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# Hazardous waste

Interpretation of the definition and classification of hazardous waste

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### **Statement of Use**

This Technical Guidance on hazardous waste has a similar purpose to WM1 Special Wastes: A technical guidance note on their definition and classification. This document defines hazardous waste for regimes that refer to hazardous waste. WM1 will continue to be used to provide guidance on the assessment of waste according to the criteria contained in the Special Waste Regulations as appropriate in England, Wales, Scotland and Northern Ireland.

It is intended as a reference document for use by the waste management industry, producers, and regulators of hazardous waste. This Technical Guidance has been produced by the Environment Agency, SEPA and the Environment and Heritage Service. In this document, they are known collectively as "the Agencies".

A consultation version of this document was released externally by the Agencies in September 2002. This document has been amended in light of those comments received as part of this formal consultation process.

### **Keywords**

Hazardous waste, special waste, European Waste Catalogue, dangerous substances, chemicals

### **Research Contractor**

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# List of Abbreviations

<b>ACDP</b>	Advisory Committee on Dangerous Pathogens	<b>LC</b>	Lethal concentration
<b>ASL</b>	Approved Supply List (7th edition)	<b>LD</b>	Lethal dose
<b>ASTM</b>	American Society for Testing and Materials	<b>LEL</b>	Lower Explosive Limits
<b>ATSDR</b>	Agency for Toxic Substances and Disease Registry	<b>MEC</b>	Minimum effective concentration
<b>BCF</b>	bioconcentration factor	<b>MECA</b>	Minimum effective concentration in adult
<b>BOD</b>	biological oxygen demand	<b>MECD</b>	Minimum effective concentration in developing embryos
<b>BSI</b>	British Standards Institute	<b>MFSU</b>	Manufacture, formulation, supply and use
<b>CAS</b>	Chemical Abstract Service	<b>MSDS</b>	Material Safety Data Sheets
<b>CD-ROM</b>	Compact Disk - Read Only Memory	<b>NCEC</b>	National Chemical Emergency Centre
<b>CDS</b>	Chemical Detection System	<b>NFPA</b>	National Fire Protection Association
<b>CFC</b>	chlorofluorocarbon	<b>NIOSH</b>	National Institute of Safety and Health
<b>CHIP3</b>	Chemicals (Hazards Information and Packaging) [Regulations]	<b>OHMTADS</b>	Oil and Hazardous Materials Technical Assistance Data Systems
<b>CIS</b>	Chemical Information System	<b>PAH</b>	polycyclic aromatic hydrocarbon
<b>DIN</b>	Deutsche Industrie Normen	<b>PCBs</b>	polychlorinated biphenyls
<b>DOSE</b>	The Dictionary of Substances and their Effects	<b>PCTs</b>	polychlorinated terphenyls
<b>DPD</b>	Dangerous Preparation Directive	<b>PETN</b>	pentaerythritol tetranitrate
<b>EC</b>	European Communities	<b>RDX</b>	cyclotrimethylene trinitramine
<b>ECB</b>	European Chemicals Bureau	<b>RTECS</b>	Registry of Toxic Effects of Chemical Substances
<b>EEC</b>	European Economic Community	<b>SCA</b>	Standing Committee of Analysts
<b>EHC</b>	Environmental Health Criteria	<b>SDSs</b>	Safety Data Sheet(s)
<b>EINECS</b>	European Inventory of Existing Commercial Chemical Substances	<b>SEPA</b>	Scottish Environment Protection Agency
<b>EU</b>	European Union	<b>SIRI MSDS</b>	Safety Information Resources and Material Safety Data Sheets
<b>EWC 1994</b>	European Waste Catalogue 1994	<b>STP</b>	Standard temperature and pressure (25°C, 1 atmosphere pressure)
<b>EWC 2002</b>	Revised European Waste Catalogue 2002	<b>TER</b>	transcutaneous Electrical Resistance
<b>FGT</b>	Flue Gas Treatment	<b>TGBE</b>	triethylene glycol mono-N-Butyl ether
<b>HSC</b>	Health and Safety Commission	<b>TGME</b>	triethylene glycol monomethyl ether
<b>HSDB</b>	Hazardous Substances Data Bank	<b>TSCA</b>	Toxic Substances Control Act
<b>HSE</b>	Health and Safety Executive	<b>UEL</b>	Upper Explosive Limits
<b>HWD</b>	Hazardous Waste Directive	<b>UK</b>	United Kingdom
<b>HWL</b>	Hazardous Waste List	<b>UKEMS</b>	UK Environmental Mutagen Society
<b>IARC</b>	International Agency for Research on Cancer	<b>URL</b>	Uniform Resource Locator
<b>IPCS INCHEM</b>	International Programme on Chemical Safety	<b>USA</b>	United States of America
<b>IRIS</b>	Integrated Risk Information System	<b>USEPA</b>	United States Environmental Protection Agency
<b>ISCS</b>	International Chemical Safety Cards	<b>WAF</b>	Water-accomodated Fraction
<b>ISO</b>	International Standards Organisation	<b>WHO</b>	World Health Organisation
<b>IUCLID</b>	International Uniform Chemical Information Database	<b>XPS</b>	Extruded Polystyrene
<b>L/S</b>	Liquid to Solid		

# Introduction

This Technical Guidance document has been developed to provide guidance on the assessment and classification of hazardous waste based on the Hazardous Waste Directive<sup>a</sup> definition of hazardous waste.

It is intended to provide guidance to all involved in the production, management and control of hazardous waste and to be a reference document for all legislation related to hazardous waste and its management.

The guidance is structured as follows:

- Chapter 1 Introduction
- Chapter 2 Regulatory Framework, setting out the legal framework for the definition of hazardous waste
- Chapter 3 Hazardous Waste Assessment Framework, outlines the methodology for assessing wastes based on the EWC
- Appendix A European Waste Catalogue, provides guidance on the use of the catalogue
- Appendix B Absolute and Mirror Entries, provides guidance on the potential hazards associated with different hazardous wastes
- Appendix C Hazardous Property Assessment, providing guidance on the assessment of each hazardous property
- Appendix D Data Sources, providing users with information on data sources and origin of the information from different sources

<sup>a</sup> Council Directive 91/689/EC



# Regulatory Framework

This chapter sets out:

- the legal framework for the definition of hazardous waste as defined by the Hazardous Waste Directive; and
- how the definition is derived and how it is linked to EU legislation.

## 2.1 Hazardous Waste Directive (HWD, Council Directive 91/689/EC)

The aim of the HWD is to provide a precise and uniform European-wide definition of hazardous waste and to ensure the correct management and regulation of such waste. The starting point of the HWD is to identify which wastes are deemed to be hazardous.

