UN/SCEGHS/5/INF.4

English

Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals
(Geneva, fifth session, 7-9 July 2003, agenda item 3)

COOPERATION WITH OTHER INTERNATIONAL ORGANIZATIONS

Classification and hazard characterization of wastes under the Basel Convention

The present document (UNEP/CHW.6/26) is referred to in session document ST/SG/AC.10/C.4/2003/4 and is provided here for facilitating the work of the delegates when preparing the 5th SCEGHS.

UNITED NATIONS **EP**

United Nations Environment Programme

Distr.
GENERAL

UNEP/CHW.6/26
20 August 2002

ORIGINAL: ENGLISH

CONFERENCE OF THE PARTIES TO THE BASEL CONVENTION ON THE CONTROL OF TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES AND THEIR DISPOSAL
Sixth meeting
Geneva, 9-13 December 2002
Item 6 (e) (iii) of the provisional agenda*

CONSIDERATION OF THE IMPLEMENTATION OF THE BASEL CONVENTION

TECHNICAL MATTERS: DEVELOPMENT OF WORK ON HAZARDOUS CHARACTERISTICS

H12 - ecotoxic of Annex III to the Convention

I. BACKGROUND

1. In its decision V/24 on classification and hazard characterization of wastes, the fifth meeting of the Conference of the Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal requested the Technical Working Group of the Basel Convention to finalize its work on, inter alia, hazardous characteristic H12 – Ecotoxic of annex III to the Convention for consideration by the Conference of the Parties at its next meeting.

2. As requested by the Conference of the Parties, the Technical Working Group at its sixteenth, seventeenth, eighteenth, nineteenth and twentieth sessions undertook, under the leadership of Denmark, to prepare and finalize the work on the hazardous characteristic H12 – Ecotoxic.

II. IMPLEMENTATION

3. At its twentieth session, in May 2002, the Technical Working Group adopted the document contained in the annex to the present note as an interim guideline. The document, entitled "Development of ecotoxicological criteria for the characterization of hazardous waste – Working document for the Technical Working Group (Basel Convention): Criteria for ecotoxicity of waste according to the Basel Convention,

* UNEP/CHW.6/1.

K0262405 160902

annex III H12 Ecotoxic – Interim guideline (August 2002)" constitutes the first paper on the development of criteria for one of the hazardous characteristics of annex III to the Convention.

III. PROPOSED ACTION

4. At its sixth meeting, the Conference of the Parties may wish to consider adopting a decision along the following lines:

The Conference,

Welcoming the finalization of the interim guideline on the hazardous characteristic H12 – Ecotoxic, of annex III to the Basel Convention,

Noting with appreciation the efforts and leadership exercised by Denmark in the development of the interim guideline on the hazardous characteristic H12 – Ecotoxic,

1. Adopts the interim guideline on the hazardous characteristic H12 – Ecotoxic as contained in the annex to the present decision;

2. Invites Parties to monitor the use of the interim guideline on hazardous characteristic H12 – Ecotoxic, with a view to improving or up-dating it as necessary;

3. Requests the secretariat to publish the interim guideline in the official languages of the United Nations and to facilitate its dissemination.

Annex

Development of ecotoxicological criteria for the characterisation of hazardous waste

Working document for the Technical Working Group (Basel Convention): Criteria for ecotoxicity of waste according to the Basel Convention, Annex III H12 Ecotoxic

Interim guideline
(August 2002)

Contents

1. Introduction

The present document proposes criteria for the ecotoxicological hazard of wastes. It is an aim of the Basel Convention that the management and transboundary movement of hazardous waste are consistent with the protection of human health and the environment. In terms of ecotoxicity, this means that wildlife as well as the functioning of the ecosystems should be protected against potential adverse effects caused by the generation, transport and disposal of hazardous waste.

According to the Basel Convention, Annex III, the hazard characteristic H12 "Ecotoxic" is defined as:

Substances or wastes which, if released, present or may present immediate or delayed adverse impacts to the environment by means of bioaccumulation and/or toxic effects upon biotic systems.

The ecotoxicological impact of a chemical substance or waste depends on the ability of the chemical substance or waste to act toxically on organisms in the environment as well as on the exposure of these organisms

Systems for classification of chemical substances as regards ecotoxicological hazard, e.g. OECD (2001), normally consider both the toxicological properties of the substances and their exposure-related properties, e.g. their potential for bioaccumulation and ability to degrade in the environment. Also, as indicated in the definition above, an ecotoxicological assessment should address acute effects (e.g. acute lethality of organisms) as well as chronic effects (e.g. reduced growth or failure of reproduction) as endpoints.

