding the food chain including biomagnification. Substance A requires an extended risk assessment and higher tier experimental studies.

1d)

- Reduce number of applications.
- A conscientious observation of risk/benefit may result in the authorization of only one, the most important, crop.
- A substance may be important regarding e.g. resistance management (risk/benefit).

Case Study 2

1a) The persistency of the **R-isomer** of Substance B is not unacceptable and the fact that only one application per year is intended brings a positive point of view.

However, the **S-isomer** of *Substance B* shows a significantly slower dissipation. It is conceivable that it is mainly the S-isomer which is responsible for the long DT_{50} value in sediment.

The additional requested studies may lead to a positive decision. The most positive effect would be achieved by applying only the biologically active **R-isomer**, which shows a much more favourable environmental behaviour than the S-isomer.

1b) Even if the K_{OW} value is above 3, bioaccumulation is not regarded to be a problem. Here again, the R-isomer shows a significantly more favourable behaviour, leading to the recommendation to use only the biologically active **R-isomer.**

1c) One has to consider potential effects regarding the food chain including biomagnification.. Substance A requires an extended risk assessment and higher tier experimental studies.

1d)

- A conscientious observation of risk/benefit may result in the authorization of only one, the most important, crop.

- A substance may be important regarding e.g. resistance management (risk/benefit).

2a)

- DT_{90f} > 1 year
- BCF for birds > 1
- BCF for fish > 1000 or 100 (if not ready biodegradable)

2b) It will apply to all enantiomers, metabolites (including fermentation products) but they do not apply in general to impurities (by-products).

2c) The same standard per PB criterion is applied to all isomers of the active substance but not to by-products of the formulation.

2d) Yes it is!

3a) Submitted literature has to be carefully watched with regard to quality and reliability.
In general: Submitted literature will be considered but studies submitted by the company are given more weight.

3b) There are no written guidelines or SOPs. It is the expert who has to judge/assess the data with respect to completeness, quality and relevance.

4a) A DT_{90f} > 1 year and DT_{50f} > 3 months lead to a negative judgment.

4b) No, with respect to persistency they are defined only for soil.

4c) Data on the formation of metabolites is based on laboratory studies but will be confirmed by field studies. Data from filed studies will supersede the lab data with respect to percentage and persistency.

4d) Detection limit: 10% of initial concentration.
The sampling strategy must allow to determine the DT_{50f} and if possible the DT_{90f} values.

4e) Request and evaluate accumulation studies.
Assess potential phytotoxicity and residues in rotational crop studies as well as residues in food.

5a) It is $BCF_{ww/wo}$.

5b) For fish it is $BCF_{ww/wo,}$ for birds there is no recent experience.

5c) Yes, if the a.i. and/or the respective metabolite of interest is/are not persistent in water, rapid depuration means lower risk.

5d) Suggesting “total radioactivity”: It may be accepted in one case but not in another one, depending on the information about metabolism in water and/or in fish.

5e) BCF = 1000 or 100 (if not ready biodegradable);K_{OW} = 10000

5f) A refined risk assessment

6) There is no recent experience. We would consider Annex III of Guidance Document SANCO/4145/2000.

7) No

8) Demonstrate efforts to characterize these residues
Special studies to evaluate the bioavailability

9) Has completing the questionnaire make you revise the assessment of the PB criteria or even change conclusions on the substances? What aspects were the most challenging?
In field of Ecotoxicology we realized that there is some tension regarding “bioaccumulation” and “biomagnification”.

C14. Japan

1a)

Case Study 1

Some DT50 of the laboratory tests in soil container of Substance A are longer than one year. Therefore, studies of residue in succeeding crops is necessary to confirm the persistency. If Substance A residues in succeeding crops, the formulated products containing Substance A won't be granted the registration by The minister of Agriculture, Forestry and Fisheries according to item 5 paragraph 1 article 3 the agricultural chemicals regulation laws.