Article 1(4) of the HWD defines hazardous waste as wastes featuring on a list drawn up by the European Commission, because they possess one or more of the hazardous properties set out in the HWD. There are 14 hazardous properties set out in Annex III of the HWD and they are detailed in Table 2.1.

In 1994 a comprehensive list of all wastes, hazardous or otherwise, was produced pursuant to Council Directive 75/442/EEC (as amended by 91/156/EEC). This list is known as the European Waste Catalogue (EWC 1994, Commission Decision 94/3/EC).

Council Decision 94/904/EC then identified which of the wastes on EWC 1994 are deemed to be hazardous, based on the properties set out in the HWD. The resulting list of wastes was called the Hazardous Waste List (HWL) and was the list defining hazardous waste required by Article 1(4) of the HWD.

The EWC is subject to periodic review in accordance with Article 1(4), second indent. After several years of debate among the EC countries the EWC 1994 and HWL were updated and combined. This resulted in a revised European Waste Catalogue (EWC 2002, Commission Decision 2000/532/EC). 2000/532/EC was subsequently amended by Commission Decisions 2001/118/EC, 2001/119/EC and Council Decision 2001/573/EC.

## 2.2 Revised European Waste Catalogue (EWC 2002)

The EWC 2002 is intended to be a catalogue of all wastes, grouped according to generic industry, process or waste type.

The EWC 2002 differentiates between non-hazardous and hazardous by identifying hazardous waste entries with an asterisk (\*).

Details of how to use the EWC 2002 and the steps that should be followed to identify a waste in the catalogue and whether that waste is hazardous are given in Commission Decision 2001/118/EC. A Hazardous Waste Assessment Framework is set out in Chapter 3, which outlines the methodology for assessing wastes based on the EWC 2002.

A consolidated version of the EWC 2002 (incorporating Commission Decision 2000/532/EC and its subsequent amendments) and a description of how to use the catalogue are set out in Appendix A.

### 2.2.1 Links to other legislation

The EWC 2002 links the classification of certain hazardous waste to the concentrations of " *dangerous substances*" within the waste. It defines " *dangerous substances*" as substances classified as dangerous in Directive 67/548/EEC and its subsequent amendments.

Directive 67/548/EEC is the European Council Directive on Dangerous Substances that specifies the hazard classification, packaging and labelling requirements for dangerous substances supplied in the European Union.

In addition, the EWC 2002 derives threshold concentrations for certain hazardous properties from the Directive 88/379/EEC, the European Council Directive on Dangerous Preparations, and its subsequent amendments. Directive 88/379/EEC specifies the hazard classification, packaging and labelling requirements for dangerous preparations supplied in the European Union.

The requirements of Directive 67/548/EEC and Directive 88/379/EEC are implemented in the UK through the Chemicals (Hazard Information and Packaging for Supply) Regulations 2002<sup>b</sup>, which are known as CHIP3. Details of how CHIP3 relates to the classification of hazardous waste are set out in the Hazardous Waste Assessment Framework in Chapter 3.

Where hazardous waste is to be transported it **also** needs to be classified in accordance with the requirements of Directives 94/55/EC and 96/49/EC regarding the transport of dangerous goods by road and rail (respectively), and the regulations which implement them in the UK. Guidance on the transport of dangerous goods can be obtained from the Health and Safety Executive.

<sup>b</sup> SI 2002 No. 1689, HMSO London, ISBN 0 11 042419 0

Table 2.1 | Hazardous Properties (Hazardous Waste Directive Annex III)<sup>1</sup>

H1	"Explosive": substances and preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene.
H2	"Oxidising": substances and preparations which exhibit highly exothermic reactions when in contact with other substances, particularly flammable substances.
H3A	"Highly Flammable" <ul style="list-style-type: none"> <li>- liquid substances and preparations having a flashpoint of below 21°C (including extremely flammable liquids), or</li> <li>- substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any application of energy, or</li> <li>- solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or to be consumed after removal of the source of ignition, or</li> <li>- gaseous substances and preparations which are flammable in air at normal pressure, or</li> <li>- substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.</li> </ul>
H3B	"Flammable": liquid substances and preparations having a flashpoint equal to or greater than 21°C and less than or equal to 55°C.
H4	"Irritant": non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation.
H5	"Harmful": substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve limited health risks.
H6	"Toxic": substances and preparations (including very toxic substances and preparations) which, if they are inhaled or ingested or if they penetrate the skin, may involve serious, acute or chronic health risks and even death.
H7	"Carcinogenic": substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce cancer or increase its incidence.
H8	"Corrosive": substances and preparations which may destroy living tissue on contact.
H9	"Infectious": substances containing viable micro-organisms or their toxins which are known or reliably believed to cause disease in man or other living organisms.
H10 <sup>2</sup>	"Toxic for reproduction": substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may produce or increase the incidence of non-heritable adverse effects in the progeny and/or of male or female reproductive functions or capacity.
H11	"Mutagenic": substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce hereditary genetic defects or increase their incidence.
H12	Substances and preparations which release toxic or very toxic gases in contact with water, air or an acid.
H13	Substances and preparations capable by any means, after disposal, of yielding another substance, e.g. a leachate, which possesses any of the characteristics listed above.
H14	"Ecotoxic": substances and preparations which present or may present immediate or delayed risks for one or more sectors of the environment.

<sup>1</sup>See Appendix C for Hazardous Property Assessments.

<sup>2</sup>EWC 2002 states that "Toxic for reproduction" is considered to be in line with the hazardous property H10 "Teratogenic" in the HWD.