In ecotoxicology, the toxic impact on biotic systems of substances or mixtures of substances is assessed by use of tests, in which organisms are exposed under controlled conditions. A range of different test systems is available, from simple short-term lethality tests with single species to enclosures with communities of organisms. Compared to the large number of chemicals used in society today, data on ecotoxicity are, however, only available for relatively few chemicals, and in most cases, these data are limited to the results of a few basic aquatic tests, e.g. for acute toxicity to fish or daphnia.

Exposure-related properties such as biodegradation and bioaccumulation are important for assessment of the ecotoxicological hazard of substances as they have significant influence on the distribution of the substances between biota and environment and the ability of these substances to persist in the environment. Test results of ready degradability and potential for bioaccumulation (according to the guidelines from OECD, 1993) are often used as indicators for these properties and included in classification schemes for chemical substances (e.g. OECD 2001).

It is a bearing principle in the proposed strategy that the ecotoxicological hazard of wastes is determined by its content of hazardous substances. The ecotoxicological hazard of these substances is evaluated by use of data from standardised ecotoxicological laboratory tests with organisms representing different levels in the ecosystem and/or different types of environments. These data and data on biodegradation and bioaccumulation are used to classify the ecotoxicological hazard of substances in wastes.

A classification of wastes should be independent of local or regional conditions. The Basel Convention aims at control of transboundary movements of hazardous wastes and the principles for evaluation should consequently be harmonised in order to facilitate the enforcement.

The following areas are not included in the criteria document but will be considered in the future:

- Assessment of the ecotoxicological hazard of metals and metal compounds is not included at present. A Draft Guidance Document on Transformation/Dissolution of Metals and Metal Compounds in Aqueous Media is, however, currently subject to a validation exercise (OECD 2001, Annex 3). The guidance document will be considered for use in the context of hazardous waste once the recommendations from this work are available.

- The proposed criteria are based on the ecotoxicological properties: Toxicity, biodegradation and bioaccumulation. Other relevant endpoints, e.g. endocrine disruption and transfer via food chains, are not included because of lack of internationally accepted criteria.

- International criteria for classification of chemical substances are currently based on aquatic toxicity (OECD 2001) but will in future include other environmental compartments as well. Data on terrestrial toxicity of chemicals are sparse and the proposals for classification criteria for terrestrial toxicity presented elsewhere are not sufficiently validated (Torstensson & Petterson 1998). At present, it is therefore recommended not to include classification of chemicals based on terrestrial toxicity.

- The use of ecotoxicological test methods for the evaluation of the hazard of wastes needs to be further validated and internationally accepted before they are considered for use in this guideline. This includes methods for sampling and preparation of wastes for testing (e.g. water extracts) as well as selection of test methods representing different environmental compartments. The area is, however, rapidly progressing and should be considered in future revisions of the criteria.

For this reason, this guideline is considered as an interim guideline.

2. Scope & definitions

In the development process of the proposed criteria for the hazard characteristic: H12 Ecotoxic, the TWG had a number of underlying discussions pertaining to the scope and definition of the hazard characteristic. These discussions are summarised below.

2.1 Scope of the work

The scope of the work was to derive criteria for the hazard characteristic: H12 Ecotoxic in order to obtain a tool for the documentation of ecotoxicological hazard of wastes. The general application of the criteria is for evaluation of waste types, which are considered by the parties for adoption in Annex VIII or IX in the Convention. The proposed criteria are based on parameters that are generally accepted as indicators of ecotoxicological hazard, e.g. toxicity and bioaccumulation.

In particular cases, the presence of a waste type in Annex VIII or IX of the Basel Convention do not, however, preclude the evaluation according to the hazard characteristics in Annex III. The criteria may thus be used in specific cases for evaluating a possible hazard of a waste indicated in these annexes, or for evaluation of specific wastes, which are not included in Annex VIII or IX.

The intended use of the proposed criteria is not, however, for routine evaluation of individual wastes as the costs and time consumption will be far too high for this purpose. The daily evaluation of individual wastes is therefore conducted by use of Annexes VIII and IX.

2.2 Definitions

It is important to have a common understanding of the definition of the hazard characteristic: H12 Ecotoxic before criteria are agreed. The characteristic H12 Ecotoxic is phrased as follows:

Basel Convention, Annex III, H12 Ecotoxic:
Substances or wastes which, if released, present or may present immediate or delayed adverse impacts to the environment by means of bioaccumulation and/or toxic effects upon biotic systems.