1a)

Case Study 2

Some DT50 of the laboratory tests of Substance B aren't longer than one year, which meets in the standards for withholding of agricultural chemicals Registration. As a result, the formulated product containing Substance B will be registered. If paddy will be included in target crop of the formulated product, studies of water polluting properties should be conducted.

1b) The assessment concerning bioaccumulation except livestock is not done at present.

1c) No specific comment.

1d) None

2a) If DT50 of active substance including its metabolite in soil is one year or longer, product including the a.s. will be not registered.

2b) Ditto.

2c) None.

2d) None.

3a) None.

3b) The residue in soil is evaluated in accordance with the standards for withholding of agricultural chemicals by the minister of environment.
Data Requirements for Supporting Registration of Pesticides (Notification No.12-Nousan-8147 24 November, 2000).
*More information is on the web-site (http://www.acis.go.jp/eng/indexeng.htm).

4a) DT50 in soil > or = one year

4b) There are no criteria, except for soil.

4c) (i) Yes
(ii) Lab-results are equivalent to results obtained from field-studies on formation of metabolities and persistency

4d) No. Owing to field result equate with lab-results, there are no specific criteria in Japan.

4e) If the DT50 in labo-test is longer than one year or the DT50 in field test is longer 100 days, residue study of succeeding crops should be conducted.

5) --

6) --

7) The standards on persistency are applicable to all agricultural chemicals.

8) Bound residues are considered on field test and laboratory test of soil, so there aren't specific considerations to the criteria.

9) --

C. 15. The Netherlands

1a) Both substances are persistent. If the substances are considered as new substances and/or substances that are not included in the Annex I listing, based on their half-life time they don't meet the criteria of the BUBg in the Netherlands.

1b) Substance A is very bioaccumulative and for substance B the non active isomer is somewhat bioaccumulating.

1c) No.

1d) The PB properties lead to the conclusion that no registration is possible considering both substances as new substances and/or substances that are not on the Annex I listing, If they were substances listed on the Annex I or so called (in the Netherlands) 'old substances' the answer under c would be that additional data on terrestrial ecotoxicity and accumulative behaviour would be required to derive a MPC value for soil.

2a) Always, based on the DT_{50} value for soil additional data may be required on terrestrial ecotoxicity.

2b) The criteria apply to all enantiomers. Byproducts and fermentation products are not considered for an environmental risk assessment.

2c) No.

2d) Yes if further assessment of a substance is performed based on the DT_{50} values.

3a) HTB (The Boards' Handbook for Registration of Pesticides), RIVM report 679101022 (RIVM Manual 1995)

3b) Council directive 97/57/EC.

4a) For new substances and/or substances that are not included in the Annex I listing a DT_{50} value of 180 days is implemented as a cut-off value. For substances listed on the Annex I and substances considered as 'old substances' additional data on terrestrial ecotoxicity and accumulative behaviour are necessary for the assessment.

4b) The criteria for persistence are only for soil.

4c) Laboratory results are super-seded by results from fieldstudies regarding persistence. For the formation of metabolites (identity and formation percentage) laboratory values are considered. For field studies occurrence and concentrations are considered.

4d) For field studies specific criteria have to be fulfilled. Selection of the field, sample frequency, climatic conditions, detection limits e.g. Specific criteria are defined in the Dutch manual for the admission of pesticides.

4e) See a.

5a) $BCF_{ww/wo}$ for fish

5b) Not exactly NL uses a BCF for earthworms in the risk assessment for birds and mammals. This is based on dw/dw.

5c) No.

5d) Yes

5e) UP criteria 100 for not-readily biodegradable substances and 1000 for readily biodegradable substances.

5f) Risk assessment for birds and mammals for secondary poisoning.

6) No risk assessment for biomagnification.

7) yes

8) Substance B does not meet the criteria for bound residue/CO_2 production additional data are required to demonstrate that no unacceptable residues are formed under field conditions.

9 No, no change in the assessment.