# Hazardous Waste Assessment Framework

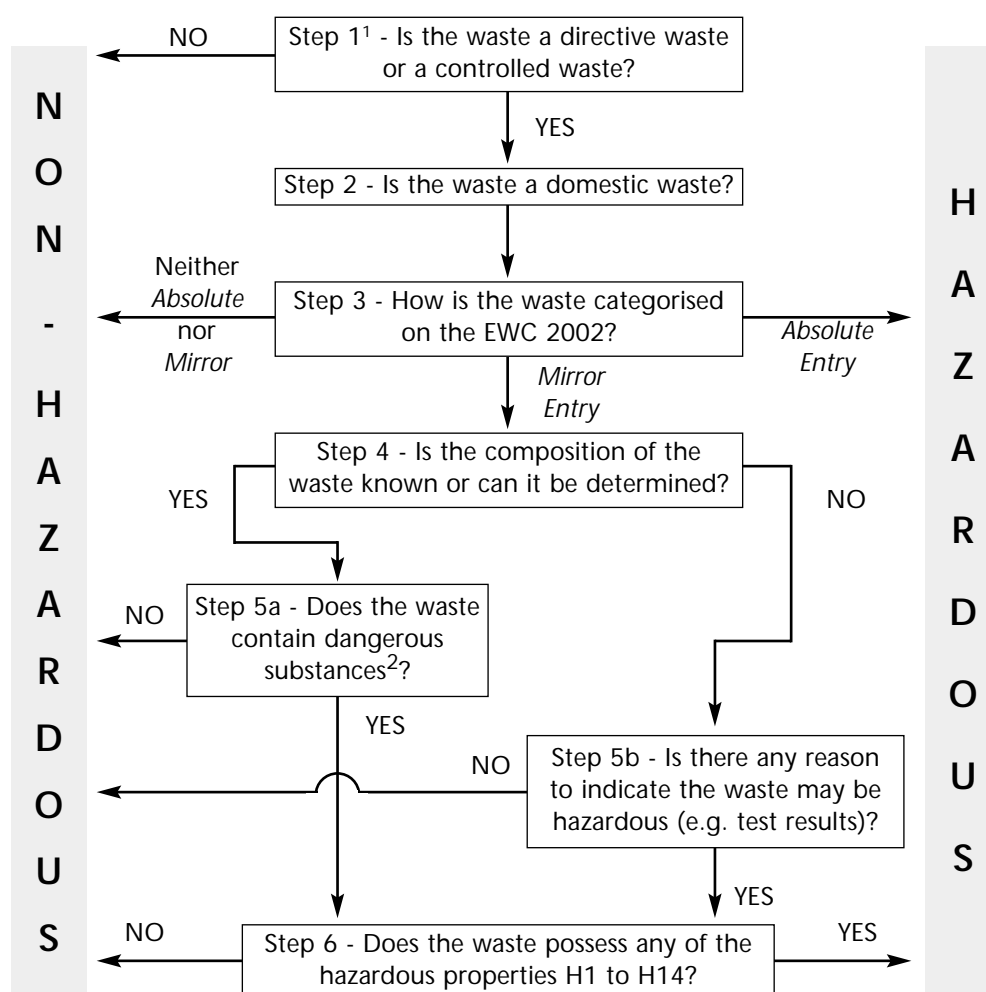
This chapter provides a practical approach to classifying hazardous waste by:

- outlining the methodology for assessing wastes based on the EWC 2002; and
- highlighting where to find more detailed advice in the Technical Guidance Note.

## 3.1 Hazardous Waste Assessment Methodology

There is a series of steps involved in determining if a waste is hazardous or non-hazardous. These steps are set out in a flowchart in Figure 3.1. The flowchart is cross-referenced to sections within the text that explain the issues underlying each decision and where to find more detailed advice in the Technical Guidance Note.

Figure 3.1: Hazardous Waste Assessment Methodology



Note

<sup>1</sup> Both directive waste and controlled waste definitions are used in UK legislation. Therefore an assessment of whether the waste is a directive waste or a controlled waste is required and this will depend on the legislation concerned.

<sup>2</sup> Infectious substances should be considered at this stage of the Hazardous Waste Assessment Methodology.

### 3.1.1 Step 1: Is the waste a directive waste or a controlled waste?

Both directive waste and controlled waste definitions are used in UK legislation. For a waste to be hazardous it must first be either a directive waste or a controlled waste. Therefore an assessment of whether the waste is a directive waste or a controlled waste is required and this will depend on the legislation concerned.

Directive waste means waste as defined in Article 1(a) of Council Directive 75/442/EEC on waste.

In Great Britain, controlled waste is defined in Section 75 (4) of the Environmental Protection Act 1990. In Northern Ireland, controlled waste is defined in Part I of the Waste and Contaminated Land (NI) Order 1997 Article 2(2).

### 3.1.2 Step 2: Is the waste domestic waste?

The HWD excludes domestic waste (Article 1(5)) from the requirements of this directive. Separate guidance will be prepared on the definition of domestic waste.

### 3.1.3 Step 3: How is the waste categorised on the EWC 2002?

The EWC 2002 details a series of steps for identifying wastes in the catalogue and the order in which entries in the catalogue must be considered. A detailed explanation of how to use the EWC 2002 is set out in Appendix A.

#### *“Absolute entry”*

A number of wastes covered by hazardous entries on the EWC 2002 are deemed to be hazardous regardless of their composition or the concentration of any “*dangerous substance*” within the waste. Such entries have been termed “*absolute entries*”. “*Absolute entries*” are those entries marked with an asterisk (\*) but **without** a specific or general reference to “*dangerous substances*”. They are highlighted in **red** and marked with an “**A**” in the consolidated version of the EWC 2002 in Appendix A. There are a number of absolute entries which have corresponding non-hazardous entries, which should be used when the absolute entry is not appropriate.

Threshold calculations are not required to determine whether wastes with an “*absolute entry*” in the EWC 2002 are hazardous waste, although the hazards associated with these wastes should be determined for Duty of Care purposes.

#### *“Mirror entry”*

The EWC 2002 recognises that certain wastes have the potential to be either hazardous or non-hazardous depending on their actual composition and the concentrations of “*dangerous substances*” within the waste. These wastes are covered by two entries, collectively called “*mirror entries*”:

- a hazardous waste entry marked with an asterisk (\*); **and**
- an alternative non-hazardous waste entry not marked with an asterisk.

The majority of hazardous “*mirror entries*” are easily identified because they make a general reference to “*dangerous substances*” and include the phrase “*containing dangerous substances*” in the description, e.g.

16 03 03\* [inorganic wastes containing dangerous substances](#)

16 03 04 inorganic wastes other than those mentioned in 16 03 03

There are a few hazardous “*mirror entries*” that refer to specific hazardous properties or the presence of a specific hazardous component, e.g.

10 08 10\* [dross and skimmings that are flammable or emit, upon contact with water, flammable gases in dangerous quantities](#)

10 08 11 dross and skimmings other than those mentioned in 10 08 10

and

06 03 11\* [solid salts and solutions containing cyanides](#)

06 03 14 solid salts and solutions other than those mentioned in 06 03 11 and 06 03 13

Hazardous "*mirror entries*" have been highlighted in blue and marked with an "M" in the consolidated version of the EWC 2002 in Appendix A.

Wastes that are not classified as either "*absolute entries*" or "*mirror entries*" in the EWC 2002 are not hazardous wastes.

#### 3.1.4 Step 4: Is the composition of the waste known or can it be determined?

One of the simplest methods of identifying whether a "*mirror entry*" waste is hazardous is to identify the chemical composition of the waste and then determine if the concentrations of the chemicals within the waste are sufficient to render the waste hazardous.

The composition of the waste could be identified using:

- knowledge of the process or activity that produced the waste; and/or
- chemical/microbiological analysis of the waste; and/or
- information on the Safety Data Sheets.