According to the definition, the adverse impact includes immediate or delayed adverse effects on biotic systems. In ecotoxicology, the toxicity to the individual organisms is used as an indicator of toxic impact on biotic systems whereas possible bioaccumulation is evaluated separately. These are the two endpoints normally used in ecotoxicological evaluations of chemical substances.

The use of the word *delayed* in the definition is important as it pertains to possible long-term effects caused by substances in the waste. Thus the evaluation should include both acute and chronic effects. This also includes the possibility of long-term effects from substances that are slowly degradable.

'*Hazard*' is a key word of the Basel Convention. P. Calow (1994) defines the hazard of chemicals as:

"The potential that chemicals have for causing adverse effects to humans or the ecological system depends upon their *intrinsic properties*, and characterizing these is sometimes known as *hazard identification*."

According to this definition, the hazard is determined by the *intrinsic* properties of a substance - or a mixture of substances (e.g. wastes), for example the ecotoxicological and physico-chemical properties under the given conditions of exposure.

The term *hazard identification* is commonly used in risk management of chemical substances and closely related to *classification* of hazard, e.g. a classification of wastes according to the Basel Convention. According to the definition by Peter Calow cited above, *hazard identification* specifies the reason for a substance being hazardous. A substance may for instance be hazardous because of a potential for carcinogenicity or an ecotoxicological property.

The Basel Convention refer in the definition of 'H12 Ecotoxic' to "*Substances or wastes which, if released..*". The H12 definition is thus in line with the general understanding of hazard identification, i.e. the potential to cause harm if exposure takes place.

International classification systems are used in countries with highly different environmental conditions and technological development levels. As classification criteria are based on the intrinsic properties, which do not take the site-specific exposure situation or the specific environmental conditions into consideration, the classification is independent of time and place and indicates the potential impact if release or exposure should take place. It thus does not refer to estimates of the likelihood of effects, which is the goal of a risk assessment.

Conclusions:

- The Basel Convention 'H12 Ecotoxic' refers to the intrinsic hazard of the waste caused by toxic substances contained in the waste, i.e. hazard *identification*. This does not include an evaluation of the *risk* of effects, i.e. an estimate of the likelihood of effects in case toxic substances are released to the environment.

- Therefore, criteria for ecotoxic hazard should be based on the properties of the substances in the waste such as toxicity, degradability and ability to bioaccumulate in line with the internationally agreed classification (OECD 2001).

3. Proposed assessment strategy

The proposed strategy is based on a tiered approach with the following individual assessment steps:

1. Initial assessment based on lists of hazardous and non-hazardous wastes (i.e. Basel Convention Annexes VIII and IX).

2. Assessment based on the content of hazardous chemicals in the waste.

(Proposed future Step 3: Ecotoxicological assessment by use of test methods)

The strategy is summarised in Figure 1.

The first step of the strategy is to determine whether the hazardous properties of the waste have already been evaluated according to the Basel Convention, i.e. the waste appears in either Annex VIII or Annex IX.

If the waste does not appear on either of these lists, an evaluation according to Step 2 is conducted. It should, however, be noted that, in a particular case, the presence of a waste on the lists in Annexes VIII and IX does not preclude an assessment according to Annex III.

The evaluation of the ecotoxicological hazard according to Step 2 is made by use of the criteria specified in Annex 1 of this document.

Step 3 is not included in the proposed criteria but should be regarded as a rapidly progressing area, which should be considered in future revisions of the criteria.

In Step 3, ecotoxicological tests are used for assessment of the hazard of the waste. It is proposed to apply two levels of tests: a screening level and a comprehensive level. The methodologies need, however, further development and validation before an implementation in the H12 characteristic can be recommended.

An outline of the proposed Step 3 assessment procedure is found in Annex 1 of this document.

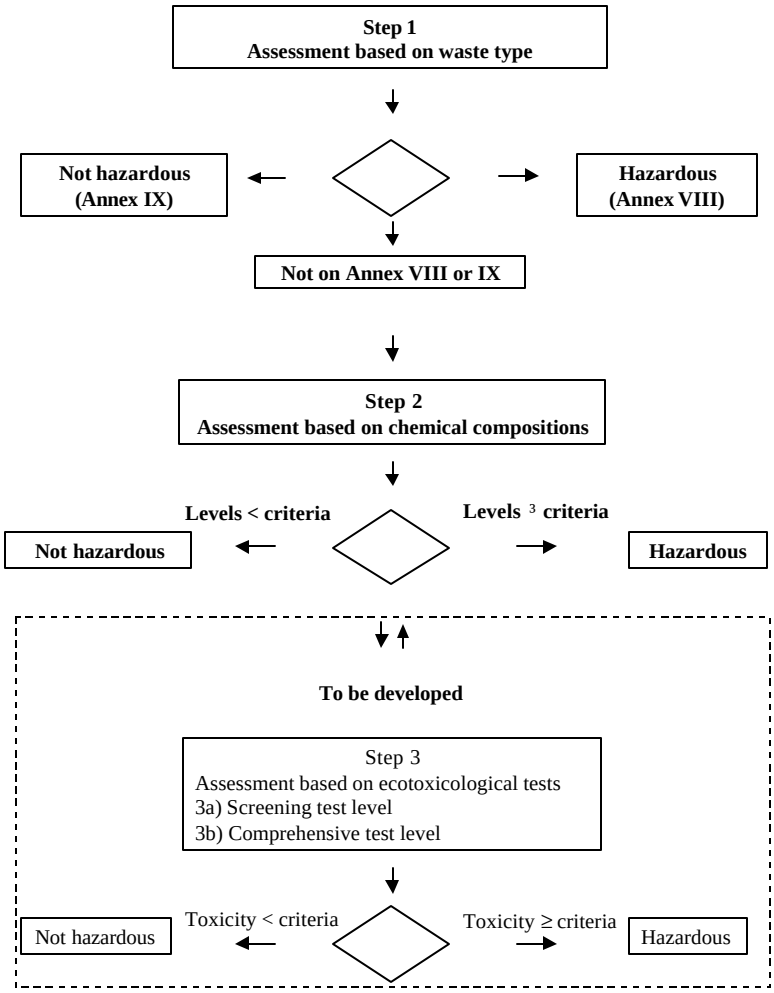

Figure 1 Strategy for assessment of the ecotoxicological hazard of wastes.

4. References

Calow P. (1994). Overview with observations on risk assessment and management. In P. Calow (ed): Handbook of ecotoxicology. Vol.2. Blackwell scientific publications.

Council Directive 1999/45/EEC concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification packaging and labelling of dangerous preparations.
http://europa.eu.int/eur-lex/en/search/search_lif.html

OECD (1993). Guidelines for testing of chemicals. OECD, Environmental Directorate, Chemicals Division, Paris, France.
http://www.oecd.org/EN/home/0,,EN-home-524-14-no-no-no-0,00.html

OECD (2001). The Harmonised Integrated Classification System for Human Health and Environmental Hazards of Chemical Substances and Mixtures. OECD Series on Testing and Assessment, No. 33. ENV/JM/MONO(2001)6.
http://www.oecd.org/EN/documents/0,,EN-documents-521-14-no-24--0,00.html

UNEP (2001). Stockholm Convention on Persistent Organic Pollutants (POP).
(http://www.chem.unep.ch/sc/)

Torstensson, L. & I. Pettersson (1998). Discussion Paper in Soil and Soil Compartments, Effects. Prepared for the OECD Terrestrial Effect Working Group.

Annex 1: Assessment procedures

The proposed assessment strategy follows a tiered approach with two (three) steps:

Step 1: Initial assessment based on lists of hazardous and non-hazardous wastes

Step 1 can be regarded as common for all assessments of wastes according to the Basel Convention. It is determined if the waste type is included on the existing list of hazardous or non-hazardous wastes according to the Basel Convention, Annex VIII or IX.

If it is not on either of these lists, the waste is evaluated according to Annex III, e.g. assessment of ecotoxicological hazard, H12, by use of the procedure in Step 2 (and 3). If the waste to be assessed is listed on annex VIII or IX the assessment procedures could be continued, step 2 (step 3) if it is deemed to be appropriate or necessary.

Step 2: Assessment based on the hazardous content of the waste

On the one hand, the assessment of the ecotoxicity of the waste is based on specific criteria for the ecotoxicological hazard of the individual substances contained in the waste and, on the other hand, it is based on *de minimis* limits for the content of hazardous substances in wastes. As the hazard of substances may be quite different, individual criteria and *de minimis* limits are defined for substances belonging to different hazard categories as specified in Table 1. The proposed hazard categories are closely related to the classification of substances for aquatic toxicity according to the recommendations from OECD (1998).