It should be noted that chemical analyses (particularly for inorganic substances) do not always identify the components within a waste, but the individual species of that waste such as anions (e.g. sulphate, chloride) and cations (e.g. metals). In such cases the waste holder would need to determine what substances are likely to be present based on the process/activity that produced the waste and the anions and cations present. If the holder cannot decide which substances might be present, they should assume the worst-case scenario for each component and assess the waste accordingly.

In the majority of cases there should be sufficient knowledge to assess a waste. However, where the composition of the waste is not known the alternatives include testing the whole waste for hazardous properties or utilising the precautionary principle (see Step 5b).

#### 3.1.5 Step 5a: Does the waste contain dangerous substance(s)?

When the composition of the "*mirror entry*" waste is known, it can be assessed to determine if the waste contains "*dangerous substances*" or not. Chapter 2 highlights that the EWC 2002 defines "*dangerous substance*" using the European Council Directive on Dangerous Substances<sup>3</sup>, which is implemented by CHIP3 in the UK.

Based on the principles used in CHIP3 for classifying substances, two methods for assessing whether a "*mirror entry*" waste contains "*dangerous substances*" have been identified. They are, in order of preference:

- using the hazard classification given in the Approved Supply List (ASL)<sup>4</sup>, which prescribes hazard information and classification for many common chemicals<sup>5</sup>;
- determining the hazard classification using information from the Safety Data Sheets or the methodology given in the Approved Guide to the Classification and Labelling of Dangerous Substances and Dangerous Preparations (the Approved Classification and Labelling Guide)<sup>6</sup>.

The classification of the chemical(s) identifies:

- the kind of hazards (categories of danger) possessed by a chemical; and
- the hazards of those chemicals by allocating risk phrases, which are standard phrases that give simple information about the hazards of a chemical in normal use.

<sup>3</sup> 67/548/EEC and amendments

<sup>4</sup> Approved Supply List (7th edition) - Information approved for the classification and labelling of substances and preparations dangerous for supply. HSE Books, ISBN 0 7176 2368 8

<sup>5</sup> **Chemical** is the common term for **substances** (a chemical element or one of its compounds, including any impurities) and **preparations** (a mixture of substances)

<sup>6</sup> Fifth edition, HSE Books, ISBN 0 7176 2369 6

## Using the ASL

The ASL prescribes hazard classifications for many common chemicals, and where a chemical is listed in the ASL the classification given therein takes precedence over classification found elsewhere.

The ASL is split into five parts with classification information contained in Part I, which is an alphabetical listing of all the substances covered. An example of the classification of a chemical given in Part I to the ASL is set out in Box 3.1.

To aid identification, each ASL entry provides alternative chemical names and the Chemical Abstract Service (CAS) number. The CAS number is the most accurate identification of a substance that may have many non-standard names.

In some cases the ASL shows risk phrases joined together by a comma (,) or an oblique stroke (/), to indicate how information should be presented on a label. For the purpose of assessing hazardous waste the comma and oblique stroke are interchangeable.

Box 3.1: Example of an entry from the ASL

Cadmium sulphide	
CAS	001306-23-6
Index	048-010-00-4
Class'n	Carc. Cat. 3: R40 T: R48/23/25 Xn: R22 R53
Label	T R22, 40, 48/23/25 S(1/2), 22, 36/37, 45 215-147-8
Conc	Note 1 Conc >= 10% T: R22, 40, 48/23/25 Conc >= 1% and < 10% Xn: R22, 40, 48/23/25 Conc >= 0.1% and < 1% Xn: R48/23/25

The classification of cadmium sulphide is therefore Carc. Cat. 3: R40, T: R48/23/25, Xn: R22, R53 with:

- Carc. Cat. 3 (Carcinogenic Category 3), T (Toxic) and Xn (Harmful) indicating the Categories of Danger or hazards; and
- R40, R48/23/25, R22 and R53 being the risk phrases. A full description of all risk phrases is set out in Part V of the ASL with a summary in Table 3.1.

**The classification required for the assessment of hazardous wastes**

**Information that must be included on the supply label**

**Some substances have specific threshold concentration limits; they are **not** used when assessing hazardous wastes**

## Approved Classification and Labelling Guide and Safety Data Sheets

The ASL only covers a small proportion of the substances on the European Inventory of Existing Commercial Chemical Substances (EINECS). If a substance is not listed in the ASL then further research is required to determine the substance classification. There are two options:

- Determine the classification using the criteria set out in the Approved Classification and Labelling Guide; or
- Use classification information from Safety Data Sheets

The **Approved Classification and Labelling Guide** provides information on:

- the type and sources of data that can be used, which include results of testing, information required by international rules on the transport of dangerous goods, reference works or scientific and technical literature and practical experience;
- the criteria for each category of danger; and
- how to assign risk phrases.

The criteria for the categories of danger specify the data or test method necessary to assign each category. The criteria for health effects are usually based on human or animal toxicological data with physico-chemical effects generally based on test results. The criteria also assign the appropriate risk phrase.

To classify a substance that is **not** on the ASL, the available data must be collected and compared against the criteria specified for each category of danger. If the data indicate a particular category of danger, the appropriate risk phrase should be assigned. It should be remembered that substances could have more than one category of danger and a number of risk phrases. Therefore the criteria for each category of danger should be considered in turn.

Appendix B provides an indication of the potential hazardous properties (i.e. category of danger) that different wastes may possess, to help the waste assessor identify which criteria to consider. The criteria relevant to the assessment of hazardous waste are set out in the individual hazard assessments in Appendix C.

CHIP3 requires chemical suppliers to provide **Safety Data Sheets** to the recipient of a chemical. The Safety Data Sheets must contain sufficient information to allow the user to decide how to protect people and the environment, and this includes providing the classifications of the substances within a chemical.

If the Safety Data Sheets for a chemical indicate a hazardous property, then a waste containing that chemical has the potential to be hazardous. Waste holders need to consider if:

- the concentrations of "*dangerous substances*" in the waste, after use of the product, remain sufficient to be hazardous; or
- any reactions take place during the use of the product which may remove the hazard or create new/different hazards from those of the product.

Labels on chemical containers should also show the risk phrases associated with a product and the substances found within a product, along with indications of the danger, i.e. symbols, which should not be mistaken as the category of danger or hazards (See Section 3.1.9). The information on labels is not as comprehensive as that provided on Safety Data Sheets.

Appendix D identifies some of the sources of data available and discusses data quality issues.

### **3.1.6 Step 5b: Is there any reason to indicate the waste may be hazardous (e.g. test results)?**

Waste holders have a duty to determine if a "*mirror entry*" waste is hazardous. Where:

- there are any reasons to indicate the waste may be hazardous, such as test results, knowledge of the production process or the raw materials used; and/or
- the composition of a waste is not known, cannot be determined or is insufficient to allow classification using the ASL or other sources.

The waste needs to be tested to determine if it possesses any hazardous properties.