It is the aim of the UNEP Stockholm Convention to derive specific limit values for certain Persistent Organic Pollutants (POP) in waste (UNEP 2001). Presently, a *de minimis* limit for PCB has been fixed at 50 mg/kg (Basel Convention, Annex VIII). Specific criteria for POPs with a reference to the Stockholm Convention are included as an option in Table 1.

De minimis limits for the content of substances belonging to the individual hazard categories are presented in Table 2. The criteria for mixtures are equivalent to the criteria for classification of chemical preparations as regards aquatic toxicity in the Harmonised Integrated Classification System (OECD 2001).

Table 1 Criteria for ecotoxicity of substances based on aquatic toxicity, resistance to biodegradation and bioaccumulation. According to OECD (2001).

Substance hazard category	Aquatic toxicity [1] (mg/l)	Not readily biodegraded[2]	Potential for bioaccumulation[3]
Acute Class 1	$LC/EC_{50} \leq 1$	no	and no
Acute Class 2	$1 < LC/EC_{50} \leq 10$	no	and no
Acute Class 3	$10 < LC/EC_{50} \leq 100$	no	and no
Chronic Class 1	$LC/EC_{50} \leq 1$	yes	and/or yes
Chronic Class 2	$1 < LC/EC50 \leq 10$ [4]	yes	and/or yes
Chronic Class 3	$10 < LC/EC_{50} \leq 100$ [4]	yes	and/or yes
Chronic Class 4	[5]	yes	and yes
UNEP POP	Priority chemicals [6]		

1) Acute toxicity to aquatic organisms expressed as LC_{50} or EC_{50}, i.e. the concentration at which 50% effect (mortality, activity or inhibition) is obtained. The lowest obtained LC(EC)50 value representing acute toxicity to fish, crustaceans or micro-algae is used.
2) According to the definitions used in OECD Guidelines 301 A-E (OECD 1993).
3) Potential for bioaccumulation is normally assumed if log K_{ow} is higher than 4 (for organic substances only) unless the experimental determined BCF < 500 (OECD 2001).
4) Unless the chronic toxicity NOECs are > 1 mg/l (OECD 2001).
5) Poorly soluble substances for which no acute toxicity is recorded at levels up to the water solubility, unless chronic NOECs are > 1 mg/l or experimentally determined BCF < 500 or evidence of rapid degradation in the environment exists.
6) The Stockholm Convention on Persistent Organic Pollutants (POP). It should be noted that in the Stockholm Convention, the criteria for bioaccumulation are BFC = 5000 or log K_{ow} = 5 whereas in the Harmonised Integrated Classification System developed by OECD (2001), the criteria are: BFC = 500 or log K_{ow} = 4. This difference is due to the fact that the focus of the Stockholm Convention is high priority pollutants in contrast to the OECD system, which aims at industrial chemicals and pesticides.

Table 2 *De minimis* limits for hazardous substances in wastes. The waste is classified as 'H12: Ecotoxic' if the aggregated concentrations of hazardous substances exceed any of the criteria in the table. The concentrations of substances are in percentages of the dry weight of the waste. Based on OECD (2001)

Sum of substances in hazard category	*De minimis* limits % in waste
Acute Class 1	25
Acute Class 2	25
Acute Class 3	25
Chronic Class 1	0.25
Chronic Class 2	2.5
Chronic Class 3	25
Chronic Class 4	25

In addition to these *de minimis* limits, there may be specific limits for the content in waste of specific high priority substances as POPs. PCB is among the presently identified POPs. A *de minimis* limits for PCB has been fixed at 50 mg/kg (Basel Convention, Annex VIII).

Components of a waste with toxicity well below 1 mg/l should be given specific attention. Such substances present an increased ecotoxicological hazard or increase the combined hazard of a mixture of substances.

A waste that contains a highly toxic component classified as Chronic Class 1 (e.g. a pesticide) may thus be hazardous even if the content is below the *de minimis* limits presented in Table 2. It is therefore recommended that the concentration of highly toxic components is multiplied by an appropriate multiplying factor. The multiplying factors to be applied to these components are defined using the toxicity value, as summarised in Table 3 below. Therefore, in order to classify a waste containing Chronic Class 1 components, the classifier needs to be informed of the value of the M factor.

Table 3 Multiplying factors for highly toxic components classified as Chronic Class 1. Based on OECD (2001).

$L(E)C_{50}$ value	Multiplying factor (M)
$0.1 < L(E)C_{50} = 1$	1
$0.01 < L(E)C_{50} \leq 0.1$	10
$0.001 < L(E)C_{50} \leq 0.01$	100
$0.0001 < L(E)C_{50} \leq 0.001$	1000
$0.00001 < L(E)C_{50} \leq 0.0001$	10000
(continue in factor 10 intervals)	

Evaluation of mixtures of hazardous substances

Often a waste can contain several chemical components with different ecotoxicological properties and it is therefore necessary to consider the combined ecotoxicological potential of such mixtures. As a first estimate, the toxicity of the substances can be considered as additive and the concentrations (in percentages of the waste) of the individual substances belonging to the same hazard category (Acute Class 1-3 or Chronic Class 1-4) are summed up (Tables 1 and 2). A method for adding up substances belonging to different hazard categories is presented in Table 4.

Substances in mixtures may, however, interact and show higher or lower toxicity than expected from addition. In case such interaction is expected, the only practical way of assessing the combined toxicity is by ecotoxicity testing (Step 3 which is still optional and has to be worked on).

The criteria for mixtures presented in Table 4 are equivalent to the criteria for classification of chemical preparations as regards aquatic toxicity in OECD (2001).

Table 4 *De minimis* limits for mixtures of hazardous substances in wastes. The waste is classified as 'H12: Ecotoxic' if it the aggregated concentrations of hazardous substances exceed any of the criteria in the table. The concentrations of substances are in % of the dry weight of the waste. Based on OECD (2001).

Sum of substances belonging to different hazard categories	*De minimis* limitl
(100 x ΣChronic Class 1) + (10 x ΣChronic Class 2) + ΣChronic Class 3	25%

For a mixture containing highly toxic substances as well as other components classified as Chronic Class 1, the approach in Table 4 should be applied using a weighted sum by multiplying the concentrations of Chronic Class 1 components by a factor instead of simply adding up the percentages. This means that the concentration of "Chronic Class 1" in the left column of Table 4 is multiplied by the appropriate multiplying factor from Table 3.

Step 3: Ecotoxicological assessment based on tests

Presently, further methodological development and validation is needed before an international consensus on the use of ecotoxicological test methods on waste can be reached. It is thus recommended that elaboration of specific criteria for assessment of waste by use of test methods await the recommendations from the international expert groups in CEN and ISO.

The scheme for assessment of the ecotoxicity of waste by use of ecotoxicological tests should therefore be regarded as a proposal, which needs further development.

It is proposed that the test strategy includes batteries of tests representing both the terrestrial and aquatic environments. Furthermore, both the tests of water extracts and the direct test of waste should be considered as they represent different exposure scenarios. It should be noted that water extracts for toxicity testing are used here to obtain a measure of the readily available fractions of toxic substances in the waste, and unlike leachate tests, they do not simulate leaching from waste under environmental conditions.

It is proposed to apply a screening and a comprehensive test level:

3a) Screening test of ecotoxicity of wastes

At the screening level, an extract of the waste (in case it is a solid) or a sample of a liquid waste is tested for acute toxicity by use of a battery of aquatic and terrestrial tests. No test methods or criteria are proposed at present. The purpose of the screening is to conduct a relatively fast and cheap assessment of the ecotoxicity of the waste. If a waste show toxicity at the screening level, it will most probably also show toxicity at the comprehensive test level.

3b) Comprehensive test of ecotoxicity of wastes

At the comprehensive test level, extracts and solid samples are tested for chronic toxicity by use of a battery of aquatic and terrestrial tests. Chronic tests are generally more sensitive than the tests used at the screening level. The purpose of the testing is to verify or reject an assessment result obtained at previous levels. No test methods or criteria are proposed at present.

Examples of standardised relevant and internationally standardised test methods are given in Table 5. Other methods that have been validated for use on waste should be considered as candidates as well.

Table 5 Examples of internationally standardised test methods for assessment of the acute and chronic toxicity of wastes.

Aquatic methods
Daphnia magna , 48 h, acute lethality (ISO 6341)
Daphnia magna , 21 days, lethality and reproduction (ISO 10706)
Algal, 72h, growth inhibition (ISO 8692)
Terrestrial methods
Higher plants, 14 days, germination and growth (ISO 11269 2)
Earthworms, 14 days, lethality (ISO 11268 1)
Collembola, lethality and reproduction (ISO 11267)
Microbial processes, short-term toxicity on soil microflora, N -cycle. (OECD test guideline)

Annex 2: Examples

General: In general a more severe classification for mixtures overrides a less severe classification, e.g. a classification with Chronic Class 1 overrides a classification with Chronic Class 2. As a consequence, the classification procedure is already completed if the result of the classification is Chronic Class 1. As a more severe classification than Chronic Class 1 is not possible, it is not necessary to proceed with the further classification procedure.