The HWD identifies the test methods in Annex V of Directive 67/548/EEC as the methods to be used to test for hazardous properties. Where a hazardous property test in Annex V is a non-mammalian test, that test should be performed on the waste. Where the test is mammalian-based, the Agencies views are that such tests should not be performed.

The Agencies consider that there are two options:

- perform a surrogate non-mammalian biological effect test; or
- if no means of non-mammalian testing is available, do not test, but ascertain from the producer or other previous waste holders information on the waste before you assume the waste is hazardous.

There are some tests that can assess a waste as hazardous without recourse to testing the waste on animals. These include simple inexpensive tests, such as flashpoint or pH determination that can be used to indicate that a waste is flammable or irritant/corrosive. Some tests do not define specific hazards but indicate that a waste is hazardous. Standard tests that are acceptable to the Agencies are given in the individual hazard assessments in Appendix C. Where a non-standard test is used the findings should be agreed with the Agencies.

It is not expected that a waste holder will assume an unknown waste is hazardous (or not) without rudimentary testing of the components of the waste, or ascertaining the nature of the waste from informed sources.

To assist with the classification of complex "*mirror entry*" wastes, Appendix B contains a section for each chapter of the EWC 2002 that highlights the range of components that may be present in the wastes covered by that EWC chapter.

### 3.1.7 Step 6: Does the waste possess any of the hazardous properties H1 to H14?

In order for a waste identified by a "*mirror entry*" to be hazardous it must "display" a hazardous property. The Hazardous Properties are listed in Table 2.1.

There are two methods of determining if a "*mirror entry*" waste is hazardous or not. These are:

- calculating whether the hazardous property is appropriate by referring to a threshold limit for a particular risk phrase; or
- testing to prove whether a particular hazardous property is present or not.

#### Calculating

For many wastes the most appropriate method is to identify the hazardous constituents/chemicals in the waste and then to use their concentrations in the waste to identify whether they confer hazardous properties on the waste.

- If a waste contains a dangerous substance(s) at a concentration at or above a threshold concentration for any of the hazardous properties H1 to H14, the waste will be hazardous and is categorised as the hazardous "*mirror entry*".
- If a waste contains a dangerous substance(s) at a concentration below the threshold for all of the hazardous properties, the waste will not be hazardous and is categorised as the non-hazardous "*mirror entry*".

#### Testing

For some hazards testing of physical properties might be the most appropriate method. For example, to identify whether a liquid waste is flammable or not, for which the threshold is 55°C, a flashpoint determination is probably the simplest method. This is because the flashpoint depends upon the concentration of the flammable chemicals in the waste. Other examples of hazards where a test could be the simplest option are H1 "Explosive" and H2 "Oxidising".

As discussed in Step 5b, sometimes testing may be the only option to determine whether a waste is hazardous because of the complex nature of a waste; this is discussed in more detail in Appendix C.

## Threshold concentrations

Article 2 of the EWC 2002 sets out thresholds for hazardous properties H3 to H8, H10 and H11, which are derived from Directive 88/379/EEC.

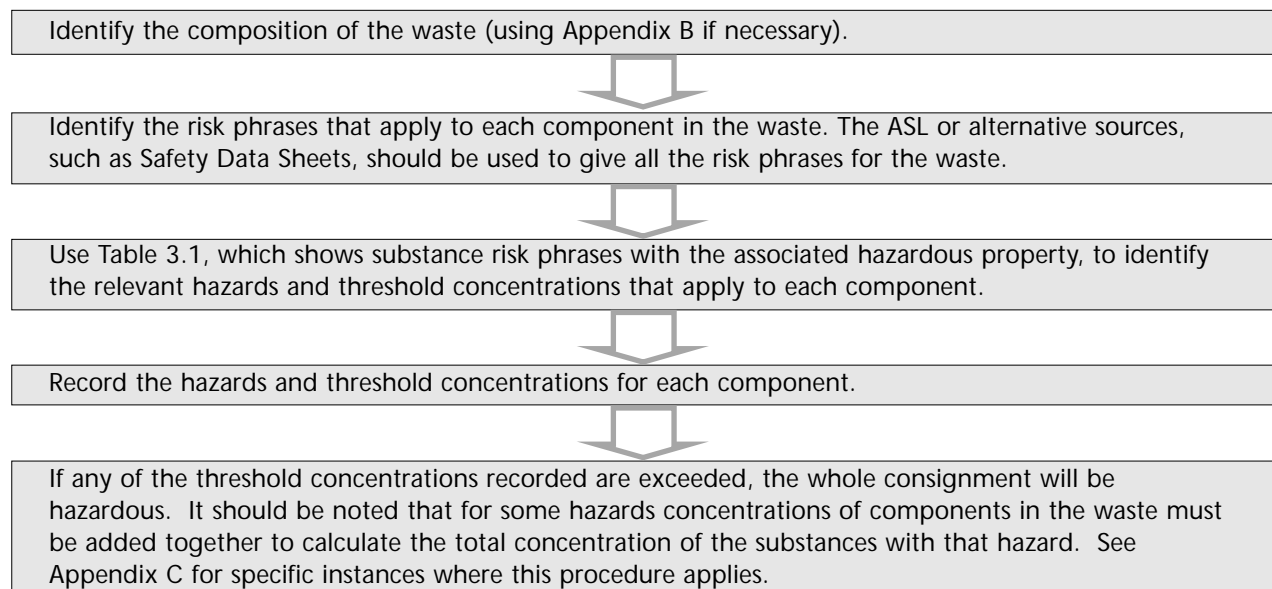
Threshold concentrations for the hazardous properties not covered by Article 2 (H1, H2, H3-A (second to fifth indents), H9, H12, H13 and H14 (with the exception of H9: Infectious<sup>9</sup>)), have been developed based on the classification and risk phrases from the CHIP3 which implement Directive 88/379/EEC. The thresholds for some of these hazards can be calculated, while others require testing of physical properties. The assessment H9 has been developed based on the presence of infectious substance and this is set out in Appendix C9.

An assessment methodology for each hazardous property is set out Appendix C, and includes:

- definition of the hazardous property;
- relevant risk phrases;
- thresholds;
- a flow diagram setting out the assessment process for that hazardous property; and
- information on test methods.

Table 3.1 summarises the concentration thresholds for each risk phrase or group of risk phrases, how they relate to hazardous properties and when testing of physical properties should be used to determine the hazard.

**In summary, for Steps 4 to 6:**



<sup>9</sup> CHIP3 does not cover infectious

### Theoretical example of Hazardous Waste Assessment Methodology

Waste A contains 10% of chemical X and 18% of chemical Y with the remainder being water.

Step 1: Waste A is a controlled waste.

Step 2: Waste A is not domestic waste.

Step 3: Waste A is listed with a "*mirror entry*" on the EWC 2002.