The evaluation of the hazard of wastes in Step 2 is based on the criteria in the Tables 1, 2, 3 and 4 below.

Table 1 Criteria for ecotoxicity of substances based on aquatic toxicity, resistance to biodegradation and bioaccumulation. According to OECD (1998).

Substance hazard category	Aquatic toxicity (mg/l)[1]	Not readily biodegraded[2]	Potential for bioaccumulation[3]
Acute Class 1	$LC/EC_{50} \leq 1$	no	and no
Acute Class 2	$1 < LC/EC_{50} \leq 10$	no	and no
Acute Class 3	$10 < LC/EC_{50} \leq 100$	no	and no
Chronic Class 1	$LC/EC_{50} \leq 1$	yes	and/or yes
Chronic Class 2	$1 < LC/EC_{50} \leq 10$	yes	and/or yes
Chronic Class 3	$10 < LC/EC_{50} \leq 100$	yes	and/or yes
Chronic Class 4	Poorly soluble .....[5]	yes	and yes
UNEP POP	Priority chemicals with specific *de minimis* limits[6]		

1) Acute toxicity to aquatic organisms expressed as LC_{50} or EC_{50}, i.e. the concentration at which 50% effect (mortality, activity or inhibition) is obtained. The lowest obtained LC(EC)50 value representing acute toxicity to fish, crustaceans or micro-algae is used.
2) According to the definitions used in OECD Guidelines 301 A-E (OECD 1993).
3) Potential for bioaccumulation is normally assumed if log K_{ow} is higher than 4 (for organic substances only) unless the experimental determined BCF < 500 (OECD 1998).
4) Unless the chronic toxicity NOECs are > 1 mg/l (OECD 1998).
5) Poorly soluble substances for which no acute toxicity is recorded at levels up to the water solubility, unless chronic NOECs are > 1 mg/l or experimentally determined BCF < 500 or evidence of rapid degradation in the environment exists.
6) The Stockholm Convention on Persistent Organic Pollutants (POP). Specific *de minimis* limits are developed for specific substances under the Stockholm Convention on POPs. It should be noted that in the Stockholm Convention, the criteria for bioaccumulation are BFC = 5000 or log K_{ow} = 5 whereas in the Harmonised Integrated Classification System developed by OECD (2001), the criteria are: BFC = 500 or log K_{ow} = 4. This difference is due to the fact that the focus of the Stockholm Convention is high priority pollutants in contrast to the OECD system, which aims at industrial chemicals and pesticides.

Table 2 *De minimis* limits for hazardous substances in wastes. The waste is classified as 'H12: Ecotoxic' if the sum of the concentrations of the individual hazardous substances in the waste exceed any of the criteria in the table. The concentrations of substances are in percentages of the dry weight of the waste.

Sum of substances in hazard category	*De minimis* limits % in waste
Acute Class 1	25
Acute Class 2	25
Acute Class 3	25
Chronic Class 1	0.25
Chronic Class 2	2.5
Chronic Class 3	25
Chronic Class 4	25

In addition to the *de minimis* limits in Table 2, there may be specific limits for the content in waste of specific high priority substances as POPs. PCB is among the presently identified POPs. A *de minimis* limit for PCB has been fixed at 50 mg/kg (Basel Convention, Annex VIII).

A waste that contains highly toxic components classified as Chronic Class 1 (e.g. a pesticide) may be hazardous at levels below the *de minimis* limits presented in Table 2. It is recommended that the concentrations of highly toxic components be multiplied by an appropriate multiplying factor. The multiplying factors to be applied to these components are defined using the toxicity value, as summarised in Table 3 below.

Table 3 Multiplying factors for highly toxic components classified as Chronic Class 1. Based on OECD (2001).

$L(E)C_{50}$ value	Multiplying factor (M)
$0.1 < L(E)C_{50} = 1$	1
$0.01 < L(E)C_{50} \leq 0.1$	10
$0.001 < L(E)C_{50} \leq 0.01$	100
$0.0001 < L(E)C_{50} \leq 0.001$	1000
$0.00001 < L(E)C_{50} \leq 0.0001$	10000
(continue in factor 10 intervals)	

Table 4 *De minimis* limits for mixtures of hazardous substances in wastes. The waste is classified as 'H12: Ecotoxic' if the sum of the concentrations of the individual hazardous substances belonging to the classes: Chronic 1, 2 or 3 exceeds the criteria in the table. The concentrations of substances are in percentages of the dry weight of the waste.