Step 4: The composition of the waste is known.

Step 5a: The waste does contain dangerous substances because:

Chemical X is listed on the ASL and is classified as F; R11, Xn: R20/22; and

Chemical Y, which is not listed on the ASL, has the classification of Xi: R36, Xn: R21 and N: R50, 53, on its Safety Data Sheets.

Water is not listed on the ASL and is not considered to be dangerous.

Step 6: Given the classifications of the chemicals Waste A could display the hazardous properties H3 (Highly Flammable/Flammable), H4 (Irritant), H5 (Harmful) and H14 (Ecotoxic).

A test is performed on the waste and the flashpoint is 75°C. H3A "Highly Flammable" and H3B "Flammable" can be discounted.

The threshold for Xi: R36 identified from Table 3.1 is 20%. This is not exceeded as the concentration of chemical Y is 18% and the waste will not be classified as H4 "Irritant".

Classifications Xn: R20/22 and Xn: R21 are appropriate to hazardous property H5 "Harmful". The risk phrases for harmful are additive and the total concentration of substances with harmful risk phrases is 28%. The threshold concentration for harmful chemicals is 25%, as given in Table 3.1. This threshold is exceeded. The waste should be classified as H5 "Harmful".

Risk phrase N: R50, 53 is appropriate to hazardous property H14 "Ecotoxic". The threshold concentration for N: R50, 53 chemicals is 0.25%. This threshold is exceeded and the waste should be classified as H14 "Ecotoxic".

Therefore Waste A is hazardous by H5 "Harmful" and H14 "Ecotoxic" and the hazardous "*mirror entry*" should be used.

**Table 3.1:** Classifications, Risk Phrases, Hazards and Hazardous Waste Threshold Limits

Classification Category of Danger	Risk Phrase	Substance Risk	Hazards	Hazardous Waste Threshold Limits	Comments
E	R1	Explosive when dry	H13 by H1	n/a	R1 is given the symbol E in the Approved Supply List but not in the Approved Classification and Labelling Guide. A waste containing substances with risk phrase R1 is a candidate for hazard H13 (by H1) because it may become dry during disposal.
E	R2	Risk of explosion by shock, friction, fire or other sources of ignition	H1	Test for explosive by ignition or shock	Tests are given in Appendix C1.
	R3	Extreme risk of explosion by shock, friction, fire or other sources of ignition			
N/a	R4	Forms very sensitive explosive metallic compounds	H13 by H1	n/a	A waste containing substances with these risk phrases is a candidate for hazard H13 (by H1).
	R5	Heating may cause an explosion			
	R6	Explosive with or without contact with air			
O	R7	May cause fire			
	R8	Contact with combustible material may cause fire	H2	Test and/or calculation	Tests are given in Appendix C2; however, test does not apply to organic peroxides.
	R9	Explosive when mixed with combustible material			
N/a	R10	Flammable	H3B	Flashpoint: >21°C to 55°C	Tests are given in Appendix C3.
F	R11	Highly flammable	H3A(i) (H3B) H3A(iii)	H3A(i) fpt ≤21°C H3A(iii) test	H3A(i) applies to liquids. H3A(iii) applies to solids.
F+	R12	Extremely flammable	H3A(i) (H3B)	H3A(i) fpt ≤21°C H3A(iv) test	H3A(iv) applies to gases. Tests are given in Appendix C3.

Classification Category of Danger	Risk Phrase	Substance Risk	Hazards	Hazardous Waste Threshold Limits	Comments
N/a	R14	Reacts violently with water	n/a	n/a	This is an additional risk phrase and such a risk phrase alone will not cause a waste to be hazardous.
F	R15	Contact with water liberates extremely flammable gases	H3A(v)	Test and/or calculation	Applies to solids and liquids in the waste. Test is given in Appendix C3.
N/a	R16	Explosive when mixed with oxidising substances	H13 by H1	n/a	A waste containing substances with these risk phrases is a candidate for hazard H13 (by H1).
F	R17	Spontaneously flammable in air	H3A(ii)	Test	Applies to solids, liquids and gases. Test is given in Appendix C3.
N/a	R18	In use may form flammable/explosive vapour-air mixture	H13 by H1 H2 or H3	n/a	A waste containing substances with these risk phrases is a candidate for hazard H13 (by H1, H2 or H3).
X <sub>n</sub>	R19	May form explosive peroxides			
	R20	Harmful by inhalation			
	R22	Harmful if swallowed	H5	≥ 25%	Threshold limit applies to the total concentration of substances classified as Harmful. Therefore the concentrations of substances with these risk phrases are additive along with the concentrations of substances with risk phrases R65 and those with combined/joint risk phrase with R48 and Xn R68.
T	R21	Harmful in contact with skin			
	R23	Toxic by inhalation			
	R24	Toxic in contact with skin	H6 (H5)	≥ 3%	Threshold limit applies to the total concentration of substances classified as Toxic. Therefore the concentrations of substances with these risk phrases are additive along with the concentrations of substances with combined/joint risk phrase with R39 or R48.
	R25	Toxic if swallowed			

Classification Category of Danger	Risk Phrase	Substance Risk	Hazards	Hazardous Waste Threshold Limits	Comments
T+	R26	Very toxic by inhalation	H6 (H5)	≥ 0.1%	Threshold limit applies to the total concentration of substances classified as Very Toxic. Therefore the concentrations of substances with these risk phrases are additive along with the concentrations of substances with combined/joint risk phrase with R39.
	R27	Very toxic in contact with skin			
	R28	Very toxic if swallowed			
N/a	R29	Contact with water liberates toxic gas	H12	Test and/or calculation	Test is given in Appendix C12.
N/a	R30	Can become highly flammable in use	n/a	n/a	This is an additional risk phrase and such a risk phrase alone will not cause a waste to be hazardous.
N/a	R31	Contact with acids liberates toxic gas	H12	Test and/or calculation	Test is given in Appendix C12.
	R32	Contact with acids liberates very toxic gas			
N/a	R33	Danger of cumulative effects	n/a	n/a	R33 is used when R48 is not warranted due to the degree of danger posed and will not constitute a hazardous waste in isolation.
C	R34	Causes burns	H8 (H4)	≥ 5%	The concentrations of substances with R34 are additive. However, they are not additive with corrosive substances assigned R35.
C	R35	Causes severe burns	H8 (H4)	≥ 1%	The concentrations of substances with R35 are additive. However, they are not additive with corrosive substances assigned R34.
X <sub>j</sub>	R36	Irritating to the eyes	H4	≥ 20%	The concentrations of substances with these risk phrases are additive. However, they are not additive with irritant substances assigned R41.
	R37	Irritating to the respiratory system			
	R38	Irritating to the skin			

Classification Category of Danger	Risk Phrase	Substance Risk	Hazards	Hazardous Waste Threshold Limits	Comments
T	R39	Danger of very serious irreversible effects	H6 (H5)	≥ 3%(T)	R39 is only used in conjunction with combinations of R23, R24, R25 or R26, R27, R28, which are used to identify the exposure route. Threshold limit will depend whether R39 is used in conjunction with a toxic or very toxic substance.
T+				≥ 0.1%(T+)	
Carc.Cat.3	R40	Limited evidence of a carcinogenic effect	H7	≥ 1%	The concentration of an individual substance assigned R40 must be above the threshold limit.
X <sub>i</sub>	R41	Risk of serious damage to the eyes	H4	≥ 10%	The concentrations of substances with R41 are additive. However, their concentrations cannot be added with irritant substances assigned R36, R37 or R38.
X <sub>n</sub>	R42	May cause sensitisation by inhalation	n/a	n/a	Sensitisation has no associated hazard in the HWD and will not constitute a hazardous waste in isolation.
X <sub>i</sub>	R43	May cause sensitisation by skin contact			
N/a	R44	Risk of explosion if heated under confinement	H13 by H1	n/a	A waste containing substances with these risk phrases is a candidate for hazard H13 (by H1).
Carc. Cat. 1 Carc. Cat. 2	R45	May cause cancer	H7	≥ 0.1%	The concentration of an individual substance assigned R45 must be above the threshold limit.
Muta. Cat. 1 Muta. Cat. 2	R46	May cause heritable genetic damage	H11	≥ 0.1%	The concentration of an individual substance assigned R46 must be above the threshold limit.

Classification		Substance Risk	Hazards	Hazardous Waste Threshold Limits	Comments
Category of Danger	Risk Phrase				
X <sub>n</sub> T	R48	Danger of serious damage to health by prolonged exposure	H5 H6 (H5)	≥ 25% (H5) ≥ 3% (H6)	R48 is only used in conjunction with combinations of R20, R21, R22 or R23, R24, R25, which are used to identify the exposure route. Threshold limit will depend whether R48 is used in conjunction with a toxic or harmful substance.  Threshold limit applies to the total concentration of substances classified as Harmful or Toxic and should be added to the concentrations of substances with the same classification.
	R49	May cause cancer by inhalation	H7	≥ 0.1%	The concentration of an individual substance assigned R49 must be above the threshold limit.
N	R50	Very toxic to aquatic organisms	H14	≥ 25%	The interrelationship between these risk phrases is complex, with different combinations of the risk phrases being additive depending on the particular effect being considered. Therefore if a waste contains a range of substances with a range of these risk phrases, it is recommended that the detailed guidance in Appendix C14 is used to consider the additive effects.
	R50-53	Very toxic to aquatic organisms and may cause long-term effects in the aquatic environment	H14	≥ 0.25%	
N	R51-53	Toxic to aquatic organisms and may cause long-term effects in the aquatic environment	H14	≥ 2.5%	
N/a	R52-53	Harmful to aquatic organisms and may cause long-term effects in the aquatic environment	H14	≥ 25%	
	R52	Harmful to aquatic organisms	H14	≥ 25%	
N/a	R53	May cause long-term effects in the aquatic environment	H14	≥ 25%	

Classification Category of Danger	Risk Phrase	Substance Risk	Hazards	Hazardous Waste Threshold Limits	Comments
N	R54	Toxic to flora	H14	Not available	Criteria for preparations containing substances with risk phrases relating to the terrestrial environment, i.e. R54 to R58, are not currently included in the Dangerous Preparation Directive (DPD). The classification of preparations using these risk phrases will be included in the DPD when detailed criteria for use of these risk phrases have been developed for the Dangerous Substances Directive. Therefore until the detailed criteria have been developed risk phrases R54 to R58 should not be considered when assessing hazardous waste.
	R55	Toxic to fauna			
	R56	Toxic to soil organisms			
	R57	Toxic to bees			
	R58	May cause long-term adverse effects in the environment			
N	R59	Dangerous for the ozone layer	H14	≥ 0.1%	Substances that are listed in Annex I to Council Regulation (EC) No 2037/2000 on substances that deplete the ozone layer and its subsequent amendments are classified as R59.
Repr.Cat.1 Repr.Cat.2	R60	May impair fertility	H10	≥ 0.5%	The concentration of an individual substance assigned R60 or R61 must be above the threshold limit.
	R61	May cause harm to the unborn child			
Repr.Cat.3	R62	Possible risk of impaired fertility	H10	≥ 5%	The concentration of an individual substance assigned R62 or R63 must be above the threshold limit.
	R63	Possible risk of harm to the unborn child			
N/a	R64	May cause harm to breast-fed babies	n/a	n/a	This is an additional risk phrase and such a risk phrase alone will not cause a waste to be hazardous.
X <sub>n</sub>	R65	Harmful: may cause lung damage if swallowed	H5	≥ 25%	Threshold limit applies to the total concentration of substances classified as Harmful. Therefore the concentrations of substances with R65 are additive with the concentrations of substances with risk phrases R20, R21, R22 and those with combined/joint risk phrase with R48 and Xn R68.

Classification		Substance Risk	Hazards	Hazardous Waste Threshold Limits	Comments
Category of Danger	Risk Phrase				
N/a	R66	Repeated exposure may cause skin dryness or cracking	n/a	n/a	This is an additional risk phrase and such a risk phrase alone will not cause a waste to be hazardous.
N/a	R67	Vapour may cause drowsiness and dizziness	n/a	n/a	This is an additional risk phrase and such a risk phrase alone will not cause a waste to be hazardous.
Muta.Cat.3	R68	Possible risk of irreversible effects	H11	≥ 1% (H11)	The concentration of an individual substance assigned Muta.Cat.3; R68 must be above the threshold limit.
X <sub>n</sub>	R68	Possible risk of irreversible effects	H5	≥ 25% (H5)	Xn R68 is only used in conjunction with combinations of R20, R21, R22, which are used to identify the exposure route. Threshold limit applies to the total concentration of substances classified as Harmful. Therefore the concentrations of substances with Xn R68 are additive with the concentrations of substances with risk phrases R20, R21, R22, R65 and those with combined/joint risk phrase with R48.

**KEY**

- N/a not applicable
- H3A (i) "Highly flammable" : - liquid substances and preparations having a flashpoint ≤ 21 °C (including extremely flammable liquids).
- H3A (ii) "Highly flammable" : - substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any application of energy.
- H3A (iii) "Highly flammable" : - solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or to be consumed after removal of the source of ignition.
- H3A (iv) "Highly flammable" : - gaseous substances and preparations which are flammable in air at normal pressure.
- H3A (v) "Highly flammable" : - substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.

### 3.1.8 Notes on using Table 3.1

Hazardous waste holders should be aware of the following issues when using Table 3.1.