Sum of substances belonging to different hazard categories	*de minimis* limit
(100 x Σ Chronic Class 1) + (10 x Σ Chronic Class 2) + Σ Chronic Class 3	25%

Example 1

Waste type: Waste containing the pesticide dieldrin in a concentration of 0.005%.

Step 1: Initial assessment based on Annex VIII and Annex IX of the Basel Convention

The waste is hazardous according to Annex VIII, A4030: *Wastes from the production, formulation and use of biocides including waste pesticides and herbicides, which are off-specification, outdated, or unfit for their originally intended use.*

Step 2: Assessment based on the content of hazardous chemicals in the waste

In the EU, dieldrin is classified: R50/53: Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Dieldrin is very toxic to aquatic organisms with LC_{50} values for the most sensitive species at levels from 1 - 10 µg/l (Verschueren 1997). In addition, the substance is persistent to degradation and able to bioaccumulate significantly in aquatic organisms (BCF > 500).

Hazard category (Table 1): Dieldrin falls within Chronic Class 1.

Multiplying factor (Table 3): $M = 100$ ($0.001 < L(E)C_{50} \leq 0.01$)

Concentration in waste (% w/w): 0.005%

Corrected concentration by use of multiplying factor: $\%w/w \cdot M = 0{,}005\% \cdot 100 = 0{,}5\ \%$

de minimis limit (Table 2): Chronic Class 1: 0.25%

Conclusion: The waste is hazardous.

Reference:
Verschueren (1997). Handbook of Environmental Data on Organic Chemicals. 3rd Edition on CD-ROM. Van Nostrand Reinhold.

Example 2

Waste type: The waste contains the following mixture of hazardous components:

1,10-Phenanthroline	0.13 % w/w
o-Anisidine	0,6 % w/w
2,4-Di-isocyanatotoluene	0.9 % w/w

Step 1: Initial assessment based on Annex VIII and Annex IX of the Basel Convention

The waste is hazardous according to the Basel Convention Annex VIII, 4070: *Wastes from the production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish excluding any such waste specified on list B (note the related entry on list B, B4010)*

Step 2: Assessment based on the content of hazardous chemicals in the waste

1,10-Phenanthroline has the EU classification: R50/53: Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The substance is toxicity to aquatic organisms at levels between 0.1 and 1 mg/l and is not readily biodegradable.

o-Anisidine has the EU classification: R 51/53: Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The substance has a medium toxicity to aquatic organisms and is not readily degradable.

2,4-Di-isocyanatotoluene has the EU classification: R 52/53: Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

According to Table 1, the compounds belong to the following hazard categories:

Hazard Category (Table 1):

1,10-Phenanthroline	Chronic Class 1
o-Anisidine	Chronic Class 2
2,4-Di-isocyanatotoluene	Chronic Class 3

Concentration in waste (% w/w):

1,10-Phenanthroline	0.13
o-Anisidine	0.6
2,4-Di-isocyanatotoluene	0.9

Multiplying factor (M) (Table 3):

1,10-Phenanthroline	1
o-Anisidine	Not applied
2,4-Di-isocyanatotoluene	Not applied

Corrected concentration by use of multiplying factor: M=1 for 1,10-Phenanthroline and does not influence assessment of the mixture. Multiplying factors are only applied for substances in Chronic Class 1.

The content in waste of the individual substances above will not lead to a classification as hazardous according to the proposed *de minimis* limits presented in Table 2. The combined hazard from these substances may, however, according to the *de minimis* limits for mixtures presented in Table 4 lead to a classification of the waste.

de minimis limit (according to Tables 2 & 4):

Example 3	OECD Haz. cat.	Conc. % w/w	Factor[1]	Weighted concentration	*de minimis*.	H12?
1,10-Phenanthroline	Chronic 1	0.13	100	13		
o-Anisidine	Chronic 2	0.6	10	6		
2,4-Di-isocyanatotoluene	Chronic 3	0.9	1	0.9		
Sum				19.9	>25	No

[1] Factor: the factors used in Table 4 for mixtures of substances in Chronic Classes 1, 2 and 3.

Conclusion: The waste is not hazardous according to the proposed criteria.