#### Concentration effects

The classification assigned to a substance relates to the substance in its pure (100%) form. If a substance is not pure or is present as a component of a complex mixture the same hazard may not apply. As an example, ethanol is classified in the ASL as F: R11, which indicates that at 100% concentration it will have a flashpoint less than 21°C. However, an aqueous ("mirror entry") waste containing 4% w/w ethanol, will have a flashpoint greater than 55°C, and so will not be hazardous. At higher concentrations of ethanol, the flashpoint will reduce to between 21°C and 55°C so the waste will be hazardous by H3B "Flammable". At even higher concentrations the flashpoint will be less than 21°C so the waste will be hazardous by H3A (first indent) "Highly Flammable". As discussed above where wastes are concerned a flashpoint determination is probably appropriate to identify whether the waste is flammable or highly flammable. Table 3.1 shows the effect of such dilution by listing the subsidiary hazard in brackets e.g. H3A (first indent) (H3B).

#### Linked hazardous properties

Some hazardous properties are linked because they relate to the same effect:

- H4 "Irritant" and H8 "Corrosive" are linked because they both refer to the potential for harm or damage to tissue. Preparations containing corrosive substances can exhibit either corrosive or irritant properties dependent upon concentration of the corrosive substance. However, substances classified as irritant cannot become corrosive.

Concentrations of irritant and corrosive chemicals and concentrations of chemicals with the classification C: R34 and C: R35 are not additive when assessing hazardous waste.

- H5 "Harmful" and H6 "Toxic" (including "Very Toxic") are linked because they both relate to acute lethal effects. Preparations containing toxic or very toxic substances can exhibit either toxic or harmful properties dependent upon concentration of the toxic or very toxic substance. Substances classified as harmful, however, cannot be toxic at any concentration.

Concentrations of very toxic, toxic and harmful chemicals are not additive when assessing hazardous waste.

#### Testing and calculation

For certain risk phrases the indicated option is testing and/or calculating: ie testing; or calculating; or both testing and calculating. In such cases the testing relates to the physical properties of a waste. The relevant hazards are:

- H1 "Explosive": the explosive nature of a waste cannot be determined by calculation, therefore testing is required. See Appendix C1 for details of test methods.
- H2 "Oxidising": for organic peroxides a calculation method is available, with testing required for other substances that may potentially exhibit hazard H2. See Appendix C2 for details of both calculation and test methods.
- H3A (fifth indent) "Highly Flammable" and H12: a calculation or test is always required. If the composition of the waste is available the gas evolution should be calculated. Alternatively, the waste can be tested to determine whether 1 kg of the waste will evolve 1 litre of a highly flammable gas (the test for H3A (fifth indent)) or a toxic/very toxic gas (the test for H12) in one hour, on addition of water or acid as appropriate. See Appendices C3 and C12 for details of both calculation and test methods.

### Highly polluting substances

It is necessary to treat certain substances differently due to their pollution potential and persistence in the environment, e.g. polychlorinated biphenyls (PCBs) and polychlorinated terphenyls (PCTs). Therefore specific concentration limits will be set for such substances based on international agreement. To maintain consistency with international and UK legislation and guidance, the Agencies consider that the level of 50 mg/kg (0.005%) should be the defining threshold concentration for wastes containing PCBs and PCTs; above that concentration such waste should be considered as hazardous waste.

In the future, specific individual thresholds for other highly polluting substances will be set, based on international agreements, as with PCBs and PCTs.

### Additional risk phrases

The Approved Classification and Labelling Guide identifies a number of " *additional risk phrases* ". When substances are classified with an " *additional risk phrase* " such a risk phrase alone will not cause a waste to be hazardous. As an example, red phosphorus is given risk phrases F: R11 (highly flammable) and R16 (explosive when mixed with oxidising substances) in the ASL. Red phosphorus is hazardous by virtue of H3A (third indent) " Highly Flammable ", due to risk phrase R11 but is not hazardous due to R16. However, if mixed with oxidising substances the resulting mixture might be classified as H1 " Explosive ", for which a test would be required.



Other risk phrases that are similar to R16 in this respect are R4, R5, R6, R14, R18, R19, R30, R44 and R64. Some of these risk phrases may give rise to hazard H13 (substances and preparations capable by any means, after disposal, of yielding another substance which possesses hazards H1 to H12).

### 3.1.9 Other important notes on the use of CHIP3 to assess hazardous waste

Waste producers familiar with CHIP3 must be aware of the differences when using CHIP3 to assess hazardous waste.

- The " conventional method " used in CHIP3 to determine the classification of preparations cannot be used for determining the classification of a hazardous waste. For example, the concentrations of a " very toxic " substance and a " toxic " substance cannot be added when assessing hazardous properties whereas they may be for CHIP3 purposes. See " Linked hazardous properties " in Section 3.1.8.
- Articles such as lead acid batteries, mercury tubes and fridges are not classified as hazardous by CHIP3. However, determining if such wastes are hazardous means determining whether they possess any hazardous properties. This should be done by considering the classifications of the substances within the article and their threshold concentrations with reference to the weight of the article. The availability of substances is not considered when assessing hazardous waste.
- The ASL considers some preparations such as blends of oils as substances. For the purposes of classifying hazardous wastes, waste can also be considered as a substance, e.g. for the purposes of testing, although it remains simpler to classify waste by knowing its chemical constituents.
- The category " Sensitising " (risk phrases R42 and R43) has no associated hazard in the HWD and will not constitute a hazardous waste.
- Threshold concentrations given in Part I of the ASL do not apply when classifying hazardous waste.
- **Categories of danger and indications of danger** should not be confused. An indication of danger is a symbol used for labelling purposes only and does not specify the category of danger or hazard, which is the information required to assess hazardous waste. Table 3.2 highlights the different hazardous properties cover by the indication of danger symbols " Harmful " and " Toxic " .

Table 3.2: Comparison of Indication of Danger and Categories of Danger in relation to hazardous waste

Indication of Danger	Categories of Danger	Hazardous Property	Hazardous Waste Threshold Limit	
 <b>Harmful</b>	Harmful	H5	≥ 25%	
	Irritant	H4	≥ 10% or ≥ 20% depending upon risk phrase	
	Sensitising	N/a	N/a	
	Carcinogenic, Category 3	H7	≥ 1%	
	Toxic for Reproduction, Category 3	H10	≥ 5%	
	Mutagenic, Category 3	H11	≥ 1%	
	 <b>Toxic</b>	Toxic	H6	≥ 3%
		Very Toxic	H6	≥ 0.1%
		Carcinogenic, Categories 1 and 2	H7	≥ 0.1%
		Mutagenic, Categories 1 and 2	H10	≥ 0.1%
Toxic for Reproduction, Categories 1 and 2		H11	≥ 0.5%	